

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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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. 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 (cf. 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 (cf. 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 (See Table 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.



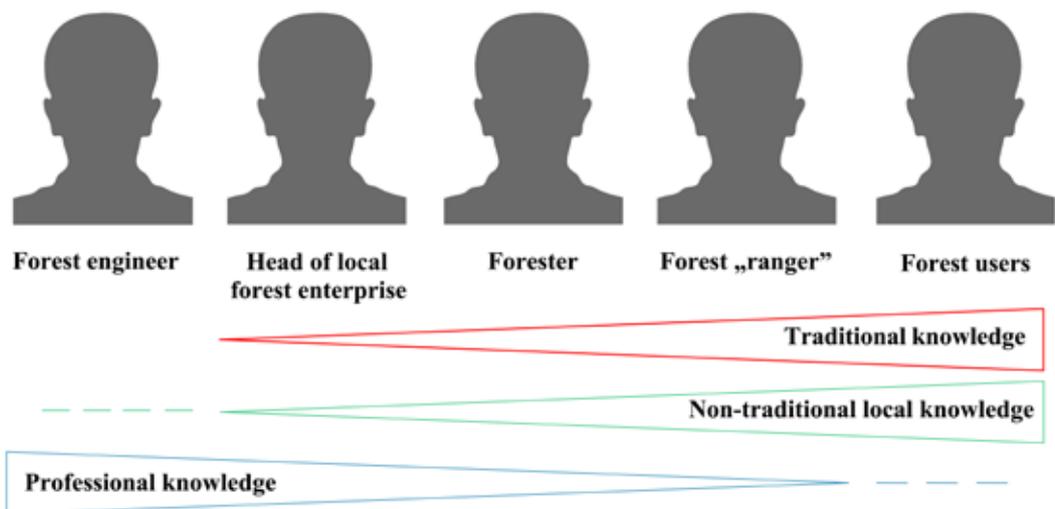


Figure 1.1. The knowledge systems of locals and foresters. The non-traditional local knowledge of the local foresters is a complex (hybrid) knowledge system that bears the characteristics of both the scientific and the traditional worldviews. Their perception of the forest ecosystems shapes the diversity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

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 p.15).

Left: 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;

Right: traditional fishing method by obstructing the river



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 p.16) *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.

Participatory fieldwork with two locals. 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. Right: It is a pity for those many fallen trees. It will all get ruined here. 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 makes 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 and 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 and 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 and 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 “ENPI East Countries Forest Law Enforcement and Governance” program, 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 and 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. *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.

Field trip to the Lapos forest on the second day of the follow-up workshop



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.

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