Preserving permanent mountain grasslands in Western Europe: Why are promising approaches not implemented more widely?

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Abstract. *To protect grasslands and maintain the ecosystem services they provide, many European countries have been offering agri-environment measures aimed at maintaining extensive grazing by cattle, sheep or goats. Yet, despite more than two decades of agri-environment measures, semi-natural mountain pastures are still seen as threatened by abandonment and subsequent shrub encroachment. Building on a three-round Delphi inquiry, we analyse the perception of a range of experts on how measures aimed at maintaining mountain grasslands are designed and implemented in Austria, France and Norway. Results show that the experts see the need for a stronger involvement of diverse regional actors, the need to increase the flexibility given to farmers in managing mountain grasslands, and the need to reconceptualise monitoring as a social learning process. While these approaches are implemented in some 'best practice' examples, they are not widespread. Understanding these approaches as requiring double-loop learning may contribute to explaining their limited spread. Indeed, they build on a radically different conceptualization of farmers and of researchers, and thus of how agri-environment measures need to be designed and implemented to be effective. Yet, such radical changes are likely to be resisted.*

Keywords: open landscapes; ecosystem services; single-loop and double-loop learning; agri-environmental schemes; mountain grassland

1. Introduction

Historically, permanent mountain grasslands have been used by farmers as pastures in the summer months, to graze cattle, sheep or goats (Poschlod and WallisDeVries, 2002). These grasslands are semi-natural, i.e. they require management by farmers to be maintained. They are species-rich, but productivity is low as the growing season is short and they are usually located on nutrient-poor soils (Hopkins, 2009). While this makes them less attractive to farmers, they are valued by society for the broad range of ecosystem services they provide.

These services are highly interconnected and include regulating services, such as buffering climate extremes, preventing flooding, and purifying water; provisioning services, such as providing high quality fodder for livestock; supporting services such as nutrient cycling, maintaining biodiversity and soil fertility; and cultural services, such as contributing to the aesthetic value of open landscapes and offering a space for recreational activities (Gibon, 2005; Quétier et al., 2010; Lindemann-Matthies et al., 2010; Lavorel et al., 2011; Ocak, 2016).

The land-use changes induced by agricultural modernisation are threatening these extensive grasslands (MacDonald et al., 2000; Eychenne, 2008). Indeed, while in favourable areas agriculture has intensified, in less favourable areas – such as mountain areas – land tends to be abandoned. As a result of abandonment, the semi-natural mountain grasslands are encroached by shrubs and may over time revert to forests (Cocca et al., 2012; Carlson et al., 2014). This change in land-use is linked to changes in the ecosystem services that can be provided (Schirpke et al., 2013).

In an effort to counter-act the adverse impact of agricultural practices on the environment, the 1992 MacSharry Reform of the Common Agricultural Policy (CAP) required every Member State to introduce an agri-environment programme[1] (see Council Regulation (EEC) 2078/92; Potter and Goodwin, 1998; Strijker, 2005; Isoni, 2015). Since their inception almost 25 years ago, the programmes have evolved over the subsequent 7-year programming periods of the CAP. The programmes are diverse, not least given the high level of subsidiarity which allows the Member States much leeway in the design of their overall programme and of individual agri-environment measures (Beckmann et al., 2009). What they have in common is the basic rationale: participation is voluntary, and the state pays participating farmers to deliver an environmental service. Such payments have been offered to farmers to maintain grazing the mountain pastures in the summer months, so as to keep the landscape open and contribute to preserving the specific biodiversity of these semi-natural grasslands.

The agri-environment measures have been relatively successful regarding their uptake, however they have been only partially successful in achieving their conservation goals

[1] While Norway is not a Member State of the EU, it has also implemented agri-environment measures as part of its agricultural policy

(Uthes and Matzdorf, 2013; Dedeurwaerdere et al., 2015; Hinojosa et al., 2016). Various reasons for this limited effectiveness have been identified, such as the influence of broader societal changes leading to continued farm abandonment (MacDonald et al., 2000; Marini et al., 2011); a lack of economic attractiveness of the measures which focus on compensating cost incurred and income forgone, rather than being incentive payments (Hasund, 2013; Saunders, 2015); or the design and implementation of the measures (Gross, 2011; Ingram et al., 2013; Girard et al., 2015). Indeed, by prescribing specific management practices, the measures insufficiently acknowledge the spatial diversity of mountain grasslands, the complexity of ecological processes, and the uncertainties regarding the impact of climate change (Komac et al., 2013; Duru et al., 2015; Girard et al., 2015).

While there have been a number of studies focusing on why farmers do (not) adopt agri-environment measures (e.g. Morris and Potter, 1995; Schenk et al., 2007; Uthes and Matzdorf, 2013), there is much less literature available on the perception of institutional actors (e.g. Beckmann et al., 2009). However, the views of these institutional experts working in government agencies, in farmer associations, and in environmental NGOs are important, as Member States have been encouraged to design the measures in a decentralised and participatory way. The design of the measures is thus the result of a complex and protracted political process (Rutz et al., 2013). This process starts at EU-level and leads to a broad framework published by the European Commission (see e.g. Regulation (EU) 1305/2013 and Regulation (EU) 1306/2013) and ends when the Commission approves the agri-environment programme defined by each Member State. The individual agri-environment measures are designed in a process at (sub-)national level, and are thus influenced by the respective policy arena, with its specific government structures, political ideologies, and administrative culture, as well as relative political power of various policy actors at various scales (Beckmann et al., 2009). While the specific processes that lead to defining a measure vary, in most cases the agricultural administration and farmers' interest groups play a defining role, but the environmental administration as well as researchers and environmental NGOs may also be involved (Beckmann et al., 2009; Benoit and Patsias, 2014). Overall, despite nationally varying efforts to include a diversity of actors during development and evaluation, agri-environment programmes can still be seen as following a state-led and expert-led mode of governance, characterised by a top-down approach to designing and monitoring (Morris, 2006; Prager, 2015).

91 This paper aims to add to the discussion why agri-environment measures have so far been
92 limited in their effectiveness in preserving semi-natural mountain grasslands. We propose
93 that while measures targeting the maintenance of grasslands have certainly changed over the
94 last 25 years, the improvements were mostly incremental, i.e. based on single-loop learning.
95 While this might have improved the effectiveness of the administration of the measures in a
96 number of ways, it has not achieved the expressed goal: maintenance of semi-natural
97 mountain grasslands. The changes needed to achieve this goal might well require double-
98 loop learning, which would imply to design and implement measures based on radically
99 different assumptions.

100 The distinction between single- and double-loop learning was developed by Argyris and
101 Schön (1978) in the context of organisational learning. It has been transferred to learning in
102 a policy context (e.g. Grin and Lober, 2007; Pahl-Wostl, 2009; Hall, 2011). In the context
103 of agri-environment measures, we understand single-loop learning as referring to
104 incremental changes, such as adaptations of contractual arrangements or fine-tuning specific
105 aspects of prescribed management practices. This constitutes instrumental or technical
106 learning, based on the experiences gained during the implementation of measures in the
107 previous programming periods. It is concerned with adjusting the measures to address day-
108 to-day problems and with increasing the efficiency of various processes. The aim is thus to
109 improve performance, without questioning established routines, or the underlying
110 assumptions and beliefs. In contrast, double-loop learning does question the assumptions
111 that guide the definition of priorities, of the boundaries of the system under consideration,
112 and of means suitable to achieve the goal. As a result, they present a radical departure from
113 established practices. As Pahl-Wostl (2009) points out, this often implies the need for social
114 learning, as it may lead to changes in the actors involved, and to shifts in the allocation of
115 resources. Distinguishing between changes that build on single-loop vs. double-loop
116 learning thus helps to understand why some proposed changes are resisted by some actors.
117 Indeed, as changes building on double-loop learning tend to be a radical departure from
118 mainstream approaches, they tend not be compatible with the dominant policy regime. This
119 may curtail their spread.

120 The next section describes how we collected the data using a Delphi inquiry to ask experts
121 in Austria, France and Norway to share their views on the current state of mountain
122 grasslands and on the agri-environment measures to maintain open landscapes. We then

summarize the changes the experts saw as necessary to make these measures more effective. We do so under three broad headings: involving a broader range of stakeholders, increasing the flexibility at farm-level, and reframing monitoring as a social learning process. We then illustrate how these changes have been implemented in 'best practices' examples provided by the experts. We close by discussing the extent to which these 'best practices' build on double-loop learning, and how this may contribute to explaining why they are not implemented more widely. Indeed, we argue that the changes imply a radically different conceptualisation of farmers and of researchers; and as a result of the designs that are perceived as effective. However, radical changes in the design and implementation process are likely to be resisted.

2. Method: the Delphi inquiry

The Delphi method of inquiry is a qualitative method through which information is gathered iteratively, involving a panel of subject-matter experts (Hsu and Sandford, 2007; Grisham, 2009; Häder, 2009). While the Delphi technique has been used to seek consensus and make predictions, in this study, it was used to reveal commonalities between the three countries, and to enable experts to learn from each other's experiences and proposals for promising design options. In contrast to interviews, the Delphi inquiry allows reflection on the results of the previous round and allows the experts to reflect on their answers in light of the answers of other experts.

Members of the expert panel were recruited in Austria, France, and Norway. Experts were identified informally, mostly through direct contacts of researchers, who were familiar with and engaged in networks related to mountainous grasslands. Further experts were identified through their membership in formal working groups and committees, as well as through referral. The aim was to include all groups who were or who could be involved – directly or indirectly – in the design or administrative implementation of measures. We thus recruited experts from a range of occupational backgrounds: experts working in government agencies (at regional, national, and EU level), in advisory services, in research and education, in NGOs concerned with environmental protection and rural development, as well as in private sector businesses. We did not include farmers because the aim was not to understand the challenges of implementing specific measures in a specific place, but gain an overall view of the administrative implementation process.

154 The target was to ensure that approximately 25 experts from each country (Tab. 1), with an
155 even spread across the occupational backgrounds (Tab. 2) participate in the first round. This
156 allowed including a sufficiently broad range of viewpoints in the study, while keeping the
157 amount of material produced to a manageable size. Some experts at EU-level were also
158 invited (Tab. 1), as were businesses (Tab. 2). However, the participation rates of these two
159 groups was low, possibly because the management of mountain grassland is not part of their
160 core tasks. Non-response from experts is a major challenge in Delphi inquiries and attrition
161 rates can be high in each round (Padel and Midmore, 2005). In this study, participation fell
162 from 87 experts involved in the first round to 39 experts in the third round (Tab. 1 and Tab.
163 2).

164

165 Table 1 – Number of experts participating in each of the three Delphi rounds, from each country and from the
166 EU-level

	Round 1	Round 2	Round 3
Austria	24	20	12
France	29	22	17
Norway	26	13	7
EU	8	5	3

167

168 Table 2 – Number of experts participating in each of the three Delphi rounds, from each occupational
169 background

	Round 1	Round 2	Round 3
Government agencies	23	15	9
Advisory services	20	16	12
NGOs	25	16	9
Research and education	18	13	9
Private sector businesses	1	0	0

170

171 Invitations to participate in the Delphi inquiry were sent out by email, which included a link
172 to the web-based platform used to collect the data. The invitations to the three rounds, were
173 mailed out in March 2014, June 2014, and January 2015. Each round included 10-15 closed
174 questions, with a number of pre-defined answer options. These were followed by open
175 questions and space for comments. In the next section, when quoting from these comments,

we include the information regarding the occupational background and the nationality of the expert. After each round, we compiled and analysed answers to refine issues and to develop the next set of questions. At the beginning of the second and third round we reported the summarized findings to the experts and we invited them to comment on them. The questions on the web-platform were translated into German, French and Norwegian and pretested before being put on-line, and the comments were translated back into English for analysis.

The first round was a 'scoping' round, to get an overview of the perceptions of the experts on major trends. Among other, we asked them to identify the biggest problem in the context of mountain grasslands. The majority of experts (88%) saw maintaining an open landscape as the biggest challenge, mainly due to land abandonment and the resulting shrub encroachment. Preserving mountain grassland was seen as linked to broader societal changes, that undermine the economic and social viability of mountain farms, and induce shifts in farming practices, i.e. the intensification of grasslands closer to the farm and the abandonment of extensive mountain grasslands.

In this paper we build on the results from the second and third rounds, which focused on the measures that aim to safeguard the openness of the landscape. The second round was used to explore which institutions should be given more competences in designing and implementing measures. The third round was used to assess which stakeholders are currently included and which should be included, as well as to ask experts for 'best case' examples.

3. Changes suggested to more effectively maintain open landscapes

3.1. Broaden the range of involved stakeholders

The experts were asked which stakeholder groups should be involved in various aspects of designing and implementing measures that aim at keeping the landscape open. For this question we distinguished between four tasks, which broadly speaking can be seen as the four stages of an agri-environment measure. With 'designing' we labelled the process of defining the measure, i.e. the conditions tied to the payments, before the agri-environment programme is submitted to and approved by the Commission. While discussions on who will cover the cost of the payments to farmers and of administering and monitoring the measures is usually part of the design process, we have included 'financing' as a separate category to

205 be able to assess the perceived potential for various stakeholders in covering the costs of the
206 measures. Regarding 'implementation' we distinguish between administrative bodies, where
207 implementation is the process leading up to the contract with a farmer; and farmers where
208 implementation refers to complying with the contract on-farm, i.e. the use appropriate
209 management practices. 'Monitoring and controlling' are the processes that ensure that the
210 management practices do comply with the terms of the contract and contribute to achieving
211 the aim of maintaining the semi-natural mountain grasslands.

212 We also distinguished between six groups of stakeholders. The 'agricultural administration'
213 included all offices linked to the ministry of agriculture, including advisory services, the
214 chamber of agriculture and the administration linked to implementing various aspects of the
215 CAP. The 'environmental administration' are the offices in charge of environmental
216 protection and of administering protected areas. 'Farmers' include individual farmers as well
217 as farmer associations. 'NGOs' are all civil society actors, e.g. environmental groups and
218 consultants. 'Food businesses' refer to all stakeholders along the food chain, i.e. processors
219 and retailers; whereas 'tourism' are associations and local/regional public bodies involved
220 in promoting tourism and cultural heritage in the region.

221 The responses show that experts thought that both the agricultural administration and the
222 environmental administration should be strongly involved (Fig. 1). However, the required
223 close coordination between agricultural and environmental administrations remained a
224 challenge. On the one hand, this may be due to the fact that in some countries they are linked
225 to different administrative structures, at different levels of government, i.e. national and
226 regional. On the other hand, experts reported that there still is a "rift between nature
227 protection and farming" (Austria, advisor). An Austrian working at an NGO attributed this
228 to persistent animosities and poor communication, including negative media reports by
229 agricultural groups against Natura 2000. Similarly, environmental awareness had led to a
230 fundamental suspicion towards farmers, which have been portrayed as "polluters, cheaters,
231 profiteers" (France, NGO).

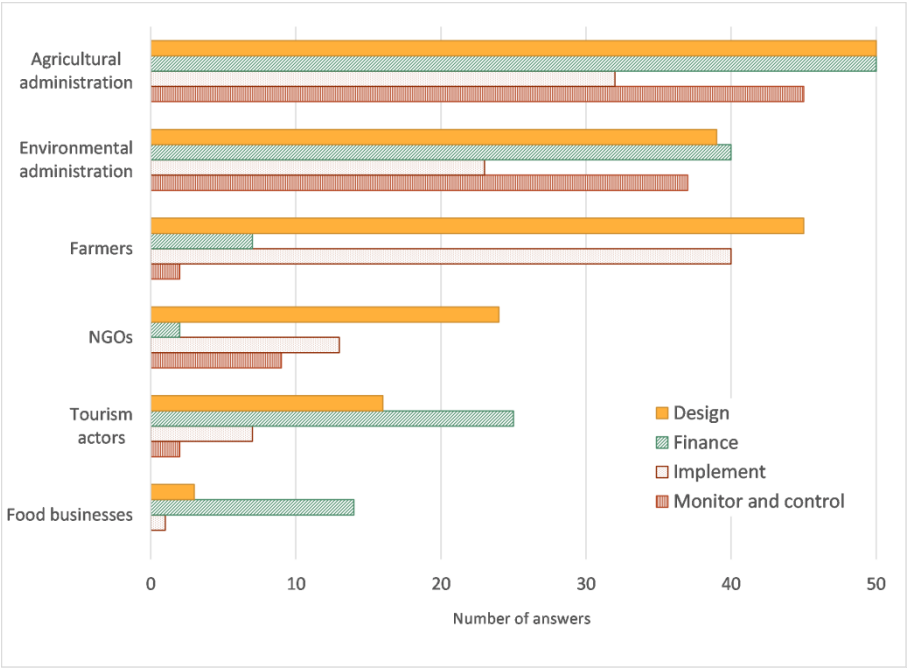

Figure 1: Number of experts indicating that a stakeholder group should be involved in a task linked to measures targeting the openness of landscapes (n=59)

The responses also show that a whole range of stakeholders should be involved in most tasks. By giving important roles to various actors such as NGOs, tourism and food businesses, the experts clearly conveyed that they saw the value of a territorial approach to environmental protection, rather than a sectoral approach with a one-sided focus on agriculture. The literature indicates various ways in which actors could be involved in a context-specific manner, e.g., through rules within geographic indications or other food labels (see e.g. Lamarque and Lambin, 2014), or financial support by tourism actors for specific measures (e.g. maintenance of traditional wooden fences, see e.g. Blumentrath et al., 2014).

We then asked experts whether those stakeholder groups they thought *should* be involved in designing measures, were actually participating in the process. Only around half of the experts indicated that this was the case (Fig. 2). As a researcher from Norway commented: "researchers generally score low on influence, as do environmental organizations and cultural heritage organizations. To ensure sustainable development in rural mountain areas all three should have a stronger influence". Other experts also pointed out that farmers' associations or associations for the maintenance of the cultural landscape often have valuable suggestions, but are not sufficiently involved in the process (see also Beckmann et al., 2009).

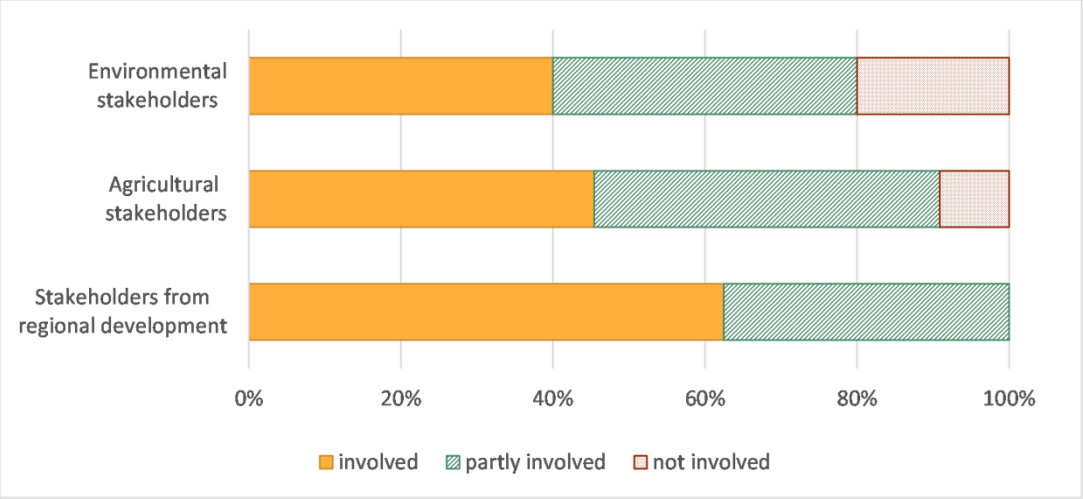

Figure 2: Percentage of experts who state whether – and to what extent – a stakeholder group should be involved in the process of designing measures (n=29)

A respondent from a French NGO highlighted that while a number of stakeholders are consulted, this 'participation' is mostly a form of tokenism (see Arnstein, 1969). Indeed, local needs and a territorial approach tended to carry little weight, as "regulations are often the outcome of highly centralized negotiations at national level, with a strong and powerful sectoral agricultural representation, which negotiates on issues that do not necessarily represent the specific interests of mountain farming" (researcher, France).

The experts clearly conveyed the need for a more inclusive, participatory process to improve the design and implementation of the measures. An advisor from Norway suggested that "the process should start with openness, like a public meeting or a survey, which then should be analysed and elaborated in a smaller working group where relevant actors participate. It is important to have an open process and make room for feedback". This approach was mirrored by an expert from a French NGO: "Ideally, the process would be initiated through a local demand, be it the farmers, the villagers or the municipality. Then researchers and locally active associations should jointly establish a diagnostic. Based on this, various scenarios and possible projects could be discussed." The experts thus advocated an integrated territorial approach guided by a committee, which would ensure that the needs of the different actors at regional level are heard. This approach implies not only a shift to more participation, but also a shift towards more flexibility in the agri-environment measures, so that their implementation can be tailored to the specific local context.

The overall understanding of the experts was that the roles of stakeholders at different levels should be more differentiated: the EU and national level should be primarily responsible for setting the financial framework and for setting (environmental) goals. Regional stakeholders should be in charge of operationalizing these goals by identifying the most economically efficient and environmentally effective way to use the available funds, given the specific regional and local context. The experts saw the collaboration between farmer associations, environmental NGOs and researchers (ecologists, agronomists, but also social science researchers) at local or regional level as very promising. It would give a stronger role to a diversity of local stakeholders (rather than prioritizing the agricultural administration or farmer lobby groups), and this "would enable more dynamism, responsiveness and coherence regarding the local context" (France, researcher). The aim of policies should thus be to "create a framework that encourages initiatives, AND trust local actors to implement the initiatives" (France, NGO, emphasis in original).

3.2. Enable flexibility at farm level

The experts in the Delphi inquiry also pointed out the need to increase flexibility at farm level. Indeed, when experts were asked whether farmers should be given more flexibility, none of the experts said 'never', while 37% said 'always' (Fig. 3). Experts who selected 'in specific situations' were asked to elaborate why and how. They distinguished between goals and practices to achieve them: while farmers should not be flexible on the goals to achieve, they should be granted more flexibility in *how* to achieve them. This would enable farmers to select the practices most appropriate in a specific year, to the specificities of a grassland plot, and to their farming system.

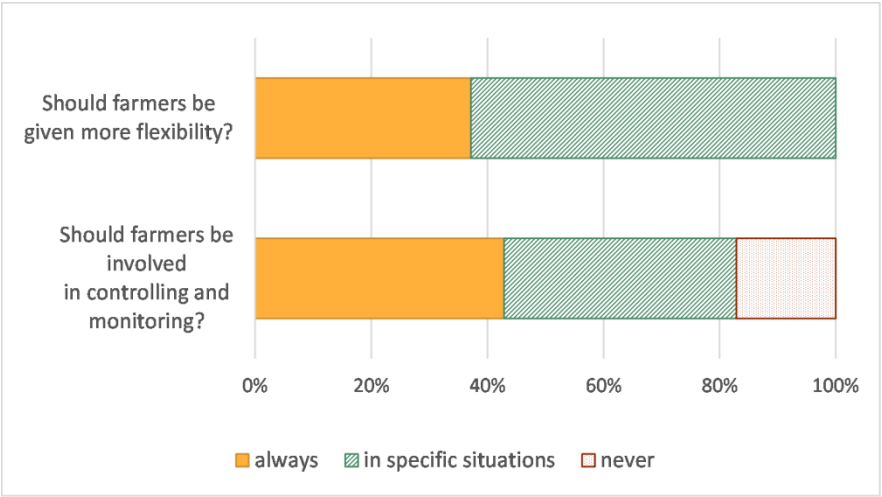

Figure 3: Percentage of experts indicating whether farmers should be given more flexibility in implementing measures to maintain an open landscape, and whether farmers should be involved in controlling and monitoring (n=35)

Indeed, some agri-environment measures seem to micro-manage farming practices (e.g. through specific cut-off dates that need to be implemented in all areas and all years). As a French researcher pointed out, many farmers "live a large mismatch between the practical realities of their job, the way they would like to farm, and the requirements stipulated in the contract, which impose new practices."

We interpret this demand for flexibility as a recognition of the site-specificity of effective management practices and thus the importance of local knowledge. Blanc (2009) details how, through observing nature and their animals, herders can acquire a detailed ecological knowledge, noting how the palatability of grass species changes over time, how microclimate, topography and soils influences species composition, all of which influence quantity and quality of grass at different times and different places of the grassland. Herders can thus have a dynamic understanding of the heterogeneity of the grassland, with season and weather patterns influencing the choice of how to optimally use the available feed resources in relation to the needs of their herd (Blanc, 2009). This dynamic and relational understanding of the appropriate use of the pastures cannot be reduced to standardized technical management rules (see also Girard et al., 2015; Peltola and Tuomisaari, 2015).

Over 60% of experts stated that farmers should be given more flexibility 'in specific situations' (Fig. 3). This conveys the importance of specifying how and under what

conditions this flexibility is given. Indeed, the experts were well aware that flexibility may be linked with a range of risks to effectively achieving the environmental goals. Some experts saw farmers as strongly constrained by economic pressures. For example, a measure may stipulate that pastures can only be grazed starting on the 15th of August to protect certain ground-breeding bird species. Yet there may be years when weather conditions and grass regrowth would make grazing possible starting early August. Flexibility may thus result in a conflict between on-farm economic interests (avoiding the purchase of feed) and broader societal interests (securing bird populations). As an advisor from Norway noted: "in some cases the farmers can have a too narrow view, especially if there are national and/or regional concerns that should get priority over the local".

Overall, the experts clearly warned against designing measures based on a naïve assumption that farmers are "benevolent landscape managers" (France, government). They pointed out that farmers do not see themselves as "landscape gardeners" or "flower caretakers" (Austria, researcher). While mountain farmers will engage in environmental protection, they are unlikely do so at the expense of agricultural production. It is important to acknowledge these tensions, as a one-sided focus on grassland biodiversity would not be compatible with farmers' primary self-identity as food producers.

This was all the more important as some measures were seen by farmers as narrowly aiming to preserve the past, which led to further tensions. Indeed, experts stated that farmers do not want to live in a "reservation" (France, government), nor do they want to practice "museum agriculture" (Austria, advisor). While they cherish many traditions, farmers are also well aware that grassland management practices need to change to adapt to an evolving economic, technological and social context, as well as to the impacts of climate change. It is thus necessary for measures to enable the evolution of practices, identifying new ways to achieve ecological goals.

The experts pointed out that an important impact of increasing the flexibility in the implementation of measures would be to enable farmers to overcome a sense of frustration and demoralisation, even "de-responsabilisation" (France, government) and the "feeling that they can no longer manage their farm autonomously" (Austria, NGO). Indeed, as the literature shows, farmers highly value their autonomy (Stock and Forney, 2014), which has been undermined by restrictions imposed by expert-led, centrally defined measures that are implemented in a top-down manner. The aim of increasing flexibility is thus to reground

353 farming practices in regional specificities, and to revalue the competencies and knowledge
354 of farmers. When designing and administering measures that increase flexibility, the
355 inherent tensions need to be carefully taken into account, i.e. between increasing farmers'
356 autonomy and avoiding a temporary 'opting-out'; between ecological and food production
357 goals; between maintaining traditional practices and enabling change.

358 ### 3.3. Reconceptualise monitoring as part of a social learning process

359 The experts also raised the need to ensure effective implementation so as to achieve the
360 ecological goal of the measures, i.e. the conservation of semi-natural grasslands, and
361 ultimately of their specific biodiversity. Thus, how monitoring and controlling is organised
362 plays an important role (Cundill and Fabricius, 2009). We asked the experts whether farmers
363 should be involved in monitoring and controlling: 43% of experts indicated that farmers
364 should 'always' be involved, and 40% indicated that this should only be the case in specific
365 situations (Fig. 3). Those who answered 'in specific situations', were asked to elaborate.
366 Through their answers the experts highlighted a flaw in the question design, i.e. the need to
367 differentiate between monitoring and control. Indeed, individual farmers could not be
368 expected to control their own implementation of practices: they would be "judge and
369 claimant" at the same time (France, advisor).

370 Interestingly, in the second round of the Delphi inquiry, only two experts indicated that
371 farmers should be involved in monitoring and controlling (Fig. 2), whereas in the third
372 round, 15 experts indicated that they should 'always' be involved (Fig. 3). It is likely that
373 this discrepancy is – in large part – due to the fact that in the second round the question was
374 asked in relation to the current design of agri-environment measures. In the third round, the
375 experts were asked the same question, but specifically referring to their recommendation to
376 design measures so as to allow more flexibility and adaption to local conditions, while also
377 avoiding overburdening the administration. This can be interpreted as an indication that the
378 experts saw the role of farmers as dependent on the broader context: if the measures are
379 designed adequately and farmers are given appropriate training and support, farmers could
380 and should take a more active role, not least in monitoring.

381 As the literature shows, involving farmers in monitoring can promote social learning, e.g.
382 through joint visits of plots, discussion of possible measures, discussions of the outcome of
383 the implemented measures and search for improvements (Prager, 2015). As experts pointed

384 out, this approach is also successfully implemented in organic group certification as well as
385 in some cheese cooperatives with Controlled Designation of Origin (AOC cheeses). Such a
386 collective approach would require that, as part of the requirements to participate in the agri-
387 environment measure, a farmer "accepts that the group takes a critical look at his practices"
388 (France, NGO). As the expert explained, the aim would be to develop a dynamic where
389 farmers as a group take responsibility for outcomes, based on mutual feedback and shared
390 learning (i.e. the aim is not to create a league against external control, as some form of
391 external control will still be necessary). The experts saw this approach as most promising if
392 the group participates in defining the outcomes, rather than outcomes being imposed
393 externally.

394 As the experts pointed out, actively involving farmers in monitoring will require resources,
395 i.e. time for the participatory processes, as well as funds – either through additional funds,
396 or through shifting the allocation of current funds. Indeed, there was a need to offer more
397 support to farmers, either individually or as a group: "When giving farmers flexibility you
398 also need to support them with training and information to ensure the effectiveness of the
399 flexibility provided" (EU, NGO). Depending on the composition of the group, it may
400 promote a dialogue between farmers and researchers, thus revaluing local knowledge linked
401 to traditional practices as well as integrating scientific ecological knowledge (see Gross,
402 2011). It may also promote a dialogue between farmers and a range of local stakeholders,
403 such as those involved in tourism, wildlife conservation, or rewilding, allowing them to
404 clarify diverging interests and identify ways to address them.

405 The experts in the Delphi inquiry pointed out that an appropriate legal framework is required
406 to encourage collective action, experimentation and social innovation. As an example, an
407 expert (France, NGO) referred to the pastoral law ('loi pastorale') in France, which enabled
408 forming 'pastoral groups', which are now important actors in the management of mountain
409 grasslands (see Charbonnier, 2012; Eychenne and Lazaro, 2014).

410 4. 'Best practice' examples of alternative approaches

411 In the third round of the Delphi inquiry, the experts were asked to name 'best practice'
412 examples, where (elements of) their suggestions were successfully implemented. These
413 examples illustrate how the identified shortcomings can be addressed, i.e. how various

stakeholders can be involved, how flexibility at farm level can be increased, and how a framework encouraging learning processes can be built. We assigned the examples provided to three broad groups and briefly characterize them based on published documents.

4.1. Contracts based on management plans

This approach is characterized by individualized management plans, in contrast to the 'one-size-fits-all' approach of many agri-environment measures. Contracts based on management plans address the complaint by farmers that the standardized practices prescribed in a measure do not 'make sense' in their particular region or for their particular grassland. As a result, the requirements are perceived as a meaningless burden, because they are either ineffective or a much stricter management constraint than would be necessary to achieve a comparable outcome.

A contract-based approach was implemented in France in a territorial agri-environment measure (Meusure Agro-Environnementale Territorialisée – MAET H09; see Agreil et al., 2011), in Norway as part of the Special Environmental Measures in Agriculture (Særskilte Miljøtiltak I Landbruket – SMIL; see Blumentrath et al., 2014), and in Austria through the tool 'nature conservation plan for alpine pastures' (see Aigner et al., 2007). In each case, the contract is based on an individualized agreement between a farmer and an agricultural or environmental administration. The specific practices to be implemented are based on an assessment by an ecologist and negotiated between this ecologist and the farmer. As a result, the defined practices are perceived by the ecologist as efficient to achieve the protection goal, and by the farmer as feasible given his/her farming system and constraints.

Another example mentioned by a Delphi expert from France is the territorial pastoral plan (Plan Pastoral Territorial – PPT), specifically the one that has been implemented in Belledonne (see PPT Belledonne, 2010). In line with the priorities defined in the broader territorial plan, individual farmers develop a plan to manage their pasture. This starts with a joint on-site visit of the mountain grassland to understand the ecological setting, followed by discussions how herding practices could be adapted to achieve the goals of the territorial plan. This is then formalized in a five-year plan, which is the foundation of the contract with a government body (Agreil et al., 2011).

In Norway, measures are available for targeted efforts to maintain landscape elements such as meadows, wetlands, traditional buildings and paths. These elements are documented and used to draw up individual contracts with farmers. This involves a participative process including farmers, local public management bodies, and researchers (Blumentrath et al., 2014; Daugstad et al., 2014).

One drawback of this individualized approach, are higher transaction costs (Matzdorf and Lorenz, 2010; Franks, 2011). As a result, in France the approach is currently implemented only in specifically designated areas, e.g. Natura 2000 areas. Another drawback is that the negotiation process may be challenging for individual farmers. This concern is partly addressed in the implementation of the MAET H09, where the farmer pays a pastoral association to draw up the contract. Another way to overcome the barriers of transaction costs for the government bodies as well as the administrative burden on individual farmers, was pioneered in the Netherlands. There, contracts were not negotiated with individual farmers, but collective management plans could be negotiated by a 'Local Environmental Cooperative' (see Franks, 2011; Franks and Emery, 2013; Westerink et al., 2014; van Dijk et al., 2015).

4.2. Contracts based on outcomes

The second group of approaches provides flexibility not so much through negotiating tailor-made contracts that stipulate which practices need to be implemented, but through agreeing on an outcome that must be achieved, giving farmers the flexibility how to achieve it. The approach also builds on a cooperative understanding between farmers, the implementing agency and environmental protection administration (Stolze et al., 2015).

The example of outcome-based contract mentioned by the Delphi experts are the 'prairies fleuries' (flowering meadows) in France, and a similar pilot scheme which is being implemented in Austria (Ergebnisorientierter Naturschutzplan, i.e. 'results-based nature conservation plan'). The 'flowering meadows' was implemented in France in the framework of an agri-environment measure (MAE H07), where farmers were provided a predefined list of 20 species, and each contracted plot needed to have at least four of these 20 species. The approach was attractive to farmers as it offered flexibility in management (Plantureux et al., 2011; Nettier et al., 2012; de Sainte Marie, 2014). Moreover, a competition conveyed social recognition for the quality of their grassland and their contribution to the maintenance of

biodiversity (Magda et al., 2015). Importantly, the competition was a joint initiative of the Federation of Natural Parks, the Chamber of Agriculture, associations for Controlled Designation of Origin (AOC) cheeses, bee-keeping, and environmental protection, thus extending the range of actors involved.

While the 'prairies fleuries' were mostly applied to more intensively used grasslands, it would seem that the principle is transferrable to semi-natural mountain pastures. For a discussion of the strengths and limits of result-oriented measures, see e.g. Matzdorf and Lorenz (2010), Nettier et al. (2012), Burton and Schwarz (2013), Stolze et al. (2015), and Russi et al. (2016).

4.3. Incentives based on collaborative learning

As an example of an approach that explicitly builds on co-learning, French experts referred to the action research project 'Alpages Sentinelles' (sentinel alpine pastures). Although no formal contract or payments were offered, the project illustrates how an open-ended learning process can be implemented. Three drought years (2004, 2005 and 2006) had raised the awareness for the impact of climate change on the grassland in a national park. To strengthen the adaptive capabilities of all actors, the park administration initiated a collaborative learning process, involving farmers, herders, researchers, and park officers (Dobremez et al., 2014). At the end of each grazing season, a team made of the herder, an officer of the national park, and an expert on pastoralism visited the grassland. Through sharing their observations about the status of the grassland in various plots, the team discussed possible causes for the observed outcome, and options to modify grassland use to improve its ecological status.

Moreover, once a year, results and observations were discussed in a broader transdisciplinary team, which also includes extension agents and researchers (agronomists, ecologists, meteorologists). During this day-long workshop, data from ecological measurements and weather data were linked with observations from the field. This enabled integrating insights by researchers with observations by herders on growth patterns, and by farmers on labour and economic constraints. This allowed raising the understanding of all actors while discussing management options, e.g. regarding routes on the pasture, herd size, herd composition and complementary feed sources. As a result, actionable knowledge was co-produced using an iterative process of inquiry; a process, which allowed taking into account on-going shifts in both core questions and context (Dobremez et al., 2014).

5. Double-loop learning to reconceptualise roles and relationships

The preservation of semi-natural grasslands has long been recognized as a priority given the ecosystem services they provide. However, preserving open landscapes remains an ongoing challenge in mountain areas. The experts in the Delphi-inquiry identified a number of changes that could increase the likelihood that agri-environment measures achieve their goal of maintaining an open landscape. These changes are characterised by inclusive participatory processes in the design of measures, increased flexibility for farmers in their implementation, and reframing monitoring as social learning. The call for such changes is not new (see e.g.: Berkes and Folke, 2002; Gunderson and Light, 2006; Stenseke, 2006; Pahl-Wostl, 2009; Williams and Brown, 2016). Moreover, the 'best practice' examples highlighted by the experts show that these principles can be – and have been – implemented successfully. The question thus is: why are they not more wide-spread?

We argue that these changes are characteristic of double-loop learning as they build on radically different assumptions and beliefs compared to those underlying current governance arrangements. They imply a shift in boundaries, not only in who is involved and how, but also in what is considered relevant when assessing the effectiveness of a measure. They build on reconceptualising the motivations and roles of farmers and researchers, and thus how administrative processes need to be designed and implemented to enable effective agri-environment measures.

Firstly, roles are reconceptualised. The role of farmers is shifted from passive recipient of measures designed and specified by others, to active participants in the process of defining which practices will be both feasible and effective in their specific context. Indeed, both best practice examples – individually negotiated contracts and outcome-based schemes – explicitly value farmers' knowledge. Moreover, farmers are no longer reduced to economically rational actors that engage in a market exchange for a conservation good (see Falconer and Whitby, 2000). Rather, participation in an agri-environment measure is understood to be motivated by monetary compensation, by the compliance with social norms, and by the expression of personal values (Schenk et al., 2007; Burton and Paragahawewa, 2011; Nettier et al., 2012; Ingram et al., 2013; Russi et al., 2016). To enable intrinsically motivated behaviour, a supportive governance and an appropriate administrative design is needed (DeCaro and Stokes, 2008). As Dedeurwaerdere et al. (2016) point out, this design should enable a feeling of competence (i.e. feeling efficacious in

relation to the task at hand, not least through discussion and feedback), a sense of autonomy (i.e. being free to make important choices and direct one's action without unwanted pressure), and promote relatedness (i.e. a sense of belonging to a group that values collective goals).

The role of researchers is also reconceptualised. Rather than them being primarily involved ex-ante in designing measures, and ex-post in evaluating their economic efficiency and ecological effectiveness, they engage in an adaptive and iterative mode of inquiry. As the example of the 'Alpages Sentinelles' shows, a transdisciplinary approach allows integrating scientific knowledge, e.g. the outcome of mechanistic models of abiotic resource flows in the plant-soil-atmosphere system, with the experiential knowledge of herders, and with the perspective of various stakeholders. The approach is thus designed as a social learning process, and explicitly acknowledges complexity, i.e. that situations are dynamic and options are context specific (Pahl-Wostl, 2015). Redefining of the role of researchers thus also builds on a radical change in the public understanding of science, shifting from a view of scientific knowledge as objective, reliable, and authoritative; towards acknowledging that it is preliminary, tentative, uncertain, and fragmented (Aufenvenne et al., 2014).

Secondly, reconceptualising the roles of farmers and researchers implies a radical shift in administrative processes. Indeed, the experts involved in the Delphi inquiry highlighted that current design, implementation and monitoring processes were problematic. In many cases these processes followed a technical-rational approach, which Morris and Reed (2007) have characterized as the 'McDonaldization' of agri-environment programmes, i.e. a rationality centering on efficiency, calculability, predictability, and control. These norms tend to value activity, control, comfort, and clarity; rather than reflection, learning, and inclusivity (see Allan and Curtis, 2005; Allen and Gunderson, 2011). However, the latter norms are needed to engage in context-sensitive, open-ended learning processes. These learning processes imply collaborative, territorial approaches, as well as iterative social learning amongst state, market, and civil society actors. And indeed, the experts in the Delphi inquiry have drawn attention to the need for most actors to be involved in most tasks linked to agri-environment measures (see Fig. 1).

To enable such social learning processes, the evaluation of measures needs to be embedded in a comprehensive iterative learning cycle to improve implementation and design (see Cundill and Fabricius, 2009). Regarding economic efficiency, it requires a radical shift from

a one-sided focus on selected transaction costs, e.g. the cost of contract negotiation between the government body and the farmer, as well as the cost of on monitoring to ensure compliance (see Falconer and Whitby, 2000; Beckmann et al., 2009). As Gorddard et al. (2016) have shown, public planning processes can restrict the type of knowledge and values taken into account to those considered valid for the decision process (e.g. utilitarian values that can be monetized) and marginalize those related to nature, culture, and sustainability (e.g. disregarding non-market costs and amenity value, discounting long-term effects, neglecting cross-scale effects). Evaluation also needs to go beyond monitoring focused on biophysical indicators and include social and procedural aspects (see Waylen and Blackstock, 2017).

6. Conclusion

The maintenance of semi-natural alpine grasslands has remained a challenge in Austria, France and Norway, despite the implementation of agri-environment measures to maintain summer grazing. The changes that have been implemented in the measures over the last two decades may well have been limited to single-loop learning, i.e. on incremental adaptations to streamline various administrative aspects and to improve prescribed management practices. Indeed, the experts who participated in the Delphi inquiry pointed out that systemic issues linked to the design and implementation process have not been (sufficiently) addressed. We argue that this would require double-loop learning, i.e. the questioning of underlying assumptions. Indeed, the 'best practice' examples identified by the experts build on a radical departure from the dominant assumptions regarding the role of both farmers and researchers, and thus of how the design and implementation processes should be administrated.

This could contribute to explaining why such agri-environment measures have not spread more widely. Indeed, implementing the lessons of this double-loop learning requires a transformation of the broader governance arrangements and the structural context, i.e. the norms and values used to assess what is effective and efficient. It would require a fundamental transformation of institutional arrangements towards one that enables and encourages more critical, inclusive, and reflexive practice (Buizer et al., 2011; McLoughlin and Thoms, 2015; Wyborn, 2015). However, as Pahl-Wostl (2009) pointed out, such a

599 transformation requires a change in boundaries and power structures, which makes it likely
600 that even individual changes are resisted (see also Eggers, 2006).

601 We posit that unless the wider structural context changes, an effective reconceptualising of
602 roles and relationships is unlikely, which will impede the spread of innovative governance
603 arrangements and management practices. However, innovative approaches that build on
604 exploratory and iterative social learning processes are important elements in the effort to
605 maintain semi-natural mountain pastures in the face of climate change, rural demographic
606 changes, and farm abandonment.

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613 8. References

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