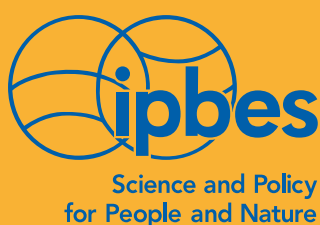


Knowing our Lands and Resources

Indigenous and Local Knowledge of Biodiversity
and Ecosystem Services in Europe and Central Asia



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Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)**

▶ **in collaboration with the:**

IPBES Expert Group for the Europe and Central Asia regional assessment

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Introduction

The Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) includes as one of its operating principles the following commitment:

Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems.

UNEP/IPBES.MI/2/9, Appendix 1, para. 2 (d)

To spearhead its work on this challenging objective, IPBES Plenary created at its Second Meeting a task force on indigenous and local knowledge systems (ILK).

The present document is a contribution to the IPBES regional assessment for Europe and Central Asia. Its aim is twofold:

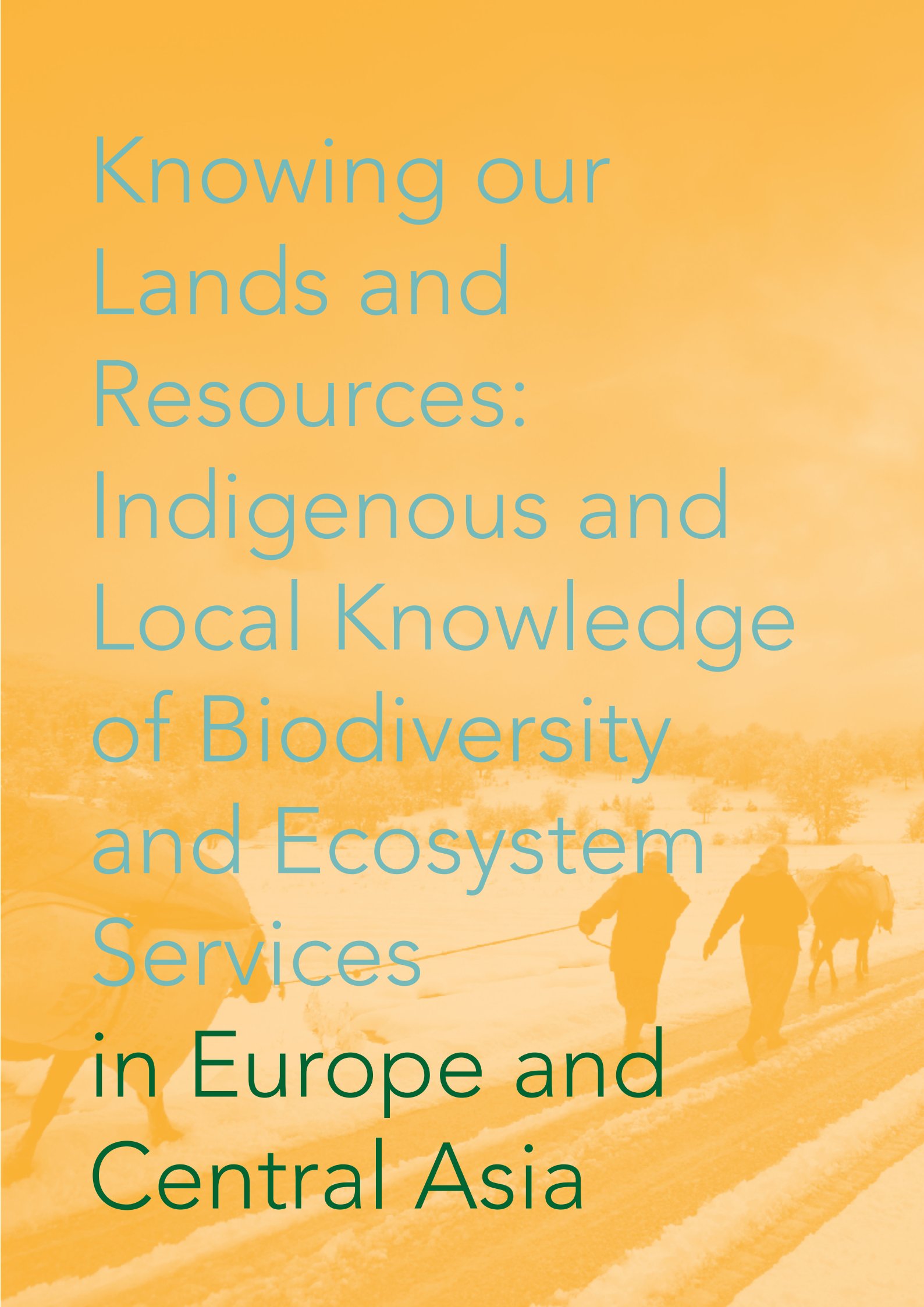
- ▶ To assist the co-chairs, coordinating lead authors and lead authors of the regional assessment by facilitating their access to indigenous and local knowledge relevant to the assessment theme.
- ▶ To pilot the initial approaches and procedures for building ILK into IPBES assessments that are under development by the ILK task force in order to test their efficacy and improve the final ILK approaches and procedures that the task force will propose to the Plenary of IPBES.

To meet these two objectives in the framework of the regional assessment, the task force on ILK implemented a step-wise process including:

- ▶ A global call for submissions on ILK related to biodiversity and ecosystem services in Europe and Central Asia;
- ▶ A selection of the most relevant submissions from ILK holders and experts, taking into account geographical representation, representation of diverse knowledge systems and gender balance;¹
- ▶ Organization of an Europe and Central Asia Dialogue Workshop (Paris, 11–13 January 2016) to bring together the selected ILK holders, ILK experts and experts on ILK with the co-chairs and several authors of the IPBES assessment report;
- ▶ Development of proceedings from the Europe and Central Asia Dialogue workshop in Paris that provide a compendium of relevant ILK for authors to consider, alongside ILK available from the scientific and grey literature, when drafting the Europe and Central Asia assessment report; and
- ▶ Organisation of local follow-up work sessions by the selected ILK holders, ILK experts and experts on ILK in order to work with their communities to address additional questions and gaps identified with authors at the Paris workshop.

These contributions from the Europe and Central Asia Dialogue Workshop in Paris and its various follow-up meetings, provide a compendium of ILK about biodiversity and ecosystem services in Europe and Central Asia that might not otherwise be available to the authors of the assessment. It complements the body of ILK on biodiversity in Europe and Central Asia that the authors are able to access from the scientific and grey literature.

¹ Note that imbalances amongst the submissions received and IPBES policy to only fund participants from developing countries made it difficult to meet target criteria. Gender representation was particularly challenging in the ECA context, as in many rural/indigenous societies, women have taken up salaried employment to bring cash to the household. Men, on the other hand, have tended to remain in traditional roles with respect to resource-based livelihoods. As a result, they are often the principal holders of ecological knowledge in ECA and thus a major source of ILK for the regional assessment.



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1. Biodiversity and ecosystem services of hardwood floodplain forests: Past, present and future from the perspective of local communities in West Ukraine

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Summary

In the rural landscapes of the poorly industrialised West Ukraine, forest resources continue to be an important part of the livelihood of the local communities. Local residents and foresters hold a detailed and profound knowledge of forest ecosystem services and biodiversity. The forest-related traditional and non-traditional knowledge systems held by the local communities and the scientific knowledge system are collectively shaping the hardwood floodplain forest ecosystems. Local foresters and rangers recognise and give explanations to the structural and species compositional changes (proportion of mixture species, spread of invasive species, etc.) occurring in the forest, and their natural (e.g. climate change) and social-economic (migration, economic recession, etc.) driving forces. The local forester, under the influence of his traditional and scientific worldview about the forest, makes his decisions often as a kind of “resiliency manager”, keeping in mind the interests of the state, the forest and the local population. The market value of the oak, the economic recession and the often corrupt forestry sector are keeping the habitat under significant pressure, threatening its diversity, ecosystem services and the livelihood of the locals. Though the Ukrainian Forest Code recognises the rights of the locals in accessing the secondary forest benefits, the lack of transparency of the legislation makes justified its reconsideration and amendment. Over the past two decades, Ukraine has made considerable efforts in reforming the forestry sector and forestry legislation. In addition, initiatives have been taken to involve the local communities in the decisions affecting forest management.

1.1. Introduction

The aim of this paper is to present the local ecological knowledge related to forest management, both traditional and non-traditional, of the communities inhabiting the lowland landscapes of Transcarpathian region (Zakarpats'ka oblast', West Ukraine). We summarize the knowledge and perceptions of the local community (mainly Hungarian and partially Ukrainian) related to the biodiversity, ecosystem services, characteristic trends and driving forces in hardwood floodplain forest ecosystems. The data, information, knowledge and wisdom related to these topics are presented with the help of edited quotes from interviews conducted between 2013 and 2015

with local foresters, fishermen, forestry workers and rangers. We found that this forest habitat was managed in diverse ways even in the not too distant past. Nowadays, however, one can notice the homogenization of the ecosystem service utilization (focussing on the timber). This may cause the degradation of the habitat and the loss of biodiversity.

In order to gain in-depth knowledge regarding the future management and associated scenarios related to this habitat – recognized as one of the hotspots of European biodiversity – we conducted a workshop discussion with the local stakeholders. These findings are summarized in a separate section of this paper. Quotes are italicized, separated with a slash when coming from different interviewees. In a significant number of quotes, we kept the past tense used by the informants. References to the past focus on the period after 1990.

1.2. Study area

We conducted our study in the hardwood floodplain forests and the local communities that use them in the lowland regions of Transcarpathia (West Ukraine). The lowland landscape constitutes a transition between the Pannonian region and the North-Eastern Carpathians (Simon 1957). The highly fragmented hardwood floodplain forests, though occasionally maintaining their natural character, are the most widespread forest community in this landscape (Shelyag-Sosonko *et al.* 2010). The habitat is found in the higher zones of the floodplains of the major rivers, where it gets flooded one or two months each year. The dominant species of the naturally species-rich habitat are *Quercus robur* and *Fraxinus excelsior* (Tkach 2001; Drescher 2003). Zakarpats'ka oblast' is one of the economically most backward regions of the country (Fodor *et al.* 2012). Throughout the 20th century, independently of which country it was part (i.e. Austro-Hungarian Monarchy, Czechoslovakia, Hungary, Ukrainian Soviet Socialist Republic and Ukraine), it was always a peripheral region (Batt 2002). The weakly industrialised region's population lives mostly (65%) in the countryside (Transcarpathian Regional Statistical Office 2003), so agriculture, animal husbandry and forest resources represent the main sources of their livelihood.

The hardwood floodplain forest habitat has been typically used by the Hungarian minority, heavily isolated in the lowland region, and by the Ukrainian communities since the 13th century (Lehoczky 1881; Móricz 1993). Out of the traditional forest management systems, selective logging, forest grazing with pigs and cattle, hunting and fishing and gathering of forest hay, fruits and mushrooms have had the greatest significance in the local people's livelihood and well-being (Takács & Udvari 1996). The management of the hardwood floodplain forest ecosystems is constantly changing and adapting to the changing socio-economic and legal conditions. Previously unrealised ecosystem services (see below) contribute to the social well-being of the local community.

1.3. Method

We conducted 34 semi-structured indoor interviews with local foresters, forestry workers, fishermen, hunters and rangers between 2013 and 2015. Furthermore, during this period we also collected data from the key informants with participatory fieldwork. In the interviews, we used semi-structured questions through which we investigated the perception of the locals related to the landscape changes and driving forces. Quotations from the interviewees are italicized, while the thoughts of different informants are separated with a slash. Acronyms in brackets refer to the relationship of the respondents to the forest as explained in **Table 1.1**. With the quotes, we summarized the knowledge regarding the changes and trends following the collapse of the communist regime after 1989. Sometimes it was inevitable to refer also to earlier periods. The text of the first draft of the manuscript was refined in consultation with the local forest users during the workshop.



Table 1.1: Relationship of respondents to the forest

Acronym	Expanded form of acronym	Meaning of the acronym
LFU	Local forest user	A local person who uses the resources of local forest on a regular basis.
LSE	Leader of local state forest enterprise	Not necessarily a local person who is responsible to lead the local state forest enterprise. He is a trained forester.
LF	Local forester	A not necessarily professional local person who is responsible to care for a certain part of the local forest. He is employed and paid by the state.
LFR	Local forest ranger	A helper of local forester without any forestry education. He is employed and paid by the state.

1.4. Knowledge systems of local people in West Ukraine

1.4.1. Forest-related traditional ecological knowledge

The villagers have a deep and thorough knowledge of the ecosystems they use. They hold not only knowledge, but also wisdom about the utilization and management of goods and gifts of these ecosystems (Elbakidze & Angelstam 2007; Styamets 2012). However, as in other rural areas of Europe, alienation from the traditional way of life is also noticeable, together with the upsurge of modernization and the migration of youth. As a result, traditional ecological knowledge related to habitats is continuously eroding (Johann 2007; Bürgi 2013; Biró 2014; Rotherham 2015). With the nationalization of forests beginning at the end of 1940s, the local communities were deprived of the traditional use of certain forest resources, which meant the end of the traditional forest management system. However, based on our data it is clear, that despite this, a considerable amount of forest related traditional ecological knowledge has survived in the poorly industrialised landscape: knowledge related to different habitats, species, their use and about the history of the landscape, which is held mostly by the elder generation. This knowledge has developed under the influence of Western science embedded in the Christian worldview, yet there is a surprisingly little overlap between the two knowledge systems. *There are many types of mushrooms here. But I don't know. As we call them is not as it is in the sciences* (LFU).

1.4.2. Local forest knowledge

Another important knowledge system, still alive and continuously adapting to the changing conditions, is practiced by a narrower layer of the local communities – that of the local foresters, which is not (or only in small part) a traditional knowledge, but still a specifically local one. Such foresters are knowledgeable locals who know the countryside and the forests where they are working since their childhood. They are typically born in umpteenth generation of forester families; as a result, they acquired most of their knowledge from their ancestors. *I've never heard of such a thing, though my grandfather was also forester in the Salánki (the Salánki forest). And my father here. And we were together all day long with that other forester (LF)./ My father-in-law's father was also a forester here. So as my brother-in-law./ I have kept the herd in the forest since I was nine. After that, I became an assistant ranger. There were occasions that I was out even at night to supervise the work* (LFR). An assistant ranger is the local helper of a forester, employed and paid by the state forestry enterprise without any forestry education (Table 1.1). On the other hand, they were and still are in permanent connection with the forestry leaders, as a consequence of which they acquire

a significant amount of professional (scientific) knowledge. *When they came here every ten years, and they are also coming nowadays to control the forest and to plan cuttings, hoeing, planting, then they planned for us for ten years ahead what can be cut. They looked around the forest and what should we cut, what not to cut? May we? Is it not possible? And we cut only in this way* (LF). However, forestry certification and qualification is not a compulsory requirement in the ranger profession, which further enhances the survival of the local non-scientific knowledge. *There was opportunity for me to go away to study, but I rather did not. / They organize such trainings, and I use to go there* (LF). In the commercial forests, the plan for cutting is developed jointly by forestry leaders, forest engineers and the local forester, who together select the trees to be cut and the areas to be extracted. *Sick trees yes, dried trees, those that did not shed leaves any more, those we knew that should be cut. Sick trees do not shed leaves. Leaves dried and became yellowed on the tree* (LF). */ When I see that there are many dry trees in this area, than I report that. Someone comes out from the office, and [together with] the forest master we decide whether to cut or not* (LF).

1.4.3. Views and perceptions of local foresters

The view and perception of local foresters regarding forest and forest management is therefore quite complex. It is characteristically an intermediate between the traditional and the scientific worldview. On one hand, the forest has to be “cultivated”, for which the modern clear-cutting type management systems with artificial regeneration are considered the most effective. *This is what I am telling, that only for reference should be some left. The rest I think it should be cut down. Not that we cut 10 ha, but to cut each year one-two, which is later planted, being cared for, hoed: to be able to deal with the saplings. Not that we plant and then leave it for you Dear God to take care of it. It is not possible this way* (LF). On the other hand, their knowledge - learned from the elders – regarding the traditional management systems (e.g. forest grazing) and the way they perceive their influence on the forest ecosystems is radically different from the way of thinking in forestry and nature conservation. *And then they explained that it started to degrade because the herd wandered around and trampled it. Well many have told us, our grandfathers. But look there, where the herd is resting at midday, where the herd is roaming, how there is the forest. And where nothing goes around, look at the forest there. Where the animals are roaming around, there is no decay, because the soil had a breath. And there, where no animals went around, the forest had all kinds of problems* (LF). */ Well, this is how we do it. This is how they used to do it. We have seen this with our ancestors, so we did it the same way. And this was good.* (LF) */ It should not be cut that way, to keep something to see for posterity* (LF). Although the local community looked at the forest as the primary source of their livelihood, in addition to this utilitarian approach, the sustainable use of forests was considered at least as important. *Then people respected the forest somehow better. Perhaps because they knew that they were living out of it* (LF).

1.4.4. Professional forestry knowledge

The third very important knowledge system is professional forestry knowledge, based on Western scientific knowledge. Nowadays most of the forests from the region bear the signs of this knowledge system. *We cut a 1 ha area. In the next spring, we try to plant it with species that are native to the region. 1.5 m interline spacing and the spacing between stems is 1 m. After this, we divide and plant four lines of oaks and one line of ash. And [put] mixed species in between. Sometimes even red oak [this is a non-native species]. After this, we make cleansings every five years, just as hoeing corn* (LF).

In forestry law, there are already significant steps towards the recognition of the multifunctional role of forests and the prescription of sustainable, close-to-nature management methods (Soloviy & Cabbage 2007; Keeton *et al.* 2013). Despite this, one of the obstacles of the transposition of these approaches into practice is the fact that this knowledge is foreign to the local foresters. *Then [five years ago] there was such a law. Because here in Csongori there are also many places where you can see through the forest. There is no place for the game to hide. This is why such windows were cut [group cutting system]. This becomes bushy and there will be places for hiding. But I cannot*



tell whether this was cut on purpose for the game. Because this is not a commercial forest, where we cut 10 ha and then plant it. Here we have to slowly “re-form” the forest (LF). The consideration of the knowledge of the local foresters, the adaptation of the management methods to the local conditions and needs and the throughout information of the foresters would be crucial for a more successful application of close to nature management practices. A comparison of knowledge systems is provided in Figure 1.1.

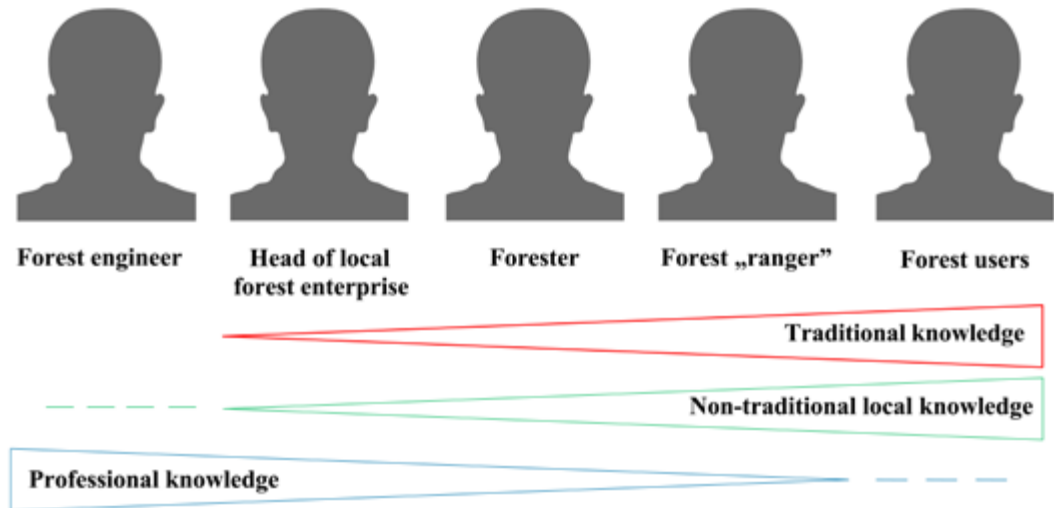


Figure 1.1. The knowledge systems of locals and foresters. The non-traditional local knowledge of the local foresters is a complex (hybrid) knowledge system that bears the characteristics of both the scientific and the traditional worldviews. Their perception of the forest ecosystems shapes the diversity of the forests in the landscape.

1.4.5. Perception of biodiversity by locals

Nowadays the local community, except the older generation, uses the word ‘forest’ only to denominate stands with a well-closed upper canopy level. The elders use the term also for the wood-pastures that once occupied vast territories. *That was also forest, just that trees were sparse in it. Big, large oaks were in it. The herd used to go there to graze* (LFU).

Local foresters, and those local inhabitants for whose livelihoods the forest had or has an important function, recognize also the outstanding role of the forest in maintaining “biodiversity”. *The best forest is the one in which one can find all kinds of trees* (LF). / *The game has to hide somewhere* (LFU). / *But elm also has several varieties. There is vincfa (white-elm, Ulmus laevis) and elm* (LFU). / *The leaf of one of these is oblong and jagged, little jagged, of the other is oblong and even. The elm is oblong and even, the vincfa is oblong and jagged. The elm oyster (Hypsizygus ulmarius) lives on that one* (LFU).

The diverse hardwood forest shouldn’t be characterised solely by its species diversity. The structural diversity of the habitat is at least as important. Both local people and foresters are emotionally tied to the old forest, with plenty of oaks and ash. *This was the best forest. There was nowhere such a forest. The Masonca, the Borostan and the Hatamsa-köze. There was nowhere such a forest. Nowhither. Large old trees. Who knows how old. Ash, oak, elm. All kinds. Very old trees, now then* (LFU). / *A nice forest is the one that has many large trees* (LF).

Besides the species and structural diversity, the landscape diversity of the forests is also of significant importance. In addition to old, diverse structured forests, there is need for young stands too. *For firewood we went only here, on the Lapos. That was the closest, and there was thin, dry wood, which could be broken by hand. That was a young forest* (LFU). *Often they use their own indicators to observe the state of the habitat. Now the forest is still of good quality (the Atak forest). The colour of*

the leaf explains all parts of the forest. It tells everything about it. When it is weak greenish, then there's already a big trouble. When it is dark green, it is good. But every year its quality is deteriorating. So the trees are old. They fall down. And if these old trees fall down, than it takes with [them] twenty (LF). / If the fruits of the hawthorn is [...] big, then the forest is beautiful. The hawthorn is an unpretentious thorny bush, but from it you can see what the forest is (LF).

1.5. Biodiversity trends of hardwood floodplain forests ecosystems

1.5.1. Monitoring invasive species

The forester or forest-worker who spent most of his life managing a particular forest area, holds a thorough and deep knowledge about the changes that have taken place in the landscape. *It was not uncommon that I had to walk 50 km per day. I had to go all year round. There was no other way (LF).* This knowledge can have an important role in monitoring the appearance and spread of new species. *Rams (Allium ursinum): There was little of it in the beginning, but now it is very widespread. Especially in the thick wood (LF). / And the spring snowflake (Leucojum vernum), we observed that it became to spread in the used areas. I don't know how it got there (LF).* The locals explain the decrease in the distribution of one of the important species of the habitat, *Ulmus minor* with two factors. *But nowadays there is no elm, that is the problem. Before they were as big as the ash. Because of the many floods, it dried out. The young ones, it dries out too. I tell you, when I was a kid, there were this big (LFU). / Well, in 1958 there came some disease and the elms started to dry out (LF).* Besides the Dutch elm disease that raged across Europe, the change of the water conditions following the transformation of the floodplains also contributed to the reduction in the proportion of this mixture species. Another mixture species characteristic to this habitat, hornbeam (*Carpinus betulus*) has increased in abundance after the political regime change. *Well there were hornbeams under even before. However, when they cut these big trees out, it received more sunlight and the seeds have outgrown quickly. Or, from the old one, which they had cut of, new sprouts have come. If we cut down a hornbeam, hundred new ones come on it (LF).*

The spread of invasive species is a significant problem in the overexploited and not adequately reforested floodplain forests. *Maple we have about three species. We have the American maple (ashleaf maple, Acer negundo), but more than before. The forest is more open and grows better. In the old times (in the 1990s) there was not possible to go through this forest by car or cart. Well, I remember that in my time those big ashes were dense. Now it can sprout everywhere it wants (LFU). / The crash weed (Japanese knotweed, Reynoutria japonica) was here before, but now there is a lot more. The forest is sparser (LFU).*

1.5.2. Changes in animal populations

There are personal observations also regarding the changes in size and distribution of the big and small game populations. *During the Russians [before 1991], there was a lot of deer. Everywhere we went, we saw them. Now, seldom a roebuck... That doesn't count. Then there were quite many wild boars, when the kolkhoz [collectives] bowled out [1991]. But then came some sort of plague and they fell down (LFU). / Pheasants are more nowadays. Much more than under the Russians. It spread somehow. During the kolkhoz, the ditch banks had to be cleansed, on the edge of the road. Everywhere they ploughed it, mowed it. Nowadays there are no livestock either. Much less than half. Now they don't mow any more. Many don't want even the land any more. They leave it as fallow. It has nowhere to hide (LFU).*



1.5.3. Changes in habitat

The abandonment of mowing on the forest roads, on the slope of the embankments at the forest fringes, and other neglected spaces have caused the ruderalisation of these areas, or the spread of alien species. *Now somehow even the forest has grown wild, then we used to mow the ditch banks, the embankments and the forest roads. Now no one needs these. In this rhythm, there will be no livestock left in the village. The young ones don't want this anymore (LFU). As a whole we can say that the naturalness of habitats decreased considerably in the last two decades. There is much less forest. Now there are a lot of clear-cuts. Here is not that bad, but they cut out almost completely the Rafajna forest (LF).*

1.6. Ecosystem services and their trends

1.6.1. Secondary forest benefits

The legal/political, social-economical and technological trends of a region significantly affect which ecosystem services are recognised and used by a community at a given time (Bürge *et al.* 2015). Some of the basic forestry services have been constantly supplying the local population for centuries. In addition to the supplying ecosystem services, firewood, timber (see below), some of the non-timber forest products are still used in a regulated form by the locals today.

The forest code allows the free use of these so-called secondary forest benefits in state forests (Forest Code of Ukraine 1994). *Oyster mushroom (Pleurotus ostreatus), chicken-of-the-woods (Laetiporus sulphureus). These are in the flooded areas. Only in the flooded areas. These are not in the Nagy-Makkos. In the Nagy-Makkos there is "bokros putypinka", "király putypinka" (Honey mushrooms, Armillaria sp.). I don't know its proper name. Cep (Boletus sp.). The putypinka is only well after the crop harvest, not always. This, what I said, the ficfa gomba will be now. It will start in a month. The oyster mushroom grows also on elm. That is the tastiest. It doesn't really grow on any other tree (LFU). / The "kopottnyak" (asarabacca, Asarum europaeum) is good for the pigs. It helps digestion (LFU). / Not at an industrial scale, but people do come and collect rams. They carry it even to Hungary. They sell it (LSE).*

An important "gift" of the habitat dominated by pedunculated oak is the mast, which is collected even nowadays as pig forage. Pork is among the most important food of the rural people, and the fattening of pigs with acorns has a centuries-old tradition in the region (Csiszár 1971). *We could always collect the acorns, when the forest was fruiting (LFU). / Acorns we could collect. That we could always. The pigs fatten on it (LFU). / 5–6 years ago there was such a mast that they came even from Ukraine and gave wheat and barley in exchange (LSE).* Besides this, the acorns are an important reproductive material, which is collected also by the local foresters, and sown in nurseries. In recent periods, however, generally speaking, the *acorn production became much depleted.*

1.6.2. Forest grazing

Regarding forest grazing as a secondary forest benefit, there is no clear formulation in the Ukrainian forestry law. Consequently, just as in the case of non-timber forest products, theoretically forest grazing can be practiced by the local population in the not-strictly-protected forest, provided they don't cause damage to the ecosystem (Forest Code of Ukraine 1994). In practice, it is up to the local forestry administration. Sometimes the *herd goes in the forest fringes*, where the forest is located directly next to the pasture.



Gábor Csérek



László Demeter

Photo 1.1 Night fishing in a hardwood floodplain forest. The local fishermen have privatized the waters within the village boundary, in which they are free to practice sport fishing.

Photo 1.2 Traditional fishing method by obstructing the river.

1.6.3. Game and fish

Local hunting companies hold hunting rights. The members of these companies are primarily locals, therefore game meat is an important additional food resource for a narrow layer of the community. The population sizes of the big game species have decreased significantly after the regime shift, the cause of which lies in the spread of overhunting and poaching. Fishing in the streams and rivers crossing the forest is an important aspect of the traditional use of hardwood floodplain forests. However, like hunting, *it depends on the person, of who has a passion for what* (LFU). Undoubtedly, fish is an important part of the locals' diet. The knowledge of the locals related to fishing must be a particularly interesting information source, which is intrinsically linked to the traditional ecological knowledge on hardwood floodplain forests (**Photos 1.1 & 1.2**).

1.6.4. Firewood and industrial wood

Locals can get access to firewood by collecting dry wood and during forest logging. *Those who are working in the cuts get firewood in exchange. They take away what they can, but there is some that we burn away, or leave as it is. This is how they do it. We've seen this from our ancestors, so we do it the same way. And it is good in this way* (LF). / *Those from Nagyberég do not collect lop-wood as they use gas for heating, but those from Beregújfalu and Kovászó are coming of course* (LSE). / *People used to collect dry twigs with carts. They put them in piles. They had to put it in between four poles. They put it on the cart in this way and took it away. As he was collecting the twigs, he hit down four poles and collected in between these. He told me they are coming after it. And he took it away. And there was a period, when he took the twigs and he needed a written paper for the road. Or he went to the company and payed for the twigs. They could take 5-6 cm twigs. Sometimes they were allowed to put in one-two 10 cm twigs too* (LF) ./ *Now I am reluctant to let them, because they would take away also the thicker ones* (LF).

Locals were therefore allowed (even after the regime shift) – and are still allowed – to use the dry fallen twigs as firewood more-or-less freely. In the good quality habitats, they make excellent quality industrial wood out of pedunculated oak. This is sold by the local forestry department under free auction. *We advertise it on the internet, and the one who offers more is the one who can buy the wood. And when they buy it, we assign a date for the cut, and they are coming after it* (LF). Up to the mid-1990s the oak was the basic raw material for barrel production. *Even in my time (the 1990s) we made barrel staves in the Atak (forest). They took it to France for brandy barrel* (LF).

1.6.5. Recreation, spiritual and community uses

In addition to supplying the services above, these hardwood floodplain forests play an important role also in recreation and spiritual charging of the local communities, and are an important scene for the cultivation of community relations (**Photos 1.3 & 1.4**) *I cannot wait for the weekend, just to have a walk in the forest* (LFU). / *I am coming out here for about 50 years* (LFU). / *If spring comes and the nights are warm enough, we stay out the whole night fishing. We fry fish and chicken. At dawn there is always someone picking mushrooms who visits us. We fry a bacon, and they give us a little wine or “pálinka” [usually plum schnapps]* (LFU). / *The “vassafa” (Cornus sanguinea) is the best skewer for bacon frying. It is firm enough* (LFU).

Local communities have always approached habitat management primarily in a utilitarian way, while still keeping in mind the long-term interests (Molnár *et al.* 2015). *There is need to have firewood, and something to build from* (LFU). But nowadays, as a result of the scientific influence, several new aspects of biodiversity are also realised in the local foresters' knowledge. *Well yes, the owl also needs a place for hiding. / They say now that we have to leave something [deadwood] for the worms too* (LF). This is how the word 'biodiversity' became an acknowledged ecosystem service, in its “Western scientific” sense.



László Demeter



László Demeter

Participatory fieldwork with two locals.

Photo 1.3 (left): the bark of the elm is a very good tying material. With this we tie up the dry wood on our back or on the bicycle.

Photo 1.4 (right): *It is a pity for those many fallen trees. It will all get ruined here* (LFU). The rural people often have daylong walks in the local oak forest.

1.7. Strong indirect factors that drive the use of forest ecosystems services

1.7.1. Lack of forest workers

Following the regime shift in the mid-90s, a significant proportion of the male population was employed abroad. The lack of forest workers made it practically impossible to carefully carry out the forestry work. Consequently, in a considerable part of the economic forests it was not possible to undertake the necessary thinning, and as a result the proportion of mixture species as well as of other invasive species has increased in the stands. *Then [before the regime shift] the forest was cleaner. People had more time to take care of it* (LFU). / *Hornbeam was not so characteristic here. Only where they did not attend the forest, there it spread out. Well I'm not telling [you] that there was none, but such hectares [were] not characteristic* (LF). / *From this dense hornbeam came more. Especially now*

where they've cut it, there hornbeam has grown up, it is so dense that... Before, when my father went around, they used to cut the hornbeam, to thin it and make poles out of it. Now it is like... Then people cut poles out of hornbeam, but now there is no need (LFU). With the increase in abundance of the mixture species characteristic for the habitat, the shrub layer becomes shaded out, and therefore natural renewal is hindered, and artificial renewal is also hampered.

1.7.2. Economic influences

In the last few years the economic recession and the gas crisis caused by the Russian-Ukrainian crisis has once again boosted the local communities' demand for firewood. *Gas is so expensive, we cannot afford to pay for it* (LFU). / *With such high gas prices it is good that we kept the good old tiled stove* (LFU). A significant part of the population switched to heating systems with mixed fuel, or to firewood only. However, both firewood and timber prices are very high, and already the number of firewood thefts, not uncommon before, has increased significantly. Moreover, in the western region of Ukraine, the importance of non-timber forest products has increased gradually after the regime shift. Following the economic recession, it became the fundamental source of income for a significant part of the rural population, especially in the mountain regions less suitable for agriculture (Stryamets *et al.* 2012). So in fact the preserved and revived forest-related traditional knowledge plays an important role even today in the livelihood and well-being of the locals (Stryamets *et al.* 2015).

One of the strongest driving forces behind the hardwood floodplain forest management rests in the high economic value of pedunculate oak. It is actually the most valuable tree species in the region. Following the regime shift, the pressure of economic demands gradually affected these habitats. *At my place there was never clear-cut [the 1990s]. There was only selective logging. So what is the form of it? Sick trees, those with holes at the base, with dried canopy, those we cut out from the forest. So in spring... How was it? In January. In mid-January, at about the 20th they gave us the permit, let's say for the cut of a 20 ha large forest. But this is only selective logging. It lasted until 31 December. Now it must be done in three months* (LF). / *Before there was only selective logging. Now clear-cuts are too many. In the 1990s they allowed only a few clear-cuts* (LF). / *But after the regime shift [after 1991] they started to look at the forest from the business side, these 170-years-old forests we started with regeneration cuttings... So the renewal of this 170-years-old area, which is not in the protected area, is going on starting from 2010 till 2020* (LSE).

1.7.3. Corruption

The high economic value of oak and the often corrupt forestry management (through the so-called sanitary cuttings) contributes significantly to the overuse and degradation of the habitat. *Here it is important how many trees are per hectare. If less than 40% then it can go for clear-cut. The number of the trees that are deterministic in that area. Here the oak. When there is a sanitary cutting, the forest engineer decides how many cubic meter of trees have to be taken out per hectare. They push you to take more out of it, with which you help the national funds. So with such cuts we use to take the forest to... To this 40%. And then they can clear-cut. If you look in more deeply this seems like a policy. They say don't make clear-cut, but make these sanitary cuttings, but do it as written in here. And so in a few years you got there, that only this has left* (LSE). This phenomenon has contributed substantially to the degradation of forests in the past two decades not only in the lowland areas of the region, but also in the Ukrainian Carpathians. Such overuse of forest resources is one of the most common forms of illegal logging in the country (Nijnik & van Kooten 2000, 2006; Kuemmerle *et al.* 2009; Pavelko & Skrylnikov 2010). The legal environment related to forest management further enhances the phenomenon. The confusedly formulated provisions are opening loopholes for these so-called sanitary cuttings and sanitary clear-cuts.



1.7.4. Local attitudes

Among the indirect drivers, the personality and attitude of the local forester towards the local communities is deterministic. Thus, the discipline of the totalitarian regime somehow softens and local foresters benefit the locals, who gain therefore access to certain forest goods. The local forester makes his decisions sometimes as a kind of “resiliency manager” (Berkes & Folke 1998; Walker *et al.* 2002), keeping in mind the interests of the state, the forest and the locals. *It happened that someone went in [to steal], but I never reported anyone. We solved it in private* (LF). According to the locals, the situation was nastier. *There was much discipline. They gave out such law in the soviet time that if someone cuts a two centimetres tree, they would count how big it would have grown and would punish for that* (F). */ If they would find a stump in the forest, it would cost my entire salary. Well not the thin ones, but those larger ones* (LF). Despite this, *people had to make fire with something. Everyone who needed something, if nothing else, went out during the night and brought. Well, people go where it is closer* (LF). In addition to the illegal clear-cuts, the local thefts also cause a number of problems to the local forestry department. However, the following statement is typical for the attitude of the local communities: *Before the kolkhoz [before 1947] people went out less to steal. Then the village had its own forest and they could take wood from there. And the villagers did not steal from each other. Or they did not dare to go, because the forest had many owners then, and many eyes were watching* (cf. Molnár *et al.* 2015). *But in the kolkhoz period [1947–1991] the forest was owned by the state...* (LFU)

The local communities are sensitive to the quantitative and qualitative changes of the acorn production of pedunculate oak, since it is an important ecosystem service for both the forestry department and the villagers. The changes experienced lately are explained with complex processes by the local foresters, including climate change. *The trees are old and I can almost say that they are not fruiting. And until there was no such drought it was possible to collect acorns. But now, since there is this big drought, what the tree fruits falls down almost entirely wormy. Maple and ash have fruits, but the seeds of the other trees are worn out by this drought. This big warm during summers* (LF). These natural and biological driving forces directly influence the quantitative and qualitative conditions of acorn production, which, beyond being an important ecosystem service to the locals, is the key to the habitat’s natural regeneration. In this way, the local knowledge contributes to the understanding of the drivers hampering the natural renewal of temperate deciduous forests dominated by pedunculate oak.

1.8. On forestry law reforms and public involvement

Following the collapse of the Soviet Union, most Central and Eastern European Countries successfully implemented the transition from planned economy to market economy. In Ukraine this process stalled in the 1990s, which has marked also the reform of the forestry sector (Nijnik & van Kooten 2000, 2006; Nordberg 2007). Ukraine still has no unified forestry law regulating forest management. The most important provisions governing forest management are in the *Ukrainian Forest Code*, the “Ukrainian Forests 2010–2015” State Program and the *Environmental Protection Law*. The reform of the sector is further complicated by the fact that almost the entire forest area in the country is state-owned. Because of the high degree of centralisation, innovation and the renewal of policy is very limited at the level of the local, district and regional administration (Nordberg 2007; Soloviy & Cubbage 2007).

The rights of the local communities in accessing certain ecosystem services are guaranteed by the Ukrainian Forest Code. However, in many cases, the provisions are vaguely worded and contradictory. The lack of transparency of the local forestry units and the lack of information cause additional problems and tensions among the population. *Before the forest belonged to the village. Nowadays we don't even know where they are taking the wood. Everything goes for the state* (LFU). The involvement of the local communities in the decision process affecting forest management plans and the forest is very limited for now. The renewal process is progressing slowly, but it

received fresh impulses in the recent times. In 2008, Ukraine joined the EU-founded “European Neighbourhood and Partnership Instrument East Countries Forest Law Enforcement and Governance” programme, within which efforts are made towards reforming the legal framework of forest management. Furthermore, with the contribution of the “Swiss-Ukrainian Forest Development Project in Transcarpathia” (FORZA), for the first time it was possible to successfully involve local communities in Ukraine in developing a forest management plan and in the related decision-making processes (Carter & Voloshina 2010). The emerging new legislation should take better account of the needs of the local communities and involve them in the decision-making processes related to forest management.

1.9. Conflicts between local inhabitants, foresters and forest legislation

As noted above, the lack of local involvement and transparency in forest management may cause conflicts between local inhabitants and foresters. One of the most important outcomes of the workshop was that locals got an introduction on how national and international forest legislation drives forest management at the regional level (**Photo 1.5**). *We are taking about 80% of the wood to Hungary and other countries of the EU.* Local foresters explained that timber certified by FSC (Forest Stewardship Council) *is worth a lot more in the EU.* Timber harvesting operations are implemented by subcontractor organizations. These organizations often buy the wood on an online auction, so they have the right to do the cuttings. Then, they export the timber. There has been an increasing pressure on local forest management to cut more in the last 15 years (See Section 1.7.3). Local foresters also fight with several contradictions between national forest legislation and the criteria of FSC. *We are required to remove deadwood by the forest law [for pest control], however we need to keep deadwood to get certification.* Foresters may be punished for leaving deadwood in the forest. Contradictions like these are among the sources of ineffective biodiversity protection of local forests and conflicts between their users. Participants of the meeting agreed that local communities should be better informed about the organisational structure of forestry, forest management planning and forest law.



Zsolt Borók

Photo 1.5: Field trip to the Lapos forest on the second day of the follow-up workshop.

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2. Biocultural adaptations and traditional ecological knowledge in a historical village from Maramureş land, Romania

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2.1. High nature value farming and traditional ecological knowledge: a necessary interrelationship?

High nature value (HNV) farming is a concept developed in the 1990s that recognizes the importance of small-scale low intensity farming in the conservation of European biodiversity and the maintenance of cultural landscapes (Beaufoy *et al.* 2012). These practices are crucial for the conservation of landscapes and biodiversity, with semi-natural farmlands creating “green infrastructure” for wildlife and a complex ecological network. The main elements of European HNV farming are meadows, semi-natural pastures and orchards, also hedges and copses, and historic agro-terraces should be considered as well. There is a growing consensus among EU policies and various non-government organisations (NGOs) that European HNV farming must be maintained (Beaufoy *et al.* 2012), not only the landscape which is the result of these practices, but also the practice and knowledge itself.

In Romania, HNV farming is currently occupying around 32% of the total of agricultural areas (Page *et al.* 2012), but the authors consider the true percentage to be considerably higher. This large extent of HNV farming is the result of the survival of small-scale semi-subsistence type farms, and the traditional way of raising animals (especially in the mountainous and sub-montane areas). Currently there are 3.9 million farms, of which 2.8 million are under 1 ha in size. However, there is a risk of losing HNV landscapes due to the high rate of abandonment of these practices (Page *et al.* 2012).

Fikret Berkes (2008) has highlighted that traditional ecological knowledge (TEK) is a dynamic way of knowing, being adaptive to change and built on experience. Moreover he considers TEK to be:

“an attribute of societies with historical continuity in resource use on a particular land [our accent]. By and large, these are non-industrial or less technologically oriented societies, many of them indigenous or tribal, but not exclusively [our accent].”

(Berkes 2008, pp. 7–8).

He gives examples of non-indigenous groups that hold traditional ecological knowledge, such as the inshore cod fishers of Newfoundland and the Swiss Alpine commons, emphasizing that

TEK is “multi-generational, culturally transmitted knowledge and ways of doing things” (Berkes 2008, pp. 7–8). More recent studies have shown that there are many traditional rural people in Eastern and Central Europe that have considerable knowledge of their environment, and use TEK regarding their subsistence activities (Molnar *et al.* 2008; Babai & Molnar 2014; Babai *et al.* 2014).

Not only do the concepts of TEK and HNV farming have much in common, but we consider that traditional ecological knowledge is the practice and knowledge behind HNV farming in many Central and Eastern European countries. We argue that there is still traditional ecological knowledge in the practices of Romanian and many Eastern European traditional farmers, and we also argue that HNV landscapes – being the result of small scale semi-subsistence farming – are linked and induced by the traditional ecological knowledge of their practitioners, proving that TEK is still present in Romania and South-Eastern Europe.

2.2. The landscape and the people

2.2.1. Introduction to Maramureş: a brief history and geography

Maramureş is a historical, geographical and ethno-cultural region in northern Romania, recognized for its living traditional culture and outstanding biodiversity, grasslands and woodlands being kept in natural conditions and has been recognised as a High Nature Value (HNV) site throughout most of its area (Paracchini *et al.* 2008). The historical Land of Maramureş, which coincides with the ethnographical area, is part of the modern county called Maramureş (**Figure 2.1**). Moreover the region which is our focus is in the biggest depression in the Eastern Carpathians. During the medieval period Maramureş was first mentioned in 1199, being at that time a independent voivodeship (an area administered by a voivode (Governor)). It later came under the Hungarian Kingdom’s rule and was transformed into a county (“comitat”) (Popa 1997), but as with most regions of Central and Eastern Europe, this region was also the subject of turbulent history: its political status and affiliation had changed over 15 times (Ilieş 2007). Maramureş is a depression surrounded by mountains and hills by all sides: some mountain peaks are above 2000 m (the highest peak is Pietrosul Rodnei, 2303 m), and the lowest altitude is found near the Tisa River (Teceu Mic, 214 m), thus it has a vertical deviation of almost 2100 m (Ilieş 2007). The climate is temperate continental, but it is part of the Hydrogeographical Carpathian Region with excessive humidity and harsh and long winters. From a phytogeographical point of view, Maramureş is part of the Central-European, East-Carpathian province, within the Euro-Siberian region (Ilieş 2007).

The region is rich in forests (60%), both leafy (68%) and conifer (32%) – overall the depression has 170,770 ha of forest cover. The beech forests of Maramureş are made of a specific regional association called *Fagion dacicum* (Ilieş 2007), found in the Carpathians.

The earliest human signs date back to the Neolithic (5500–1800), the Bronze Age and Iron Age are very well represented by the Thraco-Dacian civilization, which in some cases shows signs of the Celtic influence. Some authors consider Maramureş to be the place of Daco-Celtic-Roman fusion (Dăncuș & Cristea 2000). Archaeological findings and medieval documents show that the traditional economy in Maramureş was agro-pastoral (Dăncuș & Cristea 2000), another important occupation being small-scale forestry. In the XIV–XV documents, the toponyms linked to deforestation practices are absent, the first mention of a clearcut is in a XVII document (Popa 1997), massive clear-cuts begin only with the beginning of the XIX century (Ilieş 2007).

Maramureş is considered to be a place where the traditional Romanian “wooden civilization and culture” reached its peak. Not so long time ago, the villages of Maramureş were entirely made of wood, starting with famous Maramureş style wooden gate, the house, the fences surrounding the house, the agricultural tools (small cart, plough, harrow), furniture, sledges, carts, the shed,



the sweep, mills, presses for making oil etc. were all made of wood (Dăncuș & Cristea 2000). The wooden medieval churches, which are sometimes referred as “wooden gothic” are beautiful works of art: in the county of Maramureș, eight churches are designated as UNESCO World Heritage Sites.

The landscape, which is the result of the ancient relationship between man and his environment, has unique scenery, but in addition the strong and still living traditions made this region a hotspot for researchers and tourists alike.

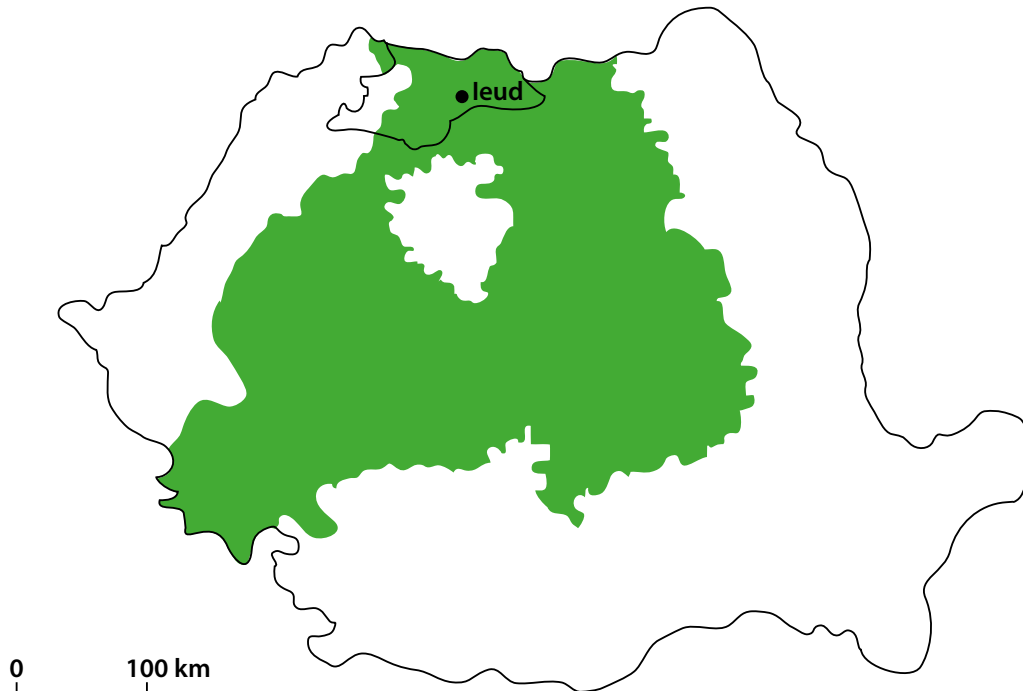


Figure 2.1. The map of Romania, showing the regions with high nature value in green, the outline of Maramureș county with black line and location of village leud.

2.2.2. leud, a traditional village in the Land of Maramureș: A Brief history

leud is one of Maramureș' most famous and old villages, it is widely known for its strong traditions, and its role in the region's history, being the place from which many important people in the cultural and political life of Maramureș originated. *Biserica din deal* (“the wooden Church from the hill”) (Photo 2.1), a UNESCO World Heritage Site, and the second wooden church from the plain (*Biserica din șes*) is a historical monument. It was first mentioned in the year 1365; in a document from 1419 it is called “*Kenesiatum Valahorum nostrorum reagalium in eadem possession Iood*”, and in a diploma from 1435, its limits were set mentioning that these are the ancient limits of the village, and encompassed a territory of around 130 km². The same document uses for landmarks nine sheepfolds scattered over the territory of the village and mentions that the lower limit starts from the arable fields (Mihaly 2009). As we can see, the landscape of that time was highly humanized. Assessing the numbers of sheep for a single sheepfold to be between 200–300 sheep, historian Radu Popa considers that around 2000–3000 sheep for a single a village at that time could be portable (Popa 1997). Nowadays it covers a territory of around 78 km², comprising plains around the village, hills and further away piedmonts and mountains.

Most villages from Maramureș had an ever-increasing population starting from 1784 until 1910. leud is one the few villages that continued to population growth starting from 1910 (although at that time it was decreasing) to the present, due the conservative worldview of the locals; today it has a population of around 4,412.

Ieud was the first village in Maramureş that was collectivized – due to political reasons – it was considered by the communists to be a reactionary village. Starting in March 1950, a terror campaign was waged against the locals because of their refusal to join the collectivization, and also because of their refusal to leave the Greek–Catholic faith (Kligman & Verdery 2015). Many of the locals took part in the resistance against the communist regime. After the authorities succeeded with the collectivization process, only the arable fields and good quality terrains (and forests) were taken into state property, the areas that were considered to be economically not worthwhile remained as private property. Paradoxically, the communists still maintained the traditional pastoral system of the people, including the specific dates for pasturing the village territory, which indicates that the traditional use was more efficient than the communist one.

The village Ieud is currently included in the Natura 2000 network of protected areas (ROSCI0264 Valea Izei și Dealul Solovan) (Photo 2.1).



Photo 2.1 The wooden Church from the hill a UNESCO World Heritage Site.

2.3. Bio-cultural adaptations and traditional ecological knowledge

2.3.1. Ethnogeographical insights

Fikret Berkes pointed out that ecosystem-like concepts exist in many Amerindian, African, Asia–Pacific and European cultures. Many indigenous concepts that refer to the physical environment or the landscape are translated in English as “land”, but their meaning is much deeper, being somehow similar to the “ecosystem” concept of western scientific thought because they include plants, animals and humans, all being interconnected in a complex web of relationships. There is a substantial difference between the scientific ecosystem concept and the traditional indigenous concepts, because the physical environment along with its biotic elements have also a spiritual dimension which is absent in the worldview of western science. According to indigenous peoples, man is a key element of the landscape, making it complete: human–nature relationships are not a dichotomy, but organic, ecosystem services on which these societies are depending are maintained through stewardship rules enforced by the elders, wisdom holders or the community (Berkes *et al.* 1998). Ethics, cultural phenomena and ecology meet in the worldview of traditional societies, therefore their understanding of the environment could benefit modern society and the current mechanistic view of nature (Berkes *et al.* 1998).

The Romanian word *loc*, meaning “place”, is a fundamental concept in the traditional Romanian society, having multiple meanings ranging from the very abstract/spiritual ones to the most

concrete geographical ones (e.g. a hill, a valley, a watershed) (Bernea 2005). The most common current use is in regard to the spatial category that it has, being a spatial marker (pointing out a *place* or a spot), but even now for some peasants – and especially in the traditional society – it had deep spiritual or metaphysical dimensions, along with the empirical ones (Vetișanu 1989; Moraru 2011; Bernea 2005). This concept is sometimes referring to the local system of private ownership of land (Praoveanu 1998) and it is used in a way that indicates a close connection between a person the land he owns. Although a *loc* is seen as being of two different types by its quality – *loc bun* (good place) and *loc rău* (bad places) – each of these qualities are the result of various factors that are of very diverse origin, either of geological or geographical nature, determined by vegetation structure, human induced or of spiritual nature, indicating an active qualitative space (Bernea 2005).

Loc rău is mostly understood as a place where there is no yield; there is a scarcity of vegetation due to various factors (physical, human or spiritual). Other ‘bad places’ are seen as being angles, marshes, forests, places where negative social events (like murders) took place, or places that were the subject of some spiritual phenomena (e.g. the presence or dances of fairies on certain spots) (Bernea 2005). In some rural communities, many bad places are found outside the village territory, these are the subject of various interdictions and because of this many locals are avoiding those (Iuga & Andreescu 2016). In Ieud ecological succession is viewed as being linked to certain places of the landscape where there is no human interference, the expression *să schimbă locu’* (“the land is changing”) means that the land which is not used any more by the people for their subsistence activities is starting to develop into a bad place (*să răie locurile* – “the lands are worsening”; e.g. they are encroached by bushes).

Good places (*loc bun*) are perceived as the parts of the landscape where human activity is present and favored, vegetation is developing and fructification is present as consequence. It also includes the dwelling place, house and household, gardens, the village, and the whole village territory as an extension of the village (Bernea 2005; Moraru 2011). Thus *loc* means also landscape for the traditional Romanian peasants (Teaci 1983), but as it encompasses a wide variety of landscapes, terrain types and places of spiritual happenings (either positive or negative ones): we consider that this word is also a traditional ecosystem-like concept of the Romanian peasants, meaning the native place (Vetișanu 1989). By this it is related to the more current notions of bioregionalism and the *sense of place* (Berkes *et al.* 1998) – it includes the physical environment, plants, animals, the village and the village territory, humans and their activities, all interlinked in dynamic set of relationships.

There is a striking similarity between the various ecosystem-like concepts of indigenous peoples around the world (Berkes *et al.* 1998) and the traditional Romanian concept of *loc*: both see man as being a natural part of the environment, a key element of the landscape, bound to the land by his activity. The land is also the main source of subsistence, the environment *per se* or fragments of it also have a spiritual dimension. For example or to highlight this argument, the belief of the James Bay Cree that considers the presence of humans not only beneficial for the land, but by this it makes the land complete (Berkes *et al.* 1998) is very similar to the a Romanian proverb which says that: *Omul sfințește locul* (“Man is the blessing of the land”).

Watershed units are fundamental to the identification of the locals from the whole Land of Maramureș. The word “*vale*” means exactly the same as *valley* in English, but it also means watershed in the sense of an ecological territorial unit. The locals from Maramureș identify themselves not only by the village from which they originate but also from the watershed in which their village is situated, along with other villages. Despite the fact that all the villages are situated in valleys, the watersheds of the main rivers of Maramureș Iza, Tisa, Cosău, Mara and Vișeu are used by the different locals to illustrate their belonging; for example a person from Ieud identifies himself at first by the village from where he originates – on a regional level he is an izan (from the Iza valley), because his village is within the Iza river watershed. Watersheds are used also by many indigenous people from North America to identify themselves in the same way,

such as the Cree (Berkes *et al.*1998). In Maramureş the main rivers of the region have created a complex micro-regional identity with ethnographic characteristics.

Local legends sometimes refer to some relief units (**Photo 2.2**) as once having mythological realities: “In ancient times, there was a giant here, with one foot he was standing on the peak of Măgura and with the other the peak of Muncel. When he died, he lay down and formed the Fieş, you can see even now his shape, it is his grave.” (Gradovici Gavrilă Botezatu, shepherd, 78 years old). Măgura and Muncel are the highest peaks within the village territory, they are separated by the river Ieudişor, that goes through the village.



Photo 2.2 Fieş Hill, the grave of a giant.

Other local legends concerning the formation of the mountains find the cause to be the biblical episode of the Great Flood. Thus the geography of the place is linked to legends and happenings, outlining what was called “the sense of place”, with local legends signifying meaning as part of the local knowledge system (Berkes 2008). Toponyms are a source of social, historical and ecological information, for example the toponym *Stânişoare* (sheepfold) is the same as when it was first mentioned in the document from 1435 (Mihaly 2009). Other toponyms reveal past land use where today there is forest (*Grâul lupului* – Wolf’s wheat, Boar’s Wheat etc.).

Toponyms, such as *Săcățuri*, are highly important in the sense that they reveal not only the action of deforestation, but also the method used for it. *Secatură* (dried out wood) is a forest which was cut down by an ancient technique which in Ieud is called *ciungit*, and in other parts of the country it is called a *seca* (to dry out). In this method the bark of the wood is striped, or a part from the growth ring is cut from the trunk and the trees are left there to die out while standing. The deadwood was eventually cut down and the terrain was used as pasture or a field (Idu 1997).

As for the social importance of toponyms, we know that Ieud was an important centre of Romanian religious culture, due to the finding of the Codex that was written here and other old religious books. These cultural activities are linked to the existence of a monastery and the minor Romanian nobles. But the only written record for the existence of the monastery here is an inscription from a 1753 religious book, a Pentecostarion, which states that the book was loaned to the monastery from Ieud (Ardelean 2012). The monastery disappeared eventually and only the toponym La *Mănăstire* (At the Monastery) survived in the landscape and showed where it was situated. Nowadays a new monastery has been built at that location.

2.3.2. Wild fauna as perceived by the local community

The locals from Ieud acknowledge at least 100–120 non-domestic animal taxa. Knowledge about the different taxa is not shared equally by all members, therefore some species occupy a special place in the worldview of the locals and some are of lesser importance. By this we have in mind the detailed empirical observations on the biology, habitats and behavior of some species, to the legends, beliefs and taboos that surround them. For example wolves are animals with a very special status, being engaged in animal husbandry the interaction with these animals was not that rare. Most of the shepherds have very detailed knowledge about the wolf's biology, ecology and behavior; we have collected two different legends about the origin of these animals, but also other beliefs, taboos and legends that concern the predatory behavior.

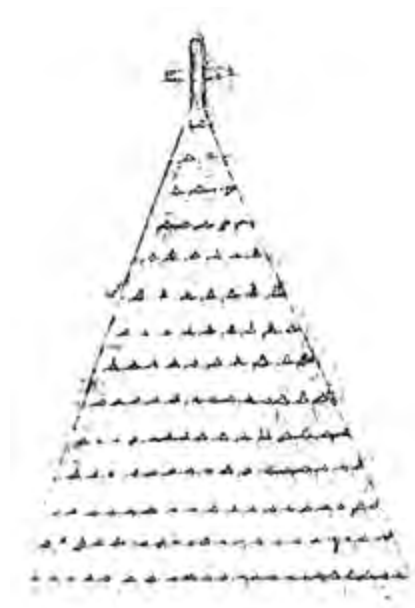
There are cases when knowledge transcends the barrier of nature and culture, and there is convergence of the two supposedly different worldviews western science and the TEK of the people (Berkes 2008). "After the wolves have finished eating an animal, and one of them remains with blood on his mouth, the other wolves will go [into a] frenzy, and eat him." (Ileana Chindriș). "If one [of the] wolves is very weak and wounded, and the other wolves in the pack will feel the smell of blood, they will get mad and eat him, wretched animals these are." (Gradovici Gavrilă Botezatu). "Yes, it is true, wolves eat the one that is wounded, they go mad when they feel the smell of blood." (Dunca Ștefan). The observation of cannibalism in wolf populations is a behavior that is very well known to the community of Ieud (not only the shepherds), but is also validated by western scientific community (Mech 1981). We can consider this to be a case of parallel validation of the two different worldviews regarding animal behaviour.

2.3.3. The knowledge of cultivated and wild flora in Ieud

Around 200 wild plants and fungi are known by the locals from Ieud. They know a great variety of the wild flora that grows within their environment, but they also know and use many alpine plants that do not grow in the surroundings of Ieud, like *Gentiana lutea*, *Pinus mugo*, *Juniperus communis var. saxatilis*, *Rhododendron kotschyi*. These plants are familiar to people because of the shepherds that were going to the alpine pastures in the summer; it is knowledge that has spread from them to the rest of the locals.

They cultivate around two varieties of corn, five of beans, and four of potatoes (19 traditional cultivated cereals and vegetables) along with around 15 ornamental and aromatic traditional cultivated plants.

Some species are of greater importance to the locals than other species – we can consider them iconic, cultural keystone species, or species on which people have more detailed observations and knowledge. Fir tree and spruce were cultivated only in front of the houses of local nobles, three phenological phases are acknowledged by the locals for this species, e.g. *buhăș* – many young trees on a spot, around 1 m height; *zmidă* – an area covered by many trees, around 2 m height; *brad*, *molid* – mature fir tree or spruce. The top of the fir tree is considered to be a cross (Figure 2.2).



Corina Vasile

Figure 2.2. A carving representing a fir tree with a cross as the top, found on a traditional wooden dish holder (scheme after a photo from Dăncuș, 1995)

This species has an important role during the custom of *Ruptu sterpelor* (the breaking of the barren: the separation of the sheep that do not produce milk) (Photo 2.3). Empirical use is especially for building houses and tools.

The beech is also the subject of considerable knowledge, although no sacred uses have been documented for this species. There are four phenological phases of it according to the locals: *turş* – small beech, around 15 years old; *turşalău* – around 30-40 years old; *fag* – mature beech tree, around 70 – 80 years old; and *fagău* – ancient beech tree. Some locals even assert that there are two different species, a *turş* is not a beech tree, it is becoming a beech (*fag*), but they are still different species. Although there is a single biological species of beech, the locals acknowledge that there are three different varieties, each having different characteristics, field beech, facing beech, backside beech, white beech and red beech.

A plant surrounded by contempt and evil is *mătrăguna* – mandrake (*Atropa belladonna*), which is considered to be maleficent, associated with witchcraft and used only by people who want to gain wealth and good fortune.



Photo 2.3 *Ruptu sterpelor* (The breaking of the barren): the fir tree is adorned with ornamental plants and flowers (peony) and round bread, it is fixed before the exit where the shepherds are milking the sheep.

2.4. Intertwined activities: Interdependence of traditional agriculture, forest use and pastoralism

2.4.1. Agriculture and pastoralism

Agriculture and animal husbandry are intertwined activities, which is why a special common way of using land still survives until today in Ieud. The agro-pastoral character of traditional society from Maramures is apparent from the XIV century documents (Mihaly 2009), and continues until today. In the document from 1435, the territory of Ieud starts from “*ad terraem arrabilibus*” and uses as markers also the nine sheepfolds scattered around the 130 km territory at that time (Mihaly 2009).

The current village territory is divided in three levels that are almost equal: the first level (*Mejdele de jos*) corresponds to the terrains near the village consisting of arable fields and meadows. The second level (*Mejdele de mijloc*) is further away, consisting of hilly areas with small patches of secondary forests and meadows (in the past arable fields were here as well). And the third level (*Mejdele de sus*) corresponds to the altitudes of 1000 m and above, nowadays the terrains here are used mostly as pasture and forest, very few locals are still mowing and making hay there.

This division is due to the absence of common pasture of the village, as result most of the terrains are commonly grazed by all animal breeders, but this is done in such a way that it respects the phenological phases of the cultivated crops and semi-natural grasslands, so that harvesting the crops and hay-making won't be endangered. This type of pastoral system is dependent on the

phenological phase of the plants, it was labeled as a *double cycling pendulation system* by some (Idu 1999) or *pastoralism* in the meadow zone with sheepfold in the mountains by others (Vuia 1964). It consists of four different phases:

- ▶ **First phase, spring (*primavaratul*)** – the grazing of the sheep was assured on the alternate grazing of the three levels of the village territory on specific dates. All locals respected the dates; plants that required earlier cultivation were barred by the owners so that they would not be damaged by the grazing animals.
- ▶ **Second phase, summer (*văratul*)** – was done in the alpine pastures in summer, the shepherds would leave the village territory with the animals (cows, sheep, goats; the horses and oxen would be brought at a later time in the mountains) for the alpine pastures to graze the animals (around 50 km distance). During this time when the animals were on the summer alpine pastures, the locals would start making hay and harvest some of the earlier cultivated plants.
- ▶ **Third phase, autumn (*tomnatul*)** – the returning of the shepherds to the village territory in the autumn and the grazing of the terrains from the upper level (from higher altitudes) to below. By this time haystacks have been made and most of the crops have been harvested, so the terrains could be commonly grazed again.
- ▶ **Last phase, winter (*iernatul*)** – is the indoor feeding of the animals, mostly with hay, it was done in the household or on scattered temporary housings (*colibe*) and barns all over the village territory. The sheep are kept under the open sky, but they are enclosed (**Photo 2.4**).

As noted earlier, after collectivization, the communists still maintained the traditional pastoral system of the people, including the specific local dates for pasturing the village territory.



Photo 2.4 A ram during wintertime, kept in an enclosure with the rest of the sheep.

Nowadays, because of the decreasing animal stocks, very few shepherds still leave for the alpine pastures; they spend the summer in the village territory, in the upper level (*Mejdele de sus*). The alpine pastures are not within the village territory, but they are situated in the high mountains from 1800–2000 m altitude.

The cultivation of plants was carried out in accordance with the environment and the harsh winters here. Ploughing was done when snow melted, a local expression *mustul omățului* (snow's juice, snow's must) refers to the time when the soil is full of water and ready to be ploughed and the first plant to cultivate is barley. From this time on, the cultivation of gardens with vegetables followed, and the rest as the weather and the signs of the weather would show. An interesting interdiction regarding the cultivation of plants is that referring to *Săptămâna Floriilor* (Flowers' week, the week before holyday of *Palm Sunday* which in Romanian is called 'Flowers Sunday'), during this time it was prohibited to cultivate anything else other than flowers, because nothing would spring up, the cereals or vegetables cultivated would bear only flowers and no fruits.

Another interesting belief and practice is that off-cultivating the vegetables in the garden on a full moon (during daytime) was supposed to help plants develop better, especially the tuberous ones.

Around half of the village territory is made up of agro-terraces (**Photo 2.5**), up to 800 m and higher altitudes you can find terraced hills. Some terraces are divided by baulks of almost 2 m height, but the medium height of a baulk is 0.5–1 m. These agro-terraces are the result of cultivation on higher altitudes undertaken in the past, and of the importance of agriculture in the history of local community from Ieud. Although only the agro-terraces near the village are cultivated today, or used as ley, the majority of them are currently used as hay meadows, and there are special rules for the management of the baulk that separates two agro-terraces and by the two neighbors (Ivașcu & Rakosy 2015).



Cosmin Vasile

Photo 2.5 Terraced hill in Ieud: a cultural landscape of hay meadows and small patches of forest.

The baulk divides in two halves between the two neighbors. Shrubs and bushes, or even trees were left to grow on the baulks, for better marking this border but also for utilitarian purposes (for example, firewood or for tools). An interesting interdiction is regarding the planting of trees or fruit trees on these structures, so that it wouldn't shade the neighbor's terrain. Also if there were some fruit trees, and the fruit fell on the side of the baulk which belonged to the neighbor, automatically these fruits became his property as well, and not of the person who owned the tree. Despite the fact that various shrubs and trees were left on the baulks as an additional marker (for example: *Prunus spinosa*, *Alnus glutinosa*, *Salix caprea*, *Quercus robur*, *Populus alba*, *Fraxinus excelsior* etc.), most commonly these structures were mowed, the resulting hay was carried home in a blanket (*ciumău* is the local term for designating such a transport and also its quantity, which is limited by the person's strength and his tool – the blanket) (Ivașcu & Rakosy 2015).

2.5. Meadow management and hay perception

The cultivated hay and the natural hay near the village is mowed first, garden hay is mowed sometimes even in May, and the meadows near the village around the holiday of Saint Peter (29 June). Around this holyday the locals usually know that the hay around the village (*Mejdele de jos*) is ready to be mowed. The second level (*Mejdele de mijloc*), is mowed usually in mid July.

The third level (*Mejdele de sus*) is mowed usually in August. For this laborious work, entire families leave the village for the hills, and stay there for mowing from a couple of days to one or two weeks. Older people would remain in the village looking after the household, the rest including the children would leave for the upper meadows with food, a horse or sometimes even a cow to start mowing there, before the shepherds would return with the animals from the alpine pastures. This practice was called *mers de mas* – going and staying overnight at the upper meadows. To support the practice, a small shelter (*cort* is the local name for this structure) was constructed from hazel trees (*Coryllus avellana*) and covered with hay. At the entrance of this shelter, a fire was set at the entrance for multiple reasons: cooking, keeping the family members warm and also to scare the wild animals (Ivaşcu *et al.* 2016).

Traditional management practices are still used currently by the locals from Ieud. Similar practices were once used by the rural communities in Western Europe, for example in Sweden (Dahlström *et al.* 2013). The management practices are carried out as follows:

- ▶ **Cleaning** of the meadow of rocks, ant hills, and deadwood – usually called *curăţatul ierbii* (grass cleansing). This is done in winter or late winter, or even spring depending on the weather. Other work implied here is also clearing sprouts using a special hoe.
- ▶ **Spreading** the manure on the meadows. Manure is brought to the field in autumn or during winter, and left there to decompose. Locals suggest that best manure for the meadows is that which is older; manure that has been standing in the field for two or more years is called *mranită*, and it is considered to be the most appropriate for the fields or meadows. Fresh manure is also used, but locals assert that this type of manure will eventually wither the hay or crop, if the summer is very hot and dry.
- ▶ **Breaking** up of manure with a harrow. Thorn bushes are bound after the harrow and big rocks are put on it, to ensure manure is dispersed almost equally all over the meadow or the field.
- ▶ **Monitoring** the development of the hay was an active practice, since the phenological phase of the plants would trigger the mowing time, along with the other markers like the holiday of Saint Peter used mostly as reference. The plant species that was used to monitor development of the hay is called *Clocotici* (*Rhinanthus* sp., vernacular *rattle*) in local speech. Similar practices are documented in other parts of Europe, where the rattle was used to monitor if the hay is ready for mowing (Tunón *et al.* 2015).
- ▶ **Hayseeds:** The local people have developed a system of meadow management and restoration based on hayseeds. In the local speech hayseeds are called *stroh* and are used in the local medicine, but they are also used in the regeneration of hay or grass. They are gathered from inside the barn or under the rack and stored in sacks. After the cleaning of ant hills, hayseeds are spread over the bare soil for the vegetation to recover. Hayseeds are spread over meadows or fields with low quality grass for the grass to improve, and also eroded terrains for the vegetation to recover. In some cases when the terrains have very low productivity, the locals used to plough them and spread hayseeds to improve and renew and improve the vegetation. There is also a modern use for hayseeds, after new buildings have been erected and the soil is bare or full of mud, hayseeds are spread over these courtyards to renew the grass. The spreading is usually done only by hand. This practice has been documented in Romania, in the Eastern Carpathians, by another ethnic group, the Hungarian Csángó people in Ghimeş (Babai & Molnar 2014).

- ▶ **Burning** of old vegetation in spring, *pârjol*, is a fairly recent practice in the management of the meadows and fields. The majority of locals have a negative opinion of this practice, firstly because fire is highly unpredictable and hard to control, there were examples where barns and houses were reduced to ashes due to vegetation burns. Secondly, some of the locals assert (especially the shepherds) that fires are altering the quality of the hay on the meadows or the quality of the grasslands. In their opinion fire will destroy the gentle, good quality vegetation, but won't harm the lesser quality plants, in fact it will favor the spreading of these ones, eventually turning a good quality pasture or meadow into one with very low yield.
- ▶ **Grazing** the hay meadows after the hay has been cut and haystacks have been made is also a traditional management practice. The sheep, cows and horses usually are grazing all the areas where the crops have been harvested, meadows being no exception in this sense. This is a practice that is said to improve the quality of the grass because the animals also manure the fields while grazing them. This type of grazing is done in two phases, the first one in late winter/early spring when the young grass springs up, and the second in autumn after the crops have been harvested (Ivaşcu *et al.* 2016).

The locals categorize hay in number of ways, excluding the good hay/bad hay binomial and the aftergrass. Most of these categories are fluent and portray the high diversity of the local environment (for example hilly hay can be of high quality or of low quality, depending on the topography and local conditions). The local people from Ieud acknowledge around 17 categories of hay (Table 2.1) (Ivaşcu *et al.* 2016); in Breb village, also situated in Maramureş, the local people acknowledge around 22–24 types of hay, according to quality, origin and species composition (Antal & Antal 1975).

Table 2.1. The hay classification system used by the local community from Ieud, Maramureş (Ivaşcu *et al.* 2016)

Name	Local name	Origin	Characteristics
According to topographical criteria			
garden / cultivated hay	<i>Fân de grădină / sămănătură</i>	found near the village	subcategorized according to the dominant cultivated species: <ul style="list-style-type: none"> • <i>trifoi</i> (<i>Trifolium</i> spp.) • <i>luţarnă</i> (<i>Medicago sativa</i>) • <i>ghizdei</i> (<i>Lotus corniculatus</i>)
lowland hay	<i>Fân de şesuri</i>	natural hay that grows on the more flat areas around the village	usually seen as not-so-good quality hay, depending on the terrain
hilly hay / mountain hay	<i>Fân de deal / fân de munte</i>	the hills and 'mountains' from the village territory	subcategorized by some locals into: <ul style="list-style-type: none"> • low quality (<i>fân rău, fân slab, fân săc</i>, "poor hay, bad hay, dry hay"), located on the crest of hills, or more open spaces • good quality hay (<i>fân bun, fân de prelucă</i>, "good hay, glade hay"), grows in open spaces near forests
marsh hay	<i>Fân de mociră</i>	marshy areas	a very bad quality hay in which the dominant species are <i>Juncus</i> spp., <i>Carex</i> spp., used only to feed the horses

Name	Local name	Origin	Characteristics
terrace hay	<i>Fân de moină</i>	nowadays it refers mostly to the hay harvested from a terrace	according to older people this type of hay is the hay that grows after a field (<i>moină</i>) is left to rest for a year or more. Younger ones assimilate <i>moină</i> with the field between two terraces
According to slope exposure			
facing hay	<i>Fân de față</i>	hay that grows on terrains with southern exposure	usually seen as good quality hay (<i>trifoiș, dulce, frunzos</i> , "with clover, sweet, leafy")
backside hay	<i>Fân de dos</i>	hay that grows on terrains with northern exposure	seen as very bad quality hay (<i>fân săc, fân rău, fân slab</i> , "poor hay, bad hay, weak hay")
According to structure or the dominant species			
dry hay	<i>Fân săc</i>	predominantly grasses, various species belonging to the <i>Poaceae</i> family	
stick hay	<i>Fân bățos</i>	hay with unpalatable thick-stemmed grasses, like <i>Nardus stricta</i> or <i>Deschampsia</i> sp.	
sweet hay	<i>Fân dulce</i>	with sweet taste and smell, preferred by the animals, often due to the presence of <i>Salvia pratensis</i>	
leafy hay	<i>Fân frunzos</i>	usually in the upper, mountain meadows	
feeble hay	<i>Fân slab</i>	without leaves, hollow straw, <i>Festuca</i> spp.	
clover hay	<i>Fân trifoiș</i>	hay with dominant <i>Trifolium</i> spp.	
nardus hay	<i>Fân pârlencos</i>	one of the worse, very low quality, with dominant <i>Nardus stricta</i>	
hedgy hay	<i>Fân rogojânos</i>	hay with dominant <i>Carex</i> spp.	
lettuce hay	<i>Fân laptucos</i>	dominant <i>Lactuca</i> spp.	

2.5.1. Traditional forest use

The large and ancient forests of Maramureș, along with the isolation of the region, have driven to locals to adapt and develop the "wooden civilization and culture" which makes it so famous today. Working in the forest is considered to be a traditional activity; although we have seen that the mention of clear-cuts appears only in the XVII document (Popa 1997), this doesn't mean that forest use (*butinărit* is the local term for forestry) hasn't played an important role in the local economy of the community. The traditional forest use is different from official state forestry, there is detailed local knowledge about each tree species and its employment for the appropriate tool (for example, ash (*Fraxinus* spp.) is used only for the handle of axes and mowers, alder (*Alnus* spp.) for the foundations of wells because it doesn't disintegrate etc.). Traditional forest use is based on the selective exploitation of species for the local needs or the household, thus being different from the modern forestry driven by free market economy.

The status of forests is linked to the status of the locals and of the official policies during various historical eras. Before the XIV century and during this century, forests were part of a commons along with the waters and the pastures, being part of the village territory they were used by all the locals. The local nobles were holding entire villages as their possessions, along with the various terrain types and biotopes it included, but during this time forests were still used as commons (Popa 1997). In some documents forests are mentioned as being part of the village estates, but some forests were properties of the local nobles, or the landlords. Some forests were communally used by neighbouring villages, or by the village community and the local nobles, especially for pig masting on oak acorns (Ardelean, 2012). This practice was very common in the documents of the XVII century – during that time some very strict regulations regarding the exploitation of the forests were issued, mostly regarded the oak forests that were highly important for pig masting and the strong demand for wood for construction. During the XVII century the Austrian authorities tried several times to take control over exploitation of the forests, they succeeded after 1763 when forests were incorporated into the property of the Fisc (public treasury), eliminating private and communal exploitations (Ardelean 2012).

In the inter-war period, the forests of Ieud were part of a compossessorate (a social union instituted with object of shared exploitation of the forest resources). After collectivization in 1950s, the forests became state property, and they remain this way today. The start of systematic exploitation was triggered by the communist regime, locals assert that the old, ancient forests of the village were cut down at that time, with an aftermath of this process being pollution of the village river and extinction of fish species (e.g. trout, taimen).

Forests are also labeled according to various categories, slope exposure, dominant species, ecological succession and by extension (e.g. *codru* – ancient forest; *pădure, pădurea mare* – forest, ample forest, covers many areas and relief units; *huceag* – copse; *sprânceană de pădure* – literally forest brow, a small patch of forest surrounded by fields etc.).

Forests are important for the local community not only for the wood, they are also used for grazing animals. Acorn and beechmast are important for pig grazing in autumn, but the forests are grazed by all animals (sheep, cows and goats) on specific dates, depending on the type of forest (the dominant wooden species) and the grasses that make up the understory. Acorn and beechmast are also used to fatten the sheep in autumn. The locals suggest that the best pastures and meadows are found near forests, the ecosystem services provided by the forest is of crucial importance to the various livelihoods of the locals.

Copses are of great importance to the locals, although foresters see them as economically not efficient. Copses are found near hay meadows, and most of the wood used for tools and local firewood are gathered from there.

Autumn arrives here earlier than in most of the country; the Transfiguration of the Lord (*Schimbaria la Față*) marks the advent of autumn, when changes start to appear in the environment. The first sign is that the angle of the leaf is changing its color; most of the people understand by this holyday that the face of the leaf is changing and not that of the Lord (Transfiguration). Other signs of the arrival of autumn starting with this holyday are: the ant-hill is starting to shade, the hay on the ground is drying up only in the afternoon, and the sap of the trees is resorbing. This was the sign that marked that the wood is closing and that work in the forest could begin. This was the right time to cut wood for construction – from this holyday to the holyday of Epiphany (6 January), the wood is considered to be closed and with no sap. For firewood there was no special date necessary. Other practices for cutting wood for construction included that it had to be cut on the full moon (daytime) and on feasting day (Wednesday and Friday are feasting days every week) – these practices were considered to better conserve the wood and avoid worm-holes. Some people asked also the priest for a special service before starting work in the wood.



2.6. Local knowledge and problems: words from local experts

The locals from Ieud have maintained considerable traditional ecological knowledge, which governs their semi-subsistence activities. Agriculture and pastoralism are intertwined activities that are still important to the local people, and forestry is also an important activity, although the people do not have forests and work is still done sometimes with horses (horse forestry).

We asked some of our locals experts 3 questions:

- ▶ What are the problems of the region?
- ▶ Are the wild beasts a problem for animal husbandry?
- ▶ How do you see the future?

We asked the second question because the conflict between animal breeders and wild carnivores is topic of great importance in the current nature conservationist undertaking.

▶ **Stefan Dunca, 50 years, shepherd:**

The problem in our region is that we can not keep as many sheep as in the plain region of the country, it is impossible to keep so many because of the mountains we have here. If you keep too many animals you won't have any profit. You will just waste your money and energy. There is no slaughterhouse in the area where I can slaughter my animals, I have to go almost 100 km and I have to pay the truck. In the market there are so many people selling their animals, they are quitting agriculture and animal husbandry because of the low prices, both for animals and products.

The wild beasts are not our problem, the problem is we can't sell our products and the prices are too low... Even beasts are made by God and have a purpose, even the bad ones like wolves, they have their own role, they eat the corpses of dead animals, they cleanse the landscape...

We will try to do something with EU projects, maybe it will work out, make a modern farm by EU standards, but there is too much bureaucracy.... All this bureaucracy, taxes and regulations are just to eliminate the smallholders like ourselves and make way to the big business and the people with lot of money....

▶ **Gradovici Gavrilă Botezatu', 78 years old, shepherd:**

We have problems with selling our animals and products the prices were very low this year. It doesn't pay off. What else I am going to do? I did this all my life, this is what I know, being a shepherd... No, the beasts are no real problem for us, we have our dogs and sticks, we are not afraid of wolves and bears. If beasts come and take an animal from us, then it is meant that, that animal was his, beasts come and take only what is theirs... I think that things will get only worse, day by day...

▶ **Chindriș Ileana, 30 years old, farmer:**

The problem is that you can't find something proper to work, only in the cities you can find proper work or abroad. But I think that the thing with working in the western countries won't last for a long time. We work here so hard and you cannot sell your products. When you go to the market, you find these 'dealers' that pay you very little and they resell your work and have huge profit. If you keep animals then you should also have market to sell your products, milk, cheese, meat, there are too many restriction. These dealers are just leeches, it would be good to sell your products directly Because of the hills you can't do proper agriculture like in other regions of the

country, keeping animals is the only way, and without animals you cannot live here. It is very good to keep animals you have enough for yourself and you can also sell products and animals.

Sure beasts are a problem here, but you for this problem you have dogs, you take some men with you, and you are safe from them. But if I am going with my products and animals to the market, and nobody will buy them from me, what I am going to do? You work all summer and won't have any money in your pocket...

People here will depend on the land in the future also, everything will turn back as it used to be, we don't know how much time we still can work abroad. In our place, hay will still be done in the future, ley can be cultivated only near the village not on the hills. The hills are with natural hay because if you have animals, you need hay to feed them. Maybe tourism will help also, we can serve our guests with local products, all things are 'bio' here.

► **Tutula Ion, 30 years old, shepherd:**

It doesn't pay off, that's the problem here, not the wild beasts. Last year I have sold my lambs for 7 lei [approximately 1.56 EUR] per kilogram. If in three years things won't get better, I will sell all my animals and do something else, I do not know what, but I will quit animal breeding.

2.7. The impact of national and E.U. policies on the traditional land use patterns

In Europe since the retreat of glaciation there has been a co-evolution of man, species and ecosystems (Plieninger *et al.* 2006). Traditional land use here has resulted, not in a loss of biodiversity as in many other parts of the world, but in a growing diversity of habitats and species (Plieninger *et al.* 2006). These cultural landscapes provide highly important ecosystem services for the existence of human society, like prevention of soil erosion, conservation of water quality and water-courses, education (Akeroyd & Page 2011), a high biodiversity (Plieninger *et al.* 2006), secondary grasslands that are used as pasturelands or meadows are highly important to carbon sequestration (Nori & Gemini, 2011), etc.

Molnar & Berkes classify cultural landscapes in two types: relict (or fossil) landscapes, where evolutionary processes driven through TEK and indigenous and local knowledge have been halted (the case of many Western European cultural landscapes), and “continuing cultural landscapes”, that still use traditional management in assuring the existence of the people. Evolutionary processes are present here (Molnar & Berkes 2016), hence the process of co-evolution between the human capital and the natural capital is ongoing. For example, in the Romanian HNV grasslands and meadows, 60 native plants are found that are related to crop plants, like variants of red clover (*Trifolium pratense*) and sainfoin (*Onobrychis* spp.), which constitute a genetic resource for plant breeding (Page *et al.* 2012).

Cultural landscapes and the ecosystem services that they provide are threatened by various factors (some of them being opposed) such as: the intensification of modern agriculture (excessive mechanization and the use of chemical fertilizers); land abandonment which favors encroachment of alien species and the loss of biodiversity (Molnar & Berkes 2016; Akeroyd & Page 2011; Schmitt & Rakosy 2007); or the migration of people. Therefore incentives are very important in preventing land abandonment, biodiversity erosion, the use of ecosystem services and maintenance of cultural landscapes (Molnar & Berkes 2016; Akeroyd & Page 2011; Page *et al.* 2012) by the rural communities of Europe. However in some cases there are examples of many highly important cultural landscapes of Western Europe that were lost or compromised in their conservation efforts due to the loss of the local agricultural knowledge (Dahlström *et al.* 2013).



Twenty years of CAP (common agricultural policy) generated grassland management in Sweden was not successful in avoiding the erosion of meadow biodiversity, the cause is considered to be the abandonment of many traditional management practices which were very similar to the traditional management practices still currently used in Maramureş (Dahlström *et al.* 2013). Despite the fact that there were similarities both in species composition (almost 75% vascular plants) and land use history between the grassland and meadows found in the Romanian Carpathians and those of Central and Southern Sweden, Swedish meadows were affected by the decreasing numbers, or local extinction of many plant species. Current Swedish national rural development programmes (NRDP) encourage the reintroduction of traditional techniques such as pollarding, aftermath grazing, hay handling, etc. (Dahlström *et al.* 2013).

Some agri-environment policies, national (mostly) or international ones (EU), have a negative impact on, or limit the traditional practices that created a certain cultural landscape. One example requirement of the Romanian national rural development programme (NDRP) that impacts traditional management is the requirement of mowing to start after 1 July: it is impeding early mowing (Dahlström *et al.* 2013), and it has no negative effect on mountainous areas but for non-mountain meadows and grasslands, this date is considered to be late by the locals, destroying the quality of the hay (Page *et al.* 2012). Other management practices which may be of ecological importance that are halted by the Romanian NDRP in semi-natural grassland management are the short periods without mowing and temporary cultivation (Dahlström *et al.* 2013).

Eligibility criteria and requirements for the agri-environment payments are of fundamental importance for the existence and conservation of semi-natural grasslands of Romania (Schmitt & Rakosy 2007). The current criteria of 0.3 ha area is blocking important HNV holdings to be eligible for CAP payments (Page *et al.* 2012). For example, in Botiza 25% of the meadow area fell outside the agri-environment payment criteria (Dahlström *et al.* 2013).

Also not eligible are holdings with more than 50 trees per ha or large rocks (Page *et al.* 2012). The requirement of a limited presence of trees on an area is sometimes exaggerated by local authorities, claiming the need for removal of all bushes or trees from grassland; in Sweden this requirement also resulted in the loss of many agri-environment payments (Dahlström *et al.* 2013). Wood pastures and wooded meadows (**Photo 2.6**) are important features of the European cultural



Cornelia Ionescu

Photo 2.6 A wooded hay meadow in leud, the bushes from the margins and the trees have been pollarded.

landscape and biodiversity. The locals from Ieud remove trees from meadows as a necessity, although they acknowledged some wooden species for the quality of the grass that grows around them, thus enhancing the quality of the hay. Alder, hazel and sycamore (*Acer pseudoplatanus*) are therefore left to grow in the meadows, their lower branches being removed to raise the canopy, which thus grows in height and does not shadow the grass nor hinder mowing (Ivaşcu *et al.* 2016).

The fact that chemical fertilizers are altering the quality of the grasslands is acknowledged by some locals from Ieud and by the locals from other villages from Maramureş county, like Şurdeşti (Anamaria Iuga, pers. comm.). In Ieud, many consider that chemical fertilizers are too expensive and that they favour the development of weeds in their meadows. In the neighbouring village of Botiza, the locals have observed that the aerial fertilization done under the communist regime has decreased the quality of the meadows by the fact they were encroached by weeds (Anamaria Iuga, pers. comm.). In cases like these, the HNV meadows and grasslands are maintained through the traditional knowledge and observations of the locals that deliberately avoid the use of chemical fertilizers.

A very recent conflict was triggered by a national hunting law (407/2006) that wanted to limit the number of dogs that shepherds can keep with them, as follows: three dogs in mountainous areas, two hilly areas and one in plain areas. On 15 December 2015 over 2000 shepherds from all over Romania had gathered in Bucharest in front of the Parliament to protest against this law, resulting in incidents with the police. The law was rescinded on the same day due to the public attention it raised; the same law also banned grazing agricultural fields between 6 December and 24 April. It seems that most of the shepherds were mad just because that law was regulating the numbers of dogs that could be kept. Our local experts were enraged by this law, believing that this is a conflict between hunters supported by politicians and the people engaged in animal husbandry. They consider their dogs to be of crucial importance in safeguarding their animals, even if they might do some occasional damage to wild animals (chasing a deer, or rarely catching a rabbit). Dogs are not seen as the main reason for the depletion of game, but rather the mismanagement of hunters and presence of poachers. Livestock guarding dogs are seen as an ecologically friendly method of mitigating the conflict between humans and big carnivores (Linnell & Leseureux, 2015). In Bulgaria, beside the payments for traditionally endangered local breeds, there is a special CAP payment for the use of traditional Karakachan dogs (Nori & Gemini 2011).

The Romanian GAEC 5 (Good Agriculture and Environment Conditions) explicitly forbids setting fires to fields or grasslands. The locals from Ieud have negative opinions regarding this practice, they consider it altering their grasslands (Ivaşcu *et al.* 2016). But in other parts of the country, fire is considered to be the most effective method to suppress ferns, mosses or *Nardus stricta* from the meadows e.g. Ghimeş (Babai & Molnar 2014).

The importance of CAP payments for the survival of HNV farming and cultural landscapes is increasing, since many farmers rely heavily on these, but many authors (Akeroyd & Page 2011, 2007; Babai *et al.* 2015; Dahlström *et al.* 2013; Molnar & Berkes 2016) outline the urgent necessity for the improvement of this framework so that it will include a greater number of farmers and avoid the conflict with the local traditional land use and knowledge. According to Page, these improvements should focus on the following current problems: adjust the eligibility criteria (highly important HNV holdings were excluded due to small size); include common grazing as eligibility criteria; adjust payment levels for the smaller farmers to continue their activities; provide better advisory services; resolve mapping anomalies, delimiting areas eligible for CAP payments, defining the limits on trees/ha and the permanent pastures (Page *et al.* 2012).

There is a need for the recognition of the traditional knowledge and management practices of the local communities in the shaping and maintenance of HNV landscapes and biodiversity, taking into account land use history (Öllerer 2013) and the complexity of the local management practices, rather than importing methods based only on science and technical expertise (Dahlström *et al.* 2013), thus making such practices eligible for CAP payments.



Conclusion

HNV landscapes in Romania and many parts of Central and South-Eastern Europe – being the result of small scale semi-subsistence farming – are linked and maintained through the traditional ecological knowledge of their practitioners. In Romania, HNV farming is the result of the survival of small-scale semi-subsistence type farms, and the traditional way of raising animals (especially in the mountainous and sub-montane areas). The traditional agriculture, forest use and pastoral systems of the people show that TEK is still present in Romania and South-Eastern Europe today.

The locals from Ieud are engaged in the complex management of their resources (fields, grasslands, forest etc.) and the use of ecosystem services through the traditional ecological knowledge that they have acquired through inter-generational cultural transmission and practice. The detailed local observations on the importance of ecosystem services, e.g., grasslands near forests have a higher quality, or the beneficial presence of certain tree species in the meadows etc., reflect the close relation and detailed knowledge of their environment. This traditional knowledge is sometimes coded in beliefs; holydays that transcend the barriers of nature and society; local customs of land use; and management practices.

The traditional practices and management driven by traditional ecological knowledge of many rural communities are the main reason for the existence and functioning of cultural landscapes and HNV farming with remarkable biodiversity. These rural communities are enhancing the supply of ecosystem services to society, through extensive farming practices based on traditional ecological knowledge (Molnar & Berkes, 2016).

CAP payments are crucial for the existence of HNV farming and European cultural landscapes, but a growing body of literature is arguing for the improvement of the eligibility criteria, since many important HNV holdings fell outside this framework and many national and EU requirements are contradicting local knowledge and land use patterns that have created HNV landscapes.

Traditional knowledge-based livelihoods must be maintained in cultural landscapes, to conserve biodiversity and ecosystem services, continuing the co-evolution of social and natural capital.

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3. “It does matter who leans on the stick”: Hungarian herders’ perspectives on biodiversity, ecosystem services and their drivers

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**MOTTO: Nature as source of knowledge
(the story of the village teacher and the old herder)**

The old shepherd is lying on his front on his suba [sheepskin greatcoat], smoking his pipe quietly. I haven't seen him for ages. Last summer I visited him a lot. I had the idea of teaching him to read, but he just shook his head.

“I don't want to be a priest,” he said. “My two books are enough for me.”

“Which two books?”

“My day-book and my night-book.”

“What are they?”

“My day-book is the field, my night-book is the starry sky.”

Then he taught me to read from his two books. He taught me about “blood grass”, which opens up locks; about “Mary's tears”, which tremble eternally among the blades of grass; the “saga herb”, whose roots everyone should wear around their neck ... and countless other secrets of the earth, and also of the sky, where every star has a name. Then the old herder talked about the crack in the sky – when it opens up, people can catch a glimpse into Heaven.

G. Gárdonyi, Fires and shadows (a novel in the book ‘My Village’). Légrédy, Budapest, 1898.



Summary

This chapter is based on a film made with traditional herders (Indigenous and Local Knowledge (ILK) holders) in Hungary for the IPBES Regional Assessment for Europe and Central Asia (Molnár *et al.* 2016b²). The goal of the film was to provide an overview of herders' traditional ecological knowledge (TEK), which is a type of ILK. The herders interviewed are traditional herders possessing rich TEK mostly inherited from the family and previous generations, and tested and adapted during their personal life. In this chapter we summarize herders' understandings, knowledge and arguments related to the origin of their knowledge, indicators of knowledge validation, trends of biodiversity, ecosystem services and drivers behind these changes, effects of invasive alien species, cooperation and conflicts with conservation management, herders' own innovations for reducing some of the conflicts, the role of ancient breeds in animal husbandry and nature conservation, effects of agricultural regulations, and effects of drivers like subsidies and the global market on herders' quality of life. A section is dedicated to planning and traditional scenario building. We put special emphasis on possibilities of knowledge co-production by herders and conservationists/scientists, and the role policies and different value systems play in the herders' well-being, resilient continuation of their livelihoods and sustainable use of biodiversity. All text *in italics* is a quotation from the herders in the film, the follow-up ILK dialogue workshops or from our own previous studies. Dashed lines (/) separate quotations of different herders.

Key messages

- ▶ Many traditional herders are knowledgeable about local biodiversity and ecosystem services, though they feel that: *a lot of people don't consider it real knowledge.* (Molnár 2012a, 2012b, 2013, 2014).
- ▶ ILK in the European, Central Asian region is a rich source of local understandings and management practices that can help the sustainable management of biodiversity and ecosystem services: *I try to fit in with both sides, so that it's good for me and for the conservation ranger. / Every area still has its own herder, who knows the area, and knows what can graze where and when.* (Oteros-Rozas *et al.* 2013; Meuret & Provenza 2014; Haraszthy 2014; Molnár 2014; Babai *et al.* 2015; Hartel *et al.* 2015; Varga *et al.* 2016a, 2016b; Varga & Molnár 2014).
- ▶ Traditional peoples are not a source of conflict, but in many cases they provide opportunities to learn about a potentially more sustainable use of natural resources (Berkes *et al.* 2000). They may help us pinpoint incentives and policies that are harmful to biodiversity and ecosystem services, and prevent misinterpretation of the local effects of policies and other drivers (Babai *et al.* 2015; Batáry *et al.* 2015; Molnár *et al.* 2016a, 2016b; Varga *et al.* 2016b).
- ▶ Local traditional knowledge is dynamic and adaptive: *I adopted what I needed from the older people.* The added value of traditional knowledge is that it is learnt through living in close relation to the environment, dependent on ecosystem services (Gugič 2009; Berkes 2012; Babai *et al.* 2014; Molnár 2012b).
- ▶ Herders deserve respect for their knowledge and the management of local ecosystem services: *If people respected us a bit more, that would mean a lot.* (Henle *et al.* 2008; Molnár 2012b; Kunkovács 2015).
- ▶ The European, Central Asian region has high biological and cultural diversity. Local people are diverse, thus policies and regulations have to respect these diversities: *The kind of herding*

2 The short, 17-minute summary version is available here: www.youtube.com/watch?v=2Dq_U-yCBfi; and the longer 38-minute version with more ecological details here: www.youtube.com/watch?v=dj5iLAuWoJg.

I do now will be killed off sooner or later, regardless of the subsidy structure. (Nori & Gemini 2011; Hernández-Morcillo *et al.* 2014; Sutcliffe *et al.* 2015; Babai *et al.* 2015; Hartel *et al.* 2015; Molnár & Berkes 2016; Molnár *et al.* 2016a, 2016b).

- ▶ Herders argue that human-nature relations of the wider society should be changed: *People should be encouraged to love nature, to see where they live. / Young people should be taught to love nature.*
- ▶ Co-production of knowledge by ILK holders and scientists produces new knowledge that neither of them would otherwise have: *In fact, for them to know something, or to write a book or make a film, they need us very much! / Conservation rangers wouldn't talk to us 20 years ago. Now they stop and we can talk about pasturing.* (Tengö *et al.* 2014; Molnár *et al.* 2016a, 2016b).

3.1. Introduction

3.1.1. Concept of the chapter

This chapter is not intended to be a conventional scientific paper. It provides a sort of structured message of Hungarian traditional herders for the regional and global assessments, and for policy makers, conservation managers, scientists and other stakeholders. The first and last authors have been studying traditional herders' ecological knowledge since 2008. They have published several papers in English and Hungarian and a bilingual book on this topic. The second, third and fourth authors are considered three of the most knowledgeable middle-aged Hungarian herders. The remaining two authors are students who participated in the research and film-making.

3.1.2. Study area

The most economic 'modern' use of species-rich grasslands and wood-pastures in protected areas in Hungary is extensive grazing that produces high-quality meat. Hungarian grasslands still provide livelihoods for hundreds of herding and thousands of farming families. Traditional herders manage grasslands by extensive, rotational grazing, clearing, deliberate trampling in certain seasons, burning and manuring to increase forage quality and quantity (Molnár 2014, Molnár *et al.* 2015; Varga & Molnár 2014). The three herders co-authoring this chapter utilize saline steppes, sand grasslands and wet *Molinia* meadows. These grasslands survived intensification because the area cannot be profitably used for intensive arable farming, and were designated as protected areas between the 1970s and the 1990s. Herders usually have been born into multigenerational herder families, even though it is increasingly common that the livestock is fenced or is accompanied by someone who is not a herder by 'training'. Grasslands are divided into pasture parcels with approximately 90–150 hectares available for a flock of sheep and 500–800 hectares for a cattle herd. Fixed fencing and hedgerows are rare, electric fencing is spreading. As a rule, a flock and a herd consists of 500–800 sheep and 250–300 heads of cattle, respectively. Herding dogs are still crucial in directing the herds. Grazing follows a recurring yearly cycle due to the seasonally variable, but annually partially repeated grazing conditions. Grazing season lasts from March/April to November/December (Molnár 2012b; Varga & Molnár 2014; Varga *et al.* 2016b), influenced by many factors, primarily weather and the hydrological condition of the pasture (Molnár 2014).



3.2. Methodology

Participatory observations of herding were carried out between 2008 and 2015 with 42 traditional herders. Parallel deep and semi-structured interviews were made with 134 herders and 43 conservation managers (for methodological details see Molnár 2014; Varga & Molnár 2014). Questions for the film were developed to serve the needs of the European and Central Asian Assessment but were culturally adapted to the herders' world view. The text of the chapter is based as much as possible on original quotations. Interviews for the film were made in July and October 2015 at Hajdúsámson (L. Sáfián, born 1969), Kunpeszér (J. Máté, born 1980) and Kunmadaras (S. Barta, born 1982), in Hungary. All text in italics is a quotation from the film, the follow-up ILK dialogue workshops or from the authors' previous studies. Dashed lines (/) separate quotations of different herders. The first version of the film was watched together with the herders on 29 March 2016, and was modified according to their comments. Informed consent was obtained at the beginning of filming and after the finishing of the film. The film is available online (see footnote 1). The messages of the chapter were reviewed and commented on during four follow-up workshops held in March, April and May 2016 in Hódmezővásárhely, Kunadacs, Poroszló, and Hajdúböszörmény.

3.3. Traditional ecological knowledge of Hungarian herders

3.3.1. Origin of herders' knowledge

Herders' knowledge is a culturally transmitted, dynamic knowledge, primarily inherited from older generations but also adapted to the modern socio-ecological environment (**Photos 3.1 & 3.2**). As herders put it: *I was born into it. I learnt everything I know about herding from my father, and I adopted what I needed from the older people. / Not from books, but from my father and grandfather. / I learnt it from my father. I didn't study this, I inherited it, I was born into it.*

The second most important source of information for traditional ecological knowledge is personal observation; that is, personal experience. Herders spend a tremendous amount of time out in the pasture, a great deal of information gets fixed consciously and unconsciously in their memory: *I was there with the herd, to fatten them, that's why we can explain so much. / I only know what I lived through, I got wet and was cold many times. Several herders explicitly said that a good herder must learn directly from the animals: We were talking with them like I do with you now. / Sheep so much don't like [this plant] that I don't even care to call it by a name. / I know only what they eat.*



Photo 3.1 Traditional herders learn their ecological knowledge in the family, from elders, and by personal experience from the livestock and nature. They argue that "it does matter who leans on the stick" – in this case on a shepherd hook, László Sáfián, shepherd (Varga *et al.* 2016a; Molnár 2012; Molnár *et al.* 2016b).

Comparison of herders' vocabulary with scientific nomenclature showed much less overlap than expected. For example, for local plant names the overlap was less than 10%, for habitat names the overlap was what science took from herders (Molnár 2012a, 2012b). The herders' knowledge system seems to develop quite independently from Western Science.

3.3.2. Indicators of knowledge validation by herders

Herders keep validate each others' knowledge. Nothing is accepted if not legitimate. *Just one sentence, or from the way he moves, from his nature, if I talk to him, and I know if he's a herder, or just faking it. / [A real herder] lives with his herd about 90% of the time. His livestock gives him away. You can tell from them [the livestock] if the person looking after them is a "pastor" or just a nobody. / The most important thing is for his family to have been herders, at least one generation back.*

The ways in which herders typically learn reflect this need for legitimacy (Varga *et al.* 2016a). When we asked what makes a good herder, the first answer was: *to love the animals. Sheep have to be as loved as a child. / One who doesn't love animals shall not stand beside them, these animals expect from us [fodder, care etc.]. / You have to love the livestock, and spend time and energy with them. An average man at home has to love his family at most, but we have to love this too. We can't take time off, there are no Sundays. / I can't just go home after an eight-hour shift. It's more than that. You wake up at night thinking, what are the sheep doing?*



Abel Molnár

Photo 3.2 Traditional herders use ancient practices to graze their livestock. However, old practices are constantly adapted to new socio-ecological environments (Molnár 2012; Molnár *et al.* 2016a,b).

3.3.3. Grass as an ecosystem service

Grass is the key ecosystem service for herders. *We live 100% on grass. / The way I see it, if there's no livestock, then I don't exist either. No money, no family, I'd have to find another way to survive. I don't want to drive a tractor or mow meadows. / I see myself as a herder, so it's very important for a calf to reach the right weight as soon as possible, without fodder, only eating grass and drinking its mother's milk. That's a source of pride to me, that's why I see myself as a herder.* As grass is the primary forage, grasses, sedges and their relatives are well known by herders (more than 29 folk taxa, Molnár 2012b).

Herders are observant people and they show a kind of elementary affection towards wildlife: *we couldn't bring over the trough for two years! By the time we got there [in spring], a hoopoe had already nested underneath....* Once a herder saved a nice plant never seen before from grazing (*Asclepias syriaca*): *I took water and watered it, goat doesn't eat it, when you come, I show it [and asked its name].* The relation of herders to pasture plants is, however, typically utilitarian: *I know them as long as they are good for me, I am into it [= learning/knowing them] because I am interested.*

3.3.4. Biodiversity trends and their drivers

Herders have a deep understanding of biodiversity and its trends (Molnár 2014; Varga & Molnár 2014). They distinguish at least 160 wild plant folk taxa, and about 80 folk habitat types (**Photo 3.3**) and they have a detailed understanding of landscape history, and processes of ecosystem degradation and regeneration (Molnár 2014). *There are fewer birds now than before. I think that's because there was more livestock in the past. [Steppe birds] put their nests where they can see all around, where things are safe. There are more beetles, more cowpats for birds to feed from [on pastures]. / The partridge has completely disappeared. / Swallows have also almost totally disappeared. And the birds that used to pick the flies off the livestock. / There are plenty of wild boars, thanks to the reeds, where they like to hide. They completely dig up the pasture. That's not good for us.*

The most general view is that there is not enough grazing livestock, and thus the landscape changes: *it was loaded in the past; [now] there is nothing to keep it clean. / The entire [area] is wild, became wild. / The grassland is dirty [full of litter].* The main term is 'to have become wild', meaning that it is no longer under the orderly control of herders, leaf litter has accumulated, and biomass production has dropped (Molnár 2014; Babai *et al.* 2014; Babai & Molnár 2014).



Photo 3.3 Some of the key folk habitat names used by Hungarian herders herding on saline steppes. Herders can assign a specific name to every part of their pastures (for details see Molnár 2012a, 2012b, 2013).

3.3.5. How invasive alien species affect ecosystem services

Hungary's natural heritage is heavily impacted by the spread of invasive species (Haraszthy 2014). Grasslands are being encroached by e.g. *Amorpha fruticosa*, *Solidago* spp. and *Asclepias syriaca*. Invasive species have expected and unexpected effects on herding. While *Asclepias* is degrading pastures, some invasive species provide new ecosystem services. According to herders *old-field grass* [ragweed], *Ambrosia artemisiifolia* is good for grazing in summer. *Sheep like to browse on old-field grass by the roadside or in stubble. It's no enemy of mine. You can fatten sheep on it.* On floodplains, cattle feed on *Amorpha* which turned out to be an effective way of meadow restoration (Schindler *et al.* 2016).

Invasive species often spread on underused or abandoned marginal areas that were utilized as reserve pastures during early spring, summer drought or winter in the past. European Union (EU) and national agricultural policies focus on conventional pasture areas (dry and wet grasslands). Marginal areas are neglected, and invasive species are encroaching. However, for the effective operation of extensive grazing systems these areas are often very important and deserve more attention (Varga *et al.* 2016b).

3.3.6. Conflicts of hay meadow management

Conservation regulations have an increasing impact on traditional land-use practices in Hungary. Some practices are subsidised, some are banned (Molnár *et al.* 2016a; Babai *et al.* 2015). As local conservation management is rarely discussed with locals there are many unexpected and unnecessary side effects. Hay meadow management regulations are important for the protection of ground-nesting birds and insects but experiences show that regulations should be adapted more to local ecology and local traditions. *You can't start before 15 June. If it's a hot year, the grass is useless by then, because it's all dried out. / We only get second-class hay, no matter how we try.* All herders agree that late mowing has an adverse effect on traditional farming.

Burning is a difficult issue too. Herders argue that with burning they could control native spreading species: *Bushes encroach and the wetlands are taken over by sedge. The simplest way to stop these plants is with fire: that kills the sedge and the bush too. But that's illegal. Willow bushes [Salix cinerea] are protected by the National Park. They take up so much land, not just the meadows, but the pastures too, and they'll never give it back. Because we aren't even allowed to kill them.* There seems to be an urgent need for landscape- and culture-specific agricultural regulation and subsidy systems. Inappropriate regulations and disrespect for local traditions result in maladaptive solutions (Babai *et al.* 2015; Molnár *et al.* 2016a).

3.3.7. Forest grazing

Forests were always part of the extensive grazing systems in Hungary (Hartel *et al.* 2015; Varga *et al.* 2015, 2016b). However, during the last 150 years grazing livestock has been increasingly banished from forests (Varga & Molnár 2014). Conscious suppression of traditional land-use practices is among the most important drivers of these changes. *Since I've lived here it's not allowed to graze in the forest. I've never done it legally, only in secret. It would make things easier. The grass starts growing there in early spring, that would mean a whole month less relying on fodder.* A more multifunctional use of forests and agroforestry systems, e.g. wood-pastures with recognized high nature and cultural value, would be beneficial also for herders (Vityi & Varga 2015).

3.3.8. Herders' solutions for reducing certain conflicts

Herders are not passive. They often develop tradition-based solutions that can serve as a compromise. Nature conservationists should acknowledge these and motivate further developments. For example: *I try to fit in with both sides, so that it's good for me and for the conservation*



ranger. I did what I heard at home from my father. They grazed on the hay meadow in early spring. It's good for me, because the grass I cut [in late June] is not too old, but the grass is still there for their [the rangers'] wildlife until June. / My father and I started cutting down and clearing out the tall vegetation from the marsh. This made a good habitat for birds. In summer the water went away, and by September there was fresh grass for the livestock to graze on. Knowledge co-production could be a useful tool to improve management. Herders and conservationists/scientists have started co-production of new knowledge that neither of them would otherwise have (Berkes 2012).

3.3.9. The role of ancient breeds in animal husbandry and nature conservation

Traditional breeds can find their place in modern pastures. *These are the breeds that are best suited for Hungary's pastures. If we had a proper lamb market, then with Hungarian racka sheep I could get the same results as I do now, with these more sensitive breeds, with half the work and half the trouble. / This is important because they [ancient breeds] graze on several types of plants that other breeds don't like to eat. Even on lower quality fodder you can produce better quality with them [Photo 3.4]. They're not [so] choosy. What's more, there are fewer problems. And it makes a herder proud to watch over Hungarian grey cattle more than with Hungarian Simmenthal.*

Grassland intensification is not permitted in protected areas. On these pastures bio meat production based on ancient breeds seems to be a good solution. Furthermore, the pasture grazed by ancient cattle and sheep breeds that are herded by traditional herders in traditional costumes has been a high quality ecotourism product since the early 20th century.



Photo 3.4 Traditional old breeds not only hold valuable genes for future cross-breeding, they are the best suited animals to manage 'poor' saline pastures while providing high quality bio meat for the market (e.g. the grey cattle meat in baby foods) (Sándor Barta, cattle herder).

3.3.10. Livestock diversity

We asked herders why they keep diverse flocks: *We're trying to cross-breed meat-producing sheep, so that our pastures can support them. That's why they're so spectacularly cross-bred. So they are productive in two types of weather, in dry weather, and in rainy years too.* This is a good example for the role genetic diversity may play during adaptation to climate variability.

3.3.11. Why is the meat sold abroad? Global drivers and the need for marketing at home

Hungarian herders are too dependent on global markets. *Lamb meat should be advertised so that people know what we make here in Hungary, that they can buy it fresh, not frozen. Look, all the cooking programmes [on TV] have wine suggestions, which means that wine gets properly advertised. But lamb doesn't! Lamb stew has gone out of fashion in Hungary, so people have forgotten how to make it. And if stew is badly made, it gets a bad name.* Better marketing locally, nationally and regionally could highly improve herders' livelihoods. See, for example, the success story of the ancient breed of pig, the Hungarian Mangalitzta (www.mangalicatenyesztok.hu/index-english.html).

3.3.12. A new driver: the European Union subsidies and their controversial effects

Agricultural payments are a vital source of income for traditional herders though there are adverse side effects too. *Subsidies are very good because they help smallholders to develop, for example, by paying for proper winter fodder. The downside is that a lot of people are only keeping animals in order to qualify for the subsidies. That's bad for the herder community, because the large subsidies mean herders aren't needed. [Because] the livestock doesn't need to be productive, all that matters is the headcount.*

As electric fencing replaces herding, traditional knowledge of herders becomes less valued. Centuries old adaptive knowledge is being lost that could otherwise help develop old-new grassland management practices. Based on our own and on herders' experiences we suggest that in landscapes where traditional grassland management is still operational, regulators should learn local management practices first and ensure that if functional practices survived, they are adapted, instead of forcefully imposing requirements on farmers which are alien to the local landscape and society (Babai *et al.* 2015; Molnár *et al.* 2016a).

3.3.13. "Scenario building" by "sedentary nomads" – herders live in unstable socio-ecological environments

Traditional herders keep adapt to the changing socio-ecological environment. Herders continually have to make plans about the place and intensity of grazing (Kis *et al.*, 2016). It has to be good for the animals so they fatten more rapidly, but some parts should be left for the rest of the year, others should not grow too tall because it would grow too old. Meanwhile, reserve pastures and places for cutting hay should also be reserved. Besides these shorter-term plans herders also have longer-term goals, visions, even scenarios, and they develop possible pathways to reach these desired goals (Molnár 2014; Molnár *et al.* 2016a).

As can be seen below, Hungarian herders have kept many nomadic elements in their ways of adaptation, as part of their world view. *What I know for sure is that the sheep do well today, but ten years from now I don't know what will happen. I'd like to do the same thing, in the same place. But there's no certainty. All I can plan with is my own expert knowledge. Even though I have my own flock, it's not enough to plan 2–3 years ahead. The problem is the pasture [tenure] and the lamb market. My father's way of thinking was: there are 100 collectives, and he won't live 100 years [so he can easily move to another place]. So he never planned long-term. And that's what we inherited. I know for sure that I look after my sheep well today, but tomorrow, who knows? / Things change. Everyone is moving into meat [from producing milk]. But change can come any time, and then... It's not easy. When you have one thing, the market needs the other, and then you have to change. / My parents said that in the 1970s, shearing was a celebration, and wool made a profit. Then things gradually got worse, so now we're happy if we can pay the shearer from the wool. In the old days, you could buy all the winter fodder from it.*

Planning processes must reflect on many unexpected drivers. European Union regulations are often based on Western European understandings and world-views that are sometimes very different from East-Central European ones (particularly, for example, in post-soviet EU member



states). Not only communism but the previous centuries have left their historical legacy that should be respected. Planning would be much easier if regulations were more respectful of local knowledge and culture.

3.4. Reading from more than one book: a future supported by multiple knowledge systems

3.4.1. Meeting of two knowledge and value systems

Traditional knowledge of herders and science-based knowledge of conservation rangers often meet as semi-natural pastures are mostly designated as protected areas. Different world views, different interests may result in conflicts (Molnár *et al.* 2016a). *Conservation rangers wouldn't talk to us 20 years ago. They criticised us without asking us anything. Now they stop and we can talk about pasturing. We agree on about 90% of things. The difference between them and me is that for the rangers, it's all about the plants [protected plant species], but for me it's all about the animals [livestock]. / Things are different here in the Kiskunság National Park. We have one ranger who wants to make things better, who represents our interests. / The situation is a bit better today. They [the rangers] still don't ask us about things, but if we have an idea, they give us more support. But we don't communicate enough for us to know what they are thinking, and they don't know what we think or want.*

The conclusion is that better communication could solve several of the conflicts (**Photo 3.5**).



Photo 3.5 Meeting of knowledge systems in the field and production of new knowledge on grassland management. European Union policies and regulations are mostly based on Western European scientific experiences, world views and value systems: this may be one of the reasons why they are often inefficient or inappropriate to support biodiversity conservation in the East-Central European context. There is an urgent need for landscape- and culture-specific agricultural regulation and subsidy systems (from left to right: Csaba Vadász, conservation ranger; Zsolt Molnár, botanist, ethnoecologist; János Máté, traditional herder).

3.4.2. The future of herders and their knowledge: the role of policies and other drivers

As traditional grazing is a cheap and easily manageable way of conservation management and as there are incentives from EU, traditional grazing is expected to survive and to adapt to upcoming socio-economic environments. National and EU policies are powerful drivers. They can help support conservation management significantly, but they also have the power to destroy local traditional livelihoods and local culture. *I think, at most, herders will be kept in the national parks, as an attraction. The kind of herding I do now will be killed off sooner or later, regardless of the subsidy structure. I can't compete with a farmer who's got hundreds of hectares. My sheep mean everything to me, it doesn't matter how big my house is. As long as I can provide for my family, I'm perfectly satisfied. / Nowadays pastures are being fenced off by the big companies and small entrepreneurs too. That's changing the nature of herding. They don't need us any more, because the cattle is kept in place by the electric fences.*

In contrast, other herders argue: *I think it [herding] will be more respected. There are fewer herders now, and those who deal with the livestock [livestock owners] will realise it mustn't be allowed to disappear. / Both the rangers and the researchers will appreciate us more than they do now. / Now things are getting a bit better, and the right connections are being made between the national park, pasture management and animal husbandry.*

National parks and other forms of nature conservation may motivate and support, or alternatively, prohibit or suppress traditional use. Parks are in a position to develop new ways of conservation management based on local and traditional knowledge, for example, by co-producing knowledge with herders. However, we do not believe that conservation-oriented extensive grazing can be built only and exclusively on traditional herder wisdom. It also needs to be adapted to the current socio-ecological environment. In order to do so you need new mechanisms to generate and transfer knowledge and experiences and an efficient cooperation between various knowledge systems (science, traditional knowledge, conservation practice) (Molnár *et al.* 2016a).

One of our suggestions is that a new profession is needed: that of the *conservation herder* (Molnár *et al.* 2016a). The conservation herder would be an individual knowledgeable about herding and pasture management, trained to some degree in conservation and ecology, able to design management experiments, and develop novel but tradition-based management practices. As such, he/she could facilitate adaptation of extensive herding in the changing socio-economic environment.

3.4.3. Herders' services: who would miss herders?

Quality meat production and nature conservation management definitely need herders. Grass-fed cattle is regarded as more healthy compared to grain-fed. Herding in protected areas can provide high quality meat. *People have got used to artificial food. People don't realise that if herders go, tasty meat will go too.* Health, productivity and well-being of the animals also depend on the herder. For example: *The yield of a flock depends on the herder. 100%! If the summer grazing is not done properly, they won't breed well, and there won't be any [enough] lambs.*

In high nature-value areas herders could function as 'ecological doctors' (*sensu* Meuret & Provenza 2014). They manage and restore grasslands and wood-pastures in many parts of Central Europe (Vityi & Varga 2014). *If there were no herders here, the area wouldn't be grazed properly. Nature would suffer. The livestock would only eat what's in front of them. Nobody would force them into the marsh, to clean the area up [from encroaching tall vegetation]. You need herders for that. So the livestock doesn't eat where it wants, because that's not proper grazing – they would only eat the good grass [like children prefer sweets]. / Every area still has its own herder, who knows the area, and knows what can graze where and when. Without herders, it wouldn't be pasture any more, just rough land. / The herders have to be asked their opinion: the starting point should be what the livestock eat. Because I can tell them what they eat in spring, in summer or now, when the frosts are coming. I know what kind of grass the cattle prefer, so I can decide if we should stay out, because they'll eat it, or if we should go in [to the winter stable], because they won't.*



3.4.4. What should be changed to improve the lives of herders?

We asked this very general question to seek general answers (i.e. not specifically related to herding). The insights we received were unexpected and surprising: *People should be encouraged to love nature, to see where they live. Not on a computer. / At herders' festivals, they can see herders dressed in fancy clothes, but they never meet them in real life. So they don't have any real idea about us. / If people respected us a bit more, that would mean a lot. Young people should be taught to love nature. Young people today don't like it. They even look down on us and on what we do. / I think honour is the most important thing for herders. In my grandfather's day, a herder had pride and appreciation. It's a lot worse these days. Also – in the 21st century – herders should be paid what they are worth, not just a minimal salary, but a higher category than that. I don't mean earning 500,000 forints [about 1500 euros/month], but enough to raise the family comfortably. Then I could be proud to be a herdsman – financially too.*

There is a vicious cycle between appropriate earnings and effective herding: if herders are not paid appropriately, they will not work properly; if they do not work properly, they will not be paid appropriately. Respect, honour and proper salaries are vital to change the trend. As shown above, herders do have valuable functions in the modern world – especially in nature protected areas (Varga & Molnár 2014; Babai *et al.* 2015; Molnár *et al.* 2016a). Herders could be paid for the services they provide. *Nowadays more livestock is being kept, which is good for the grasslands. That's very positive. After the end of communism, a lot of livestock was "killed off" in Hungary. Now things are getting a bit better, and the right connections are being made between the national park, pasture management and animal husbandry.*

3.4.5. Why aren't the bookshelves full of books about herders' knowledge?

There are only very few books on the ecological knowledge of traditional herders living in Europe and Central Asia. We asked herders, what do they think, why? *Herders don't get enough recognition. It's getting better, but it's still not enough. People never thought about herders as knowledgeable people. / I don't think people really spent much time on such things, so it got a bit lost, but now some people want to revive things. / A lot of people don't consider it real knowledge. Until people change their opinion about this, there's no point writing a book about it.* The first books on the topic were published only some years ago (Molnár 2012b; Meuret & Provenza 2014). They emphasize the 'art and science' of herding and the deep understanding of local ecology by herders. Having more books on traditional herding would help build recognition of this knowledge and skill, assist in networking and lobbying at the European level, cross language barriers and hopefully in protecting this knowledge from further loss.

3.4.6. The basics of cooperation between researchers and herders

There is a general understanding in Hungary that we need a more efficient cooperation with local people, and effective co-production of new knowledge for better, more efficient and sustainable land use and conservation management. Herders argue that *first we need to recognise each other's knowledge. Then researchers have to try living together with a herder, to understand why we do the things we do, and to realise that it's really a science. And herders have to recognise the researchers' knowledge. / Things need to be discussed. There are lots of researchers, but the fact is that not everybody comes and talks to us. The herders need to meet more people and talk to them more. If researchers treated us better, things would work out fine. / The main thing is to have a kind of friendship, so it's not just official. A researcher should get to know me and my family, and then he can ask his questions. Researchers should treat herders like humans. I don't think I'm less of a person than someone who went to university. In fact, for them to know something, or to write a book or make a film, they need us very much.*

A recent example of cooperation and co-production of new knowledge is a paper published in *Ecosystem Health and Sustainability* co-authored by herders, conservationists and researchers (Molnár *et al.* 2016a). The four follow-up ILK dialogue workshops organized during this project also contributed to this process (**Photo 3.6**).





Abel Molnár

Photo 3.6 Follow-up dialogue workshop at Hajdúböszörmény, Hungary. Herders, farmers, nature conservationists, a forest engineer and researchers were discussing common interests and conflicts of traditional grazing in protected areas and forests

Conclusion

A lot of people say traditions need to be safeguarded. It's not traditions that need safeguarding, it's livestock. Traditions need to be loved and respected, but what needs to be safeguarded is the livestock.

Sándor Barta, cattle herder

Traditional extensive grazing is supported by nature conservation management, and agri-environmental and Natura 2000 (a network of protected habitats across the EU) regulations and payments. However, most economic and political drivers act against traditional management: *the Park favors traditional herding but with these regulations the steppe lifestyle will be killed off*. As herding is a special way of management, a special way of life and livelihood, policies should better be adapted to regional ecological and cultural differences inside the European Union, and show more respect to well-adapted and “renewable” traditions. The universalism of science needs to be tempered with local and traditional knowledge to produce contextually tailored local solutions. Scientists and policy makers can help those people who still use and want to use local and traditional knowledge for their livelihoods. EU policy could effectively help maintain local knowledge-based livelihoods.

Let's not forget that although herders may not understand the key terms (e.g. biodiversity and ecosystem services) used in international arenas like the Intergovernmental Platform on Biodiversity & Ecosystem Services, they still know a lot about these issues. They have argued that *if we don't cooperate, then herding will die out and be lost forever*. In our understanding traditional herding is not backward, nor outdated, but provides an important link to sustainability.



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4. Traditional herders' knowledge and worldview and their role in managing biodiversity and ecosystem-services of extensive pastures

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Abstract

Herders have a wide-ranging and deep knowledge of nature. They know the habitat needs and biological properties of many plant and animal species living around them. Their relationship with nature is substantially different from that of a common/lay man. They hold the view that they are part of nature. They learned the “science” of herding and the “proper” use of grasslands from their ancestors and parents and from their own experiences with livestock and pasture. Using this knowledge they are able to manage and direct livestock to utilize pastures effectively while preserving or even improving the productivity of the grasslands. Additionally, they can also effectively restore the temporarily abandoned and hence, degraded areas.

Today, it has become clear that traditional land-use practices exercised by herders contribute also to the survival of a number of protected bird and plant species. Shrubs, pioneer forests and invasive species may outcompete threatened species from areas where grazing has been abandoned. In other words, traditional pasturing with herders is not an out-dated activity at all. It has been and still is adapting to the ever-changing world. Such practices assist sustainable use of ecosystem services and preservation of biodiversity, while herders contribute to producing excellent quality ecological meat products. This is achieved through using a culture several thousand years old, both by preserving traditional knowledge and at the same time developing it with adaptive practices.

The knowledge held by conservationists and herders is complementary in many respects. As a result of the IPBES European and Central Asian Regional Assessment Dialogue Workshop, a

series of dialogues have been started between herders and conservation professionals in Hungary. One of the key goals of these meetings was to achieve better cooperation and more efficient preservation of grassland diversity and ecosystem services. It is a timely issue both for nature conservation and animal husbandry. Ecological knowledge and experiences of herders may provide significant assistance in tackling a number of emerging problems. Highlights included the eventual amendment of national (i.e. Hungarian) and European Union legislation to avoid adverse impacts on the present and the future of both nature conservation and herding practices and animal husbandry.

A key message of this paper is that we, cattle herders and shepherds with traditional ecological knowledge, have a significant role in sustaining the 'functioning' of nature preserved in cultural landscapes. Herders do have a place in protecting ecosystem services and biodiversity, and contribute a great deal to ensure the natural environment which we have received from our ancestors is handed over to the upcoming generations.

4.1. Introduction

In this accelerated world of ours, more and more food and meat is required as the overall population grows. State-of-the-art livestock establishments and modern technologies are needed to produce cheap meat in large volumes, and as a result, extensive ways of animal-keeping based on traditional grazing practices are forsaken. As traditional land-use practices are abandoned, pastures will become unused and unmanaged. The wildlife on these areas will be transformed, and pioneer forests and invasive species may spread. A growing number of protected species would lose their ideal habitats.

This paper was written by the first author, who is 34 years old, has been a herder since the age of 20, and also holds a B.Sc. degree as nature conservation engineer. Data were provided by his colleagues and friends, all young and middle-aged cattle herders and shepherds in their thirties, forties and fifties. It is not about the past, it is about the present. It does not romanticise herders. The authors collected experiences which herders constantly utilise to preserve and eventually improve the grass production of their grazing lands and pastures, and regenerate and restore abandoned land or land which was not used in an appropriate manner. The paper also presents the authors' experiences with respect to the impact of grazing on wildlife.

The paper is particularly addressed to conservation professionals and research scientists who still doubt that the sustenance of pasturing and herding may be a key to preserving biodiversity of many grasslands in Europe. Do not forget: before human land management, wild herbivores (e.g. aurochs, wild horses) had the same type of impacts in the forests and on the grasslands as those herded by man.

A key message of this paper is that we, cattle herders and shepherds with traditional ecological knowledge, have a significant role in sustaining the 'functioning' of nature preserved in cultural landscapes. Herders do have a place in protecting ecosystem services and biodiversity, and contribute a great deal to ensure the natural environment which we have received from our ancestors is handed over to the upcoming generations.

4.1.1. Study area

The majority of the herders interviewed work on saline, loess and sandy land, called puszta in the eastern region of Hungary. There are some who manage wetlands in addition to steppes. Those living in sandy parts supplement forage needs by grazing on cropland, stubble-fields, fallow land and in forests. One of the herders grazed in the Trans-Danubian region in a hilly environment. The sandy lands are situated in the area between the Danube and the Tisza rivers, in the region



controlled by the Kiskunság National Park (for instance Kunadacs, Üllés). In the territories of the Hortobágy National Park and Körös-Maros National Park (such as the Csanádi-puszta) saline and loess steppes and wetlands are dominant. The Kunmadaras-puszta is part of a UNESCO Man and Biosphere Reserve.

4.1.2. Material and methods

The lead author of the paper – a herder himself – interviewed seven cattle herders and shepherds about pasturing in February 2016. These people graze their livestock in various parts of the country in different habitats. Several questions related closely to their work fit the objectives and topics of the IPBES regional assessment. Twelve hours of voice recordings were transcribed and divided into topics.

Thoughts and original quotations from shepherds and cattle herders are indicated in the text by italics. When the words of several herders are grouped together on a common theme, the quotations from different individuals are separated by a slash (/). Non-italicised words within a quote are used to better assist understanding. Scientific names were added in parentheses after folk plant names.

4.2. “Nature is everything”: Herders’ relationships to nature

4.2.1. What ‘nature’ means to a herder today

This is like home, you can't tell it. It has to be felt. This is the single sentence you can say. You don't have to add anything else. In springtime when you go out and smell the fresh air, it can not be told, the feeling of how wonderful it is.

Sándor Barta, cattle herder

The first question asked was what ‘nature’ means for herders. As can be seen below, the relationship of herders with nature is unlike that of the common/lay man. Most of them spent their childhood close to nature, several beside their herder parents and grandparents. Thus nature had significant meaning for them.

I couldn't imagine [life] without it. I'd rather live in the past, and I can fancy the past best through nature and the puszta, with all the livestock, birds, plants, emotions and fragrance. / I practically grew up there, I got accustomed to this kind of life. I wasn't involved in any other things and I think I never will be. / I went bird watching since I was 12. I have always lived close to nature. It means a lot to me, since if I couldn't be here in nature, I probably would go mad. I could always go out to nature to play, wander around when I was a kid. Then I went in the direction of ornithology. / I lived in a farmstead since I was a kid, livestock and nature for me are one and the same.

Many called nature their home, “I would rather say it's more like home. / It's like home, you can't tell anything else.” In spite of nature being their workplace, most herders also see recreation, pleasure and entertainment in it.

It makes me calm. I feel good here, I grew up into it. / For me, relaxation has always been represented by the birds. / For me, it's like recreation when I'm out. Nature is like settling for me. I feel good in it, be it grassland or forest. / For me, this means relaxation. I have time to watch the wildlife, game and birds.

Some put it like this: “Nature is a private asylum for me.” Each and every herder tries to avoid the city, they prefer the open landscapes. Even when they have to face the rigours of weather.

It means freedom, away from the noisy city. / I would feel best there, not in the middle of a city, that is too crowded, too loud and too stinky for me. / Whatever the weather is like, you have to graze the animals. Whether it rains or shines, I'm out.

Respect and humility in the face of nature also stems from the fact that nature provides their livelihood. This is how they can sustain their family and therefore they take care of it to the extent they can.

It's our livelihood. We have to do it so that you could take advantage of it, because if you can't, there will be nothing to live from. / It provides a livelihood to my family. We are exposed to nature a lot. Say, a serious drought comes, we would feel it. My family as well, because less money find back home. If there is a drought-stricken period, sheep would not rut [get pregnant] and there will be less twins. Thus it has an indirect impact on the wellbeing of my family and on my mood.

What's more, some would phase out all factors that are harmful to nature if it were possible.

The sounds, the sounds that I can hear out there. I would pull down the aeroplane from the sky with my shepherd's crook just to stop that rattling up there.

Though not expressly religious, many times they still see God behind events.

I'm not a religious man, but somehow it [nature] means the Creator. I think we are only participants in this. Servants. Somebody must control that little lamb to be born and raised. How vegetation can be renewed and shoots up when given water. Something like this.

When asked to characterise what nature means to them, they would give answers like this: Everything! / Freedom! / Relaxation!

4.2.2. Nature in the time of parents and grandparents of today's herders

Once upon a time when I was a kid and my dad was a cattle herder, we were out all time. Well it worked like that: he had a slingshot and shot that little hare or pheasant. He cooked. This is how the whole thing worked, it belonged to the herders' life.

Tibor Fegyver, cattle herder

The second question asked of herders concerned what nature meant to their parents and grandparents. Most herders held the view that nature meant the same thing for their ancestors as for them.

Almost the same. / My ancestors did the same. My grandfather was also a cattle herder. Nature means the same for my dad what it means to me. / I think with us, who tend for the livestock, there are no big differences.

However, in a way, the relationship of the previous generations with nature was a bit different: for previous generations it represented livelihood in another way. Responding herders noted differences in the relationship between man and nature.

Now the [wild] animals have less and less place to live in, because we keep on entering, trespassing on their habitats. / My grandfather was a herder and I remember how respectfully the old man talked about the puszta [steppe], that he himself can be grateful to the puszta for his existence, his work. / Our grandparents lived together with nature. It was like a part of them then. / For them it was more important for their livelihood. It meant more because it was their livelihood, their lives indeed.



Livelihood is not interpreted to mean that grazing vegetation was the fate of the farm, but rather you could find in the puszta what you needed to eat. The herders were part of the ecosystem and the local food chain.

Another difference related to biodiversity.

All plants and animals which are now gone or rare were common for my grandfather. Now you have to protect the gopher, all kinds of plants and animals. You have the small pasque flower, for instance kököröcsin (Pulsatilla pratensis). The world of my father, of my grandfather, in that world you did not have to protect, conserve. Now you have to conserve and define the value of it, so that it could be conserved. / Well, I think there were a lot more birds, a lot more livestock.

They also made references to modernisation.

There were not so many houses, roads long ago, so everything expanded [i.e. there was not such intensive urbanisation and developed infrastructure]. / Because it was untouched then, no electric fencing. / We face the same problems just, let's say, we try to make it a bit more up-to-date, as they did. They relied on vernacular observations a lot more. We rely more on scientific things; they, what they have experienced. There was no Internet at the time. They could filter out from what they heard from each other. They could build on it.

Whatever approach you take, one thing is for sure:

For the ancient folks, nature was not that kind of nature we have it now. We are just licking [hardly can image] that kind, I think.

4.3. Utilization, dosing and apportionment of the key ecosystem service: grass forage

The livestock would go for the tasty bits all at once, but I just herd them that way, let's go and munch a little here, because, well, this belongs to the puszta just as well, that'll do no harm to you, you just don't like it so much.

Lajos Elekes, cattle herder

The volume of biomass produced on pasture land is mainly determined by the prevailing weather conditions of the given year. In most years there are meteorological reasons why pasture biomass does not reach its full potential. Therefore, the main consideration in apportionment of the land is to last until the end of the year. The well-being of the livestock is of paramount importance for herders; it determines how much they can produce.

It is always the key, to keep the cattle well, to the best extent possible. Because it is apparent, I'm a herder: therefore the livestock could get along in my care [physical condition]. However, I also would have to apportion that parcel. For this to work you need high quality, nutritious forage. You have to look for the best for them, in winter they would eat the sour grass, because no better is found.

Herders know the properties of specific plant species well.

The first thing I look for is what kind of plants populate the pasture. / Each season has its own grass, which is the best and useful at that time. / Besides, you would know in which part of the vegetation period is the kind of weed or grass that sheep would like best.

In other words, they would adapt to both the composition of the vegetation and the spatio-temporal potentials of use in their daily, monthly and annual grazing schedule.



Zsolt Molnár

Photo 4.1 Herders not only use but also improve their pastures by consciously adapting the grazing regime: "I deliberately let the litter and tall grass trample in late spring after a wet year to get fresh second growth in late summer in a droughty year," József Kis, cattle herder

Herders manage grasslands to ensure a diverse diet for their livestock and a varied and gradual stress to the pasture.

When I could see that the livestock would not graze that manner any more, they are bored, I picked them and took them to another area. And I kept on trying to vary pastures not to get the animals bored. / We had them graze the edges around. Then we had them tread the middle and last we laid [i.e. the stock was left spread out on the land as they wished], well, it grazed wherever it wanted, but before we grazed them in segments. We apportioned them with this partitioned grazing.

In the implementation of partitioning, electric or fixed fencing is preferred by those who manage small amounts of land.

A grazing pen [paddock] is best. If you have 8–10 grazing pens, it can be nicely apportioned. Fencing is good, because the sheep would graze whenever it wanted, and eat out all corners. When you graze them on pastures, you can't just to push the sheep into a corner to eat it barren. / The livestock would not go around the whole lot, only a portion which is partitioned for them. What was grazed for two weeks, in the next two weeks will go to the other side. That [side] can take a rest, they would not graze it barren. Land is able to regenerate. / Maybe electric fencing is good for partitioning. You partition the pasture and give it to them in portions.

Herders graze in a diversified way, not only on an annual basis, but on a daily basis as well.

Then my father told me so, it's clattering [dry steppe] in the morning and clapping [wetlands] in the afternoon. So we graze the dry one in the morning. If you feed them well in the morning, they will only be nibbling in the afternoon, so we just lash them out to the reeds [let into the reedy parts], because it would stand it better than hunger. / If I let it to the cattle, it would seek the juicy bits. If that is gone, the worthless is left over, which is not grazed. Therefore, when I turn out in the morning, I try to push them gently, not rudely, to the direction I want them to go. / If I let them there in the morning, I would go elsewhere in the afternoon.

Typically, pastures are also allotted according to their respective distances from livestock holdings, resting and night rest sites. They adjust to the circadian and seasonal rhythm of the animals.

I would not put it in at midday [to rest for noon]. By the middle of the year [July], I would get the farthest point. / In the beginning, I'd rather be further up, and when the pasture is getting short, warm days are coming, I'd try to stay here around the farmstead.

They adapt to the biological cycles of the animals, in particular for sheep.

Closer parts are usually left for lambing, the ones around the shed. The best bits are left mainly for the pregnant ewes. / I'd try to save those places which are closer to the farm for the lambing season, so that lambs would not have to be carried in from far away.

In the background, well-being of the livestock is the key consideration, since soil is more fertile in the surroundings of livestock establishments, and more nutritious plants grow on it. The area surrounding the shed is always left for the ones with young, the lambing ewes. Ewes with lambs benefit from this, and the proximity of the buildings provide shelter against the rigours of weather too.

In the summer seasons weather conditions are usually quite extreme recently. I try to make grazing so that drive them out earlier and get them grazed by 8 or 9 a.m., 'cause by eight o'clock the sheep would start to stick together [in a single lot, due to the warm weather].

In summary: the primary consideration of pasture apportioning was to last until the end of the grazing season. This was followed by the well-being of animals, sparing of pasture and convenience and comfort for both herders and livestock. And there was another important aspect: nature conservation. One of the herders, working on a conservation area, described an entirely self-invented pasturing system with nature conservation objectives (**Box 4.1**).



Gabor Balogh

Photo 4.2 If herders and conservationists respect each other, they can efficiently work together for better conservation management. "It depends, which kind of a flower is there, you have a look at it when it opens and before or after you put livestock on the habitat. You would have them munch it, graze, tread it thoroughly. The flower would feel better afterwards," László Engi, cattle herder (on this picture, the grass was not properly grazed last autumn).

Box 4.1. Conscious exploitation of ecosystem services – the herder's way of nature conservation: grazing after blossoming, before blossoming or just in the autumn of the previous year

You have the marsh named Liliomos on Királyhegyes-puszta (Királyhegyes, SE-Hungary). Elegáns kosbor (Orchis laxiflora subsp. elegans) grows there. It ceases flowering by 15 June. Since the parts dominated by tippán (Festuca pseudovina) and üröm (Artemisia santonicum) usually dry out quite quickly, we first graze that parcel at the time of drive out, i.e. end of April, beginning of May. We bide the time until 15 June comes. By that time all kosbor plants would have ceased to flower. We wait for flowering and go into the area only then when the growing up vegetation closes and covers up the habitat of the next generation [i.e. it can not germinate in the dense thick grass]. Therefore we have them gnawed thoroughly on the edge of the marsh where the kosbor plants grow and next year a lot more flowers would unfold, thanks to our having the grass munched away.

In the adjacent higher elevations we usually have a very strong vetővirág (Sternbergia colchiciflora) stand. It would open in mid-August. These edges are done by 15 June together with the tippán and üröm stands, picking all plants off whatever we can. After 15 June these higher elevations of loess grassland will be freed from the cattle, so that vetővirág [a plant a few centimetres high] could open. Flowers will not be trodden, they can shoot up nicely.

Sites with tavaszi hérics (Adonis vernalis) are grazed in autumn, when the development of the plant slows down. From mid-August until end of September grass is taken off from it. This way a shorter lawn can be ensured for hérics which blossoms in the spring.

Pasturing is reconciled on pusztas where protected plants grow. As a result, vetővirág population increases. There were only a few stems of kosbor a couple of years ago, now, two years later, we counted at around 300 stems as a consequence of proper grazing. The same way, hérics went up from a couple of hundreds to nearly 3000, also thanks to proper grazing. So you can schedule this way. It depends, which kind of a flower is there, you have a look at it when it opens and before or after you put livestock on the habitat. You would have them munch it, graze, tread it thoroughly. The flower would feel better afterwards.

László Engi, cattle herder

4.4. The role of herders in sustaining the state of affairs in an ecosystem service

4.4.1. Protecting the pasture from disturbance

I try to make it as I saw from my father. I held it a good solution and thinking back to it, it was indeed. He spared the pasture as long as he could.

József Kecskeméti, shepherd

It is of utmost importance for a herder to relieve pastures from stress as much as possible: *You have to know well, how much livestock you can take to it. It shouldn't be overgrazed. They pay attention to*



provide the appropriate number of livestock to an area. Attempts are made to reduce excessive stress by shortening the duration of grazing periods.

The old men before, they were no fools, drive out at Saint George's Day [24th April], drive in at Saint Michael's Day [29th September]. If you drove in at Michael's Day, grass would grow in the Fall. In springtime, grass would shoot out a lot earlier from that litter, than this way that it is gnawed up to the barren land in Fall.

Autumn-winter grazing does not spare pastures since the vegetation does not have enough time to regenerate. For the herders, it is important to maintain the good state of pastures.

We try to drive the livestock so that it did not cut up the more saline [soft] parts because ours is a strictly protected biosphere reserve core area. We have to move around quite cautiously there. / I used to walk to the pastures further up and drive the sheep back changing the strips.

Herders also take care not to cause any damage where they tread. Permanently used paths are stripped from vegetation quite quickly and even more when the livestock walks on loose soil on rainy days. The herders also adapt to the grazing possibilities as the weather conditions allow in each type of pasture.

I also look at where it is more saline, where it is wet, I look how much rain was there, so that no deep tracks, if possible, are left in the puszta. When it's dry, I like to go with them to the parts where there are many nád and csattogó (Phragmites and Bolboschoenus), mainly in early periods. Another thing is that there are kinds of grasses which are not eaten in warm weather, only trodden down. But if dew softens it, it would be eaten. Damages by treading can be reduced by leading them to the parcel from different directions each time when the area is wet.

Pastures can be harmed in times of drought as well, not only in the rainy season. Dried out plants can break under the feet of the animals, and later they cannot graze them. Vegetation can also die out quite dramatically on the well trodden, compacted soil. Herders made attempts to reduce such losses.

I would not go through those parts for days. You need some dew to get the pasture refreshed. One or two days later they are willing to graze the same parts again. You can't get them munch to the ground because they would not graze in the first place.

Using electric fencing is an appropriate practice only in certain cases.

If you don't have any other option you may manage by electric fences, but I believe in pasturing with herders. / Personal contacts with the livestock are very important. I can only accept electric fencing when parcels are very small. If the herder is competent, it's much better to do it with a herder. If there is a good herder with good dogs, electric fencing has no relevance. / If you have such a small bits and pieces you can't stop the cattle because the front is in it [i.e. the pasture], and the back drags off. In such a case, I would say, enclose it.

Problems of overgrazing and damages by incorrect treading were also mentioned with respect to livestock left alone in the electric fences.

If you fence them off, the livestock would not be coordinated within the fences. If it got accustomed to a site, it would tread it down there. / Sheep must be directed here and then, they are inclined to overgraze some parts of the pasture. Where they like it, they would stop there all the times. If nothing else is left, they would still stop there. Opposed to electric fences, a herder would know if a piece of land was soaked and loose so he did not overgraze the livestock, because it's just enough, even though the livestock would still go there. Clearly, a good herder would know where and when I have to graze, where is it desirable. / When the livestock is herded, it has to go where you drive them and graze it, not to pick out the juiciest bits only and tread down the rest.

Herders make attempts to ensure permanent renewal of the vegetation and to maintain a constant quantity and quality of grass yields.

It must be done so that it could be cleared neatly (grazed nicely but completely), and the cattle would not be bad, yet regrowth should not be like some 15 hectares are able to regrow and 6 or 7 would not go anywhere because I had them trodden down and squeezed out. You don't have to have it munched down entirely, just leave the pasture in a condition where regrowth can be started. I have the area grazed in partitions, and by the time I get back there is regrowth again. / In fact I try to get a certain area in every two or three days, in other words I go elsewhere all the time.

For the purpose of pasture maintenance, minimisation of unnecessary mechanical stresses was also found an important aspect, besides observing the number of livestock appropriate for the area.

4.4.2. Factors causing a decrease in biomass production of pastures

If you have the same area grazed all the time, it would be depleted and such plants that the sheep does not feed on will dominate. They can bear seeds and scatter them.

Levente Lajkó, shepherd

In the Hungarian regions fit for extensive livestock grazing there is a lot of land unexploited. Each of the herders asked what kind of factors cause a decrease in biomass production replied:

Pastures would be ruined and go wild most when there is no livestock on them. / It can also be deteriorated when I leave the puszta to go wild, do not manage it, do not graze it. / If it is not grazed, it will be overgrown with weeds. / If you give up grazing! My twenty odd years of experience as a bird watcher shows me that many bird species disappeared from this country and many plant species disappear because these areas are encroached by taller plant species.

In other words, herders see the primary cause of pasture degradation if pastures are not kept well by grazing animals, and thus sturdy weeds overgrow and suppress useful vegetation.

Thorn-bushes and thistles (Carduus and Cirsium species) come up and those briars are cut at high fuel prices with expensive power machines. If the livestock is there in due time when that thistle is still weak they would eat it up. Once they throw out their panicles [i.e. blossom], and bear seeds, none of them would touch it. / Sandy soils can be particularly quickly overgrown if they are not grazed. Whether parlagfű (Ambrosia artemisiifolia), or vaddohány (Asclepias syriaca), when they propagate in it, they would dry out sand so much, it doesn't matter how much rain falls afterwards: it can not be soaked again because it runs off.

The other reason mentioned for deterioration was overgrazing.

Overgrazing. Grass yields next year are not like when it is left to rest. / If it is chronically overgrazed. / And, if it is over trodden, it would be ruined just as well. / Because it is not left to regrow. Additionally, it is exposed to a number of livestock exceeding the carrying capacity of the pasture. Too much livestock. In other words, if it is overexploited. Too many livestock and overgrazing would overexploit the land, if it is not left to rest, it will not be able to regenerate. Vegetation can not re-form, because no time is left.

Electric fencing was also mentioned with respect to overgrazing.

For the vegetation it is better, when the area can regrow from time to time. If it is let grazed all the time, only certain plants will thrive. Those which the sheep do not like will be able to bear seeds, and then the pasture becomes infested.

Degradation may also be caused by rainy periods.



During the rain livestock makes harm to the soil. Treads out, threshes out even the good grass. / If it is walked in muddy weather on the same path, it would ruin the turf, but the human factor, the competence of the herder is an important factor here. I still find that degradation of the puszta might be due to inappropriate grazing, inappropriate men. Human factors were mentioned with respect to inconsiderate legislation too. First of all, human thinking. Who and how they approach it, who impede the things. It's just landscape conservation professionals who set up certain laws against the interest of landscape protection.

All in all, herders could identify three key factors causing degradation of pastures in Hungary: if a pasture is underutilised, overgrazed or trodden on in rainy weather.



Abel Mondr

Photo 4.3 Both overgrazing and abandonment can result in pasture degradation. *"Abandonment may cause the death of a good puszta. Puszta can be treated, given a massage forward. It's better than make it disabled later on. By abandoning grazing, we execute the death-sentence of the puszta. Then you can say what was left to us by the ancestors, we let get ruined,"* Lajos Elekes, cattle herder

4.5. Restoration of degraded ecosystem services

When I went to an abandoned parcel, it was just like a lettuce. But once the sheep grazed on them, they dunged it. The land and vegetation got nutrients so it started to convert slowly from lettuce to a juicy steak for that livestock.

János Szabó, shepherd

There are cases when herders get into an abandoned, weedy land with their livestock. In such cases you do not only need a single treatment; the land must be managed for several years. Many experiences were collected over the past 10 or 20 years in grazing such abandoned pastures.

One of the experiences was that parts running wild [i.e. weedy and full of litter] was not very well liked and grazed by the livestock. Further up, grass grew so high that sheep turned out of it [i.e. left it there while grazing]. It was very difficult to graze it, to get them there in the first place.

Highly grown, sturdy and thick stems are not preferred by the animals.

Some places, where they could not even be seen, the smaller ones. / First you had to get rid of vadrózsa (Rosa-bushes) and szeder (Rubus), in order to be able to begin. / Dry weeds were just

having trodden down by cattle. / Old growth, old reeds were broken out by the cattle, trodden, we have second growth now instead.

The livestock looks for the tender young shoots in the undergrowth.

They are willing to stay as long as they find [tender green shoots] among the old growth. / They search it out, the green ones. Thus, during the first stage of management on such an area we have them break as long as non-desirable plants are present. It is then that the area can really regenerate.

Once the grown up vegetation was trodden down, quality changed, because the livestock would manure it in the first place and also grazed on it. By that time grass would also grow better, more nutritious, then before. It would be fed up better and richer for the livestock. / Gramineous plants started to recolonise the ground like a velvet carpet. Next year you got a cleaner puszta, better quality because the type of grass otherwise suppressed has got room to grow.

The difference is clear, as the herders say: the areas involved in grazing have become a lot more nutritious, mixed in species and clean. From the conservation perspective the results cannot be neglected, either.

The Liliomos marsh at Királyhegyes was like that. It was never grazed. Now it keeps on changing beautifully. In three years time the two metres high gyékény (Typha)-stand was cleared out, stamped out up to the last bit. The edge of the reeds was also pushed back some 5–6 metres, now that the cattle stamped it out. Kosbor (Orchis) plants grew from nothing up to a couple of hundred stems. As a result of grazing, the pasture has become a lot cleaner, it's getting refreshed. / If cattle is let on it permanently, it would settle sooner or later [to a constant quality level]. Cattle would shit on it, tread on it, picking on it, gnawing at it. That's my opinion, the pasture is cleared up this way. In my mind cattle can be used to clear the pasture and improve it.

Besides grazing, manure and dung of the animals also has an important impact on vegetation.

It would shit and stale on it, it will exhaust [i.e.: overuse] it, you will see it. But just have a look at it a month later, what does this part look like. It's such a fierce green, you can't compare with the rest.

It is important to note that management of these areas is best implemented consciously, with forward planning.

There was a year when we got back to it earlier than usual. It was a much better yield. However, you still have to watch, well, up to now and not any further! When we reach a certain format: graze with the appropriate type of livestock for the proper period and with workmanlike competence. You'll get more out of it than using a machine.

In certain cases even the use of electric fencing is found to be appropriate.

However, if it [happens that] the livestock is entering the tussocks, three metre high reeds, which you would never be able to see, electric fencing is appropriate. In grazing with nature conservation purposes electric fencing has the benefit of better enclosing parts which are difficult to cover on foot, because you can't go after the livestock under such circumstances.

Re-started grazing has a beneficial effect on animals as well, not only vegetation. This was stressed by the herders just as strongly.

If there is an area which is important for nature conservation purposes, such as a marshland with lots of birds nesting, you would take the livestock there, it would graze only there from that time on and open water develops. If you give up grazing, everything will grow back and you did not achieve anything. / Well, after all it shits and stales it, and more birds went there. Wildlife has a cycle, which requires livestock.



The most important thing in restoring abandoned land is *to have it grazed, managed.* / *That is the core of it, the livestock. It would clear up and regain its former self.* / *The key to all the grazing would be continuity.*

Conclusion

It has been demonstrated herein that traditional Hungarian herders have a detailed and deep ecological knowledge about nature (Molnár 2012b, 2014; in France see Meuret & Provenza 2014). They know the habitat needs and biological properties of plants and animals living around them (Molnár 2012a). Their relationship with nature is substantially different from that of a common/lay man. They hold the view that they are part of nature. They learned the “science” of herding and the proper use of grasslands from their ancestors and parents and from their own experiences with the livestock and the pasture (Bellon 1996; Molnár *et al.* 2016b; Meuret & Provenza 2014). Using this knowledge they are able to manage and direct livestock to utilize grasslands effectively while preserving or even improving the productivity of their grasslands (Molnár 2014; Varga & Molnár 2014). Additionally, they can also effectively restore the temporarily abandoned and hence, degraded areas.

It has become clear that traditional land-use practices exercised by herders also contribute to the survival of a number of protected bird and plant species (Báldi *et al.* 2013, Haraszthy 2014). Shrubs, pioneer forests and invasive species may outcompete threatened species from areas where grazing has been abandoned.

In other words, traditional pasturing with herders is not an outdated activity at all. It has been and is still adapting to the ever-changing world (Oteros-Rozas *et al.* 2013; Molnár 2014; Molnár *et al.* 2016a). Such practices assist sustainable use of ecosystem services and the preservation of biodiversity, while herders contribute to produce excellent quality ecological meat products (Heikkinen *et al.* 2012; Varga *et al.* 2016). This is achieved through using a several thousand-year old culture (Kunkovács 2013), both preserving and at the same time developing it with adaptive practices.

The knowledge held by conservationists and herders is complementary in many respects (Kis 2011, 2012). As a result of the IPBES European and Central Asian Regional Assessment Dialogue Workshop, a series of dialogues have been started between herders and conservation professionals in Hungary. One of the key goals of these meetings was to achieve better cooperation and more efficient preservation of grassland diversity and ecosystem services. It is a timely issue both for nature conservation and animal husbandry. Ecological knowledge and experiences of herders may provide significant assistance in tackling a number of emerging problems (de Snoo *et al.* 2013; Babai & Molnár 2014; Haraszthy 2014; Babai *et al.* 2015). Highlights included the eventual amendment of national (i.e. Hungarian) and European Union legislation to avoid adverse impacts on the present and the future of both nature conservation and herding practices and animal husbandry (Nori & Gemini 2011; Babai *et al.* 2015). A new profession is in the making: that of the ‘conservation herder’ (Molnár *et al.* 2016a; Meuret & Provenza 2014). The conservation herder shall be an individual knowledgeable about herding and pasture management, trained in conservation and ecology, able to design management experiments, and develop novel but tradition-based management practices. As such, he/she could facilitate adaptation of extensive herding in the changing socio-economic environment.



Positive expectations for the future are well summarised in the following excerpt from a poem by one of our co-authors, cattle herder Tibor Fegyver:

*'Many a grey cattle turn out to graze again
With several hundred years of history
They withstand the rigours of weather
They are just like the herdsman
Who lived all through his life side by side the herd
Great respect ought to be given for this to him
A new generation will grow
Slowly diminishing in numbers
'Cause you have to be born a herder
And you have to love the livestock!'*

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5. High nature value seminatural grasslands – European hotspots of biocultural diversity

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Abstract

The goal of this short introduction to indigenous and local knowledge (ILK)-based mountain small-scale farming is to emphasize the role of ILK in maintaining and managing cultural landscapes and mountain biodiversity in an Eastern European setting. European Union and national regulations, as well as low average incomes often threaten this type of farming, while conservationists are working to help small-scale farmers maintain their livelihoods in these marginal landscapes.

5.1. Unique diversity in a rapidly changing socio-economic world

Semi-natural grasslands of the mountainous regions in Transylvania (Romania) are one of the most diverse but at the same time – due to the unfavourable social-economic changes and the conversion of the agriculture (intensification, abandonment) – the most endangered habitats in Europe (MacDonald *et al.* 2000; Cremene *et al.* 2005; Akeroyd & Page 2011; Dahlström *et al.* 2013; Öllerer 2013). The diversity of the plant, bird and butterfly species of the extensively used open habitats are outstanding in continental and global scale as well (Baur *et al.* 2006; Batáry *et al.* 2007; Csergő & Demeter 2012; Wilson *et al.* 2012; Turtureanu *et al.* 2014).

It is impossible to tell what a lot of fine coloured flowers are here; all are beautiful...

Traditional farmer living in Gyimes, Eastern Carpathians.

5.2. Ecosystem services

Extensive, traditional agricultural land use based on traditional, local ecological knowledge, supports high levels of biodiversity (Öllerer 2013; Csergő *et al.* 2013; Babai & Molnár 2014; Babai *et al.* 2015). Rural communities' long-term experiences and inherited, culturally transmitted local ecological knowledge have created an adaptive land use system, which is able to maintain high biological diversity (Babai & Molnár 2014; Biró *et al.* 2014). For the Transylvanian rural communities which follow traditional land use methods, the hay from the diverse, oligotrophic meadows have an extremely high importance in the animals' winter feeding (Babai & Molnár



2014; Babai *et al.* 2014). Because a sufficient quality and amount of hay production is crucial for local livelihoods, hay has become one of the most important ecosystem services in the Transylvanian mountainous regions, and the strongest driver to control the vegetation (semi-natural grasslands with high nature value). The meadows and their margins are habitats for several medicinal plants that still play an important role in the life of the local rural communities. The long-term and sustainable use of these ecosystem services work through complex ecosystem-based land use management systems which function not at the species but at the landscape and complex mosaic ecosystem level (Öllerer 2013; Biró *et al.* 2014; Loos *et al.* 2015). Additionally, the traditional and complex use of the landscape, and within this the meadows, help to sustain biodiversity at landscape and parcel scale as a valuable side effect.

5.3. Values and human well-being of traditional mountain farmers

The traditional and extensive farming creates a biologically diverse cultural landscape. It carries aesthetic, cultural (because it has been created by the ancestors with ‘hard work’, it is an inherited duty to continue farming), biological (*when the cuckoo sings we are rejoicing as well* – traditional farmer living in Gyimes, Eastern Carpathians), and economic (through direct ecosystem-services, e.g. hay) value for the local inhabitants. These values contribute directly and indirectly to the well-being of the rural communities (Tudor 2015). The aesthetic values which are formed by the traditional and small-scale farming practices and local products with high market values give further economic advantage to the region through rural (eco-cultural) tourism (Young *et al.* 2007; Kuemmerle *et al.* 2009; Hanspach *et al.* 2014).

5.4. Major trends in the landscape

During centuries of trial-and-error logic, the traditional ecological knowledge-based land use built up a dynamically changing, yet (with regard to the proportion of the main land use types) stable system throughout Transylvania (Fischer *et al.* 2012; Babai *et al.* 2014). The drastic economic, social (and political) changes in the 20th century led to the significant transformation of land use, particularly the intensification of the favoured and abandonment of the unfavoured areas (Kuemmerle *et al.* 2009; Öllerer 2013). Both processes result in the decrease of biodiversity and an important transformation of landscape structure. Due to the strict regulations of the EU, the local trade of milk products became impossible. In parallel with this, livestock numbers decreased to the level of self-subsistence, while mountainous pastures and the most extensively used and most diverse hay meadows became underused or abandoned (Sólyom *et al.* 2011; Demeter & Kelemen 2012). These processes are also well-known in Western Europe (MacDonald *et al.* 2000; Dahlström *et al.* 2013; Feest *et al.* 2014).

5.5. Traditional Small Scale Farming Techniques

Local farmers in the Gyimes region (Eastern Carpathians) “improve” their mountain hay meadows by:

- ▶ (1) mowing;
- ▶ (2) optimizing seed and biomass production (rotating the hay-cut of meadow parcels from season to season – the mowing-date rotation system found in Gyimes is a unique land-use practice that could greatly enhance biodiversity–land use microdiversity);



- ▶ (3) removing ant hills, mouse hills, stones and branches;
- ▶ (4) cutting the trees and bushes (i.e. clearing);
- ▶ (5) over-seeding with *Onobrychis viciifolia* or
- ▶ (6) application of hayseed from the barn (gaps of the vegetation cover caused by trampling, extreme drought are restored by scattering of hayseed);
- ▶ (7) manuring on certain parcels;
- ▶ (8) manual thinning of unwanted plants;
- ▶ (9) suppression of mosses;
- ▶ (10) small-scale drainage.

We hypothesize that these practices, especially the application of hayseed and parcel-rotation increases the diversity of mountain hay meadows (the species number of manured and non-manured meadows does not differ significantly). We argue that local people have wide-ranging knowledge on ecological processes (species, habitats, vegetation changes); they are aware of the effects of their daily farming activities on vegetation. This extensive, labor-intensive farming is able to maintain the diversity of HNV semi-natural grasslands in the region.

5.6. Drivers of change

The regime shift from protectionist socialism to capitalism was followed by economic crises, which led to huge range of unemployment in Romania (Reif *et al.* 2008; Kuemmerle *et al.* 2009; Huband & McCracken 2011; Mikulcak *et al.* 2013). In the mountainous regions, the extensive farming was the only livelihood opportunity which created/maintained workplaces and values in the marginal mountainous communities (Reif *et al.* 2008; Kuemmerle *et al.* 2009; Tudor 2015). After joining the EU, due to the strict rules of milk production and sale, and the cancellation of the quota-system, the situation of the small-scale farmers became even more difficult, with the agro-environmental subsidy their only remaining income (Loos *et al.* 2015). This became the key driver in maintaining the farming methods that preserve this huge cultural and biological diversity.

5.7. Future prospects

Interviews undertaken in February 2016 after the ILK Dialogue Workshop revealed that the farmers judge the profitability of extensive farming to be worse than ever. Selling the products (mainly meat and milk) is almost impossible, and most of the farmers would like to get rid of their animals. Therefore the price of the livestock decreased to a quarter of its value within a year. Gossip about the cease of the subsidy system after 2020 also does not improve future possibilities. The next generation that grew up on small-scale farms is unwilling to work on the farmlands for such a low income (Biró *et al.* 2011). Due to the migration of the youth, the proportion of the abandoned grasslands and forest areas, which are rich in natural and cultural values, is expected to grow (Demeter & Kelemen 2012; Hartel *et al.* 2014; Mikulcak *et al.* 2015).



5.8. Policy recommendations

Reconsidering the allocation of the agro-environmental subsidy and implementing a more effective supporting system would help the small-scale, thus less viable farms, which nevertheless are biodiversity hot spots (Hanspach *et al.* 2014; Sutcliffe *et al.* 2015; Babai *et al.* 2015). Furthermore, it is essential to support methods that are proven to increase biodiversity, such as the application of hayseed, grazing of hay meadows (aftermath) in autumn, parcel rotation (to ensure seed ripening) (Babai *et al.* 2015). According to farmers it would be necessary to also reconsider those rules and procedures which are often contradictory and make farming harder or even impossible (e.g. fresh milk must be cooled to 4°C in one hour, to avoid the maximum germ count 100,000/ml milk, somatic cell count 400,000/ml at 30°C – these rules are impossible to carry out in a mountainous cultural landscape, like Gyimes in Eastern Carpathians and as a result milk has become unsellable); and to moderate the bureaucratic burden (Niedrist *et al.* 2009; Babai & Molnár 2014; Loos *et al.* 2015; Babai *et al.* 2015).

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6. Rangers bridge the gap: Integration of traditional ecological knowledge related to wood pastures into nature conservation

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Introduction

A new opportunity and, at the same time, a new challenge has unfolded for nature conservation in the past few years: to enhance the efficiency of conservation management through the use of traditional ecological knowledge (TEK) in strategic and practical decision-making (Berkes *et al.* 2000; Hernández-Morcillo *et al.* 2014; Sutherland *et al.* 2014). This approach is ensured by four fundamental and functionally interlinked elements of TEK: general knowledge (information on both the living and non-living components of the natural environment), practice (practical knowledge and experience), belief and cultural value (including social context) and traditional ways of learning (individual and social knowledge transmission between generations) (Berkes 2008; Berkes *et al.* 2000; Turner *et al.* 2000; Whiteman and Cooper 2000; Molnár 2014). The reason TEK is able to improve the efficiency of conservation management is that it assists conservation with a dynamic approach embedded in local situations (Whiteman & Cooper 2000; Molnár *et al.* 2008; Schmitz *et al.* 2012). Conservation management projects with the aim to use TEK were conducted in recent decades at a number of locations worldwide (Hunn *et al.* 2003; Ens *et al.* 2015), but success is still far from complete (Nadasdy 1999; Ween & Riseth 2007; Padilla & Kofinas 2014; Pooley *et al.* 2014).

Although there are a growing number of ‘best practices’, implementations often are prevented by several factors (Heikkinen *et al.* 2012). These include, inter alia: that the traditional and the Western scientific knowledge systems are different (Berkes 2008); TEK frequently holds information on species other than those conservationists intend to protect (Bíró *et al.* 2014); in many communities, TEK has eroded to a great extent, and today it exists only as a memory rather than practice (Benz *et al.* 2000; Bürgi *et al.* 2013); local populations were often chased away or forced to migrate from their home territory as a result of ‘fortress’ conservation practices, and TEK disappeared with the local people (Adams & Hutton 2007; Riseth 2007); in many cases, only the easy-to-integrate TEK elements, such as general knowledge or practice were incorporated in conservation management (Reo 2011); due to changing socio-economic and

ecological environment the adaptiveness of TEK could also change (Fernández-Llamazares *et al.* 2015). Another important factor is that governments are not taking seriously the use of TEK in conservation policy, management and education despite of the recognition of the importance of traditional farming (EC 2014). Many authors also argue (Nadasdy 1999; Berkes *et al.* 2000) that ethical and effective application of TEK requires a holistic approach, with emphasis on simultaneous usage and preservation of knowledge, practice, belief and learning.

From a conservation perspective, the use of TEK is particularly important in the case of those habitats of the cultural landscape that are created and maintained by local people (e.g. mountain hay meadows and wood pastures) (Anderson 2005; Babai & Molnár 2014). Cultivation of such habitats requires a substantial amount of manual labour, personal attention and care, including traditional management methods (Oteros-Rozas *et al.* 2013; Varga & Molnár 2014). These factors have contributed to their increasingly frequent abandonment throughout Europe (Schmitz *et al.* 2012). Today, nature conservation agencies are playing an active role in the management of these habitats, and decisions made by conservationists have a growing level of influence in addition to TEK-holders such as farmers and herders.

Our research focused on TEK related to wood pastures, a habitat associated with high natural and economic values in Europe and shaped over hundreds or thousands of years by humans (Bergmeier *et al.* 2010). During the past 100 years, changing socio-economic relations resulted in the dramatic deterioration of the extent and use of wood pastures across Europe (Johann *et al.* 2012; Hartel & Plininger 2014a). For this reason, active nature conservation management is of growing importance.

We would expect that conservation management is based on TEK in the habitats of the cultural landscape such as the wood pastures. Although quite often this is the case (Hirschnitz Garbers *et al.* 2011), in many places the recognition of TEK is only written down and not practiced. Conservation management practices (e.g. mulching hay meadows, shredding shrubbery), is often fundamentally different from traditional practices (Holl & Smith 2002). In addition to the reasons listed earlier, the values and working methods of conservationists are important factors: top-down and science-based decision-making systems dominate. Conservation managers are exposed almost exclusively to Western science in the course of their studies (Primack 2010), and the ability of TEK-holders to protect their rights and advance their own interests is relatively low (Heikkinen *et al.* 2012).

Research on traditional ecological knowledge has predominantly documented the TEK of TEK-holders (Babai & Molnár 2013; Oteros-Rozas *et al.* 2013; Hernández-Morcillo *et al.* 2014). We argue the importance to examine the relationship of TEK not only to those communities that preserve and provide local knowledge, but also to those with the potential to receive and use it. In relation to nature conservation management, the key recipient groups are rangers and national park conservation officers (Lewis 1989; Robinson & Wallington 2012).

We conducted interviews with stakeholders who interact with wood pastures, including herders and conservation managers (officers and field rangers). Traditional ecological knowledge about wood pastures and their management was collected and analysed. The knowledge held by conservation managers was compared to the traditional knowledge of herders working on wood pastures. In the present paper, we focused on the following questions:

- ▶ Can conservation managers be differentiated from each other and from herders based on their TEK related to wood pastures?
- ▶ If so, which elements of TEK are most different and to what extent?
- ▶ What lifestyle factors determine successful use of TEK by conservation managers?



6.1. Methods

6.1.1. Study area

Our studies were conducted in Hungary (East-Central Europe, Pannonian biogeographic region) in Baranya, Veszprém, Szabolcs-Szatmár-Bereg, Borsod-Abaúj-Zemplén, Békés, Győr-Moson-Sopron, Vas and Zala counties. In these regions wood pastures are characterized by oak, hornbeam and beech trees (Bölöni *et al.* 2008).

Wood pastures are the basis for traditional silvopastoral husbandry and constitute an integral part of the cultural landscape across Europe (Bergmeier *et al.* 2010; Hartel *et al.* 2013; Hartel & Plininger 2014a) (**Photo 6.1**). They were created from dense forests centuries or millennia ago (Rackham 1998). They consist of a mosaic of grasslands and trees or groves that are utilized mainly for grazing. Acorn- and fruit-bearing trees are quite common on wood pastures. In order to maintain the required mosaic-like pattern in certain parts of the wood pasture, colonizing trees must be removed, while in other areas, the regeneration and survival of young trees needs to be secured (Bugalho *et al.* 2002; Oellerer 2014; Varga & Molnár 2014). Historical and current socio-economic environments have strong influence on the extent and quality of wood pastures (Hartel & Plininger 2014b). The primary conservation values of wood pasture are best represented by ancient solitary trees, high levels of biodiversity, and continuation of traditional land-use (Manning *et al.* 2006; Bergmeier & Roellig 2014).

Utilization and extent of wood pastures in Hungary were significantly reduced in the past 50 years as a consequence of the suppression of traditional land-use practices. No more than 5500 ha wood pastures have survived (Bölöni *et al.* 2008), and only half of this area is being used. About 30% of these 5500 hectares are under protection, and 30% is designated as a NATURA 2000 area. These two areas (the protected areas and NATURA areas) partially overlap. The official nature conservation agency conducts wood pasture management directly in the main part of the protected areas and through administration of leases to resource users, including herders. NATURA 2000 is a European Union wide coordinated network of nature protected areas. The emphasis on the area that is part of the NATURA 2000 network will be on ensuring that future management is sustainable, both ecologically and economically, and to support traditional farming practices and give due recognition to the farmers involved (EC 2014).



Photo 6.1 Hungarian Grey Cattle, an ancient traditional breed, is grazing in an oak dominated wood pasture near Cserépfalu village. This area is managed by the Bükk National Park.

6.1.2. Stakeholder groups

Three stakeholders groups were investigated:

- ▶ conservation officers of national park directorates,
- ▶ field rangers of the national parks, and
- ▶ traditional herders (Table 6.1).

Hereafter, 'conservation managers' refers to both conservation officers and field rangers.

Traditional herders were identified as people who are currently engaged in traditional pasture-based livestock husbandry, or had been engaged in these activities for a long period of their lives. They earn or had previously earned a living from pastoralism and consider the long-term sustainability of pasturing and grassland use in the course of their work (Varga & Molnár 2014; Molnár 2014).

Field rangers are employed by the nationwide network of the Nature Conservation Guard, overseen by the National Park Directorates (KvVM 2009), and have been educated as forest and nature conservation engineers, agronomists, biologists, and ecologists. On average, each ranger operates within an area of approximately 400 km². Rangers are responsible for the preservation of the legally-protected natural values in his/her territory. Rangers inform higher authorities, and also directly manage and make decisions in the implementation of conservation management. For example, rangers decide where herds are driven or which tree species should be left standing when the wood pasture is restored.

Conservation officers (ecological, botanical, zoological experts) work in public administration (headquarters of national parks) and have been educated as biologists, ecologists, forest and nature conservation engineers, and agronomists. They conduct work within their respective fields of expertise. Their duty is to verify compliance with the legal statutes and conduct botanical and zoological monitoring in protected and NATURA 2000 areas, as well as to prepare and approve management and maintenance plans for the national parks.

6.1.3. Data collection

As a preliminary study, 76 semi-structured interviews and 60 days of participatory observation were conducted between 2008 and 2013 with conservation managers and traditional herders engaged in wood pasture management (Newing *et al.* 2011; Varga & Molnár 2014). Based on this research, a structured questionnaire was compiled, consisting of 50 questions for systematic data collection. The questions in the interview focused on four elements of TEK:

- ▶ general knowledge of wood pastures ('Knowledge');
- ▶ practical experiences related to the management of wood pastures ('Practice');
- ▶ belief and cultural value to wood pastures ('Belief');
- ▶ ways of acquiring knowledge about wood pastures ('Learning').

The interviews were conducted in February and March of 2014. Sixteen independent variables were gathered from each informant about their education, experiences and other lifestyle attributes that were expected to affect their knowledge related to wood pastures (Table 6.1).

In-depth structured interviews were conducted with 12 herders, 19 rangers and 18 nature conservation officers. The number of informants was limited due to the low number of people engaged in wood pasture use and management. Conservation managers (field rangers and officers) worked for the Balaton Uplands, Danube-Drava, Danube-Ipoly, Kiskunság, Körös-Maros, Aggtelek, Bükk, Hortobágy, Órség and Fertő-Hanság National Parks. Herders worked within the territories of the Balaton Uplands, Danube-Drava, Danube-Ipoly, Kiskunság, and Aggtelek National Park Directorates.



Table 6.1. Variables of conservation officers (18), rangers (19) and herders (12).

Independent Variables	Officer	Ranger	Herder
Continuous			
Age (years, mean \pm SD)	41.11 \pm 6.29	44.05 \pm 7.13	50.75 \pm 16.32
Years in occupation (years, mean \pm SD)	14.17 \pm 6.03	13.47 \pm 6.56	40.33 \pm 21.22
Dummies and ordinals			
University graduation (%)	100	100	8
<30% of worktime spent in the field (%)	78	21	0
30–50% of worktime time in the field (%)	22	32	0
>50% of worktime in the field (%)	0	47	100
Childhood spent in the area (%)	55	68	67
Living in the area at time of interview (%)	5	63	100
Practicing livestock husbandry as a child (%)	0	21	100
Childhood memories of livestock husbandry (%)	16	63	100
Engagement with livestock husbandry (%)	0	21	100
Conducting active conservation management (%)	39	74	100
Knowledge of a second language (%)	83	68	25
Interest in traditional heritage activities (%)	67	47	50
Reading scientific literature about wood pastures (%)	44	53	25
Reading management literature about wood pastures (%)	78	89	58
University studies about wood pastures (%)	5	0	8

6.1.4. Data processing

A scoring system was developed in order to quantify the amount of traditional ecological knowledge possessed by informants. The main principles of the scoring were whether the answers were dominated by traditional ecological knowledge and emphasized the interest of livestock and herder in the management or focused on the conservation of biodiversity and were based on scientific knowledge. Scores ranged from 0 to 3. Three points were assigned when the reply was relevant to livestock husbandry and was rich with TEK, two points when the reply was only partly relevant and less rich in details, one when the reply was not so relevant and not rich with details, and no points were assigned if no answer was given or the reply was not relevant to livestock or TEK. In certain cases, only 2 or 3 responses were observed (e.g. in Yes or No type questions). Each of the questions were evaluated and the scores related to the four TEK elements were summed for a total value. For the purposes of evaluation, TEK documented during previous research (Molnár 2014; Varga & Molnár 2014) and ethnographic studies (e.g. Takács 1986; Andrásfalvy 2007) served as a basis for comparison. Descriptive statistics were used to analyse the variables for the three stakeholder groups, scores of the four TEK elements and the total TEK score.

6.2. Traditional ecological knowledge of herders, rangers and conservation officers related to wood pastures

Answers to the 50 questions of the questionnaire showed differences between herders, conservation officers and rangers (**Figure 6.1**). Herders stated that grass quality, livestock carrying capacity and the role in livelihood of the wood pastures are the primary values of wood pastures (emphasized by 92% of the herders). The role of the trees was seen exclusively as provision of shade, fruits and acorns (100%). Oak and wild pear were seen as the most valuable tree species (76%). The purpose of management was to maintain the pasture (100%). All herders (100%) were able to talk about management methods extensively, ranging from clearing thickets up to various ways of pasturing. Clearing of bushes was argued to ensure the possibility for grazing (58%), but more recently because it has also become a criterion for receiving subsidies (42%). Saplings were left over in each site case or even planted proactively (100%). When selecting which individuals should be spared, the function of the tree and the growth form of the individual were taken into account (76%). These trees were mainly protected by thorny bushes and were consistently supervised by the herders (92%). Dead old trees were removed from the grazing area (84%). Herders usually consulted with elderly herders on the use of the pasture (92%) and also said they consulted with the livestock in order to meet their needs (92%). The majority of the herders had started herding young and learned herding practices from an elder (84%). Herders were familiar with plants within the wood pastures, and referred to them by traditional vernacular names (100%). Herders also demonstrated a variety of traditional world-view elements and superstitions related to livestock husbandry (84%) (**Figure 6.1**).

In addition to their conservationist perspective, rangers described the preservation of traditional land-use practices as an outstanding value related to wood pastures (40%). They predominantly highlighted the economic values of the trees on the wood pastures (e.g. shade, acorns, wild fruits) (45%), but they also mentioned their conservation value (35%). Oak and/or wild fruits trees were considered to be the most useful tree species (95%). Both conservation and economic values were mentioned as the goals of wood pasture management (70%). The leaseholder, the livestock, and weather were all thought to be important, but not as important as the conservation values in the development of conservation management plans (42%). Weather and livestock were mentioned (50%) as important factors in determining the date in spring when animals are driven out to pasture and the date in autumn when they are driven back to winter quarters, in addition to adherence to tradition and compliance with conservation laws. Grazing under the supervision of a herder was seen as a better option than pasturing by electric fencing (40%) and they tried to promote the former. Clearing of bushes was identified as important for conservation (50%) as purely for grazing (20%), or because of rules pertaining to subsidies (30%). Both the function of the species and the growth form of young trees were said to be important during the selection process (40%). Attempts were made to preserve dead old trees (85%), and rangers only approved felling them when they threaten tourists. Management options were discussed primarily with colleagues, authorities or not at all (65%). They most often met herders in the fields during herding (55%). Some of the rangers were on friendly terms with local herders (25%). Many rangers collected traditional ecological knowledge intentionally (40%). They usually did not know traditional herder's days, some mentioned the best known traditional festivals: Saint George's Day (for driving livestock out to pasture) and Saint Michael's Day (for driving livestock back) (30%). Many knew traditional vernacular plant names (65%), albeit only superficially. Superstitions regarding the protection of livestock were usually not known by them (90%).

Fifty-two percent of conservation officers focused exclusively on biodiversity as the value of wood pastures. Trees of the wood pasture were valued for conservation value with a general pasturing value (70%). Conservation officers described exclusively conservationist considerations when asked about the goals of wood pasture management (56%), such as maintenance of open habitats and repression of ecological succession. Legal provisions and nature conservation guidelines were advanced as fundamental management principles (76%). Sixty-seven percent of them had no or only general information about the management of wood pastures and focused only on



nature conservation laws and regulations. Conservation officers said that they would select trees for sparing based on their shape and location (50%). Most officers did not think protection of young trees from grazing was important in any way (64%). They would make efforts to preserve dead old trees in the area (88%) and would approve felling only when tourists were threatened. They conducted discussions with authorities, experts and the colleagues at the national park directorates in the course of developing management or maintenance plans (60%). Many officers reported that they do not meet herders, and those that did, primarily during inspection visits (40%) or biological field work (54%). Most of them knew nothing of traditional herder's days (94%), and they were unfamiliar with superstitions related to livestock husbandry (94%).

Based on the four TEK elements and TEK as a whole, conservation officers, rangers and herders differed from each other (**Figure 6.1**). Officers and herders had the lowest and highest overall scores, respectively, both in terms of the four TEK elements and in terms of the total sum. The TEK of the rangers fell between the two groups in all of the cases. Rangers had the highest variability for all four elements of traditional ecological knowledge.

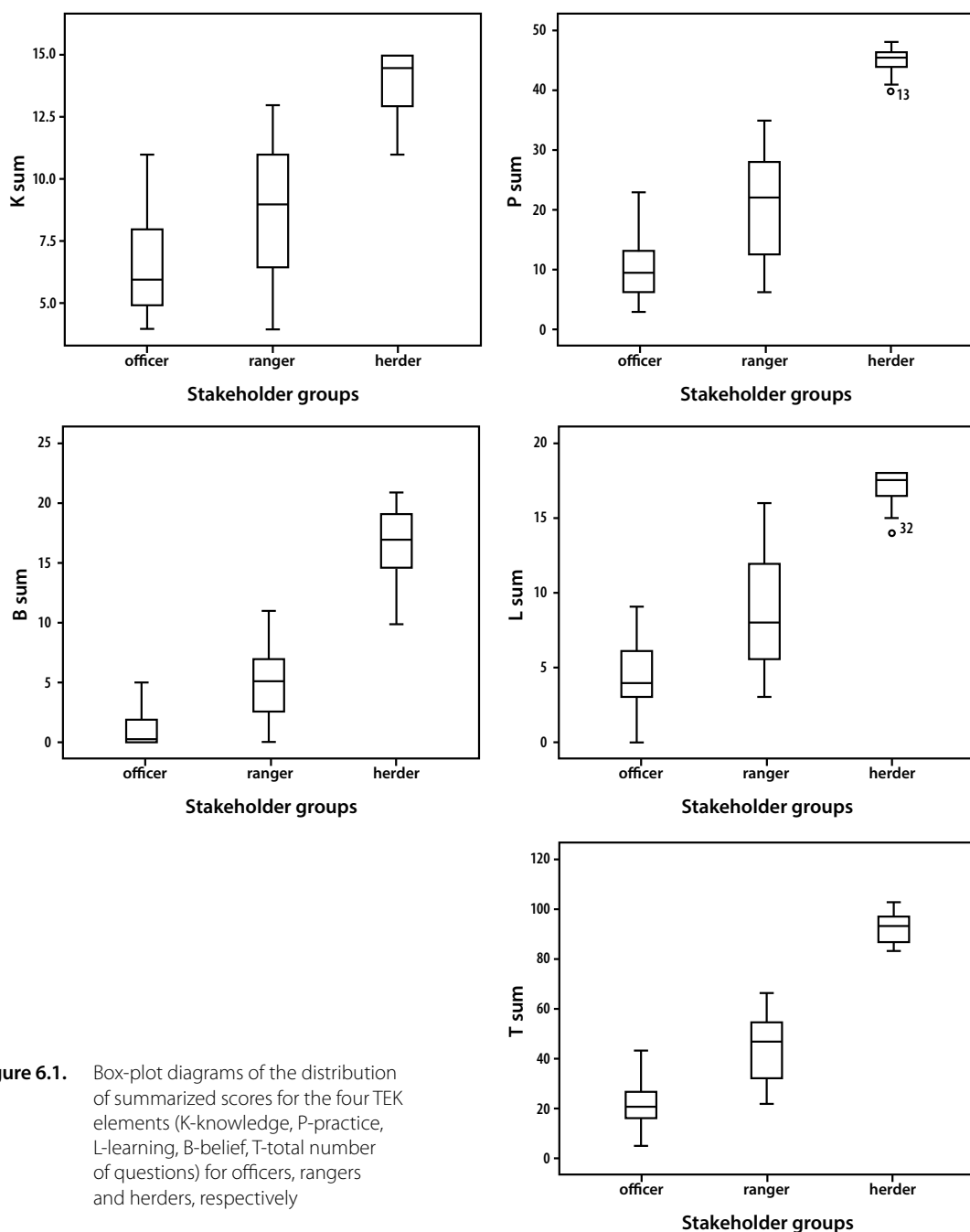


Figure 6.1. Box-plot diagrams of the distribution of summarized scores for the four TEK elements (K-knowledge, P-practice, L-learning, B-belief, T-total number of questions) for officers, rangers and herders, respectively

Photo 6.2 Tükrös (mirror box, in Hungarian – Magyargencs, Hungary, made in 1840). A traditional world view – expressed in pieces of folk art – constituted an integral part of traditional ecological knowledge. (Varga & Molnár 2014)



Hungarian Museum of Ethnography,
Inventory number: NM 1.149.69

6.3. The role of rangers in bridging the gap

The three stakeholder groups managing wood pastures (herders, conservation officers and rangers) differed in the amount of traditional ecological knowledge they possess. Herders had the highest amount of TEK; knowledge of the two conservation manager groups differed both from that of herders as well as from each other's. It was not surprising that the value system and the knowledge held by various stakeholder groups differed, similar results are reported by Andersson *et al.* (2007) for Sweden, Buijs and Elands (2013) for Netherlands, and de Koning *et al.* (2014) for Western Europe. Also, it was not unexpected that conservation managers held a predominantly biodiversity-centric view, while herders saw the world in a more holistic way with 'livestock' at the center (Roba & Oba 2009; Knapp 2009). However, the strong difference between the two conservationist groups (officers and rangers) was unexpected. Although rangers had smaller amount of TEK than herders, it was significantly higher than that of conservation officers, both in terms of the overall picture and in terms of each TEK element. It should be noted that herders did not achieve perfect scores for overall TEK or for the four elements. In Hungary, as in other parts of Europe, TEK is changing and diminishing at a high rate (Oteros-Rozas *et al.* 2013; Molnár 2014).

Our results highlighted a crucial, but not well-documented issue related to the use of traditional ecological knowledge into conservation. While the scores for 'Knowledge' were relatively high for both conservation officers and rangers, the score for 'Belief' was close to zero among officers, and rangers showed a similarly low score. This indicates that the 'Belief' element of TEK has been more difficult to integrate into nature conservation issues than lexical knowledge or practice (Berkes 2008; Nadasdy 1999; Reo 2011). The use of the practical element of TEK was more frequently observed among rangers. A similar situation is documented for rangers conducting fire management in an Australian national park (Lewis 1989). We found that rangers had higher scores for traditional learning than officers. This may indicate rangers' ability to combine different knowledge systems (Tengö *et al.* 2014). In Hungary (as in many other parts of the world) conservation management and ecology courses do not provide support for TEK. These courses focus mainly on the protection of biodiversity by applying Western-science-based methods and practices (Saunders *et al.* 2002; Pásztor & Oborny 2007; Primack 2010). Our results suggest that rangers may be able to bridge the gap between Western-science-based conservationists and herders pursuing traditional pasturing.

There are a number of examples of cooperation between local people and official nature conservation administrations (Borrini-Feyerabend *et al.* 2004; Bohensky & Maru 2011; Berkes 2008; Robinson & Wallington 2012). However, the underlying factors determining TEK utilization by conservationists are not well understood (Bohensky & Maru 2011). We found that the key factors for successful use of TEK related to wood pastures by conservation officers and rangers were similar to the traditional ways of knowledge acquisition and maintenance among indigenous and local communities (e.g. time spent in nature, role of parents and experiential knowledge transmission (Berkes *et al.* 2000; Oteros-Rozas *et al.* 2013; Iniesta-Arandia *et al.* 2015). In our research case, rangers spent an average 74% of their working hours in the field, while officers only spent 39%. In our study, the main factors for success were living in the area, spending considerable time in the field, childhood memories of and recent engagement in livestock husbandry. All of these may support local ecological 'embeddedness', of which the importance for resilience of natural

resource management was emphasized by Whitmann and Cooper (2000), as well as Knapp and Fernandez-Gimenez (2009).

The 'Practice' element of TEK was determined based on our own experiences. We argue that engagement in every-day practical management of wood pastures enhances the efficiency of TEK utilization through the hands-on experiences gained during management. The development of rangers' TEK corresponds to the crisis learning methods described by Berkes and Turner (2006). Seventy-four percent of the rangers interviewed applied traditional land-use practices as a form of adaptive conservation management (e.g. grazing, clearing of bushes) in the areas they managed (Photo 6.2).

We found that one of the main determining factors of 'Learning' and maintaining TEK was the local social and cultural context (Agrawal 1995; Eraut 2004; Berkes 2009). This was shown by the effect of childhood memories and connection to locality. More time and more interaction with local herders could enhance social connections and increase possibilities for knowledge transmission (Rodela 2011; Iniesta-Arandia *et al.* 2015). Conservation officers have a lot less opportunity to meet herders, and when they do, these meetings are related to official matters. Traditionally, an elderly guide, teacher, or community plays an important role in transferring TEK to the younger generations (Folke 2004). Due to the erosion of TEK in the changing socio-economic and ecological environment, opportunities for such encounters are expected to diminish further in the future (Schmitz *et al.* 2012; Oteros-Rozas *et al.* 2013; Fernández-Llamazares *et al.* 2015). Traditional worldviews are even more vulnerable as they cannot 'reach' people who do not meet TEK-holders on a regular basis (Berkes 2009). We found that 40% of rangers intentionally study traditional knowledge on the use of wood pastures. Hence they have a personal, mentor-like relationship with one or more highly-knowledgeable local TEK-holders. A mentor-apprentice relationship is not simply a way to gain TEK and embrace a local worldview (Barnhardt 2005; Reo 2011), it also improves communication and knowledge transfer between conservationists and local communities (Bohensky & Maru 2011; de Snoo *et al.* 2013; Fazey *et al.* 2013). Furthermore, these kinds of relationships may promote the strengthening of bottom-up initiatives and increase the conservation responsibilities of local people (Mills *et al.* 2014).



Anna Varga

Photo 6.2 Most of the Hungarian national parks do wood pasture management. They are organized by the local rangers as a form of adaptive conservation management (e.g. grazing, clearing of bushes) in the areas they managed. They use traditional ecological knowledge and sometimes they work with the local herders together on the management plan.

Conclusion

Socializing with herders, spending time in the field, practicing livestock husbandry, and spending one's childhood in a traditional community are important in the development of TEK. All of these factors increase the possibility of social learning and knowledge transfer.

We argue that the fundamentally different ways of learning within traditional and scientific knowledge systems provide presents an alternative for Western-scientific pedagogy. Use of traditional learning methods would be of paramount importance for training conservation managers (Kimmerer 2002; Lemus *et al.* 2014). Based on our results we argue that rangers may play a key role both in keeping TEK alive and in adapting it to prevailing conditions as 'brokers' between local people and government officers (Lewis 1989; Tengö *et al.* 2014). This may be particularly necessary in those areas where traditional land-use is applied or required as a form of nature conservation management (Gugić 2009; EC 2014).

The gap between traditional local communities and government conservation approaches could be bridged and conservation management and decision making could become more efficient if rangers have possibility to learn, adapt and use TEK during their work. Besides TEK holder rangers could have a consultant role between local people and conservation officers and enrich the adaptive capacity of the traditional ecological knowledge.

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7. Reindeer husbandry in the boreal forest: Sami ecological knowledge or the science of “working with nature”

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The following article is based on a 15-minute film in which three Sami reindeer herders from the Sirges community, Jakob Nygård, Lars-Evert Nutti and Mats-Peter Åstot, reflect on nature's functioning and diversity and reveal the knowledge they have acquired from thorough daily observations of reindeer herds and boreal ecosystems.

These filmed interviews were recorded on 7–9 January 2016 in the Jokkmokk area, northern Sweden, and were shown at the IPBES/Europe & Central Asia Indigenous and Local Knowledge Dialogue workshop on 11 January 2016. The quotes included in this paper are taken from these interviews. The film is available at www.canal-u.tv/video/smm/working_with_nature_sami_reindeer_herders_and_biodiversity_in_the_boreal_forest_2016.21465. During the interviews herders were asked to describe the reindeer husbandry annual cycle, their use of the different habitats, and the value of these habitats for grazing and potential threats. They were also asked about possible changes they had observed, and the origin and the consequences of these changes for their activity.

This short film, and the paper herein, do not seek to cover all aspects of the close relationship between reindeer husbandry by the Sami people and nature. They focus on the boreal conifer forests where reindeer graze during winter season. These are the most unsecured grazing areas due to other land uses, mainly forestry, and more recently climate change, and consequently this is the most difficult sequence of the annual herding cycle.

7.1. Introduction to Sami reindeer husbandry

This paper examines Sami herders' ecological knowledge and their use of forest pastures for reindeer (*Rangifer tarandus tarandus*) grazing during wintertime in northern Sweden (Box 7.1). It is based on fieldwork, participant observation and interviews carried out in the Sami community of Sirges, northern Sweden (Figure 7.1) since 2007. The study of indigenous ecological knowledge, the complex arrays of knowledge, know-how, practices and representations that guide human

societies in their innumerable interactions with the natural milieu, represents an important interdisciplinary field shared by anthropologist and ecologists, working closely with local communities. Indigenous knowledge has a number of distinctive features, among which the following are of particular interest in the context of this paper:

- ▶ a holistic approach;
- ▶ a strong empirical knowledge component;
- ▶ it is cumulative and open to change;
- ▶ it has a management practice component; and hence
- ▶ it is always embedded in a specific socio-cultural context (Berkes 1999; Posey 1999).

Box 7.1. Sami people in Sweden

The Sami are the Indigenous people of northern Fennoscandia. Sápmi, the land of the Sami people, extends over four different countries: Norway, Sweden, Finland and Russia, where there are about 80,000 to 100,000 Samis. First hunter-gatherers, fishermen and then herders, the Sami culture has always been in close connection with reindeer (*Rangifer t. tarandus*). For hundreds of years, the Sami have conducted reindeer husbandry, which has been the basis of their livelihood through the ages. Reindeer husbandry is still one of the most important aspects of the Sami culture, and the basis of the Sami's land rights. It is ruled by the *Reindeer Husbandry Act*, which gives the right to the Sami to use the land within their community. Hence reindeer graze indifferently within public or privately owned lands. In Sweden, reindeer herding is conducted on about 40% of the land, where about 4,600 reindeer owners (60% of men and 40% of women) manage ca. 250,000 reindeer. Reindeer husbandry is the main income source for about 2,500 herders grouped in 51 reindeer herding communities in Sweden. Today, a reindeer herding community or *čearru* (also called *sameby* in Swedish meaning Sami village) is defined as a geographic entity delimiting the grazing areas and an economic organization representing its members' interests. In addition, a herding community also refers to a community in the more traditional meaning, i.e. the herders and their families, who share the land and collaborate during many essential activities. The reindeer migrate within each community's territory between pasture areas, from the mountains and forests in the west during the summer, down to the forests in the east during the winter.

During the wintertime, reindeer mainly graze in the conifer forests where they feed on ground reindeer lichens (*Cladonia* spp.) and arboreal lichens (*Bryoria fuscescens* and *Alectoria sarmentosa*). A key feature of reindeer grazing in winter is that they have to dig through the snow to reach the lichen. Snow depth and the nature of snow cover, its density and hardness, even the presence of ice are thus key factors that influence the quality of grazing, reindeer survival and reproduction. As shown by Roturier and Roué (2009) the herders' definition of pasture, *guohtun* in Sami, is not restricted to the mere presence of a suitable lichen community for grazing. It also conveys the notion of accessibility: is it possible at a given time for reindeer to access the lichen under the snow layer? Even though the ground might actually be thickly covered with lichen, when the reindeer cannot dig through the snow to gain access to the lichen, there is no *guohtun*, i.e. no reindeer pasture. The concept of pasture in Sami is thus dynamic. The same pasture can exist or disappear, depending on the different factors playing in snow metamorphism (**Photo 7.1**).

During winter, the collective herd is split into smaller herds belonging to groups of families, called winter-groups or *siida*. This is a seasonal adaptation to the fact that winter is the most difficult period for grazing and represents a bottleneck in the annual cycle. Each winter group has their own specific grazing area that is known and respected by others. Even though there are no





Figure 7.1. Location of the Sirges reindeer herding community within Sápmi

visibly marked borders, the winter grazing area of each community is sub-divided by a coherent network of invisible borders that delimit each group's access rights for winter grazing. Because of the limited availability of winter pastures, the use of another group's territory is not tolerated under normal conditions.

Reindeer winter grazing therefore necessarily requires a holistic understanding of animal behaviours, ecosystem functioning and social relationships, that is the core of the herders' ecological knowledge. The first part of this article is dedicated to nature's benefits to Sami reindeer husbandry and is thus particularly relevant to chapter 2 of the Europe and Central Asia regional assessment. The second part deals with the status and trends of the main resources used by Sami herders and thus particularly concerns chapter 3. The third part will be of special interest for chapter 4 devoted to drivers of change. The last part brings up issues of governance, which is the matter of chapter 6.



S. Roturier

Photo 7.1 In the short film "The Science of Snow" (length: 2 min 48), Mats-Peter Åstot details the factors that influence snow metamorphism (Roturier & Roué 2015).

7.2. "Working with nature"

7.2.1. Reindeer husbandry relies on diversity

Reindeer husbandry is based on an annual cycle that includes migrations between seasonal pastures. Although Sami people have abandoned the 'real' nomadic way of life where the herders were moving the year round with the herd, reindeer herds are still constantly moving and grazing within and between seasonal pastures. Thus they require a large variety of habitats and rely on diversified ecosystems depending on the seasons: dry lichen-rich pine-heath, conifer forests, mires, subalpine birch forests, grasslands, and alpine tundra, etc.:

Depending on the time of the year, all grazing areas are important. There is no area that is not important. All the areas make a whole because reindeer use all the land, at different periods of the year. You cannot fully remove one of the grazing areas, otherwise the other ones fall down.

That is why free ranging is sensitive and a bit special. You can graze from the high mountain area to the coast, and in between, all the areas are vital because they are used at different seasons.

Jakob Nygård, Sami reindeer herder

For all the reindeer herding communities in Sweden, winter grazing takes place in the conifer forest between the mountain range and the Gulf of Botnia where reindeer grazing relies on lichen-rich forests, with ground lichens (*Cladonia* spp.) constituting a major proportion of the reindeer winter diet (Photo 7.2). Forests supporting large lichen cover are found on dry, oligotrophic habitats dominated by Scots pine (*Pinus sylvestris*) where ground lichen can compete



with vascular plants. Lichen-rich pine-forests represent about 13% of forestland area in Sweden. They are critical habitats for reindeer survival during winter and a cornerstone in the reindeer husbandry annual cycle.

Winter grazing is so important for us, to survive during the cold winter. So winter grazing has always been the trickiest part. We used to graze in dry pine forests that are between the mountains and the coast. That is where the best winter pastures are. In winter we are in the ground lichen forests.

Lars-Evert Nutti, Sami reindeer herder



S. Rouvier

Photo 6.2 Lichen-rich pine-forests are the most important grazing lands in wintertime for reindeer husbandry.

Bad grazing conditions in wintertime – when the snow cover becomes too thick, too hard or icy, and cannot be dug by the reindeer – can lead to dramatic consequences for reindeer and herders. The animals starve and females can abort (Kumpula & Colpaert 2003). Another consequence of bad grazing conditions is the increased spreading of the herds seeking larger grazing areas because the carrying capacity of the land suddenly drops. Herders then lose animals and have to put in a lot of energy and devise means to keep the herd together. A natural emergency grazing option for reindeer in such conditions is arboreal lichens, which remain accessible on tree stems and tree branches.

[Arboreal lichen] is a fantastic food for reindeer under catastrophic grazing conditions. There is no such feedstuff to buy with money. Even for money I don't think we would accept that they cut a forest full of arboreal lichen. There is no forage to place on level with arboreal lichen.

Jakob Nygård

Sami herders have always used forests that support a large quantity of arboreal lichen in such conditions. In case of emergency, a traditional practice consisted of cutting down small diameter trees so that a reindeer pack could feed on all the lichen growing along the tree crown (Berg *et al.* 2011). However today's forestry practices – aimed at maximizing wood production – have deeply modified the structure of conifer forests: old-growth forests have become very scarce. The proportion of forest >80 years old has halved since the 1950s over the whole reindeer herding area in Sweden (Sandström *et al.* 2016) and unevenly-aged forests with trees of various diameters have disappeared.

In wintertime, reindeer herders are more dependent than ever on forest diversity to cope with and adapt to adverse snow conditions. The characteristics of snow cover and its development are primarily governed by abiotic factors such as weather conditions (precipitation, wind and temperature), topography, altitude, sun exposure, etc. But they also depend on biotic factors and especially on the vegetation structure and composition through the interception of snow in the branches and subsequent sublimation, unloading of snow from the canopy at snowmelt, as well as through mitigation of wind and solar energy (Winkler *et al.* 2005; Li *et al.* 2008). For Sami herders, the boreal forest is thus an extremely diversified mosaic of snowscapes that can be used under different weather conditions. Herders use this diversity to adapt when lichen-rich grounds are covered with ice by using areas with lower lichen cover which have escaped to ice formation thanks to different soil and vegetation structure (Roturier & Roué 2009).

Maybe it starts to snow in mid-November, so we get 10–20 cm of snow. Then comes a thaw weather that melts the snow cover so there's only water left. In the meantime, the ground has frozen by the end of October. So the ground doesn't let through the water anymore: it pools on the ground instead, especially in dry, lichen-rich pine forests. And soon it's icing [on top of the lichen]. It can be better where you have thicker humus where the ground lets through the water.

Lars-Evert Nutti

The wide range of ecosystems in boreal regions is thus necessary to complete the annual cycle that rules reindeer husbandry. Based on free ranging from early times, reindeer husbandry allows Sami herders to carry on an activity that is economically valuable through the use of innumerable ecosystem services. For the Sami, it also has great cultural value since it is the only traditional Sami livelihood remaining.

7.2.2. “You have to work with the nature”: on the use of ecological functions

Sami reindeer herders depend heavily on biological diversity to provide grazing to their reindeer all year round, especially when adverse snow conditions decrease the access to lichen underneath the snow cover. Sami herders' knowledge demonstrates that they are using biological diversity and its associated ecological functions in a wide range of situations, and also that this knowledge is rooted in a vision of the world and an ethic of respect towards nature:

When you work in the nature, you have to work with the nature, because as a human being, you are not able to work against it. You can use all possible means, at the end you have to follow the nature. If the nature makes that the reindeer have no pasture, from mountains to the coast: you cannot do anything.

Yes you can use food pellets or stuffs, but the reindeer is not made for it with its different stomachs and so on... So diversity in nature is that everything is there.

Mats-Peter Åstot

A major characteristic of reindeer husbandry is that reindeer are grazing freely during most of the year. Because reindeer consume a wide variety of plants and lichens, and because of the relative scarcity of good pasture, they need to move a lot to find their food. But if they move too



much they lose weight and energy. Reindeer movements are thus strongly correlated with the availability of lichen: the more easily they can access lichen, the less they scatter and vice versa.

Reindeer need good conditions to access the lichen on the ground. The snow rules whether the reindeer access the lichen or not, and if the reindeer thinks that it is rewarding to start digging the snow or not. Because it's always the reindeer who decides if he will eat here, there, or not at all, and then goes somewhere else.

Lars-Evert Nutti

If they don't want to graze, they just don't. I can force them and believe that I decide where they graze, but the reindeer decides. If he doesn't want to eat, he will move. He can walk 100 km in a night, and we don't have such big areas... He has a backpack and four legs so he just leaves when he wants.

Jakob Nygård

Grazing is not a unilateral decision of the herder, but rather the result of mutual learning between men and animals, as has been demonstrated earlier by Paine (1982). Free grazing of reindeer does not mean that herders do not control their herds or manage the resources. It is subtler, as it has to be an interaction between men and animals based on added knowledge. Controlling the reindeer, their movements and their gathering is only possible by knowing the land and observing its changes. That means using ecological knowledge about ecosystem functioning to establish a strategy to anticipate the routes the reindeer are keen to follow and where the good pastures are. Rivers, hilltops, forest edges, valleys, and mires are natural borders for reindeer that herders know about and use to guide their herds. Controlling these corridors enables herders to anticipate reindeer movements and keep control of their herd. Reindeer herders depend on habitat diversity, even in the case of forest stands that do not provide pasture for grazing, but that can for instance facilitate grazing in an adjacent forest. As explained by a herder, the different functions of diversity are part of their daily management:

[All the forests] are important depending on the conditions. Some may have a shelter effect, for the wind that will harden the snow in the lichen-rich forest. This spruce forest, that has no lichen, has the function of stopping the wind. Every single forest has a function under particular conditions. That's difficult to understand in fact: every land is useful.

Jakob Nygård

Despite the general mechanisation of reindeer husbandry that has considerably reduced the travel of men, reindeer husbandry can still be considered a traditional activity based on centuries of experience, because it is not aiming at controlling fluxes of matter and energy like modern agriculture does for instance. Instead reindeer herders are able to benefit from natural processes and all forms of interactions between organisms in ecosystems. One example among hundreds is the use of insect 'harassment' in summer to naturally gather the reindeer on snow patches (**Photo 6.3**), which considerably eases the gathering of the herd before marking calves:

It is said that, in summer, the best reindeer herders are mosquitos and the heat. It's a traditional knowledge to wait for high pressure, warm temperature and insects to step up the reindeer on the snow. Then half of the work is done. You just have to go on the snow [and gather the reindeer].

Jakob Nygård

There is today a broad consensus among the scientific community that diversity increases ecosystem functioning (Hooper *et al.* 2005). Reindeer husbandry relies both on diversified ecosystems to complete the annual cycle and to adapt to different grazing conditions, and on ecological functions to control reindeer herds.



F. Sjöller

Photo 6.3 Reindeer herds gathering on snow patches to escape insect harassment.

7.3. When pasture lands are shrinking

7.3.1. Trends in reindeer winter grazing lands

For us today, it's the winter grazing lands that are shrinking the most. Summer, autumn and spring lands, they are quite protected. But winter lands are the most impacted... Because the national parks are a very good protection for reindeer husbandry as well. One should remember that.

Mats-Peter Åstot

It shrinks every day, the land shrinks every second. When you wake up in the morning the land is smaller than when you went to bed.

Jakob Nygård

A shared observation that Sami herders make about winter grazing lands is that “pasturelands are shrinking”, while being mountain areas, summer pastures on the high mountains in northern Sweden, protected by National Parks and UNESCO World Heritage designation, are not fit for any use by the global society other than tourism. Lichen-rich forests, including ground lichens (*Cladonia* spp.) and arboreal lichens (*Bryoria fuscescens* and *Alectoria sarmentosa*), which are the most important resources for reindeer during wintertime, have been severely depleted. Indeed several studies based on historical data have shown that lichens have often been the most severely affected ecosystem components by modern forestry since the beginning of the 20th century (Berg *et al.* 2008; Kivinen *et al.* 2012). Types of forest supporting large covers of ground reindeer lichen (mainly middle-aged and old pine forests) that can be considered potentially good pasture have decreased during the first part of the 20th century. This was recently confirmed in an analysis

based on data from the Swedish National Forest Inventory showing a 71% decline in northern Sweden of lichen-abundant forests over the last 60 years since 1953 (Sandström *et al.* 2016). This study shows that the decline coincided with a decrease of >60 years-old, open pine forests.

The rise of modern forest management during the 20th century has critically reduced the diversity of forest types. Based on historical data, Östlund *et al.* (1997) showed a significant increase of even-aged pine forest at the expense of multi-storied, mixed and old-grown conifer forest, a continuing trend that reindeer herders criticize:

Nowadays it's an industrial forest, I don't call it a forest anymore because there's only one kind of forest, everywhere, and even-aged. So in my view it's industrial sites produced by forestry. The old types, mixed, multi-storied, they don't exist anymore...

Jakob Nygård

Clear-cutting and artificial regeneration of denser Scots pines stands have significant effects on wind and sun exposure conditions that are detrimental to reindeer lichen. Furthermore it strongly modifies the properties of the snow and the snowscape that herders are using for reindeer grazing. During a two-year survey, Horstkotte and Roturier (2013) showed that the heterogeneity of the snow cover was greater in mixed forest stands than in even-aged pine stands after thaw weather. These results suggest that since the introduction of modern forestry, the diversity of the snowscape has decreased within and between forest stands, decreasing the potential for good grazing conditions for reindeer in wintertime.

We have the knowledge, how the land looks like, where the reindeer go. Now that I've been in this land for so long, it's much easier for me to manage reindeer in this area, compared to someone else who has never been here. I know how the reindeer used to go when they stop grazing... Now they are here... I can turn them twice, but not more otherwise... So I have to release them.

So all the areas have like a secret code; maybe not secret, but a code to manage the reindeer in this area. But with the forestry, it's changing all the time. Someone who was here 20 years ago cannot tell me how to manage the reindeer today, because the area has changed so much, year after year. Roughly it can work the same, but this hill where they grazed for three weeks before, now they graze only one. Instead of staying one week, they now stay one day. I mean the timing is faster nowadays. There's no area where they stay longer anyway. Rather the opposite because the milieu has changed. It is clear that if there are many clear-cuttings, maybe 50% of the land, of the lichen is damaged, so they graze twice as fast.

Jakob Nygård

“Fast changes”, as this herder expresses it, do not yet mean a loss of knowledge for the herders, but rather a risk of losing the “secret code” if the foresters change it, not leaving time for reindeers and men to adapt. That is why co-management, where decisions are discussed and taken together, would allow practitioners to change their know-how accordingly, while unilateral decisions might put some stakeholders out of the game.

7.3.2. Fragmentation of the winter grazing land

The spatial configuration of forests has also changed during the last century. Using historical maps, Kivinen *et al.* (2012) showed a decreased patch size of old-growth forest and an increased isolation. Their results suggest that the forest landscape mosaic has become less suitable for sustainable reindeer husbandry. Indeed this has strong consequences on the potentiality for grazing because of decreased forage biomass, and because small residues of lichen-rich forests are not always usable in the same way as larger, continuous forest. In other words, for reindeer winter pasture, the whole is greater than the sum of its parts, and large grazing areas are now very rare:

It's important to have grazing areas that are continuous, not cut off by infrastructures like roads, villages, but there are few of them today. The more you go towards the coast, the smaller are the grazing areas.

Mats-Peter Åstot

We have a big problem; namely it is difficult today to keep grazing together a reindeer herd, a gathered reindeer herd during a long time in winter grazing land. (...)

The forest has been fragmented over the years. There is one forest here that has been clear-cut 30 years ago, one forest there that has been clear-cut 5 years later, and again 5 years later. So the forest has been fragmented in different age classes. Therefore the forest that was once continuous, for example a pine-heath that was 5 km long, it is now 10 forest stands that support different grazing conditions.

Lars-Evert Nutti

In ancient times, when they were skiing around the reindeer, before the roads and buildings, and in addition the grazing conditions with old-forests... They could ski around the reindeer. Now we sit on our snowmobile during daylight hours. We can drive 100–150 km per day, there's no chance to do it by skiing.³ So you understand how much it has changed, all the areas.

Jakob Nygård

7.3.3. Old forests and arboreal lichen

As a consequence of forest management and the introduction of clear-cutting, forests have become much denser, while the mean age of the trees within them has decreased considerably (Esseen *et al.* 1997; Berg *et al.* 2008). This has had adverse ecological consequences and has eliminated certain niches. It is particularly true for arboreal lichens (**Photo 6.4**) such as *Bryoria fuscescens* and *Alectoria sarmentosa* that are more abundant in old-growth forests (Berryman & McCune 2006). Horstkotte *et al.* (2011) found that arboreal lichens were present in stands that were older than 63 years old. In their study they additionally found a decrease from 84% to 34% in the cover of forest older than 60 years since 1926. Old-growth forests have become less widespread in northern Sweden, and have almost completely disappeared in certain areas where reindeer husbandry is practiced.

We need all the forest types, but nowadays the big thing that is missing for us are the old pine forests that has almost disappeared because of forestry. And with old pine forests I mean arboreal lichens... If you remove arboreal lichen forests, it takes decades to come back... (...)

Today there are still some old-forests left... And you can feel a different feeling compared to a managed forest. When you are in an old-forest the reindeer grazing holds out longer than in a young forest having the same grazing conditions, because there's less lichen as well in the young forest.

Mats-Peter Åstot

This is a major concern for Sami reindeer herders because arboreal lichens are critical for reindeer survival when ground lichen becomes inaccessible such as in spring during the early snowmelt, and in winter after thaw weather. It can also have dramatic consequences on reindeer spreading out to find new pasture.

Then the crust on snow comes in winter-spring, March – April. So we come to graze arboreal lichen when the reindeer don't have the energy to dig the snow to access ground lichen. And the crust supports them so they start to spread and look for grazing arboreal lichen. Then it goes

³ In reality, some old-herders still use skis to go around, or within the herd, to check its wellbeing and grazing conditions.





S. Rouner

Photo 6.4 Arboreal lichen (here *Bryoria fuscescens*) constitutes an important grazing resource when ground lichen becomes inaccessible below the snow cover

very fast for a reindeer herd to disperse. In a normal situation we would have had our arboreal lichen forests left but forestry has altered everything down here. So we don't have any large and continuous forests. We have only groves or small meadows with some trees supporting lichens left.

So it goes very fast for the reindeer to disperse over a wide area. Often we end up in areas where we don't want to be: in our neighbour's pastures, on railways, on big roads... So springtime is maybe the most demanding period to control the herd. It happens that we work 24 hours a day, during several weeks, to keep the reindeer together before the migration to the mountain.

Lars-Evert Nutti

[The reindeer] disperse quite a lot, but they survive. When arboreal lichen becomes very important, it has become hard crust on which they can move, so they disperse quite a lot. (...) Then even when they have grazed an area, there can come a storm blowing away new arboreal lichen. Because they cannot graze all the arboreal lichen, not above a certain height, but it's so smart, when it has grown and become long enough, it gets loose and drops on the snow. So it portions out exactly what [it needs for] support. It's very smart in this way.

Jakob Nygård

However, today the decreases in the abundance of arboreal lichens can increase the need for supplementary feeding, and/or necessitate a reduction in herd size, which strongly challenges the cost efficiency of reindeer husbandry.

7.4. Drivers of Change

7.4.1. Modern forestry

Forestry has been the major source of change for reindeer husbandry during the 20th century. The effects of modern forest management practices on winter resources available for reindeer husbandry are now well known and well established (Sandström *et al.* 2016). Forestry affects reindeer husbandry over various space- and time-scales as reviewed by Kivinen *et al.* (2010). Clear-cutting, site preparation, fertilization, short rotation times, and forest fragmentation have largely resulted in a reduced amount of ground and arboreal lichens, and restricted access to resources (see also previous sections). The consequences of forest management on forest structure and density can also deeply affect the use of migration roads for reindeer and Sami herders. This is an important issue since frozen rivers that were traditionally used to migrate have been all dammed by hydroelectric industries during the 20th century:

We don't have the natural migration roads anymore, they are destroyed, most of them (...) It's quite large areas that must be restored to have functioning migration roads. Those that are completely destroyed today and that we used maybe 20 years ago, it can be 5 km of forest that should be made over, over 100–200 meter-wide. Of course it's a lot of money for forestry to repair them. But it's a lot of money for us as well, to find other roads, maybe using helicopter to go through the area, it's a lot of money for us to go from one place to the other if we don't have functioning migration roads.

Lars-Evert Nutti

A direct driver of modern forest management is the forest industry that rules the demand for wood products. Looking back in history, the forest industry has progressed through different ages, or eras:

- ▶ a timber era that began in the end of the 19th century until the second world war, then
- ▶ a fibre era which has extended until the present day, and finally
- ▶ a biomass era that is about to begin.

The timber era sought to maximise timber production through selective logging. This management practice proved to be favourable to reindeer grazing conditions (Berg *et al.* 2008). The subsequent fibre era seeks to maximise fibre production introducing clear-cutting and artificial regeneration, fertilization, creating denser and younger stands that have detrimental effects on reindeer husbandry (Berg *et al.* 2008; Kivinen *et al.* 2010). Finally the biomass era intends to maximise biomass production. This will be achieved through the regeneration of denser stands and even shorter growing cycles. Another means is the plantation of exotic species such as the North American lodgepole pine (*Pinus contorta*) that grow faster than native conifer species. Although Nilsson *et al.* (2008) did not find differences in understory species composition between *P. contorta* and *Pinus sylvestris* stands, the former had more than three times the litter cover on the ground which can suppress the growth of lichen. *P. contorta* stands also tend to have a denser canopy providing a more shaded environment than native species (Elfving *et al.* 2001). New wood products can also be valued, such as stumps, causing important damages to the ground. The environmental effects of such practices are not known in the long run:

Near the coast here, stump harvesting has become really interesting. When you harvest the stumps, there's only soil and stones left because you turn upside down the whole ground with all the root system. It's a huge impact, maybe 70–80% of the ground vegetation turned upside down.

Jakob Nygård

Needles fall from the contorta trees, important quantities of needles, and they suppress all the living plants on the ground. If it happens that there is a small opening in the contorta forest, there can be a little patch of ground lichen maybe. And maybe a reindeer can find it. But if it's far away in this forest, there will never come any grazing out of it. Reindeer will never find such small patches in dense forest like that.

Lars-Evert Nutti

Finally, an important driver of change since the establishment of forest industry is fire suppression, a natural key disturbance in the functioning of boreal ecosystems. Uncontrolled forest fires were common in northern Sweden until fire suppression was initiated in the early 20th century. Although fire greatly decreases the ground lichen cover in the short term, the effects in the long run depend on the forest type. Burning of lichen-rich ground benefits shrubs and has thus significant negative effects on reindeer herding. On the other hand, burning of shrub-type forests with a thick humus layer and relatively little lichen cover benefits lichens (Kivinen *et al.* 2010; Sandström *et al.* 2016). There is strong evidence that lichen-rich pine heaths originate from repeated forest fires, because the accumulation of organic material and resultant water retention in the absence of fire disturbance results in vascular plants out-competing lichens (Zackrisson 1977). Therefore at wider temporal and spatial scale, the abundance of lichen-rich pine-forests depends on the management of fire regime which today consists of protecting the value of productive forests from fire hazards; hence the fire suppression.

7.4.2. Climate change

In the past, I remember even though I'm not that old, we talked about the All Saints thaw. If you managed the All Saints thaw, the winter was safe; there was only one thaw we were anxious about. There was also the New Year thaw, but usually there was more snow then, so it was not as sensitive. Nowadays, this All Saints thaw comes several times: so to say, there are thaws before and after.

Jakob Nygård

Reindeer husbandry is highly dependent on snow conditions for reindeer to access lichen under the snow cover (see previous sections). Concerning the effects of climate change on snow conditions (snow cover duration, snow water equivalent, ice formation) there is a wide consensus about more adverse conditions for reindeer winter grazing today and in the future (Moen 2008; Callaghan *et al.* 2011). Winter grazing conditions are expected to be unstable including ice formation and more frequent thaw whether (SOU 2007). Since the beginning of the 21st century, Sami herders have already experienced extreme variability of winter grazing, both within and between years. Unpublished data collected between 2004 and 2011 by Roturier and Roué, showed the spatial variation in the patterns of land use by winter-groups due to extreme thaw-freezing events that become more frequent. As a consequence, Sami herders have to find other lands to adapt to bad grazing conditions:

If we go back in time, about 10 years ago, we were grazing every year since the 1980s in the area we used to be down here in the forest. But the last years, we had to find other solutions to complete the winter grazing. We've had to be in the mountain tundra during one winter, we've had to feed our reindeer another one, we've had to be further west another one, we've tried to be in the natural reserve in the mountain forest, expecting that our reindeer would survive two years in a row, and this year we will try to graze down here again. So out of 6 winters, we have used our natural grazing are only once. So the climate has changed drastically the last 10 years and I would say the last five years.

Lars-Evert Nutti

I think it [climate change] went very fast during the last 5–7 years, it goes worse and worse every year. It's a tricky situation: how are we going to solve this in the future, and continue... There are plenty of adversities tackling reindeer husbandry and on top of it the grazing is bad, covered by ice due to rapid weather changes... and the decreasing arboreal lichen grazing, ground lichen grazing, soil preparations...

Jakob Nygård

The decrease in old-growth forest supporting arboreal lichens is a big loss for adaptation to climate change. Since local snow conditions vary to a large degree, depending on forest structure, ground vegetation, topography and micro-climate (Roturier & Roué 2009; Horstkotte & Roturier 2013), reindeer husbandry becomes increasingly dependent upon this spatial diversity and variety of land types to cope with changing snow conditions.

The snow depends on different factors, first of all the weather. But then it depends on the forest: is it an old or a young forest? If the same amount of snow falls in the old and the young forests, then there's maybe twice as much snow in the young forest, snow on the ground. Compared to the old forest where half of the snow remains in the trees. So if you have 50 cm of snow in the young forest, you have 25 cm in the old one. So it's half of it and that means twice easier to dig the snow. Some years... It's the opposite I must say.

Lars-Evert Nutti

7.4.3. Cumulative impacts

While forestry and climate change can be easily identified as major sources of changes for reindeer husbandry, especially for winter grazing, there is a wide variety of drivers that affects Sami herders and their reindeer. The hydroelectric regulation of rivers has deeply impacted migration roads in and out from winter grazing lands. Other sources of land encroachments have contributed to the loss of grazing land. The predator population (lynx, wolf, bear, wolverine) is another source of worry that causes important loss of calves.

Unfortunately many drivers remain poorly identified and difficult to quantify. In this respect, the issue of snowmobile traffic is a good example. Tracks for snowmobiles are trailed but not always respected, especially during late winter and spring where snow leisure activity peaks. This has important consequences, disturbing reindeer a few weeks before calving and making tracks that contribute to spreading out the herds during a time period when herders try to keep them together before migrating to the calving lands.

There are many factors that impact reindeer husbandry. First forestry that has cut down our arboreal lichen forests for instance. Then we have a dense network of tracks that has been made by forestry to be more efficient. Connected to this network of tracks we have nowadays an increase in snowmobile traffic along these tracks. And because of new clear-cuts, you can see now the top of the hills. So today almost every snowmobile driver wants to go up and see what's up there. But up there, there was a reindeer flock, maybe a big one, but the driver does not even think about it. He just drives without a thought for reindeer or any other animal.

Lars-Evert Nutti



7.5. Increased knowledge for better governance

7.5.1. Reindeer husbandry and the Forestry Act

Relationships between forest managers and Sami reindeer herders have become less conflictual following the development of consultation procedures in the 1979. Forest companies and private owners are required to hold “consultations” with reindeer herding communities before applying for felling permits. This is a requirement imposed by the *Forestry Act* for clearing trees in any area larger than 20 ha in the year-round grazing areas. In theory applications for felling permits may be rejected by the Forest Agency if consultations have not been properly conducted. The Swedish Forest Stewardship Council standard for forest certification, adopted by all forest companies in Sweden today, has extended consultations to the whole reindeer grazing area, including winter grazing areas. During consultations, forest companies outline the areas that will be affected by their actions, e.g. clear-cutting, site preparation, fertilization and forest road construction. Minutes should be taken, and included in applications for felling together with a duly completed standard form detailing considerations regarding reindeer husbandry. Even though a study published in 2007 showed that the majority of Sami herders still considered this procedure as “information” only (Sandström & Widmark 2007), communication and discussion between the forestry sector and Sami herders has without doubt increased in prominence and importance as a result of this procedure. However the consultation remains unbalanced since Sami herders have no real control over forest management, which is ruled by the *Forestry Act*.

We can never stop a felling, we can postpone it. To exaggerate somewhat you can say that earlier they ran over us, now they horn before they run over us. With times, we are overrun anyway because we can simply not say “no”. The difficulty is that we try to save as much pine-heath as possible, but we forget that the other forests have also a function. Looking at it at first, it's maybe not as important as a lichen-rich forest, but the lichen-rich forest can lose a function when you cut the spruce forest just beside, so it maybe gets worse. (...)

What we have been able to do is to choose, and we have chosen to save the lichen-rich pine-heath so far. But now there are the only ones left. So we have too choose between much lichen or less lichen... Because the Forestry Act says that all the forests should be managed. The Reindeer Husbandry Act, and our need of grazing land for reindeer, is overrun by the Forestry Act. If a forest owner wants to spare an old forest, he simply cannot because the Foresry Act says he has to.

Jakob Nygård

The goal of forestry is that all the forests should be managed. If you manage to “freeze” a stand, a nice pine-heath one or two years, five years later it comes back at the consultation, because they want to take it again. We can spare it now, but only for two or three years.

Mats-Peter Åstot

As described in previous sections, reindeer herders have great interest in areas preserved for nature conservation because they provide diversified habitats, especially old-growth forest supporting arboreal lichens. However Sami herders do not advocate only for preserved areas. On the one hand Sami herders' knowledge about forest management is very advanced, with deep knowledge of the constraints and the requirements to manage forest stands in boreal regions, because they depend on it. On the other hand they are very aware of the effects on ecosystem functioning and on reindeer ecology and behaviour. Therefore it is not surprising that they consider even forest management as an adaptation pathway to climate change:

We cannot counter the climate, at least today, it's the forest that we have that is the easiest to influence, and its management. Managing the forest so it works for ground lichen that it can grow again...

Lars-Evert Nutti

Still, even if their interests are in accordance with some forestry practices, most often they fall outside of the production standards enacted by the *Forestry Act*. This is the case with uneven-aged management commonly believed to have low economic performance, but which could result in providing more favourable conditions for reindeer winter grazing (Kuuluvainen *et al.* 2012).

7.5.2. Holistic valuation of the land

Reindeer husbandry by Sami people relies on land use rights ensured by the *Reindeer Husbandry Act*. That means reindeer graze on public land, mostly during summer, and in winter graze in territories in forests owned by small private lands, private companies or the state-owned forest company. As a pastoral activity, reindeer husbandry is a dynamic form of land use that requires rapid adaptation to changing animal or environmental conditions. People unfamiliar with reindeer herding may believe that reindeer herders have access to a “huge” territory. This is a major misperception as in fact Sami herders are divided in smaller units during winter which all need a functioning territory. They also all need to have access to a large territory in order to be able to use different areas of the land according to constantly changing weather conditions.

It's also because reindeer husbandry requires so much area. We need all the grazing areas. And that's why it's so complex, depending on how the snow is: one year reindeer don't graze in this area, but the next year it will offer perfect conditions. It depends on the thaw weathers, the winds and such things... So this diversity... You must have been here long enough to learn that this area, we managed without it during 2 or 3 years, but then “pang”, you need it. You see it, the reindeer shows it: there is the pasture.

The more you follow the reindeer and nature, the more you see that every land [is needed]... You need them at least once and this is very difficult to prove, to explain to forestry. It's much more than forest, snow, reindeer and lichen, you have to understand the whole circle as well. It's so hard to document, but above all you have to experience it to understand.

Mats-Peter Åstot

Efforts have been undertaken since the 2000s under the initiative of the Swedish Forest Agency to make a “Reindeer Husbandry Plan” for each Sami community. The Reindeer Husbandry Plan is based on GIS toolkits, satellite images and herders' mapping of grazing areas (Sandström *et al.* 2003). Although it represents a major advance in the dialogue between reindeer husbandry and other stakeholders, using a so-called common language, it remains partly unsatisfactory. For example, as shown by Roué *et al.* (*in prep.*), the Reindeer Husbandry Plan tends to map “good” grazing years, leaving out what could be instead considered as the most important pasture: the ones on which reindeer rely to survive during harsh grazing conditions.

This emphasizes the question of what is the value of the land used by Sami reindeer herders? In other words, does owning property result in realising higher economical value of the land than using the land? Based on economic thinking, this is one of the reasons why property rights are much stronger than land use rights, and herders are fully aware of this unbalanced situation when they try to negotiate with forest companies.

Maybe one should thin the stands properly so it can benefit to the reindeer lichen growth as well. There can be a possibility for forestry and reindeer husbandry to work forward together. Managing the forest but also that it benefits to reindeer husbandry, but it costs money, above all for forest companies. For us, we think that the pasturelands we lose are a form of money... But they don't see it as money, because they count in crowns... They can say right away how much it costs for them, we can say it as well but it's much more difficult to prove, we don't have cubic meters as they do. We say a day of reindeer food, but there's no amount to compare really.

Jakob Nygård



The interviews of reindeer herders show that they carry out a much more sustainable and holistic valuation of the whole territory. This is particularly obvious regarding destructive land exploitation such as mining, which they argue goes against the sustainability of their livelihood:

Then nature must have a price tag, saying that it has some value: unspoilt nature versus a mine. In cash, in short term, it's more money from a mine than in the nature. But in the future, we don't know how the nature will be... Because the mine project argues that... We can take Gállok⁴ as an example: they say it's 300 jobs during 15 years, I say OK, but reindeer husbandry is 15 jobs during 300 years. It's the same amount of employment, and we keep the nature intact. But nobody wants to buy this. While the amount is the same, plus we have preserved the nature...

The day we'll see the value of nature contra a bag of money from a mine, or other. Or above all when we'll have the right to stop a mine if it is planned at the wrong place... Of course, if we had the possibility to better participate in the nature management, we could have influenced our future in a better way, for sure... Where and how managing the forest, how to thin... But this requires being well-disposed to work both for reindeer husbandry [and] to look after that forestry works. And forestry must consider and look after that reindeer husbandry works, then maybe... If both of us should exist, we must have respect for each other.

Jakob Nygård

Conclusion

The whole range of ecosystems in boreal regions is necessary to complete the annual cycle that rules reindeer husbandry. It depends on access to different types of grazing pastures, particularly conifer forests supporting extensive ground lichen cover and arboreal lichen are vital to feed reindeer during wintertime. Based on experience and knowledge of free ranging since early times, Sami reindeer herders have become experts in using ecosystem processes, “working with nature” to guide and control their herds within vast territories. They are thus highly dependent on well functioning ecosystems.

A shared observation that Sami herders make about winter grazing lands is the decline of winter pasturelands. This concerns ground lichen forests and old-growth forest supporting arboreal lichen, which have almost disappeared from a wide area of their territory. The fragmentation of the forest landscape has also strong consequences on the potentiality for grazing, which requires large, continuous forest. This increases the need for supplementary feeding and strongly challenges the economic viability of reindeer husbandry.

There is a wide consensus among the scientific community that modern forestry has had detrimental effects on reindeer husbandry since the mid-20th century. All forms of forest management aiming at maximising wood production are at the expense of lichen cover and biomass. Climate change and especially the higher frequency of thaw-freezing events is another source of concern. These two drivers interact with each other since forestry reduces the diversity of forest structures at landscape level and the diversity of the snowscape. Diversity is vital for reindeer herders to adapt to adverse climatic conditions.

One option for the future is a better governance, which would to increase the possibility for forest co-management. Some procedures already exist to increase dialogue between forestry and reindeer husbandry but still remain unsatisfactory from Sami herders' point of view because they do not allow alternative forms of forest management. As a matter of fact, reindeer herders do not own any land, they only benefit from land use rights. Their valuation of the land is much

more holistic and sustainable, offering an ethic of land use that respects the diversity and the functioning of ecosystems in the long run.

We just borrow the reindeer from our children, and grand children and so on. I manage them just for the future, and the same with nature. If I would graze out an area, or let them do clear-cutting or make mines everywhere, my children won't be able to continue with reindeer husbandry.

Jakob Nygård

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8. The sable for Evenk reindeer herders in southeastern Siberia: Interplaying drivers of changes on biodiversity and ecosystem services – climate change, worldwide market economy, and extractive industries

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Introduction

As in many other places in the Arctic, Siberian indigenous peoples have noticed that the cold seasons take hold much later than they did 20–30 years ago, especially the first snow installation. For the Evenk nomadic reindeer herders of Southern Siberia, the different snow cover qualities either permit or threaten traditional hunting practices.

Hunting is a crucial element of the nomadic subsistence economy. A high percentage of dietary energy is supplied by wild food game, and hunting activities are also an important (if not the only) source of income for both nomads and some villagers. Modification of environmental conditions such as weather patterns or land use significantly impact subsistence economies of these indigenous societies. In southeastern Siberia, nomads and villagers have complained that the returns from sable hunting have diminished. At first, we thought that the size of the sable population has decreased, but, as we will see, the reasons are much more complex and depend on many interplaying drivers of change, from climate and environmental alterations to international geopolitics.

The Evenk make daily observations of changes in climate and the environment during their economic activities that depend on both wild and domestic fauna, flora and the land. Installation of snow cover and ice on the rivers, wind directions, flooding, animal behavior, migratory periods, and transit paths all determine the wellbeing and economic viability of the nomads. Surviving



in such an extreme Arctic climate as well as adapting to climate change and external threats is possible only through the possession of Traditional Ecological Knowledge (TEK), handed down from generation to generation, and enriched by daily observation (Lavrillier 2013).

In addition to the extreme environment, the environment of nomads and their traditional economies, societies and cultures is threatened by global changes caused by regional, national and international policies, and industrial development (Lavrillier 2013; BRISK 2012; Donahoe 2004).

The Evenk live in the taiga and practice a type of reindeer herding (specific to this biome) that is highly dependent on hunting, with small herds used for transport purposes, and food and fur game hunting as subsistence economies. Through the example of the sable hunting among Siberian reindeer herders, this paper investigates the interplaying drivers of change (climate, environmental, economic and political) at local and global scales. In the same time, it analyses the consequences on ecosystem services, the adaptive practices of the nomadic society, and their repercussions on social and ritual values. To this end, data from social and cultural anthropological fieldworks, TEK including nomads' observations, economical analysis, meteorological stations and thermo-buttons installed by nomads have been collected and combined by the authors in collective analysis.

Co-production of scientific knowledge and TEK has already been investigated in previous research, including in the Arctic. Co-production offers different and complementary sources of information that, potentially, may improve our comprehension of complex and interconnected environmental systems. However, the combination of both methods may also lead to increased complexity and uncertainties (Huntington *et al.* 2004; Gearheard *et al.* 2009). Numerous studies have shown the importance of using local observations and traditional knowledge to better understand current environmental changes and their impacts in the Arctic (Agrawal 1995 (Indigenous Knowledge); Krupnik & Jolly 2002 (North-American Arctic); Huntington *et al.* 2004; Huntington *et al.* 2005 (North-American Arctic); Gearheard *et al.* 2006 (North-American Arctic); Keskitalo 2008; Gearheard *et al.* 2009; Bulgakova 2010; West & Hovelsrud 2010).

The topic of 'climate change' is quite widely studied by anthropologists and sociologists in Canada, Alaska and Greenland (Krupnik & Jolly 2002; Krupnik *et al.* 2010; Ford *et al.* 2006, 2007; Huntington *et al.* 2004; Nuttall *et al.* 2005; ACIA 2005; Berkes & Jolly 2001; among many others). However, the research for Siberia in general is much less developed with the exception of northern Russia and western Siberia, with the leading studies of Forbes, Stammer, Stammer-Gossmann, and Vlasova carried out among the Yamal Nenets (Forbes *et al.* 2006; Forbes 2008; Stammer-Gossmann 2010; among others), among Nenets and Sami (Nuttall *et al.* 2005), among Nenets and Ienisseysk Evenk (Vlasova 2006) and particularly in eastern Siberia, except for Crate among the Yakut (Crate 2008), or Sharakhmatova among the Even and Itelmen of southern Kamchatka (Sharakhmatova 2011), a little information about the Yukaghir (Shadrin 2009) and a short report on Chukchi observation (Kavry and Boltunov 2005–2006). Southeastern and central Siberia regions have received much less attention, which was the motivation for this research.

This paper reports on one of the results of the BRISK project⁵ that elaborates a transdisciplinary study of global changes (climatic, environmental, socio-economic, etc.) in the Arctic. It brings together indigenous peoples, social anthropologists, climatologists, ecologists and geographers together with UNESCO. More precisely, the present results come from one of the Community-

5 Funded by the French National Research Agency (2013–2016) and IPEV (BRISK'OBS project (2014-2017)). It aims to assess environmental, economic, political and social impacts, vulnerabilities, and adaptive strategies. First, the project documents the state of the art with respect to scientific and indigenous methods of observations of global change (UNESCO, MNHN). Second, the BRISK project juxtaposes and makes comparisons at several levels. 1) It examines human–natural environment relationships in different socio-political contexts, through the comparison of different types of reindeer herding in Eurasia (UNESCO, MNHN, CEARC). 2) It considers the notion of "extreme meteorological events" from the differing viewpoints of climate scientists and indigenous peoples (UNESCO, MNHN, LMD, CEARC). 3) In order to bring together indigenous and scientific knowledge for the observation of global changes, Community-Based Transdisciplinary Observatories are jointly conceived by scientists (natural and social) and indigenous peoples (MNHN, LMD, CEARC). Of the planned 5 observatories, 4 were opened and 3 are currently active – among the Sami of Sweden (Roturier & Roué), among the Evenk (Lavrillier & Gabyshev) and among the Tuva-Tozhu (Rojo & Chondan).



Based Transdisciplinary Observatories (*further C-B TO*) of BRISK, conceived and carried out among the Siberian Evenk from 2013 by Lavrillier (anthropologist), Gabyshev (Evenk reindeer herder and hunter) and Egorova (Evenk weather forecaster).

During our research in the BRISK project in Siberia, we (Lavrillier, Gabyshev, Rojo, Claud, Chondan) have noticed that scientists and nomadic reindeer-herders have different observing methodologies and systems of thought. For instance, climatologists observe and compare trends, mean temperatures, extreme values, threshold effect, etc. by using certain variables over the long term. In contrast, reindeer herders have their own systemic knowledge and observation systems. From their daily observations made according to their indigenous knowledge and cognition, they analyse normal and abnormal modifications of their environment. As we will see, their observations and analysis of changes focus not only on one single element of the natural environment, but on the interactions between many elements (for instance between snow, and vegetal cover, and rivers, etc.) (Lavrillier & Gabyshev 2016). Our BRISK colleagues, Roturier and Roué noted that the indigenous knowledge is “highly interdisciplinary” (Roturier & Roué 2009). Even if it is complicated to bridge both scientific and traditional knowledge paradigms, both types of observation and knowledge complement each other and improve the understanding of complex environmental systems.⁶

This paper first introduces the Evenk and their perception of global climate and environment changes. The main section of the paper then presents a case study of one of the most important ecosystem services for the Evenk nomads – sable hunting – and how it is threatened by combined drivers of change. It studies the changes in snow and vegetal covers related to sable in detail, analyses the dependency of the nomads on this economic activity, and reflects on how national and international drivers of change influence this trade and, consequently, the well-being of the Evenk. Finally, it concludes by discussing the interplaying drivers of change.

8.1. Evenk reindeer herders/hunters and perceptions of environmental change

8.1.1. A nomadic dual economy needing many ecosystem services

The Evenk are a minority indigenous people of Russia (with 38,396 individuals in 2010). In the two regions concerned by this paper, 18,232 Evenk live in Yakutia and 1,501 in the Amur region.⁷ Particularly mobile, these people live in small groups spread on a vast area defined by the Yenisei river in the West, to the Sakhalin Island in the East and from the Arctic Ocean coast to the Northern of China.

The type of reindeer herding practiced by the Evenk of southern Yakutia and the Amur region is called taiga, also known as the Orochen type or Evenki type or Tungus type, according to the Russian classification (Vasilevich & Levin 1951:5).⁸ It corresponds to a dual economy and a dual logic of subsistence between hunting and reindeer herding, with seasonal interplay between the two. They keep small herds of reindeer for transport purposes, but also in order to have a ‘stock of meat’ in case of a shortage of food game. Each species of fur game or food game is hunted

⁶ Further discussion on the transdisciplinary methodology in the Evenk C-B TO will be published as a separate paper. Although the scientific realm may wish to develop transdisciplinarity and interdisciplinarity, the scientific publication formats do not allow publishing real transdisciplinary papers where each science can equally demonstrate methods and arguments. This will include methodological discussions, climatologic data and analysis, and TEK from Evenk and Tuva peoples.

⁷ Census of the Russian Federation 2010: Nationalities. Available from: www.gks.ru/free_doc/new_site/perepis2010/croc/perepis_itogi1612.htm [21 December 2015];

⁸ The supposed different reindeer herding “Evenk” and “Sayan” types (practiced by Tozhu, Tofa, and Dukha) (Vasilevich & Levin 1951) are more similar than different. They both use reindeer for transport purposes (sledge, pack and riding) and for milking, and only exceptionally for slaughtering (Ermolova 2003).



following a rigid seasonal calendar and diverse strategies. Thus, hunting is carefully planned so that every species can breed successfully (Lavrillier 2005, 2011).

The collectivisation of herding and hunting was performed entirely during the 1960s in this region. Partly settled due to Communist Party policy, only approximately 30% of the population still lead a truly nomadic lifestyle. The others now live in villages and towns. However, even for villagers and some townspeople, fur and food game hunting represents an important economic input (Lavrillier 2005).

The southeastern Evenk inhabit small mountain natural forests (larch, pine, fir, birch, cedar) often with a rich under-storey vegetation of lichens, mosses and berry bushes. The continental climate is quite variable ($< -50^{\circ}\text{C} / + 30^{\circ}\text{C}$). Parts of the terrain are deeply cut by fast-flowing rivers and streams, while some of the wider valleys include extensive bogs and meadows, which provide ideal reindeer summer pastures. Scheduling subsistence activities over the landscape can only be achieved through high mobility (1500–2000 km yearly), in order to meet the requirements of both herding and hunting. This ability to move and sustainably manage the environment, despite its variability, is allowed by the profound indigenous knowledge and cognition of the environment and micro-climates.

The southeastern Evenk have been in contact with extractive industries (gold and coal mines) since the end of the 19th century, but recent developments demonstrate an important growth of industrial projects (pipelines, dams, roads and railways) that are either directly in their nomadic areas or close to them. It is important to note that Siberian peoples have no property rights on their ancestral lands.

Nowadays, the reindeer are owned by three kinds of economic units: *enterprises* that appeared after the collapse of soviet power, transforming former State farms (*solkhoz*) that give salaries for pastoral work; *family cooperatives*, also called *clan communities* (indigenous mini-companies, recognized by the Russian government and receiving a fee for each living reindeer); and *private herders* (without any administrative form nor official recognition, nor any regular income). For Evenk people from both family cooperatives and the private sector, fur and hunting (mostly sable) represent vital income.

The Evenk C-B TO is based within a nomadic community which lives across the regional frontier between the Amur region and southern Yakutia and takes place in one of the biggest Evenk nomadic areas of Russia with a surface of 7,000 km² and around 15,000 reindeer, led by 250 reindeer units. This is an important concentration of reindeer and human population for this kind of reindeer herding, providing for small herds (40–100 reindeer per unit) and with hunting as subsistence economy.

8.1.2. Perception of climate and environmental changes: Threats to ecosystem services

The Evenk have been noticing climate and environmental changes for several decades, such as a rise in both winter and summer temperatures. These changes have been increasing more rapidly over the last 6–11 years, according to a social anthropological study of climate and environmental changes led by Lavrillier between 2006 and 2012.⁹ Indeed, a single word sums up the main trend of weather change in the local narrative: *okollen* (in Evenk) – “it’s getting hotter”.

⁹ This research, the results of which are partly published (Lavrillier 2013), was led among diverse Evenk and Even regional groups according to classical anthropology methods (participative observation, open and semi-directive interviews, analysis of spontaneous discourses) with the deliberate choice to not mention the term “climate change”. It focussed on the global perception of climate change and adaptive practices and native notion of vulnerability, as well as on the potential changes in the perception of a link between the natural environment and human society. The results from this first study were one of the reasons for building up the BRISK project and its C-B TO among the Evenk.

They have noticed that the coldest part of winter is now around two months shorter than it was 30 years ago, and it is also warmer now, therefore the snow period is getting much shorter. In addition, the Evenk link the warming with an increase in forest fires. They also link the changes in climate with changes observed in flora and wild fauna. They have noticed the extinction of some plant species (e.g. larch ivy) and animal species (e.g. some fish from the *Salmonidae* family like *Coregonus ussuriensis*, some birds), the appearance of new species of birds (e.g. birds originally native to warmer regions such as sparrows, which they previously only knew about from their school books about central Russia's fauna) and insects (e.g. new species of flies and previously unknown horseflies). The Evenk are particularly worried about a considerable increase in predator populations and the decrease of wild reindeer and elk, to a degree where there are likely to be no longer enough of them to feed the nomadic population. They also have noticed that the wild reindeer's yearly migration has changed. Therefore climate and environmental changes in southeastern Siberia do threaten the ecosystem services for the Evenk.

In addition, the Evenk are very concerned about what is happening to the domestic reindeer. They link the major and unexplained changes affecting their domestic reindeer to climate change: some reindeer are suddenly dying during very hot weather; and there is an unexpected development of parasitic illnesses (in the epidermis, the blood, the urine, the brain, the lungs and the digestive system). In addition, the newly appeared species of flies lay larvae in antlers that cause infection and sometimes lead to the death of the reindeer. Climate change also provokes an increase in the number of fires, which reduces the amount of pasture available for domestic reindeer and thus endangers their health. Moreover, the fires reduce the natural space for wild animals which forces them to migrate to other areas (often the same as the lands occupied by the nomads): this then triggers an increase in the number of predators on herding lands and the killing of the easiest prey, the domestic reindeer. The nomads have also noticed that the sable fur is not as thick as it used to be in the past.

The Evenk sable hunting case study elaborated below highlights the many interplaying drivers of change.

8.2. Sable hunting case study among reindeer herders – interplaying drivers of change¹⁰

Several drivers of change threaten sable hunting – a vital ecosystem service for the Evenk – and consequently threaten their society, well-being and culture. These drivers include climatic and environmental drivers, as well as economic and political ones. See **Figure 8.1** for an overview of the interplaying drivers of change, each of which is examined in more detail below.

8.2.1. Climate and environmental drivers of change on sable hunting

Sable hunting is highly sensitive to climate change. Indeed, in order to be sold, the sable's fur needs to achieve a specific winter state, furnished with long hair and dense internal short grey hair. This specific state of fur appears when the very winter colds arrive. There is even a specific term in Evenk for this state, i.e. *bagdargacha* meaning "it got white", and in Russian, *vykhodnoi* meaning "for party day". Sables that are not ready for sale are said to be *sikte* in Evenk, or *ne vykhodnoj* ("not for party day" in Russian). There are also nuances, like *siktevlja* in Evenk meaning "almost ready for sale", used when the back of the skin is ready (Lavrillier 2005).

¹⁰ This study is one of the results of the BRISK Evenk C-B TO of Lavrillier and Gabyshev. It developed from 2013 a transdisciplinary method that: includes hunter-herders as "observer" and "co-researcher" at all scientific steps from project planning to final analysis; produces daily observation according to climatologic and TEK interests; installs thermo-buttons according to the TEK about micro-climates; compares abnormal years; and crosses Evenk observation with climatologic data, in addition to anthropological fieldworks with mapping and detailed documentation of the TEK resulting in knowledge co-production.



Some Evenk have noticed that the quality of sable fur is decreasing and it has less dense internal grey hair – which reduces its price and consequently the household income (Lavrillier fieldwork 2014, 2015).¹¹

In addition to the deterioration in the quality of the fur, climate change also threatens the sable hunting in other ways: it shortens the hunting season by delaying the installation of the snow cover and of the coldest part of the winter; it creates perturbations in the evolution of snow cover; and it acts upon the formation of the vegetal cover, that determines the distribution of the sable population.

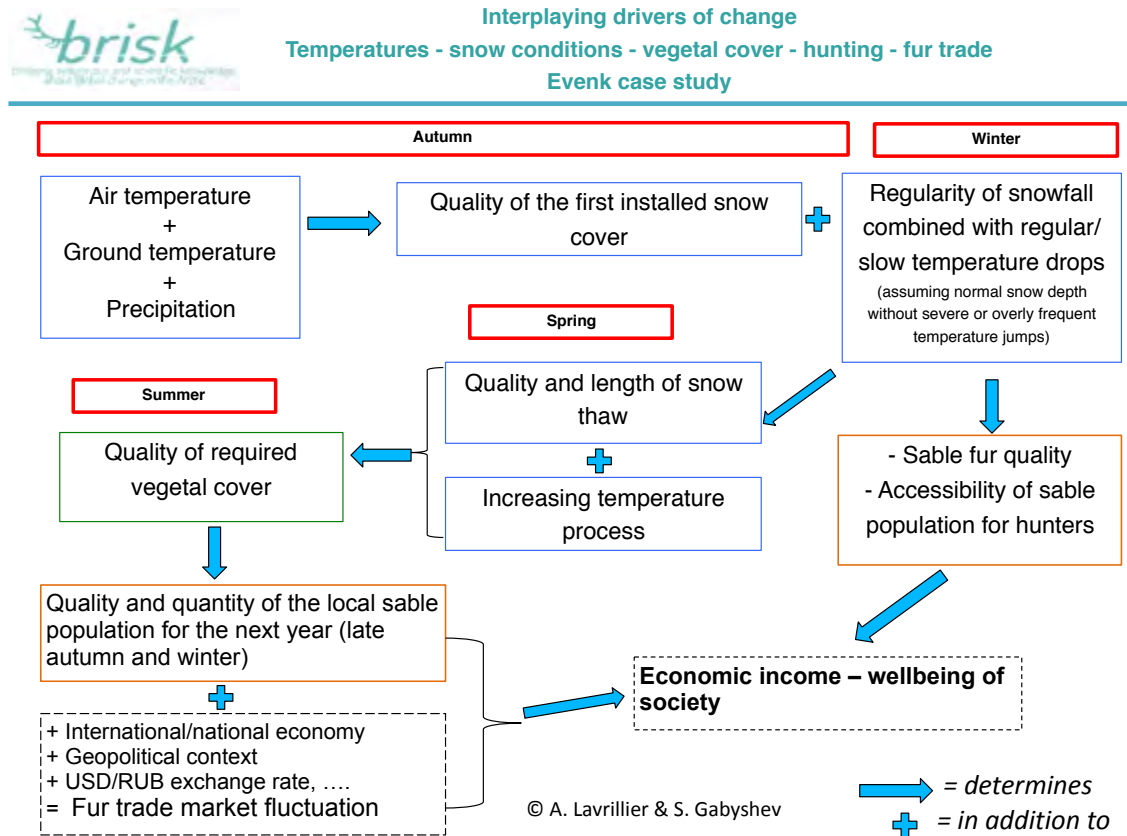


Figure 8.1. Interplaying drivers of change in Evenk: temperatures, snow conditions, vegetal cover, hunting, fluctuations in fur trade (Lavrillier & Gabyshev 2014).

► Disruptions of the schedule of snow cover installation

In the 1980s–1990s, sable hunting would start for the Evenk when all the individual animals’ sable fur was ready for sale, which was the normal period of October (even mid- or late-September for some years). In more recent testimony, based on materials gathered between 1994 and 2003, a monographic dissertation about the Evenk of the same area explains that snow cover and winter are installed between 15 and 30 September. In the past, the snow cover installation was expected around mid-September, marked by a specific day – opening the sable hunting season – named the ‘Semen day’ (inherited from the tsarist period and a vague understanding of Russian orthodox feasts),¹² with an ‘evenkisation’ of this Russian term for creating a verb meaning “it installs snow cover” – *semiondaren*, literally ‘it semions’ (Lavrillier 2005: 199). Nowadays, sable hunting starts

¹¹ Nomads notice also that elk skin that was in the past entirely thick and hardwearing, is now maintaining those qualities only on the back part of the skin (Gabyshev fieldwork 2015). Several Arctic representatives have expressed their concern about the loss of skin and fur qualities in multiple oral presentations and filmed interviews (e.g. Film on circumpolar Inuit and climate change by the Inuit film-maker Zakarias Kunuk, or on the Shishmareff Alaskan coast disaster, COP21 Arctic Day, Indigenous Pavilion).

¹² For this region, around the 18th-20th centuries.

at the beginning of November, when the real winter cold arrives. It becomes clear here that sable should be considered as an indicator of climate change.

The consequence of this delay is that Evenk hunters have lost an entire month of hunting, an important number of sable furs, and consequently income. The mean number of sable hunted in one month for a normal season is around 10–15 sables. This represents a loss of an important purchasing power.

Another consequence from having a much shorter hunting season is that hunters hunt in a hurry and are forced to always use the quickest method of reindeer transport – sitting on a sledge pulled by reindeer instead of riding reindeer – and to cover in one day a much bigger area than in the past.

Finally, having a too little time available for hunting, Evenk hunters adapt their hunting techniques as elaborated below, and change their schedules by starting hunting a bit before the deepest winter cold and before the entire sable population has fur ready for sale.

Sometimes, combined drivers of change (shortened winter and snow cover disruptions) also threaten the other main ecosystem service – the reindeer herding – as a consequence of the changes in sable hunting. The reduced period for hunting that forces hunters to spend almost all their time hunting during this period (instead of surveying the reindeer herd), adds to a very thin layer of snow (allowing the reindeer to move far in various directions), which then triggers a risk of losing the herd.

► Diverse disruptions of the snow cover impact hunting techniques

Several other environmental problems linked to the different qualities and depth of the snow cover have recurred over the past 10 to 15 years. As shown below, these problems result in multiple consequences: they threaten human access to the sables; they raise questions (for diverse reasons) regarding the presence of sable populations in certain areas; they threaten the sable access to vegetal cover; and (more indirectly), they endanger the quality of the vegetal cover.

The two techniques for sable hunting are dogs and traps. The Evenk traditionally perform the sable hunting with dogs. Dogs find the sable tracks and pursue it, followed by the hunter riding reindeer or sitting on a sledge pulled by reindeer. The dog must herd the sable in a tree, so the hunter can fire the sable (Lavrillier 2005). There is a saying in Evenk that if the snow cover reaches the level of just under the knee, this is the warning that very soon the dogs won't be able to pursue sable. It means that the hunters must hunt more intensively.

Sable hunting with dogs is much better than hunting with traps from the point of view of the Evenk. They do not like traps (which are more traditional for Russian/Slavic non-native hunters) because it allows catching too many sables, it is not 'fair play' towards the animals, it is considered as *ngaly*mo – 'ritually prohibited' in Evenk, it is likely to exhaust the sable population and 'nothing will be left for the next generations' (according to an expression of the hunters themselves), and it is also associated by the Evenk as a kind of poaching. In contrast, the non-native hunters hunt sables almost exclusively with traps, installing several hundreds of traps during the season. A non-native hunter often catches around 300 sables for the season in one hunting territory.¹³

► Disruptions in snow cover cause problems with accessing the sable

Certain circumstances prevent access to the sables for the hunters. Lavrillier and Gabyshev illustrate with a qualitative comparison of snow periods from ordinary herders' observations and the Evenk C-B TO (E C-B TO):

- **Autumn–Winter 2015–2016** (E C-B TO): It was an exceptional winter because snow came earlier, but with two anomalies. First, a lot of snow fell suddenly from 7–11 October covering

¹³ Evenk and non-native hunters hunt mostly in different hunting areas, defined either by official delimitation or by oral agreement.



the ground with 60–70cm of snow cover. Second, this snow was humid because of the warming temperature. Then, because of the temperature jumps, freezing during the nights or days, this wet snow has been transformed in a thick and hard asphalt-like layer of snow cover (*chegha* according to the Evenk snow typology). As a result, sables were running away very quickly from the hunters on the hard snow surface, while hunters and their reindeer were moving through the hard and heavy snow very slowly and with difficulty. After several unsuccessful attempts, they had to stop sable hunting with dogs on 11–12 October. Thus, they had in all, only four days of hunting with dogs (instead of between two to two and a half months in the past). At that time, only some sables' furs were ready for sale because of the warming.¹⁴

- ▶ **Autumn–Winter 2014–2015** (E C-B TO): This winter's snow cover was installed around 11 October with a too profound snow, under which appeared, a layer of 'snow-ice' attached to the ground and vegetal cover (*sy, si* in the Evenk snow typology). This type of snow, considered as an anomaly if it still exists in the winter, results from the thin layer of the first snow that melts during warm days, then, with abnormal rapid freezing, it is transformed into ice that encloses the vegetal cover, threatening access to it for domestic and wild animals.¹⁵ In addition, due to the repeated warming temperatures followed by freezing, a surface layer of 20 cm was transformed into hard snow, that made transportation difficult (*chegha* and *tepama imanna* in Evenk snow typology).¹⁶ The hunting with dogs could last until 5 November, so around 20–25 days of hunting with dogs. Some hunted sable were not/not entirely ready for sale.
- ▶ **Autumn–Winter 2012–2013** (from herder–hunter co-researcher observation): This snow period was extremely late, sable hunting started after 20 October and lasted until the end of November with dogs. The snow cover was installed on 14 October, with cold temperature and dry snow with a normal depth (just under the knee-height). It offered around 40 days of hunting with dogs. All the hunted sables were ready for sale. 2012 was a good sable hunting year (*justified by analysis Figures 8.3 and Table 8.2*).¹⁷

We can see here that different problems arise from 1) delays in the installation of the snow cover, and 2) the installation of the deep winter cold temperature that ensures the readiness of the sable fur for sale.

▶ Difficulties for sables in accessing the vegetal cover

The Evenk taxonomy distinguishes two kinds of sable population: the local sables (in Evenk *biskal*), and the migratory sables (in Evenk *ngenedjeril, alanderil* i.e. 'moving'). This distinction is made by the Evenk taxonomy for many species (wild reindeer, roe deer, black grouse, snow partridge, small birds, wolves, bears).¹⁸ It is not considered a taxon as such in Western science, although it is in the Evenk knowledge system. In contrast, the sable fur market distinguishes several sable sub-species according to biological taxonomy, but while the Evenk can identify these sub-species for the purpose of selling, these sub-species do not represent separate sub-species for the Evenk taxonomy.

The migratory sables move in small groups, moving from remote regions where snow is too deep toward regions where snow is less deep. If they find a good place (with many species of berries and field mice) they can stay a long time. They arrive in successive waves, because groups of sable are fighting for good territories and some groups can reject other groups from territories.

¹⁴ If a sable is killed that is not ready for sale, it is used by the hunters' family for sewing their own fur hats and other clothes, so it is not wasted.

¹⁵ This type of snow is known among reindeer herder peoples worldwide.

¹⁶ This hard layer supports neither human nor dogs, and crashes down. It is also difficult to go through.

¹⁷ These observations are confirmed by the temperature measurements made by the NCDC stations (used in BRISK climatologic study) and by the thermo-buttons installed by nomads. For 2014–15 and 2015–2016 it shows an important "yo-yo effect" of weather with temperature jumps of around 15°C from a day to another (Rojo).

¹⁸ Respectively: *Rangifer tarandus* L., *Cervus elaphus* L., *Tetrao urogalioides* Midd., *Lerwa lerwa* Hod., *Canis lupus albus* Kerr., *Ursus Arctos Horibillius* Ord.

Depending on the year, if the snow cover is very deep and compact, it covers and embeds the vegetal cover. The vegetal cover then becomes physically inaccessible for the sables, and sables cannot even smell/nose out berries or field mice. In this case, sables (migratory and also local ones) move away from these zones and consequently cannot be hunted by the local hunters.

► Disruption of the vegetal cover formation

Another disruption concerns the formation of the vegetal cover that determines conditions for the following hunting season. Thus, if the spring process is happening too early (as in the springs of 2014 and 2015), the snow cover melts out too early. Then, because of the night's and day's freezing, the frost freezes seeds and buds (in Evenk *bejipcha*) of the berries and *Pinus pumila* dies out. Thus, the following end-summer and early-autumn will not provide any harvest of berries and *P. pumila*, or it will be very poor, and during the winter sable won't have anything to eat.¹⁹ This means that during the following year's winter, the sable population won't be present or only very few will be in these hunting areas.

We can notice here among the herders-hunters the highly systemic type of TEK in use, and the ability for climate/environmental forecasting/hypothesis for even more than one year ahead.

From the above-presented qualitative comparison of snow periods, we understand that the key criteria that determine the sable hunting are the periods of the installation of the snow (late autumn) and of the melting of the snow (early spring).

According to Lavrillier and Gabychev's analysis, the Evenk have their own system of weather/climate observation and prediction. It understands "norms", where the yearly variations are included to a certain extent, with cases in which those variations are too important or too regular considered to be "anomalies". As reflected in this paper, for the nomadic Evenk, climate has lost its logic and has become very difficult to predict.

8.2.2. Economic and political drivers of change on sable hunting

Now that we have analysed climate and environmental drivers of change, let us study the economic and political drivers of change on sable hunting. Looking at the interplay of climate change and international economical and political drivers will allow a better understanding of the consequences upon a minority society.

The political drivers are firstly the fall of the Soviet power system followed by the destruction of the economic system in which Siberian indigenous peoples were living. Accordingly, without salaries, the ecosystem services from Siberian forest became essential for indigenous subsistence (including sable hunting). Secondly, at the international level, the measures and campaigns against the fur trade have acted against the economic interests of the nomads.

The economic drivers of change are various. They include international geopolitical interests for natural resources that raise the development of extractive industries' mega projects in the lands of nomads, and reduce their pastures and hunting areas (in addition to contributing to the anthropogenic drivers of climate change). There are other economic drivers influencing the prices of sables, and consequently the sable hunting practices and the economic wellbeing of this Siberian indigenous society. These drivers include the fluctuation of the USD/RUB exchange rate (influenced by various policies) at the international level; the international fur auctions (influenced by various economic and cultural factors); and, at the local level the micro-economy network of fur merchants (influenced also by changes in Russia's economy). In addition, the Russia's inflation and rising of price is also interplaying.

¹⁹ In Siberia, the summer berries get frozen into the snow cover all during winter until springtime – offering the animals "ready to hand" food storage within the snow cover.



► History of hunting for trading

Many Siberian peoples depend on fur trade for survival, especially those with taiga type reindeer herding like Evenk. It brings in the main income with which nomads buy all basic necessary goods such as flours, pasta, rice, salt, sodium, fish and meat cans and other basic goods (matches, tent tissue).

This trade was born during Russian colonisation (16–19th centuries according to the regions), when nomads were submitted to the fur tax (*yasak*).²⁰ Before Russian colonisation, nomads hunted mainly for food and rarely hunted the fur animals, except for clothing and decoration. The fur tax and the fur trade triggered a new hunting practice together with a new consumption of goods and food among the nomads. In contrast with other hunted animals from which almost each part is used (for food, clothing or decoration), hunters can only use the fur from the sable, while the bones and meat are not likely to be eaten, or exceptionally it is cooked for dogs (Lavrillier 2005).

The fur trade was also maintained and developed by the Soviet power for which it brought in an important income, and was maintained even after the collapse for private purposes. Between 1940–1950, in the Yakutia and Amur region, the Soviet power released a large population of sable from farms into the wild. Those farm sable have given birth to an entire sable population. It is important to note that before this introduction of the farm sable population, the Evenk hunted mostly squirrel, while sable were very rare. After the introduction, the sables have almost exterminated the squirrel population (Lavrillier 2005).

At the end of the Soviet power and the beginning of the 1990s, Evenk nomads also received income from selling reindeer spring antlers (*panyt* in Russian), mostly for the Chinese market. But this trade was cancelled in the early 2000s due to prohibition of international export. In addition to this, because the state farms were closed down, the hunters-herders stopped receiving salaries. From this time, sable trade became a vital part of the economy for the Evenk nomads (Lavrillier 2005).

► Dependency on the international fur trade

Nowadays, most of the worldwide fur production, including sable, is sold in the two St-Petersburg (Russia) and Fairbanks (Alaska) auctions. The results of these auctions in USD (with sales in January, April and December), as well as other factors, define the international and local price of the sable fur (see, for historical data, the Sojuzpushnina website).²¹

It is interesting to note that in Siberia the present commercial network through which the sables are sold and bought is the same as the one during the tsarist period and soviet power – based on the same geographical circulation of fur and the same system of credit. Indeed, in each village there is at least one local merchant that sells on credit basic food and goods at high prices to the nomads all through the year. The same nomads attempt to address their debts by “selling” their sables to this merchant who buys them at a low price. This market network includes a lot of related intermediary merchants (from small to bigger villages, from small towns to big towns, toward the St Petersburg auction) and each of them receives an important profit margin. The price difference between small villages’ and big towns’ merchants can be very important until it reaches the monthly subsistence wage for each sable.²² Of course, the price difference between small village merchants and the international auction prices is much bigger, but very few hunters can reach the St-Petersburg auction (Lavrillier 2005 and 2012–2015 fieldwork).

²⁰ During the time of Peter the Great, the fur tribute was considered to be the main resource of Siberia and was essential for state finances. During the time of Catherine the Great, it represented one third of the Imperial income (Forsyth 2000: 36–45, 57, 111 among others).

²¹ Sojuzpushnina website: www.sojuzpushnina.ru/ru/s/66/

²² Estimation by Lavrillier: in 2013, 51–60 euros difference per sable (around 4000–5000 RUB for each sable according to February 2013 EUR/RUB exchange rate). The 2013 official estimation of the subsistence wage – a good indicator of the cost of living – is between 5000–7000 RUB in Russia (<http://bs-life.ru/makroekonomika/prozitochiy-minimum2013.html>).

If an official enterprise has replaced the former State farms (Sovkhoz), it may practice another system, by buying the sable at a specific unique price, then readjusting the price for each sable after the results of their sales at the auction of St-Petersburg (Lavrillier 2005).

► **Fluctuations in the fur market: fur quality and sub-species migration**

The most important criteria for determining the price of the sable is its winter state (discussed above), the absence or presence of damage on the fur, its size (independently of being male, female or old), and the quality of the fur, which is determined by several factors.

First, some sable sub-species are valued at a better price than others (Table 8.1):

Table 8.1. Comparative table of average prices for a sable skin (St-Petersburg auction results of the sales of January 2015). The * indicates the species is hunted in the regions concerned by this study, data from Sojuzpushnina website archive. (Lavrillier)²³

Sub-species designations	Latin names	2015 USD average price per sable	% of one month's local subsistence wage, 2015
Sable skins farm	Various	115	74%
Barguzinsky*	<i>Martes zibellina princeps</i> (Bir.)	121	78%
Jakutsky*	<i>Martes zibellina jakutensis</i> (Nov.)	50	32%
Amursky*	<i>Martes zibellina vitimensis</i> (Tim. & Nad)	33	21%
Silvery sable*	Various (with scattered long white hair)	85	54%

Some sable designations correspond to sable sub-species with biological taxonomy according to the regions of usual residence of each sub-species. Nevertheless, these sub-species are often found out of their usual region. Thus, the Evenk concerned by this study also hunt sub-species migrating from other regions. So sub-species migrations have a strong influence on the nomads' income, depending on which sub-species cross their hunting area (Figure 8.2).

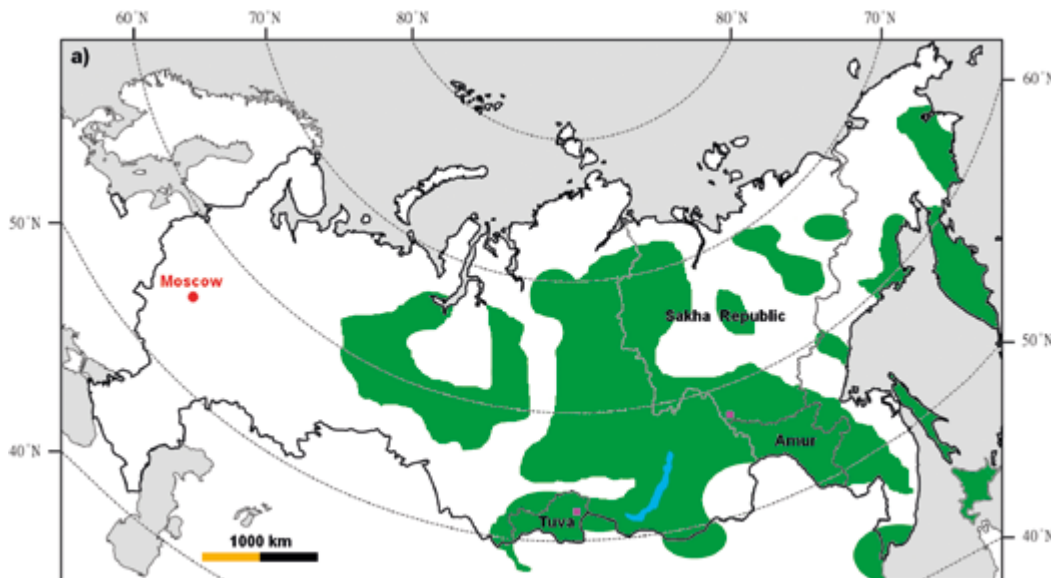


Figure 8.2. Area of repartition of Sable species from International Union for Conservation of Nature and Natural Resources (map from IUCN web site, adapted by Rojo).

²³ Estimation by Lavrillier: According to the exchange rate for USD of mid January 2015 1 USD = 64,40 RUB. The local region official subsistence wage for January 2015 was 10 000 RUB (Oanda website, Lavrillier fieldwork note).

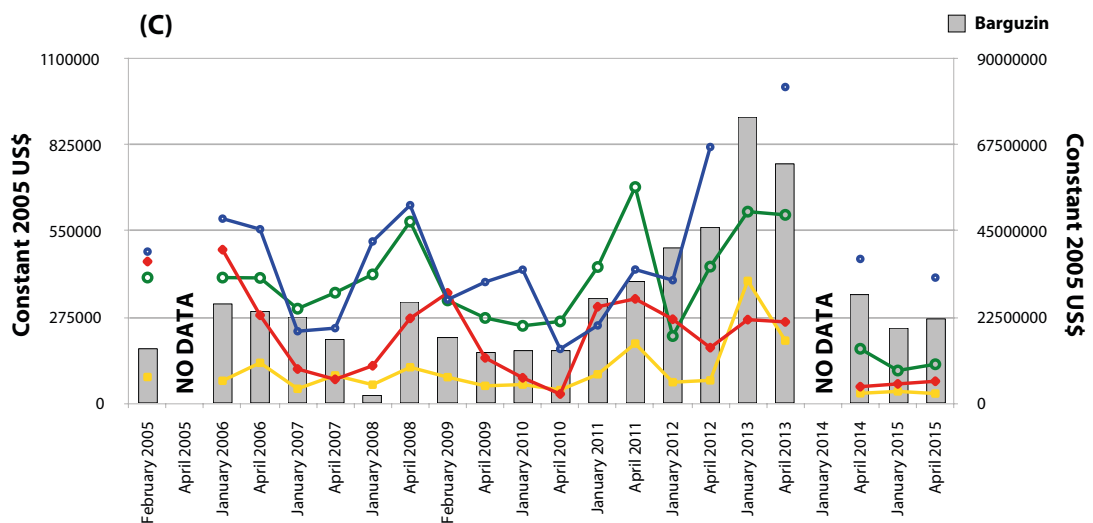
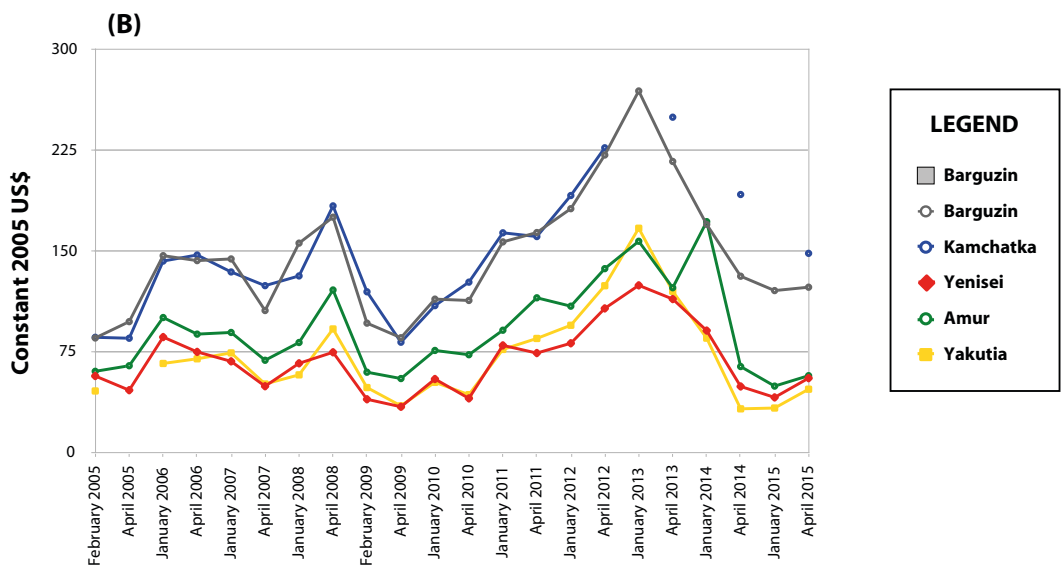
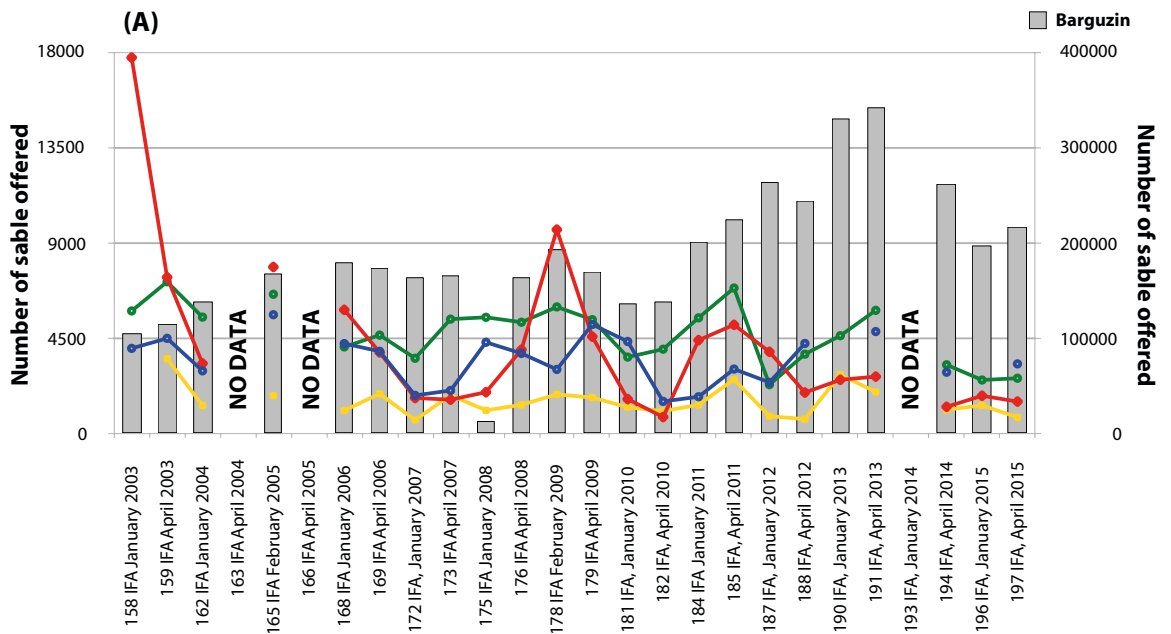


Figure 8.3. Strong fluctuation of sable fur market according to sub-species at the St-Petersburg International Fur Auction 2010–2015 (Rojo).

► The international market economy

The sable market has many fluctuations due to various drivers in addition to those elaborated above. Even the local fur trade professionals interviewed by Lavrillier in villages and in towns struggle with identifying the main factors determining the sable fur prices ranging from the Fairbanks auction results, fashion trends, the anti-fur movement, the new market of artificial fur clothes, etc. Nevertheless, the strongest influence is attributed to the past year's sable production and to the RUB/USD exchange rate variation (Figure 8.3).

The economic context in the Russian Federation during the study showed dramatic political and economical changes. After a strong crisis during the nineties, the Russian economy stabilized somewhat and then has been revived. From 2008, the Russian economy experienced a strong drop in the Russian ruble (RUB), triggering a sharp rise in prices of daily consumer goods and heavily impacting the daily life of the Russian population. Exchange rates between RUB and USD started falling between August 2008 and February 2009. Then RUB has almost constantly dropped from January 2014 (33 RUB for 1 USD) until 2016 (76 RUB for 1 USD). The fur market follows this fluctuation, which affects the nomads' income.

► Geopolitical Drivers of Change

In addition, the international geopolitics influencing the international market economy are also an interplaying driver of change. For instance, the commercial banning related to the Ukrainian conflicts acts upon the exchange rate of RUB and upon the rate of inflation in Russia, and both play an important role in reliability of sable hunting as a source of subsistence income for the Evenk population in two ways: 1) as one of the elements that influences the sable prices; and 2) by determining the purchasing capacity of this nomadic society.

8.2.3. Economic Consequences and Adaptations in Sable Hunting

► Consequences for the nomadic household's economy

According to a fieldwork study of the nomadic Evenk household economy done by Lavrillier between 2012–2015, the yearly incomes from fur hunting are mainly not enough for covering the basic expenses of the household, or else just enough. In addition, from the beginning of the Russian crisis, the sable prices have impressively declined, which induced an important decrease of income for nomads, at the same time that the national crisis resulted in a rising cost of life (Table 8.2).

Let us remember, that the snow period is the only time of the year when Evenk generate incomes. Indeed, the Evenk concerned by this study are not employees of reindeer herding enterprises and do not receive any salary; some of them receive once/twice a year subsidies for their family cooperative, but most of them are private reindeer herders without any other income than from hunting.

Thus, nowadays, the Evenk see their household purchasing power dangerously declining for several reasons. In the previous section we have seen that because of climate change they lost an entire month of hunting sable with dogs and face new difficulties of access to sable. We have now seen that the decrease of the sable price and the strong inflation in Russia add an additional pressure on household economy. The inflation is reflected by the abrupt augmentation of the subsistence wage (in 2015 it changed from 10,000 RUB in January to 15,000 RUB in December) and the impressive rise of prices.²⁴

As a consequence, an overwhelming majority of nomads are very often indebted to the hilt among the local merchants and, for the pensioner (thanks to their regular small pension) with credits in banks.

²⁴ The prices of food are growing up very impressively. For instance, in January 2015 sugar was locally 60 RUB/kg, rising to 80 RUB/kg in December; flour was 30 RUB/kg and became 40 RUB/kg.



Table 8.2. Comparative table of income/outcome from fur and food hunting for trading among nomadic Evenk (Yakutia-Amur) (from fieldwork analyses, exchanges rates, official sites for subsistence wage). (Lavrillier)²⁵

Hunting season	Sable hunting	Sable price per animal USD	Meat hunting	Meat price per animal USD	One subsistence wage USD	Beneficial USD (1 year)	Uses of all incomes (address debts + new purchase)
2015–2016	very bad	53 (4000 RUB) (bad)	bad	458	196 (15000 RUB)	NONE	Address debts + purchase basic food & goods next 5 months
2014–2015	bad	39 (2500 RUB) (very bad)	good	543	155 (10000 RUB)	1400	Address debts + purchase basic food & goods for next 10 months
2013–2014	very bad	121 (4000 RUB) (bad)	very bad	1051	285 (9400 RUB)	NONE	Partly address debts
2012–2013	good	200 (6000 RUB) (good)	medium	1166	200 (6000 RUB)	8 500	Address debts + purchase basic food & goods for next 14 months + expensive items (e.g. snowmobiles)

► Changing hunting techniques – threats to social and ritual values

A general analysis of consequences of climate change among the same Evenk highlighted adaptive practices in many domains, both pragmatic and symbolic, inducing other changes (2006-2012). For instance, some adaptations of hunting and herding practices have given rise to changes in social organisation. Also, there have been some changes in religious practices, such as modification of ritual gestures (Lavrillier 2008), as well as the creation of new rituals and changes in the perception of the human–natural environment relationship (Lavrillier 2013). Our present sable hunting case study shows new adaptive practices as outlined further below.

First, because of the bad sable hunting seasons, Evenk are sometimes forced to also hunt wild reindeer to sell, to balance the loss in order to get sufficient income for basic food and good purchases.²⁶ It follows that the wild reindeer meat is nowadays reserved mainly for selling, and only a small amount is left for personal consumption. This amount (much smaller than in the past) is now shared within a much narrow kin network than in the past. This creates some socio-familial tensions between nomads and their kin living in the village, which do not necessarily understand the situation of the nomads and their obligation to hunt sustainably.

Second, the Evenk have changed their sable hunting techniques, from hunting sable mainly with dogs, to hunting mainly with traps. From 2000–2005, step-by-step, hunters started to use more and more traps. Even if Evenk do not like sable hunting with traps for several reasons (elaborated above), they are forced to use them since they have a shorter period for hunting.

Indeed, hunting with traps requires less effort from reindeer transportation. It is enough to make a round once for installing the traps, then to check on the traps 1–2 weeks later. Thus, even if snow

²⁵ The USD/ RUB exchange rate in mid January for 2013 – 30,00, for 2014 – 33,28, for 2015 – 64,40, and for 2016 – 76,37 (Oanda website); average selling price per animal at local villages and town merchants; regional subsistence wages is for January of each year. It is in January that the Evenk make most of their purchases and sell the biggest part of their sable and meat production.

²⁶ The reindeer meat market is really underdeveloped and many hunters struggled with finding buyers. Nevertheless, there is no waste since, due to the indigenous rules of sharing, unsold meat is equally shared among close kin and friends.

is very deep, it is not too hard to go through once for installing the traps (and creating by this a “snow-road”),²⁷ then to come back along this already made snow-road for checking on the traps. In contrast, sable hunting with dogs obliges the hunters to create each day a new road and to cross fresh snow – which is either impossible, or very exhausting for reindeer in case of deep snow.

This change of hunting techniques contradicts the social and ritual values of the Evenk. Nevertheless, first the Evenk have no other choice; second, they use traps only when hunting with dogs becomes impossible; and third, they have found a compromise by installing a limited quantity of traps with a maximum of 30–50 per hunter to ensure sustainable hunting. This makes an important difference in comparison with the local non-native hunters that install several hundreds of traps.

Conclusion

Firstly, we understand that it is essential for hunters to understand, and to be able to predict, the evolution of the snow cover, as well as to know in detail the biodiversity of each small area of their huge nomadic space. The Evenk system of environmental observation and prediction is based on their knowledge about the interactions between elements of the environment. It is crucial to be able to predict changes in the vegetal cover, which is possible only by knowing (among other things) the interactions between snow cover and vegetal cover. The combined knowledge about evolutions of both vegetal and snow covers allows predicting the potential position of the animal population in the different areas, in order to adapt hunting for survival.

Secondly, we see here that climate change leads to specific environmental changes, which in turn create changes in traditional economic practices, which then triggers socio-economic problems among a population that needs to adapt its hunting techniques, and make compromises between economic needs and respect of their social and ritual values.

Thirdly, this study demonstrates that Siberian peoples (as do many other Arctic indigenous peoples) face climate change in concert with other interplaying global factors. In addition to climate change, other drivers interplay upon the Evenk society including political drivers and economic ones, at different scales. Political drivers include the destruction of the economic system in which Siberian indigenous people were living, which has led to the ecosystem services from Siberian forests, including sable hunting, becoming essential for indigenous subsistence. Economic drivers include fluctuations in the international exchange rate, the outcomes of international fur auctions, and, at the local level the micro-economy network of fur merchants (influenced also by changes in Russia’s economy).

We can see here, therefore, at both micro and macro scales, the interplay of the many different drivers of change, linking small indigenous communities of nomadic hunters-herders to the international economic and political realm.

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²⁷ The Evenk create several “snow-roads” that they regularly use during the entire snow period, by traveling once or twice along the same paths, so the snow will be hardened by the weight of the sledge and the freezing, which makes transport much easier.



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9. Sacred sites and biocultural diversity conservation in Kyrgyzstan: Co-production of knowledge between traditional practitioners and scholars

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Introduction

Sacred sites have roots in worldviews, beliefs and indigenous knowledge (Aitpaeva *et al.* 2009; Berkes 2012) and are encountered in various cultures around the world (Ramakrishnan *et al.* 1998) including Kyrgyzstan. Indeed, sacred sites are found in all regions in Kyrgyzstan, and in total there are more than 1,100 sites across the country.²⁸

This paper has been prepared by a guardian (Kalkanbekov Sezdbek) of Kochkor-Ata sacred site located in Naryn region of Kyrgyzstan and a researcher (Samakov Aibek) at Aigine Cultural Research Center located in Bishkek (Kyrgyzstan), which has surveyed sacred sites across the country in 2005–2015. We use Aitpaeva's (2013) definition of sacred sites as 'areas of land and bodies of water, as well as constructions and items, which are spiritually and/or religiously meaningful for local people and where sacral practices are performed.'

The paper consists of three main sections: first, we will explain why sacred sites should be considered as indigenous protected areas, in other words, community conserved areas (also known in scholarly literature as ICCAs); second, we will talk about the cooperation of Aigine CRC with sacred site guardians and traditional practitioners in co-production of knowledge; and third, we will conclude by highlighting how this knowledge and experience may contribute to drafting each chapter of the IPBES Report.

²⁸ A map will be available in the upcoming publication by Aitpaeva in *Asian Sacred Natural Sites: An Ancient Asian Philosophy and Practice with Fundamental Significance to Protected Areas* (B. Verschuuren, Ed.), Routledge, London and New York.



9.1. Sacred sites

Sacred sites in the Ysyk-Köl Biosphere Reserve (YKBR) are biologically and geologically diverse, and include various species of trees and bushes, bodies of water (springs, ponds, glaciers, and lakes), rock formations (cliffs, mountains, hills), and entire ecosystems. Traditional practitioners explain the diversity of sacred sites with the belief that every element of nature has its 'special' sacred representative:

Everyone knows a proverb saying that 'every seventh [one] is Khidyr.' This proverb reflects folk wisdom that all beings in this world have their representatives with special capacities. For example, we may roughly say that six poplars may be just regular poplars but the seventh one would be 'special', i.e., sacred. And it applies to everything – to trees, springs, animals, and people.

Siezbek Moldo, a guardian of Kochkor-Ata sacred site, 2014

Sacred sites in Kyrgyzstan vary in size and may contain an individual biophysical element as well as several biophysical elements (Table 9.1). There are some informal rules of visiting sacred sites, which can be distilled to several requirements and taboos.

For example, before coming to a sacred site and while being on a sacred site, a pilgrim should:

- ▶ Have good intent, respect and believe in the sanctity of a sacred site.
- ▶ Conduct an ablution before visiting a sacred site.
- ▶ Bring some ritual food, depending on the pilgrim's economic well-being.
- ▶ Keep the sacred site clean and take care of sacred places as far as opportunities permit.
- ▶ Conduct necessary rituals and ceremonies: recite the Quran, make wishes, pray, etc.
- ▶ Make a donation (as much as one can depending on his/her financial situation) if there is charity box.

Taboos for visitors of sacred sites are:

- ▶ Polluting and littering a sacred site.
- ▶ Causing damage to a sacred site's biophysical elements (e.g., cutting the branches of the trees, or bushes).
- ▶ Taking away anything that belongs to the sacred site (e.g., pilgrims leave some dishes and utensils near a sacred site so that other pilgrims can use them).
- ▶ Doing 'dirty' things such as drinking alcohol, smoking, uttering swear words, having sexual intercourse, urinating and defecating.
- ▶ Shooting firearms.
- ▶ Coming with uncovered head; all intimate parts of the body should be covered.
- ▶ Visiting sacred sites during one's menstrual cycle.
- ▶ Tying votive rags to branches of trees and bushes on sacred sites (because this causes damage to the trees and bushes by choking them).



Table 9.1. Diversity of sacred sites in the Ysyk-Köl region of Kyrgyzstan with respect to biophysical elements perceived as sacred (Samakov 2015)

Biophysical elements of sacred sites ^a	Number ^b	Example (Name in Kyrgyz [meaning in English]) ^c
Vegetation		
apple tree	3	Alma [apple] mazary, a site with a very old, single apple tree
apricot tree	10	Oruk [apricot] mazar, a big, old apricot tree grows on a hill. There is no vegetation around.
birch tree	1	Kyzyl-Jar [red cliff], a birch tree has grown on the burial place of a sheyt, an innocently killed person.
brushwood shrubs and bushes	4	Bala [child's] mazar is part of bigger sacred site called Chungkur-Bulak [spring in the hole].
dog rose bush	1	Chong-Kyzyl-Suu [big red water], a dog rose bush is located near the entrance to the Jyluu-Suu [Warm water] sanatorium (health spa)
fir tree	6	Oluya Zaur Ata [oluya Zaur father] is a big fir tree with three intertwined trunks.
hawthorn	6	Mai-Bulak [oil spring] consist of a hawthorn tree, a boulder and a spring. Local people believe that the guardian-spirit of local land lives there.
juniper bushes and trees	7	Archaluu [place with juniper] has juniper bushes and trees that grow in a hilly terrain with no other vegetation around it. Mostly people who want to have a child come for a pilgrimage.
mountain ash tree	4	Aziz [a respectful term for snake] is a mountain ash tree with prayer flags tied to it. A white snake is believed to be the guardian-spirit of the place.
Persian olive	1	Jiide, the site, has an old silver berry tree, also known as Persian olive or oleaster, locally called <i>jiide</i> .
pine tree	1	Altyn-Bulak [golden spring] is a pine tree with a warm spring next to it.*
poplar (various species)	26	Ak-Terek [white poplar] consists of six poplars and a spring. The poplars have grown bending into each other and they look like a yurt. The spring starts a little higher than the trees and flows to them.
rowan tree	1	Sary-Bulung [yellow gulf] is the name of the village where a sacred rowan tree and a spring are located.
sea-buckthorn bushes	3	Kessengir [mountain ridge covered with tall grass] consists of sea-buckthorn bushes and a spring at the beginning of the Kes-Senir canyon.
walnut tree	1	Talip-Akun-Ata [father Talip Akun] consists of a walnut and a willow tree. It was named after a very wise and skilful person who built a school in olden days.
willow (various species)	28	Mazar Bulak [mazar spring] is a cluster of old willow trees and a spring. According to local beliefs, this is one of the oldest sacred sites.

a This column is created based on document analysis of existing qualitative data on sacred sites in the Ysyk-Köl area (Aitpaeva 2009). The survey of sacred sites conducted by Aigine served as a sampling pool for the sites I [Samakov Aibek] visited during my field study in 2014.

b The number of sacred sites is calculated based on participant observation, interviews and analysis of existing qualitative data.

c Sacred sites visited or seen during the fieldwork. The site marked with an asterisk (*) was not visited. The description is adopted from (Aitpaeva 2009).

Table 9.1. Diversity of sacred sites in the Ysyk-Köl region of Kyrgyzstan with respect to biophysical elements perceived as sacred (Samakov 2015)

Biophysical elements of sacred sites	Number	Example (Name in Kyrgyz [meaning in English])
Water bodies		
lakes	2	Tuzduu-Suu [salty water] is a small salty lake whose waters are known to cure skin diseases.
ponds	3	Bakaluu-Kol [frog lake] is a pond which used to be a big lake according to folk history. Sacred white frogs were believed to inhabit this lake.
springs	42	Manjyly-Ata [father Manjyly] contains seven springs, each of which has distinct <i>kasiet</i> [a spiritual power].
Geological formations		
rocks and cliffs	3	Jeti-Oguz [seven oxen], a red limestone formation that resembles seven oxen.
hills	2	Kindik-Dobo [belly button hill] is a sacred hill with a shape resembling a belly-button.
mountains	2	Han-Tengir [Tengir is the name of the Creator] is a tall mountain with a sharp peak about 7000 meters high.
salt formation	1	Tuz [salt] is a hole with salt crystals in it.
stone	13	Tamga-Tash [stamp boulder] is a boulder with natural marks resembling a stamp (seal)
Ecosystems		
grove ecosystem	1	Kamanduu-Kol [wild boar lake] is a grove with different kinds of trees and shrubs; springs come out from under the roots of some of the trees.
alpine ecosystem	2	Tastar-Ata [father Tastar] is a valley named after a mountain with the same name. Alpine summer pastures are located at the higher elevations.
lake ecosystem	1	Ysyk- K�l Lake, the second largest high altitude lake in the world, is considered a sacred site as a whole.
Human made		
mausoleums	7	Karga-Ake is a recently built mausoleum for a historical figure known for his wisdom and justice.
tombs/graveyards	12	Karakol-Ata [Father Karakol] comprises a tomb, three yellow willow trees, a poplar tree and a spring. This complex is located in a Muslim cemetery.



Sacred sites have a body of **traditional knowledge** associated with them. This includes traditional knowledge about the sacred sites *per se*, such as oral history of the surrounding area and communities; knowledge about spirits, people, animals, and plants as well as medicinal properties of certain plants, springs, and soil; knowledge about indigenous worldviews and philosophies. Sacred sites contain knowledge that connects local people to the land.

Sacred sites have a prominent **belief** component. Beliefs regarding sacred sites shape a great deal of the behavior and perceptions of pilgrims who visit sacred sites. For example, it is believed that the sacredness of a site is manifested by its *kasiet* – special powers such as curing illnesses both spiritual and physical, bringing luck, repelling misfortunes, and easing people's burdens. The *kasiet* of a sacred site is associated with its guardian spirit, which is called *ee* (literally 'owner of the site').

Practices performed on sacred sites include various rituals related to healing, the well-being of an individual or a community, and repelling misfortunes. Some of the rituals are conducted individually, and some are done as a group. For example, the *tuloo* ritual is often conducted to ask for rain during the drought or dry season so that crops will give rich yields. Thus, sacred sites have an important connection to local people's livelihoods.

Sacred sites have a traditional institution of **guardians**, namely people who voluntarily take care of sacred sites. Sacred site guardians/custodians (called *karoolchu* or *shaiyk* in Kyrgyz) take up this responsibility of looking after particular sacred sites as a spiritual calling (Aitpaeva 2009). Some sacred site guardians are elected by communities to look after a particular site. The sacred site guardian's main responsibilities are: a) looking after a sacred site, which entails preserving the site from damage, and keeping it clean and respected; b) informing pilgrims about the *kasiet* of the sacred site and the rules to be followed; and c) reciting verses from the Quran and assisting pilgrims with conducting rituals. The combination of traditional knowledge, beliefs and informal institutions (such as rules and taboos as well as an institution of sacred site guardians) provides for protection of those sites by local communities.

9.2. Co-production of knowledge: the case of the Aigine CRC and TK holders

The Aigine Cultural Research Centre (CRC) has been cooperating with a vast range of actors while conducting participatory studies on sacred sites in Kyrgyzstan between 2005-2015. The primary purpose of those studies was to document sacred sites and indicate their name, type, location, oral history of the place.²⁹ These studies were carried out in accordance with academic ethics rules as well as 'indigenous ethics', i.e. rules and expectations that local people have towards sacred sites. Over the course of the studies, a wealth of local knowledge on healing practices, local environmental and social history, rituals, ceremonies, beliefs and worldviews have been recorded. These topics emerged because they were linked closely to the practice of visiting the sacred sites in the knowledge holders' perceptions. Observations raised during the workshop are summarised in **Table 9.2**, and various rituals conducted on sacred sites are listed in **Table 9.3**.

²⁹ For more details, see list of publications by the Aigine Cultural Research Centre: http://aigine.kg/index.php?option=com_content&view=article&id=459&Itemid=597&lang=en.

Table 9.2. How a body of traditional knowledge on sacred sites in Kyrgyzstan can contribute to the IPBES report

Report chapters	Our comments
<p>Chapter 2 biodiversity (BD) and ecosystem services (ES) and human-well being</p>	<p>Sacred sites are biodiversity hotspots in many parts of the world (Verschuuren <i>et al.</i> 2010). In Kyrgyzstan, sacred sites are conserved-through-use by local communities for spiritual reasons.</p> <p>Sacred sites in Kyrgyzstan perform social and cultural functions. The well-being of a sacred site is often linked to the well-being of the community (Aitpaeva 2016). Various rituals related to healing, personal and community well-being and livelihoods are conducted on sacred sites (Table 9.3).</p>
<p>Chapter 3 BD and ES: past, present trends</p>	<p>Local knowledge about sacred sites often contains information about how the local environment has been changing over time. This knowledge can be used to tap information about BD and ES for the periods of time and areas where there is no much scientific data (e.g. Kyrgyzstan).</p>
<p>Chapter 4 indirect and direct drivers of BD and ES change</p>	<p>Informal institutions such as sacred site guardians can be both direct and indirect driver for preserving BD on sacred sites in Kyrgyzstan. They make sure visitors observe the rules and taboos on sacred sites (thus, ensuring direct conservation of BD on sacred sites) as well as spread and uphold traditional values and worldviews, which promote harmonious co-existence with nature (thus, indirectly contributing to BD conservation).</p>
<p>Chapter 5 scenarios, visions, paths and modelling</p>	<p>Developing scenarios are regarded as a scientific tool for foreseeing and modeling the future. A traditional practice of <i>bata kyluu</i> 'making <i>bata</i>' is similar to building scenarios. We did <i>bata</i> at the beginning of the workshop and at the end. Basically, this ritual is about creating and broadcasting a common vision and making a wish about the well-being of the community and success in the undertaking that brought together people making <i>bata</i>.</p>
<p>Chapter 6 policy tools</p>	<p>Although sacred sites informally play a prominent role in biocultural conservation in Kyrgyzstan, they are not recognized legally. Legal recognition of sacred sites (that takes into account specificity of local worldviews and that leaves enough governance space for local communities) can improve biocultural conservation beyond sacred sites (Samakov and Berkes 2016).</p>

Table 9.3. Some rituals conducted on sacred sites by individuals and communities (Samakov 2015)

Name of the ritual		Description
English transliteration	Literal translation	
<i>Aidar (Niyaz) chach aluu</i>	Cutting <i>Aidar (Niyaz)</i> hair	<i>Aidar chach</i> is a lock of hair, which is left on the long-desired baby's head after the first haircut to assure well-being and protection of the baby. The ritual of <i>aidar chach</i> is usually conducted at a sacred site by healers or sacred site guardians.
<i>Ak chachuu</i>	Scattering the white	Traditionally, this is a ritual of pouring out something white such as milk, yogurt, or flour to appease, show respect, and drive snakes out of person's house, garden, or any other place. Sometimes it is also used to greet and show respect to sacred site guardian spirits.
<i>Aktykty moyunga aluu</i>	Accepting whiteness	This is a ritual of a person accepting his/her spiritual mission such as healing (physical and/or psychological conditions), fortune telling, and/or spiritual channeling. The form and content of this ritual varies from case to case, although frequently it is conducted at sacred sites.



Table 9.3. Some rituals conducted on sacred sites by individuals and communities (Samakov 2015)

Name of the ritual		Description
English transliteration	Literal translation	
<i>Dem saluu</i>	Inserting energy	This healing ritual consists of reciting <i>duba</i> , prayers and spells, which help to feed additional energy to the person in need.
<i>Jar saluu</i>	Singing <i>Jar</i>	This is a ritual of singing/reciting/chanting words from the Quran and inviting spirits who support you.
<i>Jeti tokoch</i>	Seven flat breads	<i>Tokoch</i> is a type of round fried or baked bread. It is usually prepared by pilgrims before visiting sacred sites. This ritual is done to honor the guardian spirit of a sacred site and other invisible forces.
<i>Kudai tamak</i>	God's sake food (<i>Kudai</i> is a word used for God in Kyrgyz language)	This is a sacrifice ritual of gratitude to God conducted by a group of people such as family, neighbors, villagers, pilgrims and others. Depending on the occasion and the wealth of the group, a goat, a sheep, a cow, or a horse is sacrificed; food is prepared and all participants share it. Some communities conduct this ritual in spring asking the Creator for good weather and a plentiful harvest, as well as in the fall to thank for the Creator for the harvest. When a couple gives birth to a child after conducting a pilgrimage to a sacred site, a family usually performs the <i>kudai tamak</i> ritual at that sacred site.
<i>Kurmandykka chaluu</i>	Sacrifice	This is a ritual of sacrificing livestock (such as sheep, goat, cattle, or horse) for the sake the Creator. The sacrifice is considered a ritual on its own right; however, often it becomes part of other rituals such as <i>tuloo</i> or <i>kudai tamak</i> . The ritual of sacrifice is the main purpose of some Muslim holidays such as <i>Kurman Ait</i> (Eid al-Adha).
<i>Sham jaguu</i>	Lighting a candle	<i>Sham</i> is a ritual hand-made candle. A wisp of cotton is soaked in plant oil or animal fat and is usually wrapped around a dry reed stalk. Some candles are made without stalks. <i>Sham jaguu</i> is a ritual of lighting these candles; it can be conducted both at home and on a sacred site. The ritual may be done for various purposes such as to show respect to the sacred sites' guardian spirits, to pray, and to receive spiritual information from them in memory of the departed. This ritual is outlawed by the followers of radicalized Islam, and it is prohibited at some sacred sites related to Islam.
<i>Tilek kyluu</i>	Making a wish	This is a ritual of articulating a wish (within the heart or aloud, on one's own or as part of a group). Making a wish is one of the key elements of pilgrimage to a sacred site.
<i>Tuloo</i>	Sacrifice	This sacrifice ritual is dedicated to a particular occasion. It is done to divert bad luck, overcome misfortunes, or safeguard individual or collective well-being. Livestock such as sheep, goats, cattle, and horse as well as poultry are acceptable sacrificial offerings.
<i>Zikir chaluu</i>	Chanting <i>Zikr</i>	<i>Zikr</i> is an Islamic ritual of reciting the names of Allah and glorifying his greatness, qualities, and omnipotence. This ritual is a part of other healing rituals.

Conclusion

The study of sacred sites in Kyrgyzstan from a social sciences perspective shows that these areas are revered by local people due to the spiritual and cultural significance of the sites, and they are protected as a result of this. This finding is congruent with studies of sacred sites around the world that show that sacred sites often become areas protected by indigenous and local communities (Verschuuren *et al.* 2010). Traditional practitioners and local people in Kyrgyzstan may not implicitly declare biodiversity conservation as their primary goal in protecting sacred sites. However, the rules of behavior on sacred sites, traditional knowledge and belief system leads to preservation of biota located on sacred sites. Thus, sacred sites serve as an example how a cultural phenomenon such as a tradition of visiting sacred sites can have a positive impact on biodiversity conservation.

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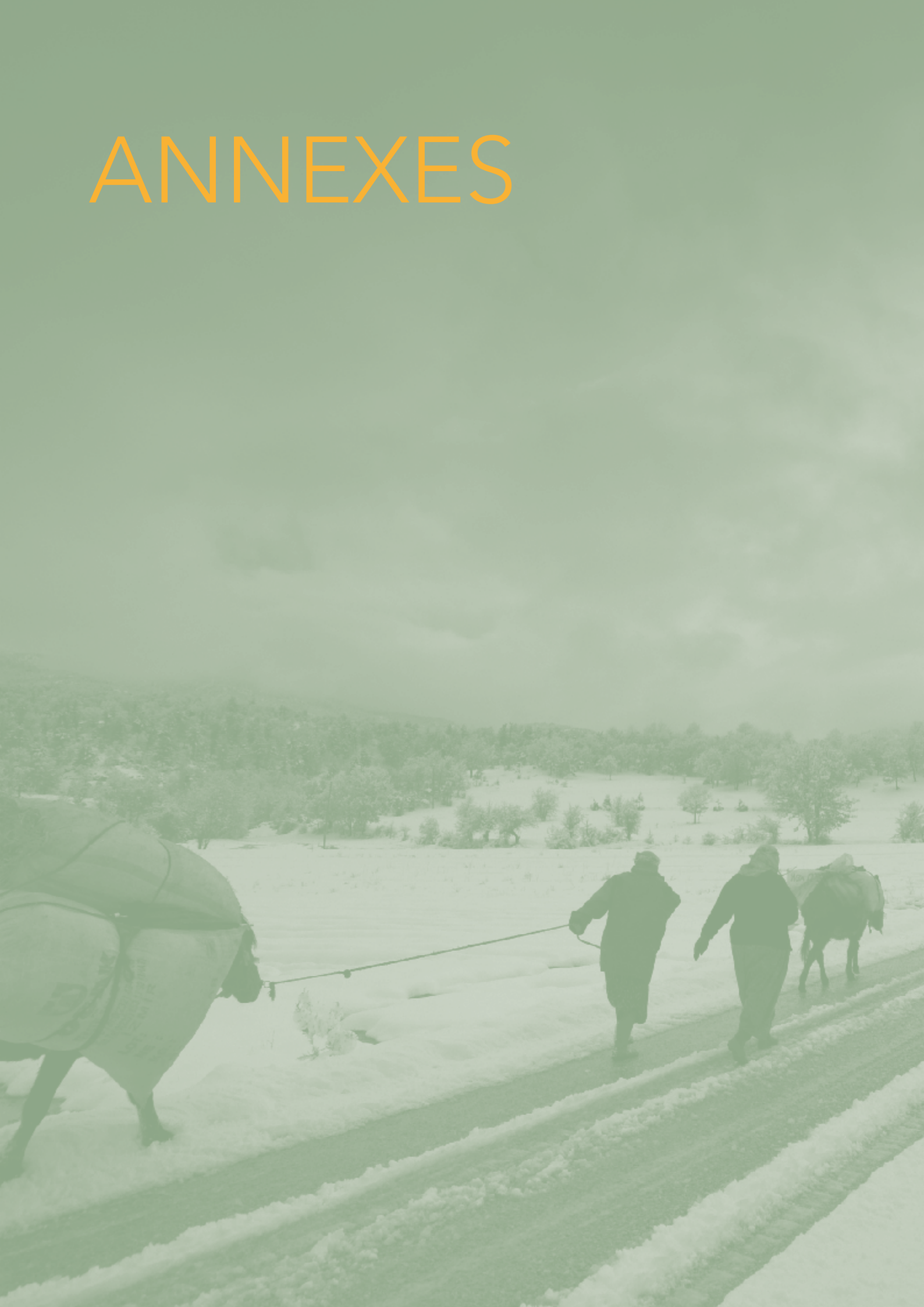
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ANNEXES



ANNEX 1

Agenda of the ILK dialogue workshop

Day 1	Monday, 11 January 2016	Participants
8:45 - 9:15	Registration	
9:15 - 9:30	Opening Session welcome by - <i>Tamar Pataridze</i> , co-chair of the Task Force on ILK - <i>Markus Fischer and Mark Rounsevell</i> , co-chairs of the Europe & Central Asia (ECA) assessment	Plenary: ILK holders/experts; Assessment co-chairs, CLAs, LAs, TSU; ILK Task Force co-chairs, MEP and TF members, TSU.
9:30 - 10:15	Setting the Scene Introductions to: <ul style="list-style-type: none"> ○ IPBES assessments (incl. conceptual framework) <i>Anne Larigauderie</i>, Executive Secretary, IPBES ○ ILK in IPBES <i>Marie Roué</i> (MEP) and <i>Zsolt Molnár</i>, ILK task force members Question period (15')	Plenary
10:15 – 10:30	<i>Coffee/tea break</i>	
10:30 - 11:15	Overview of the Europe & Central Asia Regional Assessment report: Zero Order Draft By assessment co-chairs and authors Question period (15')	Plenary

<p>11:15 - 12:45</p> <p><i>For each case study: 15' presentations and 15' discussions</i></p>	<p>Indigenous and local knowledge about Biodiversity and Ecosystem Services</p> <ul style="list-style-type: none"> ➤ land degradation & restoration ➤ sustainable use & conservation ➤ invasive alien species & their control <p><i>... your experiences and concerns</i> <i>Chaired by Çigdem Adem (tbc)</i></p> <p>Presentations by ILK holders/experts:</p> <ul style="list-style-type: none"> ○ <i>Samuel Roturier</i> (Lab. Ecology, Systematics, Evolution, AgroParisTech, France): Sami reindeer herders and subarctic ecosystems: Bridging indigenous and scientific knowledge through community-based observatory (Sweden) ○ <i>Semen Gabyshev</i> (Evenk reindeer herder from Amur region of Russia and Southern Yakoutia, Russia) and <i>Alexandra Lavrillier</i> (CEARC, Versailles Saint-Quentin-en-Yvelines University, France): BRISK - BRidging Indigenous and Scientific Knowledge about global change in the Arctic (Russia) ○ <i>Florent Mercier</i> (Réseau Semences Paysannes, France) and <i>Elise Demeulenaere</i> (CNRS/MNHN, France): Dynamic farm-based management of cultivated diversity and participatory selection of seeds by farmers 	<p>Plenary</p>
<p>12:45 - 14:15</p>	<p><i>Lunch (UNESCO Cafeteria)</i></p>	<p><i>Distribution of DSA</i></p>
<p>14:15 - 15:45</p> <p><i>For each case study: 15' presentations and 15' discussions</i></p>	<p>Presentations by ILK holders/experts (continued):</p> <ul style="list-style-type: none"> ○ <i>Sezdebek Kalkanbekov</i> (guardian of Kochkor-Ata sacred site, Kyrgyzstan) and <i>Aibek Samakov</i> (Aigine Cultural Research Center, Kyrgyzstan): Sacred sites and biocultural diversity conservation in Kyrgyzstan: co-production of knowledge between traditional practitioners and scholars ○ <i>László Demeter</i> (University of Pécs, Hungary/ Ukraine): Traditional forest use and diversity of flood plain forests of Bereg Plain (West Ukraine) ○ <i>Cosmin Marius Ivascu</i> (Babeş-Bolyai University, Romania): Bio – cultural adaptations, traditional ecological knowledge and management in Maramureş (Romania) 	<p>Plenary</p>
<p>15:45 - 16:00</p>	<p><i>Coffee/tea break</i></p>	

16:00 - 17:00 <i>For each case study: 15' presentations and 15' discussions</i>	Presentations by ILK holders/experts (continued): <ul style="list-style-type: none"> ○ <i>Anna Varga</i> (Hungarian Association for Land and People, Hungary): Restoration of the relationship between land and people in Hungary, case of agroforestry systems and traditional knowledge transmission ○ <i>József Kis</i> (herder, Hungary) with <i>Zsolt Molnár</i> (Centre for Ecological Research, Hungary): Revitalizing traditional herding for nature conservation and sustainable agricultural use of extensive grasslands (including film of 15') 	Plenary
17:00 - 18:00	Collective identification of emerging themes/issues	Plenary
18:30	Reception (7th Floor)	
Evening session	Finalization of themes/issues for dialogue sessions. Planning for Day 2	ILK Task Force, Assessment co-chairs and selected CLAs, and TSUs

Day 2	Tuesday, 12 January 2016	
9:15 - 9:30	Overview of progress and Planning for Day 2	Plenary
9:30 - 11:00	Dialogue session among ILK holders/experts and authors on Theme One Brief reflections, comments and questions by ILK holder/expert and by ECA authors	Plenary or Break-out Groups (tbd)
11:00 - 11:15	<i>Coffee/tea break</i>	
11:15 - 12:45	Dialogue session among ILK holders/experts and authors on Theme Two Brief reflections, comments and questions by ILK holder/expert and by ECA authors	Plenary or Break-out Groups (tbd)
12:45 - 14:00	<i>Lunch (sandwiches provided)</i>	
14:00 - 15:30	Dialogue session among ILK holders/experts and authors on Theme Three Brief reflections, comments and questions by ILK holder/expert and by ECA authors	Plenary or Break-out Groups (tbd)
15:30 - 15:45	<i>Coffee/tea break</i>	

Day 3	Wednesday, 13 January 2016	
9:15 - 9:30	Overview of progress and planning for Day 3	Plenary
9:30 - 10:30	Dialogue session among ILK holders/experts and authors on Additional Issues and Concerns	Plenary
10:30 – 10:45	<i>Coffee/tea break</i>	
10:45 - 12:30	Discussion and agreement on next steps <ul style="list-style-type: none"> ○ Follow-up meetings/workshops organized by ILK holders/experts (presentation by <i>Nicola Césard</i>, ILK task force TSU) ○ Developing the proceedings from the ILK dialogue workshop ○ ILK in the scientific and grey literature for the ECA region (<i>Zsolt Molnár</i>) ○ Optimizing ILK inputs for the Authors of the ECA Assessment 	Plenary
12:30 - 13:00	Conclusions and closing	Plenary
13:00 - 14:00	<i>Lunch (sandwiches provided)</i>	
14:00 - 16:00	Collective Analysis of the Challenges and Solutions for building ILK into IPBES assessments	ILK TF, Assessment co-chairs, CLAs and LAs, TSUs

ANNEX 2

Participants list for the ILK dialogue workshop

Indigenous and Local Knowledge (ILK) holders and experts

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ANNEX 3

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Mats-Peter ÅSTOT is a reindeer herder from the Sami community of Sirges in northern Sweden. He is member of the board of his community and is actively involved in the BRISK research program aiming at improving the dialogue between scientific and indigenous knowledge. He is also a recognised carpenter, having received awards for building traditional Sámi dwellings in the Lapponia World Heritage site.

Daniel BABAI studied biology and ethnology and cultural anthropology at the University of Pécs, in Hungary. He works at the Research Centre for the Humanities, Institute of Ethnology (Hungarian Academy of Sciences) since 2007. He finished his PhD in 2014 (Botanical and ethnoecological investigation of mountain vegetation in Ghymes (Eastern Carpathians Romania)). He is interested in ethnoecological knowledge and extensive grassland management.

Sándor BARTA was born in 1982 in Karcag. Married, has a daughter. He was born into a herder family, and learnt his herding skills from his father. Since the finishing of the secondary school he has been working as a herder. Sándor herds on and thus manages salt steppes and marshes of the Hortobágy National Park. He is one of the participants of the film “Traditional ecological knowledge of Hungarian herders”.

László DEMETER was born in The Ukrainian Soviet Socialist Republic, in 1986. In 2009, he became qualified as a Specialist in Biology and Geography, receiving his specialist degree from the Transcarpathian Hungarian Institute. Before he became a researcher, he worked as an English teacher in a Ukrainian primary school. Currently, he is at the early stage of his research career and is doing a PhD at the University of Pécs, Hungary. He is interested in traditional forest-related knowledge and forest management.

Lajos ELEKES is a cattle herder, born in 1964. He learnt his herding skills from his age of three, working with his herder grandfather and shepherd uncle. He has been a full-time herder since 1990, mostly working with cattle but also with horses and sheep. He herded the gray cattle herd (270-390 heads) of the Kiskunság National Park at Pusztaszer on sand, loess and salt steppes and marshes. He is employed by the Ópusztaszer Heritage Park at present, but keeps cattle, sheep and horses at his farmstead. He loves and respects Nature very much.

László ENGI is a cattle herder, born in 1975. He has been a herder for 10 years. He is working on the salt steppes of the Csanádi-puszták Protected Area, which is part of the Körös-Maros National Park. He herds the Hungarian Grey Cattle herd of the NP (150-300 cattle). He learnt his herder skill from older herders and own experience. His hobby is ornithology.

Tibor FEGYVER is a cattle herder, born in 1972. Herding has been his main job for 20 years, but he learnt his knowledge in his childhood from his herder father. He is also working for the Körös-Maros National Park, with its grey cattle herd of 150-300 heads. He likes reading a lot while herding. He is very observant toward nature and regularly writes poems about it.

Semen GABYSHEV is an Evenk reindeer herder and hunter with 26 years of experience in Amur region and Yakutia (Russia). Confirmed holder of the Evenk TEK and language, associate member of the CEARC, he is implied from 2012-2013 in scientific projects as an indigenous co-researcher: BRISK on environmental and climate changes, POLARIS on tourism and cultural and natural patrimony, PARCS on perception of pollution.

Anita HEIM completed her MAppSc in Protected Area Management at James Cook University, Australia and her MSc in Ecology at Eotvos Lorand University, Hungary. Currently she is doing her PhD studies in agroecology at the University of Helsinki on the topic of “Drivers of food and nutrition security among a Sub-Saharan indigenous group”. In her research she takes a transdisciplinary approach by combining ecological, social and nutritional sciences with cultural knowledge systems to unwrap

the complexities of the drivers of food choices, and the connections of landscape to nutrition among the San people in Namibia.

Cosmin IVAȘCU is a PhD student at the Babeș-Bolyai University, Faculty of Biology and Geology with research interest in ethnoecology, ethnobiology and historical ecology. Current research is focused mainly in Romania and the Romanian Carpathians. Starting from 2014 and ongoing he spent over 70 days of fieldwork documenting the traditional ecological knowledge of the locals from Ieud village, county Maramures, Transilvania region.

Sezdebek KALKANBEKOV is a traditional knowledge holder and a guardian of Kochkor Ata sacred site located in Kochkor district of Kyrgyzstan. This sacred site is one of the best known sacred sites in Kyrgyzstan which attracts pilgrims from all over the country and beyond.

József KECSKEMÉTI is a herder and sheep farmer, born in 1977. He has been engaged with shepherding since his childhood, almost born into it. His masters, his father and uncle were shepherds too. He owns 160 sheep, and grazes them on sand and salt grasslands at Kunadacs inside the Kiskunság National Park.

József KIS is a cattle herder, born in 1982. He learnt his herder knowledge in his childhood working with his grandfather and other herders. He has been a full-time herder since 2002. He mostly worked on the salt steppes of the Horbotágy National Park. He is now working at Fábiánsebestyén (Csongrád county), herding 250 cattle. He also graduated as a conservation manager in 2011 at the Debrecen University. His main interests are conservation-oriented traditional grazing and pasture management.

Levente LAJKÓ is a shepherd and sheep farmer, born in 1973. He owns and rents pastures at Üllés, and grazes 300 sheep on dry sand pastures. He has been farming for 12 years. He learnt his herding skills from old herders, own experience, books and internet.

Alexandra LAVRILLIER is an Associate Professor in Anthropology at the CEARC (Cultures, Environments, Arctic, Representations, Climate), (UVSQ) of University of Paris-Saclay. Fluent in Evenki, she performed around 9 years of fieldwork on hunting, reindeer herding, landscape management, representations of the natural environment, adaptations brought by postsocialism, the market economy and climate change as well as shamanism among Evenki, Even and Yakut.

János MÁTÉ was born in 1980 in Debrecenben. His parents were herders, he has been herding since the age of 10. Married, has a son and a daughter. He learnt his skills from his father, grandparents and uncle and worked as shepherd or cattle herder. János herds on and thus manages dry and wet meadows of the Kiskunság National Park. He is one of the participants of the film "Traditional ecological knowledge of Hungarian herders".

Ábel MOLNÁR was born in 1991 in Miskolc. His parents are botanists. He learnt agriculture at the Szent István University, Gödöllő (agri-environmental topics as BSc and general agriculture as MSc). He is interested in habitat mapping for nature conservation and photo documentation of traditional small-scale agriculture of mountain farmers in the Eastern Carpathians and steppe herders in the Hungarian Plain.

Lars-Evert NUTTI is a reindeer herder from the Sami community of Sirges in northern Sweden. In addition to his herding activities, he is actively involved in the dialogue between the forestry sector and reindeer husbandry, engaging regularly in dialogues at the national level. He has become an expert in forestry – reindeer husbandry interaction in Sápmi.

Jakob NYGÅRD is a reindeer herder who heads the Sami reindeer herding community of Sirges based in Jokkmokk, northern Sweden. He is a board member of the Laponia World Heritage site, and is particularly active on social networks sharing the joys and difficulties of being a reindeer herder.

Laszlo RAKOSY is a Professor, Director of the Department of Taxonomy and Ecology of the Faculty of Biology and Geology, Babeș-Bolyai University, with main research interests in Lepidopterology, zoogeography, taxonomy, biodiversity conservation of Transylvanian cultural landscapes, cultural ecology.

Samuel ROTURIER is an Associate Professor in restoration ecology at the AgroParisTech/Paris-Saclay University. He has been working for 10 years on reindeer winter pastures in northern Sweden together

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László SÁFIÁN was born in 1969 in Debrecen. Married with one daughter. He is a traditionally working shepherd having ca. 500 merino-type and crossed sheep. He works with his own and his brother's family. He learnt his herder knowledge from his father. László herds on and thus manages sand steppe pastures of the Hortobágy National Park. He is one of the participants of the film "Traditional ecological knowledge of Hungarian herders".

Aibek SAMAKOV is currently a PhD student in anthropology at the University of Tübingen (Germany) and holds a Master's degree in Natural Resources Management from the University of Manitoba (Canada). He also has been working for Bishkek-based Aigine Cultural Research Center (Kyrgyzstan), which focuses on research as well as applied projects related to traditional knowledge and sacred sites. Aibek is interested in human dimensions of natural resource management, sacred sites and environmental anthropology.

Dávid Pelé SÜTŐ was born in 1990 in Debrecen. He studies Visual Anthropology at the Miskolc University. His hobby is folk dancing. His first film is about a roma family, the second is a film for IPBES: "Traditional ecological knowledge of Hungarian herders". He has been studying the culture of the herders at the Hortobágy; his MSc topic is "Recent image change of the 'puszta'".

János SZABÓ is a shepherd, born in 1977. He was born into a herder family, his father and grandfather were shepherds too. Even during his military service he worked as a military shepherd. He has been working as a herder since 1992 in many regions of Hungary, herding sheep, goats and cattle on many different types of pastures. He has a wide experience on livestock's grazing preference and nature. He works with 300 goats on a sand pasture near Győr at present.

Anna VARGA is a traditional ecological knowledge's snippets and traditional value system was given for me by my family and ancestors through their traditional rural lifestyle. She is the leader of The Hungarian Association for Land and People NGO since 2006. Their aim was to understand the traditional connections between land and people in the Carpathian-basin. As a student she started to research silvopastoral systems in the Carpathian-basin. Anna Varga continued this research during her PhD study and still works on traditional silvopastoralism as an assistant research fellow of the Traditional Ecological Knowledge Research Group, Institute of Ecology and Botany, Hungarian Academy of Sciences. She participates in the AGFORWARD project, which focuses on agroforestry systems in Europe.

Maxence ROJO is a PhD student in anthropology and climatology at the CEARC. His studies (funded by BRISK project and the Laboratoire Météorologie Dynamique) crosses perspectives in climatology and social sciences in various frames, like polar lows and local economics. In addition to trans-Siberian analysis of climatologic data, he had also conducted fieldworks in Tuva Republic (Russia) among townspeople, villagers et various herders.

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Zsolt MOLNÁR is a botanist and ethnoecologist, born in 1966. His main fields of study are historical landscape ecology of the Hungarian Plain, traditional ecological knowledge and methodology of habitat mapping. Founder and leader of the Traditional Ecological Knowledge Research Group of the Hungarian Academy of Sciences. He studies botanical, vegetation and landscape historical knowledge of steppe herders and mountain farmers in Hungary, Romania, Russia and Mongolia, and how this knowledge could be used in nature conservation. He is the author of more than 130 scientific papers and author or editor of 12 books.

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Knowing our Lands and Resources is a compendium of knowledge, practices and worldviews of indigenous peoples and local communities from across Europe and Central Asia. It demonstrates the essential contribution that indigenous and local knowledge holders make to assessments of biodiversity and ecosystem services.

The papers in this volume have been prepared for the Author team of the IPBES assessment of biodiversity and ecosystem services for Europe and Central Asia. The objective is to assist the Author team with their task of grounding the assessment in both science and indigenous and local knowledge (ILK). The papers complement existing sources of ILK in the scientific and grey literature, and contribute relevant ILK that might not otherwise be available to the assessment process.

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