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# On the integration of collective incentives in agri-environmental policy : a behavioral and experimental economics approach

Kristin Limbach

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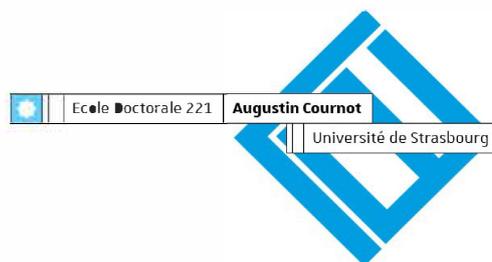
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## UNIVERSITÉ DE STRASBOURG

ÉCOLE DOCTORALE AUGUSTIN COURNOT ED 221

LABORATOIRE GESTION TERRITORIALE DE L'EAU ET DE L'ENVIRONNEMENT

ÉCOLE NATIONALE DU GÉNIE DE L'EAU ET DE L'ENVIRONNEMENT DE STRASBOURG

### THÈSE

pour l'obtention du titre de

**Docteur en Sciences Économiques**

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**KRISTIN LIMBACH**

### ON THE INTEGRATION OF COLLECTIVE INCENTIVES IN AGRI-ENVIRONMENTAL POLICY: A BEHAVIORAL AND EXPERIMENTAL ECONOMICS APPROACH

---

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# Abbreviations and Acronyms

AES	Agri-Environmental Scheme
AOP	Appellation d'Origine Protégée
cAES	collective Agri-Environmental Scheme
CA	Chambre d'Agriculture
CAP	Common Agricultural Policy
CNRS	Centre National de la Recherche Scientifique
CUMA	Coopératives d'Utilisation de Matériel Agricole
CZ	Collective Zone
DDT	Direction Départementale des Territoires
DREAL	Direction Régionale de l'Environnement de l'Aménagement et du Logement
DV	Dependent Variable
EARFD	Agricultural Fund for Rural Development
EC	Environmental Cooperative
EU	European Union
FE	Fixed Effects
GIEE	Groupement d'Intérêt Economique et Environnemental
ha	hectare
MAEC	Mesures agro-environnementales et climatiques
MOCR	Marginal Per Capita Return
MPR	Minimum Participation Rule
MR	Mills Ratio
NGO	Non-Governmental Organization
OFB	Office Francais de la Biodiversité
PES	Payments for Ecological Services
PNA	National Action Plan
PPM	Provision Point Mechanism
RAAIS	Rapid Appraisal of Agricultural Innovation Systems
RE	Random Effects
RCT	Randomized Control Trials
SPZ	Strict Protection Zone
TPGG	Threshold Public Good Game
VCM	Voluntary Contribution Mechanism



# Reading note

This thesis was written entirely in English to ease the discussion and the diffusion of its results. For French readers, a detailed summary is available in French. The thesis consists of five independent chapters, each one contributing to the analysis of collective incentives for agri-environmental policy. In order to make each chapter readable independently from the others, some elements are to be found in several chapters, especially those relating to the case study and the institutional context. Each chapter also contains its own contextual elements and a review of the literature specific to the issue addressed in the chapter. For this reason, the general introduction remains brief.

\*\*\*\*\*

## Note de Lecture

Cette thèse a été rédigée intégralement en anglais afin de faciliter la discussion et la diffusion de ses résultats. Pour les lecteurs uniquement francophones, un résumé détaillé de la thèse est proposé en Français. La thèse est composée de cinq chapitres autonomes, chacun visant à éclairer une problématique spécifique en lien avec les incitations collectives dans les politiques agri-environnementales. Afin de permettre la lecture de chaque chapitre indépendamment des autres, certains éléments sont mentionnés dans plusieurs chapitres, notamment parmi ceux ayant trait à l'étude de cas ou bien la présentation du contexte institutionnel. Chaque chapitre contient également ses propres éléments de contexte et une revue de littérature spécifique à la problématique étudiée dans le chapitre. Pour cette raison, l'introduction générale demeure brève sur les éléments de littérature, dans l'objectif de limiter les redondances.



# Résumé détaillé

Cette thèse porte sur le potentiel des incitations collectives dans les politiques agro-environnementales en Europe. Le travail de cette thèse combine l'approche de deux courants de la littérature - l'économie comportementale et l'action collective - afin d'étudier les dynamiques et enjeux de l'intégration des pratiques pro-environnementales dans le fonctionnement du secteur agricole. Compte tenu de l'objectif principal de cette thèse - développer une meilleure compréhension des outils politiques qui soutiennent et facilitent la gestion agro-environnementale collective - ma recherche est présentée au sein de cinq chapitres. Chaque chapitre met en lumière un aspect différent de la dynamique comportementale et relationnelle de la prise de décision des agriculteurs en matière de pratiques environnementales dans un contexte de coopération entre agriculteurs.

## 0.0.1 Améliorer la qualité de l'environnement

Au sein de l'Union Européenne (UE), la production agricole représente 160 millions d'hectares de terres agricoles, affectant ainsi 42% de ses sols (Lefebvre et al., 2015). La gestion agro-environnementale concerne l'influence du secteur agricole sur la qualité de l'environnement, cette dernière étant essentiellement un bien public (c'est-à-dire non exclusif et non rival). La qualité de l'environnement nécessaire pour la production de certains services écosystémiques (comme la potabilité de l'eau, la respirabilité de l'air, la capacité à accueillir la biodiversité, etc.) est caractérisée par une dynamique de seuil, impliquant que le bien public n'est produit que lorsque les efforts des agents atteignent ou dépassent un seuil donné. Dans ce texte, je me focalise sur les seuils de qualité nécessaires permettant la fourniture de certains services écosystémiques, traitant ainsi la qualité de l'environnement comme un bien public avec seuil<sup>1</sup>. L'atteinte du seuil déclenche un changement dans les paramètres définissant la qualité de l'environnement. On appelle ce fonctionnement le mécanisme de point de provision - la provision du bien public est assurée lorsque les efforts collectifs franchissent le seuil. Tant que des niveaux d'effort plus élevés conduisent à une qualité de l'environnement proportionnellement plus élevée, la production du bien public continuera à augmenter au-delà du seuil. Cela indique une fonction de production qui augmente de façon continue au-dessus de la valeur du seuil. Il existe trois caractéristiques inhérentes aux dynamiques du seuil qui causent des conflits d'intérêts entre les acteurs

---

<sup>1</sup> En général, la qualité de l'environnement n'est pas définie par rapport à la dynamique de seuil, car elle varie de façon continue. Par exemple, une diminution des polluants dans l'eau va améliorer la qualité de l'eau. Cependant, tant que la quantité des polluants ne se trouve pas sous un certain seuil réglementaire, l'eau ne va pas être considérée comme potable. Dans ce texte, je considère donc la qualité de l'environnement uniquement par rapport aux seuils permettant d'atteindre la provision de services écosystémiques (comme la potabilité de l'eau).

individuels et l'optimum social. Premièrement, une incertitude importante sur la valeur du seuil existe (Milinski et al., 2008, Dannenberg et al., 2015, Dupraz et al., 2009). Ainsi, des acteurs averses au risque peuvent ne pas être disposés à s'engager dans des efforts qui conduisent à des résultats incertains. Deuxièmement, plusieurs acteurs doivent mettre en commun leurs efforts afin d'atteindre le seuil car aucun acteur à lui seul ne peut produire suffisamment d'effort pour atteindre le seuil. Troisièmement, tous les efforts et coûts mis en oeuvre par les agriculteurs ne pourront pas être récompensés dans l'optique où le seuil ne serait pas atteint.

Le dilemme entre les acteurs individuels et l'optimum social survient lorsque les efforts sont coûteux pour l'individu, et qu'il est dans l'intérêt privé de l'individu d'engager le moins d'effort possible (Alberti et Cartwright, 2015, Rondeau et al., 1999). L'optimum social nécessite la production du bien public, et considère la valeur du seuil qui déclenche le mécanisme de point de provision comme point focal pour la coordination des efforts collectifs (Alberti et Cartwright, 2015, Bouma et al., 2018). Il convient de noter qu'en raison de la fonction de production croissante décrite plus haut, la provision maximale du bien public Pareto-domine tous les équilibres de Nash au sein desquels la combinaison d'efforts des agents atteint exactement la valeur du seuil.

Certains services écosystémiques, le contrôle de la bioinvasion, la protection de la biodiversité ou la protection de la qualité de l'eau, peuvent être considérés comme biens publics environnementaux avec seuil (Zavalloni et al., 2019). Dans la mesure où les systèmes agro-écologiques sont étroitement liés à la fourniture de services écosystémiques, ils nécessitent un contrôle réglementaire (Prager et al., 2020). Un défi majeur dans la compréhension des effets sur l'écosystème est posé par les dynamiques complexes et interconnectées inhérentes aux réaction des écosystèmes. L'identification des pratiques agro-environnementales appropriées pour la fourniture de services écosystémiques nécessite une connaissance approfondie des circonstances locales, ainsi que des interactions entre l'écosystème et le système social au sein duquel l'agriculture est intégrée. En raison d'incertitude élevée concernant la valeur du seuil du bien public (le niveau de protection de l'environnement requis), la conception des politiques doit tenir compte d'une multitude de facteurs écologiques, sociaux et économiques (Prager et al., 2020). Ceci constitue une tâche exigeante et complexe nécessitant des jugements d'experts et l'implication des acteurs locaux.

Une multitude d'origines de pollution, dont la pollution diffuse du secteur agricole, est illustrée dans la Figure 1, dans le contexte d'une aire de captage. Le secteur agricole travaille et façonne les terres principalement pour tirer du profit de la production de biomasse, tout en influençant la qualité de l'environnement (Lefebvre et al., 2015). En raison des pratiques d'agriculture intensive (monocultures, utilisation de pesticides et

d'engrais, etc.), la pollution par les sources agricoles affecte négativement la qualité de l'environnement. Dans la mesure où les produits agricoles sont commercialisés sur les marchés, les producteurs dépendent de la génération de revenus provenant de leur activité agricole. Par conséquent, l'objectif commercial du secteur agricole est de maximiser la productivité de la ferme, et donc la production du bien privé. Pour les producteurs, il n'est donc pas économiquement rationnel de considérer le bien public si ce dernier n'est pas directement lié à la productivité de la ferme (Saunders, 2015).

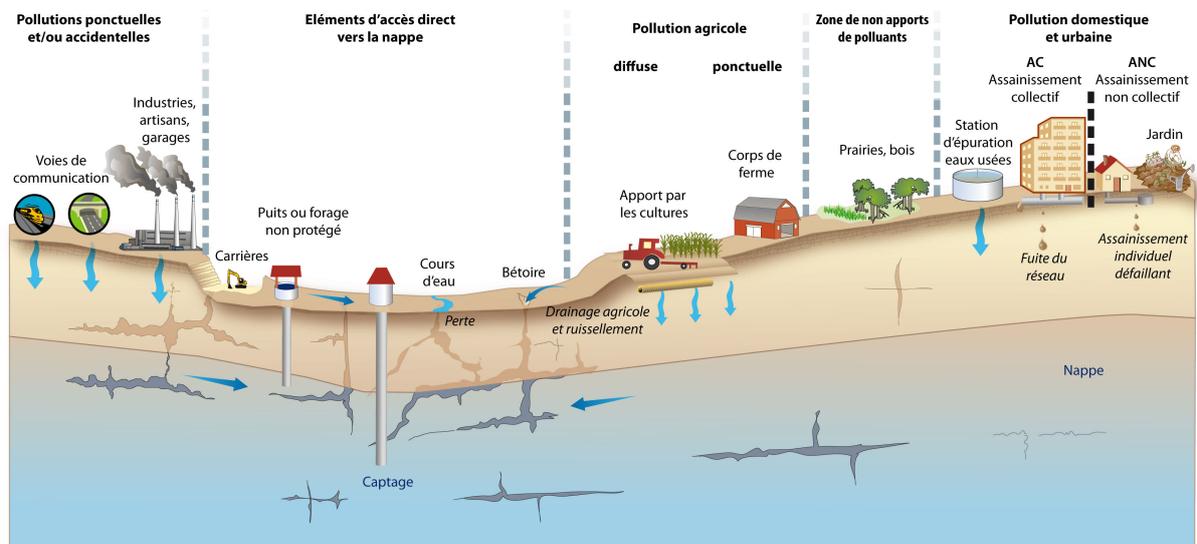


Figure 1 – Pollution diffuse du bassin versant. Source: Evreux.fr

La “tragédie des biens communs” (Hardin, 1968) résulte du conflit entre les intérêts (agricoles) individuels et l’optimum social. Le dilemme social de la production insuffisante de biens publics (Olson, 1965) et des ressources communes surexploitées (Hardin, 1968) suggère la nécessité d’une gouvernance afin d’équilibrer les intérêts économiques privés et les préoccupations publiques de qualité de l’environnement (Prager et al., 2020). Des mécanismes de régulation, tels que des sanctions (le pollueur paie) ou des incitations à la participation (le bénéficiaire paie) ont été proposés (Saunders, 2015, Wang et al., 2013). Ce sont des approches fondées sur le marché, c’est-à-dire qu’elles “institutionnalisent la demande et l’offre de biens et services écologiques” (Saunders, 2015, p.6). La position normative sous-jacente à cette approche de régulation est que les agriculteurs doivent être punis s’ils causent une qualité de l’environnement inférieure au niveau socialement souhaitable et récompensés s’ils génèrent une qualité de l’environnement supérieure au niveau minimum acceptable (ibid). En reconnaissant que l’activité agricole est nécessaire afin d’assurer l’approvisionnement alimentaire, les agriculteurs peuvent être vus comme fournisseurs

potentiels de services écologiques. En ce sens, les Paiements pour Services Ecologiques (PSE) cherchent à “internaliser ce qui serait autrement une externalité” (Saunders, 2015, p.6). Un type de PSE qui cible exclusivement le secteur agricole sont les mesures agro-environnementales et climatiques (MAEC), où les États membres de l’Union Européenne (UE) agissent en tant qu’acheteurs de biens ou de services (publics) environnementaux auprès des agriculteurs par le biais d’arrangements contractuels (ibid.). S’appuyant sur l’engagement volontaire des agriculteurs, l’approche MAEC contribue à éviter la stigmatisation des agriculteurs, qui sont autrement facilement considérés comme pollueurs dans le cadre d’approches réglementaires obligatoires (ibid). L’objectif des MAEC est de contrecarrer les effets négatifs de l’agriculture intensive en réduisant la pollution des sols et de l’eau, ainsi qu’en protégeant et en restaurant la biodiversité (Kuhfuss et al., 2019, Kleijn et Sutherland, 2003).

### **0.0.2 La politique agro-environnementale en Europe**

La Politique Agricole Commune (PAC) a été introduite en 1962 afin de moderniser le secteur agricole de l’UE et d’assurer l’approvisionnement alimentaire (Thomas et al., 2019). Actuellement, la PAC est l’instrument de financement le plus important pour l’agriculture au sein de l’UE (55 milliards d’euros par an), représentant 41% du budget total de l’UE en 2011 (ibid). Étant donné qu’elle influence la gestion de la majorité des exploitations agricoles, la PAC a le potentiel d’avoir un impact sur la qualité des terres de l’UE (Lefebvre et al., 2015). En 1992, les MAEC ont été introduites comme éléments centraux de la PAC. Les MAEC constituent un contrat volontaire entre agriculteurs et l’État, “en vertu [desquelles] le gouvernement détermine unilatéralement à la fois les récompenses et les obligations de participation, ainsi que les critères d’éligibilité” (Segerson, 2013, p.4). Afin de se conformer à des pratiques spécifiques de gestion environnementale sur un horizon de cinq ans (Dupraz et Pech, 2007), les agriculteurs perçoivent des subventions censées compenser leurs efforts supplémentaires. Depuis 1994, les MAEC sont devenues un élément obligatoire dans les plans de développement rural de tous les États membres de l’UE (Westerink et al., 2017). Les MAEC sont cofinancées par le Fonds Européen Agricole pour le Développement Rural (FEADER) et par les États membres eux-mêmes (Prager, 2015). Le budget de l’UE pour les paiements des MAEC s’élève à 2,5 milliards d’euros par an (Westerink et al., 2017), ce qui représente environ 22% des dépenses de l’UE pour le développement rural entre 2007-2013 (Lastra-Bravo et al., 2015, Kuhfuss et al., 2019). À ce jour, environ 25% des terres agricoles de l’UE sont contractualisées dans le cadre d’une MAEC (ibid). Les États membres de l’UE sont chargés de spécifier les mesures agricoles exactes en fonction de leurs objectifs environnementaux respectifs. Bien que cela offre de la flexibilité au niveau national, cela introduit également

une diversité considérable entre les régimes nationaux (Prager, 2015). La majorité des MAEC sont définies par des pratiques agricoles spécifiques plutôt que par l'obtention de résultats environnementaux (Prager et al., 2020). Ainsi, ces MAEC sont conçues afin de dédommager les agriculteurs pour des pratiques agricoles coûteuses qui peuvent néanmoins générer des résultats environnementaux positifs (Saunders, 2015). Le niveau de rémunération proposé par les MAEC aux agriculteurs dépend des coûts d'opportunité et des coûts de transaction associés aux exigences du contrat (Lastra-Bravo et al., 2015). Les coûts sont déterminés à travers des moyennes régionales sur une multitude d'exploitations diverses, de sorte que souvent les paiements sur- ou sous-compensent la situation individuelle de l'exploitation (Thomas et al., 2019). Dans cette thèse, j'utilise le terme de *subvention* pour désigner les compensations que les agriculteurs reçoivent dans le cadre de la mise en oeuvre d'une pratique particulière, alors qu'un paiement *incitatif* irait au-delà d'une simple compensation des coûts (Saunders, 2015).

Bien que les actions spécifiques des agriculteurs soient plus faciles à quantifier et à surveiller que les résultats environnementaux (Saunders, 2015, Prager et al., 2020), leur efficacité en tant que catalyseur du changement environnemental a été remise en question à plusieurs reprises dans la littérature. Malgré le budget considérable de l'UE pour les MAEC, la plupart des écosystèmes continue à se dégrader à travers l'Europe. Conséquemment, les MAEC ont été critiquées pour un manque de clarté dans leurs objectifs politiques, un suivi insuffisant, un manque de flexibilité et une faible compatibilité avec les traditions agricoles (Birge et Herzon, 2019), ainsi qu'en tant qu'outil coûteux et difficile à concevoir (Batáry et al., 2015). La principale critique se réfère à leur caractère volontaire, qui entraîne une participation insuffisante (Dupraz et al., 2009). Cette critique est directement liée aux effets de seuil discutés précédemment : la qualité de l'environnement ne change pas à moins que suffisamment d'effort collectif soit fourni sur un territoire donné. Alors que les agriculteurs sont libres de choisir les contrats les moins coûteux, l'hétérogénéité considérable des exploitations agricoles implique une incongruence dans les pratiques adoptées parmi les différents agriculteurs d'une même région (Dupraz et al., 2009). Les problèmes qui en résultent sont à la fois ceux de la sélection adverse et des effets d'aubaine (pour les agriculteurs qui auraient également adopté les pratiques proposées en absence de paiements), ainsi que le manque d'additionnalité entre les régimes et le manque de coordination spatiale (Kuhfuss et al., 2016). Le manque de coordination spatiale implique qu'il n'existe pas d'espace cohérent pour l'adoption d'un même contrat, et donc que le seuil implicite au changement environnemental ne sera souvent pas atteint. Dupraz et al. (2009) notent que la conception des politiques néglige généralement les effets de seuil, ce qui entraîne un gaspillage de fonds publics.

Cette relation négative entre l'efficacité de la MAEC (individuelle et volontaire) et

le budget qui leur est consacré a inspiré la poursuite de mesures plus rentables et plus efficaces sur le plan environnemental (par exemple Birge et Herzon, 2019, Kuhfuss et al., 2016, Dupraz et al., 2009). Un premier pan de la littérature a abordé le potentiel des approches axées sur les résultats, c'est-à-dire reflétant directement la valeur économique des services écosystémiques, comme “une voie potentielle à suivre pour surmonter les obstacles des approches existantes” (par exemple Birge et Herzon, 2019, Prager et al., 2020). Birge et Herzon (2019) ont présenté des preuves de l'acceptabilité d'un projet agro-environnemental hypothétique basé sur les résultats dans le cadre de la biodiversité des prairies en Finlande. Néanmoins, les contrats axés sur les résultats sont économiquement controversés car les résultats environnementaux sont souvent retardés et influencés par de multiples sources (Figure 1) qui peuvent inclure des facteurs externes tels que les sécheresses, les incendies de forêt ou la bioinvasion (Prager et al., 2020). Ainsi, les contrats basés sur les résultats peuvent mettre l'agriculteur en situation de ne pas être en mesure de générer les résultats environnementaux désirés (ibid.). Cependant, les contrats basés sur les résultats laissent la flexibilité aux agriculteurs de choisir des pratiques appropriées. Ils peuvent alors utiliser leurs connaissances du contexte écologique spécifique, ce qui peut permettre l'émergence de pratiques agricoles plus adaptées (ibid.).

Un deuxième courant de recherche s'intéresse aux facteurs comportementaux dans la conception des MAEC (par exemple, Burton et Wilson, 2006, Lastra-Bravo et al., 2015, Saunders, 2015, Sutherland et al., 2013, Thomas et al., 2019). L'influence des facteurs non-pécuniers est souligné à travers l'engagement des agriculteurs sur le long terme (Saunders, 2015). L'accent est mis sur les caractéristiques endogènes, telles que les attitudes, les perceptions, les comportements et les identités des agriculteurs au sein de leur groupe social. En reconnaissant que la diversité entre les individus et l'hétérogénéité spatiale des exploitations façonnent la sphère agricole (Burton et Wilson, 2006), l'accent est mis sur le contexte social dans lequel les agriculteurs agissent. Les normes sociales, les incitations et les notions de productivité sont considérés comme étant des facteurs imbriqués - plutôt qu'isolés - dans la volonté des agriculteurs d'adopter des pratiques environnementales (Saunders, 2015). Les chercheurs en économie comportementale et expérimentale ont démontré, à travers des expériences menées en laboratoire et sur le terrain, que les solutions à de nombreux dilemmes de bien public nécessitent une modification du comportement sur le long terme. Ainsi, les interventions les plus efficaces permettent de surmonter l'inertie et de changer les habitudes. Dans cette perspective, les préoccupations de réciprocité et de réputation sont les principaux moteurs de la coopération (Kraft-Todd et al., 2015).

Un troisième courant de recherche, même s'il ne vient que d'émerger, examine le potentiel de l'approche collective à la gestion agro-environnementale (par ex. Westerink et al., 2017, Zavalloni et al., 2018, 2019). Cet intérêt a été stimulé par la reconnaissance

que les MAEC individuelles ne se sont pas montrées efficaces en termes de coordination des efforts individuels par rapport au seuil inhérent aux dilemmes environnementaux spatialement définis. Par conséquent, cette recherche reconnaît la nécessité de coordonner les activités entre plusieurs exploitations afin d’obtenir des résultats à l’échelle du territoire ou du bassin versant (Prager et al., 2020, Kleijn et Sutherland, 2003). Selon cette conception, la coordination spatiale et l’adaptation des mesures aux besoins locaux devraient améliorer les taux de participation et être bénéfiques dans la gestion de nombreux problèmes, tels que les espèces mobiles avec de grandes aires de répartition, la qualité de l’eau et la gestion des inondations (Bamière et al., 2013, Kuhfuss et al., 2016, Prager, 2015, Kleijn et Sutherland, 2003). Par conséquent, les MAEC collectives sont considérées comme plus efficaces que les contrats individuels (Prager, 2015, Westerink et al., 2017). Étant relativement récente dans l’arène politique, la dimension collective des contrats est à ce jour un domaine d’innovation contractuelle peu exploré (Kuhfuss et al., 2016). Ainsi, il n’est pas surprenant que notre compréhension de la volonté des agriculteurs à coopérer au sein d’une MAEC collective soit encore limitée (Riley et al., 2018). Le travail de cette thèse combine l’approche des deux derniers courants recensés de la littérature en étudiant le potentiel collaboratif de la politique agro-environnementale à travers le prisme de l’économie comportementale. L’objectif principal de ma thèse est de développer une meilleure compréhension des outils politiques qui soutiennent et facilitent la gestion agro-environnementale à l’échelle collective. Les considérations à la fois comportementales et collectives sont pertinentes et étroitement liées, car l’ensemble des relations entre les agriculteurs déterminent leurs dispositions collectives, et car ces relations évoluent au fil du temps et ne s’appliquent pas uniformément à toutes les activités agricoles (Riley et al., 2018). Cela signifie que nous ne pouvons pas supposer que la coopération des agriculteurs dans un contexte - par exemple les achats d’équipement partagé - se traduit directement dans un autre contexte - par exemple la protection de l’environnement. Ainsi, cette thèse contribue à la littérature existante en mettant en évidence les dynamiques comportementales et relationnelles de la prise de décision des agriculteurs en matière de pratiques environnementales dans un contexte de coopération entre fermes.

### 0.0.3 Pourquoi des incitations collectives ?

*La coopération et l’action collective pourraient constituer des réponses au double défi d’alimenter une population croissante et d’utiliser durablement et efficacement les principales ressources naturelles.* - (traduit de Zavalloni et al. 2019, p. 479).

S’agissant essentiellement d’un dilemme d’action collective au sein d’un territoire défini, l’hypothèse sous-jacente aux MAEC collectives est que celles-ci garantiront la fourniture

de biens publics avec seuil - tels que la qualité de l'environnement - de manière plus efficace (Prager et al. 2020, Westerink et al. 2017). Cependant, l'incertitude concernant la conception des contrats collectifs et leur mise en œuvre persiste parmi les décideurs politiques ainsi que dans la littérature académique. Les discussions récentes se sont concentrées sur les éléments financiers des politiques publiques ainsi que sur des cas hypothétiques (Riley et al. 2018), comme les taux de participation minimums, les taux de surface contractualisée, ou encore le nombre minimum d'agriculteurs engagés (Zavalloni et al. 2019). Des expériences de choix hypothétiques ont été menées proposant alternativement des primes de coalition, des primes d'agglomération ou des paiements compensatoires homogènes (Zavalloni et al. 2019, Kuhfuss et al. 2016a). Dans un modèle théorique, Zavalloni et al. (2019) utilisent une contrainte de participation minimale afin de rémunérer exclusivement les agriculteurs coopérant sous un contrat collectif (et non pas tous les agriculteurs éligibles à la participation). Ils trouvent que ces paiements sélectifs sont relativement plus efficaces pour coordonner les efforts des agriculteurs, car ils assurent une coalition d'agriculteurs plus stable que les paiements (traditionnels) homogènes. Ils notent aussi que les conditions sous lesquelles les primes collectives deviennent efficaces dépendent des caractéristiques du système agricole dans lequel les paiements sont mises en œuvre, et que cela nécessite une connaissance détaillée des conditions locales. Ce constat est corroboré par les conclusions de Bamière et al. (2013), qui affirment qu'il n'existe pas de consensus scientifique sur la configuration spatiale optimale pour l'efficacité environnementale, car celle-ci dépend des besoins des écosystèmes locaux. Bien que les MAEC soient traditionnellement déployées au niveau régional, ces observations soulignent la nécessité d'une recherche interdisciplinaire sur la gouvernance de la coopération locale, notamment à la lumière de l'hétérogénéité considérable des exploitations agricoles.

Outre le rôle des incitations et des paiements compensatoires, il a été reconnu - au moins dans la théorie académique - que les valeurs environnementales liées à la production agricole constituent la base d'une MAEC collective culturellement durable au sein d'une communauté d'agriculteurs (Emery et Franks 2012). En accordant un soutien aux agriculteurs dans la transition agroécologique, la MAEC devrait être accompagnée d'interventions comportementales et d'une visibilité accrue des résultats et des succès environnementaux obtenus à travers des pratiques agricoles durables. Ainsi, les procédures bureaucratiques devraient être réduites au minimum et être accompagnées d'opportunités de conseil et de formation (Birge et Herzon 2019). Un suivi culturel qui s'inscrit dans les idéaux de "bonne agriculture" pourrait être intégré par les communautés d'agriculteurs (ibid). Formellement, la gouvernance des MAEC collectives nécessite l'adaptation des mesures au contexte local (Birge et Herzon 2019), aux relations inter-agriculteurs (Riley et al. 2018, Emery et Franks 2012), et au soutien institutionnel (Prager et al. 2020). Par

conséquent, la politique agroenvironnementale doit concevoir des institutions adéquates afin d'aborder la gestion des biens publics environnementaux, en ciblant plusieurs strates, dont trois ont été définies par Lefebvre et al. (2015) : (1) une perspective plus large du territoire au niveau de l'exploitation; (2) la coordination des actions des agriculteurs au niveau du territoire; et (3) la fourniture de services écologiques par l'agriculture en tant que bien public mondial. Nous allons maintenant nous pencher sur le rôle des institutions dans la résolution de ces problèmes de gestion agro-environnementale à l'échelle collective.

#### 0.0.4 Institutions d'action collective pour les MAECs

Le soutien financier à la collaboration entre agriculteurs a été rendu possible par le FEADER, qui autorise les “approches conjointes des projets environnementaux et des pratiques environnementales en cours, y compris (...) la préservation des paysages agricoles” (article 35, 2g) et par la reconnaissance par l'UE que “les actions conjointes impliquent des coûts de transaction supplémentaires qui devraient être compensés de manière adéquate” (article 5) (Prager 2015, p. 59). Bien que la collaboration entre agriculteurs dans le cadre de pratiques environnementales ait émergé de manière informelle et graduelle, celle-ci a influencé la . Néanmoins, la question se pose : quel cadre institutionnel permet d'accompagner et de faciliter la réforme de la PAC pour la période 2014-2020, dans la mesure où les demandes de groupes d'agriculteurs pour des MAEC collectives ont été pour la première fois rendues possibles (cf. Règlement (UE) n° 1305/2013, article 28) (Prager et al. 2020, Kuhfuss et al. 2016a) améliorer au mieux la gestion collective de l'environnement par les agriculteurs? Prager et al. (2020) distinguent deux situations pour la gestion agro-environnementale: celles qui nécessitent une coordination et celles qui nécessitent une coopération entre agriculteurs. Les situations nécessitant la coordination exigent que les parties prenantes s'accordent initialement sur un objectif commun. Ensuite, le recours à un gestionnaire (externe) permet de les aider à atteindre leur objectif. Dans ce cas, aucune collaboration directe entre les agriculteurs n'est nécessaire. En revanche, les situations nécessitant la coopération demandent l'alignement des intérêts entre les différentes parties prenantes, de longues négociations ainsi que la résolution potentielle de conflits, dans l'objectif de parvenir à un accord commun. Dans ce cas, la communication directe entre les agriculteurs et les autres parties prenantes est nécessaire avant même la mise en place du contrat, et la collaboration directe est essentielle afin de soutenir le projet commun. Les règles d'application, qui peuvent être distinguées entre institutions formelles et informelles, sont liées à ces deux situations d'action collective (Prager et al. 2020). Les règles d'application formelles, comprenant entre autres les règlements, les lois, ou la jurisprudence, sont de nature paternaliste et prescrivent les actions requises. Les comportements qui ne sont pas conformes aux règles formelles sont en principe suivis d'une sanction

## RÉSUMÉ DÉTAILLÉ

(ibid). Les règles informelles sont plus libertaires et comprennent entre autres les codes, les coutumes, ou encore les normes implicites et intégrées dans les interactions sociales (ibid.). Un comportement incompatible avec les règles informelles peut être suivi de sanctions sociales telles que l'ostracisme, bien qu'elles ne puissent être appliquées légalement puisqu'elles ne sont pas explicitement codées. Les deux types d'institutions façonnent et conditionnent ce que les acteurs peuvent, devraient et ne devraient pas faire. Ainsi, l'intérêt d'une analyse institutionnelle réside dans la découverte des règles produisant un certain comportement, ainsi que dans l'optimisation de ces règles afin de susciter un comportement plus (socialement) souhaitable (ibid). Dans ce sens, nous considérons différents types d'institutions permettant de soutenir une gestion agro-environnementale collective. Le tableau 1 recense la gamme d'outils politiques disponibles pour la gestion de la qualité de l'environnement dans le secteur agricole, le long d'un spectre allant du paternalisme au libetarisme : de la réglementation paternaliste, où le choix est supprimé, en passant aux incitations traditionnelles par les prix, où le choix est restreint, à la réglementation libertarienne, où le choix est informé, et enfin aux nudges (coups de pouce), où le choix est préservé (adapté de Barnes et al. 2013).

Contraindre le choix					Conserver le choix			
Régulation paternaliste		Incitations pécuniaires			Régulation libertaire		Coups de pouce	
Éliminer le choix	Restreindre le choix	Paiement positif	Paiement négatif	Economies	Persuasion	Information Boost	Type 1	Type 2
Interdictions	Lois	Subventions	Impôts	Bons de réduction	Appel à la morale	Meilleures pratiques	Option par défaut	Rappel
Prohibitions	Règles	Primes	Amendes	Programme de fidélité	Conseils	Consulting	Emotions	Saillance
	Contrats	Récompenses			Prévention	Formation	Priming	Normes sociales

Table 1 – Gamme d'interventions politiques allant de la restriction du choix à la préservation du choix. Adapté de l'échelle de Nuffield présentée dans Barnes et al. (2013, p.449).

Dans la recherche de modèles contractuels innovants pour les MAEC, Prager et al. (2020) ont identifié quatre aspects qui sont pertinents afin de stimuler la fourniture de biens public environnementaux avec seuil, tout en promouvant une agriculture économiquement viable. Il s'agit (i) des caractéristiques de l'écosystème local (ce qui est géré), (ii) des technologies,

infrastructures et pratiques disponibles (comment c'est géré), (iii) des acteurs impliqués, de leurs caractéristiques et de leurs relations mutuelles (qui gère), et (iv) des institutions formelles et informelles qui régissent la gestion agro-environnementale collective. Ces caractéristiques déterminent ensuite si l'approche collective est une approche de coopération ou de coordination. Les dispositions institutionnelles actuelles en faveur de la gestion agro-environnementale collective comprennent surtout des interventions réglementaires (par exemple, des exigences de verdissage), des campagnes d'information, des services de conseil, la coopération inter-agricole ou encore des accords volontaires tels que les MAEC (Lefebvre et al. 2015, Kuhfuss et al. 2019). La littérature suggère principalement de développer davantage l'aspect formel du cadre institutionnel. Les éléments proposés pour la conception des MAEC collectives comprennent les enchères pondérées dans l'espace (attribution des contrats en fonction des offres de paiements compensatoires des agriculteurs), des contrats collectifs et conditionnels (fixation d'un seuil de participation qui constitue un point focal pour la coordination et renforce la motivation sociale), le malus d'agglomération (incitation à une configuration spatiale de parcelles qui constituent une mosaïque aléatoire) et le bonus d'agglomération (incitation à des configurations locales de parcelles connectées dans l'espace) (Kuhfuss et al. 2019, Zavalloni et al. 2019, Bamière et al. 2013). Alors que ces instruments tendent davantage vers le côté paternaliste du spectre institutionnel (Figure 1), certains chercheurs plaident pour une réglementation moins formelle qui s'appuie surtout sur la promotion de la responsabilité individuelle et sur le changement de comportement durable par le biais des normes sociales (Barnes et al. 2013, Saunders 2015, Lastra-Bravo et al. 2015, Sutherland et al. 2013).

Le côté libertaire des outils politiques est lié aux travaux d'Elinor Ostrom, qui a proposé des "principes de conception" pour la gestion des ressources communes dans des communautés de petite taille (Ostrom 1990). Sur la base de cette première approche de règles informelles, Agrawal (2001) a catégorisé ensuite 16 critères de réussite de l'action collective, parmi lesquels sont recensés les caractéristiques des ressources, les caractéristiques du groupe, les arrangements institutionnels, l'infrastructure externe ou encore les relations entre ces différentes catégories. L'auteur milite pour une approche statistique plus comparative, en utilisant ces critères comme variables critiques dans les études de cas. L'approche la plus fréquente de l'analyse institutionnelle, l'étude de cas approfondie, a été largement utilisée afin d'évaluer les principes institutionnels de la gouvernance durable des ressources (Prager et al. 2020). Les études de cas permettent d'acquérir une compréhension globale des systèmes complexes et de leurs dynamiques spécifiques au contexte (Westerink et al. 2017). Cependant, en vertu de leur nature spécifique au contexte, les conclusions ne peuvent souvent pas être généralisées au-delà du système local examiné. De plus, cette approche a été critiquée pour son individualisme méthodologique et la

négligence fréquente des forces structurelles et globales du marché (Prager et al. 2020). Néanmoins, les systèmes écologiques étant très complexes et dépendant du contexte local, la gestion optimale des biens publics environnementaux avec seuil doit être identifiée au cas par cas (ibid).

La partie nudging (coup de pouce) du spectre institutionnel comprend les nudges automatiques de type 1 et les nudges délibérés de type 2. Ces derniers ont été mobilisés principalement afin d'influencer la consommation des ménages, mais leur potentiel pour la transition agro-écologique n'a été évalué que de manière hypothétique, et ces évaluations ont souvent été limitées à de petites expériences. L'élément le plus prometteur pour soutenir l'action collective semble être le pouvoir des normes sociales (Barnes et al. 2013). Dans ce sens, les associations locales d'agriculteurs ont démontré qu'elles offraient des avantages plus larges à leurs membres, au-delà de la qualité de l'environnement et de la viabilité économique de la profession agricole (Kuhfuss et al. 2019, Lastra-Bravo et al. 2015). En outre, il a été constaté que la cohérence sociale augmentent la participation aux MAEC (Burton et Wilson 2006), et que la confiance dans les autres agriculteurs et les institutions est la principale source d'une coopération réussie entre agriculteurs (Lastra-Bravo et al. 2015). En outre, la crédibilité institutionnelle, la communication par le biais de messagers de confiance (tels que les conseillers agricoles), la visibilité des externalités positives générées par les pratiques agroécologiques et les faibles coûts de suivi et de contrôle, ont vu la confiance des agriculteurs dans les MAEC s'accroître (Lastra-Bravo et al. 2015, Sutherland et al. 2013). La dimension comportementale des arrangements institutionnels - représentés par les règles informelles et l'environnement social - constitue donc un point de levier important pour favoriser la gestion collaborative agri-environnementale.

### **0.0.5 Enjeux pour les MAEC collectives**

La littérature académique a identifié la nécessité pour les politiques agro-environnementales d'orienter les incitations vers la gestion à l'échelle du territoire et de créer un environnement de collaboration approprié entre les agriculteurs (Zavalloni et al. 2018). Les défis comprennent la motivation de collaborer entre les agriculteurs et les autres parties prenantes, la mise en place de politiques cohérentes dans le temps, et la réduction de l'incertitude quant aux résultats environnementaux et économiques pour les agriculteurs (Dupraz et al. 2009, Zavalloni et al. 2018). Les coûts liés aux traditions, au désir de conformité sociale, à l'information incomplète, ou encore aux coûts de transaction et d'opportunité ont tous été répertoriés comme des obstacles à l'engagement dans la gestion agroenvironnementale collective (par exemple, Franks 2011). Étant donné que ces défis sont de nature sociale mais aussi économique, ils doivent être abordés à travers une

combinaison d’options institutionnelles comprenant à la fois des incitations financières et comportementales. Comme l’indique Dupraz et al. 2009, p. 627 : “Les communautés locales ont un rôle clé à jouer dans la conception progressive de programmes agroenvironnementaux qui maintiennent la motivation et la coopération entre les différents acteurs. L’implication des conseils locaux et régionaux doit être soulignée.” Les spécificités locales des écosystèmes et la complexité sociale des réseaux d’agriculteurs suggèrent qu’il n’existe pas d’approche unique.

En résumé, l’état actuel de la littérature académique a identifié le besoin d’approches collectives de la politique agro-environnementale, mais n’est pas concluant sur la forme institutionnelle la plus appropriée. De plus, il existe à l’heure actuelle peu de résultats concrets provenant de données de terrain concernant les incitations collectives pour la MAEC. Par conséquent, cette thèse propose d’étudier une série d’approches de la gestion collective de l’environnement pour le secteur agricole. A cet égard, je m’intéresse au potentiel des incitations collectives pour la politique agro-environnementale à travers la discussion de leurs fondements théoriques, l’analyse quantitative de leur application sur le terrain, et la présentation de témoignages provenant des parties prenantes et des praticiens. Par conséquent, la thèse propose de nouvelles perspectives afin d’affiner l’étude des incitations collectives dans le cadre des MAEC, et fournit des implications pour l’élaboration et la mise en œuvre des politiques publiques.

## 0.0.6 Aperçu de la thèse

La question centrale qui a guidé le travail de cette thèse est la suivante : Quel est le potentiel des incitations collectives dans la politique agro-environnementale Européenne? Ce potentiel des incitations collectives pour la politique agro-environnementale est étudié à travers le prisme de l’économie comportementale. Afin d’aborder cet objectif, cinq chapitres sont présentés dans le cadre de cette thèse.

Le premier chapitre compare les résultats d’expériences en laboratoire et en lab-in-field de deux types de dispositifs de subvention dans le cadre d’un jeu de bien public avec seuil. Le deuxième chapitre présente une étude de cas sur une mesure agro-environnementale et climatique (MAEC) collective qui constitue essentiellement une version appliquée du bien public avec seuil. Le troisième chapitre comprend une analyse économétrique plus détaillée des données de la MAEC collective. Le quatrième chapitre discute le rôle des associations d’agriculteurs dans la mise en œuvre de la MAEC collective. Le cinquième chapitre propose une conception d’atelier participatif afin d’identifier le potentiel des interventions comportementales, telles que les nudges, pour la politique agro-environnementale.

En étudiant la validité externe d’un mécanisme de subvention collective et conditionnelle, cette recherche passe progressivement de la comparaison de résultats décontextu-

alisés d'étudiants en laboratoire aux résultats contextualisés d'agriculteurs en lab-in-field (chapitre 1), aux données de terrain d'une MAEC collective au niveau agrégé (chapitre 2), et ensuite aux décisions de contractualisation des agriculteurs au niveau individuel (chapitre 3). Le débat concernant le potentiel de la MAEC collective est renforcé à travers une discussion d'une structure associative pour la coordination entre agriculteurs (Chapitre 4) et à travers la présentation d'une méthodologie interactive pour le développement d'interventions comportementales sous la forme de nudges verts (Chapitre 5).

La structure de la thèse est définie par ses chapitres indépendants qui sont résumés ci-dessous.

### Chapitre 1

Le chapitre 1 présente une étude expérimentale sur deux mécanismes de subvention. Face à l'adoption insuffisante et dispersée de contrats agro-environnementaux individuels, les subventions qui sont conditionnées à un seuil d'effort collectif pourraient apporter une solution viable. J'étudie ainsi l'efficacité de telles incitations collectives pour les contrats agro-environnementaux. En particulier, je teste deux types de subventions. Dans un premier cas, la subvention est attribuée de manière inconditionnelle, que le seuil soit atteint ou pas, dès lors que l'individu contribue. Dans un second cas, la subvention est conditionnée à l'atteinte du seuil, c'est-à-dire que la subvention n'est déclenchée seulement si une superficie minimum de terres agricoles est contractualisée sur un territoire donné. En raison de données manquantes sur ces incitations collectives, notamment des données de terrain, leur validité externe n'est pas encore établie. Je contribue à cette question de recherche en comparant les données contextualisées du lab-in-field avec des agriculteurs à des données décontextualisées en laboratoire obtenues avec des étudiants (Le Coent et al. 2014). Cette étude cherche à (i) reproduire les résultats initiaux prometteurs du laboratoire et (ii) établir une validité externe pour le mécanisme d'incitation collective. En particulier, l'étude vise à répondre à deux questions de recherche : Les résultats du laboratoire sont-ils reproductibles en lab-in-field ? et La subvention conditionnelle est-elle un instrument acceptable pour les agriculteurs? Les effets du traitement sont comparés entre les deux expériences : laboratoire et lab-in-field. Nous partons d'un protocole décontextualisé d'un jeu de bien public avec seuil (TPGG), pour lequel deux traitements sont étudiés: une subvention inconditionnelle et une subvention conditionnelle. Nous contextualisons ensuite le cadre du TPGG et réalisons une expérience de lab-in-field avec des agriculteurs. Ainsi, nous sommes en mesure de comparer les résultats du TPGG décontextualisé mené au sein du laboratoire avec les étudiants (Le Coent et al. 2014) au TPGG contextualisé sous la forme d'une expérience en lab-in-field appliquée directement à notre population cible, les agriculteurs.

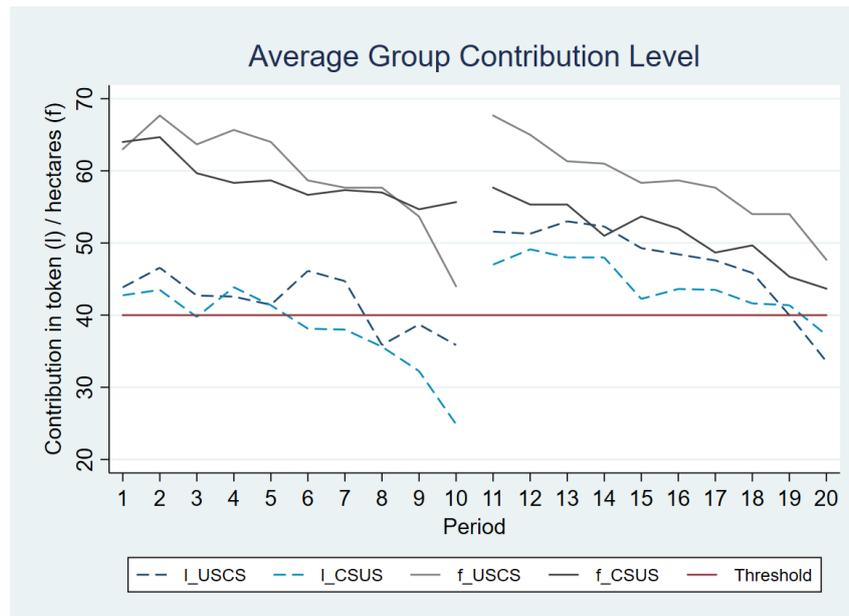


Figure 2 – Les moyennes de contributions par séquence et par traitement des expériences en laboratoire (l) et en terrain (f).

Les résultats montrent que les agriculteurs coopèrent davantage que les étudiants. Dans une comparaison intra-sujet avec deux séquences (figure 2), le mécanisme de subvention conditionnelle permet de mieux coordonner les contributions dans la seconde séquence, en laboratoire et sur le terrain (lab-in-field), tout en maintenant des résultats plus efficaces et plus stables avec les agriculteurs.

Cette étude contribue à la littérature sur les incitations pour le secteur agricole dans le pilotage de la transition agroécologique. En identifiant le mécanisme de subvention conditionnelle comme un outil acceptable et efficace afin d’inciter la coopération entre agriculteurs pour des pratiques plus écologiques, cette première étude fournit la base pour les chapitres suivants, qui approfondissent la dimension collective des politiques agro-environnementales.

## Chapitre 2

Le chapitre 2 présente et analyse de nouvelles données issues d’une MAEC collective mise en place pour la protection de l’espèce du Grand hamster d’Alsace (*crictus crictus*). Ayant été considéré longtemps comme une espèce nuisible, le Grand hamster a été chassé en Alsace jusqu’aux années 1990. Ces pratiques l’ont amené sur la voie de l’extinction en provoquant une forte diminution de sa population (Figure 3). Etant aujourd’hui classée comme espèce protégée, des mesures sont mises en oeuvre afin de réinstaurer un habitat favorable à sa survie. La MAEC collective repose sur une subvention conditionnelle à un taux minimum de participation collective dans des zones de protection d’habitat du

hamster. Le mécanisme de subvention conditionnelle incite la coordination des efforts au sein des groupes d'agriculteurs. En ce sens, ce mécanisme de subvention est assez proche de la subvention conditionnelle mobilisée dans les expériences du chapitre 1. Cette étude répond à l'incertitude existante sur la capacité des mesures collectives à atteindre les objectifs environnementaux souhaités, en adressant la question de recherche suivante : Les données de terrain confirment-elles l'efficacité environnementale de l'incitation collective de la MAEC? Une analyse quantitative de l'approche collective de ce dispositif agro-environnemental est menée au niveau des groupes d'agriculteurs. L'analyse utilise des techniques statistiques visant à lier la participation globale à la MAEC collective aux résultats environnementaux, afin de conclure sur l'efficacité environnementale d'un tel dispositif collectif. Les résultats montrent que les contributions de surface dépassent largement la valeur du taux minimum (figure 4 et que les petits groupes d'agriculteurs font des contributions proportionnellement plus importantes que les grands groupes. L'effort collectif des agriculteurs est positivement lié à une amélioration de la qualité de l'environnement.

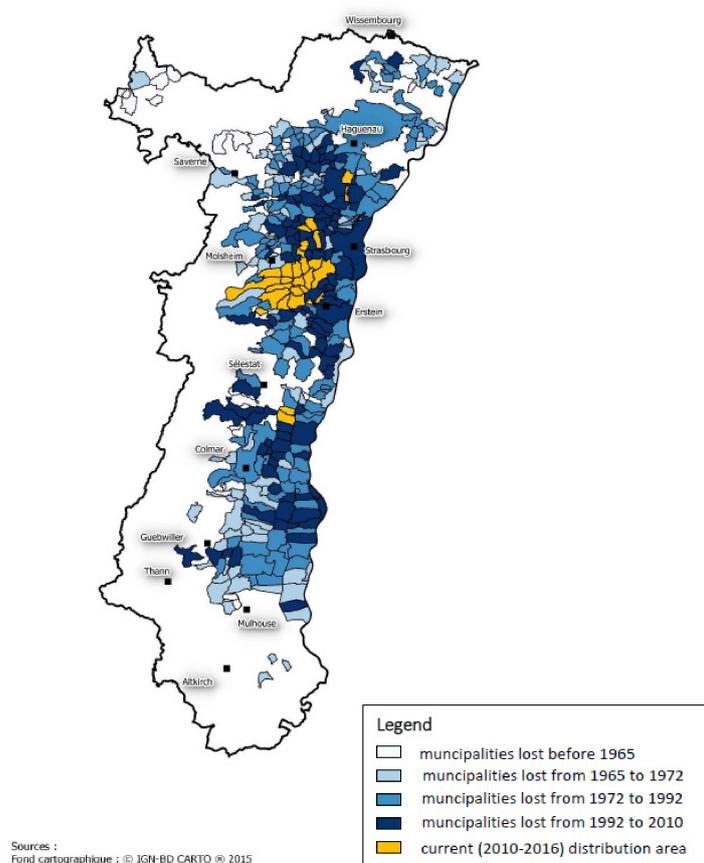


Figure 3 – Evolutions des secteurs de distribution du Grand hamster d'Alsace au cours du temps.

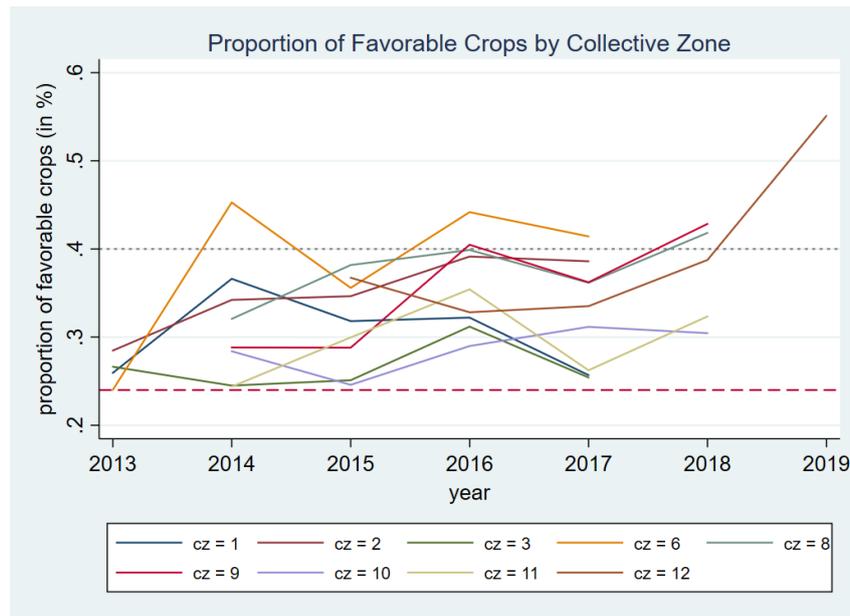


Figure 4 – Rate of favorable crops by collective zones per calendar year since the start of cAES in 2013. Note. The threshold is situated at .24 (dashed line), the ceiling is situated at .4 (dotted line).

Ces résultats provenant du terrain sont importants afin de valider les résultats des expériences en laboratoire et en lab-in-field. Ces résultats fournissent ainsi une validité externe pour le mécanisme de subvention conditionnelle. En présentant de rares données de terrain sur une MAEC collective, l'efficacité d'un tel mécanisme d'incitation est mise en avant. De plus, cette étude a montré que la coopération entre agriculteurs sur un territoire commun bénéficie de (i) la présence d'une association d'agriculteurs modératrice, (ii) la flexibilité dans la conception des contrats et (iii) la visibilité des résultats environnementaux obtenus grâce au programme.

### Chapitre 3

Le chapitre 3 se concentre sur la façon dont les agriculteurs s'organisent et se coordonnent au fil du temps afin de fournir de manière permanente un habitat favorable à la survie du Grand hamster. Dans ce but, les zones collectives au sein du périmètre de protection du Grand hamster sont étudiées en détail (Figure 5). Des zones collectives sont créées autour d'une commune agricole si les agriculteurs de cette commune arrivent à se mettre d'accord pour engager ensemble suffisamment de territoire favorable pour le Grand hamster. Une fois que la zone collective est créée, les agriculteurs peuvent bénéficier de la subvention conditionnelle au taux minimal de surface favorable.

Afin de comprendre ce qui pousse les agriculteurs à contribuer dans le cadre d'une MAEC collective proposant à un régime de subvention collective et conditionnelle, deux questions sont abordées : Qu'est-ce qui détermine la participation à la MAEC collective

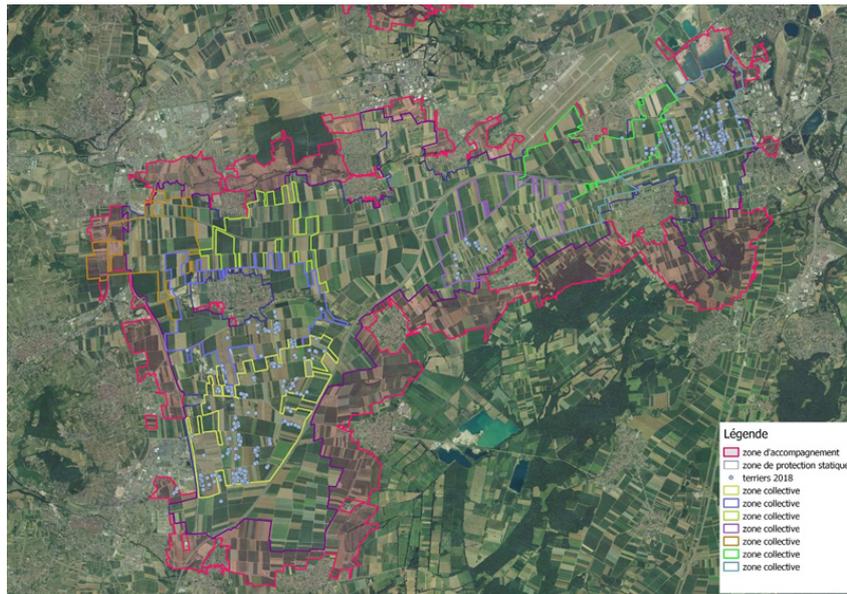


Figure 5 – Zone de protection stricte du grand hamster (périmètre rouge) groupant les zones collectives (autres périmètres colorés). *Source: DREAL 2018, PNA 2019-2028, p. 118*

? et Qu'est-ce qui détermine la taille de la surface contribué à la MAEC collective ? L'analyse des données de la MAEC collective se concentre sur la contribution individuelle de chaque agriculteur. J'utilise des techniques économétriques d'estimation de panel et de correction pour la sélection. L'analyse économétrique a pour but d'identifier les facteurs déterminants de la participation des agriculteurs à la MAEC collective, ainsi que les facteurs déterminants leurs contributions de surfaces. Les résultats révèlent que plus la surface de l'agriculteur dans la zone de protection est élevée, plus la contribution à la MAEC collective est importante. Les groupes plus nombreuses produisent légèrement plus de participants et le plus de surface une exploitation a dans la zone collective le plus probable il est qu'elle participe dans la MAEC collective (tableau 2). La surface de l'exploitation dans la zone influence aussi positivement les contributions de celle-ci sous le dispositif. Cependant, la taille du groupe influence légèrement négativement les contributions individuelle de surface au contrat collectif.

Sur la base des modèles de contribution individuelle au sein des groupes, une typologie de contributeurs est proposée. A notre connaissance, il s'agit de la première étude fournissant une analyse économétrique des données d'une MAEC collective avec subvention conditionnelle. Par conséquent, elle contribue à la littérature académique en introduisant de nouvelles données de terrain, et aux politiques publiques en montrant que le défi, lorsqu'il s'agit de proposer des subventions collectives et conditionnelles, consiste à cibler de manière appropriée les exploitations influentes tout en déterminant une taille de groupe appropriée pour chaque contrat collectif.

Table 2 – Probit for P(Asso=1) on cross section by year

VARIABLES	(1) Y2013	(2) Y2014	(3) Y2015	(4) Y2016	(5) Y2017	(6) Y2018
Gs	0.0560** (0.0276)	0.0184 (0.0208)	0.0152 (0.0172)	0.0402*** (0.0126)	0.0444*** (0.0140)	0.0497*** (0.0163)
multi	0.832 (0.543)	0.276 (0.315)	0.151 (0.255)	0.450* (0.242)	0.275 (0.228)	-0.117 (0.249)
Surf	0.00760 (0.00772)	0.00497 (0.00518)	0.00729 (0.00501)	0.00384 (0.00457)	0.00205 (0.00364)	0.00382 (0.00351)
ratio_CZ	8.572** (3.384)	20.54*** (4.234)	12.03*** (2.821)	15.73*** (3.048)	18.50*** (3.185)	16.35*** (2.855)
CY1		-0.415** (0.209)	-0.755* (0.437)			
Constant	-1.228** (0.518)	-0.616 (0.456)	-0.603* (0.348)	-1.202*** (0.291)	-1.339*** (0.304)	-1.350*** (0.306)
Pseudo $R^2$	0.1664	0.2033	0.1293	0.1598	0.1796	0.1997
Observations	73	212	244	249	252	249

Standard errors in parentheses (no clustering).

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

## Chapitre 4

Le chapitre 4 évalue le potentiel des associations d'agriculteurs, telles que les coopératives environnementales (CE), en termes de gestion de contrats collectifs. Les conventions collectives telles que les MAEC collectives doivent être coordonnées, ce qui implique un processus complexe réunissant plusieurs acteurs et une planification sur un horizon de 5 ans. Lorsqu'elles sont dirigées par une structure associative, les activités de coordination peuvent être centralisées et homogénéisées. Je cherche à comprendre comment les communautés d'agriculteurs s'organisent et se coordonnent afin de s'assurer d'obtenir des contributions suffisantes au contrat collectif. L'étude cherche à répondre à deux questions : Quel rôle la CE assume-t-elle dans la gestion des contrats collectifs ? et Quelle forme d'organisation est la mieux adaptée ? A l'aide d'une étude de cas du Grand hamster, la nature complexe et spécifique d'une CE est étudiée. Afin de pouvoir contractualiser la MAEC collective, les agriculteurs doivent adhérer à une association (la CE). Le tableau 3 montre l'évolution des membres de la CE au cours des premières années du dispositif collectif.

Year	2013	2014	2015	2016	2017	2018
Association Member	44	118	138	143	136	127
Total Farms	73	212	244	249	252	249
Ratio Group Size	0,60	0,56	0,57	0,57	0,54	0,51

Table 3 – Nombre de membres de la coopérative environnementale par année.

Ce chapitre passe en revue les études de cas récentes tirées de la littérature sur la collaboration des agriculteurs et présente les entretiens que j’ai mené - dans le cadre de l’étude de cas - avec le président de la CE ainsi qu’avec quatre agriculteurs adhérents. Les entretiens montrent que le rôle de la CE est avant tout un rôle de facilitateur et d’intermédiaire entre les différents groupes d’intérêt dans la gestion agro-environnementale. L’objectif de la CE est de permettre l’application de la MAEC collective en garantissant trois critères contractuels importants : (1) des objectifs environnementaux adaptés au contexte local, (2) la flexibilité dans la conception et l’adaptation des contrats, (3) la participation active des agriculteurs. A travers son rôle dans la conception et dans l’implémentation de la MAEC collective, la CE s’avère être un acteur clé de ce dispositif. La CE est fondée sur la confiance des agriculteurs et reflète la situation agricole spécifique au contexte local. Une forme organisationnelle démocratique et participative est recommandée afin que la CE puisse fonctionner comme une institution centrale dans la gestion des contrats collectifs.

Cette analyse qualitative contribue à résoudre l’incertitude qui prévaut parmi les décideurs publiques et au sein de la communauté académique sur la conception des contrats collectifs dans le secteur agricole. Le fonctionnement d’une CE est décrit en détail comme étant une institution de facilitation et de médiation. Les avantages tant pour les agriculteurs que pour les autorités publiques sont soulignés. Cette étude contribue ainsi à la littérature émergente sur la gouvernance collaborative d’une MAEC.

## Chapitre 5

Le chapitre 5 examine le potentiel des interventions comportementales en complément des incitations financières pour la MAEC collective. Bien que les agriculteurs opèrent dans un contexte commercial, un intérêt pour des alternatives aux incitations monétaires traditionnelles et pour une forme plus libérale de la politique agro-environnementale est en train d’émerger. Dans le cadre d’une politique économique durable, la question est de savoir comment aligner les intérêts économiques et environnementaux avec les pratiques agricoles. Les nudges verts proposent de réaliser cette congruence d’intérêts tout en préservant la liberté de choix, à un coût faible et de manière efficace. Cependant,

en ce qui concerne la politique agro-environnementale, la question de savoir si le nudge peut être un instrument politique efficace fait encore l'objet d'un débat. Étant donnée la large gamme d'options pour la promotion de la qualité de l'environnement, il est important d'identifier quand, comment, et à qui appliquer les nudges verts. La question de recherche abordée par cette étude est : Quelles sont les caractéristiques des nudges verts permettant un recours plus important aux pratiques pro-environnementales dans le secteur agricole, particulièrement dans le cadre de la transition agroécologique ? Une méthodologie d'atelier participatif est développée dans le but d'identifier et de concevoir les nudges verts les plus adaptés à la problématique agro-environnementale. Tout d'abord, une revue des études récentes sur les nudges verts pour le secteur agricole ainsi que de leurs implications éthiques est présentée. Deuxièmement, je propose un cadre mettant en relation des situations comportementales avec leur nudge correspondant, et je développe une méthodologie pour l'atelier qui est ensuite appliquée à des acteurs en France (Figure 6). Les praticiens dans notre atelier ont identifié six thèmes clés qui constituent des obstacles



Figure 6 – Discussions en groupes pendant l'atelier participatif.

au changement de pratiques agricoles. Ceux-ci incluent l'inconscience des responsabilités et de l'impact personnel, la peur du changement, la peur de perdre son statut social, et l'inquiétude par rapport à un manque de guidance, de garanties de succès, et de rentabilité. Par conséquent, le nudge doit répondre à au moins deux caractéristiques : rendre les efforts des agriculteurs visibles pour la communauté, et favoriser le leadership local. Ce travail contribue à la littérature émergente sur le potentiel et les limites des nudges verts dans la politique agro-environnementale. L'atelier avec des praticiens constitue un outil viable pour améliorer les programmes agro-environnementaux.

Afin de sélectionner les bonnes interventions, l'atelier vise à identifier des outils pour aider différents niveaux du gouvernement et des communautés d'agriculteurs dans la mise en oeuvre de mesures agro-environnementales pertinentes. En suggérant une méthodologie

pour développer des nudges verts au sein d'un atelier participatif, une conception impliquant toutes les parties prenantes est proposée, et peut être appliquée à une multitude de contextes agro-environnementaux.

La thèse conclue par un aperçu des résultats présentés lors des cinq chapitres, leur principaux points à retenir et leurs limites. Je discute les implications pour la recherche universitaire, la conception de politiques publiques et les praticiens du domaine, et je termine sur une discussion des perspectives de recherches futures.

### 0.0.7 Principales Conclusions

Ce travail fournit une série de résultats sur le potentiel des incitations collectives pour la politique agro-environnementale. Premièrement, le mécanisme de subvention collective et conditionnelle a montré des résultats prometteurs, générant à la fois une coopération accrue et une augmentation des contributions dans le cadre des MAEC collectives. Initialement testé dans un cadre de laboratoire, la transposition sur le terrain donne un premier indicateur de validité externe au mécanisme de subvention conditionnelle. Ce résultat est renforcé par l'analyse des données d'un contrat collectif mis en oeuvre en France. En transposant l'analyse de la conditionnalité collective sur le terrain (lab-in-field), la validité externe des résultats expérimentaux est confirmée. En particulier, les données de terrain montrent que les contributions des agriculteurs dans le cadre du contrat collectif vont bien au-delà de la valeur seuil pour toutes les années du contrat. En plus de la participation collective réussie, la MAEC aide à coordonner les agriculteurs afin de fournir un territoire agricole connecté favorable à la survie de l'espèce (*cricetus cricetus*). Ce travail a montré que le système de subvention collective et conditionnelle a le potentiel de soutenir efficacement une participation (collective) des agriculteurs aux pratiques agro-environnementales, lorsque ceux-ci sont confrontés à la provision d'un bien public environnemental avec seuil. La subvention conditionnelle pourrait donc constituer un outil viable dans les politiques agro-environnementales.

Deuxièmement, les étudiants dans un laboratoire universitaire ne ressemblent pas nécessairement à la population concernée (dans notre cas, les agriculteurs), et le contexte décisionnel parfaitement contrôlé ne ressemble pas non plus à celui des interactions complexes de la vie réelle. Néanmoins, le laboratoire permet de tester l'effet d'un instrument politique indépendamment d'autres facteurs. En effet, les résultats de Le Coent et al. (2014) ont attesté un impact positif des régimes de subventions conditionnelles sur la facilitation de la coopération en laboratoire. Dans leur étude, cet effet se montre en l'absence d'enjeux réels ou de facteurs d'influence, comme les intérêts concurrents et la communication entre acteurs. Par conséquent, nous ne pouvons pas conclure qu'un mécanisme d'incitation testé en laboratoire fonctionnera de la même manière dans un

environnement décisionnel plus complexe. Cependant, le laboratoire est un moyen peu coûteux et assez simple à organiser pour obtenir une première impression de l'effet d'un instrument d'incitation sur les décisions. Dans une étape ultérieure, en se basant sur les résultats prometteurs de Le Coent et al. et en se rapprochant du contexte décisionnel réel, nous avons réalisé un lab-in-field. Ce cadre d'expérience plus proche du terrain nous permet d'observer comment la population concernée réagit à l'incitation proposée. Il est intéressant de noter que les contributions moyennes des agriculteurs sont systématiquement plus élevées que celles des étudiants, et qu'elles restent supérieures à la valeur du seuil pendant toutes les périodes du jeu. Bien que pour les deux échantillons, le mécanisme de subvention conditionnelle suscite des contributions plus élevées dans la deuxième séquence, nous pouvons conclure qu'en moyenne les agriculteurs coopèrent avec plus de succès que les étudiants, car ils obtiennent des résultats plus efficaces au cours du temps. Rétrospectivement, l'expérience en laboratoire nous a renseignés sur la direction de l'effet du traitement, tandis que le lab-in-field affine les paramètres de l'effet en fonction de la population cible.

Troisièmement, l'analyse des données réelles de la MAEC collective nous permet d'affiner notre compréhension de l'influence du mécanisme de subvention conditionnelle. Les résultats révèlent que la MAEC collective permet à des groupes d'agriculteurs d'adapter leurs contributions en surface afin de répartir les efforts environnementaux au sein de leur zone sur un territoire agricole concentré. Malgré un délai assez long, cette coordination inter-agricole provoquée par le dispositif collectif semble avoir un impact positif sur la qualité de l'environnement. Cependant, les groupes d'agriculteurs les plus petits contribuent proportionnellement plus de surface dans leur zone de protection. Ce constat peut être approfondi en examinant de plus près les décisions individuelles des agriculteurs. Les groupes plus nombreux d'agriculteurs produisent relativement plus de participants, mais chaque agriculteur individuel apporte une contribution moins importante au contrat collectif. Cette relation entre la taille du groupe et les contributions en surface peut s'expliquer par les parts territoriales des exploitations dans la zone de protection. Ce sont les exploitations qui ont une grande influence territoriale dans la zone qui sont les plus susceptibles de contractualiser dans le cadre de la MAEC collective, et qui engagent en moyenne une surface plus importante dans le contrat collectif. Bien sûr, nous pouvons soupçonner que ceux qui ont le plus de territoire dans une zone collective peuvent également récolter le plus de bénéfices de la subvention collective, tout en assumant une plus grande responsabilité envers l'atteinte du seuil, en comparaison aux exploitations avec des parts territoriales marginales.

Quatrièmement, étant donné les différents modèles de contribution, il est intéressant de comprendre comment les agriculteurs parviennent à se coordonner dans leur envi-

ronnement décisionnel complexe, afin de coopérer avec succès dans le cadre du contrat collectif. Les associations d'agriculteurs, telles que les coopératives environnementales (CE), jouent un rôle important dans la gestion des contrats collectifs. Un examen plus approfondi de la structure organisationnelle montre que le rôle de la CE est avant tout un rôle de facilitation, de médiation entre les différents groupes d'intérêt. L'objectif de la CE est de permettre l'application de la MAEC collective dans le contexte local spécifique et d'assurer que les critères du contrat reflètent ces besoins locaux. La CE forme le capital social de la communauté des agriculteurs, car elle leur fournit une plateforme où exprimer leurs besoins en matière de soutien gouvernemental et où apprendre, comprendre, former et contrôler les pratiques agricoles. En augmentant la cohérence des attitudes des agriculteurs, en diminuant l'incertitude quant aux efforts des autres et en synchronisant la coordination spatiale, la CE peut constituer un instrument transparent, rentable, fiable et indispensable pour mettre en œuvre des contrats agro-environnementaux collectifs.

Cinquièmement, étant donné l'importance de la participation des agriculteurs dans la conception d'une MAEC collective réussie, il existe un potentiel d'interventions comportementales pour compléter les incitations financières existantes. Lors de l'atelier avec les acteurs et praticiens locaux, deux aspects critiques pour la gestion des pratiques agro-environnementales ont été identifiés. Tout d'abord, il est nécessaire de fournir un retour d'information fiable sur les efforts collectifs déployés dans le cadre de la MAEC collective, et de rendre les réalisations collectives visibles pour tous. Cela pourrait réduire la stigmatisation des agriculteurs (agribashing). Ainsi, les agriculteurs pourraient renforcer la reconnaissance sociale de leurs efforts. Ensuite, le leadership local est important pour guider les efforts collectifs et diffuser les meilleures pratiques parmi les agriculteurs. Le leadership local peut également s'avérer important pour accroître l'acceptation de ces interventions innovantes par les agriculteurs. Ainsi, il semble que des interventions comportementales innovantes, telles que les nudges verts, puissent coexister avec les compensations financières accordées par le biais des MAEC. Cependant, l'acceptabilité des nudges dans le contexte agro-environnemental doit d'abord être explorée. Néanmoins, en particulier dans le cas de la pollution diffuse, mais aussi pour d'autres défis agro-environnementaux, il ne suffira pas de cibler les agriculteurs. Bien que les subventions collectives et conditionnelles compensent les efforts collectifs des agriculteurs, et que les incitations peuvent améliorer l'efficacité et la portée des mesures traditionnelles telles que la MAEC, l'engagement des parties prenantes et des modifications structurelles sont tout aussi importantes dans la transition agroécologique. Comme l'indique les chapitre 4 et 5, le changement permanent des pratiques agro-environnementales repose sur le soutien et l'adaptabilité de tous les acteurs (producteurs, consommateurs, décideurs politiques) qui s'engagent dans le secteur agricole.

### 0.0.8 Implications pour les Politiques Publiques

Le mécanisme d'incitation collective conditionnelle a montré un effet prometteur dans le laboratoire, le lab-in-field et l'étude de cas. En fonction du service environnemental visé, le système de subvention conditionnelle peut constituer un outil politique efficace et acceptable pour les MAEC. Néanmoins, la dynamique des seuils environnementaux implique des processus plutôt lents, qui dépendent donc de la fourniture continue de services environnementaux. Les efforts agro-environnementaux - tels que la restauration de l'habitat des espèces - impliquent un délai important entre la première mise en œuvre des pratiques et la réalisation des résultats environnementaux. Par conséquent, la durée et la continuité des soutiens publiques doivent être adaptées et révisées à plusieurs reprises afin de fournir un soutien permanent et optimal aux agriculteurs. Il n'est pas réaliste d'attendre des résultats rapides d'une mise en œuvre initiale d'une MAEC, car le temps de réponse des paramètres de l'écosystème est systématiquement différé. Notamment, les cycles saisonniers déterminent la vitesse de changement de la qualité de l'environnement. Comme les conditions météorologiques, d'autres facteurs externes peuvent modérer l'influence des efforts agro-écologiques fournis. L'étude de cas a montré que grâce à une approche intégrative, impliquant l'association des agriculteurs, la chambre d'agriculture, l'office national de la chasse et de la faune sauvage, des chercheurs de différents domaines ainsi que d'autres parties prenantes, la conception et l'application de la mesure de protection des espèces peuvent prendre en compte les aspects divers du système socio-écologique. Grâce à cette approche intégrative, les récentes découvertes des biologistes sur les besoins de l'espèce en matière d'alimentation et de protection, par exemple, peuvent déboucher sur des recommandations précises en matière de pratiques agro-environnementales. Celles-ci peuvent alors être reprises dans le cahier des charges de la MAEC. De plus, cette MAEC comprend également une composante axée sur les résultats : la prime au terrier. La combinaison d'actions et d'incitations collectives basées sur les résultats pourrait atténuer les risques pour les agriculteurs et aligner les intérêts économiques et écologiques concurrents du secteur agricole. Bien que l'étude de cas porte sur un programme de protection d'une espèce très spécifique, le cas du Grand hamster d'Alsace est révélateur de l'ensemble de l'écosystème local (Virion 2018). Le hamster étant une espèce parapluie, les actions menées pour sa protection ont également un impact sur d'autres espèces telles que les insectes et les petits vertébrés qui partagent son habitat. Ensemble, l'état de cet écosystème influence la qualité des terres et vice versa. Ainsi, en s'intéressant aux sols riches en nutriments, le secteur agricole a en fait un intérêt important dans la survie des espèces locales. La mise en place des efforts en faveur de l'amélioration de la biodiversité à une échelle intégrative devrait donc être d'une importance prépondérante pour la gestion de la zone agroécologique concernée.

Cela implique également l'établissement d'une meilleure gestion des liens avec d'autres programmes existants, afin que les mesures ne soient pas contre-productives les unes les autres. Plutôt, les différentes mesures devraient se compléter et se soutenir dans un objectif global et cohérent. A cet égard, il faudrait souligner l'importance pour la conception des MAEC de prendre en compte les facteurs comportementaux. Les relations entre acteurs, la dynamique sociale, les attitudes, la culture et le potentiel de leadership constituent tous des éléments importants de la gestion agro-environnementale. Ces enjeux devraient donc être pris en compte de manière adéquate dans la conception des politiques, ainsi qu'être reflétés dans des conditions contractuelles flexibles et adaptables. Ainsi, l'intégration des incitations comportementales dans la politique agro-environnementale présente un large potentiel. Compte tenu du contexte économique dans lequel s'inscrit la production agricole, je considère les incitations comportementales comme un complément aux incitations financières dans la promotion d'un changement de comportement durable. Toutefois, des approches scientifiques rigoureuses sont fortement recommandées dans la conception des interventions comportementales, afin d'éviter des effets secondaires indésirables. Des tests pilotes en laboratoire et sur le terrain (tels que ceux présentés dans cette thèse), suivis d'une procédure d'évaluation, de modification et de réévaluation (dont plusieurs cycles, si nécessaire), devraient être considérés comme des composantes essentielles pour la conception d'une intervention comportementale.

En résumé, cette thèse contribue à la littérature sur les outils innovants des politiques agro-environnementales, et fournit des idées pour la gestion du pilotage de la transition agro-écologique. En fournissant une validité externe pour le mécanisme de subvention collective et conditionnelle, ce travail identifie un outil nouveau, efficace et acceptable pour inciter la coopération entre les agriculteurs en ce qui concerne l'effort environnemental. En outre, en étudiant la dimension collective d'un contrat collectif existant, des données rares provenant du terrain révèlent la relation entre la MAEC collective et les résultats environnementaux obtenus. Cette analyse est instructive pour l'élaboration des politiques, car elle met en lumière plusieurs défis liés aux incitations conditionnelles collectives. Premièrement, il sera utile de cibler de manière appropriée les agriculteurs influents de la communauté afin d'obtenir l'acceptation et la participation aux MAEC collectives. Deuxièmement, la détermination de la taille appropriée du groupe pour chaque contrat collectif va influencer le degré de collaboration entre les agriculteurs. Troisièmement, la conception des contrats collectifs et l'application des MAEC bénéficient de la présence d'une CE qui joue le rôle d'une institution de facilitation et de médiation entre les agriculteurs et les autorités publiques. Quatrièmement, les connaissances comportementales et la

participation des parties prenantes pourraient être bénéfiques dans l'objectif de concevoir des politiques agro-environnementales équitables et durables. Dans l'ensemble, ce travail contribue à la littérature existante sur les outils politiques innovants afin de soutenir une gouvernance collaborative pour les pratiques agro-environnementales.



# General introduction

## 0.1 Environmental Quality as a Threshold Public Good

In the European Union (EU), agricultural production represents 160 million hectares of farmland, thus affecting 42% of its grounds (Lefebvre et al. 2015). Agri-environmental management is concerned with the influence of the agricultural sector on environmental quality, the latter being essentially a public good (i.e. non-excludable and non-rival). The environmental quality that is necessary for the production of certain ecosystem services (such as the potability of water, the breathability of air, the capacity to accommodate biodiversity, etc.) is characterized by a threshold dynamic, implying that the public good is produced only when efforts reach or exceed a given threshold. In this text, I focus on the quality thresholds necessary for the provision of certain ecosystem services, thus treating the environmental quality as a threshold public good<sup>2</sup>. This means that the public good of environmental quality is only produced when efforts meet or exceed a given threshold. Meeting the threshold then triggers change in the parameters defining environmental quality. This is referred to as the provision point mechanism. Provided that higher effort levels lead to proportionally better environmental quality, the production of the public good is increasing beyond the threshold. Thus, we are not looking at a constant step return at and beyond the threshold value, but at a continuously increasing production function above the threshold value. There are three characteristics to these threshold dynamics that cause conflicts of interest between individual actors and the social optimum. First, substantial uncertainty about the location of the exogenous threshold for environmental change exists (Milinski et al. 2008, Dannenberg et al. 2015, Dupraz et al. 2009). Thus, risk averse actors may not be willing to engage in efforts that lead to uncertain outcomes. Second, multiple actors are required to pool collective efforts in order to reach the threshold. This means that no single actor alone can produce enough effort to reach the threshold. Third, the threshold public good of environmental quality does not grant any refund to efforts that come short of the threshold value. Therefore, all efforts made while the threshold is not reached are costly but are not rewarded through the inherent value of the public good. The conflict of interest between individual actors

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<sup>2</sup> In general, as environmental quality varies over a continuous scale, it is not defined with respect to a threshold dynamic. For example, a decrease in pollutants in the water will improve the quality of the water. However, as long as the quantity of pollutants is not below a certain regulatory threshold, the water will not be considered potable. In this text, I therefore consider the environmental quality only in relation to the thresholds that have to be met for the provision of ecosystem services (such as the potability of water).

and the social optimum arises as efforts are costly to the individual and it is in the individual's private interest to incur as little costs as possible (Alberti and Cartwright 2015, Rondeau et al. 1999). Contrarily, the social optimum demands the production of the public good and proposes the threshold value that triggers the provision point mechanism as a focal point for the coordination of collective efforts (Alberti and Cartwright 2015, Bouma et al. 2018). It should be noted that due to the increasing production function, the maximum provision of the public good Pareto dominates the efficient Nash equilibrium of any combination of efforts that exactly sum up to the provision point.

Examples of such environmental threshold public goods are some ecosystem services, bioinvasion control, biodiversity protection, and water management (Zavalloni et al. 2019). Because agroecological systems are intertwined with the provision of ecosystem services, they require regulatory attention (Prager et al. 2020). A major challenge in the evaluation of ecosystems are their locally specific and complex dynamics. The identification of appropriate agri-environmental practices for the provision of ecosystem services thus requires in-depth knowledge of the locally specific circumstances as well as on the interplay between the ecosystem and the social system within which agriculture is embedded. Due to the high levels of uncertainty on possible tipping points for environmental quality, policy design needs to take into account the multitude of ecological, social and economic factors it touches upon (ibid). This constitutes a demanding and complex task requiring expert judgements and the involvement of local actors.

A multitude of origins for non-point source pollution<sup>3</sup>, among which the agricultural sector, is illustrated in figure 0.1 on the example of a water catchment area. Agriculture works and shapes the land primarily to derive the private good of biomass production, while at the same time influencing the public good of environmental quality (Lefebvre et al. 2015). Due to intensive agricultural practices (including among others monocultures, the use of pesticides and fertilizers), pollution from agricultural sources affects environmental quality negatively. Because agricultural produce is traded in free markets, producers depend on revenue generation through their agricultural activity. Therefore, the business objective to farming is to maximize the productivity of the farm and thus the production

of the private good. For producers it is thus not economically rational to consider the public good of environmental quality if it is not directly related to the productivity of the farm (Saunders 2015).

The “Tragedy of the Commons” (Hardin 1968) results as individual farm interests conflict with the social and environmental optimum of unpolluted ecosystems. The social

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<sup>3</sup> Non-point source pollution is defined as pollution resulting from many different and not distinguishable sources.

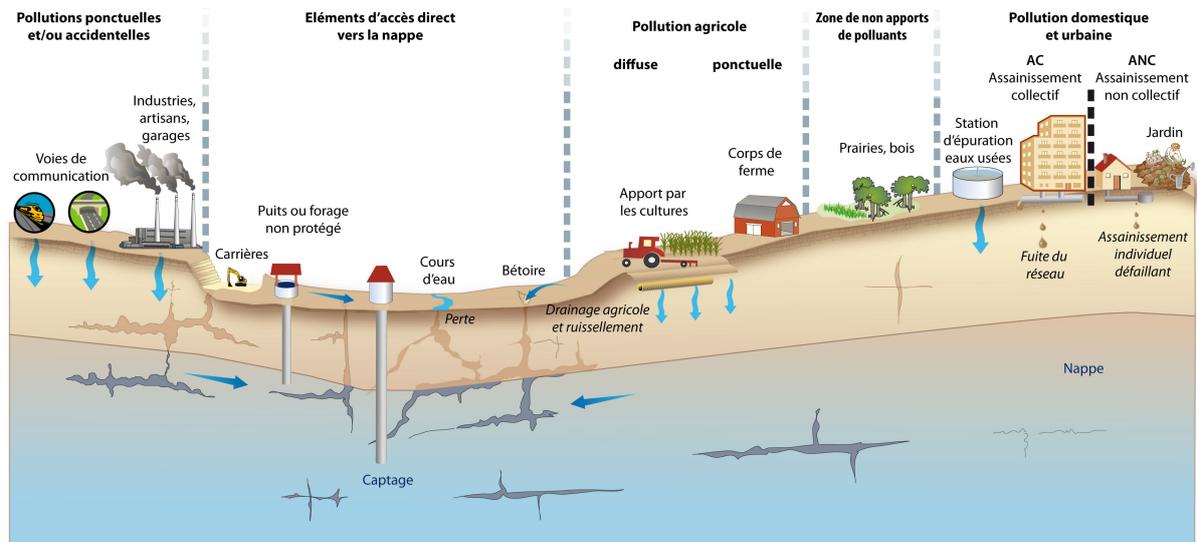


Figure 0.1 – Non-point source pollution for the water catchment area. Source: Evreux.fr

dilemma of public goods being underprovided (Olson 1965) and common pool resources being overused (Hardin 1968), implies the need for governance to balance private economic interests with public concerns of environmental quality (Prager et al. 2020). Regulatory mechanisms, such as costly punishment (polluter pays) and participation incentives (beneficiary pays), have been proposed (Saunders 2015, Wang et al. 2013). These are market-based approaches, that is they “institutionalize demand for and supply of ecological goods and services” (Saunders 2015, p.6). The normative stance to this regulatory approach is that farmers should be punished for causing environmental quality below the socially desirable level and rewarded for providing environmental benefits above the minimum acceptable level (ibid). In recognizing that the farming activity is necessary in ensuring food supply, farmers can be seen as potential providers of an ecological service. In this sense, payments for ecological services (PES) seek “to internalize what would otherwise be an externality” (Saunders 2015, p.6). A type of PES that are exclusively targeted at the agricultural sector are agri-environmental schemes (AES)<sup>4</sup>, where EU member states act as the purchaser of public environmental goods or services from individual farmers through contractual arrangements (ibid). Being based on the voluntary engagement of individual farmers, AES try to avoid the stigmatization of farmers otherwise readily seen as polluters under compulsory regulatory approaches (ibid). The overall objective of AES is to counteract the negative effects of intensive agriculture by reducing soil and water pollution, protecting and restoring biodiversity, and shaping landscapes (Kuhfuss et al. 2019, Kleijn and Sutherland 2003).

<sup>4</sup> in French : Mesures agro-environnementales et climatiques (MAEC)

## 0.2 Agri-Environmental Policy in Europe

The Common Agriculture Policy (CAP) was introduced in 1962 to modernize the European Union’s (EU) agricultural sector and to ensure food supply (Thomas et al. 2019). Presently, the CAP is the most important funding instrument for EU agriculture (€55 billion per year) making up for 41% of the EU’s total budget in 2011 (ibid). Given that it influences the management of the majority of agricultural land, the CAP has the potential to impact EU landscapes (Lefebvre et al. 2015). In 1992, AES were introduced as one central element to the CAP. AES are a voluntary contract between farmers and the state, “under which the government unilaterally determines both the rewards from and obligations of participation, as well as the eligibility criteria” (Segerson 2013, p.4). In exchange for complying with specific environmental management practices over a five year horizon (Dupraz and Pech 2007), farmers receive subsidy payments to compensate their transaction and opportunity costs. Since 1994, AES became a mandatory element in all EU member states’ Rural Development Plans (Westerink et al. 2017). AES are co-financed by the European Agricultural Fund for Rural Development (EAFRD) and the member states themselves (Prager 2015). The EU’s budget for AES payments amounts to €2.5 billion per year (Westerink et al. 2017) which represented around 22% of the EU expenditure for rural development between 2007-2013 (Lastra-Bravo et al. 2015, Kuhfuss et al. 2019). To date, approximately 25% of EU farmland is contracted under AES (ibid). The EU’s member states are responsible for specifying the exact AES measures according to their respective environmental goals. While this provides flexibility at the national level, it also introduces considerable diversity among national schemes (Prager 2015).

The majority of AES are action-based (also referred to as input-based) rather than results-based (also referred to as outcome-based) (Prager et al. 2020). Action-based AES are designed to compensate farmers for specific farming practices - costly actions - that are thought to result in environmental benefits (Saunders 2015). The level of payment proposed by the AES contract to the farmer depends on the income forgone (opportunity costs) and the additional expenses (transaction costs) associated with the requirements of the scheme (Lastra-Bravo et al. 2015). Costs are determined through regional averages over a multitude of heterogeneous farms, so that payments often either over- or under-compensate the individual farm situation (Thomas et al. 2019). In this text, I use the term *subsidy payment* to refer to compensations that farmers receive for implementing a particular AES measure, while an *incentive payment* would go beyond a simple transaction cost-offsetting compensation (Saunders 2015). Although the specific actions of farmers are easier to quantify and to monitor than environmental outcomes (Saunders 2015, Prager et al. 2020), their efficiency in achieving environmental change has been

repeatedly questioned in the literature. Despite the considerable EU budget for AES, ecosystem states continue to deteriorate across Europe. Action-based AES thus have been criticised for unclear policy aims, insufficient monitoring, lack of flexibility, and poor cultural sustainability (Birge and Herzon 2019) as well as for being expensive and difficult to design (Batáry et al. 2015). The major point of critique refers to their voluntary nature which results in insufficient participation (Dupraz et al. 2009). This issue is directly related to the environmental threshold effects discussed above: environmental quality does not change unless sufficient effort over a coherent territory is provided. While farmers are free to choose the least costly options and combinations of contracts, the considerable heterogeneity among farm characteristics results in a variety of different practices among neighboring farmers (Dupraz et al. 2009). The ensuing problems are those of adverse selection and windfall gains to farmers who would have adopted the proposed practices also in the absence of payments, lack of additionality between schemes, and lack of spatial coordination (Kuhfuss et al. 2016a). The latter implies that there is no coherent spatial pattern of adoption for the same contract and thus the tipping point for environmental change is not reached. Dupraz et al. (2009) note that policy design usually neglects threshold effects, leading to a waste of public funds.

This negative relation between the effectiveness of individual, voluntary, action-based AES and their budget has inspired the search for more cost efficient and environmentally effective measures (e.g. Birge and Herzon 2019, Kuhfuss et al. 2016a, Dupraz et al. 2009). One stream of literature has addressed the potential of results-based approaches, i.e. directly reflecting the economic value of ecosystem services, as “a potential way forward to overcome obstacles of the existing actions-based approach” (e.g. Birge and Herzon 2019, p.2), for example in mixed schemes Prager et al. (2020). Birge and Herzon (2019) have presented evidence for the cultural acceptability of a hypothetical results-based agri-environmental payment for grassland biodiversity in Finland. Nevertheless, results-based contracts are economically controversial as environmental outcomes are often delayed and influenced through multiple sources (figure 0.1) that can include external factors, such as droughts, natural forest fires, or bioinvasion, for instance (Prager et al. 2020). Thus, on the one hand, results-based contracts can put the farmer at risk of not being able to manifest environmental outcomes (ibid). On the other hand, results-based contracts leave the flexibility of choosing appropriate practices to the farmers, who can then capitalize on their local knowledge of the specific ecological context, which may produce innovative farming practices (ibid).

A further stream of research is looking at behavioral factors in the design of AES (e.g. Burton and Wilson 2006, Lastra-Bravo et al. 2015, Saunders 2015, Sutherland et al. 2013, Thomas et al. 2019). Non-economic factors are highlighted as influential in affecting

farmers participation in AES over the long term (Saunders 2015). An emphasis is given to endogenous characteristics, such as attitudes, perceptions, behaviour and identities of farmers within their social community, recognizing that diversity, non-linearity and spatial heterogeneity among farms shape the EU's agricultural sphere (Burton and Wilson 2006). The roles of social norms, incentives and notions of productivity are considered as intertwined - rather than isolated - factors in farmers' willingness to adopt environmental practices (Saunders 2015). These insights are born out of the broader social sciences, with a significant input from behavioral and experimental economics. Laboratory and field research across different economic contexts has demonstrated that solutions to many real-world public goods dilemmas require long-term behavior modification, that successful interventions will help to overcome inertia and change habits and that reciprocity and reputation concerns are major driving forces to cooperation (Kraft-Todd et al. 2015).

Yet another stream of research, albeit in its infancy, is looking at the potential of collective approaches to agri-environmental management (e.g. Westerink et al. 2017, Zavalloni et al. 2018, 2019). This interest has been spurred through the acknowledgement that individual AES have not shown effective in coordinating individual efforts with regard to the collective effort threshold inherent to spatially defined environmental dilemmas. Hence, this research recognizes the need for coordinating activities to achieve outcomes at the landscape or catchment scale (Prager et al. 2020, Kleijn and Sutherland 2003). Spatial coordination and the tailoring of measures to local needs are argued to enhance participation rates and to be beneficial in the management of many environmental problems, such as mobile species with larger ranges, water quality and flood management (Bamière et al. 2013, Kuhfuss et al. 2016a, Prager 2015, Kleijn and Sutherland 2003). Therefore, inter-farm collaborative approaches for AES are considered as more effective than individual schemes (Prager 2015, Westerink et al. 2017). Being relatively novel in the policy arena, the collective dimension of contracts is to date a rather under-explored area of contract innovation (Kuhfuss et al. 2016a). Thus, it is little surprising that our understanding of farmers' willingness to cooperate for AES is still limited (Riley et al. 2018).

The work of this thesis combines the approach of the two latter strands of literature in investigating the collaborative potential for agri-environmental policy through the lens of behavioral economics. **The principal objective of my thesis is thus to develop a better understanding of which policy tools support and facilitate collective agri-environmental management.** Both behavioral and collective considerations are relevant and necessarily connected as the historically shaped farming relations underpin farmers' collective dispositions (Riley et al. 2018). Although these relations are temporally layered, they are not universal to all farming activities (ibid). This means that we cannot assume that farmer cooperation from one context (e.g. purchases of

shared equipment) readily translates to another context (e.g. environmental protection). Therefore, this thesis contributes by highlighting the behavioral and relational dynamics of farmer decision making with respect to environmental practices in light of inter-farm cooperation.

### 0.3 Why collective incentives ?

*Cooperation and collective action could be one of the answers to the double challenge of feeding an increasing population and the need for today's agriculture to sustainably and efficiently use key natural resources. - (Zavalloni et al. 2019, p.479)*

Being essentially a spatially defined collective action dilemma, the underlying assumption to a collaborative approach for AES is that this will ensure the provision of threshold public goods such as environmental quality more effectively (Prager et al. 2020, Westerink et al. 2017). However, uncertainty about the design of collective contracts and their implementation persists among policy makers and within the academic literature. The recent discussion has focused on the structural elements of schemes and on hypothetical cases (Riley et al. 2018). Examples are Minimum Participation Rules (MPR) either with respect to the surface of land contracted or on a minimum number of farmers engaged (Zavalloni et al. 2019). Hypothetical choice experiments have been conducted that alternatively propose coalition bonuses, agglomeration bonuses or homogeneous compensation payments (Zavalloni et al. 2019, Kuhfuss et al. 2016a). In a theoretical model, Zavalloni et al. (2019) use the MPR to discriminate between groups of cooperating farmers and non-members and find that this is relatively more effective for coordinating farmers efforts than the traditional homogeneous payments. They further realize that the conditions under which collective bonuses become effective depend on the characteristics of the specific agricultural system in which they are implemented and that this requires a detailed knowledge of the local conditions. This is supported by the findings of Bamière et al. (2013) who argue that there is no overall scientific consensus on the optimal spatial pattern for environmental effectiveness which depends on the local ecosystem needs. Although AES are traditionally rolled out on a regional level, these insights clearly highlight the need for interdisciplinary research on governance of local cooperation in the light of considerable farm heterogeneity in a complex agroecological context.

Next to the role of incentives and compensation payments, it has been recognized, at least in academic theory, that environmental and production-related values form the

basis of culturally-sustainable collaborative AES within a farmer community (Emery and Franks 2012). In granting support to farmers in the agroecological transition, AES should be accompanied by behavioral interventions and increased advice and training opportunities, minimally reduced bureaucratic procedures, increased visibility of environmental results and successes achieved through sustainable farming practices and integrated cultural monitoring by peers that fits within ‘good farming’ ideals (Birge and Herzon 2019). Despite this growing awareness, only very few policy instruments have been developed to take into consideration these issues of spatial aspects to scheme design (Bamière et al. 2013), the tailoring of measures to the local context (Birge and Herzon 2019), inter-farm relationships (Riley et al. 2018, Emery and Franks 2012), and institutional support in the governance of collective AES (Prager et al. 2020). Consequently, agri-environmental policy needs to design adequate institutions in order to address the management of environmental threshold public goods by targeting multiple layers, three of which have been defined by Lefebvre et al. (2015): (1) a broader landscape perspective at the farm level; (2) the coordination of farmers’ actions at the landscape level; and (3) the provision of ecological services through agriculture as a global public good. We will now turn to the role of institutions in addressing these agri-environmental management issues.

## 0.4 Institutions for collective action in AES

Financial support for farmer collaboration has been made possible through the EAFRD in allowing for ‘joint approaches to environmental projects and ongoing environmental practices, including (...) the preservation of agricultural landscapes’ (Art. 35, 2g) and through the EU’s acknowledgement that ‘joint actions involve additional transaction costs which should be compensated adequately’ (Art. 5) (Prager 2015, p.59). Although farmer collaboration for environmental practices emerged informally and from the bottom-up, it has influenced the CAP reform for the period 2014-2020 for which applications by groups of farmers for collective AES were made possible (cf. Regulation (EU) No 1305/2013, article 28) (Prager et al. 2020, Kuhfuss et al. 2016a). Having been formally recognized, the question arises which institutional concept best accompanies and facilitates the collective environmental management by farmers.

Prager et al. (2020) distinguish between two collective action situations for agri-environmental management: those that require coordination and those that require cooperation among farmers. Accordingly, coordination situations require stakeholders to initially agree on a common goal and then to employ an external coordinator to achieve this goal by coordinating the individual stakeholders’ activities. In this case, no direct collaboration between the individual farmers is needed. Contrarily, cooperation situa-

tions require the alignment of diverse stakeholder interests, substantial negotiation and potential conflict resolution to reach a common agreement. In this case, direct communication between farmers and other stakeholders is required already before the setup of the contract and direct collaboration is essential for sustaining the common project. Related to those two collective action situations are the enforcement rules, which can be distinguished between formal or informal institutions (Prager et al. 2020). Formal enforcement rules are paternalistic in their nature, including regulations, laws, policies and legal principles, they prescribe which action is required. Conduct that is inconsistent with formal rules is in principle followed by a sanction (ibid). Informal rules are more libertarian, including codes of conduct, customs, implicit standards and norms embedded in social interactions (ibid). Conduct that is inconsistent with informal rules can be followed by social sanctions such as ostracism although they cannot be legally enforced as they are not explicitly written. Both types of institutions shape and condition what actors can do, should and should not do and the interest in an institutional analysis lies in discovering the rules that have produced a certain behaviour and to then optimize those rules to provoke a more desirable behaviour (ibid). In that sense, we are considering different types of institutions for eliciting collective agri-environmental management.

Table 0.1 categorizes the range of policy options available for environmental quality management for the agricultural sector along the paternalistic to libertarian spectrum. These stretch from paternalistic regulation, where choice is removed, over traditional price incentives, where choice is restricted, further to libertarian regulation, where choice is informed, and finally to nudges, where choice is preserved (adapted from Barnes et al. 2013).

Table 0.1 – Spectrum of policy interventions from choice restraining to choice preserving. Adapted from the Nuffield ladder (Barnes et al. 2013, p.449).

Constrain Choice					Preserve Choice			
Paternalistic Regulation		Pecuniary Incentives			Libertarian Regulation		Nudges	
Eliminate Choice	Restrict Choice	Positive Payment	Negative Payment	Savings	Persuasion	Information Boost	Type 1	Type 2
Bans	Laws	Subsidies	Taxes	Coupons	Moral Suasion	Best Practices	Defaults	Reminder
Prohibition	Rules	Bonus	Fines	Loyalty program	Advice	Consulting	Affect	Saliency
	Contracts	Rewards			Prevention	Training	Priming	Social Norms

In the quest for innovative contract models for collective AES, four aspects have been

identified by [Prager et al. \(2020\)](#) that are relevant for boosting the provision of environmental threshold goods while simultaneously promoting an economically viable agriculture. These comprise (i) the characteristics of the local ecosystem (what is managed), (ii) available technologies, infrastructure and practices (how it is managed), (iii) the actors involved, their characteristics and their relationships to each other (who manages), and (iv) formal and informal institutions that govern the collective agri-environmental management. These characteristics then determine whether the collective approach is one of cooperation or one of coordination.

Current institutional arrangements in support of collective agri-environmental management include regulatory interventions (e.g. greening requirements), information campaigns, advisory services, inter-farm cooperation, and voluntary agreements such as AES ([Lefebvre et al. 2015](#), [Kuhfuss et al. 2019](#)). The literature mainly suggests to further develop the formal aspect to institutional settings. Proposed elements for the design of collective AES include spatially weighted auctions (allocate contracts according to bids for compensation payments from farmers), collectively conditional contracts (provide a participation threshold that constitutes a focal point for coordination and crowds-in social motivation), the agglomeration malus (incentivize a spatial pattern of plots that constitute a random mosaic) and the agglomeration bonus (incentivize local patterns of spatially connected plots) ([Kuhfuss et al. 2019](#), [Zavalloni et al. 2019](#), [Bamière et al. 2013](#)). While these instruments are tending more towards the paternalistic side of the institutional spectrum (figure 0.1), some scholars argue for less formal regulation and towards the promotion of individual responsibility and lasting behavioral change through normative standards ([Barnes et al. 2013](#), [Saunders 2015](#), [Lastra-Bravo et al. 2015](#), [Sutherland et al. 2013](#)).

The libertarian side of policy tools relates to the works of Elinor Ostrom who proposed ‘design principles’ for the management of common pool resources in small scale communities ([Ostrom 1990](#)). Based on this initial approach towards informal rules, [Agrawal \(2001\)](#) then categorizes 16 criteria for successful collective action into resource characteristics, group characteristics, institutional arrangements, the external infrastructure and the relationships between those categories. The author calls for a more comparative statistical approach by using these criteria as critical variables in case study research. The idea is to conduct causal tests on the external validity of these design elements across cases. Being the most frequent approach to institutional analysis, the in-depth case study approach has been widely used to assess institutional principles for sustainable resource governance ([Prager et al. 2020](#)). Case studies permit to gain a comprehensive understanding of complex systems and their context specific dynamics ([Westerink et al. 2017](#)). However, because of their context specific nature, conclusions hardly allow for generalization be-

yond the local system under examination in the particular case study. Moreover, this approach has been criticised for methodological individualism and the frequent neglect of structural and global market forces (Prager et al. 2020). Nevertheless, because ecological systems are highly complex and locally context dependent, the optimal management of environmental threshold public goods must be identified on a case-by-case basis (ibid).

The nudging part of the institutional spectrum includes automatic type 1 nudges and deliberate type 2 nudges. They have been mobilized principally for household consumption settings, but their potential for the agroecological transition has only been assessed hypothetically for the most part and has otherwise been restricted to brief and rather small experiments for the other part. The most promising feature in support of collective action seems to be the power of social norms (Barnes et al. 2013). Fostering social capital in general has been identified as a beneficial driver for collective action among farmers. Local farmer associations have shown to provide broader benefits to their members that go beyond environmental quality and economic viability of the farming profession (Kuhfuss et al. 2019, Lastra-Bravo et al. 2015). Moreover, social forces have been found to increase participation in AES (Burton and Wilson 2006), with trust in both cooperators and institutions as the principal component to successful farmer cooperation (Lastra-Bravo et al. 2015). Institutional credibility, communication through trusted messengers, such as farm advisors, the visibility of positive externalities generated by agroecological practices, and low associated monitoring and control efforts have been found to increase trust in AES among farmers (Lastra-Bravo et al. 2015, Sutherland et al. 2013). The behavioral dimension to institutional arrangements represented through informal rules and the social environment thus constitutes an important point of leverage in fostering collaborative agri-environmental management.

## 0.5 Challenges for collective AES

The literature has identified the need for agri-environmental policy to direct incentives towards landscape scale management and to build a suitably collaborative environment among farmers (Zavalloni et al. 2018). The remaining challenges include motivating collaboration among farmers and other relevant stakeholders, providing consistent policy agendas over time and reducing uncertainty over both environmental and economic outcomes for farmers (Dupraz et al. 2009, Zavalloni et al. 2018). Moral costs related to traditions, the desire for social compliance, incomplete information, transaction and opportunity costs have all been listed as barriers to engagement in collective agri-environmental management (e.g. Franks 2011). Given that these challenges are social but also economic in nature, they need to be addressed by a combination of institutional options including

both financial and behavioral incentives. As noted by (Dupraz et al. 2009, p.627):

*Local communities have a key role to play in leading a progressive design of agri-environmental schemes that maintain motivation and co-operation between the different actors. The involvement of local and regional councils must be emphasised.*

The local specificities of ecosystems and the social complexity of farmer networks suggests that there is no one-size-fits-all approach. Rather, agri-environmental policies need to consider a combination of institutional arrangements to exploit the complementarity between financial, social and ecological aspects.

In summary, the current state of the literature has identified the need for collective approaches to agri-environmental policy but is not conclusive on the institutional form that would be most appropriate. Moreover, the current state of the literature as well as that of policy evidence is lacking first hand results from field data on collective incentives for AES. Therefore, this thesis set out to investigate a range of policy approaches to collective agri-environmental management in order to address this gap. With this regard, this thesis presents my research on the potential of collective incentives for agri-environmental policy through the discussion of their theoretical foundations, the quantitative analysis of their application in the field and the presentation of qualitative evidence from stakeholders and practitioners. Consequently, the thesis proposes further perspectives on refining the study of collective incentives for AES and provides implications for policy making with regards to their implementation.

## 0.6 Outline of the Thesis

The central question that guided the work of this thesis is: **What is the potential for collective incentives in the European Agri-Environmental policy?** In order to address this research aim, five chapters are presented in the scope of this thesis.

In studying the external validity of the collectively conditional subsidy mechanism, this research moves gradually from comparing my lab-in-field results with farmers to data from the literature on students in the lab (Chapter 1), to first hand cAES field data at the aggregate level (Chapter 2), and further to farmers' contribution decisions at the individual level (Chapter 3). The debate of the potential of collective AES is enhanced with a discussion of the coordination of farmer cooperation through an associative structure (Chapter 4) and finally, with the presentation of a workshop methodology towards the development of alternative approaches such as behavioral interventions in the form of green nudges (Chapter 5).

The structure of the thesis is defined by its independent chapters which are summarized below.

### 0.6.1 Chapter 1

Chapter 1 presents an experimental study on two subsidy mechanisms that are contrasted with regards to their effectiveness in achieving cooperation among farmers. Individual subsidy payments that are conditional on a collective contribution threshold could provide a viable resolution to the insufficient and dispersed adoption of agri-environmental contracts aiming at attaining environmental quality targets. I study the effectiveness of such collective incentives by means of a conditional subsidy mechanism that is triggered only if a sufficiently large and interconnected area of farmland is contracted under AES as compared to an unconditional subsidy payment. Due to missing data on collective incentives, particularly from the field, their external validity has not been established yet. Clear evidence on the practical viability of this incentive mechanism is therefore needed.

I contribute to this gap by comparing my data from the contextualized lab-in-field setting with farmers to data provided by [Le Coent et al. \(2014\)](#) from a decontextualized laboratory setting with students. This study seeks to (a) replicate initial promising findings from the lab and to (b) establish external validity for the collective incentive mechanism. In particular, the study seeks to address two research questions: **Do the results from the lab reproduce in the lab-in-field? and Is the conditional subsidy mechanism an acceptable instrument for farmers?**

Therefore, the treatment effects are analyzed both within the experimental setting and between the two experiments. We start from the decontextualized protocol of a threshold public good game (TPGG), for which two treatments are studied, an unconditional subsidy and a conditional subsidy mechanism. We then contextualize the TPGG setting and realize a lab-in-field experiment with farmers. Thus, we are able to compare the results from the standard decontextualized TPGG in a strictly controlled laboratory environment with students to those of a contextualized TPGG in the form of a framed lab-in-field experiment directly applied to the target population. Results show that farmers cooperate more successfully than do students. The conditional subsidy mechanism elicits higher contributions in the second sequence in both lab and field, while sustaining more efficient outcomes over time in the field. The collectively conditional incentive mechanism thus shows promising potential as a tool for agri-environmental policy. This study contributes to the literature on agri-environmental policy tools and provides insights for agricultural policy in steering the agroecological transition. By identifying the conditional subsidy mechanism as an acceptable and efficient tool for incentivizing cooperation among farmers with regards to environmental practices, this initial study provides the basis for the subsequent chapters that further investigate the collective dimension to AES in the field.

## 0.6.2 Chapter 2

Chapter 2 uses novel collective agri-environmental data from a species protection measure to provide a quantitative analysis of the collective approach to agri-environmental schemes. The case study presents a biodiversity protection measure that has been put in place in Alsace, France to preserve the local European hamster (*Cricetus cricetus*) population. The resulting collective AES (cAES) is based on a subsidy dependent on an MPR for the creation of a connected territory of favorable habitat for the European hamster. In this sense, the subsidy mechanism case study is analogous to the collectively conditional subsidy mechanism used in the experiments of chapter 1. This study addresses the existing uncertainty on whether collective measures are capable of attaining the desired environmental objective that the respective cAES contract is laid out to address.

This chapter thus addresses the following research question: **Does data from the field confirm the environmental effectiveness of collective incentives in AES?**

The analysis focuses on the collective agri-environmental scheme data at the aggregate level. Statistical techniques are used to relate participation in the collective AES to the environmental outcomes in order to conclude on the environmental effectiveness of a cAES approach. The results show that effort contributions under the collective contract go well beyond the contract's threshold value and that smaller groups of farmers may find it easier to make proportionally large contributions to the scheme. Farmers' collective effort contributed under the cAES is positively linked to an improvement in environmental quality. Cooperation among farmers across a common territory benefits from (i) the presence of a moderating farmer association, (ii) flexibility in contract design and (iii) visibility of environmental outcomes achieved through the scheme. The contributions from this study are twofold. First, rare data from the field on the relationship between collective AES and the environmental outcomes is provided. Second, this evidence from the field is important for validating the findings from the lab and lab-in-field experiments as experimental conditions often do not represent real world conditions. These results thus provide external validity for collectively conditional subsidies to policy mechanism design.

## 0.6.3 Chapter 3

Chapter 3 takes a closer look at the novel cAES data at the individual farmer level. The collectively conditional subsidy mechanism incentivizes the coordination of contribution efforts within groups of farmers. This study focuses on how communities of farmers organize and coordinate across years as to continuously provide an interconnected territory of favorable surface for the survival of the species.

In order to understand what drives individual farmers to contribute under a cAES for biodiversity preservation when exposed to a collectively conditional subsidy scheme, two questions are addressed: **What determines participation in the cAES? and What determines individual contribution to the cAES?**

The econometric analysis uses panel estimation techniques and corrects for sample selection in identifying the driving factors for farmers' participation in the cAES as well as for their individual contributions to the collective aim. The results reveal that both territorial shares and group size seem to positively influence participation under the cAES, with larger groups producing slightly more contractors. However, group size shows to negatively influence farms' surface contributions for the collective scheme. Based on individual contribution patterns within groups, a typology for contributions under collective conditionality is proposed. To our knowledge this is the first study providing an econometric analysis of real world cAES data from the field. Therefore, it contributes to the academic literature in breaching the gap of missing data from the field. It contributes to policy making by highlighting that the policy challenge when proposing collectively conditional subsidies lies in appropriately targeting influential farms while determining the appropriate group size for each collective contract.

#### 0.6.4 Chapter 4

Chapter 4 assesses the potential of farmer associations such as environmental cooperatives (EC) in managing spatially defined collective contracts. Collective contracts such as cAES need to be coordinated, a complex process that involves multiple stakeholders and planning over a 5-year horizon. When chaperoned through an associative structure, the coordination activities can be centralized and homogenized. I seek to understand how actual communities of farmers organize and coordinate as to make sure to always attain sufficient contributions from their members.

The study seeks to address two questions: **Which role does the farmer association assume in the management of collective contracts? and Which organizational form corresponds best?**

Through a case study approach the complex and context specific nature of ECs is investigated. The chapter provides a review of recent case studies on farmer collaboration from the literature followed by our own case study discussion. In the scope of the cAES case study, interviews are conducted with the president of the EC and four member-farmers. Interview evidence highlights that the role of the EC is above all a facilitating one, mediating between the different interest groups in order to enable the application of cAES. Through the moderation of the design and implementation of cAES, the EC is a cost efficient and locally adaptive structure that is grounded in farmers' trust and

that is representative of the context specific agricultural situation. A democratic and participatory organizational form is recommended for the EC to optimally function as a central institution in the management of collective contracts. This qualitative analysis contributes to resolving the prevalent uncertainty among policy makers and within the academic literature about the design of collective contracts and the application of cAES. In highlighting success factors and barriers to cAES management, the functioning of an EC is described in detail as a facilitating and mediating institution. The benefits for both farmers and regulatory authorities are highlighted. This study is thereby contributing to the scarce literature on collaborative governance arrangements for AES.

### 0.6.5 Chapter 5

Chapter 5 considers the potential of behavioral interventions in complementing financial incentives for cAES. Although farmers operate in a revenue generating business environment, the interest for alternatives to traditional price incentives and for more liberal forms of agri-environmental policy making is emerging. For sustainable economic policy, the question persists on how to align public, environmental and competing economic interests with the actual farming practices. Green nudges propose to achieve this congruence of interests while preserving freedom of choice in yet a cost efficient way. However, with regards to agri-environmental policy, the question of whether nudging can be an effective policy instrument for the agricultural sector, is still in debate. Given the wide range of options for environmental promotion, it is important to identify when to apply green nudges, how and to whom.

The research question addressed by this study is: **What are the characteristics of effective green nudges for the increase of widespread environmental consideration in the agricultural sector, in particular with respect to the agroecological transition?**

A participatory workshop design is applied to a stakeholder discourse with the goal of identifying and designing green nudges that are most suitable to the agri-environmental problematic. First, a review of recent studies on green nudges for the agricultural sector as well as their ethical implications is presented, to discuss the potential for green nudges in agri-environmental policy. Second, I propose a framework for matching behavioral situations with the corresponding nudge and develop a workshop methodology that is then applied to practitioners in France. Practitioners in our workshop identified six key themes that constitute hurdles to behavioral change in agriculture. Those include unawareness of responsibility, fear of change, fear of losing social status, concerns on guarantees for success, facilitation, and profitability. Therefore, a nudge for agri-environmental purposes needs to address two features: making efforts and achievements visible to the community

of farmers and enabling local leadership. I then propose a nudging intervention that could complement existing cAES. While nudges can augment and enhance the effectiveness and outreach of traditional measures such as AES, rigorous pilot testing before the intervention is advised. This work contributes to the recently emerging literature on the potential and limitations of green nudges in agri-environmental policy. The practitioners' workshop constitutes a viable tool for addressing the building interest among academics and policy makers to improve agri-environmental schemes with behavioral insights, to identify good practices and to develop policy tools to assist different levels of government and farmer communities in implementing fair and sustainable agri-environmental policies. By suggesting a methodology to develop green nudges for AES in stakeholder workshops, a participatory design for behavioral policy is proposed that can be applied to a multitude of agri-environmental contexts.

The thesis concludes with an overview of the results from these five chapters, their main takeaways and potential limitations. I discuss implications for academic research, policy design and practitioners in the field and open towards perspectives for further research.



# Chapter 1

## Collectively Conditional Incentive Mechanisms: towards a more efficient European agri-environmental policy?

### Abstract

Individual subsidy payments that are conditional on a collective contribution threshold could provide a viable resolution to the insufficient and dispersed adoption of agri-environmental contracts aiming at attaining environmental quality targets. Based on a threshold public good game (TPGG), two treatments are studied, an unconditional subsidy and a conditional subsidy mechanism. Two experiments are compared: one examines the standard decontextualized TPGG in a strictly controlled laboratory environment, and one studies a contextualized TPGG by means of a framed lab-in-field experiment directly applied to the target population. Indeed, the initial laboratory experiment of [Le Coent et al. \(2014\)](#) offers promising results of a conditional subsidy compared to an unconditional subsidy. Our results show that farmers cooperate even more successfully than do students. In a within subject design with two sequences, the conditional subsidy mechanism elicits higher contributions in the second sequence in both lab and lab-in-field, while farmers sustain more efficient outcomes over time. The collectively conditional incentive mechanism thus shows promising potential as a tool for agri-environmental policy.

**JEL Classification:** Q58, C92, C93

**Keywords:** Collective Agri-Environmental Schemes, Threshold Public Good, Collective Conditionality, Lab-in-Field Experiment.

**Note.** This chapter constitutes a first version of a joint article with Philippe Le Coent, Raphaël Préget, Anne Rozan, and Sophie Thoyer. The contextualized protocol benefited from a collective reflection of all contributors. The lab-in-field experiment and the data analysis was conducted by Kristin Limbach in the scope of her doctoral research.

## 1.1 Introduction

The European Union’s Common Agricultural Policy (EU CAP) set out in 1992 to incentivize agri-environmental farming practices by contracting individual farmers. These agri-environmental schemes (AES) reward individual commitment to pro-environmental practices. To this date, however, the insufficient and geographically dispersed adoption of individual AES has not yet resulted in the attainment of environmental quality targets. Rather negative externalities to farming such as ground- and surface water pollution, soil erosion, greenhouse gas emissions, and biodiversity decline continue to cause lasting environmental damage (Grüner et al. 2021). The threshold dynamics inherent to environmental public goods (e.g. ground water quality improvement, habitat reinstatement, biodiversity management) necessitate collective efforts on a landscape scale that often stretches across individual farmland territory. By neglecting the collective effort needed to elicit environmental threshold dynamics, public funds are invested in vain while hindering a coherent agri-ecological transition (Dupraz et al. 2009). Rather, through the coordination of farmers’ efforts in ecological focus areas, an interconnected corridor of farmland can provide ecological services that are relevant to the local ecosystem. Therefore, a collective incentive mechanism is needed for AES that achieves sufficient farmer coordination.

We study the effectiveness of such collective incentives by means of a conditional subsidy mechanism that is triggered only if a sufficiently high rate of participation from farmers of the same community is attained. Given that only farmers whose territories are located within the same protection perimeter (e.g. water catchment area) can apply as a group, the aim is to contract an interconnected area of farmland under the cAES. Le Coent et al. (2014) have tested this subsidy mechanism in a decontextualized laboratory experiment with students. However, due to missing data on collective incentives, particularly from the field, their external validity has not been established yet. Clear evidence on the practical viability of this incentive mechanism is therefore needed. This study addresses two research aims, that comprise (a) to replicate initial promising findings from the lab and (b) to establish external validity for the collective incentive mechanism. In particular, the study seeks to examine whether subsidy schemes impact cooperation in collectively conditional scenarios differently depending on the context. This study contributes in two ways: first, to the literature on agri-environmental policy with an aim to provide insights for steering the agri-ecological transition; and second, to the literature on lab-to-field generalizability.

These two research aims are addressed methodologically by comparing data from Le Coent et al. (2014) on a decontextualized lab experiment to a contextualized lab-in-field setting. For this purpose, the context of AES for the attainment of environmental threshold goods is transposed into an economic experiment based on a threshold public good game (TPGG). In a TPGG, the provision point mechanism is triggered only once the aggregate of individual contributions to the public good attains or exceeds a pre-set minimum threshold value. Provided that collective efforts are at or above the provision point (i.e. the threshold value), then the public

good is produced. In the AES contract the threshold is specified through a minimum participation rule (MPR). This MPR imposes a group effort upon which the production of the public good depends. Although participation rate and spatial coordination are two distinct concepts, both are needed in combination in order to impact local environmental threshold dynamics on a coherent area that is relevant to the ecosystem (e.g. water catchment area, habitat reservoir, lake etc.). It has to be taken into account that the subsidy schemes do reward participation explicitly, while the spatial aspect is considered only implicitly. By grouping participants, the ecological focus area is represented by the group. The analogy to cAES contracts is that only farmers that have territories within the same ecological focus area are eligible to join the collective contract. The decontextualized lab experiment of [Le Coent et al. \(2014\)](#) provides data from university students in Southern France. In order to prevent an overgeneralization ([List 2007](#)) from the lab results to the AES application, this paper investigates what happens when the lab is moved to the field. A subsequent study thus transposes the decontextualized lab setting into a contextualized lab-in-field ([Levitt and List 2007b](#)), also called extra-laboratory experiment ([Charness et al. 2013](#)).

Two treatments are studied, a subsidy that is conditional on the collective threshold attainment and a subsidy that rewards all individual contributions to the public good independent of threshold attainment. The unconditional subsidy mechanism (US) reflects the current incentives of individual AES. The conditional subsidy mechanism (CS) proposes a ‘*collectively conditional*’ incentive that is triggered only if aggregate group contributions reach the threshold. This reflects the threshold dynamics of an environmental public good which is only produced if aggregate efforts are sufficiently high and concentrated on an interconnected area relevant to the ecosystem. While in both treatments the production of the public good depends on the group’s aggregate contributions, the subsidy payment rewards individually efforts differently depending on the treatment. By conditioning the payment on a collective effort level, the CS treatment adds a private interest to the production of the public good that comes in form of a bonus proportional to individual contributions. This private interest in the production of the public good is absent in the US treatment, where payments are not contingent on the production of the public good. Rather, the unconditional subsidy acts as a utilization rebate ([Marks and Croson 1998](#)), i.e. contributions become less costly once they are at or above the threshold.

The lab results obtained by [Le Coent et al. \(2014\)](#) show that the subsidy schemes elicit higher contributions to the public good than what is provided in absence of any subsidy. Both subsidy schemes show to be effective in incentivizing the attainment of the threshold. The within subject design with two sequences reveals that the CS treatment is eliciting higher contributions on average. However, the difference in contributions between the two treatments is significant only during the second sequence. Nevertheless, during the first sequence, the CS is more efficient than the US when considering the ratio of average group contribution to average subsidy paid. In the framed lab-in-field setting, average contribution rates are sustained well above the threshold and, across all periods, are strictly exceeding those observed in the decontextualized lab experiment. Contributions of the CS treatment exceed those of the US treatment during the second sequence

while they also show to be more efficient during the first sequence. The lab-in-field results thus confirm the efficiency of the CS as had been demonstrated in the lab. Moreover, farmers' contributions even exceed those of students. Therefore, introducing collective conditionality on the payment of subsidies appears to be a promising tool for incentivizing the adoption of agricultural practices in the light of environmental threshold dynamics.

The paper is organized as follows: section 2 provides an overview of relevant findings from the literature in relation to two aims of our study, section 3 describes the methodology underlying the experiments and section 4 presents the analysis of the experimental data. Section 5 discusses the results and section 6 concludes.

## 1.2 Related Literature

Previous research has addressed the environmental threshold dynamics relevant to AES theoretically (e.g. Dupraz et al. 2009) and has proposed new elements for the design of collective AES include minimum participation rates (Zavalloni et al. 2019), collective bonuses (Kuhfuss et al. 2016b) spatially weighted auctions, the agglomeration malus and the agglomeration bonus (Kuhfuss et al. 2019, Bamière et al. 2013). To our knowledge only Le Coent et al. (2014) have so far studied a collectively conditional subsidy scheme for agri-environmental purposes. With respect to our two research aims of replication and validation, the following review focuses on a discussion of lab-to-field generalizability and, more particularly, the external validity for behavior observed in TPGGs.

### 1.2.1 External Validity of Experiments

For academics and policy makers alike, the question of generalizability of experimental results is relevant: Do behavioral principles as discovered in the lab reproduce in the real world? Generalizability of economic experiments is defined by List (2007) as the reproduction of observed behavior patterns from the decontextualized lab in contextualized field settings. In a review of tests on lab-to-field generalizability, Camerer (2011) stipulates that there is a shortfall in replicated evidence that reliably supports the absence of generalizability from empirical lab findings to field data. The author thus suggests that the replication of empirics for closely matched lab-to-field settings should be assumed until this can be disproven with sufficient statistical power. However, depending on the research question, each setting has different advantages and drawbacks, a one-to-one replication of empirical findings from one context to another may not be the ultimate goal. Rather, the inference from the data drawn out of any experiment should always be regarded in its specific context, where data from several different contexts are likely to provide a better picture on the larger question than can be obtained from one experimental setting standing on its own (Levitt and List 2007a). A complementary approach together with a stepwise transition from lab to field or vice versa (List 2007) can provide several benchmarks as

to identify which elements to the design produce behavioral change and to which design elements responses show robust across settings.

Previous literature has already addressed some of the questions on lab-to-field generalizability using different experimental settings and subject pools. Experiments on cooperation behavior evoking different degrees of context as collected in [Camerer \(2011\)](#) seem to attest quite strong context dependencies for cooperation in lab-field contrasts (e.g. [Benz and Meier \(2008\)](#) in a donation setting or [Stoop et al. \(2012\)](#) in a CPR setting). Nevertheless, [Camerer \(2011\)](#) claims that “there is no replicated evidence that experimental economics lab data fail to generalize to central empirical features of field data (when the lab features are deliberately closely matched to the field features)”. While we can think of multiple reasons for the importance of questioning lab-to-field generalizability, implications for the application of incentive setting in policy making is probably the most relevant for our purpose. An overview of the advantages to comparing lab with extra-laboratory results is given by [Charness et al. \(2013\)](#) which include changing the selection process as well as the subject pool, leveraging stakes or decreasing experimentation costs, and introducing other forms of variation. The purposes of lab-in-field experiments proposed by [Viceisza \(2016\)](#) include the testing of theories or heuristic principles; the identification of parameters associated with the observed behavior, the analysis of the structural nature of these parameters, the assessment of methodological difficulties, and their influence on parameter estimates. In this sense, extra-laboratory experiments are to be understood as complements to lab experiments rather than as an attempt to replace them. How to draw reliable implications for real world behavior from findings collected in the lab thus remains to be a central question to the external validity of economic experiments ([Levitt and List 2007b](#)).

When comparing fisherman in the field to fishermen in the lab-in-field in a CPR dilemma, [Stoop et al. \(2012\)](#) reveal that the stakes (fish vs. money) foregone matter dramatically for the cooperative outcome. Fishermen in the field fishing real fish show no cooperative behavior at all, whereas fishermen in the lab-in-field conditions show significantly higher contributions as compared to those obtained with students. The authors find that when monetary stakes are used but the context closely resembles that from the field, then cooperation is considerably higher and much more stable over time as compared to pure field or lab situations. This important study reveals that there is a bridge to be built between findings from the traditional lab experiment to the behavior observed in natural field studies. This gap in generalizability can be examined by carefully and subsequently peeling the layers of the structural parameters underlying each experimental setting.

When contrasting cooperative, competitive and neutral Prisoner’s Dilemma settings, [Engel and Rand \(2014\)](#) find that the tendency of participants in the neutral setting is to assume a cooperative frame by default. That is, the decisions made under the neutral frame resemble those in the cooperative setting, whereas the competitive frame significantly reduces cooperation relative to neutral ( $p=0.011$ ). Moreover, a ‘clean’ decontextualized setup may not exist ([Engel and Rand 2014](#), [Harrison and List 2004](#)). Participants are found to implicitly project their own story onto ‘neutrally’ framed experiments ([Engel and Rand 2014](#)). Thus, even care-

fully designed lab abstractions are not immune to subjectively projected frames that are outside of the control of the experimenter. To that extent a comparison between findings from several context settings may be a large advantage as to identify common mechanisms in decision making and to enrich context specific inferences (Levitt and List 2007a). Policy recommendations that are drawn from field settings benefit from improved precision due to inference over multiple contexts and population segments. Vice versa, laboratory designs can benefit from the field analogy as to improve the precision to modelled incentive mechanisms and imposed decision constraints. Traditionally, in the lab exogenous dynamics are controlled for, completely eliminating all real world uncertainty and ambiguity. This allows for isolating effects on behavior in the absence of confounds. The challenge clearly lies in the degree of comparability of conditions created in lab and field (Camerer 2011). Take the time frame to decision making, for instance. While several years of enrollment with an AES contract leave long periods of reflection between yearly decisions, the lab handles 20 decision rounds within 2 hours. Moreover, information asymmetries due to unknown threshold levels, efficient effort levels, real transaction costs and heterogeneity in group composition, may provoke dynamics over time that are left unaccounted for in a natural field setting (Dupraz et al. 2007) while they can be controlled for in the laboratory. Moreover, when extrapolating results from the lab to field situations, simple tasks seem to produce coherent behavioral patterns while behavior in complex tasks does not reproduce in the field (Saldarriaga-Isaza et al. 2019). The authors argue that this is most likely due to important context effects which differ between population segments. Rather, laboratory experiments with students should be understood as a "test bed" for behavioral tendencies of the general population (Saldarriaga-Isaza et al. 2019). Caution also is expressed in extrapolating the external validity of findings across cultural contexts, where a large gap between developing and developed countries is observed (Cárdenas 2009, Bchir 2014). For the purpose of providing policy implications for EU CAP, this study focuses on the context of developed countries.

Taking those effects into consideration, it seems only natural that variation across contexts produces results that are to a certain extent heterogeneous due to the different degrees of control applied over confounding factors across experimental settings. Therefore, Cárdenas (2009) proposes to use randomized control trials (RCT) ex-ante policy-interventions to obtain insights into which policy tools obtain the desired results, and to use field and lab experiments ex-post policy interventions to test hypotheses onto why something worked or did not work. However, it may not always be feasible to conduct laborious and time consuming RCTs to select among policy tools. Therefore, lab and lab-in-field experiments still provide a useful starting point to discover principal mechanisms that are guiding decision making and that could be of interest for policy instruments.

## 1.2.2 Threshold Public Good Games

We use the framework of a TPGG to study the lab-to-field comparison as this is the setting that most closely represents the collective AES (cAES) decision scenario. Through the introduction

of a focal point for coordination, the provision point (as given by the threshold) inherent to the TPGG creates multiple equilibria while diminishing the incentive to free-riding behavior (Marks et al. 2006). In their study on the influence of the size of the step return to the public good, Croson and Marks (2000) find that similarly to the effects of higher marginal per capita rates (MPCR), higher step returns elicit higher rates of cooperation and threshold attainment. They conclude that when "the cost of the public good project is lower, voluntary financing by a threshold mechanism is likely to be more successful".

Studies on the lab-to-field comparison in TPGGs find that an artefactual sample on average contributes more at group level across all treatment variations and is more successful in sustaining cooperation at or above the threshold than a student sample (punishment and external advisor with frame and miners in Saldarriaga-Isaza et al. (2019), membership fee without frame and farmers in Bchir (2014), baseline without frame and nurses in Cadsby and Maynes (1998)).

Both subject pools show oscillation around the efficient Nash equilibrium (NE) in a TPGG without a rebate as found in Saldarriaga-Isaza et al. (2019) and Marks and Croson (1998). For treatments that include a rebate rule this changes, coordination towards the Pareto-efficient outcome is observed in the field with contributions well above the threshold (Saldarriaga-Isaza et al. 2019). Only treatments that do not provide a rebate rule in TPGG show convergence towards the inefficient equilibrium (Cárdenas 2009). For the case of a relatively low endowment size, the likelihood of defection is even aggravated whereas a rebate rule can significantly alter group contributions towards the efficient NE. Similarly, Bchir (2014) find improved coordination towards the threshold value (focal point) due to a membership fee for consumption of the public good. Their artefactual sample of farmers sustains on average higher cooperation rates across all treatment variations that are stable over time. While the threshold clearly plays an important role in the coordination of contributions to the public good, there is no consensus on what represents the 'right' threshold level. Whereas real environmental threshold levels may not be known, thresholds in experiments are evaluated with respect to endowments and the presence or absence of rebate rules or money back guarantees (Suleiman and Rapoport 1992). Essential for setting the threshold in a TPGG is ensuring collective conditionality: no player alone can attain the threshold, only through the coordinated group effort can contributions trigger the provision point mechanism. For coordination to work, it is essential to provide certainty about (or at least a sufficiently high probability for) the expected threshold value (Dannenberg et al. 2015). Therefore, rather than obsessing over the exact value for the threshold, a credible and realistic benchmark for collective action needs to be provided. Otherwise, when facing uncertainty and ambiguity, individual contributions tend to become erratic and participants increasingly risk averse (Dannenberg et al. 2015, Bocquého et al. 2014). A way of mitigating excessive risk aversion in the light of uncertain threshold effects is to build an environment of trust among the group members. Trusting farmers are found to be less inclined to probability distortions in their decision making (Bocquého et al. 2014).

### 1.2.3 Risk Attitudes in TPGG

In economics experiments risk attitudes are usually assessed using the [Holt and Laury \(2002\)](#) lottery procedure, upon which [Vollmer et al. \(2017\)](#) conclude that it is externally valid in assessing farmer’s risk preferences. [Saldarriaga-Isaza et al. \(2019\)](#) have found students to portray similar attitudes as compared to the artefactual sample of miners when assessed in risk attitudes, empathy and trust. [Grüner et al. \(2021\)](#) vary the size of stakes in the [Holt and Laury \(2002\)](#) procedure and find near identical risk attitudes between agricultural students and farmers across all variations. Likewise, other studies comparing student and artefactual samples find similar risk preferences using a constant relative risk aversion (CRRA) function on foresters and forestry students ([Sauter et al. 2015](#)) and using rank dependent utility theory with consumers but not when using expected utility and CRRA ([Drichoutis and Koundouri 2012](#)). In the case of the study by [Maart-Noelck and Musshoff \(2014\)](#) conducted in Germany, however, students and farmers differ significantly in their assessed risk preferences, with students being more risk-averse than farmers. As pointed out by [Drichoutis and Koundouri \(2012\)](#), this result is common but erroneous when using expected utility and CRRA and equals out when using rank dependent utility. We can thus assume that both subject pools (student and artefactual) are prone to be guided by roughly the same attitudes with regard to those variables.

The literature already provides a partial answer to whether empirics from the lab reproduce in the field, namely that it depends on the modulated parameters. Nevertheless, we are still interested in our initial question on whether subsidy schemes impact cooperation in collectively conditional scenarios differently depending on the context. We are aware of no other study that has addressed this subsidy mechanism in a lab-to-field comparison before. Based on the findings of the most prominent lab-to-field comparison in the literature (however in a CPR game with fishermen) by [Stoop et al. \(2012\)](#), cooperation is expected to be more pronounced in a contextualized lab-in-field setting than in the decontextualized lab. As suggested by [Camerer \(2011\)](#) we will assume generalizability unless it is disproved by our data so that the findings from the lab on the effectiveness of the conditional subsidy scheme are expected to be replicated in the lab-in-field experiment. With respect to this research aim we are going to test whether the empirics from the decontextualized lab experiment reproduce in a contextualized lab-in-field experiment and which role the subsidy mechanism plays in incentivizing cooperation.

## 1.3 Methodology

[List \(2007\)](#) suggests to progress “slowly toward the environment of ultimate interest” in order to learn about the role of each experimental feature in producing the observed behavior. In this capacity, the lab serves as a methodological control for the applied treatments by abstracting from naturally occurring confounds ([List 2007](#)). This study analyzes how results from a decontextualized laboratory experiment with student participants compare to results from a

Table 1.1 – Contextual transposition from lab to lab-in-field

<b>Context</b>	<b>Transposition to the laboratory (decontextualized)</b>	<b>Transposition to the lab-in-field (contextualized)</b>
Threshold environmental public good such as water quality or biodiversity conservation	Generic version of threshold public good	Framed version of threshold public good
Cost related to the adoption of pro-environmental agricultural practices	Contribution to the group account in tokens	Contribution to the public good in hectares
Absence of agri-environmental scheme: voluntary adoption of pro-environmental agricultural practices in light of threshold but without payment prospect	Standard provision point mechanism without individual subsidy prospect (NS)	Voluntary implementation of AES without individual subsidy prospect (NS)
Traditional agri-environmental scheme: payment to each farmer per ha enrolled independent of other farmers' enrollment rates with respect to the collective threshold.	Subsidy proportional to individual contribution: unconditional subsidy scheme (US). The subsidy partially covers the cost of contributions.	Subsidy proportional to individual contribution: unconditional subsidy scheme (US). The subsidy partially covers the cost of implementation of AES.
Agri-environmental scheme with collective conditionality: payment to each farmer per ha enrolled provided the sum of ha enrolled by all farmers is at least equal to the collective threshold necessary for ensuring an improvement of environmental quality.	Subsidy, proportional to individual contribution, dependent on collective attainment of threshold at group level: conditional subsidy scheme (CS). The subsidy partially covers the cost of contributions.	Subsidy, proportional to individual contribution, dependent on collective attainment of threshold at group level: conditional subsidy scheme (CS). The subsidy partially covers the cost of implementation of AES.
Stakeholders involved in the implementation of AES	Student sample	Artefactual sample (farmers)
Choice environment: the farmer community where individuals are socially embedded in, see and communicate with each other	The university laboratory, participants seated in isolated computer cubicles, no visual contact and no communication	Farmers seated in the same room with individual iPads, visual contact but no communication

lab-in-field setting with artefactual participants. While [Le Coent et al. \(2014\)](#) removed all confounds from their experiment and by using a student sample, completely abstract from the agricultural decision context, this method allows us to investigate the purely financial motivation elicited through the experimental setting. The exact procedure for the laboratory experiment is described in [Le Coent et al. \(2014\)](#). The lab-in-field then transposes the experiment back into an agricultural frame that attempts to mimic the AES context. This allows us to examine two additional features that are important for decisions in our environment of interest. First, we add a confounding factor, the role of the AES context, to the design. The context provides a decision environment that mimics that of a collective AES scenario. Second, our artefactual sample of farmers allows us to study decisions makers that are naturally immersed in, and thus familiar with, the evoked context. The stylized experimental design features are summarized in table 1.1.

Groups consist of 4 members. Each participant  $i$  is endowed with 20 units ( $E_i$ ) and must decide how many units to contribute ( $C_i$ ) to a public account which benefits all members of the group, but only if the collective threshold of minimum group contributions is reached. The threshold is set at 50% of the group's total endowment ( $0.5 \times 4 \times 20$ ). The marginal per capita return (MPCR) for contributions to the public good is set at 0.3. This return to the production of the public good, where contributions beyond the threshold keep producing a continuous public good, can be understood as a *utilization rebate* as defined by [Isaac et al. \(1989\)](#) and [Marks and Croson \(1998\)](#). A linearly increasing production function as in [Isaac et al. \(1989\)](#) is assumed: the public good production function keeps increasing well beyond the provision point. The game has several equilibria that can be summarized as follows:

- *efficient* NE:  $\sum_{i=1}^4 C_i = 40$  (pareto dominates *inefficient* NE)
- *inefficient* NE:  $\sum_{i=1}^4 C_i = 0$
- Pareto optimum:  $\sum_{i=1}^4 C_i = 80$

The efficient, and Pareto dominating, Nash equilibrium (NE) is located exactly at threshold level. Thus, with a threshold of 40 units per group, the game proposes an average individual contribution of half of the 20 unit endowment:  $\sum_{i=1}^4 (0.5 * E_i) = 40$ . An inefficient Nash equilibrium exists when all contributions are zero. The Pareto optimum holds for full contribution levels which maximizes overall payoff for all players.

### 1.3.1 Treatments

The experiment studies two variations of subsidy schemes, an unconditional and a conditional incentive. The interest lies in the variation of contributions between treatments, next to the standard control TPGG.

- **NS**, the control group (traditional TPGG) and thus *No Subsidy* (only available for

the lab study);

- **US**, this treatment pays an *Unconditional Subsidy* to all contributors proportionally to their contribution independent of the outcome in terms of public good production;
- **CS**, this treatment pays a *Conditional Subsidy* only if the threshold is reached by the group.

Individual payoffs,  $\pi_i$ , depend on the individual's contribution,  $C_i$ , the subsidy scheme and the group contribution,  $\sum_{i=1}^4 C_i$ , which can either be above or below the threshold of 40. Within-subject combinations: 2 sequences of 10 periods per treatment.

No subsidy (NS)

$$\pi_{NS} = \begin{cases} 20 - C_i & \text{if } \sum_{i=1}^4 C_i < 40 \\ 20 - C_i + 0.3 \sum_{i=1}^4 C_i & \text{if } \sum_{i=1}^4 C_i \geq 40 \end{cases}$$

Unconditional subsidy (US)

$$\pi_{US} = \begin{cases} 20 - 0.7C_i & \text{if } \sum_{i=1}^4 C_i < 40 \\ 20 - 0.7C_i + 0.3 \sum_{i=1}^4 C_i & \text{if } \sum_{i=1}^4 C_i \geq 40 \end{cases}$$

Conditional subsidy (CS)

$$\pi_{CS} = \begin{cases} 20 - C_i & \text{if } \sum_{i=1}^4 C_i < 40 \\ 20 - 0.7C_i + 0.3 \sum_{i=1}^4 C_i & \text{if } \sum_{i=1}^4 C_i \geq 40 \end{cases}$$

The control NS represents a situation in absence of AES. The treatment US represents the traditional AES in which farmers receive an individual subsidy proportional to the agricultural surface enrolled in the scheme. The treatment CS represents the collectively conditional subsidy scheme, which grants an individual subsidy proportional to each farmer's agricultural surface enrolled in the scheme only if the aggregate contracted surface by the community meets or exceeds the threshold that is necessary to ensure an improvement in environmental quality, i.e. the provision of the public good. It may appear strange at first sight that the agricultural surface is represented as payoff relevant currency. Therefore, try thinking of it this way: by contracting hectares of agricultural surface the farmer incurs transaction costs that are exactly the same and additive for each hectare contracted. Now the subsidy payment reduces these transaction costs from 100% to 70% (but not the surface contracted). The return from the public good account is to be referred to as the environmental externality, the positive spillover that each individual perceives from an improvement of environmental quality (e.g. improved well-being,

potable ground water, presence of biodiversity, etc.). Although participation rate and spatial coordination are two distinct concepts, both are required in combination in order to impact local environmental threshold dynamics at catchment level. The subsidy schemes do reward participation (in terms of hectares enrolled) explicitly, while the spatial aspect is considered only implicitly through the grouping of participants which is analogous to farmers within the same ecological focus area.

### 1.3.2 Experimental Procedure

The instructions of the underlying experimental protocol<sup>1</sup> are based on standard TPGG procedures (e.g. Croson and Marks 2000, Marks and Croson 1998). Participants arriving to the sessions were seated individually and asked to restrain from communication throughout the experiment. First, in order to control for risk preferences on individual contributions in the different treatments, a series of lottery combinations (adapted from Holt and Laury 2002) is presented. Participants were informed that, at the end of the experiment, one of the games was randomly drawn and its inherent gamble would determine the earnings for this part of the experiment. Second, groups of 4 participants each were created through random and anonymous composition, which was maintained throughout both of the following parts of the experiment, sequence 1 and sequence 2. Each sequence consisted of a threshold public good game over 10 periods. One treatment was applied per sequence. Each period, two choices had to be indicated per participant: the estimation of the other three group members' contribution (adapted from Fischbacher and Gächter 2010) and the respective personal contribution to the public good. The decision frame for contributions varied according to lab or lab-in-field setting. Students in the decontextualized lab experiment were asked to decide how many token of their initial endowment they wanted to contribute to a group account. Depending on the treatment and threshold attainment, contents of the group account were then redistributed among all group members proportional to their contributions. Farmers in the contextualized setting were asked to chose hectares from their endowed agricultural surface which they then contracted under the collective AES. Each group represents a collective of farmers whose exploitation touches upon the same groundwater catchment area. Depending on the treatment and threshold attainment, the contracted surface was then subsidized according to the rebate rule. At the end of each period, feedback on the aggregate group contribution to the public account and on individual payoff was displayed to each participant. At the end of the 10 periods, the earnings for that sequence were displayed as an aggregate over all the periods of that sequence. Participants had been informed that, at the end of the experiment, one of the two sequences would be chosen at random for payment, in addition to the lottery outcome and the participation fee. Corresponding instructions were distributed separately at the beginning of each part (risk elicitation, sequence 1 and sequence 2). Sequence variations among the three treatments were run in all reverse order combinations for the lab sessions and in the most pertinent combinations, i.e. the

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<sup>1</sup> An example of lab-in-field instructions (in French) can be consulted in part C of the Appendix.

subsidy treatments, for the lab-in-field sessions.

### 1.3.3 Participants and Earnings

For the laboratory experiments as presented in [Le Coent et al. \(2014\)](#), students were recruited in 2013 and 2014 via ORSEE ([Greiner 2004](#)) and all of the experimental sessions were conducted at the Laboratoire d'Economie Expérimentale de Montpellier (LEEM). A simple random sample of 220 participants had been drawn from the student population of the University of Montpellier. All participants self selected into both the data base and the experiment. In the decontextualized university laboratory, participants were seated in isolated computer cubicles where they had no visual contact with other participants. The sessions lasted a maximum of 2 hours and the average earning was €15.90 with a standard deviation of €3. In addition, a show-up fee of €2 was provided for students of the same campus the experiment was carried out at and of €6 for students from a different campus.

For the lab-in-field experiments, farmers were invited via telephone and e-mail to participate in sessions at three different locations in the French region of Alsace, according to a least distance criterion given their postal address. Contact data had been obtained in 2012 from INSEE (Institut national de la statistique et des études économiques) of which around 350 addresses had been contacted. The resulting volunteer sample of 24 participants clustered by community implies that some participants knew each other and that all self selected into the experiment. Facilities for the experimental sessions were provided by the regional agriculture chamber (Chambre d'Agriculture d'Alsace) and composed of individual desks (one per participant) each supplied with an iPad from the mobile laboratory of the Laboratoire d'Economie Expérimentale de Strasbourg (LEES). All farmers were seated in the same room and could make visual contact with each other. The sessions lasted a maximum of 2 hours and the average earning was €16.38 with a standard deviation of €2.34 in addition to the show-up fee of €20.

## 1.4 Data Analysis

The data analysis is structured in three sections, where the first section presents descriptive statistics on average values by treatment and sequence for individual and group contribution levels, stated beliefs over others' contributions, and group size. The second section uses non-parametric estimation techniques to compare average contributions between treatments. The third section provides a parametric estimation on the determinants of individual and group contributions including time lags, treatment dummies, elicited beliefs and risk aversion as predictors.

### 1.4.1 Descriptive Statistics: Averages by Treatment

Table 1.2 depicts average contribution rates, average stated beliefs and the number of groups for each treatment sequence. From this, we can already see that average contributions and stated beliefs are higher in the lab-in field than in the lab experiment. These contribution averages are graphically portrayed in figure 1.1, where all lab-in-field treatment averages show higher contributions rates as compared to the lab. Moreover, we can see from this graph that average group contribution rates in the laboratory evolve slightly above the threshold for about the first 2/3 of each sequence, they decline well below threshold in the very last periods of the sequence. In the lab-in-field setting, average group contributions are always above threshold (around 70% of endowment), apart from one group in the CS-US treatment that is not cooperating effectively and draws down the average for that treatment. Nevertheless, farmers' group contribution rates also do decrease on average with later periods of the game.

Table 1.2 – Averages for group and individual contributions as well as for stated belief over others' contribution (in %). Note. Data from lab taken from [Le Coent et al. \(2014\)](#). Data from lab-in-field from my own experiments.

Treatment	Group Contribution		Individual Contribution		Stated Belief		Participants	Groups
Sequence	1	2	1	2	1	2	n	N
US-CS	41,84	47,29	10,46	11,82	32,57	36,74	28	7
CS-US	38,01	44,18	9,50	11,04	30,89	34,58	32	8
NS-US	25,96	41,12	6,49	10,28	23,55	32,25	40	10
NS-CS	29,58	53,66	7,40	13,42	26,16	41,01	40	10
US-NS	41,46	28,42	10,36	7,11	32,73	22,95	40	10
CS-NS	45,20	18,69	11,30	4,67	38,14	17,10	40	10
<b>Lab</b>	37,01	38,89	9,25	9,72	30,67	30,77	220	55
US-CS	59,56	58,53	14,89	14,63	42,12	41,85	12	3
CS-US	62,37	53,03	15,59	13,26	46,93	41,73	12	3
<b>Lab-in-Field</b>	60,96	55,78	15,24	13,94	44,52	41,79	24	6

The results from participants' belief elicitation over group members' contributions (adapted from [Fischbacher and Gächter 2010](#)) show that, compared to students, farmers indicate more optimistic beliefs over their group members' intentions to cooperate. The observed difference may be attributed to a higher control of anonymity in the lab. Moreover, in absence of the subsidy (NS) beliefs are considerably more pessimistic than for the subsidy treatments. In the absence of financial rewards, participants in the lab think it less likely for their group members to cooperate. Within either lab or lab-in-field, average reported beliefs over other group members' contributions differ significantly between treatments for the earlier periods of the first sequence with the CS treatment eliciting more positive beliefs (Kruskal-Wallis equality-of-populations

rank test). This result holds for the second sequence as well although it is not significant anymore for the lab-in-field experiment.

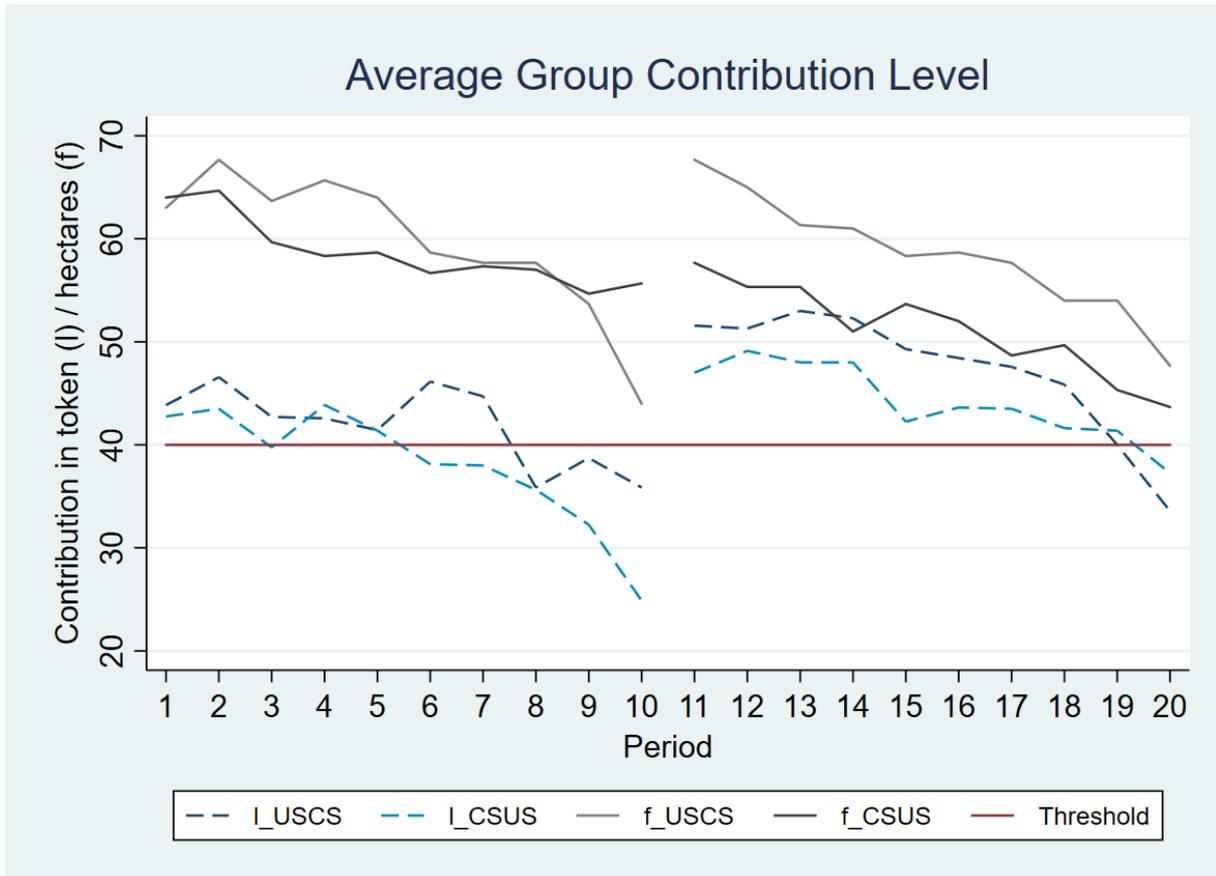


Figure 1.1 – Laboratory (l) and Field (f) experiment average group contributions per treatment sequence.

As expected, we can see from the individual belief graphs (figure 1.2) that participants adjust their beliefs over others' contributions according to the feedback on group members' actual contributions from the previous round. Moreover, most participants also adjust their own contribution to the group in the same direction. That is if they think others will contribute less then they also contribute less, rather than to try to make up for the lack in overall contributions and vice versa. A positive (or negative) signal from group members leads to an adjustment in the participants' contribution level in accordance with the group tendency.

#### 1.4.2 Non-Parametric Estimation: Group Contributions Between Treatments

Wilcoxon-Mann-Whitney are performed to assess non-parametrically the significance in average group contributions between treatments. Similar to [Stoop et al. \(2012\)](#)'s cooperation contrast

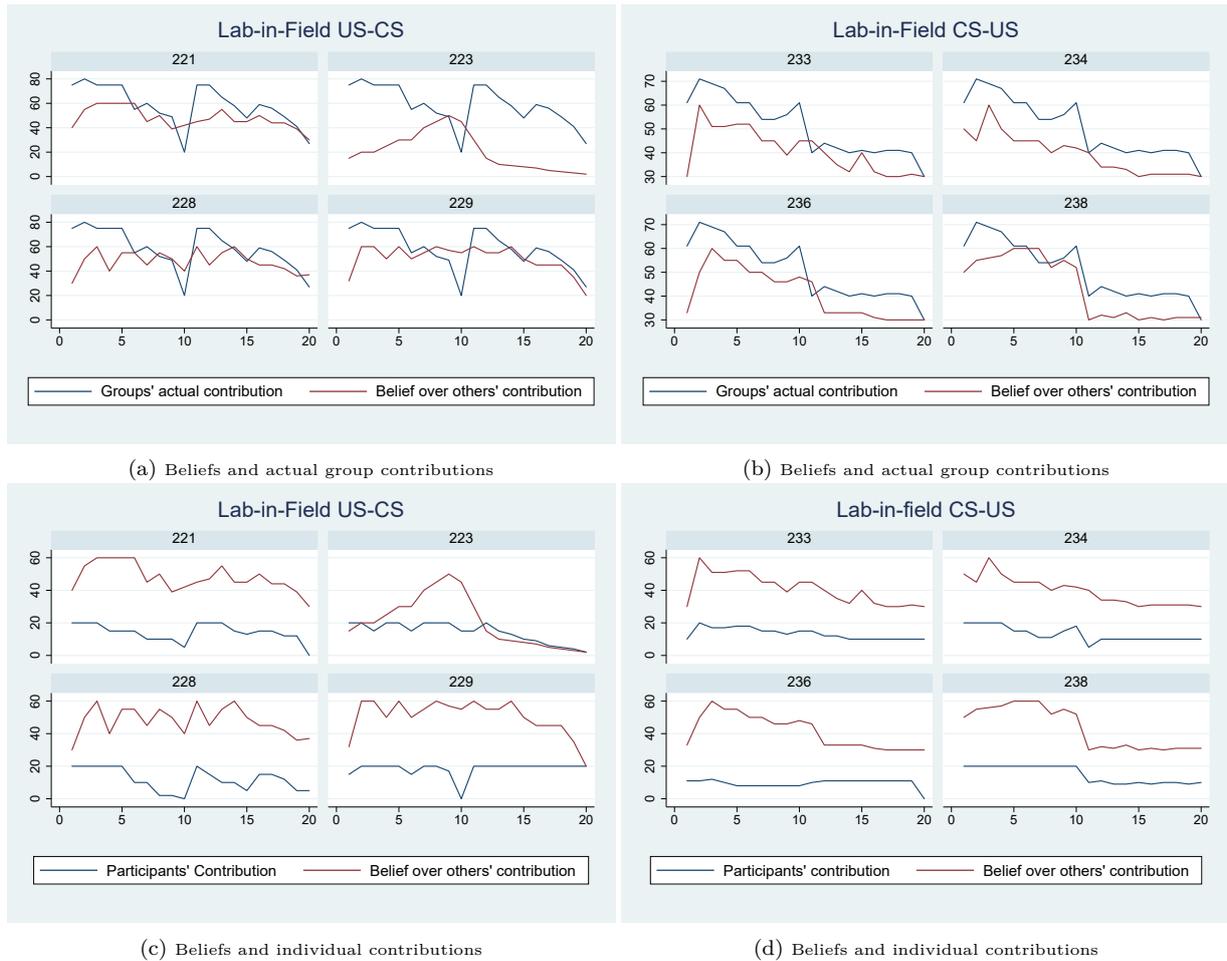


Figure 1.2 – Beliefs over group members’ contributions and actual group contributions in graphs (a) and (b). Beliefs over group members’ contributions and individual contributions in graphs (c) and (d). Lab-in-field groups in treatment US-CS in graphs (a) and (c), in treatment CS-US in graphs (b) and (d).

between fishermen and students in lab-in-field experiments, Alsatian farmers seem to be consistently more prosocial than students. Averaging over all groups and periods per treatment of the first sequence (periods 1-10), this difference between settings shows highly significant (WMW,  $p < 0.001$ ). While in the second sequence the lab-field gap remains pronounced for the US treatment (WMW,  $p < 0.05$ ), this difference is not significant any more for the CS treatment groups (periods 11-20). Table 1.3 summarizes the non-parametric results. Within the lab setting, average group contributions between the two subsidy treatments show significantly different in the second sequence (WMW,  $p < 0.1$ ) but not in the first sequence. However, consistently throughout both sequences, the two treatments do show significantly higher contribution rates than do groups in the baseline without any subsidy (WMW,  $p < 0.01$ ). Within the field setting, average group contributions between the two subsidy treatments show significantly different in the second sequence (WMW,  $p < 0.05$ ) but not in the first sequence. Nevertheless, the collectively conditional subsidy shows to be more efficient than the unconditional subsidy, which is

congruent to efficiency findings from the lab. Moreover, while in the first sequence (periods 1-10) differences among lab and lab-in-field group averages are very pronounced (WMW,  $p < 0.01$ ), the difference for the US treatment groups in the second sequence

Table 1.3 – Non-parametric comparison of average contribution rates at group level by sequence across all treatments in lab and lab-in-field Sequence 1 & 2. (n.s. = not significant)

Treatment	N	Wilcoxon-Mann-Whitney test Sequence 1		Wilcoxon-Mann-Whitney test Sequence 2	
		US	CS	US	CS
Lab					
US	17		n.s.		$CS > US^*$
CS	18				
NS	20	$US > NS^{***}$	$CS > NS^{***}$	$US > NS^{***}$	$CS > NS^{***}$
Lab-in-field					
US	3		n.s.		$CS > US^{**}$
CS	3				
Field vs. Lab					
US		$f > l^{***}$	$f > l^{***}$	n.s.	n.s.
CS		$f > l^{***}$	$f > l^{***}$	$f > l^{***}$	$f > l^{***}$

(periods 11-20) is not significant any more. This convergence in collaboration behavior over time may be a signal for learning and moderation effects to occur in lab and lab-in-field alike. Student group averages indicate strong free riding in the last periods of each sequence whereas groups of farmers on average sustain cooperation levels above threshold. The observed difference may be attributed to more perfect stranger matching in the lab.

Risk aversion seems to differ on average between the two samples, with students being more risk-averse than farmers ( $\chi^2(1) = 35.29$ ; p-value  $< 0.000$ ). Similar results have been obtained with French farmers by [Bocquého et al. \(2014\)](#) and [Bougherara et al. \(2017\)](#). As explained above, this may be due to the evaluation method used and misleading ([Drichoutis and Koundouri 2012](#)).

### 1.4.3 Parametric Estimation: Determinants of Individual and Group Contributions

The econometric analysis focuses on the determinants of individual as well as group contributions. The explanatory variables (summarized in table 1.4) comprise of the previous period's group contribution and the individual's belief over others' contributions in the upcoming period as well as several control variables including a field dummy, a sequence dummy, two treatment dummies (keeping the NS treatment as the baseline), a indicator variable for each period of the session, and a risk aversion dummy.

Table 1.4 – Description of Variables used in Econometric Analysis

Variables	Values	Interpretation
L.SumC	{0:80}, discrete	$\sum_{t-1}^4 C_i$
field	binary	lab-in-field experiment
seq	binary	second sequence
US	binary	unconditional subsidy treatment
CS	binary	conditional subsidy treatment
period	{1:10}, discrete	indicates period in sequence
belief	{0:60}, discrete	$\sum_{t+1}^3 C_{-i}$
RA	binary	risk averse

Models (1) - (3) of the random effects panel regression have individual contributions as its dependent variable and the specification is given below. Interaction terms were created between sequence and treatment types, between sequence and period, between sequence and belief and between belief and field. Error terms account for time and individual specific random effects. Individual observations are clustered by group.

For models (4) - (6) the dependent variable is the sum of group contributions and the estimation is thus performed at group level. Model 1 and model 4 omit the interaction terms. Model (3)

$$\begin{aligned}
Contr_{it} = & \alpha_0 + \alpha_1 L.SumC_{it} + \alpha_2 field_i + \alpha_3 seq_i \\
& + \alpha_4 US_i + \alpha_5 seq * US_i \\
& + \alpha_6 CS_i + \alpha_7 seq * CS_i + \alpha_{13} field * CS_{it} \\
& + \alpha_8 period_{it} + \alpha_9 seq * per_{it} \\
& + \alpha_{10} belief_{it} + \alpha_{11} seq * belief_{it} + \alpha_{12} field * belief_{it} \\
& + \alpha_{14} RA_i + \gamma_i + \epsilon_{it}
\end{aligned}$$

We base our panel data analysis on the random effects (RE) estimator, which yields a weighted average of the between and within estimates. Contrary to the FE model, the time invariant effects are not eliminated and individual-specific effects that are not explicitly controlled for rest in the error term. That is, differences among individuals are considered random (instead of fixed and possible to estimate) and are accounted for by the individual-specific component of the error term,  $\gamma_i$ . For this reason, the RE estimation is chosen over the usually more consistent FE estimator: the time-invariant treatment and lab-in-field dummies would disappear in an FE estimation. However, the RE estimates are consistent only if the individual effect  $i$  is uncorrelated to the explanatory variables.

Table 1.5 summarizes the regression results. Regression coefficients show to be rather robust across the four RE specifications. The lagged group contributions are highly significant and

explain for a large part of the variance in each model irrespective of which controls are present. The belief over other group members' contributions in the upcoming period also shows to be an important predictor of individuals' choices for contribution to the group account. The treatment dummies show persistently significant although their coefficients vary slightly depending on covariates included in the estimation. This confirms again what could already be seen in figure 1.1, average contributions in the lab-in-field are consistently higher than those of the analogue lab treatment groups and consistently above the threshold value. Although the field dummy shows very significant for individual contributions, it is not significant anymore for group contributions. This intriguing result is fully attributable to the small sample size of the lab-in-field experiment, leaving only 6x20 data points for the estimation with group contributions as the dependent variable. The period coefficient being negative and highly significant formally attests the decline in contribution levels over periods, in particular for the very last period of each sequence. The sequence dummy shows to be significant which confirms what could already be seen on the average group contribution graph (figure 1.1): treatments in the first sequence produce more pronounced differences in contribution levels between field and lab whereas treatments in the second sequence produce generally higher contribution levels within any treatment combination. When including the interaction terms, the variable *sequence* is represented 5 times in the estimation and is thus attributed a large share of explanatory power. The second sequence CS treatment shows group contributions that significantly exceed the second sequence US contributions as is confirmed by the pronounced coefficient for the *seq\*CS* interaction term at group level (coef.: 3.4,  $p < 0.05$ ). Moreover, the *field\*CS* interaction term, although positive, is not significant. Likewise, we have to consider the small sample size from the field when interpreting this coefficient. Together these two treatment interaction terms seem to indicate that the collectively conditional subsidy scheme is more successful in incentivizing higher collective contributions during the second sequence for both lab and lab-in-field.

Eliciting beliefs over others' contributions seems to have an overall positive effect on participants: the more participants believe that others will contribute the higher their personal contribution, independent of treatment type. Risk aversion does not show to significantly influence contributions while the tendency of the coefficients is negative, implying smaller contributions from risk averse participants.

Combined coefficients are estimated for all variables figuring in interaction terms of model (3) and (6). Almost all are strongly significant and detailed results are presented in part A in the appendix. Combined coefficients for the treatment variables attest quite strong order effects with higher average contributions for treatments in the second sequence. Moreover, in the second period a stronger decline in contributions over time as compared to the first sequence becomes visible for the combined estimation results of the period variable and its interaction

Table 1.5 – Random Effects Panel Regression. Average contribution rates at individual level (1 + 2 + 3) and at group level (4 + 5 + 6).

VARIABLES	Individual Contribution			Group Contribution		
	(1)	(2)	(3)	(4)	(5)	(6)
L.SumC	0.0859*** (0.00831)	0.0859*** (0.00830)	0.0839*** (0.00811)	0.717*** (0.0226)	0.717*** (0.0226)	0.720*** (0.0232)
field	0.829** (0.338)	0.608 (0.462)	3.130 (1.928)	0.988 (0.956)	-0.265 (1.337)	3.649 (3.487)
CS	1.443*** (0.271)	1.401*** (0.284)	1.306*** (0.406)	3.861*** (0.722)	3.669*** (0.735)	2.077** (1.021)
US	1.289*** (0.209)	1.329*** (0.211)	1.475*** (0.366)	3.492*** (0.703)	3.670*** (0.715)	2.836*** (1.026)
sequence	0.364** (0.167)	0.363** (0.166)	0.732 (0.629)	1.667*** (0.546)	1.662*** (0.545)	2.664 (1.750)
period	-0.182*** (0.0279)	-0.182*** (0.0278)	-0.170*** (0.0438)	-0.812*** (0.101)	-0.812*** (0.101)	-0.565*** (0.155)
belief	0.153*** (0.0104)	0.153*** (0.0104)	0.162*** (0.0111)	0.256*** (0.0275)	0.257*** (0.0274)	0.256*** (0.0315)
field*CS		0.442 (0.475)	0.568 (0.457)		2.506 (1.868)	2.566 (1.866)
seq*CS			0.146 (0.570)			2.966** (1.434)
seq*US			-0.336 (0.657)			1.538 (1.401)
seq*per			-0.0188 (0.0527)			-0.436** (0.206)
seq*belief			-0.00681 (0.0105)			-0.00130 (0.0303)
field*belief			-0.0598 (0.0376)			-0.0905 (0.0743)
RA	-0.507 (0.448)	-0.502 (0.448)	-0.473 (0.449)	-0.702 (0.681)	-0.676 (0.681)	-0.354 (0.690)
Constant	1.796*** (0.469)	1.791*** (0.470)	1.511** (0.645)	4.246*** (1.066)	4.215*** (1.066)	3.237** (1.462)
$R^2$	0.6147	0.6148	0.6155	0.8618	0.8620	0.8633
Observations	4,636	4,636	4,636	1,159	1,159	1,159
Groups	244	244	244	61	61	61

Robust standard errors in parentheses, clustered by group for models 1, 2 and 3.

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

term with sequence. While the interaction terms for beliefs are not significant in the regression model, the estimated combined coefficient shows that they reduce the general positive tendency of beliefs on contributions. They show that beliefs in the second sequence and those in the field are less positively related to contributions. Similarly, including the interaction terms for the CS treatment in the regression diminishes the explanatory power of the variable CS in the model.

## 1.5 Discussion

Based on the above analysis, four key results can be formulated from this study.

**Result 1:** Alsatian farmers contribute more than do students in the lab. This result is coherent with findings from other contexts of collective action such as the findings reported by [Stoop et al. \(2012\)](#), [Saldarriaga-Isaza et al. \(2019\)](#), [Bchir \(2014\)](#), and [Cadsby and Maynes \(1998\)](#) who also observed higher provision rates and more sustained cooperation in the lab-in-field with artefactual participants as compared to the lab with student participants. One explanation might be that farmers of the same region identify closer with the economic situation of their group members and with the environmental impact of their choices.

**Result 2:** The conditional subsidy scheme elicits higher contributions in both lab and lab-in-field as compared to the unconditional subsidy scheme. Although this difference is statistically significant only in the second sequence, it also exists in the first sequence albeit to a lesser extent. The reproduction of a result from the lab in a field setting is thus achieved. The difference in average contributions is roughly coherent with the findings from [Marks and Croson \(1998\)](#), who observe significantly higher contributions under the utilization rebate as compared to a proportional rebate or no rebate. [Croson and Marks \(2000\)](#) conclude that when “the cost of the public good project is lower, voluntary financing by a threshold mechanism is likely to be more successful”. The rebate makes a difference for scenarios characterized by low endowments, where defection in the absence of a rebate is most likely ([Cárdenas 2009](#)). Heterogeneity in endowments applies to the AES context where farms exist in different sizes and only the largest farms can reap substantial economies of scale from AES payments. The collective scheme provides some insurance against incurring high transaction costs, as efforts, and thus investments, are to be made on an inter-farm scale.

**Result 3:** Among farmers, the CS treatment is sustaining more efficient outcomes over time. This is not the case for students, whose average group contribution drops below the threshold in the last two periods of each sequence despite the subsidy mechanism. This difference could be explained by two factors. First, the average group contribution is generally higher among farmers who might just be better cooperators ([Bchir 2014](#)). Second, different motivations may be introduced in the two different samples due to the respective context ([Levitt and List 2007a](#)). Students most likely seek to reap free riding benefits in the absence of subsequent punishment during the last periods of the experiment. Farmers in contextualized frames may be motivated by other elements than just payoffs, such as environmental concern and solidarity with their

group members. Agribashing, the tendency of the media to blame the agricultural sector for environmental dilemmas, has also led to a detriment in the perceived image of farmers. It can thus be expected that farmers, when investigated in experiments, surveys or interviews, will try to polish their image with respect to environmental matters.

**Result 4:** Participants adjust their beliefs over others' contribution according to past observed behaviors independent of the subsidy treatment. They then adjust their own contributions accordingly in the same direction. This finding is congruent with the standard finding of *conditional cooperators* in pure public good games (Fischbacher et al. 2001) and the updating of beliefs about injunctive norms, i.e. the perception of morally acceptable behavior (Bicchieri 2005) based on descriptive norms, i.e. the observation of others' behavior. Therefore, social learning and trust in others' cooperative intentions are important factors in the success and durability of cooperation for threshold attainment in environmental TPGG. Miners are found to be less forgiving than students in a TPGG with punishment possibility (Saldarriaga-Isaza et al. 2019) as they continue to punish free-riders over more periods. Reasons that have been suggested for conditional cooperation based on social norms include (i) a desire for social conformity, (ii) reciprocity motives and (iii) signalling the importance of a public good (Frey and Meier 2004). Policy will do wisely to take those social aspects to farmers' decision making for collective AES into account. Next to financial rewards, trust and social norms show to have strong modulating influence for individuals' behavior within a group (see for example Dessart et al. 2019).

By moving gradually closer to the field context, these results teach us about the external validity of findings from the lab. In our examination of the transposition from decontextualized lab to framed lab-in-field experiment we do find support for the argument by Levitt and List (2007b) that decisions in experiments are more complex than a simple financial assessment of choice prospects and rather depend on social factors such as others' behavior, the context and the selection procedure. Any experimental result thus needs to be interpreted with respect to its potential biases and shortcomings imposed by the experimental setting. Moving between lab and field settings can thus enhance and complement our understanding of behavior from particular situations and provide a more comprehensive picture.

Nevertheless, there are four important points to the experimental design that need to be discussed in light of interpretation of the results obtained. First, with the current experimental setup (i.e. in absence of controlling for environmental preferences) it is difficult to say what participants' underlying motivation is. In particular, it would be of interest to disentangle the two motives of (i) empathy and (ii) environmental concern. Empathy could be important, as farmers of the same region seem to identify closer with the economic situation of their group members than do students in the lab. Environmental concern could be induced by the context, and because farmers have a stronger relationship with nature as this is their principal work environment. Thus, farmers are thought to be more sensitive to the environmental impact of their choices than students in a decontextualized lab setting. Perhaps, the behavior in the lab-in-field is due to a combination of both 'empathy' and 'environmental' motives. Thus, explicitly

assessing these motives in field settings could inform policy makers about the existing intrinsic willingness of farmers to contract under cAES.

Second, it is noteworthy for the interpretation of our results and the related discussion on generalizability that, in this experimental setting, environmental externalities are represented in the form of monetary stakes. Therefore, public externalities to the provision of the environmental public good are exclusive to the group as only the financial returns to the group account are relevant. Natural field experiments on conditional subsidy schemes would be useful to investigate behavior facing real environmental stakes that are relevant for society at large.

Third, so far, two variations were implemented when moving from lab to lab-in-field: the artefactual sample and the AES context. Similar to [Stoop et al. \(2012\)](#), a further experiment that provides a decontextualized setting to the artefactual sample would be necessary in order to control for sample and context effects. Such a setting would abstract from any environmental and pro-social motives and would thus assess principally farmers' financial interest in cAES. The results would be informative to policy makers in defining optimal incentives for collective AES payments.

Fourth, the experiment uses a relatively low marginal per capita return ( $MPCR = 0.3$ ). In a way this may reflect farmer's conventional perception of a rather low individual spillover from an improvement of environmental quality in return to changing their agricultural practices as outlined in the AES. This may become more intuitive when considering that any environmental improvement happens only gradually over the medium to long term. Farmers' investments in changing their agricultural practices, however, are immediate, so that delayed benefits are offset, at least in the short term, by relatively high transaction and investment costs and potentially lower or less profitable yields. For example, existing collective AES for species protection run over a period of 5 years and require specific crop, rotation of farm land and adapted machinery to be put in place by farmers but show rather unstable effects on the recovery of the species. The experimental literature shows significant variations in contributions in response to variations of the MPCR. Most studies find an increase in contributions when augmenting the return to the public good (e.g. [Isaac et al. 1989](#)), as long as group size is kept stable and rather small. It may thus be that increasing the MPCR of this experiment could introduce even more pronounced group contributions. Moreover, as farmers have a higher opportunity cost of time (i.e. higher income level) than students ([Saldarriaga-Isaza et al. 2019](#)), their experimental rewards should be adapted accordingly to represent more realistic stakes. The time investment proportional to the lab has been used to give an indication of the earnings transition from lab to field, e.g. a field experiment taking four times as much time as the lab counterpart should generate average earnings four times as high as those from the lab ([Stoop et al. 2012](#)).

Our experiments faced several limitations. Due to the sanitary situation we had to cancel further experimental sessions in the field, while the current atmosphere due to concerns for agribashing made it already difficult to motivate participants. Ideally, more data is to be collected to augment the validity and meaning inferred from the lab-in-field. In particular for the baseline treatment (NS) data from the lab-in-field setting would nicely serve as a field control.

A benchmark for the minimum number of observations is given by the study by [Stoop et al. \(2012\)](#) who present 8 groups of four participants each per treatment in the field.

For future research it would be helpful to disentangle the two motives of empathy and environmental concern in the decision of farmers to contract under cAES. A better understanding of the underlying motivations for contributions to an environmental threshold public good would indeed be useful in the design of cAES and their incentive structure.

## 1.6 Conclusion

In this study we have transposed the TPGG framework of a decontextualized lab experiment into a framed lab-in-field experiment to study the reproducibility of behavior under a choice setting that imitates the social dilemma inherent to environmental threshold public goods. In the two experiments, conditional and unconditional subsidies are evaluated as a potential tool for agri-environmental policies.

In the lab, a positive impact of subsidy schemes on facilitating cooperation has been attested ([Le Coent et al. 2014](#)). In the lab-in-field, we observe average group contributions that are consistently higher than those of the analogue lab treatment and that remain above the threshold value across all periods. For both samples, the conditional subsidy scheme elicits higher contribution rates as compared to the US treatment. The collectively conditional subsidy scheme thus has the potential to sustain more efficient collective outcomes and could make for a viable policy tool in AES. More field data is needed to draw better inferences ([Camerer 2011](#), [Levitt and List 2007a](#)) upon (1) the role of a conditional subsidy mechanisms in facilitating cooperation in an environmentally motivated context and (2) farmers' preferences in order to verify and disentangle pro-social and environmental motives. Moving forward, the analysis is to be augmented with natural field data stemming from a French collective AES implementation as presented in chapters 2 and 3.

**Preamble:**  
**the Case of the European Hamster in Alsace**

## Case study: the European hamster of Alsace

The Alsatian plain is the main historical distribution area of the European hamster (Villemey et al. 2013) and constitutes one of the westernmost parts of their range (Nechay et al. 2000), which stretches further East across Eastern Europe and Central Asia. The main period of activity for the European hamster (*crictus crictus*) is during the months of April to October, with a hibernation period lasting roughly throughout the winter months (figure 2.a). During the active months the hamster seeks shelter, thermal protection, nesting material, and food provision (Jacob 2008). Protection from predators and foraging space is important especially during the hamster’s reproductive period in spring. The Alsatian agricultural landscape,

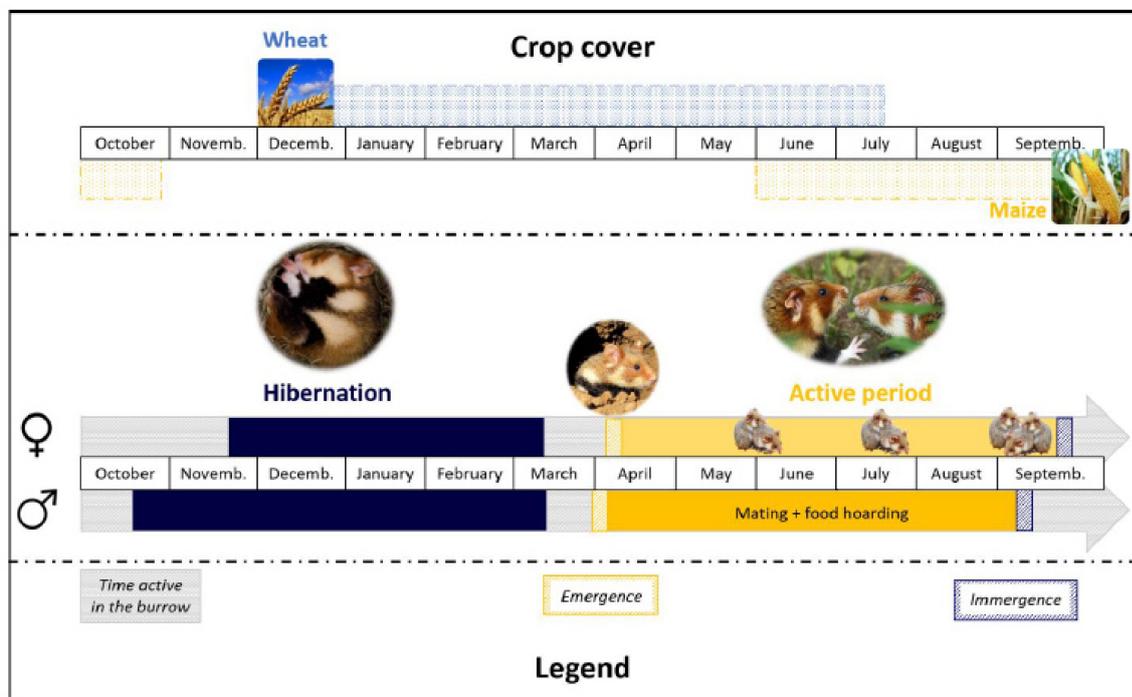


Figure 2.a – Seasonal Cycle of Wheat and Corn Crop Cover and of the European hamster’s Active and Hibernation Periods. Source: (Tissier 2017, p.33).

however, cultivated mostly with corn and spring crops, is characterized by bare soils in spring as well as yearly environmental changes necessitating frequent displacement of the hamster’s burrows. Given that the hamster’s exposure to predation depends mainly on the seasonal availability of vegetation cover, this implies predation vulnerability as the critical risk factor in the hamster’s struggle for survival (Villemey et al. 2013). Naturally, seasonal fluctuations in vegetation height are inherent to any agricultural landscape (Jacob 2008). Thus, small fields cultivated with a diversity of suitable crops for the species would increase chances for survival. Most likely, the survival of the hamster would benefit from a high density of favorable crops but also from ensuring a permanent vegetation cover. Moreover, due to its habitat in agricultural

landscapes, the dilemma of the European hamster in Alsace has the potential to highlight the problems of intensive farming practices for biodiversity in this region (O'Brien 2015). The needs of the species may serve to provoke alternative practices that are more sustainable for the entire local ecosystem.

## Protected species history

The European hamster used to be generally considered a farmyard pest and to be systematically eradicated until the 1960s, by means of flooding burrows and by installing poison traps. This drove the hamster population in Alsace close to extinction, so that from 1993 on it was legally protected under the Berne Convention<sup>2</sup>. Figure 2.b illustrates the change in distribution areas since the 1960s to date.

However, with the hamster's population stock rapidly declining, a complaint for insufficient protection measures had been filed in 2006 by the regional wildlife protection association (Sauvergarde Faune Sauvage) to the European Commission (Erlanger 2011). By 2008, the European hamster population had dropped dramatically in the Alsatian plain. Less than 10 active burrows were found (Villemey et al. 2013), whereas the critical threshold for population viability is considered to be around 1500 individual hamsters for a territory of 600 hectares (i.e. density of 2.5 burrows per ha on average) as stipulated by the European court ruling on June 9, 2011:

*In this regard, it appears from the documents in the file that, between 2001 and 2007, the number of large hamster burrows in the "core zones", which served as a reference for observation of the population of this species has dropped from over 1,160 to less than 180. In addition, according to the balance of counts for the year 2009, drawn up by the National Office for Hunting and Wildlife and whose content is not disputed by the French Republic, no population of the said species reaches in Alsace the minimum viable population threshold, which is estimated 1,500 individuals spread over an area of favorable habitat of 600 hectares that are interconnected. - European court ruling, Case C-383/09, June 9, 2011*

O'Brien (2015) judges the reluctance to put in place appropriate protective measures to be a result of administrative lethargy. An "extermination through inaction" mentality, so the author, has clearly contributed to the drastic decline of the species, perhaps because the costs of adequate conservation measures are perceived to outweigh the benefits of protection. In favor of the populations' recovery, the European Court of Justice sentenced France<sup>3</sup> to improve its

<sup>2</sup> Both, the European Union with its Habitats Directive 93/43/EEC (Appendix IV) and the Bern Convention (Appendix II) require strict protection of European hamster (*crictus crictus*) populations.

<sup>3</sup> Original wording: "Par sa requête, la Commission européenne demande à la Cour de constater que, en n'intégrant pas un programme de mesures permettant une protection stricte de l'espèce *Cricetus crictus* (grand hamster), la République française a manqué aux obligations qui lui incombent en vertu de l'article 12, paragraphe 1, sous d), de la directive 92/43/CEE du Conseil, du 21 mai 1992, concernant la conservation des habitats naturels ainsi que de la faune et de la flore sauvages (JO L 206, p. 7), telle que modifiée par la directive 2006/105/CE du Conseil, du 20 novembre 2006 (JO L 363, p. 368, ci-après la directive 'habitats')."

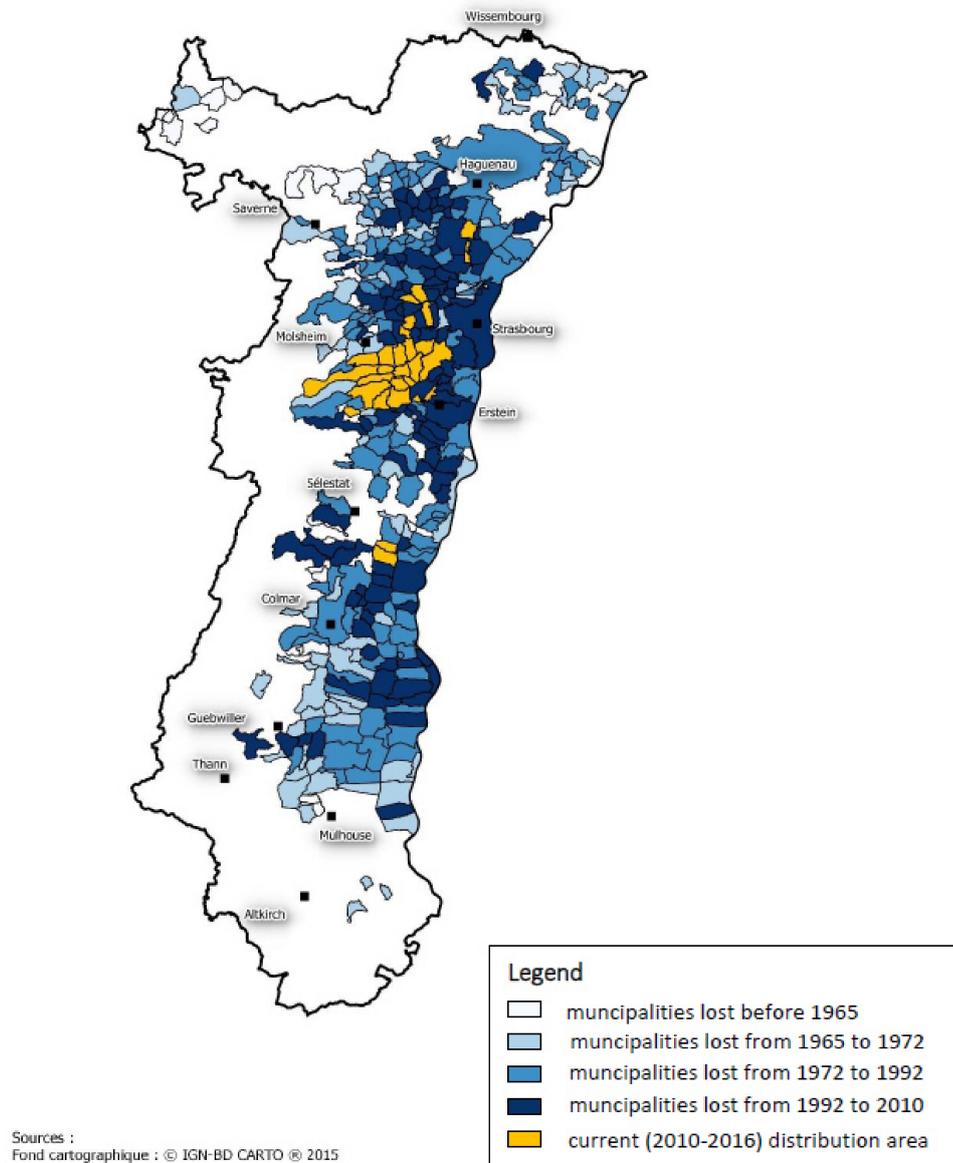


Figure 2.b – Former distribution areas of the European hamster in Alsace, France. Source: (Tissier 2017, p.38).

measures for strict protection as defined by European law under threat of a substantial fine for failure to act.

*The Court of Justice in Luxembourg, the European Union’s highest court, ruled Thursday that France had failed to protect the Great hamster of Alsace, sometimes known as the European hamster, the last wild hamster species in Western Europe. If France does not adjust its agricultural and urbanization policies sufficiently to protect it, the court said, the government will be subject to fines of as much as \$24.6 million. - NY Times by Steven Erlanger, June 9, 2011*

Consequently, from 2008 the area deployed considerable conservation efforts to protect the ham-

ster population from extinction. The Habitat Framework Directive declares the European hamster as an endangered species subject to strict protection (listed in Annex IV to Directive 92/43 / EEC "habitats, fauna, flora"). In response, three Strict Protection Zones (SPZ) have been created to preserve the last nuclei of existing populations. These SPZ incorporate around twenty Alsatian municipalities and extend over approximately 9000 hectares ([Chambre d'Agriculture d'Alsace, France 2019](#), [Direction départementale des territoires du Bas-Rhin, France 2016](#)).

A National Action Plan for the period 2012-2016 (PNA) has been drawn up in favor of the European hamster ([Virion 2017](#)) that defines safeguard measures to be carried out in the three Strict Protection Zones (SPZ). In this protected territory efforts to improve the habitat of the species are deployed in cooperation with the agricultural sector. In parallel, a program in support of restoring the most vulnerable populations has been implemented by the National Office for Biodiversity (OFB). Through the release of lab bred hamsters on territories with restored habitat, the population is supposed to be exogenously strengthened. Although these measures appear to have contributed to the stabilization of the abundance and distribution of the hamster in the last 6 years, hamster populations remain fragile and highly fragmented. While the average life expectancy of hamsters in the wild is 4 years ([Tissier 2017](#)), it appears that populations released since 2012 systematically disappear already two to three years after their release ([Wagner et al. 2016](#)).

## Habitat

Applying Franks' (2011) framework, the hamster's habitat is characterized by high asset specificity (high conservation value) and low separability (high perimeter of dispersion) over a large foraging area. Therefore, the hamster population is best managed jointly over an interconnected territory. The restoration of a viable population size requires the implementation of a set of measures in favor of the species' habitat. An environment suitable for the European hamster consists of a diversity in plant cultures and crop rotation according to its biological needs for foraging and shelter from predators. The region of Alsace is considered to be "one of the best agricultural terrains [...], with deep loess-soil where the level of underground water is ca. 30m [...] and is covered by intensely cultivated fields" ([Nechay et al. 2000](#), p.28). Within the area presenting such advantageous agricultural habitat are located the SPZs in which collective agro-environmental schemes (collective AES) have been contracted by groups of farmers. These collective management zones guarantee the provision of favorable habitat to the species, as well as refuge areas made up of crops not harvested (OFB, 2017). Ideally, the hamster should be able to exist in synergy with this form of agricultural management. However, it is recognized that preserving and reinforcing the last French European hamster population, while pursuing economic objectives for agriculture, is "not an easy task" ([Nechay et al. 2000](#)). Therefore, compensation payments have been put in place that support farmers in the creation an environment conducive to the species' survival.

Territories conducive to survival are those cultivated with straw cereal and alfalfa not har-

vested until at least October. Non-harvesting provides a permanent cover which guarantees protection and food for animals and their young born in a natural environment until they enter hibernation in September (Villemey et al. 2013, Müskens et al. 2005, Kayser et al. 2003). As long as a permanent cover of non-harvested cereal crops is maintained, reproduction rates for female hamsters of around 50% are generally observed (Villemey et al. 2013). Especially, plots of alfalfa have shown very favorable to promote the survival of freshly released hamsters, with a survival rate of 100% in the first 16 days after release, as measured in 2012 (Villemey et al. 2013). Alfalfa stays green all year round and is particularly drought tolerant because it has a very deep root pivot of over 1.50 meters into the ground (Villemey et al. 2013). The hamster can thus benefit from its water supply. However, compared to a diversified crop territory, the hamster's success in survival and reproduction is reduced in a monoculture territory composed exclusively of wheat or corn (Tissier et al. 2017). Therefore, complementing the conventional wheat cultivation by diversified vegetable bands composed of sunflower, Chinese radish and common vetch has been recommended (Villemey et al. 2013). In general, a multi-crop cover is hypothesized to diversify food sources and to avoid hydric stress for the hamster population.

## Ecosystem interactions

The hamster population is estimated on the basis of burrow counts in spring and currently still shows very low densities. The preservation of this remaining population constitutes a non-negligible intervention for the local ecosystem, including even reintroductions into areas where the species has disappeared in recent years. Since 2012, releases have been carried out under conditions deemed optimal (Villemey et al. 2013) that were evaluated scientifically within the scope of the European LIFE Alister<sup>4</sup> project (Chambre d'Agriculture d'Alsace, France 2019). These conditions relate to the type of crop (e.g. wheat not harvested), the installation of anti-predation fences and the digging of artificial burrows. Despite these efforts, a drop in the rate of survival for released hamsters has been observed over the past years. In September 2016, the number of active burrows counted represented only 8.6% of the number of animals released in the same year compared to 22% in 2015, 45% in 2014 and 90% in 2013. None of the populations reinforced since 2012 saw their numbers increase during the 2 to 3 years after the releases. On the contrary, these populations have tended to decline, or even disappear (Wagner et al. 2016). A plausible explanation may be the changed ecological conditions that also play a significant role in the survival of the hamster population. Those ecosystem factors include an increased

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<sup>4</sup> The LIFE ALISTER project is implemented in Alsace, France and revolves around 4 objectives:

1. Improvement of habitat, i.e. adaptation of crops to the hamster;
2. Reconnection of habitat zones using specific passages protecting from predators and traffic;
3. Creation of new opportunities, i.e. introducing hamsters into new areas;
4. Raising public awareness: inform about issues related to the maintenance of biodiversity.

intensity of predation, meteorological conditions, as well as the health and adaptability of the released, lab bred hamsters (Wagner et al. 2016).

## Agri-environmental management for protection of the hamster

Agri-environmental schemes (AES) are the major tools of the second pillar of the Common Agricultural Policy (CAP) to support the change in agricultural practices in order to reduce pressures on the environment and to cultivate a respectful management thereof. Environmental challenges are identified at a regional level. In accordance with the concerned territory, the perimeter of zones in which the AES may be applied are defined. The AES then attributes the compensation payments to farmers who engage in pro-environmental practices. The implementation of different types of AES<sup>5</sup> is the key driver of the agro-ecological project in France. Although AES are usually based on individual contracts, the case of the European hamster in Alsace has demanded a joint management approach.

Different types of AESs were defined for the protection of the European hamster in Alsace (Direction départementale des territoires du Bas-Rhin, France 2016):

1. The collective measure “*Hamster01*” supports the collective management of crop rotations on a predefined territory based on the density of burrows. Several farmers are involved in a collective area in order to collectively achieve a favorable crop rate (straw cereals, alfalfa, winter legumes and winter metes) greater than 24% (26% since 2018). This measure is often combined with releases of lab bred animals into the agricultural habitat.
2. Outside collective areas, the individual measures “COVER12” (rotation based on alfalfa) and “COVER13” (rotation based on winter straw cereals) can be applied.
3. In addition, within a radius of 600m around the burrows identified by the OFB during the years n, n-1 and n-2, refuge areas may be subscribed. These areas are to be composed of alfalfa and winter straw cereals that are not harvested. For plots that indicate the presence of burrows before and after the hibernation period, farmers are asked to leave the crop growing throughout the following year.

### Administration of the collective measure

This research focuses on the collective measure “*Hamster01*” for the protection and reinforcement of existing populations. Strict Protection Zones (SPZs) have been identified according

<sup>5</sup> Three types of measures are proposed: (1) system measures: the specifications apply on almost all of the farm; (2) localized measures: the specifications apply to a predefined territory where the environmental stakes are located; (3) measures to protect genetic resources: the specifications apply to protection of endangered breeds, to preservation of plant resources, to improvement of bee pollinators for preservation of biodiversity.

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to “place based priority conservation targets” (Franks 2011, p.649), i.e. the hamsters’ habitat needs. The SPZs were defined in accordance with the ministerial decree of October 31, 2012 related to the location of hamsters’ burrows (Dominiak 2016). Within the SPZs, groups of farmers can form a collective zone and apply as a group for the collective contract.

**Eligibility of surfaces.** Only plots located within a defined territory (the SPZ) are eligible to be contracted under the cAES measure. Surfaces must be located within the eligible perimeters favorable to the hamster’s territory as specified<sup>6</sup>, consistent with the distribution of burrows (Chambre d’Agriculture d’Alsace, France 2019). Only surfaces within one of the collective zones of each SPZ that are not already engaged under the 5% requirement for ecological focus areas, i.e. surfaces favorable for biodiversity, can be declared for this cAES. The minimum surface in each zone had been fixed at 24% of the collective zone’s perimeter since 2013 (for the 2018 campaign, this was increased to 26%).

**Compliance.** Each farmer voluntarily commits areas in the SPZ of their choice. The farmer collective the contracts the cAES for a period of five years (<http://www.bas-rhin.gouv.fr/>, 17/01/2020). In return for the compensation payment, compliance with the specifications of the measure is expected from all participating farmers. The farmers are directly responsible for honoring their engagements and are checked on the basis of an annual management plan transmitted to the administration which outlines the distribution of the individual commitments (Dominiak 2016, p.4). Although a minimum collective surface has to be ensured each year, the distribution of the commitments between the farmers belonging to the same collective zone can be adapted each year.

**Administrative checkpoints.** In order to be eligible for the implementation of the *Hamster\_01* measure, a farmer collective has to be validated based on all of the three following conditions (Dominiak 2016, p.4).

1. The rate of favorable crops within the collective zone must be at least 24%. When the territory defined for the establishment of the collective AES includes plots committed to compensation measures from both private and public actors, these surfaces may be accounted for under the collective contract, but the payment for non-harvesting on the corresponding surfaces must be ensured by the structure in charge of compensation.
2. Unharvested bands of cereal or alfalfa must be located directly next to or in close proximity to burrows. The distance to the burrow of the unharvested strip must be less than 300 meters. The relevance of the plots is evaluated in relation to the burrows identified by the OFB each year.
3. The spatial distribution of favorable crops must respect a ratio of 1 to 5 between alfalfa and winter straw cereals. This condition will be considered respected if this ratio, in principle fixed at 20%, is between 10% and 30%. In view of the disparity of plots, the

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<sup>6</sup> Decree of December 9, 2016 (Chambre d’Agriculture d’Alsace, France 2019)

verification of compliance with this ratio cannot be carried out with an accuracy of less than 5 percentage points.

**Coordination.** Farmers are grouped in collective zones according to the municipality their land is located in. Crop rotations are managed collectively within the zones according to the density of burrows. Coordination of the collective contract takes place within the farmer collective. In yearly meetings the distribution of commitments between farmers is discussed in order to optimize the spatial arrangement of crop cover and to adapt the locations of favorable crops according to the burrows. Regional institutions, such as the chamber of agriculture, help farmers in the area to subscribe to the cAES and to succeed in their commitments.

**Non-compliance.** In case the minimum collective surface is not reached, the collective implementation cannot be recognized and each farmer will then have to make a request for assistance according to the individual AES modality (e.g. COVER12 or COVER13).

**Compensation.** Payments to the farmers are organized via an intermediary: the EC as an approved collective structure is a beneficiary of funding from the Collective AES which it then redistributes between its members. The co-financing parties consist of the European Union (50%), the Ministry of Ecological Transition and Solidarity, the regional division of the French Ministry of Agriculture and the Environment (DREAL Alsace, 20%), and the region (Grand Est, 20%). The individual subsidy payment depends on the unit amount per hectare of favorable crop supplied by each farmer according to the total surface of favorable crops within the collective zone (€ 435/ha for the 24% threshold, 452 for the 26% threshold and up to € 520/ha for 40% and above). In addition, a one-time annual payment (€ 177.5) is provided for each plot with favorable crop types that contains at least one burrow ([Chambre d'Agriculture d'Alsace, France 2019](#)). The compensation payment thus tries to reflect an amount that corresponds to the transaction costs (e.g. equipment, crop yield and margin) and to the opportunity costs (e.g. shortfall in income) incurred by each farmer.

**Change in perimeter.** For the governmental authorities it is acceptable to enlarge a collective zone (the threshold rate remaining the same), if it is not in the last year of the contract. A reduction in the perimeter of any collective zone, however, is officially not allowed. Nevertheless, an official change in perimeter becomes possible at the beginning of a new contract period. For most of the zones that had started the 5-year cAES in 2013 the perimeter of the collective zone was redefined when the new contract period started in 2018. For instance in 2013 the largest collective zone included one village, in 2014 a second village was added and since 2018 the two communities are split into two separate collective zones.

## Farm heterogeneity

It has to be noted that collective zones can vary considerably in size. Both the number of cooperating farmers and the agricultural surface vary from zone to zone. Even if larger zones comprise of more members that each contribute smaller amounts of their farm's surface, the aggregate group contribution still has to reach the threshold. There can be one large farm

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that makes a relatively large contribution as compared to the zone's smaller farms. Although the large farm does provide a proportionately similar ratio in terms of total farm territory, the total contribution is much larger than that of the other members. For example, if all farmers contribute 25% of their total farm surface, where there are 15 farmers who have 20 hectares at their disposal and one farmer who has 100 hectares, the contributions amount to  $15 \times 5\text{ha} + 25\text{ha}$ . Together, all the farmers contribute enough to reach the zone's threshold in terms of favorable surface. However, one farm contributes a surface that is five times the size of the other contributions, although proportionally identical to other farms' share of surface. This heterogeneity implies that farmers, depending on their size and share of land in the protection perimeter, have different degrees of impact in the collective contract.

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## Chapter 2

# Do Collective Agri-Environmental Schemes Achieve Desired Environmental Outcomes?

### The Case of the European Hamster (*cricketus cricketus*)

#### Abstract

Using novel data from a species protection measure, this paper studies a collective approach to agri-environmental schemes. In order to elicit change in environmental quality a minimum effort is required that no farmer alone can provide. Individual agri-environmental schemes (AES) have not shown effective in coordinating individual efforts with regard to this collective effort threshold inherent to spatially defined environmental dilemmas. The case study presents a collective AES for biodiversity based on the creation of a connected territory of favorable habitat for the European hamster (*cricketus cricketus*). As an umbrella species to the local ecosystem, protection of the European hamster in Alsace is relevant in at least two aspects: (1) highlight the problems of intensive farming practices for biodiversity and (2) provoke alternative farming practices that are more sustainable for the local ecosystem as a whole to serve many threatened species in this intensively-managed agricultural landscape. The results show that cooperation among farmers across a common territory benefits from (i) the presence of a moderating farmer association, (ii) flexibility in contract design and (iii) visibility of environmental outcomes achieved through the scheme. Smaller groups may find it easier to make proportionally large contributions and most contributions go well beyond threshold. The collective effort contributed is positively linked to an improvement in environmental quality.

**JEL Classification:** Q18, Q56, Q57

**Keywords:** Collective Agri-environmental Schemes, Species Protection, European Hamster.

This work has been submitted to Land Use Policy.

## 2.1 Introduction

In 1992<sup>1</sup>, when agri-environmental schemes (AES) were introduced to the European Union's (EU) common agricultural policy, they consisted solely of individual farm agreements granting access to financial resources in exchange for particular, specifically defined practices to be implemented by the contracted farmer (Kuhfuss et al. 2013). These single farm contracts have not shown to improve biodiversity and ecosystem conditions to a significant degree (Emery and Franks 2012, Espinosa-Goded et al. 2010). In order to halt the rapidly increasing biodiversity loss, conservation efforts would need to be homogenized over a larger ecological corridor making up for a territory spreading over, most likely, several agricultural communities. The original "piecemeal approach" (Emery and Franks 2012, p.8), i.e. the scattered adoption of contracts, has at least shown the existence of a willingness among individual farmers to adapt their farming practices for the sake of ecological outcomes. However, this individual approach has left desired ecological outcomes unattained. Difficulties, such as institutional complexity, make participation rates difficult to anticipate and result in budgets being under-consumed. In the absence of a rigorous assessment method for environmental effects, uncertainty about the environmental effectiveness<sup>2</sup> of individual AES persists (Dupraz and Pech 2007). Therefore, while budget and individual efforts are invested in AES with the goal of improving the state of deteriorating ecosystems, schemes might as well be designed to achieve this objective in a reliable manner. A collective contract involving connected farm areas would ensure a better interconnection between agricultural territories. Nevertheless, environmental quality<sup>3</sup> targets can only be realized with regard to a threshold inherent to the environmental good. This threshold translates directly into a minimum effort level that is required to elicit environmental change. Only if enough farmers change their farming practices over a coherent territory can they affect the ecological system positively. Collective contracts imply coordinated effort on a spatially defined area, thereby facilitating the concentration of collective action needed to meet the environmental threshold. Emery and Franks (2012) find that 81% in their sample of British farmers are favorable to the idea of collective contracts. Moreover, their sample reveals current participation in AES to be positively correlated to the stated willingness to adopt collective schemes in the future. However, their sample also reveals a general tendency to avoid change, favoring contracts that do keep most of the farmland productive and only introduce incremental changes. Franks (2011) finds that farmer associations play a key role in making collective AES (cAES) more cost- and time-efficient as compared to conventional, individual AES. It remains to be investigated whether collective measures are capable of attaining the desired environmental objective that the respective cAES contract is laid out to address. Using novel collective agri-environmental scheme

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<sup>1</sup> In 1992, 168 countries committed to the conservation of biodiversity by signing the Convention on Biological Diversity (Kleijn et al. 2011).

<sup>2</sup> Effectiveness is defined as the successful attainment of intended outcomes.

<sup>3</sup> Environmental quality is defined as a measure of the state of an ecosystem relative to the requirements of its users (e.g. air and water purity or pollution).

data from a species protection measure, this paper investigates the environmental effectiveness of a cAES approach. The potential of collectively conditional incentives with regard to threshold attainment has been demonstrated experimentally (Le Coent et al. 2014, and chapter 1). However, data from the field on the cause and effect relationship of such collective incentives is substantially lacking. Evidence from the field is important for policy mechanism design as experimental conditions often do not represent real world conditions<sup>4</sup> (Feltovich and Grossman 2015). Therefore, this paper presents novel cAES data from a case study with farmers enrolled in a collectively conditional scheme that has recently been introduced in France. The results show that effort contributions under the collective contract go well beyond the threshold value and that smaller zones may find it easier to make proportionally large contributions to the scheme. Findings further indicate that effort contributed under the cAES is positively linked to an improvement in environmental quality.

The paper is organized as follows: Section 1 is dedicated to a contrast between individual schemes and collective contracts. In section 2 the case study on cAES for species protection is presented. Section 3 describes novel data from the case study and methods. In section 4 the link between invested economic resources and environmental outcomes is established through the presentation and discussion of the results. Sections 5 delineates the future potential of cAES for the Common Agricultural Policy (CAP) in Europe and concludes on the remaining challenges.

## 2.2 Innovating policy: the collective AES

We focus on a particular type of localized agri-environmental measure where groups of farmers are to apply specific farming practices on a predefined territory. Given the environmental threshold dynamics inherent to any ecosystem, the environmental management necessitates joint efforts on an interconnected territory. This territory is the agricultural land that mostly affects the local ecosystem and on which ecosystem services thus have to be performed. Once signed by the farmer, AES contracts usually have a term of 5 years. It is thus important to define sensible measures that are pertinent over this rather long time span. Traditional AES require individual commitment to environmental targets as outlined in the European Union's CAP. Because they are neglecting the collective aspect, the limited and scattered adoption of contracts shows inefficient and unsuccessful in attaining environmental quality targets (Kuhfuss et al. 2016b). Novel, collective AES, on the other hand, propose one contract to a group of farmers whose land is located on the predefined territory. Because they are fairly recent, the relationship between collective AES and environmental effectiveness has not been established yet. To gain a better overview on the policy challenges to agri-environmental management, both individual and collective AES are discussed.

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<sup>4</sup> Laboratory and lab-in-field experiments often rely on relatively small, manageable groups due to budget and equipment constraints. However, the effect of communication may vary substantially based on the size of the group, so that results from experiments with small groups may have little implication for real-world settings with larger groups (Feltovich and Grossman 2015), for example.

### 2.2.1 Challenges of individual AES

The challenges inherent to individual AES include a lack in transparency between the contracting parties, the development towards farmland intensification and the environmental threshold dynamics that are often defined on a spatial scale.

**Lacking Transparency.** Agri-environmental regulation is confronted with the principal agent problem of information asymmetries and uncertainty about real effort requirements for eliciting environmental change (Dupraz et al. 2009, Van Dijk et al. 2015). Due to uncertainty on the environmental quality threshold, regulators design contracts on a best estimate of the situation. Farmers then perceive the proposed contract clauses as incoherent with the actual farmland requirements, an ecosystem they engage with on a daily basis. Moreover, subsidy and bonus payments often reflect transaction, opportunity and effort costs through averaged-out estimates that are likely to over or undervalue actual requirements of heterogeneous farms (Carvin 2019). In addition, a multitude of factors exogenous to the agricultural system can influence and alter environmental quality, making it difficult for both regulator (principal) and farmer (agent) to monitor and control a cause-and-effect relationship between the individual farmer's practices (as prescribed by the AES) and the environmental outcome. For example, measures to improve ground water quality that apply restrictions on pesticide and fertilizer use to the agricultural sector do not control pollutants stemming from industry, air quality, private households and other origins of non-point source pollution. Thus, even in the presence of monitoring and penalties for non-compliance, environmental thresholds may not be reached in spite of well-intentioned AES. However, contract designs that stipulate a realistic environmental threshold with regard to farming efforts combined with a precisely delineated territory for contract application, could circumvent excessive discouragement among farmers and improve the manageability of AES for both sides of the contract (Dupraz et al. 2009).

**Farmland Intensification.** The increasing size of farmland territories cultivated with intensively managed monocultures comes at the expense of biodiversity degradation (Groeneveld et al. 2019, Kleijn et al. 2011). The formerly complex mosaic of naturally evolved habitats that balance the hosting and co-existence of diverse species, is homogenized through intensive agricultural practices. With about 45% of rural areas being covered by farmland, agriculture is invading the habitat and eradicating the ecological niches of many species (Kleijn et al. 2011). Monoculture lowers biodiversity levels to a species threatening extent with extinction forestalling any other evolutionary process (ibid). Where small population stocks of threatened species still exist, their numbers are well below the threshold for autonomous recovery (Tschardt et al. 2005). While cleared landscapes (< 2% semi-natural habitats) are considered unrecoverable, structurally simple landscapes (2-20% semi-natural habitats) are thought to still be responsive to human intervention (Kleijn et al. 2011). In order to halt this fast growing rate of biodiversity loss, the European Union has already twice revised its goal to impede ecosystem deprivation stemming to a large extent from intensive agriculture (Van Dijk et al. 2015). In this regard, AES are considered an integrative part of conservation efforts by the EU (Groeneveld et al.

2019, Van Dijk et al. 2015). Despite a considerable budget for AES, their effectiveness has been limited.

**Spatially defined Thresholds.** Recognizing a need for explicit environmental protection measures for the agricultural sector, the EU created a system of payments that compensate agricultural efforts to protect and reinstall natural focus areas and to apply explicit practices for the restoration of ecosystems (Van Dijk et al. 2015). Since 1992, farmers can apply to AES in order to obtain subsidies in return for the adoption of specific farming practices with the goal to improve environmental quality (Kleijn and Sutherland 2003, Kuhfuss et al. 2013). Traditionally, AES propose individual contracts to farmers. However, inherent to environmental quality targets are threshold dynamics which translate to a minimum effort level. The minimum effort level is defined as the amount of effort needed in order to elicit a response from the ecological system, i.e. the threshold. To the extent that no single farmer alone can supply the total amount of ecological services needed in order to meet the effort threshold for a larger region, sufficient participation across the implicated territory is necessary (Groeneveld et al. 2019, Lastra-Bravo et al. 2015). Insufficient participation rates and considerable geographic dispersion of AES adoption has resulted in biodiversity rates that continue to decline in spite of more conservation measures being put in place (Groeneveld et al. 2019, Kleijn et al. 2011, Kuhfuss et al. 2016b). According to the conservation literature (Van Dijk et al. 2015, Kleijn et al. 2011, Balmford et al. 2012) around €5 billion of the yearly EU budget go towards AES. The most effective types of AES are reported to be those that target species diversity and habitat quality for species protection (Finn et al. 2007). Yet, conservation and restoration results do not seem to reflect this investment and results vary across measures and territories (Van Dijk et al. 2015, Groeneveld et al. 2019). Clearly, a better understanding of the factors linking the costs of schemes, the recommended agricultural practices for environmental quality management, the required effort and the resulting environmental outcomes is needed (Finn et al. 2007, Kleijn and Sutherland 2003).

### 2.2.2 Collective AES as an innovative measure

According to theories on cooperation in the presence of a threshold (Dupraz et al. 2009, Le Coent et al. 2014), collective action (Cadsby and Maynes 1999, Ostrom 1992), farmer coordination (Franks 2011, Emery and Franks 2012, Riley et al. 2018, Van Dijk et al. 2015), spatial dynamics (Barreteau et al. 2016, Bamière et al. 2013, Banerjee et al. 2012) and collective bonus schemes (Kuhfuss et al. 2016b, Parkhurst et al. 2002, Banerjee et al. 2014), financial incentives can motivate coordination among groups of farmers in an attempt to ameliorate environmental outcomes. Being characterized by threshold dynamics, environmental dilemmas often demand a minimum group effort in order for change in environmental quality to be elicited. Collectively conditional incentives, therefore, could facilitate the attainment of effort thresholds and spatial coordination.

Whether key problems of individual-commitment based contract types can be mitigated by

collective agri-environmental management requires a threefold discussion. First, the impact of collective AES on the above mentioned principal-agent dilemma (i.e. information asymmetries, participation rates) is to be investigated. Second, the incentive structure of the collectively conditional subsidy mechanism is to be analyzed with regard to cooperation. Third, the role of group size in coordinating<sup>5</sup> the collective effort is to be discussed.

**Collective Conditionality and Participation Rates.** Participation rate is directly connected to the environmental threshold dynamics. The underlying assumption is that no single farmer alone can meet the threshold that stipulates change in environmental quality. Unfortunately, the threshold effects inherent to environmental quality, diffuse pollution, and ecosystem consequences are poorly understood but clearly very sensitively interrelated. Two entirely different states of a system may exist depending on whether the system's parameter values are above or below the required threshold level. For example, a species may be able to reproduce and self-sustain its population level without need for interference or it may be at the verge of extinction, depending on habitat conditions. Likewise, groundwater quality may be sufficiently clean to be potable or it may be highly polluted as to be effectively poisonous, depending on the quantity of chemicals that penetrate the ground and seep into the water catchment zones.

Only if collaborating individuals manage to achieve a threshold effect at the aggregate effort level can ecosystem change be initiated (Finn et al. 2007). In order to address an environmental challenge at a collective level, the condition of a shared, commonly affected territory has to be fulfilled. Only farmers that are interconnected through their farmland can have an impact on a spatially defined problem. In the scope of agri-environmental schemes, the desired outcome is an improvement of the quality of the local ecosystem through the practices implemented under the measure.

*Hypothesis 1: Environmental quality increases with the proportion of aggregate contributions to the public good.*

In light of this threshold effect inherent to ecosystems and environmental quality, the favorable attitudes of individual agents are no longer enough. Rather, a collaborative, unanimous approach that covers entire territories is required. However, such a collaborative approach relies on high participation rates over a geographical corridor requiring significant farm-scale efforts (Finn et al. 2007). Such dependence on others' cooperation<sup>6</sup> can demotivate or hinder individual farmers that would nevertheless be willing to contract under individual schemes (Groeneveld et al. 2019). Communities that do not manage to cooperate sufficiently under the collective

<sup>5</sup> Coordination is defined as the synchronization of efforts to pursue a common goal.

<sup>6</sup> Boulton et al. (2013) recommend to recognize the difference between collaborative and coordinated governance approaches to collective action: Collaborative approaches are defined as "Land managers meet, work together and maintain a dialogue. Land managers need to engage with each other for the project to deliver its desired outcomes.", while coordinated approaches are defined as "Land managers working towards the same objective but in isolation. Joint working between participants is not necessary for the project to deliver its desired outcomes. External facilitation is a common feature of this approach."

scheme will be penalized and risk losing all subsidy payments even if individual farmers made every effort they were able to contribute. If at the aggregate, collective level the applied effort does not meet the imposed contribution threshold, all farmers are penalized, regardless of their individual effort contribution. However, subsidy payments that are conditional on a collective effort are hypothesized to help farmers to provide a connected agricultural landscape favorable to the species' survival. Therefore, the collective incentive mechanism proposes that only groups of farmers who are willing and able to supply the specified threshold of aggregate group contribution participate by contracting under the agri-environmental scheme. The financial incentive structure (see table B1 in the appendix) stipulates yearly payments per hectare of contributed surface depending on the collective contribution level. Given that this payment structure is staggered, individual payments increase with the provision of favorable surface beyond the threshold.

*Hypothesis 2: The payment structure has a positive and increasing impact on contributions to the public good.*

Ideally, collective pressures would lead individual farmers to comply with these objectives and thus ensure high participation rates (Van Dijk et al. 2015). This mechanism could translate into a social norm. Hence, a better understanding of the incentive mechanism underlying collective schemes is needed.

**Group Size.** Depending on the number of farmers that participate under the collective scheme, coordination within any one group of farmers can be more or less complex. Findings from collective action research and experimental economics are useful in analyzing the effect of variations in group size for the functioning of cAES.

The group size hypothesis as pronounced by Olson (1965) stipulates that public good provision is decreasing in group size, a paradox to 'the more the better'. A weaker interrelation is described by Pecorino (2015), who finds that real public good provision deviates the stronger from the optimum the larger the group. Correspondingly, in a contingent valuation study, Bohara et al. (1998) show that the willingness to pay for the public good decreases with group size in open ended choice settings. Economic experiments on Voluntary Contribution Mechanisms (VCM) to public goods in absence of threshold effects reveal a number of interaction effects that mediate the role of group size on individual contribution levels. Kerr (1989) demonstrates experimentally the prevalent belief that individual contributions to the public good matter less as group size increases. This belief is based on the reasoning that risks of coordination losses increase the larger the group. Beliefs that associate large groups with lower self-efficacy are referred to as an oversensitivity to group size (ibid). Other studies have looked at the relation between the marginal per capita return (MPCR) and group size. Isaac and Walker (1988) demonstrated through student experiments that group size is negatively related to allocative efficiency for public goods of low marginal return (MPCR constant at 0.3). They do not find an effect related purely to the number of group members (either 4 or 10), e.g. an absolute number in terms of group size that elicits the change in aggregate contributions. Later on,

Isaac et al. (1994) report that groups of 40 and 100 members allocate more efficiently under the standard VCM than do groups of original size 4 and 10 given a constant low MPCR of 0.3. Increasing the MPCR to 0.75, this difference in allocations vanishes and contributions rise on average. Nosenzo et al. (2015) find that under high MPCR, larger groups have more difficulties to sustain cooperation, whereas under low MPCR, larger groups succeed more often to sustain cooperation than do small groups. It has to be noted that in their experiment differences in group size vary from 2, 3, 4 to 8 participants. Conclusions on group effects are thus based on merely one additional person joining or leaving the group. Nevertheless, the driving element of those studies thus seems to be the interaction effect of MPCR (either high or low) with group size. Therefore it seems to be the incentive compatibility that moderates whether group size has a beneficial effect on cooperation. When the MPCR is low, increasing group size to reap the benefits of cooperation may be favorable to the provision of the public good (Nosenzo et al. 2015). When the MPCR is high, cooperation may already be sufficiently high in small groups (ibid). Unfortunately, in the case of environmental quality, the “real” MPCR associated with providing the public good is highly subjective as some people may value biodiversity, for example, more highly than others. In field settings it is thus rather ambiguous to determine or even to induce a marginal return to individual efforts.

In the literature on threshold public good games, findings on allocative efficiency generally oppose the group size paradox. The provision of threshold public goods seems to benefit from larger<sup>7</sup> groups which are coordinated through the provision point mechanism<sup>8</sup>. Rondeau et al. (1999) demonstrate that the provision point mechanism (PPM) induces aggregate demand revelation for the public good and therefore coordinates contributions at the group level. Alberti and Cartwright (2015) find a U-shaped relationship between the size of endowments and the successful provision of public goods. Although they do not investigate group size explicitly, it can be conjectured that a large group size should be of help if endowments are particularly small. Even if individual contributions to the public good decrease with group size, the collective potential increases with the size of the group as long as the good remains non-excludable (Esteban and Ray 2001). This is because more group members entail more resources that are available to the production of the same public good. Environmental quality, for example, can only benefit from more citizens with pro-environmental behavior, even if the average citizen can only behave pro-environmentally in a limited amount of ways. Every additional unit or resource (effort, attention, time etc.) contributed to the public good can only improve the group’s effectiveness. Being able to draw from a larger pool of resources increases the group’s span of action although this may come at the sacrifice of communication and coordination ((Oliver and Marwell 1988)). Therefore, Oliver and Marwell (1988) note the importance of the ‘critical mass’, a smaller sub-team of pioneers within the group that steers

<sup>7</sup> Groups of size above 40 to 100 members are considered as large in economic experiments. Groups of size 4 to 10 show no reliable difference in allocative efficiency (Isaac et al. 1994).

<sup>8</sup> The provision point mechanism regulates that the public good is produced only if contributions reach a predetermined threshold. In order for the provision point mechanism to facilitate the group’s coordination, the threshold has to be known with sufficient certainty.

the group's efforts and coordinates the small individual contributions. This implies that a small sub-group of highly motivated and ambitious pioneers is sufficient to steer the larger interest group towards the common goal as long as benefits outweigh costs for the core - irrespective of other individuals' benefits. Thus, larger groups may find it easier to provide enough territory so as to reach the imposed threshold for environmental quality change. Many farmers are likely to have more resources and to find willing contributors among their large group than few farmers in a small group.

*Hypothesis 3: Group size is positively related to the aggregate contribution to the public good.*

**Information Asymmetries and Communication.** Agri-environmental policies that rely solely on an economic rationale have shown to be too short-sighted (Van Dijk et al. 2015). While economic research has found that incomplete information on others' contributions does not diminish the successful attainment of an aggregate contribution threshold (Marks and Croson 1999), these findings relate to isolated laboratory environments. Decision making under AES is more complex than a simplistic earnings calculation in an economics laboratory experiment. Rather, farmers' intention to participate in AES incorporates social and psychological aspects related to group norms, self-identity and attitude towards AES and the environment in general (Lastra-Bravo et al. 2015, Van Dijk et al. 2015). Those intangible items to the cost-benefit analysis are difficult to capture by the regulator and translate only partly if at all into financial compensation. For instance, transaction costs such as barriers to contracting, access to information, the farmer's confidence in reliability of administrative procedures and confidence in goodwill of the state all seem to be correlated to the likelihood of contract adoption (Dupraz and Pech 2007, Lastra-Bravo et al. 2015). This means that better paid contracts are not necessarily better received if the inherent constraints and ambitions increase transaction costs beyond what is captured by the measure's compensation. Risk mitigation for possible income reduction due to the application of agro-environmental changes to farm practices appears to be facilitated on large farms that practice crop diversification and generate economies of scale as well as on farms with alternative sources of household income (Lastra-Bravo et al. 2015). Finally, farmers' characteristics are positively related to the willingness to adopt AES along the dimensions of education level, age and social capacity as, for example, engagement in agricultural organizations (Lastra-Bravo et al. 2015). Decision factors related to tradition, cultural practices, group pressure, actual transaction costs that are intertwined with future meteorological conditions, pests and labour force available on the farm, all leave a considerable margin of uncertainty to both the agent and the principal designing the scheme. In order to smooth out any information asymmetries, communication is key. Intermediaries that act between farmers and policy makers have the possibility to work in both directions, to represent farmers' needs and interests and to translate policy targets into viable farming practices. However, for any collective measure to be implemented, a basis for communication first needs to be introduced. The

establishment of such a forum for exchange of interests and discussion (Franks 2011) is more likely when a common topic of interest is shared among members of the same territory, such as an environmental problem imposing a significant challenge to conventional agricultural practices.

*Hypothesis 4: A shared communication platform facilitates sufficiently large contributions to the public good.*

However, problems that require change in agricultural practices are not always of interest to the individual farmers, as the implied change from established traditions might introduce significant transaction and effort costs that could entail repercussions well beyond one single management practice. Not surprisingly, those collective measures that require the least adaptation or effort for change are those most likely to be considered an acceptable topic of interest around which a platform for discussion can be built and for which adoption of the measure is most likely to be obtained (Emery and Franks 2012). Therefore, policy needs to be targeted spatially precisely to those communities and areas that share a common ecological zone to which the measure is to be applied. In order to reliably provide all this information, experts on ecological, agricultural, economic, and societal levels need to efficiently communicate requirements for the effectiveness of a new measure towards the regulating authority. Close contact and knowledge of the socio-economic culture, which the farming practices are embedded in, is therefore indispensable for information asymmetries to be avoided.

### 2.2.3 Relevance to policy design

European farmland makes up roughly 45% of the countryside, signifying important implications for a majority of European species' habitat and ecological niches (Kleijn et al. 2011). For those species particularly associated with farmland habitats, steep declines in numbers and in territory available for foraging and protection were registered (ibid). Kleijn et al. (2011) advocate that the underlying objective to agri-environmental efforts should be considered before any suggestions for scheme design are made. Similarly, Finn et al. (2007) contemplate the need for causality between the prescribed farming practices and the desired environmental effects. Only if the magnitude of effects is sufficiently pronounced can the environmental target be reached. Farmland management is thus thought to be the means through which environmental states are to be provoked and thus needs to be directed accordingly. While in 2002 the goal to halt biodiversity loss by the year 2010 has been set as a global agreement, the treaties and measures put in place have shown insufficient in reaching this goal well beyond the year 2010 (Kleijn et al. 2011). With the rate of biodiversity decline accelerating despite supra-national efforts and means put in place, the urgency to identify how to design conservation measures and how to best channel efforts in order to halt biodiversity loss is ubiquitous. In the words of Kleijn and Sutherland (2003), there is a concrete "need for studies that directly link the costs of schemes with their biodiversity benefits" (p.965). While the need for action is clear,

there is uncertainty about which instrument to apply in order to respond most effectively to environmental problems involving collective territories.

In 2014 the EU Rural Development Regulation (Regulation (EU) No 1305/2013, Article 28) strived to improve the spatial dilemma of scattered individual AES contracts. Measures requiring farmers to apply for agri-environmental contracts as a group (Groeneveld et al. 2019) are introduced for EU member states. In France, the collective AES are proposed in parallel to the former individual measures, leaving space for individually motivated farm applications as well. In the Netherlands collective contracts have already been available since the year 2000 (Van Dijk et al. 2015) within a national program. From 2016 onward, however, only joint applications by farmer collectives were permitted by the Dutch government (Groeneveld et al. 2019). Whether this strategy leads to better ecological results is questionable as, under cAES, payment is available only to those communities that attain the critical collective participation threshold. Insights on the effectiveness of the so far still controversial collectively conditional incentive mechanism are needed in order to develop policy recommendations.

Using novel agri-environmental scheme data from a species protection measure, this paper investigates whether the collective AES can realize its environmental objective of recovering a self-sufficient population stock. The species protection measure for the European hamster of the region of Alsace in northeastern France provides first insights on the elicited efforts in favor of species protection due to a collective incentive mechanism as opposed to the stipulated counterfactual of isolated individual contracts. Through the provision of crop diversity and year round vegetative cover, a significant stabilization of the hamster population across the involved territory, comprising 22 farming communities, is aspired. The cost for this five year cAES implementation over 8000 - 9000 hectares of farmland has been estimated to amount to € 1.3 million (Chambre d'Agriculture d'Alsace, France 2019, Wagner et al. 2016, Virion 2018). How does this tangible investment relate to the species' survival? Can the collectively conditional incentive mechanism provoke a homogenization and an increase in spatially distributed efforts under the agri-environmental scheme? Central to our investigation is the relationship between collective AES implementation and the sought environmental outcome.

## 2.3 Case study: the collective AES for species protection

The European court clearly states that the Republic of France is held responsible for upholding strict protection measures to reinstate a viable population of the endangered species on French territory (European court ruling, case C-383/09, June 9, 2011). The population stock is considered viable at a count of at least 1500 hamsters over a 600 hectares area. The restoration of a viable population size requires the implementation of a set of measures favorable to the species' habitat. Therefore, the purpose of the agri-environmental measure is to improve the habitat available to the European hamster.

The objectives of the national action plan 2012-2016, based on the development of a habitat favorable to the hamster based on the cultivation of favorable crops in its feeding and breeding areas (Dominiak 2016), were:

1. to improve the network of favorable crops around the burrows;
2. to ensure the continuous presence of covered surfaces near burrows;
3. to allow for population reinforcement, such as early improvement of the habitat, the creation of suitable release sites and reintroductions.

Due to its habitat in agricultural landscapes, the dilemma of the European hamster in Alsace has the potential to highlight the problems of intensive farming practices for biodiversity in this region (O'Brien 2015). The needs of the species may serve to provoke alternative practices that are more sustainable for the entire local ecosystem.

The collective measure “*Hamster01*” aims to allow collective management of agricultural surfaces, within a specific community characterized by a high density of burrows, as well as strengthening of populations through reintroductions of lab-bred hamsters. Strict Protection Zones (SPZs) in France or National Character Areas in England are identified according to “place based priority conservation targets” (Franks 2011, p.649), i.e. land management goals that are specific to a region’s biodiversity needs. Accordingly, the measure specifies, at the plot level, the eligible perimeters of SPZs<sup>9</sup> for the European hamster in order to ensure the restoration of adequate habitat for the animal. The perimeter is defined based on the density of burrows of existing hamster populations. The SPZ is then divided further into collective zones (CZs), which correspond to local communities of farmers. Each SPZ thus comprises several CZ which can vary considerably in size.

The collective contract imposes farming practices for all adherent farms within the CZs. The measure advocates the collective management of favorable habitat over the zone’s perimeter, which consists of (i) the establishment of a minimum of 24% (26% since 2018) favorable crops (straw cereals, alfalfa, winter legumes and winter metes), (ii) early crop cover implantation (a mix containing grass, vegetable and sunflower) in the feeding and breeding areas of hamsters, (iii) bands of non-harvest of straw cereals, and (iv) the prohibition of drilling deep into the ground (> 30cm).

An approved collective structure - the *environmental cooperative* (EC) - coordinates each year the distribution of commitments between farmers in order to adapt the locations of favorable crops according to the presence of burrows. Each participating farmer voluntarily commits farmland to the cAES for which payment is then organized via the EC. As an intermediary to governmental authorities, the EC redistributes subsidy payments between its members proportional to the surfaces contributed. Subsidy payments are staggered: the per hectare unit

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<sup>9</sup> The SPZs are defined in accordance with the ministerial decree of October 31, 2012 related to the location of hamsters’ terriers (Dominiak 2016, p.7).

amount of the subsidy payment depends on the total surface of favorable crops within the collective zone. For example, a zone that reaches 24% of its perimeter receives €435/ha, while €452/ha are awarded for 26% and up to €520/ha are granted for 40% and above (table B1). While group contributions below the threshold are not rewarded, payments for contributions above threshold increase in per hectare rewards up until a ceiling of 40% of favorable crops within the collective zone. Contributions above the ceiling are rewarded at a constant per hectare rate (Dominiak 2016, p.7). Therefore, an incentive is provided to increase contributions over the interval between threshold and ceiling as more payment per hectare can be earned with increasing surfaces contributed. In addition, a one-time annual payment (€177.5) is provided for each plot with favorable crop types that contains at least one burrow (Chambre d’Agriculture d’Alsace, France 2019). The compensation provided by the cAES to each individual farmer thus tries to reflect an amount that corresponds to the transaction costs (e.g. equipment, crop yield and margin) and to the opportunity cost (e.g. shortfall in income).

In order to gain a better understanding for how effective the measure and its management recommendations turned out, the change in environmental quality has to be linked to efforts made under the scheme. In an attempt to understand whether the relationship between cAES implementation and population reinforcement is *causal*<sup>10</sup>, participation rates under the collectively conditional incentive mechanism are put in relation to biodiversity conservation results. The four generic hypotheses from section 1 are summarized in table 2.1 and are applied to the species protection case of the European hamster in France.

## 2.4 Methods and Data

Access to the fully anonymized contract results under the agri-environmental scheme for species protection that ran consecutively from 2013 on has been granted by the French Ministry of Agriculture (<https://agriculture.gouv.fr/>). The data set grants unique insight into an innovative, one-of-its-kind subsidy mechanism conditional on collective, as opposed to individual, efforts. The data reveals decision patterns at the group level of French agricultural communities exposed to the subsidy scheme over a 5-year horizon. Interview evidence is presented to enrich the discussion on the potential underlying drivers of farmer behavior as revealed by the data.

This collective AES was introduced for the first period in 2013, running until 2017. The second period has started in 2018, running until 2022. Because the second period of the contract is still running, the analysis concentrates mainly on the first contract period. Due to commonly experienced meteorological, market and climate conditions, the comparison of zones by actual calendar year is important in order to spot those trends. Given that some CZ started the contract agreement earlier and some CZ joined later, the initial year of contract (y1) is not

<sup>10</sup> Assuming a causal effect between AES and environmental outcome requires controlling for all confounding factors and factors exogenous to the measure. The reasonability of this assumption is discussed in section 2.6.

Table 2.1 – Hypotheses: generic and applied versions

Hypothesis	Generic	Applied
1	Environmental quality increases with the aggregate contribution to the public good.	The number of hamster burrows increases with the proportion of favorable crop surface.
2	The payment structure has a positive and increasing impact on the contributions to the public good.	Farmer collectives provide more surface of favorable crops the more they are paid per hectare.
3	Group size is positively related to the aggregate contribution outcome to the public good.	The more farmers in a collective zone, the higher the proportion of favorable crops provided.
4	A shared communication platform facilitates sufficiently large contributions to the public good.	A shared communication platform facilitates cooperation among farmers across a common territory.

identical for all CZ. Therefore, years are represented respectively in the data set:  $y_1 = 2013$  for zones 1, 2, 3, 5, 6 & 7;  $y_1 = 2014$  for zones 8, 9, 10 & 11;  $y_1 = 2015$  for zone 12. Moreover, during the first contract period 2013 to 2017 zones 1, 5 & 7 were combined into one CZ and are thus referred to as CZ1.

10 communities participated in the scheme forming 10 collective zones situated within the 3 strict protection zones of the Alsatian plain (cartographic illustrations of SPZs can be found in figures B.6-B.8 in the appendix). SPZ North (3000ha) includes CZ 6 & 8 (figure B.6); SPZ Centre (4400ha) includes CZ 1, 2, 3, 4, 5, 7, 9, 11 (figure B.7); SPZ South (1600ha) includes CZ 10 & 12 (figure B.8). The size of each collective zone varies, reaching from 60ha for zone 12 to 475ha for zone 1. Collective Zones are normally not allowed to reduce their territory once declared at the start of the 5-year contract period. However, exogenous events such as death or change of ownership may introduce some variation to the zones' surfaces between years. Nevertheless, it also happened in CZ1, for instance, that an entire farm withdrew in year 3 from the collective contract. Although withdrawal from the 5-year commitment is not officially tolerated, authorities and members of the community could not change the farm owner's mind, who did from then on refrain from any communication with the community members and the EC regardless of the project or issue concerned. This example demonstrates that interpersonal conflict may constitute a significant barrier to the successful implementation of the collective scheme. Increasing the size of a collective zone, however, is tolerated by EU authorities as long as it does not happen in the last year of the contract period. Therefore, some zones do increase their surface by including neighboring farms that are situated within the SPZ. For example, CZ2 increases the surface in 2016 by 70ha and CZ6 increases the surface in 2015 by 54ha. Table 2

**Table 2.** Total agricultural surface , its respective proportion of favorable crops & number of contributing farms for each collective zone per year: First period AES 2013 – 2017, threshold for favorable crop surface at 24%. Second period AES 2018 – 2022, threshold for favorable crop surface at 26%. Legend: ZC = collective zone; surf ZC = total surface of collective zone; surf CF = surface of favorable cultures ; %CF = rate of CF with regard to ZC. Source: DDT, 2019.

ZC	2013			2014			2015			2016			
	surf ZC	surf CF	% CF	surf ZC	surf CF	% CF	surf ZC	surf CF	% CF	surf ZC	surf CF	% CF	number of contributors
1, 5 & 7	319,63	82,91	26%	475,06	173,95	37%	440,49	140,13	32%	471,31	151,83	32%	27
2	210,96	60,07	28%	228,84	78,32	34%	228,82	79,27	35%	297,23	116,33	39%	21
6	108,13	25,96	24%	109,86	49,74	45%	154,67	55,04	36%	153,33	67,74	44%	13
3	267,47	71,26	27%	271,71	66,58	25%	270,29	67,87	25%	267,51	83,44	31%	8
8				216,28	69,36	32%	216,13	82,51	38%	216,64	86,41	40%	18
9				364,55	105,08	29%	362,25	104,33	29%	362,56	146,76	40%	15
11				475,06	115,83	24%	527,99	158,20	30%	527,06	186,69	35%	21
10				302,25	85,83	28%	347,34	85,40	25%	320,53	92,91	29%	9
12							60,19	22,11	37%	60,27	19,78	33%	5

ZC	2017			2018			2019			average num contrib 1st period
	surf ZC	surf CF	% CF	surf ZC	surf CF	% CF	surf ZC	surf CF	% CF	
1, 5 & 7	471,31	121,08	26%	197,00	67,49	34%	200,07	71,21	36%	19
2	297,23	114,73	39%	227,31	66,03	29%	240,39	80,82	34%	19
6	153,33	63,51	41%	305,03	116,41	38%	306,65	135,73	44%	9
3	267,51	68,01	25%	112,50	41,44	37%	112,31	45,05	40%	11
8	216,64	78,36	36%	271,89	86,26	32%	287,53	76,93	27%	16
9	362,56	131,31	36%	217,27	90,87	42%	218,13	69,17	32%	12
11	527,06	138,30	26%	351,49	150,60	43%	256,51	94,68	37%	20
10	320,53	99,89	31%	511,28	165,39	32%	520,06	158,34	30%	10
12	60,22	20,18	34%	480,88	146,43	30%	490,14	200,04	41%	5

threshold	1st period AES	2nd period AES
threshold	24%	26%

provides the descriptive statistics for each CZ.

## 2.5 Results and Discussion

With regard to the specified territory to be cultivated with favorable crops, all collective zones' contributed surfaces are beyond the threshold of 24% for each year of the contract. Participation rates during the first period of the cAES stretch from 5 to 27 farmers per zone, proportional to the size of each CZ's territory.

**Result 1: Endangered Species' Population Count.** A strong overall population drop of -49% occurred in 2015. Population count recovered steadily, increasing every year thereafter up to 682 burrows in 2018 (figure 2.1). Most burrows of the active hamster population (absolute count) are located in the central SPZ, while only a fraction are situated in SPZ South and still less in SPZ North (figure 2.1). However, putting the count of burrows in relation to the size of each SPZ shows that the southern zone has the highest number of burrows per hectare of favorable crops across all years since start of the cAES with up to 1.22 burrows per hectare in 2017 (figure 2.2).

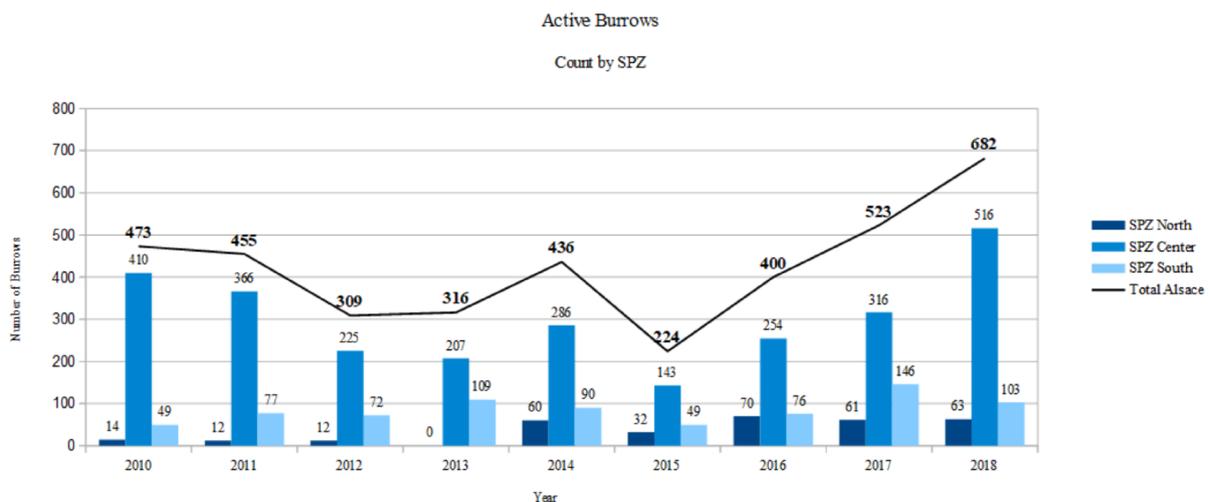


Figure 2.1 – Active burrows in Alsace, count by year and SPZ. Source: Author's compilation based on Virion (2017, 2018), Wagner et al. (2016).

In order to understand how much the hamster population did improve in response to the first cAES contract period, population count has to be put into relation with favorable surfaces provided through the scheme. While the EU ruling requires an average rate of 2.5 burrows per hectare, the count of burrows in the past years is evidently well below half of this requirement. The Southern zone seems to provide the highest number of burrows per hectare. However, it needs to be considered that over 100 burrows were already active in the rather small Southern SPZ in 2013, that is even before a collective zone formed to put favorable crops in place in

2014 (figure B.9). The northern zone on the contrary joined with collective contracts already in 2013 but had to rely exclusively on releases to settle a lab-bred hamster population within that zone (figure B.9). Therefore, starting conditions need to be controlled for when interpreting the environmental success for each zone. Of course, a zone in which a hamster population is already active and reproducing is more likely to show relatively higher results in terms of success per unit of effort invested (i.e. burrows per hectare of favorable crops). A small zone that provides only little surface in terms of favorable crops while hosting the most numerous hamster cluster of the region may yield the impression of a disproportionately large success rate for the measure.

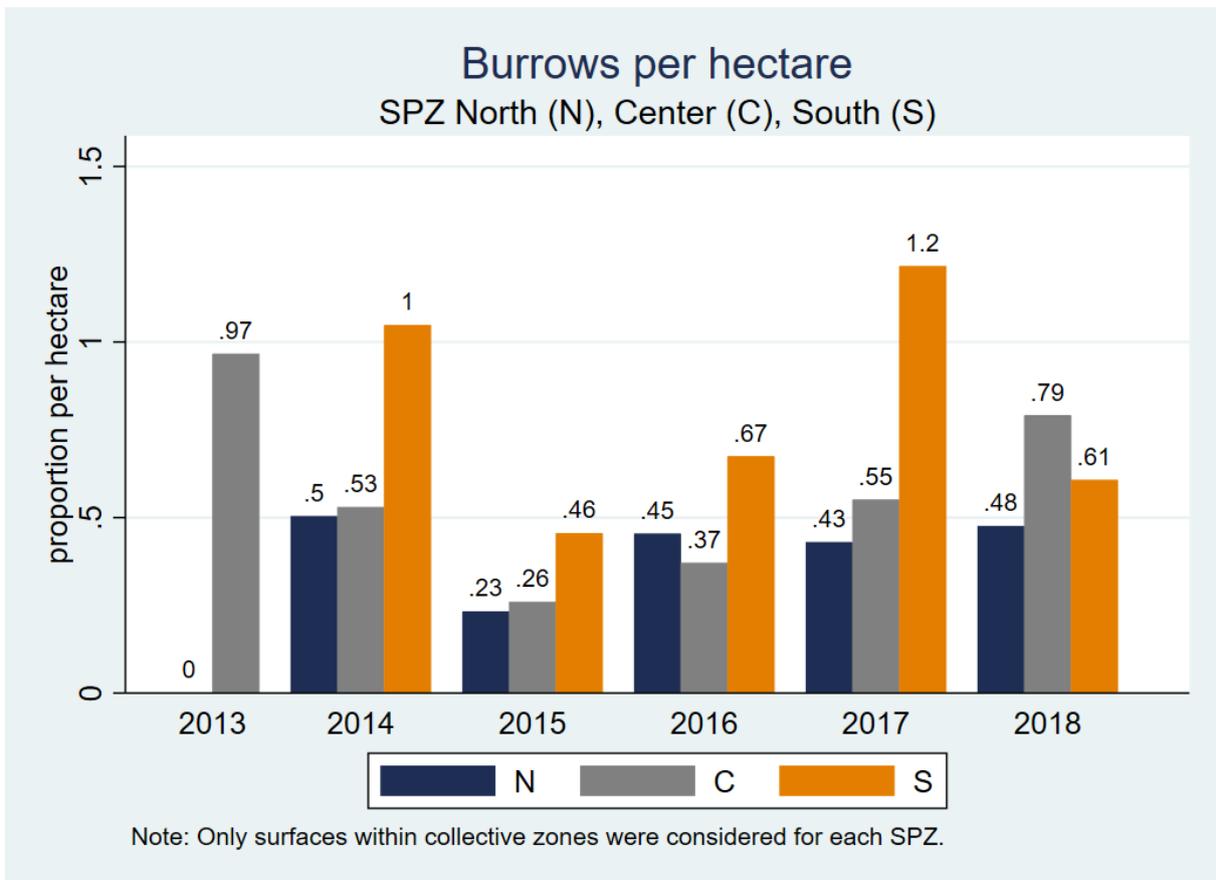


Figure 2.2 – Burrows per Hectare of Collective Zones’ Favorable Crops in each Strict Protection Zone. Source: Author’s compilation based on Virion (2017, 2018), Wagner et al. (2016).

Therefore, the change in the number of burrows between years needs to be evaluated, rather than the absolute count (figure 2.2). After a first round of favorable crops in the year 2013, the population count in 2014 registers a particularly strong increase (+ 37%) in burrows. The success of that year is thought to be mainly due to the efficiency of releases in 2013 combined with a successful protection of the hamster population already present (Wagner et al. 2016). The strong drop of the hamster population count in 2015 (-49%) could be due to the extreme climatic conditions of that year (Wagner et al. 2016). Extreme heat and drought were experienced as challenging not only for the agricultural sector, affecting a considerable proportion of the harvest

for that year, but also for species relying on the agricultural habitat. The already fragile hamster population shows a considerable collapse facing a lack of foraging areas. The population slowly recovered thereafter, with a high of 682 burrows counted in the year 2018.

The measure's effectiveness in terms of environmental outcome (habitat surface) can be assessed only to an indicative extent. The percentage of favorable crops provided by each SPZ shows to be positively correlated to the change in number of burrows, although the scatter is fanning out somewhat (figure 2.3). With a correlation coefficient of 0.038 the relationship is weak and not significant [ $r(15)=0.038$ ,  $p=1.67$ ], yielding only weak support to hypothesis 1. This weak correlation may indicate that the effect of favorable crops on the number of new burrows is not immediate. It is likely that stabilization and continuous increase in the hamster population require more than one season, so that an evolution of the growth rate over several years should be considered. Being able to keep a track record and to monitor the change in environmental outcome seems to be an important driver for farmer participation in the scheme. [Emery and Franks \(2012\)](#) show that being able to contribute constructively to a useful measure

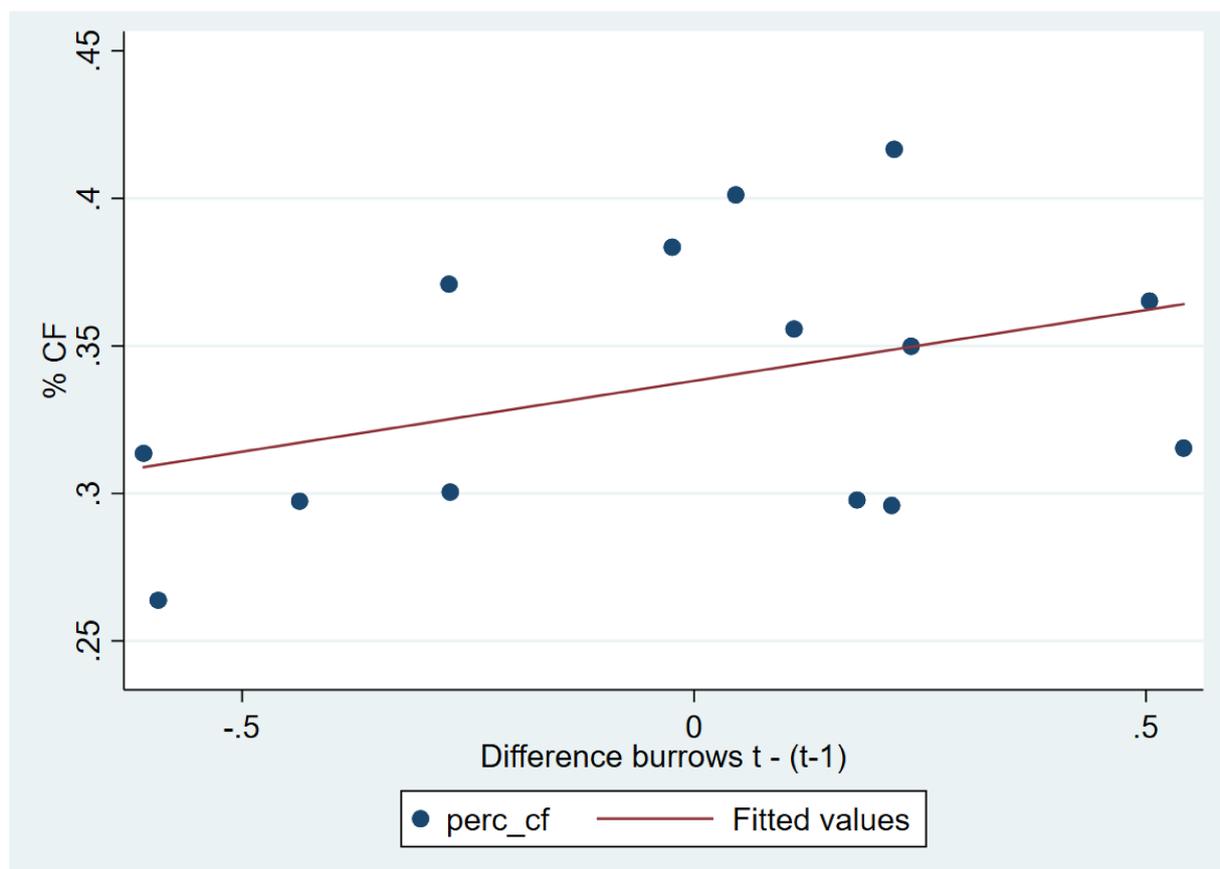


Figure 2.3 – Scatter plot: change in number of burrows (d-burr) as compared to previous year to percentage of favorable crops (perc-cf) of current year.

is more motivating to farmers than financial incentives. If only monitoring of efforts and achievements was sufficiently refined and visible, an important condition for farmer participation would

be met already through smart scheme design.

However, counting burrows is only an approximate measure for establishing a population assessment. Hamsters can build and occupy multiple burrows at a time. Therefore, electronic tracking chips were implemented by the research laboratory that breeds the hamsters which are released in spring. Each newly bred hamster obtained a chip implanted under the skin to be tracked via radio frequency. However, it turned out that the tracking requires extensive equipment that has at the time been available in spatially limited zones only, which was poorly adapted to the hamster's high separability characterized by large foraging journeys (Franks 2011). As it already has shown difficult to track chip implanted lab bred hamsters, wild hamsters may be even less trackable. Therefore, counting burrows remains the closest proxy for the assessment of the size of the hamster population. After all, as there must be a linear relationship between observed hamster activity and hamster count, more burrows ultimately conclude on more hamsters. The existence and population size of the European hamster also acts as a bioindicator for the ecological milieu of the concerned territory: where there are hamsters, there is fertile ground and particularly healthy loess granting a habitat to numerous insects and smaller vertebrate species, such as rodents and birds. Interrelatedly, the existence of other small species could serve as a bioindicator that may be easier to access in order to measure the success of farmers' conservation efforts. If the hamster remains difficult to track and to count, insects that share common conditions of habitat with the hamster could substitute as a proxy for environmental success and biodiversity outcomes.

Nevertheless, the relationship between favorable crops and burrows cannot be regarded in isolation of other environmental confounds. While principal factors such as intensification of monocultures and absence of crop cover during active periods are addressed through the cAES by ensuring favorable habitat for the species, other factors also determine the population success of the European hamster. Among these factors are predators, nutrition deficiencies due to corn and wheat monocultures, more and stronger rainy days during the winter that destroy food stocks and flood burrows, and the segregation of habitat areas by urbanization and highways. Biologists have already explored other means to protect the hamster. An artificial tube, for instance, has been experimented on to act as a wildlife underpass for small species such as the hamster (Tissier 2017). The tube is supposed to yield protection from predators and cars when hamsters are transferring between two habitat areas divided by a highway. Moreover, the Life Alistar program carried out campaigns to inform the public about the hamster's situation and to raise awareness among stakeholders. Biologists also discovered that combinations of certain crops provide a more optimal nutrition supply for survival and the ability to reproduce healthy and numerous offspring. As such, combinations of wheat and soy bean, corn and sunflower and corn and radish (Tissier et al. 2017, Tissier 2017, p.114), have been found to ensure optimal nutrition for the hamster. Combined with seasonal alfalfa cover these combinations of crop cultures would significantly improve the hamster's foraging area by providing year round vegetation cover for protection from predators and optimal nutrition intake for augmented reproductive success (Tissier et al. 2017).

**Result 2:** Favorable Surface Contributions. Although some CZ only started to contract in later years, the presentation in figure 2.4 is a pure chronological recapitulation in real time. In order to compare the evolution of contributions since the start of the contract, in figure B.4 the year since the start of the contract is counted rather than the actual calendar year. In 2015, the three strict protection zones each hosted several collective zones, with CZ12 being the last CZ to join the first period cAES that year. The surface of collective zones in 2017 made up 370ha in SPZ North, 1926ha in SPZ Center and 381ha in SPZ South. While being the smallest of all three SPZ, the northern zone shows to have the highest ratio of favorable surface contracted consecutively since 2014 (figure 2.5).

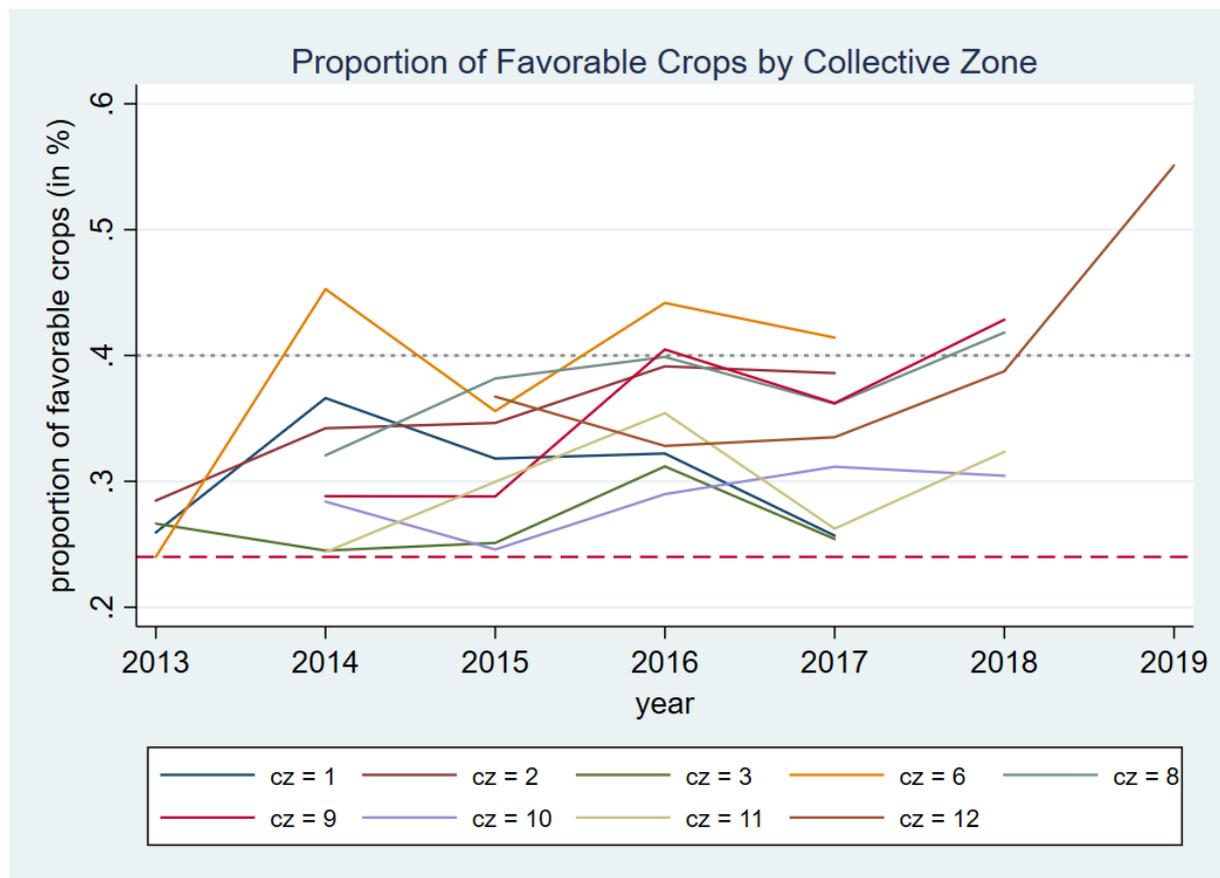


Figure 2.4 – Rate of favorable crops by collective zones per calendar year since the start of cAES in 2013. Note. The threshold is situated at .24 (dashed line), the ceiling is situated at .4 (dotted line).

Surprisingly, some zones excel to contributions of surfaces well beyond the ceiling of 40%. While the hectares contributed above the ceiling are still paid, the rate of payment per hectare is not increasing anymore (table B1), i.e. no more payment staggering. Contrary to hypothesis 2, the absolute amount earned may be more decisive for high contributions than the amount paid per hectare. Especially in the fifth and last contract period, four zones reach beyond the ceiling for payment staggering (figure B.4). While favorable surfaces decrease over time for areas outside of the SPZs, the favorable surfaces within SPZs are on average increasing over time. This trend

can be traced on the heat map as shown in figure B.5.

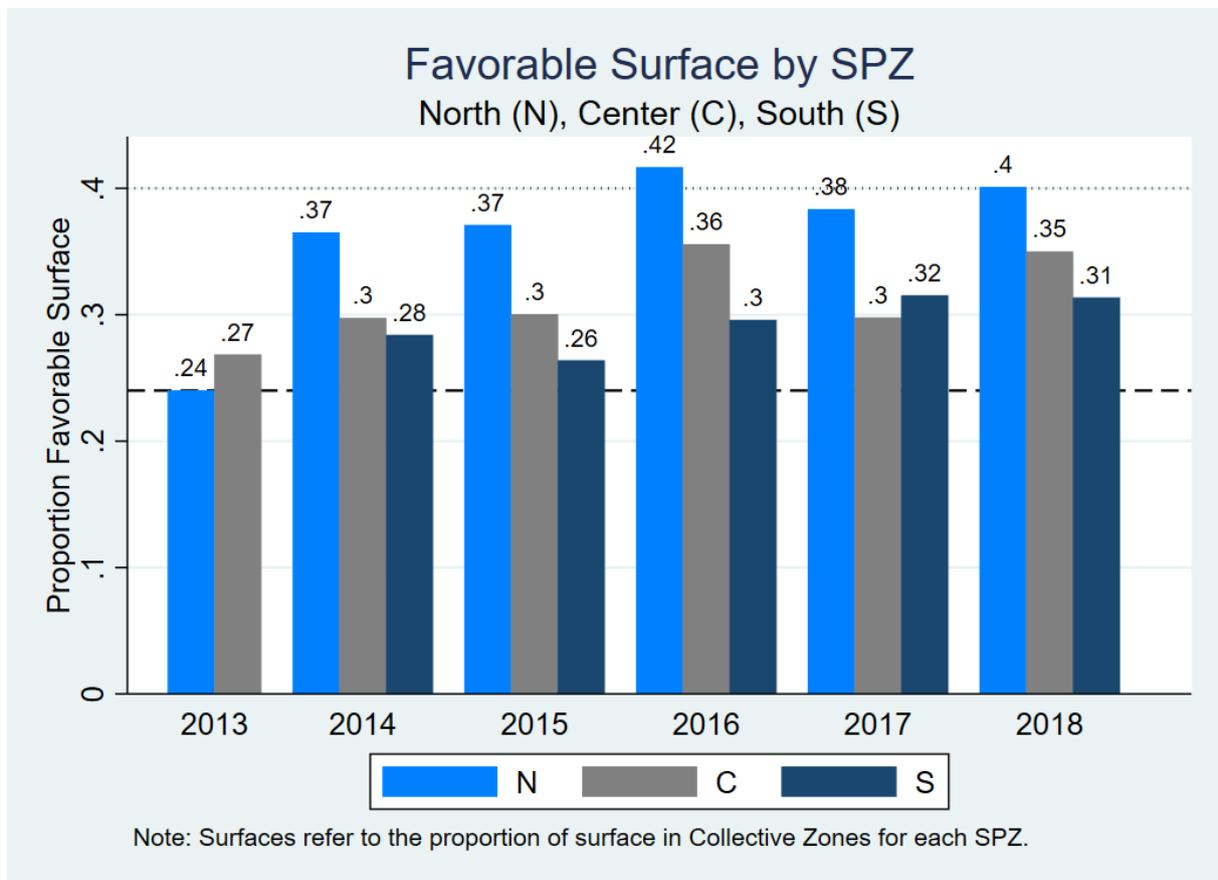


Figure 2.5 – Surfaces of Collective Zones’ favorable crops per Strict Protection Zone. Source: Author’s compilation based on DREAL (2018) PNA 2019-2028. Note. The threshold is situated at .24 (dashed line), the ceiling is situated at .4 (dotted line).

The increase in participation rates and contributed surfaces across time for at least four of the 9 surveyed zones seems to be a positive result of the collectively conditional payment scheme. Zone 12, 9, 8, and 6 all show contribution rates above the ceiling for payment staggering of 40% in the last period. This may be attributable to what Marks and Croson (1999) termed the utilization rebate: excess contributions beyond the threshold increase the size of the public good. This is particularly striking when compared to laboratory results, where convergence towards the threshold value usually prevails during the later periods of the game (Marks and Croson 1999). However, most zones show a common trend with decline in the years 2015 and 2017 and peaks in the years 2016 and 2018. Contribution rates are kept nearly parallel across calendar years for most zones. Zone 6 and zone 12 are the two smallest zones with 6 and 5 contributing farmers respectively which seems to favor the idea that agreement and mobilization of effort is easier the smaller the core group. CZ 8 and 9 are medium sized but also demonstrate above average contributions in the later periods of the contract, which could be due to a somewhat larger core group that needs more time to motivate and engage all members into higher effort

contributions.

**Result 3: The Role of Group Size.** As table 2 shows, collective zones with larger surfaces have more members. However, this is not a linearly increasing function, i.e the ratio of members per hectare is not stable across years. However, the number of contributors does not predict the rate of favorable surface contributed in a zone (figure B.2). For instance, CZ3 in 2015 achieved 25% of favorable surface with 13 contributing farmers, but in 2016 as much as 31% of favorable surface with only 8 contributing farmers, while in 2017 again 25% of favorable surface are realized with as much as 16 contributors. The correlation between group size and the zone's favorable surface does not show significant ( $r(48) = -0.0401$ ,  $p = 0.7865$ ), which contradicts hypothesis 3.

Comparing hectares contributed per group member and group size (figure B.3) yields a negative correlation coefficient ( $r = -0.2039$ ,  $p = 0.1645$ ). The reason for this negative correlation between contributors and rate of surface contributed may be that certain farms are larger in size and can thus easily contribute a larger territory to the collective effort while many small farms may be needed to contribute only a fraction of the large farm's territory. Another reason may also be that coordination is easier in smaller groups (Van Dijk et al. 2015).

While the perimeter of zones remains rather constant, there seems to be considerable inter-annual variation in the number of members' contributions per zone. Indeed, farmers are not consistently represented each year. Rather, some farmers exchange their turn in contributing to the collective contract, a coordination dynamic that cannot be identified in the aggregate result. Moreover, while keeping its rate of favorable crops stable over the first few years of the contract, CZ12 raises contributions well beyond the ceiling in the last year of the contract (55%). It may thus be suspected that coordination and communication functions particularly well in the smallest group of the sample. Nevertheless, the largest group of the sample, CZ11, also manages stable contribution rates over the course of the contract period. Starting with 16 contributing farmers and a rate of 24% of favorable area in 2014, the collective zone stabilizes around 21 contributors and 30-35% of favorable surface throughout the following years, with only one exception in 2017 when the rate dropped to 26% of favorable surface while the number of contributors remained stable. The surprising result for this CZ11 is the last year of the contract (2018), where one member and some surface of the zone's territory seem to have been lost. Although a reduction in size of CZs is usually not approved by authorities, particularly changes made in the last year of the contract seem unreasonable. Given the overall negative correlation and the individual group variations, hypothesis 3 cannot be supported. It is, however, rather intuitive that larger zones comprised of more members are exposed to more possibilities for variation, as more members introduce more individuality and thus more variation in terms of issues (e.g. health, financial, interpersonal conflict) that may arise and may affect the group and the realization of the collective contract. The smaller the collective zone, the easier coordination and communication among the participating farmers becomes. Therefore, it is no longer surprising that larger CZs achieve more generous absolute hectare contributions whereas the smaller CZs achieve a higher rate in contributions proportional to the entire surface of their zone. A better understanding of the individual constraints each farmer faces within the collective zone would

be needed to interpret these results further.

**Result 4: Communication.** Beliefs on others' willingness to contribute or to realize promised contributions also cause hesitation in larger groups, where there is more heterogeneity among farmers. This could explain why some communities did not manage to coordinate sufficiently in order to be able to contract under the cAES scheme. Rather than expressing concerns about the scheme, farmers seem to worry about others' effort realizations, which has been considered as the most frequent drawback to the individual willingness for contracting under a collective scheme (Emery and Franks 2012). As the local EC president (author's interview, 04/05/2020) reveals, the interdependence of farmers' practices can be rather challenging to coordinate:

*People interact easily concerning the cultivation of wheat and alfalfa and therefore [there are concerns] just with the distribution a little bit. And then also something that is sometimes [...] not easy to set up, is in relation to the crops of wheat which must not be mowed in order to remain close to the hamsters' burrows. It's not always easy to do, because these are small areas, you have to recognize the hamsters' burrow beforehand, so there is still a lot of discussion. Perhaps the most complicated issue today is having to leave the wheat outside for the hamster.*

In order to build trust and mutual understanding among community members, the EC can play a strong, intermediary role for facilitation of credible communication among farmers. Clearly, getting to know and being on good terms with neighboring farmers is essential for building trust in the community. Emery and Franks (2012) see the prevalent reason for lack of trust to be a fear of exposure to the potential judgement of others provoking inertia in individual farmers and inhibiting any innovative change. Nevertheless, the authors advocate that cAES can overcome these self-reinforcing social pressures through an adapted design which includes (i) a success record of achievements and benefits (e.g. environmental quality improvements), (ii) interactive scheme design based on farmer involvement and flexibility, (iii) locally targeted and clearly defined aims. Our interviewee underlines the importance of voluntary participation and interactive scheme design:

*As soon as the farmers, but it can be other sectors of activity for that matter, feel that in the end they have a say, they can contribute something to this file, they are also much more likely to commit. And I am convinced of one thing, if it is done on a voluntary basis over time it is much more effective than when it is imposed. - local EC president.*

Through meetings and informal discussions, farmers of one community can find agreements on how to split the contributions according to the resources and means of each group member. Those face-to-face interactions among a smaller group of people lead to mobilization, irrespective of the size of the wider interest group, thereby overcoming the perceptibility problem. The EC clearly takes the leading role in the organization of the production of the public good across collective zones and in the homogenization of farmers' efforts, coherent with hypothesis 4. For this cAES, interpersonal relations are clearly at play when collectively restoring the species' habitat:

*Of course you have the human factor. Do people get along? Are there family problems between the farmers? Lots of things like that. So it is certain that if you have 30 farmers in a community, it is less obvious. There are old stories between the families and it does not always work. [...] There is nothing we can do. There are groups, they work very well because they are used to working together already because they help each other. So all the communities are different. You cannot have a typical photograph, it's almost impossible. Really, the story of the village between the farmers, what has happened, what has not happened, it [determines] whether it goes well or not. - local EC president.*

## 2.6 Conclusion

The area of land covered by the cAES needs to be determined by the underlying collective dilemma and has to be reflected by appropriate contract design. Such “place based priority conservation targets” (Franks 2011, p.649) are well integrated in cAES through the creation of ecological focus areas represented in this case study through the SPZs. The collective AES allows adapting year by year to the situations of each farmer and to spread environmental efforts on an interconnected corridor of farmland that reaches beyond a single farm. Using novel data on French farmers enrolled in a species protection program, this paper provides insights on the effectiveness as to the so far still controversial collectively conditional incentive mechanism. The case study on the European hamster has shown that individual subsidy payments that are conditional on a collective effort help farmers to provide a connected agricultural landscape favorable to the species’ survival. The collectively conditional subsidy mechanism remunerates for the environmental service performed by farmers and the burrow premium creates a results-driven incentive system. The population of the European hamster has improved with increasing provision of favorable crop areas. While knowledge on the species’ needs is improving (e.g. which combination of crops for optimal nutrition) the collective AES evolves over time and can be complemented more effectively by other measures (e.g. optimal fences to protect from predators, tracking of lab bred hamsters, underground tubes). Therefore, the renewable 5-year cAES contracts show to be well suited for the introduction of innovative farming practices and accompanying measures for species protection. Nevertheless, the time frame of 5 years is too short in order to conclude with precision on the causal link to the environmental outcome (habitat surface). More evidence on the practical viability of this incentive mechanism is therefore needed (Harrison 2014, List 2007, 2011), ideally through the lens of rigorous RCT policy pre-testing (Behaghel et al. 2019).

It should also be noted that slow agroecological processes such as restoring species habitat rely on continued efforts and environmental services from stakeholders. Therefore, the time span and continuity of payment need to be considered and repeatedly revised to grant optimal permanent support to farmers implementing the measures. Through an integrative approach involving the farmer association, the chamber of agriculture, the national hunting and wildlife bureau, researchers from various fields and related stakeholders, the design and application of

the species' protection measure can take into account various demands. This approach should favor the integration of recent findings from biologists on the species' nutrition and protection needs. A subsequent cAES contract would do wisely to incorporate the researchers' suggestions and to request their application by farmers. Moreover, the protection of the European hamster reflects an integral effort for the entire ecosystem (Virion 2018). The hamster being an umbrella species, the actions carried out for its protection also impact other species such as insects and small vertebrates that share the hamster's habitat. Pooling efforts in favor of biodiversity improvement on an integrative scale for all that rely on the agroecological area at stake should thus be of predominant importance to its management. This involves also the establishment and improved management of links with other existing programs so that measures do not eradicate each other but at best superpose and support each other in a coherent global aim.

Furthermore, in order to increase the comprehensibility of these results, an individual level analysis across time periods is of importance to better understand the coordination among members of a collective zone. More elaborate data would be needed to allow controlling for a number of confounding factors such as the crop cover of previous years, and climate conditions. Further research is planned to address this question. Bioindicators for environmental quality should be developed that stand in relation with the hamster's conditions for favorable habitat, so that an alternative measure can be established. This bioindicator can then hold in absence of reliable population counting, or at best complement the reliability of the burrow proxy by augmenting quality information on the state of the ecosystem.



## Chapter 3

# Coordinating farms within multiple zones: collectively conditional incentives in Agri-Environmental Schemes

### Abstract

This paper presents novel collective agri-environmental scheme (cAES) data from a biodiversity protection measure that has been put in place in Alsace, France, to preserve the local European hamster population. A collectively conditional subsidy mechanism incentivizes the coordination of contribution efforts within groups of farmers. We analyze how communities of farmers organize and coordinate across years as to collectively provide an interconnected territory of favorable surface for the survival of the species. Both territorial shares and group size seem to positively influence participation under the cAES, with larger groups producing slightly more contractors. However, group size shows to negatively influence farms' surface contributions (in ha) for the collective scheme. Based on individual contribution patterns within collective zones, a typology for contributions under collective conditionality is proposed.

**JEL Classification:** Q18, Q57, D7

**Keywords:** Collective Agri-Environmental Schemes, Threshold Public Good, Collective Conditionality, European Hamster.

### 3.1 Introduction

Agri-environmental schemes (AESs) specify the scope and the criteria of measures as defined in the European Union’s Common Agricultural Policy for application at a regional level. Farmers contracting under AES are remunerated for environmental farming practices that are sensible towards the environment. Depending on regionally specific environmental challenges, AES’s objectives stretch across the preservation of water resources and quality, the maintenance of biodiversity (preservation of species and habitats), and protection against soil erosion. The implementation of different types of AES is the key driver of the agro-ecological protection in the EU.

In order to halt the rapidly increasing biodiversity loss, conservation efforts would need to be homogenized over a large ecological corridor making up for a territory spreading over, most likely, several agricultural communities. The original “piecemeal approach” (Emery and Franks 2012, p.8), i.e. the scattered adoption of individual contracts, has not shown to be sufficient for eliciting environmental change. However, it has at least shown the existence of a willingness among individual farmers to adapt their farming practices for the sake of ecological outcomes. Previous research has identified collective AES (cAES) to be more cost-efficient than individual contracts, provided that participation rates are sustained sufficiently high (Kuhfuss et al. 2016b, Franks 2011). Collective contracts would imply a coordinated effort on a concentrated territory, thereby facilitating the attainment of a collective effort threshold.

Theoretically, as long as contributions under the collective contract meet or exceed a pre-determined threshold level, environmental outcomes should be obtained. Contributions below the threshold are not expected to be sufficient to have an impact on environmental quality. Economic experiments on spatial coordination under the agglomeration bonus<sup>1</sup> have found significant differences in coordination patterns between groups (Banerjee et al. (2012, 2014), Banerjee (2018)). In those experiments of rather sterile network formations, some groups manage to coordinate on a global scale, while some groups are only locally efficient. When comparing bigger networks to smaller ones, they find efficient coordination more difficult to be obtained in larger groups and thus conclude that global coordination for land management is more likely to be efficient for landscapes with fewer farms (Banerjee et al. 2012, 2014). Moreover, the authors conclude that both higher payments and social comparison between communities would generate higher coordination rates (Banerjee 2018). In a range of choice experiments with farmers, Kuhfuss et al. (2014, 2016b,a) attribute promising potential to a hypothetical collective bonus to be paid at the end of a 5-year period of an individual AES contract. While it can be assumed that farmers are, like most other people, present-biased (Palm-Forster et al. 2019), the external validity of these choice experiments appears questionable. Five years may be a rather long horizon for farmers when deciding whether they would engage more transaction and opportunity costs now

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<sup>1</sup> “The Agglomeration Bonus is a Payment for Ecosystem Services scheme that focuses on achieving spatially-coordinated land use across neighboring, privately-owned agricultural properties.” (Banerjee 2018, p. 172)

in exchange for a substantially delayed and uncertain payment at the end of the AES contract period.

Collectively conditional subsidy payments are timely and coupled on the attainment of an aggregate contribution threshold. That is, subsidy payments are elicited each year of the contract period but only if the group of farmers achieves to contribute a sufficient percentage of their land to the AES. The collectively conditional subsidy mechanism has shown to be more successful in incentivizing contribution levels well above the threshold when compared to unconditional subsidies or the absence thereof. However, these studies were implemented either in the lab with students (Le Coent et al. 2014) or in a lab-in-the-field experiment with farmers (chapter 1). Data on real life applications from the field is so far missing.

The imposed collective conditionality of cAES should incentivize the coordination of efforts sufficiently high so as to elicit the sought environmental outcomes. This relationship between collective conditionality and threshold attainment has been confirmed in the previously mentioned experimental studies. However, how actual communities of farmers organize and coordinate so as to ensure that they always attain sufficient contributions from members remains to be explored.

This paper presents novel collective agri-environmental scheme data from the North Eastern French region of Alsace, where strict protection measures have been put in place to preserve the European hamster population unique to this region<sup>2</sup>. A first study (chapter 2) described the aggregate results of the collective scheme and put them in relation to actual biodiversity outcomes. To our knowledge this is the first paper applying an econometric analysis to collective AES field data. The econometric analysis employs an exploratory approach to investigate what drives individual farmers to contribute under a cAES for biodiversity preservation when exposed to a collectively conditional subsidy scheme. Two questions are addressed: (1) What determines participation in the cAES? and (2) What determines individual contribution to the cAES?

Our results identify territorial influence - impact in terms of territorial shares - as the main driver for enrollment with cAES, while group size shows to be only slightly correlated to the likelihood of participation in the collective scheme. Rather, a core of pioneering leaders seems to be essential for successful coordination under the collective contract. The size of individual contributions under cAES also shows to significantly increase with the degree of the farm's territorial influence within the protection zone.

The paper is organized as follows: Section 2 describes the empirical study and provides relevant descriptive statistics. Section 3 presents the empirical strategy and methods used. Section 4 describes the empirical results which are discussed in detail in section 5, and section 6 concludes.

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<sup>2</sup> While the European hamster exists in the Netherlands, Eastern Europe and Central Asia, in France the species is present only in the North Eastern region of Alsace.

## 3.2 Empirical Study

In an effort to reinstate self-sufficient population levels for the European hamster<sup>3</sup> (*crictus crictus*), the entire region of Alsace in North Eastern France was urged to put protection measures for the species in place. Being endemic to farmland habitat, the European hamster in France has been threatened by extinction due to intensive farming practices. A specifically developed AES proposes measures to reinstate the hamster’s habitat, granting protection from predators and providing nutritious foraging territory. Access to the fully anonymized contract results has been granted by the French Ministry of Agriculture (<https://agriculture.gouv.fr/>). Data is available for the years 2013 to 2018.

In order to target most of the region’s geographical farmland area simultaneously, the cAES proposes exclusively collective contracts to farmers. Spatially interconnected communities of farmers thus have to engage collectively under the contract in order to be approved for subsidy payments through the cAES. Only if a threshold<sup>4</sup> of at least 24% of the zone’s farmland managed and cultivated in accordance with the measure’s regulations is attained, the farmer collectivity will trigger the subsidy mechanism. Payments are redistributed on an annual basis to individual farms proportional to the contributions in surface made. However, any individual contributions made while the group of farmers does not reach the threshold are not remunerated. The purpose is to incentivize the majority of farms with territory located in the protection zone to participate and to discourage spatially scattered application of protection measures. It is thus rational for farmers to engage with the collective contract only if they believe that the community as a whole is able to reach *at least* a sufficient contribution level throughout the 5-year contract period.

Strict Protection Zones (SPZs) have been defined for the region, within which collective zones (CZs) can be formed by farmers. CZs can only exist within the perimeter of an SPZ, as can be seen in figure 3.1. The perimeter highlighted in red indicates the SPZ with an accompanying margin for hamster burrows. The smaller perimeters highlighted in various colors inside the SPZ represent the CZs. For the first contract wave there have been 9 CZ contracted under the cAES within three SPZs for protection of the Common hamster. As can be seen, some CZs touch at the boarder of a neighboring CZ. This makes it likely for some farms to have territory in more than one CZ. The blue dots represent the burrows as counted in 2018.

Subsidy payments per hectare increase with the amount of collective surface contributed in a CZ. For instance, a surface of exactly 24% of the CZ’s territory is rewarded with 452€ per hectare of favorable crops. A surface of 40%, however, is rewarded with 520€ per hectare of favorable crops. While 24% represents the threshold and 40% represents the ceiling for payment staggering, every additional percentage point within those limits adds around 3-11€ to the per hectare reward (see appendix B, table B.1). Contributions of more than 40% do not increase the subsidy’s per hectare amount anymore, but are still rewarded at the same rate as the 40% contributions. The individual observations show contributions of favourable surfaces by farms

<sup>3</sup> Also referred to as Common hamster.

<sup>4</sup> The threshold was raised to 26% for the second contract wave from 2018 on.

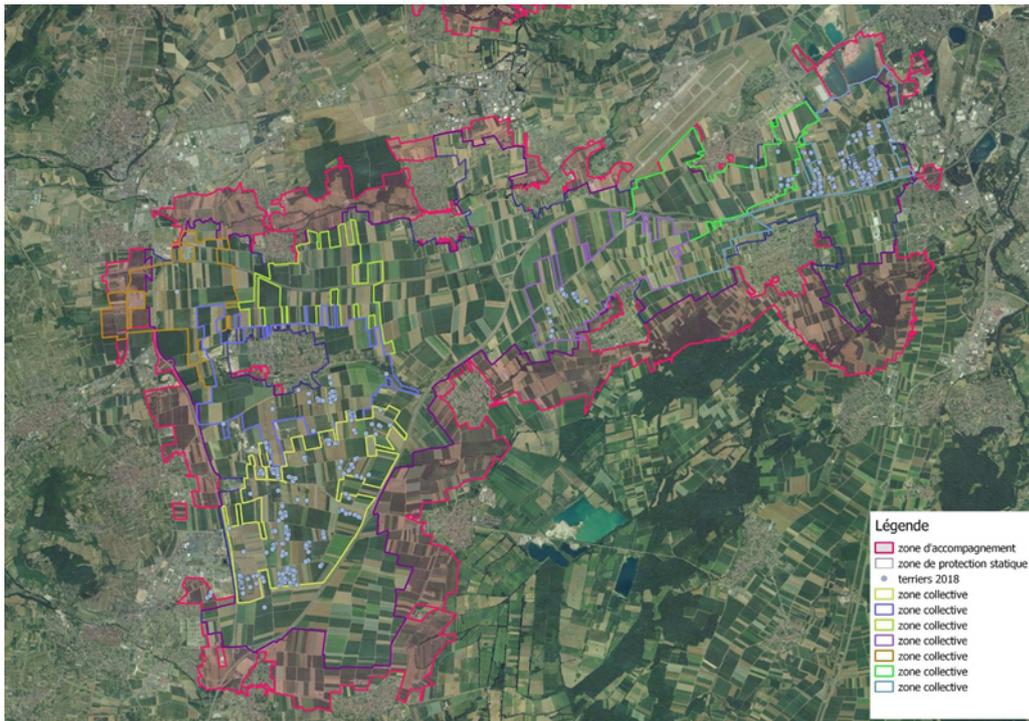


Figure 3.1 – Strict Protection Zone including Collective Zones Source: DREAL 2018, PNA 2019-2028, p. 118

with territory within SPZs. Farm territories are spatially grouped into CZs, depending on the location of farm units. This means that one farm entity can be allocated to multiple CZs due to spatial overlap of farm units across perimeters of different zones. Therefore, the analysis has to account for the clustering at both farm and zone level, specifically as the two are non-nested. That is, one farm is not necessarily included within a single CZ, but can be part of several zones. Moreover, not all zones started to contract under the scheme during the same year. Rather, zones joined the cAES throughout the three years between 2013 and 2015, while each zone committed for a contract period of 5 years. This implies that the last year of contract also differs respectively by zone.

A farmer association, in the literature referred to as environmental cooperative (EC)<sup>5</sup>, is involved with the management of the collective contract. Normally, all farmers that wish to participate under the collective scheme have to join the local EC. Our first research aim is thus to address the factors that determine participation in the cAES.

Each year, the EC is entrusted to report the declarations of surfaces of all its members and to distribute the resulting subsidies to the individual farmers proportional to the respective individual contributions. Being a member of the EC, however, does not mean that the farm has to contribute surfaces under the cAES every year during the contract period. Rather, the community of each CZ has to ensure collectively that the threshold of 24% of favorable crop surface on the CZ's perimeter is attained. How the individual contributions are partitioned is

<sup>5</sup> See literature by Daniel (2011a), Franks (2011), Emery and Franks (2012), Van Dijk et al. (2015).

not specified in the contract but has to be entirely decided by the farmers of the CZ. Therefore, regular meetings of members of the EC are required in order to discuss individual surface contributions for each CZ so as to arrive at a rate of favorable crops above the threshold for each CZ's territory. Our second research aim is thus to address the factors that determine individual contribution to the cAES.

### 3.2.1 Descriptive Statistics

Table 3.1 shows the minimum, maximum and average farm size for farms in (1) the region of Alsace, (2) the sample underlying this data, and (3) each SPZ respectively. While in all of Alsace farm size may well extend beyond 200 hectares (ha), the farms included in this data set have a size equal or inferior to 170,95ha. While in all of Alsace farm size may be below 20ha, the sample underlying our data shows minimum farm sizes of below 1ha. This is due to the particularity of our data, which only captures surfaces inside the SPZs. Therefore, the actual farm size is most likely larger than the extract included in our data. Unfortunately, we have had no access to the plot registry of the entire region (specifically areas outside the SPZs) so that it was not possible to correct for actual farm size. The interpretation of our data thus always has to be in light of this surface constraint, as only farm territories within an SPZ could be accessed and measured.

Moreover, table 3.1 summarizes by SPZ (i) the number of CZs, (ii) the number of farms (varies by year), (iii) the number of farms present in more than one CZ, (iv) the percentage of farms present in more than one CZ, and (v) the maximum number of CZs this subset of farms is simultaneously represented in.

Table 3.1 – Descriptive statistics of farms in each SPZ

Farm size (ha)	Alsace	Sample	SPZ South	SPZ Center	SPZ North
max	>200	170,97	170,97	156,72	96,87
min	< 20	0,16	0,19	0,4	0,16
mean	46,6	28,12	28,58	30,78	19,9
Number CZ	10	9	2	5	2
Number farms		97 - 244	24 - 43	66 - 153	7 - 58
Number farms multi CZ			0	34	9
farms multi CZ (%)			0,00	0,22	0,16
max number CZ per farm		4	1	4	3

Our variable of interest is the surface of favorable crops contributed to the collective contract by each farm in each CZ. Analogous to a threshold public goods game, individual contributions

to the public good can be studied. Figure 3.2 shows the individual contributions of farmers in one of the CZs from our data set. We can see that across the 6 years, 10 farmers are implicated in the cAES for this CZ. However, not all 10 farmers contribute surfaces equally, nor do they contribute consistent amounts across time. Although the CZ has to meet the required threshold in aggregate surface contribution, efforts seem to be very heterogeneous across time.

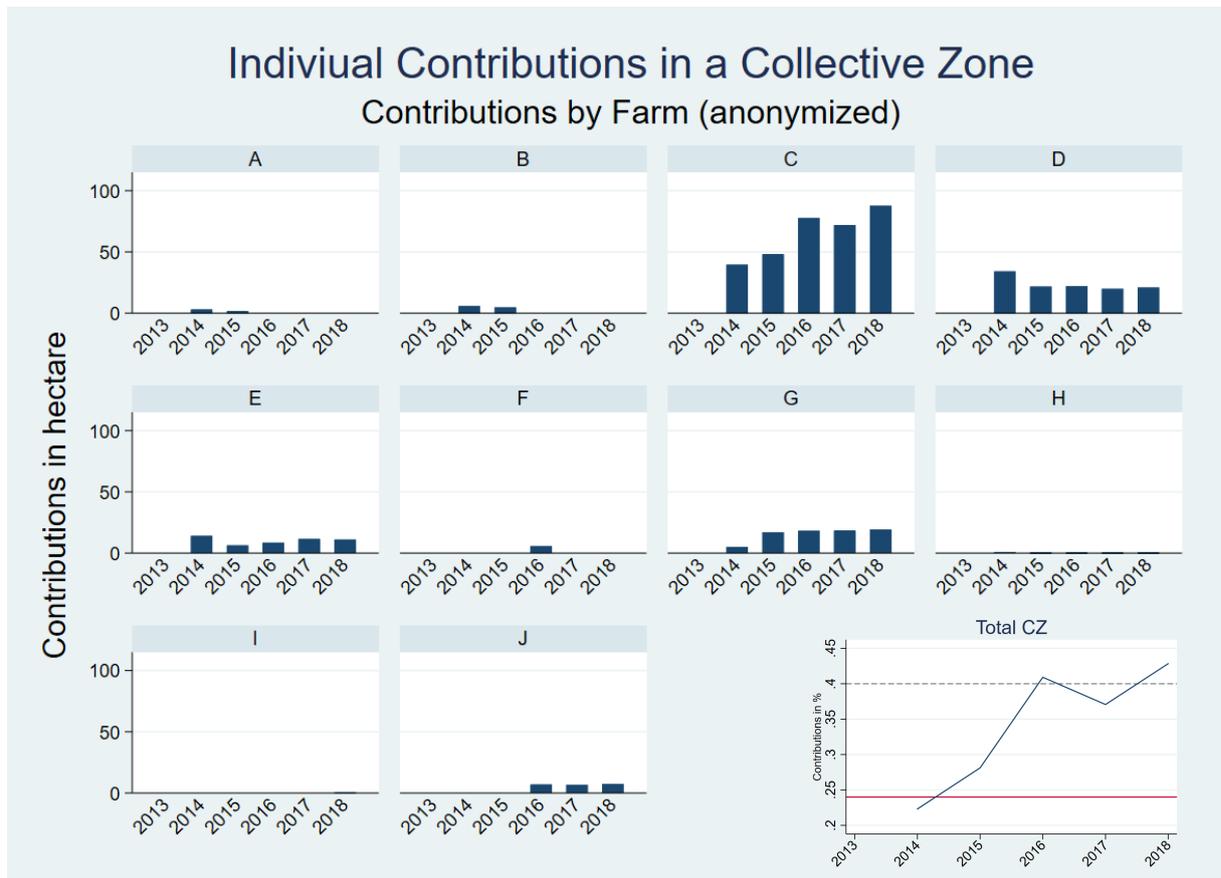


Figure 3.2 – Individual contributions in a collective zone

From the variations in surface contributions, we can see that the aggregate contributed surface in a CZ absorbs (i) variations across time and (ii) variations between farmers. While the first may be a question of coordination, the latter may be due to variations in farm size and farm territory within the CZ. Graphs on individual contribution patterns at the farm level are studied for each zone in order to take a closer look at the individual shares within each group of farmers. The graph in figure 3.2 shows surface contributions for each year for one of the collective zones, all other graphs can be found in part C of the appendix. It has to be considered that graphs for different CZs cannot be directly compared between zones and serve for within group comparison only as the scale variations, depending on the CZ’s perimeter, have to be considered. The bar graphs show very clearly the continuity or absence of surface contributions over time. However, very small surface contributions are difficult to read and may thus easily be regarded as negligible if farm size is left unconsidered. A relatively small contribution may be a large proportion of

overall farm size just as well as a relatively large contribution may be a small corner of a gigantic farm area. Therefore, by the nature of these graphs, no judgment can be made on farmers' contribution share with regard to the initial endowment of total farm size. Their purpose is simply to disentangle the individual contributions underlying the aggregate contribution level of the collective.

### Environmental Cooperative

Table 3.2 shows a summary of EC members and non-members by CZ per year for farms with territory inside a SPZ. The proportion of EC members over all farmers in the zones is above 50% for all years.

Table 3.2 – Association Members by Zone and Year

Year	Farms	ID Collective Zone									Total
		1	2	3	6	8	9	10	11	12	
2013	Member	9	21	10	4						44
	Total	19	32	15	7						73
	Ratio Group Size	0,47	0,66	0,67	0,57						0,60
2014	Member	23	20	10	6	18	11	10	20		118
	Total	39	27	14	8	36	21	24	43		212
	Ratio Group Size	0,59	0,74	0,71	0,75	0,50	0,52	0,42	0,47		0,56
2015	Member	25	21	10	14	19	11	11	21	6	138
	Total	43	29	14	19	37	20	25	43	14	244
	Ratio Group Size	0,58	0,72	0,71	0,74	0,51	0,55	0,44	0,49	0,43	0,57
2016	Member	28	25	9	14	19	10	11	21	6	143
	Total	45	37	13	19	38	20	26	37	14	249
	Ratio Group Size	0,62	0,68	0,69	0,74	0,50	0,50	0,42	0,57	0,43	0,57
2017	Member	27	21	8	14	18	11	11	21	5	136
	Total	44	35	13	19	39	22	26	40	14	252
	Ratio Group Size	0,61	0,60	0,62	0,74	0,46	0,50	0,42	0,53	0,36	0,54
2018	Member	20	21	9	9	20	9	13	21	5	127
	Total	46	33	15	11	40	22	29	39	14	249
	Ratio Group Size	0,43	0,64	0,60	0,82	0,50	0,41	0,45	0,54	0,36	0,51

In order to see if there is a significant difference in contributions of favorable surfaces between the two groups, a t-test on the difference between contribution means of association members (1) and non-members (0) is conducted. This produces a t-statistic of  $t = -15.2387$  with 1277 degrees of freedom. The null hypothesis of no difference between the two means has to be rejected at the 1% significance level as association members contribute significantly more surface.

The number of farms increases over the years as the perimeter for territory contracted under the cAES scheme is regularly increased. Table 3.2 shows in detail when zones were added to the

protection perimeter and in which CZs territories were widened to include more farms. It can be seen that the scheme set out in 2013 with only four CZs. In 2014 four more CZs were contracted and in 2016 one more CZ was contracted. The duration of the AES contract is 5 years, so that in 2018, CZ12 is in its 4th year of contract while CZ8 to CZ11 are in their last year of contract and those CZs that started in 2013 already commenced the second contract wave.

### 3.2.2 Construction of the Data Set

Upon our demand, the data has been extracted from a larger data base from the French Ministry of Agriculture. Anonymized records have then been transferred to us for the purpose of the above research aim. While some relevant surfaces might have been lost during the data extraction, it also seems that the early years, 2013 and 2014, are not very well documented (perhaps because of the novel management approach). Substantial cleaning and recoding has thus been done. Unfortunately, for some zones the documentation gaps in the data could not be filled. This means that there are rare cases in which the 24% threshold is not reached<sup>6</sup>.

In most zones, association members are able to reach the threshold without any help from non-members. In some cases the CZs seem to have included small amounts of favorable surface from non-members in order to reach the threshold. Nevertheless, the association members contribute over 90% of favorable surfaces in most cases.

The cleaning and selection procedure involved merging the data sheets from separate years as well as the corresponding variables and terminology in order to arrive at a coherent data set. All double entries as well as all observations with zero cultivated surface were removed. After calculating the respective sums of surface for the same farm in the same CZ in the same year, all entries at plot level but one were eliminated to keep only one observation per year and entity. This selection procedure left 1279 farm-per-year observations.

As mentioned above, farms can be situated in multiple CZs and reappear thus multiple times in the data set for the same year. Rather than just adopting the identifier specific to each farm, an identifier specific to each farm within its CZ was created. This allows for a clean panel structure where there is one observation per entity and per year. The relationship between the same farms in different CZs is nevertheless taken into account by clustering standard errors for both farm and CZ (Cameron et al. 2012, Cameron and Miller 2015).

We are seeking to identify the driving factors behind the amount of favorable crop surface contributed to the collective scheme, within the limits of the variables included in our data set. Besides farm size, the explanatory variables also include the proportion of farm territory relative to the size of the CZ, association membership, proportion of favorable surface contributed

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<sup>6</sup> The reference values for the data set are those surfaces per year and collective zone that were essentially paid out with subsidies. They are thus the values declared to the ministry and further up toward EU authorities. In an exchange with local representatives from the ministry, it was explained to us that declared and actual surfaces can vary due to farm-specific decisions, meteorological circumstances and last minute changes in spring. From the discussion, we understood that an error of up to 10 hectares between reference values and values obtained from the data can be judged as admissible.

within the CZ during the previous year, previous year farm contributions, first year of cAES participation, calendar year, whether the farm is in multiple CZs, and number of farmers in a CZ. New variables, among which ratios of surfaces contributed relative to farm size, relative to group size and relative to CZ territory were created. All variables are described in table 3.3.

Table 3.3 – Description of Variables used in Econometric Analysis

VARIABLES	Values	Meaning
Contri	continuous	farm contribution in hectare, dependent variable
Asso	binary	Association member
Surf	continuous	Farm surface across all CZ in ha
ratio_CZ	percent	Territorial share of farm in CZ
ratio_Gs	percent	Share of association members over all farms in CZ
L.Contri	continuous	Previous year farm contribution in hectare
L.ratio_T	percent	Previous year CZ contribution share
$L.C_{-i}$	continuous	Previous year others' contributions in ha
Gs	discrete	Number of Farms in CZ
multi	binary	Farm is present in multiple CZs
Y2	2014	second year since start of cAES
Y3	2015	third year since start of cAES
Y4	2016	fourth year since start of cAES
Y5	2017	fifth year since start of cAES
Y6	2018	sixth year since start of cAES
CY1	binary	first year of contract for CZ
d.var	continuous	Variable demeaned by time average
m.var	continuous	Variable's time average
x1_2013	continuous	Surf average for 2013
x2_2013	continuous	ratio_CZ average for 2013
x3_2013	continuous	ratio_Gs average for 2013

### 3.3 Empirical Strategy

In order to investigate what determines participation in the cAES, we conduct a Probit estimation. The dependent variable of our *Participation Equation* is association membership (binary). The explanatory variables include:

1. Whether a farm is present in multiple CZs (binary)

According to [Glowacki and von Rueden \(2015\)](#), transaction costs of coordination can be reduced by those who have above average resources at their disposal and the highest degree of network centrality, which leads them to assume a leadership role. Therefore,

we hypothesize that *if a farm is present in more than one CZ, the more likely it is to participate.*

2. Number of farms in the respective CZ (discrete)

Economic experiments have shown that the willingness to pay for public goods decreases with group size (Bohara et al. 1998) and risks of coordination losses are generally thought to be higher, the larger the group (Kerr 1989). As a consequence, these findings have lend support to the theoretical reasoning (Olson 1965) that as group size increases both the belief that individual contributions matter (Kerr 1989) and real cooperative actions decrease sharply (Esteban and Ray 2001), even if communication is available (Feltovich and Grossman 2015). This leads us to predict that *the more farms there are in a CZ, the less likely a farm is to participate.*

In order to test what determines individual contribution to the cAES, we conduct panel estimations using both fixed and random effects models. The dependent variable of the *Contribution Equation* is individual farm contribution in hectare (continuous). The explanatory variables include:

3. Farm surface, total across all CZ (continuous)

Risks and costs from transaction decrease marginally with scale, so that if there is alternative farmland available, contributing relatively small patches is potentially less risky for large farms that do not exclusively depend on those plots. Hence it can be assumed that *the more agricultural surface a farm has, the more it will contribute.*

4. Farm's territorial share in CZ (percent)

Similar to point 1 and 3 above transaction costs and perceived risks of contributing are reduced by the availability of alternative resources Glowacki and von Rueden (2015) while expectations lie on those who are most influential. Thus we can suspect that *the more surface a farm has in the CZ, the more it will contribute.*

5. Share of association members over all farms in CZ (percent)

The experimental economics literature has studied contributions to public goods in relation to group size and other mediating factors. However, there does not seem to exist a clear consensus on whether group size generally has a positive or a negative effect on individual contributions to the public good. For instance, the prominent studies by Isaac and Walker demonstrated conditions under which group size is negatively related to allocative efficiency for public goods (Isaac and Walker 1988), while they also identify conditions under which large groups allocate more efficiently on average (Isaac et al. 1994).<sup>7</sup> Being able to draw from a larger pool of resources increases the group's span of action (Oliver and Marwell 1988), which may lead to more moderate average

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<sup>7</sup> For a detailed overview, see chapter 2.

contributions. Given that more members introduce more noise and reduce perceived individual impact (Kerr 1989), we can expect that *the more association members there are in a CZ, the smaller individual contributions will be.*

### 3.3.1 Participation Equation

This section presents the econometric set up to estimate the likelihood of participation in the collective scheme. To do so we use a Probit regression model on the probability of joining the farmer association. *Asso* is a binary dependent variable of the form  $D_i \in \{0, 1\}$ , equal to one if the farm is member of the farmers' association and zero otherwise. The linear probability model (LPM), where  $D_i$  is regressed on a  $(k \times 1)$ -vector of explanatory variables  $X_i$ , is given by  $D_i = X_i' \gamma + u_i$ .

$Asso_{igt}^*$  is a latent continuous dependent variable for the likelihood of the farm joining the association. For the latent variable of the form  $D_i^*$  there exists an observable binary counterpart  $D_i \in \{0, 1\}$ , that changes its value if  $D_i^*$  goes above zero:

$$D_i = \begin{cases} 1 & \text{if } D_i^* > 0 \\ 0 & \text{otherwise.} \end{cases}$$

$\Phi$  is the standard normal cumulative distribution function for the probit estimation that defines the likelihood for a farm to be an association member:

$$\begin{aligned} Pr(Asso = 1) &= \Phi(X_i' \gamma) \\ Asso^* &= X_i' \gamma + \epsilon_i \end{aligned}$$

The regression equation of the latent model is given in scalar notation by:

$$\begin{aligned} Asso_{igt}^* &= \gamma_0 + \gamma_1 Gs_{igt} + \gamma_2 multi_{it} + \gamma_3 Surf_{igt} + \gamma_4 ratioCZ_{igt} \\ &+ \gamma_5 CY1_{igt} + \gamma_t \sum_{t=1}^t Y_t + \delta_g + \epsilon_{igt} \end{aligned}$$

where  $Gs_{it}$  indicates the number of farms that touch upon a given CZ (i.e. group size) and  $multi_{it}$  is an indicator for farms present in more than one CZ in a given year; these are variables that are only used for the selection equation. The error term is assumed to be independently, identically, normally distributed and the zero conditional mean assumption applies:  $E[\epsilon_{igt}|X_i] = 0$ ,  $\epsilon_{igt} \sim \mathcal{N}(0, \sigma^2)$ . Standard errors of the probit model are clustered by CZ.

### 3.3.2 Contribution Equation

The panel structure allows for modelization of the data by either fixed or random effects models. The fixed effects (within) model allows for unobserved fixed effects to be correlated with the regressors, while the random effects model incorporates the estimation of time-invariant variables. The dependent variable,  $Contri_{igt}$ , is a continuous measure of the surface contributed by farm  $i$  in its CZ  $g$  during year  $t$ . The prefix  $d$  represents the demeaned values from the within transformation.

RE-Model:

$$Contri_{igt} = \beta_0 + \beta_1 Surf_{igt} + \beta_2 ratioCZ_{igt} + \beta_3 ratioGs_{igt} + \beta_4 CY1_{igt} + \gamma_t \sum_{t=1}^t Y_t + \alpha_i + \delta_g + \epsilon_{igt}$$

2-way FE-Model:

$$dContri_{igt} = \beta_0 + \beta_1 dSurf_{igt} + \beta_2 dratioCZ_{igt} + \beta_3 dratioGs_{igt} + \beta_4 dCY1_{igt} + \beta_5 \sum_{t=1}^t dY_t + \epsilon_{igt}$$

Contributed surfaces are explained by a range of explanatory variables, among which  $Surf_{igt}$  represents the total agricultural surface of the farm across all zones,  $ratioCZ_{igt}$  represents the ratio of a farm's agricultural surface within the zone over the total zone's surface,  $ratioGs_{igt}$  represents the ratio of farms enrolled in the cAES over all the farms within a zone, and  $CY1_{igt}$  represents a dummy for the first year of contract enrollment. This last dummy variable varies across time and farm entities as not all zones started to contract under the scheme during the same year. The variable  $\sum Y_t$  represents a vector of year fixed effects,  $\alpha_i$  an unobserved farm specific effect,  $\delta_g$  an unobserved zone specific effect, while  $\epsilon_{igt}$  is the level 1 error term. While we assume a zero conditional mean for the level 1 error  $E[\epsilon_{igt}|X_i] = 0$ , there is reason to assume endogeneity in the level 2 errors, so that  $E[\alpha_i|X_i] \neq 0$  and  $E[\delta_g|X_i] \neq 0$ . In order to account for endogeneity at the individual and at the time level, a two way fixed effects model is chosen.

Given that this specification includes an overall year effect through  $\sum_{t=1}^t Y_t$ , the effects of year-specific covariates such as weather conditions cannot be identified, even if they were available, due to collinearity. Effects of level 2 covariates that are not included in our data, such as history and conflicts between farmers of one collective zone, farmer's age, etc., are assumed to be random and to affect each zone and each individual farm entity in a heterogeneous way, so that they cannot be fixed across all farms. These time invariant effects, in our case unmeasured and represented by the level 2 error term  $\alpha_i$ , are averaged out in the FE model. This "within transformation" allows for consistent estimation of level 1 covariates without having to rely on

the restrictive RE assumptions of no correlation with the level 2 error term (Schunck and Perales 2017). Standard errors are clustered by farm and by CZ (Cameron and Miller 2015).

### 3.3.3 Correlated Random Effects Model

In order to decide between the fixed and random effects estimation methods, a Hausman test is usually performed. However, with the double clustered standard errors, this test cannot be performed in Stata. Therefore, the approach proposed by Mundlak (1978) for a robust test of uncorrelated unobserved heterogeneity is implemented<sup>8</sup>. This test is based on an augmented auxiliary regression specification testing for equivalence of within and between estimates (Schunck 2013) under the null hypothesis  $H_0 : \beta_{RE} - \beta_{FE} = 0$  (Kolev 2008). The auxiliary regression is essentially a random effects model that is augmented by the inclusion of group specific mean values for all included variables that vary over time. Wooldridge (2005, 2010) termed it the *correlated random effects model*.

2-way cluster Correlated RE-Model:

$$\begin{aligned} Contri_{igt} = & \beta_0 + \beta_1 Surf_{igt} + \beta_2 ratioCZ_{igt} + \beta_3 ratioGs_{igt} + \beta_4 CY1_{igt} + \gamma_t \sum_{t=1}^t Y_t \\ & + \beta_5 mSurf_{ig} + \beta_6 mratioCZ_{ig} + \beta_7 mratioGs_{ig} + \beta_8 mY_{ig} + \beta_9 CY1_{ig} \\ & + \alpha_i + \delta_g + \epsilon_{igt} \end{aligned}$$

Variables with the prefix *m* represent time averages for all time varying variables included in the fixed effects model. The auxiliary model is thus augmented by the time-invariant mean variables. Wooldridge (2019) states the assumptions for the error terms of correlated random effects models with unbalanced panels as follows. With an unbalanced panel, the key assumption is that of strict exogeneity of the observable covariates conditional on the unobservables. This implies that observing a data point in any time period cannot be systematically related to the idiosyncratic errors. The level 2 error remains uncorrelated with covariates:  $E(\alpha_i | X_i) = 0$ , while it is assumed to be normally distributed:  $\alpha_i \sim N(0, \sigma^2)$  (Schunck and Perales 2017). Thus we can use the assumption of a conditional expectation given the response variable, as is crucial for nonlinear models.

In order to chose between FE and RE specifications, a test for the H0 of all parameters related to mean variables being jointly equal to zero is performed. If the null hypothesis fails to be rejected, implying that between and within effects are essentially equal, the correlated random-effects model collapses into a random intercept model (Schunck 2013). For the case where the unobservables are not correlated with the explanatory variables, the within and the between estimators yield the same results (Mundlak 1978). A significant test result favors the

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<sup>8</sup> Other tests have been performed, e.g. a hybrid estimation, which essentially arrived at the same conclusion.

fixed effects model, as the FE specification remains at least consistent.

The test result for the parameters related to the mean variables of our estimation is a  $\chi^2(9) = 127.76$  with significance below the 1% level. Therefore, it is concluded that estimation should be based on the fixed effects model because estimates of level 1 variables are unbiased by unobserved heterogeneity at level 2 (Schunck and Perales 2017).

### 3.3.4 The Hybrid Model

Essentially the same augmented regression test can be performed using a hybrid model (Schunck 2013). This approach decomposes level 1 variables into two components: averaged between variation and demeaned within variation. The hybrid model thus consists of the coefficients from the fixed effects estimation for all demeaned time varying variables (the within effect,  $\beta_W$ ) plus the means across time (the between effect,  $\beta_B$ ) (Schunck and Perales 2017). This can be illustrated on a generic model taken for illustrative purposes from Schunck and Perales (2017):  $g(\mu_{ij}) = \beta_W(x_{ij} - \bar{x}_i) + \beta_B\bar{x}_i + \gamma c_i + u_i$ . We now apply this generic version to our data.

Hybrid 2-way cluster Model:

$$\begin{aligned} Contri_{igt} &= \beta_0 + \beta_{10}dSurf_{igt} + \beta_{11}dratioCZ_{igt} + \beta_{12}dratioGs_{igt} + \beta_{13}dCY1_{igt} + \gamma_t \sum_{t=1}^t dY_{igt} \\ &+ \beta_5mSurf_{ig} + \beta_6mratioCZ_{ig} + \beta_7mratioGs_{ig} + \beta_8mY_{ig} + \beta_9mCY1_{ig} \\ &+ \alpha_i + \delta_g \end{aligned}$$

The means represent the between-group difference, while deviations from the group mean represent the within-group variability. The decomposition into between and within effects can be used with generalized estimating equations, which enables to specify less restrictive within-cluster error structures. Moreover, this allows to test for the equivalence of within and between estimates, which is referred to as an augmented regression test and can be used as an alternative to the Hausman specification test (Schunck 2013). Thus the augmented regression test for the hybrid model consists of comparing between and within effects of the regression coefficients, e.g.  $\beta_{10} = \beta_5$ .

For the estimate of level 2 variables to be unbiased, the zero conditional mean assumption and the standard normal distribution assumption of the level 2 error term still have to hold. Including the time averages ensures that effect estimates of level 2 variables are corrected for between-cluster differences in the time varying variables (Schunck 2013). We do not have any level 2 variables included in this model, so that the hybrid specification here serves simply as a second way to implement an augmented regression test.

### 3.3.5 The relation between the Hybrid Model and the Correlated Random-Effects Model

Correlated random-effects (Mundlak 1978, Wooldridge 2010) and hybrid models (Allison 2009) are attractive alternatives to standard random-effects and fixed-effects models because they provide within estimates of (level 1) variables and allow for the inclusion of variables that do not vary between time periods (level 2). A level 1 variable, i.e.  $x_{it}$ , varies between individuals and within time for the same individual, while a level 2 variable, i.e.  $c_i$ , varies only between individuals and is constant in time for the same individual. In the demeaned case of fixed effects estimation the level 2 error is, together with all level 2 characteristics, entirely removed, therefore controlling for both measured or unmeasured effects (Allison 2009, Schunck 2013, Wooldridge 2010) while making an estimation of level 2 variables impossible. Using a hybrid approach allows for estimation of within effects in random-effects models by decomposing level 1 variables into two components: averaged between variation and demeaned within variation. In the hybrid model, we assume for both individual and time fixed effects to be correlated with the explanatory variables (B. Koebel, personal communication).

Similarly, by introducing a composite error term, the correlated random-effects model (Wooldridge 2019) relaxes the assumption of zero correlation between the level 2 error and the level 1 variables. Therefore, the level 2 error can depend on the level 1 variables through their cluster means (Schunck 2013).

*"The correlated random-effects model (Wooldridge 2010), sometimes called the Mundlak (1978) model, is mathematically equivalent to the hybrid model. However, it includes the level-one variables in undemeaned form." - (p.95 Schunck and Perales 2017)*

Schunck and Perales (2017) show that the relationship between the two model specifications is apparent when rewriting the hybrid model:  $g(\mu_{ij}) = \beta_W x_{ij} + (\beta_B - \beta_W)\bar{x}_i + \gamma c_i + u_i$ . The within effects fit by both specifications are identical to the FE estimates:  $\beta_W = \beta_{FE}$ .

Both methods are useful in multiple ways. First, they allow for performing an augmented regression test whenever the Hausman test statistic is not available. Second, they allow for including information from level 2 variables and thereby for exploiting panel data more efficiently:

*"... a comparison of within and between effects (or their difference) provides an assessment of the degree to which unobserved heterogeneity in level 2 characteristics is responsible for an observable relation between the outcome and a level 1 variable ... Importantly, these advantages apply when handling any clustered data, [i.e. panel data] ..." - (p.74 Schunck 2013)*

### 3.3.6 Correcting for Sample Selection

If some of the factors determining participation in the farmers' association also affect contributed surfaces to the cAES, selection correction methods are in order (Jäckle and Himmler 2010). As such, a farm's total agricultural surface as well as its territorial share in the collective zone may very well influence both participation and contribution. Given that our estimates of the principal contribution equation are likely to be subject to an endogenous selection bias, a Heckman Selection Model (Heckman 1979) is considered. However, this technique does not account for the panel structure of our data and thus presents a biased Mills Ratio (MR). The bias results from a pooled estimate for the MR that does not take into account the farm-year structure of the panel. Rather, the estimated lambda would be based on the assumption that all observations are taken from the same time period.

As we treat panel data, the correction method proposed by Wooldridge (1995) is applied. This method proposes a first stage of standard probit estimates for each year, calculating one MR for each annual cross section. In the second stage equation, the conditional mean of the error terms is explicitly modeled by a multivariate linear regression that integrates the time specific inverse MRs (Jäckle and Himmler 2010). Correction for a potential selection bias is then applied to the main estimation through the introduction of the annual inverse MRs.

The Wooldridge (1995) estimator assumes normality on the errors in the selection equation while allowing for these errors to display arbitrary serial correlation and unconditional heteroskedasticity. Arbitrary correlation between the unobserved effect and the regressors is allowed. As selection may depend on the unobserved effect, this estimation method is complementary to a Hausman test. Analogous to the correlated random effects model, a significant test result for all parameters related to mean variables being jointly equal to zero favors the fixed effects model, as the FE specification remains consistent. Further assumptions are that the cross-section observations are independent and identically distributed, although no assumption is made on the dependence across time. Standard errors are clustered by farm and by CZ (Cameron and Miller 2015).

## 3.4 Empirical Results

### 3.4.1 Participation Equation

Table C1 in the appendix shows a pooled probit model for  $P(\text{Asso}=1)$  over the entire panel. It is assumed that explanatory variables are independent of unobservables (Jäckle and Himmler 2010). Standard errors for specifications (1) & (2) are clustered by farm, and those for specifications (3) & (4) are clustered by CZ. Both group size and a farm's territorial share in the CZ significantly and positively influence the probability for participation in the farmer association and thus in the collective scheme. This counters our intuition that larger groups may find it more difficult to convince on joining the association. However, this supports our conjecture that

farms with larger shares of territory may feel more responsibility to join the cAES. While both effects are positive, the coefficients for `ratio_CZ` are considerably larger, which shows a much stronger influence of the territorial effect as compared to the group size effect. It can be noted that columns (1) and (3) also show positive and significant effects of the ratio of association members to non-members, which can be understood as a spill-over effect: the larger the share of association members within a community, the more likely other farmers are to contract as well. Coherent with intuition, columns (3) and (4) show a significantly negative effect on participation for the first year in which a zone enrolls with the collective scheme. This seems to be absorbed when controlling explicitly for zone fixed effects, which makes sense when considering that there is perfect correlation between the first year of contract and zones appearing in the data set for the first time.

### 3.4.2 Contribution Equation

Table C2 in the appendix shows the Hybrid model by Schunck (2013) as compared to the correlated random effects model as proposed by Mundlak (1978) and to the standard RE and FE model. The mean coefficients of the correlated random effects model equal the sum of hybrid mean coefficients minus the FE coefficients. As our test result for the joint significance of the mean coefficients of the correlated random effects model has shown, we should base our interpretation on the FE specification.

Specification (1), the hybrid model, combines between and within effects by including only the means and demeaned values (prefix ‘d’ for deviation from the mean) for each of the standard variables. Therefore, the coefficients from demeaned variables should equal the coefficients of the FE estimation (4). The test statistics for the coefficients of the hybrid model suggest that the null hypothesis of equality for within and between estimates can be rejected for at least three variables. Therefore, as we obtain the same result on joint significance of all variables, this can be considered evidence for the fixed-effects model. In fact this is convenient for our data as we do not have observations on any level 2 variables and thus prefer to average them out in the error term to avoid any endogeneity issues at level 2.

Since the principal aim of this study is to identify the variables influencing contributions under the collective scheme, different specifications for the FE model are studied. Table C3 in the appendix shows fixed effects regression results for four specifications<sup>9</sup>: (1) includes the three main explanatory variables and year dummies, (2) adds lag operators for the dependent variable (`Contri`), for the group level contribution (`ratio_T`) and for group members’ contributions, (3) adds an indicator for association membership and (4) takes out two lag operators. All specifications’ standard errors are clustered by farm and by CZ. Model fit is rather poor (note: this estimation does not correct for sample selection). The addition of lags in specifications (2) and (3), changes the explanatory power of the coefficient for group size (`ratio_Gs`). As compared to specification (1), it shows positive and statistically significant whereas the size of the coefficient

<sup>9</sup> Specifications based on the `-vcem-` command (Gu and Yoo 2019).

for territorial share (ratio\_CZ) decreases. The coefficient of association membership is positive and statistically significant. The lag for other group members' contributions does not show significant, the same holds for the other lag operators.

### 3.4.3 Correcting for Selection

We use the technique proposed by Wooldridge (1995) in order to correct for sample selection when the data imposes a panel structure. Table 3.4 presents a cross section Probit estimation for each year of the panel in order to calculate Mills Ratios for each year. Contrary to our expectations, having territories in multiple CZs does not seem to influence the decision to become association member. That is, there are no such impact related considerations at play when deciding to contract under the cAES. However, there clearly are efficiency considerations involved, considering that the proportion of territory within the zone clearly drives engagement. That is, those who have a large share of territory within a zone are more likely to contract their surfaces under the collective scheme.

Table 3.4 – Probit for P(Asso=1) on cross section by year

VARIABLES	(1) Y2013	(2) Y2014	(3) Y2015	(4) Y2016	(5) Y2017	(6) Y2018
Gs	0.0560** (0.0276)	0.0184 (0.0208)	0.0152 (0.0172)	0.0402*** (0.0126)	0.0444*** (0.0140)	0.0497*** (0.0163)
multi	0.832 (0.543)	0.276 (0.315)	0.151 (0.255)	0.450* (0.242)	0.275 (0.228)	-0.117 (0.249)
Surf	0.00760 (0.00772)	0.00497 (0.00518)	0.00729 (0.00501)	0.00384 (0.00457)	0.00205 (0.00364)	0.00382 (0.00351)
ratio_CZ	8.572** (3.384)	20.54*** (4.234)	12.03*** (2.821)	15.73*** (3.048)	18.50*** (3.185)	16.35*** (2.855)
CY1		-0.415** (0.209)	-0.755* (0.437)			
Constant	-1.228** (0.518)	-0.616 (0.456)	-0.603* (0.348)	-1.202*** (0.291)	-1.339*** (0.304)	-1.350*** (0.306)
Pseudo $R^2$	0.1664	0.2033	0.1293	0.1598	0.1796	0.1997
Observations	73	212	244	249	252	249

Standard errors in parentheses (no clustering).

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

CHAPTER 3

Table 3.5 – Wooldridge 1995 Estimator. DV: Contri. Coefficients for lambda are jointly significant [ $F(6, 8) = 16.40$ ;  $Prob > F = 0.0004$ ].

VARIABLES	(1) Wooldridge 1995 RE Estimator	(2) Wooldridge 1995 FE Estimator
Surf	0.00703 (0.0134)	-0.00773 (0.0201)
ratio_CZ	42.30*** (8.979)	23.22* (10.12)
ratio_Gs	-4.812* (2.902)	-3.008 (5.410)
Y2	-3.383* (1.971)	-3.070 (1.755)
Y3	-0.180 (2.451)	0.365 (2.165)
Y4	2.965* (1.633)	3.355** (1.377)
Y5	0.771 (1.412)	1.289 (1.168)
Y6	3.872*** (1.465)	4.565** (1.424)
CY1	-2.961** (1.295)	-2.635* (1.296)
Annual Means		
Surf	Yes	No
ratio_CZ	Yes	No
ratio_Gs	Yes	No
lambda_2013	1.367 (1.064)	0.708 (0.657)
lambda_2014	4.478* (2.288)	3.286 (1.841)
lambda_2015	0.0474 (2.498)	-1.424 (2.009)
lambda_2016	-3.899*** (1.292)	-5.147*** (0.875)
lambda_2017	-1.465 (1.365)	-2.470** (0.872)
lambda_2018	-4.585*** (1.087)	-5.867*** (1.226)
Constant	5.253* (2.779)	6.638 (4.292)
R-squared	0.733	0.475
Observations	706	706
Number of farms	194	194

Robust standard errors in parentheses, clustered by farm and CZ.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The Wooldridge (1995) estimator includes yearly mean variables for the standard time-varying variables. The corresponding Mills Ratios are included in table 3.5 as the yearly lambda coefficients. The coefficients for lambda are jointly significant [ $F(6, 8) = 16.40; Prob > F = 0.0004$ ]. Selection seems to be important especially for the later years, with significant coefficients for 2016 to 2018. Indeed, as can be seen in table 3.5, the year dummies for 2016 and 2018 show significant when controlling for between variation while the first year of contract shows to have a negative impact on surface contributions. This could be explained by a spill-over effect of pioneers convincing their neighboring farms during subsequent years to participate in the collective scheme. As in the previous panel estimations, the coefficient for territorial share within the CZ still shows significant, although less so than before accounting for selection. The coefficient for the ratio of association members over all farms in the CZ indicates that the higher the percentage of contributors in the zone, the smaller individual surface contributions are. Although this coefficient is not significant in the FE estimation, it is larger than in the previous panel estimations and its trend is clearly negative.

The complete estimation results for all annual means are presented in table C4 in the appendix, where x1 corresponds to Surf, x2 corresponds to ratio\_CZ and x3 corresponds to ratio\_Gs. These mean variables capture the variation between individuals of the same year and we are interested in their joint significance. The  $\chi^2$  test for all mean variables being jointly equal to zero shows to be highly significant, [ $\chi^2(18) = 1795.23; Prob > F = 0.0000$ ], so that estimation should be based on the fixed effects model.

## 3.5 Discussion

### 3.5.1 The Role of Territorial Shares

Territorial shares seem to be the key driver for both participation and contribution to the collective AES. The coefficient for territorial shares is robust and significant across all specifications. This hints at a sense of responsibility among those farms that have the largest impact over the protection perimeter. Indeed, it seems to be those with the proportionally largest share in CZ surface, that assume the role of the leader within their CZ. Of course, those with the largest territorial shares are also those who can benefit the most from the allocation of subsidy payments. Accordingly, Ducos et al. (2007) state that large farms are more likely to enrol in AES because the fixed costs associated with a change in agricultural practices are the same independent of farm size and thus are offset more easily through economies of scale and relatively more subsidy payments.

### 3.5.2 The Role of Group Size

The group size hypothesis, as pronounced by Olson (1965), stipulates that public good provision is decreasing in group size, a paradox to ‘the more the better’. Indeed, in our data, group size

shows to negatively influence farms' surface contributions for the collective scheme. The larger the group, the less individual actions are noticeable and the less influence any individual perceives over the aggregate outcome (Kerr 1989). However, in the literature on threshold public good games, findings on allocative efficiency generally oppose the group size paradox. The provision of threshold public goods (such as environmental quality) seems to benefit from larger groups which are coordinated through the provision point mechanism (PPM). The PPM regulates that the public good is produced only if aggregate group contributions reach a predetermined threshold. In order for the PPM to facilitate the group's coordination, the threshold has to be known with sufficient certainty. This is the case in this cAES setting, where the collectively conditional subsidy mechanism imposes a known contribution threshold. Marwell et al. (1988) note that "when a 'social' solution to the collective dilemma is required, what matters is the relationship among the possible contributors in the critical mass, not the relationship among everyone in the interest group. Resources and social organization are the problem, not group size." (p.6). The importance of the 'critical mass' stems from effective coordination of the small individual contributions (Marwell et al. 1988). Indeed we find that group size seems to slightly influence participation in a positive way. This implies that a small sub group of highly motivated and ambitious pioneers is sufficient to steer the larger interest group towards the common goal. Glowacki and von Rueden (2015) consider these leaders to "solve collective action problems by facilitating coordination and reducing the transaction costs of cooperation" (p.4) because they have above average resources at their disposal and the highest degree of network centrality (Glowacki and von Rueden 2015). Leadership thus seems to be the best means by which to organize the production of threshold public goods. In the case of cAES management, regulators would do wisely to identify the core group of local leaders for the scheme and establish functional communication with those key initiators.

### 3.5.3 Perspectives: Individual Contribution Patterns under Collective Conditionality

When looking at the individual contribution patterns across farms of each CZ, two criteria for contributions can be identified. One criterion is the regularity of contributions which can be divided into two categories. First, there are farms that contribute each year more or less the same surface of favorable crops (stable). Second, there are farms that vary the surface contributed considerably each year or that contribute some surfaces some years and then nothing in between (fluctuating). The other criterion is the scale of surfaces contributed for which three categories exist. Some farms contribute a substantial share to their zone's collective surface (major) while others contribute rather a rather small share to their zone's collective surface (marginal). Of course there are also farms that contribute intermediate surfaces (medium) which lie in between those of major and marginal contributors. It is not visible purely from their contributions, however, how large or small the entire farm is. While territorial share is a main driver for contribution, the coefficient for farm size was not significant in the regression estimation.

Table 3.6 – Types of Contributors

Type	Major	Medium or Marginal
Stable	leader	critical mass
Fluctuating	in-for-the-money	help-out

Table 3.6 depicts an attempt to categorize contribution types and their potential motives. *Leaders* are those who contribute major amounts of CZ surface consistently over time. The *critical mass* consists of those contributors that participate marginally in the collective scheme but whose joint contributions nevertheless add up to a significant proportion for the CZ. Those that contribute major shares of CZ territory in a rather fluctuating manner, are considered to be *in-for-the-money*. They may find it beneficial to participate under the collective scheme in some but not all years in order to touch the low hanging fruit of easily available subsidy payments, perhaps because they would have cultivated favorable cultures on those plots within the zone either way, with or without the cAES. Those who contribute marginally and fluctuate in the size of their contributions from year to year are considered to be *help-outs*. We assume that they contribute the critical margin to reaching the threshold whenever the core group needs some additional plots for the collective scheme. However, it is not easy to distinguish contributors between those who seek to help out and those who simply benefit from the payments. A helpful approach is proposed by the sociologically and psychologically inspired agriculture literature which proposes a typology of motivations underlying the farming activity.

The principal typology according to the motivations pursued by farmers relates to productivist (concerned with maximizing productivity and revenue of the farm), conservationist (engaged for the land and ecosystem the farm lives on), innovation/lifestyle (enjoying the activity of farming) and social (seeking status and recognition through farming) goals (Cullen et al. 2020, Howley et al. 2015, Greiner and Gregg 2011, Burton and Wilson 2006). Some scholars suspect a hierarchical ordering of motivations depending on which identity-concept is activated, as several self-identities can exist within the same farmer, yet to varying proportions (Cullen et al. 2020, Burton and Wilson 2006). Greiner and Gregg (2011) studied barriers to AES adoption and policy tools that alleviate those barriers with respect to farmers' motivations. Barriers to AES adoption include opportunity costs, resource constraints, uncertainty, and lack of cooperation. Alleviating factors to those barriers were found to be collective action, social recognition, financial support, and community involvement. Depending on farmers' principal motivations to farming, they perceived barriers and use of AES differently (Greiner and Gregg 2011). Farmers with lifestyle and conservationist motives were unfavorable to imposed regulatory measures and saw more benefit in innovation and collective action. Contrarily, those with productivist motives were primarily concerned with resource constraints and opportunity costs and seemed to favor financial support. Finally, socially motivated farmers were predominantly concerned with a lack of cooperation within the agricultural network and strongly favored collective action and social

recognition. There may be a relationship between these motives for the farming activity in general and the contribution of surfaces under the presented cAES. Accordingly, leaders are likely to be those farmers with a strong innovation or lifestyle motive, as they are likely to attribute an importance to technological development and innovative practices without being too constrained by costs. The critical mass is likely composed by a mix of those with productivist, conservationist and social motives. The category of those in-for-the-money clearly refers to productivist motives: they are only participating when this increases their productivity and they would probably have adopted the farming practice even in the absence of the scheme. The help-outs are likely to be motivated by social and conservationist concerns as they are happy to support the larger cause, although they cannot make that big of a difference by themselves. Therefore, targeting farmers according to their motivations with the correspondingly most attractive policy tool might increase participation in agri-environmental practices.

Nevertheless, although the declaration of motives and the resulting typology have been scientifically derived in the literature (as cited above), the interpretation of contribution types with respect to our data is not based on a formal analysis. More work on identifying formal criteria for different cAES types, on analyzing contribution patterns and on gathering qualitative information (i.e. interviews with farmers) has to be conducted in order to make the inference on contribution motives with respect to our data more robust.

### 3.5.4 Limitations

Given the limited amount of variables in our data set, there is a concern for omitted variable bias. Unfortunately, we have no measured data on variables such as interpersonal relations and history of families in the village, intrinsic motives, farm productivity, and specific meteorological conditions in these rural areas for those past years available. A considerable amount of unobservability is thus left in the error term of our econometric specifications. A potential solution to address remaining endogeneity in the error term would be to employ an instrumental variable approach. Possible instruments are crop prices and evapotranspiration which affect the farm's profitability as well as surfaces contributed when contracting under the AES. While those year specific variables are controlled for through the year dummies, it is also not certain that they would provide for strong instruments. Therefore, this instrumental variables approach is not pursued at this point. Nevertheless, the two way FE specification helps avoid omitted variable bias at both the individual and the time level. By demeaning and by controlling for time-invariant variables, effects that may not have been measured are accounted for (Williams 2018). However, as we cannot measure these variables, their effects cannot be estimated. Therefore, we tolerate a degree of omitted-variable bias so that we can examine the effects of our time-varying variables we are especially interested in (Williams 2018). The external validity and generalizability of reported findings should also be considered carefully, as these results may be specific to the French (if not Alsatian) agricultural and cultural context.

## 3.6 Conclusion

This paper analyzes novel cAES data in order to explore which factors determine participation and contribution under the collective scheme. Based on their contribution pattern, types of contributors for collective conditionality are developed. Territorial shares over the protection perimeter and group size are identified as the main drivers for participation in the collective scheme. Nevertheless, while the proportion of CZ territory positively influences the contribution of surfaces under collective conditionality, group size has a negative correlation to contribution rate. Therefore, the policy challenge when proposing collectively conditional subsidies seems to be to appropriately target influential farms while determining the appropriate group size for each collective contract. To our knowledge, this is the first study providing an econometric analysis of real world cAES data from the field. Our study contributes to the academic literature by breaching the gap of missing data from the field and to policy making by highlighting that the policy challenge when proposing collectively conditional subsidies lies in the appropriate targeting of farmers.

For future research, it would be interesting to test whether the leadership effect of large territorial shares reproduces in absence of the financial incentive. That is, whether there is a purely ecologically motivated effect to contracting under the cAEs or whether the collectively conditional subsidy mechanism alone drives major and stable contributions. This could be done in a natural field experiment, for example, by conducting randomized control trials among farmer communities.



## Chapter 4

# What Role for Environmental Cooperatives in Collective Agri-Environmental Schemes? On the Rising Importance of Inter-Farm Cooperation

### Abstract

The collective action dilemma inherent to environmental quality problems implies that agri environmental schemes (AES) are best to be managed collectively (Emery and Franks 2012). Such collective contracts need to be coordinated, a complex process that involves multiple stakeholders and planning over a 5-year horizon. When chaperoned through an associative structure the coordination activities can be centralized and homogenized. Through a review of the recent literature followed by a case study analysis, this research assesses the potential of environmental cooperatives (EC) in managing spatially defined collective contracts. Interview evidence highlights that the role of the EC is above all a facilitating one, mediating between the different interest groups. The purpose of the EC is to enable the application of collective AES by ensuring three important contract criteria: (1) place based targets and locally specific measures, (2) flexibility in contract design and adaptation, (3) active farmer involvement. Through bridging collective AES design and implementation, the EC is a cost efficient and locally adaptive structure that is grounded in farmers' trust and that is representative of the context specific agricultural situation. A democratic and participatory organizational form is recommended for the EC to optimally function as a central institution in the management of collective contracts.

**JEL Classification:** Q18, Q56, D71

**Keywords:** Environmental Cooperatives, Collective Agri-Environmental Schemes, Collective Action.

## 4.1 Introduction

Agri-environmental management turns around the influence of the agricultural sector on environmental quality, the latter being essentially a public good (i.e. non-excludable and non-rival). Agri-environmental schemes (AES) that set out to address the environmental management have been proposed initially through individual contracts. While AES are a mandatory element of the Common Agricultural Policy (CAP) in all EU member states since 1994 and amount to €2.5 billion of EU funds per year (Westerink et al., 2017), this rather expensive policy tool has only shown mixed success in achieving desired environmental outcomes (e.g. [Batáry et al. 2015](#)). This lack in effectiveness is mostly attributed to the scattered adoption of contracts ([Dupraz et al. 2009](#), [Zavalloni et al. 2019](#)). Being voluntary in nature, the decision to contract individual AES is mostly driven by utilitarian motivations: payment rate and ease of fit with existing or traditional farm practices determine the profitability of the transaction ([Batáry et al. 2015](#), [Häfner and Piorr 2020](#)). Only relatively large farms can set off the transaction costs that come with AES adoption ([Amblard 2021](#)). Rather than promoting coordinated landscape management, the CAP system of individual agri-environmental contracts results in the fragmentation of isolated efforts ([Häfner and Piorr 2020](#)) which do not suffice for environmental quality improvements. A single farmer alone cannot have sufficient impact on the ecosystem to reach the spatially defined threshold inherent to resource and environmental management situations. Managing land at the landscape rather than the farm scale may provide greater effectiveness for AES outcomes than the insufficient environmental impact obtained from individual farm-level agreements ([Mills et al. 2011](#), [Westerink et al. 2017](#)). However, uncertainty about the design of collective contracts and their integration with the CAP persists among policy makers and within the academic literature. Being essentially a spatially defined collective action dilemma, agri-environmental management may best be addressed collectively. By focusing on particular regions of interconnected territory, collective schemes have the leverage to tailor measures to the local context. Furthermore, designing and implementing AES on landscape rather than on farm scale is thought to assure the provision of threshold public goods such as environmental quality more effectively ([Häfner and Piorr 2020](#)).

In parallel, the shared project of farmer cooperatives set out to seek better representation for the agricultural profession and to invent new forms of agriculture adapted to local needs ([Daniel 2012](#)). These cooperatives are groups of like minded farmers that are based on the principle of cooperation for a shared interest. Eventually, so called environmental cooperatives (ECs) managed to obtain a financial supplement in the form of agri-environmental subventions for collective collaboration on a specific territory (*ibid*). This collective financial incentive can be understood as the main driver for the environmental orientation of such farmer cooperatives. Having initiated this opportunity for collective rewards, the role of cooperatives inherits a degree of endogeneity vis-à-vis the emergence of landscape scale AES. While the contemporary perspective identifies farmer cooperatives as a management tool for collective agri-environmental contracts, it was really the creation of cooperatives that stimulated the political development

towards collective and place-based contracts in the first place. The interlinkage between farmers associations and territorially bound, collective contracts seems self-evident: because they are inevitably involved with and geographically bound to the agricultural territory of their communities, local farmer cooperatives can provide more detailed insight to and assessment of environmental questions concerning their territory. By being the principal modulators of their land, ECs allow for extending efforts across all actors on a common territory as well as for including other stakeholders on matters of shared responsibility (Daniel 2012). In this sense, cooperatives provide the foundation for fostering local solidarity within the farmer community (ibid). Moreover, by constituting a platform for contact and cooperation with non-agricultural actors, the farmer cooperative is in a position to elicit solidarity within the wider community towards the agricultural sector (ibid). Franks (2011) finds that farmer associations play a key role in making collective AES (cAES) more cost and time efficient as compared to conventional, individual AES.

This discussion of farmers associations seeks to gain a clearer understanding of the role of such farmer associations in managing environmental dilemmas within the scope of cAES. The study seeks to address two questions: (1) which role does the farmer association assume in the management of collective contracts and (2) which organizational form corresponds best? Through a case study approach the complex and context specific nature of farmer associations (hereafter referred to as ECs) is investigated. This study is thereby contributing to the scarce literature of collaborative governance arrangements for AES (Westerink et al. 2017).

A detailed review of the literature on collective action situations and collective agri-environmental management summarizes success factors and potential barriers according to five key categories: (i) Governance and institutions, (ii) Participatory contract design, (iii) Social capital, (iv) Group characteristics and (v) Information. The case study is discussed with respect to these five categories and confirms that (1) collective measures need to be adapted to locally specific environmental situations while taking the practical requirements of farming into account, (2) sufficient flexibility in the application of measures needs to be granted to farmers who make use of their local and context specific knowledge, (3) the role of the EC is above all a facilitating one, granting a voice and a platform to active farmer involvement in all aspects of cAES. The discussion strongly advocates a democratic and participatory organizational form for the successful functioning of an EC.

The paper is constructed as follows: Section 2 delineates the challenge to cAES in light of the aspects of collective governance arrangements while section 3 presents a detailed review on the emergence and role of farmers associations. Section 4 presents the case study and section 5 then discusses the interview evidence to develop a comprehensive position of ECs in the management of collective agri-environmental contracts. Section 6 concludes.

## 4.2 Challenges: Aspects of Collective Governance to cAES

In delineating the challenges to cAES, a better understanding of the interplay among governance forms, spatial arrangements and transaction costs for collective action has to be discussed.

### 4.2.1 Governance forms for collective action

Collective action is defined as the “action taken by a group in pursuit of perceived shared interests of its members” (Scott and Marshall 2009). Boulton et al. (2013) recommend to recognize the difference between collaborative and coordinated governance approaches to collective action: Collaborative approaches are defined as “Land managers meet, work together and maintain a dialogue. Land managers need to engage with each other for the project to deliver its desired outcomes.”, while coordinated approaches are defined as “Land managers working towards the same objective but in isolation. Joint working between participants is not necessary for the project to deliver its desired outcomes. External facilitation is a common feature of this approach.” The authors distinguish between three forms of initiation: (1) Bottom-up where the “impetus comes from and is maintained by land managers”, (2) Evolved where “activities start independently, in an ad-hoc manner, but are brought together into a collaborative venture by an adviser” and (3) Top-down which is “initiated by a Government Agency, NGO or by a Government funded adviser to deliver public policy”.

Villamayor-Tomas et al. (2019) argue that situations relying exclusively on coordination should require mainly informational and/or organizational resources that reduce transaction costs and uncertainty through a single intervention that installs a course of action which then can be followed autonomously by the farmers. Contrarily, situations requiring a certain level of collaboration should include financial, coercive and social resources over the longer term that, through a continuous process, lastingly change pay-offs and understandings among the farmers. Whereas traditionally governance for collective action in agriculture used to be either imposed by the government or completely left to self-initiation (Villamayor-Tomas et al. 2019), hybrid approaches may enable governments to promote self-organization through the establishment of new rules adapted to the local collective action situation. Rather than leaving the farmer alone in figuring out a way to handle ecosystem services, these mixed strategies could lead to shared responsibilities and to the participatory design of measures.

### 4.2.2 Eliciting collective action

Factors beneficial to collective action have been intensively studied by Ostrom and colleagues, particularly in the context of common pool resources (non-excludable and rival). Dietz et al. (2003), for example, describe five components to adaptive governance of environmental resources that include (i) providing information on rules that are congruent with ecological conditions, (ii)

managing conflict over boundaries to resource use, (iii) allocating authority and install accountability mechanisms to ensure compliance, (iv) providing a mix of institutions for stakeholder dialogue, and (v) favoring designs that facilitate experimentation, learning, and change. While agri-environmental management refers mostly to threshold public goods (non-excludable but non-rival), differences in factors promoting cAES can be expected. Measures of cAES prescribe mostly land management practices that make more efficient use of commonly shared resources, rather than necessarily restraining access to it (Mills et al. 2011). Nevertheless, the general tendency holds: “the context within which individuals face social dilemmas is more important in explaining levels of collective action than relying on a single model of rational behavior” (Ostrom 2010). Structural variables such as anonymity among individuals, trust through previous reciprocity experience, sanctioning linked to cooperation, and the presence or absence of communication all affect the degree of cooperation a group can achieve (ibid). However, a range of sceptical attitudes such as individualism, inertia, missing awareness, and acceptability concerns can constitute barriers to collective action (Uetake 2014). For the case of cAES, we can thus stipulate that the regrouping of farmers and other actors in an environmental cooperation facilitates the construction of favorable structural factors (through building of social capital) and the emergence of solidarity (through shared norms and aims) among like minded individuals.

The literature on AES distinguishes between public and private benefits as the goal for collective action (Prager 2015, Häfner and Piorr 2020). Where there is a shared private interest in environmental management, collaboration becomes possible and is likely to be initiated by farmers themselves (bottom-up). A predominant public benefit to be obtained through the environmental policy, on the contrary, requires relatively high financial incentives in order to elicit collaboration among farmers. In this case, a government initiated approach (top-down) is more likely. In situations where public and private benefits balance (e.g. diffuse pollution), farmers have shown to take independent actions and to be subsequently coordinated by an external adviser into a collaborative undertaking (evolved). While a lack of communication among individual farmers seems to constitute the main barrier to coordination (Häfner and Piorr 2020), the role of a facilitator to coordination is not clear yet. A facilitating institution could initiate communication among farmers and accompany collaboration, which likely increases transaction costs for everyone. Otherwise, an institutional process could take over the centralized coordination effort and thus lower the barrier of entering a collective scheme by eliminating most transaction costs related to communication (Häfner and Piorr 2020). Prager (2015) notices that coordination is more straightforward to organize from a government point of view, which may explain the traditional top-down, coordinated approaches to AES. Although collaborative approaches are considered to be more efficient in attaining landscape-wide environmental outcomes, they do imply additional challenges. Specifically, narrowly defined AES measures may only partly accommodate the broader objectives and local needs of collaborating farmers (Prager 2015). The policy challenge thus consists of channeling the existing territorial and cultural conditions towards the collective adoption of locally adaptable agroecological practices.

In the scope of agri-environmental policy making, Dessart et al. (2019) advise to select pol-

icy tools specific to the likelihood, scope and duration of the intended effect, and to distinguish between methods targeted at distal or proximal decision elements. Eliciting merely the adoption of a specifically defined agroecological practice can be achieved already with policy instruments oriented towards proximal factors (i.e. subsidies that reward a specific behavior). Inducing a profound change in collective behavior entails addressing more distal factors (i.e. attitudes, values, core beliefs) and a modulation thereof so that environmental concern becomes a central objective to farming and is coupled to important social recognition (Dessart et al. 2019). Moreover, the authors argue that a holistic approach to policy design is needed in order to account for the variety of behavioral and environmental consequences a single intervention can produce.

### 4.2.3 Spatial aspect

Inherent to environmental threshold dynamics is the spatial aspect of resource management: only if sufficient territory is managed can change in environmental quality be triggered.

Spatial coordination is required in order to achieve coherent application of environmental measures across an interconnected corridor of farmland. Regulations that are applied through zoning (Amblard 2021) can achieve the concentration of efforts within the perimeter of a specific protection or conservation zone. This degree of spatial coordination requires collective governance arrangements for the implementation of AES (Westerink et al. 2017). Governance is defined as “the structures and processes by which people in societies make decisions and share power, creating the conditions for ordered rule and collective action, or institutions of social coordination” (Westerink et al. 2017).

In an econometric analysis including spatial interactions, Boncinelli et al. (2016) find that the rate of participants to AES for organic farming shows regional agglomeration effects meaning that there is a clear spatial relation among the farms that obtain funding through AES. The authors conclude that the adoption of agri-environmental contracts is predominantly driven by imitation processes and external economies of scale. They advocate that the hypothesis of the “atomistic agent who makes decisions irrespective of the effects of decisions taken by other agents” is too isolated from the social and cultural context farmers are embedded in. Neighbors’ intentions to re-enroll in AES in China (Chen et al. 2009) and collective bonuses in France (Kuhfuss et al. 2013) have a significant and positive influence on farmers’ intention to contract under AES in hypothetical choice settings. While China clearly provides the context of a collectivist culture, the neighborhood effect also seems to show in more individualist Western countries. Farmers’ decision to contract under AES with a conditional financial incentive depends on whether they believe that the threshold can be reached by the group (Kuhfuss et al. 2013, chapter 1). Only if collective efforts are sufficiently high can an environmental outcome be achieved and the subsidy payment triggered. Therefore, the design of cAES could benefit from explicitly integrating the social effects of imitation, social comparison and norms of social conformity. Making public benefits salient through private incentive mechanisms that take the spatial threshold dynamics and social conformity effects into account has the potential to stir

individual farmer behaviors towards the collective goal. Diffusion of innovative practices in the agricultural sector through imitation of pioneers is determined by the role of local networks (Boncinelli et al. 2016). The influence of neighborhood networks is directly linked to the spatial aim of concentrating environmental efforts within specific zones. Smart policy design could thus address both issues through geographic targeting by adapting measures locally to both territorial and cultural specificities.

#### 4.2.4 Transaction costs

Farmer cooperation has been recognized by the European Union (EU) as involving ‘additional transaction costs which should be compensated adequately’<sup>1</sup> (Prager 2015). Social, economic and political settings, the resource system, the governance system and the actors themselves all influence the transaction costs to collective action (Amblard 2021). In the scope of AES, transaction costs for both the farmer and the regulator may include (i) search and information costs, (ii) bargaining, decision and contracting costs and (iii) monitoring, enforcement and compliance costs (Amblard 2021, Bartolini et al. 2021, Burton and Schwarz 2013, Quillérou and Fraser 2010). Farmers’ decisions to contract under AES often involve large investments and long-term commitment which imply perpetual personal and economic consequences (Dessart et al. 2019). If the fixed transaction costs are very high, smaller farms are likely to be relatively disadvantaged which can significantly constrain their participation in the AES (Amblard 2021). Indeed, the recent literature largely agrees on a prevalent financial motivation to farmers’ adoption of AES (Hardy et al. 2020, Häfner and Piorr 2020, Dessart et al. 2019, Batáry et al. 2015). Given that farmer participation is the primary requirement for the provision of agroecological public goods, transaction costs should be equally shared among all stakeholders benefiting from the provision of these environmental public goods (Uetake 2014). Collective action has the potential to mitigate the constraints that transaction costs impose on farmer participation in agroecological practices. Such “transactional economies of scale” (Amblard 2021, p.6) relate to a groups’ ability to share and harmonize knowledge and costs among its members leading to important learning and scale effects for collective investments. The reduction in transaction costs and the shared environmental purpose to collective land management is likely to translate into increased participation among farmers of the same community (Amblard 2021).

### 4.3 The potential of Environmental Cooperatives

Due to the joint effort needed to elicit a change in environmental quality, sustainable ecosystem and landscape management can only occur with collaboration (Prager 2015). It is possible to spatially coordinate the agroecological practices among farmer communities (Uetake 2014). Indeed, farmers should be considered as a key component in the management of environmental

<sup>1</sup> Article 5 of Regulation (EU) No. 1305/2013 of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD). 2013.

dilemmas (Dessart et al. 2019). Collective landscape management can provide the necessary flexibility and pooling of joint resources to adapt efforts to the local ecosystem requirements. Moreover, other benefits can emerge from farmer collaboration that reach beyond the AES context. For instance, in the scope of French machinery coops (CUMA), ‘local inter-farm cooperation’ is defined as “the formal and informal collaborative practices between farmers that are explicitly designed to share, manage and/or exchange equipment, labor and or/material resources” (Lucas et al. 2019, p.146). Mobilizing social capital has been demonstrated to support farmers in the wider development of sustainable practices. Secondary benefits to local inter-farm cooperation include the satisfaction of new material needs induced by diversification, the reorganization of work patterns, the management of uncertainty and risk, and the emergence of technical dialogues that encourage the coproduction of local knowledge (Lucas et al. 2019, Slimi et al. 2021).

Indeed, farmer collaborations in the Netherlands have shown to be able to reduce drawbacks of AES through the collective management of contracts (Franks 2011). Environmental Cooperatives act as a forum to discuss collective AES members’ intentions, increasing the predictability for others’ decisions and thus circumventing the ‘assurance problem’ by eliciting a credible signal for own and others’ contributions to the collective contract goal (ibid). However, ECs impose costs as the work must be coordinated. Thus, EU funding acts partially to compensate those coordination costs, next to transfer and expert consultation expenses. Coordination is further facilitated through interventions of regional agricultural authorities. Nevertheless, the degree of functionality and beneficial influence of ECs on collective AES is, according to Franks (2011), dependent on a composition of multiple factors:

1. like-minded members (e.g. environmental attitudes);
2. a stable, trust-building organization;
3. a low level of conflict between members;
4. allowing for the transmission of private information and mutual monitoring among members;
5. sharing similar views and beliefs ;
6. the willingness to cooperate.

This multi-factor view is supported by the works of Elinor Ostrom and colleagues, who classify communication as the key device to facilitate cooperation among agents with heterogeneous interests, even in the absence of enforcement mechanisms (Ahn et al. 2003, Ostrom and Walker 1991). Cooperative approaches to AES can be encouraged through (i) contracts coordinated at landscape scale, (ii) tender processes at group level and (iii) the participatory design of locally adaptive agri-environmental measures (Prager 2015). All of these would benefit from the facilitating role of an EC in centralizing efforts and representing farmers needs.

### 4.3.1 Historical Developments

Environmental cooperatives first emerged in 1991 in the Netherlands as a response to farmers' concerns about the government's agricultural policy. The innovation of these ECs initiated less from a conflict of interest over environmental problems but rather to resist contradictory constraints faced by local groups (Daniel 2011b). The EC sought interaction with local and national authorities in the form of an independent and autonomous representation of the agricultural profession (ibid). In response to a loss of influence after the liberalization of the CAP during the 1980s, the EC allowed farmers to innovate a new form of solidarity in order to overcome internal divergence on the strategic positioning and changing financial modes of the agricultural council (Daniel 2012). Daniel (2012) defines solidarity as the set of reciprocal links which, in an organization, mark the stability of the relationships between individuals and allow for a collective project to be sustainable. The approach to create a new form of solidarity was thus a strategic one in order to reverse the loss of influence the agricultural profession experienced during the 1980s and to rebuild a consensus among the community of Dutch farmers (Daniel 2012, 2011b).

Disadvantages that were sought to be rectified were (1) a lack in representation of farmers' opinions within the policy framework at the time, (2) attributing environmental outcomes to a lack of good will among farmers, (3) the government's top-down approach, and (4) farmers' alleged lack of responsibility for the environment (Van Dijk et al. 2015). The spread of ECs was facilitated through their contribution to environmental politics and through financial opportunities (Daniel, 2011). The Dutch "Programma Beheer" in 1997 attributed questions of environmental management to ECs. In the scope of the Dutch Agri-environmental program from 2000, ECs were given the possibility to apply for regional agri-environmental schemes on restoration of ecological focus areas and species protection. As these schemes involve territories of over 100 hectares of farmland, the role of ECs shifted towards facilitation of contract management among several farmers, thereby strengthening its intermediary position and influence with the government. By 2006 collective contracts covered 39% of the total Dutch AES territory (Van Dijk et al. 2015). Today, Dutch ECs are local organizations composed predominantly of farm collaborators that assure the intermediation to local and national agencies for numerous projects and that act primarily for the coordination and implementation of collective AES (ibid). ECs are organized as associations rather than under cooperative law but are nevertheless required to submit a formal constitution with named officers. They have to provide annual accounts declaring cash flows, bank balances and a balance sheet (ibid).

### 4.3.2 Contemporary Developments

Since the 2013 CAP reform,<sup>2</sup> groups of farmers are eligible to be the end-beneficiaries of agri-environmental payments in Europe (Westerink et al. 2017). Variations of ECs nowadays also exist in other countries, whereof England's Environmental Stewardship and Australia's Landcare

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<sup>2</sup> see consideration 29 opening the Regulation (EU) 1305/201

Table 4.1 – A selection of collective agri-environmental management arrangements from the literature

Literature	Name of EC	Country	Environmental target	Year assessed	Group size	Area engaged in AES (ha)	Spatial coordination by			Contract	
							Government agency (top-down)	Farmer association (bottom-up)	Individual	Collective	
Westernik et al. (2017)	AWB	France	Watershed quality	2015	810	506	x			x	
	Eco2	Belgium	Landscape maintenance	2015	4-11	110		x		x	
	HR8	England	Meadows grazing	2014	701	102000		x			x
	SRK	Germany	Biodiversity conservation	2016	na	520		x		x	
	WLD	Netherlands	Meadow bird conservation	2016	500	5480		x			x
	De Lingestreek	Netherlands	na	2005	100	800		x			x
	Meander	Netherlands	na	2005	55-60	na		x			x
Franks (2011)	PION	Netherlands	na	2005	1700	na		x			x
	Zwarteneerdijk	Netherlands	na	2005	16	500		x			x
	Kollumer Grien	Netherlands	na	2005	190	na		x			x
	Den Haneker	Netherlands	na	2005	950	na		x			x
	VEL/VANLA	Netherlands	Landscape maintenance	2005	209	3550		x			x
	Aoree Catchment	New Zealand	Watershed Quality	2010	33	na		x			x
	East Coast Forest	New Zealand	Soil Erosion	2010	356	60000		x			x
Mills et al. (2011)	North Otago Irrigation	New Zealand	Water Supply	2010	100	14000		x			x
	Pontbren	Wales	Landscape management	2008	10	1000			x		x
	Ireland Moor	Wales	Livestock destocking	2008	100	2500			x		x
Prager and Vanclay (2010)	Landcare	Australia	Sustainable land management	2006/2007	varied	regional		x			x
	Landschaftspflegeverbände	Germany	Landscape maintenance	2006/2007	varied	regional		x			x
	Groningen	Netherlands	na	1999	200	7000			x		x
	Friesland	Netherlands	Landscape maintenance	1999	590	23000			x		x
	Drethe	Netherlands	na	1999	70	4000			x		x
	Overijssel	Netherlands	na	1999	130	< 1000			x		x
	Gelderland	Netherlands	na	1999	330	4000			x		x
	Limburg	Netherlands	na	1999	3030	15000			x		x
	Utrecht	Netherlands	na	1999	590	17000			x		x
	Noord-Holland	Netherlands	na	1999	530	27000			x		x
Renting and Van Der Ploeg (2001)	Zuid-Holland	Netherlands	na	1999	1060	34000			x		x
	Zeeland	Netherlands	na	1999	70	3000			x		x

na = not available

are the most prominent example in the literature (Emery and Franks 2012, Van Dijk et al. 2015, Prager and Vanclay 2010). Table 4.1 provides an overview of cAES arrangements from various case studies. The EU’s promotion of “agroecological practices and systems” has led to a flourishing of “Environmental and Economic Interest Groups” (GIEE<sup>3</sup>) in France, from 135 groups in 2015 to 250 in mid 2016 (Westerink et al. 2017). Recognizing the collaborative effort, farmers engaged in a GIEE are eligible for higher levels of public subsidies (Lucas 2021).

The territorial organization of ECs is defined by zones, which are called Strict Protection Zones in France and Ecological Focus Areas or National Character Areas in England. These zones are identified according to “place based priority conservation targets” (Franks 2011), i.e. environmental outcomes sought that are specific to a region’s biodiversity needs. One EC is representative of the management of one cAES that can involve multiple protection zones but, in order to facilitate communication and coordination, is likely located within one region (figure 4.1). Unlike traditional, individual AES where the interaction between authorities follows a top-down approach, ECs allow for a bilateral exchange through their moderating role in cAES design and implementation. Moreover, ECs coordinate farmers within smaller collective zones so that a community of farmers is responsible for their own territory under the collective contract. Each of the collective zones are situated strictly within the larger protection perimeter and declare their surface contributions directly to the EC. The collective zones are then remunerated proportional to their contributed territory and redistribute the payment among individual farmers. Although in some cases individual AES may be implemented in parallel to cAES, individual contracts do not achieve the necessary degree of spatial coordination as is illustrated in figure 4.1.

As can be seen in figure 4.1, the EC is coordinating several zones in one region managing one collective contract. When self-governing groups grow large, nested structures are considered to facilitate the collaborative effort (Ostrom and Walker 1991, Westerink et al. 2017). Franks (2011) notices that creating one EC for each protection zone would be a cumbersome organizational enterprise that would most likely lead farmers to adhere to multiple ECs depending on which zones their farmland touches upon. This could easily imply several memberships for the same cAES, which clearly does not strike as the most efficient organization of collective efforts. On the other side, cooperatives too large in number in terms of adhering farmers introduce increasing heterogeneity of preferences which may imply complications for reaching agreements and for coordination among members (Franks 2011). However, having one cAES managed by a single EC can centralize organizational and informational efforts and keep bureaucratic procedures to a minimum. Centralized EC management can oversee and homogenize the recruiting of participants, contract management, monitoring and payment without interference of government (Westerink et al. 2017). Next to gaining leverage in negotiations with government authorities, a larger scope is also likely to increase fairness as the same rules and procedures are applied coherently to all members. Therefore, a trade-off between group size and efficiency seems to influence the success of cAES coordination through the EC.

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<sup>3</sup> GIEE: Groupement d’intérêt économique et environnemental

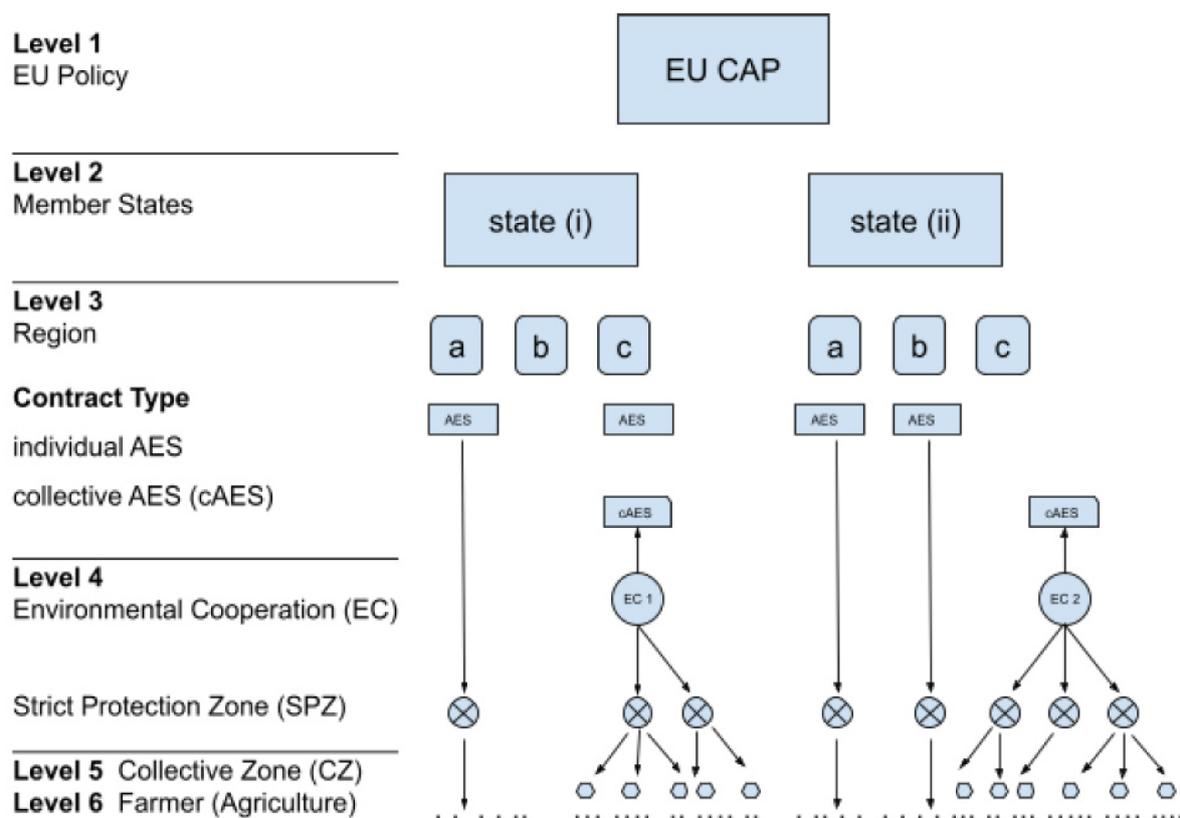


Figure 4.1 – Schematic representation of collective AES as organized, e.g. in France, under European Common Agricultural Policy. Source: Author’s compilation.

Increased transaction costs in managing the EC due to large group size may be worthwhile if this improves scheme effectiveness (Westerink et al. 2017). The mobilization of financial support for farmers’ collectives and cooperative dynamics has been emphasized for the CAP 2020 reform, recognizing experience sharing as an important social dimension in the construction of agroecological knowledge for the promotion of sustainable practices (Slimi et al. 2021). Peer-to-peer farmer networks are considered as creators of a knowledge base that is adapted to the local context (Blesh and Wolf 2014, Slimi et al. 2021). This collective learning process is thought to establish a connectedness to the “wider sustainable agriculture movement” by establishing shared values, aims and norms (Slimi et al. 2021). While learning from results is essential in the development of these collective schemes, innovation is constrained by administrative considerations (Westerink et al. 2017). In their case studies of European farmers associations, Westerink et al. (2017) found that the increased involvement of farmer groups in cAES did not diminish the role of government involvement which continued with its traditional tasks. Next to the collective aspect, the behavioral dimension to AES management is gaining importance in the policy arena (Dessart et al. 2019). In order to appeal to the socially informed dimension of decision making, Dessart et al. (2019) propose to include policy tools that are targeted at ‘proximal’ and ‘distal’ decision factors. According to the authors, agroecological interventions that address proximal decision factors may have a powerful effect on the adoption of specific

sustainable practices, especially for those farmers that are already considering a conversion. Inducing longer term and more generalisable behavioural change entails addressing more distal factors, such as farmers' environmental concern and their need for social recognition for the efforts toward the environment. While policy interventions tackling these distal factors may take more time and have more uncertain outcomes, they are likely to produce more durable behavioural change. Together, the behaviorally informed design of collective voluntary schemes and results based payments are thought to align financial incentives with the collective aim (Dessart et al. 2019).

### 4.3.3 Factors influencing the success of Environmental Cooperatives

The “power of collectives” is recognized as a key factor in support of transition dynamics to agri-environmental sustainability (Slimi et al. 2021). The peer-to-peer network of farmers associations has the potential to substantially alter the farmers' value system (ibid). Slimi et al. (2021) describe three processes relevant to the individuals' agroecological transition: (1) the shift in criteria for peer recognition, (2) relevant skills acquisition through social learning, (3) construction of meaning through an emotionally evaluated experience. While the first of these processes can be considered an external event to the individuals' experience, namely the emergence of a new injunctive social norm, the other two processes are deeply intrinsic to the individuals' experience. All of these processes address the distal decision environment of the individual farmer and on a societal scale can provoke a paradigm shift to a global agroecology. An overview from the literature of factors influencing the success of ECs in managing cAES has been summarized in table 4.2. In this review I have divided the relevant factors into five categories: Social Capital, Institutions, Participatory Contract Design, Information, and Group Characteristics.

*Governance & Institutions.* Learning through social comparison, adaptation to injunctive norms and imitation of peers require feedback processes, flexibility and monitoring of results from agri-environmental management practices (Westerink et al. 2017). Adaptive governance to AES is needed that takes into account the scope of such transaction costs and economic uncertainty as to their results (Hardy et al. 2020, Westerink et al. 2017, Boncinelli et al. 2016). Sufficient financial means and support structures are essential in accompanying farmer communities in the transition and application of agroecological practices. By targeting specific regions and by setting local environmental priorities, adaptive governance can increase the probability of a measure's success and the profitability for complying farmers (Boncinelli et al. 2016). External factors such as support from local institutions (Boncinelli et al. 2016), training opportunities (Häfner and Pierr 2020, Mills et al. 2011) as well as clear and measurable feedback on results achieved through the implemented measures (Häfner and Pierr 2020, Boulton et al. 2013, Mills et al. 2011) are all found to support the collective adoption of agroecological practices. Nevertheless, besides smart scheme design and governmental support, the presence of an EC constitutes

Table 4.2 – Factors influencing the success of Environmental Cooperatives

Category	Facilitating Factors	Literature	Factors that increase Transaction Costs	Literature
Social	Norms of trust and reciprocity	Amblard (2021), Riley et al. (2018), Sutherland et al. (2012), Franks (2011)	Risk of defection of neighbors	Häfner and Piorr (2020), Emery and Franks (2012), Sutherland et al. (2012), Saengsupavanich et al. (2012)
	Shared awareness of common problem or threat	Prager (2015), Mills et al. (2011)	Traditional structures, intergenerational aspect	Emery and Franks (2012), Dessart et al. (2019)
Capital	Reciprocal learning and cooperative spirit	Riley et al. (2018), Fulton and Harris (2000), Franks (2011)	Sceptical attitudes towards collective action (e.g. individualism, inertia, awareness, concerns about acceptability of the evidence)	Uetake (2012)
	Strong, local leadership	Amblard (2021), Mills et al. (2011)		
Governance & Institutions	Good communication	Häfner and Piorr (2020), Riley et al. (2018), Prager (2015), Franks (2011)		
	Support of local facilitator to assist in group development process	Mills et al. (2011)	Asymmetry of information	Bartolini et al. (2021), Prager (2015), Quillérou and Fraser (2010)
	Access to high quality advice and support	Amblard (2021), Prager (2015), Westerink et al. (2015), Boulton et al. (2013), Häfner and Piorr (2020), Boncinelli et al. (2016)	Scheme administration and bureaucracy or paperwork	Westerink et al. (2017), Emery and Franks (2012), Saengsupavanich et al. (2012)
	Provide group training and learning opportunities	Häfner and Piorr (2020), Mills et al. (2011)	Time spent in meetings	Emery and Franks (2012)
	Support group product marketing, if relevant	Mills et al. (2011)	Unequal distribution of benefits	Saengsupavanich et al. (2012)
Institutions	Offer financial support in 2 stages (planning and management)	Mills et al. (2011), Boulton et al. (2013)	Adverse selection	Bartolini et al. (2021), Burton and Schwarz (2013), Quillérou and Fraser (2010)
	Feedback on results achieved	Häfner and Piorr (2020), Boulton et al. (2013), Mills et al. (2011)		
	Conflict Resolution Mechanisms	Westerink et al. (2015)		

Table 4.2 (continued). Factors influencing the success of Environmental Cooperatives

Category	Facilitating Factors	Literature	Factors that increase Transaction Costs	Literature
Participatory	Adapt engagement strategies to local features and resources	Riley et al. (2018), Westerink et al. (2015), Boulton et al. (2013), Mills et al. (2011), Carmona-Torres et al. (2011)	'Hold-up', 'end-of-contract', 'assurance' problems	Prager (2015), Hardy et al. (2020)
	Allow farmers to submit own landscape-scale environmental plans	Prager (2015), Westerink et al. (2015)	Incomplete contracts	Prager (2015)
Contract	Allow groups to develop own solutions and implementation rules	Mills et al. (2011), Westerink et al. (2015), Boulton et al. (2013), Hardy et al. (2020)	Monitoring and sanctioning rules	Amblard (2021)
Design	Offer single payment to properly constituted group to distribute	Mills et al. (2011), Westerink et al. (2015)		
	Clearly defined boundaries and responsibilities	Westerink et al. (2015), Riley et al. (2018)		
Information	Financial incentive compatibility	Bartolini et al. (2021), Hardy et al. (2020), Burton and Schwarz (2013), Carmona-Torres et al. (2011), Quillérou and Fraser (2010), Dessart et al. (2019)		
	Perceived behavioral control	Josefsson et al. (2017)	Ineffective communication	Saengsupavanich et al. (2012)
Group	Knowledge of the ecological system	Amblard (2021)		
	Predictability of system dynamics	Amblard (2021)		
Characteristics	Awareness and availability of conservation options	Josefsson et al. (2017)		
	Monitoring of measurable indicators of ecological efforts made	Burton and Schwarz (2013)		
Group	Limit group size	Mills et al. (2011)	High number of relevant actors (large group size)	Amblard (2021)
	Nested Structures	Ostrom and Walker (1991), Westerink et al. (2015, 2017), Carmona-Torres et al. (2011)		
Characteristics	Self-correction	Saengsupavanich et al. (2012)	Size of protection area	Amblard (2021), Westerink et al. (2017)
	Members with common aims and objectives	Mills et al. (2011), Franks (2011)	Heterogeneity of actors	Amblard (2021), Riley et al. (2018), Emery and Franks (2012)
	Members known to each other	Mills et al. (2011)		

a relevant aspect in the implementation of cAES. In fact, it is already the mere presence of a facilitating body representative of farmers' interests that increases their intention to participate in collective AES (Van Dijk et al. 2015). Häfner and Piorr (2020) find that preferences for the facilitating role of the EC differ across farm types and farmers' characteristics. Accordingly, part-time farmers and those without formal agricultural training value support for cooperation. Full-time farmers with formal agricultural training tended to reject support for cooperation. Moreover, the institution that offers the support under cAES is deemed decisive in mobilizing farmers' approval for cooperation. While the EC operates bottom-up, imposed top-down support is likely to be perceived as intrusive and compulsory (Häfner and Piorr 2020). Across institutional settings however, the importance of strong local leadership for landscape scale inter-farm cooperation is unanimously advocated (e.g. Amblard 2021, Mills et al. 2011).

*Participatory Contract Design.* In a role-playing game with French farmers, Hardy et al. (2020) find that the less constraining agroecological practices are and the more freedom to choose among them, the more likely farmers are to contract as the risk of non-compliance and transaction costs is reduced. Moreover, the collective contract and presence of the EC imply a certain degree of risk sharing for participants, which was found to be considered as preferable to individual contracts. Indeed, the collective effort showed to be more profitable at the end of the game than an individual strategy. By stating that "they were increasingly driven to think in strict economic terms in real life", the participating farmers acknowledged that AES payments were mainly perceived as a risk insurance for their business. The farmers' motivation to participate in AES is primarily to secure income support, while the environmental benefits are perceived as second-order effects (Hardy et al. 2020, Häfner and Piorr 2020). The study concludes that payments from AES are generally not perceived as a compensation for ecological services but as a support for shortcomings in revenue from their agricultural production (Hardy et al. 2020). This may explain why inertia to adopt more challenging sustainable practices is so widespread. Other studies have confirmed the principally financial motivation to join AES (Daniel 2011b, Häfner and Piorr 2020, Dessart et al. 2019, Batáry et al. 2015). Incentive compatibility is thus an important factor in scheme design, not least because the public benefits to ecological services are privatized through subsidy payments.

*Social Capital.* In a discrete choice experiment on farmers' willingness to participate in a hypothetical AES targeted at climate friendly peatland management, Häfner and Piorr (2020) find that the number of neighbours did not have a highly significant effect on preferences for institutions supportive of cooperation. Rather, a negative attitude towards cAES is due to farmers' scepticism about others' willingness to cooperate (Villamayor-Tomas et al. 2019, Häfner and Piorr 2020). Instead of the anticipation of high transaction costs, trust seems to be the main issue for reluctance to contract under collective schemes. While external institutions do have the potential to facilitate coordination between farmers (e.g. by providing advice, resolving conflicts, building trust, raising awareness and providing a platform for dialogue) their role needs to be carefully delimited. Otherwise the risk is high that by unburdening farmers from communication and coordination efforts, most of the benefits related to social capital and group solidarity are

excluded (Häfner and Piorr 2020).

*Group Characteristics.* Group characteristics can moderate the transaction costs (TC) imposed by collective action: while ‘large’ group size and zone perimeters as well as strong heterogeneity of group members’ attitudes and objectives are on average considered to increase TC, norms of trust and reciprocity, strong leadership and sufficient decision autonomy vis-à-vis regulatory authorities combined with a sufficiently high level of education are all considered to decrease TC (Amblard 2021, Boncinelli et al. 2016). Moreover, a strong correlation is found between the level of education and the pro-environmental attitudes of farmers (Boncinelli et al. 2016).

*Information.* Rather, communication and feedback processes have to be actively managed and explicitly encouraged to create a basis for joint monitoring, learning, and scheme adjustments (Prager et al. 2012). As ecosystems and social systems are recognized to be continuously evolving, their management must involve flexible and adaptive procedures that are responsive to constant change (ibid). Therefore, integrative feedback loops need to produce comprehensive and understandable information about results achieved through the AES. Only then can the design and impacts of the AES reflect local needs in its administrative arrangements (ibid).

#### 4.3.4 Benefits achieved through Environmental Cooperatives in managing cAES

The EC is a facilitating institution that coordinates groups of farmers and moderates the dialogue with other stakeholders such as governmental authorities, environmental protection agencies, academics and the wider public. The role of the EC in cAES can be understood as that of a ‘bridging organisation’ that lowers the cost of collaboration and facilitates social learning (Prager 2015). The EC has the power to provide a “sense of a wider purpose, that the collective agreement is something bigger than just farming” (Mills et al. 2011, p.73) and to create a ‘feeling of belonging’ (Prager 2015). During the intensification of agriculture, farmers’ work was driven towards social isolation (Mills et al. 2011). Being based on the principle of cooperation, the bottom-up mobilization of the EC can be understood as a counterbalance to the individualistic farming style. Roles of shared cognition, group identity, fairness, transparency, and feedback emerge in the construction of social capital through the EC and serve in homogenizing norms and objectives for the collaborative effort. The resulting shift in attitudes, values and aspirations among members is said to reduce monitoring costs due to social conformity (Boncinelli et al. 2016, Prager 2015). The EC further has the potential to mobilize the sharing of resources, to coordinate flexibility in measure application, to support group learning and the development of adaptive technical skills, and, through the provision of a platform for communication and exchange of experiences, helps in building solidarity and adaptive capacity for farmers to cope with transformations (ibid). For instance, the EC can coordinate last-minute measures such as postponing mowing when a field is still densely populated with birds (Uetake 2012) and compensate the respective farmer accordingly. This mutual support lends business confidence

Table 4.3 – Benefits of Environmental Cooperatives in collective AES

<b>Benefit</b>	<b>Example</b>	<b>Literature</b>
Social Conformity	Group working helps to frame decisions in ways that shift attitudes, values and aspirations among members and thus reduce monitoring costs; aid the harmonisation of multiple objectives, produces shared cognition and group identity.	Prager (2015), Boncinelli et al. (2016), Kuhfuss et al. (2013), Häfner and Piorr (2020), Slimi et al. (2021)
Sharing and mobilising of re-sources	CUMA 'Grand hamster'	Prager (2015)
Flexible, locally relevant responses	Transparency and user feedback, participation in designing the AES	Prager (2015), Häfner and Piorr (2020)
Building capacity to cope with future change	Opened up new opportunities that would have been impossible to access by the farmers individually.	Prager (2015)
Creation of context specific knowledge	farmers “generated site-specific knowledge, and [recognize that] in the process of sharing this knowledge they forged connections to the wider sustainable agriculture movement and established an alternative knowledge system.” (Blesh and Wolf 2014, p.629)	Slimi et al. (2021), Blesh and Wolf (2014)
Sustainable management and social-ecological resilience of the wider landscape	"Emphasize the role of farmers' collectives and the paramount importance of experience sharing as a key factor for success during transition to sustainable agriculture" (Slimi et al. 2021, p.269)	Prager (2015), Häfner and Piorr (2020), Slimi et al. (2021)
Development of social capital within the groups	Increased willingness to provide advice and mutual support, resulting in increased social interaction and the 'feeling of belonging', development of social and technical skills	Prager (2015), Slimi et al. (2021)
Increased business confidence	Experiencing increased legitimacy and fairness	Prager (2015), Häfner and Piorr (2020)
Increase in farmers' intentions to participate in the schemes	Regional agglomeration effects in Italy. In China (collectivist culture) main driver of re-enrollment in AES is the information that the neighborhood is also intending to re-enroll.	Van Dijk et al. (2015), Boncinelli et al. (2016), Chen et al. (2009), Kuhfuss et al. (2013)
Transactional economies of scale	Information and knowledge sharing about AES and implications of participation within a group may reduce the costs of decision-making for individual farmers, role of education in reducing transaction costs associated with the measure's application.	Amblard (2021), Boncinelli et al. (2016), Franks (2011)
Risk sharing	“collective insurance” (Hardy et al. 2020, p.6)	Hardy et al. (2020)

and a sense of personal relevance to the farmers that become engaged in setting agroecological standards.

The centralized representation of a community of farmers is considered to lend legitimacy and negotiation leverage to the agroecological movement which is relevant for farmers' participation in design of cAES (Westerink et al. 2017, Häfner and Piorr 2020, Mills et al. 2011). Nevertheless, Mills et al. (2011) advocate that participatory approaches can only supplement, but not replace government implication in AES. They recommend an increase in trust between government and farmers accompanied by a cultural change in governance arrangements. The road towards autonomous AES management would nonetheless require external guidance in establishing a legal framework for credible commitment, monitoring and sanctioning structures, distribution of payments and conflict resolution.

Although the risk of being unsuccessful in meeting the collective target persists for the group of farmers, the potential AES payment is a strong motivation to work together, even for smaller farms that would otherwise not be eligible for individual contracts due to their missing territorial influence (Hardy et al. 2020). Therefore, while there are also factors that can mitigate the efficiency of the EC (table 4.2), the collective insurance lends a considerable advantage to collective schemes (Hardy et al. 2020). The benefits provided by ECs in overseeing collective contracts are summarized in table 4.3.

#### 4.3.5 Other types of collective agri-environmental management initiatives

Machinery co-ops (in French CUMA<sup>4</sup>) are sharing arrangements between farmers of one community that facilitate the purchase of equipment and coordinate the sharing of agricultural resources. These structures of inter-farm cooperation are said to be vital in the agroecological transition (Slimi et al. 2021, Lucas 2021). Far from being exclusively related to sharing equipment, CUMAs organize collective activities for their members, including agronomic training programs for members, seed exchange, rotation of employees across farms, inter farm grazing arrangements, comparison of best practices and mutual support (Lucas 2021). Lucas et al. (2019) find that, through the collaborative effort, farmers contribute to the creation of an "agroecology of knowledge". By pooling resources and sharing equipment, farmers are urged to adapt their work patterns in tandem with those of their collaborators while intensifying communication with each other, processes that imply technical dialogues and social learning. Other benefits that farmers derive from their membership in a CUMA are said to be a larger scope for diversification of farm business, risk sharing among member farms, and increased courage in adopting agri-environmental practices (Lucas et al. 2019, Lucas 2021). In the process of adopting agri-environmental practices, farmers could initially rely on their CUMA to access the equipment needed for the realization of more sustainable farming. Beyond that, they managed to infor-

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<sup>4</sup> CUMA: coopératives d'utilisation de matériel agricole

mally arrange discussion groups to exchange help and information and even organized expert consultations for the group (Lucas 2021). In spite of these advantages, Lucas (2021) realizes that

*the concrete realities faced by these farmers, their successes as well as their difficulties, fail to find a place within current discussions of the agroecological transition. This in turn deprives policymakers, civil servants, research institutions, and agricultural education programs of key information needed to improve the ways in which agriculture is supported, regulated, and reproduced. (p.17)*

Tackling this “widespread institutional invisibility” through recognition of farmers’ experiences with the application of agri-environmental measures would be a key component to resolving the challenges faced (ibid, p.17). Similarly, Fulton and Harris (2000) identify institutional arrangements such as external (governmental) support and clearly defined organizational structures with limited personal liability as key success factors for CUMAs in Québec. They delineate seven attributes that they see as essential for the realization of economic gains and the community’s development: commitment to helping one another, functional communication, frequent social interaction, partnership, cooperative spirit, training and discipline. Therefore, by actively facilitating the installation of these structural components, government supported farmer collaborations should have the potential to lend the social and institutional capacity to farmers that is required for the adoption of agri-environmental measures.

## 4.4 Case Study : France discovers the EC

The first French EC was created under local associative law in 2013 in response to the start of a collective AES in favour of habitat protection for the locally endemic European hamster. In determining how successful coordination under the collective contract has shown, the central, coordinating role of the EC is discussed with respect to this example from the French region of Alsace. The next paragraphs describe how the French EC makes use of the facilitating factors from table 4.2.

*Governance & Institutions.* As was described in figure 4.1, the EC is managing one collective contract for this region by coordinating several strict protection zones (SPZ) that comprise multiple collective zones (CZ). The evolution of members of the EC since the start of the cAES can be traced in table 4.4. It can be seen that, while the total number of EC members is increasing across years, the ratio to non-member farms of the region seems to decline. This is due to the widening of the protection perimeter throughout the early years 2013-2015. New zones had been included and thus more farms were eligible to contract. The president of the EC is a local farmer which has been elected by the farmers contracting under the cAES. The president of the EC works in close contact with a representative from the chamber of agriculture. While the EC president often manages communication during evening hours next

to his full time farm job, the representative from the chamber of agriculture commits up to 50% of his full time position to the coordination of the collective contract.

Table 4.4 – Members of the Environmental Cooperative by year

Year	2013	2014	2015	2016	2017	2018
Association Member	44	118	138	143	136	127
Total Farms	73	212	244	249	252	249
Ratio Group Size	0,60	0,56	0,57	0,57	0,54	0,51

Several focus committees, organized by the chamber of agriculture and the EC, take place in autumn to determine needs and engagements for the following year's cAES contributions of each zone. This means that farmers declare their favorable surface to the chamber of agriculture already up to 5 months prior to actual crop sowing in spring. The meeting in autumn does not end before farmers of the respective CZ have declared sufficient surfaces in order to reach at least the contribution threshold.

In governing the application of the cAES, the EC works with a number of relevant institutions. Next to the chamber of agriculture, those comprise the National Biodiversity Office, the Departmental Directorate of Territories, the Regional Directorate for the Environment, Planning and Housing and the French National Centre for Scientific Research, all of which are described in Box 1. Before a new contract for the cAES is set up, all stakeholders meet and discuss the measure specifications in detail.

*Participatory Contract Design.* Remuneration is handled directly by the EC. The EC distributes subsidy payments to its members in proportion of individual surface contributions. Farmers place more confidence in the distribution of payments through the EC and find reassurance in their group when payments are (substantially) delayed by the government. Some farmers noticed that the subsidy payments did not cover the loss in income due to plummeting market prices for cereals, while others stated to almost exactly cover their expenses through the scheme. However, additional working hours for scheme compliance were almost never counted.

The EC practices self-monitoring among its members. Groups of farmers in a CZ easily oversee and notice the application of measures (or lack thereof). Usually farmers stick to the surfaces that were agreed upon in the focus meeting. However, there have been rare cases where individual farmers did not continue with the cAES, in spite of their 5-year engagement. This was either due to severe illness, farm succession or unresolvable interpersonal conflict. Noteworthy is the existence of a competition between groups of farmers in the different CZs. Each CZ tries to outrun the others in contracting the most land and in achieving the highest number of burrows.

**Box 1. A mix of institutional types involved in the cAES design and implementation.**

The **Chamber of Agriculture** (CA: *Chambre d'Agriculture*) was created in 1924 for the development of agriculture and its territories. The CA is the principal intermediary between government authorities and the agricultural, rural and forestry sphere. Across the French territory, CAs provide a network of 111 local, regional and national public establishments. The principal representative from the local CA is dedicated to animating coordination meetings and to accompanying farmers, through training and support, in complying with the administrative requirements of the AES. The CA also is in the position to communicate farmers' concerns with the scheme to regulating authorities.

The **National Biodiversity Office** (OFB: *Office Français de la Biodiversité*) is a public institution dedicated to conserving biodiversity. The OFB is attached to the Ministry of Ecological and Inclusive Transition and the Ministry of Agriculture and Food and was created on January 1, 2020 under the law No. 2019-773 of July 24, 2019. One of its priorities is to respond to the challenges of preserving wildlife. The OFB is responsible for counting the species' population each spring in order to provide concrete feedback on the measures results to all stakeholders.

The **Departmental Directorate of Territories** (DDT: *Direction Départementale des Territoires*) incorporates 250 agents under the authority of the departmental prefect. Created in 2009, n ° 3 of decree n ° 2009-1484 of December 3, 2009 its role relates to departmental interministerial directions. Therefore, the DDT is responsible for operationalizing at the departmental level the policies carried by the respective ministries responsible for agriculture, forestry, land use planning, the environment, town planning, prevention of risks, habitat, housing, transport, safety and road traffic. It also actively participates in crisis management mechanisms, both prefectural and ministerial. The DDT oversees the spatial arrangement of the collective scheme and defines protection perimeters within which farmers can form CZs.

The **Regional Directorate for the Environment, Planning and Housing** (DREAL: *Direction Régionale de l'Environnement de l'Aménagement et du Logement*) implements, under the authority of the regional prefect and the departmental prefects, the public policies of the Ministry of Ecological Transition. Its missions are focused on the Energy Transition for green growth, reinforcement of multi-modality, fluidity and safety of travel, the construction of a regional housing policy adapted to the needs of the inhabitants and the territory, prevention of risks with a strong human and economic impact, preservation of natural resources and biodiversity, support for ecological transition and environmental assessment, and the promotion of sustainable development. The DREAL oversees the formal contract management and payment of EU CAP subsidies.

The **French National Centre for Scientific Research** (CNRS: *Centre National de la Recherche Scientifique*) is an interdisciplinary public research organisation under the administrative supervision of the French Ministry of Higher Education and Research. The CNRS conducts scientific research with the aim of advancing knowledge for the benefit of society. Researchers from the CNRS have informed the design of agri-environmental measures through insights on the species' nutrition, foraging and habitat needs.

The EC coordinates context specific solutions. Many of the farmers had already contracted under the individual AES for species protection but have come to find the collective contract more advantageous despite the increased coordination effort. The farmers explained that the collective measures' constraints are evolving with recent experiences and that the collective contract allows them to be more flexible within their CZ while efforts are generally more structured. For instance, when rotating cultures across plots, some favorable crops such as wheat can only be cultivated every three years on the same plot. The collective measure allows them to alternate between different plots, which would not have been possible with an individual AES that is strictly bound to specific plots.

*Social Capital & Group Characteristics.* Around 16 to 18 farms across CZs have joined a CUMA to facilitate the purchase of equipment needed for the implementation of this cAES. The CUMA allowed farmers to avoid pesticide use and to apply innovative farming practices in favor of the environment. Some farmers reported having found more social interaction and community inclusion through the collective scheme. Next to solidarity among each other, farmers reported that they had found a collective spirit for the environment together with a stronger voice towards authorities. The farmers further stated that the social dimension made them want to represent a good example to other farmers and helped them to develop best practices with regards to the measure's application as they could learn from each others' successes and frustrations. In some zones leadership was very pronounced, with a core of around three motivated farmers that had started out under the cAES and later on convinced their neighbours to join as well. Moreover, the local EC president is very engaged in communication with the CA and bridges a lot of communication between farmers.

*Information.* Through meetings and in collaboration with the biologists from the CNRS and ecologists from the OFB, farmers have learned about the needs and habits of the species. They gained a better understanding of their impact and the related ecosystem through training and dialogue with the involved environmental and scientific organizations. While the hamster used to be perceived as a farmland pest up until the 1960s, it is now understood to be a bioindicator for soil and ecosystem quality, ensuring oxygenated and fertile loess soils and facilitating the presence of numerous useful invertebrates.

## 4.5 Discussion: What organizational form corresponds best?

Interview evidence is presented to support the discussion on the role of environmental cooperatives. First hand statements are available from the interviews with a French EC president and four local farmers. This evidence is complemented by the translation and reproduction of interview data with French farmers as presented in Méchin (2013) as well as on AES pro-

gram websites. *Governance & Institutions*. The EC took over the management of the collective contract in order to gain in autonomy and locus of control for its members:

*It's a 'loi 1901' association<sup>5</sup>, so it's a basic association to begin with, like any other French association. And so we created this association because at one point there was a question why the CA would not animate the measure 100%. And finally, since the CA already manages a lot of measures, what was important for us was that the money that is paid by the state is paid in full to the farmers. And so that's why we really wanted to separate even if the CA with [the representative of the CA] in particular is following the measure. Therefore, [to improve] clarity at the farmer level I think it was the right solution. - local EC president.*

The meetings held at the occasion of focus committees are a formal means of declaring officially to the community of contractualized farmers what changes are made for the next year under the cAES. Well beyond those formal focus committees, farmers are also exchanging informally over implementation and concerns with the cAES within their communities.

*Already between them sometimes they discuss among [farmers]. So they say: 'here I want to put corn, beets there.' Thus, already beforehand they discuss among themselves. And then, there is the key moment at the end of August, the beginning of September, we have the meeting of crop rotation in each community where in the end each farmer states where he wants to put wheat and alfalfa for the hamster. And from there we already have a photograph of what is going to be the following year and if [surface] is missing or if it is a bit poorly distributed we discuss at this meeting and in general this is going pretty well. - local EC president.*

This informal exchange of communication further strengthens the sense of collectivism and helps farmers to gather and present concerns and needs to the respective authorities, such as the president of the EC and the delegate of the chamber of agriculture. The EC has provided farmers with a platform fostered by understanding of the agricultural profession and eye-to-eye communication where controversy is possible.

*Now people know it is necessary to leave wheat for the hamster where there are the burrows. So that's already an advantage and then there are mainly discussions with the [OFB] which will also say: 'there it would be important to put wheat on the ground, in this place and here'. And so the discussion is ultimately with the EC, the farmers of the territory and the [OFB]. Nowadays [the facilitation] takes a bit of a rotation so it's going relatively well. - local EC president.*

The collective contract also requires additional time to be invested in the management of the measures' application. Especially, the president of the EC has a quantifiable management role at the interface of farmers, governmental authorities and biodiversity associations. While

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<sup>5</sup> Loi 1901 association: The law of July 1, 1901 sets the legal framework for an association defined by an agreement under which at least two people decide to share their knowledge and / or their activity for a purpose other than profit sharing or profit seeking. This text provides that the association is, in principle, non-profit. Thus, it differs from a traditional company and is relatively uncomplicated to be declared.

the interviewee could not make a precise estimation of the hours devoted to the management of the EC, the time commitment seems to be a considerable part of his activities. Although the workload associated with the management of the EC may vary across periods over the year, the president seems to have integrated this role as a regular evening occupation.

*I intervene when sometimes there are concerns in the communities and normally afterwards in autumn also when there are consultation meetings between the farmers for the rotation. So here we are, there are four or five boards of directors that I chair, plus the general assembly too. Then there are a lot of phone calls too and emails and all that I never counted exactly, but actually it takes a few hours a week, yes. I do this in the evening often. - local EC president.*

Nevertheless, several challenges have been encountered in the management of the collective contract.

First, inter-annual variation in the CZs' perimeter may cause discontinuity. Areas declared for the cAES can vary slightly between years if some farmers do not correctly declare their areas in the respective CZ. The scope of the plots entered is decided in September but does not take effect until next spring so that some slight variations are not always reflected in the data already communicated to the ministry. While the measure set out to circumvent variations in perimeter by engaging the participating farmers over a 5-year period, not all disruptive events can be prevented. For example, in 2015, a farmer stopped participating in the collective scheme and has since refused to declare his areas and to cultivate any favorable surface<sup>6</sup>. Such disruptions inhibit the continuity of the measure on the same area of farmland which most likely comes at the expense of ecosystem improvement.

Second, the changes made to the measures' specifications are not always justified to the farmers who have to work with the constraints. This can cause frustration and reluctance to renew the contract:

*After the first 5 years the system has been reviewed and changed. So that's a little more complicated. For example, for alfalfa we received a significant amount, it was almost 1000€. Today it is less than 700 € and on top of that you can only cut half etc., with lots of additional constraints. But we haven't necessarily always received very clear explanations and when the rules of the game change all the time it's tiring. After the first 5 years we almost didn't contract again, it was too complicated. Then, we ended up agreeing. But I mean it took a lot of negotiation, a lot of talking. - farmer 4*

Third, navigating between the interests of different stakeholder groups can be challenging.

*It's very complicated because there is always politics. [...] Either way, it's all compromise, it's politics. - farmer 4*

Fourth, although the participation in the cAES is voluntary, free riding still exists to some degree under the collective approach.

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<sup>6</sup> Source: interview with a representative of the chamber of agriculture, conducted on 19/12/2019

*Then there are those little tricksters, some colleagues, who put explicitly less crop cover because they know that others are putting enough of it. - farmer 3*

Fifth, practicalities and logistical problems can arise that may not be transparent to outside authorities. For example, it may happen that a previously included farm identification is not included in the subsidy request for a subsequent year if the farmer has not declared areas that year, there is a change of the farm's registry, or there is a change of ownership. Also, if there are non-EC members who maintain small plots of favourable surface, they often are included in the count of the total surface per CZ, however not remunerated.

The above challenges require a significant amount of coordination as well as sensible insight and problem solving capacities in direct contact with the farmers. In tackling these challenges, the EC is a central and moderating institution. The president confirms that the role of the EC is above all a facilitating one, mediating between the different stakeholder groups and helping the farmers cooperate under the collective contract.

*It is above all that, depending on the territories, depending on the farmers, there may be small concerns and therefore at some point we must all be coordinated to solve the problems and then to move forward from there. In particular, the [OFB], formerly ONCFS, is also very active in the field with farmers regarding the counting of hamsters. So here they are, they also have feedback and so here we are, we all work together. - local EC president.*

*Getting 20 farmers around a table and defining a common crop rotation is something that's great. Everyone has their way of working and we can only benefit, not necessarily from the successes but from the failures. Rather than repeating things that don't work without having talked to each other, there we were all around a table and when we proposed a way of working, the other would say: 'Don't do that, that's not worth it. I tried, it did not work.' This really created a synergy between the farmers, that was good. - farmer 1*

*Participatory Contract Design.* The joint meetings among EC members, chamber of agriculture and the national hunting and wildlife association allow for discussions that highlight all aspects of the agri-environmental situation at stake and thereby make deliberate incremental shifts in decision-making at all possible. Context specific solutions:

*The program allows me to do cultivation trials with technical and financial support, which limits the risks for my operation. The problem of vegetables is more complicated than cereals. For potatoes, you still have to work the soil. With the [CA] and the [OFB], we discuss, we try to find leads. They must understand our constraints, the experiments take time and the climate has not helped us for a few years. It is not because a test works once that it is the solution and vice versa. We work for the next generation. We cannot leave them with soil that has run out of resources." - farmer of CZ11<sup>7</sup>*

<sup>7</sup> Source: Life ALISTER, translated and retrieved on 05/04/2020 from: <http://www.grand-hamster-alsace.eu/les-portraits-life-alister/>

While individual contracts were perceived as being constraining and imposed with pressure, cAES allow farmers to cooperate in finding a solution. In an approach of "participatory democracy" farmers are encouraged to agree among themselves on the environmental management effort each farmer can contribute (Méchin 2013).

*[Individual efforts] were not enough, it just prevented the hamster from dying. Now, [under cAES] the protection perimeter is quite larger. Before there was just a field there and one there, they were not connected. - farmer 2*

*We followed meetings with the [CA], there was slight pressure. Needed anyway to do something... so we tried collectively to find a solution [...] - anonymous Alsatian farmer (translated and reproduced from Méchin (2013), p.34).*

In those cases the EC can help homogenize efforts to integrate all members in a dynamic community exposed to structural changes. The gain in participation and inclusive decision making through cAES is particularly important to the farmers.

*[...] this is very important, to the whole hamster project we were ready to commit on one condition: that nothing was imposed on us. In a society it is often imposed and then not discussed. And we are ready to act but we have to discuss. There are things we can do and there are things we cannot do. This is really the typical discussion. The CNRS did a study, we discussed this study and then we looked at how we could best use this study and apply it in the field. - local EC president.*

*If you have a problem, there are several of us, so it makes more sense than when you are alone. The more we are, the more likely we are to succeed. It's like a union, we have more leverage. - farmer 2*

Financial incentive compatibility clearly is key in getting farmers on board for the cAES:

*I think that if today you proposed to the farmers to help the hamster to multiply in the fields with a little more compensation yet, it would work very well. - farmer 4*

Although only some farmers' motivation for participating under the collective contract is exclusively financial, even among the organic farmers it becomes clear that the cAES payments are an important compensation for transaction costs. While some farmers wish for higher payments per hectare, all of them, even the most pro-environmental farmers, agree that if there were no payments at all, the efforts would not be sustained.

*For organic farming [the cAES payment] is not interesting, in organic farming it is better to harvest and market with the additional valuation. Given what we get is the compensation calculated on the price of the conventional product, there is no differentiation between organic or non-organic wheat, the compensation is the same. [...] If you take it off tomorrow, there won't be any more. That's clear. It gives us a bit of pride and societal recognition. [...] We're not charities either. Society's demand for the environment is enormous. - farmer 1*

*No, [the cAES payment] helps but you are more comfortable if you are just producing corn. If it was only for the money, I wouldn't do it, I would generate losses. - farmer 2*

*Then, there is also the financial aspect, all our expenses are taken care of. We are paid for that, we are not losing. Here, people are quite willing to participate. - farmer 3*

*When cereal prices are low and there is financial compensation [for our harvest], [cAES] works for everyone very quickly. We do not have a choice. Anyway we have no other reason, because [cAES] involves additional complications. Here we were practically in the process of giving up wheat for good, but as there was compensation for the hamster, we put in some wheat and we realized that it was not necessarily a bad thing for the soil. For the land, it is rather a good thing to put more straw cereal crops. - farmer 4*

Even though some farmers set out with purely economic motives, they soon come to recognize the ecological and social benefits provided through the cAEs, as the last statement reveals. Overall, the farmers seem to place more confidence in the collectively managed measure, accounting for social conformity and self-monitoring. This newly found collective goal seems to reassure farmers among themselves that they are doing the right thing:

*Maybe it makes more sense what has been done now. It's easier to control too, it avoids anarchy a bit because as it's collective and it's controlled, it's precise. - farmer 4*

*Social Capital & Group Characteristics.* Although farmers are aware that some of their group members may not hold up their contributions to the collective contract, they are confident that together they can find a solution:

*So collectively, if there is one who cannot put wheat at all, well it is taken care of by the others. So in fact, being on your own you can't do it. Then, in the collective contract, if one farmer does not put wheat he does not touch anything. But that does not matter, the collective, the others, they are in for it. - farmer 1*

Those with the largest territory in the CZ seem to perceive themselves as local group leaders. However, the leadership role is not understood in the same way. While some farmers see their role purely as mobilizing enough contributions to reap the subsidy payments, others seem to want to spread best practices in the interest of environmental improvements.

*In the [CZ] there are a few small farms but the three most important farmers [in the CZ] succeeded in convincing the others who are in the communes around. Anyway we are 3-4 important leaders and the others follow the lead. - farmer 4*

*[...] later on I [contributed] a little too, because I also wanted to set an example and then we made more and more efforts. - farmer 1*

The differences in leadership roles seems to be strongly connected to whether farmers act on intrinsic or extrinsic motivations. Farmer 1 recognizes the social benefit of bringing even the most isolated farmers into a collective project and reestablishing a sense of community.

*There is the social aspect of course since there are some who are single, elderly, isolated, who live in their corner... each of us has a different cultural itinerary and [the cAES] allowed us to find again a common model for which we worked together.*  
- farmer 1

Farmer 4, on the contrary, is very pragmatic in using the collective aim for the redistribution of financial benefits and the co-financing of required purchases for the measure.

*It seems logical that there is indeed a burrow bonus, but we decide to split it between us and we actually pay for the seed purchase of the green manure that we put in after the harvest. We buy this together.* - farmer 4

These different intentions among the groups' leaders are likely to translate into different atmospheres within the community. The ecologically (intrinsically) motivated leader may install an atmosphere of trust in doing the right thing and solidarity among group members, fostering all the benefits to social capital such as mutual learning and support. The financially (extrinsically) focused leader may create an atmosphere of economic efficiency but that is void of most benefits to social capital as only little or no informal bonds between farmers are created.

*Information.* Feedback on the environmental outcomes that are achieved through the farmers' efforts is highly appreciated and vital in keeping farmers' intrinsic motivation up. Similarly to the farmers in Hardy et al. (2020)'s role playing game, the groups of neighboring CZ's are in competition with each other when it comes to environmental outcomes achieved.

*There is a bit of competition between different [CZ], we are very interested to know if what we have done is working or not. We would like to have a few more burrows than the neighboring [CZ]. It is also to know from what percentage [of favorable crops] on [the number of burrows] increases ...* - farmer 1

This inter-group competition could be used in smart contract design. By providing inter group comparisons of environmental outcomes achieved in the previous year (such as hamster burrows per CZ), the cAES could spur the involvement of participating farmers by proposing an internal contest between members of the EC. Such an informal contest could raise pride and awareness among the communities while increasing the benefits to the local ecosystem. As long as the inter-group competition stays positive and does not result in groups undermining or distorting each others' efforts, the social comparison could elicit increased intrinsic motivation for the environmental effort.

Yet, there seems to be scope for more information on the practices defined by the measure. It may be that some theoretical solutions or findings from the laboratory do not translate exactly onto the field. Farmers can find it impudent to comply with imposed methods from organizations outside of the agricultural profession, especially if they feel that understanding for their professional techniques is lacking:

*Today we have the impression that we are being told [what to do] from so-called scientists or experts, and we realize that it does not work. So if we combined good agricultural sense and if we listened to farmers a little more, I think it could be more effective.* - farmer 4

Here, it would be helpful to include farmers' perspectives on proposed practices beforehand or to incorporate pilot trials that can then be approved if useful.

Three points of importance to cAES functioning stand out from these quotes that benefit from the moderating role of an EC. First, contracts have to be specified in accordance with practical requirements of the farming profession in order to be considered for adoption. This finding is coherent with those of [Franks et al. \(2011\)](#) who state that among cAES participants “those options that were seen to take the least amount of land out of production, or that required the least amount of change were supported the most”. Second, as stated in the president’s quote above, contracts have to be flexible enough to be adapted along the route according to conditions arising with time or that have been neglected at the initial outset of the contract period. Third, training and continuous, respectful communication between farmers and contract managing authorities has to be assured. The need for a platform for communication is demonstrated nicely by a farmer stating that “at the [EC] meeting, with the head of the ONCFS, it takes an hour [to explain his point of view], and behind it we discuss everything that is going on.” ([Méchin 2013](#), p.35). Together, these points underline the importance of an accompanying facilitator for the cAES. In the form of a farmer association in close cooperation with other stakeholders, the current EC versions propose a promising tool for collective management of environmental challenges under AES.

## 4.6 Conclusion

The collective action dilemma inherent to environmental quality problems implies that agri-environmental contracts are best to be managed collectively ([Emery and Franks 2012](#)). Such collective contracts need to be coordinated, a complex process that has shown to be chaperoned in some countries through an associative structure. Such cooperation allows for the coordination of activities to be centralized and to be made more coherent. Therefore, the role of the EC seems to be above all a facilitating one, mediating between the different interest groups and helping the farmers cooperate under the collective contract. Through its centralizing position, the EC as a local farmer association for environmental management may exert group pressure on farmers in their community, therefore altering perception, attitudes and prevailing norms with an increasing number of members. Moreover, an association also provides a platform to farmers where to express needs for governmental support as well as a platform where to learn about, understand, train and monitor farming practices. In the most influential scenario the EC as a formal club creates a self-reinforcing norm that may influence the farmer community well beyond the initial EC members. In this capacity, the presence of ECs facilitates vertical communication, therefore reducing information asymmetries and improving the transparency of the collective AES contract implementation and requirements. Beyond that, ECs reduce overall transaction costs not only by reducing individuals’ uncertainty and by facilitating coordination but also by reducing time allocated to convince, inform and monitor individual efforts through

group pressure and injunctive norm transmission. Centralizing coordination efforts can increase efficiency for applying cAES's measures in practice. Therefore, ECs have the social power to modulate attitudes, values and aspirations of their members. This can reduce the principal-agent dilemma of asymmetric information on the real effort (to be) employed to achieve the ecological outcome (Dupraz et al. 2009, Franks 2011). By increasing coherence among farmers' attitudes, by decreasing uncertainty about others' efforts and by synchronizing spatial coordination, ECs can constitute a transparent, cost-efficient, reliable and indispensable instrument to implement collective agri-environmental contracts.

The central modulating capacity of ECs essentially represents a holistic approach addressing a multitude of behavioural factors while making farmers the key actors in the management of the agri-environmental sphere. In the context of the cAES setting, the role of ECs therefore is to facilitate participation of farmers in the design of the collective AES contract, its requirements and implementation. A democratic and participatory organizational form is thus strongly recommended for the EC as an institution in the management of collective contracts.



# Chapter 5

## On the Potential of Nudges in Agri-Environmental Policy

### Abstract

A review of recent studies on green nudges for the agricultural sector as well as its ethical implications discusses the potential for green nudges in agri-environmental schemes. I propose a framework for matching behavioral situations with the corresponding nudge and develop a workshop methodology that is then applied to practitioners in France. Based on the identification of six key hurdles for eliciting behavioral change in the agricultural sector, I determine two critical features that an agri-environmental nudge should respond to. While nudges can enhance the effectiveness and outreach of traditional measures such as AES, rigorous pilot testing before the intervention is advised.

**JEL Classification:** D63, D91, Q15

**Keywords:** Green Nudges, Collective Action, Agriecology.

## 5.1 Introduction

A lack of acceptance among farmers for ‘hard’ regulation and the lack of motivation for participation in agri-environmental schemes (AES) has been demonstrated in the agricultural economics literature (Thomas et al. 2018). Barnes et al. (2013) indicate that traditional regulatory enforcement is problematic as it creates a vicious cycle where an increase in financial threats affects agroecological behaviours negatively. In their analysis of non-compliant farmer types, they find that restricting choice and enforcing regulation is often met by clusters of resistance. Thus, in spite of the competitive and already high budget for AES, financial incentives have not always shown successful in motivating farmers towards sensible agroecological practices (Thomas et al. 2018). Hence, there is a building interest to improve agri-environmental schemes (AES), to identify good practices and to develop policy tools that assist different levels of government and farmer communities in implementing fair and sustainable agri-environmental policies (Barnes et al. 2013). From an economic but also from a sustainability perspective it would thus be of interest to discover alternative mechanisms for incentivizing the use of agricultural land towards more responsible patterns. Sapci and Considine (2014) find that environmental problems could be managed by the promotion of behavioral changes. Indeed, individuals can contribute to environmental sustainability by adopting pro-environmental behaviors. In the sector of household consumption, for example, previous policy initiatives show a trend towards more behaviorally oriented interventions. Among those, are feedback on resource use and social comparison with neighbors’ water or energy consumption (e.g. Ferraro et al. 2011, Allcott and Kessler 2019). Although large-scale information disclosure campaigns have shown to be the most popular household intervention so far, depending on how information is conveyed, the effect of information campaigns on choices may differ drastically (Allcott and Kessler 2019, Chabe-Ferret et al. 2019). Simply providing people with information alone is not enough to change their ingrained behaviors (Kurz et al. 2005). Rather, a better understanding of how to target a specific behavior with the right type of intervention is important for promoting environmentally sustainable practices.

*Green nudges* are targeted at improving the environmental aspect of economic decision making. In their review on green nudging, Croson and Treich (2014) position the nudge as an instrument that alters the framing of the decision context but does not change the set of choices. Accordingly, a nudge is any aspect in the framing of a decision problem that can affect people’s decisions without changing economic incentives. Whether they can align the competing agri-environmental and agri-economic interests and redefine environmental considerations as a legitimate objective in economic decision making needs to be examined. While the intention of green nudges inevitably is to transform the average economic agent into a better environmental citizen, a plausible motivation for a nudge-based policy approach is their cost-effective suitability, especially for segments of the population that are particularly responsive to such treatments (Costa and Kahn 2011). Furthermore, Thaler and Sunstein (2009) argue that nudges have performed well empirically in randomized field experiments and have listed a number of advantages to nudging, such as preserving individuality through freedom of choice (and despite possible

conflicts of interest), yielding a large scale population outreach while respecting diversity and protecting the individual decision making from lobbied political interests (see also [Sunstein 2014](#)).

Although certain green nudges have shown positive effects for reducing household consumption, to date it is not clear whether these behavioral effects translate directly to the context of agricultural production ([Palm-Forster et al. 2019](#)). While in the context of household consumption the predominant concern refers to restraining the use of common pool resources, this environmental goal is aligned with economic incentives of reduced household spending. The agricultural context, however, imposes two very different characteristics: (i) environmental efforts often imply the production of impure public goods that (ii) may oppose long-term production objectives in competitive economic markets ([Palm-Forster et al. 2019](#)). Due to the non-excludability characteristics of public goods, those providing them can neither capitalize nor fully control them. Most agricultural practices that are respective of the environment constitute costly efforts to farmers who in turn risk losing income due to reduced agricultural output. For instance, reducing pesticide use may imply significant transaction and investment costs for installing alternative production strategies that on top are then followed by a reduced harvest. Given that this business objective to farming is not equally present in the context of household consumption, nudging interventions on their own may not reproduce identical pro-environmental effects. From an economic policy perspective, the question thus arises what can be done in order to align public, environmental and competing economic interests with the actual farming practices.

Particularly with regard to agri-environmental schemes, the question of whether nudging can be an effective policy instrument for the agricultural sector is still in debate. [Schlag \(2010\)](#), for example, argues that choice architecture may not be the right instrument with climate change as future generations are not invited to make any choices at all. Nevertheless, it is in the responsibility of current generations to preserve adequate living conditions. With a reminder that the goal is not to constrain society's freedom of choice, but to make people as well off as possible overall ([Allcott and Kessler 2019](#)), alternative mechanisms to traditional tax and subsidy schemes are sought for. Given the wide range of options for environmental promotion, it is important to identify when to apply green nudges, how and to whom ([BIT 2014](#)).

In fact, there is an urgency to investigate this trend in policy making. As policy makers design policies that may be little effective, they are wasting public and economic resources that could serve better in sufficiently refined measures. The literature on behavioral environmental economics has identified the potential for *green nudging* in the design of agricultural policy (e.g. [Ouvrard et al. 2020](#), [Peth and Mußhoff 2020](#), [Buchholz et al. 2018](#), [Thomas et al. 2018](#), [Kuhfuss et al. 2016c](#), [Czap et al. 2015](#)) but has neglected so far under what circumstances these nudges become effective. Among the previous studies are field pilots ([Chabe-Ferret et al. 2019](#)) or surveys relying on stated preferences ([Kuhfuss et al. 2016c](#), [Ouvrard et al. 2020](#)) to assess farmers' willingness to adopt agroecological practices when exposed to green nudges. However, there is still considerable uncertainty as to which types of green nudges are sensible

and effective for agri-environmental policy (Thomas et al. 2018). Specifically, it is important to clarify what the potential and limitations of green nudges are and how they contribute to social welfare maximization for both the agricultural sector and society at large. Therefore, this study proposes a participatory methodology to identify effective green nudges for the increase of widespread environmental consideration in the agricultural sector.

The present study applies a participatory workshop design to a stakeholder discourse with the goal of identifying and designing green nudges that are most suitable to accompany the agroecological transition. Investigating the underlying cause to environmentally inefficient behavior based on the specific case of nitrogen pollution allows for defining a behavioral intervention that is targeted at a particular agricultural situation. For this purpose, a practitioners' workshop on green nudges for agri-environmental policy has been held. Practitioners identified six key themes that constitute hurdles to behavioral change in agriculture. Those include personal impact, unawareness of responsibility, fear of change, fear of losing social status, concerns on guarantees for success, facilitation, and profitability. Therefore, a nudge for agri-environmental purposes needs to address two key features: making efforts and achievements visible to the community of farmers and providing local leadership.

The paper is organized as follows: Section 2 outlines the potential for green nudges in agri-environmental schemes as well as their ethical implications and provides a review of recent studies on green nudges for the agricultural sector. Section 3 describes the underlying methodology and Section 4 the workshop procedure. Section 5 presents workshop results and Section 6 discusses the implications for nudges in agri-environmental policy. Section 7 concludes.

## 5.2 Nudges: general aspects

In this review, the potential of nudging for steering pro-environmental behavior in the scope of agri-environmental management is discussed. The practice of nudging is not new, it has been used for decades in the domain of marketing to steer consumer behavior towards increased spending patterns. Since the past decade nudging has become of interest for the design of policies to improve economic behavior in a variety of domains. Being based mainly on theories from social and cognitive psychology, nudging has found its way into the field of behavioral economics through the works of Thaler and Sunstein (2009). Although nudges have been around before the era of behavioral economics, the new aspect relates to their intentional, "systematic and evidence-based development and implementation in creating behaviour change" (Hansen 2019, p. 73).

According to Hansen (2016), an instrument can be classified as a nudge if it satisfies the following four conditions. The measure is (1) not forbidding any options (2) nor changing incentives, it is needed (3) due to a cognitive bias and it (4) makes use of this bias. While the principal sponsors to the concept of nudging, Thaler and Sunstein (2009), categorize nudges as a particular case of libertarian paternalism, Hansen sees the nudge as a distinct concept. The

nudge respects principles of libertarian paternalism, such as preserving freedom of choice, but acts independent of components such as factual information and rational argumentation. As such, information campaigns that are solely based on rational information are not considered as nudges although they do align with libertarianism (Hansen 2019).

In this discussion of nudges for the agricultural sector I only consider interventions that meet the above definitions<sup>1</sup>. I am also going to restrain point (2) of the definition by Hansen (2016) to pecuniary incentives as there actually are nudges that change the incentive structure to choice prospects with respect to time investments (e.g. changing the default) or social recognition (social status competitions). Furthermore, Schubert (2017) distinguishes between three paradigms exploited by green nudges that specifically seek to address pro-environmental behavior: (i) nurturing an idealized self-image, (ii) following the herd and (iii) inertia. As those paradigms may overlap and are not always mutually exclusive, I will take them as an indication to green nudging categories but not restrain myself to them. Rather, I take all types of nudges into consideration that have previously been defined (e.g. Thaler and Sunstein 2009, Dolan et al. 2012) and provide examples of how they could be applied to the agri-environmental context. Table 5.1 provides an overview of the available nudge options.

Next to Nudges, the category of Boosts has also appeared in the literature. Contrary to subliminal nudges, the objective of boosts is to foster the general competence to make informed choices (Hertwig and Grüne-Yanoff 2017). The borders between nudges and boosts are not always very clear (e.g. precommitment strategies, simplification of complex information). Besides this overlap, boosts really consist of training and education programs, so that they can be substantially more costly for the policy maker but also for the decision maker who needs to invest time and effort into learning. In order to better distinguish between nudges and boosts, Hertwig (2017) proposes 6 rules to consider when deciding whether to use a nudge or a boost. Accordingly, boosts are recommended for situations that require a high degree of transparency and long term behavioral change. Nudges are recommended for situations for which acquiring new competences is unlikely. It is, however, not clear why nudges should not be able to provoke lasting behavioral change (e.g. defaults). Precisely because they come in more subliminal forms, nudges may have the potential to reach out to those who have shown to be resistant to other types of interventions for sustainability, such as information campaigns (Bornemann and Burger 2019). Clearly, the benefits of green nudges lie in the relatively small cost for both users and policy makers. First, policy making benefits from an easily modifiable instrument that is easier to implement than market-changing structures. The decision maker benefits from quick adaptation to the intervention and no investment at all. Second, the most apparent advantage is that green nudges, if efficiently designed, lead to immediate results by directly altering decision outcomes.

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<sup>1</sup> This excludes studies on farmer behavior that refer to Nudges in their title, but whose intervention really presents pecuniary incentives to farmers, as for example in the case of a rebate coupon for early fertilizer purchases in Kenya (Duflo et al. 2011) or a collective bonus at the end of an AES contract period (Kuhfuss et al. 2016b)

Table 5.1 – Types of Nudges. Source: author’s compilation.

<b>Nudge</b>	<b>Definition</b>	<b>Example</b>
Default	Automatic enrollment	Propose default surface enrollment
Simplification	Reduce informational complexity and confusion	List of best practices
Social Norms	Emphasize what most people do	Communicate regional participation rates
Ease & Convenience	Improve accessibility of options	Reduce bureaucracy of AES
Disclosure	Provide information on hidden effects	externalities, additional costs, consequences
Warnings	Risk indication in the form of graphics	Pesticide packaging
Commitment Devices	Prompting Intentions and Active choosing	Survey farmers
Reminders	Timely messages	SMS to farmers
Priming	Introduce subliminal cues that elicit an automatic response	Traffic light colours on farming products
Framing	Induce loss aversion by stressing negative outcomes and induce risk seeking by stressing positive outcomes	AES contract wording
Affect	Introduce positive associations	Societal recognition for AES
Saliency	Increase visibility	Pioneers, leaders
Ego	Make contributions visible to others	Publish collective environmental achievements

Although the foundations to human decision making and behavior have long been researched in the social sciences and have been cleverly exploited by marketing strategies, the interplay of cognition, behavior and nudging in different policy contexts across heterogeneous segments of the population is not well established, yet (Byerly et al. 2018). Especially, the effectiveness of nudging interventions over the long term and potential secondary effects are poorly documented (Lin et al. 2017). Moreover, the rather exploratory manner of choosing and implementing nudging policies has given rise to ethical concerns and the questioning of the regulator’s intentions (Lin et al. 2017, Hansen 2019).

### 5.2.1 Ethical concerns

Although choice architecture may be inevitable (Thaler and Sunstein 2009), nudges represent an intentional attempt to alter the choice architecture for decision makers (Schubert 2017). Now the question may arise: if a nudge is an intentional attempt at influencing peoples' behaviors in a predictable way, then what motivates the intention? There are several objectives that can be used to classify the 'right choice' (Schlag 2010). Among those are the greater good, social welfare considerations, individual preferences, future cost-benefit evaluations, and economic rationality. However, the context of the decision problem may inevitably involve opposed interests and coercion (Schlag 2010). Thus, what policy makers consider as the 'right choice' may provoke third-party effects or externalities that contradict the best interest for other groups of decision makers. One of the greater challenges of nudging policies is thus to understand whether behavioral approaches could be effective in different cultural, organizational and political contexts.

Three relevant intentions are formulated by Hansen (2019) with respect to the concept of nudging. First, nudges assume 'irrationality' as they would simply be ignored under pure rationality axioms: nudging interventions are only "motivated because of cognitive boundaries, biases and habits in individual and social decision-making posing barriers for people to perform rationally in their own self-declared interests" (p.70). Second, nudges work by exploiting 'irrationality': a nudging intervention "should be regarded as the attempt to influence behaviour through the activation of a psychological mechanism or function by means of contextual features so as to cause patterns of irrational behaviour" (p. 69). Third, nudges are intentional, attributing an ethical responsibility to their creator: in this they are different from 'accidental choice architecture' and attribute a normative stance to the policy. The principal defenders of the nudge approach argue that the regulators' intentions also guide all other regulatory instruments, such as pecuniary incentives and laws, which may explain why choice architecture is often portrayed as unavoidable. Nevertheless, the intentionality behind nudging interventions assigns a distinct responsibility to the architect as compared to random or 'accidental' arrangements (Hansen 2019).

In contrasting views from both sides of the spectrum of purely conscious to purely subliminal interventions, arguments for and against the intentional altering of choice architecture have been made. With respect to the intentions of the regulator, Bornemann and Burger (2019) highlight that overly relying on nudging interventions could lead to a society void of the capacity to self-improve through the making of mistakes and resulting in a lack of political deliberation. With respect to pro-environmental behavior, the authors criticise that nudges rely strongly on existing preferences, which would imply that preferences for sustainability need not be cultivated in the first place. Accordingly, such nudging techniques that take advantage of status quo biases (e.g. defaults) would lead to a conservative rather than transformative approach. Moreover, subconsciously nudging people towards more economic rationality may even aggravate the tragedy of the commons (Bornemann and Burger 2019). Nudges solely aimed at increasing the rationality of individual decisions may come at the expense of unsustainable collective outcomes as the col-

lective effects of individually rational behaviour can turn out to be highly irrational (Bornemann and Burger 2019, Ostrom 1990). Steering behavior towards more economically rational outcomes could thus lead to the exploitation and overuse of public goods and common pool resources. By making active choice redundant, nudges risk to inhibit social processes of learning and identity creation (Bornemann and Burger 2019). Drawing on evolutionary theories of behavior, Hardin (1968) argues that exclusively relying on “an appeal to independently acting consciences selects for the disappearance of all conscience in the long run, and an increase in anxiety in the short” (p.8). The policy challenge thus seems to be to find the right mix of interventions that create an equilibrium between economic, social and environmental goals.

Scholars of different fields in the social sciences have identified that a better understanding of “the risks and concerns involved with any intervention is pivotal to ensuring its appropriate implementation” (Croson and Treich 2014, p.342). In this regard, so called ‘normative costs’ (Schubert 2017) involve the effectiveness of nudging interventions, autonomy concerns, personal integrity and fairness considerations. Schubert (2017) explains that all of these aspects can undermine the legitimacy of the policy maker. First, ineffective nudges, when being perceived as green washing, come at the detriment of seeking genuine solutions for environmental issues. Second, nontransparent nudges, while relieving decision makers from cognitive load, compromise their personal integrity by preventing active choice, which constitutes a part of an individual’s identity. Third, exploiting cognitive biases can be seen as disrespectful as it transforms deliberative decision-makers into ‘manipulable means to an end’ that are excluded from the democratic process of choosing their own best interest. Fourth, not all people may be able to identify the nudge, which on one side is restricting their decision autonomy and on the other side may be exploited by those who are able to identify the nudge.

In an attempt to reduce inefficient and ethically controversial nudging, Hansen et al. (2016) distinguish behavioral interventions based on their degree of transparency for the decision maker and the automaticity of the decision process they are targeted at (figure 5.1).

Similarly, Lin et al. (2017) distinguish between type 1 and type 2 nudges. While type 1 nudges target automated responses and habitual choices, they are minimally disruptive and thus less transparent because they do not lead to a critical reevaluation of the choice prospects (Hansen 2019, Lin et al. 2017). Although they can be quick and cost effective, they do not easily declare their intentions to the decision maker and fail to trigger a lasting reevaluation of options. Transparent type 2 nudges, those that lead to a reevaluation of choice prospects by disrupting the coherence between evidence and preference, are advocated for meaningful sustained behavioral change (Lin et al. 2017)<sup>2</sup>. Thus, with a preference for transparency of policy interventions, explicit type 2 nudges are much more approved of by the wider population as compared to what is perceived as hidden manipulation (Lin et al. 2017). Thus, ensuring the transparency of intentions and allowing for deliberate evaluation of choice options (if desired) are means to avoid a potentially manipulative character of nudging interventions (Hansen 2019,

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<sup>2</sup> Although the authors are referring in particular to the health domain, the arguments are generic enough so that this principle could also translate to other contexts.

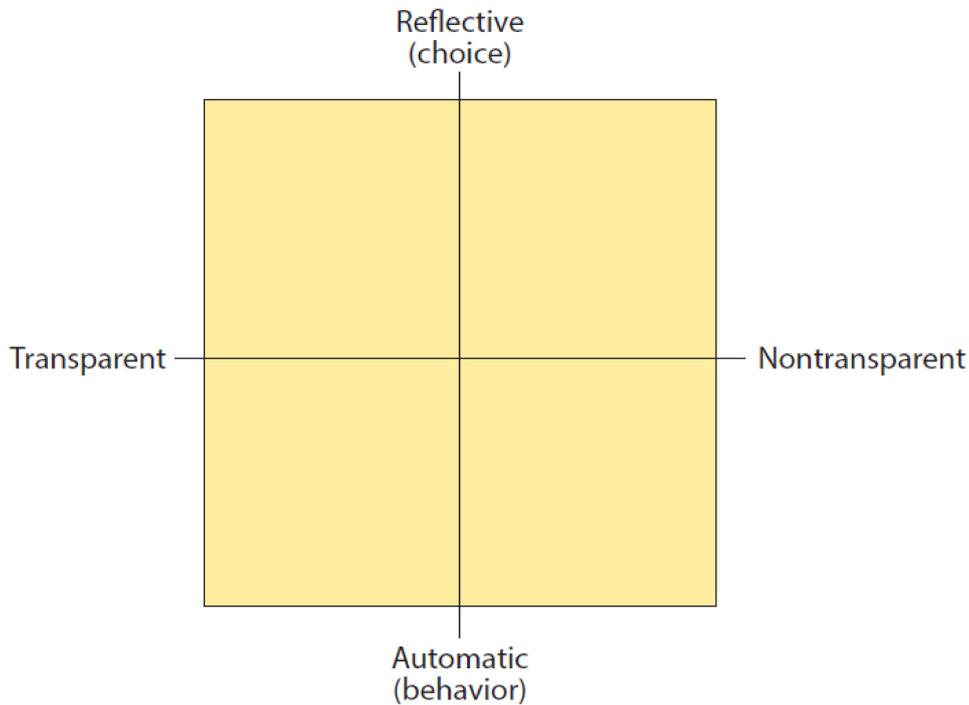


Figure 5.1 – A framework to classify the functions of interventions with respect to regulatory responsibility and manipulative potential. Source: Hansen et al. (2016), p.248

Lin et al. 2017). Additionally, the evidence based evaluation standards for pre-testing nudges by means of pilot tests and randomized control trials should lend more scrutiny to these tools (Hansen 2019).

In an interview with the New York Times (Gertner 2009), Elke Weber, Professor of Psychology and Public Affairs at Princeton University, explains that the intention behind nudges is to structure choices so that our natural cognitive shortcomings don't make us err. Asking for the person's true preference is the wrong question, she argues, because people have multiple goals. Ideally, nudges direct us, gently, toward actions that are in our long-term interest, like an automated retirement savings plan that circumvents our typical inertia. A success-praised example is the launch of the Kiwi Saver's Plan in New Zealand. The plan consists of a default for retirement planning and a reduction in associated paperwork, so that its subscribers are automatically saving for retirement without having to go through great lengths for setting up a tailored retirement scheme. Based on the argument that individuals are prone to biases in decision making, expressed preferences may counteract what is in the individual's best interest. To the extent that these biased choices impair social welfare concerns, policy can apply an intentional attempt for correction of the bias. In this sense nudges may even be viewed as liberty enhancing, instead of only liberty preserving, because they allow aligning goals with otherwise automatized and unquestioned habits (Hansen 2019). Keeping in mind the social welfare maximizing equilibrium, any choice architecture should be constructed so as to make people as well

off as possible overall, while minimizing negative externalities.

### 5.2.2 Why Nudge ?

Having discussed the controversial aspects of nudging, one might ask: Why nudge at all? A rather intuitive answer is provided by the social aspect to human behavior. All agricultural activity is socially embedded - behavior takes place in a local community of farmers that exerts group pressure and instills social norms. Given that most traditional agri-environmental policies do not target any other aspect to the decision environment other than pecuniary incentives, the scope for innovative behavioral approaches has been highlighted.

In its 2015 World Development Report, the [World Bank \(2014\)](#) identifies that “Concentrating more on the definition and diagnosis of problems, [...] using psychological and social insights and active experimentation, [...] can lead to better-designed interventions. An experimental approach that incorporates testing during the implementation phase and tolerates failure can help identify cost-effective interventions.” (p.192). Similarly, the [OECD \(2012\)](#) identified the creation of an environment that fosters psychological and behavior change through learning as fundamental for sustainable development. Social psychology has long recognized that forming habitual behaviors requires repetition of situational cues and associated responses ([Lin et al. 2017](#)). As such, [Kurz et al. \(2005\)](#) propose to explore the interaction of physical environments (involving situational aspects) with the social circumstances in which people’s behavior is embedded. Accordingly, fostering environmental concern as a social goal is advocated to be achieved with the help of nudging techniques ([OECD 2012](#)).

Although economics pursues social welfare maximization, individual utility maximization lead to behavior that contradicts this social and economical optimum. In the case of environmental concern, a wide range of reasons may be underlying the behavioral deviation from what would be optimal under social welfare maximizing considerations. One reason for the apparent lack of environmental concern might be that the values of environmental protection heavily conflict with present biased preferences such as comfort or immediate financial rewards. Other causes may be a lack of information, initial attitudes or social norm perceptions that all contradict the environmentally sustainable behavior.

In a predictive model of human behavior, [Ajzen \(1991\)](#) declares behavioral achievement to jointly depend on attitude and motivation (intention) as well as ability (behavioral control). To the extent that a person has the required opportunities and resources, and intends to perform the behavior, he or she should succeed in doing so. More importantly, according to the theory of planned behavior ([Ajzen 1991](#)) in which cognitive self-regulation plays an important part, each can serve as a mediator in attempts to change the behavior. As a general rule, [Ajzen \(1991\)](#) declares the more favorable the attitude and subjective norm with respect to a behavior, the stronger should be an individual’s intention to perform this behavior. However, whether the intended behavior is actually enacted depends also on behavioral control. Despite the existing motivation, biases in decision making may result in a deviation from the intended behavior.

For instance, [Costa and Kahn \(2011\)](#) highlight the confirmation bias in human cognition, by summarizing a number of studies that conclude that people find information more reliable when it confirms their strong prior beliefs (e.g. [Lord et al. 1979](#)). Other researchers have focused on the status quo bias, which predicts a general tendency to stick with the habitual behavior rather than to adopt a new one ([Samuelson and Zeckhauser 1988](#)). Furthermore, behavior happens in a socially embedded context. Whether the social environment is directly salient or imagined in a particular moment, people are influenced mainly by those in their network ([Murphy and Shleifer 2004](#)). All of these biases, heuristics and habitual patterns are usually summed up under the term ‘*bounded rationality*’. As stated by [Bornemann and Burger \(2019\)](#): “people hardly ever possess the kind of complete information, unlimited cognitive abilities, and perfect self-control to make best (or even second best) decisions as suggested by rational choice models”.

The gap between cognitive determinants of preferences and economically rational behavior has been thoroughly discussed in the academic literature. A range of theories from cognitive and social psychology provides plausible explanations for the causes of dissonance between expected ‘rational’ and observed ‘irrational’ behavior<sup>3</sup> among which are Dual-Process models in reasoning ([Neys 2006](#), [Evans 2003](#), [Evans and Frankish 2009](#), [Evans and Stanovich 2013](#), [Glimcher and Fehr 2013](#), [Osman 2004](#)), Prospect Theory ([Kahneman and Tversky 1980](#)), Equity Theory ([Furnham and Argyle 1998](#)), and Social Comparison Theory ([Festinger 1954](#), [Gibbons and Buunk 1999](#)). Most influential of which, dual process theories are seen as the foundation for behavioral economics in explaining “how the supposedly irrelevant features of decision-making contexts systematically influence behavior” and thus lead to deviations from ‘rationality’ ([Hansen 2019](#), p.66). According to dual process theory, people possess two modes of decision making: one that is intuitive, fast and based on heuristics (system-1-thinking), and one that is conscious, deliberate and reflective (system-2- thinking). The theory states that because system 1 is so fast, it does not always grant enough time for system-2 to intervene and correct ‘irrational’ decisions ([Kahneman and Tversky 1980](#), [Hansen 2019](#), [Bornemann and Burger 2019](#)). Respectively, nudges can be targeted at either type of decision process to make use of the different processes and steer behavior into the desired direction without imposing formal sanctions or threats ([Bornemann and Burger 2019](#)).

In light of the above, nudges are presented as a “real third way” to standard paternalistic regulation ([Thaler and Sunstein 2009](#), p.255). Paternalistic policies that target extrinsic compensation such as pure price incentives risk crowding out intrinsic environmental social motivations ([Czap et al. 2015](#)). If well-designed nudging interventions are based on an understanding of both the socioeconomic and agri-environmental dynamics, however, they could show extremely beneficial in the agroecological transition ([Barnes et al. 2013](#)). Thus, building an environment which stimulates intrinsically motivated activities ([Pugno 2008](#)) is inevitable for the design of sustainable agri-environmental policies. As an initial point of departure, policy makers need

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<sup>3</sup> I deal with the term rationality as the final outcome of a behavioral pattern that is fully intended and desired although the irrational behavior is not over the long term. Introspection on the individual’s rational preferences is required to judge the rationality of a given behavior.

to consider the heterogeneous effects of behavioral factors on sub-parts of the population with scrutiny in the design of nudging policies. Therefore, the state of current work with respect to the agri-environmental context is explored next.

### 5.2.3 Current Studies on Nudges for Agri-environmental Management

Although some studies have started to investigate the potential of green nudges for agri-environmental management, they have led to a series of questions on the purpose of nudging in the agricultural sector rather than to concrete recommendations. First, the experimental evidence is not conclusive as to how to target the profit seeking activity of farming through behavioral policy (Chabe-Ferret et al. 2019, Barnes et al. 2013). Second, it is not clear whether nudges can ‘super-charge’ pecuniary incentives (Kuhfuss et al. 2016c), are best used in complement to financial schemes (Chabe-Ferret et al. 2019, Czap et al. 2015, Ouvrard et al. 2020, Byerly et al. 2018) or whether they may be too soft as to influence long-term production decisions in competitive markets (Palm-Forster et al. 2019). Third, nudges may be too short lived as to permanently ensure the production of public goods over the long term (Palm-Forster et al. 2019). Most of the experimental studies advocate that long term behavioral change is to be elicited through a shift in social norms (Cullen et al. 2020, Barnes et al. 2013, Chabe-Ferret et al. 2019, Kuhfuss et al. 2016c). Therefore, the most relevant question seems to be, which nudge can achieve which effect depending on the respective agri-environmental context that farmers’ behavior is socially embedded in ?

**Social Comparison Nudges.** Barnes et al. (2013) argue for the power of activating social norms through participatory monitoring approaches to create attitudinal alignment and ownership of the environmental issues. Although they do not base their argument on empirical data, they reason that the positive example of voluntary adoption of agri-environmental measures would make for a softer attitude among otherwise skeptical, rejecting farmers and ideally lead to a consistent adoption of agroecological practices.

Hypothetical decision scenarios in the form of choice experiments and surveys attribute a rather promising potential to social comparison nudges. When eliciting intentions on whether or not to maintain agri-environmental practices after the end of an AES contract in France, Kuhfuss et al. (2016c) find that 61% of farmers who have received social comparison information indicate a willingness to continue in the absence of the scheme as compared to 43% of farmers in the control group.

Similarly, in a survey with Irish farmers, Cullen et al. (2020) find that farmers’ decision to participate in AES is significantly influenced by their social network. Farmers were 50% more likely to sign up for an AES when they stated that all (some) of their neighbours had already joined. The likelihood of participation increased by 90% for those who were member of a discussion group on environmental management.

Two experimental studies show, however, that social comparison nudges can produce unin-

tended side effects. First, in randomised controlled trials on water consumption as measured by irrigation smart meters in France, [Chabe-Ferret et al. \(2019\)](#) implement a social comparison nudge over 4 months in addition to already existing structural incentives. The nudge does decrease the water consumption of farmers that compare unfavorably to the average water consumption of their neighbors. However, it inspires the use of water consumption for farmers who have previously not made use of their water rights. This is considered a ‘boomerang effect’: while farmers indeed adjust their behavior towards the social norm as intended by the nudge, the nudge backfires as those who previously did not consume start to do so in response to the social comparison.

Second, in a business management game on water protection rules, [Peth and Mußhoff \(2020\)](#) compare the compliance behavior of German farmers to that of agricultural students. The authors employ two nudge treatments: empathy messages highlighting the consequences of water pollution through moral suasion as well as a social comparison. The results show that the nudge intervention increases rule compliance for both samples. However, the magnitude of non-compliance is found to be stronger among the farmers and when exposed to social comparison, which the authors attribute to a boomerang effect. While the social comparison may backfire (as in [Chabe-Ferret et al. 2019](#)), it is not clear from their discussion why deviant farmers increase non-compliance when facing a nudge.

**Other Types of Nudges.** Several other types of nudges (besides social comparison) have already been examined for agri-environmental purposes. First, in their review on nudges for land management, [Byerly et al. \(2018\)](#) find that nudges that are based on (i) a same gender messenger, (ii) the priming of conservation as socially desirable and (iii) a default cost-sharing setting all have a positive impact on the likelihood of farmers to adopt agroecological practices. Eliciting commitments, pro-environmental framing and pure information treatments on the other hand are not found to have a positive impact on farmers’ agroecological engagement.

Second, agriculturally framed laboratory experiments on water pollution with students in the U.S. have shown promising effects of empathy messages. In their experiment, [Czap et al. \(2015\)](#) provide the possibility to a downstream water user to send a message containing moral suasion to the upstream farmer. In absence of a financial incentive, the empathy nudge could sustain previous conservation efforts. Although being on average less effective than financial incentives, a synergy effect is found when combining the empathy nudge with financial incentives in which case conservation increased significantly compared to using one of the treatments alone. The combination of empathy nudge and financial incentive is found to be particularly effective in initially low conservation cases. An appeal to empathy is suggested for policies that seek farmers’ implication for conservation and environmental protection.

Third, by simulating real production decisions with German farmers in a business management game, [Buchholz et al. \(2018\)](#) compare the pesticide tax to a traffic light labelling for toxicity levels. The employed nudge is targeted at bounded rationality constraints, simplifying the information on toxicity of pesticide use and making it more salient. While both policy interventions reduce the use of pesticides in the game, the tax has a higher impact than the nudge

(10.5% to 4.2% reduction respectively) although being more costly to the farmer (€79 vs €10 per hectare).

Finally, [Ouvrard et al. \(2020\)](#) conduct a randomized choice experiment with farmers across all of France for smart meter adoption. They use two nudge treatments: a combination of priming and commitment as well as a testimony appealing to farmers' social identity. The baseline scenario proposes a collectively conditional bonus and the nudge treatments act as complements to the pecuniary incentive. In that sense the baseline scenario is analogue to that of real AES proposing financial compensation payments. The bonus is collectively conditional as it is paid out to smart meter adopters only if enough other farmers adopt the new technology as well. By altering the amount of the subsidy and the level of the collective adoption threshold, they reveal that when both the subsidy and the threshold are high, both nudges significantly reduce inertia in the decision of smart meter adoption. However, the higher the collective threshold, the more optimistic the average beliefs on others' contributions become. While the authors interpret this as a social norm farmers wish to follow, they do not explain why, in the absence of any reference to others' behavior, the threshold should reveal a social norm<sup>4</sup>. In fact, this effect is likely to be due to the provision of a reference point, especially since beliefs are quite stable across questions within the same threshold treatment. In light of previous experimental studies that have already illustrated the coordination advantage of a focal point provided by means of a contribution threshold (e.g. [Marks and Croson 1998](#), [Saldarriaga-Isaza et al. 2019](#)), the reference point hypothesis seems more plausible. The authors conclude that nudges should be used as complements to financial incentives and that nudges may be inefficient in the absence of pecuniary incentives. This is again surprising as other studies have already shown positive, albeit small, effects of nudges in isolation of pecuniary incentives (e.g. [Czap et al. 2015](#)). Vis-à-vis these stated preference results, although based on randomization, latent variables referring to image concerns and context dependencies should be examined to refine conclusions on treatment effects.

These studies present findings that stretch over a wide range of agri-environmental decision situations, as well as a broad spectrum of types of intervention and experimental methods used. Overall, those nudges that produce positive effects seem to evoke a strong social component (such as empathy or peer group comparison) or are coupled with a financial incentive. In the light of the rather mixed results from these experiments the central question remains open: Which nudges work best for the agri-environmental context? In order to better address this question, the next section outlines a participative stakeholder workshop for identifying which nudge to use according to the targeted behavioral change. The proposed workshop methodology

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<sup>4</sup> Given that the authors do not discuss this interpretation, two arguments come to mind. First, one could assume third order beliefs, along the lines of: "I think the threshold reveals a social norm. I think others think the same way. I choose the best strategy given what I think that others think. Second, one could assume that the threshold reveals beliefs of the regulator who chose it. In that case one has to assume that the regulator is being sufficiently optimistic, perhaps based on private information from survey results, that farmers are likely to attain the chosen threshold. Both of these arguments presuppose a rather sophisticated train of thought and a certain direction of optimistic reasoning. It does not come clear from the experimental framing that this assumption would be warranted.

therefore seeks to contribute to resolve the uncertainty about who, when and how to nudge in an agri-environmental context.

## 5.3 Methodology: Designing a Practitioners' Workshop

Given the need to identify which nudges work when applied to real agricultural situations, a platform for those involved has to be created. A participatory workshop allows practitioners of the agricultural sector to exchange experiences and to identify key behavioral issues to address for a specific problematic. In order to facilitate such a platform for exchange, I developed a workshop methodology directly for the design of nudging interventions that can be used by practitioners from the field and by public policy makers. Based on findings from the broader social sciences, government and industry reports, I developed the workshop design in 2015 and further modified this in 2017. The content of the workshop presentation and material is explained in the following sections. The resulting practitioner's guide from the workshop can be consulted in part A of the appendix.

### 5.3.1 Choosing the right Nudge

In order for participants to learn how to identify the corresponding nudge for the behavior they wish to target, I developed a four step framework (inspired by [Wendel 2020](#), [Roundtable 2006](#), [BIT 2014](#)).

The first step in the process of defining the intervention is to **EXPLAIN** the desired outcome. Prior to designing an intervention for change, the practitioners and policy makers need to define exactly what they are trying to achieve through it. In defining the desired outcome to behavioral change, three principal questions have to be answered at this stage:

1. What behavior is desired?
2. How can it be measured?
3. What is the optimal outcome after the intervention?

The second step is to **EXPLORE** the complex socio-economic dynamics of the decision context. In this step the practitioners are prompted to develop a better understanding of the context of a problem. In particular, the focus is on the heterogeneity of decision makers and decision situations: considerable variation in attitudes towards a particular issue across segments of the population can be expected. Segmentation is a very important aspect for nudging as it allows targeting those who may be most receptive to a particular intervention in ways they may find more appealing.

The context for pro-environmental behavior can be categorized into (1) *situational factors* such as a household's socioeconomic situation, individual's knowledge concerning harmful and proactive environmental behavior, and their sensitivity to environmental topics, (2) *environmental values* such as a general concern for the environment as well as favorable environmental attitudes, and (3) *psychological factors* related to the perception of the consequences of one's actions (Grafton 2014). Unfortunately, and in particular in complex environments, it is not always evident whether it is environmental concern or another intrinsic motivation for a certain action (as described in section 2.2), that causes the pro-environmental conduct. Hence, the underlying behavioral cause should be clarified before a policy intervention is designed to target certain behavioral outcomes. Otherwise, unanticipated secondary effects may result that yield counterproductive returns to the nudging intervention.

In understanding the underlying cause to behavior, four principal questions have to be answered at this stage that refer to the effect, timing and origin of the behavior as well as the principal target segment and the potential barriers to behavioral change.

1. Effect: What is the current behavioral outcome? (e.g. pollution, species loss, etc.)
2. Timing: When does the behavior occur? (e.g. specific times of the year, every day)
3. Origin: What triggers this behavior? (e.g. cognitive bias, incomplete information, cultural beliefs etc.)
4. People: Whose behavior is to change? (e.g. one or more segments of the population)
5. Barriers: What stops behavior from changing? (i.e. practical and structural barriers that may hinder behavioral change)

The third step is to **ENABLE** decision makers to change their behavior. By altering the choice architecture, practitioners can facilitate peoples' ability to choose the 'right' option. Several aspects to the choice environment can be altered through an intervention, which include removing barriers, providing information, making viable alternatives salient, increasing access to training and skills acquisition, simplifying procedures. An overview on the relationship between causes to behavior and the corresponding types of nudges is provided in table 5.2.

In designing the intervention three principal questions have to be answered:

1. How can the desired behavior be elicited?
2. Which Nudge to use?
3. Can a combination of Nudges be more effective?

By giving policy makers a better understanding of how people respond to cues in their decision environment and which types of information are salient, the behavioral dimension of all government action is highlighted. Based on the underlying cognitive mechanism to behavior,

Table 5.2 – Causes to Behavior and the Corresponding Types of Nudges. Adapted from [Dolan et al. \(2012\)](#)

Cognitive Mechanism	Behavior	Appropriate Nudge
Authority Bias	We are heavily influenced by who communicates information to us.	Messenger
Loss Aversion	Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses.	Framing
Social Comparison	We are strongly influenced by what others do	Injunctive Social Norms
Status Quo Bias, Inertia, Anchoring	We ‘go with the flow’ of pre-set options. We evaluate choice prospects relative to a reference point.	Defaults
Limited Cognitive Resources, Confirmation Bias	Our attention is drawn to what is novel and seems relevant to us.	Saliency
Perceiving Subliminal Cues	Our acts are often influenced by sub-conscious cues.	Priming
Emotion	Our emotional associations can powerfully shape our actions	Affect
Reciprocity	We seek to be consistent with our public promises and reciprocate acts.	Commitment Devices
Positive Self Image	We act in ways that make us feel better about ourselves.	Ego

nudges are proposed that make use of the corresponding choice architecture to steer behavior in the desired direction. Table 5.2 proposes corresponding nudges to respective behavioral tendencies and is adapted from the MINDSPACE framework by [Dolan et al. \(2012\)](#), of which incentives were excluded to comply with the above definition of a nudge.

The fourth step is to **EVALUATE** and **ENHANCE** the outcome of the behavioral intervention. At this stage practitioners are ‘working out what works’. They are encouraged to conduct pilot tests of their designed nudging intervention to evaluate how it works and, if neces-

sary, to adapt the intervention in order to enhance its effect. Practitioners are made aware that this is an iterative process that can comprise multiple stages of enhancing, testing and reassessing the nudge until a satisfactory outcome can be observed and secondary effects mitigated. Three criteria for the evaluation stage are proposed:

1. Pilot test: Is the intervention having the intended effect or does it conflict with other interests?
2. Randomized controlled trials: How do different segments of the population react when facing the nudge?
3. Replicability: Does the intervention work across different decision contexts?

Practitioners are encouraged to monitor and rigorously document the effects of their nudging interventions as to gain an overview on what works, when and how.

### 5.3.2 When and how to Nudge?

Depending on the context, a range of situations may warrant a nudging intervention. For this purpose I distinguish among three principal types of situations in which behavior is usually considered as sub-optimal with regard to the desired outcome (adapted from [Thaler and Sunstein 2009](#), [Schlag 2010](#)). Those situations refer to a lack of information, self-control and interest. I then propose to match a category of nudges to each situation.

1. Lack of Information: When people have difficulties understanding their choices, when feedback is lacking or when choice is risky.  
*Nudges that are self-sustaining.* This category of nudges makes use of the cognitive mechanism to achieve lasting behavioral change. They can include defaults, priming, affect, ego and social norms.
2. Lack of Self-Control: When convenience is preferred or when temptation looms.  
*Nudges that trigger change.* This category of nudges tries to circumvent the cognitive mechanism by changing the cue and thus triggers a temporarily different response. They can include leading by example, salience and messenger.
3. Lack of Interest: When choice is not timely or when decisions are difficult.  
*Nudges that prompt reflection.* This category of nudges confronts the habitual response by provoking a reevaluation of the behavior. Their effect on behavior may not be immediate and the effect will only last if a change in the choice evaluation is provoked. They can include reminders, feedback, and commitment devices.

As noticed by [Schlag \(2010\)](#), the decision of when to nudge may sometimes be difficult as other regulatory and political interests may coincide with a decision problem. It is therefore

important to evaluate side effects, possible consequences and interaction effects with other regulatory aims as explained in step 4 above. Therefore, in order to make nudging successful, scrutiny has to be applied when evaluating public outcomes. This should involve :

- being clear about what behavior could be like;
- focusing on the corresponding nudge to achieve very specific improvements;
- using segmentation approaches to adapt the intervention to parts of the population, their attitudes and values that frame the choice context;
- taking a long-term approach to behavioral change ;
- if appropriate, using a mix of interventions and ways of reaching people;
- do not consider nudging as a "one-fits-all" solution or a definite replacement for other regulatory tools.

Nevertheless, even the best intention for a nudging intervention can backfire (as explained in the literature review). Therefore, the pitfalls in public policy need to be highlighted in order to anticipate what can go wrong (BIT 2014). First, with regard to segmentation, the target group can be misspecified so that message reach is not optimal or causes boomerang effects. Second, with regard to replication, applying nudges across different contexts may lead to an accumulation of measures in specific contexts that risk to counter each others' effects or to produce unintended side effects. Third, the more complexity is introduced, for instance through the combination of several nudges, the more likely phenomena such as reverse effects, side effects, third-party effects, and unintended externalities become. Fourth, the perception of the policy may also vary from laboratory contexts to the real world so that observed outcomes from the lab do not reproduce as intended in the real world. In light of those pitfalls, small scale trials and pilot studies are of importance as they help to anticipate undesired effects to the planned intervention.

## 5.4 Workshop Realization

A pilot workshop was conducted with researchers from the laboratory GESTE at ENGEES to test the methodology and to identify any questions related to the understanding of the content presented. The actual practitioner's workshop was then conducted in 2018 with the goal to explore nudging opportunities for AES based on the topic of water catchment zones in Alsace, France. For this purpose, representatives from local and regional agriculture-related institutions as well as farmers were invited to participate in a workshop on Nudging techniques. The goal was to ensure a well-balanced composition of participants for the workshop, restricting participation to one representative per institution.

### 5.4.1 Expectations

The pre-workshop questionnaire indicated that most participants had already heard about the concept but did not have a very concrete idea on what Nudges really are (figure 2). They were thus very interested in learning more about this concept, brainstorming about applications and discussing their ideas with the group (on average 8 out of 9 respondents indicated a strong interest in these workshop elements).

#### Dans quelle mesure êtes-vous déjà familiarisé avec le concept du Nudge ?

9 réponses

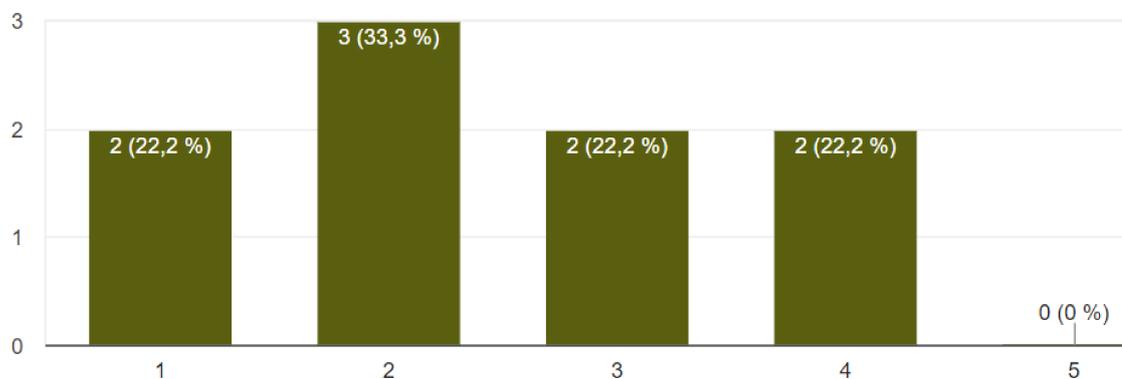


Figure 5.2 – Survey Results: Are you already familiar with the Nudge concept? (1) Never heard of – (5) Already worked with.

From the research side, the goal was to learn more about the actual possibilities for application to the AES context. The workshop structure was based on a methodology proposed by [Schut et al. \(2015\)](#), the Rapid Appraisal of Agricultural Innovation Systems (RAAIS), a diagnostic tool for integrated analysis of complex problems and innovation capacity. We adapted this participatory workshop methodology to heterogeneous stakeholder groups that were to (1) identify constraints to changing agricultural practices, (2) categorize these constraints within their group, and (3) develop one specific application for a Nudging intervention per group. By identifying and categorizing constraints for changing behavior of individuals within the agricultural system, the basis for intervention, i.e. the problem area, was outlined. By means of a guided brainstorming session, participants were lead along five steps towards the creation of their Nudging intervention.

### 5.4.2 Procedure

We exchanged the use of colored cards as proposed under RAAIS with the use of colored post-its, where the color was group specific. At the start of the workshop, each of the participants

received the practitioner’s guide and a set of 5 post-its. After a short introduction to the problem area (ground water pollution due to high nitrogen levels from agricultural sources), each participant was to individually list five constraints or challenges they face in their work on changing agricultural practices and was to write down one per colored post-it. Within their group, all post-its were



Figure 5.3 – Impressions from the Practitioners’ Workshop

assembled on the white board followed by a discussion of the noted constraints in order to identify similarities and differences among them. The group then was expected to agree on a top-5 ranking of priority constraints. These top-5 were to be written down in the individual leaflet and served as the basis for all further steps during the workshop.

A short presentation of the Nudging framework was provided for the workshop participants as illustrated in figure 5.3. The groups were then instructed to work through their leaflet together. A copy of the practitioner’s guide can be found in part A of the appendix. Three workshop animators were present to answer questions, to explain steps in detail and to help resolve misunderstandings from the material as well as disagreements between group members.

At the end of the brainstorming session, each group then presented their Nudge and all participants were free to engage in the discussion about the proposed interventions. Before deliberating all participants, they were asked to provide feedback on their experience with the workshop on a separate sheet. They were furthermore allowed to keep the practitioner’s guide for future reference and to share the content with their colleagues. Some of the stakeholders had

to leave already before the end of the workshop which influenced group composition and size and, of course, did not grant them the full experience. However, the feedback from participants was overall positive, they seemed to be satisfied with their learning and brainstorming experience.

## 5.5 Workshop Results

The results of the workshop focus mainly on those obtained from the brainstorming session, as the most part of the workshop was used by the groups to identify what causes behavior. Nevertheless, based on those insights, a concrete nudging intervention can be proposed.

### 5.5.1 Explaining the Desired Outcome

The first step in defining a nudge, explain the desired outcome, has been part of the workshop presentation. In that presentation, it was explained to the participants that the context for their discussions would be based on the problematic of nitrogen pollution stemming from the agricultural sector and degrading the ground water quality of local water catchment zones. The desired outcome thus was defined as improving the ground water quality up to an acceptable level of non-toxicity by reducing the nitrogen residues from agricultural practices. With this aim in mind, the nudge would support an AES in reducing pollution activities, either by increasing acceptability, participation or outreach.

### 5.5.2 Exploring the Context

The second step was for participants to identify the underlying cause to existent behavior. In positioning the problem, participants used their colored post-its within their groups to note in bullet points the issues they could identify during their group discussion (see figure 5.4).

The brainstorming session within the groups highlighted several components to the problem of nitrogen pollution in the water catchment context. By combining post-its from all groups and matching them according to common topics, these components can be grouped as listed in bullet points in the boxes below. I identified six underlying key themes that emerged as causes for existing behavior from the post-its. Those are personal impact, unawareness of responsibility, fear of change, fear of losing social status, absence of guarantees for success, lack in facilitation, and profitability concerns. They can also be understood more broadly as barriers to behavioral change in the agroecological transition with respect to the particular problem of excess nitrogen residues.

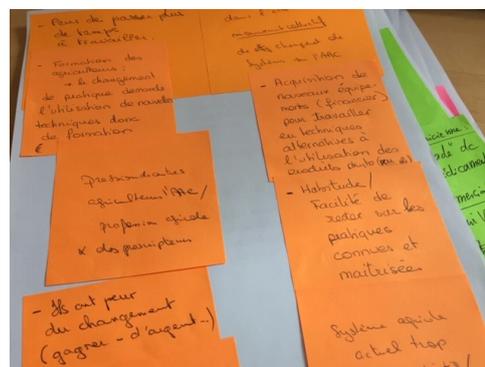


Figure 5.4 – Colored Post-its

### Brainstorming Topics

1. The first topic refers to general excuses for not changing agricultural practices.

- I pollute less than others
- Products that are authorized are not dangerous
- Why can't others take care?
- New techniques based on "new molecules" will be the solution
- I do not pay the consequences stemming from agricultural practices
- Pollution is stemming from industry and medication
- We are waiting for a collective movement to change the system on ground water catchment zones

The key theme identified in this list is the lack of a sense of personal impact and *responsibility* with respect to the pollution issue.

2. The second topic refers to changing agricultural practices towards organic farming.

- Will increase work and time requirements
- Drop in productivity
- Who is going to buy organic products anyway?
- Will new cultures be as efficient?
- Step into unknown territory
- Fear of not being successful in managing all new demands and requirements

The key theme identified in this list is a *fear of change* with regard to the prospect of adopting organic agriculture.

3. The third topic refers to the collective pressures that farmers experience within their community.

- Collective image as ‘AOP’ (French: Appellation d’origine protégée)
- Leadership (in the case of abuse of power) may induce a system driven by fear and inter-dependence
- No discussion outside of the agricultural circle, no inclusion of mixed parties from the village community, regional authorities, others. . .
- Would require an agreement between farmers of the same community to exchange grounds, declare territories. . .
- Absence of conscience of collective impact on the environment
- Fear of being isolated from conventional farmers
- Group pressure in community stemming from other farmers who resist change
- External pressure to produce reliably in order to feed the planet
- Fear of judgment from neighbors and friends

The key theme identified in this list is a *fear of losing social status* when adopting new agroecological practices.

4. The fourth topic relates to traditions that characterize the agricultural profession.

- Heritage
- Habits
- Limits and constraints imposed by the farm setting
- Fear of change
- Easier to keep up existing practices
- Difficult communication between authorities and local actors in the community (“they do not speak the same language”)

The key theme identified in this list is an absence of *guarantees for success* of a new system.

5. The fifth topic relates to a need for training and information sessions to accompany the agroecological transition.

- Unawareness of responsibility and impact on ground water quality
- Facilitate adoption of better practices
- Sensitize better understanding of the impacts
- Fear of not finding a way to “make it work”
- Fear of heavy administrative burden
- Lack in expertise for other agricultural practices, technical requirements, cultures, systems
- Training will take time off from productivity
- Current agricultural system too far away from objective of ideal system
- New definition and understanding of the agricultural discipline

The key theme identified in this list is an absence of external *facilitation* for the agroecological transition.

6. The sixth topic relates to the economic system that agricultural production is positioned in.

- Need to produce more to obtain the same revenue as with conventional practices
- Industry requirements, e.g. keep up required quality of products
- Otherwise will lose income
- Capitalist commercial system that requires stable sales
- Price volatility
- High investment costs for new equipment and alternatives to pesticide use
- Other work/time/employment obligations (e.g. ‘double-active’, family, social group)
- Profitability of new cultures
- Lack of information on risks, real costs and related statistics

The key theme identified in this list is *risk and uncertainty* in the agroecological transition.

### 5.5.3 Designing the Nudge

The third step was to define a nudge that would enable farmers in the change towards agroecological practices. Based on the above six key themes for eliciting change in the agricultural sector, two features have been identified as critical for the construction of a nudge. First, efforts and achievements to behavioral change need to be made salient and visible for all. Second, behavioral change needs to be accompanied and pioneered by a high status leader or a team of ‘best practice’ advocates. These two features lead to the construction of the following nudge. An energy bar that visualizes the state of collective efforts homogenizes the feedback that all farmers receive in real time, i.e. through an app on their smartphones. Two possible prototypes for the graphical representation of such an energy bar are illustrated in figure 5.5. The use of traffic light colours immediately informs the user of the urgency to act, i.e. to contribute pro-environmental efforts. The progression of the bar indicates how much collective effort has been contributed overall. This nudge is targeted at bounded rationality constraints, simplifying information on collective efforts and making it more salient.

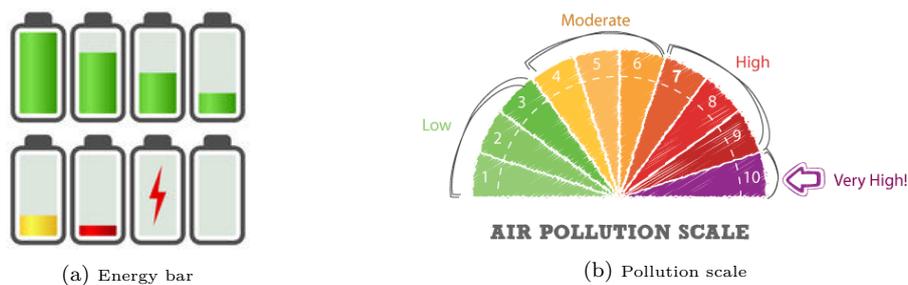


Figure 5.5 – A potential Green Nudge for agri-environmental management: the visualization of collective efforts. Source: Google images.

### 5.5.4 Evaluating the Nudge

The fourth step, evaluate and enhance, was not within the scope of this workshop. A protocol for a laboratory experiment is currently in development so that the nudge could be tested initially.

## 5.6 Discussion: Nudges for Agri-Environmental Policy

The proposed nudge is a measure of collective efforts that is visible to all but does not identify individual contributions. Therefore, I argue that it is fair, ethical and transparent. Moreover, while it allows for the information to be processed quite automatically, it leaves room for reflective choice. For example, if the nudge indicates that collective contributions are just below the collective threshold value (e.g. as specified in the AES contract), then individual farmers can

make the deliberate choice to augment their individual efforts a little bit as to make sure that the threshold is reached. They do not have to do so, however. In absence of this information on the state of collective efforts, farmers risk to be unaware of their impacts and responsibilities. There would exist considerable uncertainty as to whether enough other farmers contribute and what the general norm with respect to environmental efforts in their society is. The real time feedback on collective efforts reduces uncertainties and provides a social norm, farmers know how much others contribute on an aggregate level. Therefore, measuring collective efforts in real time can help mitigate fears with respect to change and social status while increasing a sense of responsibility and personal impact. Next to these advantages, a set of less evident aspects should be clarified.

First, the proposed nudge critically relies on the reliable measurement of efforts. In the given example of nitrogen levels in ground water, this would mean that the reduction in nitrogen-containing substances has to be measured. This could be done by keeping records of nitrogen purchases and applications, although this would clearly rely on honest reporting from the individual farmers. The process could be simplified and anonymized if farmers were to enter their usage directly into an app that would update the collective effort measure in real time. Alternatively, instead of efforts, the outcome variable, water quality, could be measured. However, this may be tricky as with any non-point source pollution issue, other actors from industry and households also contribute to the pollution situation. Moreover, changes to environmental quality are often slow and thus substantially delayed in time with respect to the efforts made. A principal challenge for any results-based intervention is thus to develop a measure for environmental outcomes that is timely and reliable at once.

Second, the discussion of the nudge is based on an AES context. This means financial incentives would co-exist with the nudging intervention. This is coherent with the general tendency of the green nudging literature to advocate a combination of traditional monetary and innovative behavioral interventions (Byerly et al. 2018, Schubert 2017). The current aim in agri-environmental policy making is to augment and complement existing regulatory approaches (Thomas et al. 2018, Mackay et al. 2018). According to Barnes et al. (2013) the “virtuous spiral towards deregulation will begin by identifying the right combination of nudging and regulation which are seen as more legitimate by the actors being regulated” (p.457). Similarly, Schubert (2017) argues that incremental behavioral change is not enough, but that a societal and institutional paradigm shift is required to move towards an environmentally sustainable [agro]economy. Therefore, nudges should be able to coexist with incentive-based measures. In the best case scenario, nudges should be able to amplify and enhance the effectiveness and outreach of pecuniary incentives such as those provided by AES.

Third, the acceptability of nudges in an agri-environmental context has to be discussed. For example, a social comparison nudge revealing farm pollution rates would expose less environmentally engaged farmers and therefore create an environment of stigmatization and resistance towards agroecological measures in general. Therefore, the proposed nudge should not focus on individual pollution rates but rather on collective efforts to ameliorate the environmental

quality. Moreover, nudges are highly context-dependent and are perceived differently depending on the individuals' characteristics, as explained in section 2. Positive environmental attitudes are strictly linked to the responsiveness of individuals to green nudges (Schubert 2017). In order to increase the acceptability of certain nudges, it may thus be reasonable, in a first step, to target those farmers scoring high on environmental attitudes and to assign them a leadership role, before, in a second step, rolling out the intervention to all farmers.

Fourth, in particular for the case of non-point source pollution but also for other agri-environmental challenges, targeting farmers alone is not going to be enough. Engaging other stakeholders, business partners, and consumers in the agroecological transition is just as important. Permanent change to agri-environmental practices relies on the support and adaptability of all the actors engaging with and benefiting from the agricultural sector.

Finally, it has to be made explicit that any nudging intervention benefits from a systematic design process and should always be rigorously tested, e.g. through field and laboratory experiments (Mackay et al. 2018), before rolling it out on the population of interest. This is important in order to demonstrate the intervention's (cost-) effectiveness and to avoid unintended consequences. While there is no "one fits all" solution (Thomas et al. 2018), the scientific rigour to designing and targeting nudging interventions needs to include an iterative process of "test, learn and adapt", ideally through Randomized Control Trials (BIT 2014, Mackay et al. 2018).

Nevertheless, it has to be stressed that big challenges such as the agroenvironmental transformation, involving complex sustainability issues, also have structural next to behavioral components (Bornemann and Burger 2019). Thus, it is not only behavior that needs to be altered in order to tackle agri-environmental dilemmas. Rather, governance for the agroecological transition needs to be based on integrated policy mixes, for which nudges are one component of a more complex institutional environment (Bornemann and Burger 2019). We cannot rely on nudges as the "only and all-curing remedy for sustainability problems" (Bornemann and Burger 2019, p.221), but they do have their role as policy tools in more complex sustainability governance arrangements. Their potential for broad societal transformations lies in normalizing and mainstreaming sustainability-oriented behaviours (ibid). In accompanying structural and pecuniary elements such as AES, nudges could find their place in the policy mix targeted at the agroecological transition.

## 5.7 Conclusion

In this article, a review of recent studies on green nudges for the agricultural sector as well as its ethical implications is provided. I outline the potential for green nudges in agri-environmental schemes and describe the workshop methodology used with practitioners from France. The goal of the workshop was to design a nudge that could be applicable to the context of nitrogen pollution in water catchment zones. Based on the identification of six key hurdles for eliciting change in the agricultural sector, two features have been identified as critical for the construction

of a nudge: the visibility of efforts and achievements as well as the presence of ‘best practice’ advocates. The proposed nudge addresses those two features by providing an energy bar that visualize the state of collective efforts in real time, i.e. through an app on their smartphones. The nudge is targeted at bounded rationality constraints by increasing the salience of and homogenizing the feedback that all farmers receive.

This work contributes to the still developing literature on the potential and constraints of green nudges in agri-environmental policy. By suggesting a methodology to develop green nudges for AES in stakeholder workshops, a participatory design for behavioral policy is proposed. Practitioners, being experts in their domain, can evaluate and assess the particular context in which a nudging intervention is to take place. Policy makers and ethics consultants can then critically assess the welfare implications of the proposed nudges. Scientific scrutiny is critical to the design of nudging interventions and rigorous pilot studies prior to the roll out on the target population are strongly recommended.



# General conclusion

The work of this thesis combines the approach of two strands of literature - behavioral economics and collective action - in investigating the potential of collective incentives for agri-environmental policy through the lens of behavioral economics. Given the principal objective - to develop a better understanding on which policy tools support and facilitate collective agri-environmental management - this thesis presents five chapters that address this research aim. Each chapter highlights a different aspect to the behavioral and relational dynamics of farmer decision making with respect to environmental practices in light of inter-farm cooperation.

In studying the external validity of the collectively conditional subsidy mechanism, this research moves gradually from the lab, to a lab-in-field and finally to the field. We start from a decontextualized lab experiment with students (Le Coent et al. 2014) which we transposed to a contextualized lab-in-field with farmers (Chapter 1). The field analysis then presents first hand cAES field data at the aggregate level (Chapter 2), followed by farmers' contracting decisions at the individual level (Chapter 3). The debate of the potential of collective AES is enhanced with a discussion of the coordination of farmer cooperation through an associative structure (Chapter 4) and finally, with the presentation of a workshop methodology towards the development of alternative approaches such as behavioral interventions in the form of green nudges (Chapter 5).

The main findings of the thesis as reported in its five chapters are summarized below, followed by a discussion of their limitations and implications for academic research, policy design and practitioners in the field and then opens towards perspectives for further research.

## Main findings

This work provides a range of insights on the potential of collective incentives for agri-environmental policy. The collectively conditional subsidy mechanism has shown promising results for both increased cooperation and increased contributions under the cAES. Initially attested in a controlled lab setting, the transposition to the field grants a first indicator for external validity to the conditional subsidy mechanism. This result is strengthened through the data analysis of real-world cAES contract results. By moving the collective conditionality analysis further into the field, support for the external validity of the experimental findings is found. In particular, the field data shows that farmers' contributions under the collective contract go well beyond the MPR's threshold value across all years of the contract. Next to the successful collective participation, the cAES helps coordinate farmers to provide a connected agricultural landscape favorable to the species' survival. This work has shown that the collectively conditional subsidy scheme has the potential to sustain efficient collective participation to agro-environmental practices among farmers when facing environmental threshold dynamics. The conditional subsidy thus could make for a viable policy tool in agri-environmental policy.

Arguably, students in a university lab do not necessarily resemble the characteristics of the

## GENERAL CONCLUSION

population of interest (in our case farmers) nor does the perfectly controlled decision context resemble that of complex real-life interactions. Nevertheless, the lab allows us to test for the effect of a policy instrument in isolation of other factors. Indeed, a positive impact of the conditional subsidy schemes on facilitating cooperation has been attested in the lab, albeit in absence of real stakes, competing interests, communication and other confounding factors. Therefore, we cannot conclude from the lab that an incentive mechanism tested there will work in the same way in a more complex decision environment. However, the lab is a cost-friendly and rather simple to organize means in order to gain a first impression of an incentive instrument on the decision outcome. In a next step, moving further to the real decision context, the lab-in-field allows us to observe how the population of interest reacts to the proposed incentive. Interestingly, we observe average group contributions that are consistently higher than those of the analogue lab treatment and that remain above the threshold value across all periods. Although for both samples, the conditional subsidy mechanism elicits higher contributions in the second sequence, we can conclude that on average farmers cooperate more successfully than do students as they sustain more efficient outcomes over time. In retrospective, the lab experiment informed us about the direction of a treatment effect while the lab-in-field fine-tunes the parameters of the effect according to the target population.

Analyzing the real-life cAES data allows us to further refine our understanding of the influence of the conditional subsidy mechanism. The aggregate contract results reveal that the collective AES allows groups of farmers to adapt their surface contributions in order to spread environmental efforts on an interconnected corridor of farmland within their zone. This inter-farm coordination has a positive, albeit slow, effect on the environmental outcome variable. While especially smaller groups of farmers make proportionally larger contributions to the scheme, the cAES seems to have a positive impact on environmental quality. This can be further developed, by taking a closer look at farmers' individual contracting decisions. Larger groups of participating farmers show to produce relatively more contractors, but each individual farmer makes smaller surface contributions to the collective contract. This relation between group size and surface contributions can be explained by farms' territorial shares within the protection zone. It is those farms that have a lot of territorial influence within the zone that are most likely to contract under the cAES and on average contribute more surface to the collectively conditional contract. Of course, we can suspect that those with the most territory in a collective zone also can reap the most benefits from the collective subsidy while at the same time carrying more responsibility for threshold attainment than farms with marginal territorial shares.

Given these different types of contribution patterns, it is of interest to understand how farmers manage to coordinate in their complex decision environment, so as to successfully cooperate under the collective contract. Farmer associations, such as ECs, play an important role in managing spatially defined collective contracts. Taking a closer look at the organizational structure shows that role of the EC is above all a facilitating one, mediating between the different interest groups. The purpose of the EC is to enable the application of cAES in the locally specific context and to negotiate that the contract criteria are reflective of these local needs. The EC

shapes the social capital of the farmer community, as it provides a platform to farmers where to express needs for governmental support as well as where to learn about, understand, train and monitor farming practices. By increasing coherence among farmers' attitudes, by decreasing uncertainty about others' efforts and by synchronizing spatial coordination, ECs can constitute a transparent, cost-efficient, reliable and indispensable instrument to implement collective agri-environmental contracts. However, for the EC to work smoothly, a democratic and participatory organizational form is recommended.

Given the importance of farmer participation in the design of successful cAES, there may exist potential for behavioral interventions to complement existing financial incentives. In the stakeholder workshop, two critical aspects to the management of agri-environmental behavior have been identified. First, reliable feedback on collective efforts made under the cAES has to be provided and collective achievements should be made visible to all. This could reduce stigmatization of farmers often portrayed as polluters (agribashing) and could build social recognition for their efforts. Second, local leadership is important in guiding collective efforts and in spreading best practices among the farmers. Thus, there seems to be potential for innovative behavioral interventions, such as green nudges, to co-exist next to the financial compensations made through cAES. However, the acceptability of nudges in the agri-environmental context has first to be explored. Local leadership may again be of importance to increase the acceptance among farmers for such innovative interventions.

Nevertheless, in particular for the case of non-point source pollution but also for other agri-environmental challenges, targeting farmers alone is not going to be enough. While conditional subsidy payments compensate collective efforts for farmers and while nudges can enhance the effectiveness and outreach of traditional measures such as AES, stakeholder engagement and structural modifications are just as important in the agroecological transition. Permanent change to agri-environmental practices relies on the support and adaptability of all the actors engaging with and benefiting from the agricultural sector.

This thesis contributes to the literature on innovative agri-environmental policy tools and provides insights for agricultural policy in steering the agroecological transition. In providing external validity for the collectively conditional subsidy mechanism, this work identifies a novel, efficient and acceptable tool for incentivizing cooperation among farmers with regards to connected environmental effort. Furthermore, by investigating the collective dimension to an existing cAES contract, rare data from the field reveals the relationship between collective AES and the environmental outcomes achieved. This analysis is informative for policy making as it highlights several policy challenges to collectively conditional incentives. First, appropriately targeting influential farmers of the community will be helpful for gaining acceptability and participation for the cAES. Second, determining the appropriate group size for each collective contract is decisive for the degree of collaboration among farmers. Third, the design of collective contracts and the application of cAES benefits from the presence of an EC that takes the role of a facilitating and mediating institution between farmers and regulatory authorities. Fourth, behavioral insights and stakeholder participation could be beneficial in the aim to design fair and

sustainable agri-environmental policies. Overall this work is contributing to the scarce literature on innovative policy tools in support of collaborative governance arrangements for AES.

### Limitations

Although great care has been applied in the design of the presented studies, several limitations have been met during this research.

First, the study on the lab-in-field experiment would benefit from more participants. Unfortunately, during the time of this thesis work, the sanitary situation required us to cancel further experimental sessions in the field. Moreover, the current atmosphere due to concerns for ‘*agribashing*’ made it difficult to motivate farmers to participate in an academic study on their behavior. Ideally, more data is to be collected to augment the validity and statistical power for the lab-in-field experiment. In particular for the baseline treatment (NS), data from the lab-in-field setting would nicely serve as a field control. A benchmark for the minimum number of observations is given by the study by [Stoop et al. \(2012\)](#) who present 8 groups of four participants each per treatment in the field. This would allow us to draw better inferences upon the role of a conditional subsidy mechanisms in facilitating cooperation in an environmentally motivated context.

Second, the study on the relation between cAES implementation and environmental outcomes would benefit from more years of data. The initial time frame of 5 years is too short in order to conclude with precision on a causal link from the provision of favorable surface to an expansion of the local hamster population. More evidence, ideally through the lens of rigorous RCT policy pre-testing, could substantiate the conclusion. The proxy of burrows is also an imprecise measure for population count, as one hamster can occupy multiple burrows. Thus, bioindicators for environmental quality should be developed that stand in relation with the hamster’s conditions for favorable habitat so that an alternative measure can be established. This bioindicator can then hold in absence of reliable population counting or at best complement the reliability of the burrow proxy by augmenting the availability of information on the state of the ecosystem.

Third, the econometric analysis could benefit from more elaborate data to allow controlling for a number of confounding factors such as the crop cover of years prior to the start of the measure, crop prices and climate conditions. Admittedly, by demeaning and by controlling for time-invariant variables, the econometric specification does eliminate fixed effects. However, as we cannot measure these variables, their effects cannot be estimated. Therefore, we tolerate a degree of omitted-variable bias in order to focus on the effects of our time-varying variables that we are especially interested in. In a similar vein, acquiring data on the total farm surface would grant a more complete analysis on the role of farm size for participation in the cAES. So far, we could only assess the territory farms have within the protection perimeter, which restricts our interpretation of the determinants for participation to this measure.

Fourth, the identification of the types of collectively conditional contributors in the threshold

public good settings would benefit from more qualitative evidence and quantitative identification criteria. Moreover, the leadership literature could serve to refine the discussion of influential farms in the collective zones. Within the limited time frame of this thesis work, however, these topics could not have been satisfactorily addressed and are thus reserved for future work.

Fifth, to the extent that three chapters are based on a case study approach, the external validity and generalizability of the corresponding findings should be considered carefully, as these results may be specific to the French (if not Alsatian) agricultural and cultural context.

## Implications

The collectively conditional incentive mechanism has shown a promising effect in the lab, the lab-in-field and the case study. Depending on the environmental service targeted, the conditional subsidy scheme can make for an effective and acceptable policy tool for cAES measures.

Nevertheless, environmental threshold dynamics involve rather slow processes and therefore rely on the continued provision of environmental services. Agri-environmental efforts, such as restoring species habitat, require a substantial time frame in order to be realized. Thus, the time span and the continuity of cAES measures need to be adapted and repeatedly revised to grant optimal permanent support to farmers that are implementing the measures. Expecting quick results from an initial cAES implication seems unrealistic in the face of rather slow and delayed response times to the parameters of the ecosystem. Seasonal cycles determine the speed of change in environmental quality, while meteorological conditions and other external factors all can moderate the agroecological efforts provided.

The case study has shown that through an integrative approach, involving the farmer association, the chamber of agriculture, the national hunting and wildlife bureau, researchers from various fields and related stakeholders, the design and application of the species' protection measure can take into account various aspects to the socio-ecological system. Through such an integrative approach, the recent findings from biologists on the species' nutrition and protection needs, for instance, can lead to precise recommendations for agri-environmental practices. Those can then be adopted in the cAES specifications. Moreover, this cAES also includes a results-based component, the burrow premium. The combination of action and results based collective incentives could mitigate the risks for farmers and align competing economic and ecological interests.

Although the case study addresses one very specific species protection program, the case of the European hamster is reflective for the entire local ecosystem (Virion 2018). The hamster being an umbrella species, the actions carried out for its protection also impact other species such as insects and small vertebrates that share the hamster's habitat. Together, the state of this ecosystem influences the quality of the soil and vice versa. Thus, being interested in nutrient-rich and fertile grounds, the agricultural sector actually has an important stake in the survival of its local species. Pooling efforts in favor of biodiversity improvement on an integrative scale should thus be of predominant importance to the management of the agroecological area at stake. This

also involves the establishment and improved management of links with other existing programs so that measures do not eradicate each other but at best superpose and support each other in a coherent global aim.

In this respect, the importance to take behavioral factors into account for the design of cAES should be highlighted. Relationships, social dynamics, attitudes, culture and leadership potential all make for important elements in agri-environmental management. They should thus be adequately addressed through policy design as well as flexible and adaptable contract terms. There is a broad potential to the integration of behavioral incentives in agri-environmental policy. Given the economic context in which agricultural production is embedded, I see behavioral incentives as a complement to financial incentives in the promotion of lasting behavioral change. However, rigorous scientific approaches are strongly recommended in the design of behavioral interventions in order to avoid unintended side effects. Pilot testing through lab and field experiments (such as those presented in this work), followed by an assessment, modification and re-evaluation procedure (or multiple thereof, if necessary), should be considered the most essential component to the design of behavioral interventions.

### **Future Research**

The research presented in this thesis opens up several perspectives for future research. First, a better understanding of the underlying motivations for contributions to an environmental threshold public good would be useful in the design of cAES and their incentive structure. Thus, it would be of interest to carry out studies that attempt to disentangle the three motives of financial rewards, empathy and environmental concern in the decision of farmers to contract under cAES. Second, it would be interesting to test whether the leadership effect of large territorial shares reproduces in absence of the financial incentive. That is, whether there is a purely ecologically motivated effect to contracting under the cAES or whether the collectively conditional subsidy mechanism alone drives major and stable contributions. This could be done in a natural field experiment, for example, by conducting randomized control trials among farmer communities. Third, in order to measure environmental outcomes to cAES and to provide feedback to farmers, the development of a reliable indicator for the measurement of environmental quality is imperative. To date, several proxies are used to assess the state of the ecosystem, as for example the count of burrows to assess the hamster population. However, none of these measures is very exact and more reliable methods for measuring environmental quality in real time need to be employed to grant immediate and adequate feedback in response to farmers' efforts. As such, bioindicators could be used, that rely on soil samples or the count of more easily traceable species such as invertebrates. Although this issue is very important for the implementation of cAES, it stretches beyond the economics discipline and would most likely be addressed by biologists and ecologists. Fourth, an experiment on Green Nudges is planned that would test the suggested nudge from the practitioners workshop. Ideally, a lab experiment could test the effect of the nudge on the general decision process in relation to people's environmental attitudes. A draft

for such an experiment is currently in development but needs to be developed and refined, a project that could be tackled during post-doctoral research. A further field study based on an RCT design could then examine whether the results reproduce in the real world and whether the nudge indeed makes for a viable complement to the financial payments proposed by cAES.



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# Appendix A

## Appendix to Chapter 1

### A.1 Combined Coefficients

For cases figuring in the first sequence, interaction terms as well as the sequence dummy take the value of zero, reducing the model to: for sequence = 0

$$\begin{aligned} Contr_{it} = & \alpha_0 + \alpha_1 L.SumC_{it} + \alpha_2 field_i \\ & + \alpha_4 US_i \\ & + \alpha_5 CS_i \\ & + \alpha_8 period_{it} \\ & + \alpha_{10} belief + \alpha_{12} field * belief_{it} \\ & + \alpha_{13} field * CS_{it} \\ & + \alpha_{14} RA_i + \gamma_i + \epsilon_{it} \end{aligned}$$

For cases figuring in the second sequence, interaction terms as well as the sequence dummy take the value of one, which allows for collapsing the joint coefficients to: for sequence = 1

$$\begin{aligned} Contr_{it} = & (\alpha_0 + \alpha_3) + \alpha_1 L.SumC_{it} + \alpha_2 field_i \\ & + (\alpha_4 + \alpha_5) US_i \\ & + (\alpha_6 + \alpha_7) CS_i \\ & + (\alpha_8 + \alpha_9) period_{it} \\ & + (\alpha_{10} + \alpha_{11}) belief_{it} \\ & + \alpha_{12} field * belief_{it} \\ & + \alpha_{13} field * CS_{it} \\ & + \alpha_{14} RA_i + \gamma_i + \epsilon_{it} \end{aligned}$$

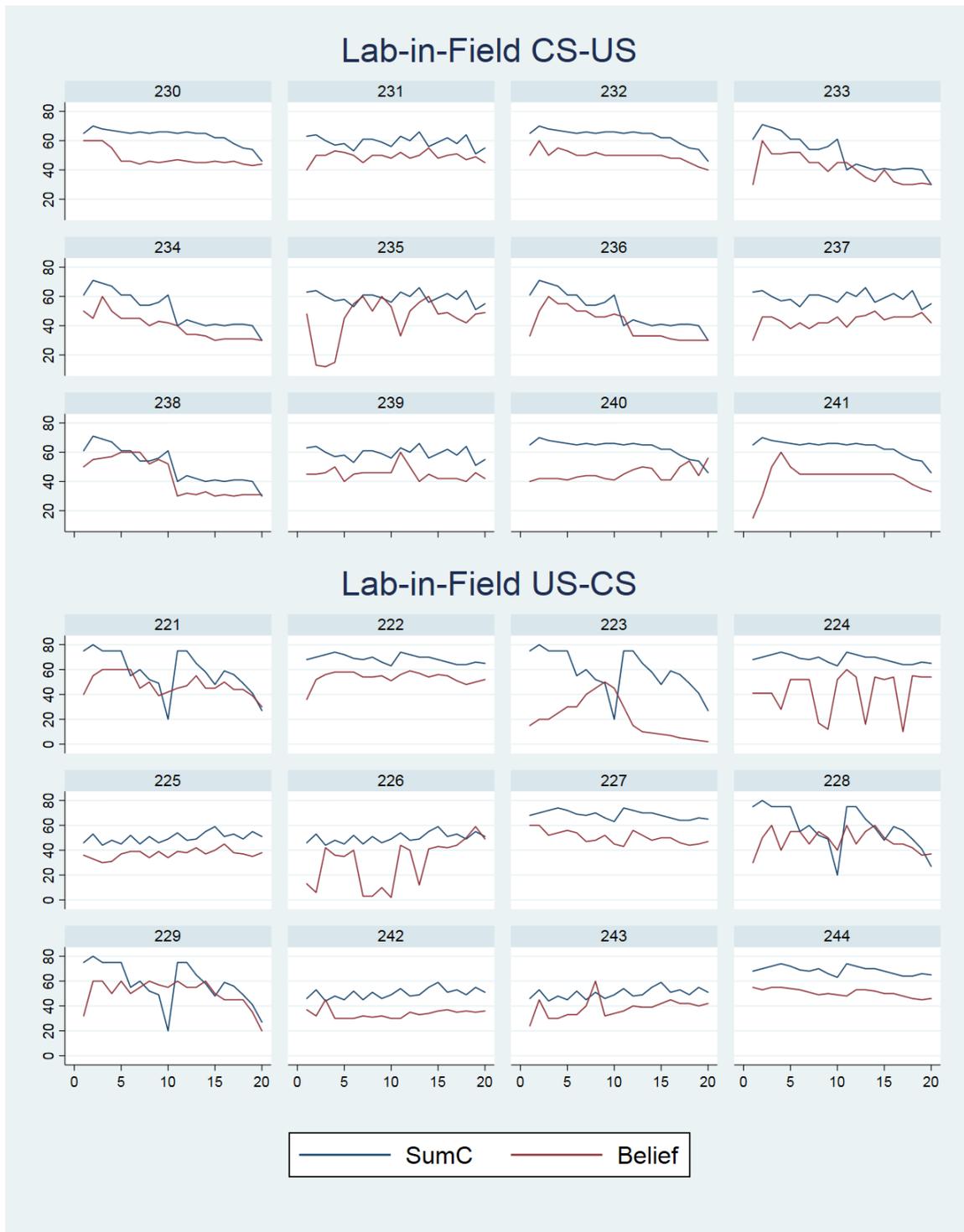
In order to identify the effect of sequence=1 on variables figuring in the respective interaction terms, combined coefficients are estimated for model 3 and 6 using Stata's `lincom` command.

Table A1 – Combined coefficients for sequence = 1 and field = 1 for Regression Models 3 and 6

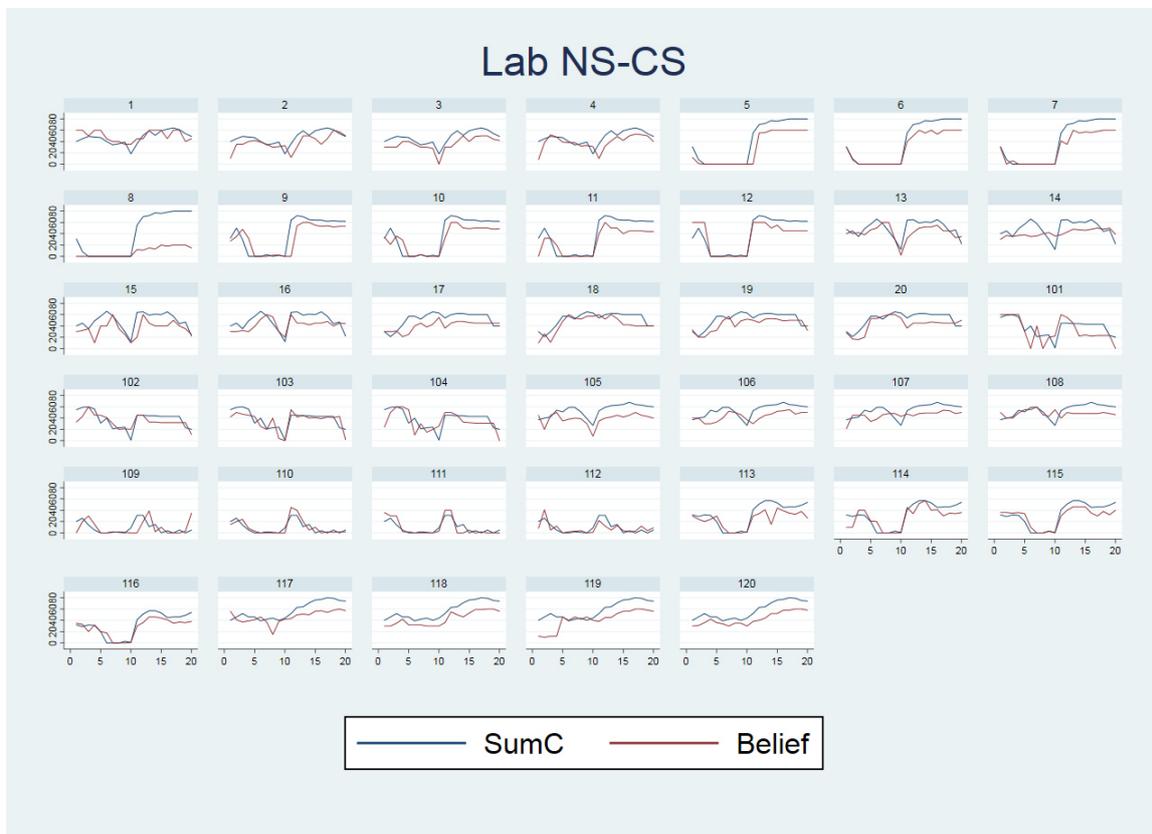
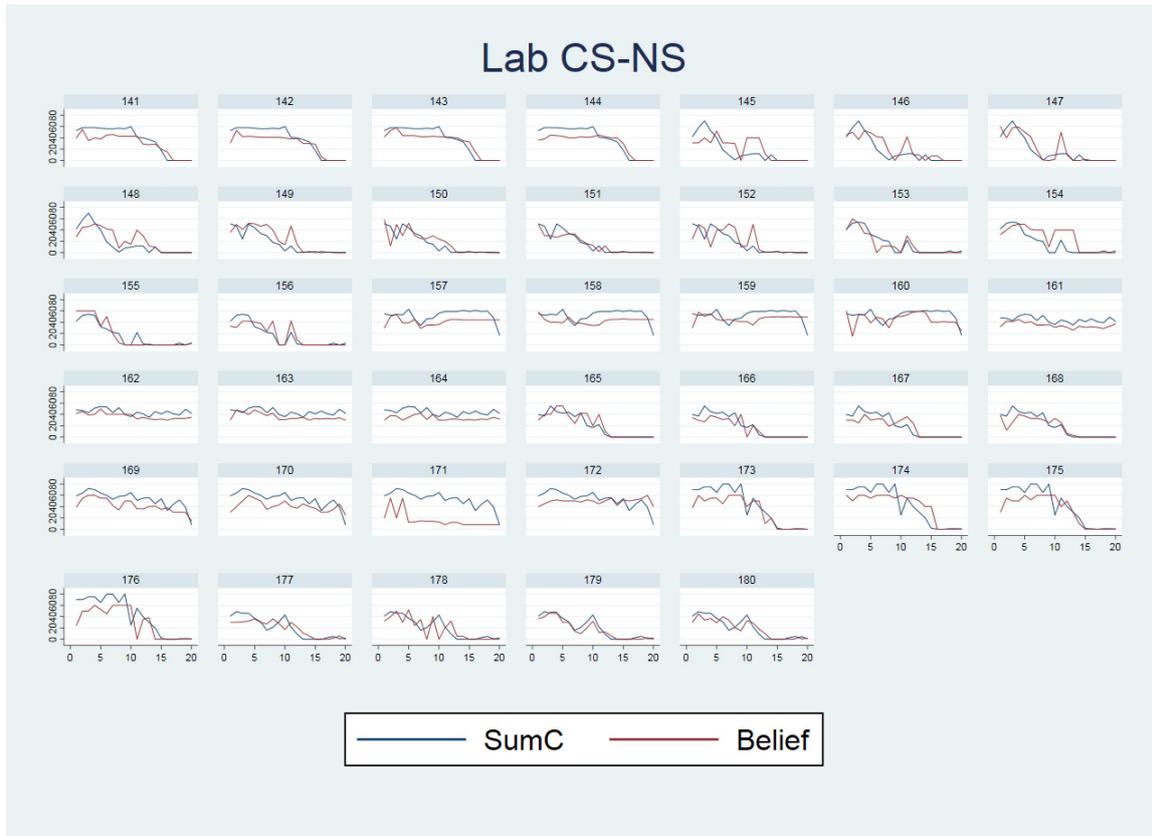
Model	Combined estimator	Coefficient	SE
(3)	US + seq*US	1.139***	.4144
	CS + seq*CS	1.451***	.4011
	period10 + seq*per	-.189***	.0338
	belief + seq*belief	.155***	.0118
	belief + field*belief	.102***	.0358
	belief + seq*belief + field*belief	.095**	.0387
	CS + field*CS	1.873***	.5204
	CS + seq*CS + field*CS	2.019***	.5125
(6)	US + seq*US	3.982***	.9599
	CS + seq*CS	4.644***	1.014
	period10 + seq*per	-1.036***	.1294
	belief + seq*belief	.3216***	.0320
	belief + field*belief	.078	.0799
	belief + seq*belief + field*belief	.0940	.0809
	CS + field*CS	4.4708**	1.997
	CS + seq*CS + field*CS	7.237***	1.9622

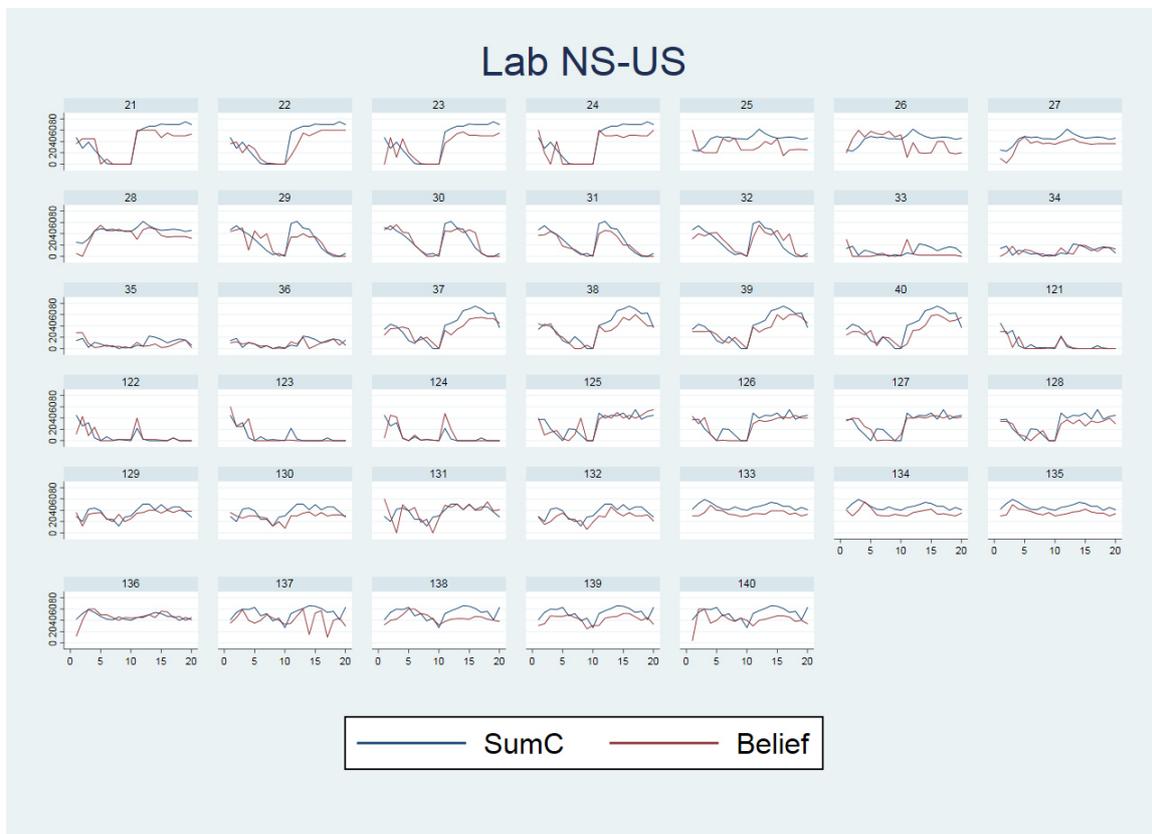
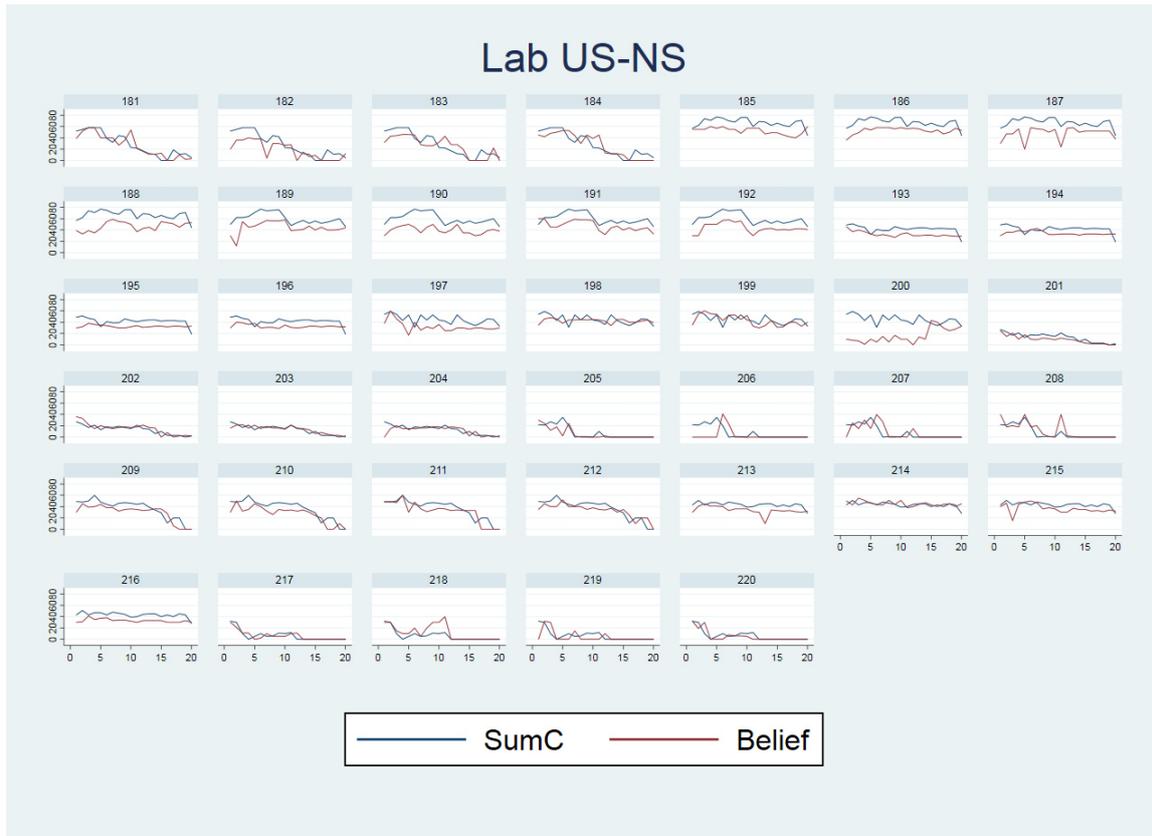
## A.2 Beliefs over others' contributions and actual contributions

Figures A.1 (a) - (h): Graphs on beliefs over others' contributions and actual group contributions by treatment sequence.



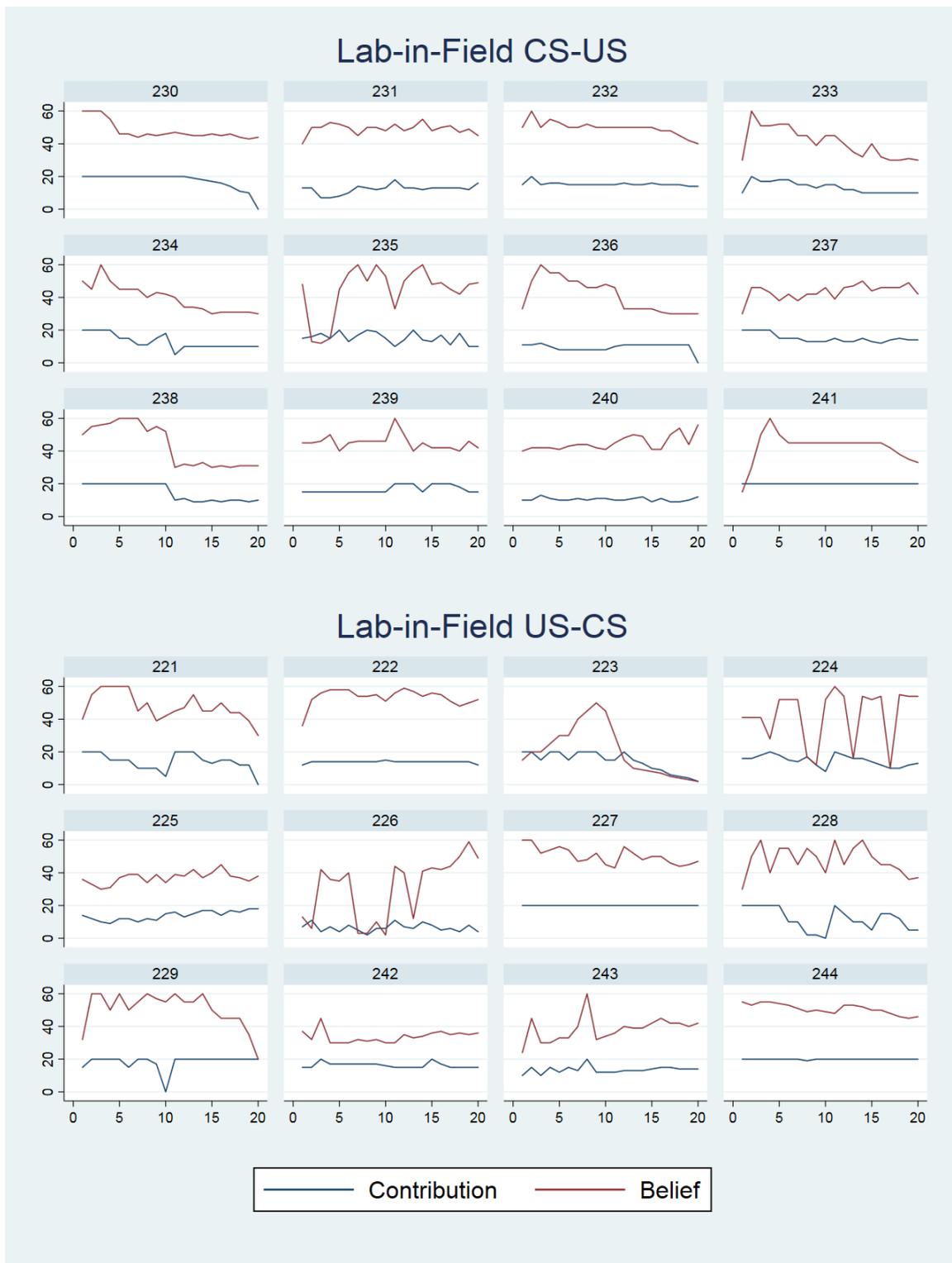
APPENDIX



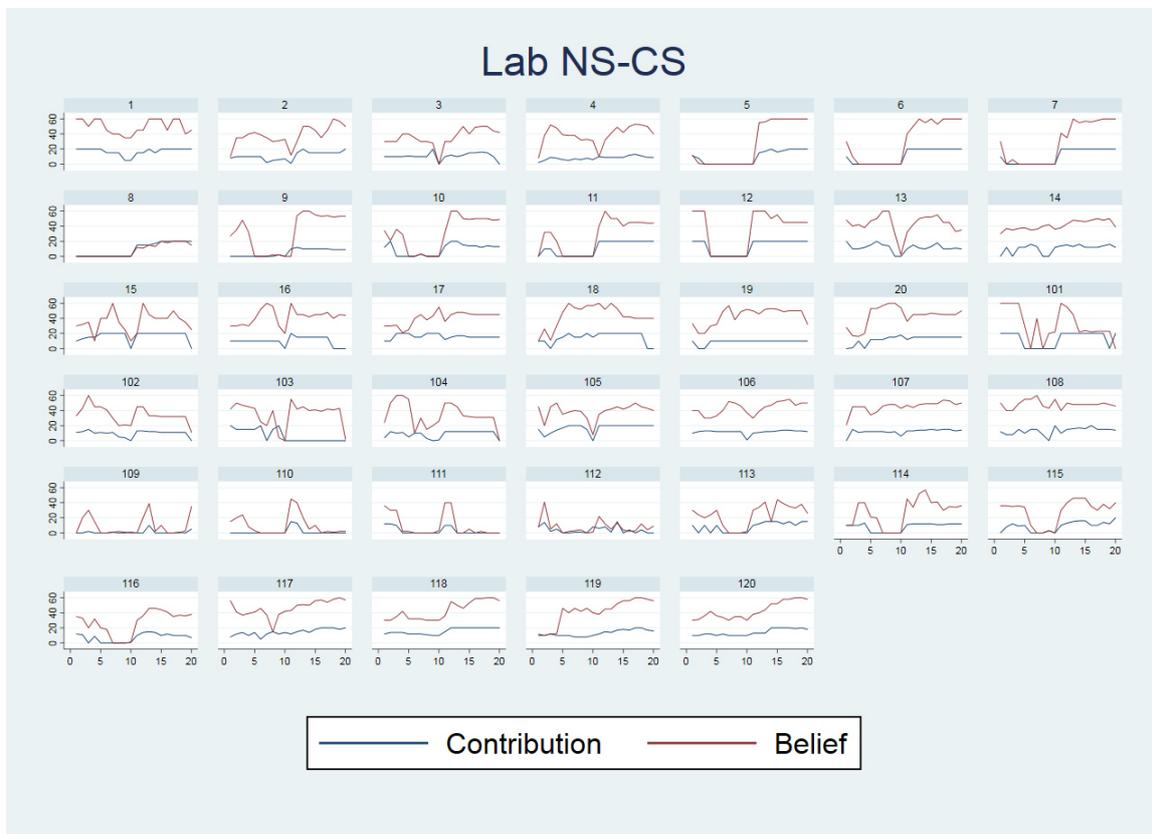
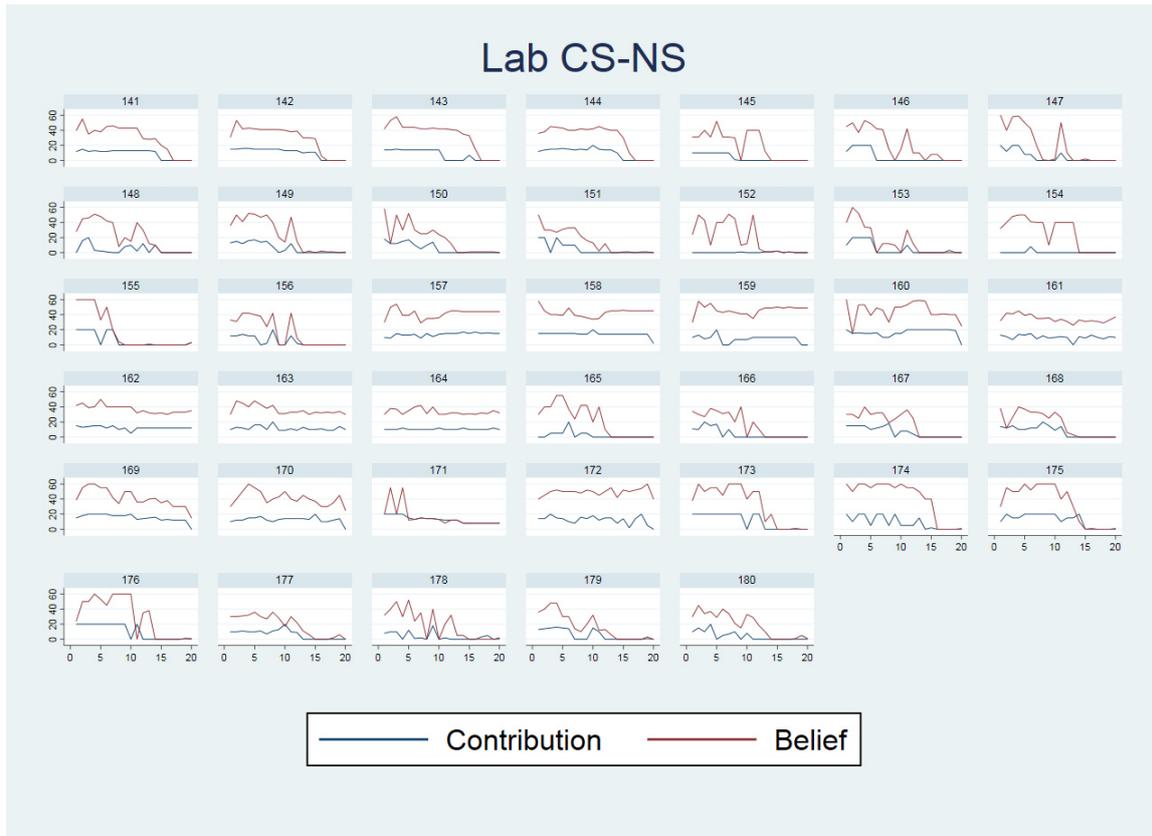


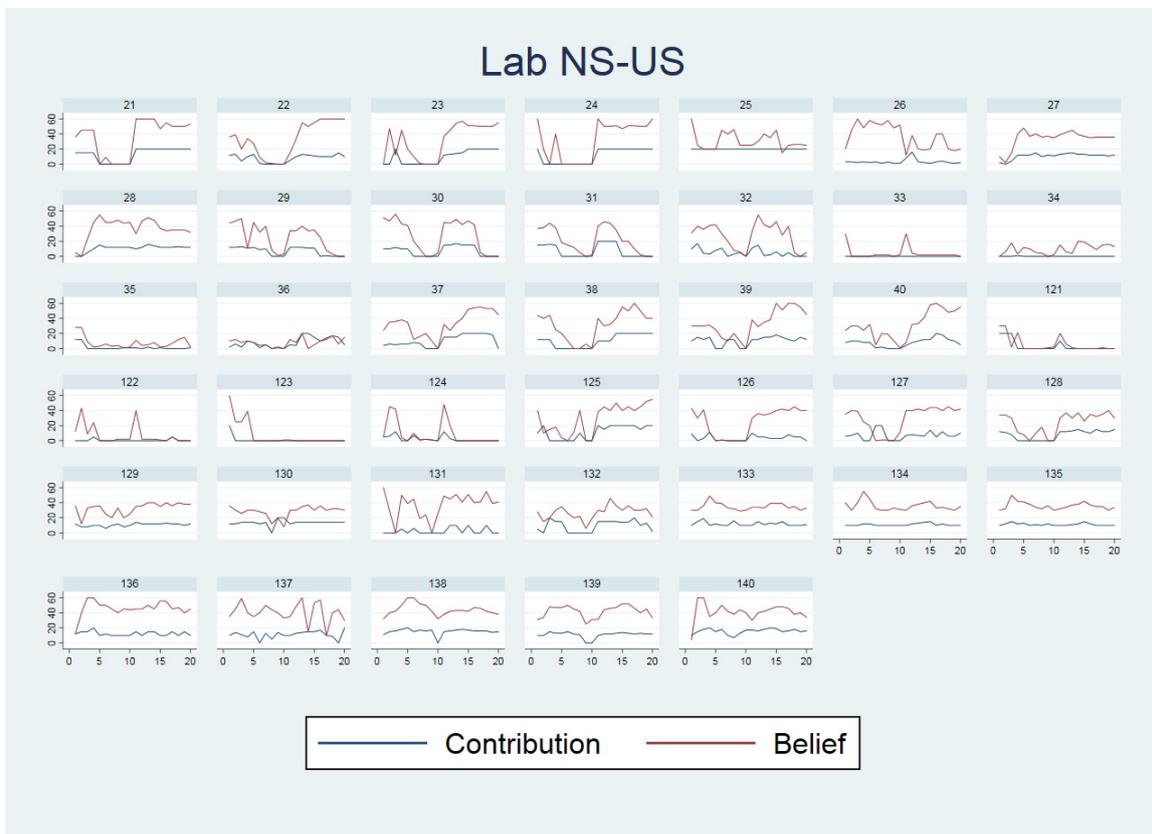
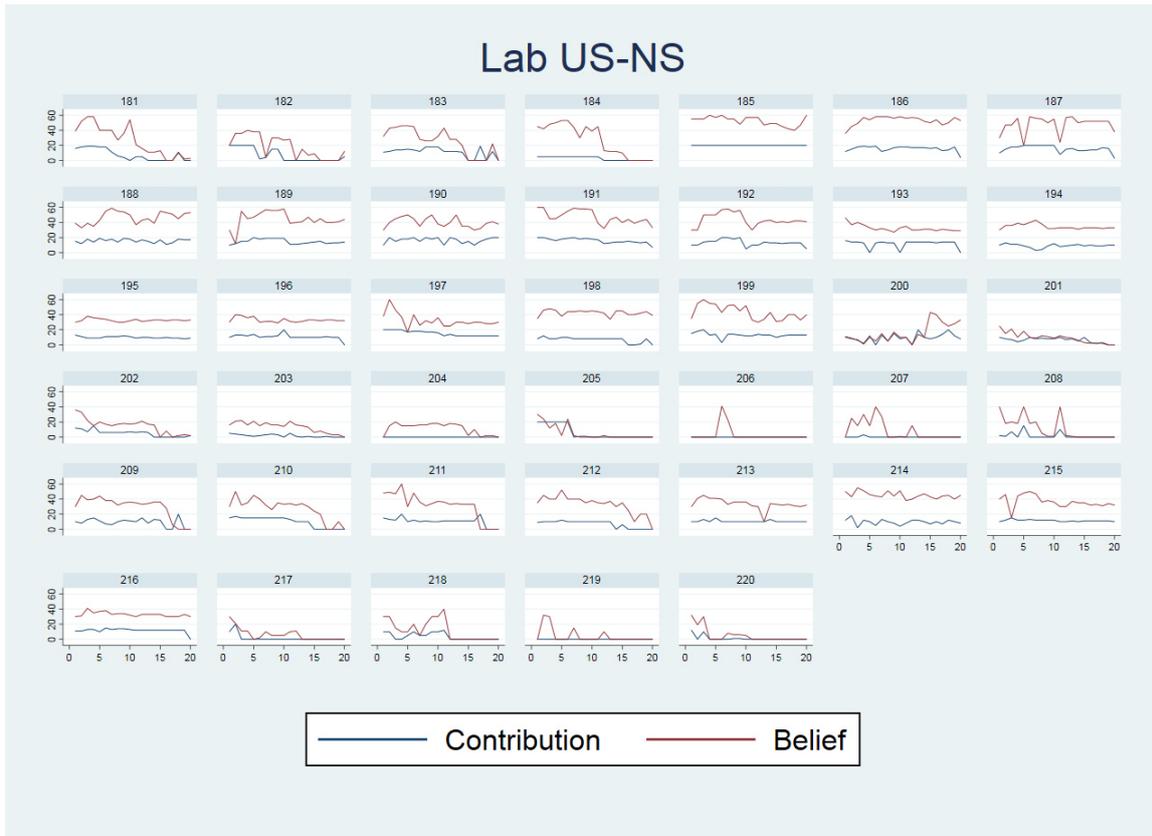


Figures A.2 (a) - (h): Graphs on beliefs over others' contributions and individual contributions by treatment sequence.

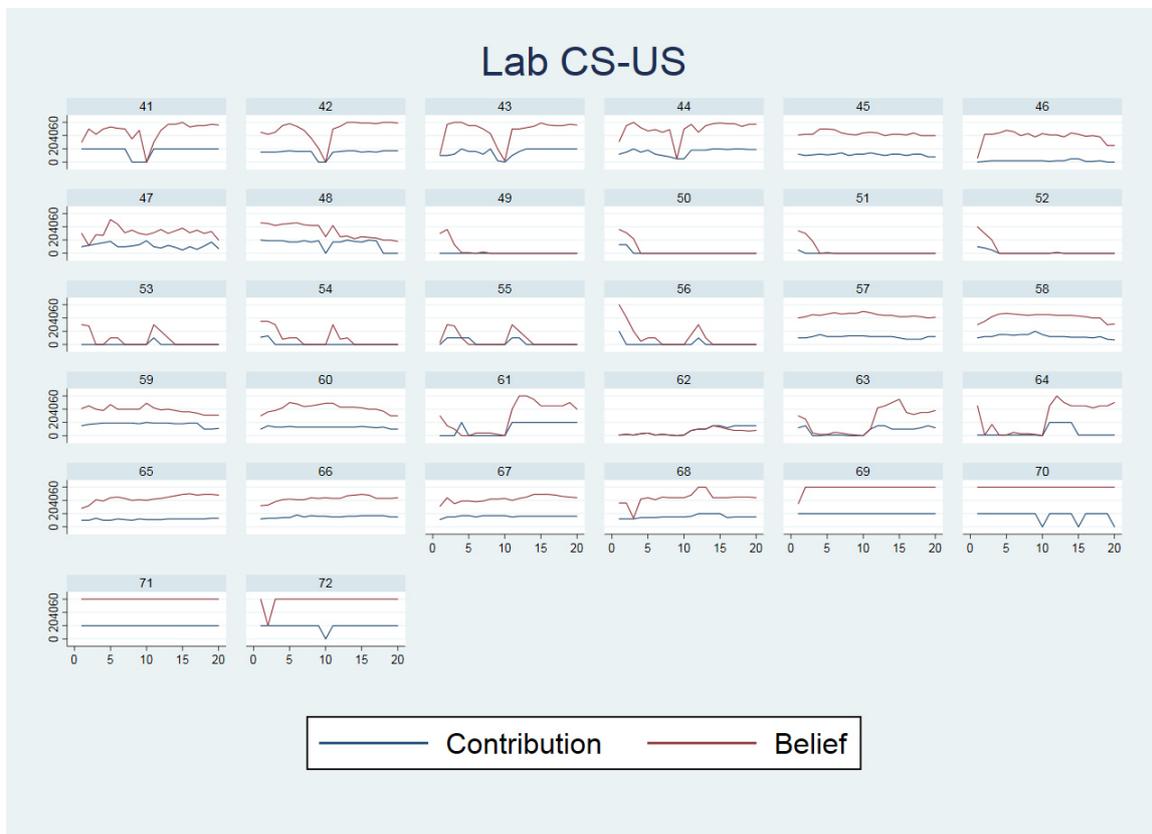
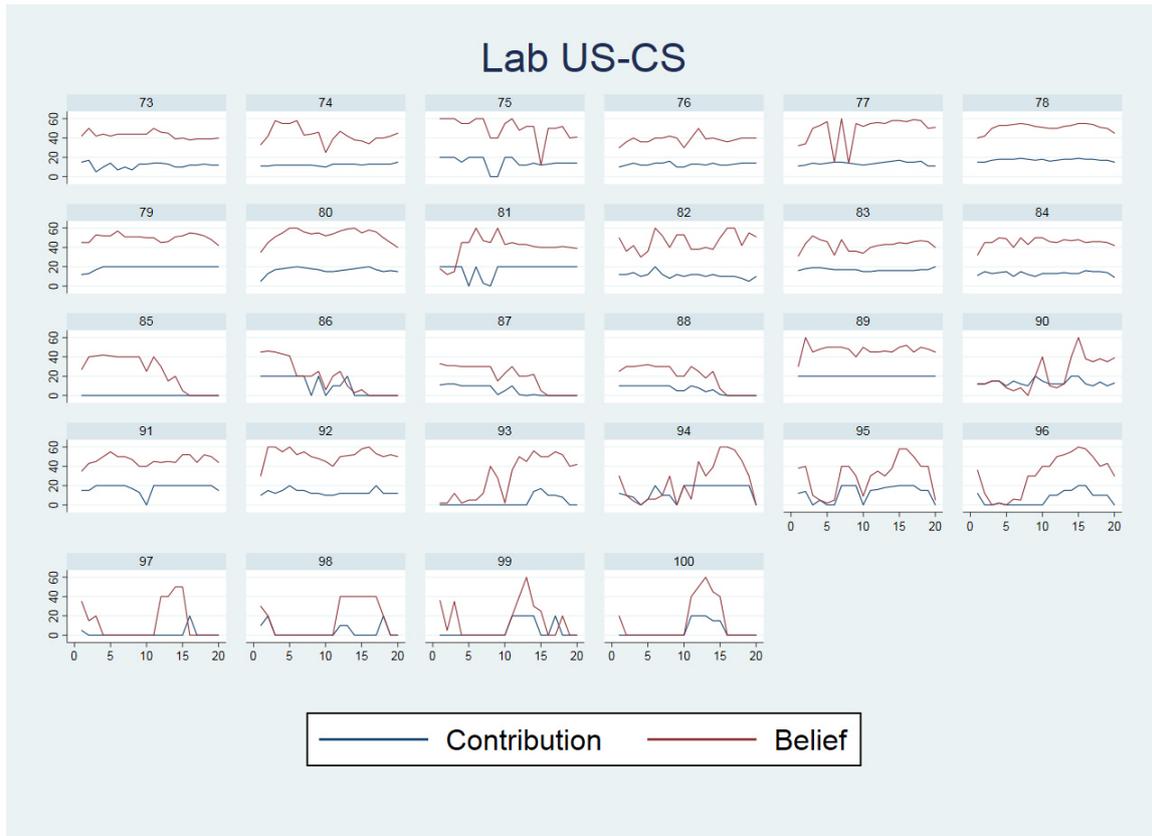


APPENDIX





APPENDIX



## A.3 Experimental Protocol

### INSTRUCTIONS traitement US-CS:

L'expérience à laquelle vous allez participer est destinée à l'étude des décisions sur les pratiques agricoles en Alsace. Toutes vos réponses seront traitées de façon anonyme. Vous indiquerez vos choix sur votre iPad et vos gains réalisés au cours de l'expérience vous seront communiqués à la fin de l'expérience. A partir de maintenant, il vous est demandé de ne plus parler. Si vous avez une question, levez la main et un expérimentateur viendra vous répondre en privé.

Durant toute l'expérience, vos gains seront exprimés en points. A la fin de l'expérience, le nombre total de points que vous aurez gagnés sera converti en euros selon la règle suivante :

$$1 \text{ point} = 6 \text{ centimes d'euro.}$$

L'expérience comporte 3 séquences. Votre rémunération pour cette expérience sera égale à la somme de votre gain pour la séquence 1 et de votre gain pour l'une des deux autres séquences (2 ou 3). En d'autres termes **une des deux dernières séquences sera tirée au sort pour être rémunérée en plus de la première séquence.**

A la fin de la séquence 3 **nous récapitulerons l'ensemble des points que vous avez gagnés dans les différentes séquences et nous tirerons au sort une séquence (entre la séquence 2 et la séquence 3). Vous serez ainsi informés de votre gain final, en euros, pour l'expérience.**

En plus des gains liés à l'expérience et afin de vous indemniser pour votre déplacement, un forfait de participation de 15 euros vous sera versé à la fin de l'expérience.

Avant chaque séquence, vous devrez répondre à une série de questions qui a pour objet de vérifier votre compréhension des instructions. Les réponses données à ces questions n'interviennent pas dans le calcul de vos gains.

### SEQUENCE 1

Dans cette séquence, vous devrez prendre une décision pour chacun des **10 jeux différents**. Lisez attentivement pour identifier la différence entre les jeux. Pour chacun de ces jeux vous devrez choisir entre A et B.

- Si vous choisissez A, vous recevrez un **gain certain** de 20,5 points.
- Si vous choisissez B, vous aurez un **pourcentage de chance** donné de recevoir 40 points, et un pourcentage de chance donné de recevoir 1 seul point. Ce pourcentage varie dans les différents jeux selon les modalités indiquées dans le tableau ci-dessous:

## APPENDIX

	<b>A</b>	<b>B</b>
Jeu 1	Gain certain de 20,5 points	10% de chance de recevoir 40 points 90% de chance de recevoir 1 point
Jeu 2	Gain certain de 20,5 points	20% de chance de recevoir 40 points 80% de chance de recevoir 1 point
Jeu 3	Gain certain de 20,5 points	30% de chance de recevoir 40 points 70% de chance de recevoir 1 point
Jeu 4	Gain certain de 20,5 points	40% de chance de recevoir 40 points 60% de chance de recevoir 1 point
Jeu 5	Gain certain de 20,5 points	50% de chance de recevoir 40 points 50% de chance de recevoir 1 point
Jeu 6	Gain certain de 20,5 points	60% de chance de recevoir 40 points 40% de chance de recevoir 1 point
Jeu 7	Gain certain de 20,5 points	70% de chance de recevoir 40 points 30% de chance de recevoir 1 point
Jeu 8	Gain certain de 20,5 points	80% de chance de recevoir 40 points 20% de chance de recevoir 1 point
Jeu 9	Gain certain de 20,5 points	90% de chance de recevoir 40 points 10% de chance de recevoir 1 point
Jeu 10	Gain certain de 20,5 points	Gain certain de 40 points

Vous devrez indiquer votre choix pour chacun des 10 jeux. Une fois vos choix effectués, appuyez sur la touche OK.

Rémunération : Pour calculer votre gain pour la séquence, un jeu parmi les 10 sera tiré au sort. Si, pour ce jeu, vous avez choisi A, vous recevrez automatiquement 20,5 points. Si vous avez choisi B, votre gain résultera d'un tirage au sort respectant les probabilités annoncées. Les gains réalisés vous seront indiqués à la fin de l'expérience.

## SEQUENCE 2

Pour cette séquence, des groupes de 4 agriculteurs sont formés aléatoirement. Vous ne pouvez pas identifier les autres membres de votre groupe et ces derniers ne peuvent pas vous identifier. Vos gains vont dépendre de vos décisions ainsi que des décisions des 3 autres membres de votre groupe.

Dans cette séquence, nous vous demandons de considérer que vous disposez d'une surface agricole utile (SAU) de 20 hectares située dans une aire d'alimentation de captage d'eau potable (AAC). Chaque groupe étant composé de 4 exploitants agricoles, on suppose que l'AAC s'étend sur 80 hectares au total (4 fois 20 hectares). L'aire de captage a des concentrations en nitrates élevées. Vos activités agricoles peuvent avoir un impact sur la qualité de l'eau du captage.

Vous avez la possibilité, afin de diminuer les rejets de nitrates, de changer de pratiques agricoles. Pensez maintenant à au moins deux pratiques qui permettent de réduire la quantité de nitrates dans l'eau souterraine et que vous connaissez déjà.

Pour simplifier nous parlerons de bonnes pratiques bas-intrants (BPBI). Ces pratiques peuvent entraîner une réduction de votre profit individuel, mais elles peuvent aussi conduire à une amélioration de la qualité de l'eau. Ces coûts et bénéfices seront précisés par la suite.

Vous avez la possibilité d'engager tout ou partie des 20 hectares de votre SAU dans les BPBI, le reste de vos hectares étant alors non engagé et consacré à l'agriculture conventionnelle.

Si la moitié ou plus de la moitié de la SAU de l'AAC est engagée dans les BPBI, soit 40 hectares ou plus, alors la qualité de l'eau du captage s'améliore significativement, ce qui génère un bénéfice pour tous les agriculteurs de votre groupe.

Cette séquence comporte 10 périodes. **Chaque période présente les mêmes conditions initiales. Les agriculteurs qui composent votre groupe resteront les mêmes à chaque période, jusqu'à la fin de la séquence.** Au début de chaque période, vous et les 3 autres agriculteurs de votre groupe êtes donc dotés chacun de 20 hectares situés dans l'AAC. A chaque période, vous avez la possibilité d'engager tout ou partie de vos 20 hectares dans les BPBI pour améliorer la qualité de l'eau du captage. Les hectares non engagés restent alors consacrés à l'agriculture conventionnelle. Vous êtes libre d'engager n'importe quel nombre entier d'hectares compris entre 0 et 20.

Rémunération : Chaque hectare non engagé dans les BPBI vous rapporte 1 point. Ainsi, si vous maintenez tels quels 6 hectares de votre SAU, votre gain est de 6 points et vous seul remportez ces 6 points. **Si 40 hectares ou plus sont engagés dans les BPBI à l'échelle de l'AAC**, alors la qualité de l'eau du captage est améliorée et **chaque hectare engagé dans les BPBI** (par vous-même ou l'un des agriculteurs de votre groupe) **rapporte un bénéfice de 0,3 point à chacun des exploitants agricoles de l'AAC** (cf. page 7, annexe I : tableau des gains). Si la surface convertie est inférieure à 40 hectares, alors l'amélioration de la qualité de l'eau n'est pas suffisante et cela ne rapporte aucun point à personne.

**Un mécanisme de subvention** porte sur le nombre d'hectares engagés individuellement

dans les BPBI. **Le montant de la subvention est de 0,3 point par hectare que vous engagez dans les BPBI, que le seuil de 40 hectares soit atteint ou non.** Le tableau de l'annexe II (cf. page 8) vous permet de calculer votre subvention en fonction du nombre d'hectares engagés.

Exemple 1 : Vous décidez d'engager 12 hectares de votre SAU dans les BPBI, donc 8 hectares de cette surface restent associés aux pratiques conventionnelles. Supposons que les 3 autres agriculteurs de votre groupe engagent au total 38 hectares dans les BPBI. La surface totale engagée au sein de l'aire de captage atteint donc 50 hectares (38 + 12). Le seuil de 40 hectares étant dépassé, l'amélioration de la qualité de l'eau rapporte un bénéfice de  $0,3 \times 50 = 15$  points à chaque exploitant agricole de l'AAC.

Ainsi, votre gain total comporte ces 15 points auxquels se rajoutent 8 points provenant des 8 hectares non engagés ( $20 - 12$ ), ainsi que la subvention égale à 0,3 point par hectare engagé, soit  $0,3 \times 12 = 3,6$  points. Votre gain total pour la période est donc de 26,6 points ( $15 + 8 + 3,6$ ).

Exemple 2 : Vous engagez 8 hectares de votre SAU dans les BPBI, donc 12 hectares de cette surface restent associés aux pratiques conventionnelles. Supposons que les 3 autres agriculteurs engagent au total 8 hectares dans les BPBI. La surface totale engagée au sein de l'aire de captage est donc 16 hectares ( $8 + 8$ ) et le seuil de 40 hectares n'est pas atteint. L'amélioration de la qualité de l'eau n'est pas suffisante et ne rapporte donc aucun point (bénéfice = 0 point).

Ainsi, vous gagnez 12 points provenant des 12 hectares non engagés ( $20 - 8$ ), auxquels se rajoute la subvention égale à 0,3 point par hectare engagé soit  $0,3 \times 8 = 2,4$  points. Votre gain total pour la période est donc de 14,4 points ( $12 + 2,4 + 0$ ).

### **Estimation du nombre total d'hectares engagés dans les BPBI par les 3 autres exploitants agricoles de l'AAC :**

Vous devrez à chaque période estimer le nombre total d'hectares engagés dans les BPBI par les 3 autres exploitants agricoles de l'AAC. Votre gain lié à cette estimation dépend de la différence entre votre estimation et la surface exacte effectivement engagée par les autres membres du groupe. Plus vous serez proche du nombre d'hectares effectif, plus votre gain sera élevé. Le tableau ci-dessous vous donne votre gain en fonction de la différence entre l'estimation et le nombre effectif :

**Tableau Estimation.** Gains liés à la différence entre le nombre estimé et le nombre effectif d'hectares engagés dans les BPBI par les 3 autres exploitants agricoles de l'AAC :

Différence estimation	Gain lié à l'estimation
0 (estimation exacte)	5 points
Plus ou moins 1 hectare	4 points
Plus ou moins 2 hectares	3 points
Supérieur à 2 hectares (en plus ou en moins)	0 point

Exemple 1 : Vous avez estimé que les 3 autres agriculteurs engageraient 31 hectares dans les BPBI. A la fin de la période, il s'avère qu'ils ont effectivement engagé 31 hectares. Vous gagnez donc 5 points (cf. tableau estimation).

Exemple 2 : Vous avez estimé que les 3 autres agriculteurs engageraient 31 hectares dans les BPBI. A la fin de la période, il s'avère qu'ils ont engagé 33 hectares. L'écart entre votre estimation et le nombre effectif est de 2 hectares. Vous gagnez donc 3 points (cf. tableau estimation).

#### **Déroulement d'une période :**

Chaque période, vous devrez tout d'abord indiquer sur votre iPad un nombre entier compris entre 0 et 20 correspondant au nombre d'hectares que vous décidez personnellement d'engager dans les BPBI. Les hectares non engagés dans les BPBI représenteront alors la surface restant consacrée à l'agriculture conventionnelle.

Puis vous devrez écrire le nombre d'hectares que vous pensez que les trois agriculteurs de votre groupe engageront au total dans les BPBI. Le nombre doit être un entier compris entre 0 (si vous pensez que les 3 autres agriculteurs n'engagent aucun hectare dans les BPBI) et 60 hectares (si vous pensez que les 3 autres agriculteurs engagent chacun leurs 20 hectares dans les BPBI).

**Lorsque tous les exploitants agricoles auront pris leur décision,** votre décision (nombre d'hectares engagés dans les BPBI) sera afficher sur votre iPad, ainsi que le nombre total d'hectares engagés à l'échelle de l'AAC, le montant de la subvention obtenue, le montant obtenu du fait du maintien en agriculture conventionnelle, le bénéfice éventuel lié à l'amélioration de la qualité de l'eau du captage et donc vos gains totaux pour la période.

**Annexe I : Evolution du montant du bénéfice pour le groupe :**

Hectares engagés dans les BPBI par le groupe	Bénéfice issu de cet engagement pour chaque membre du groupe	Hectares engagés dans les BPBI par le groupe	Bénéfice issu de cet engagement pour chaque membre du groupe
< 40	0	60	18
40	12	61	18,3
41	12,3	62	18,6
42	12,6	63	18,9
43	12,9	64	19,2
44	13,2	65	19,5
45	13,5	66	19,8
46	13,8	67	20,1
47	14,1	68	20,4
48	14,4	69	20,7
49	14,7	70	21
50	15	71	21,3
51	15,3	72	21,6
52	15,6	73	21,9
53	15,9	74	22,2
54	16,2	75	22,5
55	16,5	76	22,8
56	16,8	77	23,1
57	17,1	78	23,4
58	17,4	79	23,7
59	17,7	80	24
60	18		

**Annexe II : Gains liés à la subvention :**

Hectares engagés dans les BPBI	Montant de la subvention
0	0
1	0,3
2	0,6
3	0,9
4	1,2
5	1,5
6	1,8
7	2,1
8	2,4
9	2,7
10	3
11	3,3
12	3,6
13	3,9
14	4,2
15	4,5
16	4,8
17	5,1
18	5,4
19	5,7
20	6

**SEQUENCE 3**

La composition des groupes est **identique** à celle de la séquence précédente et restera inchangée jusqu'à la fin de l'expérience. Comme dans la séquence 2, au début de chacune des 10 périodes, chaque exploitant agricole de l'AAC dispose d'une SAU de 20 hectares qu'il peut engager en partie ou totalement dans les BPBI, pour une surface comprise entre 0 et 20 hectares. Les gains relatifs au bénéfice, ainsi que ceux relatifs à la surface non engagée sont identiques à ceux de la séquence 2. L'annexe I vous sert donc toujours afin de calculer ces gains.

**La différence avec la séquence 2 réside dans la modification du mécanisme de subvention. Dans cette séquence, le montant de la subvention que vous touchez est de 0,3 point par hectare que vous aurez vous-même engagé, seulement si la surface totale engagée par le groupe atteint ou dépasse 40 hectares.** Le tableau de l'annexe II (cf. page 8) vous permet toujours de calculer votre subvention en fonction du nombre d'hectares engagés. **Dans le cas où le seuil de 40 hectares n'est pas atteint par le groupe, alors vous ne toucherez pas la subvention.**

Exemple 1 : Vous décidez d'engager 12 hectares de votre SAU dans les BPBI, donc 8 hectares de cette surface restent associés aux pratiques conventionnelles. Supposons que les 3 autres agriculteurs de votre groupe engagent au total 38 hectares dans les BPBI. La surface totale engagée au sein de l'aire de captage atteint donc 50 hectares (38 + 12). Le seuil de 40 hectares étant dépassé, l'amélioration de la qualité de l'eau rapporte un bénéfice de  $0,3 \times 50 = 15$  points à chaque exploitant agricole de l'AAC. Ainsi, votre gain total comporte ces 15 points auxquels se rajoutent 8 points provenant des 8 hectares non engagés (20 - 12), ainsi que la subvention égale à 0,3 point par hectare engagé puisque le seuil de 40 hectares engagés par le groupe est atteint, soit  $0,3 \times 12 = 3,6$  points. Votre gain total pour la période est donc de 26,6 points (15 + 8 + 3,6).

Exemple 2 : Vous engagez 8 hectares de votre SAU dans les BPBI, donc 12 hectares de cette surface restent associés aux pratiques conventionnelles. Supposons que les 3 autres agriculteurs engagent au total 8 hectares dans les BPBI. La surface totale engagée au sein de l'aire de captage est donc 16 hectares (8 + 8) et le seuil de 40 hectares n'est pas atteint. Le bénéfice lié à l'amélioration de la qualité de l'eau n'est pas suffisante et ne rapporte donc aucun point (bénéfice = 0 point). Ainsi, votre gain total comporte 12 points provenant des 12 hectares non engagés (20 - 8), et la subvention ne vous est pas versée dans la mesure où le seuil de 40 hectares engagés par le groupe n'est pas atteint (subvention = 0 point). Votre gain total pour la période est donc de 12 points (12 + 0 + 0).

**Déroulement d'une période :**

Le déroulement est identique à celui de la séquence 2 (la séquence précédente).

# Appendix B

## Appendix to Chapter 2

Table B1 – Yearly payment for the collective engagement of the cAES “*Hamster 01*” depending on contribution level (threshold at 24% in 2013, threshold at 26% from 2018 on). Source: Dominiak (2016)

Contribution Level CZ	Paid amount (€ / ha of favorable crops)
<b>24%</b>	435
25%	444
<b>26%</b>	452
27%	459
28%	466
29%	472
30%	478
31%	483
32%	488
33%	493
34%	498
35%	502
36%	506
37%	510
38%	513
39%	517
≥ 40%	520

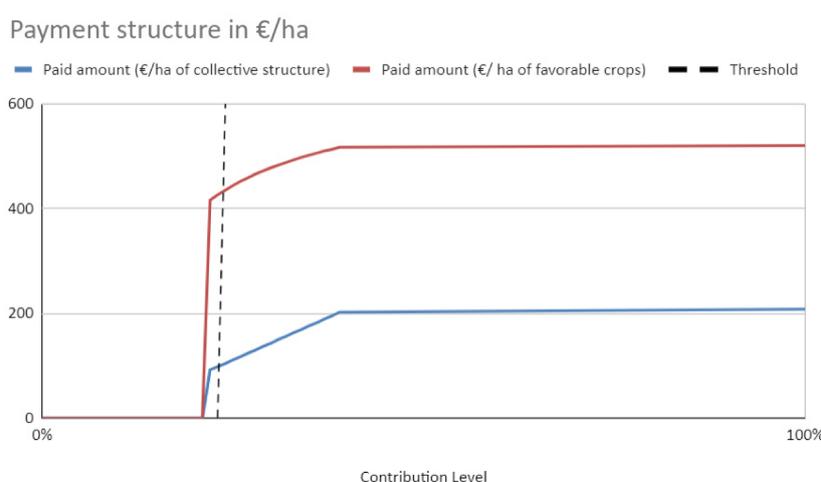


Figure B.1 – Payment structure of the collective subsidy scheme (€ per hectare).

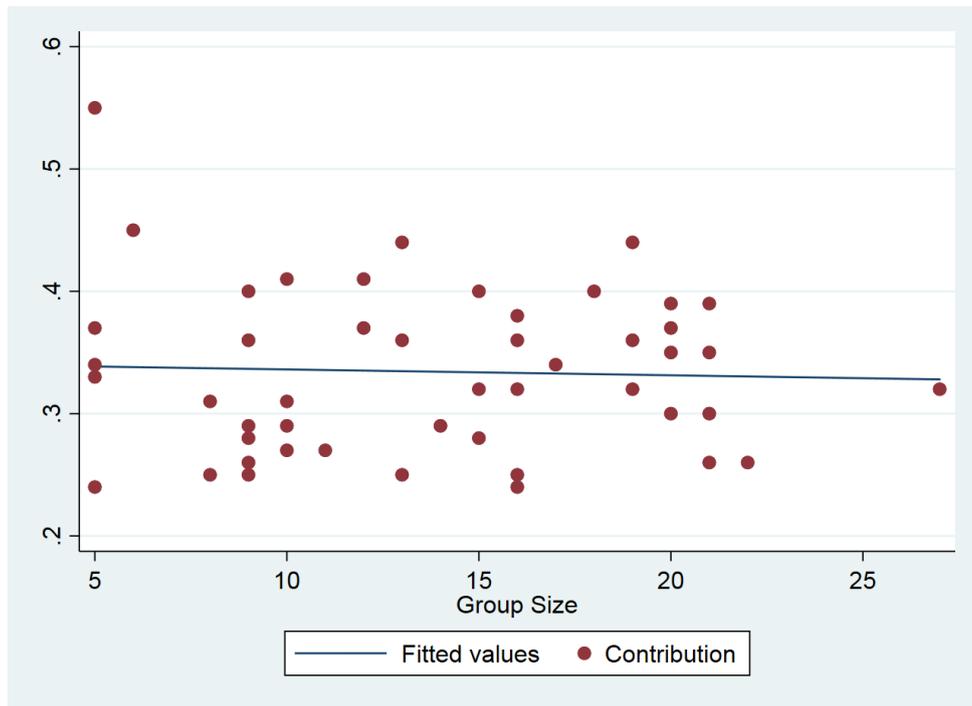


Figure B.2 – Scatter plot between group size and percentage of surface contributed in the zone ( $r(48) = -0.0401$ ,  $p = 0.7865$ ).

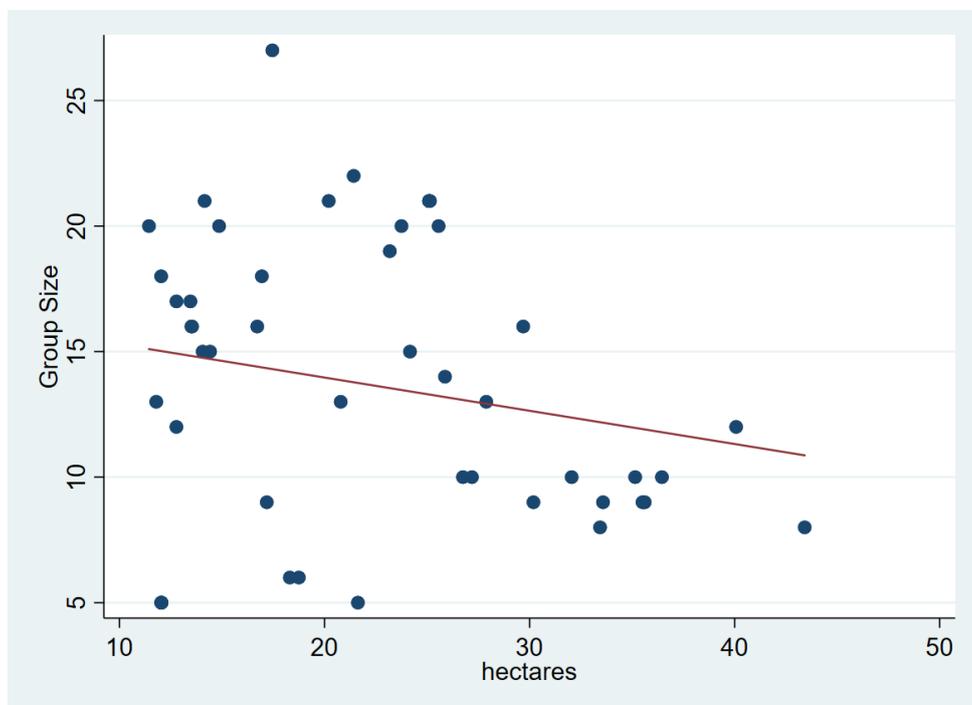


Figure B.3 – Scatter plot between group size and hectares per member contributed under cAES ( $r(48) = -0.2039$ ,  $p = 0.1645$ ).

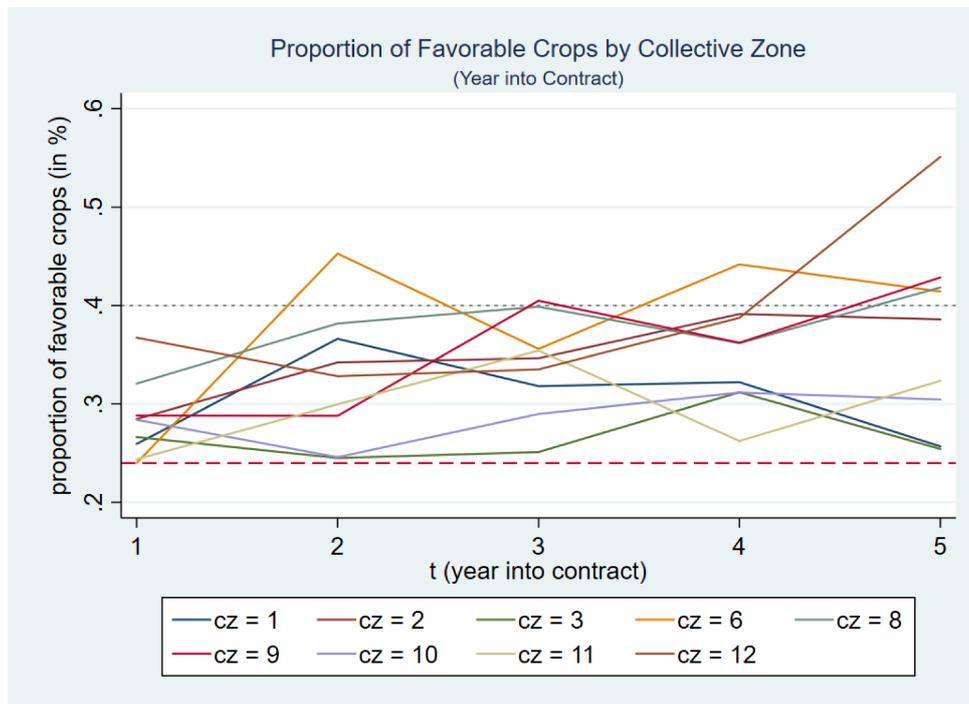


Figure B.4 – Rate of favorable crops by collective zones per year since start of AES contract. Note. y1 = 2013 for zones 1, 2, 3, 5, 6 & 7; y1 = 2014 for zones 8, 9, 10 & 11; y1 = 2015 for zone 12. From 2013 to 2017 zones 1, 5 & 7 were combined into one CZ. The threshold is situated at .24 (dashed line), the ceiling is situated at .4 (dotted line).

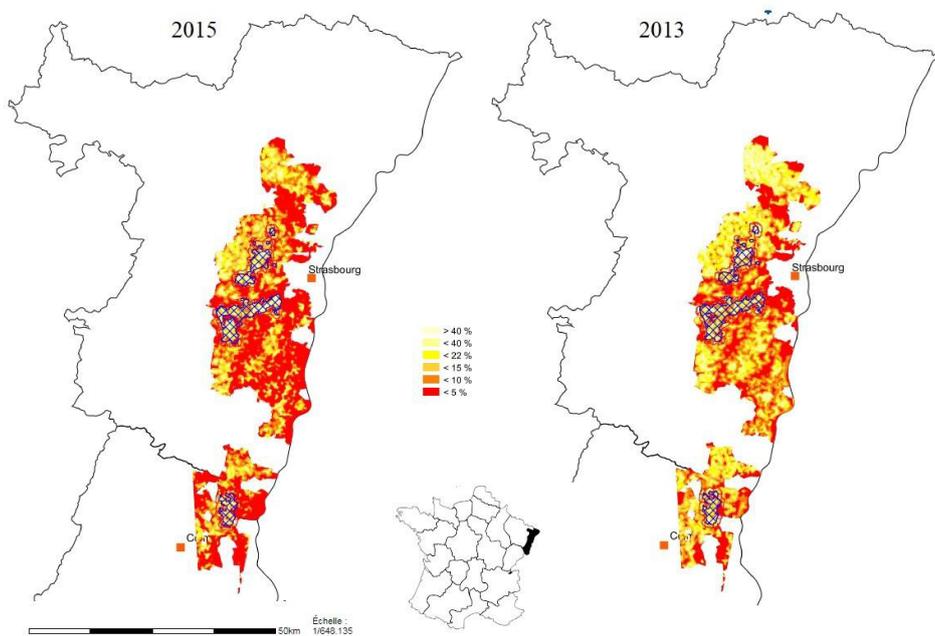


Figure B.5 – Map of France showing the location of the region of Alsace (marked in black). Surface of favorable crops in Alsace for the years 2013 and 2015. Favorable crops from less than 5% (red) to over 40% (light yellow) and corresponding Strict Protection Zones in blue. Source: Cartographie Interactive DREAL Alsace. Retrieved 10/03/2020 from: [http://carmen.developpement-durable.gouv.fr/5/Carte\\_Alsace.map](http://carmen.developpement-durable.gouv.fr/5/Carte_Alsace.map)

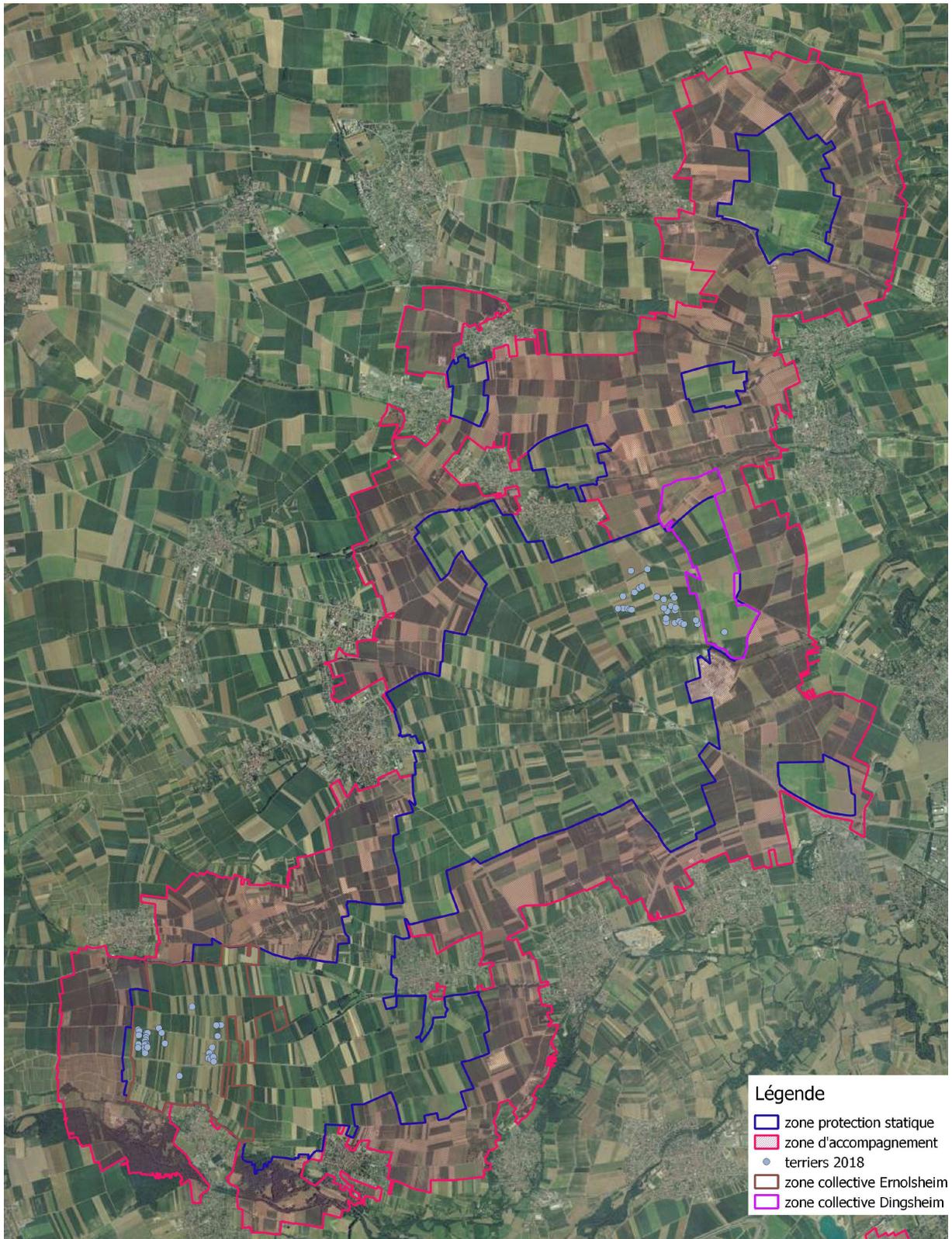


Figure B.6 – Collective zones and burrows within SPZ Nord in 2018. Reprinted from (Virion 2018, p.117). Copyright (2018), with permission from DREAL.

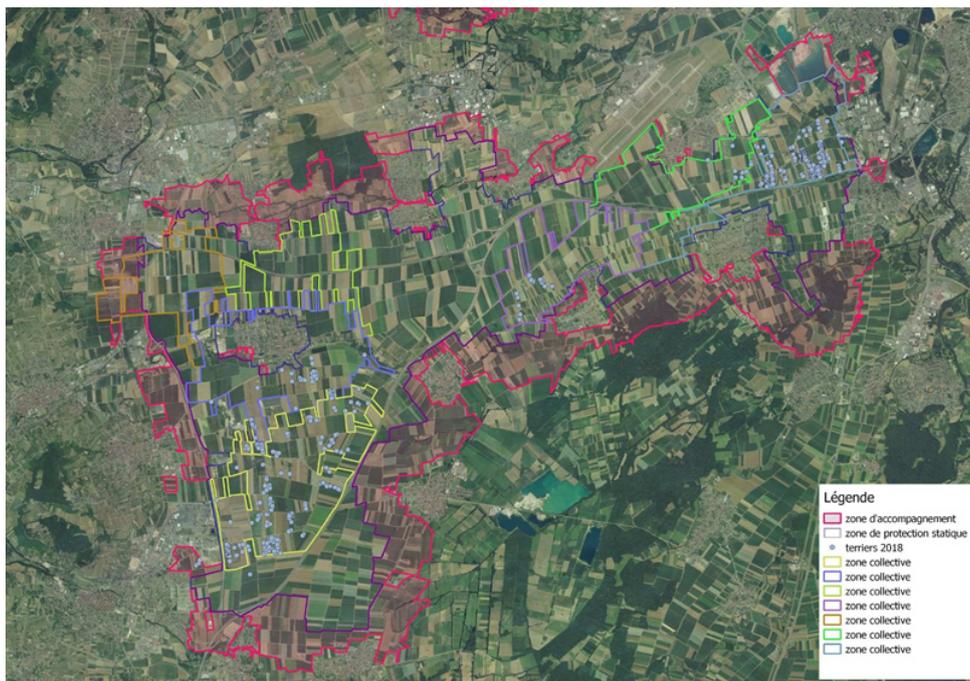


Figure B.7 – Collective zones and burrows within SPZ Center in 2018. Reprinted from (Virion 2018, p.117). Copyright (2018), with permission from DREAL.

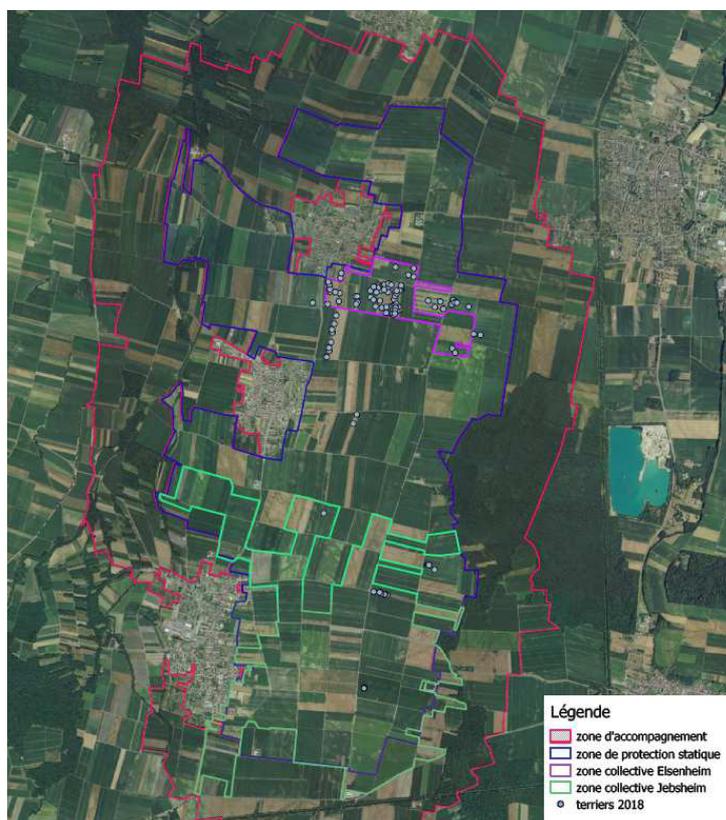


Figure B.8 – Collective zones and burrows within SPZ South in 2018. Reprinted from (Virion 2018, p.117). Copyright (2018), with permission from DREAL.

## APPENDIX

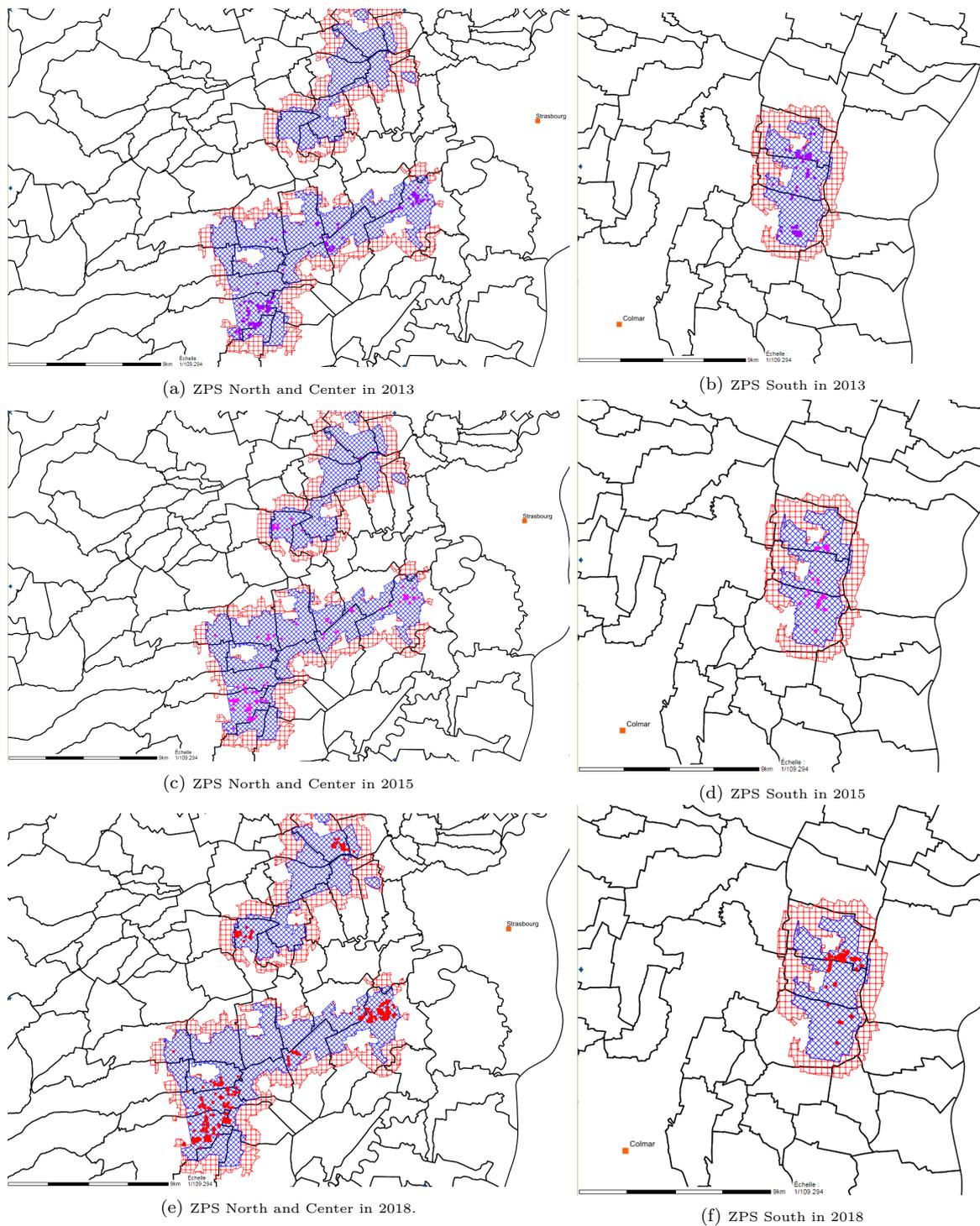


Figure B.9 – Location of burrows in the Strict Protection Zones for the years 2013, 2015 and 2018. Source: Cartographie Interactive DREAL Alsace. Retrieved 10/03/2020 from: [http://carmen.developpement-durable.gouv.fr/5/Carte\\_Alsace.map](http://carmen.developpement-durable.gouv.fr/5/Carte_Alsace.map)

# Appendix C

## Appendix to Chapter 3

APPENDIX

Table C1 – Probit Estimation for P(Asso=1) over the entire panel. Specification (1) & (2) clustered by farm, specification (3) & (4) clustered by CZ.

VARIABLES	(1)	(2)	(3)	(4)
DV	Asso=1	Asso=1	Asso = 1	Asso = 1
Gs	0.0199* (0.0103)	0.0309*** (0.00863)	0.0153*** (0.00455)	0.0145** (0.00673)
multi	0.186 (0.317)	0.0900 (0.264)	0.267 (0.326)	0.225 (0.242)
Surf	0.00775 (0.00473)	0.00546 (0.00424)	0.00753* (0.00408)	0.00438 (0.00297)
ratio_CZ	14.06*** (3.700)	15.84*** (3.794)	12.97*** (3.941)	14.18*** (4.370)
L.ratio_Gs	2.103** (0.925)		2.705*** (0.463)	
Y2	0.0612 (0.181)	0.159 (0.177)	0.0627 (0.168)	-0.247 (0.248)
Y3	-0.00516 (0.234)	0.0837 (0.222)	-0.0628 (0.165)	-0.549 (0.341)
Y4	0.0398 (0.247)	0.0593 (0.229)	0.0123 (0.160)	-0.572 (0.368)
Y5	-0.145 (0.253)	-0.0881 (0.230)	-0.133 (0.143)	-0.705* (0.393)
Y6		-0.101 (0.242)		-0.785** (0.315)
CY1	-0.184 (0.120)	-0.157 (0.110)	-0.209*** (0.0734)	-0.557*** (0.139)
CZ2	0.387 (0.299)	0.494** (0.243)		
CZ3	0.434 (0.519)	0.937** (0.415)		
CZ6	0.0714 (0.464)	0.788** (0.373)		
CZ8	0.133 (0.285)	-0.0729 (0.246)		
CZ9	0.399 (0.424)	0.350 (0.316)		
CZ10	0.116 (0.406)	-0.0933 (0.325)		
CZ11	0.0399 (0.286)	-0.141 (0.246)		
CZ12	-0.279 (0.673)	-0.471 (0.611)		
Constant	-2.352*** (0.806)	-1.600*** (0.450)	-2.352*** (0.356)	-0.271 (0.340)
Pseudo $R^2$	0.1866	0.1813	0.1778	0.1501
Observations	887	1,279	887	1,279

Robust standard errors in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table C2 – Hybrid Model and Correlated Random Effects Model compared to FE and RE.  
Dependent Variable: Contribution at farm level.

VARIABLES	(1) Hybrid	(2) Corr RE	(3) RE	(4) FE
dSurf	0.00582 (0.0145)			
dratio_CZ	23.95*** (8.274)			
dratio_Gs	-0.325 (2.664)			
dY2	0.135 (0.508)			
dY3	0.934 (0.642)			
dY4	1.644** (0.660)			
dY5	1.227* (0.658)			
dY6	2.084*** (0.679)			
dCY1	-0.504 (0.427)			
mSurf	0.00991 (0.00629)	0.00367 (0.0157)		
mratio_CZ	81.33*** (3.137)	57.46*** (8.744)		
mratio_Gs	-3.331 (2.210)	-2.912 (3.469)		
mY2	2.719 (1.736)	2.491 (1.843)		
mY3	-1.518 (1.975)	-2.441 (2.122)		
mY4	-0.600 (2.099)	-2.273 (2.246)		
mY5	-0.636 (2.128)	-1.878 (2.275)		
mY6	-2.116 (2.080)	-4.199* (2.238)		
mCY1	-3.737** (1.587)	-3.155* (1.680)		
Surf		0.00582 (0.0143)	0.0139** (0.00601)	0.00582 (0.0139)
ratio_CZ		23.95*** (8.115)	73.24*** (3.057)	23.95*** (7.924)
ratio_Gs		-0.325 (2.612)	0.168 (1.412)	-0.325 (2.551)
Y2		0.135 (0.499)	0.525 (0.461)	0.135 (0.487)
Y3		0.934 (0.630)	1.262** (0.587)	0.934 (0.615)
Y4		1.644** (0.647)	1.945*** (0.602)	1.644*** (0.632)
Y5		1.227* (0.645)	1.461** (0.612)	1.227* (0.630)
Y6		2.084*** (0.666)	1.926*** (0.626)	2.084*** (0.651)
CY1		-0.504 (0.419)	-0.534 (0.414)	-0.504 (0.409)
Constant	2.812 (2.873)	2.774 (2.953)	-1.406 (1.051)	1.285 (1.502)
$R^2$	0.605	0.605	0.584	0.099
Observations	1,279	1,279	1,279	1,279
Number of farms	376	376	376	376

Standard errors in parentheses, clustered by farm and collective zone.  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table C3 – Fixed Effects Estimation

VARIABLES	(1)	(2)	(3)	(4)
DV	Contri	Contri	Contri	Contri
Surf	0.00582 (0.0128)	-0.0259 (0.0208)	-0.0269 (0.0217)	-0.0311 (0.0242)
ratio_CZ	23.95 (16.52)	0.657 (9.463)	2.076 (9.160)	0.766 (8.325)
ratio_Gs	-0.325 (2.321)	6.190** (2.590)	4.679* (2.376)	3.705 (3.555)
L.Contri		0.148 (0.144)	0.147 (0.146)	
L.ratio_T		1.488 (3.666)	0.929 (3.452)	
<i>L.C<sub>-i</sub></i>		-0.00112 (0.0103)	-0.000880 (0.0103)	-0.00184 (0.00985)
Asso			2.717** (1.126)	2.783** (1.167)
Y2	0.135 (0.540)	-0.255 (0.335)	-0.190 (0.333)	0.101 (0.408)
Y3	0.934 (0.559)	0.655* (0.343)	0.732* (0.372)	1.195* (0.602)
Y4	1.644** (0.554)	1.413*** (0.227)	1.440*** (0.224)	1.812** (0.628)
Y5	1.227* (0.539)	1.507** (0.618)	1.545** (0.627)	2.107** (0.785)
Y6	2.084** (0.651)			
CY1	-0.504 (0.457)			
Constant	1.285 (1.983)	-1.187 (1.597)	-1.833 (1.687)	-0.590 (2.289)
$R^2$	0.099	0.110	0.123	0.107
Observations	1,279	887	887	887
Number of farms	376	273	273	273

Robust standard errors in parentheses, clustered by farm and collective zone.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table C4 – Wooldridge 1995 Estimator, dependent variable: individual surface contributions. Coefficients for lambda are jointly significant [ $F(6, 8) = 16.40$ ;  $Prob > F = 0.0004$ ].

VARIABLES	(1) RE	(2) FE	(3) FE	(4) FE
x1_2013	0.0126 (0.0367)			
x1_2014	0.00492 (0.0285)			
x1_2015	0.0840** (0.0396)			
x1_2016	-0.0604 (0.0619)			
x1_2017	0.00636 (0.0306)			
x1_2018	-0.0208 (0.0133)			
x2_2013	-56.74*** (18.93)			
x2_2014	72.63*** (24.82)			
x2_2015	-39.27** (18.31)			
x2_2016	86.83*** (26.91)			
x2_2017	-45.55** (19.95)			
x2_2018	-7.347 (12.04)			
x3_2013	2.836* (1.684)			
x3_2014	-0.750 (1.286)			
x3_2015	-4.470*** (1.476)			
x3_2016	-1.363 (1.791)			
x3_2017	3.151 (1.976)			
x3_2018	-0.966 (1.358)			
Surf	0.00423 (0.0143)	-0.00784 (0.0220)	-0.0459 (0.0287)	-0.0371 (0.0243)
ratio_ZC	40.02*** (8.672)	20.54* (9.916)	0.752 (18.17)	0.577 (18.54)
ratio_Gs	-6.754* (3.845)	-5.960 (6.875)		
$L.C_{-i}$			-0.00369 (0.0167)	0.00892 (0.0185)
L.Contri				0.133 (0.149)
L.ratio_T				-8.471 (8.211)
Y2	-3.301* (1.842)	-3.154* (1.633)	-3.092* (1.644)	-3.273 (1.783)
Y3	-0.395 (2.190)	0.0278 (1.886)	0.589 (2.035)	0.336 (2.391)
Y4	2.410 (1.733)	2.635* (1.387)	3.108* (1.506)	2.781* (1.487)
Y5	0.536 (1.470)	0.766 (1.225)	1.773 (1.443)	1.011 (1.656)
Y6	3.151* (1.625)	3.489** (1.441)		
CY1	-3.188** (1.373)	-3.071* (1.373)	-2.400* (1.255)	-2.541* (1.335)
lambda_hat_d_2013	0.855 (1.120)	-0.363 (1.168)	0.293 (1.161)	-0.283 (1.079)
lambda_hat_d_2014	3.456 (2.272)	1.427 (1.908)	2.773 (2.120)	2.772 (1.683)
lambda_hat_d_2015	-0.620 (2.347)	-3.141 (2.088)	-2.039 (2.177)	-1.962 (2.118)
lambda_hat_d_2016	-4.059*** (1.473)	-6.341*** (1.533)	-5.175*** (0.997)	-5.203*** (1.144)
lambda_hat_d_2017	-2.194 (1.586)	-4.076** (1.362)	-2.555** (0.811)	-2.116** (0.877)
lambda_hat_d_2018	-4.721*** (1.252)	-6.813*** (1.662)		
Constant	7.396* (3.874)	9.842 (5.484)	8.078*** (2.144)	8.902** (3.346)
Observations	706	706	515	515
$R^2$		0.265	0.266	0.278
Number of farms	194	194	154	154

Robust standard errors in parentheses, clustered by farm and CZ.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



# Appendix D

## Appendix to Chapter 4

### D.1 Interview with the president of an Environmental Cooperative in France

(Conducted by Kristin Limbach in May 2020)

Bonjour [le président],

Je vous appelle pour un petit entretien concernant le fonctionnement de l'[EC] dont vous êtes le président. Est-ce que ce moment vous convient ?

*Oui.*

Merci d'accepter de participer à l'entretien. Nous travaillons actuellement sur la MAEC collective du Grand hamster d'Alsace et sommes intéressées par le rôle de l'association des agriculteurs, donc l'[EC], dans l'organisation et l'application de cette mesure. Je vais donc vous poser quelques questions auxquelles vous pouvez répondre librement. Est-ce que vous seriez d'accord que j'enregistre l'appel pour éviter de prendre trop de notes pendant la conversation?

*Oui, il n'y a pas de souci.*

Quel est votre rôle dans l'[EC] en tant que président ?

*Je préside le conseil d'administration de l'[EC], et donc un des buts c'est de gérer la MAE collective en zone collective dans chaque commune et donc aussi de faire le lien avec les agriculteurs et l'administration. Donc sur le point administratif mais aussi financier parce qu'en fin de compte c'est nous aussi qui payons les agriculteurs directement. Ce n'est pas l'état français. L'état français nous verse de l'argent et nous on redistribue aux agriculteurs. Voilà pourquoi on a tout un volet aussi administratif à faire pour que les surfaces soient justes et ainsi de suite.*

Combien de temps est-ce que vous y consacrez ?

*Moi personnellement ? Ah, j'ai jamais quantifié hein. Bon ça dépend des périodes. En temps normal, ben là c'est une période, il y a quand même des réunions à faire dans les communes par rapport aux zones collectives, normalement hein, pour comptage des hamsters, mais bon cette année ça se fait pas. Et ensuite ben j'interviens quand parfois il y a des soucis dans les communes et après normalement en automne aussi quand il y a des réunions de concertation entre les agriculteurs pour l'assolement. Et donc voilà après il y a quatre ou cinq conseils d'administration que je préside et plus l'assemblée générale aussi. Après il y a beaucoup de téléphone aussi et des mails et tout ça que j'ai jamais comptabilisé exactement, mais effectivement ça prends quelques heures par semaine, oui. Je fais ça le soir souvent.*

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Combien de temps est-ce que le représentant de la [CA] y consacre ?

*Il n'est pas consacré en totalité sur la MAE, il a encore d'autres attributions au niveau de la chambre d'agriculture. Notamment tout ce qui est biodiversité et eau.*

Il prend une partie de son temps pour gérer le contact avec l'[EC] et le fonctionnement de la MAEC mais son rôle n'est pas complètement consacré à ce projet?

*Non, pas complètement. Là par contre on a encore à gérer toute la partie de compensation des entreprises, notamment le [projet]. Aujourd'hui ça commence à poser problème par rapport à son travail, et voilà c'est vraiment très limite. Faudrait donner soit quelqu'un à temps plein soit une personne qui le seconde.*

Donc vous souhaitez plus de capacité de la chambre d'agriculture dédiée à la MAEC ?

*Pas seulement la MAE, parce que vu qu'à l'[EC] l'on gère aussi maintenant tout ce qui est compensation des entreprises. Donc chaque fois qu'une entreprise fait une construction, elle doit compenser la perte de biodiversité et donc du hamster. Et ça, ça commence aussi à devenir très intensif, c'est à côté de la MAE même si les mesures sont quasiment les mêmes.*

Quelles sont les activités de l'[EC] ?

*Aujourd'hui tout est consacré sur le dossier du hamster, au niveau de l'[EC]. Maintenant c'est que ça. Voilà, après on intervient aussi quand il y a des demandes d'agriculteurs ou de communes. Pour l'instant il n'y a pas d'autre MAE... Pour l'instant il n'y a que l'hamster parce qu'il y a des gens qui sont intéressés. Alors c'est un peu de la promotion si vous voulez. Oui, maintenant ça devient compliqué parce que surtout avec tout ce qui arrive c'est beaucoup de financement. Donc l'état doit suivre financièrement et là, bon, j'ai quand même quelques craintes dans le futur quoi.*

Réunions Combien de réunions est-ce que vous avez par année pour l'[EC] ?

*Oh en tout... Il y en a quelques unes hein. Il y a encore des réunions en vidéo avec moi, le [représentant de la CA], le directeur de la chambre. Après il y a des réunions avec l'administration avec la DDT, la DREAL, l'Office Français de la Biodiversité... Ouais il y a quand même beaucoup de réunions durant l'année. Je pense, à la louche là, au moins une quarantaine. C'est pas facile, hein. Il y a toujours autre chose qu'il y a à régler et oui c'est un dossier qui prend quand même du temps.*

Qui est chargé de l'animation des réunions ?

*Ça dépend de qui demande la réunion, qui va présider la réunion. Parfois c'est la [CA], parfois la DREAL...*

Est-ce que l'[EC] permet un meilleur suivi pour les agriculteurs ?

*C'est surtout ça, quoi, c'est que suivant les territoires, suivant les agriculteurs il peut y avoir des petits soucis et donc à un moment donné il faut qu'on soit tous coordonnés pour régler les problèmes et puis pour aller de l'avant. Notamment l'Office Français de la Biodiversité, anciennement ONCFS, qui est beaucoup sur le terrain aussi avec les agriculteurs par rapport au comptage des hamsters. Donc voilà eux ils ont aussi des retours et donc voilà on travaille tous ensemble.*

Est-ce qu'il y a une rémunération pour la participation aux réunions ?

*Les agriculteurs on les réunit tous, on les réunit pas trop souvent quoi. Donc il y a l'assemblée générale où tout le monde est invité, des réunions dans les communes où les agriculteurs de la commune sont invités, autrement c'est soit moi soit des gens du conseil d'administration qui discuteront avec l'administration.*

Comment est-ce que vous arrivez à la coordination des surfaces par rapport au seuil et aux variations entre années ?

*Déjà les agriculteurs entre eux maintenant ils connaissent le système. Voilà en connaissant ce système c'est déjà beaucoup plus facile. Déjà entre eux parfois ils discutent entre eux. Alors ils disent : " Voilà moi je veux mettre du maïs là, des betteraves là. . ." et donc déjà au préalable ils discutent entre eux. Et ensuite, il y a le moment clé, c'est fin août, début septembre, on a la réunion assolement dans la commune où en fin de compte chaque agriculteur donne ses vœux voilà où il veut mettre du blé et de la luzerne pour le hamster. Et à partir de là on a déjà une photographie de ce qui va être l'année d'après et si jamais il manque ou si c'est un peu mal réparti on discute à cette réunion et en général voilà ça se passe assez bien. Aujourd'hui on a quand même de la chance, c'est que dans beaucoup de zones collectives on est largement au dessus des 26%. On est plutôt entre 30% et 40% voire plus parfois. Donc déjà au niveau des pourcentages là il n'y a plus de souci vraiment. Les gens interagissent facilement par rapport à la culture du blé et de la luzerne et donc [il y a des soucis] juste par rapport à la répartition un petit peu. Et ensuite aussi quelque chose qui est parfois difficile, pas difficile mais pas évident à mettre en place, c'est par rapport aux cultures du blé qui ne doit pas être fauché, donc qui va rester à proximité des terriers des hamsters. Ça c'est pas toujours facile à faire, parce que ce sont des petites surfaces, il faut connaître les trous des hamsters au préalable, donc là il y a quand même pas mal de discussions encore. Peut être la seule chose la plus compliquée aujourd'hui c'est de devoir laisser le blé dehors donc pour le hamster.*

Comment gérez vous ces difficultés ?

*Dis donc. . . Maintenant les gens savent qu'il faut laisser du blé pour le hamster là où il y a les trous. Donc ça c'est déjà un avantage et ensuite il y a surtout des discussions avec l'OFB qui va aussi dire voilà "là ce serait important de mettre le blé sur pied, dans cet endroit plus ici". Et donc la discussion se fait en fin de compte avec l'[EC], les agriculteurs sur le terrain et l'OFB. Maintenant [la facilitation] est un peu arrivée dans un roulement donc ça se passe relativement bien.*

Petits vs. Grands Groupes Est-ce qu'il est plus facile de se coordonner en petit groupe ?

*En théorie oui. La théorie c'est que moins vous avez d'agriculteurs, plus les surfaces sont importantes, dans la théorie, oui.*

Quels facteurs facilitent la coordination en zone collective ?

*Bien sûr vous avez le facteur humain. Est-ce que les gens se comprennent? Est-ce qu'il y a des problèmes de familles entre les agriculteurs. Plein de choses comme ça. Alors c'est sûr que si vous êtes 30 agriculteurs dans une commune, c'est moins évident. Voilà, il y a des vieilles histoires entre les agriculteurs, hein, et ça marche*

*pas toujours, voilà. Dans la théorie effectivement, moins il y a d'agriculteurs, plus les territoires sont grands, plus c'est facile de positionner les parcelles de blé, de luzerne, de pissenlit.*

Est-ce qu'il y a une meilleure surveillance entre agriculteurs dans les petits groupes ?

*Oui. Voilà, les gens se comprennent ou ne se comprennent pas, ça c'est l'important. Ça on peut rien faire. Oui après il y a des groupes ça va très bien parce qu'ils sont habitués à travailler ensemble déjà à la base entre agriculteurs parce qu'ils s'entraident. Donc toutes les communes sont différentes. On peut pas avoir une photographie typique, ce n'est presque pas possible. Vraiment, l'histoire du village entre les agriculteurs, ce qui s'est fait ce qui s'est pas fait, ça [prévoit] si ça se passe bien ou pas.*

Negotiations Quels sont vos contacts institutionnels ?

*Avec les politiques je dirais qu'on a un peu de mal, avec les hommes politiques, hein. Parce que, à la base, les maires des différentes communes sont totalement contre le hamster. Oui, les maires des communes... Parce qu'on est quand même dans un département très urbanisé et puis chaque commune veut se développer, faire un lotissement, faire une zone d'activités, ainsi de suite. Et donc le dossier hamster est donc bloqué au bout des dossiers. Et donc globalement les politiques ne sont pas trop favorables au hamster. Voilà je vais être méchant, mais pour certains, s'il n'existait plus le hamster, ils seraient bien content. C'est la vérité, hein. Aujourd'hui les politiques sur un dossier comme ça, voilà, publiquement ils disent il faut faire comme ça, biodiversité il faut faire, il faut faire et dans la réalité ce n'est pas comme ça. Dans la réalité ils veulent construire, hein. Voilà, c'est compliqué avec les politiques publiques. Sincèrement en fin de compte, on ne travaille pas beaucoup avec les politiques. On travaille bien avec le conseil d'administration.*

Est-ce que vous avez l'impression que l'[EC] permet aux agriculteurs une meilleure influence sur la structure des MAEC ?

*Alors une MAE c'est cinq ans. Et donc au bout des cinq ans, enfin avant les cinq ans, donc on a discuté avec l'administration, DREAL, DDT, OFB notamment, les plus importantes, sur les futures mesures par rapport à la prochaine MAE, donc qui devait repartir pour cinq ans. Donc ça c'est une discussion qui a duré pendant un an et demi entre nous pour savoir ce qui était important de faire et d'améliorer sur le dispositif. Voilà bon là c'est beaucoup de réunions, c'est beaucoup de discussions. Il y a le CNRS qui nous a aussi éclairés sur un certain nombre de choses. Notamment l'alimentation de l'espèce parce qu'il ne peut pas survivre s'il n'arrive pas à s'alimenter. Et c'est pour ça que notamment dans la MAE qui était signée en 2018, aujourd'hui on fait après la récolte de blé on sème ce qu'on appelle du CIPAN, qui sont des pièges à nitrates. Et là dedans se consomme un mélange, tournesol, bette, avoine par exemple. Différentes plantes à consommer, et notamment le tournesol, parce que le tournesol a l'avantage qu'à n'importe quel stade de la plante c'est bénéfique au hamster. Donc en tant que planture plus grande et puis après les graines. Donc ça ce sont des recherches qui ont été faites par le CNRS. Voilà on les applique maintenant sur le terrain. Ils ne nous l'ont pas imposé, c'est très important : sur tout le dossier hamster on était prêt à s'engager à condition qu'on ne nous impose rien. Dans une société on aime bien imposer et puis ne pas discuter. Et nous on*

*est prêt à le faire mais on discute. Il y a des choses qu'on peut faire et il y a des choses qu'on ne peut pas faire. Et donc voilà là c'est vraiment la discussion type. Le CNRS a fait une étude, on a discuté de cette étude et puis on a regardé comment on pouvait au mieux utiliser cette étude et l'appliquer sur le terrain.*

Est-ce que les besoins des agriculteurs sont bien représentés dans la nouvelle MAEC de 2018 ?

*Aujourd'hui le souci qu'il y a [le] plus sur la nouvelle MAE c'est par rapport à la fauche de la luzerne. Les agriculteurs sont vraiment... sont pas très d'accord avec ce qui a été décidé. C'est-à-dire [disons] vous avez une parcelle au-delà des cinquante ares, qui est plus grande que cinquante ares en luzerne, et vous devez la faucher en deux fois. Donc une première partie la moitié de la parcelle et ensuite un jour après la deuxième. Donc il y a en fin de compte toujours de la luzerne dans la parcelle. Le problème c'est que ça leur fait deux fois plus de travail. Aujourd'hui c'est un peu compliqué [de vendre la luzerne] et le souci est aussi au niveau du coût quoi. Si vous devez sortir deux fois plus avec le tracteur ça commence à devenir cher quoi. Bon, c'est vraiment le point aujourd'hui qui pose des problèmes aux agriculteurs, vraiment hein. C'est-à-dire si vous avez signé un MAE c'est pour cinq ans. Donc vous ne pouvez quasiment rien changer pour cinq ans. Bon un moment donné faut trancher quand même sinon on avance pas quoi. Mais une fois que c'est décidé vous pouvez pas revenir en arrière, le contrat est sur cinq ans quoi. Donc on va dire, je ne veux pas dire que c'est le point négatif de la MAE. Mais comment dire, je veux pas dire négatif, mais c'est un problème quoi, en cinq ans la situation peut évoluer soit d'une façon positive soit d'une façon négative. Et donc vous ne pouvez pas changer pendant cinq ans le dispositif. Ça c'est un peu le... on va dire, le problème quoi. Parce que parfois les situations évoluent et vous ne pouvez pas réagir parce qu'il y a une contrainte. [L'inflexibilité] que ce soit pour les besoins agricoles ou pour les besoins de l'hamster... Parfois vous pouvez trouver quelque chose de positif, qui pourrait être intéressant à mettre en place pour le hamster et ben vous ne pouvez pas le rentrer dans le dispositif parce que c'est un contrat de cinq ans.*

Est-ce que l'[EC] est basée sur un modèle d'exemple ?

*L'[EC] a été créée entre guillemet par hasard. Donc je dis ça en rigolant mais c'est ça un peu quand même. Donc on était prêt à s'engager pour faire des mesures pour le hamster, hein, au niveau des agriculteurs. Et on était une poignée d'agriculteurs au départ. Donc on s'est mis autour d'une table et on a dit : "Mais comment on va gérer ces mesures hamster ?". Voilà vous ne pouvez pas [avoir] une mesure par agriculteur, on voulait une mesure collective parce que ça nous paraissait beaucoup plus simple et beaucoup plus efficace sur le territoire. Et donc l'idée est venue de créer une association où tous les agriculteurs qui font partie du dispositif hamster adhèrent. Et donc c'est venu comme ça, on a pas réfléchi à ce qu'ils font ailleurs. C'était un tort au départ, et donc je dois dire que tous ceux qui étaient à la table à l'époque ne pensaient pas que ça allait prendre une telle ampleur.*

L'[EC] est consacrée uniquement au hamster ?

*Alors demain ça peut être d'autres choses hein. Parce que le but de l'association est assez large, déjà dans le titre. [...] vous pouvez quand même avoir d'autres espèces qui peuvent à la rigueur rentrer dans une MAE et être gérées par l'[EC] quoi. Donc*

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*on s'est donné cette latitude là au cas où demain il y a quelque chose d'autre qui pourrait être. . . Après il faut avoir des projets, des projets avec l'administration, avec d'autres personnes sur le terrain, avec les agriculteurs. Il y a des choses qui vont certainement évoluer dans les années à venir. On ne sait pas encore comment mais je veux dire nous, on a la possibilité. Aujourd'hui on a l'expérience de ce dossier hamster, voilà, qu'il faudrait certainement pas transcrire à 100% sur l'autre espèce mais parce que chaque espèce a ses spécificités. Mais dans la façon administrative on va dire, de gestion au quotidien on sait déjà faire quoi.*

Est-ce que l'[EC] est basée sur un cadre légal ?

*En fin de compte c'est une association dix-neuf cent cinq donc c'est une association basique au départ, hein, comme toute autre association française. Et donc on s'est exercé là dessus parce que on a créé cette association parce qu'à un moment donné il était question pourquoi la chambre ne porterait pas à 100% le dossier. Et en fin de compte comme la chambre gère déjà beaucoup de dossiers, nous ce qui était important, c'est que l'argent qui est versé par l'état soit intégralement versé aux agriculteurs. Et donc c'est pour ça qu'on voulait vraiment se séparer même si la chambre d'agriculture avec [le représentant de la CA] notamment suit le dossier. Voilà pour la clarté au niveau des agriculteurs, je crois que c'était la bonne solution.*

Est-ce que l'[EC] possède d'un document officiel ou d'un site web ?

*Non ça on n'a pas. Mais si vous voulez un peu plus de renseignements sur l'association en tant que telle, vous pouvez téléphoner à Monsieur [représentant de la CA].*

Merci pour vos réponses. Est ce que vous aimeriez ajouter quelque chose ?

*Avec tout ça il faut quand même garder un principe qui pour nous agriculteurs est quand même très important c'est que c'est volontaire. Parce que aujourd'hui il y a quand même beaucoup de choses qui sont imposées d'office sans discussion, sans rien et ça les gens le perçoivent dès le départ très mal. Même si c'est quelque chose qui peut être positif. Du moment où les agriculteurs, mais ça peut être d'autres secteurs d'activité d'ailleurs, sentent qu'en fin de compte ils ont leur mot à dire, ils peuvent apporter quelque chose à ce dossier, ils sont prêts aussi beaucoup plus facilement à s'engager. Et moi je suis persuadé d'une chose, si c'est fait de façon volontaire dans la durée c'est beaucoup plus efficace que quand c'est imposé.*

Je vous remercie pour votre temps. Si vous avez des questions, n'hésitez pas à revenir vers moi. Si vous êtes intéressé par notre travail je peux vous communiquer l'article une fois qu'il sera prêt.

32:02 minutes

## D.2 Interviews with members of an “Environmental Cooperative” in France

(Conducted by Kristin Limbach in March 2021)

### D.2.1 Agriculteur 1

Pourquoi avez-vous décidé de participer dans la MAEC collective ?

*Je suis agriculteur en bio et une des mesures pour la protection du grand hamster c'était de mettre en place de la luzerne. En bio on utilise globalement la culture de la luzerne pour nettoyer les parcelles par rapport aux mauvaises herbes. Je me suis dit que ça pourrait à la fois être favorable pour notre exploitation dans le sens où ça nous permettait de mettre le plus de surface dans la luzerne et également favorable au grand hamster d'Alsace. Donc j'ai contacté les autres agriculteurs de la commune pour voir si on rentre dans les critères des surfaces au minimum.*

Et les autres étaient tout de suite partants ?

*Ah non, pas du tout [rit]. On était 4 à la première réunion qui a été initiée par la CA dans notre village et donc j'ai dit: “écoute, on va en faire une deuxième”, et je suis allé les voir individuellement pour qu'ils viennent. Et donc on a fait une deuxième réunion 15 jours après. J'ai dit qu'il y aurait quelque chose qui pourrait être intéressant pour tout le monde parce que chaque agriculteur faisait déjà du blé. Et j'ai dit: “ben si déjà vous faites du blé, ça pourrait faire un effet levier et puis par rapport à la mise en route du grand contournement ouest également ça pourrait avoir un peu de poids pour éviter que ça traverse nos parcelles à nous quoi.” Donc on a fait cette réunion et à la deuxième réunion on s'est rendu compte qu'on était déjà au-delà des 26% de cultures favorables.*

Vous pensez que même sans la mesure collective vous auriez fait l'effort ?

*On s'est dit: “si de toute façon on rentre dans les critères même si on n'adhère pas ou on ne fait rien, autant le faire, ce n'est pas ces critères qui vont nous freiner ou modifier fondamentalement nos assolements.” Et à partir de là on a dit, bon ben ok on y va quoi.*

Donc la mesure ne vous a pas introduit énormément de changement ?

*Le minimum était déjà fait. Ensuite on a souscrit à la mesure collective et bien entendu ça fait un petit peu chacun discuter, débats, les uns étaient pour, les autres étaient contre. Et là j'ai dit: “Attendez. La question n'est pas d'être pour ou contre. La question est: en faisant nos pratiques, est-ce que ça peut en même temps favoriser la préservation du grand hamster et en contrepartie être rémunéré pour les efforts supplémentaires qu'on fait.”*

Quels étaient vos efforts supplémentaires, vous avez rencontré beaucoup de contraintes avec la MAEC ?

*Ça se fait tout seul à partir du moment où ils ont dit il faudrait jeter du blé sur pied, il faudrait faire ceci, faudrait faire cela. Et vu l'indemnité qui était proposée... On avait pas mal d'agriculteurs retraités, qui étaient en double activité encore ou qui laissaient faire pas mal de travaux par les entreprises et le fait de ne pas payer la moissonneuse batteuse et d'être quand même indemnisé par la mesure, ça leur a permis de faire des économies de charges et tout en étant payé quoi. Pour eux, vendre, commercialiser le blé ou ne pas commercialiser le blé, à partir du moment où on leur paye la surface, ben ils sont d'accord pour en laisser quoi.*

Est-ce que la subvention est financièrement intéressante ?

*D'abord ce n'est pas une subvention. C'est une indemnisation pour que chacun puisse rentrer dans ses prêts quoi. En bio ce n'est pas intéressant, en bio il vaut mieux récolter et commercialiser avec la valorisation en bio. Vu ce qu'on touche c'est l'indemnité calculée sur le prix du conventionnel, il n'y a pas de différenciation que ce soit du blé bio ou pas bio, l'indemnité c'est la même. Donc ce n'est pas forcément intéressant. Ceux qui n'étaient pas en bio, ils étaient prêts à le faire. Moi je n'ai pas laissé du blé sur pied, bon par la suite j'en ai laissé un peu aussi, parce que je voulais aussi montrer l'exemple et puis les efforts on les a fait de plus en plus. Après on a pu créer la CUMA et on a acheté du matériel en commun. Tout ça c'était intéressant, surtout le fait de pouvoir acquérir du matériel ensemble est toujours moins cher en terme d'investissement pour les exploitations, ça fait baisser un peu nos charges de structure.*

Est-ce que le partage du matériel marche bien ?

*Oui, oui très bien. On gère nous même la structure donc on était un peu dans l'ère des temps puisque les pratiques agricoles ont évolué. A partir du moment où on avait le matériel sur place, ça nous permettait d'éviter des traitements phyto et de passer uniquement par un désherbage mécanique. Ce qui était bien dans ce genre de collectif c'était que les uns et les autres se sont rencontrés et puis on pouvait discuter, ce qui ne se faisait presque plus. On est 18 agriculteurs maintenant ou 20... De remettre 20 agriculteurs autour d'une table et définir un assolement commun c'est quelque chose qui est super. Chacun a sa façon de travailler et on ne peut que s'enrichir, pas forcément des réussites mais des échecs. Plutôt que de répéter des choses qui ne fonctionnent pas sans en avoir parlé les uns avec les autres, là on était tous autour d'une table et quand on proposait une façon de travailler, l'autre disait: "Fais pas ça, c'est pas la peine. J'ai essayé, ça ne fonctionne pas." Ça a créé vraiment une synergie entre les agriculteurs, c'était bien.*

Vous êtes devenus plus solidaires entre agriculteurs ?

*Ah oui, bien sûr, oui. Il y a le volet social bien sûr puisque il y en a qui sont célibataires, agés, isolés, qui vivaient dans leur coin, chacun avait un itinéraire culturel différent et là ça nous permettait de trouver de nouveau un modèle commun pour lequel on travaillait ensemble.*

Avant, le dispositif MAEC pour le hamster existait en individuel ?

*Je les avais prévenu: "Si on ne part pas sur le collectif, j'ai une surface assez grande pour partir tout seul." Individuellement vous êtes lié à la parcelle, c'est une gestion plus contraignante. Alors collectivement, s'il y a un qui ne peut pas faire du blé du*

*tout, ben c'est pris en charge par les autres. On a des agriculteurs qui n'ont qu'une ou deux parcelles dans le périmètre, si en plus ils font du betterave ils reviennent avec du blé que tous les trois ans. Pendant deux ans ils font des betteraves, ils font du maïs et après ils refont du blé donc ils reviennent tous les trois ans avec une parcelle de céréale à paille. Donc en fait, d'être en individuel tout seul vous ne pouvez pas le faire. Après en collectif s'il ne met pas de blé il ne touche rien. Mais ça ne fait rien, le collectif, les autres, ils sont dedans. Et ce qui était encore mieux c'est que ceux qui n'acceptent pas de faire partie du collectif mais qui ont des parcelles à l'intérieur du périmètre ben ces surfaces elles comptent.*

Donc même s'ils n'ont pas souscrit la MAEC, même s'ils ne sont pas membre dans l'EC, leurs surfaces comptent ?

*Ah ben, il y en a encore qui refusent hein ! ...qui n'ont pas encore évolué. Après, ce n'est pas à nous de faire évoluer les gens. Ce qui est bien, c'est que ça a changé un peu la façon de voir l'autre qui n'est pas forcément dans le même système. Avant il y avait un vrai clivage entre le bio et le conventionnel, aujourd'hui ce n'est plus le cas, enfin dans mon secteur. Je pense que le fait d'être en collectif ça y a contribué.*

Vous recevez aussi une prime pour les terriers du hamster ?

*Ça a été mis en place par la suite pour favoriser un peu le maintien des hamsters dans les parcelles. Mais on n'a pas vraiment... c'est un petit peu un plus, c'est tout. Ce n'est pas forcément un objectif qu'on visait. Ce n'est pas nous qui [comptent les terriers], c'est l'OFB. Surtout puisque l'année dernière, en 2020, [le comptage] n'a pas été fait à cause de la COVID. C'est un des leviers sur lequel il faut vraiment agir, puisque le comptage ne peut pas être fait par hasard, une fois on le fait une fois non. On a mis en place un comptage par drone, parce que c'est très difficile à faire en rentrant dans les parcelles. On est un peu en compétition entre différents collectifs, on est très intéressé de savoir si ce qu'on a fait fonctionne ou pas. On aimerait avoir un peu plus de terriers que le collectif d'à côté. C'est aussi pour savoir à partir de quel pourcentage [de cultures favorables] ça augmente... Bon après c'est multifactoriel, c'est quand même un animal sauvage quoi.*

Est-ce que l'indemnisation est une incitation économique pour vous ?

*Ça ne couvre pas, les heures ne sont pas comptées dans la rémunération. Si demain vous l'enlevez, il n'y en aura plus. Ça c'est clair. Ça nous donne un petit peu une fierté de la reconnaissance sociétale. On essaye aussi dans le collectif de traiter le sujet des coulées de boue. Ce n'est pas juste pour le terrier. Il y a beaucoup de facteurs qui sont pris en compte dans la mise en place de l'assolement commun. Ce n'est pas l'indemnité du hamster qui nous enrichit. On est loin du compte. L'indemnité a été calculée sur un tarif de base et puis elle a été maintenue à ce niveau là. Ce sont des budgets qui sont bloqués pendant 5 ans, par contre ce qu'on a à chaque fois ce sont des contraintes supplémentaires.*

Est-ce qu'on vous a contacté pour demander quel montant serait approprié pour l'indemnité ?

*Là je pense qu'il y avait un comité qui s'était mis en place au tout début, et puis ils ont calculé ça au niveau de la CA pour le proposer. On n'a pas fait ça pour l'argent. La part qui revient aux agriculteurs dans le budget global consacré à la protection du*

*hamster, elle n'est pas énorme. Cette indemnité nous a permis de couvrir ce qu'on allait faire en plus de ce qu'on a fait déjà, et c'est pour ça que ça fonctionnait. On n'est pas des oeuvres de bienfaisance non plus. La demande de la société sur l'environnement est énorme. On est prêt à accueillir des bénévoles pour s'occuper de l'environnement, mais il n'y en a pas beaucoup qui se présentent.*

[Remerciements]

25:20 minutes

## D.2.2 Agriculteur 2

Pourquoi est-ce que vous avez contractualisé dans la MAEC collective ?

*Déjà c'est plus organisé, si t'as un problème t'es à plusieurs, donc ça raisonne mieux que quand t'es tout seul. Si tu reçois pas l'argent, si t'es à plusieurs, ça a plus d'impact. Les factures elles viennent plus vite que [l'indemnisation].*

Est-ce que l'incitation financière est intéressante économiquement ?

*Non, elle aide mais vous êtes plus tranquille si vous faites juste du maïs. Si c'est que l'argent, je ne le ferais pas, sinon je perdrais. Je le fais pour qu'il y ait un peu de tout. Chez nous sinon c'est surtout du maïs. C'est pour la nature. Maintenant on a du blé et de la luzerne.*

Est-ce que la mesure vous a demandé beaucoup de changement au niveau des pratiques agricoles ?

*Non, on le faisait déjà avant. On n'a pas acheté de matériel pour ça. On a encore des vaches, alors il fallait toujours du blé ou de la paille.*

Comment est-ce que vous vous êtes organisés entre agriculteurs pour la MAEC collective ?

*Au sein des réunions, en automne. Si je vois qu'il faut un peu plus, je fais un peu plus de ça pour qu'on arrive aux 26%. Jusqu'à présent il n'y a pas de problème.*

Comment vous êtes vous convaincu de participer ? C'était la CA qui vous a sollicitée ?

*Oui.*

Avant vous avez fait la MAEC individuelle pour le hamster ?

*Oui. On a commencé en 2000 à peu près, avant le collectif j'ai déjà commencé. Il y avait des contrats avec l'OFB, ce n'était pas la CA.*

Avez vous l'impression que la MAEC individuelle a fait quelque chose pour le hamster ?

*C'était pas assez, juste pour qu'il ne meurt pas. Maintenant le territoire est quand même plus grand. Avant il y avait juste un champ là et un là-bas, c'était pas connecté.*

Vous préférez quel type de contrat ?

*Collectif. C'est toujours mieux, si t'as un problème, plus on est, plus on a de la chance que ça passe. C'est comme un syndicat, on a plus de poids.*

Vous trouvez plus de solidarité et de liens entre agriculteurs ?

*Oui, au moins tu les vois encore.*

Est-ce que vous auriez fait les mêmes efforts si la mesure pour le hamster n'avait pas été mise en place ?

*Tu ne peux pas, déjà comme ça c'est juste, on a trop de contraintes.*

Sinon vous auriez préféré le maïs ?

*Oui bien sûr.*

Est-ce que les contraintes imposées par la MAEC collective sont raisonnables ?

*Oui, bon il faut quand même respecter. Ça pose problème quand tu ne respectes pas. Il faut faire plus de choses, il ne faut pas oublier de laisser du blé en hiver et faucher la luzerne de la bonne manière en été. Il faut y penser, on a tellement de trucs alors il ne faut rien oublier. C'est plus de contraintes ça c'est sûr. Si tu as que du maïs il ne faut rien laisser, tu fais tout le champ et c'est fini.*

Est-ce que la diversité de cultures améliore quand même la qualité des terres ?

*Oui, un peu.*

Donc votre motivation n'est pas purement économique ?

*Non, pas pour moi. Il y en a qui pensent qu'économiquement, mais pas moi. C'est pour la nature.*

Est-ce que vous trouvez que l'EC apporte quelque chose à la mesure collective ?

*Oui, quand même. Ça change aussi un peu le paysage, il n'y a pas que du maïs.*

[Remerciements]

14:51 minutes

### D.2.3 Agriculteur 3

Comment est-ce que la MAEC collective a commencé pour vous ?

*J'étais déjà engagé pour le hamster quelques années auparavant dans un autre secteur, donc j'étais de toute façon pour protéger le hamster, donc je me suis engagé là dedans et j'ai démarché mes collègues, il y en a certains qui ont dit oui et certains qui ont dit non, et on a réussi à créer cette zone tant bien que mal mais bon, on a réussi à la faire fonctionner.*

## APPENDIX

Donc c'était vous qui avez mobilisé vos voisins ?

*Pas directement, certains oui. On a fait des réunions d'information chez moi, et puis certains ont dit oui, d'autres ne veulent pas parler du hamster. Disons bon, on est dans une zone où il y avait beaucoup de hamsters il y a une quarantaine d'années, on les a chassés, on les a exterminés. Mon papa nous a amené dans les champs quand j'avais 10-12 ans avec du poison contre le hamster. Parce qu'à l'époque il y avait beaucoup de dégâts à cause du hamster, rien ne poussait plus, tout a été mangé [par le hamster]. Aujourd'hui ce n'est plus le cas.*

Donc les plus âgés ont gardé un mauvais souvenir du hamster?

*Oui, oui, le plus âgé de la zone dont le fils a repris l'exploitation a dit: "Ça c'est exclu pour nous, on les a détruit, je ne veux plus parler du hamster!" Bon après c'est une personne, c'est juste une anecdote.*

Comment avez vous pu convaincre les autres agriculteurs de participer au dispositif collectif?

*C'est surtout [le représentant de la CA], il a montré, il avait tout un organigramme de cultures à mettre en place et ainsi de suite, et donc tout le monde était plus ou moins intéressé et donc voilà. Il y avait plus d'avantages que de contraintes pour la plupart, donc c'est bien.*

Quels en sont les avantages ?

*Ben disons, déjà on fait des cultures d'ongle vert, ce qu'on faisait pas avant. Avant on faisait nos cultures comme on voulait quoi. Maintenant il faut quand même mettre des légumineuses, donc on est gagnant de l'autre côté quoi. Avant on prenait un ongle vert tout simple, le premier engrais est le moins cher. Donc là maintenant pour le hamster il faut mettre des granulés, des légumineuses et un tournesol. Donc maintenant c'est obligatoire de le faire et tout le monde voit que c'est quand même mieux pour le sol aussi, donc voilà. Après il y a aussi l'aspect financier que toutes nos charges sont prises en charge. On est payé pour ça, on est pas perdant quoi. Voilà là les gens sont assez partants.*

Est-ce que les indemnités couvrent les coûts ?

*Pour moi c'est juste pile poil. Je fais beaucoup d'ongle vert, donc je fais plus que mes collègues, donc tout ce que moi je rentre en économies passe dans les ongles verts. Après c'est aussi la gestion globale de ma ferme, pour avoir moins d'intrants et moins de chimie de l'autre côté aussi quoi. Moi je fais plus que les autres, mais bon ça c'est mon tempérament quoi.*

Est-ce que vous étiez dans une MAEC individuelle pour le hamster avant le dispositif collectif ?

*Oui, j'étais déjà dans une MAEC individuelle et après c'est devenu collectif.*

Pensez-vous que la MAEC collective est plus avantageuse ou plus difficile à gérer ?

*C'est plus facile à gérer, on a un groupe quoi, si on est seul on n'arrive pas à tenir tous les paramètres. Tous les ans on a une réunion pour mettre notre rotation, toutes nos cultures de blé en place, au mois de septembre. Parfois c'est difficile, certains sont réticents, mais bon il faut les convaincre, il faut leur parler. Après ils repartent quoi.*

Avez-vous l'impression que cela augmente un peu la solidarité entre agriculteurs ?

*Non, non, non je ne pense pas, non, non. Ça s'individualise, il faut juste qu'on ait notre ratio. Tout le monde trouve l'intérêt mais c'est pas... Mais bon l'année dernière on était pas sur d'arriver à nos 26%, mais on est quand même arrivé. Lors de la réunion trois collègues n'étaient pas là, mais on les a quand même convaincus. Après [le représentant de la CA] les a contactés personnellement et s'est renseigné sur leurs surfaces exactes d'assolement. Donc après il les a eu donc c'est parti quoi.*

Vous avez l'impression que la prime pour les terriers donne une incitation supplémentaire ?

*Non, on n'est pas trop concerné. Il n'y a pas encore trop de terriers dans mon secteur. Si demain il y en a un qui en a, c'est sûr qu'il va le garder.*

Est-ce qu'il y a des lâchers dans votre zone ?

*Oui, il y en a trois qui se sont fait dans notre secteur. Le premier n'a pas trop marché, donc ils l'ont refait l'année dernière et cette année ils en font un troisième. Sur 138 lâchers il y en a 120 qui ont survécu, qui étaient là en automne.*

Vous pensez que quel dispositif est le mieux, individuel ou collectif ?

*Bon l'individuel est beaucoup plus contraignant. Dans le collectif il y a moins de contraintes, il n'y a pas de bandes enherbées à mettre en place, par exemple. Même dans le couvert de blé c'est moins contraignant, au moins 50% de couvert au lieu de 100%. Donc il y a des petits filous, des collègues, qui font moins de couverts parce qu'ils savent que les autres en font quoi.*

Est-ce que vous voulez dire autre chose sur la mesure collective ?

*Oui bon, on a créé une CUMA pour le hamster et ça m'a permis de rentrer là dedans aussi et on a acheté du matériel en commun. Et donc ça, dans mon collectif je suis le seul à rentrer dans la CUMA. C'est avec les autres zones, on a 18 agriculteurs. On est assez éparpillés.*

Les agriculteurs de votre ZC n'ont-ils pas besoin de ce matériel ?

*Non, ils ne le veulent pas. Ils utilisent les méthodes traditionnelles pour mettre en place les pratiques, ça leur évite d'investir dans des machines tout seul.*

[Remerciements]

15 minutes.

## D.2.4 Agriculteur 4.

Comment est-ce que la MEAC collective a commencé ?

*En fait, on était la commune la plus proche de la ville. Donc il y avait des choses qui se sont construites et qui ont dû compenser au titre privé, comme la plateforme LIDL par exemple, et ils se sont engagés à verser aux agriculteurs concernés une compensation sur une certaine surface. Mais c'était individuel, c'était des contrats privés. Donc on était les premiers à faire ça et en fait rapidement des associations qui se sont occupées du hamster se sont rendu compte qu'en collectif ce serait mieux. Donc là on s'est retrouvé dans une première réunion avec [le représentant de la CA], et comme on n'est que trois qui sont encore actifs, on a pu facilement se mettre d'accord.*

Vous n'êtes que trois dans la mesure collective ?

*Non, dans le groupe il y a des petits mais les trois plus importants ont réussi à convaincre les autres qui sont dans les communes autour.*

Donc il y trois agriculteurs, parmi vous, qui sont le cœur de la ZC ?

*Oui, tout à fait.*

Comment vous avez convaincu les autres ?

*Ben vous savez si les prix des céréales sont bas et il y a une compensation financière ça convient à tout le monde très vite. On n'a pas le choix.*

Donc c'était plutôt pour des raisons économiques ?

*Ah oui oui, de toute façon on a aucune autre raison, parce que ça implique des complications supplémentaires. Ici on était pratiquement en train d'abandonner le blé définitivement, mais comme il y avait des compensations pour le hamster, on a remis du blé et on s'est rendu compte que ce n'était pas forcément une mauvaise chose pour l'assolement. Pour la terre c'est plutôt une bonne chose de mettre plus de céréales à paille.*

Est-ce que la prime de terriers est intéressante pour vous ?

*Oui, bon c'est un système qui est difficile à contrôler. L'année dernière on s'est rendu compte qu'on avait beaucoup plus de terriers que ce qui a été compté, parce que rien a été compté au final, comme la moyenne a été faite sur l'année d'avant, voilà. . . Mais ça semble logique qu'il y ait effectivement une prime sur le terrier, mais nous on décide de la répartir entre nous et on en paie en fait l'achat de semences de l'engrais vert qu'on met après la récolte. On achète ça ensemble.*

Est-ce que la communication entre agriculteurs dans votre ZC marche bien ?

*Oui, oui, il n'y a pas de souci là-dessus. De toute façon on est 3-4 importants qui sont des leaders et les autres ils suivent quoi. Ils sont dans les villages à côté.*

Pendant les réunions de concertations est-ce que c'est plutôt facile de mettre en place les 26% de surfaces favorables ?

*Tout le monde connaît les règles du jeu, donc voilà on se retrouve avec nos assolements et puis on ajuste, on se rappelle quoi. Le plus grand souci ce sont les extérieurs, parce qu'ils ont des assolements tournants et des petites surfaces chez nous. Donc il y a des années où ils ont tous du blé et dans ce cas là nous on peut réduire nos surfaces, et il y a des années où ils n'ont pas du blé du tout et dans ce cas là on est obligés d'en rajouter chez nous quoi.*

Est-ce que vous arrivez facilement à vous mettre d'accord avec les extérieurs ?

*Oui ça va à peu près.*

Les extérieurs, ce sont des personnes en dehors de votre village ?

*Oui voilà c'est ça. Vous avez par exemple un qui a 4 ha de luzerne chez nous [dans la CZ]. Ils ont des terres ou des échanges chez nous, pour avoir la rotation de cultures.*

Avez-vous contractualisé la MAEC individuelle avant ?

*Oui, ça rapportait plus et c'était plus simple. Parce que c'était direct, on touchait la totalité de la somme. Alors qu'aujourd'hui on la partage pour atteindre la surface.*

Vous mettez toujours les mêmes surfaces en œuvre ?

*A peu près.*

Pour vous ce serait plus avantageux de revenir sur une mesure individuelle ?

*Oui bon, après philosophiquement, c'est peut-être plus logique ce qui a été fait maintenant. C'est plus facile à contrôler aussi, ça évite un peu l'anarchie parce que comme c'est collectif et que c'est contrôlé, c'est précis. On va dire ça comme ça.*

Vous trouvez que la MAEC collective impose plus de contraintes que la MAEC individuelle ou c'est à peu près la même chose ?

*Non, il y a forcément plus de contraintes parce que en plus le souci qu'on a c'est qu'au cours du contrat les règles du jeu ont changé. Ça veut dire qu'au bout des 5 premières années le système a été revu et changé. Donc ça c'est un peu plus compliqué. Par exemple, pour la luzerne on touchait un montant important, c'était presque 1000€. Aujourd'hui c'est moins de 700€ et en plus on peut faucher que la moitié etc., avec plein de contraintes supplémentaires. Mais on n'a pas forcément reçu des explications toujours très claires et quand on change tout le temps les règles du jeu c'est fatigant. Au bout des 5 ans on a failli ne pas repartir, c'était trop compliqué. Après on l'a fait, on a fini par tomber d'accord. Mais je veux dire beaucoup de négociations, beaucoup de discussions.*

Qu'est-ce qui vous a convaincu ?

*L'argent, enfin je ne vais pas vous mentir. On n'a pas le choix. Si dans trois ans les cultures sont payées au vrai prix, ce n'est pas sûr que tout le monde reparte. Le prix des céréales est trop bas. Tous les prix sont trop bas.*

Est-ce que les indemnités récompensent ?

## APPENDIX

*Cela évite de perdre des sous. Mais le prix des céréales fluctue quand même et puis c'est très loin payé, spécialité française. Là on a pas encore touché la totalité de 2020 alors qu'on est déjà en mars 2021. Les contrats privés le 11 novembre de l'année en cours c'était payé quoi. C'était comme si on avait le revenu de la récolte. Maintenant on est tout le temps décalé, enfin bref, ça rajoute des soucis à la discussion. Il y a eu une période il y a deux, trois ans qui n'a pas été payée. C'est un peu compliqué.*

Est-ce que vous avez pu profiter de la CUMA ?

*Non on n'est pas concerné à ce point sur nos surfaces, et puis on est équipé pour faire ce qu'il faut.*

Donc si je peux résumer, votre motivation était principalement économique et sans la MAEC vous auriez pas fait d'efforts pour le hamster ?

*C'est correct, c'est même pire que ça. Aujourd'hui on a l'impression qu'on nous impose des conclusions de soit disant scientifiques ou experts, et on se rend compte que ça ne marche pas. Alors si on associait le bon sens agricole et si on écoutait un peu plus les agriculteurs, je pense qu'il pourrait en avoir plus. Mais on est résigné, on ne dit plus rien. C'est triste mais on le fait pour l'argent. Il y a beaucoup de discours, beaucoup de blabla, et puis si vous voulez vraiment augmenter le nombre de hamster on peut faire autrement.*

D'après vous, qu'est-ce qu'il faudrait faire ?

*La personne qui a porté plainte contre l'état français parce que le hamster était en voie de disparition, c'est celui qui élève les hamsters qui sont relâchés. Donc c'était un peu choquant au début. Je pense que si aujourd'hui vous proposez aux agriculteurs d'aider le hamster pour qu'il se multiplie sur les champs avec des compensations un peu plus importantes encore, ça marcherait très bien encore. Au niveau des pratiques agricoles, pour que le hamster revienne il faut tuer les renards, tuer les hérons, réduire le nombre de cigognes et s'occuper aussi de tout ce qui est nuisible qui n'existait pas à l'époque où il y avait beaucoup de hamster. Premier problème, parce qu'à l'époque on chassait les hamster, on n'a jamais vu de renards, par exemple. Le préfet va dire qu'il organise une battue pour réduire le nombre de renards, mais il va avoir une association qui va porter plainte et qui remet sa décision en question. C'est très compliqué parce qu'il y a de la politique en permanence.*

Donc c'est plutôt une sorte de compromis ?

*De toute façon c'est que du compromis, c'est de la politique quoi. On a vu la meilleure avance pour le nombre de trous, ça a été 2020 où l'homme a été confiné. Si l'humain est confiné, forcément la nature se porte mieux. Après si vous voulez favoriser le hamster il faut créer un déséquilibre et réduire la prédation aussi, c'est sûr.*

[Remerciements]

17 minutes.

# Appendix E

## Appendix to Chapter 5

### E.1 Practitioners' Guide to Nudging

# ATELIER NUDGE

Brainstorming

Matériel Individuel

## GUIDE DE MISE EN OEUVRE

Afin de faciliter votre expérience de Brainstorming, ce guide vous sert de support pendant votre travail en groupe.

**18 JUIN 2018**  
mené par le laboratoire





# LE NUDGE

et sa définition

Une intervention est qualifiée comme *Nudge* si les 4 conditions suivantes sont respectées:

1. on n'interdit pas d'options de choix
2. on ne change pas les incitations financières
3. le besoin d'intervention et causé par un biais de décision
4. on utilise ce biais

Adapté de Hansen, P. (2015)

Le *Nudge* une incitation douce qui permet d'influencer le jugement, les choix ou le comportement des individus d'un façon prévisible. Le *Nudge* est motivé par les limites cognitives, les biais, les routines, et les habitudes qui sont en conflit avec les décisions rationnelles. Le *Nudge* respecte l'intérêt et les préférences de l'individu mais se sert de ses biais de décision pour améliorer les choix d'après ce qui est considéré optimal.



**Nudging est le développement systématique et factuel (basé sur l'observation de comportement réel) de Nudges mises en oeuvre pour créer un changement de comportement.**

1

# LE BON NUDGE

en 5 étapes

**1. Positionnement**  
Comprendre le contexte du problème: quel comportement est souhaité et comment peut-il être mesuré ?

**2. Découvrir**  
Comprendre les dynamiques socio-économiques: réactions aux autres personnes, contexte culturel, barrières structurelles, réglementations ... Réfléchir à segmenter la population..

**3. Faciliter**  
Aider à choisir la bonne option:

- Enlever les barrières
- Simplifier l'information
- Améliorer les compétences
- Mobiliser les capacités

Créer l'intervention

- Comment susciter les bons choix?
- Quel Nudge mettre en place ?
- Préférer une combinaison de Nudges ?

**4. Tester le Nudge**  
Échantillon: une étude de petite taille sur des personnes choisies aléatoirement parmi la population d'intérêt. Est-ce que l'on observe les effets désirés ? Les effets sont-ils pareils pour tous ? Quels sont les effets secondaires, sont-ils souhaitables ?

**5. Evaluer et Améliorer**  
Trouver la solution qui marche bien. Comparer l'intervention entre les segments et suivre la durée des effets.

**2**

Suivez l'évolution de votre intervention Nudge régulièrement.

## 1. POSITIONNEMENT

Les observations pertinentes  
max. 5 points

1.

2.

3.

4.

5.

**PROBLÈME**  
Décrire la situation actuelle

---

**COMPORTEMENT**

Qui :

Quoi :

Comment :

---

**L'IDEAL**  
Scénario amélioré

**3**

C'est trop pénible !



**1**

**MANQUE D'INTÉRÊT & D'ENGAGEMENT**

Orientation vers le Statu Quo,  
Évaluation à court-terme,  
Orientation selon les autres,  
Pression du Groupe

**2**

**MANQUE DE MAÎTRISE**

Attention Sélective,  
Récompense par les Émotions Positives,  
Aversion aux Pertes,  
Se donner la bonne conscience

Je ne m'y connais pas, ça ne me concerne pas.



**3**

**MANQUE D'INFORMATION**

Asymétrie d'Information,  
Structures Complexes,  
Oubli,  
Ressources Cognitives Limitées

**4**

**LES CAUSES DE COMPORTEMENT**

Je ne peux pas faire autrement...



**2**

**1**

**AUTOPORTANT**

Option par Défaut,  
Normes Sociales,  
Priming,  
Formulation,  
Affect,  
Réciprocité,  
Appel à l'E'go



**2**

**DÉCLENCHEUR**

Simplification,  
Intention,  
Provocation,  
Mise en évidence,  
Messager,  
Pionnier

**3**

**PRISE DE CONSCIENCE**

Campagne d'Informations,  
Avertissement,  
Rappel,  
Feedback,  
Exiger un Engagement



**5**

**LES NUDGES**

**INCITATIONS DOUCES**

Inspiré de Dolan et al. (2012) et de Schrag (2010). Images : recherche Google

## 2. DÉCOUVRIR

Quoi, pourquoi et comment le résoudre ?

CAUSE Pourquoi ?	EFFET Quoi ?	REMÈDE Comment ?
<input type="radio"/> Réaction aux autres Personnes <input type="radio"/> Information <input type="radio"/> Manque de Temps <input type="radio"/> Barrières Structurelles <input type="radio"/> Finances <input type="radio"/> Coutumes Culturelles <input type="radio"/> Autre :	<input type="radio"/> Manque de Maîtrise de Soi <input type="radio"/> Manque de Conscience <input type="radio"/> Manque de Sensibilisation <input type="radio"/> Manque d'intérêt <input type="radio"/> Autre : <input type="radio"/> Rien : Besoin d'intervenir ?	<input type="radio"/> Utiliser le biais <input type="radio"/> Eviter le biais <input type="radio"/> Confronter le biais <input type="radio"/> Autre : <input type="radio"/> Rien : Possibilité du Nudge ?

**NOTES :**



6

## 3. FACILITER

Le biais et le Nudge



### AUTOPORTANT

**Utiliser le biais.**

- Les effets seront répandus, permanents et autoporteurs
- L'impact sera fonction de l'effet désiré, plutôt exigeant à mettre en place
- Le succès sera déterminé par un changement de comportement durable

### DÉCLENCHEUR

**Eviter le biais.**

- Les effets seront temporaires, plus prononcés directement après la mise en place
- L'impact ne sera permanent que si le changement de comportement est effectué pendant le temps initial de l'effet
- Le succès sera déterminé par le renforcement de l'effet au cours du temps

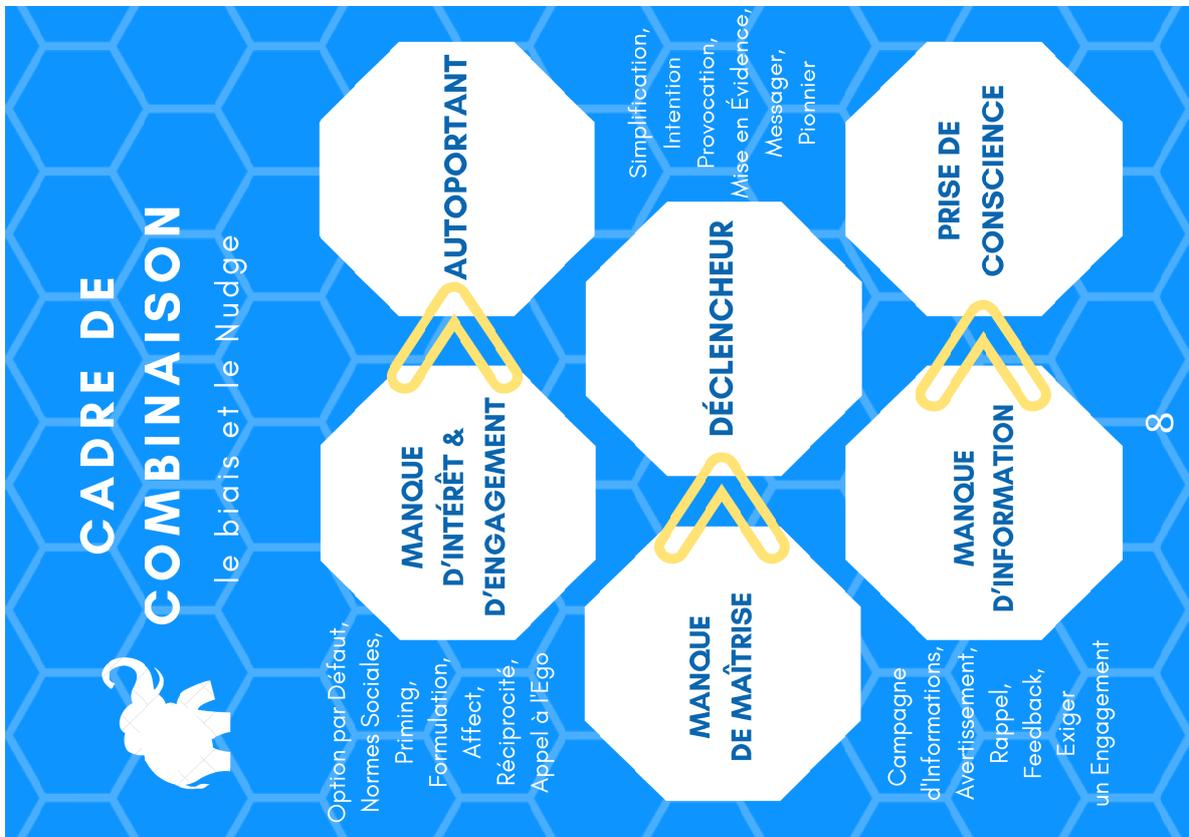
### PRISE DE CONSCIENCE

**Confronter le biais.**

- Les effets seront décalés de la mise en place : le moment de réception de l'information peut varier du moment de comportement
- L'impact ne sera long que si un changement dans le processus de décision est obtenu
- Le succès sera déterminé par le moment et le lieu d'exposition et par l'image du message

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Adapté de Schlag (2010)



## 4. TESTER

Améliorer et Ajuster

### Check-list

Segment(s) ciblé(s):

Critères de catégorisation des segment(s):

Tendance comportementale:

Cause:

Quand:

Nudge:

Liberté de choix:

Effets secondaires à anticiper:

Étude pilote (qui, quand, etc):

Réplication:

Durée des effets:

Renforts:

Suivi:

Effets de post-intervention:

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# CONSEILS

d'experts

**EASY** facile à mettre en oeuvre

**ATTRACTIVE** attire l'attention

**SOCIAL** orienter vers les réseaux sociaux

**TIMELY** cibler le bon moment

- BIT 2014

Identifier ce qui marche, quand et pour qui.

- BIT 2015

## Segmentation

- des causes diverses peuvent provoquer le même effet
- un Nudge ciblé sur une cause peut devenir invalide face à une autre cause
- dans certaines situations complexes, une combinaison de Nudges peut mieux gérer des causes diverses

S

**Découvrez toutes les causes. Segmentez la population d'intérêt en conséquence.**

**étude pilote**

tester l'effet du Nudge sur une petite échelle

Un échantillon sur le segment de la population ciblée permet de vérifier si les effets désirés se réalisent et si des effets secondaires non-désirés sont provoqués.

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Adapté de Behavioural Insights Team (2014) EAST- Four simple ways to apply behavioural insights.

# FEEDBACK

Vos réflexions sur le processus en 5 étapes

À améliorer



À relaire



Vos remarques:

Merci!

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INTÉGRATION DES INCITATIONS COLLECTIVES DANS LES POLITIQUES AGRO-ENVIRONNEMENTALES : APPROCHE PAR L'ÉCONOMIE EXPÉRIMENTALE ET COMPORTEMENTALE.

Le potentiel des incitations collectives pour la politique agro-environnementale est étudié à travers le prisme de l'économie comportementale. Le premier chapitre compare les résultats d'expériences en laboratoire et en lab-in-field sur deux types de dispositifs de subvention dans le cadre d'un jeu de bien public avec seuil. Le deuxième chapitre présente une étude de cas sur une mesure agro-environnementale et climatique (MAEC) collective qui constitue essentiellement une version appliquée du bien public avec seuil. Le troisième chapitre comprend une analyse économétrique plus détaillée des données de la MAEC au niveau de chaque exploitation. Le quatrième chapitre traite le rôle des associations d'agriculteurs dans la mise en œuvre de la MAEC. Le cinquième chapitre propose une conception d'atelier participatif afin d'identifier le rôle des interventions comportementales, telles que les nudges, pour la politique agro-environnementale.

*mots-clés : Économie Comportementale Environnementale, Politique Agro-Environnementale, Incitations Collectives*

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ON THE INTEGRATION OF COLLECTIVE INCENTIVES IN AGRI-ENVIRONMENTAL POLICY: A BEHAVIORAL AND EXPERIMENTAL ECONOMICS APPROACH.

The potential of collective incentives for agri-environmental policy is investigated through the lens of behavioral economics. The first chapter compares results from lab and lab-in-field experiments on two types of subsidy schemes within the framework of a threshold public good game. The second chapter presents a case study analysis of data from a collective agri-environmental scheme (cAES) that essentially constitutes an applied version of the threshold public good with the conditional subsidy framework. The third chapter comprises a more detailed econometric analysis of the cAES data at the individual farm level. The fourth chapter discusses the role of collective farmer organizations in the implementation of cAES. The fifth chapter proposes a participatory workshop design to identify behavioral interventions, such as nudges, for agri-environmental policy.

*keywords: Behavioral Environmental Economics, Agri-Environmental Policy, Collective Incentives*