Master's Thesis
for the Attainment of the Degree
Master of Science

Understanding pro-environmental collaboration amongst farmers

Management approaches and incentives underlying farmer clusters in the UK

by
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Abstract

Attempts for agri-environmental transformation in the EU are challenged by the need to coordinate conservation measures implemented at the farm-level across larger spatial scales. This thesis examines collaborative 'farmer clusters' in the UK as an approach to enable environmental outcomes on a landscape-scale. The thesis draws upon known factors of success in collaborative, decentralised resource management to unravel clusters' performance in delivering environmental and social objectives. Literature reviews were conducted to aggregate relevant success factors which were subsequently contrasted with the farmer cluster concept by conducting a qualitative data analysis of the publicised and grey farmer cluster literature. Furthermore, clusters' interplay with financial incentives for environmentally friendly farming (i.e., agri-environmental schemes) was investigated. It was found that clusters excel in ensuring meaningful farmer participation, integrating both local and expert knowledge in decision-making, and enhancing farmers' capacity for self-contained agri-environmental management. Identified shortcomings were translated into 15 policy and management recommendations. On a methodological level, the consideration of three management approaches (participatory management, community-based management, and co-management) proved too coarse-grained to equally inform a comparison with the cluster concept. Due to a considerable overlap in success factors, one approach did not contribute significantly to this thesis' findings.

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List of acronyms

ACM Adaptive Co-Management

AES Agri-Environment Scheme

CAP Common Agricultural Policy

CBNRM Community-based Natural Resource Management

CLA Country Land and Business Association

CS Countryside Stewardship

CSFF Countryside Stewardship Facilitation Fund

ES Ecosystem Service

FC Farmer cluster

GWCT Game and Wildlife Conservation Trust

NRM Natural Resource Management

PES Payment for Environmental Services

PNRM Participatory Natural Resource Management

PP Participatory Process

RSPB Royal Society for the Protection of Birds

1. Introduction

> "If continued, conventional intensive agriculture will jeopardize both sustainable land management and food production." (IPBES 2018, 417)

Farmers have long found themselves in a field of tension between the most diverse and frequently contradictory demands: the provision of high-quality food for a growing world population, complying with increasingly stringent environmental requirements and responding to the expectations of an environmentally conscious society, and not last earning a decent living in a highly globalised and pressured market setting. Combined with a historical past of state-initiated incentives aiming at intensification and increased production (Stoate et al. 2009), it is not surprising that the ongoing debate around agricultural transformation is highly polarised. On the one side environmental activists and increasingly larger parts of the public are calling for stronger requirements for farmers regarding the use of agri-chemicals and fertilisers, on the other side affronted farmers express their resentment against 'agribashing' by flooding European cities with tractors (Ploeg 2020). While the ecological consequences of intensive agricultural farming are long known, especially in regard to amplifying climate change, water deterioration and biodiversity decline (Stoate et al. 2001; Pachauri, Mayer, and Team 2015; European Environment Agency. 2021; IPBES 2018), policy has as yet failed to resolve the dilemma of globally competitive production of agricultural commodities (through - mostly - intensive practices) and its associated environmental damages (Guy Pe'er et al. 2020).

This thesis examines an innovative approach of collaborative farmer groups in UK that seeks to tackle this dilemma by implementing agri-environmental conservation measures across farms on a landscape-scale. The so-called 'farmer clusters' comprise land managers with adjacent or spatially close holdings, who, supported by an external advisor, join up to collaboratively decide on environmental goals and corresponding conservation measures (Nye 2018). The advisor, or 'facilitator', is financed through government funding and the groups environmental efforts are generally, though not exclusively, compensated through existing agri-environmental schemes (AES) (ibid.). The latter presents a policy tool established through the European Union's Common Agriculture Policy (CAP) that refunds farmers for voluntarily adopting practices to protect the environment (Science for Environment Policy 2017). Scheme options, i.e., particular measures that are eligible for funding through AES, are defined individually under the EU's Member State's Rural Development Programmes and are thus manifold, reflecting differing local contexts and environmental objectives as well as varying approaches to incentivise participation (Hodge, Hauck, and Bonn 2015). The farmer cluster concept is increasingly gaining attention as it approaches a major challenge in recent agri-environmental policy, i.e., a mismatch of scales in offering AES to individual farms while the ecological processes that account for ecosystem service provision operate at larger spatial scales (Cumming, Cumming, and Redman 2006). Farmer clusters are thus anticipated to enable environmental outcomes on a landscape-scale by coordinating conservation efforts across multiple adjoining holdings instead of isolated measures implemented by individual farmers.

At the time of writing (i.e., June 2021), about 100 farmer clusters are in operation after three

rounds of funding from 2015 to 2017.[1] While unpublicised reports unanimously document positive outcomes of cluster activities, particularly in terms of social benefits (N. Jones et al. 2020; Nye 2018; Prager 2019; Adamson et al. 2020), in-depth knowledge regarding the functioning and management of clusters, and enablers and barriers is as yet scarce. Both Prager (2019) and Nye (2018) examine cluster participation and engagement from a social science perspective based on a relatively small sample of groups (6 and 9 clusters, respectively). Both authors stress particular findings such as the crucial role of the facilitator to steer group efforts and sustain clusters' momentum, while simultaneously highlighting a significant heterogeneity in their sample in terms of group identity, a shared understanding of the groups purpose, the governance models in place, or group cohesion. A comprehensive examination of existing means for clusters' set-up and management, as well as enabling or obstructive group dynamics, that might reconcile this observed variety in clusters organisation and outcomes, is as yet lacking in the academic discourse. This thesis aims to close this gap.

Against this objective, the study draws upon existing knowledge in the area of decentralised, collaborative natural resource management (NRM) to unravel how cluster activities shape social and environmental outcomes on a landscape-scale. Three management approaches are considered in this regard: participatory natural resource management (PNRM), community-based management (CBNRM) and adaptive co-management (ACM). All approaches are united in collaboratively organising the utilisation of natural resources, but differ in terms of instrumentality, degree of participatory power sharing, and formalisation. Given the crucial role of AES in financing clusters environmental efforts, the analysis is complemented by considering clusters' interplay with AES in terms of promoting or diminishing farmers' willingness for AES uptake.

To summarise, the research question of this thesis may be concluded as follows:

> "How can existing knowledge about the success of collaborative, decentralised natural resource management and drivers for AES uptake enhance our understanding of farmer clusters performance in promoting the delivery of environmental objectives on a landscape-scale?"

Consequently, this study is composed of four steps:

1. *Introduction of the theoretical background.* This includes the definition and differentiation of natural resource management approaches to enable and frame a subsequent comparison with the farmer clusters concept (section 3), as well as providing an overview of AES as financial incentives to promote environmentally friendly farming (section 4).
2. *Deducing factors of success* of the respective management approaches and factors promoting AES uptake by farmers to set the scope of this thesis' qualitative analysis (section 5).
3. *Conducting a qualitative data analysis* of the publicised and grey literature on the cluster concept to examine cluster agreement with or divergence to the NRM and AES literature' recommendations (section 6).
4. *Discussion and conclusion* of the analysis' results.

1. https://www.farmerclusters.com, accessed 16 June 2021

2. Method

The methodological approach applied in this thesis is twofold: The first part aims to conceptualise prevailing approaches for the management of natural resources and to outline the functioning of agri-environmental schemes as financial incentives to promote agricultural behavioural change. This is complemented by a collection of factors from the publicised literature that are argued to enhance the success of collaborative management and farmers' willingness to adopt AES. The research method applied for sections 3 to 5 thus constitutes a literature review.

The insights gained in this first part subsequently inform a qualitative data analysis of the publicised and grey literature regarding the farmer cluster concept in UK. This chapter aims to unravel farmer clusters agreement or divergence with the findings aggregated in the previous literature reviews. Both methodological approaches are specified in the following subsections.

2.1. Literature review

The thesis follows the classification made by Snyder (2019), who differentiates three approaches to conducting a literature review: A *systematic* review is designed to include and evaluate all existing empirical evidence of interest for a particular and narrowly defined hypothesis in a "systematic, transparent, and reproducible way" (Snyder 2019, 334). A *semi-systematic* approach takes in a broader perspective for research topics that have been conceptualized and studied within diverse disciplines over time and aims to provide an overview of a research area or its development. Last, an *integrative* review is closely related to semi-systematic approaches, but focuses on re-conceptualising mature theoretical models or creating initial frameworks for emerging, new topics. In contrast to the descriptive nature of a semi-systematic literature review, it thus tries to enhance knowledge by developing a new theory or conceptual framework.

The following sections primarily serve two roles: First, they aim to define and differentiate existing natural resource management approaches and payments as a tool to incentivise pro-environmental behaviour in the agricultural sector. Hence, the goal is to develop an overview of the respective fields of research in order to extract the underlying understanding of the approaches and their fundamental characteristics as portrayed or implied in the literature. Including all possibly relevant papers on, e.g., participatory resource management for this purpose is neither feasible nor advisable. Instead, a semi-systematic literature review as outlined above (and more detailed in Snyder 2019) is conducted for this part of the thesis.

Second, they seek to aggregate the state of knowledge regarding how and why a specific approach is successful in ensuring a sustainable use or conservation of resources by identifying their corresponding factors of success. Against this objective, it was aimed to conduct a systematic review covering all publicised literature on NRM and AES success factors. However, the body of publicised knowledge proved to be too extensive to be entirely covered within the scope of this study (e.g., the literature search revealed almost 1,500 papers concerned with PNRM success). For this reason, a semi-systematic approach was adopted for section 5 as well.

The literature reviews were conducted as follows: Two research platforms - *Web of Science* and *Google Scholar* - were used. Table 1 summarises the keywords used and criteria for pre-selecting relevant publications. As Google Scholar does not allow the definition of more complex literature

Table 1: Keywords and criteria applied for the literature reviews

Section	Keywords	Criteria
3.1	resource management AND (participation OR participatory process*) AND (concept* OR characteristics OR terminology)	deals with PNRM functioning or outcomes; case study, meta-analysis, review, or conceptual study
3.2	community-based resource management AND (concepts OR characteristics OR terminology)	deals with CBNRM functioning or outcomes; case study, meta-analysis, review, or conceptual study
3.3	co-management AND (concepts OR characteristics OR terminology)	deals with ACM functioning or outcomes; case study, meta-analysis, review, or conceptual study
4	(agri-environment* scheme*) OR (agri-environment* measure) OR (collective agri-environment* scheme*)	deals with AES; case study, meta-analysis, review, or conceptual study
5.2	resource management AND (participation OR participatory process*) AND (success factor OR best practice OR principle*)	evaluative study, meta-analysis, or review based on 3 or more case studies
5.3	community-based resource management AND (success factor OR best practice OR principle*)	evaluative study, meta-analysis, or review based on 3 or more case studies
5.4	co-management AND (success factor OR best practice OR principle*)	evaluative study, meta-analysis, or review based on 3 or more case studies
5.5	(agri-environment* scheme*) AND (success OR participation)	evaluative study, meta-analysis, or review based on 3 or more case studies
6	(farmer cluster*) AND agriculture AND (uk OR england OR united kingdom)	focus on CSFF funded farmer clusters

queries that apply logical operators ('AND', 'OR'), multiple queries were conducted to cover all combinations of keywords presented in Table 1. For each combination, the abstracts of the first 50 publications were read and the publications that met the defined criteria were obtained for a more detailed consideration. In case of the more comprehensive queries made to the platform Web of Science, the first 100 publications were scanned. All pre-selected publications were reviewed in order to inform the analysis, though not all articles proved relevant after closer examination. The publications obtained in this way were complemented during the review by 'snowballing', i.e., adding relevant publications cited in the articles to the review. However, the number of articles added through snowballing was not extensive, indicating that the literature search provided a comprehensive knowledge base for the respective fields of research. The temporal scope of the literature review is limited roughly by the 1990s, taking into account that publications on some of the approaches (e.g. participatory NRM) go back several decades.

2.2. Qualitative data analysis

The factors of success derived in section 5 are subsequently used to inform a qualitative data analysis of the publicised and grey literature on farmer clusters in the UK. The published cluster literature was identified through a literature search and review as described in Table 1 using the search engines *Google Scholar* and *Web of Science*. Complementary grey literature was obtained by manually searching the websites of organisations linked to farmer cluster funding and evaluation (e.g., UK government, DEFRA, Game & Wildlife Conservation Trust, Natural England), and by utilising academic networks within the EU-Horizon project *FRAMEwork*.[2] Seven reports and papers concerning the cluster approach (hereinafter referred to as 'articles') were identified and selected for the qualitative data analysis. Table 2 provides a short summary of the articles key characteristics and data sources.

The data analysis was conducted using the software *MaxQDA Analytics Pro 2020* (v20.4.1). A 'thematic analysis' was conducted, aiming for an in-depth consideration and presentation of qualitative data along pre-defined thematic categories (i.e., the factors of success) instead of, e.g., more abstract theory or framework development (Rädiker and Kuckartz 2019). The success factors derived in section 5 were translated into a code system, with each factor being attributed to a corresponding code. The code system was thus derived inductively based on pre-existing empirical studies on natural resource management or AES uptake rates. Given the overlap of success factors across the considered management approaches (see section 5), identical or closely related codes were merged to generate a comprehensive but non-redundant set of codes to provide focus to the subsequent analysis. No further alterations or supplements to the code system were made. All articles listed in Table 2 were coded by the author, resulting in more than 900 coded segments across all articles as specified in the table. Afterwards, the coded segments related to particular success factors were successively reviewed, summarised and discussed in section 6.

2. The EU-Horizon 2020 project *FRAMEwork* aims to identify and implement solutions to enhance biodiversity management on agricultural lands on a landscape-scale. 18 organisations in 11 countries are part of the project, including Osnabrueck University. For further information see https://www.framework-biodiversity.eu (accessed 23 September 2021).

Table 2: Articles considered in the qualitative data analysis

Reference	Study type	Sample[a]	Description	Codings[b]
Adamson et al. 2020	Case study	28	Case study reports, covering group characteristics, AES uptake, type and attendance to training events, and success and barriers.	458
ADAS 2018	Evaluative report	12 / 49 [c]	Evaluative report on CSFF clusters operating in 2015/16. Including group sizes, area covered, group activities and priorities.	8
Franks 2019	Review, publicised	-	Review on the evolution of AES in England, particularly concerning landscape-scale dimensions.	5
Jones et al. 2020	Evaluative report	10 / 67 [d]	Extensive report on the CSFF. Including interviews with cluster members (n=10) and the results of a facilitator survey (n=67).	231
Nye 2018	Evaluative report	9	Report on farmers motivations for, benefits of, and barriers to cluster membership, based on 7 CSFF funded groups and 2 privately funded clusters.	166
Prager 2019	Case study	6	Study investigates how clusters operate in two case study regions in England, based on 38 semi-structured interviews with land managers (cluster members and non-members) and facilitators.	44
RPA 2021	Manual	-	Countryside Stewardship Manual, elaborating the process of scheme application and scoring for agreements starting on 1 January 2022.	3

[a] - No. of clusters.

[b] - No. of coded segments in MaxQDA.

[c] - Group characteristics are provided for all 49 CSFF funded clusters in 2015/16. A more detailed review was conducted for a sample of 12 clusters.

[d] - 10 land manager interviews representing 10 clusters and 67 cluster facilitators partaking in a survey.

3. Collaborative Natural Resource Management

Decentralised approaches for the management and conservation of natural resources emerged during the last century as society became increasingly aware that conventional, top-down policy was unable to meet the expectations placed in it. In the face of local and global environmental problems, including deforestation, soil erosion, ozone depletion and acid rain, the hitherto prevailing idea of 'nature as a resource' that can - and, in order to serve economic growth, should - be made use of in the most centralised and efficiency-focused way, began to falter (Kapoor 2001). The perception of community and local people shifted from being a hindrance for rational and sustainable resource management to being seen as a means to access sources of valuable, new knowledge and thus increase the quality of management decisions, enhancing their democratic legitimacy by allowing the public to participate, and achieving a variety of social goals such as strengthening public trust in the government (Kapoor 2001; Özerol and Newig 2008). Consequently, by the 1990s, decentralisation and participation had become established as the norm for sustainable development agendas (Reed 2008; Akbulut and Soylu 2012).

During this course, various decentralised policy and management approaches developed, accompanied by their own terminology and perspectives, representative of their respective research disciplines in which they were applied. The approaches differ in terms of intensity of participation, types of stakeholders or user groups involved, and the degrees of formalisation in their contextual setting and methodology. Commonly cited approaches include participatory natural resource management (PNRM), community-based natural resource management (CBNRM), adaptive co-management (ACM), public-private partnerships, as well as collaborative, participatory and adaptive governance. These terms overlap in their conceptualisation and application, with participatory management often used as an umbrella term comprising more narrowly defined approaches such as co-management and CBNRM, co-management and public-private-partnerships being defined almost synonymously in the realms of NRM (Castro and Nielsen 2001; Berkes 2009; Carlsson and Berkes 2005; Thellbro, Bjärstig, and Eckerberg 2018; Bjärstig 2017), and collaborative governance approaches resembling participatory management in including participatory processes while being mainly applied by political scientists in the context of governmental processes (Gash 2016; Fischer 2012). The analysis and delimitation of the terminology used in collaborative natural resource management itself represents an insightful area for academic research and has at least partially been addressed in the literature (see Plummer and FitzGibbon 2004), but is not feasible to the required extent as part of this thesis. Instead, three management approaches are selected for the following analysis to cover notable characteristics and dynamics innate to the cluster concept while avoiding redundancies between the approaches as far as possible. The management approaches under subsequent study are participatory NRM, community-based NRM, and (adaptive) co-management.

A model by Plummer and FitzGibbon (2004) is introduced and applied hereinafter to differentiate the management concepts. The authors present a three-dimensional sphere to delineate co-operative management approaches, which they define as including participatory elements and the sharing of rights and responsibilities between resource managers and the public (Figure 1). The first dimension describes the degree to which power is devolved to civil society or stakeholders and is based on Arnstein's ladder of participation (Arnstein 1969). It ranges from pure state-run management modes, in which the public is merely informed without being actively involved in the decision-making

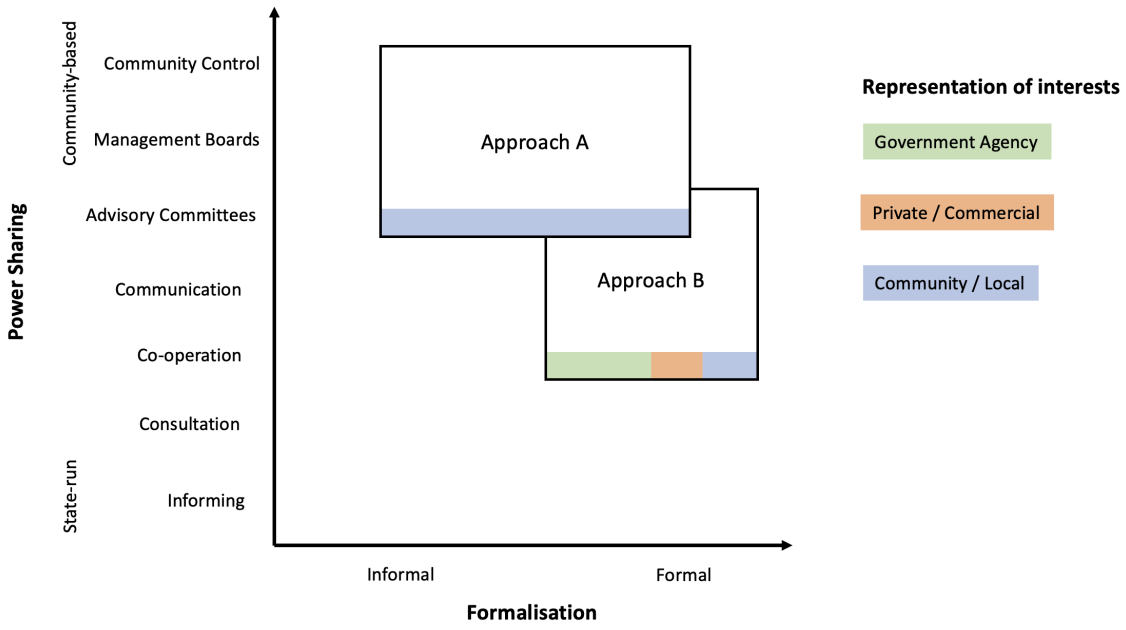

Figure 1: A multi-dimensional model of collaborative, decentralized NRM
(Source: Own illustration adapted from Plummer and FitzGibbon 2004, 68)

process, to the complete transfer of power to non-state actors. The highest levels of community participation tend to be bottom-up organised and levels below 'consultation' top-down, while the participation regimes in between generally represent a mixture of both (Currie-Alder 2005). The second dimension portrays the formalisation of management processes that shape the outcomes of collaborative efforts and is linked to characteristics of the institutional arrangements in place. According to the authors, this includes "(1) legislation and regulation, (2) policies and guidelines, (3) administrative structures, (4) economic and financial arrangements, (5) political structures and processes, (6) historical and traditional customs and values, and (7) key participants or actors" (Mitchell 1989, 245 cited by Plummer and FitzGibbon 2004, 69). The formalisation-dimension thus reflects how management is influenced through the institutional setting that comprises political, legislative, administrative, and sociocultural aspects. On a methodological level, a strongly formalised participatory process constitutes, e.g., cognitive mapping, while unstructured, qualitative interviews would be placed at the relatively informal end of the spectrum (Newig, Haberl, et al. 2008). Last, the third dimension maps the scope of actors represented in the management approach. Three groups of participants are distinguished: representatives from government agencies, the private or commercial sector and community interests.

In summary, the model depicts where approaches for the management of natural resources are located depending on *how* resources are managed regarding (a) the intensity of community participation and (b) process formalisation (dimensions 1 and 2) and *who* is involved (dimension 3). It needs to be stressed that even though the model portrays distinct boundaries between management approaches, their arrangement is rather blurred and multilayered in practice. On the one hand, this is a matter of scales, i.e., the model dimensions' ordinal nature. While it is, for example, possible to qualitatively compare two approaches in regard to their degree of formalisation, positioning them on a linear scale is challenging due to the lack of an operationalised measure of formalisation. The

same is applies to dimensions 1 and 3, even though the differentiation of their manifestations is somewhat easier in practice. On the other hand, the management approaches under consideration in this thesis are usually not strictly or exclusively defined in regard to the model dimensions. For example, community-based natural resource management might for most scholars imply a high degree of community control; however, some use the term to describe mere cooperation with communities. Ultimately, community-based management projects (i.e., with high levels of participation) might also use relatively low-level participatory processes (such as informational events). Thus, applying the model subsequently seeks to convey a general understanding of different management approaches and their key characteristics instead of representing every collaborative project labelled accordingly.

For visualisation purposes, the spatially three-dimensional model, as illustrated by Plummer and FitzGibbon (2004, 68), is reduced to a two-dimensional graph (see Figure 1), with the third dimension integrated through colour-coding. The relative width of the coloured bars represents the distribution of interests involved.

3.1. Participatory Natural Resource Management

Participatory natural resource management likely represents the oldest and most prominent approach under consideration in this thesis. However, despite its popularity, the concept is seldom explicitly defined in the literature. Two reasons for this are evident: First, the term is to a high degree self-explanatory, as will be shown below; and secondly, it is frequently conceptualised in such a broad manner that defining it does not offer clarity or informational value to the respective studies. Where it is defined or described, definitions tend to diverge, as they are tailored to fit the individual case study or research question under examination (Currie-Alder 2005; Kapoor 2001). Thus, the term itself will serve as a starting point for a more detailed investigation.

Participation is understood as "involvement in a process" (Carr, Blöschl, and Loucks 2012, 2). In general, this involvement can be active (e.g., being a member of an advisory committee) or passive (e.g., receiving information) (ibid.); even though some authors, such as Reed (2008), link it exclusively to active engagement in decision-making processes. Participation can take many forms, as described by Ashford and Rest (2008, III-3) as ways to "communicate, interact, exchange information, provide input around a particular set of issues, problems, or decisions, and share in decision-making to one degree or another". Consequently, the concept of participation has been investigated within a range of research areas, being loaded with diverse ideological, social, political and methodological meanings and giving rise to various typologies of participation, focusing on (a) the intensity of participation, such as Arnstein's (1969) ladder, (b) the nature of communication flows, (c) theoretical differentiations, including normative and pragmatic dimensions, or (d) the objectives for which participation is used (Reed 2008). In this thesis, the definition by Carr et al. (2012) is adopted and an inclusive interpretation of participation covering both the lower, more passive ends as well as highly intense forms of participation on the borderline to citizen ownership (and thus community-based natural resource management, see section 3.2) is applied.

Natural Resources Management describes a subset of sustainability problems that "embraces watershed or catchment and landscape-scale management strategies, and engages with biodiversity conservation, control of pest plants and animals, and maintenance of soil and water quality"

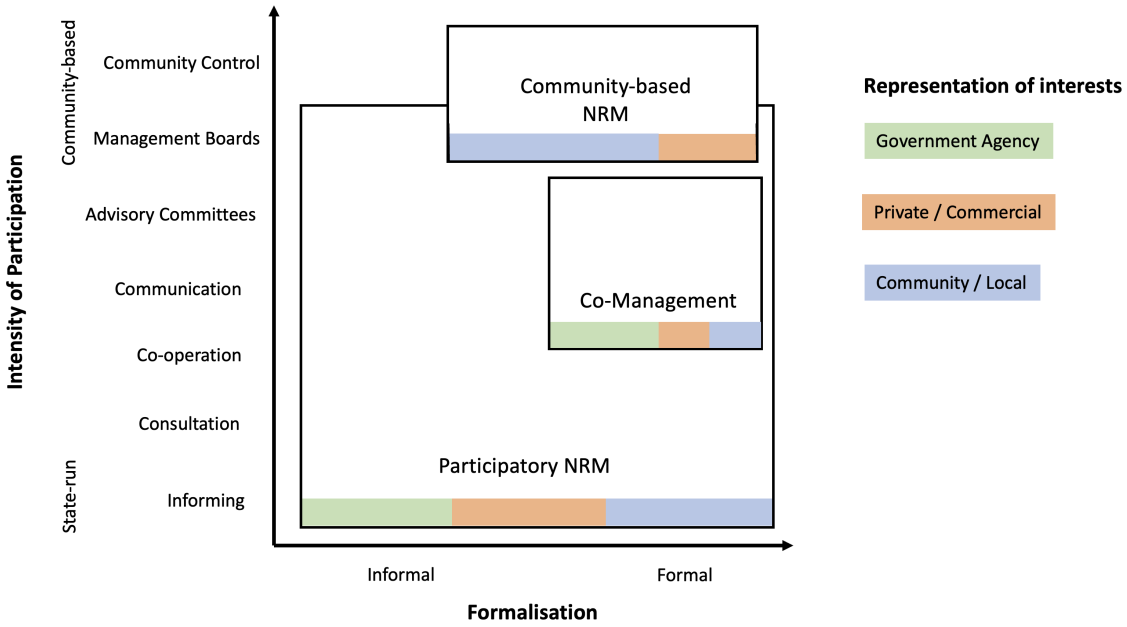

Figure 2: NRM approaches illustrated through model of co-operative NRM
(Source: Own illustration adapted from Plummer and FitzGibbon 2004, 68)

(Lockwood et al. 2010, 987). It thus concerns sectors including forestry, agriculture, water allocation, and tourism (ibid.). Hence, this expresses the objective and rationale for applying PNRM approaches rather than further specifying means, especially since all the approaches considered in this section are used within NRM.

In summary, the only definitive claim that can be made regarding the definition of PNRM is that *it contains and makes use of participatory processes* (apart, of course, from being applied within NRM, which is valid for all approaches). These processes may be mandatory or voluntary (Krishnaswamy 2012), and, in line with the broad definition of 'participation' above, range from loosely defined to strictly formalised methods, which are selected depending on goals, contexts, the stage in the decision-making process, and the particular stakeholders involved (Newig, Haberl, et al. 2008; Newig, Gaube, et al. 2008; Currie-Alder 2005). Introduced to the presented model of co-operative management, PNRM does stretch along almost the entire dimensions of participation intensity and process formalisation, illustrating its broad definition and emphasising its application as an umbrella term for collaborative resource management (see Figure 2). The only dimension of PNRM not considered as yet concerns whose interests are represented through it. This field of *stakeholder identification* and *analysis* represents a research area of its own. *Stakeholders* are understood as all those "who affect or are affected by a decision or action" (Reed et al. 2009, 1934), including "individuals, communities, social groups or institutions of any size, aggregation or level in society", such as "policy makers, planners and administrators in government and other organisations, as well as commercial and subsistence user groups" (Grimble and Chan 1995, 114). Therefore, PNRM is not exclusive for defined interest groups but claims to consider all actors with a legitimate stake to participate. This is illustrated in Figure 2 by marking all three groups with bars of equal size. However, it needs to be stressed that theoretical objectives (as portrayed in the model) do not necessarily equal reality. A large body of literature is concerned with how power

asymmetries are transferred into participatory processes, marginalising socially disadvantaged stakeholders and endangering effective participation by all (Akbulut and Soylu 2012; Barnaud and Van Paassen 2013). Thus, Figure 2 needs to be interpreted as a representation of the theoretical concept of PNRM, giving no indication about challenges and inequalities arising at the stage of implementation.

3.2. Community-based Natural Resource Management

The term Community-based Natural Resource Management (CBNRM) came into use in the 1980s (Blaikie 2006) and, as the name suggests, puts the community at the core of decision-making. The community, it is assumed, not only has a greater interest in conserving its resources than any distant governance authority but also possesses the capital, especially of human (knowledge and labour) and social (e.g., social networks, trust) sorts, to ensure efficiently and socially just resource management (Brosius, Tsing, and Zerner 1998). CBNRM is thus seen as a means to meet both environmental and socio-economic goals simultaneously, a claim it has frequently failed to deliver (Fabricius and Collins 2007). Some scholars, such as Kumar (2005), reject to define CBNRM in detail, arguing that the term does not represent a single approach but rather a range of strategies. Others draw near by making general statements that, for example, describe CBNRM to "encourage better resource management outcomes with the full participation of communities and resource users in decision-making activities, and the incorporation of local institutions, customary practices, and knowledge systems in management, regulatory, and enforcement processes" (Armitage 2005, 703). Finally, some authors do not seek to squeeze CBNRM into a precise definition but instead point to commonalities between all interpretations. These include, as Kellert and Metha (2000, 706) state:

- Involving community members and local institutions in the management and conservation of natural resources;
- Devolving power and authority from state government to more local institutions and people;
- Linking socio-economic and environmental objectives; and
- Defending local and/or indigenous rights.

The governmental and scientific sphere, which dominated decision-making processes in traditional, top-down approaches, takes in a supporting role in CBNRM, focusing on tasks such as research, facilitation, and institutional design (Child and Barnes 2010). The resources managed through CBNRM are, in most cases, although not exclusively, common-pool resources; thus, including forests for wood supply or recreational services, grasslands and farmland, wildlife, or fish in open waters and lakes (Blaikie 2006).

Placing CBNRM in the model of co-operative NRM (Figure 2) reveals similarities as well as deviations to PNRM. First, it must be noted that participatory processes are an integral part of CBNRM (Fabricius 2004) and, as some authors find, even essential for the success of CBNRM programs (Gruber 2010). Hence, PNRM does, to some degree, encompass CBNRM. However, CBNRM goes further than PNRM, not only making use of PP but setting community participation and, at the highest level, community ownership at the core of their practice and including public participation at all stages of CBNRM projects (Gruber 2010). Consequently, state authority devolves

to local levels representative of community interests, enabling a more distinct differentiation of the two approaches. In terms of the first dimension of the model (intensity of power-sharing), CBNRM is placed at the upper end of Arnstein's ladder. Ideally, all decision-making power is transferred to community entities, but in any case they are an elementary driver for the management activities that take place.

In addition, through the delegation of power at a legislative or institutional level, CBNRM is placed in a more formalised setting than typical PNRM approaches, which are generally carried out voluntarily and without a legal framework. Those adjustments to the institutional setting may include the establishment or modification of institutions to represent community interests, transfer of property rights to the local level, and the establishment of financial incentives to motivate participation by community members (Armitage 2005; Suich 2013). The nature of participatory processes itself can, naturally, range from highly formalised methods to open, loosely structured options, as described in section 3.1. However, considering the institutional arrangements that accompany CBNRM, it is positioned at the more formal end of dimension 2 in the model of co-operative NRM (Figure 2).

The third specification of CBNRM distinguishing it from PNRM concerns the third model dimension, namely, whose interests are represented through it. The answer appears to be noticeable, as it is given in the term for CBNRM itself: the community. However, there has been a controversial discussion in the literature on how to define 'communities', who is included and according to which criteria boundaries to the external world can be drawn (Brosius, Tsing, and Zerner 1998; Agrawal and Gibson 1999; Natcher and Hickey 2002; Kumar 2005; Stone and Nyaupane 2014). This is not an issue that only gained attention with the emergence of CBNRM; as early as 1955, Hillary found 49 different definitions for the concept of community in the scientific literature (Hillery 1955 quoted by Kumar 2005). In the most generic terms, "community refers to a group of people united by at least one common characteristic" (Ashford and Rest 1999, III-4). However, difficulties arise in application as soon as these characteristics are to be defined for a given resource system. Many scholars concerned with NRM see the common characteristic(s) of communities include either (1) a close spatial relationship, i.e., living near the resource in question, (2) being embedded in a homogeneous social structure, or (3) shared norms and interests (Agrawal and Gibson 1999). Each notion potentially suffers from over-simplification: Communities are not necessarily spatially clearly bounded, nor do all resource types easily link to individual and distinct user groups (including, for example, mobile resources like fish and wild stock) (Kumar 2005). Perceiving communities as socially homogenous groups, despite the existence of competing groups or diverging interests, does not reflect the complexity of social systems and gives way to conflicts, potentially jeopardising CBNRM success (Berkes 2006). Nevertheless, the three characteristics are helpful to approach the concept of community. For the integration of CBNRM into the model of co-operative management, it must be taken into account that the community level also includes and, ideally, represents private and commercial interests on a smaller scale. While the primary decision-making power lies in the hands of community institutions, the community, defined, e.g. by spatial proximity, logically also includes individual private or commercial interests in the form of local residents and companies, which can and should be included in management activities through participation. Therefore, CBNRM does not only represent community interests but also private and

commercial entities, as visualised in Figure 2.

3.3. Co-Management

Like CBNRM, the term Co-Management emerged in the second half of the 20th century. In the 1970s, it was used to describe an innovative management regime in which US treaty tribes were granted collective choice rights over harvesting regulations of fishing grounds (Pinkerton 2003), while the James Bay and Northern Quebec Agreement almost simultaneously constituted the first Canadian co-management arrangement in 1975 (Rusnak 1997). However, approaches that fit the contemporary definition of co-management but were not referred to as such at their time date back even to the 1890s (Plummer and D. Armitage 2007). Co-management is, in many ways, a 'middle course' between conventional, state-controlled management and outright devolution of authority to local levels, as in CBNRM (ibid.). It aims at combining the advantages of both regimes, adding their individual strengths while compensating for their respective weaknesses. Access to local resources enables benefits including knowledge about particular ecosystem intricacies, cost-effective monitoring or compliance with requirements due to increased legitimacy, while governmental agencies can draw upon their management capacities, add scientific findings to fine-tune management decisions, and contribute a measure of accountability to the larger public (Singleton 2000). While initially being rewarded mainly as a means to settle aboriginal claims and conflicts regarding resource use (Notzke 1995; Castro and Nielsen 2001), co-management is nowadays attributed to other social, economic and ecological rationales of collaborative NRM. These include the reduction of transaction costs, sharing risks, enhancing livelihoods, equity and legitimisation, facilitating transformative processes and building resilience (Carlsson and Berkes 2005; Plummer and D. Armitage 2007; Plummer et al. 2012).

As with other terms in the field of collaborative NRM, there is considerable confusion and divergence in the scientific literature regarding the definition of co-management. Two distinct approaches to the concept of co-management were identified: Some scholars, especially in earlier publications, refrain from tying it to a strictly constrained and exclusive definition and instead apply it in rather general terms that resemble PNRM (Notzke 1995; Rusnak 1997). They understand *co-management* as a mere abbreviation for *collaborative management*, including a variety of measures that range "from those for example, that merely feature local participation in government research, to those in which local communities retain all the management power and responsibility" (Notzke 1995, 190). Its overlap to other management approaches that involve multiple actors have been recognised in the literature (Berkes 2009), and voices against using the term in such a highly inclusive manner have been raised (Castro and Nielsen 2001).

A more precise understanding of co-management is presented by Berkes (2009, 1693), who refers to it as "a range of arrangements, with different degrees of power-sharing, for joint decision-making by the state and communities (or user groups) about a set of resources or an area". This definition points to a set of particular characteristics, which are usually linked to co-management: The first is power-sharing. This is not only understood as participating in decision-making processes but also includes negotiating and defining a fair share of the responsibilities and duties that accompany management functions (Carlsson and Berkes 2005). It is thus often described as a partnership in which each party specifies and guarantees their respective rights, functions, and tasks. This,

secondly, requires some formal institutional arrangement that reflects and documents the joint agreement and creates accountability for each party (Berkes 2009). And third, one actor prevalent in co-management arrangements is the government (Plummer and FitzGibbon 2004), tied to community or stakeholder groups through at least one strong linkage.

This linkage represents the relationship between the state and community sphere and, as Carlsson and Berkes (2005) illustrate, can take various forms (Figure 3). For the sake of simplicity, the authors depict two distinct entities symbolising governmental and local institutions and groups. However, they stress that both public authorities and the private or community sector are multi-level and fragmented bodies with many faces and inter- and intrasectoral links, which need to be accounted for in co-management projects. The first variant (top image of Figure 3), portrays co-management as a mere exchange system. Both the state and community sphere are autonomous entities and interact through the exchange of information, goods and services, in line with the lower ranks of Arnstein's ladder and the first dimension of the applied model in Figure 2. The second version describes a configuration in which state and community overlap to build a joint management body, e.g., in the form of a management board. In this scenario, the cooperation and intensity of power-sharing are more extensive; however, both sectors keep an (almost) equivalent share of authority and autonomy. The bottom two images illustrate what the authors describe as 'nested' systems. Here, the legal rights regarding a resource system (for example, property and exploration rights) are imbalanced to one side. In the first and more common case, the state exercises almost all legal rights and devolves a part of its power to the local level as part of a co-management agreement. The last configuration is related but reversed in structure. Legal rights are located at the community or private level, and the state is involved outside of its actual field of authority. As the author's remark, this involvement may include monitoring activities or even enforcing regulations, provided that they are based on mutual consent. These configurations emphasise the variety of contexts and legal systems in which co-management projects can take place. Even accounted for its high degree of abstraction and simplification, it illustrates the complexity and diversity of co-management settings.

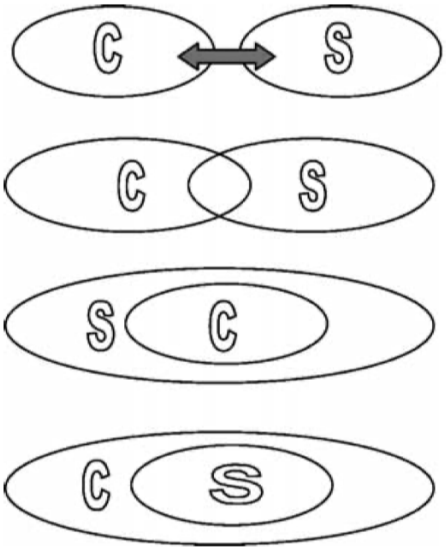

Figure 3: Types of CM arrangements (Source: Carlsson and Berkes 2005, 68)

In the last two decades, the understanding and application of the concept of co-management underwent a substantial change. Due to the realisation that time-tested co-management heavily depends on learning-by-doing, the conceptualisation of co-management shifted from materialising as rather static formal agreements to being understood as a dynamic process, characterised by continuous monitoring, evaluation and adaption (Berkes 2009). On a theoretical level, this was expressed and accompanied by the merging of the theories of *adaptive management* and *co-management* into *adaptive co-management*. By adding horizontal linkages between actors at the

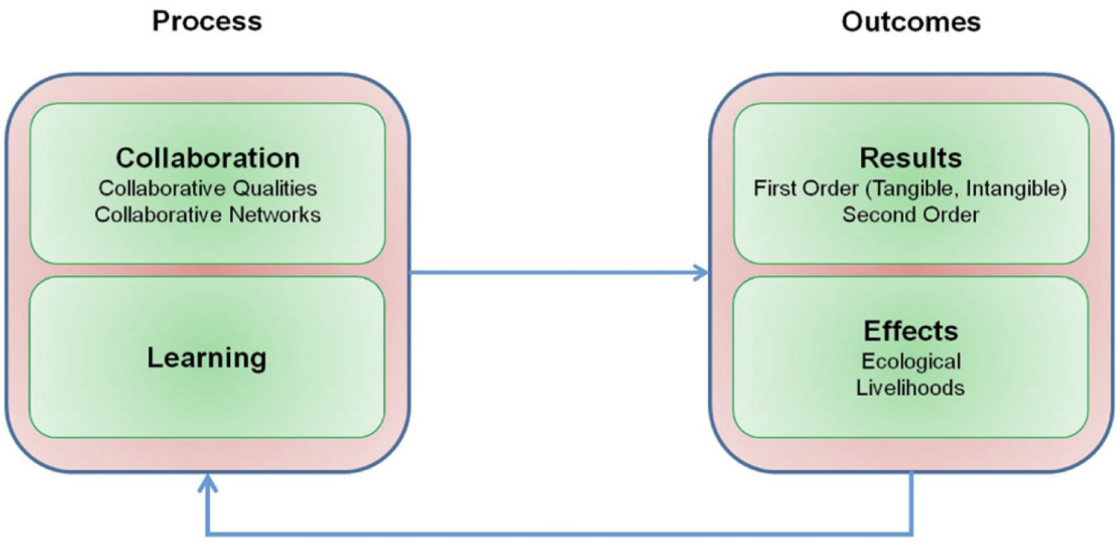

Figure 4: Conceptual framework of adaptive co-management
(Source: Plummer et al. 2017, 81)

same level (i.e., intersectoral), adaptive co-management seeks to enable learning processes, feedback loops, and institutional flexibility to cope with rapid changes and ensure resilience (Plummer and D. Armitage 2007). On a practical level, the iterative character of the concept is expressed, for example, in the three steps of a co-management process, as described by Borrini-Feyerabend et al. (2007):

1. Preparing for the partnership (organising);
2. Negotiating co-management plans and agreements; and
3. Impelementing and revising the plans and agreements (learning-by-doing).

Steps 2 and 3 are repeated cyclically, thus accounting for the dynamic character of co-management projects.

A visual approach to the concept of adaptive co-management is offered by Plummer et al. (2017) and portrayed in Figure 4. According to the authors, adaptive co-management processes are characterised by both collaboration and learning. The process leads to outcomes in the form of immediate results (tangible or intangible, and direct or indirect) and their consequences, i.e., ecological or livelihoods effects. Those, if monitored adequately, can inform the management process, resulting in learning and adaption of particular measures and plans. Thus, adaptive co-management is envisioned as an ongoing loop of jointly implementing management measures, monitoring the outcomes and adjusting management activities accordingly.

Finally, co-management can be included in the model of co-operative NRM (Figure 2). Considering its role as a ‘middle course’ between pure state-run and community-based management, co-management is positioned in the midfield of dimension 1 (power-sharing). It must be noted that this does not imply that co-management methods do not exceed formats such as advisory committees in participation intensity, but that community responsibility for a resource system is shared with state authorities. Communities or user groups might exercise complete control and autonomy concerning specific management functions, but the overall power is shared with at least

one government institution. Regarding dimension 2 (formalisation), co-management is placed in a rather formal setting since it requires institutional arrangements to define how responsibilities and rights are shared among the involved parties. Last, the interests represented in co-management projects include government agencies and community and/or private interests. This is visualised in Figure 2 by granting both state and non-state (i.e., community and private) actors an equal share of representation. However, neither do all co-management projects necessarily include community and private or commercial interests - a mere arrangement between a state and community institution, for example, would also legitimately count as co-management -, nor is power necessarily balanced equally. Instead, a variety of power configurations in line with Figure 3 might occur.

4. Economic Incentives: Agri-Environment Schemes

This chapter deals with Agri-Environment Schemes (AES) as a tool to incentivise behavioural change of farmers. After introducing its theoretical foundation, i.e., the concept of Payments for Environmental Services (PES), this section considers the history of AES and agri-policy in the EU, shedding light on how the historical path of policy-making gave way to the policy instruments in use today. Subsequently, the various forms and issues of AES are considered, leading from action-based to result-oriented AES and finally to collective AES, thus preparing the ground for farmer clusters as the main focus of this thesis. As the literature on agri-environment schemes is extensive, this chapter does not aim to reflect the entire scientific discourse, but instead provides an overview of the objectives, functioning and development of AES.

4.1. Payments for Environmental Services

PES gained popularity as an instrument to internalise the high public or commercial value of the provision of particular ecosystem or environmental services (ES). It thus provides an incentive for local actors to protect and maintain the delivery of ES on their lands, which would otherwise not be taken into account in management activities due to their lack of market-based value for their providers. Following the classification of ES given in the Millennium Ecosystem Assessment this can include provisioning services (e.g., food and water), regulating services (e.g., regulation of floods and droughts), supporting services (e.g., nutrient cycling), and even (though less common) cultural services (e.g., recreational benefits) (Hassan et al. 2005).

Engel et al. (2008) illustrate the basic logic of PES with an example of forest conservation (Figure 5). From the perspective of a forest owner, and thus provider of ES such as water filtration, biodiversity, and carbon sequestration, it might be rational to maximise benefits by converting the land to pasture. This however would result in increased costs for populations or companies who benefit from the ES provided by the forest (i.e., the *ES beneficiaries*). Thus, they have an interest in conserving the forest and might be willing to pay the landowner for not transforming the land. This payment would need to exceed the benefits the forest owner would receive from conversion in order to be considered as an alternative choice, while being limited upwards by the perceived value of the ES to the beneficiaries. If this gap between minimum payment that compensates the ES provider for his opportunity costs and maximum amount that ES beneficiaries are willing to pay is sufficiently large, PES can represent an adequate tool to reach an agreement to mutual advantage.

Put into a definition, this logic translates to five criteria, as defined by Wunder (2015, 8): PES are "(1) voluntary transactions (2) between service users (3) and service providers (4) that are conditional on agreed rules of natural resource management (5) for generating offsite services." The fifth condition refers to the external nature of the services that are provided, since the beneficiaries are spatially separated from the physical site of service generation (Wunder 2015). As we will see in the following subsections, AES meet this criteria and are thus an example for PES.

The situation presented in Figure 5 reveals some potential challenges when dealing with PES: First, it requires different and extensive kinds of knowledge including opportunity costs of ecosystem managers and the causal relationships linking actions of land managers to their effects on ES provision, which are a driver for uncertainty in PES in general and AES in particular. Further, even

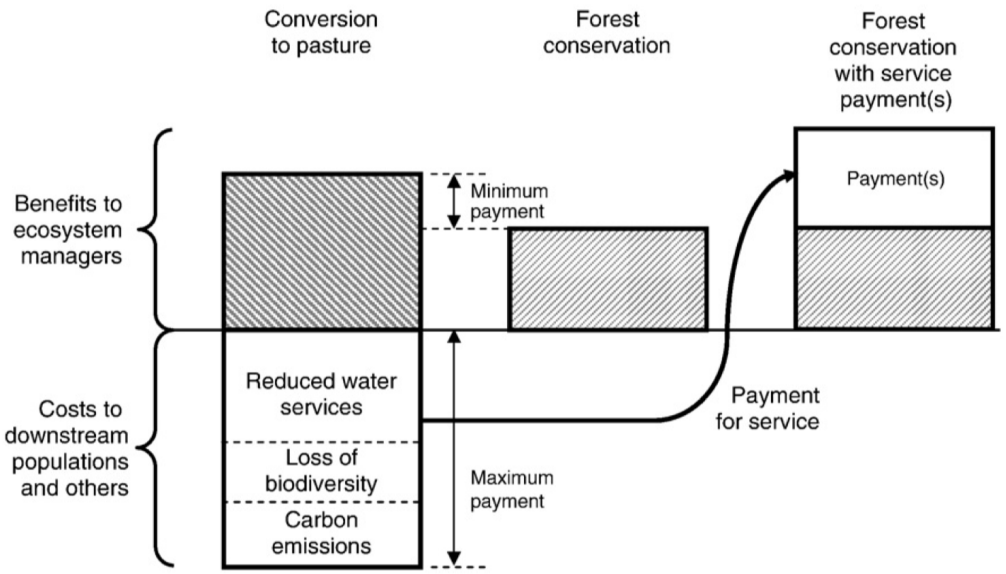

Figure 5: The logic of payments for environmental services
(Source: Engel, Pagiola, and Wunder 2008, 665)

if these effects are known, the resulting benefits in terms of ES provision need to be monetized in order to inform indemnities, a task that challenges scholars for decades (Mehvar et al. 2018). Finally, speaking of ES providers and beneficiaries implies a notion of two distinct and explicit groups of people or organisations. In reality, however, many ES enhance public goods such as clean air, and thus benefit more people than could be included in any formal arrangement. Some of these challenges, as will be discussed subsequently, can be addressed by PES design, others are still unresolved and contribute to the mixed results attributed to PES initiatives.

The latter problem, i.e., defining PES for regional or global externalities with no distinct groups of ES beneficiaries, can be dealt with by adapting PES design. Two design variants are differentiated in this regard: 'user-financed' or 'Coasean' PES and 'government-financed' or 'Pigouvian' PES (Engel, Pagiola, and Wunder 2008; Engel 2016). The first represents the ideal setting in which ES beneficiaries can be directly linked to ES providers. Thus, all affected actors can be involved in negotiations, enabling access to relevant local knowledge as well as cost-effective monitoring (Engel, Pagiola, and Wunder 2008; Pagiola and Platais 2007). A prominent example of this scheme is the PES implemented by the water bottling company Vittel (belonging to the Nestlé concern) and farmers in the catchment of an aquifer in north-eastern France in the 1990s (Engel 2016; Perrot-Maître 2006). In a ten-year process payments were negotiated that compensated the farmers for adopting less intensive farming practices, thus reducing nutrient load in the catchment and improving the quality of the water extracted and sold by Vittel (see further Perrot-Maître 2006).

If it is, on the other hand, not possible or feasible to include all ES beneficiaries in PES arrangements, a third party, typically a government agency, acts as ES buyer on their behalf (Engel, Pagiola, and Wunder 2008). This is, at least theoretically, the less preferable solution. As the intermediary party (e.g., a government) does not benefit from ES provision itself, no direct incentive is given to ensure PES functionality. In addition, access to local knowledge systems and on-site monitoring is often limited, hampering effective PES design and evaluation (ibid.).

However, in many cases government-financed PES may constitute the only viable and appropriate approach. This holds true, e.g., for confused or undefined property rights, high transaction costs, a high incentive to free ride, and relatively low individual ES benefits (ibid.). As will be shown in the following subsections, the mentioned challenges of government-financed PES are highly characteristic for AES.

An essential aspect in PES design is the conditionality of payments, as reflected in the aforementioned definition by Wunder (2015). The conditionality of PES is in principle enforced either by prescribing management activities ('input-based' PES) or by making disbursement dependent on the delivery of defined results, e.g., specific water quality measures ('outcome-based' PES) (Engel 2016). Both approaches and their variants are used in AES design and will be discussed in more detail later.

Finally, two more aspects shall be considered before approaching AES. The first is concerned with the suitability of PES as a policy approach. Engel (2016) stresses that PES are by no means the only (or best) policy tool to address externalities. Other possible solutions include taxes, subsidies, tradable permits, and command-and-control approaches (ibid.). Each is accompanied by individual strengths and weaknesses in terms of economic efficiency, societal acceptance, or vulnerability to mismanagement (e.g., abuse of subsidies for protectionist reasons).[3] Besides, if mismanagement of a social-ecological system is not primarily induced by external factors but due to, for example, lack of property rights, lack of awareness or information, or capital market imperfections, the effect of PES will be limited and other measures might prove more appropriate (Engel, Pagiola, and Wunder 2008). This leads to the second aspect, i.e., known shortcomings of PES one should keep in mind when designing, monitoring and evaluating PES projects. These are covered here only briefly, as they are not the focus of this section, but are included to raise awareness to common issues associated with PES before turning to AES as a practical realisation of the concept. Frequent challenges linked to PES are elaborated by Engel et al. (2008) and Engel (2015):

- *Social inefficiencies*: They arise when payments are set too low, thus causing environmentally harming practices to remain unchanged, or too high, consequently exceeding the value of the ES provided.
- *Lack of additionality* refers to spending money to incentivise actions (or outcomes) which would have been applied or achieved anyway.
- *Leakage* describes a phenomenon, where undesired practices are merely displaced outside the area of PES intervention and not omitted completely.
- *Lack of permanence* refers to the performance of PES in terms of long-term behavioural change, adapting to changes in external conditions, and ensuring ongoing fundings.
- *'Crowding-out' intrinsic motivation* is a potential outcome from introducing financial incentives, and can unintentionally lead to an overall decreased willingness to adopt environmentally friendly practices.

3. For a more detailed comparison and evaluation of policy approaches see Engel, Pagiola, and Wunder 2008

4.2. A Short History of AES

This subsection outlines the historical path of AES as reconstructed in a review by Latacz-Lohmann and Hodge (2003). If not indicated otherwise, their paper constitutes the reference for the following synopsis.

Modern European agricultural policy has been shaped through a production- and efficiency-centered focus during the post-war era in the middle of the 20th century. The expansion and intensification of agricultural land was seen as a means to achieve multiple objectives: the insurance of food security, increasing rural employment, and reestablishing a sense of amenity after the destruction and deterioration that characterized previous decades. These objectives were set in the Treaty of Rome, followed by the introduction of the Common Agricultural Policy (CAP) in the 1960s, which henceforth supported and encouraged famers to maximise productivity (Science for Environment Policy 2017). However, the environmental damages accompanying this path became apparent in the 1970s, as European countries were faced with environmental emergencies linked to extensive fertiliser and pesticide use, the loss of natural landscape features, soil erosion, and landscape homogenisation. Thus, voices were raised in favour of implementing a European agri-environmental policy, the first generation of which followed in the 1980s. This first set of agri-environmental measures constituted command-and-control interventions regulating nitrate pollution, the use of pesticides, fertilisers, and silage production. The EU applied a twofold strategy in this regard: While Regulations defined specific rules for management activities such as storage and use of pesticides, Directives took in an outcome-oriented approach and, e.g., prescribed nitrate concentrations in groundwater without limiting or controlling the means to attain this target. Thus, they resemble the differentiation of input- and output-based PES introduced in section 4.1.

The command-and-control approach applied to regulate pollution was reasonably well-accepted by the agricultural community, hence efforts were made by the German government to expand these measures to the wider scale of landscape change, wildlife loss, and habitat destruction. However, this resulted in a widespread and rigid opposition of the farming community, which opposed the perceived interference with their property rights and eventually were awarded compensation for their profits forgone. This constituted the beginning of a shift in European agri-environmental policy-making, stepping back from regulatory measures characterized by measures of force and obligation to incentive-based approaches in line with the ‘steward-rewarded’ principle (Engel, Pagiola, and Wunder 2008).

The first piloting set-up of new measures in the UK was the British Wildlife and Countryside Act of 1981, which obliged farmers in sensitive areas to inform authorities about intentions to carry out so-called ‘potentially damaging operations’. If refused, authorities would henceforth compensate farmers for their opportunity costs. This however led to an escalating financial burden for nature conservation agencies, which provided the necessary financial resources and found themselves inadvertently replacing disestablished agricultural subsidies. Hence, a more fundamental and pro-active scheme was introduced, initially funded by the Treasury, which did not aim at compensating farmers for refraining from environmentally damaging practices but instead offered a flat-rate payment for farming at a low intensity, regardless of any intention to change the farming system. This marked the stepping stone for incentive-based agri-environmental measures in the EU.

This approach was institutionalised through EU policy in 1985 when regulation ECC 797/85 allowed Member States to allocate finances from their own resources for the provision of AES in environmentally sensitive areas. This led to the introduction of and experimentation with multiple incentive-oriented programs, particularly in the northern states of the EU. In contrast, southern states still clung to a rather production-centered notion of agricultural policy and refrained from developing measures aiming foremost on environmental conservation. However, this became mandatory for all Member States with regulation ECC 2078/92 in 1992. In addition, this regulation established a wider financial footing by allowing co-financing AES from EU funds, introduced an expanded range of measures eligible for funding, and opened up all agricultural areas for enrolment in AES instead of being limited to environmentally sensitive lands. Thus, by 1992 AES were set as one of the key policy instruments to shape agricultural practices in Europe.

The Agenda 2000 reform further consolidated this path by establishing the second pillar of the CAP, thus "bringing together policies promoting agricultural diversification, economic development in rural areas and environmental enhancement" (Latacz-Lohmann and Hodge 2003, 131). The two pillars comprise both income support for farmers and market measures, partly conditional on compliance with environmental regulations (pillar 1), and rural development programmes as well as climate change adaption measures and AES in pillar 2 (Guy Pe'er et al. 2020). Further reforms in 2005 and 2013 focused on decoupling agricultural subsidies from incentivising intensification (e.g., by introducing a fixed single farm payment per hectare based on historic production levels) or enhancing environmental conservation by introducing payments conditional on meeting environmental standards (i.e., greening) (Hodge, Hauck, and Bonn 2015). In recent years, both CAP in general and AES in particular have been subject to criticism and a number of reforms, mainly addressing its claimed failure to tackle biodiversity decline (G. Pe'er et al. 2014), supporting SDGs (Guy Pe'er et al. 2019), or redistributing and cutting budgets favouring inefficient or unambitious measures (Guy Pe'er et al. 2020). The post-2020 CAP for the period 2021 to 2027 is currently under ongoing negotiations between the European Parliament and the Council of the EU. Hence, a transitional regulation has been agreed upon for the years 2021 and 2022, and the planned start date for the post-2020 CAP has been postponed to 1 January 2023.[4]

4.3. AES Design

As outlined in the previous section, offering AES to their farming communities is mandatory for all Member States of the EU, participation by farmers however is voluntary (Science for Environment Policy 2017). The voluntary nature of enrolment in AES is thus in line with the first criteria of PES as discussed in section 4.1. A specification of AES is not prescribed by the EU, instead all Member States are encouraged to develop AES that match their respective environmental goals and conditions (ibid.). Practically, AES design not only reflects ecological and environmental conditions, but is also influenced by socioeconomic and political drivers (Kleijn and Sutherland 2003). Consequently, the variety of AES is extensive: Hodge et al. (2015, 1001) estimated the total number of EU-funded AES to exceed 355.

4. https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/new-cap-2023-27_en, accessed on 23 June 2021.

The basic idea of AES follows the logic of PES: Farmers are compensated for adopting environmentally friendly practices that go beyond mandatory requirements (set, e.g., in the first pillar of the CAP or through national regulations) (Science for Environment Policy 2017). Those practices generally do not hold any direct market-based value or incentive for the farmers and address wide-scale ES linked to, e.g., biodiversity or water quality. Common measures that are covered by AES include, for example, organic farming, integrated production, reducing fertiliser or pesticide use, crop rotation, or establishing buffer strips (ibid.). Given the fact that AES financing mainly originates from EU funds and/or Member State budgets and the ES addressed through AES are mostly common goods in nature, AES clearly constitute a governance-financed PES (see section 4.1). Hence, PES theory predicts major efficiency-related challenges due to limited access to local knowledge and monitoring capacities; a threat that has partly proved true, despite the efforts of the EU to attenuate this weakness by devolving authority over AES design to the Member States.

Payments made in AES are based on income foregone (Hodge, Hauck, and Bonn 2015), thus aiming at the minimum payment illustrated in Figure 5 and not supporting farmer incomes generally. However, spatial heterogeneity and technological as well as market-related limitations and oscillations challenge matching farmers opportunity costs with AES payments and result in considerable uncertainty and potential inefficiency of AES (e.g., Mennig and Sauer 2020). These can, at least partially, be addressed by AES design as will be discussed subsequently.

The scientific discourse relating to AES design is primarily concerned with (1) the influence of the conditionality of payments on AES uptake and performance, (2) how AES efficiency can be enhanced by aligning payments with actual opportunity costs of farmers and targeting areas of particular interest, and (3) how environmental outcomes can be enabled on a landscape scale. Each objective is addressed by particular adaptions to AES design and will be presented successively in the following sections. This includes action-based and result-oriented AES in regard to objective (1) (subsections 4.3.1 and 4.3.2), making use of auctions and spatial or cost targeting for objective (2) (subsection 4.3.3), and collective AES aiming for objective (3) (subsection 4.3.4).

4.3.1. Action-based AES

Action-based AES constitute the predominant design type of AES in the past decades (Cullen et al. 2018) and correspond to input-based PES as mentioned in section 4.1. Hence, they link disbursement of payments to the implementation of specific management activities that are assumed to result in environmental outcomes (Uthes and Matzdorf 2013). Their high popularity is foremost linked to practical advantages, as monitoring the realisation of management activities is less challenging than monitoring ecological outcomes in the field (ibid.). In addition, action-based AES are usually well accepted by risk-averse farmers, as they represent a reliable source of income and are thus expected to result in higher rates of participation (ibid.). However, potential limitations of action-based AES are self-evident, as they do not presume the delivery of environmental outcomes per se. Instead, they place the responsibility for AES success in the hands of scheme designers, usually located in national government departments and thus often ignorant of local ecosystem peculiarities that need to be addressed to meaningfully enable environmental outcomes. Further, action-based AES are accused of falling short in enhancing long-term behavioural change, as they do not actively foster farmers engagement with environmental issues on their farms, but instead

offer a mere payment for undertaking defined services (Burton and Schwarz 2013). Because of this underlying conception of AES as a mere exchange of service provision for money, action-based AES are in particular under suspicion to crowd-out existing environmental values of farmers (ibid.).

4.3.2. Result-oriented AES

Result-oriented AES provide more control over environmental impacts than action-based AES by making payments conditional on the delivery of defined outcomes (Russi et al. 2016). Besides the insurance of environmental benefits, expectations in result-oriented AES are held high because increased flexibility of farmers in choosing appropriate means to achieve the prescribed results is argued to benefit cost-efficiency. According to this notion, farmers are able to choose and fine-tune measures to match the local conditions on their farms (Uthes and Matzdorf 2013). In addition, result-oriented AES enable learning processes as farmers adapt measures based on their past experiences (ibid.), thus further reducing their opportunity costs and fostering their willingness to maintain participation in AES. From a behavioural-psychologist point of view, result-oriented AES are argued to shift farmers perceptions of environmental benefits to being seen as 'products' that can be generated (and sold), and thus are considered in setting farm objectives and management activities (Burton and Schwarz 2013). Burton et al. (2013) find a corresponding increase in farmers interest in nature after participating in result-oriented AES, indicating a causal relationship.

However, they are by no means a panacea and the much praised flexibility frequently resembles a ridge walk in practice. First, farmers must possess the knowledge to oversee and evaluate all possible management options and their effects on ecosystem dynamics in order to identify the most appropriate measure, a task that scholars fail to accomplish frequently (Moxey and White 2014). In line with this, Uthes and Matzdorf (2013) find evidence in their review that result-oriented AES depend on clear and immediate causal relationships between management activities and the set outcomes to be successful. On the other hand, in some case studies of result-oriented AES flexibility was only of putative nature, as outcomes were set in a way that allowed only for one management action, thus limiting those AES to a mere fine-tuning of practically predefined measures and resulting in farmers feeling restricted in their management opportunities (Russi et al. 2016).

In addition, result-oriented AES are less attractive to farmers due to their inherent risk of not receiving a payment. This is not only enhanced by a lack of knowledge regarding the effects of management actions but also linked to factors outside of farmers control, including weather events, behaviour of neighbouring farmers, or natural oscillations in species abundance (Burton and Schwarz 2013). However, it must be noted that risk can also be reduced compared to action-based AES, if, for example, mowing dates can be adapted to seasonal variations (ibid.). This seems to hold true in particular for result-oriented AES in which the overall flexibility is low and merely serves for fine-tuning.

An important issue of result-oriented AES is the development of an indicator set to evaluate farmers eligibility for payments. The complexity of this task varies considerably, depending on the respective objectives and targeted species that AES aim for. In the case of large carnivores or some bird species monitoring efforts are likely moderate, oftentimes however result-oriented AES are targeted at increasing biodiversity, challenging AES practitioners to identify meaningful indicators in face of complex and spatially heterogeneous outcomes (Burton and Schwarz 2013). Burton et al.

(2013) integrate theoretical and empirical papers on selecting indicators for result-oriented AES and conclude, that they should be (a) measurable and identifiable, (b) not conflicting with agricultural or ecological goals, in order to be acceptable for farmers and relevant for the ecosystem under consideration, and (c) reflect the efforts of participating farmers. Since biodiversity by definition can't be assessed by monitoring one single species, a suitable indicator set is additionally challenged by identifying a balanced number of indicator species that represent the status of biodiversity of an area without unnecessarily boosting costs by setting the monitoring scope too widely (ibid.).

Burton and Schwarz (2013) propose three dimensions to classify result-oriented AES:

- The *proportion of income derived from outcomes*: Usually result-oriented AES are coupled with action-based approaches, e.g., by granting a payment for implementing management activities and offering an additional bonus for the delivery of ecological outcomes (or vice versa). Depending on the proportion of one to the other the resulting scheme can exhibit characteristics that resemble both action-based and result-oriented approaches, thus posing the challenge to get the balance right to maximise farmers participation.
- The *sensitivity of payments structures* refers to payments dependence on the quantity of generated ecological outcomes. It ranges from rather simple schemes, e.g., setting a single threshold of indicator species above which a payment is granted, to more complex and sensitive ones that reward famers for achieving additional ecological outcomes. The authors note that while simple threshold-based payments are prevalent in result-oriented schemes, farmers motivation to further pursue environmental goals diminishes after the threshold is met (i.e., 'threshold-effect').
- In regard to the *temporal extent of contracts and schemes* the authors argue for larger time frames than used in action-based AES, as the result-oriented approach depends on learning processes for farmers to innovate.

In the last decade an increasing need of advisory services for both action-based and result-oriented AES was recognised. The rising complexity of schemes, it is argued, requires extensive knowledge transfer and assistance for farmers during all stages from planning to implementation in order to prevent non-participation (Cullen et al. 2018). In Irelands Green Low-carbon Agri-Environment Scheme the inclusion of advisors was even found to present a critical component, as the reduction of advisory services resulted in poor uptake of the scheme (ibid.). Result-oriented approaches are in particular need of advisors, as their success depends on expert knowledge about management measures and their ecological effects (Moxey and White 2014).

4.3.3. Targeting

Targeting is used when the funding for PES is limited and applications from ES providers, i.e., farmers in the case of AES, exceeds the number of AES contracts that can be offered (Engel 2016). In addition, it presents a tool to enhance the cost-efficiency of AES, thus maximising the ecological benefits that can be generated through a given amount of funding (Uthes and Matzdorf 2013). In general, there are two approaches of targeting AES applications:

Cost Targeting: The first seeks to align the payments granted in AES with the costs for ES provision, i.e., the farmers opportunity costs. In AES this is realised by conducting environmental

auctions at which farmers bid on which payments they would be willing to participate in a specific scheme (Kuhfuss, Piras, et al. 2019). Thus, as farmers neither know how many farmers participate in the auction nor the level of their bids, they are incentivised to make bids close to their actual opportunity costs (ibid.). However, multiple drawbacks of environmental auctions are known: First, if the budget for AES funding really is limited and farmers are excluded from participation, they might turn to converse management choices, intensifying farming or carrying out other environmentally damaging practices (Uthes and Matzdorf 2013). Second, collusion amongst farmers might occur, especially in repeated auctions, weakening potential efficiency gains if farmers collectively decide to submit higher bids (ibid.). And third, auctions allowing for individual bids usually do not achieve spatial patterns of uptake that allow for landscape-scale ecological outcomes (Kuhfuss, Piras, et al. 2019). However, neither do standard AES distributed in a first-come-first-served manner and possible adaptions to auctions to serve landscape-scale goals exist (see section 4.3.4).

Benefit or Spatial Targeting does not consider the costs of implementing measures, but prioritises sites based on the expected effects those measures might entail. Hence, it tries to carry out AES at the most suitable sites (Uthes and Matzdorf 2013). A practical approach would be, for example, to allow only ecological priority areas for enrolment in AES (Engel 2016), as has been the case for all AES before 1992 (see section 4.2). Usually spatial targeting is conducted by including geographical and ecological criteria (e.g., slope, proximity to water sources, biodiversity status, ...), but might also include criteria assessing the threat of loss of ES provision capability (ibid.). The latter seeks to address the issue of additionality by prioritising sites in which the absence of payments would presumably result in a decline of ES provision. Known shortcomings of spatial targeting include the risk of being perceived as unfair, since farmers who have managed their lands well in the past might not be eligible for payments, as well as high transaction costs due to the large amounts of data needed to calculate a indicator based on site specific ecological and geographical conditions (Uthes and Matzdorf 2013).

In practice, benefit and cost targeting are often combined in order to identify sites which are characterized by both low opportunity costs and a high ecological potential (or threat) for ES provision. This necessarily leads to considerations about how multiple indicators can be integrated to one single measure. Common practices, as reviewed by Engel (2016), include weighted sums of standardised indices, normalising indicators, ranking attributes and objectives subjectively according to importance, and non-parametric distance function approaches.

4.3.4. Collaborative AES

A call for collaborative AES has been prompted by the recognition of a scale mismatch between the administrative units that are addressed by AES, i.e., the individual farm, and the ecological processes that contribute to ES provision (Cumming, Cumming, and Redman 2006; Emery and Franks 2012). On a theoretical basis, McKenzie et al. (2013) argued for the need of collaborative AES by showing that more than a third of the native bird, mammal, reptile, amphibian, and bumblebee species in England operate at scales larger than the typical farm size (146 ha), thus limiting the potential effects of measures realised on individual farms. Sutherland et al. (2012) confirmed this findings empirically by showing that organic farms in so-called ‘hotspot’ areas (i.e.,

areas that feature a high concentration of organic farms) exhibit higher overall levels of biodiversity compared to areas with low concentration of organic farms.

Leventon et al. (2017) provide a useful conceptualization of the current agricultural mismanagement and its linkages to CAP incentives. They argue that an ideal management setting to promote biodiversity on a landscape scale should resemble the network illustrated in Figure 6 (a). This setting is characterised by its high density of links. Starting at the bottom is the ecological resource (ER) under consideration, i.e., the farm or, more precisely, the level of biodiversity on a farm scale. The biodiversity on individual farms is linked to the ecological status of neighbouring farms (link EE), thus necessitating a landscape-scale approach for biodiversity management. Located on the first management level is the individual farmer (F). This farmer naturally influences the biodiversity on its own lands through the farming practices in place (link FO), but also the biodiversity on neighbouring farms (link FN). This cross-scale influence may happen intentionally (e.g., through collaboration) and unintentionally (e.g., through spill-over effects from pesticide use). To account for this cross-scale interactions of farmers behavior and the ecological status of neighbouring lands, farmers ideally collaborate and jointly work towards biodiversity goals (link FF). This process could (and should) be facilitated and supported by a coordinating actor (CA), e.g., a government agency or NGO, who coordinates the efforts undertaken by both farmers (link CL). However, by conducting multi-stakeholder workshops in Germany and Sweden, the authors found that the management setting in place resembles the so-called 'bucket-motif' portrayed in Figure 6 (b). As such, management regimes in the two case studies lacked collaborative links between farmers and, even though advisory services were offered to farmers, they are usually provided by different persons or organisations and thus miss the capability to initiate and coordinate collaborative efforts amongst farmers. In addition, it is peculiar that the stakeholders did not identify cross-farm influences on biodiversity (i.e., FN links in Figure 6 (a)). This indicates a lack of awareness in regard to the landscape-scale impacts of management practices realised at individual farm level. The authors further argue that CAP reinforces this management regime by (1) promoting individualisation by addressing measures to individual farmers, (2) stimulating the emergence of multiple competing advisory entities, thus limiting the probability that one single advisor supports several adjacent farmers, and (3) failing to address challenges posed by high land prices and tenure insecurity. The latter impeded collaborative action as tenure agreements are often shorter than the length of scheme contracts or the necessary time to foster collaborative networks.

In summary, the need for landscape-scale approaches for environmental conservation on agricultural lands is well recognised in the literature. Several adaptions to AES design have been introduced in the attempt to enable spatially widespread and connected ecological outcomes.

Probably the most evident approach to widen the scope of conventional AES are *collective contracts*. Instead of offering contracts to individual farmers, collective payments are addressed to groups of farmers, who deliver ES or implement actions that are assumed to benefit ES delivery collectively (Kuhfuss, Piras, et al. 2019). As farmers usually hold more precise information regarding differing costs for implementing measures, collective contracts provide a tool to tackle information asymmetry and realise spatial cost targeting if farmers are allowed to internally decide on the distribution of measures and payments (ibid.). Collaborative contracts are, as yet, implemented in some countries and are, for example, utilised by Dutch Agri-Environmental

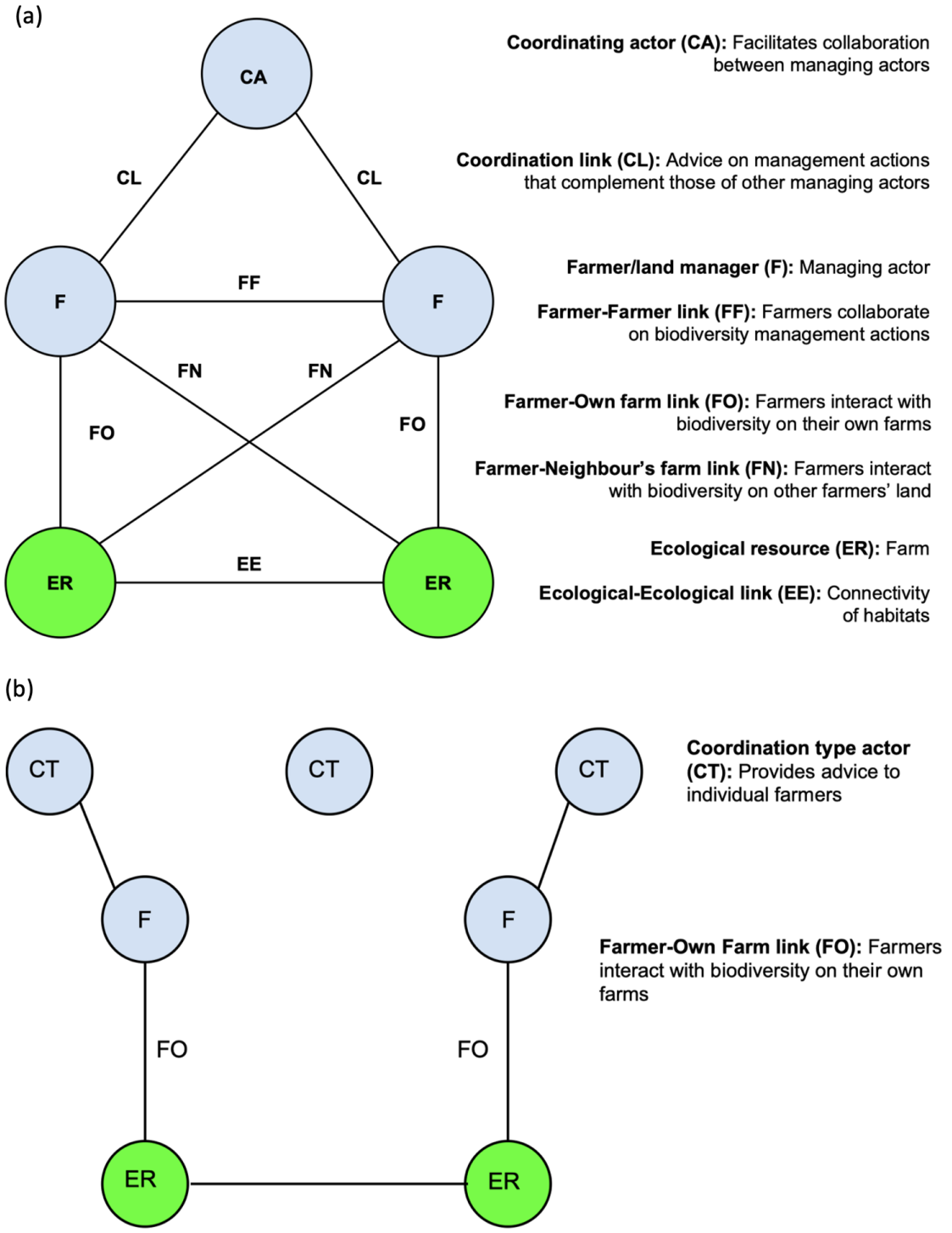

Figure 6: Network representation of management regimes to promote biodiversity on agricultural lands. (a) Ideal configuration characterised by farmers collaboration and cross-scale linkages. (b) Actual management regimes identified in case studies in Germany and Sweden.
(Source: Leventon et al. 2017, 3 and 6)

Cooperatives (i.e., a related approach of collaborated farmer groups in the Netherlands) (ibid.).

Agglomeration bonuses or *payments* constitute an alternative approach. In contrast to collective contracts they do not prescribe collaborative efforts among farmers per se, but instead seek to achieve landscape scale outcomes by rewarding farmers if defined thresholds of overall AES participation or beneficial spatial patterns of scheme uptake (e.g., connected areas for conservation, habitat corridors) are attained (Rotsches-Ribalta and O hUallachain 2018). They can be fashioned either as an additional, voluntary bonus paid on top of an individual payment (i.e., agglomeration bonus) or as a conditionality for payment eligibility (i.e., agglomeration payment) (ibid.). Kuhfuss et al. (2015) found some indication that collective bonuses might enhance AES participation beyond what could be expected from a mere financial incentive. By conducting a choice experiment with winegrowers in France the authors revealed a higher willingness to enrol land in AES with collective bonus compared to a payment of the same amount without any collective incentive, indicating that the agglomeration bonus lead to a social norm effect.

Finally, in order to allow for cost targeting on a wider spatial scale, *auctions* can be adjusted to include *bids made by farmer groups* (Kuhfuss, Piras, et al. 2019). Collective bids were found to reduce transaction costs for individual farmers, however, there is little empirical evidence as yet that farmers prefer joint bids over individual ones (ibid.). Nevertheless, favouring collective bids in auctions could provide an additional incentive for farmers to engage in collaborative action.

Despite the mere necessity for coordinated collective approaches to align with the spatial scale of ecological processes that account for ES provision, collaborative AES are additionally assumed to more soundly foster sustained behavioural change of farmers. According to this notion, they provide a contrasting approach to standard top-down scheme implementation by not primarily focusing on the realisation of measures or the achievement of environmental outcomes, but instead building upon community empowerment, participatory approaches, and normative shifts, which subsequently alter individual behaviour (Emery and Franks 2012). Hence, the point of leverage of collaborative AES does not lie in paying for an environmental conservation measure itself, but in nudging farmers towards a shift in belief and value systems that consequently entails a natural and lasting change of behaviours.

Ultimately, it must be noted that adaptions to AES design are not the only possible instrument to enable environmental outcomes on a landscape-scale. Toderi et al. (2017) discuss how conventional AES promoting measures to individual farmers can be embedded in co-management projects to organise and align AES uptake on a landscape-scale. The so-called agri-environmental agreements implemented in Italy between 2007 and 2013 defined shared responsibilities between public and/or private stakeholders including administrational duties, organising participatory processes to discuss AES design, and integrating results into rural development programs in cooperation with regional authorities (ibid.). Farmer clusters in the UK follow a similar strategy in (at least partly) building upon conventional, individual farm AES but organising participation collectively, though in a less formalised setting than compared to co-management initiatives (see section 6.1). However, co-management agreements present by no means the only application of AES in resource management approaches as discussed in section 3. Rather, the development of AES resembles decentralized, collaborative resource management approaches, moving from measures implemented top-down and limiting farmers flexibility in management activities to participatory projects and partnerships,

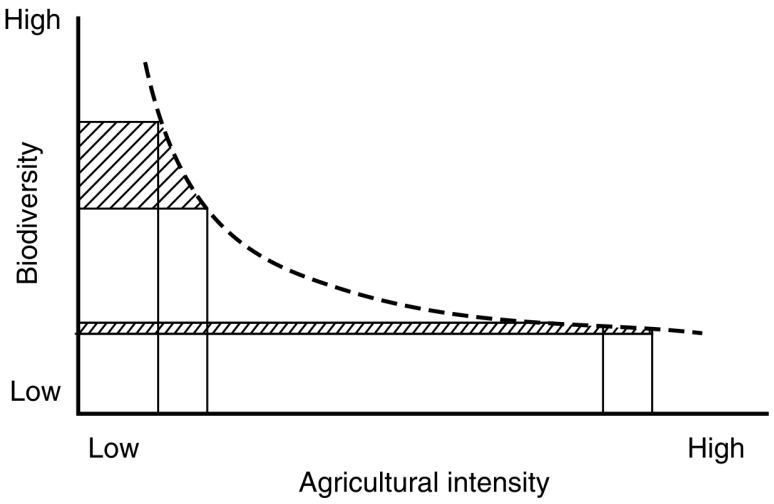

Figure 7: Conceptual relationship of farming intensity and biodiversity levels (Source: adapted from Kleijn and Sutherland 2003, 952)

granting farmers more responsibility as 'AES designers' instead of mere 'AES implementors' (Cullen et al. 2018; Toderi et al. 2017).

4.4. Applicability

There is some at least subliminal disagreement amongst scholars about whether AES should primarily aim at intensive or extensively farmed areas. This has been prompted by the recognition that enrolment in AES usually mainly includes extensively farmed areas due to their lower opportunity costs in adopting prescribed measures or achieving the necessary ecological outcomes (Kleijn and Sutherland 2003; Uthes and Matzdorf 2013; Sterner and Coria 2012; Zimmermann and Britz 2016). This is often labeled as an 'unintended effect', implying that environmental outcomes might be enhanced by aiming for AES implementation on intensive farmland. However, several scholars argue in favor of targeting extensive farms (Uthes and Matzdorf 2013), building upon the assumption of an exponential relationship between farming intensity and biodiversity levels (Fig. 7). Following their argumentation, the same absolute change in agricultural intensity leads to greater biodiversity benefits when addressed to extensively managed farms, as higher overall biodiversity levels react more sensitive to changes of farming practices. From an ecological perspective, this exponential decline is explained by the additive effects of habitat disturbances that accompany agricultural intensification (e.g., harvesting dates, fertilizer and pesticide output) (David Kleijn et al. 2011). However, the empirical evidence regarding the link between agricultural intensity and AES effectiveness is still limited, in part due to the fact that most research focus on countries that are dominated by intensive farming practices (Batáry et al. 2015).

Tscharntke et al. (2005) propose a somewhat more nuanced hypothesis, linking AES effectiveness not with agricultural intensity per se, but with landscape type in terms of how much non-crop habitat remains on agricultural land. According to their argumentation, AES provide most ecological benefits when applied to moderate complex landscapes that include 1-20 % non-crop habitat. These so-called 'simple' landscapes are able to respond to management changes initiated through AES as the non-crop habitats serve as species pools to re-colonise former intensively managed areas.

Cleared landscapes on the other hand lack the necessary species abundance to result in recognisable changes of biodiversity levels, while species-rich landscapes exhibit high levels of biodiversity everywhere and irrespective of land management changes (ibid.).

4.5. Outcomes and Efficiency

AES outcomes are - overall - mixed. In their review in 2003, Kleijn and Sutherland attested AES rather poor results in promoting botanical biodiversity, with only half of the studies under consideration reporting positive effects of schemes. In contrast, increases in diversity and abundance after AES implementation was more likely for arthropods (including spiders and insects) with 14 out of 20 case studies finding significant increases. The review identified no consistent pattern for AES effects on bird populations however, as many studies observed both positive and negative developments in bird species richness or abundance. This indicated a necessity to tailor AES towards specific bird taxa, instead of trying to promote bird species in general through one single scheme.

Uthes and Matzdorf (2013) report similar findings in their much more extensive review of 203 articles concerned with AES effects on biodiversity. They stress the variety of AES outcomes, depending on the AES under investigation and which indicators are monitored and evaluated. In addition, they find less environmental benefits in intensively farmed areas, thus confirming that AES might be more effective in targeting extensive farmland.

Several studies argue for targeting either particular areas in order to enable environmental outcomes (Feehan, Gillmor, and Culleton 2005) or specific species, as general AES often only benefit common species but do not enhance uncommon species or species under threat of extinction (D. Kleijn et al. 2006).

A more recent review by Kuhfuss et al. (2019) concludes that “although examples can be found that demonstrate positive effects of specific AES options on individual target taxa, there is very little empirical evidence in the literature that AESs in general have any national scale benefit to farmland wildlife or ecosystem services” (Kuhfuss, Begg, et al. 2019, 6). Thus, after even three decades of AES implementation and research, reliable knowledge regarding AES functioning and success is still scarce, in particular on scales above field, farm or regional administration.

In addition, singling out effects of specific adoptions to AES design on environmental outcomes poses challenges. For example, Burton et al. (2013) attest early result-oriented AES in Europe positive ecological results, but acknowledge difficulties in differentiating the impacts of result-oriented from action-based schemes due to the simultaneous application of a variety of AES types in any geological region. This challenge might have contributed to the lack of any comprehensive review on ecological outcomes linked to particular design adaptions (e.g., conditionality on results or participation, targeting, ...).

Not surprisingly, empirical evidence on the cost-efficiency of AES is just as scarce, as it requires both data on ecological effects of AES implementation as well as associated economic costs (Ansell et al. 2016). In 2003, Kleijn and Sutherland found almost no research on the effectiveness of schemes and attested former evaluative studies a weak design as comparing areas under AES enrolment with control areas not covered by schemes biased researchers towards giving favourable results (due the fact that the former usually constituted designated Environmentally Sensitive Areas,

whereas the latter lay outside designated areas). In 2016, a review by Ansell et al. indicates some improvement in this regard, however not by much. The authors reviewed the global evaluation literature on AES and found some reference to the costs of schemes in less than half of the studies considered and some measure of cost effectiveness in only 15 %. They conclude that an aversion towards integrating the disciplines of economics and conservation (e.g., measuring the value of biodiversity in monetary terms), a lack of explicitly defined environmental objectives in AES (against which the effectiveness of interventions might be measured), and the limited availability of cost data possibly contributed to the meagre state of knowledge regarding the effectiveness of AES. However, they provide insights from individual case studies that confirm some of the theoretical considerations presented in this chapter. This includes cost savings linked to the use of auctions to allocate schemes instead of fixed-price AES (Stoneham et al. 2003; Bamière, David, and Vermont 2013; White and Sadler 2012) and making payments conditional on ecological results instead of the implementation of management activities (White and Sadler 2012).

5. A Review of Success Factors

After laying a theoretical foundation in regard to collaborative resource management approaches and agri-environment schemes in their role as incentives to promote sustainable farming practices, this chapter is concerned with knowledge about if, when and why these efforts bear fruits. Against this objective, the conceptualisation of 'success' and how it can be measured is considered first. Consequently, the literature on participatory natural resource management, community-based natural resource management, co-management and agri-environment schemes is reviewed to identify, merge, and discuss essential factors and characteristics associated with successful projects. For details on the review process and the keywords used in the literature search, see section 2.

5.1. Conceptualising Success

A self-evident approach to conceptualise success represents contrasting the outcomes of a management project with its objectives. However, this simple and unequivocal appropriate understanding of success points to a couple of challenges when it comes to practically evaluating collaborative management approaches (including the application of AES).

First, objectives for implementing collaborative management concepts are rarely singular, at least not in measurable terms. One might, for example, set sustainability as one single objective at the core of evaluating management activities. In practice, this would entail considering ecological, social and economic dimensions, each, in turn, encompassing a host of specific parameters and measurements. Hence, assessing the success of natural resource management projects usually implies the consideration and weighting of multiple outcomes (e.g., costs, ecological parameters, the satisfaction of participants), not rarely combined with the necessity to accept trade-offs between conflicting objectives. The different objectives that are set for a specific approach usually fall in two broad categories: process- and outcome-related (Carr, Blöschl, and Loucks 2012; Ashford and Rest 1999), whereas the latter might be further differentiated, e.g., into environmental and socioeconomic outcome criteria (Conley and Moote 2003). In practice, a contrary situation to manifold objectives might occur as well: As has been mentioned briefly in the previous section, AES often lack a clear definition of objectives, thus hampering any efforts to evaluate their achievement (Ansell et al. 2016; Uthes and Matzdorf 2013).

Second, it matters who is asked. An environmental conservationist will exert a different set of criteria for evaluation than a project manager, or industrial representative might do. For example, Schweitzer et al. (1996, quoted by Ashford and Rest 1999) found 17 different definitions for the success of participatory processes as mentioned by stakeholders in US environmental departments (DOEs). Thus, if success is evaluated by asking participants about their perceptions - which is a standard data gathering method (Conley and Moote 2003) - one should hold in mind the composition of interests and value systems involved.

Finally, issues of time pose several challenges to any attempts of evaluating management projects. On the one hand, this is due to scale mismatches between management and, in particular, monitoring projects and measurable ecological responses of the managed ecosystems. Evaluating management activities might be impeded if ecological outcomes can not be expected to occur on a time scale that resembles the managing or monitoring project (Reed et al. 2018). On the other hand, it must

be taken into account that any collaborative management program constitutes a dynamic process. Hence, if project evaluation is pursued by asking participants about their perceptions, timing matters as individual viewpoints usually change and develop over time (Cradock-Henry et al. 2017).

In general, any attempt of evaluation, might it include assessing *if* (or to what degree) a project is successful or *why* it is successful, means comparing a set of criteria to reality (Conley and Moote 2003). This thesis applies an inclusive understanding of success, allowing objectives to differ between management approaches or AES types. This is necessary, as result-oriented AES might explicitly focus on ecological outcomes, whereas collaborative AES projects likely aim at social dimensions of success such as enhancing social capital or inducing transitions of value systems, which are assumed to result in behavioural change consequently. Thus, allowing for diverging individual objectives enables one to build a holistic set of success factors but incorporates uncertainty regarding how differing objectives promote ecological outcomes. Further, the following review considers literature that is primarily concerned with factors of success in terms of recommendations regarding process design which are assumed to result in successful projects and includes findings from the literature that seek to identify successful management projects by searching for success indicators. Indicators of success often resemble success factors in containing some practical recommendation to stimulate project outcomes and thus meaningfully complement the analysis. For example, Kovács et al. (2017) compared participatory management processes by assessing predefined indicators of project success, including the indicators 'Independence of the facilitator team' and 'Early involvement of stakeholders'. Evidently, both aspects resemble a factor of success in nature as they can inform the design and implementation of participatory processes and not merely present a measure of outcomes.

5.2. Success of Participatory Natural Resource Management

Factors that influence the success of PNRM projects and participatory processes can be grouped into three categories. The first is concerned with characteristics that describe the actual process of participation (i.e., 'process factors'). It considers how the interaction of project managers and stakeholders should be organised to promote participants satisfaction and productive collaboration. The second group, 'organisational setting', widens the scope of analysis and considers how participatory processes are embedded in management projects. It thus relates to factors which foremost need to be considered prior or subsequent to participatory activities. Finally, 'contextual factors' outline how PNRM success is influenced by external drivers on an individual, community and state level. Context factors cannot be influenced by project managers, or at least not with measurable effects during the project life span, but are assumed to significantly influence project outcomes.

Table 3: Factors attributed to the success of PNRM projects

Categories	**Factor(s)**
Process factors	
Communication	Two-way communication and education
	Clear language & accessible, concise and consistent information
	Face-to-face contact

Table 3: (continued)

	Transparency (i.e., one-way flow of information) regarding process in general, information handling, and stakeholder identification and selection
Adaptivity	Interactive and iterative processes
	Learning from and adaption to past experiences
	Existence of feedback-loops
	Responsiveness to stakeholders
Equality	Frank and open communication
	Equal opportunities to contribute in PP
	Philosophy that emphasises equity
	Awareness of power asymmetries and ways to manage them
PP design	PP methods are tailored to context, objectives, project stage
	Existence of milestones and deadlines
	Priority to trust building actions
Organisational setting	
Goals and roles	Clearly defined goals
	Clearly defined stakeholder roles
Representation	Relevant stakeholders are represented systematically
Empowerment	Stakeholders have impact on the decision-making process
	Management commitment to the process
	PP are promoted through institutional setting
	PP are considered from the outset and throughout the project
Incentives	Incentives to initiate and maintain participation are given
Facilitation	Provision of skilled facilitation
Diverse knowledge	Relevant information from multiple sources, including local and scientific knowledge, is provided
Match scales	Match temporal and spatial scales of the PP with scales of ecological processes and jurisdiction
Contextual factors	
Individual level	Distribution of wealth and education
	Gender equality
Community level	Resource dependence, supportive local belief systems, prevalence of social networks, community size and heterogeneity, social capital (e.g., bonds, norms, provisional trust between stakeholders, sense of community, feeling of connection and support), presence of bridging capacities
	Existence of a participatory culture (e.g., through former experiences with PPs)
	Adequate resources: especially financial, but also concerning time of participants and decision-makers, and availability of locations which are easily accessible for all stakeholders
State level	Well-defined property rights and local tenure regimes

The factors attributed to the success of PNRM projects in the literature are summarised in Table 3.

The table does not include sources to enhance readability. However, the complete list of factors and references is attached to the appendix (A.1), and sources will be presented in an exemplary manner during the subsequent description of success factors. Additionally, it must be noted that the order of factors in Table 3 is random and does not represent any evaluation of factors relevance for project success. The fact that some elements are mentioned more frequently than others (see appendix A.1) indicates that differences in relative contributions of factors to project outcomes exist, however, the qualitative approach adopted in this section does not allow for any valid interpretations.

5.2.1. Process factors

Communication. As PNRM builds upon aligning different sources of knowledge and perceptions of environmental issues, the nature of information flows are of particular importance for shaping project outcomes. In contrast to conventional top-down measures, two-way communication between project managers and stakeholders has proven to be essential for reaching PNRM objectives by enabling mutual learning and adaptive responses based on project outcomes (Reed 2008; Peelle et al. 1999; Krishnaswamy 2012). Thus, this would count against using participatory methods at the lowest ranks of Arnstein's ladder in which information merely flows from managers to participants but not vice versa. However, as will be discussed later, a linear relationship between participation intensity and project outcomes is usually negated in the literature, and it is argued in favour of applying diverse participatory methods that fit the respective stage and objective of the participatory process in the project course. Özerol and Newig (2008) attest an imbalance of information flows towards management authorities for many PNRM projects (which usually do not include sharing a significant part of decision-making power with the public), thus arguing to carefully design stakeholder interactions which enable two-way communication. As a shared understanding of information constitutes the foundation of effective communication, the language and information used in participatory processes need to be clear and understandable to all participants and - at best - should encourage further engagement with project activities (Özerol and Newig 2008; Jiménez et al. 2019; Sterling et al. 2017; Balint 2011). In addition, any provided information should represent an objective perspective to enhance public trust to project managers, and information sources and dissemination should be made transparent while ensuring confidentiality if necessary (Özerol and Newig 2008). Further, the transparency of projects represents one influential driver for the perceived level of involvement of stakeholders and is called for concerning general project management (i.e., knowing what goes on and how decision-making takes place, Kovács 2017), how and by whom information and their sources are chosen, used and distributed (Özerol and Newig 2008), and how stakeholders are identified and selected (Buchy and Race 2001; Vente et al. 2016). Finally, de Vente et al. (2016) find a significant positive effect of face-to-face communication in terms of probability of reaching sustainable solutions, conflict resolution, and increased trust between stakeholders and stakeholders and state-actors.

Adaptivity. Participation in successful management projects is often described as an iterative and interactive and thus highly dynamic process (Peelle et al. 1999). Instead of stipulating a clearly defined process, it is argued to incorporate principles of adaptive management into participatory processes, enabling learning processes and adjustment of management projects to changes of the complex, external environment (Cradock-Henry et al. 2017; Reed 2008). As Reed (2008)

emphasises, adaptivity is particularly relevant for long-term participatory projects but can benefit short-term projects as well, if scenario planning or modelling is included in management projects. Naturally, adaptive efforts require monitoring in order to evaluate outcomes (Reed 2008), including feedback from participants in order to align participatory projects to stakeholders needs and wishes (Chess and Purcell 1999; Cradock-Henry et al. 2017). Finally, authorities need to be open and responsive to stakeholders feedback and inquiries to allow for adaption, which might be hampered or at least delayed by the sluggishness of modern bureaucracy (Peelle et al. 1999).

Equality. Another factor is linked to the group of communication-related issues but is considered as a discrete category due to its high relevance for success (or, perhaps more frequently, failure) of participatory processes in the evaluative PNRM literature. The underlying driver for success is "frank and open discussion" (Krishnaswamy 2012, 9) or, as de Vente et al. (2016, 7) put it: the opportunity for "all participants [to] freely make statements and participate in discussion and decision making". This is said to lead to win-win solutions that are socially equitable, achieve predefined goals, contribute to conflict resolution, facilitate learning, and increase trust (ibid.). However, actual PNRM projects frequently fall short of this goal, as power asymmetries in participatory processes are reported to marginalise particular stakeholder groups while granting others a disproportionate exertion of influence (Akbulut and Soylu 2012). Hence, a large number of evaluative studies considered in this review call for particular attention to the effects of power dynamics in shaping collaborative outcomes (Reed 2008; Reed et al. 2018; Buchy and Race 2001; Carr, Blöschl, and Loucks 2012; Sterling et al. 2017; Resurreccion, Jane Real, and Pantana 2004). Most studies only point to the necessity to deal with power asymmetries without specifying any means, indicating the lack of easy solutions to overcome power imbalances. However, Reed (2008) describes a case study in which a careful design of participatory methods (e.g., conducting site visits instead of theoretical workshops using notes and flipcharts) enhanced project outcomes when stakeholders had diverse educational backgrounds (Reed 2008; Prell et al. 2007). Additionally, a stand-alone body of literature concerns this topic solely but has not been systematically reviewed for this thesis. This includes, for example, a research framework clustered around power dynamics in PNRM proposed by Akbulut and Soylu (2012) or Barnaud's and Van Paassen's (2013) 'critical companion' posture, that makes managers assumptions about power asymmetries explicit in participatory projects and prompts participants to consider and accept or reject them.

PP design. The last set of process factors that are argued to enhance the probability of success in PNRM projects concerns the design of participatory processes. This section has already shown that the necessity to ensure both two-directional information flows to enable social learning and collective decision-making and one-way provision of information to build transparency calls for different participatory methods to meet those individual objectives. In practice, PNRM projects pursue a much more extensive and diverse range of objectives. Project designers are faced with an equally large collection of participatory methods, thus posing the considerable challenge of selecting appropriate means to generate the desired outcomes. The evaluative literature on PNRM, in general, argues for applying multiple different forms of engagement during one project (Kovács 2017; Reed et al. 2018; Chess and Purcell 1999), favouring relatively more collaborative methods over rather passive ones (Sterling et al. 2017), and adapting methods to the socio-cultural and environmental context (e.g., power configurations, available time and resources, skills of stakeholders) and

the stage in the process (Reed 2008; Newig, Haberl, et al. 2008). Consideration of the latter might include using low-participation methods at the initial stages to harmonise different levels of knowledge before applying more active forms of involvement in the advanced decision-making stages (Özerol and Newig 2008; Harrison et al. 2001). If stakeholders provide the main expertise regarding system dynamics, Newig et al. (2008) find that rather unstructured and open methods turn out to be appropriate in the early information-gathering phases, while more formalised and rigorous methods enhance information reduction and aggregation. Additionally, Carr et al. (2012) review desirable characteristics of participatory water resource management and find that process design can be improved by setting a defined agenda that includes milestones and deadlines. Peelle et al. (1999) finally stress that trust-building actions are essential in most cases of participatory management, as will be considered more detailed in section 5.2.3.

5.2.2. Organisational setting

Goals and roles. In order to enable purposeful and efficient collaborative action, project managers and participants must be aware of the project goals and boundaries of participation from the outset (Peelle et al. 1999; Özerol and Newig 2008; Buchy and Race 2001; Chess and Purcell 1999; Kovács 2017). Defining and communicating objectives prevents raising false expectations from the public (Buchy and Race 2001) and aligns participants perceptions of project progress and outcomes with jointly defined measures of success, thus enabling an accurate evaluation of the project's performance (see section 5.1). Reed (2008) finds that if stakeholders develop goals through dialogue, this further enhances a sense of ownership over the process and improves the likelihood that outcomes are relevant for the participants, thus fostering engagement in the process.

Representation. The issue of stakeholder representation, i.e., how all relevant community members or organisations can be identified and motivated to participate in PNRM projects, has already been touched upon in section 3.1. Sufficient stakeholder identification is one of the essential aspects of conducting successful participatory management projects, and as such mentioned in almost every paper reviewed for this section and described as a key component of PNRM in Özerol and Newig 2008; Reed 2008, and Buchy and Race 2001. As the feasible scope of presentation is limited in this section and the research on stakeholder identification and analysis is extensive, this thesis will only stress the importance of analysing and selecting stakeholders carefully, without going into detail about specific means and challenges (but see Reed et al. 2009). In general, stakeholder analysis aims to identify all people who affect or are affected by management activities (Reed et al. 2009) but avoids engaging too large a group which tends to compromise to either broad and vague results or propose plenty of management options from which decision-makers have difficulties choosing the best alternative (Sterling et al. 2017). As de Dente et al. (2016, 6) find from statistical analysis of 11 case studies in Spain and Portugal:

> "Legitimate representation of stakeholders, including opinion leaders and those who would need to implement decisions, significantly increased the likelihood of learning among participants; development of mutual gains and sustainable solutions that addressed socioeconomic and environmental concerns; and attaining the goals specified at the start of the process".

Further, the authors discover a positive effect of conducting a stakeholder analysis before starting participatory processes to increase trust and learning between multiple stakeholder groups.

Empowerment. Another important factor of success represents the real empowerment of stakeholders to influence decision-making. This includes both allowing participants to affect management decisions and ensuring that they possess the capability to engage with the decision (Reed 2008). Technical constraints can limit this capability (e.g., a decision has already been made) or the skills and expertise of stakeholders (e.g., a lack of knowledge) (ibid.), whereas the latter might be compensated by providing information or facilitation services (see below). In line with this, a review by Jiménez et al. (2019) find that the management of rural drinking-water systems is more sustainable when communities engage in general management and finance decisions instead of technical considerations, thus emphasising that empowerment is no panacea but needs to be tailored to fit stakeholders capabilities. Real empowerment of stakeholders additionally requires commitment of managers or decision-makers to the principles of participation (Peelle et al. 1999; Buchy and Race 2001; Kovács 2017). If low-intensity participation is used as a mere tool to legitimate pre-set management decisions and the results of community involvement do not inform management activities, neither will stakeholders perceive their contributions to be much valued nor will management authorities benefit from the stakeholders input, thus likely resulting in less sophisticated and sustainable decisions. On the contrary, the evaluative literature on PNRM argues for considering public involvement as early as possible and throughout the process (Reed 2008; Özerol and Newig 2008; Chess and Purcell 1999; Kovács 2017). This at best includes the earliest stages of problem definition, as it ensures that issues of public interest are addressed, and the public is thus incentivised to engage in the process (Özerol and Newig 2008). Toderi et al. (2017) empirically confirmed the importance of timing stakeholder participation by analysing and comparing nine case studies of collaborative agri-environmental programs in Italy. Programs that involved farmers from the beginning were found to permanently shift farmers perceived roles from passive 'AEM implementors' to active 'AEM designers', ultimately resulting in trust, integrated local knowledge and high acceptance of the jointly agreed measures. On the other hand, some programs returned to conventional top-down decision-making after some initial participation or only included farmers at later stages of the design process, both resulting in limited trust, a perceived lack of transparency and generally less preferred outcomes. Further, as decision making typically is embedded in institutional structures that are historically designed hierarchical and top-down, devolving authority over decisions to stakeholders implies a, often rather radical, shift in organisational culture (Reed 2008). Hence, empowerment of stakeholders is not only a matter of designing appropriate participatory processes but needs to be accompanied by adapting the institutional setting to provide the flexibility and means of meaningful public participation (Carr, Blöschl, and Loucks 2012; Jiménez et al. 2019). This raises matters of scales, as changing institutional frameworks requires efforts, time, and resources that likely exceed the objectives (and abilities) of any PNRM project. Hence, this aspect might also be understood as a contextual factor (see section 5.2.3).

Incentives. In order to motivate stakeholders ongoing participation in PNRM projects, managers should provide incentives (Krishnaswamy 2012; Özerol and Newig 2008; Sterling et al. 2017). These might be extrinsic in nature, for example, financial compensation for participants time and effort (Özerol and Newig 2008), or intrinsic, i.e., resulting from the participation itself. The latter

might be realised by empowering stakeholders to influence decision-making jointly (see factor 'Empowerment' above) and consequently communicating project results to participants to document that their efforts are not wasted (ibid.). Other non-financial benefits include personal well-being, conservation for future generations, or providing a public environmental good (Sterling et al. 2017).

Facilitation. A critical factor that is closely linked to fostering other, in particular process-based, drivers for success is facilitation. As Reed (2008, 2425) argues, the outcomes of any PP is "far more sensitive to the manner in which it is conducted than the tools that are used". Open and free communication, the willingness to learn and adjust, and a shared feeling of equity and trust promote desirable outcomes (Table 3) and can itself be promoted by skilful facilitation. Facilitators are thus frequently associated with conflict resolution and prevention, generating and maintaining positive group dynamics, providing technical advice and skill in the use of participatory methods and moderation, balancing power dynamics and contributions of dominating and reluctant participants, and fostering trust-building (Reed 2008; Carr, Blöschl, and Loucks 2012; Vente et al. 2016; Kovács 2017). A common notion exists that facilitators in PNRM should be impartial and independent from all stakeholders participating in the project (Reed 2008; Carr, Blöschl, and Loucks 2012; Kovács 2017). This is partly confirmed by de Vente et al. (2016), who find that facilitation provided by government authorities is less likely to result in information gain, mutual learning, adaptive solutions or trust. However, governmental facilitation or participation more frequently resulted in the actual realisation of plans, thus indicating that those who decide or implement on the ground should be involved in PNRM projects (ibid.).

Diverse knowledge. Linked to the empowerment of stakeholders to meaningfully engage in decision-making processes is the provision and use of multiple knowledge sources, in particular including local or indigenous and scientific knowledge (Krishnaswamy 2012; Carr, Blöschl, and Loucks 2012; Balint 2011; Kovács 2017; Reed et al. 2018; Jiménez et al. 2019). As Reed (2008) discusses in his review, integrating decontextualised, transferable, and systematic scientific knowledge with context dependant and informal local knowledge gained from generations of experience is anticipated to result in a more comprehensive understanding of complex system dynamics, thus enabling more robust and sustainable decision-making (Reed 2008). Of course, this requires translating scientific findings into a language that is comprehensible for the non-scientific community, hence further highlighting the need for a shared language of all stakeholders (see factor group 'Communication' in section 5.2.1).

Match scales. Finally, PNRM projects should be designed in awareness of the variety of scales concerned in participatory management (Reed et al. 2018). This includes matching the length and frequency of participation to project goals (e.g., changing deeply rooted value systems will need more time and effort than jointly implementing one single environmental conservation measure), matching stakeholder selection to the spatial scale of institutional jurisdiction (e.g., including all governmental departments with jurisdiction over the projects area of concern), and matching the project to the spatial and temporal scale of the ecological processes that are addressed (ibid.).

5.2.3. Contextual factors

The role of societal, institutional and cultural context for the success of participatory management efforts is still contested in the scientific literature. Whereas multiple authors stress the importance

of context (Koontz 2005; Reed et al. 2018; Cradock-Henry et al. 2017) and some even consider it as the predominant driver for shaping PNRM outcomes (Baker and Chapin III 2018), others do not find any systematic influence of contextual variables on project outcomes (Vente et al. 2016; Brooks, Waylen, and Borgerhoff Mulder 2012; Reed et al. 2018).[5] At any rate, it can be said that causal relationships linking contextual factors with outcomes are less clear and explicit. Hence, the contextual factors presented in this section need to be interpreted cautiously.

On an individual level, Baker and Chapin (2018) stress the role of social stratification, as members of the social and political elite are found to be both more willing and better equipped to participate in PNRM projects, thus resulting in a deficient representation and contribution of less educated and wealthy social groups. On a community level, influential context factors are associated with resource dependence, the nature of local belief systems, characteristics of local communities (e.g., size and heterogeneity), and particularly the existence of social capital (Baker and Chapin III 2018; Peelle et al. 1999; Krishnaswamy 2012; Sterling et al. 2017; Cradock-Henry et al. 2017; Gallo et al. 2018). The latter is foremost characterised by trust, shared norms and bonds, a sense of community, and a feeling of connection and support (Gallo et al. 2018; Baker and Chapin III 2018). Willingness to participate can be both fostered or diminished by former participatory experiences and their outcomes (Reed et al. 2018). Finally, successful participatory management requires resources. This includes adequate financing, time of participants and project designers and decision-makers, as well as sufficient locations to conduct participatory events that are easily accessible for all stakeholders (Peelle et al. 1999; Özerol and Newig 2008; Baker and Chapin III 2018; Carr, Blöschl, and Loucks 2012; Kovács 2017; Reed et al. 2018; Sterling et al. 2017).

The state-level context is only considered briefly by Baker and Chapin (2018). They assert property rights and tenure regimes a prominent role in enabling general influence of property owners or tenants over management decisions that affect their lands. Besides, the authors mention general principles of good governance such as “rule of law, gender equality, and accountability and transparency in the political system” (Baker and Chapin III 2018, 5) that feed back to the individual or community level.

5.3. Success of Community-based Natural Resource Management

Analysing drivers for success in CBNRM projects poses a considerable challenge of method, as has been recognised by Agrawal in the early 2000s (Agrawal 2001, 2003). This challenge arises from the sheer number of factors that are frequently associated with CBNRM success. Agrawal (2001, 2003) identified 33 success factors based on three ground-breaking publications in the 1990s (Ostrom 1990; Wade 1994; Baland and Platteau 1996). Another meta-analysis of community-based forestry management by Pagdee (2006) identified 43 independent variables, notably in the field of community forest management alone. Gruber (2010) even reports identifying 222 characteristics linked to effective and/or successful community-based environmental initiatives in 23 research papers. The review conducted for this thesis initially resulted in 63 drivers for CBNRM success (excluding factors linked to participation, which have been considered already in Table 3), which were subsequently merged and aggregated to form a set of 46 factors as summarised in Table 4.

5. Please note that Brooks (2012) is concerned with community-based conservation projects and not with PNRM in general. However, the role of context is assumed to be comparable for both approaches.

Again, sources are excluded from Table 4 to enhance readability but are presented in the Appendix A.2.

The former discussion of participatory and community-based NRM in section 3, including the model of collaborative NRM approaches as depicted in Figure 2, allows for some considerations regarding the reasons for the seemingly interminable quantity of factors influencing the success of CBNRM projects compared to the relatively manageable number of success factors identified for PNRM. First, the scope of analysis of the CBNRM evaluative literature is widened, actively incorporating contextual factors which are merely touched upon in the PNRM literature. This particularly includes contextual variables on the individual and community level, as community characteristics and dynamics are found to be essential drivers for success or failure of CBNRM projects, thus constituting a major field of research and a discrete category of success factors in Table 4. The role of community characteristics is further amplified in CBNRM through the high degree of devolution of authority to communities (dimension 1 in Figure 2). Whereas community characteristics in PNRM 'merely' influence the outcomes of participatory processes and failures or undesirable dynamics thus might be compensated or attenuated by mediating government authorities, the near lack of government presence in community-based management render projects reliant on the outcomes of community collaboration. Besides, the scope of analysis in CBNRM literature considers community characteristics and comprises a broader project-based perspective compared to PNRM, which is primarily concerned with managing participatory processes acting on a shorter temporal scale. In contrast, community-based management concerns a variety of multi-scale processes, including rule-making and implementing enforcement strategies, establishing platforms for adjudication and conflict resolution, and creating or adapting institutions on multiple administrative scales to devolve or exercise decision-making power in line with the subsidiarity principle. This constitutes a second reason for the complexity of success in CBNRM projects and is reflected in dimension 2 of Figure 2, as multiple success factors that concern the aforementioned processes describe how CBNRM is successfully embedded in formal organisational and institutional settings to enable community-driven decision-making.

The resulting challenges arising from analysing an extensive set of variables are manifold. Efforts and costs of data acquisition and analysis proliferate with increasing numbers of significant variables under consideration. Especially if interdependence between variables exists, thus variables being dependent on the state of other variables, conducting any meaningful data analysis would imply consideration of a significant quantity of case studies (Agrawal 2001). As can be easily demonstrated, the interdependence of at least a portion of variables needs to be considered. For example, low levels of community poverty as a group characteristic are unequivocally linked to socio-economic equality in communities and fairness in the allocation of benefits provided by the common managed resource. Baynes (2015, 232) illustrates this interconnectedness of success factors and the resulting complexity in assessing the overall project success by developing a causal loop diagram that depicts the interplay of five general categories of success factors for community forestry management in Mexico, Nepal and the Philippines. Agrawal proposes to tackle CBNRM complexity by conflating correlated factors to integrated indices (2003) or concentrating efforts on conducting large-N studies to define general causal chains of success factors (2001). Understandably, most case studies do not consider or explicitly define the majority of variables summarised in Table

4, thus giving way for 'omitted variables biases' and consequently misinterpreting the relevance of the identified causal factors (Agrawal 2001).

In line with Agrawal's (2001, 2003) proposal, Table 4 groups factors that are frequently linked with CBNRM success into four categories: (1) resource system, (2) group characteristics, (3) institutional arrangements, and (4) external environment. Additionally, some factors describe the relationship between two categories. For example, the dependence of community livelihoods on resource systems is argued to enhance CBNRM project outcomes, thus describing how communities relate to the resource systems in their responsibility or the relationship between categories (1) and (2). The high number of factors in Table 4 poses a challenge of method for this thesis, as a detailed discussion of each factor is not feasible in this section. For this reason, the section builds upon the results of section 5.2.1 in explaining the relevance of participation for CBNRM projects and subsequently focuses on discussing complex or contested factors in Table 4.

Table 4: Factors attributed to the success of CBNRM projects (excl. factors linked to PP)
(Source: Categories adapted from Agrawal 2003, Factor sources see Appendix)

Categories	**Factor(s)**
Resource system (1)	
Characteristics	Small size
	Well-defined boundaries
	Low levels of mobility
Utilisation	Benefits from the resource can be stored
	Predictability
	Financial value
Group characteristics (2)	
Population	Small size
	No or only gradual population change
	Clearly defined boundaries
Social	Social capital (shared norms, homogeneity of identities and interests), e.g. through past successful experiences
	Supportive cultural traditions / local beliefs
Leadership	Appropriate (adaptive) leadership
Dependence	Interdependence among group members
Equality	Equality in terms of socio-economic status and gender
Capacity	Community members possess management capacity (knowledge, skills)
Poverty	Low levels of poverty
(1) and (2): Relationship between Resource System and Communities	
Proximity	Overlap or proximity between user-group residential locations and resource system
Dependence	Group members are dependent on resource system
	Diversity of livelihood options / independence from one single resource
Perceived Crisis	Perceived resource crisis before project-initiation

Table 4: (continued)

Fairness	Fairness in allocation of benefits from resource system and management project
Demand	Low levels and only gradual changes of user demand
Knowledge	Understanding of SES dynamics, based on open/integrative information base including scientific and local knowledge
Institutional arrangements (3)	
Participation	Significant and ongoing involvement of community members
Rule-making	Rules exist that are simple and easy to understand
	Rules can be easily enforced
	Graduated sanctions are provided
	Collective choice arrangements, affected individual are able to participate in rule-making
Rights	Locally devised and secure tenure, access and management rules
Adaptivity	(Participatory) Monitoring is in place
	Monitored data is fed back and evaluated
	Adaptive capacity: Flexibility to adapt as project is implemented
Accountability	Accountability of monitors and other officials to community members
Anticipation	Introduce management plans and a shared vision
Incentives	Provide lasting incentives
Conflict resolution	Mechanisms for communication and low-cost conflict resolution
	Easy access to low-cost adjudication
Outreach	Vision, plan and rules are communicated to the external public
(1) and (3): Relationship between resource system and institutional arrangements	
Match scales	Match restrictions on resource system to its regenerative powers
(2) and (3): Relationship between community characteristics and institutional arrangements	
Engagement	Engagement with traditional organisations, cultural beliefs, practices, and traditions
External environment (4)	
Technology	Low cost exclusion technology
	Quick adaption to new technologies
	High costs of resource extraction
Markets	Low levels and/or only gradual change of articulation with external markets
State	Extensive devolution of power to local institutions
	Supportive external sanctioning institutions
	Appropriate levels of external aid to compensate conservation activities, especially in initial stages, includes funding but also facilitation and capacity building
	Nested levels of appropriation, provision, enforcement, and governance

Success factors that are linked to characteristics of the resource system are relatively unambiguous and rarely contested. Small size, well-defined boundaries and low levels of resource mobility ease

the necessary effort to jointly manage a resource system as they facilitate both the identification of affected community members as well as getting them together on a regular basis to participate in management activities (Agrawal 2003; Armitage 2005; Crawford 2000; Pagdee, Kim, and Daugherty 2006). Other factors are linked to the utilisation or exploitation of a resource and are valid for resource management in general. This includes possibilities to store the benefits provided by the resource (Agrawal 2003), the importance of predictability of resource dynamics and its development to shape management measures (Agrawal 2003; Pagdee, Kim, and Daugherty 2006), and the provision of some benefit (generally in terms of financial value) by the resource system to incentivise community members to engage in collaborative management efforts (Thakadu 2005; Pagdee, Kim, and Daugherty 2006; Baynes et al. 2015). Just in considering these initial factors linked to the resource system, the interplay of success factors foreshadows as, for example, the importance of being able to store resource benefits is likely affected by resource predictability. If unforeseen resource scarcity occurs, the existence or absence of stored resource benefits will strongly affect the livelihoods of community members dependent on resource provision.

The role of community size involved in resource management is somewhat more debated in the literature. While many scholars argue in favour of relatively small community sizes to enhance the probability of management success (Thakadu 2005; Pollnac, Crawford, and Gorospe 2001; Agrawal 2003), others doubt a one-dimensional and linear relationship of community size and management success (e.g., Pagdee, Kim, and Daugherty 2006). For example, Brooks et al. (2012) predict an inverted U-shape relationship between population size and CBNRM success in line with Collective Action Theory. This is partly confirmed by findings of Agrawal and Chhatre (2006) who find a significant positive relationship between the number of households involved in management and resource system condition in analysing 95 cases of community-based forest management in Indian Himalaya. However, the authors argue that this relationship is unlikely to hold for excessive community sizes, thus indicating an inverted U-shape dependence that maximises the probability of management success at relatively small community sizes. The line of argumentation for this relationship usually includes larger communities being able to aggregate more extensive overall contributions to management efforts which are at some point counterbalanced and outweighed by increasing efforts to organise participation of increasing numbers of stakeholders (Agrawal and Chhatre 2006; Brooks, Waylen, and Borgerhoff Mulder 2012).

Leadership constitutes an important factor in actuating community-driven efforts for resource management or conservation (Agrawal 2003; Gruber 2010; Mountjoy et al. 2013; Crawford 2000; Pagdee, Kim, and Daugherty 2006; Tantoh et al. 2021). Strong, charismatic leaders are reported to help community members face and manage tough realities and conflicts (Gruber 2010), secure funding through outside networks to the local traditional elite (Sterling et al. 2017), and establish and uphold a common vision to guide collaborative efforts (Sterling et al. 2017; Mountjoy et al. 2013). Interestingly, successful leadership is frequently associated with adaptive capacity (Gruber 2010; Mountjoy et al. 2013; Agrawal 2003). In this notion, leaders account for the dynamic nature of CBNRM projects and enable flexible adaption to changes of the external environment (Gruber 2010).

Regarding the role of dependency by communities on the managed resource system, some divergence in the evaluative literature can be noted. The majority of reviewed papers that concerned

resource dependency attested a positive impact on the willingness of community members to participate in CBNRM projects if subsistence is reliant on resource conditions (Agrawal 2003; Gruber 2010; Agrawal and Chhatre 2006; Pagdee, Kim, and Daugherty 2006). Shackleton (2000, cited by Fabricius 2004), however, stresses the importance of diverse livelihood options based on different resource types between which communities are able to switch rapidly if needed. Pollnac (2001) additionally finds the existence of alternative income projects especially important for promoting the success of community-based marine protected areas in the Philippines. These at first sight contradictory findings might be reconciled by considering issues of time and trade-offs between conflicting objectives. First, it is plausible to argue that high levels of dependency by communities on resource systems constitute a powerful incentive for said communities to engage in sustainable resource management. This dependency would thus be essential in the initial stages of project initiation and outreach to relevant community members. At later project stages, however, a legitimate and successful management strategy might include generating and promoting alternative income opportunities, thus lowering the community's demand (which represents a success factor in its own accord, see Table 4) as well as its dependency on the resource. This raises questions about how a decreasing dependence retroacts on community members ongoing motivation to manage the resource sustainably. However, this was not discussed in the reviewed literature. Second, the existence of diverse livelihood opportunities might promote other project-related objectives such as enhancing adaptive capacity and thus contribute to the overall resilience of the project and consequently its perceived success when faced with changing environments. Additionally, moderate levels of dependence might benefit CBNRM projects as it is imaginable that communities are more open to changes of management practices or land uses, which might even be experimental in nature if their subsistence is not entirely reliant on the resource system.

The role of participation in shaping outcomes of CBNRM projects has already been addressed in section 3.2. It needs to be stressed that meaningful participation at all stages of CBNRM initiatives embodies a key principle of successful community-based management (Gruber 2010) and is thus mentioned in almost all papers reviewed for this section (e.g., Pomeroy, Katon, and Harkes 2001; Pollnac, Crawford, and Gorospe 2001; Crawford 2000; Thakadu 2005; Pagdee, Kim, and Daugherty 2006; Brooks, Waylen, and Borgerhoff Mulder 2012; Dyer et al. 2014; Tantoh et al. 2021). Hence, successful CBNRM incorporates the factors presented in Table 3 to a great extent, especially including factors that concern the process of participation itself (section 5.2.1). Those factors are excluded from Table 4 as Table 3 is considered a complement for this section in aggregating factors that are linked to stakeholder participation.

Contextual factors of CBNRM describe its embedment in the supra-regional, national and international environment, including the effects of externally imposed technology (changes), interactions with markets, and influences of policy and governance exerted above the community level. Technology is particularly linked with efforts to exclude non-community members from resource utilisation (Agrawal 2003) to prevent free-riding and enforcing restrictions on resource use, the role of rapid technology changes as a potential stressor for collective resource management (Agrawal 2001; Crawford 2000), and technology as the main determinant of resource extraction costs linking it to resource demand and thus to anthropogenic pressures on the resource system (Crawford 2000). Regarding the articulation with external markets Agrawal (2003) attests an increase of probability

for CBNRM project success if articulation happens on relatively low levels and only changes gradually. These findings appear reasonable, as higher market demands inevitably result in increased pressure on the resource system and rapid changes, similar to technology changes, likely overstrain the relatively long process of community-based consent-building and thus jeopardises management success. These findings are challenged by a later analysis of Agrawal and Chhatre (2006) on community-based forest management in India, in which they identify a positive relationship between market access and resource condition. However, the authors assume a confusion of their proxy for market access (distance from roads) with the influence of government presence (which is assumed to correlate with distance from roads, too) on the motivation to engage in deforestation and thus refrain from generally attesting market access a positive influence on resource conditions in CBNRM.

5.4. Success of (Adaptive) Co-Management

The review on factors influencing the success of (adaptive) co-management projects revealed a surprisingly extensive overlap with factors linked to CBNRM success as presented in Table 4. The great majority of factors identified in this review is also considered in the CBNRM literature, raising the question why the considerable differences between both approaches deduced in section 3 are not reflected in differing drivers for successful ACM projects. This section seeks to unravel this finding. Right from the start, it can be noted that the emergence of co-management as a means for collaborative and decentralised management of common-pool resources allows for the application of rather general rules for successfully governing the commons, such as Ostrom's design principles (1990). Hence, numerous evaluative studies of co-management (and, naturally, CBNRM) build their assessment on these general principles (such as Wiederkehr, Berghöfer, and Otsuki 2019; Ming'ate, Rennie, and Memon 2014; Gutiérrez, Hilborn, and Defeo 2011; Sattler et al. 2015; Trimble and Berkes 2015) and potentially never leave the common ground pegged by Ostrom's work, thus failing to address more nuanced differences between the management approaches as is aimed for in this study.

Another possible explanation is linked to potential weaknesses of method. As elaborated in section 2, the reviewed studies for this part of the thesis comprise meta-analyses and evaluative primary literature if their findings are based on consideration of three or more case studies, responding to the extensive bodies of evaluative literature for natural resource management and the limited feasible research scope of this study. Thus, if best practices for particularities of co-management such as jointly designing and enforcing management agreements are highly context-dependent, averaging factors of success over a large number of studies might omit these aspects and leaves rather general success factors that are valid for diverse political and socio-economical contexts. As has been already discussed in regard to PNRM, the role of context in shaping outcomes of collaborative natural resource management is contested. However, evidence exists that the broader political economy significantly influences outcomes of co-management projects (Nunan 2020). Thus, negative impacts of the chosen study design cannot be negated per se.

For this reason and to avoid redundancy with the previous sections, the following discussion of factors will focus on differences between the drivers identified in the CBNRM literature (Table 4) and ACM literature (Table 5). As the ACM literature is less explicit on the role of participation

compared to literature concerning community-based management, section 5.2 is not understood as a complement for the success factors considered in this section; instead, all factors linked to participation in co-management projects are listed in Table 5.

Table 5: Factors attributed to the success of (adaptive) co-management projects
(Source: Categories adapted from Agrawal 2003, Factor sources see Appendix)

Categories	**Factor(s)**
Resource system (1)	
Characteristics	Stability / Lack of disturbances
	Low levels of mobility
	Small size / small scale systems
	Well-defined boundaries
Group characteristics (2)	
Size	Small size
Leadership	Charismatic leadership that motivates and steeres collective action
Commitment	Long-term commitment to the process by both local government and stakeholders
Homogeneity	Homogeneity in terms of kinship, ethnicity, religion, culture, and socio-economic status
	Shared interests / Diversity of interests (?)
Social capital	Relationship of trust and mutual respect
	Group cohesion
	Social networks
	Mutual learning
(1) and (2): Relationship between resource system and communities	
Spatial proximity	Proximity of members residential location to managed areas
Knowledge	Stakeholders share extensive knowledge and understanding regarding resource system dynamics, the addressed problem and potential solutions
Institutional arrangement (3)	
Objectives	Simple and clearly defined objectives
Membership	Clearly defined membership
Rules	Enforcement of and/or compliance with legislation
Conflict	Adequate means for conflict resolution, e.g., collaborative and mediated forum
Equality	Means to tackle power asymmetries that impede equal participation and redistribution of power
Adaptivity	Management measures are monitored, evaluated and adapted, if necessary
	Effective resource monitoring
	Possibility to experiment with management measures
Empowerment	Government action establishes supportive and enabling legislation, policies, rights, and authority structures
	Decentralisation of authority

Table 5: (continued)

	Existence of community organisations
	Capacity building, including consciousness raising, training of management and mediation skills, principles of co-management, and imparting scientific understanding of SESs
	Participation of all relevant stakeholders
	Identifying relevant stakeholders by conducting a stakeholder analysis
Accountability	All involved partners are held accountable based on accepted standards for evaluating objectives and outcomes
Communication	Clear communication of privileges, guidelines, ACM process and responsibilities
Incentives	Individual incentive structure is provided and promoted (e.g., higher incomes, protection of livelihoods, prestige, legitimate access to resources, reduction of conflicts, ...)
Resources	Sufficient, timely and sustained funding and financial resources
	Human resources (e.g., full-time facilitator, volunteers) and time
	Technical equipment (e.g., for monitoring)
	Provision of information to participants in a way that suits their skills and preferences
Knowledge	Scientific and local/indigenous knowledge is integrated to inform management design
Facilitation	A facilitator or external agent expedites the process by providing assistance, advice, ideas, expertise, training and/or guidance
(1) and (3): Relationship between resource system and institutional agreements	
Matching scales	Resource distribution matches areas of jurisdiction

Resource system (1). The very first factor listed as a preferable characteristic of a co-managed resource system, i.e., stability or lack of ecological disturbances, is not mentioned in the CBNRM literature. On the contrary, the CBNRM success factor 'Perceived resource crisis before project-initiation' (which was not found to promote ACM success) somewhat contradicts this characteristic as instability of resource dynamics represents a powerful crisis that potentially jeopardises community subsistence and encourages collaborative conservation efforts. The conducted review only allows for hypothesising a possible explanation for this discrepancy: The CM literature stresses the long-term process nature of co-management projects, negating any end-points to co-management (Armitage et al. 2011) and instead conceptualising it as an evolving, continuous loop of management implementation, learning and adaption (see section 3.3). Hence, in the face of a potential trade-off between the incentivising effect of resource crisis in encouraging conservation efforts and the facilitating effect of resource stability for successfully implementing management measures, the long term nature of co-management (and thus higher probability of ecological disturbances to occur during the process) might promote prioritising the latter. However, it could also be argued that adaptive co-management is exceptionally well equipped to deal with unforeseen instabilities of the resource system due to its incorporation of adaptive management principles. Hence, this finding should be interpreted cautiously.

Another distinct difference in drivers for success is less unamenable for interpretation. By

throwing a glance at Table 5 the complete lack of any resource characteristics linked to resource utilisation is striking. In community-based projects, management is more likely to be successful if the resource system is of financial value for the managing communities, its dynamics can be adequately foreseen and opportunities to store benefits provided by the resource system are given (see Table 4). Other success factors linking CBNRM projects with community subsistence include 'Low levels of poverty', 'Group members are dependent on resource system' and 'Fairness in the allocation of benefits from the resource system and management project'. All those factors are not particularly important for co-management projects, indicating that resource utilisation plays a relatively smaller role in guiding CM initiatives. However, this is likely not due to a general irrelevance of the resource systems for the involved users. Many co-management agreements are, for example, implemented in the context of artisanal or local fisheries, which are generally highly dependent on incomes generated through resource exploitation (d'Armengol et al. 2018; Dalton, Forrester, and Pollnac 2011; Gutiérrez, Hilborn, and Defeo 2011; McConney, Pomeroy, and Mahon 2003; Pomeroy and Mcconney 2007; Wiederkehr, Berghöfer, and Otsuki 2019). Instead, two hypothesised explanations for this observation are (1) the appearance of the state as a provider of an incentive structure that is not foremost based on resource utilisation (e.g., in the form of payments for environmental services) or (2) the substitution of incentives based on resource utilisation in CBNRM by binding formal agreements in co-management projects. According to the second explanation, the necessity of continuous awareness of benefits in terms of resource utilisation that drives engagement in CBNRM might be bypassed in co-management if initial consensus amongst the partners can be translated into a formal arrangement. However, CM success is questionable if resource users perceive no further apparent incentive structure, especially given the dynamic and adaptive approach inherent to co-management, which probably allows to drop out of agreements eventually.

Group characteristics (2). Four observations can be made regarding the characteristics of the managing group of community members and state representatives. The first concerns the importance of commitment of both the local government and stakeholders to the co-management process. Commitment is found to be crucial for success both in terms of embracing the long-term perspective necessary for adaptive management and institution-building processes to unfold (Armitage et al. 2009; Armitage et al. 2011) and to prevent management capture by the political elite (Pomeroy, Katon, and Harkes 2001). Co-management as an institutional arrangement involving both holders of traditional power (e.g., politicians) and user groups historically excluded from decision-making is particularly vulnerable to being trapped in existing power structures. For this reason, ongoing and fundamental political willingness to engage in co-management is indispensable for sustained CM success (Pomeroy, Katon, and Harkes 2001).

Another set of factors that differs in co-management regards the social sphere. On the one hand, this includes mutual learning and thus a factor closely linked to adaptive capacity (see section 3.3). Given that learning processes take time, this likely additionally contributes to the necessity of long-term commitment described beforehand. On the other hand, social networks were found to enhance the likelihood of CM success substantially. Plummer et al. (2012) state that social networks are the factor most frequently associated with the success of CM projects in their systematic review of the adaptive co-management literature. Unfortunately, their work does not specify the role of

social networks in enhancing co-management outcomes but instead aggregate all factors linked to the so-called 'theme' of social networks. Hence, it might be assumed to include the effects of both (a) informal personal relationships between actors as a means to generate social outcomes including group cohesion (i.e., another factor of success), preventing conflicts or facilitating their resolution, and building of trust, and (b) the role of existing social structures to guide institution-building processes by efficiently distributing privileges and duties aligned to the capabilities and skills existent in the given social system of resource users and managers. Likely, the rather loose definition adopted in their review contributed to the high number of identified matches, given that social networks were documented almost twice as many times as the second strongest factor.

A further driver of success missing in the CM evaluative literature is 'Interdependence among group members'. From a game theory perspective, stakeholder interdependence is likely influential in CBNRM in encouraging community participation in joint management efforts, ensuring compliance with resource restrictions, and discouraging free-riding behaviour. A possible explanation for its minor relevance in co-management projects is again linked to both formal arrangements functioning as a substitute incentive for compliance and the perceived presence of government authorities for discouraging misbehaving. Besides, given the generally lower levels of community control in co-management projects (compared to CBNRM), factors influencing the motivation to engage in collaborative decision-making are probably less essential for outcome generation.

Finally, opposing influences of homogeneity of interests amongst group members can be observed. While d'Armengol et al. (2018) assert diversity of interests among co-managed fisheries a strong positive impact on outcomes, Armitage et al. (2009) argue in favour of shared interests in CM projects based on an expert Delphi process and in line with the CBNRM literature (see Table 4). Explanations for these contrasting findings are not obvious. A positive relationship of shared interests and management success seems to be more intuitive and aligns with the CBNRM literature findings. A possible explanation for the divergent finding of d'Armengol et al. (2018) might be interference with the factor 'Participation of all relevant stakeholders'. If the proxy for 'diversity of interests' used in their study is compounded with a measure of 'all relevant stakeholders are represented', e.g., by using a proxy such as 'number of different sectors involved', the positive relationship might actually reflect the effect of including all relevant stakeholders and positions in the process. Checking the supplementary material provided in the paper's appendix confirms this notion: Diversity of interests is defined there as "Participants represent the diversity of actors' interests" (p. 7). Hence, a high diversity of interests does not indicate diversity in an absolute manner but refers to representing all prevailing interests of the affected CM members.

Institutional arrangement (3). Factors of success grouped around institutional arrangements are generally less explicit in co-management compared to community-based management due to the variety of possible configurations of institutional power-sharing (see Figure 3 in section 3.3). For example, the evaluative CBNRM literature has derived rather specific recommendations regarding how communities might organise for rule-making and enforcement, whereas formulating similar, universal suggestions for co-management is challenged as not all CM projects require legislative measures. Furthermore, legislation might be in the responsibility of both communities or state authorities (in community-nested or state-nested settings, respectively) faced with different intricacies that require individual solutions. The diversity of institutional settings thus hampers

deducing universal factors of success. Concerning rule-making, most evaluative CM studies thus only stress the importance of the existence of rules and their enforcement (Dalton, Forrester, and Pollnac 2011; Gutiérrez, Hilborn, and Defeo 2011; McConney, Pomeroy, and Mahon 2003) without specifying means and responsible actors. Pomeroy et al. (2001) numerate some potential strategies for law enforcement in CM projects, including implementing objective enforcement units, combining local or traditional enforcers (e.g., senior fisher), community sanctions (e.g., social pressure), and conventional government enforcement. Furthermore, the legitimacy of authorities charged with rule-making and enforcement as perceived by resource users must be ensured to prevent opposition and noncompliance (ibid.).

A focal point of the evaluative literature on institutional arrangements supporting CM success represents community empowerment. Following Reed's (2008) argumentation, this entails two distinct areas of intervention. First, arrangements must be set that allow community members to participate in the management process equally. This frequently includes identifying relevant stakeholders by conducting a stakeholder analysis, significant devolution and decentralisation of authority to stakeholders or community organisations, and adapting local legislation, rights and power regimes to allow for non-governmental decision-making affecting management measures, regulations and enforcement. On the other hand, it comprises ensuring that all involved parties possess the capacity to meet the roles and responsibilities assigned to them. In line with the diverse demands of co-management duties, empowerment thus necessitates substantial capacity-building addressing various skills and fields of knowledge:

> "Capacity building must address not only technical and managerial dimensions but also attitudes and behavioral patterns. Training and education may include leadership, situation analysis and problem solving, consensus building, value reorientation, basic biology and ecology, technology application, livelihood and enterprise management, conflict management, advocacy, facilitation, networking, ecological and socioeconomic monitoring and evaluation, and legal/para-legal, among others" (Pomeroy, Katon, and Harkes 2001, 201).

An interesting finding linked to community empowerment is the explicit notion of the importance of a sense of ownership to the co-management arrangement found for co-managed fisheries in Asia (Pomeroy, Katon, and Harkes 2001). While this rather presents an outcome of intense participation than a self-contained recommendation for management measures, it deems valuable as it is (a) a success indicator that can be measured (i.e., through interrogation or participants) easily and (b) might inform co-management design in favouring configurations that grant all partners an equal (or at least perceived sufficient) exertion of influence on the project design and process.

In community-based management, facilitation is generally described as a rather passive role assigned to supra-community level administrations, comprising the provision of advice, initial funding, capacity building, or supportive external sanctioning institutions (Fabricius and Collins 2007; Pollnac, Crawford, and Gorospe 2001; Baynes et al. 2015; Agrawal 2003). Positive outcomes of active facilitation in the form of on-site advisors that offer counsel on a day-to-day basis are reported for individual case studies (e.g., Thakadu 2005) but are not documented as general drivers for success. In contrast, facilitation is attested to a significant role in co-management projects. The facilitator usually constitutes an external agent originating from non-government organisations,

academic or research institutions, or project teams (Pomeroy, Katon, and Harkes 2001). His function typically includes steering group dynamics efficiently towards aspired outcomes, giving objective and neutral counsel to the participants, encouraging participation, and mediating conflicts or releasing blocks during the process (McConney, Pomeroy, and Mahon 2003). However, facilitators are not meant to actively engage in the process in terms of acting towards their individual objectives but serve "a catalytic role" (Pomeroy, Katon, and Harkes 2001, 199) in helping the group to achieve their collective goals. Interestingly, Pomeroy et al. (2001) argue for a temporary relationship with the CM project, with facilitators working towards a defined and particular objective and phasing out after it is reached.

Ultimately, the lack of factors attributed to the external environment is apparent. As has already been indicated at the beginning of this section, evidence exists that co-management projects are significantly influenced by the broader political and economic landscape (Nunan 2020). However, corresponding causal links have not been identified in the meta-analysis' considered in this review. Furthermore, making universally valid assumptions regarding the division of co-management system and external environment is again challenged by the flexibility of the co-management concept that allows for arrangements including multiple administrative scales. Hence, all factors linked to government activities were understood to be positioned inside the co-management system, for example, providing a supportive legislative framework. However, naturally, legislative governmental departments might not be part of the co-management agreement and would thus count as a contextual variable.

Some indication regarding the lack of factors linked to formal agreements in co-management projects is given by Dalton et al. (2010), who find no significant effect of formalising agreements in co-managed marine protected areas in the wider Caribbean and thus put its contribution for management success into perspective. This is at least partly confirmed by De Pourcq et al. (2015), who attest formal arrangements no influence in preventing or resolving conflicts emerging during co-management projects. Hence, the absence of factors related to formalised arrangements might reflect their minor relevance for CM success. However, this would partly contradict assumptions made above that promote formal arrangements for substituting economic incentive structures or enhancing compliance with jointly agreed rules. To summarise, the impact of formal arrangements cannot be resolved based on this review, however, no empirical indication for its relevance has been found.

5.5. Participation in Agri-Environment Schemes

Section 4.5 uncovered the challenge of linking AES design variants with ecological or social outcomes across case studies and their respective individual implemented AES and targeted species. Hence, deriving a set of success factors with informative value valid for the diversity of farming systems, ecological conditions, and AES objectives across EU member states presents a continuing challenge and task for future research or, probably more likely, is infeasible in the end. After all, the complex interplay of ecological, social, political and economic factors that drive AES applicability, acceptance, and outcomes motivated and necessitated the devolution of authority over AES design from the EU to member state level and, increasingly, to sub-national participatory formats. Attempts to develop a comprehensive set of success factors with cross-state validity thus probably falls short

of the convoluted context- and path-dependent reality of modern socio-agricultural systems.

However, auspicious and extensive research across the EU has been conducted around farmer's decision to participate or non-participate in AES (Cullen et al. 2021). Given the voluntary nature of AES enrolment, the willingness of farmers to participate constitutes a major determinant for achieving policy objectives (Lastra-Bravo et al. 2015). As human decision-making is unlikely to be based on fundamentally different dynamics across EU member states, this research focus allowed for supra-national comparative studies (e.g., Zimmermann and Britz 2016; Lastra-Bravo et al. 2015), which constitute the basis for the collection of factors associated with farmers willingness to adopt agri-environmental measures presented in Table 6. The factors will be discussed subsequently to inform the analysis conducted in section 6.

Table 6: Factors correlated with farmers willingness to participate in AES

Influencing factors	**Source**
Farm structure and characteristics (1)	
Large farm size *	Lastra-Bravo et al. 2015; Pavlis et al. 2016; Wilson and Hart 2000; Defrancesco et al. 2007; Ducos, Dupraz, and Bonnieux 2009; Zimmermann and Britz 2016; Cullen et al. 2020; Mack, Ritzel, and Jan 2020; Cullen et al. 2021
Rather extensive farming practice	Lastra-Bravo et al. 2015; Wilson and Hart 2000; Ducos, Dupraz, and Bonnieux 2009; Zimmermann and Britz 2016; Cullen et al. 2020; Mack, Ritzel, and Jan 2020; Cullen et al. 2021
Low level of fixed assets *	Lastra-Bravo et al. 2015
Low level of family labour *	Lastra-Bravo et al. 2015
Farmer characteristics (2)	
Higher level of education	Lastra-Bravo et al. 2015; Pavlis et al. 2016; Wilson and Hart 2000; Defrancesco et al. 2007; Ducos, Dupraz, and Bonnieux 2009
Young age *	Lastra-Bravo et al. 2015; Pavlis et al. 2016; Zimmermann and Britz 2016; Cullen et al. 2021; Defrancesco et al. 2007; Ducos, Dupraz, and Bonnieux 2009
Prior participation in AES	Wilson and Hart 2000; Cullen et al. 2021
Existence of successor / children *	Lastra-Bravo et al. 2015; Cullen et al. 2021
Positive attitude towards environment and/or environmentally friendly farming practices	Lastra-Bravo et al. 2015; Ducos, Dupraz, and Bonnieux 2009; Wilson and Hart 2000; Van Herzele et al. 2013
Forward looking self identity	Cullen et al. 2020
Trust in government *	Lastra-Bravo et al. 2015
Social pressure / participation of neighbouring farms *	Defrancesco et al. 2007; Cullen et al. 2020; Wilson and Hart 2000; Lastra-Bravo et al. 2015
Perceived source for personal satisfaction (e.g., learning new skills, moral/ethical motives, ...)	Pavlis et al. 2016

Table 6: (continued)

(1) and (2): Factors linking the farm- and the farmer-level	
Farm income constitutes moderate proportion of total household income	Lastra-Bravo et al. 2015; Cullen et al. 2021; Wilson and Hart 2000; Mack, Ritzel, and Jan 2020; Defrancesco et al. 2007
High proportion of landed property	Lastra-Bravo et al. 2015; Wilson and Hart 2000; Defrancesco et al. 2007
AES design (3)	
Fixed transaction and compliance costs impede participation of smaller farms	Falconer 2000; Ducos, Dupraz, and Bonnieux 2009
Higher per hectre payments that cover costs of participation	Wilson and Hart 2000; Lastra-Bravo et al. 2015
Availability and quality of information to farmers on AES	Wilson and Hart 2000; Defrancesco et al. 2007; Lastra-Bravo et al. 2015; Pavlis et al. 2016
Technical advice / extension services	Lastra-Bravo et al. 2015; Wilson and Hart 2000
(1) and (3): Factors linking AES design with farm characteristics	
Goodness of fit in regard to AES options and farm characteristics	Lastra-Bravo et al. 2015; Pavlis et al. 2016; Zimmermann and Britz 2016; Defrancesco et al. 2007; Van Herzele et al. 2013
(2) and (3): Factors linking AES design with farmer characteristics	
Goodness of fit in regard to farmers management plans and AES requirements	Wilson and Hart 2000; Van Herzele et al. 2013
Institutional and policy design (4)	
Clear institutional design and stable policy for future periods	Lastra-Bravo et al. 2015

* Direction or significance of effect is contested in the literature

Farm structure and characteristics (1). One group of factors attributed to farmers' willingness to participate in AES programs concerns the level of agricultural acreage in terms of area size, farming systems, distribution of assets and utilisation of family labour. The first, i.e., the size of holdings in possession of farmers, is frequently positively correlated with their likelihood to register for AES. This relationship is assumed to be linked to economies of scale that allow farmers on larger holdings more flexibility in management decisions due to decreased dependence on agricultural outputs (Wilson and Hart 2000; Zimmermann and Britz 2016) as well as the higher likelihood of habitats eligible for AES payments on larger farms compared to smaller property sizes (Pavlis et al. 2016). Hence, AES seem better to fit larger farm owners' occupational and economic conditions and do not reflect a generally lower willingness of small farms to participate. This is partly confirmed by case studies that attest small farm holders an increased interest in participation, such as Capitanio et al. (2011). A recent study by Cullen et al. (2021) furthermore showed that the relationship between farm size and participation is non-linear, more precisely quadratic, with the likelihood of participation increasing at a decreasing rate for larger farm sizes. The authors link this to AES design variants that limit per hectare payments at defined farm sizes, thus additionally confirming that the effect of farm size on AES uptake can be influenced through AES design choices. Finally,

Zimmermann et al. (2016) show that more wealthy farms (in terms of economic European Size Units) tend to enrol smaller portions of lands, indicating that they may have specialised in more productive and relatively small farming systems such as vegetables and fruits, or that larger farms assign smaller portions of their lands for conservation measures.

Extensive agricultural practices are generally more likely to result in AES enrolment. This is frequently linked to AES design that intentionally aims for extensively farmed areas to counter intensification trends (Zimmermann and Britz 2016; Lastra-Bravo et al. 2015) as well as an increased 'goodness of fit' and corresponding lower costs for AES implementation for extensive farms (Mack, Ritzel, and Jan 2020), thus potentially raising issues of additionality.

Two contested factors linked to the farm level are reviewed by Lastra-Bravo (2015). The first concerns the effect of fixed assets such as harvesters and other machinery in increasing transaction costs of participating farmers if this machinery is not required for the farming practices promoted through AES adoption. In line with this, Ducos et al. (2009) and Barreiro-Hurle et al. (2010) mention decreasing participation for agricultural systems that entail heavy investments in machinery. However, Capitanio et al. (2011) found a reverse effect with high levels of fixed assets being positively correlated with farmers' enrolment in AES. One possible explanation might include statistical confusion of the effect of binding assets in machinery and production sites with the correlated impact of larger farm sizes and wealthier farmers (who are probably more likely to bind huge quantities of assets in farming equipment). The second factor considers farmers' personnel and attests a higher willingness for AES adoption if part-time workers are employed (Mathijs 2003) and a reverse effect if the farm is mostly run by family labour (Capitanio, Adinolfi, and Malorgio 2011). As Mathijs (2003) suggests, this might be linked to additional cost-savings generated if less labour is required and fewer employees are needed. However, another case study did not find any significant link between family labour and farmers' participation in AES (Lastra-Bravo et al. 2015).

Farmer characteristics (2). Farmer characteristics, attitudes and experiences were found to substantially shape their enthusiasm when confronted with the choice to register for a scheme. For example, AES participants tend to have completed higher levels of post-primary education, indicating that participation is alleviated if knowledge about schemes and ecosystems as well as reading, writing and communication skills are abound (Pavlis et al. 2016; Wilson and Hart 2000). Pavlis et al. (2016) further highlights the positive impact of agricultural training or education for farmers' participation, confirming findings from the previous chapters about the importance of capacity (building) to enable meaningful participation in environmental management. Furthermore, Mack et al. (2020) find that well-educated farmers are more likely to participate in result-oriented or collaborative AES. In contrast, lower educated farmers prefer action-based schemes, thus confirming the extensive demands farmers are challenged with in attempts to (jointly, in the case of collaborative AES) identifying adequate management measures to achieve prescribed outcomes.

Besides, farmers' engaging in AES are frequently reported to be rather young. This is attributed to a higher risk-tolerance as well as flexibility and open-mindedness to adopt novel farming techniques (Pavlis et al. 2016; Defrancesco et al. 2007). For example, Pavlis et al. (2016) found that younger farmers usually implemented intense measures like land-use changes. However, the influence of age on farmers participation is by no means undisputed. For example, a significant relationship between age and participation is negated for the majority of EU member states (Zimmermann and

Britz 2016) and some, like Ireland, even find that participants are significantly older than their non-participating peers (Ducos, Dupraz, and Bonnieux 2009). This indicates that contrary dynamics might be at play, as suggested by Potter and Lobley (1992), who report that elderly farmers with no successors tend to perceive AES as opportunities to wine down their farms.

This leads to a related factor linked to farmers eagerness for AES adoption, i.e., the existence of successors or children. Findings in this regard are highly contrary, ranging from reports of positive relationships between the existence of successors and AEM participation (Wilson and Hart 2000), negative significant relationships (Defrancesco et al. 2007) or no significant effects at all (Lastra-Bravo et al. 2015; Defrancesco et al. 2007). In addition, Cullen et al. (2021) find that AES participants are more likely to have children in their household, however, the effect is not extensive (46.9 % versus 40.7 % of approximately 23,000 farms) and besides not overly surprising as participating farmers generally are younger.

A strong statistic correlation with farmers prior involvement in AES points to a high degree of path-dependency in farmers decision-making. As Wilson and Hart found as early as 2000, so-called 'interscheme continuity' emerged in all countries under consideration where previous schemes had existed, with 90 % of participants of earlier schemes also registering for subsequent ones (Wilson and Hart 2000). This is supported by Cullen et al. (2021) two decades later, who analysed representative panel data of farmers in Ireland over 23 years and found that farmers were between twice and up to 50 times as likely to participate in AES if they had adopted AES in the past. This might be of particular relevance to inform policy-making as focussing efforts such as extension services and advertisement on recruiting farmers for AES might prove highly effective if farmers end up participating in environmental schemes continuously (Wilson and Hart 2000).

Furthermore, farmers' attitudes for or against environmental conservation are frequently cited for influencing their willingness for AES adoption. Empirically this is, for example, shown by Ducos et al. (2009), who asserted farmers from a cross-European sample a higher likelihood to enrol in AES if they were involved in farmer groups with nature orientation. In contrast, memberships in production-oriented associations were negatively correlated with AES enrolment.[6] Additionally, environmental concerns constitute a vital motivation for farmers participation (Wilson and Hart 2000), which is usually only outnumbered in terms of stated significance by financial reasons such as increased incomes and reduction of economic risks (ibid.; Pavlis et al. 2016; Van Herzele et al. 2013). The commingling of external economic motivators and intrinsic drivers for AES registration founded upon environmental appreciation raises concerns about potentially crowding out intrinsic motivations of farmers by offering them a payment for adopting pro-environmental behaviour (Engel, Pagiola, and Wunder 2008; Engel 2016). However, this issue is not considered in the meta- and cross-regional studies reviewed for this section. Interestingly, Van Herzele et al. (2013) find in a case study in Belgium that environmental concerns become more significant in shaping farmers willingness to enter into an AES if the scheme features a higher degree of complexity. Given the rising voices that argue in favour of complex AES tailored to narrowly defined environmental goals and regional spatial scales (Meyer et al. 2015; Whittingham et al. 2007) this indicates that environmental reasons to sign up for AES might be of particular importance in the future.

6. This, of course, not only points to the importance of environmental values but might also be affected by group dynamics such as social pressure.

A more nuanced description of farmer characteristics that are likely to promote AES participation is offered by Cullen et al. (2020). By conducting a factor analysis of traits linked to farmers self-identity in Ireland (n=1000), they find that farmers involved in environmental schemes frequently exhibit a so-called 'Forward looking' self-identity characterised by openness towards new farming practices and technology, utilising diverse types of information to ensure a healthy business, and a willingness to continue farming in the long-term future including the expectation to pass the farm to their children eventually. Their discovery thus partly correlates with the factor 'Existence of successor / children' presented above.

The influence of the social and cultural environment on decision-making processes around AES is mixed in the empirical literature. Some papers attest neighbouring farmers and peers or family members a grand influence on farmers decision to enrol land in AES. For example, Cullen et al. (2020) calculate a ten times greater likelihood for farmers to participate in AES when all neighbouring farms participate themselves and a 50 % increase in likelihood if a fraction of neighbours implements AES. Besides, and of particular relevance in the light of this thesis' focus, the authors observe that participation likelihood increases by 90 % if farmers are members of discussion groups. Findings of Defrancesco et al. (2007) are more confounded, as the authors describe a significant negative effect of neighbours opinions on conditional non-adopters (defined as farmers who "would participate under some circumstances", Defrancesco et al. 2007, 118) but a significant positive relationship with active adopters (i.e., farmers who "adopt voluntary AEMs for both environmental protection and financial reasons", ibid.). Other authors, such as Pavlis et al. (2016) and Wilson and Hart (2000), find no substantial influence of neighbours opinions on farmers behaviour regarding AES enrolment. Schroeder et al. (2015) adopted a case study approach to study farmers' acceptance of AES in England by applying the Theory of Planned Behaviour. They found that farmers' families exercised a strong positive social pressure on farmers' behaviours in contrast to other farmers or farm advisors. This might be explained in terms of the strength of social bonds, with neighbouring farmers having only limited influence on behaviour due to the often loose relationship between adjacent farmers. Hence, it might be argued that strengthening the relationship between farmers (for example, through farmer groups) could benefit AES adoption rates. However, this is purely hypothesised, and the study by Schroeder et al. (2015) did not inform Table 6 given the narrow focus of case studies approaches and the methodological constraints of this review as described above.

Stated motives for joining AES in Pavlis et al. (2016) highlight the relevance of non-economic incentives to promote participation in schemes. While the majority of farmers rated economic considerations as their primary motive for entering an AES, at least 30 % stated other reasons linked to personal satisfaction, such as learning new skills, challenging themselves, enhancing professional pride and corresponding to moral or ethical beliefs. Hence, factors driving environmentally friendly farming practices besides mere economic reasons exist and constitute potential leverage for environmental policy.

(1) and (2): Factors linking the farm- and the farmer-level. Farmers' dependence on income generated through agricultural commodities is frequently found to negatively affect their willingness to adopt AES (Lastra-Bravo et al. 2015). This is usually associated with the risk of income reduction through AES implementation, thus keeping risk-averse farmers who lack alternative sources of

income from entering into a scheme (ibid.). However, contrary findings are also reported, for example, in Pavlis et al. 2016. This indicates that more complex or diverse dynamics might be at play, as is confirmed by Wilson and Hart (2000) and Mack et al. (2020). The first reports a non-linear relationship between farmers dependence on farm income and their willingness to enrol in AES. According to the authors, farmers who generate the main proportion of their income off-farm are less likely to participate in AES because they usually offer relatively meagre financial benefits. This is furthermore amplified as part-time farmers are empirically found to be relatively well off financially (ibid.). On the other hand, farmers who rely entirely on incomes generated on the farm tend to maximise farm profits and thus restrain from adopting less intensive farming practices. Hence, this translates into a reverted U-shape relationship between dependence on farm income and AES participation. Finally, Mack et al. (2020) complement and differentiate this relationship by showing that particularly result-oriented schemes require full-time efforts of farmers, further highlighting the relevance of expertise regarding the complex cause-effect relationships on agricultural lands that comes from intense involvement in farming activities.

Land tenure agreements are unanimously associated with lower levels of AES participation (Defrancesco et al. 2007; Lastra-Bravo et al. 2015; Wilson and Hart 2000). This is linked to high levels of uncertainty for farmers under fixed-term tenancy contracts that prevent participation in long-lasting agri-environmental schemes and the additional necessity to agree on an arrangement between landowners and tenants that defines how AES benefits are shared (Wilson and Hart 2000; Lastra-Bravo et al. 2015).

AES design (3). Several factors driving scheme participation or non-participation are linked to AES design. The first concerns farmers' costs related to AES participation and is linked to the factor 'Larger farm size' discussed above. It is argued that many expenses farmers face when deciding to enter and implement a scheme are fixed (i.e., independent of the farm size) and hence present a relatively larger burden on smaller farms that receive less total compensatory payments. Fixed costs may originate, for example, from investments in necessary equipment to comply with AES requirements or be related to information gathering, acquiring specific knowledge and filling out contract forms (Ducos, Dupraz, and Bonnieux 2009). Thus, policymakers are called on to either adjust compensation payments for smaller farms or to reduce farmers' transaction costs, e.g., by addressing determinants through trust-building actions[7] and attenuating the effects of bounded rationality (e.g., providing quality information or advice) (Ducos, Dupraz, and Bonnieux 2009).

This links to the next pair of factors, i.e., the delivery of information or advisory services to farmers.[8] As Wilson and Hart (2000) report, one-quarter of non-participants across nine EU countries stated that a lack of information constituted the main reason for their absence from scheme registration. The more recent study by Pavlis et al. (2016) confirms that the information policy around AES has not improved by much, with 46 % of non-participants across five EU countries mentioning lack of knowledge on scheme opportunities and 36 % lack of information sources as drivers for restraining participation. Hence, improving information channels to farmers' about new schemes and the technical knowledge necessary for implementation presents a powerful

7. The authors define trust as an "expectation held by an agent that its trading partner will behave in a mutually beneficial manner" (Ducos, Dupraz, and Bonnieux 2009, 674). Hence, trust decreases transaction costs by lowering the demand for explicitly defined agreements, extensive monitoring, among others.

8. The factor 'Higher per hectre payments' is somewhat self-evident and thus not further discussed here.

tool to increase participation rates. As Lastra-Bravo et al. (2015, 6) list, this includes the use of "technical advisors, extension, social- and agriculture-related organisations, technical media, and government". Agriculture-related cooperatives are particularly mentioned as a promising approach to reduce public transaction costs for information distribution, boosting farmers willingness to enrol in AES and increasing trust in scheme design (ibid.).

Goodness of fit. The next two factors have already been discussed in section 4.1 and describe the phenomenon of farmers choosing schemes that are relatively easily (i.e., less costly) to implement or require no adaption to farming practices at all, and match with farmers management plans. At first sight, this observation might be rejected for lack of additionality and hence reducing scheme effectiveness, however, one might argue that paying farmers to desist from plans to intensify their practices justifies PES given the higher biodiversity gains of conservation measures on extensively farmed land (see section 4.4). Nevertheless, given that 50 % of farmers stated 'goodness of fit' as the primary driver for AES participation in Wilson and Hart (2000), these factors constitute a powerful determinant of farmers' AES adoption rates.

Institutional and policy design (4). Finally, Lastra-Bravo et al. (2015) summarise findings from different case studies that promote clarity of institutional design and future policy in order to ensure the reliability of management plans, for example, in regard to weighing AES adoption against potential introductions of restrictive regulations in the future. Ignorance and uncertainty regarding future policy development promote idleness and thus hampers the effectiveness of policy tools aiming for behavioural change.

6. Synthesis of NRM, AES and FC knowledge

This section approaches the research question of this thesis, i.e., how existing knowledge of success factors in decentralised resource management and agri-environment schemes might (a) promote a refined understanding of farmer cluster dynamics and outcomes and (b) inform future policy and AES design regarding farmer cluster set-up and management in order to enhance land managers satisfaction with FC membership and, consequently, contribute to achieving agri-environmental outcomes on a landscape-scale. Against this objective, the section starts with a short introduction to the UK's farmer cluster approach. Besides introducing the subject of the subsequent analysis, this overview enables a comparison of farmer clusters with the considered environmental management approaches. It thus informs the subsequent investigation by uncovering the 'conceptual fit' of the different approaches and highlighting areas of similarity as well as significant differences. The analysis is based on an in-depth qualitative evaluation of the publicised and grey literature on farmer clusters using the *MaxQDA* software (see Methods, section 2.2, for details about the reviewed literature and the analysis process). The coding of the seven publications and reports (hereinafter referred to as 'articles') revealed over 900 references to identified factors of success in Tables 3 to 6, thus indicating a broad knowledge base for the subsequent analysis. However, some groups of success factors are covered more elaborately than others. This can be linked to both differences in the significance of individual factors for outcomes of cluster activities and data constraints, as the reviewed papers differ in their scope of analysis and partly apply research foci that do not match with the extensive perspective provided through the lists of success factors in this thesis. This aspect will be covered in more detail as part of the Discussion (section 7).

6.1. Farmer Clusters: An overview

The concept of farmer clusters in the UK developed a rough decade ago as a response to the so-called 'Lawton report' in 2010 (Lawton et al. 2010) that assessed the status of England's ecological network and asserted an urgent need for concerted environmental efforts to enhance the resilience and coherence of England's ecosystems. Consequently, the Game and Wildlife Conservation Trust (GWCT) piloted the first farmer clusters funded by the nature conservation agency Natural England (Prager 2019). Starting with the question "What wildlife do you want on your farm?" land managers joined up to collaboratively decide on habitat management and monitoring measures, educational activities, and local partnerships to achieve self-defined environmental goals (Thompson, Dent, and Watts 2015 cited by Prager 2019). This farmer-led approach was consolidated and institutionalised in 2015 by launching the Countryside Stewardship Facilitation Fund (CSFF) that supports farmer clusters by providing funding for an external facilitator (Prager 2019). The facilitator, often a farm adviser affiliated with an NGO, serves multiple objectives as listed by ADAS (2018, 1), including

- developing cooperation amongst farmers;
- helping with group members AES applications or adjustments to existing arrangements;
- developing skills and expertise necessary for scheme delivery;
- ensuring that group activities align with actions of local partners and initiatives; and

- demonstrating the CSFF impact in terms of identifying outcomes linked to collaborative efforts.

In order to be eligible for facilitation through CSFF, farmer groups need to comprise no less than four adjacent farms covering at least 2000 ha of agricultural land and are called to deliver outcomes that go beyond what would be achievable through isolated measures by individual land managers (Franks 2019). For financing measures implemented by the group, the Countryside Stewardship (CS) scheme offers different sets of AES to individual farmers, so-called 'Tiers'. Mid Tier agreements comprise AES options with moderate complexity or implementation effort designed to fit a wide range of geological conditions and farming systems (RPA 2021). It thus follows a 'broad and shallow' approach, aiming foremost at uptake rates and area covered while accepting relatively low environmental outcomes and limited coherence with local conditions (McKenzie et al. 2013). On the other hand, Higher Tier agreements represent a converse approach (sometimes referred to as 'narrow and deep') in offering land managers more sophisticated scheme options tailored to specific local contexts (RPA 2021). Both tiers are competitively funded, meaning that land managers have to apply for scheme participation and applications are assessed by defined criteria, including their fit with pre-defined locally devised environmental priorities[9] and the size of enrolled land or other measures concerning the extent of scheme participation (e.g., length of managed ditches or number of planted trees) (RPA 2021). Additionally, applicants receive a 20 % uplift in their score if they are members of a CSFF funded farmer cluster (ibid.).

In 2018, a total of 98 farmer clusters were financed through the CSFF at the end of the fourth application term (Franks 2019). At the time of writing (i.e., in August 2021), 118 clusters were listed on the farmer clusters initiative website.[10]

Before diving into the analysis, the three dimensions applied to differentiate approaches to collaborative natural resource management by Plummer and FitzGibbon (2004) are examined as a framework to guide the comparison with the farmer cluster approach (see section 3.2, Figure 4). Concerning participation intensity, some variety can be noted across all reviewed articles. Nye (2018) summarises the three different modes of farmer empowerment typically adopted in funded farmer groups. The first resembles the original notion of farmer clusters as a collaborative, farmer-led, and bottom-up approach that brings motivated farmers together to jointly and equally decide on priorities of group activities and corresponding management measures. This organisational concept is thus located at the highest levels of participation intensity. Many groups, however, report appointing a steering group to decide upon group matters. Jones et al. (2020) revealed that 60 % of the surveyed facilitators (n=67) stated that views of the steering group had an influential role in identifying the training needs of group members, thus indicating that the majority of clusters had a representative steering group installed. While Nye (2018) reports that steering committees usually comprise both farmers and representatives of other organisations such as environmental NGOs, individual cases of clusters that are non-inclusive for the non-farming community are also documented (Adamson et al. 2020). Clusters chaired by a steering group tend to be relatively larger, thus responding to the increasing challenge of collaborative decision-making with expanding group sizes (Nye 2018). Farmers who are a member of a steering group could be conceptualised to

9. These can be reviewed online at https://www.gov.uk/government/collections/countryside-stewardship-statements-of-priorities (accessed 30th August 2021)

10. https://www.farmerclusters.com (accessed 30th August 2021)

exercise power at moderate to strong levels of power-sharing. In contrast, 'basic' cluster members fulfil a consulting role in backing up decisions made by the steering committee. However, it must be noted that governance modes as described in this section are usually not strictly executed regarding all group activities and decision-making processes, but decision-making power is devolved flexibly dependent on the task at hand and group members' preferences in terms of desired levels of involvement. For example, Adamson et al. (2020) describe clusters in which farmer representatives in steering groups define group priorities while the whole group has a say in defining joint group activities. Hence, the governance modes described represent cornerstones along a continuum instead of reflecting three distinct organisational settings. The third and last mode of cluster governance is an organisation-led approach in which land managers hold a somewhat representative role, whereas group goals and measures are frequently pre-defined top-down in line with the organisation's agenda (Nye 2018). The level of prevalence of this organisational model is challenging to assess. 42 % of surveyed facilitators described the initial group formation as 'Organisation led' (N. Jones et al. 2020, 119), thus indicating that a significant share of clusters might prescribe to this model of governance. However, it is reported that some groups tend to rely on top-down management at the initial stages of group formation, and decision-making authority is increasingly devolved later on as the groups develop dynamics that are less dependent on guidance or steering. In summary, the degree of power-sharing in farmer clusters ranges broadly from small, bottom-up clusters in complete control of group activities to larger farmer associations led by external organisations with their own agenda and limited possibilities for meaningful participation. However, the common notion of the cluster approach (and the analysis of success factors, as will be shown subsequently) favours smaller, farmer-led groups with or without a steering group in place and thus supports higher tiers of participation intensity.

Regarding the second dimension, 'Formalisation', it is helpful to differentiate formalisation of the participatory process in group activities from the degree of formalisation concerning the institutional setting of farmer clusters. The former is frequently documented to benefit land managers' satisfaction at relatively low levels, i.e., informal activities such as site visits and outdoor events characterised by open discussions and peer-to-peer learning are reported to be more likely to generate desired outcomes by most facilitators (Adamson et al. 2020). The latter is foremost influenced through clusters commingling with AES, particularly requirements set by the CSFF, such as defining planned group activities after group formation (ADAS 2018) or restrictions regarding facilitator activities that are eligible for funding (and, for example, do not include 1-to-1 advice to land managers) (Nye 2018). The institutional set-up resulting from CSFF funding is furthermore defined through pre-set and limited funding periods (3-5 years) (Franks 2019) that preclude time-consuming group activities and result in uncertainty for group members about long-term subsistence, as well as a lack of flexibility to make changes to, or drop out of existing schemes (N. Jones et al. 2020). The latter impedes joint implementation of conservation measures if members enter clusters (and AES) consecutively or are engaged with pre-existing arrangements that do not support the aspired group measures. Finally, the institutional setting is influenced by both the provision of economic incentives that make disbursement dependent on implementing defined measures or achieving specified outcomes and the bureaucratic and highly complex procedure of scheme application and enrolment (N. Jones et al. 2020). However, CSFF

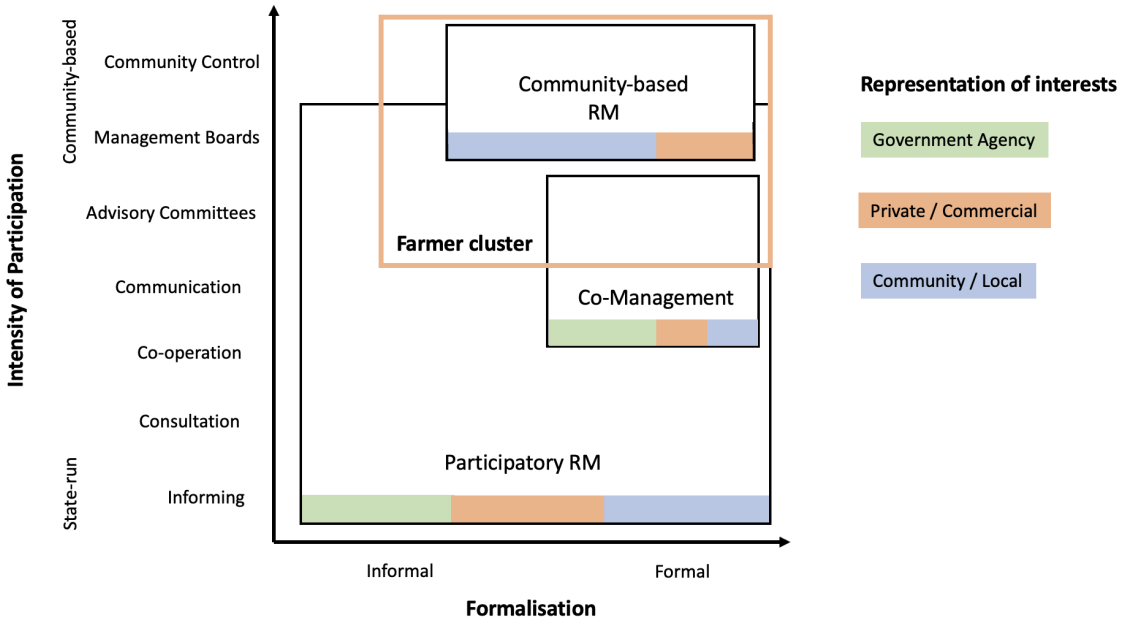

Figure 8: NRM approaches and farmer clusters illustrated through model of co-operative NRM (Source: Own illustration adapted from Plummer and FitzGibbon 2004, 68)

funding constitutes no prerequisite for cluster initiation, nor does participation in an AES. Hence the institutional context outlined above is not necessarily inherent or even significant to all operating farmer clusters. For example, the case studies described by Jones et al. (2020) include clusters that report AES uptakes of 25 to 50 per cent and are thus likely not unduly influenced through AES requirements.

Farmer clusters' fit with the third model dimension, i.e., 'representation of interests', appears to be less intricate. The concept is generally visualised as an initiative in farmers' sole ownership, hence predominantly composed of private and commercial interests of the involved farmers. However, as indicated above (and will be further elaborated later), clusters rarely work in complete isolation but engage in partnerships with local actors such as trusts, environmental NGOs or government authorities (Adamson et al. 2020). The extent of this collaboration appears to be manifold, though most case studies considered in this analysis portray the role of interaction with external parties as predominantly functional. For example, the collaboration between clusters and NGOs is often related to the integration of expert knowledge into farmer clusters activities (ibid.). Hence, the farmer cluster approach is visualised as primarily composed of member farmers' interests in Figure 8, with negligible influence of community or government actors on cluster activities.

6.2. Agreement with NRM success factors

This section presents and discusses the results of the qualitative analysis of the farmer cluster literature in regard to how well the NRM approaches under consideration fit the cluster approach and whether farmer clusters meet their respective factors of success. The subsequent subsections follow the same organisational structure: First, the conceptual fit of the respective NRM approach with the cluster concept is evaluated based on the model of co-operative resource management depicted in Figure 8. Subsequently, the results of the qualitative analysis are presented in table

form to provide a consolidated summary of the analysis' results. And finally, the success factors' relevance for and agreement with the cluster approach are discussed in more detail.

The evaluation of the success factors fit in Tables 9 to 11 is conducted through a subjective classification by the author based on the empirical evidence presented in each subsection. Three indicators are applied to assess farmer clusters agreement with the factors of success:

0	The evidence does not, or not significantly, support clusters agreement with the factor.
1	The factor is moderately well matched within the cluster concept, but areas of disagreement are evident.
2	The factor is mostly or fully realised in farmer clusters.
n.a.	not applicable / The factor cannot be logically evaluated for the cluster concept due to conceptual differences.

Occasionally, factors of success in natural resource management are not assumed to similarly promote desired outcomes within farmer clusters. In order to not confuse these factors in Tables 9 to 11 with actual shortcomings of the cluster approach, their respective evaluation is crossed:

~~0~~	Factor is not met by farmer clusters, but does not constitute a factor of success for the cluster concept.

6.2.1. Participatory Natural Resource Management

Introducing the farmer cluster approach into the model of co-operative resource management in Figure 8 reveals a broad conceptual overlap of both approaches. This is not surprising, given that farmer clusters as a (mostly) bottom-up approach are based on farmers' voluntary and proactive engagement with biodiversity-sensitive agricultural management. In regard to participation intensity (dimension 1), many clusters exceed the levels usually considered in participatory resource management, where the source of decision-making authority typically lies outside participants' control and is to some degree devolved to stakeholders as part of the participatory process. However, as described in the previous section, farmer clusters frequently establish steering boards as representative units to organise collective action, thus applying characteristic participatory formats frequently considered in the PNRM literature. Regarding the degree of formalisation, both approaches exhibit high levels of variety, with PNRM not being explicitly restricted to or set in a particular institutional setting. In contrast, farmer clusters are usually strongly linked to the requirements of AES and the CSFF but are less stipulated regarding group priorities and activities. Probably the most significant difference between approaches lies in the configuration of involved interests (dimension 3). PNRM projects are designed to represent multiple, diverse, if not even conflicting, groups of interest. Project management is thus concerned with issues of adequate stakeholder representation, power asymmetries, and conflict resolution. On the other hand, farmer clusters are visualised as relatively homogenous groups of neighbouring farmers that may even hold friendly or familial bonds. Consequently, group dynamics and emerging challenges in collaborative decision-making likely differ between both approaches and require adapted solutions. However, close relationships between farmers are frequently reported to be hampered by a prevailing culture of independence

amongst land managers (Nye 2018), indicating that PNRM findings might apply rather well to the cluster approach.

Table 9: PNRM success factors fit with the farmer cluster approach *

Categories	**Factor(s)**	**Factors fit**			
		0 [a]	*1* [b]	*2* [c]	*n.a.* [d]
Process factors					
Communication	Two-way communication and education			2	
	Clear language & accessible, concise and consistent information		1		
	Face-to-face contact			2	
	Transparency (i.e., one-way flow of information) regarding process in general, information handling, and stakeholder identification and selection		1		
Adaptivity	Interactive and iterative processes			2	
	Learning from and adaption to past experiences			2	
	Existence of feedback-loops		1		
	Responsiveness to stakeholders			2	
Equality	Frank and open communication			2	
	Equal opportunities to contribute in PP			2	
	Philosophy that emphasises equity			2	
	Awareness of power asymmetries and ways to manage them	~~0~~[e]			
PP design	Participatory methods are tailored to context, objectives, project stage			2	
	Existence of milestones and deadlines		1		
	Priority to trust building actions			2	
Organisational setting					
Goals and roles	Clearly defined goals			2	
	Clearly defined stakeholder roles		1		
Representation	Relevant stakeholders are represented systematically				n.a.
Empowerment	Stakeholders have impact on the decision-making process			2	
	Management commitment to the process				n.a.
	PP are promoted through institutional setting		1		
	PP are considered from the outset and throughout the project			2	
Incentives	Incentives to initiate and maintain participation are given		1		
Facilitation	Provision of skilled facilitation			2	
Diverse knowledge	Relevant information from multiple sources, including local and scientific knowledge, is provided			2	
Match scales	Match temporal and spatial scales of the PP with scales of ecological processes and jurisdiction	0			

Table 9: (continued)

* - Contextual factors listed in Table 3 are omitted as they are discussed more detailed for CBNRM and ACM projects and will be thus considered in the subsequent sections.

[a] - Factor is not or only marginally matched.

[b] - Factor is moderately well matched.

[c] - Factor is mostly or fully matched.

[d] - Factor cannot be applied to the cluster approach.

[e] - Lack of agreement with factor is not found to be detrimental for clusters' performance.

Communication. Factors linked to communication in participatory processes appear to be relatively well met by most farmer clusters reviewed in the analysis. It can be noted that clusters likely benefit from being predominantly composed of land managers, hence sharing similar educational backgrounds and a common language. In contrast, typical PNRM projects need to align experts of diverse areas of expertise and contrasting knowledge systems (e.g., indigenous and scientific knowledge). All 28 case studies gathered by Adamson et al. (2020) report that clusters conducted training events that allowed for two-way communication, such as field trips to members farms or workshops. The authors stress the importance of peer-to-peer learning and informal discussions to enhance mutual understanding of SES dynamics and management measures and build social capital. All articles included in the analysis solely reported face-to-face meetings, thus supporting meaningful interactions between cluster members. Ensuring the accessibility of information to members is frequently documented to result in refraining from using online services, as not all land managers possess sufficient IT skills or have only poor access to broadband (Adamson et al. 2020). Discontent regarding the communication of farmer clusters is mainly related to the institutional setting. For example, Nye (2018) reports dissatisfaction with the language of CSFF regulatory documents, resulting in uncertainty of facilitators whether 1-to-1 advice to land managers is eligible for compensation through CSFF or not. Furthermore, communication with external parties such as Natural England (responsible for the disbursement of payments for some schemes) has been criticised for occasional non-responsiveness to inquiries (N. Jones et al. 2020). However, some issues are also reported regarding in-cluster communication. One concerns the transparency of cluster goals and priorities. As Nye (2018) describes, considerable confusion related to the clusters' purpose and the role of the CSFF existed in some cases, with particular ignorance of the landscape scale dimension that is aimed for in conservation efforts. However, this is partly explained by the clusters' young age and a temporary focus on getting to know each other and building social capital before more specifically addressing environmental objectives (ibid.). Finally, one facilitator explicitly reports communicative challenges with some members of their clusters who consequently "may not have fully benefitted from the scheme" (Adamson et al. 2020, 109). The case study report concludes that the group is trying to address this challenge (ibid.). Evidently, efficient and open communication is nothing that comes naturally to all clusters but requires both joint efforts and engagement and adequate means of information provision and participatory formats.

Adaptivity. Cluster adaptivity in terms of adjusting group activities and priorities to both changes of the external environment and changing needs and wishes of cluster members appears to be realised sufficiently. 10 % (3 out of 28) of case study reports by Adamson et al. (2020) and 21 %

of surveyed facilitators (14 out of 67, N. Jones et al. 2020) document making changes to group priorities during the funding period. If changes were made, these were typically in response to group suggestions (ibid.), thus showing that (at least a portion) of clusters actively adapts according to group demand. As the interview of land managers by Jones et al. (2020) revealed no dissatisfaction of farmers with group priorities or a lack of adaptivity, it is assumed that the relatively low levels of adaption rates of group priorities reflect cluster members' satisfaction with the agreed group priorities instead of a lack of adaptivity or responsiveness. Besides, it might be argued that the funding period of 3-5 years in the CSFF is too short to necessitate significant reorientation of group goals, given that the funding length is frequently criticised for being too short for achieving the environmental goals pursued by the clusters (Adamson et al. 2020).

The cluster reports additionally mention feedback given to the facilitators, particularly concerning participants' satisfaction with group activities. For example:

> "The facilitator receives positive feedback from on farm demonstrations and classroom training events, with members indicating that they have made changes on their farm in response to training events." (Adamson et al. 2020, 41)

However, whether this feedback was collected systematically from all cluster members or merely provided by individual land managers and thus potentially biased towards enthusiastic responses is not clarified.

The reviewed articles also consider some deficiencies related to clusters adaptivity. The first displays as dissatisfaction expressed by a number of farmers in the case study by Nye (2018) about group activities not being relevant to them, resulting in poor attendance to clusters events. This finding might indicate an actual lack of responsiveness to members' wishes regarding the topic of workshops and events held by the cluster, possibly resulting from insufficient involvement of land managers in deciding on group activities. However, it is also likely influenced by other factors that will be considered in the subsequent sections, such as heterogeneity of members interests and the related influence of the group size. As Nye (2018) reports a significant variety of group sizes in her sample selection, these factors might have contributed to the members' discontent regarding group activities. But since the author does not specify group sizes of the malcontent farmers' clusters, this influence can only be hypothesised.

Other shortcomings are - again - linked to the role of AES. Two articles mention dissatisfaction of facilitators and land managers with scheme flexibility. This is linked to (a) the inability to make changes to schemes throughout the funding period (Nye 2018), thus impeding concerted uptake and realisation of schemes if farmers entered into AES at different times; and (b) inflexibility of the Countryside Stewardship Scheme in general in not being able to respond to land managers funding needs beyond the provision of training events, particularly related to the funding of capital items (N. Jones et al. 2020). The latter aspect attracts attention as the CS provides means for financing capital items through Mid Tier and Higher Tier agreements. However, it is assumed that the author refers to a perceived insufficient variety of options eligible for funding instead of a complete lack of funding opportunities. Finally, one cluster in the reviewed articles reports deficient opportunities to give feedback to the authorities (Adamson et al. 2020), thus indicating a demand for involvement and influence in the design of agri-environmental schemes. In summary, it appears that particularly the more formal setting of cluster activities that is shaped through CSFF and AES

financing handicaps clusters' flexibility to adapt to changes of members needs by overly restricting clusters' 'room for manoeuvre' and entailing highly bureaucratic efforts if a modification to the formal setting is to be made.

Equality. The third group of factors is linked to means of managing power asymmetries in order to enable equal opportunities of contribution to the collaborative process, e.g., through frank and open discussions in the clusters. This aspect is rarely mentioned in the reviewed articles, with only three coded segments considering equality issues. Figure 8 provides a possible explanation for this apparent insignificance, as the homogeneity of involved interests and backgrounds (dimension 3) indicates reasonably well-balanced power relations within clusters. Although power imbalances could be anticipated in terms of larger and more wealthy farms dictating the supply of agricultural commodities and thus determining price levels, no negative effects of power imbalances are reported in the reviewed articles. Instead, several case studies stress the positive effect of particular event types such as farm visits and outdoor workshops in generating a relaxed and informal atmosphere that promotes land managers' willingness to engage with group activities. This hence supports the finding by Reed (2008) that careful design of participatory formats might promote equal participation of all involved stakeholders (see section 5.2.1). One cluster documented by Adamson et al. (2020) reports limited participation by some farmers due to a lack of technical expertise on the topics discussed in cluster meetings, indicating a failure to ensure equal opportunities for participation through capacity building. As this constitutes a factor of success on its own (see factor 'Capacity' in section 5.3), this will be discussed in more detail later. Related to gender equality, clusters, like the agricultural community in general, are predominantly composed of male farmers. Nye (2018, 61) reports more than 80 % of farmers in the author's sample being male. The gender ratio of facilitators is more balanced, with a smaller majority of 61 % of facilitators being men. Issues of gender equality are not reported across the reviewed articles. As no power imbalances are documented to challenge cluster activities, the lack of means to tackle power asymmetries (i.e., the last factor of the Equality-category) does not represent a shortcoming of the cluster concept.

PP design. The analysis showed that most clusters considered in the reviewed articles excel in regard to factors concerning the design of participatory formats. This is particularly associated with the variety of participatory methods that are applied within cluster activities. Reported formats include general group meetings, training formats with expert speakers, joint trips to other farms or environmental protection areas, outdoor and indoor workshops, and promotion and networking events. The case study by Nye (2018) as well as the facilitator survey (N. Jones et al. 2020) praised combining different participatory formats at events, for example, theoretical with practical elements, thus accurately following the recommendations given in the PNRM literature (see section 5.2.1). The validity of this success factor is additionally confirmed by multiple farmer cluster reports in Adamson et al. (2020) that explicitly stress cluster members' satisfaction with conducting different types of events. An overwhelming majority of facilitators awarded on-farm demonstrations and other outdoor events the highest effectiveness of training formats (rated as 'very effective' by 96 % of facilitators, with 'peer to peer learning' following with 57 %, J. I. Jones et al. 2017, 127). This high diversity of participatory formats is actively promoted through CSFF requirements, as facilitators need to specify all planned group activities throughout the funding period in Facilitation Plans at the outset of group formation (ADAS 2018). Further learnings regarding the design of

participatory processes in farmer clusters include keeping information events short and focused, using visuals such as films and charts to enhance understanding (Adamson et al. 2020), and choosing venues that are appealing for land managers (Nye 2018). Hence, it is called for tailoring participatory formats to stakeholders' preferences and skills, as is recommended in the PNRM literature.

The factor 'Priority to trust-building actions' is seldom explicitly mentioned in the articles. However, Prager (2019) describes that farmers of relatively young clusters in the authors' case study focus on getting to know each other and generating trust before addressing specific environmental issues, thus indicating that trust-building actions appear to be set as a priority at early stages of cluster formation. Additionally, in general, building trust and social capital are reported as one of the most evident and beneficial outcomes of cluster activities across all articles, indicating that an explicit commitment to trust-building actions might not be necessary as it is deeply conjoined with clusters identity.

The existence of milestones and deadlines to guide collaborative efforts is not documented in the articles. However, it is assumed that enrolment in AES serves a similar role as scheme requirements define time scales to implement defined conservation measures or achieve prescribed environmental outcomes. As not all cluster members participate in AES, this factor is likely not met by all clusters.

Goals and roles. The definition of group priorities, i.e., key areas that groups focus their collaborative efforts on is stipulated through CSFF requirements. In Facilitation Plans submitted after group initiation, the facilitators are asked to specify group priorities for the whole length of the agreement (ADAS 2018). A list of priorities of all 49 CSFF funded farmer groups initiated in 2015 and 2016 can be found in ADAS (2018, 45). While the formal definition of group priorities is necessary to ensure that collaborative action is steered towards a common goal, effects will be minor if group members are not included in the process or, at least, informed about the results. This links to Nye's (2018) finding described above about some cluster members not being aware of the purpose of their group and the collaborative nature inherent to the cluster approach. Although the author does not report empirical evidence linking this confusion with adverse effects on clusters' outcomes, it is anticipated to act as a barrier to farmer collaboration. Reed (2008) suggests participants active involvement in setting goals for participatory processes to promote a sense of ownership and further engagement with the project (see section 5.2.2). As this is closely connected to the factor group 'Empowerment' it will not be considered in-depth at this point. However, it can be said that most clusters engage their members in setting group priorities at moderate to strong levels (N. Jones et al. 2020), whilst only a few clusters report sticking to pre-defined priorities without meaningful cluster involvement (Adamson et al. 2020).

Regarding the definition of participants' roles, two organisational aspects deem significant: appointing a chairperson and establishing steering groups. Nye (2018) reports that two-thirds of clusters in her sample selection (6 out of 9) had appointed a chairperson, typically a farmer from the cluster and, in one case, a person affiliated with an independent organisation. Facilitators describe the chairperson's role "as galvanising group members into action, encouraging feedback, or assisting in the recruitment of new members amongst the farming community" (Nye 2018, 27). Hence, chairpersons appear to execute leadership functions, a role that is considered more detailed in section 6.2.2. However, the reviewed articles do not specify whether chairpersons

acted according to a uniform understanding of the role and its duties or were instructed in some way. Nye (2018) finds a high variance regarding knowledge and attitudes towards chairpersons in the clusters, with some members being ignorant of their chairs while other clusters report strong relationships. This indicates that differences in chairperson's role and importance for their clusters exist that might be linked to a failure to clarify this task's boundaries. However, Nye (2018) also attested causal links to group size, the group's age, and group cohesion. The second indication of some distribution and definition of farmer roles are steering groups that appear to be established in the majority of clusters.[11] Steering groups are frequently formed to decide on group matters that either do not require the involvement of all group members or where reaching consensus of the entire group is believed to be too time-consuming. In Adamson et al. (2020), cluster reports document steering groups importance, particularly for setting group priorities and deciding on collaborative activities. Hence, role definition takes place at least in terms of deciding on a steering group and assigning decision-making power over particular tasks to the group. In contrast, the role of individual farmers in the cluster is generally not prescribed but shaped through individuals engagement and (potentially) community influences.

Representation. The issue of stakeholder representation is generally not considered in the farmer clusters literature, as selecting 'relevant' participants to some degree disagrees with the notion of a voluntary conservation program offered to farmers across EU member states. Naturally, delivering environmental outcomes on a landscape scale requires implementing spatially coordinated conservation measures by multiple, typically adjacent land managers. Hence, participation in clusters by particular farmers, for example, to generate habitat corridors, might be essential. Success in motivating farmers in an area to join a cluster might be thus influenced through extension services and promotional events. The facilitator survey revealed that most group members are recruited by utilising existing professional, personal and local networks (70 %, whereas 34 % of facilitators referred to open invitations for member recruitment, N. Jones et al. 2020, 119). Given that networks likely exist where farmers are also geographically close, this method is assumed to be effective in enabling cluster membership of multiple, spatially connected land managers. However, the reviewed articles do not allow for a more nuanced evaluation.

Empowerment. As was elaborated in section 5.2.2, stakeholder empowerment refers to providing the opportunity for participants to meaningfully influence decision-making processes and ensuring that they possess the capacity (in terms of skills, expertise and resources) to do so. The latter constitutes a stand-alone factor of success in community-based resource management and co-management and will be thus considered in the subsequent section. The former is closely linked to the three modes of cluster governance described by Nye (2018, 24f.) and summarised in the introduction of the cluster concept (section 6.1): farmer-led, farmer-led with steering board, and organisation-led. According to all articles included in the analysis, farmers involvement typically relates to deciding on group priorities and training needs. The level of farmers' engagement varies between clusters, with members deciding on group matters directly through group meetings, representatively through steering group ruling, or a combination of both (e.g., steering group proposing group priorities that the whole group afterwards discusses) (Adamson et al. 2020). For

11. This has not been explicitly sampled in the reviewed articles. The assumption is based on a finding from the facilitator survey that almost 60 % of facilitators valued views of the steering group as influential in shaping clusters training activities (N. Jones et al. 2020, 126).

most clusters, group priorities are pre-defined, for example, in the form of local environmental objectives or demands to handle the consequences of extreme weather events and catastrophes (67 % as stated in the facilitator survey; N. Jones et al. 2020, 122). However, groups that applied pre-defined objectives frequently also involved members in the process of priority selection (i.e., 64 % of clusters with pre-defined objectives, ibid.). Thus, complete ignorance of members' preferences is rare.

On the contrary, training needs appear to be overwhelmingly shaped by the views of the whole group (cited as the most important factor in identifying training needs by 94 % of facilitators; 126). Clusters with marginal member involvement following the organisation-led mode are reported occasionally, often associated with rather negative outcomes:

> "It was very hard for us to get workshops to happen because it wasn't down to us to say whether they happened or not, it was very much the [other delivery partner] saying whether they'd happen or not, even though we'd said, we've got five members of our group who are really keen to make this happen (Facilitator 2)." (Nye 2018, 28)

Abandoning a mainly farmer-led approach is additionally reported to diminish farmers' engagement with their clusters, as a lacking sense of ownership over group activities reduces farmers' motivation to attend meetings and workshops (Nye 2018). On the other hand, meaningful land manager involvement is documented to promote a sense of ownership over addressing environmental issues (reported by 4 case studies in Adamson et al. 2020), thus indicating farmers' willingness to tackle environmental challenges and a perceived capability to do so. However, it must be noted that achieving significant levels of participants empowerment is not solely influenced by the clusters' organisational structure. Some facilitators report a lack of land managers' commitment to and engagement with the group acting as a barrier for the cluster to be truly farmer-led (N. Jones et al. 2020), thus pointing to a potentially insufficient incentive structure to promote higher levels of engagement. Overall, Nye (2018) concludes that many clusters "lay somewhere between bottom-up and top-down" (Nye 2018, 53), and farmers' influence on group matters varies accordingly. However, high levels of farmers empowerment are usually preferred or, as one land manager puts it:

> "[F]armer led is really key because it's about having the feeling that we are in control of our own destiny". (N. Jones et al. 2020, 62)

As clusters are usually not managed by an external authority, the factor 'Management commitment to the process' does not apply to the cluster approach. However, the commitment of cluster members is essential, as will be discussed related to co-management success factors in section 6.2.3.

Clusters' performance regarding the factor 'PP are promoted through institutional setting' might be discussed controversially. First, it may be noted that the institutional setting promotes entering into a cluster by offering a 20 % uplift of points to land managers scheme applications (Franks 2019). On the other side, assessing the effect of AES design in encouraging participation in farmer clusters reveals a counterproductive and highly path-dependent incentive structure aiming for scheme uptake of individual holdings while neglecting any landscape-scale considerations or incentivising spatially coordinated scheme uptake (also see section 4.3.4). While adaptions to scheme design aiming for collaborative scheme implementation exist (including collective bids

on auctions, agglomerations bonuses, or collective contracts, see section 4.3.4), these are not as yet widely applied across the EU. Hence, farmer clusters' performance regarding this factor is moderate.

Incentives. In light of the voluntary nature of cluster membership and AES enrolment and their importance for achieving policy goals, the incentive structure of the cluster approach has received considerable attention, particularly by Nye (2018). Incentives to enter into CSFF funded farmer groups and participate in AES can be grouped into four categories that consider financial, social, individual, and environmental reasons.

The financial dimension is based on participation in environmental schemes and thus stands on the PES principle considered in section 4.1. As mentioned briefly, cluster membership promotes the attractiveness of AES enrolment by offering cluster members endorsement of a 20 % uplift in their individual AES application score (Franks 2019). Further incentives linked to AES funding reported in the reviewed articles include being kept up-to-date regarding new funding opportunities and one-to-many advice and guidance for scheme application provided by the facilitator (Nye 2018). Financial reasons appear to play a relatively minor role in shaping farmers' willingness to enter a cluster. Only 1 out of 22 land managers in Nye (2018) stated the 20 % uplift in scheme application as their primary driver. Occasionally, saving costs for machinery by sharing farming equipment is stated as an additional economic benefit of cluster membership (Adamson et al. 2020).

Another group of incentives is linked to the social dimension of cluster membership. Social benefits are frequently reported as one of the most enjoyable aspects of being part of a farmer cluster (Nye 2018). This is mainly associated with outcomes generated through social capital enhancement (e.g., social cohesion, network creation, emotional support, and preventing social isolation; Nye 2018). However, benefits linked to social capital building do not represent the only stimulus for engaging in farmer groups, but social capital itself can act as an incentive to participate in environmental measures in the form of peer-to-peer encouraging and motivation, as reported by Nye (2018). Finally, some land managers report that their motivation to participate in clusters resulted from a close relationship with their facilitator and a desire to support him (ibid.).

The third group of incentives comprises factors related to individuals satisfaction and well-being. Naturally, this is linked to the incentives described above, as perceiving a feeling of social affiliation due to cluster membership or increased income security because of AES payments likely positively affects members' well-being. In line with this, case study reports in Adamson et al. (2020) document increases in well-being (particularly of older farmers) due to social interaction, and the facilitator survey revealed that 20 % of groups experiencing significant increases in members physical and mental health whereas almost 40 % reported a moderate change of personal satisfaction levels (N. Jones et al. 2020, 133). However, individual incentives not only originate from social outcomes or economic benefits but are also linked to opportunities presented to members to enhance their knowledge regarding SES dynamics and environmental measures, and to exchange knowledge and information with peers, external organisations, or the wider public (Adamson et al. 2020; Nye 2018). Finally, increases in confidence to select and implement appropriate conservation measures and to tackle environmental issues are documented and thus indicate the incentivising role that capacity building plays (considered in section 6.2.2).

The last set of incentives constitutes intrinsic motivators for farmers that are linked to achieving

the environmental objectives set out in the groups. Nye (2018) finds that the majority of farmers in the study's sample entered clusters for environmental reasons (12 out of 22 farmers), such as positively influencing the landscape scale environment or halting biodiversity decline. Four farmers named environmental benefits the most enjoyable aspect of being a member of a farmer cluster (ibid.).

A few negative incentives, i.e., stimuli that keep farmers from entering a cluster or result in members disengaging and not attending group events, are also evident. The most prominent complaint regards AES disbursement, as issues with payments due are frequently reported as a source for farmers' frustration (Nye 2018; Adamson et al. 2020; N. Jones et al. 2020). This particularly disadvantages smaller farms that tend to be more reliant on income generated through AES participation and thus potentially exacerbates findings presented in section 5.5 about farmers of smaller holdings being less disposed to enrol land in AES. Smaller farms are additionally disadvantaged through the process of competitive AES application since applicants score is calculated based on a measure of enrolled capital items (RPA 2021), thus favouring larger farms that naturally are able to invest more land. Furthermore, the case study reports (Adamson et al. 2020) mention some disincentives linked to the institutional setting of AES funding. This includes the complexity of applying for group funding acting as a barrier for new groups to form up, an insufficient supply of AES Mid Tier options that prevent applying best practice methods in grassland farming systems, and AES penalties discouraging farmers participation. Furthermore, adverse effects on farmers motivation are reported in one cluster where collaboratively implemented environmental measures for river restoration were perceived to result in flooding downstream (ibid.), thus highlighting the need to equip land managers with the expertise and skill to select appropriate measures.

Interestingly, Nye (2018) discovers that members of larger, less cohesive groups tend to be more strongly dependent on financial incentives to sustain members' engagement, whereas smaller groups appear to substitute extrinsic, financial motivators by social or environmental benefits. This indicates that social capital gains in smaller groups might constitute strong leverage for incentivising environmental actions and potentially decreases the need for financial compensation.

Finally, the author finds that more engaged members are more likely to experience social, cultural, and financial benefits[12], thus indicating a potential reinforcing feedback loop as perceiving benefits of cluster membership likely in turn motivates stronger engagement with the group.

Overall, the factor group 'Incentives' is rated as 'partly matched'. While highly effective incentives are provided, particularly related to the social benefits of being a cluster member, negative incentives such as late AES payments present extensive areas of potential for improvement.

Facilitation. Facilitation is deeply embedded in the concept of CSFF funded farmer clusters, with each group being closely supported by an advisor. As described in the introductory section of this part, the facilitator role essentially comprises organising and motivating collaborative group efforts, helping with AES applications, and building skills and expertise required for scheme delivery. Against this objective, the CSFF provides financing for the facilitator's activities for periods of 3-5 years (Prager 2019).

Most facilitators are described as having a farming background, thus being familiar with farming

12. AES payments are generally not linked to engagement in the clusters, as long as farmers meet their individual scheme requirements. Here, Nye (2018, 51) refers to information about new funding opportunities that members who do not attend group meetings are likely to miss.

realities, local issues, and land managers' seasonal and daily time availability (Prager 2019; J. I. Jones et al. 2017). Moreover, as facilitators frequently are affiliated with local agricultural consulting agencies or government authorities, pre-existing relationships to cluster farmers are common, with many farmers even referring to their facilitator as a 'friend' (ADAS 2018; Prager 2019; Adamson et al. 2020). Facilitators' strong affiliation to the farming community constitutes a significant divergence from PNRM literature recommendations that strictly promote the impartiality of facilitating persons or organisations (see section 5.2.2). This divergence might be aligned by considering the conceptual fit of both approaches, as presented at the beginning of this section. As PNRM aims for involving diverse and often conflicting groups of interests, the impartiality of the facilitating entity is crucial to prevent resentment of individual interest groups and ensure that all participants benefit from the facilitator's input. Favouring some stakeholder groups over others or being suspected to be biased towards a particular position would jeopardise the objective of giving all participants an equal say in the process. The situation in farmer clusters is remarkably different. Strongly divergent attitudes of members are relatively rare, and the overarching goal of group efforts is not to reconcile diverse stakeholder demands and interests but to establish a sense of unity and solidarity that drives collective behavioural change. Hence, the clusters discrepancy to the impartiality principle recommended in PNRM rather reflects the difference in objectives and group configurations of both approaches than a deficiency of the clusters concept.

Facilitators and land managers in the reviewed articles consistently stressed the importance of the facilitator to generate group outcomes. A reiterating theme emerging across the articles was the facilitator's role of creating and maintaining the momentum of the group in collaboratively working towards a common goal (Adamson et al. 2020; N. Jones et al. 2020). 67 % of facilitators partaking in the survey believed that group activity and outcomes are not self-sustaining (J. I. Jones et al. 2017, 135), a notion confirmed by a farmer's description of the facilitator being able to "keep everybody interested" (N. Jones et al. 2020, 63). Regarding scheme complexity Nye (2018) finds that more complex AES render farmers more reliant on facilitator's support, albeit aid is for the most part required concerning the administrative aspects of scheme organisation and less linked to scheme delivery (Nye 2018). Furthermore, facilitators are frequently reported to boost member recruitment by utilising pre-existent personal or professional relationships with farmers in the area (Adamson et al. 2020).

Two matters of contention with clusters facilitation are apparent throughout the considered articles: The first is documented in almost every cluster report or case study and concerns facilitators inability to provide 1-to-1 advice to cluster members (or, more precisely, facilitators inability to receive funding for giving individual advice) (Adamson et al. 2020; N. Jones et al. 2020; Nye 2018; Prager 2019). Several negative consequences of this deficiency are reported, including limited opportunities for members and facilitators to build strong relationships, the inability to give members advice that is tailored towards local particularities of their farms, and not being able to meaningfully engage with farmers that do not attend to group activities (Nye 2018). The second issue regards facilitator turn-over, i.e., the facilitator dropping out after group formation and being replaced by another staff member of his organisation. Prager (2019) reports staff turn-over for almost every cluster considered in her case study (n=6). Although the author does not mention negative consequences of facilitator change in her sample, Nye (2018) states the risk of groups

losing momentum if facilitators disengage with the group, as a land manager in the author's sample states: "They [farmers] are like well you're leaving so what's the point?" (Nye 2018, 36).

Overall, it strikes that issues of facilitation in terms of facilitators being in conflict with members, or members being dissatisfied with the support provided by their facilitator, are entirely lacking in all considered articles. While this might be linked to some limitations of method, as data is frequently gathered through facilitator interviews or surveys, it appears that facilitation in farmer clusters is rather well implemented.

Diverse knowledge. Integrating multiple sources of knowledge to guide the direction of collective activities emerges as another area of salient cluster performance. As the facilitator is actively called for to promote partnerships with external organisations in CSFF guidance in order to align group efforts with local priorities and initiatives, all clusters appear to utilise external knowledge systems. This is primarily reported in the form of experts who are invited to speak at cluster events (Adamson et al. 2020). However, diverse types of partnerships are documented in the articles, including collaboration with conservation agencies, government authorities, environmental or rural development trusts, and other farmer clusters (ibid.). Knowledge integration is reported to be highly beneficial for enhancing cluster members' understanding of SES dynamics, selecting group priorities, and providing guidance to group activities in general (ibid.). Some clusters even stated that knowledge transfer constitutes the most successful aspect of their clusters activities (ibid.). The facilitator survey confirms this notion, with more than 90 % of participating facilitators expressing that knowledge and information exchange increased moderately ($> 50\,\%$ of facilitators) or significantly ($> 40\,\%$ of facilitators) due to cluster impacts (N. Jones et al. 2020, 133).

Match scales. Matching the scales of participation with the spatial and temporal scales of ecological and social processes as well as administrative boundaries (e.g., areas of jurisdiction) presents some apparent shortcomings in clusters operation. For the most part, this is linked to the temporal limitations of cluster funding to 3-5 years. This period is criticised for being too short for both achieving significant environmental outcomes on the field and for social processes such as trust-building to meaningfully unfold (Franks 2019; Adamson et al. 2020; N. Jones et al. 2020; Prager 2019; Adamson et al. 2020). The latter is, for example, described by Prager (2019), who finds that younger clusters without strong pre-existing relationships are likely unable to achieve group priorities in time due to a lack of networks and trust.

Furthermore, an issue of scale mismatch that has been described before is linked to the inability to temporally match cluster members scheme uptake if farmers are already enrolled in AES or enter into clusters at different times, thus hampering joint and concerted implementation of the required measures (Nye 2018).

6.2.2. Community-based Natural Resource Management

As is apparent from Figure 8, farmer clusters and CBNRM projects share a common notion of laying decision-making authority to a great extent into the hands of defined and distinct user groups. However, whereas CBNRM projects usually concern diverse local professions and industries, usage claims, and interest groups (i.e., all stakeholders associated with the resource system under consideration), farmer clusters are less inclusive and are confined to represent the interests of the involved

land managers. Thus, CBRNM rather resembles PNRM regarding stakeholder representation[13] and potentially diverges from the cluster concept in terms of managing power balances, ensuring equality of stakeholder representation and aligning diverse knowledge systems and interests. In addition, whilst farmers freedom to voluntarily decide to enter clusters and engage in conservation efforts reflects the prevailing property regimes and responsibilities of land managers in EU member states and thus requires no adaption to matters of ownership or jurisdiction for farmer clusters, CBNRM projects usually entail the devolvement of decision making power from government authorities to local institutions that are representative of community interests. This institutional delegation of power mainly contributes to the rather formal setting of community-based resource management reflected in dimension 2 of Figure 8 (see section 3.2). Although the cluster approach likewise commits to a rather formal institutional setting, this is related to its utilisation of the CSFF for financing facilitation and individual AES to incentivise and frame conservation measures implemented by the clusters and thus greatly differs from the institutional and legislative framework that guides CBNRM initiatives. However, the provision of incentives through formal arrangements constitutes a potential similarity of both approaches.

Table 10: CBNRM success factors fit with the farmer cluster approach

Categories	**Factor(s)**	**Factors fit**			
		0 [a]	*1* [b]	*2* [c]	*n.a.* [d]
Resource system (1)					
	Small size			2	
	Well-defined boundaries			2	
	Low levels of mobility			2	
Utilisation	Benefits from the resource can be stored			2	
	Predictability		1		
	Financial value			2	
Group characteristics (2)					
Population	Small size		1		
	No or only gradual population change		1		
	Clearly defined boundaries			2	
Social	Social capital (shared norms, homogeneity of identities and interests), e.g. through past successful experiences			2	
	Supportive cultural traditions / local beliefs		1		
Leadership	Appropriate (adaptive) leadership		1		
Dependence	Interdependence among group members	0			
Equality	Equality in terms of socio-economic status and gender			2	
Capacity	Community members possess management capacity (knowledge, skills)t			2	
Poverty	Low levels of poverty				n.a.
(1) and (2): Relationship between Resource System and Communities					

13. The most prominent difference being the lack of government influence in most CBNRM initiatives.

Table 10: (continued)

Proximity	Overlap or proximity between user-group residential locations and resource system		2	
Dependence	Group members are dependent on resource system		2	
	Diversity of livelihood options / independence from one single resource		1	
Perceived Crisis	Perceived resource crisis before project-initiation		1	
Fairness	Fairness in allocation of benefits from resource system and management project		2	
Demand	Low levels and only gradual changes of user demand		1	
Knowledge	Understanding of SES dynamics, based on open/integrative information base including scientific and local knowledge		2	
Institutional arrangements (3)				
Participation	Significant and ongoing involvement of community members		2	
Rule-making	Rules exist that are simple and easy to understand	θ^e		
	Rules can be easily enforced			n.a.
	Graduated sanctions are provided	θ^e		
	Collective choice arrangements, affected individual are able to participate in rule-making			n.a.
Rights	Locally devised and secure tenure, access and management rights		2	
Adaptivity	(Participatory) Monitoring is in place		1	
	Monitored data is fed back and evaluated			n.a.
	Adaptive capacity: Flexibility to adapt as project is implemented		2	
Accountability	Accountability of monitors and other officials to community members			n.a.
Anticipation	Introduce management plans and a shared vision		1	
Incentives	Provide lasting incentives		1	
Conflict resolution	Mechanisms for communication and low-cost conflict resolution	θ^e		
	Easy access to low-cost adjudication			n.a.
Outreach	Vision, plan and rules are communicated to the external public		1	
(1) and (3): Relationship between resource system and institutional arrangements				
Match scales	Match restrictions on resource system to its regenerative powers			n.a.
(2) and (3): Relationship between community characteristics and institutional arrangements				
Engagement	Engagement with traditional organisations, cultural beliefs, practices, and traditions			n.a.
External environment (4)				
Technology	Low cost exclusion technology			n.a.

Table 10: (continued)

	Quick adaption to new technologies			n.a.
	High costs of resource extraction			n.a.
Markets	Low levels and/or only gradual change of articulation with external markets	0		
State	Appropriate levels of external aid to compensate conservation activities, especially in initial stages, includes funding but also facilitation and capacity building		2	
	Nested levels of appropriation, provision, enforcement, and governance	0[e]		

[a] - Factor is not or only marginally matched.

[b] - Factor is moderately well matched.

[c] - Factor is mostly or fully matched.

[d] - Factor cannot be applied to the cluster approach.

[e] - Lack of agreement with factor is not found to be detrimental for clusters' performance.

Resource system (1). The first group of success factors comprises characteristics of the resource system that is managed through community efforts. It was found in section 5.3 that CBNRM projects are more likely to succeed if the commonly managed resource system is rather small in size, exhibits clearly defined boundaries and is preferably immobile. Linking this to agricultural systems across the EU, it appears that farmer clusters face rather advantageous starting conditions compared to typical community-based management projects. First, sizes of agricultural holdings are usually governable through group efforts, especially since decision-making authority ultimately lies in the hands of individual land managers.[14] Nonetheless, the total area of land consolidated in one cluster can be extensive, particularly in clusters that involve larger numbers of farmers. For example, the biggest cluster in terms of area covered initiated in 2016 comprised almost 9,000 ha of land across 21 holdings (ADAS 2018, 10). This potentially raises concerns of coherence as it might be unfeasible to decide on locally devised measures that generate benefits across large areas of land. Furthermore, a constraint linked to the size of clusters area is reported in one case study, where natural barriers, such as mountains, impeded easy accessibility of event venues for all members (Prager 2019). Naturally, boundaries of agricultural holdings are clearly defined and confirmed through legal property arrangements, thus offering a plain and explicit setting regarding the area of concern for conservation measures. The same applies to the mobility of agricultural commodities, as capital and generated agricultural output can be easily linked to the land manager who runs the respective farm.

Factors related to resource utilisation likewise appear to predispose agricultural holdings for community-based management. Agricultural goods are generally storable; however, the length of feasible storage naturally depends on the particular type of commodity. The predictability of resource development is at best moderate as important natural drivers for farming productivity such as precipitation, temperature and solar irradiation challenge precise predictions. For this reason, short-term decisions frequently can be guided by the prediction of weather conditions (e.g., preponing harvesting dates responding to anticipated changes in weather), whereas middle- to

14. Provided that property regimes are not complicated through tenure arrangements.

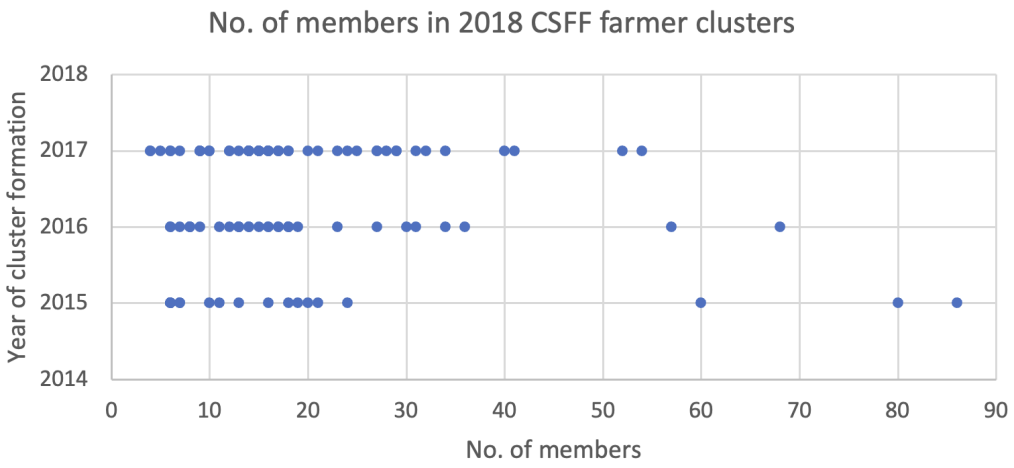

Figure 9: Sizes of all clusters operating in 2018
(Source: Own illustration based on data from Nye 2018, 58ff.)

long-term planning regarding farming systems and crop rotations is challenged by considerable uncertainty. Finally, land managers certainly receive some financial value from the resource system under consideration (frequently even being dependent on agricultural outputs, as will be discussed subsequently) and are thus incentivised to maintain the resource system in a condition that ensures future subsistence.

Group characteristics (2) - Population. As described in section 5.3, the CBNRM literature predominantly recommends small community sizes. Some authors argue for an inverted U-shape relationship between group size and CBNRM project success as overly small groups might not be able to aggregate sufficient resources (e.g., time, money, equipment) for sustained successful management. One might suggest that this argumentation applies to the cluster approach as well, given that members are reported to invest both time and money into conservation efforts (Nye 2018). However, the extent of accumulated resources introduced by each member is anticipated to be of relatively minor relevance for the overall cluster success since CSFF and AES funding provide the finances for both group activities and implemented measures.[15] As there is no easily sampled measure of success that could have been contrasted with group sizes for the clusters considered in this analysis, the specific relationship between group size and cluster outcomes can be hardly evaluated. Nonetheless, some insights regarding the influence of group size on cluster performance are apparent.

Figure 9 illustrates empirical data on cluster sizes in 2018 dependent on the age of the group. Most clusters tend to comprise less than 30 members. A relatively strong variance can be noted, with the largest cluster including 86 members and the smallest only four farmers. The average size of clusters in 2018 was 20 members. Some confusion might occur due to the impression that younger clusters tend to hold more members than older farmer groups in Figure 9. However, if translated into statistical parameters, this effect proves minor significant. In terms of arithmetic averages, older groups even tend to be larger, with an average of 23 members in groups that started in 2015 and 19 members in the groups of 2016 and 2017. As Figure 9 indicates, 2015 farmer member averages have likely been contorted by three clusters of exceptionally large size. Hence,

15. Provided that members enrol in AES and clusters are funded through the CSFF. However, this is the case for most clusters.

the median provides a more realistic evaluation of cluster sizes. The median of group sizes for the two younger cohorts (i.e., 2016 and 2017) equals 16 members, whereas groups formed in 2015 exhibit a median of 14.5 members. Thus, a slight imbalance of group sizes related to the group's age is apparent, though it deems not significant to allow valid interpretations.

Based on two case studies on clusters in East Anglia and Cumbria, Prager (2019) reports that sizes of 12-15 people may be the most beneficial to enhance efficient group dynamics. Accordingly, many clusters currently in operation would exceed this level. Negative influences of large membership numbers on group outcomes are indeed reported by Nye (2018); including a lack of personal relationships between members, ignorance of the chairperson's identity, members referring to their cluster in isolated and passive terms, lower attendance rates at group events, and lower levels of group cohesiveness. Overall, it can be surmised that a significant number of clusters exceed membership sizes that promote meaningful participation of all farmers and consequent group outcomes.

Considering the institutional setting and incentive structure reveals, again, that counterproductive incentives are at play. First, facilitators payments are calculated per-holding, thus incentivising the formation of larger groups (Franks 2019; Prager 2019).[16] Furthermore, given that a cluster is required to cover at least 2000 ha to be eligible for funding, clusters in areas of predominantly smaller holdings are forced to increase membership to match the scheme requirements (Nye 2018).

Regarding the development of cluster sizes (no, or only gradual increases of community size are found to benefit CBNRM projects), it can be noted that most cluster reports in Adamson et al. (2020) document a willingness of clusters to recruit members further. Adverse effects of new members frequently entering existing clusters are anticipated in terms of decelerating trust-building or potentially questioning formerly agreed group priorities and activities. However, given the rather similar membership figures of older and younger clusters presented above, clusters can be assumed to halt member recruitment after a certain level is reached.

Group characteristics (2) - Social. As has already been considered in discussing the incentive structure of cluster membership in the previous section, social capital plays a major role in shaping farmer clusters' outcomes. According to the facilitators partaking in the survey in Jones et al. (2020, 138), "relationships and trust between members is key to achieving objectives". Evaluating the relevance of social capital for clusters performance thereby includes consideration of two distinct levels. The first concerns the role of pre-existing relationships between both cluster members and farmers with their facilitators in influencing group configurations and outcomes. Multiple articles included in the analysis report the existence of relationships between group members and their facilitators prior to cluster formation (Adamson et al. 2020; Prager 2019; ADAS 2018). This is likely promoted through the process of member recruitment, as 70 % of groups document utilising existing networks for this purpose (N. Jones et al. 2020, 119). Given the important role social capital plays in enhancing collaborative decision-making and the arduous process of building trust and respect through group efforts (see also the factor 'Match scales' above), the utilisation of pre-existing networks represents a valuable asset for farmer clusters.

The second level considers the process of social capital building within the clusters themselves. Both the facilitator survey and the 28 case study reports reveal that social capital constitutes a

16. More precisely, facilitators receive a fix annual payment of £10,000/group plus £500 for each holding up to £50,000 or 80 holdings (Franks 2019).

frequently mentioned and highly esteemed outcome of group activities (N. Jones et al. 2020; Adamson et al. 2020). Almost 90 % of facilitators documented moderate or significant increases in social capital components, such as trust between peers, trust between the facilitator and members, confidence, and social interactions amongst group members (N. Jones et al. 2020, 133). 4 clusters even conducted events dedicated solely to networking (N. Jones et al. 2020). Furthermore, the high relevance of social capital building is mirrored in the report on land manager interviews, as it represents the factor of success cited most frequently (ibid.). Social capital building thereby is not limited to in-cluster results but is also reported regarding collaboration with external organisations. For example, Jones et al. (2020) document the creation of networks between clusters and local experts or external organisations and communication channels between authorities and clusters that both enhanced members' knowledge and their levels of trust towards government authorities.

As has been described before, the extent of social capital within clusters is related to group size, with larger clusters usually exhibiting less personal relationships and lower levels of group cohesiveness (Nye 2018). Some farmers of clusters that exceed 50 members even state not being in direct contact with the other members of their cluster (ibid.). However, the negative effect of large cluster membership is found to be eliminated or at least attenuated by setting up smaller subgroups for cluster activities and duties (Nye 2018).

Evidence regarding the fit of the factor 'Supportive cultural traditions / local beliefs' is limited, indicating that local belief systems and traditions are either not widespread or pronounced throughout the UK or do not significantly influence cluster dynamics. Some cases of culture impeding farmer collaboration are reported by land managers in Nye (2018), who state that farmers tend to prescribe to a culture characterised by self-interest, independence, and competition and are thus reluctant to enter into a cluster that promotes collaboratively working towards a common goal.

Group characteristics (2) - Leadership. The CBNRM literature stresses the importance of charismatic leaders for providing guidance to group efforts, motivating engagement of community members, helping with the identification and access to sufficient sources of funding, and promoting flexibility to adapt to unforeseen changes of the internal or external environment (see section 5.3). Comparing this description with the role that facilitators play in farmer clusters (see the factor 'Facilitation' in the previous section) reveals that facilitators, to a large extent, match leadership functions in CBNRM. In line with this observation, Prager (2019) argues for strong in-cluster leadership, particularly in cases where facilitation is absent (e.g., to guide farmer-led cluster formation without the involvement of an external facilitator). Furthermore, Nye (2018, 28) finds that farmer-led groups (in contrast to organisation-led clusters or clusters with a steering board in place) are more reliant on "very dynamic individuals within the group who could rally the other farmers into becoming more engaged".

A role that is frequently established in clusters and further resembles leaders in CBNRM are chairpersons, described by facilitators according to Nye (2018, 27) as "galvanising group members into action, encouraging feedback, or assisting in the recruitment of new members amongst the farming community". However, it is unknown how many clusters appointed chairpersons, nor whether they hold a similar understanding of their roles and duties.

Nye (2018) and Jones (2020) describe clusters where a lack of leaders limited group outcomes as members refrained to meaningfully participate in group activities or provide input regarding their

preferences. It thus appears that a lack of leadership can have negative consequences for cluster dynamics if the overall engagement levels of members are relatively low. This is confirmed by the cluster reports, with four reports explicitly stressing the importance of pro-active members to boost motivation in their groups (Adamson et al. 2020).

Leaders involvement in ensuring the adaptivity of clusters (as is recommended in the CBNRM literature) is not explicitly mentioned in the reviewed articles. As described above, leadership functions in farmer clusters are frequently carried out by the facilitators, chairpersons, and/or engaged individual members. Considering clusters' realisation of the 'Adaptivity'-factor discussed in the previous section, the facilitator most likely plays a predominant role in ensuring clusters' adaptive capacity as they organise group events, collect feedback from members, and hold a perspective on the overall direction towards which their cluster is heading.

Group characteristics (2) - Dependence. Interdependence among cluster members is not reported in the analysed articles, as land managers tend to work in isolation and frequently even competition to other farmers. Accordingly, reciprocity (i.e., farmers engaging in clusters because disengagement might entail negative repercussions for their professional or private relations) is not believed to act as a powerful additional incentive for farmers commitment to their clusters.

Group characteristics (2) - Equality. See factor group 'Equality' in the previous section.

Group characteristics (2) - Capacity. CBNRM, as well as cluster outcomes, depends on members capacity to efficiently engage in collaborative decision-making, identify and select appropriate management measures to achieve group goals and implement them on the field. The resulting demand for capacity building is acknowledged by CSFF guidance in putting cluster facilitators into responsibility to provide members with the necessary expertise and skills for scheme delivery (ADAS 2018). Accordingly, a major part of cluster activities constitute training events, workshops, knowledge and information exchange between peers, inviting expert speakers, or conducting site visits (Adamson et al. 2020). An overview of training events, topics and outcomes is provided in ADAS (2018, 67ff.) and the cluster reports in Adamson et al. (2020). As described above, training needs are, for the most part, set by group demand (factor 'Empowerment', section 6.2.1) and aim for capacity enhancement in line with the clusters' environmental goals. Hence, training events concern topics such as biodiversity, woodlands, water, soil, landscape-scale conservation, or AES application and monitoring (Adamson et al. 2020). All facilitators partaking the survey valued training events as important (over 60 % even as 'very important', N. Jones et al. 2020, 134) for achieving group goals.

Jones et al. (2020) give some indication regarding clusters performance in enhancing farmers' capacity to participate in group discussions and jointly implement measures. 84 % of facilitators report increases of some or even all members ability to assess environmental measures on their farms, 79 % document building the capability of cluster members to train others, and 84 % mention practical changes to farm methods and input use that are assumed to be at least promoted and facilitated by members' increased capacity (Jones et al. 2020, 128). Wider impacts of the CSFF stated by the facilitators include moderate to significant increases in the ability to implement conservation measures (reported by almost all facilitators, Jones et al. 2020, 133) and confidence (stated by more than 80 %, ibid.). The facilitator survey does not specify whether 'confidence' refers to land managers feelings towards implementing environmental measures or the social interactions

associated with cluster membership. However, increases in the latter are reported by Nye (2018) and thus represent an additional dimension of capacity building that likely promotes members willingness to provide input to group discussions.

One cluster in Adamson et al. (2020) declares a lack of expertise and skill about forestry acting as a barrier to achieving group goals, whereas another cluster reports some members feeling disabled to participate due to a lack of technical knowledge on the issue at hand. Overall, farmer clusters appear to be rather successful in equipping members with the required knowledge and skills to achieve group goals.

Group characteristics (2) - Poverty. The factor 'Low levels of poverty' is related to land managers dependence on income generated on-farm and is discussed subsequently.

(1) and (2): Relationship between resource system and communities - Proximity. The factor 'Overlap or proximity between user-group residential locations and resource system' is evidently matched, as land managers usually live on or in close proximity to their holdings.

(1) and (2): Relationship between resource system and communities - Dependence. Section 5.3 found that resource users dependence on a given resource system influences their engagement in CBNRM projects in multiple, ambiguous ways. Strong levels of resource dependence act as a powerful incentive for resource users to engage in efforts to maintain the resource in desirable conditions. On the other side, community members who are not (overly) reliant on income generated through resource utilisation are likely more disposed to accept changes of land management, while diverse flows of income additionally enhance communities adaptive capacity and thus the resilience of the respective social-ecological system.

Some aspects of resource dependence and its influence on farmers decision to participate in AES have already been described in section 5.5. It was found that farmers willingness to enrol land in AES is usually negatively correlated to their dependence on farm income, as risk-averse land managers prove reluctant to adopt less productive farming methods if household income is mostly generated on-farm. Some authors argue in favour of non-linear, inverted U-shaped relationships between dependence on farm income and willingness to participate in AES, where moderate levels of dependence maximise farmers willingness whilst highly dependent land managers hold on to productivity-centred farming approaches.

The analysis on farmer clusters could neither confirm findings from the CBNRM literature nor the suggestions made regarding AES participation. Instead, cluster members dependence on income generated on-farm is most frequently related to matters of resource availability. According to this notion, land managers who are less dependent on farm income (e.g., farmers of larger holdings that offer more extensive margins or farmers who contracted out their agricultural lands) tend to be able to commit more resources to group efforts compared to land managers of smaller holdings that "actually have to farm" (Nye 2018, 37). Hence, farmers dependence on farm income does not appear to influence engagement with clusters per se but rather restricts the resources land managers are able to invest in cluster efforts.

To summarise, land managers are generally (at least to a substantial degree) dependent on income generated on-farm (first factor of the group). Likewise, a presumably much smaller portion of farmers has access to alternative sources of income such as tenancy (second factor). While the impact of the former on cluster performance can not be specified based on the analysis results, the

latter appears to promote farmers' engagement in their clusters due to the increased availability of resources (e.g., time, money).

(1) and (2): Relationship between resource system and communities - Perceived crisis. References to resource crises, or at least undesirable ecosystem conditions are occasionally mentioned in the reviewed articles as drivers for entering a farmer cluster. As such, more than half of the farmers included in the case study by Nye (2018) state environmental reasons (e.g., concern about biodiversity decline and a wish to positively impact the landscape) as primary drivers for cluster entry. Furthermore, perceived losses of wildlife and biodiversity influenced priority selection of some clusters that chose to focus on biodiversity in response to local issues or threats (N. Jones et al. 2020).

Overall, it appears that farmers are relatively more incentivised by positive outcomes linked to cluster membership, such as knowledge enhancement and social capital building, instead of reacting to an urgent need for collaborative action due to environmental crises.

(1) and (2): Relationship between resource system and communities - Fairness. No issues of fairness regarding the allocation of benefits generated within clusters are reported. This is likely because economic incentives in the form of AES are - as yet - offered to individual farmers and not distributed by clusters themselves. However, AES design adaptions such as collective contracts (see section 4.3.4) might raise issues of fairness in the future.

(1) and (2): Relationship between resource system and communities - Demand. The factor 'low levels of user demand' points to rather extensively managed farms. While the analysed articles do not address farming systems of cluster participants, section 5.5 has found that extensively farming land managers are more likely to participate in AES. Thus, it is assumed that clusters likewise tend to comprise rather extensively farmed areas compared to the nationwide average, increasing their likeliness to enrol in Higher Tier agreements and thus enabling meaningful ecological outcomes.

(1) and (2): Relationship between resource system and communities - Knowledge. The extent of knowledge integration into cluster decision-making processes has already been discussed in the previous section (factor group 'Diverse knowledge'). Similarly, cluster performance in enhancing members understanding of SES dynamics and its interplay with environmental measures has been examined as a key area of clusters' capacity building activities earlier in this section (factor 'Group characteristics (2) - Capacity'). Based on these considerations, farmer clusters' efficiency in enhancing their members' understanding of farmland dynamics and the integration of scientific knowledge is valued as a strength of the cluster approach.

Institutional arrangements (3) - Participation. This factor has been extensively discussed in the previous section and is rated as 'mostly matched' (with deficiencies in member participation linked to rather few very large and/or organisation-led groups).

Institutional arrangements (3) - Rule-making. Community-based management recommends the existence of jointly agreed on rules that define the way and extent of communities' utilisation of a given resource system (e.g., harvesting levels and rights, closed seasons for resource recovery). At best, rules are defined in a participatory manner, with all stakeholders affected by new regulations having a say in the process of rule-making. Further, efficient means for rule enforcement need to be ensured, including sanctions or penalties in case of non-compliance.

Farmer clusters' legal setting differs in this regard, as property and exploitation rights are not

altered through clusters activities but are pre-defined in federal and state law. Furthermore, as clusters' do not usually commonly manage the same resource system in terms of, e.g., sharing grazing rights on farmland (though individual cases of such arrangements are reported, for example, in Prager (2019)), there is no need for specifying joint resource use through legislation. Nonetheless, some measure of force is apparent in farmer clusters through their application of environmental schemes. As described in section 4, enrolment in AES requires farmers to implement defined management measures (in the case of action-based schemes) or achieve prescribed environmental outcomes (outcome-oriented AES, respectively). Disbursement of payments is linked to compliance with scheme requirements, thus somewhat coercing farmers into action. However, AES non-compliance does not entail additional penalties but leads to withholding payments or seeking recovery for payments already made (RPA 2021). Hence, AES do not significantly exert force on farmers' behaviour but merely ensure that the environmental actions paid for in AES are delivered. Besides, as participation in AES is entirely voluntary for farmers, the application of force in farmer clusters appears marginal.

This notion is confirmed by the analysis, with some positive references being made to the non-obligatory nature of farmer clusters. According to Prager (2019) it supports member recruitment, as farmers are eager to join a cluster if it does not entail a binding commitment. However, some demand for rule-making emerges concerning members' commitment to the group, as Prager (2019) and Nye (2018) document issues with members signing up for cluster membership but never attending any meetings. Nye (2018) even mentions the existence of a rule that prescribes a minimum level of attendance to remain a group member; however, this rule was not enforced in the author's case study as the respective clusters were trying to connect to disengaged members and motivate them instead of kicking them out.

Overall, the absence of rules or their enforcement does not appear detrimental to clusters' performance. On the contrary, introducing binding requirements into cluster activities would potentially render farmers' willingness for environmental action obsolete, thus contradicting the voluntary nature inherent to the cluster approach that aims for long-term behavioural change instead the mere singular implementation of an environmental measure.

Institutional arrangements (3) - Rights. Securing that communities possess the power to devise and implement management regimes that they see fit constitutes a necessary condition for meaningful community empowerment in CBNRM. As decision-making power and property rights often lie in government authorities or local commercial parties in CBNRM projects, this entails significant devolution of control to community entities. On the other hand, farmer clusters are faced with more favourable conditions for self-contained management, as decision-making authority naturally lies in the jurisdiction of individual landowners. However, this points to a potential issue of farmer clusters when farmers do not hold their agricultural lands but are contracted under tenancy agreements with external landowners. Tenancy has been found to negatively influence farmers' willingness to participate in AES, as it entails uncertainty for farmers regarding their long-term commitment to the agricultural land, in some cases stipulates particular farming methods and thus limits farmers' flexibility for environmental action, and requires additional agreements between land owners and tenants about how AES benefits are shared (see section 5.5).

The empirical evidence for this factor provided by the analysis is limited. Adamson et al. (2020)

include a report on one cluster with 18 members entirely composed of tenant farmers, thus indicating that tenancy by no means renders cluster membership uncomely or unfeasible. The report does not mention any challenges arising from tenancy while particularly considering barriers faced by the cluster. However, another cluster report documents conflicts between landlords and tenancies about taking land out of production, thus indicating that tenancy potentially poses additional barriers for farmers participation in clusters. Overall, this factor appears to be well met.

Institutional arrangements (3) - Adaptivity. Some aspects of adaptivity have already been considered as part of the previous section, namely clusters' ability to adapt the participatory process to changes of the external environment or member demand (factor 'Adaptivity' in section 6.2.1, correspondingly). Adaptivity in CBNRM aims for similar objectives whilst particularly stressing the importance of monitoring the outcomes of CBNRM projects and readjusting community efforts accordingly. Hence, this section builds upon findings regarding the adaptive capacity of participation from the previous section and subsequently focuses on clusters' monitoring endeavours, both in surveying the achievement of group goals and the delivery of scheme requirements.

Starting with the piloting farmer clusters prior to CSFF introduction, it can be noted that the monitoring of ecological and social outcomes was recognised as an integral part of cluster activities (Prager 2019). Monitoring constituted 1 out of 5 implementation steps that outlined piloting clusters actions, besides identification and selection of a lead farmer and an advisor, mapping the ecological status quo on farms, agreeing on group priorities and activities, and recruiting new members (6f.).

Comparing this to CSFF funded farmer clusters, it appears that the recognition of the importance of monitoring efforts is somewhat lost in contemporary farmer clusters or - more frequently - is not systematically translated into actual monitoring trails due to a lack of facilitation and funding. While most land managers in Nye (2018) partook in some monitoring operation in the past, these were generally not conducted systematically across all farms in a cluster and varied considerably in terms of extent, monitoring means and the availability of qualified assistance or training. Furthermore, members frequently expressed confusion about where monitoring efforts originated (i.e., in the cluster or elsewhere), indicating that monitoring efforts were frequently not initiated as a concerted cluster activity but were influenced or executed by external drivers (ibid.). This impression is confirmed through cluster reports in Adamson et al. (2020) that document three cases of monitoring ecological outcomes (two assessing particular target species abundance, one concerning soil quality). Each case was not initiated and conducted through cluster activities but resulted from partnerships with external organisations. Hence, monitoring the social and ecological effects of cluster actions as yet does not constitute an institutionalised or integral part of cluster activities.

This manifests into the discontent of both facilitators and land managers, as the inability to measure outcomes on the ground enhances uncertainty regarding the ecological impacts of group efforts and potentially demotivates farmers' ongoing engagement (Nye 2018; Prager 2019). Reasons for the lack of surveying are collected by Nye (2018) and include the inability of the CSFF to finance monitoring trails, the high costs associated with monitoring that render clusters reliant on extensive volunteer work, the complexity of conducting and interpreting monitoring results (particularly differentiating cluster outcomes from natural oscillations), and the reticence of some farmers to let strangers on to their land. The cluster reports affirm those hindrances, particularly emphasising frustration arising from CSFFs insufficient funding opportunities and clusters inability to ensure

systematic self-monitoring due to its high demand on volunteer work (Adamson et al. 2020). Given that more than half of the clusters presented in ADAS (2018, 15f.) (i.e., 27 out of 49 clusters) planned training for monitoring and evaluation in their Facilitation plans, the apparent absence of monitoring is likely related to a lack of resources (financing, time) instead of insufficient capacity building on the part of farmer clusters.

Finally, on a more conceptual level, monitoring and evaluation of the cluster approach as a whole is aimed for by Natural England in order to assess the efficiency of the CSFF as a policy tool. The data gathered against this objective constitutes a significant knowledge base for this analysis (i.e., N. Jones et al. 2020; ADAS 2018; Adamson et al. 2020). However, the data aggregated across clusters and used for evaluation and comparison mostly comprises easily measurable indicators such as group size, the number of meetings held and attendees, area covered by cluster member holdings, or the number of AES assignments resulting from group activities. Those indicators fall short on mapping more complex social dynamics, and outcomes within clusters and are thus criticised by some authors (e.g., Prager 2019). However, it must be noted that more recent reports also include relatively nuanced presentations and evaluations of socio-economic parameters as well as success factors, enablers and barriers (ADAS 2018).

Institutional arrangements (3) - Accountability. As the cluster approach does not comprise the distribution of decision-making authority or management duties between community and government entities per se, there is generally no need to ensure the accountability of external officials to land managers. Hence, this factor cannot be applied to the cluster concept.

Institutional arrangements (3) - Anticipation. Clusters' anticipation of prospective development and management impacts is not significantly promoted through cluster activities. Although some measures of foresight are apparent, such as roughly planning group activities in Facilitation Plans and defining group priorities, the application of more thorough management plans to organise collective action is only mentioned once in the reviewed articles (Adamson et al. 2020). This apparent lack might be linked to data constraints, as facilitators and land managers likely not consider the relatively secondary means of cluster organisation very significant and thus might not mention it in interviews or surveys.

In terms of establishing a shared vision, the clusters appear to be in a better position due to their definition of group priorities. As listed in ADAS (2018, 50ff.), group priorities frequently not only provide a direction for the collective environmental efforts (e.g., enhancing biodiversity) but include specific characteristics of the desired target state (e.g., the abundance of particular species). Thus, group priorities might support concentrating group efforts on particular environmental goals and evaluating the progress towards these goals based on suitable indicators (provided that efficient monitoring is in place, as discussed above).

Institutional arrangements (3) - Incentives. Farmer clusters' incentive structure has been discussed in the previous section (passage 'Incentives', accordingly).

Institutional arrangements (3) - Conflict resolution. Conflicts between cluster members are seldom reported in the reviewed articles. Nye (2018) mentions occasional in-cluster differences; however, these were typically not related to cluster activities but arose from personality differences or pre-existing personal disputes between members. Some conflicts are mentioned that resulted from members lack of engagement or converse opinions regarding the preferred cluster size (ibid.).

Overall, conflicts do not appear to constitute a significant barrier to collaboration for most of the groups. It can be noted that clusters instrumentality to cope with conflicts is rather limited due to CSFF regulations (that, for example, do not cover colloquies with parts of the group aiming for conflict resolution) (Prager 2019). However, given the minor role of conflicts in influencing clusters' performance, this is not perceived as a hindrance by most facilitators or farmers.

Institutional arrangements (3) - Outreach. The in-cluster communication, in terms of two-way information delivery through a shared language and ensuring transparency over group matters, have been discussed related to PNRM success factors in the previous section (i.e., factor group 'Communication' in section 6.2.1). This aspect is complemented by the CBNRM literature, recommending that the project outline and its results are communicated to the wider public in order to raise awareness, enhance the approval of or compliance with the agreed management decisions, and promote a sense of community ownership over the project by presenting it to external visitors.

The analysis' reveals that community outreach does constitute a momentous area of cluster activities. For example, strategies to promote cluster cohesiveness and proactivity identified by facilitators in Nye (2018) advocate informing the public (and potential new members) over social media or group websites. The reviewed articles consistently reported a high relevance of community outreach to cluster members and facilitators, frequently associated with 'bridging the gap' between the public and the agricultural community (Nye 2018). Community outreach is perceived as an instrument to improve farmers' perception by the public and being recognised and appreciated for their environmental efforts, thus contrasting the 'them-and-us'-mentality that prevails farmers relationships with the public (ibid.). Means of public engagement documented across the considered articles are manifold. They include websites, social media, blogs, promotion via schools, 'Open Farm Sundays', press releases, guest speakers, radio, local selling points, community participation in wildlife surveys, and in one case even a tv report (Nye 2018; Adamson et al. 2020; N. Jones et al. 2020). The latter was conducted in a cluster that prescribed community involvement as one of their group priorities (Adamson et al. 2020, 101ff.). The frequency of community engagement is sampled in the facilitator survey, and 60 % of facilitators stated that the community had been involved in group activities (N. Jones et al. 2020, 136). Additionally, 40 % of groups report that some or most of their members have started engaging with the public due to cluster influences (ibid., 128). Nye (2018) finds relatively less pronounced community involvement in her sample of nine clusters, with 30 % of groups reporting that they engaged in public outreach.

Involving the wider public is not promoted through CSFF funding, as costs related to, e.g., running a website are not eligible for compensation through AES. Thus, members report undertaking community involvement on their own costs and time, though frequently asserting that the benefits outweighed their personal costs (Nye 2018). One group even institutionalised community participation by establishing an associate membership for non-agricultural individuals (ibid.). This cluster is also presented in a cluster report in Adamson et al. (2020), therein highlighting an increase in awareness of local environmental issues resulting from community engagement and pride arising from teaching the public. Barriers to community outreach are identified by Nye (2018) and include reticence of farmers due to bad experiences in the past and reluctance to be subject to scrutiny, fear of changes in their land designation status if protected species are found on their lands, and reluctance to engage in additional workload resulting from public involvement efforts. Overall,

it appears that the success factor 'Outreach' is reasonably well-matched. However, community participation is not the norm in all reviewed clusters and might be further promoted through AES funding or more stringent embedding of outreach into the institutional setting of farmer clusters (e.g., through the provision of associate memberships).

(1) and (3): Relationship between resource system and institutional arrangements - Match scales. In contrast to the matter of scales discussed in the previous section, i.e., matching participatory processes to the spatial and temporal scales of ecosystem dynamics and administrative scales of institutional jurisdiction, this factor relates to the coherence of institutional arrangements in CBNRM projects and the ecological conditions and powers of the resource system that is managed. Thereby, it particularly refers to the design of restrictions that are collectively put on resource utilisation to ensure long-term resource system resilience. However, this points to a significant difference to the cluster approach, which refrains from restricting resource utilisation in any way but is entirely based on voluntarily adopting environmental-friendly farming practices. For this reason, this factor cannot be applied to the cluster concept.

(2) and (3): Relationship between community characteristics and institutional arrangements - Engagement. This factor is linked to the factor 'Supportive cultural traditions / local beliefs' that has been considered related to the social dimension of community characteristics earlier in this section. Whereas this factor describes the positive consequences of local traditions and belief systems that align with CBNRM project goals and processes, the factor considered here refers to CBNRMs' adaption to and consideration of divergent cultural beliefs and practices in the design of institutional arrangements (and the process of collectively deciding on them). However, as has been discussed related to the former factor, local traditions and beliefs did not emerge as an influential driver for group outcomes in the UK. Thus, the factor cannot be well applied to the cluster approach.

External environment (4) - Technology. The factors related to technology in CBNRM projects cannot be generally evaluated for farmer clusters. The existence of exclusion technology constitutes no matter of concern for farmer groups, as property rights on agricultural lands in the UK are well-defined and excluding resource users from resource utilisation is unnecessary. 'Quick adaption to new technologies' represents a potential influencing factor for farmers' willingness to adopt environmentally sensitive (or harmful) farming methods if cost savings related to technology changes favour a particular farming practice. However, this aspect has not been considered in the reviewed articles, and it can be assumed that the heterogeneity of farming systems in the UK prevents deriving any conclusions that are valid across all operating clusters. The same applies to the factor 'High costs of resource extraction', which evidently influences farmers' profits and thus potentially encourages farmers to intensify their farming methods. Generally, it might be noted that the distribution of costs and profits related to agricultural cultivation tend to favour intensive farming systems over extensive ones, thus putting clusters and their aim for environmental benefits into disadvantage compared to conventional farming systems with only limited consideration of environmental outcomes. These boundary conditions thus resemble CBNRM projects with low resource extraction costs in incentivising higher levels of resource depletion that are detrimental to CBNRM goals.

External environment (4) - Markets. The farmers in clusters are naturally deeply intertwined with local, national, and possibly even global markets for agricultural commodities. Even though

this aspect is not explicitly considered in the analysed articles, it can be argued that tight margins of land managers that result from global demand-and-supply dynamics affect their willingness and ability to engage in cluster activities. This is thus related to the factor group 'Dependence' discussed above that found that farmers' access to alternative income sources (e.g., tenancy) enhances their ability to aggregate time and money for cluster engagement. Overall it can be concluded that farmers general high levels of interaction with external markets do not promote taking up environmental conservation efforts, given that existing market price pressures favour more intensive and cost-efficient farming practices.

External environment (4) - State. Some references are made in the articles regarding the support provided by public bodies. Facilitators in Jones et al. (2020) mention consulting with Natural England[17] to seek guidance regarding group priority selection. Another form of support documented in the facilitator survey is external funding by the public sector that some clusters used to finance measures not eligible for funding through the CSFF (ibid.). Furthermore, officials from Natural England and government authorities are documented to attend events, giving expert speeches or providing input for workshops to support the capacity building of group members (Adamson et al. 2020; N. Jones et al. 2020). As has already been mentioned regarding the responsiveness to member demand (factor group 'Adaptivity' in section 6.2.1), Natural England is occasionally accused of delaying communication with cluster members by tardily responding to inquiries, thus pointing to a small potential for improvement. Otherwise, no issues with state support are documented, indicating that clusters (relatively low) demand for external support is well matched.

The final factor, 'Nested levels of appropriation, provision, enforcement, and governance', can be discussed controversially. Regarding the cluster activities themselves, authority and responsibilities are not significantly nested across multiple administrative scales. One exception arises for clusters that appointed a steering group and thus distributed decision-making authority between the steering committee and cluster members. Other aspects, such as enforcement or appropriation, do not significantly influence cluster activities and their allocation across administrative levels thus constitutes no concern for cluster management. Taking in a broader perspective, the provision of financial compensation through AES is a matter of national policy. However, it can be argued whether this level of nested responsibility favours cluster outcomes, given that issues of 'goodness of fit' are frequently reported to diminish farmers' willingness to participate in AES and voices are raised to further devolve AES design to more local, participatory levels (see section 6.3). Overall, these aspects appear to be only marginally matched by farmer clusters but are not understood to entail detrimental effects for clusters' performance.

6.2.3. (Adaptive) Co-Management

As co-management represents a middle-course between community empowerment and state-run, top-down management, ACM projects tend to apply moderate levels of community participation. In this regard, they differ from the average farmer cluster with relatively strong levels of farmer control. However, as was found before, lower levels of land manager involvement also occur in farmer clusters, particularly when group sizes are large and decision-making authority is to some

17. Natural England is "an executive non-departmental public body, sponsored by the Department for Environment, Food & Rural Affairs" (https://www.gov.uk/government/organisations/natural-england, accessed 15 September 2021).

degree transferred to a subset of farmers in steering committees. Hence, ACM projects likely exhibit participation intensities that resemble participatory settings encountered in some farmer clusters.

ACM projects are guided by a relatively formal institutional setting. This relates to the formal arrangements that define how authority and implicated obligations are shared between the project partners. Whereas clusters do not require an explicit allocation of duties among multiple parties, the formal base of farmer clusters (i.e., the CSFF and individual AES) resembles ACM arrangements in defining management or conservation efforts (or, in the case of result-oriented AES, ecological outcomes) that need to be implemented (or achieved, respectively). Hence, both AES and ACM agreements prescribe obligations regarding the management of the resource (or ecological) system under consideration and are thus conceptually more closely related regarding the formalisation dimension than farmer clusters and community-based management.

The divergence mentioned above, i.e., the lack of multiple involved parties in farmer clusters that need to be aligned to enable integrated management efforts, links to the third model dimension. As described in section 3.3, one partner in ACM typically constitutes a government authority that collaborates with one or multiple community or stakeholder groups. Hence, co-management rather resembles participatory management in bringing diverse stakeholders together for collaborative management efforts, whilst farmer clusters represent a more homogeneous and cohesive group setting.

Table 11: ACM success factors fit with the farmer cluster approach

Categories	**Factor(s)**	**Factors fit**			
		0 [a]	*1* [b]	*2* [c]	*n.a.* [d]
Resource system (1)					
Characteristics	Stability / Lack of disturbances		1		
	Low levels of mobility			2	
	Small size / small scale systems			2	
	Well-defined boundaries			2	
Group characteristics (2)					
Size	Small size		1		
Leadership	Charismatic leadership that motivates and steers collective action		1		
Commitment	Long-term commitment to the process by both local government and stakeholders			2	
Homogeneity	Homogeneity in terms of kinship, ethnicity, religion, culture, and socio-economic status			2	
	Shared interests			2	
Social capital	Relationship of trust and mutual respect			2	
	Group cohesion			2	
	Social networks			2	
	Mutual learning			2	

(1) and (2): Relationship between resource system and communities

Table 11: (continued)

Proximity	Proximity of members residential location to managed area		2	
Knowledge	Stakeholders share extensive knowledge and understanding regarding resource system dynamics, the addressed problem and potential solutions		2	
Institutional arrangement (3)				
Objectives	Simple and clearly defined objectives		2	
Membership	Clearly defined membership		2	
Rules	Enforcement of and/or compliance with legislation	θ^e		
Conflict resolution	Adequate means for conflict resolution, e.g., collaborative and mediated forum	0		
Equality	Means to tackle power asymmetries that impede equal participation and redistribution of power			n.a.
Adaptivity	Management measures are monitored, evaluated and adapted, if necessary		1	
	Effective resource monitoring		1	
	Possibility to experiment with management measures		1	
Empowerment	Government action establishes supportive and enabling legislation, policies, rights, and authority structures		2	
	Decentralisation of authority		2	
	Existence of community organisations			n.a.
	Capacity building, including consciousness raising, training of management and mediation skills, principles of co-management, and imparting scientific understanding of SESs		2	
	Participation of all relevant stakeholders		2	
	Identifying relevant stakeholders by conducting a stakeholder analysis			n.a.
Accountability	All involved partners are held accountable based on accepted standards for evaluating objectives and outcomes		1	
Communication	Clear communication of privileges, guidelines, ACM process and responsibilities		1	
Incentives	Individual incentive structure is provided and promoted (e.g., higher incomes, protection of livelihoods, prestige, legitimate access to resources, reduction of conflicts, ...)		1	
Resources	Sufficient, timely and sustained funding and financial resources		1	
	Human resources (e.g., full-time facilitator, volunteers) and time		1	
	Technical equipment (e.g., for monitoring)			n.a.
	Provision of information to participants in a way that suits their skills and preferences		1	
Knowledge	Scientific and local/indigenous knowledge is integrated to inform management design		2	

Table 11: (continued)

Facilitation	A facilitator or external agent expedites the process by providing assistance, advice, ideas, expertise, training and/or guidance	2
(1) and (3): Relationship between resource system and institutional agreements		
Matching scales	Resource distribution matches areas of jurisdiction	2

[a] - Factor is not or only marginally matched.

[b] - Factor is moderately well matched.

[c] - Factor is mostly or fully matched.

[d] - Factor cannot be applied to the cluster approach.

[e] - Lack of agreement with factor is not found to be detrimental for clusters' performance.

Section 5.4 revealed a broad overlap of drivers for success in both community-based and co-management projects. Consequently, the great majority of factors that are deemed important to enhance project outcomes in community-based natural resource management are likewise expected to amplify benefits in the co-management evaluative literature. In order to avoid discussing similar or strongly related factors of success repeatedly, Table 17 in the Appendix lists references to the previous sections if a success factor has already been considered. In these cases, the evaluation of the factors' fit with the cluster approach as determined in the previous sections is adopted for Table 11. Subsequently, the remaining drivers for ACM success, which have not been examined yet, are discussed.

Resource System (1) - Characteristics. The only factor regarding the characteristics of the common managed resource system that is not mentioned in the CBNRM literature represents 'Stability / Lack of disturbances'. Linking this to agricultural systems, potential disturbances that affect land managers interaction with their lands and their choice of management measures arise from changes in weather and climate (e.g., droughts, flooding, storms). It can be anticipated that extreme weather events might jeopardise the implementation of joint conservation efforts if catastrophic events pose an urgent demand for rehabilitation or reconstruction actions. However, no negative consequences of extreme weather events or similar crises on cluster activities are reported in any reviewed articles. Instead, resource crises are described to occasionally incentivise group efforts, for example, in jointly implementing flood control measures after deluges, in line with the factor 'Perceived resource crisis' considered in the previous section. Hence, this factor is only partially matched as extreme weather events increasingly preclude long-term stability and planning reliability for land managers, but no empirical evidence for negative impacts of this instability was found across the analysed articles.

Group characteristics (2) - Commitment. The literature stresses the importance of long-term commitment to co-management projects. This particularly refers to government authorities or local elites, i.e., traditional holders of power in many ACM settings, who are needed to thoroughly commit to ACM projects if pre-existing, imbalanced power structures are to be resolved (see section 5.4). This factor is thus predominantly motivated by ACMs configuration of involved interests (dimension 3 of the model of co-operative resource management in Figure 8). As farmer clusters are not reliant on the input or the benevolence of external parties, the commitment of government

authorities is less significant for cluster activities and outcomes (although, as discussed in the previous sections, external partnerships contribute significantly to clusters capacity-building and monitoring efforts).

However, issues of farmers' commitment to the group are frequently reported to have a significant negative impact on cluster outcomes (Nye 2018). Prager (2019) and Jones et al. (2020) report cases of members registering for cluster membership but subsequently never attending any group events. Nye (2018) reports a lack of commitment in some clusters in the author's sample that manifests as a reluctance to provide input to group goals or taking the lead in deciding on group activities. Multiple articles mention a wide variety of member commitment in terms of attendance to group events, with some clusters being used to attendance rates around 80 % whereas others are satisfied with 30 to 50 % attendance (Nye 2018; Adamson et al. 2020; N. Jones et al. 2020). Nye (2018) mentions several drivers for low levels of member commitment. First, disengagement was noted resulting from a high frequency of workshops that outstrip members available time contingent, thus confirming recommendations from participatory resource management about tailoring participatory processes to stakeholders preferences. Furthermore, a lack of monitoring is argued to detract members' commitment, as they are not able to witness the impacts of their efforts on the ground. Generally, it is assumed that all limitations of the incentive structure, that promotes cluster engagement, potentially result in decreases in member commitment. Consequently, additional drivers for low commitment levels might include delayed AES payments, members confusion with the high complexity of CSFF regulations, AES penalties, or unanticipated adverse consequences of environmental efforts (see section 6.2.1). As described before, member commitment tends to be more pronounced in smaller and farmer-led clusters, indicated by members' higher willingness to spend time and money on cluster efforts (Nye 2018).

Additionally, as ACM typically comprises time-consuming institution-building processes to enhance locally devolved management capacity, the ACM literature calls for acknowledging and embracing a long-term perspective in co-management projects. Section 6.2.1 revealed a similar understanding prevailing in most clusters in terms of the extensive temporal scales required for social capital building (factor 'Match scales'). A call for adopting a long-term perspective on evaluating cluster performance is additionally given by surveyed facilitators in Jones et al. (2020). They argue that most social and environmental outcomes of cluster activity are likely not self-sustaining but require continuous support not to lose momentum. Hence, and similar to co-management, a long-term perspective is argued to benefit cluster performance. However, embracing a long-term perspective in farmer clusters is reported to be hampered by short CSFF funding periods of 3-5 years. Altogether, members' commitment to their clusters is argued to be reasonably well developed. It appears, however, that commitment does not constitute a success factor on its own but is predominantly shaped through clusters' performance with other factors considered previously. These include the provision of sufficient and sustained incentives, empowering cluster members to influence group activities, or communicating group outcomes through participatory monitoring.

Group characteristics (2) - Shared interests. Some issues of group homogeneity have been discussed previously, such as power relations, ensuring efficient communication through a common language, or cluster members' relatively strong resemblance in terms of educational backgrounds. A related but distinct factor of success in the ACM literature represents the consistency of members

interests. Naturally, some degree of harmony regarding the interests involved is crucial for collaboratively deciding on group measures. Farmer clusters appear to generally attract land managers with related areas of interest and environmental values, as dissension or conflicts within clusters are seldom reported (see factor group 'Conflict resolution' in section 6.2.2). This notion is confirmed by Nye (2018), who found that participating farmers in the author's sample are predominantly driven by environmental reasons and, to a minor degree, influenced by financial concerns. Thus, clusters' homogeneity in terms of involved interests is assumed to promote efficient and goal-oriented collaborative decision-making and to enable more extensive ecological and social benefits than could be anticipated in case of divergent or conflicting interests between cluster members.

Institutional arrangement (3) - Membership. The explicit definition of cluster affiliation is institutionalised in farmer clusters through the existence of a formal membership. Thus, this factor is met by the cluster approach. Some non-conformance might be asserted in terms of inactive members that do not engage in cluster activities but are tolerated (and not excluded) by their clusters as to potentially foster higher levels of commitment in the future (Nye 2018; Prager 2019). However, no negative consequences of holding disengaged members' in the cluster are reported, and this aspect is thus not deemed significant.

Institutional arrangement (3) - Adaptivity. Issues of cluster adaptivity have been extensively discussed in terms of adapting the participatory process of farmer involvement to unforeseen influences of external or internal drivers (see factor group 'Adaptivity' in section 6.2.1) and the role of monitoring and feed-back processes to inform adaptive management (see factor group 'Adaptivity' in section 6.2.2, respectively). This scope is complemented by the adaptive co-management literature, which found ACM projects benefit from opportunities to experiment with management measures before implementing them on larger scales. If translated to cluster activities, this success factor is linked to AES design variants. Whereas action-based schemes prohibit experimentation with conservation measures by explicitly prescribing the environmental action that is to be implemented, result-oriented AES offer land managers more flexibility in their choice of measures and enables learning by allowing to readjust environmental efforts if results fall short of the anticipated outcomes (see section 4.3). As action-based schemes still represent the most prominent AES variant offered to land managers, this institutional setting of farmer clusters tends to impede experimentation with management measures.

In terms of other group activities such as group events and participatory formats, the factor appears to be well-matched, as the previous sections illustrated how cluster members are enabled to decide upon collective group activities and priorities.

Institutional arrangement (3) - Existence of community organisations. This factor is, again, linked to the configuration of involved interests in ACM projects and aims for institutionalising representative bodies that act on behalf of community interests. As farmer clusters' usually do not incorporate decision-making processes that involve parties outside the agricultural community,[18] community organisations are not required.

Institutional arrangement (3) - Accountability. Whereas the evaluative CBNRM literature considered accountability in terms of government representatives being held accountable by community members, the ACM literature recommends mutual accountability of and by all involved partners

18. Exceptions exist: For example, 'associate memberships' for non-farming community participants in one cluster described by Adamson et al. (2020).

based on the agreed formal management arrangement. As with many factors discussed in the previous sections, accountability in farmer clusters is established through the application of agri-environmental schemes and is thus incorporated through clusters' institutional setting. Cluster members decide to enter individual AES and, consequently, assert to implement the mandated environmental measures or achieve prescribed ecological results. Accountability is ensured by CSFF officials monitoring the fulfilment of scheme requirements and, if necessary, withhold or reclaim AES payments. No references are made in the reviewed articles related to more informal means of establishing accountability within clusters (such as evaluating the progress towards the collectively agreed goals). Given that not all clusters and cluster members participate in AES, accountability is not systematically integrated into cluster organisation.

External environment (4) - Resources. Matters of resource availability have been considered across the previous two sections, but were as yet not aggregated to form a holistic evaluation of clusters provision with financial, human, or technical resources. This passage aims to close this gap.

The role of financing in the cluster concept concerns two different dimensions. The first constitutes funding for the facilitators' activities and has been considered in the 'Facilitation' passage in section 6.2.1. It was found that facilitators generally receive sufficient funding to support their activities within their clusters. A major constraint of CSFF funding emerged across all articles regarding facilitators not being able to finance 1-to-1 advice to land managers. Other limitations include funding periods of 3-5 years being perceived as too short to enable meaningful social and ecological outcomes (factor 'Match scales' in section 6.2.1) and the inflexibility of CSFF to compensate for particular activities (e.g., events aiming for conflict resolution, monitoring). The second dimension of funding represents funding offered to individual cluster members in the form of AES to compensate for costs related to environmental efforts. Issues of AES funding are described linked to the incentive-structure in section 6.2.1 and predominantly concern delays in the disbursement of payments. Another limitation mentioned by land managers across the reviewed articles represents scheme inflexibility to cover the groups' environmental actions. This is frequently reported to be compensated by accessing external sources for funding, including other agri-environmental programs but also private supplies (e.g., partnerships with local water companies) (Adamson et al. 2020). No reference is made in the reviewed articles regarding AES compensation being too small to cover the costs of implementing environmental measures, indicating that funding levels in existing scheme options are sufficiently high.

A lack of human resources is frequently reported in terms of (a) time availability of cluster members themselves, and (b) related to the high demand for volunteer work to realise thorough on-farm monitoring of outcomes (see passage 'Adaptivity' in section 6.2.2). The former is described as a "leading constraint" for collaborative efforts in the clusters examined by Nye (2018, 49) and likely contributes to the moderate attendance rates at group events in some clusters or the occurrence of disengaging farmers. The latter comprises both time constraints, as facilitators and land managers report being unable to raise the time required for self-monitoring on their farms (Adamson et al. 2020), and a lack of expertise about accurately conducting and interpreting biodiversity monitoring trails (Nye 2018). Finally, the previous section found that another area of limited resource availability constitutes public outreach, as cluster members report initiating

community participation on their own costs (factor 'Outreach' in section 6.2.2). Apart from other factors such as the group's age (relatively young clusters are reported to focus on cluster formation and orientation prior to engaging in public outreach, Nye 2018), this lack of formal support of community involvement through CSFF or AES funding likely contributes to the considerable share of clusters that as yet refrain from reaching out to the public (i.e., 40 % of clusters, according to Jones et al. (2020)).

Overall, clusters appear to be mostly well supplied with resources to pursue their group goals, with the most urgent shortcomings being related to CSFFs inability to cover 1-to-1 advice and lack of support to engage in monitoring and surveying.

6.3. Interplay with AES knowledge

The final part of the qualitative data analysis is not concerned with farmer clusters' fit with NRM approaches but considers its interplay with factors that shape farmers' willingness to participate in agri-environmental schemes. Introducing AES to the model of co-operative natural resource management thus offers no additional informational value and is, given AES' function as an economic incentive rather than a holistic management approach, not feasible conceptually. If anything, it may be remarked that AES account for the more formal boundary of the cluster concept represented through the second model dimension (see section 6.1).

Consequently, the interpretation of factors presented in this section differs from previous results. The factors listed in Table 13 were found to increase farmers probability to participate in AES (see section 5.5). In the following, the farmer cluster literature is analysed in regard to how clusters relate to those factors. This section thus aims to elaborate whether and how farmer clusters promote, attenuate or complement known drivers for farmers engagement with AES. Against this objective, this section follows a similar line of argumentation to the previous parts. The empirical evidence provided by the analysis is presented subsequently. This evidence is then subjectively translated into a simple evaluation system that displays farmer clusters' interplay with the respective factors as presented in Table 13. The applied indicators are:

-1	The factors influence on farmers willingness to participate in AES is attenuated and/or complemented through cluster activities.
0	Farmer clusters do not relate to this factor, or clusters influence is ambivalent.
1	The factors influence is amplified through the cluster concept.
n.d.	no data / The analysis did not provide evidence to evaluate this factor.

Table 13: Farmer clusters' relation to factors promoting AES enrolment

Influencing factors	**Evaluation**			
	-1 [a]	*0* [b]	*1* [c]	*n.d.* [d]
Farm structure and characteristics (1)				
Large farm size			1	
Rather extensive farming practice				n.d.
Low level of fixed assets *	-1			

Table 13: (continued)

Low level of family labour *			n.d.
Farmer characteristics (2)			
Higher level of education			n.d.
Young age		0	
Prior participation in AES		1	
Existence of successor / children *			n.d.
Positive attitude towards environment and/or environmentally friendly farming		1	
Forward looking self identity		1	
Trust in government *		0	
Social pressure / participation of neighbouring farms *		1	
Perceived source for personal satisfaction (e.g., learning new skills, moral/ethical motives, ...)		1	
(1) and (2): Factors linking the farm- and the farmer-level			
Farm income constitutes moderate proportion of total household income		1	
High proportion of landed property			n.d.
AES design (3)			
Fixed transaction and compliance costs impede participation of smaller farms	-1		
Higher per hectre payments that cover costs of participation	-1		
Availability and quality of information to farmers on AES		1	
Technical advice / extension services		1	
(1) and (3): Factors linking AES design with farm characteristics			
Goodness of fit in regard to AES options and farm characteristics		1	
(2) and (3): Factors linking AES design with farmer characteristics			
Goodness of fit in regard to farmers management plans and AES requirements			n.d.
Institutional and policy design (4)			
Clear institutional design and stable policy for future periods		0	

[a] - Factors influence is attenuated through cluster activities.

[b] - Farmer clusters do not relate to this factor, or clusters influence is ambivalent.

[c] - Factors influence is amplified through the cluster concept.

[d] - no data. The analysis did not provide evidence to evaluate this factor.

* - Significance of factor is contested in the AES literature.

Farm structure and characteristics (1). Section 5.5 revealed that farmers with larger holdings are more likely to enter AES due to economies of scale that provide relatively larger profits and thus the flexibility to take land out of highly productive farming systems. Additionally, more extensive acreage naturally holds potentially more land eligible for scheme enrolment, thus further advantaging larger farm sizes. The analysis displayed that this imbalance is not rectified by entering a farmer cluster. On the contrary, farmer clusters are shown to exacerbate this asymmetry in multiple ways. First, CSFF requirements prescribe an aggregated cluster size of 2000 ha, thus favouring clusters composed of relatively large farms and forcing farmer groups composed of

smaller holdings to recruit more members.[19] Further, the bidding procedure applied for individual CS scheme funding (that is promoted through cluster membership by endorsing a 20 % uplift on members' application scores) favours applications that offer to enrol relatively more land as individual scores are calculated based on the quantity of the option applied for (see RPA 2021, 167 for details on the CS scoring procedure). Naturally, land managers of larger holdings can enrol more land into AES and are thus more likely to receive funding through CS Mid Tier or High Tier agreements. Finally, Nye (2018) found that land managers with larger property tend to engage more intensely in cluster activities, while owners of smaller acreage are more likely to be restricted by time constraints. Hence, it is concluded that cluster membership and engagement is facilitated if holding sizes are relatively large.

The intensity of cluster members' farming systems is not sampled by any of the considered articles. As farmers' motivation to enter a cluster is reported to be predominantly driven by environmental concerns (Nye 2018), it is assumed that cluster members' tend to uphold environmental values and consequently apply rather extensive farming practices. However, as this cannot be confirmed by the empirical data under consideration, no evaluation of this factor is proposed.

Some references to the utilisation of assets within clusters are made in cluster reports by Adamson et al. (2020), with multiple clusters documenting to share machinery between peers and thus enabling cost savings. This observation might, to some degree, counterbalance the finding from the AES literature that heavy investments into machinery potentially renders AES participation economically unviable if said investments can be allocated and shared across cluster members. Hence, cluster membership might enhance the AES uptake of farmers with high levels of fixed assets.

The reviewed articles do not consider the extent to which cluster farms utilise family labour. Hence, the factor 'Low level of family labour' cannot be evaluated.

Farmer characteristics (2) - Higher levels of education. No references are made across the articles about the education levels of farmers participating in a cluster. Even though it can be anticipated that educational degrees of cluster members are above average, given that environmental-friendly attitudes are frequently correlated with higher educational levels, this can not be confirmed by the analysis.

Farmer characteristics (2) - Young age. Similar to the AES literature, the evidence for farmer clusters appeal for particular age ranges is ambiguous. Nye (2018) illustrates the age profiles of the farmers in her sample of nine clusters as depicted in Figure 10 b). Compared to the average age profile of English' farmers derived from Farm Business Survey data[20] (Figure 10 a)) it appears that clusters collate relatively older farmers than the nationwide average. This observation might be linked to clusters reporting particular positive outcomes of cluster activities for older farmers in terms of socialising with peers (Adamson et al. 2020). However, three clusters in Adamson et al. (2020) likewise stress the importance of their group in involving younger farmers in group activities. Additionally, given that the age profiles in Figure 10 are aggregated along different age groups (i.e.,

19. The average farm size in the UK is 86.4 ha (https://www.macintyrehudson.co.uk/insights/article/what-size-is-the-average-farm, accessed 22 September 2021). Thus, 24 holdings of average size would be required to initiate a CSFF funded cluster.

20. The data was aggregated using the FBS Data Builder of the Department of Environment, Food & Rural affairs: http://farmbusinesssurvey.co.uk/DataBuilder/Default.aspx?Menu=Menu&Module=Variables (accessed 23 September 2021)

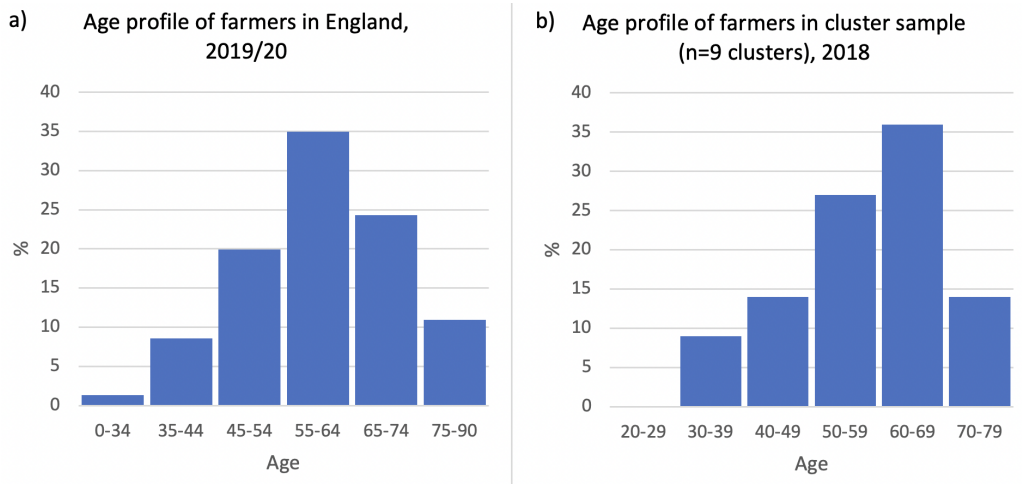

Figure 10: Age profile of a) farmers in England and b) cluster members in sample of Nye (2018) (Source: Own illustration based on data from a) the Farm Business Survey, DEFRA and b) Nye 2018, 61)

comprising whole decades vs starting mid-decade), some statistical distortion potentially biases the visual impression. Overall, no univocal trend in cluster members' age levels is evident.

Farmer characteristics (2) - Prior participation in AES. The factor 'Prior participation in AES' appears to be confirmed by the analysis' results. 96 % of facilitators in the facilitator survey report involvement of their group with AES prior to CSFF funding (N. Jones et al. 2020, 125), indicating that a majority of members had land enrolled in AES before entering into a cluster. This aligns with observations that cluster farmers tend to be environmentally engaged and potentially raises concerns regarding clusters' efficiency in reaching out to farmers that as yet prescribe to rather conventional agricultural practices. Hence, farmer clusters tend to attract land managers with a predisposition towards environmental conservation, who frequently participated in AES prior to their cluster involvement. Thus, clusters likely pool farmers with former AES experiences.

Farmer characteristics (2) - Existence of successor / children. The reviewed articles do not allow for any valid interpretations regarding clusters interplay with farmers' family status in terms of increasing the probability to participate in clusters if children or a successor exists. While Nye (2018) reports that more than half of the land managers in the author's sample stated to have a successor, this observation cannot be linked to cluster influences due to a lack of a non-cluster control group. Generally, the author argues that handing land over to a successor who agrees with the group's environmental goals is crucial for achieving sustained environmental benefits, particularly as one farmer in the sample had experienced rapid destruction of his conservation efforts by a new owner (ibid.).

*Farmer characteristics (2) - Environmental attitudes.*The AES literature asserts that farmers' participating in AES disproportionately hold positive attitudes towards the environment and environmentally sensitive farming practices and are thus predisposed to engage in environmental efforts. The analysis revealed that this is not attenuated through cluster membership, i.e., clusters are not found to significantly address land managers who prescribe to a conventional, productivity-focused farming approach. Two aspects need to be differentiated in this regard. The first concerns farmers' environmental attitudes *prior* to entering a CSFF funded farmer group. The reviewed articles

unanimously report that farmers entering into clusters predominantly uphold environmental values. This is, for example, indicated by members' frequent participation in environmental initiatives prior to being a member of a farmer cluster. According to the facilitator survey, only 9 % of clusters (6 out of 67) have not engaged in environmental initiatives before being funded through the CSFF (N. Jones et al. 2020, 125).[21] Farmer cluster members' predisposition towards environmental conservation is additionally noted by Nye (2018), as a majority of farmers state environmental concerns as the main driver for entering a cluster. Finally, this notion is confirmed by the land manager interviews, concluding that most farmers "had an interest in environmentally friendly farming practices" (59).

The second aspect regards attitudinal changes of cluster farmers due to group activities. The transition of value systems constitutes a frequently cited outcome in both Nye (2018) and cluster reports in Adamson et al. (2020). Interestingly, changes in attitudes are not only reported in relatively small and strictly farmer-led groups but also in a cluster comprising 55 members, thus demonstrating that large groups are capable of inducing changes in attitudes and (potentially) behaviour (Adamson et al. 2020).

In summary, clusters can be anticipated to impact production-led members positively by promoting environmentally friendly attitudes. However, as clusters, as yet, predominantly attract land managers who are predisposed to environmental conservation, clusters potential in this regard likely has not yet been fully exploited.

Farmer characteristics (2) - Forward looking self identity. The identity traits argued to enhance the probability of AES participation identified by Cullen et al. (2020), i.e., being forward-looking, open towards new farming practices, integrating diverse types of knowledge and adopting a long-term perspective on agricultural management, are occasionally mentioned in several articles. For example, facilitators in Jones et al. (2020) describe positive effects in their groups by embracing innovation and adopting a pro-active attitude towards tackling environmental issues. This is confirmed by an interviewed farmer describing his cluster as "really forward thinking" (N. Jones et al. 2020, 63) and stressing the role of the facilitator in initiating and sustaining this spirit. While the empirical evidence in terms of explicit references to the described identity traits is limited across the articles, it is expected that they are promoted through cluster activities, given that the essence of cluster objectives constitutes making positive changes to farmers' interaction with their natural environment.

Farmer characteristics (2) - Trust in government. Evidence for cluster members trust in government is scarce. One detrimental outcome is reported regarding farmers' attitude towards governmental schemes, as late AES payments are reported to diminish farmers motivation to partake in other agri-environmental programs (Nye 2018). On the other side, partnerships between clusters and government authorities are documented to have increased members' levels of trust (N. Jones et al. 2020). Overall, clusters are expected to affect members' perception of the government only moderately.

Farmer characteristics (2) - Social pressure. Some effects of peer-to-peer pressure on cluster members behaviour can be confirmed based on the analysis results. Nye (2018) reports social

21. However, querying prior engagement in environmental initiatives cluster by cluster raises questions concerning the informative value, as most groups were not pre-existing (88 %, N. Jones et al. 2020, 118) and it remains unclear how many members were involved in environmental initiatives for the facilitator to affirm this question.

pressure resulting in higher attendance rates at cluster events presupposed that clusters are not too large for all members to know who belongs to the group. Furthermore, the author documents the occurrence of 'friendly competition' amongst members in striving to attract desired species on farmers' land that are abundant on neighbouring holdings. More than 20 % of surveyed facilitators assess peer pressure as 'very important' to achieve group goals and almost 50 % as 'somewhat important' (134). Hence, social pressure plays a role in shaping farmers' motivation to engage in their cluster and potentially enrol in AES, though it is not described as the main motive for cluster participation (ibid.).

Farmer characteristics (2) - Source for personal satisfaction. Farmer clusters' performance in contributing to members' well-being and personal satisfaction have been considered related to the incentive structure in section 5.2.2. Altogether, clusters were found to enhance members satisfaction levels by multiple means, particularly if engagement levels are high. As cluster membership frequently entails AES enrolment, this likely promotes scheme uptake.

(1) and (2): Factors linking the farm- and the farmer-level - Income generated on-farm. Matters of income generation and diversity of income flows have been considered in section 5.3 (factor group 'Dependence'). It was found that higher proportions of income generated off-farm tend to increase farmers' ability to invest time and efforts in their clusters, thus confirming this factor. Given that being engaged in a cluster requires more efforts and resources than mere enrolment in AES (e.g., attending to group events), it is anticipated that this aspect is even more pronounced within clusters compared to non-cluster farmers who participate in schemes.

(1) and (2): Factors linking the farm- and the farmer-level - High proportion of landed property. This factor has been considered related to the CBNRM findings about securing enabling property and power regimes (factor 'Rights' in section 5.3). Evidence of clusters appeal to tenant farmers is scarce. While clusters with members under tenancy agreements evidently exist, the reviewed articles do not extensively deal with issues of tenancy. It might be anticipated that clusters promote AES enrolment of tenancy farmers by enabling knowledge exchange and mutual support among tenant members, but this is not covered by the analysis.

AES design (3) - Fixed costs and repercussions for small farms. This factor describes the disproportionate burden smaller farms are challenged with when implementing AES due to fixed costs. Farmer clusters likely attenuate this disadvantage by lowering members' overall transaction costs, e.g., by facilitating information gathering and knowledge enhancement through group events and facilitator or expert speaker input or sharing investments into farming equipment among multiple cluster members. Naturally, clusters do not reduce transaction costs exclusively for smaller farms but for all members and thus do not counterbalance disparate transaction costs for land managers with varying farm sizes. However, the impact of this inequality on farmers decision to enrol land in AES is likely reduced when overall transaction costs decrease. Thus, clusters are argued to attenuate the negative effect of fixed transaction costs on smaller farms.

AES design (3) - Higher per hectare payments. Naturally, higher AES payments promote scheme uptake by farmers. In terms of clusters effect on this factor, it is argued that the need for financial compensation is reduced through clusters in offering non-financial benefits to members that substitute mere economic incentives. This effect has been described in relation to the incentive structure of farmer clusters in section 5.2.2.

AES design (3) - Availability and quality of information on AES. As has been considered across many previous success factors, the provision of guidance and support regarding AES application and implementation constitutes a major focus and benefit of cluster activities (see, for example, the 'facilitator'-factor in section 5.2.2 or the factor 'state support' in section 5.3). Besides the facilitator's role in promoting and supporting members scheme application and delivery, the analysis revealed how input provided by organisations such as Natural England, the Royal Society for the Protection of Birds (RSPB) or the Country Land and Business Association (CLA) have helped cluster members in enhancing their knowledge and setting up scheme applications (Adamson et al. 2020; N. Jones et al. 2020). Overall, the urgent need to improve information dissemination about AES among farmers identified in the AES literature appears to be realised to a great extent through the cluster concept.

AES design (3) - Technical advice and extension services. This factor is related to the factor described above but broadens the scope by not only considering the provision of information but extension services in general. Extension services are hereby defined as the provision of "human capital-enhancing inputs" (Anderson and Feder 2007, 2345) to farmers in order to enhance their knowledge, guide decision-making and empowering farmers to identify and realise their individual goals (ibid.). Agricultural extension is thus closely related to human 'capacity building' discussed in section 5.3 and implemented in clusters both through the facilitator and partnerships with external public and private organisations (N. Jones et al. 2020).

(1) and (3): Factors linking AES design with farm characteristics - Goodness of fit. The analysis confirmed the importance of 'goodness of fit' in terms of providing AES options that agree with characteristics of farmers' lands. Frustration and resentment were reported resulting from poor suitability of available scheme options that not only hampered AES uptake (Adamson et al. 2020; N. Jones et al. 2020) but were also attributed to farmers choice not to participate in a cluster (Nye 2018). However, the cluster reports in Adamson et al. (2020) document that training events had helped farmers to improve the goodness of fit of their selected schemes (Adamson et al. 2020). Furthermore, almost 80 % of facilitators partaking in the survey reported changes in CS applications by some or most members of their clusters as a result of training, indicating that a significant portion of cluster members identified and selected scheme options with increased goodness of fit (N. Jones et al. 2020, 128). One potential for improvement emerged, as the facilitators' inability to give 1-to-1 advice likely impedes assessing individual farms suitability for particular scheme options if the land exhibits characteristics that are unique within a cluster.

(2) and (3): Factors linking AES design with farmer characteristics - Goodness of fit. No cases of farmers refraining from AES implementation because of contrastive management plans are reported in the reviewed articles. Whether this is due to cluster influences, i.e., farmers adopting management plans that align with the group's environmental objectives, or due to a general absence of farmers with conflictive agricultural agendas in most operating farmer clusters, can only be hypothesised.

Institutional and policy design (4). The importance of this factor is confirmed by the analysis, as the adaption to future farming policy is cited not only as a motivation to enter a cluster (Nye 2018) but also set as a group priority in some clusters (N. Jones et al. 2020). A significant cause for uncertainty emerged across the articles in terms of the UK's affiliation to the EU, with multiple

clusters reporting discussions with local ministers and a reluctance of members to enter CS schemes due to the UK's potential exit of the EU (Adamson et al. 2020; N. Jones et al. 2020). One facilitator reports members requesting local interpretations of national policy, indicating that policy implications at the farm level are not generally evident to land managers. While facilitators are likely able to improve farmers understanding of policy issues in this regard, it is doubtful whether clusters significantly helped land managers to cope with the uncertainty that accompanied the UK's exit of the EU.

7. Discussion

This section aims to reconcile and interpret the findings presented in the previous parts in light of this thesis' research question. It thus elaborates how approaching the concept of farmer clusters from a natural resource management perspective enables a more refined understanding of cluster dynamics and outcomes. Additionally, it considers farmer clusters interplay with public incentives to adopt environmentally-friendly farming methods through AES. Both sections are subsequently translated into policy recommendations. And finally, the findings are scrutinised against potential limitations of method and set in the broader context of academic research on collaborative farmer groups to provide a lookout towards needs for future investigation.

7.1. Results

PNRM success factors. Recommendations of the PNRM literature are to a high degree internalised in cluster (self-) management, indicating clusters' success in enabling thorough and meaningful farmer involvement. As summarised in Table 9, the majority of (applicable) success factors in participatory management are mostly or fully matched by most farmer clusters (15 out of 23 factors), whereas 7 are partially met, and only one factor uncovered a significant (but not insuperable) shortcoming of the cluster approach. In evaluating clusters agreement with the PNRM literature, it deems expedient to differentiate factors linked to the formal institutional setting of farmer clusters from rather informal and less stipulated group activities. As described in section 6.1, the former is predominantly shaped by requirements set through CSFF and individual AES funding. Across the analysis, this institutional context emerged as a driving force for building - and frequently hampering - cluster outcomes. On the enabling site of clusters' institutional setting, the facilitators' role surfaced as a crucial and essential component to farmer clusters' success. The analysis showed that facilitators are indispensable for beneficial cluster outcomes as they build and sustain the momentum of their group, focus group efforts and training on collectively decided goals, and not least promote members' AES uptake by providing support and identifying suitable scheme options. Positive impacts on clusters performance are additionally generated by the institutionalised boundaries in terms of the provision of milestones and deadlines regarding AES delivery, defining group goals as priority areas in Facilitation Plans, promoting knowledge integration through CSFF guidance, and contributing to the incentive structure of clusters by offering economic benefits to cluster members (i.e., 20 % uplift on AES application, support for AES delivery and disbursement, and knowledge on AES funding opportunities provided by the facilitator).

On the other side, however, most limitations and deviations to PNRM success factors are linked to CSFF and AES regulations. This includes facilitators inability to receive funding for giving 1-to-1 advice to farmers', a complex language in funding regulations impeding members' understanding and compliance, the limited adaptive capacity of clusters if alterations to existing schemes are required, and frustration arising due to delayed disbursement of AES payments. The single factor not met by farmer clusters (i.e., matching the temporal scales of CSFF funding to both targeted ecological and social processes) is additionally induced by the institutional setting in restricting facilitator funding periods to 3-5 years.

The informal part of cluster activities, i.e., events held by the cluster, means of collectively

deciding on group matters and in-cluster communication, are generally rated higher by facilitators and land managers and appear to be predominantly linked to much-valued social benefits of cluster membership. Bringing farmers together in a non-obligatory manner, being flexible in adapting group activities according to members' preferences, and establishing a notion of a self-induced initiative in farmers' sole ownership is reported to enhance members' identification with the group and to foster their engagement (Nye 2018). This is particularly shown by Nye's (2018) finding of farmers' reluctance to be branded as a 'cluster' and their wish to be perceived as an individualistic and self-dependent farmer group. Consequently, some degree of flexibility and openness in cluster management appears to be crucial to give space for farmers engagement to unfold along with their own preferences instead of predefining means for all steps of collaborative decision-making. However, this naturally also provides room for inter-cluster heterogeneity and entails some clusters diverging from 'ideal' participation as outlined through the PNRM success factors. This was, for example, noted in terms of a lack of transparency in some clusters, where members were not aware of group objectives or the lack of systematic (social) feedback processes in most clusters. Overall, however, the informal dimension of cluster operation appears to be highly beneficial for generating desirable group outcomes.

Compared to typical PNRM projects, clusters absence of needing to deal with significant power imbalances and conflicts became apparent. This likely contributed to clusters' high performance in other success factors, as two-way communication, mutual learning, and trust-building are likely enhanced in a setting characterised by equality and mutual respect instead of competing interests and power imbalances.

CBNRM success factors. Farmer clusters' agreement with CBNRM success factors is more ambiguous and complex. At first sight, it can be noted that the vast majority of applicable factors is either fully realised in farmer clusters or at least partially implemented. This particularly holds true for characteristics of the resource system under consideration, i.e., the clusters agricultural holdings, which were found to be relatively favourable to community-based management due to manageable area sizes, well-defined boundaries, low levels of mobility, and a high financial value of the resource acting as an incentive to preserve the lands productive capacity in the long term. On the other hand, a considerable portion of CBNRM success factors does not conceptually apply to farmer clusters. This particularly includes the necessity and means of rule-making and enforcement, which was not found to be required or beneficial for cluster dynamics, factors describing communities relation to subordinate authorities (e.g., ensuring accountability and locally devised rights), or the role of technology in shaping communities interaction with and demand for a resource.

The CBNRM literature also uncovered apparent strengths of the cluster approach, both in utilising and boosting social capital within clusters through group activities and enhancing farmers capacity required for scheme application and delivery. Factors not met by the cluster approach are also evident but were frequently not understood to point to an actual limitation of the cluster approach but are linked to conceptual differences of farmer clusters and community-based management projects. This includes, for example, the lack of interdependence amongst group members representing a potentially missed opportunity to further incentivise members engagement with the group. Given the extensive incentive structure established through cluster membership that encompasses social, individual, economic and environmental drivers, the lack of interdependence is not anticipated

to hamper clusters efficiency considerably. On the contrary, as the analysis showed that cluster engagement is predominantly driven by positive incentives such as social capital building and having a beneficial impact on the landscape, the introduction of an incentive that is based on dependency and a fear of negative repercussions can be anticipated to derogate clusters positive momentum. The only factor that is not met and is understood to impact farmer clusters performance negatively concerns their articulation with external markets. Market forces are frequently reported to favour intensive farming practices and thus render cluster participation the economically less viable option for many farmers. Furthermore, mixed performance of clusters was asserted regarding the ecological monitoring of agricultural holdings, that is - as yet - not realised systematically across clusters or institutionalised through CSFF funding, resulting in uncertainty on farmers' side about their progress towards group goals and additionally missing the opportunity to foster engagement by communicating cluster achievements to members and the wider public.

ACM success factors. The consideration of ACM success factors proved to add little additional value to the analysis due to the broad overlap of success factors in community-based management and co-management. Reasons for this apparent lack of accentuation in the co-management literature have been touched upon previously (section 5.4) and will be elaborated more thoroughly in the subsequent discussion of methods. Overall, the co-management literature stood out compared to CBNRM in lacking consideration of factors linked to resource utilisation (such as a high financial value of the resource to its users, communities dependency on the resource system, or being able to store resource commodities). This was interpreted in terms of ACM projects substituting resource utilisation as a driver for community engagement and compliance by including state representatives that add a measure of formality and authority to the project, as well as the role of formal arrangements in ensuring participants ongoing involvement and realisation of agreed tasks. However, no new perspective on cluster dynamics was offered by the ACM literature. Instead, a shift of focus could be noted in explicitly addressing some factors that were implicitly considered across multiple factors in the PNRM or CBNRM literature. This includes, for example, the supply with financial, human, and technological resources that constitute a stand-alone factor group in the ACM literature, or the individual consideration of group cohesion, trust, respect, and social networks instead of bundling those elements into one 'social capital' item. In contrast to the initial expectations, the formal arrangements between all involved partners as a key characteristic of ACM projects are not mirrored in ACM success factors, thus preventing a consideration and comparison of ACM findings regarding the role of AES agreements in farmer clusters. Altogether, the consideration of (adaptive) co-management provided only limited new insights into the dynamics shaping farmer cluster outcomes.

Interplay with factors promoting AES uptake. The final part of the analysis considered clusters relationship to factors that are found to promote AES uptake of farmers. As Table 13 summarises, the analysis revealed that clusters promote a variety of factors associated with higher AES adoption rates (i.e., 10 factors), while a smaller subset of three factors is attenuated or complemented through cluster activities. It needs to be stressed that a factors classification as one or the other (i.e., promoting the factors influence or attenuating it) does not necessarily correspond to an evaluation in terms of representing a desirable or detrimental impact. Instead, the factors and clusters influence on them need to be considered and evaluated individually. For example, clusters

were found to exacerbate an imbalance in AES uptake rates' dependence on farm sizes by favouring the participation of owners of relatively large lands, who are more likely to receive AES funding and can commit more time and money to group efforts. Thus, clusters reinforcing influence on this factor represents a rather unwanted consequence. On the other hand, clusters were found to attenuate the burden posed by fixed transaction costs on smaller farms in decreasing the overall transaction costs cluster members face, thus counterbalancing the factor above and illustrating the positive effect of an attenuating factor. Overall, a relatively large influence of farmer clusters on AES uptake rates can be attested based on the evaluation of factors in Table 13. Out of 22 factors, 13 are significantly influenced through cluster operation. Only three detrimental influences are promoted through cluster activities,[22] whereas ten desirable factors are supported. These include, for example, the establishment and fostering of environmentally friendly attitudes and forward-looking identity traits, exercising social pressure and friendly competition amongst members, or providing quality information on AES requirements, application, and delivery, as well as agri-environmental education to farmers.

Recommendations. This thesis was challenged by a large quantity and diversity of factors that are frequently associated with the success of participatory management, community-based management, co-management or AES adoption rates (see also the subsequent section). The evaluation of farmer clusters agreement with said factors of success as presented in Tables 9 to 13 was seldom one-dimensional or unambiguous, and frequently factors are predefined through the contextual setting and are thus outside of direct influence by cluster members, facilitators, or policymakers responsible for CSFF or AES design. While some factors have been highlighted above in an exemplary manner to illustrate analysis' results, presenting all findings in this way is not feasible in the scope of this section. Instead, areas for potential improvement uncovered through the consideration of success factors are aggregated subsequently to provide a comprehensive set of recommendations deduced from the PNRM, CBNRM, ACM and AES literature that might inform future policy and cluster management.

1. Ensure that official documents concerning CSFF or AES guidance and requirements are written in a comprehensible and clear language to promote cluster members' understanding and compliance. If needed, issues of uncertainty or misunderstanding might be addressed through training events.
2. Communicate cluster goals and the objectives of CSFF funding to all members to avoid false perceptions and expectations concerning the purpose of the cluster.
3. Feedback processes to monitor members satisfaction with group activities and the direction of collaborative efforts should be incorporated to ensure members' sustained approval and engagement.
4. Consider the use of milestones and deadlines apart of scheme requirements to focus group efforts and motivate the timely implementation of measures.

22. Besides clusters tendency to favour membership of relatively large farms, this includes their limited ability to address farmers that have not as yet been involved with environmental conservation (factor 'Prior participation in AES') and the promotion of cluster membership and engagement for farmers who generate only moderate portions of their income on-farm (factor 'Farm income constitutes moderate proportion of total household income').

5. If a chair farmer or steering group is in place, define corresponding tasks and duties to the respective members and the group itself to ensure a shared understanding of the role and the in-cluster distribution of functions and obligations.
6. Collaborative environmental efforts by clusters should be promoted by the institutional setting, i.e., by offering schemes that actively demand farmer collaboration for scheme delivery (see section 4.3.4 for potential scheme designs).
7. Negative incentives should be avoided as best as possible. This particularly includes ensuring the timely disbursement of AES payments and equal chances for both larger and smaller farms to receive AES funding (the latter is as yet prevented by calculating CS application scores based on the quantity of applied scheme options).
8. Provide facilitator funding for giving 1-to-1 advice to cluster members.
9. Ensure funding security to clusters to enable the achievement of both social and ecological outcomes. This frequently necessitates funding periods that exceed 3-5 years.
10. Raise in-cluster awareness about the influence of cluster size on group dynamics, particularly concerning the increasing challenge of meaningful participation of all members for larger group sizes. Potentially nudge facilitators towards promoting manageable farm sizes or provide knowledge regarding means for member involvement in larger clusters, such as forming subgroups to work on specific topics or implement particular measures. Consider abolishing incentives promoting larger groups' formation, i.e., by decoupling facilitator funding from the cluster size and reducing the required minimum area covered to be eligible for CSFF funding.
11. Raise awareness of environmental challenges in the agricultural community and the wider public to incentivise cluster membership and to enhance public acknowledgement and appreciation of farmers' environmental efforts.
12. Institutionalise environmental monitoring on the ground by providing funding for conducting monitoring trails. Furthermore, communicate monitoring as an integral part of cluster activities to enable mapping the outcomes of cluster activities and tracking clusters' progress towards their environmental goals.
13. Enhance clusters' motivation for involving the wider public by providing funding for public outreach. This may include finances for conducting public events, hosting and maintaining a website or a social media presence, or publishing press releases in local newspapers.
14. Consider introducing means for holding cluster members accountable, for example, by introducing cluster management plans that specify cluster goals, environmental measures and members' responsibilities.
15. Try to address farmers through recruitment efforts who as yet do not commit to environmentally friendly farming to ensure additionality in terms of AES uptake (as many farmers in operating clusters have participated in AES prior to group formation).

7.2. Limitations of Method

Limitations of method in this thesis may be asserted in regard to three distinct areas: the process of coding, data constraints, and issues of scope.

Coding. As qualitative data analysis necessarily entails subjective decision-making and evaluation concerning data substance, validity, relevance, and interpretation, results are naturally at risk of being biased by the coder's subjective perception, attitude, and personal or professional background. Qualitative data analysis methodology thus promotes means for ensuring inter-rater reliability such as recoding texts by multiple researchers and discussing and reconciling differences between coders (Belotto 2018). Given the function of this study as a masters' thesis and associated limited time availability for time-consuming recoding, all articles were solely coded by the author. Thus, the author's subjective evaluation likely influenced the analysis' results, particularly given the extensive numbers of codes under consideration that potentially led to relevant passages being overlooked occasionally. However, this is not anticipated to have a radical impact on the analysis as a thematic approach focusing on the presentation of data (see Method-section) is argued to be less prone for subjectivity-induced inconsistency than more abstract or evaluative coding methods. Nonetheless, multiple codings of a sample of articles to ensure inter-rater reliability would have benefitted this study in strengthening confidence in the analysis' findings.

Data. This thesis is challenged by multiple issues of data constraints. First, the evaluative CSFF literature (particularly N. Jones et al. 2020) is predominantly based on results of an online facilitator survey sent to all 98 operating (CSFF funded) farmer clusters in 2019. Two thirds (n=67) of facilitators answered the survey, thus representing a considerable response rate and constituting a valuable database for this thesis' analysis. However, Jones et al. (2020) anticipate that the most engaged facilitators likely answered the survey, and answers might be thus biased towards overly enthusiastic responses. This is further amplified given the objective of the survey to evaluate the outcomes and performance of the cluster approach and particularly the Facilitation Fund by the CSFF financier, i.e., the organisation Natural England. It is assumed that facilitators were aware of the survey's purpose, which likely contributed to the remarkable response rate and potentially animated facilitators towards giving what they assumed to be 'desired' answers to ensure Natural England's continued financial support. And finally, some concerns arose regarding the questionnaire's design, as multiple questions included predefined answers from which participants were asked to select all that apply (e.g., to identify cluster outcomes). This might have led to facilitators selecting more outcomes than they would have been aware of if confronted with an open question, thus potentially over-representing the relevance of some outcomes. However, given that the analysis was based on multiple case studies and reports that considered both facilitators' and farmers' perspective on cluster dynamics and outcomes (see Table 2), this potential shortcoming in data acquisition is not anticipated to have biased the thesis' findings significantly.

Another potential limitation of data is linked to the differentiation of CSFF and privately funded farmer clusters. As presented in the methods-section 2, the literature review on farmer clusters focused on clusters funded through the CSFF and, for the most part, did not include privately funded clusters such as the piloting farmer clusters that formed prior to the CSFF introduction in 2015 (these are considered, e.g., by Bennet et al. 2015 and Thompson, Dent, and Watts 2015). This focus was set intentionally to ensure comparability of results across the considered articles

and to serve the objective of linking cluster outcomes to the institutional setting resulting from the CSFF. On the other hand, this entails the under-representation of privately funded clusters in this analysis and raises some concerns regarding the relevance of said clusters for the cluster movement. Evaluating the consequence of this focus poses challenges, as the number of operating privately funded farmer groups is unknown to the author. Nye (2018) reports 98 CSFF and two privately funded clusters operating at the time of writing, indicating a minor relevance of privately funded groups compared to CSFF clusters in quantitative terms. The farmer clusters website[23], however, documents 117 active clusters in October 2021, indicating that almost 20 % of clusters were not funded through the CSFF.[24] While this may be linked to the timeliness of data presented on the website, the existence of a considerable number of privately funded farmer clusters cannot be ruled out with certainty.

Scope. Issues of research scope in this thesis are asserted twofold: First, the consideration of three approaches for the management of natural resources as well as factors influencing AES adoption rates resulted in an extensive number of success factors whose in-depth consideration somewhat exceeded the feasible scope of analysis in the limited time of this masters' research. For this reason, the presentation and discussion of individual factors might have fallen short of their actual relevance for the cluster concept while at the same time unduly increasing the extent of this thesis. Second, a coarse granularity of method is asserted in the consideration of NRM approaches. This rough granularity is argued to have accounted for the overlap of success factors in the CBNRM and ACM literature (see also section 5.4) that fell short of reflecting more nuanced differences in the management approaches that would have likewise enabled a more detailed comparison with the cluster concept. In this regard, this study did not meet its anticipated outcomes. Potential future research to complement this study and overcome these issues will be discussed in the following subsection.

7.3. Outlook

As yet, publicised literature on the farmer cluster concept is scarce. The only published paper considered in the analysis represents the review by Franks (2019) that concerns the landscape-scale dimensions of agri-environmental programs offered in England and is thus interested in the institutional setting of providing financial incentives for environmental efforts. Hence, a strong need for publications that examine cluster dynamics and management is evident. The grey literature presented in Table 2 covers this to a great extent, applying case study approaches to investigate farmer clusters organisational structure, outcomes, and lessons learned in terms of barriers and enabling factors.

As discussed previously, this study did not entirely meet its anticipated outcomes as approaching success factors of natural resource management in terms of meta-analysis proved to be too coarse-grained to reflect relatively subtle differences in organisational settings of decentralised resource management. For this reason, a comparison of the cluster concept with similar collaborative agri-environmental initiatives in other countries is proposed as a future complement to this thesis

23. https://www.farmerclusters.com, accessed 2 October 2021

24. The last official application round for CSFF funding was conducted in 2017 and resulted in said 98 clusters that are frequently referred to across this thesis (https://www.gov.uk/government/collections/countryside-stewardship-facilitation-funding, accessed 3 October 2021).

to enable a more nuanced analysis. This perspective is argued to potentially cover particularities of agricultural subsistence, as findings are not restricted by the necessity to apply to a diverse range of resource systems or participatory formats encountered across EU member states. Potential agri-environmental initiatives that as yet apply AES at a landscape-scale include the Landcare Programme in Australia, Landcare associations ('Landschaftspflegeverbände') in Germany, or Dutch environmental cooperatives (Rotsches-Ribalta and O hUallachain 2018).[25] Many of these have been subject to extensive academic research (e.g., Prager 2015; Glasbergen 2000; Dijk et al. 2015) and some authors particularly aimed for extracting lessons learned of these approaches to inform the set-up of a related approach in UK ex-ante, i.e., what subsequently became the farmer clusters concept (Franks and Mc Gloin 2007b, 2007a; Emery and Franks 2012). However, an ex-post evaluation and comparison of the cluster concept with agri-environmental initiatives to comparatively assess farmer clusters' performance in delivering environmental outcomes on a landscape scale is as yet pending, thus representing a promising area for future research.

7.4. Conclusion

This thesis approached the concept of farmer clusters to promote landscape-scale agri-environmental conservation by evaluating cluster dynamics and outcomes from a resource management perspective. By assessing clusters' agreement with known factors of success in participatory management, community-based management, and co-management, multiple strengths, as well as areas for improvement, became apparent. Clusters were found to excel in most areas of farmers' participation, particularly by institutionalising skilled facilitation through an agricultural advisor, integrating diverse sources of knowledge to enhance farmers' capacity for AES delivery, and applying a variety of participatory formats in response to members' preferences. Some shortcomings in farmers' involvement are, on the other hand, linked to negative incentives such as tardily disbursement of AES payments or a temporal mismatch of cluster funding and the social and ecological processes that need to be addressed for delivering outcomes. This was confirmed and complemented by the CBNRM evaluative literature. A salient performance was asserted regarding clusters training efforts aiming to enhance farmers' skills and expertise and social capital building in enabling mutual learning, efficient collaboration, and fostering farmers' engagement with the group. Significant potential for improvement emerged in monitoring cluster outcomes on the field to steer group efforts and drive farmers' motivation. Both the PNRM and CBNRM literature offered a potential explanation for the rather high levels of enthusiasm and contentment accompanying the cluster approach, as it was found that clusters are faced with relatively favourable conditions for collaborative decision-making and realisation of measures. The PNRM literature linked this to clusters socioeconomic homogeneity and a resulting sparsity of strongly diverging interests or conflicts that enables efficient collaboration towards a common goal. The CBNRM literature asserted agricultural lands highly beneficial economic and legislative characteristics for collaborative management (e.g., well-defined boundaries, financial value, ...) and ease in collaborative management efforts due to the absence of a need to restrict resource utilisation through rule-making and enforcement. Finally, it was found that farmer clusters predominantly promote AES uptake rates by multiple means, whereas small room for potential emerged in disadvantaging participation by smaller farms and

25. A consideration of the latter was initially planned within this study but neglected due to time constraints.

insufficiently addressing farmers that do not as yet prescribe to environmentally-friendly farming.

Overall, it emerged that farmer clusters present a promising approach to promote environmentally-sensitive farming on a landscape scale. While social benefits of cluster membership are widely evident and can be anticipated to drive subsequent attitudinal and behavioural change, systematic monitoring of environmental outcomes across clusters is still needed to verify clusters' success on the ground. In order to overcome the barriers uncovered in this thesis, a comparison with related agricultural initiatives in other countries might facilitate the identification and realisation of suitable adaptive measures to the cluster approach. However, this thesis reaffirmed and emphasised the power of bottom-led collaborative approaches to drive agricultural transformation, reconcile the polarisation of the agricultural community and the wider public, and contribute towards establishing means for food production that ensure both farmers' subsistence and the ecological boundaries of agricultural lands.

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A. Appendix

A.1. PNRM success factors - References

Table 14: Factors attributed to the success of PNRM projects - References

Categories	Factor(s)	Reference
Process factors		
Communication	Two-way communication and education	Peelle et al. 1999; Krishnaswamy 2012; Reed 2008; Özerol and Newig 2008
	Clear language & accessible, concise and consistent information	Özerol and Newig 2008; Buchy and Race 2001; Sterling et al. 2017; Jiménez et al. 2019
	Face-to-face contact	Vente et al. 2016
	Transparency (i.e., one-way flow of information) regarding process in general, information handling, and stakeholder identification and selection	Buchy and Race 2001; Vente et al. 2016; Kovács 2017; Reed et al. 2018
Adaptivity	Interactive and iterative processes	Peelle et al. 1999; Balint 2011; Cradock-Henry et al. 2017; Reed 2008
	Learning from and adaption to past experiences	
	Existence of feedback-loops	Chess and Purcell 1999; Cradock-Henry et al. 2017
	Responsiveness to stakeholders	Peelle et al. 1999
Equality	Frank and open communication	Krishnaswamy 2012; Vente et al. 2016
	Equal opportunities to contribute in PP	Reed 2008; Akbulut and Soylu 2012; Barnaud and Van Paassen 2013; Buchy and Race 2001; Carr, Blöschl, and Loucks 2012; Reed et al. 2018; Sterling et al. 2017; Resurreccion, Jane Real, and Pantana 2004
	Philosophy that emphasises equity	
	Awareness of power asymmetries and ways to manage them	
PP design	PP methods are taylord to context, objectives, project stage	Reed 2008; Newig, Haberl, et al. 2008; Chess and Purcell 1999; Kovács 2017; Reed et al. 2018; Sterling et al. 2017
	Existence of milestones and deadlines	Carr, Blöschl, and Loucks 2012
	Priority to trust building actions	Peelle et al. 1999
Organisational setting		
Goals and roles	Clearly defined goals	Peelle et al. 1999; Reed 2008; Özerol and Newig 2008; Buchy and Race 2001; Chess and Purcell 1999; Kovács 2017
	Clearly defined stakeholder roles	Peelle et al. 1999; Carr, Blöschl, and Loucks 2012; Reed et al. 2018
Representation	Relevant stakeholders are represented systematically	Krishnaswamy 2012; Reed 2008; Özerol and Newig 2008; Buchy and Race 2001; Carr, Blöschl, and Loucks 2012; Vente et al. 2016; Kovács 2017; Reed et al. 2018; Sterling et al. 2017; Cradock-Henry et al. 2017; Jiménez et al. 2019
Empowerment	Stakeholders have impact on the decision-making process	Krishnaswamy 2012; Reed 2008; Carr, Blöschl, and Loucks 2012; Vente et al. 2016; Kovács 2017; Reed et al. 2018; Jiménez et al. 2019
	Management commitment to the process	Peelle et al. 1999; Buchy and Race 2001; Kovács 2017
	PP are promoted through institutional setting	Reed 2008; Carr, Blöschl, and Loucks 2012; Jiménez et al. 2019

Table 14: (continued)

	PP are considered from the outset and throughout the project	Reed 2008; Özerol and Newig 2008; Chess and Purcell 1999; Carr, Blöschl, and Loucks 2012; Balint 2011; Kovács 2017; Reed et al. 2018; Sterling et al. 2017
Incentives	Incentives to initiate and maintain participation are given	Krishnaswamy 2012; Özerol and Newig 2008; Carr, Blöschl, and Loucks 2012; Sterling et al. 2017
Facilitation	Provision of skilled facilitation	Reed 2008; Carr, Blöschl, and Loucks 2012; Balint 2011; Vente et al. 2016; Kovács 2017; Reed et al. 2018; Jiménez et al. 2019
Diverse knowledge	Relevant information from multiple sources, including local and scientific knowledge, is provided	Krishnaswamy 2012; Reed 2008; Carr, Blöschl, and Loucks 2012; Balint 2011; Vente et al. 2016; Kovács 2017; Reed et al. 2018; Sterling et al. 2017; Jiménez et al. 2019
Match scales	Match temporal and spatial scales of the PP with scales of ecological processes and jurisdiction	Reed 2008
Contextual factors		
Individual level	Distribution of wealth and education	Baker and Chapin III 2018
	Gender equality	Baker and Chapin III 2018
Community level	Resource dependence, supportive local belief systems, prevalence of social networks, community size and heterogeneity, social capital (e.g., bonds, norms, provisional trust between stakeholders, sense of community, feeling of connection and support), presence of bridging capacities	Baker and Chapin III 2018
	Existence of a participatory culture (e.g., through former experiences with PPs)	Reed et al. 2018
	Adequate resources: especially financial, but also concerning time of participants and decision-makers, and availability of locations which are easily accessible for all stakeholders	Peelle et al. 1999; Özerol and Newig 2008; Baker and Chapin III 2018; Carr, Blöschl, and Loucks 2012; Kovács 2017; Reed et al. 2018; Sterling et al. 2017
State level	Well-defined property rights and local tenure regimes	Baker and Chapin III 2018

A.2. CBNRM success factors - References

Table 15: Factors attributed to the success of CBNRM projects - References

Categories	**Factor(s)**	**Reference**
Resource system (1)		
	Small size	Agrawal 2003
	Well-defined boundaries	Agrawal 2003; Armitage 2005; Crawford 2000; Pagdee, Kim, and Daugherty 2006
	Low levels of mobility	Agrawal 2003
Utilization	Benefits from the resource can be stored	Agrawal 2003
	Predictability	Agrawal 2003; Pagdee, Kim, and Daugherty 2006

Table 15: (continued)

	Financial value	Thakadu 2005; Pagdee, Kim, and Daugherty 2006; Baynes et al. 2015
Group characteristics (2)		
Population	Small size	Agrawal 2003; Pollnac, Crawford, and Gorospe 2001; Thakadu 2005; Brooks, Waylen, and Borgerhoff Mulder 2012
	No or only gradual population change	Agrawal and Chhatre 2006
	Clearly defined boundaries	Agrawal 2003; Armitage 2005; Gruber 2010
Social	Social capital (shared norms, homogeneity of identities and interests), e.g. through past successful experiences	Agrawal 2003; Gruber 2010; Pomeroy et al. 1997; Crawford 2000; Mbaiwa 2004; Thakadu 2005; Brooks, Waylen, and Borgerhoff Mulder 2012; Mountjoy et al. 2013; Pagdee, Kim, and Daugherty 2006
	Supportive cultural traditions / local beliefs	Brooks, Waylen, and Borgerhoff Mulder 2012; Baynes et al. 2015
Leadership	Appropriate (adaptive) leadership	Agrawal 2003; Gruber 2010; Mountjoy et al. 2013; Crawford 2000; Pagdee, Kim, and Daugherty 2006; Tantoh et al. 2021
Dependence	Interdependence among group members	Agrawal 2003
Equality	Equality in terms of socio-economic status and gender	Agrawal and Chhatre 2006; Baynes et al. 2015; Thakadu 2005
Capacity	Community members possess management capacity (knowledge, skills)	Fabricius and Collins 2007; Brooks, Waylen, and Borgerhoff Mulder 2012; Baynes et al. 2015; Pagdee, Kim, and Daugherty 2006
Poverty	Low levels of poverty	Agrawal 2003
(1) and (2): Relationship between Resource System and Communities		
Proximity	Overlap or proximity between user-group residential locations and resource system	Agrawal 2003; Pagdee, Kim, and Daugherty 2006
Dependence	Group members are dependent on resource system	Agrawal 2003; Gruber 2010; Crawford 2000; Agrawal and Chhatre 2006; Pagdee, Kim, and Daugherty 2006
	Diversity of livelihood options / independence from one single resource	Fabricius 2004; Pomeroy et al. 1997; Pollnac, Crawford, and Gorospe 2001
Perceived Crisis	Perceived resource crisis before project-initiation	Pollnac, Crawford, and Gorospe 2001; Crawford 2000; Matta and Alavalapati 2006; Pagdee, Kim, and Daugherty 2006
Fairness	Fairness in allocation of benefits from resource system and management project	Agrawal 2003; Mbaiwa 2004; Thakadu 2005; Matta and Alavalapati 2006; Brooks, Waylen, and Borgerhoff Mulder 2012; Baynes et al. 2015; Pagdee, Kim, and Daugherty 2006; Gruber 2010
Demand	Low levels and only gradual changes of user demand	Agrawal 2003
Knowledge	Understanding of SES dynamics, based on open/integrative information base including scientific and local knowledge	Fabricius and Collins 2007; Gruber 2010; Crawford 2000; Matta and Alavalapati 2006
Institutional arrangements (3)		
Rule-making	Rules exist that are simple and easy to understand	Agrawal 2003; Fabricius and Collins 2007; Pagdee, Kim, and Daugherty 2006; Tole 2010

Table 15: (continued)

	Rules can be easily enforced	Agrawal 2003; Fabricius and Collins 2007; Pagdee, Kim, and Daugherty 2006; Tole 2010
	Graduated sanctions are provided	Agrawal 2003; Pagdee, Kim, and Daugherty 2006
	Collective choice arrangements, affected individual are able to participate in rule-making	Armitage 2005
Rights	Locally devised and secure tenure, access and management rights	Agrawal 2003; Crawford 2000; Brooks, Waylen, and Borgerhoff Mulder 2012; Baynes et al. 2015; Pagdee, Kim, and Daugherty 2006; Robinson et al. 2021; Tole 2010; Lindsay 1998; Mbaiwa 2004; Thakadu 2005
Adaptivity	(Participatory) Monitoring is in place	Fabricius 2004; Fabricius and Collins 2007; Armitage 2005; Gruber 2010; Thakadu 2005
	Monitored data is fed back and evaluated	Armitage 2005; Gruber 2010; Crawford 2000
	Adaptive capacity: Flexibility to adapt as project is implemented	Armitage 2005; Gruber 2010; Crawford 2000
Accountability	Accountability of monitors and other officials to community members	Agrawal 2003; Armitage 2005; Gruber 2010; Tole 2010
Anticipation	Introduce management plans and a shared vision	Fabricius and Collins 2007; Mountjoy et al. 2013
Incentives	Provide lasting incentives	Fabricius and Collins 2007; Thakadu 2005; Matta and Alavalapati 2006; Measham and Lumbasi 2013; Tole 2010; Measham and Lumbasi 2013
Conflict resolution	Mechanisms for communication and low-cost conflict resolution	Tole 2010; Armitage 2005; Gruber 2010
	Easy access to low-cost adjudication	Agrawal 2003
Outreach	Vision, plan and rules are communicated to the external public	Mountjoy et al. 2013; Fabricius and Collins 2007; Gruber 2010
(1) and (3): Relationship between resource system and institutional arrangements		
Match scales	Match restrictions on resource system to its regenerative powers	Agrawal 2003
(2) and (3): Relationship between community characteristics and institutional arrangements		
Engagement	Engagement with traditional organisations, cultural beliefs, practices, and traditions	Brooks, Waylen, and Borgerhoff Mulder 2012; Waylen et al. 2010
External environment (4)		
Technology	Low cost exclusion technology	Agrawal 2003; Crawford 2000; Pagdee, Kim, and Daugherty 2006
	Quick adaption to new technologies	Agrawal 2003; Crawford 2000; Pagdee, Kim, and Daugherty 2006
	High costs of resource extraction	Agrawal 2003; Crawford 2000; Pagdee, Kim, and Daugherty 2006
Markets	Low levels and/or only gradual change of articulation with external markets	Agrawal 2003; Crawford 2000; Pagdee, Kim, and Daugherty 2006
State	Appropriate levels of external aid to compensate conservation activities, especially in initial stages, includes funding but also facilitation and capacity building	Agrawal 2003; Fabricius 2004; Gruber 2010; Pollnac, Crawford, and Gorospe 2001; Thakadu 2005; Baynes et al. 2015; Pagdee, Kim, and Daugherty 2006; Tole 2010

Table 15: (continued)

	Nested levels of appropriation, provision, enforcement, and governance	Agrawal 2003; Armitage 2005

A.3. ACM success factors - References

Table 16: Factors attributed to the success of ACM projects - References

Categories	**Factor(s)**	**Reference**
Resource system (1)		
Characteristics	Stability / Lack of disturbances	Plummer et al. 2012
	Low levels of mobility	Armitage et al. 2009; Pomeroy and Mcconney 2007
	Small size / small scale systems	Armitage et al. 2009; Pomeroy, Katon, and Harkes 2001
	Well-defined boundaries	Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007
Group characteristics (2)		
Size	Small size	Armitage et al. 2009; Pomeroy, Katon, and Harkes 2001
Leadership	Charismatic leadership that motivates and steers collective action	Plummer et al. 2012; Pomeroy and Mcconney 2007; Armitage et al. 2009; McConney, Pomeroy, and Mahon 2003; Napier, Branch, and Harris 2005; Gutiérrez, Hilborn, and Defeo 2011
Commitment	Long-term commitment to the process by both local government and stakeholders	Armitage et al. 2009; Napier, Branch, and Harris 2005; Armitage et al. 2011; Gutiérrez, Hilborn, and Defeo 2011; Plummer et al. 2012; Pomeroy, Katon, and Harkes 2001
Homogeneity	Homogeneity in terms of kinship, ethnicity, religion, culture, and socioeconomic status	Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007
	Shared interests	Armitage et al. 2009
Social capital	Relationship of trust and mutual respect	Pomeroy, Katon, and Harkes 2001; McConney, Pomeroy, and Mahon 2003; Pomeroy and Mcconney 2007
	Group cohesion	Pomeroy and Mcconney 2007; Gutiérrez, Hilborn, and Defeo 2011
	Social networks	Plummer et al. 2012
	Mutual learning	Plummer et al. 2012
(1) and (2): Relationship between resource system and communities		
Proximity	Proximity of members residential location to managed area	Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007
Knowledge	Stakeholders share extensive knowledge and understanding regarding resource system dynamics, the addressed problem and potential solutions	Pomeroy and Mcconney 2007
Institutional arrangement (3)		
Objectives	Simple and clearly defined objectives	Pomeroy, Katon, and Harkes 2001; McConney, Pomeroy, and Mahon 2003; Pomeroy and Mcconney 2007

Table 16: (continued)

Membership	Clearly defined membership	Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007
Rules	Enforcement of and/or compliance with legislation	McConney, Pomeroy, and Mahon 2003; Pomeroy, Katon, and Harkes 2001; Gutiérrez, Hilborn, and Defeo 2011; d'Armengol et al. 2018; Pomeroy, Katon, and Harkes 2001
Conflict resolution	Adequate means for conflict resolution, e.g., collaborative and mediated forum	Plummer et al. 2012; Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007; De Pourcq et al. 2015
Equality	Means to tackle power asymmetries that impede equal participation and re-distribution of power	Plummer et al. 2012; McConney, Pomeroy, and Mahon 2003; Pomeroy and Mcconney 2007; Armitage et al. 2011
Adaptivity	Management measures are monitored, evaluated and adapted, if necessary	Plummer and D. R. Armitage 2007; Pomeroy and Mcconney 2007; d'Armengol et al. 2018; Plummer et al. 2012
	Effective resource monitoring	Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007
	Possibility to experiment with management measures	Armitage et al. 2009
Empowerment	Government action establishes supportive and enabling legislation, policies, rights, and authority structures	Pomeroy, Katon, and Harkes 2001; Armitage et al. 2009; Napier, Branch, and Harris 2005; Plummer and D. R. Armitage 2007; Pomeroy and Mcconney 2007; Armitage et al. 2011; Plummer et al. 2012
	Decentralisation of authority	Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007
	Existence of community organisations	Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007
	Capacity building, including consciousness raising, training of management and mediation skills, principles of co-management, and imparting scientific understanding of SESs	Pomeroy, Katon, and Harkes 2001; McConney, Pomeroy, and Mahon 2003; Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007; Armitage et al. 2009; Plummer et al. 2012
	Participation of all relevant stakeholders	Plummer et al. 2012; McConney, Pomeroy, and Mahon 2003; Pomeroy and Mcconney 2007; d'Armengol et al. 2018; Pomeroy, Katon, and Harkes 2001; Plummer and D. R. Armitage 2007
	Identifying relevant stakeholders by conducting a stakeholder analysis	McConney, Pomeroy, and Mahon 2003
Accountability	All involved partners are held accountable based on accepted standards for evaluating objectives and outcomes	Pomeroy, Katon, and Harkes 2001; Pomeroy and Mcconney 2007
Communication	Clear communication of privileges, guidelines, ACM process and responsibilities	Plummer et al. 2012; Pomeroy and Mcconney 2007; Armitage et al. 2011
Incentives	Individual incentive structure is provided and promoted (e.g., higher incomes, protection of livelihoods, prestige, legitimate access to resources, reduction of conflicts, ...)	Pomeroy, Katon, and Harkes 2001; Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007
Resources	Sufficient, timely and sustained funding and financial resources	Plummer et al. 2012; Pomeroy, Katon, and Harkes 2001; Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007

Table 16: (continued)

	Human resources (e.g., full-time facilitator, volunteers) and time	Plummer et al. 2012; Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007
	Technical equipment (e.g., for monitoring)	Plummer et al. 2012; Pomeroy and Mcconney 2007
	Provision of information to participants in a way that suits their skills and preferences	Pomeroy and Mcconney 2007
Knowledge	Scientific and local/indigenous knowledge is integrated to inform management design	Armitage et al. 2009; McConney, Pomeroy, and Mahon 2003; Napier, Branch, and Harris 2005; Pomeroy and Mcconney 2007; Cullen-Unsworth et al. 2012; Plummer et al. 2012
Facilitation	A facilitator or external agent expedites the process by providing assistance, advice, ideas, expertise, training and/or guidance	Pomeroy, Katon, and Harkes 2001; McConney, Pomeroy, and Mahon 2003; Pomeroy and Mcconney 2007
(1) and (3): Relationship between resource system and institutional agreements		
Matching scales	Resource distribution matches areas of jurisdiction	Pomeroy and Mcconney 2007

A.4. In-text references for ACM success factors

Table 17: ACM success factors fit: in-text references

Categories	**Factor(s)**	**Reference**
Resource system (1)		
Characteristics	Stability / Lack of disturbances	none*
	Low levels of mobility	Sec. 6.2.2, p. 79
	Small size / small scale systems	Sec. 6.2.2, p. 79
	Well-defined boundaries	Sec. 6.2.2, p. 79
Group characteristics (2)		
Size	Small size	Sec. 6.2.2, p. 80
Leadership	Charismatic leadership that motivates and steeres collective action	Sec. 6.2.2, p. 82
Commitment	Long-term commitment to the process by both local government and stakeholders	none*
Homogeneity	Homogeneity in terms of kinship, ethnicity, religion, culture, and socio-economic status	Sec. 6.2.1, p. 69
	Shared interests	none*
Social capital	Relationship of trust and mutual respect	Sec. 6.2.2, p. 81
	Group cohesion	Sec. 6.2.2, p. 81
	Social networks	Sec. 6.2.2, p. 81
	Mutual learning	Sec. 6.2.2, p. 81
(1) and (2): Relationship between resource system and communities		
Proximity	Proximity of members residential location to managed area	Sec. 6.2.2, p. 84
Knowledge	Stakeholders share extensive knowledge and understanding regarding resource system dynamics, the addressed problem and potential solutions	Sec. 6.2.2, p. 85
Institutional arrangement (3)		

Table 17: (continued)

Objectives	Simple and clearly defined objectives	Sec. 6.2.1, p. 70
Membership	Clearly defined membership	none*
Rules	Enforcement of and/or compliance with legislation	Sec. 6.2.2, p. 85
Conflict resolution	Adequate means for conflict resolution, e.g., collaborative and mediated forum	Sec. 6.2.2, p. 88
Equality	Means to tackle power asymmetries that impede equal participation and redistribution of power	Sec. 6.2.1, p. 69
Adaptivity	Management measures are monitored, evaluated and adapted, if necessary	Sec. 6.2.2, p. 87
	Effective resource monitoring	Sec. 6.2.2, p. 87
	Possibility to experiment with management measures	none*
Empowerment	Government action establishes supportive and enabling legislation, policies, rights, and authority structures	Sec. 6.2.2, p. 86
	Decentralisation of authority	Sec. 6.2.2, p. 86
	Existence of community organisations	none*
	Capacity building, including consciousness raising, training of management and mediation skills, principles of co-management, and imparting scientific understanding of SESs	Sec. 6.2.2, p. 83
	Participation of all relevant stakeholders	Sec. 6.2.1, p. 71
	Identifying relevant stakeholders by conducting a stakeholder analysis	Sec. 6.2.1, p. 71
Accountability	All involved partners are held accountable based on accepted standards for evaluating objectives and outcomes	Sec. 6.2.2, p. 88
Communication	Clear communication of privileges, guidelines, ACM process and responsibilities	Sec. 6.2.1, p. 67
Incentives	Individual incentive structure is provided and promoted (e.g., higher incomes, protection of livelihoods, prestige, legitimate access to resources, reduction of conflicts, ...)	Sec. 6.2.1, p. 73
Resources	Sufficient, timely and sustained funding and financial resources	none*
	Human resources (e.g., full-time facilitator, volunteers) and time	none*
	Technical equipment (e.g., for monitoring)	none*
	Provision of information to participants in a way that suits their skills and preferences	Sec. 6.2.1, p. 67
Knowledge	Scientific and local/indigenous knowledge is integrated to inform management design	Sec. 6.2.1, p. 67
Facilitation	A facilitator or external agent expedites the process by providing assistance, advice, ideas, expertise, training and/or guidance	Sec. 6.2.1, p. 74
(1) and (3): Relationship between resource system and institutional agreements		
Matching scales	Resource distribution matches areas of jurisdiction	Sec. 6.2.1, p. 76

* - Factor is not considered in the PNRM or CBNRM literature.

Erklärung zur selbstständigen Abfassung der Masterarbeit

Name: Thomas Rellensmann
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Titel der Masterarbeit: Understanding pro-environmental collaboration amongst farmers: Management approaches and incentives underlying farmer clusters in the UK

Ich versichere, dass ich die eingereichte Masterarbeit selbstständig und ohne unerlaubte Hilfe verfasst habe. Anderer als der von mir angegebenen Hilfsmittel und Schriften habe ich mich nicht bedient. Alle wörtlich oder sinngemäß den Schriften anderer Autor:innen entnommenen Stellen habe ich kenntlich gemacht.

Osnabrück, der 14.10.2021

Unterschrift