Bottom-up design process of agri-environmental measures at a landscape scale: Evidence from case studies on biodiversity conservation and water protection

# Bottom-up design process of agri-environmental measures at a landscape scale: Evidence from case studies on biodiversity conservation and water protection

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**Abbreviations:** AEA, agri-environmental agreement at landscape scale; AEM, agri-environmental measure; BIO AEA, biodiversity agri-environmental agreement at landscape scale; EU, European Union; NVZ, Nitrate-Vulnerable Zone; RDP, Rural Development Programme; WP AEA, water protection agri-environmental agreement at landscape scale

# 1 Introduction

To support sustainable development of rural areas and to respond to increasing demands for environmental quality by society, the European Union (EU) introduced agri-environmental measures (AEMs) in 1985, with Council (EEC) Regulation 797/85. Later, the EU prescribed the mandatory implementation of agri-environmental programmes for all Member States (EEC Regulation 2078/92). The Agenda 2000 Common Agricultural Policy reform (EEC Regulation 1257/1999) then transferred AEMs into Rural Development Programmes (RDPs) (Defrancesco et al., 2008).

Agri-environmental measures can be defined at different levels (i.e., national, regional, local), and they are adopted by farmers on a voluntary basis. Most AEMs are management agreements that give compensation payments for the temporary adoption of specific practices, such as input-reduction, and landscape and habitat conservation measures (Uthes and Matzdorf, 2013). Several studies have highlighted the limitations of such AEMs. For example, some studies have stressed the "patchy success" of AEMs (Jones et al., 2016; Kleijn et al., 2006; Sutherland, 2004), with the objectives often too vague (Prager and Nagel, 2008). Others have stated that AEMs are not always suited for all kinds of farms (Evans and Morris, 1997; Hodge and Reader, 2010), and over/under compensation can be expected, in addition to several application problems (Klimek et al., 2008). On the other hand, there is evidence that the landscape spatial organisation can affect environmental processes like biodiversity conservation (Benton et al., 2003; Joannon et al., 2008; Kleijn and Sutherland, 2003) and water pollution (Beaujouan et al., 2001; Benoit et al., 1997; Toderi et al., 2007).

Existing incentive programmes typically neither require nor encourage landscape coordination, but instead favour a farm-level approach. However, many of the biophysical and ecological processes in agriculture do not occur at the farm level, but at the landscape scale (Kleijn et al., 2011; McKenzie et al., 2013; Prager et al., 2012). For these reasons, AEMs at the farm level can generate problems of spatial scale mismatch (Armitage et al., 2008; Cumming et al., 2006; Pelosi et al., 2010; Toderi et al., 2007).

The integration of knowledge from different stakeholders (e.g., farmers, scientists, experts) is considered a precondition for successful sustainable land management (Schwilch et al., 2012; Tarrasón et al., 2016). Participatory approaches and system perspectives for the identification and selection of options are becoming increasingly popular, and are required by the EU RDP (Prager and Freese, 2009). However, the unknown outcome for policy makers of a participatory process can limit its institutionalisation (Reed, 2008), and at all political levels, a big gap remains in the broad implementation of participatory processes (Rauschmayer et al., 2009). Stakeholder participation is increasingly seen as insufficient, and attention has shifted to social learning, co-management and empowerment goals as key issues (Armitage et al., 2008; Reed et al., 2008; Selin and Chavez, 1995).

Because the adoption of AEMs by farmers is voluntary, a high level of acceptance is required for their successful implementation. The perceived risk, effectiveness, scale of application (i.e., field, farm, landscape), and time and effort required for the implementation of measures are important factors that affect the willingness of farmers to join AEMs (McKenzie et al., 2013; Sattler and Nagel, 2010; Uthes and Matzdorf, 2013).

To involve stakeholders in the design of AEMs, and to overcome the spatial scale mismatch generated by the field/farm level approach, the authority responsible for the control and coordination of RDPs in the Marche Region (central Italy) provided for agri-environmental agreements at the landscape scale (AEAs) in the RDP of 2007–2013 (Regione Marche, 2016). An AEA is defined as an agreement between public and/or private stakeholders to apply one or more shared AEMs in a specific territory of the region (e.g., a river basin, a protected area) above the level of farm, field or local-scale administration, with this designed to manage an environmental issue with a landscape dimension (e.g., water pollution, biodiversity conservation).

In the present study, we analysed how different AEAs and their AEM design process in nine case studies led to AEMs that are site-specific and/or that take into account biophysical phenomena on a larger scale with respect to the farm (a scale defined as "landscape AEMs" in this article). We also discuss how the differences between design processes: (i) affect local knowledge inclusion and stakeholder empowerment; (ii) have effects on the ability of stakeholders to generate innovative AEMs; and (iii) affect the degree of acceptance of the AEMs. From the analysis of these different case studies, we identified a design process of shared, site-specific and/or landscape AEMs with new roles for stakeholder involved.

# 2 Materials and methods

## 2.1 AEAs in the Marche Region RDP 2007–2013

According to the AEA procedure, stakeholders have to identify a lead partner who is responsible for: (i) administering an AEA; (ii) involving the stakeholders in a participatory process for AEM discussions; and (iii) planning the changes in the RDP with the regional authority (Regione Marche, 2010, 2011). In RDP 2007–2013, the Marche Region identified four major local environmental priorities on which to activate AEAs (Table 1). During the 2007–2013 planning period, the Marche Region activated AEAs exclusively on two of the priorities for which the stakeholders showed interest: one AEA on water pollution (WP AEA), and six AEAs on biodiversity (BIO AEAs) (Fig. 1). Two other attempts to create additional BIO AEAs were made, but these failed. Here, we also analyse the causes of these failures.

**Table 1** Agri-environmental priorities and target areas identified by the Marche Region for AEA activation, and the case studies analysed.

alt-text: Table 1

| Priority | Aims | Target areas | Agri-environmental agreements | | |
|---|---|---|---|---|---|
| | | | Expression of interest | Successfully implemented | Analysed |
| Soil protection | Reduction of soil erosion and hydrogeological instability | Erosion hazard areas | 0 | – | – |
| Water conservation | Reduction of ground water pollution | Nitrate-Vulnerable Zones (Fig. 1) | 1 | 1 | 1 |
| Rural landscape conservation | Protection and recovery of hilly landscapes affected by agricultural mechanisation | High-value landscape zones | 0 | – | – |
| Biodiversity conservation | Conservation of biodiversity in protected areas | Natura 2000 sites (Fig. 1) | 13 | 6 | 8 |

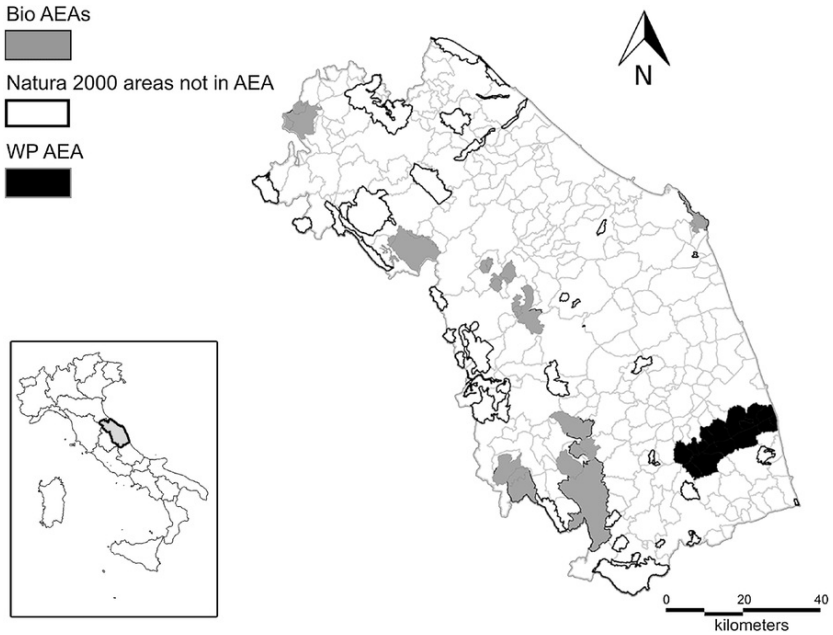


**Fig. 1** Natura 2000 sites and AEAs activated in the Marche Region.

alt-text: Fig. 1

The WP AEA was activated in the Aso River valley, to reduce the high input of pesticides used in pest management by the dominant tree-fruit production-oriented farms. This included the territory of 15 municipalities, which were partially included in a Nitrate-Vulnerable Zone (NVZ) (EU Directive 91/676/CEE, and further modifications).

The BIO AEAs involved different Natura 2000 areas in terms of the pedo-climatic, environmental and socio-economic conditions. Five of the BIO AEAs were located in mountain areas, and one along the Adriatic coast. Natura 2000 sites in the Marche Region cover 136,900 ha, which corresponds to over 14% of the total area of the region. Specifically, the BIO AEAs require conservation of grassland habitats, as mainly the EU classifications of: 6210*, Semi-natural dry grasslands and scrubland *facies* on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites); and 6510, Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*), in the mountain areas where most of the grasslands are common pasturelands mainly subjected to customary grazing rights.

## 2.2 Theoretical framework adopted in the AEA analysis

The agri-environmental issues that occur at larger spatial dimensions than the farm/field level are often resource dilemmas that are characterised by common pool resources, multiple stakeholders, interdependence, controversy, complexity and uncertainty (Blackmore, 2007; Ison et al., 2007). Inefficiencies occur and/or important components of the system are lost when there is a lack of alignment between the scale of the environmental variation and the scale of the social organisation, in which the responsibility for management resides. This can thus generate spatial scale mismatches. In these systems, long-term solutions will depend on social learning and the development of flexible institutions that can adjust and reorganise in response to changes in ecosystems (Cumming et al., 2006).

Reed et al. (2009) defined social learning as a change in understanding that goes beyond the individual, to become situated within wider social units or communities of practice through social interactions between actors within social networks. Collins and Ison (2010) considered social learning as an alternative governance mechanism and a process of systemic change and transformation undertaken by stakeholders in complex situations. Although more than one definition of social learning is available, the literature generally uses this term to refer to a “sustainability” type of transformative change that occurs at different levels, and in this, social learning is framed as a normative goal (Rodela, 2014). Armitage et al. (2008) analysed three potential loops of learning for co-management: fixing errors from routines (single loop); correcting errors by adjusting values and policies (double loop); and correcting errors by designing governance norms and protocols (triple loop).

Berkes (2009) identified the need for co-management for natural resources (i.e., the sharing of power and responsibility between government and local users), because of its complexity. Indeed, it is difficult for any one group or

agency to have the full range of knowledge for environmental governance, and so the different partners have the potential to bring knowledge that is acquired at different scales to the discussion table, which will facilitate social learning. The important features of co-management include the sharing of authority, partnerships of government and local people, decentralised decision making, and vertical linkages for governance (Galappaththi and Berkes, 2015). Time-tested co-management with learning-by-doing turns into adaptive co-management. This can evolve spontaneously through feed-back learning over time from simple systems of management, and even if it does not appear to require legal arrangements to enable it, these might be required to sustain it (Galappaththi and Berkes, 2015). In this article, we highlight how legal arrangements that favour co-managment derive from a shift in the roles of policy makers in the system. When the shift in the roles of the policy makers does not occur, the co-management fails, or is at least delayed.

The integration of different types of knowledge into a "hybrid knowledge" for environmental management can foster collaborative approaches and social learning (e.g., Berkes, 2009; Prager et al., 2012; Raymond et al., 2010; Reed, 2008; Tarrasón et al., 2016). In this article, we argue that the integration of different knowledge is favoured by a shift in the roles of stakeholders, and that any interruption in this process will lead to interruption of the learning flux within the sytem. The shift in the roles of stakeholders is often unconscious, and it should be promoted in a stakeholder reflection process (Table 2, stakeholding). In the Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale (SLIM) project (FP5-EVK1-2000-00695SLIM), which relates to NVZs, Natura 2000 and AEM issues, a heuristic tool was developed that can help stakeholders reflect on their own role in the management process (Blackmore et al., 2007; Ison et al., 2007; Steyaert and Jiggins, 2007). This diagnostic framework defines how a transformational change is positioned in a specific context (i.e., the history of the situation; Fig. 2, S1) that shapes current stakeholder practice and understanding (Fig. 2, S2). In addition, the diagnostic framework explains how changes in practice and understanding can be brought about by facilitation of the relationships among the stakeholders (i.e., the stakeholding), the ecological dynamics (i.e., the ecological constraints), and the whole complex of institutions and policies. These factors were identified as the four main variables that influence transformational changes (Table 2, Fig. 2), and also as variables in the sense that transformational changes can lead to transformation of each of the variables themselves. The diagnostic framework can be used to allow stakeholders to become aware of their role in transformational change (Steyaert and Jiggins, 2007), and for this reason, it was used to analyse the design and implementation processes of the AEAs.

**Table 2** The SLIM diagnostic framework variables.

alt-text: Table 2

| Variable | Description |
|---|---|
| Stakeholding | Participatory process often leads to changes in the legitimacy of the stakeholder position or to the emergence of new stakeholders. The process by which stakeholders become aware of their role in the context is called "stakeholding". Stakeholding takes over the concept of classical stakeholder analysis, and it monitors how the interests and social positions of the people involved can change over time, in relation to the issues at stake. |
| Ecological constraints | Stakeholders who live in and act on a specific territory deal with the components and processes that have to be taken into account. This variable analyses the stakeholder knowledge and awareness about these elements, called "eco-constraints", because what is known about these processes tends to be fragmentary and based on expert sectorial knowledge. |
| Institutions and policies | This variable deals with the constitutive elements of the "institutional frameworks" (e.g., laws, social norms), constraints and deriving outcomes (e.g., new norms). |
| Facilitation | The facilitation in participatory process is a combination of the skills, activities and tools used to support the multi-stakeholder learning process. Moreover, the facilitation variable also analyses the stakeholder first-order learning (i.e., "what they are doing") and second-order learning (i.e., "why they are doing what they do"), as described by Groot and Maarleveld (2000). |

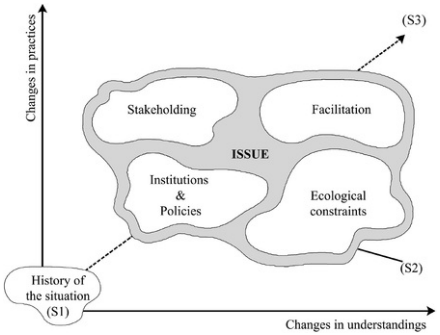


**Fig. 2** The SLIM diagnostic framework. Heuristics for exploring the dynamics of transformational change, which are understood as changes in practices with changes in understanding, in complex and uncertain natural resources managing situations (S1–S3, situations one, two or

three) (Steyaert and Jiggins, 2007).

alt-text: Fig. 2

## 2.3 AEA and AEM design process analysis

To assess the AEA design process, the stakeholders of the nine case studies were interviewed (i.e., one WP AEA; eight BIO AEAs, of which six were activated and two were aborted; Table 1). In the interviews, the stakeholders were asked to identify the issues that occurred in the design phase of the AEAs and in the later stages of their implementation, to identify potential cause–effect relationships.

The identification of the stakeholders was conducted as an interactive and iterative process (i.e., the snowball sampling technique). Therefore, the stakeholders interviewed were asked to identify other relevant stakeholders in the AEAs who can be interviewed. The survey started with two policy makers who were responsible for the Marche Region RDP.

Semi-structured interviews were performed after the AEAs were started, to discuss three main topics: issues that occurred in the AEA and/or AEM design and implementation processes; the stakeholder involvement; and the origin of the scientific knowledge used in the AEM definition (Table 3). The interviews were recorded on a digital recorder and transcribed on a spreadsheet. The sentences obtained were clustered and analysed according to the SLIM diagnostic framework variables. Seventeen stakeholders were interviewed for the WP AEA, and 33 for the BIO AEAs (Table 4).

**Table 3** Topics addressed in the semi-structured interviews to analyse the design and implementation processes of the AEAs/AEMs according to the related diagnostic framework variables.

alt-text: Table 3

| Topic | Related diagnostic framework variables |
|---|---|
| Design and implementation of the AEA/AEMs | |
| How the RDP or the AEMs were modified according to your needs? | Institutions and policies, Facilitation, Ecological constraints |
| How the institutional and normative framework were included in the AEAs and AEMs? | Institutions and policies |
| Why the AEMs were/were not site-specific? | Ecological constraints |
| How would you like to improve the AEA/AEM design and/or implementation processes? | Institutions and policies |
| How and when was the stakeholder involved in the AEMs design and/or implementation processes? | Facilitation, Institutions and policies |
| | |
| The process of stakeholder involvement | |
| Who triggered the AEA activation, and how? | Facilitation, Stakeholder and stakeholding |
| Who contacted/informed/involved you, and how? | Facilitation, Stakeholder and stakeholding |
| Who was the facilitator, and how did they act? | Facilitation, Stakeholder and stakeholding |
| Who were the stakeholders involved? | Stakeholder and stakeholding |
| Were some relevant stakeholders excluded or not considered? | Facilitation, Stakeholder and stakeholding |
| | |
| Scientific knowledge supporting the design of AEA/AEMs | |
| Was the scientific knowledge discussed and in which phase of the design of AEAs/AEMs? | Facilitation, Ecological constraints |
| Who were the knowledge brokers and what were their roles in the design process? | Stakeholder and stakeholding |

**Table 4** Stakeholders active in the design and implementation processes of the AEAs/AEMs, their roles that emerged from the interviews, and the number of stakeholders interviewed in the WP AEA and the BIO AEAs. Grey shading, people who were not stakeholders in the AEAs/AEMs.

alt-text: Table 4

| Stakeholder | Role in the AEA | WP AEA | BIO AEAs |
|---|---|---|---|
| Policy makers of the Marche Region Agriculture Service | Responsible for Marche Region RDP and AEMs | 3 | 3 |
| Policy makers of the Marche Region Environment Service | Responsible for Natura 2000 sites and their AEMs | No active role | 3 |
| Agents of the Regional Extension Service | Carrying out of local demonstration projects | 2 | No active role |
| Farmers | Implementation of AEMs | 6 | 8 |
| Policy maker of the local public administrative body | Lead partner of an AEA | 1 | No active role |
| Practitioners | Dialogue with farmers | 1 | 3 |
| Natura 2000 Site Managers | Lead partners of the BIO AEAs | | 8 |
| Payment authority | AEM control of the eligibility for payments | 0 | 0 |
| Policy makers of the Agriculture Ministry | Responsible for Italian Natura 2000 sites management | | 1, but no active role |
| Farmers' Union staff members | Responsible for dialogue with farmers and policy makers | 1 | 3 |
| Inhabitants | Consumers of local products | 3, but no active role | No active role |
| Managers of the bodies that regulate the customary grazing rights (e.g., municipalities, collective bodies) | Implementation of the AEMs in the common lands | | 3 |
| EU Directorate-General for Agriculture and Rural Development | Responsible for the agriculture and rural development policy | 0 | 0 |
| University researcher | Research activities on grassland management and Natura 2000 site manager | | 1 |

## 2.4 Documents analysed to derive the historical context and AEA/AEM design process

To evaluate the process that led the Marche Region to activate AEAs, the following official reports were analysed (available online): (i) ex-post evaluation of EEC Regulation N° 2078/92 implemented in the Marche Region, and ex-ante evaluation of the Marche Region RDP 2000–2006 (Ministero delle Politiche Agricole, Alimentari e Forestali, 2016); (ii) ex-post evaluation of the Marche Region RDP 2000–2006 (EU Directorate-General for Agriculture and Rural Development, 2016); (iii) ex-post evaluation of the AEMs included in the Marche Region RDP 2000–2006 (Rete Rurale Nazionale, 2016); and (iv) ex-ante evaluation of the Marche Region RDP 2007–2013 (Regione Marche, 2016). The research team participated in the mid-term review and the ex-post evaluation of the effects of the AEMs included in EEC Regulation N° 2078/92 and in the Marche Region RDP 2000–2006.

# 3 Results

## 3.1 AEMs of the Marche Region: history of the situation

The historical background emerges from analysis of the official documents of the Marche Region. From 1998 to 2006, the research group performed an evaluation of the effects of the AEMs included in EEC Regulation N° 2078/92 and in RDP 2000–2006 of the Marche Region, on water soil erosion and nitrate leaching reduction. Ex-post evaluations showed that the application of AEMs at the field scale did not significantly reduce soil erosion and nitrate leaching, due to their landscape dimension (Toderi et al., 2007; Perugini et al., 2009). The results were discussed in several informal meetings with the policy makers, and it was recommended that AEMs at the landscape scale be designed also in cooperation with local stakeholders. As a consequence, in an ex-ante RDP 2007–2013 evaluation document, the Marche Region administration reported that: *"…the quantitative evaluation of AEMs in the RDP* [2000–2006] *highlighted the importance of adopting an integrated territorial approach that could be complementary to the farm payments and would foster greater awareness of the action by farmers…"*. In the same document, the Marche Region considered the involvement and participation of stakeholders as indispensable for landscape-scale AEM definition. To address these issues, the Marche Region included the AEA approach in RDP 2007–2013.

## 3.2 The WP AEA design process

### *3.2.1 History of the situation*

The interviews showed that in the Aso River valley, an agent of the Marche Region Extension Service was particularly active, and in the past, demonstration projects had been conducted in close collaboration with four local farmers to reduce the high input of pesticides in pest management for fruit production, and particularly for peaches. The trials focused on mating disruption, which is a situation where pheromones are released into a pest habitat in sufficient amounts to reduce the ability of the males to find females, or *vice versa* (Baker and Heath, 2005). The demonstration projects were successful only in some areas, because the farms were small and this technique is *"... effective only if implemented over wide areas, in order to avoid the entrance of mated females from non-treated areas..."* (an interviewed expert).

### *3.2.2 Stakeholder and stakeholding*

The WP AEA was born as a result of the triggering of the regional Extension Service agent, who was well-informed about the AEAs. Based on the results of previous investigations performed in the area, the agent proposed the creation of a local AEA to four farmers. A first group of stakeholders was created, which included other local stakeholders (Table 4), and then they asked the policy makers of the Marche Region Agriculture Service to activate a new mating-disruption AEM under WP AEA. Considering the small area of the Aso Valley, the policy makers underlined the risk of the low participation compared to the complex procedures to renegotiate the RDP with EU officials. At the end of the AEA implementation, "*...the applications were so many that regional managers could not believe it...*" (the Extension Service agent), and this result "*...was related to the trust that the agent had with the stakeholders...*" (regional officer). Stakeholders designated the local public administrative body as the lead partner, but maintained control of the AEA. Almost 100 farms and about 1000 ha (80% arable land; 20% orchards) were included in this WP AEA.

### *3.2.3 Facilitation*

Many stakeholders highlighted that the WP AEA measures were discussed in participatory meetings where the regional Extension Service agent demonstrated strong connections and mutual trust with the farmers, with whom she (probably unconsciously) had the role of a facilitator. The farmers were not passive in the design process of the AEA, but as the Extension Service agent said, *"...they discussed the AEMs with regional officers, they called me when necessary, they organised the meetings, and they went house to house to involve more farmers ... we worked very well in synergy..."* and many other farmers joined the AEA design process after *"...they saw the results of the experiments..."* (a farmer).

### *3.2.4 Institutions and policies*

Negotiations with the EU concerning some RDP modifications was required to include the new the mating-disruption technique AEM that had emerged in the participatory design process. The negotiations were carried out directly by the regional officers, who agreed to the requests of the local stakeholders step-by-step, and reported the objections of the EU to the stakeholders. Normative problems emerged concerning the farming areas; as the local RDP allowed the WP AEA only within the NVZs, the Marche Region and the EU negotiated the enlargement of the eligible area to make the application of the mating-disruption technique more effective.

Even if the EU showed interest in this AEA approach, the RDP renegotiation process was so laborious that a regional officer who was interviewed defined it as *"...a delirium..."* because *"...innovative bottom-up actions need to be translated into bureaucratic language, which is tricky, hostile and complex..."* (Agriculture Ministry officer).

The process to define and negotiate the new RDP AEMs lasted approximately 1 year, and led to the AEA measures that are listed in Table 5.

**Table 5** The new WP AEA measures agreed between the stakeholders and included in the Marche Region RDP 2007-2013 after negotiations with EU.

alt-text: Table 5

| Measure | Description |
|---|---|
| 1.1.1.b | Training activities and information actions |
| 2.1.4.a | Integrated farming with advanced integrated pest management (mating disruption) |
| 2.1.4.b | Organic farming systems |
| 2.1.4.c | Permanent swards |

### *3.2.5 Ecological constraints*

The only constraint that emerged in the WP AEA was related to the small farm areas, which would have constrained the application of the mating-disruption technique if this was applied by the individual farmers. The enlargement of the eligible area beyond the boundaries of the NVZ allowed the aggregation of sufficient orchard areas to effectively apply the techniques.

## 3.3 The BIO AEA design process

### *3.3.1 History of the situation*

The design process of the BIO AEAs began in the final phases of the WP AEA design process. As for most of the other regional administrations in Italy, the Marche Region was late in the preparation of the AEMs for the management of the Natura 2000 sites, mainly due to strong conflicts with farmers.

In one of the Natura 2000 sites (called Torricchio), the manager was also a researcher from a local University who had previously carried out research into grassland conservation management in close collaboration with the local farmers, and who had a role similar to that of the Extension Service agent in the WP AEA. Some shared management practices emerged from these collaborations.

### *3.3.2 Stakeholder and stakeholding*

The analysis of the BIO AEAs describes a different genesis path compared to the WP AEA. The same policy makers of the Agriculture Service involved in the WP AEA were the trigger for the BIO AEAs. Considering the unexpected success of the WP AEA, they hypothesised the activation of AEAs for the Natura 2000 sites. The policy makers proposed that the Marche Region Environment Service join in the drafting phase. Together, they identified the managing authorities of the Natura 2000 sites as AEA lead partners.

Each lead partner was asked to identify the AEMs to be implemented in their areas. Only the Torricchio manager proposed a set of AEMs shared with local stakeholders. These AEMs were then evaluated by the policy makers and, after a negotiation phase with the EU, they were included in the RDP with some modifications, and without any other consultations with the AEA stakeholders.

Each BIO AEA lead partner was then asked by the Marche Region to design their AEAs through participatory meetings with other local stakeholders, to select from among the proposed AEMs those that were most suitable and applicable in their area. To select the AEMs, the BIO AEA lead partners involved the municipalities that are included in the Natura 2000 sites, along with the farmers and the Farmers' Union staff members. Most of the BIO AEAs facilitators were practitioners with different backgrounds (e.g., agronomists, biologists) and/or local Farmers' Union staff members, while in the Torricchio BIO AEA, the facilitator was the researcher who was managing the area. Some other managers adopted all of the AEMs without any discussion with the stakeholders, and asked them to submit their applications to join the BIO AEAs.

In the BIO AEAs design process, no active role was taken by the Ministry of Agriculture. A Ministry officer who was responsible for the management of the Italian Natura 2000 sites stated when interviewed: *"…in Italy* [April 2013] *we have not spent enough on Natura 2000 yet…"* and highlighted how the AEA approach *"…is innovative but risky, in terms of payment, if the Payment Authority is not involved from the starting phase…"*. This lack of involvement in the BIO AEAs caused payment delays that discouraged other farmers from submitting applications.

### *3.3.3 Facilitation*

Unlike what was observed for the WP AEA, in the BIO AEAs only the Agriculture Service, the Environment Service, and the Natura 2000 site lead partners shared this process. The Torricchio BIO AEA was an exception here, where the measures were designed in close collaboration with the local stakeholders. In all of the other cases, the local stakeholders were involved only in the later stages, where they were only able to choose which AEM to be implemented in their AEA, and which to exclude.

The missed opportunity for modification of the AEMs restricted the number of farmer applications, and created conflicts and uncertainty. In these cases, the facilitators were perceived as, *"…people who did not understand the environmental context of the place…"* (Farmers' Union staff member) or even as *"…dictators…"* (farmer). Moreover, *"…the AEA was seen as a new restriction to the farmers' activities…"* (Farmers' Unions staff member) due to the impossibility of adapting the AEMs to local conditions. Other conflicts emerged between the managers of the Natura 2000 sites and the farmers concerning the constraints linked to grassland management. For example, a farmer stated: *"…cutting a shrub in a pastureland was impossible* [due to strong vegetation protection measures], *and the managing authority has to understand that pasturelands must be managed to be maintained…*".

Different outcomes emerged in the Torricchio BIO AEA. A Farmers' Union staff member stated that, "*…the initial number of the application forms were around 60 in all of the BIO AEAs, with about 40* [of these] *from the Torricchio AEA…*", which was a consequence of the involvement of the stakeholders in the definition of the AEMs and of the past co-reasearch activities, and thus the AEMs were site-specific. Despite this, some of the AEMs modified by the Marche Region generated uncertainty among local stakeholders, due to their lack of knowledge and understanding of the modified AEMs "*…because we did not know how to apply the AEM prescription…*" (farmer).

For the Natura 2000 sites, where all of the predefined AEMs were adopted by an AEA lead partner without any discussion, the lack of involvement of the stakeholders created high levels of conflict with the farmers. As a result, some of the AEMs were refused and the lead partners were forced to withdraw from the AEA implementation.

### 3.3.4 Institutions and policies

Independent of the area and the site-specific conditions, each AEM was mostly the same in each of the BIO AEAs. For this reason, some farmers faced paradoxes, like "*...the request to control non-present invasive species...*" (farmer) in their area (e.g., *Brachypodium* sp.), or the request to increase wooded hedges in woodland-dominated areas. Some AEMs were refused in the EU negotiation phase because they were *"...not controllable by the Payment Authority..."* (regional officer). As mentioned in Section 3.3.2. (Stakeholder and stakeholding), in the first 2 years of the BIO AEAs, the farmers experienced long delays in the payments due to property issues that were linked to the use of common pasturelands. These delays were overcome after long negotiations between the Marche Region, the EU, and the Payment Authority.

The AEMs proposed for the BIO AEAs are listed in Table 6, although not all of these AEMs were necessarily adopted in each of the BIO AEAs.

**Table 6** BIO AEA measures included in the Marche Region RDP 2007–2013 after negotiations with the EU. The local stakeholders could choose those to be applied or not in their AEA, but no changes were allowed to their content.

alt-text: Table 6

| Measure | Description |
|---|---|
| 1.1.1.b | Training activities and information actions |
| 1.2.5.a | Improvement of drinking troughs in pasturelands |
| 2.1.1.a | Natural handicap payments for farmers in mountain areas |
| 2.1.3.a | Natura 2000 compensation payments |
| 2.1.4.b | Organic farming compensation payments |
| 2.1.4.d | Conservation of native endangered germplasm resource compensation payments |
| 2.1.6.a | Non-productive investments measures |

### 3.3.5 Ecological constraints

The ecological constraints that emerged were closely connected to the different climatic and environmental conditions of the different AEA areas. As the Marche Region applied similar AEMs in each of the BIO AEAs, the farmers perceived some measures as not being site-specific, and therefore as inadequate for their conditions; e.g., postponed ploughing on clay soils for winter cereals in mountain areas. Similar issues emerged for the measures aimed at the conservation of 6210* grassland habitats without taking into account the behaviours of the different grazing animals, as was suggested by the local farmers.

As for the WP AEA, the interviews highlighted some constraints related to the BIO AEA eligibility areas. Farmers with smaller farm areas included in the Natura 2000 sites did not obtain any economic advantages from joining the AEA. Therefore, some of the lead partners did not reach any agreement with these farmers, and the AEA design process failed.

Six BIO AEAs are currently ongoing throughout the Marche Region, which cover around 52,000 ha, and are mainly for conservation management of 6210* grassland habitats.

# 4 Discussion

The analysis of the AEA design process applied in the different case studies (Table 7) allowed the identification of the key elements that led to AEMs that were well accepted, site-specific, and took into account the landscape dimension of the biophysical processes (landscape AEMs). In the following paragraphs, we analyse in more detail the consequences of the different design pathways that were used in the AEA case studies.

**Table 7** Differences in the design processes of the AEMs adopted in the AEA case studies.

alt-text: Table 7

| Phase | WP AEA | Torricchio BIO AEA | Other BIO AEAs |
|---|---|---|---|
| AEA trigger | Local stakeholders proposed the activation of an AEA to the Marche Region. They planned their own AEA, identified | The policy makers understood the potential of the WP AEA and tried to apply the same framework to the BIO AEAs. The policy makers involved the Natura 2000 site managing authorities, who were designated as the AEA lead partners and were asked to define the AEMs | |

| | | | |
|---|---|---|---|
| | their lead partner, got other stakeholders involved, and managed the participatory meetings to plan their shared measures. | for the target areas in close cooperation with the stakeholders. | |
| AEM design | In participatory meetings, local stakeholders planned their shared measures. The introduction of the mating-disruption technique was the result of several demonstration projects that had been carried out with farmers previously, and it was shaped according to their needs. | A University researcher and the Torricchio Natura 2000 site manager discussed the AEMs to be defined for their area with the local stakeholders. The AEMs were already well known by the local stakeholders from previous research activities in the area. | The lead partners of all of the other BIO AEAs had poor relationships with the local stakeholders. Furthermore, the farmers were never involved in the local research activities. For these reasons, they were not involved in the design processes of the AEMs. |
| | The Marche Region discussed each single modification requested by the EU with the stakeholders. | Due to the lack of further proposals and on the grounds of urgency, the Marche Region adopted the measures proposed by Torricchio for all of the BIO AEAs, with some changes that had not been agreed with the Torricchio stakeholders. In the following steps, the local stakeholders of all of the BIO AEAs were only allowed to choose between the AEMs that were proposed based on the Torricchio experience. | |
| | A new site-specific and landscape scale AEM emerged, to take into account the landscape dimension of the pest management of orchards. The new measures included were therefore highly accepted by the local stakeholders. | The AEMs were site-specific, and some of them were also AEMs at a landscape scale. Some other modified AEMs were considered of little use or improvable by the farmers, but probably not detrimental to their income. Despite the uncertainties generated from the modified measures, the new measures were highly accepted by the local stakeholders. | No site-specific or landscape scale AEMs emerged. Some of the AEMs were considered to be of little use, improvable, or even detrimental to their income by the farmers. Many conflicts emerged between the stakeholders. |
| EU negotiations | A long phase of negotiations was needed to modify the Marche Region RDP and to justify the AEMs not presented in the RDP ex-ante evaluation. | | |
| AEA applications | AEAs were successfully implemented with a high number of farmer applications. | | Five AEAs were implemented with different results between the areas. The AEA implementation failed in two case studies. |

## 4.1 Inclusion of local knowledge leads to site-specific AEMs

In the case studies analysed, the design process of the AEAs highlighted the different levels of inclusion of local knowledge and the different effects on the site specificity of the AEMs, and thus on their acceptance (Table 7, AEM design phase).

The WP and Torricchio BIO AEAs were the most successful in terms of stakeholder agreement. Probably unconsciously, some of these stakeholders will have acted as key stakeholders and carried out the role of knowledge brokers (Reed et al., 2009), thus shifting their institutional role in the system (Table 4). In these two case studies, the AEMs were defined in close cooperation with the farmers from the beginning, and arose from the combination of trust and local knowledge that had been generated in previous research activities and in the participatory meetings, and were therefore site-specific and well known, and thus also well accepted. Essential conditions for 'win–win' agri-environmental policy making are: interest in the issue, decision alternatives, trust among the parties, transparency of the process, and dedicated personnel (Prager and Freese, 2009); stakeholder participation right from concept development and planning (Reed, 2008); responsibility for developing management solutions remains with farmers (Burton and Paragahawewa, 2011); and flexible schemes that are adaptable to changing circumstances (Emery and Franks, 2012). Similar indications emerged also from the WP and Torricchio BIO AEAs, which also emphasises the need for a shift in the roles of all of the stakeholders (Table 4). The farmers shifted from the passive role of "implementors of AEMs" to the active role of "AEM designers". The Farmers' Unions staff members, who are usually in charge of the lobbying activities, shifted their role to "supporters of the participatory process".

The flow of local knowledge should not be interrupted in any phase of the AEM design process. Indeed, despite the similarities between the WP and Torricchio BIO AEAs, some differences can be seen. In WP AEA, the measures were planned as a result of cooperation between local stakeholders, and the policy makers shifted their "command and control" role (Table 4) to stakeholders working in collaboration with other stakeholders. Indeed, there was continual debate between the stakeholders at all of the steps of the AEA design process (e.g., negotiations of the AEMs with the EU), and local knowledge flow was fed into each step, facilitated by the shift in the stakeholder roles. In addition to this shift, in WP and Torricchio BIO AEAs, it was possibile to observe: (i) sharing of authority; (ii) partnerships of government and local people; (iii) decentralised decision-making; and (iv) vertical linkages for governance; these are features that were listed as very important for co-management by Galappaththi and Berkes (2015). On the other hand, in the Torricchio BIO AEA, policy makers returned to the original "command and control" role when they changed some measures without sharing these with the local stakeholders. Sharing of authority was replaced with a linear transfer of knowledge (Ison et al., 2011), and the farmers switched back to the role of "predefined AEM implementors". The flow of local knowledge was interrupted, creating diffidence among the stakeholders, and problems for the site-specificity of some of the AEMs (Table 7, AEM design). However, for both of the case studies, co-management spontaneously emerged and evolved through feed-back learning (i.e., past research and demonstration projects).

In the other BIO AEAs, stakeholder involvement took place only at the later stages of the design processes and with limited decision alternatives (Table 7, AEM design), which in turn limited the trust among the parties and in the process (i.e., lack of co-management features). For these reasons, the design process was perceived by local stakeholders as not being transparent, and this created ed lack of empowerment (i.e., limited or no sharing of authority), and the facilitators were perceived as mere executors of the decisions of the lead partners. Thus the shift of the stakeholder role in the system (Table 4) did not occur in these cases. This situation arose due to the lack of reflection by the policy makers on their new role in the system. In particular, they did not analyse the reasons behind the success of the WP and Torricchio BIO AEAs and they hypothesised the same AEMs for the other BIO AEAs.This decision led to the implementation of meaningless (from the stakeholders perspective) or inapplicable measures. Some studies have observed similar dynamics, where historical and contextual differences have led to policies that were successfully adopted in one area and were inappropriate or refused in other similar areas (Armitage et al., 2008; Steyaert and Jiggins, 2007).

As suggested by Burton and Paragahawewa (2011), to produce agri-environmental goods, farmers need to learn about the connections between their land management practices and environmental outcomes. In terms of this vision, The policy makers should have analysed the whole of the WP AEA process (e.g., using the SLIM diagnostic framework and its variables) to highlight the reasons behind its success.

According to Galappaththi and Berkes (2015), the other BIO AEAs could be classified as cases of "unsuccessful top-down co-management", due to the lack of knowledge of the features needed for a co-management process.

## 4.2 AEAs legal arrangement allows inclusion of a landscape approach in AEMs

In the WP and Torricchio BIO AEAs, the aggregation of the farmers favoured the emergence of the landscape dimension of some environmental issues, and overcame the farm-level approach.

In the WP AEA, the stakeholder understanding of the landscape dimension emerged during the AEA design process. The request to expand the target areas to include farms located outside the NVZ came from the stakeholders, and was designed to improve the effectiveness of the measures based on the mating-disruption technique. McKenzie et al. (2013) observed high willingness of farmers to participate in collaborative AEMs as long as these were applied only to portions of their farm, and not to their whole farm. We believe that the learning that was generated from the beginning in the WP AEA design process strongly increased the "willingness" of the farmers. Indeed, the new site-specific and landscape AEM were applied to the entire farms, even for the most valuable products, like the orchards.

In the Torricchio BIO AEA, the stakeholders showed an understanding of the landscape dimensions by analysing their areas as a continuum to be managed collectively, and not as a collection of fields. Indeed, during the meetings, the stakeholders identified some areas where the grazing period for biodiversity conservation should be earlier, and others in which it should be postponed. This confirms what was observed by Prager and Freese (2009), that farmers or local stakeholders can identify fields of cooperation, find innovative solutions to problems identified, and generate win–win situations.

In the other BIO AEAs, despite the imposing of the AEMs by the policy makers, the AEA design process was sufficient to create some attempts for landscape planning, co-management, and a tentative shift in the stakeholder roles for farmers, similar to Torricchio BIO AEA. This highlights that the AEA formal arrangements allowed the emergence of a landscape dimension and favoured the shift in roles also under these less than ideal circumstances for knowledge inclusion and sharing. For example, collective management of the fragmented properties and of the pasturelands under customary rights was proposed by the stakeholders during the participatory meetings. However, these proposals were not accepted because the AEMs were already included in the Marche Region RDP after the negotiations with the EU Directorate-General for Agriculture and Rural Development, and they were not modifiable again within a reasonable time. In this case, the "rulebook" for land management, that was criticised by Burton and Paragahawewa (2011) because it was seen to constrain the abilities of the farmers to develop unique and innovative solutions to reach scheme targets, limited the possibility of generating shared choices in most of the BIO AEAs.

At a landscape scale, Prager et al. (2012) stressed the need for participatory and collaborative approaches that facilitate the processes of communication, negotiation and feedback, to allow joint monitoring, learning, and scheme adjustments. The AEAs did indeed favour the co-management of natural resources and scheme adjustments whenever the shift in stakeholder roles and local knowledge inclusion occurred.

Prager and Nagel (2008) observed that authorities tend to feel threatened by participatory approaches due to the risk that they might lose their power and legitimacy. The analysis of WP and Torricchio BIO AEAs highlights the empowerment of some stakeholders, which however was not a consequence of power loss or legitimacy from other stakeholders (i.e., policy makers), but derived from the sharing of power and responsibility. The policy makers could have stopped the process triggered by the AEA legal arrangement at any moment, as they actually did in other BIO AEAs. However the policy makers themselves were involved in the process, and they shifted their role and participated in the sharing of knowledge. For these reasons they were not delegitimised by the process and they were encouraged to propose the BIO AEA.

However, a missing part of the process that was not envisaged by the policy makers was the definition of the monitoring and feedback mechanisms that should generate, in turn, learning among stakeholders. Moreover, the "stakeholder involvement" within the AEA process remained vague, which according to many studies (e.g., Prager and Freese, 2009; Reed, 2008; Tarrasón et al., 2016) highlights the need to include skilled facilitators, and the institutionalisation of the participatory processes. The results of this evaluation carried out by our research group were discussed in several informal meetings with the policy makers responsible for coordination of the Marche Region RDP 2014–2020, who decided to include a "skilled facilitator" among the eligible costs for the new call for AEAs (AEA 2.0) that was published in September 2016.

Also, the reciprocal trust among the stakeholders generated in the AEA design process was seen to create an informal learning platform and favourable conditions for further concerted actions at a landscape scale. Starting from the WP AEA experience, the Aso Valley stakeholders have activated a supply production chain of fruit based on the mating-disruption technique, with the deeper involvement of the inhabitants and local environmentalists. In the Torricchio BIO AEA, the stakeholders have started to reflect on the possibility of applying for a short food-supply chain based on lamb meat.

The emergence of social learning within a process of co-management turns into adaptive co-management (Galappaththi and Berkes, 2015). In a review, Rodela (2014) suggested that learning and social learning are not interchangeable. An attempt to distinguish between these was provided by Reed et al. (2009), who proposed that if learning is to be considered "social learning" then it must: (i) demonstrate that a change in understanding has taken place in the individuals involved; (ii) demonstrate that this change goes beyond the individual and becomes situated within the wider social units or communities of practice; and (iii) occur through social interactions and processes between actors within a social network. From what we observed for WP and Torricchio BIO AEAs, it is possible to highlight many examples of learning processes generated from the knowledge sharing. Indeed, we observed in the stakeholders (and not only for the farmers) signs of "changes in understanding" and learning that occurred "through social interactions". We cannot say the same with any certainty with regard to point two of Reed et al. (2009) (i.e., "goes beyond the individual"), which is probably still ongoing (i.e., supply production chain processes). However, it is possibile to identify a double loop of learning in the design process of both the AEAs, which is defined as correcting errors by adjusting values and policies (Armitage et al., 2008).

According to Galappaththi and Berkes (2015), from our case studies it emerged that adaptive co-management can evolve from simple systems of management spontaneously through feed-back learning over time (i.e., the past research and the demonstration project). It emerged also that a formal arrangement was necessary to sustained this, which was provided by the approach of the AEAs in the local RDP.

## 4.3 Framework for the design of AEMs at a landscape scale, as emerged from the case studies

To improve the definition of site-specific and/or landscape scale AEMs, an iterative process that was based on the experiences of the AEA case studies was identified (Fig. 3). In light of the EU environmental priorities, local policy makers should only identify a set of targets in the RDPs without predefined measures, to create room for the bottom-up emergence of the AEMs (i.e., sharing of authority, decentralised decision making). In this vision, the AEMs should emerge from a participatory analysis of the site-specific conditions by the local stakeholders (i.e., shift of the stakeholder role in the system, knowledge sharing and inclusion), who need to be involved from the very first phases of the design process. In a following step, co-analysis of the proposed AEMs is required that includes the local and EU policy makers (i.e., partnerships of government and local people, vertical linkages for governance), and also other relevant stakeholders that can be identified (e.g., researchers). Policy makers need to avoid making any changes to the AEMs without sharing the reasons with the other stakeholders.

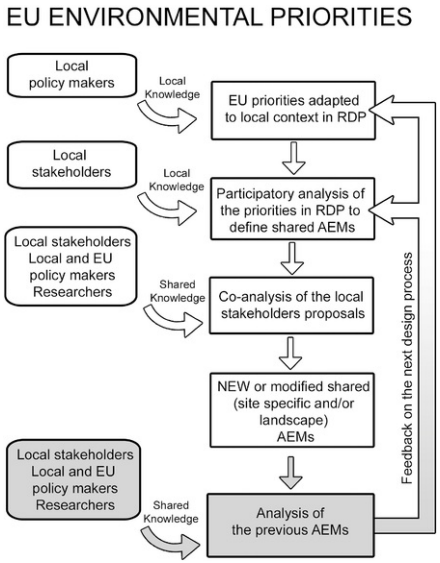


**Fig. 3** The iterative process for the design and evaluation processes of the AEMs.

alt-text: Fig. 3

In this framework, the stakeholders will improve their system knowledge, which will lead to: (i) identification of new stakeholders who were not included at the beginning (e.g., the Payment Authorities); (ii) analysis of the ecological constraints that affect the system (e.g., the need for a landscape approach for the mating-disruption technique); or (iii) taking into account the institutional and policy framework (e.g., time constraints for RDP fund expenditure, grazing rules on common land) that might limit or create new conditions for the stakeholder actions.

In agreement with the SLIM diagnostic framework and with other studies (e.g., Berkes, 2009; Prager and Freese, 2009), an analysis of the previous measures by the stakeholders should be performed (Fig. 3). This is because the socio-ecological conditions of the ecosystems are constantly changing, and the successive loops of learning and problem solving in learning networks can incorporate new knowledge that can be used to deal with problems at increasingly larger scales (Berkes, 2009).

The design process described was applied in the WP AEA, mostly applied in the Torricchio BIO AEA, and not applied at all in the other BIO AEAs (Fig. 4). As the WP AEA had all of the characteristics mentioned above, new shared site-specific and landscape measures emerged. In the Torricchio BIO AEA, the process was altered by the intervention of the regional authorities that imposed some AEMs, which thus created problems with farmer acceptance. In the other BIO AEAs, many conflicts arose because of the lack of local stakeholder involvement. There was no evaluation process in any of these case studies because it was not required by the local RDP.

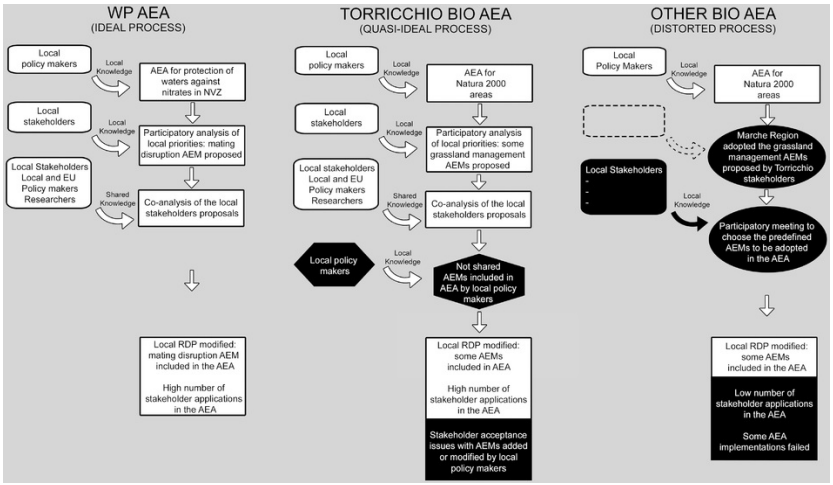


**Fig. 4** The ideal design process that was applied in the WP AEA, and the differences seen for the other case studies.

alt-text: Fig. 4

In a review on AEM, Uthes and Matzdorf (2013) underlined that "*…there is not yet extensive literature on collaborative AEM, but the existing studies suggest that collaboration among farmers on a larger or even landscape-wide scale may be promising, if properly designed and implemented*". In a viewpoint article, from other case studies, Prager et al. (2012) derived the factors and overlapping phases needed in the design and implementation process, which started from the various types of information collection needed to feed the process. Prager (2015) underlined many different aspects that lead to collaborative agri-environmental management: awareness of a problem; good horizontal and vertical communication; access to high quality advice and support; support of existing groups and networks; trust; flexibility in scheme design; funding for feedback; monitoring and evaluation of the results. Except for the last two (i.e., funding for feedback; monitoring and evaluation of the results), these features were present in the successful examples of the AEM and AEA design processes that we have discussed here. Our case studies add to these features the need for a shift in the stakeholder roles in the system, and the framework we propose creates a legal arrangement that targets the shift in the roles of all of the stakeholders, including the policy makers. Indeed, delegation of stakeholders to produce AEMs facilitates the shift in their roles and implies the need to involve other different stakeholders with different knowledge in the analysis and design processes (e.g., researchers, but also policy makers and other land managers).

Again, the main driver of the successful AEA and AEM design process was sharing and inclusion in the participatory process of the different knowledge bases (e.g., local, scientific, policy). In the cases where this occurred, it was driven by shifts in the stakeholder roles that were allowed by the formal AEA arrangement.

This role shifting might have occurred in other contexts too; e.g., for the "Bordeproject Lower Saxony" case study (Prager and Freese, 2009), the "dialogical tools" case study (Toderi et al., 2007), the "collaborative management in Sri Lankan shrimp aquaculture" case study (Galappaththi and Berkes, 2015), and the "pastoral systems in northern Nicaragua" case study (Tarrasón et al., 2016). However, in all of these examples, the authors never directly referred to any

shift in the stakeholder roles in the system.

This shift in the stakeholder roles might be seen as a signal of empowerment of some stakeholders (e.g., farmers) in a co-management process. However, with a more general vision, and also including other stakeholders in the analysis (e.g., the policy makers), this can be seen as a feature of a co-management process.

The design process will be faster in systems where there is already spontaneous co-management, and slower in situations where it is necessary to initiate co-management from the start (i.e., in the cases here of the BIO AEAs, where we observed tentative shifts in the roles). However, this is likely to run into the time constrains of the RDP (as emerged in the other BIO AEAs here), as these processes are time consuming.

# 5 Conclusions

The analysis of these case studies has highlighted the key elements that are needed to create site-specific and/or landscape AEMs within an RDP that will have high levels of acceptance among the stakeholders: (i) stakeholder involvement must take place from the very beginning of the design process of the AEAs and/or the AEMs; (ii) stakeholder involvement must take place at each phase of the process, to avoid changes in the AEMs without sharing of the reasons for these changes with the stakeholders; (iii) a predefined "rulebook" must not be imposed, as the stakeholders must be allowed to design their own measures to create site-specific AEMs with a landscape dimension; (iv) the AEA legal arrangement must allow the analysis to be focussed on specific local conditions, and lead to the emergence of the "landscape dimension" of the environmental issues addressed. In this process, a shift in the stakeholder roles in the system is required from the very begining, because this favours the flow of local knowledge in the design of the AEMs. This shift in the stakeholder roles in the system is a feature of co-management.

However, the creation of room within RDPs for bottom-up and stakeholder actions might be lost by the long and complex EU bureaucratic procedures for the implementation of what emerges from the stakeholder involvement. If this problem is of minor importance when spontaneous co-management processes are already present, this can create time constraints for the expenditure of funds within the RDP period, which is a relevant issue that concerns policy makers.

# Uncited references

Egdell (2000), O'Sullivan (2012) and Rowlinson and Cheung (2008).

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**Highlights**

- Agri-environmental measures (AEMs) with landscape goals are analysed.
- A legal arrangement for the inclusion of the landscape approach in AEMs is analysed.
- Inclusion of local knowledge leads to site-specific and/or landscape scale AEMs.
- A shift in stakeholder roles is needed for natural resources co-management.
- A framework for site-specific and/or landscape AEM design processes is proposed.

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An Agri-environmental measure (AEM) is a payment to farmers to reduce environmental risks or to preserve cultivated landscapes. The single farm scale that is the basis for the AEM has often inhibited the achievement of the environmental goals since many biophysical processes (e.g. soil erosion, water pollution, biodiversity losses) occur at landscape scale. This creates a spatial scale mismatch between the implementation scale of the measures and the ecological processes controlling the target agri-environmental issues. In this paper, we propose how to address this spatial scale mismatch by analysing nine case studies of AEMs implementation at landscape scale concerning biodiversity conservation and water protection. The analysis highlights that the inclusion of the landscape scale in AEMs depends on the level of the involvement of the local stakeholders (SH) in the building process. When the authorities created the space for the SHs to participate in the defining process of AEMs, the inclusion of local knowledge led to the emergence of new landscape and site-specific AEMs which were not previously considered by the autorities. On the contrary, when the SHs were only allowed to choose among the AEMs predefined by the authorities, many site specificity and acceptance issues arose. The creation of space in Rural Development Programmes for collaborative, bottom-up and landscape scale AEMs and the overcoming of institutional constraints in the design of specific actions are the key ingredients for the successful adoption of measures and for enhancing their effectiveness. In this paper, we explore in depth what made these stories successful and provide a framework for the implementation of site-specific and landscape AEMs.

*Keywords;* Rural Development Programme; agri-environmental measures; spatial scale mismatch; local knowledge; co-management; shift in stakeholder roles

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