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Enhancing social-ecological resilience through social learning: A case study of communal pasture management in the Highlands of Ethiopia

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Social learning processes can play an important role in enabling communities to sustainably manage the natural resources they depend upon. We examine how a community in the highlands of Ethiopia has succeeded to manage its communal pasture sustainably over the past decades. We identified three processes that played a key role in enabling the community to take the window of opportunity offered by a radical policy change to transform their management approach. Firstly, traditional leaders recognized the window of opportunity and mobilized the community. Secondly, a participatory process led to an informal institution that has governed the access and use of the communal pasture. Thirdly, the community was able to effectively interact with various government agencies to safeguard its autonomy. The study thus indicates that, in face of the complexity and uncertainty associated with pervasive change, social-ecological resilience relies on social learning and the ability to engage in open-ended processes. It also emphasizes that rather than promoting technical 'packages' that focus on the biophysical productivity of a natural resource, it may be more effective to facilitate integrative social processes, thereby enabling communities to identify and implement locally adapted management approaches.

Key words: Human-nature interaction, natural resources management, grassland, bricolage, collective action, community resilience.

INTRODUCTION

Resilience thinking is a conceptual framework to understand the change dynamics in social-ecological systems (Chapin, 2009; Folke et al., 2010; Adger et al., 2011). In these systems, the social and ecological subsystems are understood as interconnected and as co-evolving. This co-evolution means that the ecological subsystem is influenced by and reflects the characteristics of the social subsystem (e.g. its knowledge, values, social organization, and technologies), while the social subsystem is influenced by

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the characteristics of the ecological subsystem (e.g. its mix of species, rates of productivity, spatial and temporal variability). Furthermore, social-ecological systems are conceptualized as complex systems (Holling, 2001; Scarlett, 2013), highlighting the fact that the feedback dynamics between the two subsystems are non-linear, so that small changes can amplify and cascade into major shifts, while large interventions may have little or no effect. As a result, the dynamic of the social-ecological system tends to be unpredictable, with fairly stable periods that are interspersed with episodic crises, following which the system may undergo transformative change. Resilience is thus not understood as a return to a previous state, but rather as the ability of a socio-ecological system to adapt and transform in response to stresses and strains. The key to ensuring the sustainable use of natural resources is thus not limited to identifying a management regime that suits the current situation, but ensuring that the management regime can be adapted whenever the relevant context changes (e.g. the policy framework, social norms, population density, market opportunities, climate change). Resilience thinking has given rise to numerous studies, often focusing on large-scale ecosystems such national parks, rangelands or wetlands and deriving recommendations for adaptive co-management or governance approaches (Gunderson et al., 2006; Olsson et al., 2007; Walker et al., 2009).

While resilience thinking has its roots in ecology, its application to social-ecological systems has raised the interest of social scientists. This is partly due to its value as a concept that bridges the natural and the social sciences; its emphasis on the unpredictability of change and what this implies for conceptualizing planning (Davoudi, 2012); and the shift in focus it initiated, from the availability of resources towards response options (Cote and Nightingale, 2012). As in many intensely used ecological systems, human activities are the primary driver of change (Beratan, 2014), authors have pointed out that it is important to give due attention to the internal dynamics of the social subsystem and how these shape environmental outcomes (Crona and Hubacek, 2010; Lanckriet et al., 2015). This may contribute towards a better understanding of how communities can structure their management regime to ensure it is responsive and can adapt to changes both in the ecological and in the social sub-system. As resilience thinking emphasizes, these changes are often unpredictable in their timing and unfolding, and given complex interdependencies, communities cannot fully anticipate the impact of these changes or of the management measures they implement (Olsson et al., 2004a; Magis, 2010; Matarrita-Cascante and Trejos, 2013).

Despite the fact that societal change is fundamentally unpredictable and that specific historical configurations are unlikely to repeat themselves, historical studies can yield interesting insights (Carpenter et al., 2005; Woolcock et al., 2011) by analyzing the dynamics of coupled social and environmental systems: what has (not) changed? And: how did change come about? Archeological and historical studies have shown that there is often an intricate interplay of environmental, political and socio-cultural factors that affect the resilience of a society (Barton et al., 2012; Butzer, 2012; Ekblom, 2012; Rotanrangi and Stephenson, 2014). On the one hand the studies have highlighted the role of slow-moving environmental processes and the recurrence of periods characterized by abrupt change, thus showing the value of a long-term perspective on contemporary issues (van der Leeuw and Redman, 2002; van der Leeuw et al., 2011; Butzer, 2012; Enfors, 2013). On the other hand, studies have shown that local cultural perceptions of resources and local problem-solving capacity often played an important role in whether and how changes in natural resource use were implemented (Butzer, 2012; van der Leeuw, 2012; Tainter and Taylor, 2014).

Focusing on how a society copes with change lies at the heart of the literature on community resilience (Berkes and Ross, 2013). Magis defined community resilience as “the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise” (Magis, 2010). Community resilience thus includes the notion of agency as well as the ability to cope with change. Human agency involves purposeful interventions that draw on disparate human capacities to imagine, anticipate, and motivate individual and collective action (Davidson, 2010). Agency can thus be understood as “the capacity of an individual or group to organize, and act independently of direction and authority” (Ross and Berkes, 2014). Coping with change, i.e. the capability of a system to adjust its responses to change in external drivers and internal processes is usually understood as including adaptation as well as occasional transformation (Magis, 2010; Ross and Berkes, 2014; Darnhofer, 2014). In the context of social-ecological systems, adaptation has been defined as changes in the structures and activities of the system but without changing the dominant feedbacks between ecological and social subsystems; while transformation is a more significant change, one that recombines existing elements in fundamentally novel ways (Moore et al., 2014).

Natural resource dependent communities, that is, those whose livelihood strongly depends on local natural resources such as agriculture, forestry or fisheries are well suited to shed light on the interdependence of the social and ecological subsystems. Such communities are subject to multiple stressors, including shifts in resource availability (e.g. due to weather fluctuations) and in resource demands (e.g. due to policy measures, market changes or population growth). In such a social-ecological system, there are clear linkages between the resilience of a community and the ecosystem on which it

depends (Ross and Berkes, 2014).

In this study we focus on one community in Ethiopia and retrace the changes in the management of its communal pasture between 1973 and 2013. During this 40-year period, there have been three distinct political regimes in Ethiopia, each setting a very different context for the community and thus influencing how it managed its pasture. We retrace how the institutions that governed the use of communal resources co-evolved with the broader socio-political environment. We especially focus on the early 1990s, where the community implemented transformative change, both in response to and in anticipation of further policy changes. The aim of the study is to understand the interdependencies of social and ecological processes and identify the conditions that enable these processes to lead to adaptive and transformative changes. As Walker et al. (2002) have pointed out, understanding how rules evolve in a social-ecological system is crucial to design institutions that enable these systems to self-organize in response to change. The insights derived from past responses to changes and past adaptation processes may thus help in understanding how institutions need to be structured to strengthen social learning, and how these learning processes may strengthen the ability of communities to flexibly respond to challenges.

METHODOLOGY

Data collection and analysis

A qualitative case study approach was selected as it offers an opportunity to explore a situation in sufficient detail to unravel its complexity (Yin, 2003; Flyvbjerg, 2006). The choice was made to select a 'positive deviant' community, that is, one that is widely seen as managing its communal pasture in a sustainable manner. For the purpose of this study it did not seem necessary to base the selection of a community on an in-depth ecological assessment, and sufficient to rely on the assessment by experts, based on ecological and social considerations. A list of selection criteria was thus developed, which included rough indicators of sustainability, that is, the extent of soil erosion, vegetation cover, diversity of the species in the pasture, as well as socio-economic criteria such as the number of households and livestock that depend on the communal pasture, the heterogeneity of the users and the existence of informal institutions.

The site was selected through three steps. Firstly, three officials from the District Office of Agriculture and from the Office of Environmental Protection Land Administration and Use were asked to suggest potential study sites in Bure *woreda* (district) of Amhara region, that are known for having communal pastures in good condition, that is, with a controlled grazing system. This yielded a list of 12 potential sites. In a second step, eleven experts from the Bureau of Agriculture were asked to select those sites on the list that they were familiar with, and rate them based on the selection criteria. This ensured that each site was rated by at least six experts. Based on the average of the ratings, the top five potential sites were identified and visited. During this visit, the bio-physical status of the communal pasture was assessed, and the socio-economic importance of the pasture to the community was discussed with village representatives and development agents. Based on the outcome of these visits, Kuwalla village was selected. It had the best fit with the selection criteria, and during the site visit the chairman of the *kebele* had expressed his approval of the research project and permitted the collection of data. Permission to do the research was solicited and granted orally by the Bure District Office of Agriculture in September 2012.

As few historical documents on the pasture management system in Kuwalla were available, data was collected through group discussions, key informant interviews and participant observation. The aim was to reconstruct the evolution of the pasture management system over a 40-year period, focusing on the processes that allowed a community to change, i.e. when, why and how it adapted or transformed the management of its communal pasture. A retrospective approach was taken to retrace the evolution of the management system, asking participants to identify historical turning points, to explore how the community perceived, responded to and recovered from shocks and stresses, as well as to achieve an in-depth understanding of the current management system. The interviews and the group discussions covered similar topics, but the latter had the advantage that participants could generate new collective understandings based one another's contributions (Ross and Berkes, 2014). Interviews were mostly used to clarify specific points and to capture the memories and viewpoints of key actors. The interviews and group discussions were held by the first author in Amharic. Participant observation, that is, observing daily happenings, hearing and initiating conversations during the six months spent on-site, was also useful to gain a deeper insight into the social and cultural processes in context.

Data collection was designed to ensure that the participants covered the diverse groups within the community, that is, taking into account different age groups, wealth status, family configurations, gender and roles of individuals in relation to the communal pasture (that is, users and non-users, committee members). A total of eleven group discussions, each with 5-10 villagers, were held with four different groups: a core group (comprised of elders, youngsters, poor, rich, men, and women), a management group (comprised of the current management committee and the fathers of herders), and two gender-specific groups, that is, one with women only and the second with men only.

Participants for the group discussions were selected based on their familiarity with the discussion topics. The participants in the group discussions were also asked to suggest individuals for interviews, that is, people who were particularly knowledgeable on a specific issue or who were perceived as particularly adept at explaining the views held by a group within the community. The selection was also guided by a purposive grid to ensure that the individuals interviewed would span the diversity of community members. As a result, a total of 14 interviews were held with community members. This included ten interviews with men and women of different age and wealth categories (locally indicated by land and livestock ownership); one interview with an elder involved in initiating the informal institution; one interview with a current member of the committee guiding the informal institution managing the communal pasture; and two interviews with current *kebele* officials. Furthermore, seven interviews were held with members of official institutions (i.e. development agents, supervisors and experts of the District Office of Agriculture and of the District Office of Land Administration and Use). The number of interviews was guided by saturation, that is, when the diversity of perceptions that might be important were covered, while the collection of new data no longer shed additional light on how and why the management of the pasture had changed over the past 40 years.

Triangulation of the data collected through the focus groups, through the interviews with community members and the interview with government officials was used to cross-verify information (e.g. the information from villagers vs. officials regarding the relations between Kuwalla and the other villages in the *kebele*, the support granted to enforce rules, the changes in government policies and

their local implementation, the current expectations regarding pasture management). If discrepancies were identified, an additional interview was held to seek information that would explain the discrepancy. Also, where available, documents were also used to triangulate data, in particular records kept by the *kebele* administration and development agents (e.g. regarding the number of households and cattle). Official documents were used to confirm the timeline of events (e.g. government policies such as the creation of producer cooperatives and the villagization program).

The research took a multi-stage approach, with data being collected during two periods: September-December 2012 and September-October 2013. This approach allowed the data collected in the first round to be analyzed in detail, and specific issues clarified and deepened in a second round. At the end of each data collection period, the results of the preliminary analysis of the collected data was shared and discussed with the community. The aim was on the one hand to ensure that the preliminary findings were an accurate description of the management system and its evolution, as it was understood by the community. On the other hand, through presenting and discussing the findings in a synthetic way, the aim was also to contribute towards reflexive learning processes in the community, thus attempting to contribute to community resilience through the research process (Ross and Berkes, 2014). Indeed, the research revealed processes and patterns that the community was not aware of, or had not verbalized.

For the detailed analysis of the change processes, the relevant sections of the focus group discussions and the interviews were translated into English and transcribed. The transcriptions were coded using the software ATLAS.ti. Based on the literature, an initial list of codes was defined, which included: changes, adaptation, social learning, knowledge, experimentation, collective action and programs. During data analysis, additional codes were included when it appeared useful. These new codes included: incentive, social network, trust, negotiation and social memories. Qualitative content analysis (Berg, 2009) was then used firstly to compile the sequence of events, the individuals involved and the issues that were most salient at different periods; and secondly to identify more specifically the themes linked to the period of transformational change in the early 1990s. This approach allowed information that was either manifest or latent in the textual data to emerge, to examine its meaning, and to ground the inferences in the data. The analysis thus took an iterative, abductive approach, integrating empirical data and theoretical insights from the literature on resilience (e.g. through the initial list of codes), so that empirical facts and theory were both successively reinterpreted in the light of each other.

Study area

Kuwalla village is located at an altitude of 2300 meter above sea level, in the Amhara region, Bure *woreda* (district), Wundgi *kebele* (local administrative unit) (Figure 1). As is typical for the Ethiopian highlands, agriculture is dominated by subsistence-oriented crop-livestock farming. With an average of about 1700 mm of rain, spread over two rainy seasons, it receives sufficient rainfall for growing a variety of crops. There are about 160 households in Kuwalla, and the average land holding is currently around 1.1 ha (CSA, 2012).

Livestock plays a critical role in Kuwalla, as generally in the highlands of Ethiopia: oxen are needed to plow the land, cows produce milk, and cattle provide dung, which is used as cooking fuel and as organic fertilizer (Gebremedhin et al., 2004). Given the limited cropland available, farmers can usually not afford to set some aside to grow forages. Thus oxen and cows, as well as other livestock, only receive crop residues, which make up about half of the feed. As cash to purchase additional feed is rarely available (Benin and Pender, 2006), the remainder of the feed is covered through grazing. Due to the increasing human population density in the highlands, an increasing share of the land is used for cropping, thus decreasing the land available for grazing (Tilahun and Schmidt, 2013). The available communal pastures tend to be overgrazed, often leading to soil erosion (Pender and Ehui, 2006).

FINDINGS: SOCIAL DYNAMICS 1973-2013

The social dynamics between 1975 and 1990 and their ecological impact

We first present an overview of how the communal pasture in Kuwalla was used and managed, to show that the problems related to the communal pasture were the emergent and contingent outcome of many, complexly interrelated social and ecological processes. This analysis illustrates the interdependent nature of a social-ecological system, that is, how social processes led to a degradation of the communal pasture, and how this overuse triggered a social response and reorganization. It also illustrates how some of the changes were the result of progressive trends (e.g. increasing population density), while others were induced by unpredictable ‘shocks’ (e.g. shifts in political regimes). This unpredictability of change limits the ability of the community to plan and prepare for their impact, and emphasizes the need to be able to flexibly respond to change as it unfolds.

Over the last 40 years Ethiopian governments were led by different political ideologies, which brought radical changes in the land tenure system and the rules governing the access to communal pastures. Broadly, three different regimes can be distinguished (Figure 2): the feudal system under Emperor Haile Selassie, who reigned until 1974; the military Derg regime, which embraced communism and ruled Ethiopia from 1974 to 1991; and since then, the Ethiopian People’s Revolutionary Democratic Front (EPRDF) which implemented a controlled market system and political decentralization (Lanckriet et al., 2015). There have thus been two major breaks (1974/1975 and 1990/1991) which radically changed the broader context and thus the options for pasture management, challenging the community’s adaptive capacity.

Imperial regime

During the imperial regime of Haile Selassie, population density in the area was relatively low and feed supply for cattle was not a major issue. Land was owned by a *ristegna* (landlord) (Hoben, 1995), who appointed a ‘father of herders’ to oversee the management of the land by the tenant farmers. He decided when animals were allowed on the various pastures, and managed the rotation system. There was thus a controlled system where, depending on the season, animals were allowed to graze on the communal pastures (one close to the

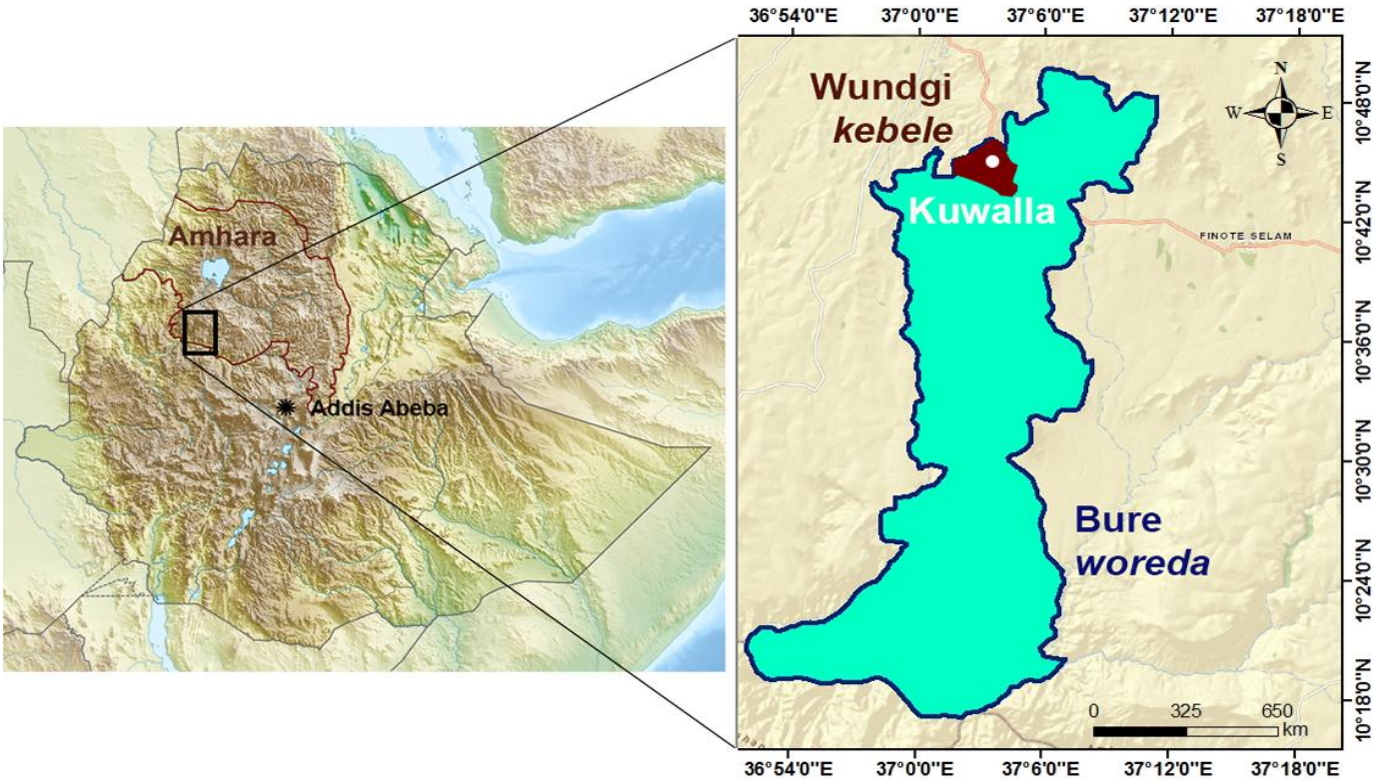

Figure 1. Location of the study site: Physical map of Ethiopia with the capital city (Addis Ababa) and the Amhara National Regional State. The enlarged map shows the location of Kuwalla village, in Wundgi kebele, in Bure woreda (district). Source of map: Wikimedia commons, physical location map of Ethiopia; carport / CC-BY-SA-3.0; modified to indicate the study region.

village, and one uphill), on cropland left fallow, on crop residues after the harvest, and in forests. The 'father of herders' was also in charge of organizing collective actions, such as the *hura* where, at night during the rainy seasons, animals are held on the pastures so that their manure could contribute to soil fertility.

Derg regime

Upon coming to power in 1975, and in accordance with its communist ideology, the Derg abolished the feudal *rist* system. Agricultural land and forests were declared state property. To protect forests, the local communities were no longer allowed to use them to graze their animals. To administer land issues, including pastures, the Derg established a formal institution called 'peasant association' (Nega et al., 2003; Pankhurst, 2003). The Derg thus disbanded previous structures of authority, in effect disregarding and discrediting the traditional role of the 'father of herders', and his knowledge of pasture management. Positions in the various institutions were held by 'cadres', which were often appointed for their ideological orientation, rather than for their knowledge of natural resource management. These radical changes severely affected the ability of the community to influence how the pastures were used, as they in effect became 'open access'. Initially, the pressure on the pastures increased as villagers were banned from using the forest as grazing area. Later this pressure increased further due to population growth and the implementation of further political programs by the central government, such as the establishment of producer cooperatives and the villagization program.

In 1984, the central government established agricultural producer cooperatives, where resources (land, tools, harvests) were pooled (Desta, 1995). In Wundgi *kebele* the cooperative included several villages. The government enticed farmers to join the cooperative by giving members better access to resources (e.g. improved seeds, fertilizer), and also by granting them exclusive access to the pasture close to Kuwalla, while retaining their right to access a second pasture uphill, which was open to use by all. Despite these incentives, a number of farmers resisted collectivization, and thus had only access to the pasture uphill, which over time became severely overgrazed.

Furthermore, in 1987 a villagization program was initiated, which aimed at grouping the dispersed rural population so that the government could provide infrastructure (water, sanitation, schools, etc.) (HRW, 1991). Farmers were thus pressured to leave their

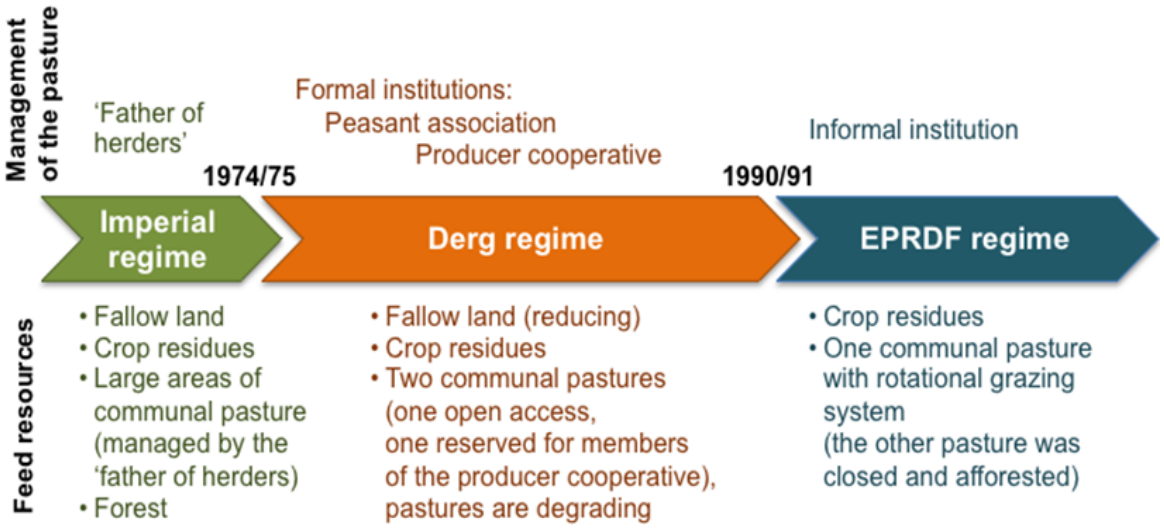

Figure 2. Changes in institutions that guided the management of the communal pasture. The changes in the pasture management and more broadly in the feed resources available for cattle were driven by political regime changes as well as by increasing population density which lead to a higher pressure on natural resources (that is, forests, crop land and pastures).

houses, which were traditionally located close to their fields (Hoben, 1973), and to settle in a village. However, settling in the village also implied that animals had to be held on the compound surrounding the house, which provided little space and barely any feed. As a result, most villagers had little choice but to send their animals to the communal pastures during the day. This increase in population density further increased the pressure on the pastures.

Overall, during the 15 years of the Derg regime, various developments in the social sub-system had a negative impact on the ecological sub-system. Firstly, the abolition of *rist* system meant that rules guiding land use were no longer made locally, but by the central government. This limited the ability of the community to fine-tune the management measures to fit the local conditions and imposed restrictions that might not have been justified, e.g. the closure of the forest when the local forest was not overused. Secondly, by discrediting the previous management structures, that is, the 'father of herders', his ecological knowledge regarding the suitable rotation of feed sources and indicators for appropriate opening and closing seasons was also discredited.

"During the Derg regime who listens to elders? Unless you are a cadre… no one listens to elders!" (Elder, founding member of the informal institution, Nov. 2012)

Thirdly, the increase in population density, not least due to the villagization program, resulted in intensification of land use around the village, i.e. the conversion of pasture into cropland, and the reduction of land left fallow. This was exacerbated by the instrumentalisation of access to pasture to motivate farmers to join the producer cooperative, increasing the pressure on the uphill pasture.

Towards the end of the 1980s the Derg regime was increasingly contested at national level, with a civil war taking place both in Tigray and in Eritrea (Tareke, 2004). In 1990, that is, a year before the Derg's fall, the Wundgi agricultural producer cooperative collapsed. While multiple interacting factors led to the collapse, the fact that their pastures were degraded and thus did not provide sufficient feed for the oxen, which are essential for plowing the fields, contributed to the perception that the system was dysfunctional. The collapse triggered a number of changes, with some farmers returning to their previous homes, the village reasserting its exclusive right to use the pasture close to the village, and establishing a controlled grazing system to curb overgrazing.

Preparing for change

The evolution of the pasture use over these 15 years highlights the interdependent dynamics of social and ecological processes, that is, "how society impacts environmental processes and how environmental processes impact social practices" (Prior and Eriksen, 2013). Driven by policy incentives, the cumulative practices of individual community members led to an overgrazing of the communal pastures. In some cases, this can lead to a social trap, where individuals are unable to cooperate to achieve joint benefits – those that exceed short-term individual benefits – leading to the overuse of natural resources.

However, in 1990 in Kuwalla, the community took action, identifying ways to address both ecological

sustainability and social needs. In Kuwalla, the environmental degradation thus contributed to social innovation through establishing an institution that regulates and controls access to the pasture, that reflects on the impact of management measures, and adapts them as needed. Conversely, the social innovation had a positive impact on the pasture, contributing to the sustainable use of the natural resource.

In the next section we analyze how this community managed to cope with complexity, interconnectedness, uncertainty and change, how it recognized the 'window of opportunity' offered by the collapse of the producer cooperative, and seized it to self-organize rather than wait for further political developments or external interventions.

Social dynamics after 1991: Establishing an informal institution

In Kuwalla, the 'father of herders' during the Haile Selassie period, together with three other elders, mobilized villagers to support a controlled grazing system. They started discussions on management measures that would take into account the needs of the villagers while avoiding overgrazing. Through a participatory process, the community settled on a system characterized by periods when cattle is allowed to graze and periods without grazing, thus allowing the grassland to regenerate. It builds on a sophisticated rotational system, where the cattle are only allowed on specific sections of the pasture during specific seasons. To implement this management system, an informal institution was set up. This institution was a platform, which over the years mediated changes in the management system to account for expressed needs of community members. The community thus displayed not only the ability to cope with the changes brought about by the fall of the Derg, taking it as an opportunity for transformative change, the community also displayed the ability to implement marginal changes to adapt as new needs were voiced by the community.

In the analysis of the resilience of the Kuwalla community, we identified three interrelated factors that played an important role in the process of developing the new pasture management system: the leadership of experienced individuals, the informal institutions that enabled deliberation and social learning, and the careful interaction with official administration, which secured external support.

FINDINGS: THREE PROCESSES ENABLING TRANSFORMATIONAL CHANGE

Leadership: Recognize opportunities and mobilize the community

In Kuwalla, the initiative and leadership by the elder who was the 'father of herders' under the Haile Selassie regime was decisive. He recognized the 'window of opportunity' presented by the collapse of the producer cooperative and the broader political instability linked to the fall of the Derg regime in Ethiopia. His knowledge of how to organize a rotational grazing system to ensure sustainable use of the pasture allowed him to guide the process of analyzing the problem and designing a solution. But, importantly, he ensured that the community was involved and thus supported the process.

Envision and initiate change

The collapse of the producer cooperative and the fall of the Derg, offered a 'window of opportunity' not least because it created an atmosphere conducive to the reassessment and reevaluation of the strengths and weaknesses of the management structures during the imperial and the Derg regimes. This reevaluation allowed the creative and innovative mixing of elements of both structures to address the current situation. Indeed, it became clear that the open access to the pasture during the Derg had led to overgrazing, and thus a return to a controlled grazing as practiced under the Haile Selassie regime would be desirable. At the same time the elder realized that a top-down imposition, as was the case under Haile Selassie, was no longer socially acceptable. As villagers had been involved in issues affecting the community through meetings during the Derg, a participative approach would increase acceptance. Thus the social memory from past experiences was deliberately integrated to design a new management system for the communal pasture. Drawing on and adapting past mechanisms to new purpose may have contributed to acceptance by conferring the legitimacy of 'tradition' (Cleaver, 2002) on the proposed management system.

The 'father of herders' first contacted three other elders to discuss his idea of replacing the current open access of the communal pasture with a controlled, rotational grazing. These three elders had senior positions in the community: one was the chairman of a traditional institution (*idir*), another was a member of the *kebele* administration, and the third was a member of the community police. They agreed with his idea and helped him mobilize the community.

The four elders called the attention of the community to the need to adapt the controlled grazing system, raising the awareness that their communal pasture was degraded. They pointed to the fact that it no longer fulfilled its role as a source of feed in critical periods, especially the end of the dry seasons when oxen need additional feed to plough and prepare the fields for the coming rainy season. This situation was worsened by the decision of the *kebele* administration to afforest the severely degraded uphill pasture, which was thus no longer available for grazing (Lemenih and Kassa, 2014).

This not only substantially increased the pressure on the pasture close to the village; the loss of the uphill pasture was also seen as indicative of the ability of the government to prohibit access to resources if they are not well managed. The elders were thus able to convey the urgency of taking action to safeguard the pasture close to the village, and to frame the collapse of the producer cooperative as well as the uncertainty of the broader political development as a 'window of opportunity' to self-organize and enact radical change.

This was done through raising the idea at various gatherings within informal institutions, such as the *idir* (a traditional self-help institution to help cover the cost of burial services), *mekleft* (common breakfast after the Sunday church service) and *mehaber* (monthly church meetings to celebrate specific saints). As a result the villagers discussed the issue informally over coffee with relatives, neighbors and friends. These discussions raised the awareness that the degraded pasture was a serious problem for all, and that the solution lie in concerted action.

A mandate from the community

Once there was a consensus that the community should and could act, the community agreed to give the four elders the responsibility to design a new management system.

"Once community members agreed on the need to adapt the pasture management, they said: let us first assign people who would guide the whole management process. (…) So they requested the four of us to lead the management of the controlled grazing system as a management committee, at least for the next three years. They also requested us to propose and craft the new management rules. (…) Because they assumed that we know better and that we could organize people". (Elder, founding member of the informal institution, Nov. 2012)

The leadership by the elder who had been the 'father of herder' under Haile Selassie, as well as the other three elders, were thus decisive in two ways: firstly to raise the awareness and to frame the problem, and secondly to share the vision for an alternative way to manage the pasture. The leaders were important, especially because they raised the salience of issues related to the communal pasture relative to other everyday considerations among the community members. In effect the leaders were necessary to ensure that the diffuse feeling that 'our oxen do not have enough feed', coalesced into a shared understanding of the problem (that is, 'the pasture is getting degraded'), which enabled a shared perception of the necessity to act and catalyzed support for collective action. Through raising the issues at various community events, the elders influenced individual attitudes and thus ensured that resources were made available for community action. This support was needed as by closing the pasture, all families had to look for other feed sources while the grassland regenerated.

Importantly, the leadership was based less on traditional hierarchical relationships, but rather on a collaborative, consensus-oriented approach. This was the case between the four leaders, which enabled the collaboration across various formal and informal institutions. It also enabled the creation of an alliance which projected consensus between respected members of the community, making the message stronger than if it had come from just one individual. It was also the case between the leaders and the community: mobilizing the community was not based on pressure or an exercise in power, but on a discursive and participatory approach, enabling trust building. This is likely to have played an important role in the future development of the institution to govern the communal pasture, as other studies have shown the importance of adaptive and collaborative processes, which enable community members to be involved in the design of the management rules right from the beginning (Greig et al., 2013; Beratan, 2014).

The leaders thus nurtured a sense of self-efficacy, rather than waiting for external intervention. They ensured that the community achieved a shared perception of the "necessity to act", but they also pointed out options, thus indicating that the community had the "ability to act". Indeed, they shared a vision of how the communal pasture could be managed and proposed specific ideas, both regarding the informal institution and management measures, based esp. on the ecological knowledge by the former 'father of herders'.

A participatory approach

The elders nurtured trust through a participatory trial-and-error approach where each community member could see for him- and herself the benefits of proposed management measures, e.g. closing the pasture to allow the regeneration of the degraded pasture, as well as to conserve the feed for those months when it was most needed by the oxen.

"We first needed to prove whether the area enclosure would work on our pasture or not. So in the first year we enclosed only one quarter of our pasture for one growing season. After one rainy season the local grass species, which were gone for some years due to overgrazing, regenerated and grew very well. We were happy and community members were convinced that we need to use area enclosure for the rest of the communal pasture." (Elder, founding member of the informal institution, Nov. 2012)

By using this approach, the elders initiated an approach akin to adaptive management, that is, a process by which ecological knowledge is tested and revised as an ongoing process of trial-and-error (Folke et al., 2002). Ecological knowledge was integrated in further management

measures, such as e.g. the decision when to open or close the pasture, which is based on ecological indicators such as growth stage of the various species on the grazing land (e.g. to avoid the bloating effect of *Trifolium* and *Medicago* spp. when they are in flowering stage); as well as other indicators such as the feed availability from other sources such as crop residue, or the rainfall which influences not just grass growth but the time when oxen requires most energy for plowing. Moreover, during the opening seasons, the community gradually developed an intricate rotational system (Aregu, 2014: 44ff). This system is a creative adaptation of the rotational system that was practiced during the Haile-Selassie regime, when the animals were allowed to graze on communal pastures, fallow land, stubbles on cropland, and forests, depending on the season. The overall principle of rotational use has been adapted and the communal pasture divided into paddocks each of which is only grazed once per year, with opening times and grazing duration guided by the 'fathers of herders'. The management of the communal pasture is thus based on the balance between ecological indicators to safeguard sustainable use, and social factors to take into account the needs of community members.

Importance of leadership

The leadership by the elders played a key role in Kuwalla, by raising awareness, by proposing a vision and specific measures to implement it, by creating an enabling environment through promoting a participatory and adaptive approach, and ultimately, by motivating the community members to coordinate their efforts and collaborate. All these are factors that have been recognized as contributing to resilience, especially to initiate a transformation (Olsson et al., 2004b, 2006; Gelcich et al., 2010; Stephenson, 2010; Gutiérrez et al., 2011; Kenward et al., 2011). As Olsson et al. (2004a, 2006, 2010) have pointed out, leaders play a key role as they develop and communicate a vision, build networks to connect people, initiate processes to build trust, guide the exploration of alternate configurations, steer the sense-making process to change the perception of problems, of opportunities and of resources that can be mobilized. Through these activities, leaders can inspire people to invest in an alternative approach to managing a natural resource.

Through their activities, the elders in Kuwalla also enabled social learning, where individual thought, emerging in a specific context, becomes part of collective knowledge. The aim is to 'learn together to manage together' (Pahl-Wostl et al., 2007). The participatory approach and discussions involving many members of the community also contributed to the legitimacy of the rules, and thus the compliance by community members. As such the four elders fulfilled many of the roles of "adaptive managers" as characterized by Fabricius et al. (2007).

In many ways, the elders were also an example of transformational leadership, as they enabled processes that transcend organizational, environmental and human limitations to guide a process of change (Davies, 2009). The leadership was transformational in the sense that the four elders did not aim to make themselves indispensable, avoiding an over-reliance on one or a few individuals (Einstein and Humphreys, 2001). Through actively involving the community, they encouraged debates over means and ends. These processes allowed the community to become aware of the role they can have in overcoming shared problems, giving the community a sense that they could influence their development trajectory. The leaders thus had a transformational effect on the community's sense of agency. This is a capital that a community can leverage for subsequent adaptations (Davies, 2009; McSweeney and Coomes, 2011). By taking ownership of the process, the community strengthened its adaptive capacity, and over time adjusted and re-designed the management of the communal pasture.

Kuwalla also joins other reported cases, which highlight the importance of timing, that is, of seizing a 'windows of opportunity' that might be opened for a short time by an environmental crisis or by political turbulences (Gunderson et al., 2006; Gelcich et al., 2010; McSweeney and Coomes, 2011). Leaders often play a key role in recognizing a window of opportunity and in using it to initiate a transition (Olsson et al., 2004a; Gunderson et al., 2006). Such a window of opportunity is a critical moment, an opening, a bifurcation where the social-ecological system may enter an alternate trajectory. And indeed, a hallmark of a resilient system is its ability to make use of disturbances, recognizing them as an opportunity to transform into a more desired state (Folke et al., 2003, 2005). Such transformational change is most likely to occur when a window of opportunity for change arises, and stakeholders agree that the current system is dysfunctional (Gelcich et al., 2010). Thus, a transforma-tion in how an ecosystem is managed builds on shifts in perception, in social relations, in network configurations, and in institutional arrangements, and cannot be reduced to the implementation of a new set of technical measures (Olsson et al., 2004a; Gunderson et al., 2006).

An informal institution: Promote communication and build trust

While the four elders initiated the controlled grazing system, and while they guided the process of establishing rules of access and use, they also established an informal institution that has governed the access to and use of the communal pasture since the early 1990s. This institution has offered a platform for co-operation, enabling interactions and the articulation of interests, as well as the negotiation of norms, such as standards of

conduct and rules of use. The institution is socially embedded, that is, based on local culture and daily practice, which crafted arrangements based on distributional norms and relations of trust (Cleaver, 2002). Establishing and adapting the informal institution was a process of 'institutional bricolage' (Cleaver, 2002, 2012), that is, a processes where mechanisms for resource management and collective action are borrowed or constructed from existing institutions, styles of thinking and sanctioned social relationships. This process of drawing on and adapting existing norms and mechanisms to new purposes, is less based on rational and conscious selection but rather a messy process of piecing together, shaped by individuals acting within the bounds of circumstantial constraints. The informal institution is a platform to share the struggle to ensure adequate feed supply but also to maintain social networks, to reflect on past management successes as well as failures, and to discuss possible adaptations, thereby renegotiating distributive norms. As such the institution may strengthen social cohesion, which in turn facilitates the transfer of information, influencing the social construction of issues and approaches to solve problems (Prior and Eriksen, 2013).

Structure of the institution

This informal institution is locally called '*Ye amaga tibik committee*' (the 'committee for the conservation of the communal pasture') and has four committee members. The number of committee members was linked to the fact that initially four elders had initiated the institution and they were the first committee members, and it corresponded to the typical committee structure at *kebele*-level under the Derg period, with a chairperson, a secretary, a treasurer and an inspector. The aim of such a structure was that several views could be represented and that there is mutual control (rather than one 'father of herder' deciding autocratically as was the case under Haile Selassie).

To ensure a close communication with the users, the informal institution also includes nine 'fathers of herders'. Given that the village was now much larger than under Haile Selassie, the elders proposed to have nine 'fathers of herders', each of which coordinates 13-15 households of users.

"*We asked ourselves how we can have a close communications with the users because we are only four so we realized that a regular communication and information flow would be a problem. (…) We asked the community to be grouped based on the proximity of their houses and have a representative for each group of neighbors. So we called the neighborhood representatives 'fathers of herders'*" (Elder, founding member of the informal institution, Nov. 2012).

The four committee members oversee, coordinate and monitor the implementation of the management rules and regulations; while the nine 'fathers of herders' provide information to their sub-group of users (e.g. when grazing is allowed, the beginning and end of *hura*, that is, the period during which cattle are kept on the pasture at night, so that depositions of dung and urine can enhance soil fertility), and mobilize them for collective actions such as labor contributions during *kello* (during the closing periods, two users are assigned to guard the pasture each day, to ensure no animals feeds on the regenerating grass) and *kirat* (when users stand guard at night while the cattle is kept on the pasture during *hura*, to prevent theft of animals or attacks by wild animals). The fathers of herders also relay concerns raised by the users to the management committee. To ensure a smooth flow of information, the management committee meets with the 'fathers of herders' twice in a month. This ensures that insights from monitoring and assessment of the state of the pasture as well as the needs of the community (that is, impending plowing dates) are shared and discussed, thus achieving e.g. consensus on opening and closure dates.

In addition, there are one or two general assembly meetings per year, where emerging issues are discussed and decisions are taken on needed adaptations. For example, fines to be levied when by-laws are breached are revised and agreed upon, e.g. to penalize those farmers who have allowed their animals to graze during the closing season, or who have not contributed to collective labor groups:

"A person who sends his or her animals to the communal pasture during the closing time will pay 20 birr per animal as a fine. If a person does not participate in kello when it is his turn, he will pay 30 birr." (Young man, current committee member, Nov. 2012).

This institutional structure has ensured knowledge and information sharing. As Janssen et al. (2011) point out, the possibility of communication can be more important than the type of rules crafted. Indeed, the current governance structure ensures transparency of decision-making processes, thus contributing to compliance, as the reason behind the rules have been openly discussed, and the general assembly has legitimized the fines. Also, every two to four years, during general assemblies, new management committee members as well as the 'fathers of herders' are elected.

"Before the final selection day we informally discuss among neighborhoods, relatives and friends whom we need to select for the next management committee." (Older woman, Nov. 2012).

The regular election of committee members and of 'fathers of herders' over the last 20 years has avoided a

sense of entitlement, as was the case under the Haile Selassie period, where the 'father of herder' was essentially a permanent position, which could only be revoked by the *ristegna*. The elections and changes in individuals holding positions in the institution also offered number of community members opportunities to learn about leadership and pasture management.

Strengthen trust and enable social learning

The clear boundaries of users, that is, those who can access the pasture, the clear definition of roles and responsibilities of the 'fathers of herders' and of the management committee, and the existence of transparent rules has helped the community members to cooperate and collaborate through the informal institution. The design of the institution, as well as its systematic implementation over the past 20 years, has contributed to building trust in the institution. First trust with regardto the implementation of rules and sanctions, and second, trust that the controlled management was effective in ensuring nutritious feed for the oxen when they need it most, i.e. for plowing. Trust has long been recognized as an essential ingredient for effective natural resource management, especially where collaborative efforts are involved, not least because trust is closely linked to compliance (Ostrom, 2010; Stern and Coleman, 2015).

The informal institution has also allowed for social learning, that is, a change in understanding that goes beyond individuals, leading to new, shared practices, enabled through social interactions between actors within the social network (Pahl-Wostl, 2007; Reed et al., 2010). The changes in arrangements were the results of a dynamic, ongoing process of trial-and-error and bricolage, both regarding the institutional structure and the management practices. Indeed, experiential knowledge was used to decide on features such as the number of committee members, the number of households that can be coordinated by one 'father of herder', the need to limit the duration for which any person holds a position, the process through which prospective position holders are identified and nominated. The choices show the ability to reflect on strengths and weaknesses of various structural elements and to combine them to fit the task at hand, as well as and the ability to reach a consensus between the needs and preferences of various groups are all important features of the capacity of a community to self-organize.

Management practices were also revised. For example access rules were adapted, that is, who could send which cattle for grazing. This meant balancing the social demands with ecological limits to avoid overstocking and overgrazing. Initially, access was only granted to oxen, as they are needed for plowing and thus crucial for cropping.

"I have an ox. It is very strong as it feeds on the communal pasture. Although I do not have farmland, I can still produce my own food through sharecropping. I pool my ox with a friend or relative to have a pair of oxen for plowing. We use the pair of oxen in turn. So the ox is my food and the conserved pasture is the feed for my ox" (Young man, landless farmer, Nov. 2012).

The rules clearly prioritize oxen over other types of cattle. This highlights the collective interest in ensuring well-fed oxen, essential for plowing the fields of the whole community. Thus, while oxen owners benefit directly, indirectly all community members benefit from the communal pasture. This is a strong incentive to ensure its protection (Baland and Platteau, 1999; Ostrom, 2010).

Building on the consensus that oxen are the most important type of animal, initially it was agreed that only those households that own oxen were allowed to be users and that they could send all their oxen to the pasture. However, as this excluded those households that did not own oxen, it was not perceived as fair and the rule was re-negotiated and modified. As a result, households who own cattle are now allowed to send up to two cows, bulls, heifers and/or calves for grazing on the communal pasture.

Bricolage as an ongoing process

The design of the institution allowed context-specific norms and shared understandings to emerge and to be revised through trial-and-error. The evolution of the informal institution thus does not follow an instrumentalist view, which assumes that actors rationally design institutions to ensure optimal resource management. The change processes in Kuwalla is more akin to 'bricolage' (Cleaver, 2002, 2012), that is, ad hoc, shaped by social life and culture. This understanding emphasizes the relational nature of collective action and the mix between conscious and unconscious motivations on the part of the community members. Indeed the informal institution, while engaged in negotiating distributional norms and sharing observations of the ecological dynamics of the pasture, is also embedded in everyday relations, in networks of reciprocity. Thus, maintaining social consensus and solidarity is often as important as ensuring the productivity of the communal pasture.

Yet, while here we have emphasized the ability of the informal institution to achieve cohesion and integration, we do not mean to indicate that there was unanimous agreement. Indeed, the current access rules privilege richer households, that is, those that own several oxen. Obviously, these richer members of the community have a vested interest in marginalizing dissenting voices and maintaining exclusionary practices. These distributional norms are increasingly contested by some groups in the community who do not directly benefit from the communal pasture (especially women and poorer households).

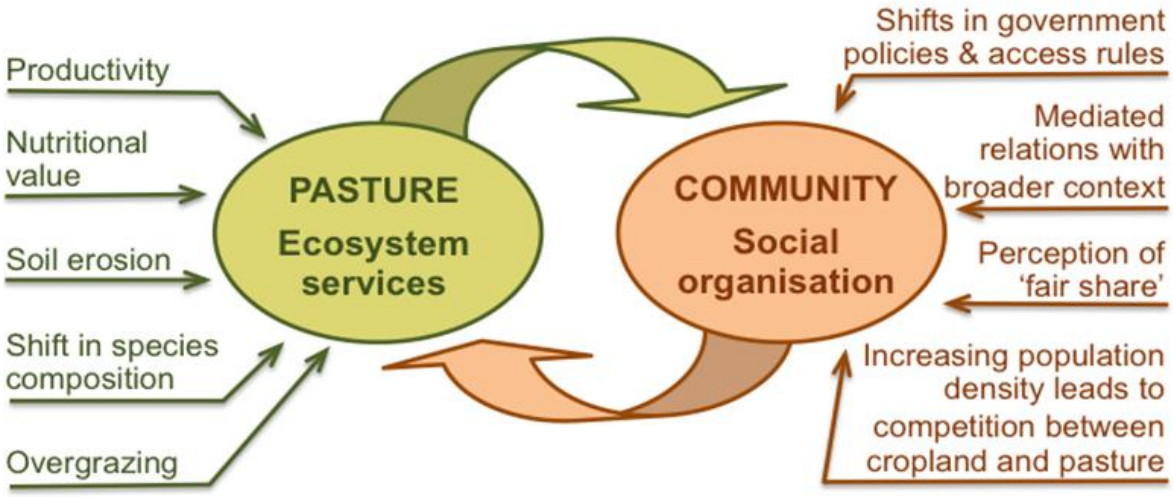

Figure 3. Interactions between the social and ecological subsystems. As a social-ecological system, the communal pasture is shaped by both ecological and social processes. The social processes were not only driven by experiential knowledge, but also by the broader context and what is locally perceived as desirable and feasible.

Furthermore, this questioning is fuelled by broader societal changes, especially development efforts targeting the empowerment of women and the access to resources by poor community members (Aregu, 2014: 59ff).

These tensions show that social learning and adaptation is needed not only in response to ecological dynamics, but also in response to social dynamics (Figure 3). Social norms and expectations change, including what is perceived as a 'fair' share of the common resources. However, these (as yet) unresolved issues of social justice and equity may be less a sign of failure of the informal institution, but an indication that change is an open and on-going process, constantly testing the resilience of a social-ecological system and its ability to address emerging dynamics.

Mediate relations with the wider context

The ability of the community to self-organize was key to the establishment of the informal institution, which has proven effective in maintaining a sustainable use of the pasture over the last 20 years. For the informal institution to be effective, it not only required managing internal social and ecological dynamics, but also to effectively mediate external influences, especially by formal governmental institutions. Indeed, leadership cannot be examined in isolation; it is necessary to consider the relationship between local leaders and government power (Beer, 2014). Leaders may need to act independently of government when the public sector is perceived as inadequate, to challenge actions and decisions of state and local government if they are perceived to be ineffective, or to trade-off endorsing one set of government initiatives, for the capacity to challenge and change other decisions (Beer, 2014).

Challenge to maintain autonomy

Initially, the political turmoil surrounding the fall of the Derg regime may have contributed to the fact that little attention was paid to what happened in a village such as Kuwalla. However, as the EPRDF regime established itself, it implemented agricultural and rural development programs. The Kuwalla community thus had to maintain local autonomy and resist exogenous intrusions, including how 'problems' are defined and what 'solutions' are imposed by external agencies. This required a process of negotiations with various government agencies, despite the limited formal power of the community and its leaders.

This struggle to retain autonomy over the management of the communal pasture is not trivial. Indeed, farmers often feel vulnerable and dependent on the goodwill of the government, which they know to be conditional on their active participation in the development goals (Planel, 2014). These rural development programs often take a top-down and blueprint approach, as agricultural extension remains focused on technology transfer (Segers et al., 2014). These technologies are bundled in 'packages', and registering for these 'packages' tends to deepen the farmers' dependence on state-mediated resources, thus disempowering them vis-à-vis the state (Planel, 2014). The community thus has to secure the goodwill of the government agents while avoiding

dependence, has to carefully tread the line between compliance and resistance, between participation in government programs and retaining the rotational grassland management that they designed over time.

Relations spanning spatial scales and institutions

At the outset, that is, in the early 1990s, two of the elders had formal positions in the community: one was a member of the *kebele* administration and the other was a member of the community police. This allowed them to use their network with the official administration, e.g. with officers from the District Office of Agriculture and other district administrators. Through this network, they were able to secure the support of other administrators at *kebele* level, to enforce the exclusive use of the pasture by Kuwalla villagers. This was needed not least to exclude farmers from other villages who had been members of the common producer cooperative and thus had had access to the pasture for some years. These farmers did not perceive the exclusive use of the pasture by Kuwalla villagers as legitimate. The support from the *kebele* administrators was thus necessary both to back up the claim of exclusive use, and to enforce the payment of fines should the rule not be adhered to.

"Before we had the controlled grazing system (…) the Senbel and Wereba villagers used to graze their livestock on our pasture. However after we excluded the other villagers from access (…) there was a lot of resistance from the Senbel and Wereba villagers. (…) The management committee frequently appealed to the kebele and through the mediation of the government officials, they learned over time that the pasture is ours"(Man, user of the pasture, Dec. 2012).

The endorsement by the *kebele* administration of the informal institution governing the communal pasture was thus necessary to ensure its effectiveness (Ostrom, 1990). To ensure this endorsement, the elders submitted the proposed rules to the *kebele* administrators, who approved them. Indeed, the *kebele* administrators were aware of the problem caused by degraded grazing land and thus supported the initiative as it would allow them to report progress in rehabilitating degraded land and allow them to use scarce resources in other areas.

The elders were also able to secure the access to government resources, when they felt it would be helpful to address ecological issues. For example, right at the beginning of the controlled management initiative, the elders requested technical assistance to demonstrate the effectiveness of enclosing the pasture to allow it to regenerate. The experts provided seeds of exotic feed species to sow on the degraded pasture, aiming at improving the nutritional content of the feed. However, while the exotic species germinated, they disappeared over the following years. It was a useful learning experience: it demonstrated that the enclosure helps the grass regenerate, while at the same time yielding the insight for both the community and the experts that the indigenous species are better adapted to the local conditions than the exotic species.

More recently, the community has had to engage in a still on-going process of defending its rotational grazing system against the pressure by extension agents to replace grazing through a cut-and-carry system, which is heavily promoted by the governmental Sustainable Land Management Program (EDRI, 2005). Unfortunately, the dominant extension approach focuses on one-size-fits-all recommendations, rather than encouraging social learning to identify the practices that are most appropriate to a specific social-ecological system. As a result, villages are expected to comply and implement strategies that are defined centrally. While Kuwalla has been successful at avoiding the pressure for several years, it has now had to show its goodwill and cooperate with the program.

"We have been told to start zero grazing and adopt the cut-and-carry system on our pasture this year. But since we were not sure how it fits to our situation we delineated one quarter of the communal grazing land for the cut-and-carry system… So we will see how it works" (Older man, current committee member, Oct. 2012).

As it happens, the rainfall in 2012 was limited, so that grass regrowth was poor, making it unsuitable for scything. The committee used this result to argue that their pasture was generally not suitable for a cut-and-carry system, as the grass species do not grow tall and plant density is too low to justify the manual labor required to harvest the grass. Yet, extension agents perceived this as a resistance against adopting the zero grazing system and have continued to put pressure on the Kuwalla villagers to dismantle their rotational grazing system. The community is thus engaged in an on-going process which involves negotiating both actions and meanings, treading the fine line between securing the goodwill of officials while avoiding to change their pasture management system in ways that suit external demands, but not the needs of the villagers or the potential of their grassland.

Resilient communities are those that not only learn to cope with and adapt to change, but are also able to shape change (Magis, 2010). The negotiations with government administrators are an example of the community in Kuwalla shaping change. Indeed, they did not just buffer the impact of exogenous change, or adapt internal processes as a response to policy change. They actively engaged with local administrators and negotiated with them. As a result, they influenced the official's expectations of what can be considered acceptable, in that it can be seen as complying with the directives of the central government. However, any success is provisory and will be questioned when officials or directives change, making it an on-going process. To be resilient,

the community thus needs to be able to persistently contest and resist the interests of the powerful centralized state when these are not suited for the local social-ecological system.

DISCUSSION

Strengthening resilience through social learning

We identified three key factors that enabled the community in Kuwalla to transform and adapt the management of their communal pasture, so as to ensure its sustained productivity: The initiative by the leaders, who were able to seize a 'window of opportunity' and mobilize the community; the establishment of an informal institution which became a platform of social learning; and finally, the ability of the community to mediate external influences and to safeguard their autonomy. However, these three factors are not distinct, but in many ways interdependent. For example, the leaders not only initiated change and mobilized the community; they also operationalized the informal institution and ensured initial support by official government agencies, through their personal relations. Similarly, over the past decade, the evolution of the informal institution and the management of the pasture were in part shaped by the need to accommodate some external demands. Also, the relative importance of the three key factors for enabling change shifted over time: while initially the leaders were instrumental in instigating transformative change, leadership does not seem to play a prominent role during adaptive change, which relies more on the informal institution as a platform for integration and communication.

The study shows that to sustain its resilience over the past 40 years, the social-ecological system had to be able to implement two qualitatively different change processes. Indeed, the community needed to display both transformative capability, i.e. the ability to radically change the management system when the pasture was no longer able to fulfill its function, and adaptive capability, that is, the ability to implement marginal, incremental changes (e.g. to the access rules) (Walker et al., 2004; Darnhofer, 2014). Indeed, the establishment of the informal institution was transformative, both in the structure of the feedback loops between the community and the pasture, and in how community engaged in social learning, collaborated and approached change.

These two types of changes are in line with the heuristic model of the 'adaptive cycle' in resilience thinking (Holling, 2001; Burkhard et al., 2011). The model illustrates that many social-ecological systems go through long periods of incremental change, interspersed with short periods of turbulence, which may lead to a renewal and reorganization. This has several implications. Firstly, change processes are unlikely to be steady and continuous (Young, 2010). Thus it is important to take a long-term view to understand how the system coevolved with its environment as well as which choices were made by the community and why. Such a longer-term analysis allows appreciating the complex interdependencies between the social and ecological sub-systems (Barton et al., 2012; Butzer, 2012; Lanckriet et al., 2015). Secondly, the fact that a social-ecological system has been fairly stable over a longer term does not necessarily indicate that it is not capable of transformative change. Thirdly, the key to transformative change is to recognize and seize the opportunity created by a sudden disruption, a shock.

These implications open new understandings, both of the potential value of shocks as 'windows of opportunity', and of the need for on-going change rather than a one-sided commitment to bolstering the established system. Such a commitment is often the outcome of disagreements that polarize stakeholder groups, or of powerful actors who have a vested interest in maintaining the status quo (Olsson et al., 2006; Walker et al., 2009). Yet if stability is prioritized and shocks primarily framed as threats, learning and change is impeded, which is likely to undermine the resilience of the system.

The case of Kuwalla also highlights that the solution to an environmental problem, such as a degraded pasture, is to a large extent socially derived, rather than being a primarily dependent on identifying and promoting technical management 'packages' that are scientifically proven to address the biophysical aspects. The community in Kuwalla did not need an intervention by the government or a development project to impose a predefined 'solution'. Rather, it was successful because it relied on social memory and experiential ecological knowledge, and above all on the ability to imagine an alternative way to organize the use of its communal pasture, and to engage in an open-ended social learning process. For the community to initiate this process and to embrace transformative change, it was necessary for it to perceive the problem as salient (there are always many issues competing for attention), and to perceive the proposed way forward as feasible and desirable (that is, as compatible with its livelihood system and cultural norms). This shared perception was informed by observations of the pasture (that is, its degraded state and its ability to regenerate upon closure), but was ultimately the result of a social sense-making process. There are thus important social processes at play within the social sub-system, which influence its ability to take action so as to respond to undesirable changes in the ecological sub-system (Figure 3).

The study thus indicates that recommendations and intervention efforts, which only focus on enhancing the status of the biophysical elements, that is, the natural resource, may not experience widespread adoption (Enfors, 2013; Planel, 2014). Rather than focusing on 'upscaling' or disseminating technical solutions which have proven successful in trials, it seems more promising

to focus on endogenous development efforts and ways to promote social learning processes, which may well integrate relevant scientific insights (Röling and Wagemakers, 1998; Kilelu et al., 2013). The solutions developed within such social learning processes are more likely to take into account social issues (e.g. the impact on labor organization) and cultural values which make a change feasible, desirable, and sustainable. Indeed, a community is likely to want to ensure both a sustainable management of the natural resources its livelihood depends upon, and maintain social consensus and solidarity (Cleaver, 2002). Thus, at least as much effort should be put on understanding the dynamics of ecological processes as the dynamics of social processes involved in designing the management system, that is, how experiments can be designed, how monitoring outcomes can be incorporated in the shared understanding and how they can help shape future management actions. In Kuwalla, through taking such a trial-and-error approach, the four elders implicitly framed management rules as an open-ended process, rather than a set of rules that is fixed once and for all. This encouraged the community to continue seeking appropriate responses to changes in the pasture ecosystem, in the social needs, and in government policies. Indeed, even a transformational change leading to a (radically) new management system is not an end-point, but one step in an ongoing process of change. On-going adaptations are needed, not only in response to the dynamics of the ecosystem being managed but to respond to changes in the social subsystem (e.g. social norms, government policies, markets) (Olsson et al., 2004a; Folke et al., 2005; Lanckriet et al., 2015). Going even further, Folke et al. (2003) point out that resilience not only requires actively responding to change, but also creating and shaping it. Indeed, opportunities to improve sustainability and resilience are as much seized as constructed.

Understanding the social processes involved in nurturing or halting change needs to build on the understanding that a 'community' is rarely a harmonious whole (Barrett, 2014). Indeed, there are internal tensions between groups with different interests, often linked to the gender-division of labor or to differing priorities between groups of different wealth status. These tensions may linger and remain under the surface for a while, but over time they will erupt and require attention, e.g. through adapting the access and use rules. Any established rule will thus, sooner or later, be challenged by a sub-group of the community or by external agents. This reinforces the need to strengthen the community's ability to self-organize (Prior and Eriksen, 2013), e.g. by encouraging learning through negotiations and reflecting on past experiences. While in this paper the emphasis is on the factors that allowed for a successful adaptation, this is not meant to indicate that the processes in this community have been problem-free or that the current rules are not being contested (Aregu, 2014: 59ff).

Promoting social learning processes and empowering local action to strengthen the adaptive capacity of the community implies a departure from 'top-down' approaches to rural development and agricultural extension. The aim is no longer to disseminate technical 'packages', but to encourage communities to develop management approaches suited to their specific local setting while facilitating the process, among other by offering information on options that may be relevant in their context. The site-specificity of natural resource management problems is linked both to the variability in ecosystems such as pastures, and in social variability linked e.g. to the experiential knowledge that can be mobilized, the tensions between groups in a community, or the ability of leaders to mobilize for collective action. The process will thus need to take into consideration antecedent conditions, as well as contextual and situational factors, which drive the emergent dynamics of the social-ecological system (Green et al., 2013; Greig et al., 2013; Monroe et al., 2013). Enabling self-organization will strengthen resilience as it strengthens the ability of communities to effectively and creatively engage with the next disruption, be it internal contestation or external shock. This approach, building on collaborative adaptive management (Beratan, 2014) should not be construed as advocating a 'hands off' approach by policy makers. Indeed, the broader market and policy context can undermine the ability of communities to be resilient (Fabricius et al., 2007; Beilin et al., 2012).

Conclusion

The case of Kuwalla shows that there is no structural determinism: a series of trends and events (e.g. population growth, changes in government policies, shifts in institutions, dry spells) does not inevitably lead to a negative outcome such as the severe degradation of a communal pasture. While such trends and events might increase the incidence of negative outcomes, some communities effectively escape the 'trap' by self-organizing (McSweeney and Coomes, 2011). A key to strengthening the resilience of social-ecological systems is thus to promote policies and institutions that facilitate social learning and enable communities to identify and continuously adapt management approaches suitable to their specific ecological and social context.

Indeed, to be resilient in a turbulent world, a community whose livelihood is dependent on local natural resources needs to be able to engage in an open process of adaptation, integrating lessons from past experiences. This is less about rational planning or the effective implementation of technical 'packages', and more about 'bricolage', that is, borrowing from past institutions, existing styles of thinking and sanctioned social relationships, as well as adapting existing norms, practices and mechanisms for new purposes (Cleaver, 2002, 2012). It implies an on-going, non-linear process in

which the management system is adapted to ensure that the natural resource is used sustainably, and that the management rules are socially acceptable. This highlights that resilience is 'emergent', that is, not a fixed asset, but a continually changing process, not a 'being' but a 'becoming' (Davoudi, 2012). Thus, to ensure resilience, the community needs to be able to understand signals both from the natural resource and from the social context, and to respond to them through an open-ended process of adaptation.

Conflict of Interests

The authors have not declared any conflict of interests.

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