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AUTHOR'S NOTE

The transliteration rules that have been applied are those of the *Cahiers d'Asie Centrale* journal, except in the case of proper nouns that already exist in French and English (ISO: 9 1995).

Context and research question

1 Kyrgyzstan is a mountainous country, and 94% of its territory is located more than 1,000 m above sea level (Fitzherbert, 2006). After the country gained independence in 1991, international organisations supported policies to reform the agricultural sector. Arable land, livestock and production means were rapidly privatised. This did not happen with pastures, which represent 49% of the country's area and remained state property. Until 2009, pasture management was spread out across three administrative levels, according to the type of pasture, and available for long-term lease.[1]

2 Pasture management was delegated to user associations and their executive body – the Pasture Committee (PC) created at the *ajyl ajmak* level (rural municipality). The PCs' implementing bodies –non-governmental organisations (NGOs) and the Agency for

Development and Investment for Communities– promoted the concept of pasture degradation, which became a major discourse at both the local and the national level (Kerven *et al.,* 2012). The new management model is based on the concept of community-based natural resource management. This model was developed based on the theory of the commons, which states that management by resource users can be an alternative to privatisation and governmental management (Ostrom, 1990).

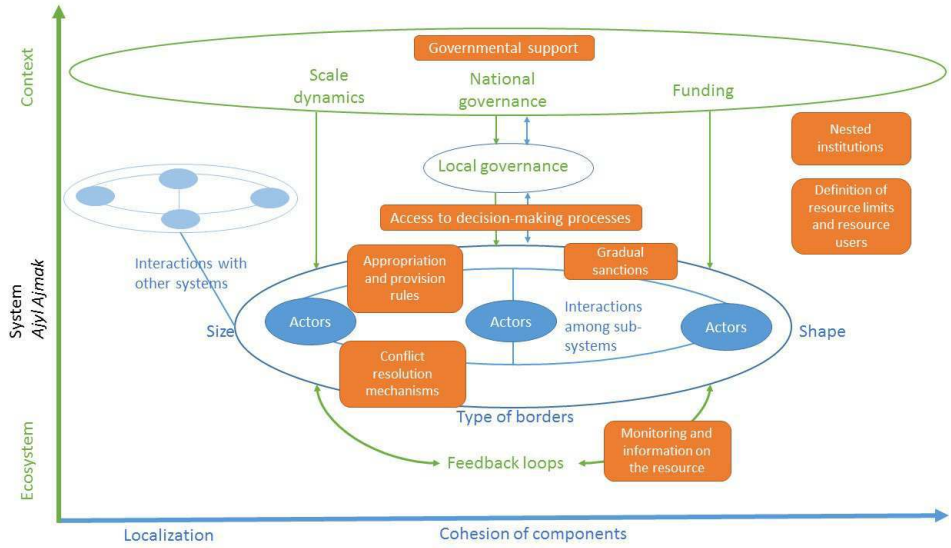
3 According to Ostrom (ibid.), high income–generating activities are an obstacle to robust community-based natural resource management. This study investigates the impact of community-based management and how it affects territorial resilience in a system that combines low and high income–generating activities, such as agropastoralism and mining.

4 Mining activities are economically significant in both artisanal and industrial form (Appel et al., 2003; Gullette and Kaldybekova, 2014). The Kumtor goldmine, operated by a Canadian enterprise, represented 5.5% of Kyrgyzstan's GDP in 2012 and employed around 2,600 Kyrgyz nationals (Gullette and Kaldybekova, 2014). Artisanal mining is hard to track because many miners do not report their activities to the authorities. Nonetheless, it is believed that around 5,500 people in three provinces were involved in artisanal mining in 2003 and that artisanal mining existed on a smaller scale in the country's other four provinces (Appel *et al.*, 2003). Usually, extraction sites are located at an altitude above even the highest-lying used pasturelands. Although these areas are formally considered pasturelands, they have no value for agropastoralism. However, industrial extraction also has an impact on the surrounding environment as it implies building access infrastructures, which influences the choice of location for a herder's settlements.

5 The resilience of a socio-ecological system is ensured when changes in the environment – influenced by or related to human activity – and adaptation to these activities are equal and create an equal development (Stokols et al., 2013). The study of territorial resilience[2] is aimed at understanding how spatial aspects can affect the resilience of a socio-ecological system (SES) and vice versa (Cumming, 2011; Aschan-Leygonie, 2000). Thus, the study of spatial resilience not only is an analytical tool for existing systems but also helps to understand ongoing changes in socio-ecological systems.

6 The impact of community-based management is analysed in this research through an adapted version of the eight design principles for common-pool resource institutions (Ostrom, 1990) in order to determine its effects on the resilience of agropastoral systems and the effects of mining activities in the framework of community-based pasture management (Fig. 1). Territorial resilience is organised around horizontal (shown in blue) and vertical interactions (shown in green). Horizontal interactions represent the cohesion between internal components and their spatial situation, while vertical interactions represent interscale relationships such as support from higher-level institutions (i.e. through funding) and the existence of nested institutions (i.e. scale dynamics and national governance) (Aschan-Leygonie, ibid.). Forms of local governance and interactions between groups of actors inside the system are investigated by examining access to decision-making processes, appropriation rules, sanctions and conflict resolution processes. This analysis also takes into account how the limits of a resource and user access to a resource are set and considers feedback loops between the ecological and social systems.

Figure 1: Design principles for common-pool resource institutions within the framework of horizontal and vertical interactions of resilience



Realisation I. Mestre, 2016.

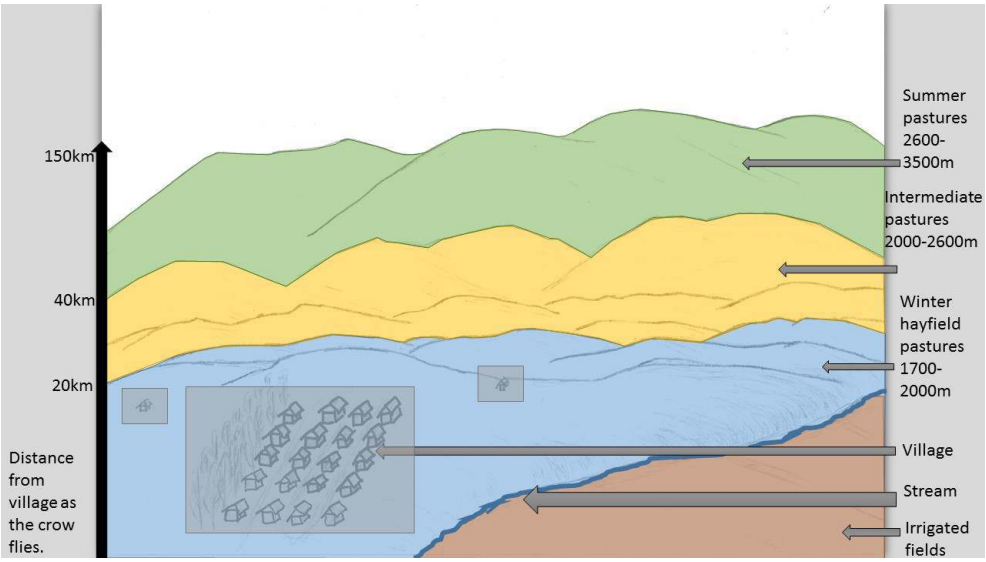
Study area and methods

The study area: the socio-ecological system and embedded scales

7 By analysing a case study based on a village in Naryn Province where artisanal mining has been on the rise since 2010, the same year the PC was created, we investigate how artisanal mining transforms agropastoral practices, household strategies and pasture management models. Two gold mines had been opened by the government on the territory of Altyn,[3] a rural municipality with 3,500 inhabitants. The industrial exploitation of one of the mines stopped in the 1990s, and it then became a place of artisanal mining. The local population's three main income-generating activities are artisanal mining, livestock breeding and barley and fodder production.

8 Agropastoral activities rely on crop production for human consumption and fodder in the valleys. The highest pastures are used in summer, while irrigated fields and pastures in lower areas are graationed in winter, as are pastures on the windy, sun-drenched slopes where the snow layer is thin and does not prevent livestock from accessing the vegetal cover (Fig. 2).

Fig. 2: Scheme of land use for agropastoralism within the territory of Altyn



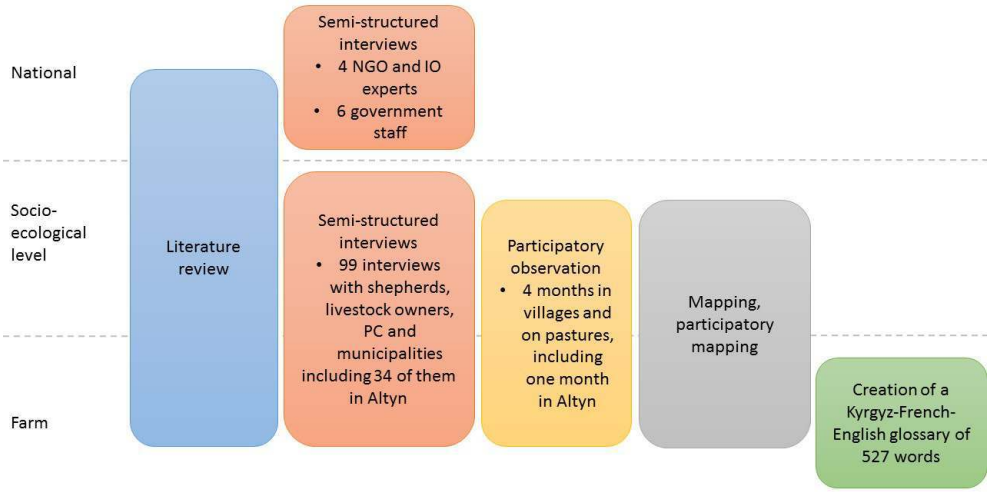
Realisation I. Mestre, 2016.

9 Since the post-independence dismantling of collective and state farms, agropastoral activities have been divided between livestock owners who are mainly involved in cultivation and mostly stay in the villages, and shepherds who own livestock and graze other villagers' livestock as a paid service. The shepherds migrate to spring, summer and autumn pastures. During the winter, they often stay on farms on the periphery of villages to have better access to winter pastures, while livestock owners stay in the villages all year round.

Data collection and analysis

10 Field research was conducted between 2010 and 2015 by employing a range of tools appropriate to the various levels studied (Fig. 3). The method of embedded case studies takes into account the interactions between scales. Thus, interviews conducted with the governmental administration, international organisations (IOs) and local NGOs investigated dynamics at the national level.

Figure 3: Data used for the research



Realisation I. Mestre, 2016.

11 A qualitative analysis of the data was made by categorising using the Sonal[4] software. The study of the evolution of pasture use since the creation of the PC was done through mapping. Data collected during participatory observation on various seasonal pastures and in villages were used to triangulate data collected in interviews. As statistical data are not always reliable, they were used only to frame the main trends (Schoch et al., 2010; Mestre et al., 2013). The indicators of the impact of community-based pasture management and mining on territorial resilience were specifically elaborated upon for the agropastoral systems of Kyrgyzstan's Naryn Province (Mestre, 2014).

Results

Artisanal mining: factors of change in territorialisation and pastoral practices

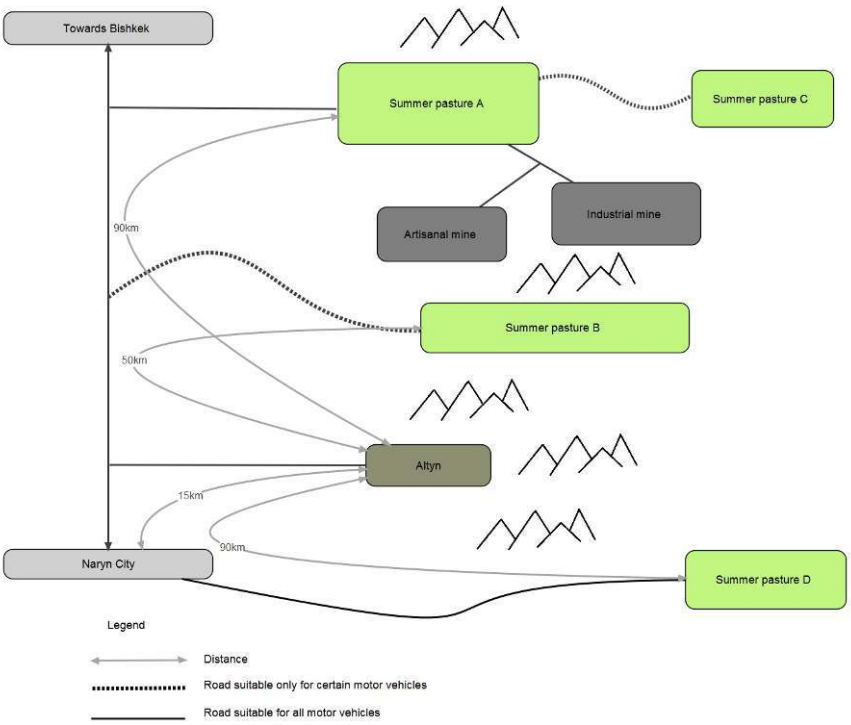
Networks at the core of agropastoral organisation

12 In Altyn, industrial mining involved a small share of the village's labour force, while a large share of households is now involved in artisanal mining. The development of artisanal mining led to a growing demand for labour and to increased cash flow for households, with both factors consequently affecting agropastoral activities. Despite differences in the strategies of specialisation and diversification, agropastoralism remains the main pillar of households' livelihoods.

13 Informal artisanal activities intensified in 2010 close to summer pasture A (Fig. 4) in parallel with an industrial mine that has been operated by the state enterprise since the 2000s. A network of access and electricity provision infrastructures (roads, bridges, etc.) was created to support the industrial mine. On pastures close to the mine, shepherds benefitted from a list of advantages: easy access to pastures, commercial opportunities selling to traders and miners from the industrial and artisanal mines, and an opportunity to be involved in both livestock grazing and mining. Men can easily alternate working in

the mines with grazing livestock. Extraction sites are located at an altitude where vegetal cover is too scarce to graze animals, and therefore mining and grazing activities do not compete for land. The environmental impact of industrial mining is largely the result of dust produced by the construction and maintenance of access infrastructure and the release of untreated effluents from gold processing. The impact is also commercial, as workers buy dairy products from nearby herders.

Figure 4: Diagram of the socio-ecological system



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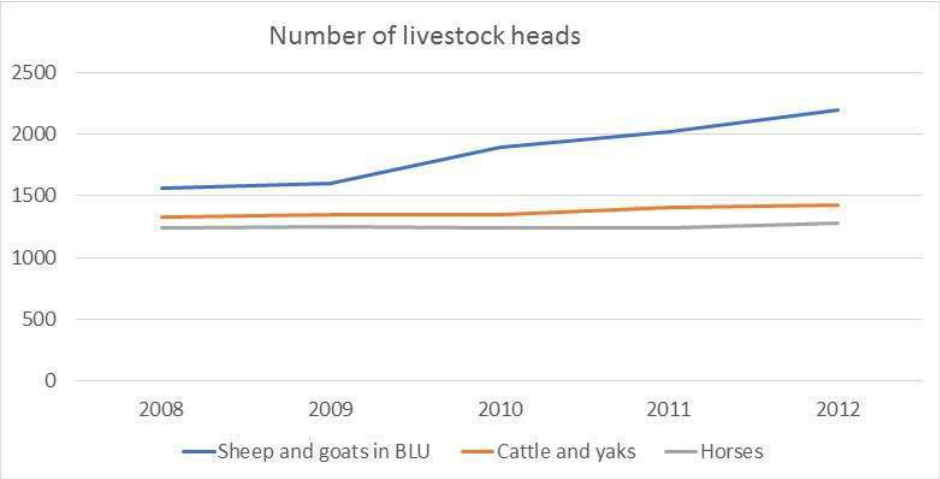
Agropastoralism as a pillar in strategies of livelihood diversification

14 As in most agropastoral systems, cash income from mining activities is saved in the form of livestock (Schoch et al., 2010; Duteurtre and Faye, 2009), something that has led to an increased number of livestock per village inhabitant, while the labour force available for livestock activities has been decreasing. The number of domestic animals has been increasing faster than in the other municipalities of the province and intensified in 2010 (Fig. 5).

Figure 5: Number of livestock by type based on data collected in the municipality – sheep and goats in big livestock units (BLU)



Realisation I. Mestre, 2016.

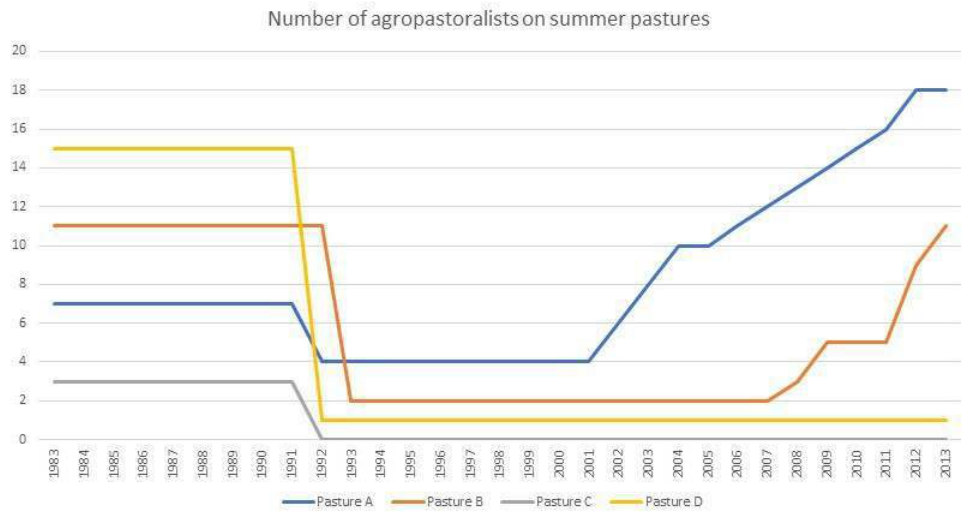
15 Our findings show that new systems for herding services are being implemented. During the winter time, an increasing number of livestock owners place their animals in the care of shepherds living outside the village and grazing on southern slopes, thus reducing the amount of fodder needed. Households involved in diversification strategies are mostly non-migrating livestock owners and shepherds who migrate to pastures close to the mines, which are made accessible via the road maintained by the state-owned mine (Fig. 4, summer pasture A).

16 Conversely, those who specialise in livestock activities and do not diversify their livelihoods choose to migrate to the less accessible summer pastures, where livestock concentration is lower and there is richer vegetal cover (Fig. 4, summer pastures B, C and D).

Land use of marginal pastures under pressure from increasing livestock numbers

17 The use of summer pastures evolved due to the pressure of increasing livestock numbers and the repairs to access infrastructure. The allocation of pastures in a new way led to the territorialisation of agropastoralists according to their involvement in artisanal mining. In 2012, access to pasture B became easier as the road leading there was renovated as part of a project implemented by an NGO. It contributed to reducing the pressure on pasture A, where most livestock was concentrated, as the access infrastructure is regularly maintained by the state-enterprise operating the nearby industrial mine (Fig 6).

Figure 6: Number of agropastoralists on summer pastures, 1983-2013 – data collected through interviews and field observations



Realisation I. Mestre, 2016.

18 The high density of livestock on pasture A and the decrease in productivity are clearly perceived by agropastoralists. Herders responsible for large herds (more than 700 sheep)[5] and not involved in mining have – since the opening of the state-run mine – taken the opportunity to go to pasture B, a pasture that had been used during the Soviet era but was abandoned when the number of livestock decreased and access infrastructure was no longer maintained.[6]

19 Before 2010, stakeholders interactions had been organised into two main groups distinguished by their territorialisation: 1) agropastoralists who do not migrate to summer pastures but live in the centre of the village, and 2) agropastoralists who migrate to summer pastures and mostly live outside the village and use the most accessible pastures. The development of mining transformed this into a configuration based on three groups with different territorial and pastoral practices: 1) livestock owners who combine livestock activities with artisanal mining, with ever decreasing involvement in livestock activities, 2) shepherds who also own livestock and whose activities are closely related to mining since they combine both activities or benefit from the advantages of using pastures located close to the mine, and 3) shepherds who also own livestock and take care of the increasing livestock numbers generated by mining activities but use pastures that are not connected to the mines.

Borders of use and resistance to external users

20 The increasing number of livestock (Fig. 5) puts pressure on winter pastures and enhances the need for winter fodder. This demand is barely met, and winter pastures are fenced in in order to be illegally used as hayfields. The shift from pastureland to hayfield leads to conflict, but management institutions are not active in resolving them.

21 The competition for resources between mining and agropastoral activities is not as fierce. This is because of the different areas of these activities: The extraction site is located above the pasture limit. Nonetheless, mining activities do contaminate the soil and can

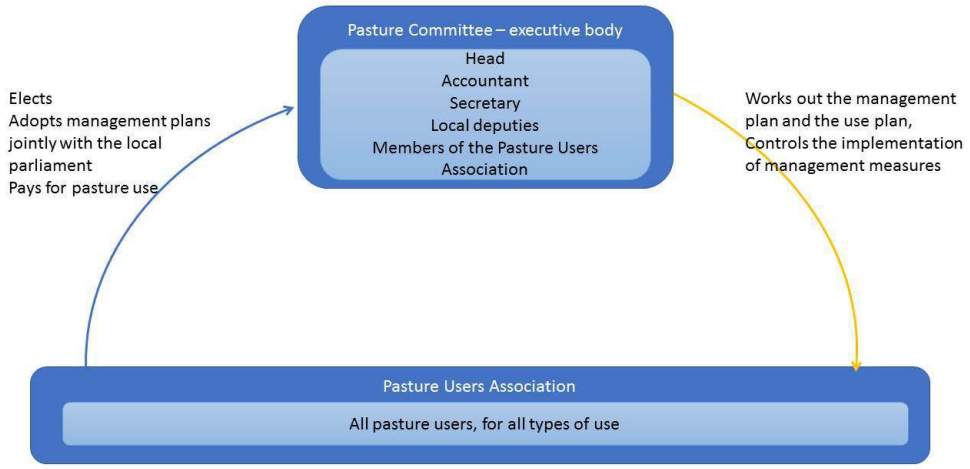
potentially contaminate the food chain, too (Appel, ibid.). However, activities start to clash when foreign companies exploit the mines, and environmental and social claims are often expressed. This is not the case when state-run enterprises undertake the mining, despite there being no independent evaluation of the environmental impact of state-run mines, nor in the case of artisanal mining (Steimann, 2011).

Community-based pasture management, a platform supporting dynamic stakeholder interaction

Participation in the PC: adaptation inside the interest groups

22 The tension between mining and non-mining agropastoralists is manifested during the traditional gathering where the price of livestock herding is negotiated (Steimann, 2011). The creation of the PC, which is led by local administration officials when the herding agriculturalists are on summer pastures, helps to reinforce the position of the livestock owner (Crewett, 2015). Moreover, the fact that livestock owners live closer to the centre of the village gives them easier access to decision-making platforms for pasture management (Mestre, 2014). According to the law, the PC is the executive body of the association of pasture users, and both should cooperate closely with each other (Fig. 7). In practice, however, decisions are made by the head of the PC, and the participation of agropastoralists is not explicit with regard to either the forms that participation can take or the stakeholders who can participate.

Figure 7: Diagram showing PC functions as described by the law



Realisation I. Mestre, 2016.

23 The choice of which pastures are used and the way in which households manage the herds in practice are not perceived as management measures but rather as an answer to the withdrawal of the detailed centralised management measures that existed during the Soviet period. The concept of management is associated with a top-down power structure.

The involvement of marginal stakeholders in management: non-mining agropastoralists

24 The polarisation between mining and non-mining agropastoralists is based on older categorisations of agropastoralists living inside the village, namely those involved mostly in mining and those living on farms far from the village centre who are rarely involved in mining. Although households from both groups interact with each other, these two groups are distinct regarding pasture resources in terms of their pasture management and function. This research has shown that mining agropastoralists, because of their location, have easier access to formal management institutions such as the local parliament and the PC. They initiated the association to protect artisanal mining activities. Non-mining agropastoralists have less access to being involved in the management plans of the PC. This spatial distribution influences the ability of agropastoralists to take part in decision-making processes and enhances the risk of marginalisation of certain stakeholders and of their pastureland.

25 In order to have their voices heard, non-mining agropastoralists living outside of the village are organised into groups and send their representatives to PC meetings. Disagreements at these meetings are most often related to which infrastructure to repair and to the dates for migration to summer pastures. Agropastoralists from distant farms use pastures whose access road is in bad condition. Conversely, agropastoralists living in the village use pastures whose access road is regularly maintained by the government-owned mining enterprise. The weak legitimacy of PC members amongst herding agropastoralists, associated with the willingness to ensure good management of financial resources under its responsibilities, led the herding agropastoralists to develop their own control mechanisms through a cross-checking count of taxes collected.

The issue of resource information

26 Artisanal and industrial mining activities reinforced issues related to the transmission of information on environmental impacts and economic dynamics. Artisanal mining became widespread when gold prices increased, drawing attention to industrial mining and its effects on environment and health. In 2012, while the industrial exploitation was about to be launched on the artisanal mining spot, the enterprise had to stop the process because of a conflict with inhabitants. One of the triggers of the conflict was the lack of transparency about potential impacts on health and the environment (Gullette, 2014). The intensification of artisanal mining had caused local inhabitants to raise questions about the levels of heavy metal concentration. Paradoxically, as artisanal mining is not legal, there is no formal framework for an impact study, and no private request was submitted as they feared that the results could be used to stop the artisanal mining.

27 Data on the increase of livestock are not collected in a reliable way; this is a factor that impedes the monitoring of pasture quality. The PCs are responsible for designing the five-year management plan and an annual use plan to allocate pastures to each user according to the size of their herd and the pastures' carrying capacity. However, the PCs do not always have the adequate skills and knowledge to carry out these tasks. Moreover, although these plans are supposedly the expression of the common interest and traditional knowledge (Jacquesson, 2010a), Altyn's PC does not implement mechanisms for systematic joint management with users.

28 Regarding the development of artisanal mining, groups of mining and non-mining agropastoralists have worked on processes to protect their interests from other members of the community and outsiders questioning the legitimacy of artisanal mining. Within the community, the strong mobilisation of mining agropastoralists supporting the continuation of artisanal mining placed the participation of non-mining agropastoralists in the PC, the institution responsible for management, at risk. Because of their migration to summer pastures and their scattered winter houses, the usual participation processes occurring in village centres barely reach non-mining agropastoralists.

29 The trend of agropastoral system expansion through the integration of sub-systems into decision-making processes has an influence on interactions between space, society and environment that positively affects the resilience of the socio-ecological system (Table 1). However, resilience is threatened by the weakness of the conflict resolution processes and could lead to a privatisation of (both mining and pasture) resources and the parcelling of the system. Fast changes in practices and a lack of coordination between PC management and traditional and informal management limit the system's ability to anticipate impacts on ecosystems.

Table 1: Impacts of community-based management on interactions between space, society and environment

Interactions between space, society and environment	Indicators of resilience	Impacts on the resilience of the SES
Participation in pastoral resource management	User groups influenced by rules of use are able to change them; the process is transparent.	Not all sub-systems have the same access to decision-making processes but a tendency towards integration is noticeable.
Representativeness in pastoral resource management	All user groups (from each use type, for each level, perceived as legitimate and as not legitimate) participate.	
Information on pastoral resources and their dynamics	Resource limits and the processes that make these limits flexible are known. The pastures' carrying capacity is known.	Fast changes in practices do not allow the anticipation of impacts on ecosystems.
	Inspectors are accountable to users and control the state of the resource. Information on the resource dynamic and feedback loops is available.	
Monitoring pastoral resource use	Inspectors are accountable to users and control levels of appropriation and provision.	

Gradual sanctions according to the importance of violation of the use rules	Users who violate rules have to comply with gradual sanctions according to the gravity and context of the violation. Sanctions are enforced by other users, officials (accountable to users) or both.	
Mechanisms for conflict resolution around pastoral resource use	Users and officials have access to local and inexpensive platforms for resolving conflicts amongst users or between users and officials. Mechanisms are known and respected.	Internal conflicts are not regulated and can contribute to the parcelling of the system.
Absence of widespread corruption	The level of corruption is acceptable for pasture users.	The risk of misappropriation is low.
Adaptation of rules to the local context	Local rules of appropriation and provision are adapted to the local context.	The PC rules are not connected to local rules, which reduces the adaptation capacity.
	The expression of informal rules in policies do not threaten the functioning of the system.	The implementation models limit feedback loops between users groups and natural resources.
	Models are not imposed by central structures on local institutions.	

Reactions to external stakeholders and redefining local relations

30 The development of artisanal mining reinforced local dynamics to protect resource access from external stakeholders such as public authorities attempting to regulate extraction.

Mobilising support to push for enterprises to pay compensation for pasture use

31 The inhabitants of Altyn mobilised and formed an organisation to protect artisanal mining activities. Because of the informal nature of artisanal mining, the PC did not involve itself in formalising payments for pasture use for mining activities, which is permissible under the law. The PC feared its involvement could trigger a conflict between the institutions responsible for regulating mining activities and the villagers' newly created organisation. The controversy surrounding questions of villagers' right to mine strengthened the social role of the villagers. These villagers subsequently felt empowered to seize other domains such as village planning and compensation for the environmental impact of the governmental mine.

Community-based management and interactions with higher levels in a centralised system

32 The responsibility for pasture management was delegated to PCs without allocating them the necessary support in terms of capacity and legal knowledge relevant for implementing the law. PCs are supported by the Pasture Department, which falls under the Ministry of Agriculture, with regional offices supporting the 454 PCs spread across the country. There is no institutional platform for interactions between PCs and administration levels higher than the municipality, and in general interactions occur in a mostly centralised system dominated by a technical understanding of natural resource management (Shigaeva et al., 2013).

33 The creation of PCs deprived municipalities of a key resource. Unlike municipalities, PCs and their predecessors were able to capture international funding, and consequently, municipalities were able to claim a share of the funds received. However, in 2012 the Association of Pasture Committees was created, in some areas of the country at the district level. PCs gathered in associations can lobby private sector stakeholders and high-level government structures.

34 In Altyn, as villagers' mining rights claims were settled and cooperation with neighbouring villages in the district is limited, they have no interest in creating an association. The analysis of vertical interactions between spatial entities highlights the PC's isolation as a community-based institution and its vulnerability because of its financial reliance on the central governmental (Table 2). Support for PCs is low, and funding could be further decreased if PCs have to share their incomes with the municipalities. Conversely, the ability of sub-systems to organise at the local level strengthens the resilience of the SES.

Table 2: Impact of community-based management on the cohesion of spatial entities

Cohesion of spatial entities	Indicators of resilience	Consequences of community-based management on SES resilience
Existence of sub-systems	Sub-systems are organised as centres and margins.	Sub-systems create new interactions amongst themselves.
Embedded scales	Vertical interactions are organised at multiple embedded scales.	The vertical integration of the PC is very limited.
Support from higher levels	A large-scale structure can support local-level institutions of pasture management.	The institution at a national level cannot support the PC to fulfil its role.
Recognition of the right to self-organise	Authorities do not question a local community's right to manage its resources.	The notion of community-based management is opposed to the existing approaches to natural resource management in governmental agencies.

Context	Rapid exogenous changes do not affect the functioning of the village.	The management model is vulnerable to political changes.

Conclusion

35 With the implementation of community-based pasture management, the agropastoral system is undergoing a parallel process of the construction of both internal and external cohesion. On the one hand, the internal cohesion between the stakeholder groups tends to be reinforced by stakeholders themselves using the platform created by community-based pasture management, despite the lack of support from the PC. The theory of the commons is based on the hypothesis that communities are able to manage common resources when some conditions are met. However, the process through which these conditions can be met or lost is mostly outside the scope of that field of research (Cox et al., 2010).

36 While investigating the two-fold powerful developments of post-Soviet transformation and the growth of artisanal mining activities, the dynamic of social learning was highlighted and revealed how groups develop mechanisms in order to control different dimensions of the use of a common resource. Both the interactions between different stakeholder groups and the ongoing learning processes demonstrate the complexity of the dynamics and reveal a community far from homogenous and static. In this case study, the development of mining acted as a catalyst for mining agropastoralists to participate in decision making. However, agropastoralists not involved in mining were not marginalised and seized the PC decision-making platform.

37 Thus, the existence of a high income–generating activity did not appear to be an obstacle per se to community-based management and could even trigger the elaboration of management mechanisms for information about the resource and for coordination between the different groups forming the community. On the one hand, the system is nevertheless vulnerable because of the difficulty connecting management models built by public policies at a national level with local and informal management practices. This situation is not unheard of in Kyrgyzstan: Eychenne and Lazaro (2014) emphasised the "external" *pastorality* in opposition to an "internal" *pastorality*. On the other hand, community-based management in its current form does not fit with natural resources management approaches that dominate in government structures, revealing nuances of the "external" *pastorality* of public policies that juggle diverse approaches.

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NOTES

1. Management of winter pastures was the responsibility of the *ajyl okmotu* (rural municipality). Spring and autumn pastures were managed by the district, and summer pastures by the province. According to the law, pastures were allocated through auctions.
2. Cumming (2011) uses the term "spatial resilience", but we prefer *territorial resilience*, in line with the research of Aschan-Leygonie (2000).
3. The names of the village and pastures have been changed and coded for ethical reasons.
4. Version 2.0, see: http://sonal.hypotheses.org/
5. Interview VN860093 and Jacquesson (2010b).
6. Between 1990 and 1996 in Kyrgyzstan, when the agricultural sector was privatised, cattle numbers decreased by 65%, and goat and sheep numbers decreased by 33% (Farrington, 2005).

ABSTRACTS

In 2009, Kyrgyzstan adopted a community-based pasture management model. While agropastoralism is the main subsistence activity for 65% of the population living in rural areas, pastures are also an essential resource for other activities, such as mining. By analysing a rural municipality where agropastoralism and mining co-exist, we explore the impacts of artisanal mining activities on community-based pasture management and territorial resilience. Our key findings show that mining income is capitalised in the form of livestock, and that the mechanisms for animal herding by agropastoralists who are not involved in mining activities and who live on the periphery and have little access to formal decision-making processes are at risk of further marginalisation. Furthermore, the lack of mechanisms for collecting and analysing data on the state of the natural resources necessary for agropastoralism, such as water and pastures, poses a risk to community-based pasture management. Finally, interactions within the system and between the system and external components are a transversal issue for the maintenance of community-based management. Thus, the co-existence of high income–generating activities and traditional activities such as agropastoralism does not limit community-based management and can even be a lever for a dynamic process that helps to support the creation of management rules.

Le Kirghizistan a adopté en 2009 un mode de gestion communautaire des pâturages. Alors que l'agropastoralisme est l'activité de subsistance de 65 % de la population qui vit en zone rurale, les pâturages représentent également une ressource essentielle pour d'autres activités telles que les activités minières. À travers l'étude d'une municipalité rurale où mines et élevage coexistent, nous analysons les impacts des activités minières artisanales sur la gestion communautaire des pâturages et sur la résilience de ces territoires. Les principaux résultats mettent en avant une capitalisation des revenus miniers sous forme de bétail ce qui conduit à l'augmentation du confiage du bétail aux agropastoralistes non impliqués dans les activités minières vivant en périphéries du village. Ces agropastoralistes ont un accès limité aux processus formels de prise de décision, ce qui renforce le risque de marginalisation de ces acteurs. Par ailleurs, le manque de mécanisme de collecte et de traitement de données sur l'état des ressources naturelles nécessaires à l'agropastoralisme, eau et pâturages, s'avère être un risque pour la gestion communautaire. Enfin, les interactions internes et externes au système représentent un enjeu transversal pour la continuité de gestion communautaire. Ainsi, la coexistence d'une activité générant des hauts revenus avec une activité traditionnelle telle que l'agropastoralisme n'est pas un facteur limitatif d'une gestion communautaire des ressources naturelles et peut, à l'inverse, se révéler être un déclencheur pour dynamiser le processus d'élaboration de règles de gestion.

INDEX

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