WOODED RURAL LANDSCAPES IN CENTRAL AND EASTERN EUROPE:

BIODIVERSITY, CULTURAL LEGACY AND CONSERVATION

University of Rzeszów

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STRUCTURE – DYNAMICS – BIODIVERSITY

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Photo: Annemiek Vera

'I am by profession ecologist, but my motivation to study ecology was nature conservation. I am fascinated by the enormous resilience of nature. If you offer her the conditions that are analogue to natural one, you will get a modern analogue of a natural functioning ecosystem. My research interest is rehabilitating natural processes in order to preserve our natural heritage. A statement from my book Grazing Ecology and Forest History is: We cannot understand our culture without understanding the wilderness.'

The marriage between the kaleidoscope of grasslands, shrubs and trees and the large grazing mammals

The forest was not a forest

The German etymologist Trier (1963) once wrote: "One cannot emphasise enough that the modern interpretation and concept of "forest"… has arisen essentially through the expulsion and banishment of so-called secondary activities which were once the main uses. Among these uses, shifting cultivation and providing food for livestock, including herding and collecting tree fodder, played a leading role. The forest was something quite different from what it is today. The change happened in the late 18th and early 19th centuries."[1]

Up to that time the "forest" was the uncultivated, common land, beyond the cultivated land or "fields". Fields were areas which were ploughed or scythed. Forest was by comparison any land outside the settlements and nearby fields which was used for grazing and browsing by animals and therefore indirectly a different source of food for people. It was where free-range or herded livestock grazed grasses and herbs, browsed shrubs and trees and where people collected tree fodder to feed the animals during the winter or summer droughts. Pigs were fattened by seeds and wild fruit, provided by so-called "fruitful" or "bearing" trees. The most important fruit trees were the oaks. They provided acorns –

[1] "Man kann nicht deutlichgenug sagen, daβ Begriff und Anschauung "Wald", wie sie unsern Zeit – und Sprachgenossen vertraut sind, ganz wesentlich durch neuzeitliche Austreibung und Verbannung der sogenannten Nebennutzungen, die früher einmal Hauptnutzungen waren, entstanden sind. Und unter diesen Nutzungen spielte Wanderacker und Viehernährung samt Hude und Laubgewinnung eine Hauptrolle. Wald – das war einmal etwas ganz anderes als es heute ist. Den Wandel hat das 18. und beginnende 19. Jahrhundert gebracht." (J. Trier, 1963, *Venus. Etymologien um das Futterlaub*. Böhlau Verlag Köln, Graz, p. 10).

the most valuable of all fruit for fattening pigs. The fruits of wild pear, wild apple and wild cherry were also important food for the pigs. The fruits of all such trees were called "mast". The tree species that produced mast were all specially protected, but especially oaks. Regulations controlled the cutting of oaks because they were also important for timber. This permission was given by "forestarii" who were appointed by the king to control royal rights, or by the judge of the common who was elected from the commoners to oversee the regulations for the use of the common. There were heavy punishments for infringements of these regulations. It should be noted that the importance of oak for fattening the pigs was much more important than for timber.

During this period, regulations were introduced that required anyone who had permission to fell an oak to replace it by planting. The planted tree was surrounded by thorns to protect it – either it was planted with thorny shrubs in a single planting hole or by winding thorny material round it. Thorns were even raised in special areas for this purpose. By using thorns to regenerate trees in the presence of large herbivores, people were imitating a process they were already familiar with in the forest, the uncultivated outside the fields. It can still be observed today in wood-pastures, grazed by livestock, with or without wild herbivores.

Trees generating in the wood-pasture

In wood-pastures, light demanding oak and other tree species regenerate successfully in grazed grassland where they are protected by or within thorny and spiny shrubs and scrub. The thorns are a defence mechanism which makes shrubs less palatable to large herbivores. They act as natural barbed wire, 'fencing out' palatable seedlings and sapling of trees and shrub species that lack a defence mechanism themselves against large herbivores. In addition to thorns and spines, plants that are poisonous to large herbivores also act as a defence mechanism. These protective species are called "nurse-species".

The oak, in particular, benefits from grazing animals that create grassland. In its seedling stage, as a light-demanding tree species, it needs plenty of daylight to grow successfully. In wood-pasture, oak seedlings are found in the outer fringes of thorny and spiny shrubs species such as blackthorn and hawthorn. The acorns are placed there in caches preferentially by jays. The jay hoards them in scrub a few meters to several kilometres from the oak tree where it collected the acorns. The fringes and structural shape of the scrub help to remind the jay where it buried acorns in the autumn. The jays pull up the acorns throughout the winter; however they leave some until the period from April to August, after the seedling has developed from the acorn. The jay with its young comes along and lifts the young oaks by the beak pulling the remnant acorn still attached to the taproot above ground. The jay removes the acorn from the taproot, peels it and feeds it to its young. The development of the seedlings is not affected by the removal of the old seed, because the jay does not fully uproot the seedling and because it is as, a forester said "with its head in full daylight", the optimal condition for seedlings of both oak species to grow.

By comparison, in closed canopy situations, the seedlings and saplings of light demanding species such as oak succumb through lack of daylight, or over time are they are outcompeted or over grown by shade tolerant tree species such as beech, hornbeam and both lime species, and kill it from their shade .

Grazed grassland is the optimal biotope for oak to regenerate, however it needs the protection of the light demanding spiny and thorny nurse species to grow

up successfully. It is a remarkable phenomenon in the wood-pastures of lowland Europe that both oak species are very common and regenerate very well thanks to the activity of the jay. The wood mouse also hoards acorns in the ground, although it will sometimes hoard several acorns in one cache. It appears that wood mouse also contributes to the successful regeneration of oak in the spiny shrubs of wood-pastures. However, they hoard most of their acorns in the centre of a patch of scrub where there is much less daylight and therefore considerably reducing the chances of successful establishment of light demanding oak species. To a lesser extent they may hoard acorns at the outer edge of the scrub, where the jay prefers to place acorns singly. Therefore the jay overall contributes more to the successful regeneration of oak in wood pastures than wood mice.

If the thorny species expands clonally by rootsuckers, such as blackthorn, scrub expands radially into the open grazed grassland. Herbivores browse the early spring shoots because they lack the thorns. This causes widely diverged branching of the spiny shrub, resulting in an almost impenetrable thicket for herbivores. In the fringes of this thicket, tree and shrub seedlings become established and grow. The expansion of the thicket happens in all directions and a circular or convex shaped group of trees develops, called a grove. Trees that grow up within a grove have to compete for daylight. This results in trees with long branchless trunks and small narrow crowns with branches growing on the trunk at an angle of about forty-five degrees. A grove is what we nowadays call a forest, plantation or wood.

Unlike blackthorn, hawthorn does not spread clonally, because it lacks rootsuckers. Therefore, it mostly nurses a single tree or just a few trees, which results in open grown trees that are trees characterised by huge crowns which start very low down the trunk. The very thick lower horizontal, branches grow out from the stem at an angle of almost ninety degrees. This kind process of regeneration of individual trees results in a savannah-like landscape. The shade from in the closed canopy grove and the large crown of open grown trees eventually kills the light-demanding nurse shrubs under the crowns.

Both groves of trees and individual open grown trees develop to form a mosaic of patches of different sizes of grassland, groves of different sizes and in between scattered trees with open crowned form.

Within the grove the regeneration of trees initially is prevented by the shade of the canopy, but moreover by the trampling and browsing by the large herbivores. In existing wood-pastures and also historically documented, grazing animals enter the grove through small gaps in the spiny vegetation that surrounds the grove known as the mantle and fringe. They continue to prevent the regeneration of trees inside the grove through trampling and browsing even after a gap is formed in the canopy by the loss of a tree through age or stress. As more trees die or collapse the canopy of the grove opens up more and more; a process that maybe facilitated by stresses such as drought or diseases. Grass seeds are brought in by the large ungulates in their dung and fur and a grazed lawn develops inside the grove that continues to expand. In this way, groves turn gradually into grassland again. Variability in grazing intensity of herbivores causes spiny and thorny nurse species to establish in the by now very open grazed grassland and once again at their edges, palatable shrub and tree species establish, especially the light demanding ones. So, while the grove expands in the grassland, the centres of the groves disintegrate.

The wood-pasture system is a non-linear succession of shrubs establishing in grasslands allowing the development of solitary trees and groves, which eventually turn back into

grassland again. This dynamic system results in a kaleidoscope of grasslands, shrubs, scrub, solitary trees and groves.

In the past the variability of grazing intensity in wood-pastures was caused by regulations that prevented animals, or food for animals, being brought in from the outside, or exported the other way around. The rule was that a commoner was not allowed to have more animals that he could keep through the winter. In fact the wood-pasture system reflected the ecological carrying capacity of the local situation and restricted the number of animals.

The marriage between the kaleidoscope of grasslands, shrubs and trees with the large grazing mammals

The process of grassland becoming a grove and the grove changing back into grassland again, is driven by large herbivores. This is in fact the marriage between the kaleidoscope of grasslands, shrubs and trees with the large grazing mammals.

As previously mentioned, pedunculate and sessile oak in the lowlands of Europe are very well represented in wood-pastures. Other tree species do regenerate successfully, but they are not so frequent also because they lack a vector for their dispersal such as the jay. This bird species gives both oak species a huge establishment advantage above other tree species in wood-pastures. Grazing animals also help this process in two ways: first by creating the grassland as a germination niche for both the light-demanding shrub nurse and then the oak, secondly by preventing the regeneration in the grove of shade tolerant tree species such beech, sycamore, lime, hornbeam and elm. Without the impact of grazing animals, the crowns of oaks would permit sufficient daylight to penetrate through the canopy for shade tolerant species to regenerate and to grow up successfully. When fully grown, shade tolerant species ultimately kill the standing oak trees by their shade. This process of displacement of oak by shade tolerant tree species in forests is a well-known phenomenon and documented issue in forest ecology and forestry and can be seen in many forest reserves in Europe. It occurs in former wood-pastures where livestock has been removed and/or wild ungulates reduced by culling to densities that no longer prevent the regeneration of trees in forests. Along with oak, other light demanding tree species disappear, such as wild apple (*Malus sylvestris*), wild pear (*Pyrus pyraster*) and wild cherry (*Prunus avium*), as well as light demanding shrubs species, such as hazel, blackthorn and Guelder rose. According to historic data these species were all also very common in wood-pastures and were important and enjoyed special protection as mast trees for the pigs.

A wood-pasture system was the mother of all uses

The wood-pasture system was indispensable for the survival of the local people. It delivered grassland, browse and fruits for their livestock, but also firewood and timber, both of which had their origin in the wood-pasture system. The earliest regulations for cutting firewood in commons refer mainly to thorn bushes, hazel and holly. Blackthorn and hawthorn were particularly popular for firewood. Specific words in these regulations clearly refer to the mantle and fringe vegetation in the wood-pasture that formed a belt around the groves.

When firewood was being cut from thorny scrub and bushes, the remaining stools and saplings had to be protected from grazing so they could regenerate. Regulations were therefore introduced to restrict the grazing by animals in these areas until the regeneration of the thorny scrub had occurred. From as early as the 13th century, there were regulated

coppices, in which the stools were cut down on plots according to an established rotation of the felling cycle, where livestock grazing was temporarily forbidden. This ban was mostly no longer then 3 to 6 years, exceptionally up to 9 years. Even after just three years new sprouts from the stools of thorny shrubs would have grown high enough and after one year have formed new thorns so they could protect any seedlings and saplings of trees so grazing could once more be allowed. In a modern forest system this timescale for removal of livestock would be far too short to make it possible for unprotected seedlings to grow up successfully in what is nowadays called natural regeneration whereas it is quite sufficient for successful regeneration in the wood-pasture system. The earliest references to this kind of regulation date from the 12th century.

Besides regulations to protect seedlings and saplings, there were also regulations to thin young oak seedlings and saplings to allow sufficient light for the remaining young oaks. The purpose was to get them to form an open grown crown and therefore blossom more profusely. As a result, the oaks produced more acorns and therefore more mast for the pigs. Also young oaks were cut low on the trunk in order to form a pollard to make it easier for the herdsman to reach with a stick to beat the acorns from the low crown to feed the pigs. A second reason mentioned in documents for thinning trees established in the scrub, is to protect the thorny shrubs which would disappear owing to the shade cast by the closed canopy and with this the scrub as potential firewood. For instance, the commoners who had the right to cut underwood in the Forest of Dean tried to prevent the growth of "timber", because this was at the expense of underwood that delivered their firewood. This is also known from reports from German-speaking countries. Through thinning some seedlings and saplings and the cutting of underwood for firewood, the coppice with standards system developed out of the mantle and fringe vegetation. The standards initially served the pigs as a source of acorns and then subsequently became a source of timber.

Other variations on management systems developed through the centuries depending on the demand for different products, soil types and climate conditions. One example is the combination of arable land and trees in Spain. This is a system of alternate years of arable and grazing combined with scattered evergreen Holm oak trees (*Quercus ilex*) to produce acorns for the pigs called dehesa. It looks like a savannah, however is highly managed. The oaks are pruned or cut in a particular way so that the herdsman can kick out the acorns for the pigs. Where there is more emphasis on grazing, the result is more widely dispersed large oaks in grassland as can be seen in Transylvania in Rumania.

The divorce between the kaleidoscope and large grazing mammals

It was the invention of modern forestry in the 19th and 20th century that caused the divorce between the kaleidoscope of grasslands, shrubs and trees and the large grazing mammals. It was the development of forestry techniques such as shelterwood cutting, the selection system and group selection system. The new methods required the regeneration of trees within the forest without the protection of thorny and spiny shrub species. While large herbivores prevented the regeneration of the trees within the groves and was essential for the functioning of the wood-pasture system, in modern forestry it was strongly characterised in terms of damage to the forest. In forest science and forest ecology it is often described as retrogressive succession of the high forest towards open grassland or heath. It is not considered as a part of the cyclical process in the wood-pasture system. It focusses only on the trees for wood production. The original grove which was as an

integral part of the wood-pasture system has become isolated as a high forest and lack of regeneration due to large grazing mammals as a degradation. It does not take into account grasslands, shrubs, scrubs, trees and groves as integral parts of one well-functioning ecosystem. Grazing livestock were seen as the greatest enemy of forests, which made any improvement of forestry in the sense of wood production impossible. As the Swiss forester Landolt formulated it in 1866: "Where there is wood-pasture without restriction, livestock is the most dangerous enemy of the forest, because grazing animals destroy the young tree growth through biting and trampling."[2] About the wild ungulates he had the same opinion, witness his saying: "Wild ungulates damage the "Wald" in the same way as livestock."[3]

How the not-forest became the forest and the forest the not-forest

From that time onwards there was a strong commitment in favour of forestry to end grazing and pannage rights. This commitment was also supported by the introduction of so-called new agriculture and with it 'improved' grass seed, clover as fertilizer and the potato. The grass seed made it possible to create and maintain fields as permanent pasture for livestock and thereby the complete separation of "forest" and "pasture". The introduction of the potato led to the end of pannage and the need for mast in the forest for the pigs. They were kept inside in farm buildings and fed with potatoes. The potato became also the main source of energy for people, replacing the bacon from the pigs as the main source of energy for the winter. This meant the end for the oak as the most important tree for people. As Meyer formulated it in 1931: Indeed the oak forest gave way for the potatoes! The indigenous tree for an exotic weed."[4]

From that time onwards the forest became the modern forest as a place to produce "wood" as a single crop. People forgot what a forest originally meant. The image that large herbivores are the enemies of trees and that grassland and trees should be separated is disastrous for wood-pastures and the biodiversity that is connected with the wood-pasture ecosystem. A change in this perception is in my opinion of the greatest importance to preserve or recreate the wood-pasture ecosystem.

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2 "Wo die Waldweide schonungslos ausgeübt wird, da sind die Haustiere die gefährlichsten Feinde des Waldes, indem sie die jungen Holzgewächse durch Biβ und Tritt vernichten…" El. Landolt (1866), *Der Wald. Seine Verjüngung, Pflege und Benutzung*. Zürich, p. 152.

3 "Das wild schädigt den Wald in ähnlicher Weise wie die Haustiere…" El. Landolt (1866), *Der Wald. Seine Verjüngung, Pflege und Benutzung*. Zürich, p. 155.

4 "Tatsächlich ist der Eichwald der Erdäpfeln gewichen! Der einheimische Baum einem exotischen Kraut."

THE BIOLOGICAL POTENTIAL OF FIELD EDGES IN TERMS OF INTEGRATED PLANT PROTECTION

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The purpose of this study was to determine the abundance and diversity of beetle assemblages, especially Carabidae, in field edges and associated crop fields. Insects were caught using soil traps. They were emptied every 10 days between May and August. The sites were located on two crop fields and four field edges in the Lower Vistula Valley in northern Poland. The number of beetles caught in 2006 was about 14000 in the remaining years a smaller number of insects were recorded, ranging from 8000 in 2008 to 11200 in 2009 and 11700 in 2007. The most abundant were the beetle communities in the stand of bushes, only in 2007 the beetles were far less collected than in other habitats. In all the years, Carabidae beetles predominated in the study sites. The diversity of beetle communities measured by the Shannon-Weaver index (H') in the years 2007–2009 was generally lower in fields than in the adjacent field margins. On the other hand, the coefficient of similarity of dominance structure (Renkonen's index - Re) between groupings in fields and their surroundings was high, over 70%. In the years 2006–2009, despite significant differences in the Carabidae abundance between the tested habitats, ecological indices such as species diversity (H') and similarity of dominance structure (Re) showed a clear impact of these beetles on insect abundance in the fields. In addition, it has been shown that forest and ditches have been proven to enrich agrocenoses in beneficial fauna with respect to the remaining margin habitats. The richness and similarity of the beneficial carabid fauna in the non-crop areas and adjacent fields is an evidence to the positive role of the field edges on the agrocenoses. The following carabid species were determined: *Agonum assimile* (Payk.), *Agonum dorsale* (Pont.), *Agonum gracile* Sturm, *Agonum sexpunctatum* L., *Agonum viduum* (Panz.), *Amara apricaria* Payk., *Amara aulica* Panz., *Amara plebeja* Gyll., *Asaphidion flavipes* (L.), *Bembidion femoratum* Sturm., *Bembidion lampros* Herbst., *Bembidion properans* Steph., *Bembidion quadrimaculatum* (L.), *Bembidion ustulatum* L., *Calathus ambiguus* Payk., *Calathus erratus* (Sahlb.), *Calathus fuscipes* Goeze, *Calathus melanocephalus* (L.), *Calathus micropterus* Duft., *Harpalus affinis* (Schrank), *Harpalus rufipes* (DeGeer), *Loricera pilicornis* (L.), *Pterostichus angustatus* (Duft.), *Pterostichus caerulescens* (L.), *Pterostichus cupreus* (L.), *Pterostichus lepidus* Leske, *Pterostichus niger* (Schall.), *Pterostichus oblongopunctatus* Fabr., *Pterostichus punctulatus* (Shall.), *Pterostichus strenuus* Panz., *Pterostichus vernalis* Panz., *Pterostichus vulgaris* (L.) and *Synuchus nivalis* Panz.

Keywords: agricultural management

Poster

POTENTIAL OF OAK (*QUERCUS ROBUR*) REGENERATION IN THE RURAL LANDSCAPE OF THE CARPATHIAN FOOTHILLS IN SE POLAND. THE CASE OF PLH180012 NATURA 2000 SITE

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Introduction. One of the characteristic features of the lower parts of the rural Carpathian foothills are marginal oak woods, developed under the conditions shaped by traditional agriculture with a strong pasturing component. It continued over the centuries until the end of WWII, when drastic demographic, social and economic changes were imposed on the region. In early 1970s the ban on grazing in forest areas was enacted, and by the early 1990s the pasturing has been reduced to negligible proportion of the pre-war scale. After the accession to EU the traditional farming has been superseded by the grasslands regular mowing, sustained by the EU agro-environment scheme.

Objective and Methods. The study was aimed at the assessment of the present oak regeneration potential in wooded and non-wooded patches of the PLH180012 landscape. To do this we applied the systematic survey of oak regeneration in six existing oak woods and the detailed analysis of structural and spatial characteristics of young oaks assemblages identified in the "neglected" pockets of grasslands.

Results and Conclusions. The study revealed that:

1. There is no natural oak regeneration in the existing oak woods. The ban on their pastoral use resulted in fast development of the dense undergrowth layer (in particular hazel), preventing oaks under-canopy regeneration. Silvicultural treatment (oak stands thinning) enhanced the development of scrub and intensified habitats' changes, putting oaks at further disadvantage.

2. In untreated pockets of grasslands, among the emerging successional wooded vegetation, young promising oak saplings are common. Their occurrence depends on the relative proximity (usually less than 200 m) of mature, acorn bearing individuals.

3. The recruitment success of an individual oak, though apparently enhanced by the immediate proximity of protective plants, in particular common blackthorn (*Prunus spinosa*), hawthorns (*Crategus* sp.) and roses (*Rubus* sp.), is not unconditionally determined by such neighbourhood. A substantial portion of well-developed tall saplings succeeded without protection.

4. The identified assemblages of young oaks consist of several cohorts, following subsequent mast years, meaning that they can potentially develop age-diverse stands. However, most of the young oaks assemblages are ephemeral, either because of returned mowing (driven by agro-environmental subsidies) or illegal grass burning. The study revealed that many saplings emerging in grasslands close to the borders to oak woods are re-sprouts from the older under-ground stools.

Financial support was received through the project 'Oak woods in rural landscapes of the Carpathian region: origin, dynamics and conservation values', financed by the National Science Centre, Poland, following the decision DEC-2013/11/B/NZ9/00793.

Keywords: agro-environmental scheme, ecological succession, landscape management, pasturing, protective plants

Poster

THE MAN'S OLD FAITHFUL OAKS. HOW DO *QUERCUS ROBUR* AND *Q. PETRAEA* COPE WITH THE MODERN LANDSCAPE CHANGES?

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Introduction. The oaks' broad regeneration niche, encompassing a great variety of habitats (from poor to eutrophic, from acidic to calcic, from wet to xeric) as well as the species' multiple adaptations (starch-rich acorns, far distance zoochoric dispersal, longevity and physical robustness), makes them very skilled colonizers in most of Europe's bio-geographic regions. The actual regeneration success, however, depends on favourable light conditions. Rural landscapes, shaped by traditional ways of farming and use of woodland, produced and sustained plethora of habitats fostering development of 'oakscape' – a variegated landscape with distinct oak presence.

Objective and Methods. The study was aimed to track back the oak recruitment dynamics in stands representing the gradient stretching from Białowieża (PL) to south Transylvania (RO). That past dynamic, reconstructed with dendroecological methods, was referred to the conditions and processes influencing the present oak regeneration and recruitment.

Results and Conclusions. The individual dynamic of a particular oak stand's recruitment can be assigned to either of three major models: A – narrow overall recruitment time window (on average 20 years to produce 80% of future canopy oak trees) and sharp recruitment end; B – long-lasting and continuous recruitment (on average 50 years) with gradual slowdown towards end; C – separate recruitment waves resulting in wide overall recruitment window (average 80 years).

Within the scale of the study's geographic range, a stand's affinity to a particular model does not depend either on its age or regional location.

The oak recruitment history reveals that neither but one of 21 studied stands could have been established within a single or even two subsequent oak mast years. Most of stands required substantially longer time for their establishment. That means that the common silvicultural rule of European forestry, requiring swift reforestation of larger canopy gaps, almost entirely precludes the natural oak regeneration and recruitment, dependent on the conducive, long-lasting, light regime.

Despite the high oak regeneration potential manifested by widespread local assemblages of oak seedlings and saplings, contemporary agricultural systems, including agro-environment schemes, prevent them to develop into the oak groves.

The only observed exceptions to the present overwhelming constraints in oak regeneration were the Prykarpattya's (UA) marginal oak woods, subject to regular spring grass burning and the fragment of the Transylvanian wood-pasture temporary excluded from intensive grazing.

The restoration and sustenance of the European 'oakscape' requires substantial changes in landscapes use and management. In particular, forestry should embrace natural and anthropogenic disturbances sustaining open and semi-open habitats, long enough to become spontaneously colonized by oaks. Analogically, agro-environmental schemes should reward spontaneous development of new oak groves in rural landscapes. The same policy could be applied in sub-urban areas as a way of development of the highly valued "green infrastructure".

Financial support was received through the project 'Oak woods in rural landscapes of the Carpathian region: origin, dynamics and conservation values', financed by the National Science Centre, Poland, following the decision DEC-2013/11/B/NZ9/00793.

Keywords: CE Europe, dendroecological reconstruction, landscape management, oakscape, recruitment dynamics

Oral presentation

BROWN WORLD FORESTS: INCREASED UNGULATE BROWSING KEEPS TEMPERATE TREES IN RECRUITMENT BOTTLENECKS IN RESOURCE HOTSPOTS

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Plant biomass consumers (mammalian herbivory and fire) are increasingly seen as major drivers of ecosystem structure and function but the prevailing paradigm in temperate forest ecology is still that their dynamics are mainly bottom-up resource-controlled. Using conceptual advances from savanna ecology, particularly the demographic bottleneck model, we present a novel view on temperate forest dynamics that integrates consumer and resource control. We used a fully factorial experiment, with varying levels of ungulate herbivory and resource (light) availability, to investigate how these factors shape recruitment of five temperate tree species. We ran simulations to project how inter- and intraspecific differences in height increment under the different experimental scenarios influence long-term recruitment of tree species. Strong herbivore-driven demographic bottlenecks occurred in our temperate forest system, and bottlenecks were as strong under resource-rich as under resource-poor conditions. Increased browsing by herbivores in resource-rich patches strongly counteracted the increased escape strength of saplings in these patches. This finding is a crucial extension of the demographic bottleneck model which assumes that increased resource availability allows plants to more easily escape consumer-driven bottlenecks. Our study demonstrates that a more dynamic understanding of consumer–resource interactions is necessary, where consumers and plants both respond to resource availability.

Keywords: Białowieża Forest, consumer control, demographic bottleneck model (DBM), green vs brown world species, savanna vs forest ecology

Poster

REMNANTS OF FORMER WOOD PASTURES IN THE CARPATHIANS ARE KEY HABITATS FOR MANY LICHENS INHABITING OLD-GROWTH FORESTS

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Several ancient oak wood pastures located in the Carpathians (in Poland, Hungary, Ukraine and Romania) have been lichenologically investigated. 183 species of lichenized and lichenicolous fungi have been found altogether, many of them regarded to be confined to forest habitats. Some species are usually known as indicators of old-growth forests (e.g. *Arthonia byssacea*, *A. vinosa*, *Cetrelia monachorum*, *Hypotrachyna revoluta*, *Lecanora albella*) what suggests that the abandoned pastures were formerly only edges of larger forest complexes or that the regeneration of forest habitats can run there in a shorter time than we thought. It is interesting that neighboring, still existing open wood pastures are also inhabited by the forest lichens despite the solitary, well-lit oaks are mostly occupied by nitrophilous and photophilous lichen species. The results show that the wood pastures are important habitats in the Carpathians for many very rare or unknown to date species in this part of Europe, including e.g. *Agonimia borysthenica* – new for Eastern Carpathians, *Ramonia chrysophaea* and *Verrucaria viridigrana* – new for Poland and Polish Carpathians, *Lecanora farinaria* – new for Hungary and Western Carpathians, *Psoroglaena dictyospora* – new for Romania, *Rinodina isidioides* - new for Eastern Europe, Carpathians and Romania. A share of forest species and apophytes in particular plots shows that from ecological point of view the most advanced changes in the traditional rural use of forests have occurred in most western part of the Eastern Carpathians, perhaps irreversibly without an active protection.

Financial support was received through the project 'Oak woods in rural landscapes of the Carpathian region: origin, dynamics and conservation values', financed by the National Science Centre, Poland, following the decision DEC-2013/11/B/NZ9/00793.

Keywords: ancient woodland, lichen indicator, lichen protection, rural landscape, forest succession, Transylvania,

Oral presentation

BIODIVERSITY OF APHIDS IN DIFFERENT WOODED RURAL LANDSCAPES OF POLAND

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Aphids are herbivores that cause damage by sucking sap from plants and in some cases by using toxic saliva. They are also viral vectors that infect plants. Out of the global aphid fauna, as much as 40% of species and 55% of genera are associated with woody plants. Aphids evince high migratory activity and can colonize numerous trees and shrubs.

The aim of the following paper is to specify the biodiversity of aphids in different forest communities: fresh forest, hornbeam-oak forest, thermophilous oak forest, and continental mixed coniferous forest. Specimens were collected using Moericke traps over the period of two growing seasons.

The results confirm high changeability in the activity of aphid flights between the seasons, which is evidenced both in species composition and taxon abundance. It is determined by a whole complex of environmental conditions. The most numerous specimen population was collected from the hornbeam-oak forest, whereas the highest species biodiversity was reported from the coniferous forest.

In the fresh forest, two species associated with *Pinus sylvestris Eulachnus agilis* and *Eulachnus rileyi* were found, with *Myzocallis castanicola* dominating in the habitat of *Quercus robur*. A significant position was obtained by *Aphis ruborum*, which develops on *Rubus* sp. In the fauna collections of *Myzocallis carpini*, this aphid was not found in a hornbeam-oak forest. This species is associated with *Carpinus betulus*, which is evidenced by this taxon's low flight activity. *Drepanosiphum platanoidis* and *Rhopalosiphum padi* were the dominating species. In the thermophilous oak forest, *Myzocallis castanicola* dominated, which develops on *Quercus robur* and *Quercus petraea*. An activity of two other species associated with *Tuberculatus annulatus* and *T. borealis* was also recorded. Monoecious, dendrophilic species were active throughout the whole vegetation season. Heteroecious species, on the other hand, are associated with woody plants and their highest activity occurred during the autumn.

Keywords: aphids, biodiversity, forests, dendrophilic species

Poster

CHANGES IN INTERACTIONS BETWEEN WOODY SPECIES SPREADING ON ABANDONED MOUNTAIN MEADOWS IN THE EAST CARPATHIANS

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In the last decades, major changes were observed in the structure of vegetation on abandoned agricultural mountain areas. Therefore, there is an urgent need to acquire the widened knowledge on the ecological processes triggered by the ceasing agricultural activities. In our presentation, we will try to explain the relationships between two tree species: green alder (*Alnus viridis*) and rowan (*Sorbus aucuparia*), colonising the abandoned meadows in the Eastern Carpathians (Western Bieszczady Mts). At present, the rowan predominates in spreading woody vegetation. The green alder constitutes on average about 10% of the species composition. Nevertheless, there are some sites where alders predominate. The presented results were obtained on 32 (100 m^2) plots distributed regularly in the patches of rowan/green alder. During the study, all individuals were measured (counting number of shoots, measuring diameter, and height), and the age of the thickest rowan trees was determined.

It was found that alders appeared in the area at least at the same time as rowans. Based on the age determination in the oldest rowans, two groups of patches of woody vegetation were distinguished: younger and older. In the younger patches, the density amounted to average 7 rowans/100 m^2 and 9 alders/100 m^2 whereas in the older patches – 7 and 8 individuals/100 m^2, respectively. In the younger patches, great differences were noted between the density of rowan and alder shoots (average of 60 vs. 146 shoots/100 m^2, respectively) which were not reflected, however, in the differences between the basal areas (average 928 vs. 806 cm^2/100 m^2, respectively). A strong negative correlation was found between the age of the rowan and the density of individuals and shoots of the alder. Additionally, the density of alder shoots was strongly negatively correlated with the maximum height and the basal area of the rowans.

In the older patches, the density of rowans and alders was the same as in the younger patches. The density of shoots increased slightly in the case of rowans whereas among the alders it decreased markedly compared with the younger patches and amounted to average of 80 and 73 shoots/100 m^2. At the same time, the basal area of rowans was twice larger than in the younger patches while in the case of alders it was similar (1818 and 726 cm^2/100 m^2).

It seems that in the first stages of succession the alder is better adapted to the colonisation of abandoned mountain meadows. The presence of the alder facilitates the colonisation of the area by rowans during the subsequent stage. Our results indicate that with time, the nature of relationship between rowan and the green alder changes. The proportion of the rowan in the forest patches increases and it becomes the competitor against the alder.

Poster

STATING THE OBVIOUS. VERA CIRCLES, PATTERNS IN NATURE

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In the late 20th century workers such as Francis Rose and Oliver Rackham were exploring and questioning what was the prevailing hypothesis that wild Europe was originally continuous closed canopy tree cover. However Frans Vera, in 2000, put forward an hypothesis of a landscape in lowland Europe of parkland, open grown trees, wood pasture, scrub and groves of trees within an expanding mantle of thorns and areas of continuous woodland with the whole system driven by grazing and browsing animals, together with pests and diseases.

Vera's central theory is the example of the continuous expansion of groves of trees where eventually the aging centre dies and the process will begin again.

Examples of such process can be found throughout the natural world from the minutest individual micro-organisms to the largest plants such as trees and even whole communities. As Vera points out in the vast majority of cases the centre of the circle dies for various reasons with obviously the aging process being the primary cause. This aging process and final death is pivotal in providing an essential part of the dynamics for creating the open space in the centre of the expanding organism or community.

In many circumstances in the natural world the demise of the aging centre can be accelerated primarily by stress from events such as long droughts and high temperatures and the subsequent increase in susceptibility to pests and diseases. Perhaps the dynamic ever changing process of the expanding organism or community through senescence to final death can best be illustrated with colonies of lichens and fungal fairy rings.

In many cases vegetation cover it is the grazing and browsing animals which are the key drivers. Animal numbers can be affected by pests and diseases which would often lead to the pressure and effects on vegetation being reduced to some degree. There are examples in the past of diseases such as Rindepest, Anthrax and Mixamatosis having drastic effects on animals and of course not forgetting plague and flu epidemics on man.

It appears that virtually all species of tree whether light demanding or shade tolerant are capable of growing exposed conditions. However at times of stress such as high temperatures and long droughts shade tolerant species succumb first. Most trees that are established usually require several years of protection from scrubs with thorns or spines from animals until they achieve heights above browsing.

Keywords: circles in nature, dynamic communities, stress, light demanding trees

Oral presentation

FACTORS AFFECTING THE OCCURRENCE OF WOODPECKERS PICIDAE IN FORESTS IN RURAL LANDSCAPE OF SE POLAND

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Woodpeckers Picidae are recognized as a good biological indicator of ecological forests quality. The occurrence of particular species as well as their densities depend on many features of the forest stands e.g. forest patch size, tree age and health condition or dead wood resources.

The study aim was to determine the characteristics of the forest stands that affect occurrence of three woodpecker species: Syrian Woodpecker *Dendrocopos syriacus* (SW), Great Spotted Woodpecker *Dendrocopos major* (GSW) and Middle Spotted Woodpecker *Dendrocoptes medius* (MSW) in forests located in agricultural landscape of SE Poland. To assess inhabitation of forests by these species, in 2015 the territory searching method with voice stimulation or nest searching methods were used. During the study 74 forests with an area from 0.23 up to 284.51 ha and average trees age from 10 up to 74 years were controlled in the 330 km2 study area.

Generally woodpeckers inhabited larger forest patches ($x = 47.0$ ha, $SD = 74.6$, $n = 35$) compared to uninhabited ones ($x = 0.8$ ha, $SD = 0.6$, $n = 39$, U Mann-Whitney test $Z = 5.84$, $p < 0.000001$). The preferences of each species were different (Kruskall-Wallis test $H = 16.00$, $df = 2$, $p = 0.0003$). The smallest forest patches were occupied mainly by SW ($x = 34.8$ ha, $SD = 71.5$, $n = 13$) whereas significantly larger forests were inhabited by GSW ($x = 62.9$ ha, $SD = 80.9$, $n = 26$) and MSW ($x = 146.9$ ha, $SD = 83.7$, $n = 9$).

Woodpeckers also occupied older tree stands ($x = 39.0$ years, $SD = 15.2$, $n = 35$) compared to non-settled ones ($x = 23.0$ years, $SD = 11.7$, $n = 39$, Mann-Whitney U test $= 4.65$, $p = 0.000003$). The SW occupied the youngest woods ($x = 33$ years, $SD = 12.3$, $n = 13$), slightly older ones were inhabited by GSW ($x = 42$ years, $SD = 15.9$, $n = 26$) and the oldest by MSW ($x = 57$ years, $SD = 14.3$, $n = 9$). In this case, statistical differences were found only between SW and MSW (Kruskall-Wallis test $H = 12.0$, $df = 2$, $p = 0.0025$, post hoc Dunn test $p = 0.0017$).

Research has shown that the forest patch size and the tree age are equally important for the occurrence and conservation of primary hole nesters in woods in agricultural landscape. The most demanding is the specialized MSW, who needs older tree stands and bigger forest patches with a minimum area of about 40.0 hectares. GSW and SW as opportunists can inhabit smaller and younger forests, which for the SW may have an area less than 1.0 ha.

Keywords: biodiversity conservation

Oral presentation

FROM WOOD PASTURE TO THE FOREST. STRUCTURE OF THE BREEDING BIRD COMMUNITY IN OAK FORESTS UNDER VARIOUS WAYS OF MANAGEMENT

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Birds are often used as an indicator of condition of environment, they can be used also in evaluation of changes in forest habitats. One of the type of land use in Europe are wood pastures, but in many places this type of managing is abandoned. In the results at this moment we can observe various stages of reforestation. We conducted study of the composition and structure of the breeding bird assemblage in oak forests in four countries (Hungary, Poland, Romania, Ukraine) in 2015-2017. We used mapping technique (a combined mapping method) for censusing breeding birds community. Ten study plots were chosen in various type of using and regeneration; from open pasture areas with solitary oaks to mixed forest. The species composition, richness and densities of the breeding avifauna differed between various stages of forest use. The highest species richness and densities were observed in old mixed forests but old oaks give cavity-nesting birds opportunity to breed also in the pastures. Thus wood pastures with old oaks are important factor influencing birds species richness and biodiversity.

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Keywords: biodiversity, biodiversity conservation, bird community structure, species richness, oak forest

Oral presentation

THE DIVERSITY OF GROUND BEETLES (COLEOPTERA, CARABIDAE) IN STANDS REPRESENTING RURAL LANDSCAPE OF PACŁAW (SE POLAND) AND IVANIVKA (SW UKRAINE)

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Observations above the quantity-quality structure of *Carabidae* family were carried out in 2015 and 2016 with the use of pitfall (Barber's) traps. In each site three oaks, representing different habitats were selected: in high forest, in the middle of the park-like oak grove, and on the very edge of the oak grove and treeless grassland.

Whilst Pacław was represented by 24 samples (11 collected in 2015 and 13 in 2016), in Ivanivka only 13 samples were taken (8 in 2015 and 5 in 2016).

As a result of observations in Pacław we recorded 1267 carabid beetles representing over 40 species. Under the oak representing grove 582 beetles were collected, under the edge tree 443, and 242 in the forest habitat.

The most abundant in the both sampling years was *Abax* (*Abax*) *parallelus* (Duftschmid, 1812) and *Platynus* (*Platynus*) *assimilis* (Paykull, 1790). Most of species were found under the edge and the grove oaks.

Among the collected ground beetles there are some species under Polish legal protection: *Carabus* (*Chrysocarabus*) *auronitens* Fabricius, 1792, *C.* (*Eucarabus*) *obsoletus* Sturm J., 1815, *C.* (*Eucarabus*) *ulrichii* Germar, 1824, *C.* (*Morphocarabus*) *scheidleri zawadzkii* Kraatz, 1854, *C.* (*Procrustes*) *coriaceus* Linnaeus, 1758 and *C.* (*Tomocarabus*) *convexus* Fabricius, 1775.

In Ivanivka we have collected 296 beetles representing 18 species. The largest number in both research periods were observed under the edge oak (149 specimens). *Abax* (*Abax*) *parallelus* (Duftschmid, 1812) was the dominant under the grove and the edge oaks, however in the high forest habitat *Abax* (*Abax*) *parallelepipedus* (Piller et Mitterpacher, 1783) was the most abundant species. None of the collected beetles was enlisted in The Red Book of Ukrainian Carphatians.

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Keywords: oak grove, Carabidae, ground beetles, ecology, biodiversity

Poster

PROTECTED AND RARE SPECIES OF BEETLES IN RURAL WOODED LANDSCAPES OF PACŁAW (SE POLAND) AND IVANIVKA (SW UKRAINE)

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Observations of the fauna of beetles related to oaks were conducted in 2015 and 2016 with the use of 3 kinds of traps: pitfall (Barber's) traps, barrier traps and Moericke's (yellow) pan traps. They were placed either on (barrier traps and Moericke's traps) or under (Barber's traps) three oaks representing three different habitats: high forest, oak park-like grove, edge of the grove neighbouring with open grassland. In both of research periods in Pacław, observations were carried out from the beginning of the May to the end of October, while in Ivanivka from the half of the May to the half of October 2015 and since the beginning of July to the end of September 2016.

Whilst Pacław was represented by 24 samples (11 collected in 2015 and 13 in 2016), in Ivanivka only 13 samples were taken (8 in 2015 and 5 in 2016).

Among the collected beetles, several species deserve special attention, in particular strictly protected *Carabus* (*Morphocarabus*) *scheidleri zawadzkii* Kraatz, 1854*, Cucujus cinnaberinnus, Rhysodes sulcatus*, and partially protected *Carabus* (*Chrysocarabus*) *auronitens* Fabricius, 1792, *C.* (*Eucarabus*) *obsoletus* Sturm J., 1815, *C.* (*Eucarabus*) *ulrichii* Germar, 1824, *C.* (*Procrustes*) *coriaceus* Linnaeus, 1758 and *C.* (*Tomocarabus*) *convexus* Fabricius, 1775, and *Velleius dilatatus* (Fabricius, 1787). Several other species, though not protected, are rare in south-eastern Poland. For instance, *Trechus* (*Trechus*) *obtusus* Erichson, 1837 turned a new variety in this part of the country, whilst *Phymatodes* (*Phymatodellus*) *rufipes* (Fabricius, 1777), *Licinus* (*Neorescius*) *hoffmannseggii* (Panzer, 1803) and *Cymindis* (*Cymindis*) *cingulata* Dejean, 1825 have so far been known from few localities.

In the Ivanivka research area three species deserve a particular attention: *Metoecus paradoxus* (Linnaeus, 1760), the rare beetle associated with wasp nests, rare saproxylic *Cucujus haematodes* (Erichson, 1845), and *Leiopus (Leiopus) femoratus* Fairmaire, 1859, an invasive species of longhorn beetles.

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Keywords: oak grove, protected beetles, ecology, biodiversity

Poster

STUDYING THE EFFECTS OF EXTENSIVE GRAZING ON THE VEGETATION IN FORESTS AND MARSHES – AN INVITATION

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From the Neolithic times, grazing by large domestic herbivores has had a significant impact on European forests, but the issue of the real impact of this disturbance continues to imply several questions. Diversification of disturbances, including the reintroduction of some "traditional"/ "historical" disturbances in collaboration with local knowledge holders is an important trend in conservation biology. It is known that appropriate grazing through inducing patchiness can result in a larger diversity of species, increased habitat functioning and diversity. In relation with this, in the last decade the issue of reintroducing grazing as a biodiversity management practice in forests and inland marshlands has been intensely discussed by ecologists and conservation practitioners. However, though there are many studies on the impact of wild herbivores on forest vegetation, there are very few studies on the deliberate grazing of forests with domestic herbivores, and even less on lowland marshes. There is little knowledge on how, why and when grazing was conducted in former times and even less about the impact of grazing on different attributes of vegetation.

While in most parts of Europe these practices are part of the past, in some parts of the Carpathian basin the living versions of these land-use systems and their effects can still be studied. Our aim is to use this opportunity and study forest and marsh grazing combining historical data, interviewing local knowledge holders of these practices, and vegetation surveys.

The aim of this presentation is concept framing, to start discussion on Why to study? and mainly How and Where to study? these issues. We would like to make our research interests known, and therefore, hopefully, find potential scientific collaborators who could contribute in broadening our view. We therefore invite all those interested in this topic, who have knowledge either on historical or present grazing in lowland marshes and/or (alluvial) forests to contact us.

We are looking forward to some hopefully fruitful collaborations!

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Keywords: extensive grazing, alluvial forests, lowland marshes

Poster

SMALL WOODLAND AND TREES AS A COMPONENT OF TRADITIONAL AGRICULTURAL LANDSCAPE IN SLOVAKIA

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Traditional agricultural landscape (TAL) in Slovakia reflects the history and long-time mutual relation between generations of farmers and landscape resulting in occurrence of specific agricultural features. TALs are characterized by small-scale structure of plot division, and by unchanged ways of land use during socialistic collectivisation, or by preserved forms of anthropogenic relief, or by preserved features of traditional agricultural technologies. The countrywide inventory of TAL in Slovakia was aimed to provide new knowledge of TAL distribution and conditions in Slovakia. TAL sites were identified from aerial photos using Google Earth across the whole Slovakia based on analysis of 1 km^2 grid network and 20% of sites were validated in the field. From a land use viewpoint, 4 classes of TAL were distinguished: (1) TAL with dispersed settlement, (2) TAL of vineyards, (3) TAL of arable-land, grasslands and orchards and (4) TAL of arable-land and grasslands.

This contribution was focused on woody vegetation generally tied to unproductive bounds which is an important part of the landscape structure and a determining feature of the landscape character. Depending on the shape, size, morphometric and genetic characteristics we have distinguished three main types of woodland structure: solitaire trees, lines of trees or shrubs or small woodland. Based on the occurrence of woodland types, which form distinctive landscape character and structure of TAL, we divided TAL into five subtypes: 1) TAL with less occurrence of woodland - coverage of woods is up to 10% of the site, 2) TAL with various woodland types, 3) TAL with dominant solitaire trees, 4) TAL with dominant lines of trees or shrubs and 5) TAL with dominant small woodland.

The proportion of woodland was relatively low, as TAL with less occurrence of woodland (36%) was the most extended subtypes of TAL. The most common dominant woodland structure was lines of trees and shrubs, considerably represented in TAL of arable-land and grassland and TAL with dispersed settlement. They were bound on typical agrarian relief forms. Evaluation was supported by statistical analyses focused on relation between different types of woodland in TAL and other biotic and abiotic characteristics of landscape and TAL land use.

Oral presentation

COMPARATIVE ANALYSES OF ANT ASSEMBLAGES (HYMENOPTERA: FORMICIDAE) IN OAK ASSOCIATED HABITATS - A CASE STUDY FROM EASTERN EUROPE (TRANSYLVANIA, ROMANIA)

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Oak associated habitats host high insect diversity, especially saproxylic species, due to the availability of specific microhabitats such as dead wood, rotten logs and woody debris. Within the insects occurring in such habitats, ants play a major role in forest ecosystems as generalist predators. Ant assemblages were studied using pitfall traps, barrier traps and Moericke (yellow) pan traps. Sampling was undertaken two times per month, between May and October in 2015 and 2016, in a site near Crăciunel, Harghita (Transylvania, Romania). We sampled three types of oak habitats: wood-pastures, forests and the ecotone separating them. We identified a total of 18 ant species. Most of the species are common for Romania. However, we highlight the presence of thermophilic species: *Aphaenogaster subterranea* (Latreille, 1798), *Dolichoderus quadripunctatus* (Linnaeus, 1771), *Temnothorax affinis* (Mayr, 1855) and *Temnothorax corticalis* (Schenck, 1852). The highest diversity was recorded in the forest habitats. The three habitats shared an important proportion of the species, yet we recorded significant differences between the three habitats in terms of community composition. Oak associated habitats can sustain high diversity of ant species and moreover thermophilic specialists thrive.

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Keywords: wood-pastures, community-ecology, trapping, thermophilic ants

Oral presentation

DIFFERENT SAMPLING METHODS REVEAL HIGH TAXA RICHNESS OF INSECT ASSEMBLAGES IN OAK ASSOCIATED HABITATS – A CASE STUDY FROM EASTERN EUROPE (TRANSYLVANIA, ROMANIA)

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Oak associated habitats are known to host high species richness due to a wide range of microhabitats (dead-wood, rotten logs, woody debris). We sampled three types of oak habitats: wood-pastures, forests and the ecotone separating them. Within these habitats, we sampled insect assemblages using pitfall traps, barrier traps and Moericke (yellow) pan traps. Sampling was carried out two times per month, between May and October in 2015 and 2016, in Crăciunel, Harghita (Transylvania, Romania). Our results indicate high rich taxa, mainly in Coleoptera, Hymenoptera and Diptera. Altogether, we identified species belonging to more than 45 Coleoptera families, 27 Hymenoptera and Diptera families. Amongst these families, we highlight the presence of beetle species belonging to Zopheridae, Cerylonidae with a poorly known biology. A mosaic structure is indicated by the sampling method: high diversity of beetle taxa were sampled with the barrier traps, whereas the Moericke traps collected more Diptera and Hymenoptera families. Pitfall traps recorded the lowest number of families in terms of beetles, flies and hymenopterans. Besides these three major insect orders, we sampled other groups such as Raphidioptera, Neuroptera, Dermaptera, Hemiptera, Blattodea, Lepidoptera and others. Our results enhance the importance of oak habitats as reservoirs for insect biodiversity.

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Keywords: wood-pastures, Coleoptera, Diptera, Hymenoptera, insect diversity

Poster

FIRE MANAGEMENT IN PAST AND PRESENT RURAL LANDSCAPES – SWEDISH AND POLISH EXAMPLES

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Fire is a natural and controversial phenomenon, mostly associated with threat and large economic losses. As such it is effectively suppressed, often legally forbidden and to a large extent eliminated from land management practices in many of Northern, Central and Eastern European countries. However, fire was important in the past land use of that region, which is not always acknowledged today. In addition, the earlier use of fire may also be underestimated due to long time passed and a lack of quantifiable records of fire use and fire activity. Since the annual number of fires across Central and Eastern Europe is continuously increasing in the recent decades and will likely continue to do so because of the ongoing temperature and human population trends, a broader discussion of that disturbance agent seems relevant for the current and future ecosystem management. Here we present examples of past human fire management and we discuss the potential for modern fire use in rural landscapes of Sweden and Poland. We applied historical documents, literature and tree ring data to obtain both qualitative and quantitative information on the historical fire occurrence. The combined picture of fires from historical and natural archives shows a wide application of fire in local economies for many purposes, including improvement of pasture grounds, cultivation or active firefighting. Dendroecological data from selected study areas confirm the occurrence of frequent low-intensity fires until relatively recently, ca. 100–150 years ago. Depending on time and region, the human share of these fires have likely varied from low to dominating. However, the negative effects on biodiversity from the elimination of fire in temperate European landscapes as well as the fundamental role of fire in shaping ecosystems is now slowly starting to be acknowledged more widely. One example is the use of prescribed fire for nature conservation in the Nordic countries. Since the ecological aspect of fire in the past and present Central and Eastern European landscapes is not fully recognized, we suggest the need for wide interdisciplinary research and discussion, which could potentially enable a revision of the exiting view on fire in this region.

Keywords: disturbance, environmental history, land use, prescribed fire, tree ring

Oral presentation

HISTORY

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'I am interested in the historical interactions between people and forests at all spatial and temporal scales.'

The history of wooded landscapes: how to study it and why should we care?

Landscapes are obviously results of historic processes. In this present interglacial, some landscapes have had a turbulent history, while others have been more static. Some are very complex, with recognizable features from many periods, while the present appearance of others was predominantly formed in a single period obliterating most of what had been there before. Wooded landscapes are no exception. Each ancient forest contains its distinctive and usually rich flora and fauna, traces of former woodland use and often other features, such as remains of former human habitats or land use. By contrast, a recent conifer plantation on a bulldozed and ploughed site will usually offer little above being a monument of forestry techniques fashionable in the 20th century.

There are basically three kinds of sources of information to study the historical processes that led to wooded landscapes as they are today.[5] With considerable simplification of a more complex reality, these could be called archival sources, fossil sources and current features. Archival sources can be very many kinds. In a Central European context they usually begin sometime around AD 1000. For the study of woodland history, the most important types include for example early medieval polyptychs and their later counterparts (*urbaria*), boundary perambulations, estate conscriptions and evaluations, woodland account books, forest management plans, national cadastral and other taxation surveys. Maps may form a separate category even though strictly separating them from 'written' sources would be difficult, because they usually contain written text as well as pictorial representations. Furthermore, most maps have corresponding textual descriptions. Each region has its specific sources with their own temporal arrangement. Although with the passage of time usually more and more sources are available, this development is not always linear. Whether more recent periods of woodland history are easier to study also depends on the kind

[5] People's memories, which can be accessed through interviews, are another important type of source, but I will not deal with them here. On this topic, see more in Zsolt Molnár's contribution in the present volume.

of questions one asks. The same type of archival source can occur in different quantities and in different periods in various regions. For example boundary perambulations are important sources for landscape studies in the Anglo-Saxon period in Britain, in the Middle Ages in Hungary and in the 16th century in Bohemia. Forestry management plans are the typical sources for much of Europe in the late-19th-20th centuries, providing detailed information on practically every forest patch. By contrast, according to Oliver Rackham, "1890 to 1950, as far as written evidence is concerned, is the darkest period in the woodland history of Eastern England since the twelfth century." For East-Central Europe, I would venture that the greatest variety (but not necessarily quantity) of archival sources for individual forests exists for approximately the period between 1750 and 1850. While during this century the new sources of 'scientific' forestry (such as management plans or activity logbooks of foresters) were already being produced, many of the 'older' sources types (estate conscriptions, cadastral surveys, perambulations) that disappeared by the 20th century were still in use.

Fossil sources are *remains* of living organisms that for some reason survived until the present. They can be especially durable (such as animal bones or timber) or get fossilized by various processes (such as getting stuck in anaerobic conditions or being charred). For forest history, the materials most often used are pollen and charcoal. Pollen analysis (or palynology) makes use of the fact that the pollen of each plant species or genus is, if deposited in the right conditions, extremely durable and distinct. After taking a sediment core, palynologist can count the number of pollen grains of each species or genus in each layer of the core, from which percentage curves are constructed. Turning these percentage into landscapes is a real challenge. For sure, 23% oak pollen in a layer does not mean that 23% of the landscape around the site (and establishing the size of this landscape patch is also increasingly difficult) was covered by oak forests, because different plants produce different amounts of differently resistant pollen. Furthermore, some pollen types can fly far, others will be mostly deposited near their mother tree, and all this also depends on local environmental conditions. In the past few decades, various modelling approaches were developed to tackle this problem, which were tested by comparing current pollen rain with vegetation, and, less frequently, subrecent vegetation data with coeval pollen layers. Results showed that models can turn pollen percentages into landscape reconstructions reasonably well. Charcoal analysis (or anthracology) works along similar lines, but in this case researchers look at the actual remains of trees rather than an otherwise invisible part. Larger pieces of charcoal can be identified to the species or genus and used for studying changes in vegetation. Smaller pieces are simply counted and used as indicators of fire history. Charcoal may originate from archaeological contexts (such as fireplaces or charcoal burning hearths) or random soil pits. Charcoal and pollen analyses are often carried out on the same profile. In such profiles, layers are dated with radiocarbon (^{14}C) or lead (^{210}Pb) analysis, based on which depth-age models are created. Similarly to charcoal, the fossilized macroremains of plants can also be used in the study of forest history, even though such research has been mostly done in archaeological contexts for the study of edible plants. In addition, there are other, so far less used sources and methods (such as phytolith, or siliceous plant remains, analysis), which have great potential for future research. One of the most important non-archival sources for woodland history is tree rings. In the temperate regions of the Earth, trees grow quicker in the spring and slower later in the year, which results in recognizable rings. Because ring-width differs from year to year, a sufficiently long series

is unique. When such series overlap, tree ring chronology (which is region and species specific) can be extended towards the past. Tree rings are in fact a transition category between fossil and current sources: recognizable rings can originate from old living trees, standing buildings or *excavations*. As far as woodland history is concerned, tree rings can be used for example in the study of disturbance dynamics (such as windstorms) and, importantly, in research on prehistoric and historic woodland management. While attempts at drawing conclusions on management practices from pollen have been sparse and moderately successful, dendrochronology (also carried out on charred wood remains) put forward many interesting results. For example, some archaeologically recovered wood samples from Roman Period and medieval Flemish sites showed growth patterns similar to modern coppiced oaks. Bronze Ages timber from Lake Constance also showed signs of growing in coppices or coppices-with-standards. In another example, models of original wood sizes reconstructed from charred fragments in the Jura Mts. demonstrated the use of small underwood for domestic fire in the Neolithic. There are further sources (notably fossil molluscs) that do not give direct indication of tree species composition but can be used to infer the proportion of open vegetation in the landscape. Lastly, one must not forget about animal bones (the study material of archaeozoology), which almost exclusively come from archaeological excavations but are informative as to the possible amount of hunting in forests and also evidence the kinds of animals that may have been pastured in wood-pasture areas.

The current landscape offers information in two forms. First, what lives on it (plants and animals) is to some degree determined by historic processes. The best-known example of this is the 'ancient woodland' concept, which argues that the flora of woods with long-term continuity (meaning several centuries) is different from that of more recent woodlands. Past management also matters: there are many studies that described changes in the herb layer of forests following the general decline of traditional management in many European lowland regions since the mid-20th century. This was done mainly with the help of repeated vegetation surveys, where the old surveys (usually from the mid-20th century) are in fact archival sources in their own right, and the standard methods of source criticism (such as reliability and author bias checks) should be applied to them. Differences in vegetation can indicate former non-woodland uses in currently wooded areas for centuries or even millennia. Sometimes such areas (notably traces of cultivation) are located through landscape archaeological research and the vegetation examined afterwards, as was famously done for Roman fields in a forested area in northeastern France by Dupouey and colleagues. In other, rarer cases, vegetation is used as an indicator of areas of possible archaeological interest. This brings us to the second set of information the current landscape offers. Forested areas tend to preserve archaeological features that had been in the given territory before it became overgrown by trees. Such features can be independent of forests (such as field remains, deserted settlements or fishpond dams), but many were created as part of management operations (such as woodbanks, drainage and flotation channels or saw-pits). Perhaps the best-documented remains are charcoal platforms, which were mostly created on sloping ground. Even a few decades ago the airborne detection of archaeological features in forested areas seemed impossible (the human eye cannot see through tree canopy).

With the appearance of LIDAR (originally a blend of light+radar) this has drastically changed. LIDAR does see through the canopy and can map features with high accuracy in any region.

It was extensively used for example to locate hundreds of thousands of charcoal platforms in many European mountains.

The history of woodland has been studied (in a form that would be recognizable for current researchers) since the mid-18th century. Scores of studies and books were written in the 19th century, many of which employed what would nowadays be called an interdisciplinary approach. Somewhat by contrast, much research in the first half of the 20th century focused on the more institutional aspects of forest history, especially the development of centralized legal frameworks. Since ca. the late 1960s, a new trend of woodland historical investigations emerged, which researched the history of individual sites and combined archival, fossil and current data into what is increasingly called woodland historical ecology. This trend questioned the linear development of forestry management techniques from primitive to advanced, a central tenet of many 20th-century forest historical works. Much research went into describing earlier, traditional management techniques, especially coppicing, pollarding and various wood-pasture systems. This knowledge, through the reintroduction of traditional management in select sites, proved useful for nature conservation purposes. More recently, woodland history also joined in the international trend towards big data and modelling. Several papers tackled deforestation on continental or even global scales, and historical data were used to model for example the role of traditional non-timber management in carbon cycling. In the work I did together with my colleagues, we for example combined a pollen-based quantitative landscape model with a macrophysical climate model and a model of prehistoric human presence (the model itself was based on a complete database of archaeological finds and aimed to quantify the uncertainty inherent in all archaeological data) to try to understand the role woodland played in human adaptation to changed climatic conditions in the Copper Age.

There are some aspects of history that seem particularly relevant when talking about 'wooded rural landscapes'. An example is whether the current sharp division line between forest and non-forest (and by implication between forest uses and non-forest uses) has really, as usually assumed, resulted from socioeconomic processes in the past few centuries; in other words, whether open, often communal, multiple-use forests can indeed be considered a more ancient version of wooded landscapes than for example intensive coppice woods. The answer, as it often happens in history, is yes and no, depending on what, where and when we study. The prehistoric beginnings of woodland management are difficult to grasp. There is good evidence, as I noted above, to show that that intensive forms of management existed throughout prehistory, but whether for example coppicing was practiced in the Bronze Age the same way as in the Middle Ages and Early Modern Period would be hard to say. Palaeoecological methods can provide indications as to the openness of the landscape, but they are not capable of defining patchiness: we usually cannot tell whether 30% openness at the landscape scale meant a large open patch or a mosaic-like structure with many small open patches evenly or unevenly distributed. The co-occurrence of various plant species may be indicative, but the possible conclusions are difficult to substantiate from the actual prehistoric evidence. Where and when written sources are available to study this issue, the evidence is ambiguous. There are of course many well-documented cases in which we can observe how multiple use and open woodland structure were replaced by timber production and closed forests, mostly in the 19th century. At the same time, much depends on our perspective. As I write these lines, I could go into practically any forest in the two East-Central European countries I spend most of my

time in, and, so the law says, gather wild fruits and dry wood for my own use. This is a level of 'communal' freedom unparalleled in the history of these woods even though not many people would think about it this way. In any case, in many European regions that I have some familiarity with, intensive management was present already in the first available archival sources in the Middle Ages. So can it be that such regions simply lack the sources that would tell us something about previous management? Richard Keyser's work in France suggested that this may be so. In the Champagne region of France, the transition from extensive exploitation (including pasture) to intensive woodland management happened during the AD 13th century. Nonetheless, such a development can only be assumed for regions where written sources to document the transition do not exist. In medieval Hungary, for example, extensively and intensively exploited woodlands appear to have co-existed and there is nothing to suggest which type was more ancient. In general, I would argue that more research is needed to understand the historical trajectories of extensive and intensive woodland exploitation. For many forests, 'enclosure' (meaning the separation of land uses) happened not in the later parts of the Early Modern Period but already in the Middle Ages. The physical evidence for this is woodbanks and walls surrounding woodlands. In Britain, most woods were surrounded by woodbanks in the Middle Ages, and this was unusual enough to be remarked upon by a 15th-century Bohemian traveller. Indeed, most woodbanks I know in the Czech Republic seem to be early modern. By contrast in Denmark in the 15th century, even neighbouring woodlots of individual owners could be separate by ditches, but most banks and stone walls surrounding forests are from the 18th century.

Why should anyone outside academic circles be interested in woodland history? The answer to this question is complex and not self-explanatory. On the most general level, the simple fact that wooded landscapes evolve through time makes it impossible to understand their future without knowing their past. Furthermore, forests change slowly, therefore one needs to look at their long-term history through several centuries to gain meaningful knowledge. Topical issues, such extinction debt or migration credit, are connected to the speed of change. An historical perspective also reminds us that people and forests co-evolved through the millennia and it is more useful to conceptualize humans as an intrinsic factor rather than outside disturbance in this development. For example, in many regions woods have been small and far in between for many centuries partly due to human influence. They have evolved in such conditions and this has contributed to their unique flora and fauna – larger and more contiguous woods are not necessarily and in all conditions better than smaller and isolated ones. For practical management, knowledge of history can be useful by providing baselines – nowadays mostly understood not as rigid steady-states (lest one fall victim to the 'shifting baseline syndrome') but rather as the historical range of variation. Such range can inform managers whether changes observed are indeed outside the 'usual' dynamics of their forests. Historical studies are also important to put the practice of conservation and restoration itself into a historical perspective. It is useful for woodland managers to understand how their own profession has changed through the ages, not least in order not to repeat the mistakes of their predecessors, as was demonstrated for Yellowstone National Park. But there is more to such knowledge than the simple improvement of schemes. Nature protection is eventually based on human values and perception, and these also change. Historical knowledge – not only of ecosystems but also of the human perception of these systems – can help woodland managers to better

understand the drivers behind their own decisions. Lastly, historical investigations emphasize the individual features and unique development of each forest, which is something that tends to get lost in the centralized schemes that dominate current national and European nature conservation and forestry. All this being said, it is well-worth noticing that interest in historical matters has existed for centuries in practical woodland management. A set, although not overly important part of forest management plans is site history. From the 19th century onwards, foresters aimed to look at the history of their forests in order to gain insights for future management. This aim has remained the same, but the context has changed.

A question researchers from East Central Europe can ask themselves is what our region can offer in terms woodlands and their history, whether there is anything that is uniquely interesting in our countries. While it is only natural to be interested in the landscapes one inhabits, therefore the issue might be moot, there are elements to make our region appealing in a European context. While the quantity and quality of archival sources can hardly match those of Western and Mediterranean Europe, not at least until the Early Modern Period, several aspects deserve attention. First, and somewhat paradoxically, the fact that most of East-Central Europe underwent industrialization later than Western Europe means that certain social structures and wooded landscapes to go with them survived in our region longer than elsewhere. At the same time, especially during the 18th-19th centuries, East-Central Europe was very well-documented partly because of its integration into larger (and bureaucratic) polities, such as the Habsburg Empire. To this can be added the rich tradition in historical-ethnographic research characteristic for a number of countries, which studied traditional landscapes and their management in great detail. Even though communist regimes were extremely destructive especially through collectivization, the likes of Transylvanian working wood-pastures, for example, are rarely to be seen anywhere else in Europe. Second, natural heritage in the region is rich and uniquely interesting. For example, researchers from all over the world visit Europe's 'last primeval forest' on the border between Poland and Belarus. Through the works of Tomasz Samojlik and his colleagues, we have a good picture of why this forest survived, how it developed and how close to its 'natural' state it may be. Another example is the forest-steppes of Hungary, the westernmost fringes of this vegetation type, which – unlike much of their Eastern European and Asian counterparts – are reasonably well documented throughout history. The list could go on; there is much more work to be done. Wooded landscapes in East-Central Europe are fascinating – it is my hope that the next generation of researchers will share in this view and discover even more about the past (and therefore the present and future) of these landscapes.

LAND OWNERSHIP AS A KEY DETERMINANT OF LONG-TERM LANDSCAPE DYNAMICS

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Landscape change is driven by a variety of forces acting on different scales, from regional to global. However, the final landscape pattern, its composition and configuration, is a result of complex interactions between external drivers and local conditions. In cultural landscapes many of the predefined conditions seem to be closely related to the qualities of primary landscape users, namely, the owners.

The aim of this study was to name and rank spatial determinants of historic and current landscape patterns and long-term landscape stability, with particular focus on landowners. The explanatory spatial analysis was carried out in the carefully selected study area (the upper Wiar river basin in the Polish Eastern Carpathians (233 km^2)) with the use of data mining techniques and descriptive analytical methods. A total of 15 environmental and socio-economic potential determinants were included in the model. Land cover data for the 8 time slices between 1780 and 2012 was derived mainly from detailed military maps. Classifications of landowners and mapping ownership were based on land registers from the feudal, socialist and capitalist age.

The results show that the landscape pattern and land cover stability can be best predicted on the basis of land ownership structure. Environmental conditions can be seen as mediators rather than determinants of landscape stability, regulating the pace and pattern of spatial changes resulting from local socio-economic factors. The main conclusion is that land ownership determines land cover in periods of evolutionary changes, whereas during revolutionary land system transformations (e.g. colonization, mass resettlements), it adjusts to actual natural conditions, including land cover.

Keywords: land cover change, land ownership, landscape pattern, landscape stability, spatial analysis, Carpathians

Oral presentation

ANCIENT TREESCAPES IN THE UK – HERITAGE, LANDSCAPE AND BIODIVERSITY LESSONS FROM SURVIVING ANCIENT TREES

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The UK is extraordinarily rich in ancient trees especially in Forests and deer parks with historic continuity from early Mediaeval if not earlier times and in Caledonian pine forests. Some of these trees are 1000s of years old.

In many cases the greatest assemblages of these trees of national special interest (VI Trees) can be traced back through the earliest of maps where they are represented through individual tree iconography. Many of these trees, in the form of pollards, contributed limbs to the ships that took European settlers around the world and should claim their place in the shared cultural history.

Their open grown form is living testament to the history of the landscapes around them and shed insights into old growth origins and structure and our cultural heritage in Europe. The value of the open crowned trees, especially those that at the most light demanding end of the spectrum, has been overlooked in favour of shade tolerant trees of closed canopy, high forest.

In the UK, the Ancient Tree Inventory, which started in 2002 as a partnership between the Woodland Trust, Ancient Tree Forum and Tree Register of the British Isles (all non-profit organisations) is an on-going citizen science project to catalogue their location and condition as a first step towards securing their future and specialist care. The cumulative records also add value to the assessment of a priority habitat inventory for European wood pasture and parkland.

Keywords: ancient, tree, open grown, light demanding, heritage

Oral presentation

PERSISTENT RURAL LANDSCAPE RELICTS AND THEIR RELEVANCE TO CULTURAL HERITAGE: CASE STUDY OF ZUBRNICE, CZECH REPUBLIC

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Persistent rural landscape elements (relicts) such as clearance cairns or agrarian terraces are acknowledged for their ecological and historical values. Besides their intrinsic values, they also contribute to diversity of cultural landscapes and together with land use/land cover structure enable to reflect landscape dynamics and its drivers. Here we present the field and archival study of Zubrnice (N Czechia) area, which is recognized for its historical rural architecture and has an official status of open-air museum. The general research goal is to suggest an approach to evaluate historical landscape structures and integrate them into the conservation scheme of the open-air museum. In this particular study, we aim to answer the question of historical landscape development and its driving forces that results in current state of landscape relicts. Based on historical maps, cadastral and archive sources we reconstructed the past landscape structure (within time periods 1845, 1954, 2003 and 2013) with its drivers (based on archive sources) that results in current state of landscape in subjected area.

The landscape structure of past segments were derived from aerial imagery (1954, 2003 and 2013) and historical map sources (1845) and processed via GIS (ESRI) software package. Additionally the landscape metrics (Shannon's Diversity Index, Mean Patch Size and Number of Classes) were used for description of change. The driving forces and their causal logic were derived from current literature sources, archive and iconographic sources. The dominant persistence in landscape structure was found mainly in forested areas in comparison to arable land. The landscape relicts were found mainly in forms of clearance cairns and remnants of abandoned orchards that correspond with the use depicted in 1845. The synthetic map with dynamic of change was produced along with method and recommendations for conservation interventions.

Keywords: landscape relict, clearance cairns, LULC change, Zubrnice

Poster

CONTRAST BETWEEN LAND-USE CLASSES IN THE MID 19TH CENTURY IN CZECHIA

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Research of long-term land-use changes often relies on archival map sources. So called Stable (or Franciscan) cadaster, made in Czech lands in 1826–1843, belongs among the mostly used sources in the Czech Republic. It uses about 40 land-use classes, while the current cadaster records only 10 classes. The most significant difference is that there were registered different agroforestry land-uses (Krčmářová, 2016), e. g. vineyards with fruit trees or meadows and pastures with trees. There arises a question how were such parcels delineated. Generally, a parcel was delineated if it had different owner or land use from the neighbouring one. Here we are addressing question how different the land-use had to be to delineate a new parcel. The results indicate which boundaries were the most contrasting and which the most fuzzy. The most fuzzy seem boundary between forest and wood-pasture and between pasture and wood-pasture. The results have important implications for studies dealing with archival map sources.

Keywords: stable cadaster, agroforestry, LUCC, archival map sources

Poster

USING OLD TREES FROM WOOD-PASTURES IN LAND USE CHANGE DYNAMICS: CASE STUDY FROM SOUTHERN TRANSYLVANIA

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The rural landscapes in Transylvania have changed dramatically in the last 100 years. Most of the changes that have occurred, are conversions from semi-natural habitats such as grasslands and forests to arable land. Several old trees still withstand as old landmarks in the rapidly changing landscape. Most of the trees are found in old pastures illustrating the resilience of this unique ecosystem. However, there is a strong pressure from the local communities, which concerns cutting or burning down the existing trees. This usually is an act of poverty or ignorance, while there are no formal regulations explicitly targeting the maintenance of large old trees. In my study I am going to chronologically observe the representation and evolution of old wood pastures using old maps from the last 250 years. In contrast, I will follow in neighbouring areas the evolution of semi-natural habitats into arable or constructed land, and snapshot the territorial balance for each period the maps were developed. The map sets that are going to be used for the study are the Habsurgic first, second, and third military surveys, the Romanian Military survey, the Romanian Topographical Maps. The data collected from the maps is going to be overlaid with the field data on large old trees collected in 2015 and 2016 through the Remarkable Trees of Romania project.

Keywords: wood-pastures, old trees, resilience, land cover change, archival map sources, Transylvania

Oral presentation

DETERMINATION OF SPATIAL DISTRIBUTIONS OF LANDSCAPE VALUES IN PROTECTED AREA PLANNING: İĞNEADA FLOODPLAIN FORESTS NATIONAL PARK

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Definition of an area as a national park, determination of border and status, and management techniques that rely completely on expert assessment in traditional approaches. This perspective may ignore the local knowledge and thus landscape values in the area substantially. There is a need to understand local knowledge and landscape values in order to be able to identify the appropriateness and conflict areas in the use of land, and to make decisions on land use in the direction of local people's perceptions and opinions. Brown and Reed (2000) developed the first typology of landscape values consisting of 13 values (aesthetic, recreation, biodiversity, life supporting, economic, learning, historic, cultural, future, intrinsic, spiritual, therapeutic and subsistence). In this study, it is aimed to determine how the landscape values diversify with different kind of stakeholders (local people, decision-makers, non-governmental organizations, scientists and tourists) that are directly or indirectly in contact with İğneada Floodplain Forests National Park and to locate the spatial distributions of determined landscape values with grading by priority order on the map with the help of Public Participation GIS (PPGIS). As a result, a rational basis for a management approach based on landscape values and local knowledge has been established.

Keywords: landscape values, national park planning, public participation GIS

Oral presentation

THE BEGINNINGS OF MOBILE HUSBANDRY IN THE MOUNTAIN PERIPHERY OF SOUTH-EASTERN POLAND. THE CASE OF THE HIGH BIESZCZADY MTS

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This paper is focused on exploitation of mountain landscapes of the eastern part of Polish Carpathians (Bieszczady Mts.). In all pollen diagrams from this area the traces of presence of man become evident from about 3200 BC, and several stages of human activity were distinguished. The first anthropomorphic changes of vegetation dated to the period 3200–1500 BC are referred to animals herding, and the later changes up to ca. 400 AD are connected with permanent occupation of some parts of this area. The last stage is dated to the historic time and began from XV century. Unfortunately until 2013 there were not archaeological conformations of prehistoric human's activity in this part of the Carpathians.

This paper presents the results of archaeological works started in 2013 in the eastern part of Polish Bieszczady Mts. as well as the questions which occurred from the palynological and archaeological data. Surface surveys and LIDAR-based prospection resulted in discovery of numerous sites located on high altitude mountain landscapes between 700 and 1250 m a.s.l.

1. Single finds of lithic artefacts dated to Late Neolithic (blades, blade end-scraper, heart-shaped arrow head) and Early Bronze Age (e.g. flake cores) are located in different landscape zones at the altitude between 700 and 1200 m a.s.l. Some on them were found above the natural forest line e.g. arrow head and blade end-scraper in a close spatial context of salt springs.

2. Stone structures rectangular and circular in shape and up to 120 m^2 in size are located between 1000 and 1100 m a.s.l. There are the first such structures discovered in the Polish Carpathians.

3. Late Neolithic culture camp-sites located at the altitude of 1150–1250 m a.s.l. are placed above the natural forest line. There is the highest location of the Late Neolithic camp-sites in Polish Carpathians.

All of the sites are located in the clear context of the salt springs and/or near the longitudinally oriented natural routs crossing the main ridge of the Carpathians which were used also in the historical times.

In my presentation I would like to signalize several important questions e.g.: function of different stone structures, reasons which motivated the men to enter into the Bieszczady Mts. (the role of the salt, the role of climatic changes, and natural routs), different kinds of mountain landscapes use (transhumance in the Late Neolithic and Early Bronze Age), and the men – environment mutual relationships.

Important questions also refers to the methods of field works, and to the future investigations.

Keywords: Late Neolithic, Early Bronze Age, transhumance, silica raw material, Bieszczady Mts., Eastern Polish Carpathians.

Oral presentation

PEOPLE IN LANDSCAPES

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'I am a botanist carrying out research in ethnobotany: traditional use of plants and utalitarian botany; I have been developing my own "Wild Garden" in Pietrusza Wola'

Wild edible plants in semi-wooded landscapes: from fields, meadows or from woodlands?

Foraging for wild plants has become a trendy activity now. Gathering wild edible species, however, apart from a short period of neglect, has always been an important part of rural livelihoods.

Over the last several years I have carried out projects documenting the gathering of wild edible plants (and fungi) in Poland, Croatia, Bosnia-Herzegovina, Romania, Georgia and China (the Qinling Mountains and the Tibetan Plateau). In my presentation I would like to share my observations on the extent to which the gathering of wild food is distributed between open habitats (ruderal communities, grasslands) and forests.

The main plant organs used for food are the green parts of plants, fruits and underground organs. The green parts of plants are mainly used as wild vegetables eaten cooked, fried or raw. They usually come from arable fields, and are weedy species. They form a part of wider agriecosystems and are by-products of agricultural activities. It is rare that they come from wooded areas, however such instances exist. For example compared to central-eastern Europe, in Caucasus and the Qinling Mountains of central China many more forest species are utilized as wild vegetables, and I will try to explain why this happens.

We also have to mention the terms 'herbophobia' and 'herbophilia', i.e. the attitudes of avoiding or appreciating wild vegetables in the diet. For example in southern Europe many more such vegetables are used, but they are mainly open-landscape species like in Central-eastern Europe.

On the other hand fruits come mainly from wooded areas as they are produced predominantly by shrubs and trees. Most fruits used in rural areas in Europe are either spiny Rosaceae species from forest edges and clearings or *Vaccinium* species from acidic habitats. Both categories of fruits may have benefited from the semi-open landscape which is actually their optimal habitat. Underground storage organs were rarely utilized in eastern Europe,

and they came from a variety of habitats. Fungi come predominantly from wooded places, though many traditionally utilized grassland species also exist.

Pastures were an important habitat for gathering wild plants. They host a variety of bitter or aromatic plants used as medicine and spices. They are probably the habitats which suffered the largest losses in the central European mountains. In many areas of southern Poland the collection of several important herbs used for medicine ceased due to their disappearance from the landscape as a result of the cessation of grazing. Thus any efforts to recreate semi-wooded habitats should not only aim at creating wooded meadows but also secure a place for wooded pastures.

Another issue I will discuss will be the importance of oak acorns for human food in history. In semi-wooded landscape oaks are usually (sub)dominant species. I will discuss chemical differences between different oak species in Europe and elsewhere and characterize how they were used for food in human history.

At the end of my presentation I will devote some time to contemporary foraging trends and I will explain why they are more focused on using plants from forests and parks than open habitats. I will also discuss the prospects of using secondary habitats dominated by invasive, exotic plant species for wild food gathering.

AGROFORESTRY SYSTEMS IN POLAND. THE CASE STUDY OF SILVOPASTORAL SYSTEMS AS INNOVATIVE AND TRADITIONAL KNOWLEDGE-BASED WAY OF FARMING IN POLAND ON SOILS OF LOW AGRICULTURAL SUITABILITY

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Agroforestry systems in Poland are strongly varied, depending on local conditions and farmers perception of the functionality of trees. Scattered trees on farmlands and small woodlots are common to find in many areas. Shelterbelts and alley trees were actively introduced to Polish agriculture by public authorities. Silvopastoral systems has long tradition in Poland including animals grazing in wet extensive pastures with willow, birch and alder trees; orchards; woodlands and forests or free-range mast-feeding to name just a few. Nowadays, using of wooded or abandoned lands, covered partly by wood or bushes as a land for grazing can be an alternative for small and medium-sized farms. It offers animals protection against wind, snow and rain, making them healthier and delivers woody biomass at the same time, while both components (animal grazing and tree growth) interact with each other. Apart from wood for renewable energy or timber, meat can be considered as a specific product coming from traditional silvopastoral system. Farming of traditional breeds, naturally adapted to local conditions, particularly sheep, goat and horse breeding helps to protect extensive wood-pastures, including mountain rangelands and at the same time might provide traditional products into the market. Keeping Highland, Galloway or Limousine cattle in open system of pastures, often practiced throughout the year allows high-quality beef production, appreciated by consumers. In terms of sale for breeding; since these breads are rare in Poland, usually there is no problem with a lacking demand. Considering silvopastoral systems as an alternative for revitalizing rural areas with marginal soils (sandy, acid soils, steep slopes) or just abandoned, they might constitute important source of income for farmers working under similar conditions.

Keywords: silvopasture, cattle, marginal lands, alternative farming, beef, wood

Oral presentation

THE TREE. CHANGES IN THE PERCEPTION OF INHABITANTS OF SUBCARPATHIAN VOIVODESHIP VILLAGES IN LAST 150 YEARS

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The role of trees in the life of people and culture of societies had in the past multi-dimensional meaning. Their role in life was invaluable. Timber served as construction material and fuel, from which depended human life. The tree gave shade, valuable fruits and protected from gale. There was therefore very strong relationship between a man and a tree. Their significance in everyday life of central Europeans reflected in many legends, beliefs and myths. Therefore acquiring this divine meaning people used to treat trees with respect and care. Such a relation between the trees and the social attitude reflected particularly in the wooded rural landscape. Rural roads frequently had form of parkways, trees surrounded temples and mansions, particular trees species accompanied houses, fields were separated by woodlots. Today we observe significant change in attitudes towards trees, which regularly disappear from the landscape of cities, towns and villages, especially after the recent legislative changes.

The aim of the study is to determine and describe the changes in wooden rural landscape of Subcarpathian voivodeship. The authors look for the causes of such significant changes in the attitude to trees and its spatial consequences.

Research methods are focused on the work involving analysis of source materials and literature, as well as comparative iconographic material analysis. Social research were carried out. It was interviews with few inhabitants of Subcarpathian.

The study clearly suggests changing awareness of villages inhabitants. It seems that the biggest impact was a top-down planned economy (in years 1945-1990). Currently village inhabitants have lost the need of being in relationship with nature. This has far-reaching spatial consequences. Rural landscape is no longer associated with large-scale composed wooded areas, rather with arable land slowly changing into greenfield land and with neat evergreen gardens surrounding new villas.

Keywords: tree, perception, wooded rural landscape

Poster

THE HERITAGE OF TRADITIONAL CRAFTS – 'JOINT VENTURE' OF CULTURAL LANDSCAPE, KNOWLEDGE AND SKILLS

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The traditional crafts are an important element of our heritage, like the landscape which has changed rapidly during last fifty years. The preservation of traditional crafts means not only preservation of knowledge and skills, but also the protection of cultural landscape and natural resources. The study shows the importance of traditional crafts to the Polish culture and ponders the influence of natural and cultural factors on their development and differentiation. This in turn leads to several important questions, in particular:

1. What was the decisive force leading to the invention and development of a traditional craft? How strong was the role of "higher motivations," modifying the pure practical approach of craftsmen?

2. Is a traditional craft a part of a system of values?

3. What do the traditional crafts say about our ancestors' attitudes to nature and their resources?

4. What is the present value of a traditional craft? What is its asset to a modern society? Could 'eco-' mean 'traditional'?

5. Who can perform a craft today? How traditional skills can be transferred and incorporate to a modern society?

6. Why should we care about traditional crafts?

In traditional crafts implicitly embrace and reflect cultural and natural identities of peoples and their landscapes. Because the culture is not only about knowledge and skills: it is also a Man who cultivates and feels the importance of his land.

Keywords: traditional culture, disappearing skills and crafts, material culture

Oral presentation

ECOSYSTEM SERVICES OF TREES AND WOODLAND VEGETATION CONNECTED TO DRAINAGE CANAL SYSTEMS OF INTENSIVELY UTILIZED AGRICULTURAL LANDSCAPE

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The reason of construction of drainage canal system was the intensification of agricultural production and discharge of inland waters. Their construction characters are analogical to a stream. As artificial multifunctional anthropogenic elements in a intensively utilized agricultural landscape they provide different ecosystem services to populations and human society which were not paid attention yet. The aim of our study was focused on trees and woodland vegetation in vicinity of drainage canals which were distinguished by shape to plots, lines of trees or solitaire trees. Despite their small size, these woodland patches along the primary and secondary drainage canals are important connective landscape elements and serve also as a refugium, or biocentre for several kinds of organisms. On the other hand, as the secondary drainage canals are gradually overgrown, wood vegetation develops and canals stop fulfilling their main function. Based on re-evaluation of present state of drainage canals we try to elaborate a proposal of measures of their primary functions and proposal of their multifunctional use.

Oral presentation

TRADITIONAL ECOLOGICAL KNOWLEDGE ABOUT GRASSLANDS OF LOCAL FARMERS IN NORTH-EASTERN POLAND

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Introduction. Traditional ecological knowledge is held by local people who live in the rural landscape for decades. Moreover comprehensive ecological knowledge is kept and preserved in conditions of marginalization and isolation of the community which have geographical, topographical and economical base. On the way of direct management, use of land and existing in the landscape, people gain specific, local knowledge. Many research show, that practices of local communities are relevant for sustainable and effective conservation of biodiversity and traditional landscape they are surrounded by, for example meadows and pastures. Hence preservation and documentation of local farmers knowledge about management of grasslands is needed.

Methods and research questions. North-eastern Poland belongs to areas with species-rich, high nature value farmlands, where small-scale farming are common. Sulwaszczyzna and Podlasie regions (with pristine Biebrza and Narwia Rivers), were chosen as case study area. The local history, natural barriers (widespread bogs), low productive soil, economical conditions, the life in direct relations with nature indicate, that local community can hold valuable ecological knowledge, culturally transmitted from generation to generation. In research, interviews with local farmers, analyze of historical maps and local, native and EU agro-environmental implemented regulations, are applied. Following, relevant research questions are state: What is elderly people knowledge about extensive grassland management, past activities, which is eroding among younger generations? How grasslands and local rural landscape have changed in last decades? What is the impact of EU and polish regulations on traditional grassland management and biodiversity?

Conclusions. In Poland, until now traditional people knowledge about grassland has been not documented and investigated. The EU and native environmental regulations often do not support locally specific grassland management. That is why the impact of the general regulations on traditional grassland management and local biodiversity should be analyzed.

Poster

GENERATION TO GENERATION: PAST, PRESENT AND FUTURE OF WOOD PASTURES IN HUNGARY

Anna Varga, Judit Bódis, Szandra Varjú, Zoltán Tamás Samu, Dénes Saláta, András Zlinszky, Attila Borhidi, Andrea Vityi, Gerardo Moreno, Zsolt Molnár:
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Rethinking the connections between man and landscape again and again is a perpetual issue of humankind. These days this topic has become a central and key issue for not only nature conservation, but sustainable agriculture and forestry, food sovereignty, education, human health and human well-being as well. Just like in the case of other wooded landscapes in Europe, wood pastures constituted and still constitute an integral part of both husbandry and natural and cultural heritage in Hungary. In our research the current expanse, past and future potentials of wood pastures in Hungary were revealed. A wood pasture database was prepared based on existing data and recent field visits. The landscape history of wood pastures in the past 200 years was summarised with the use of written historical sources, maps and mapping oral history. Relations between wood pastures and local children, farmers, herders and conservation rangers as well as the and knowledge of the letter on the former were revealed in semi-structured and structured interviews. At the time being there are 333 318 hectares high nature and value wood pastures. 28% of the sites are protected areas, 60% are Natura sites. 88% of them was wood pasture in the 1950s. Compared to the 1950s the areas are now afforested and overgrown with shrubbery and forest, representing one of the most serious problems at the farm level. Most typical tree species include *Quercus* sp., *Pyrus pyraster, Carpinus betulus, Fraxinus* sp. Wood pastures up to the 1990s were typically used by the community and livestock were grazed by shepherds. Conversely, at the time being the most current features include private ownership and grazing in electric fences. In the last 20 years the attitude of nature conservation officials towards wood pasture management has grown into an intense interest and consequently traditional ecological knowledge and the world of herders are now held in higher esteem. A key to wood pasture preservation is the support given to land users working on them through policy and funding. Additionally, recognition of the values inherent in a wood pasture by the public is an important factor. One of the approaches to this is the consumption of wood pasture grown produces, another is the incorporation of wood pastures in the curricula in public education, both representing a revival of the once prevailing connections. In the second part of the 20th century children still generally visited local wood pastures with family members which practice was dropped as they were abandoned or privatised. This role is taken over more and more by the schools. The revitalisation of the connections between wooded pastures and man is important not only for the purposes of preserving the values prevalent in the wood pastures, but also to conserve the biocultural diversity of the European wooded landscapes.

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Keywords: high nature and cultural value agroforestry, traditional ecological knowledge, education, innovation, landscape history, Carpathian-basin

Oral presentation

RESTORATION – MANAGEMENT – PROTECTION

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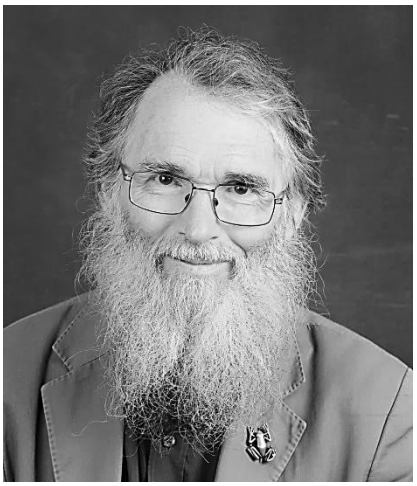

'My main research is on long-term changes in the woodland ground flora and the factors, including grazing, that drive them.'

Wooded rural landscapes: how do we make the best of the past relevant for the future?

Whatever the natural landscape of Europe was like, mosaic landscapes with trees, woodland and open habitats have been critical to local and national community life for at least the last 6,000 years. They are rich in wildlife and features associated with our cultural heritage. Arguments that George Peterken (1983) put forward for ancient woodland in Britain apply also to the conservation of such wider landscapes. Yet, while the merits of conservation may seem obvious, the reality, as with ancient woodland in the 1980s, is that they continue to be lost, or damaged through changes in agricultural and forestry practices.

Not that landscapes have ever been totally unchanging – disturbance, in the form of natural fires, windstorms, pest and disease attack, or the effects of large mammals, is a key feature of natural ecosystems, essential for maintaining their biodiversity. Similarly, cultural landscapes have always been subject to human disturbances, some more-or-less cyclical and regular, such as the cutting of coppice, others irregular and non-linear. For example during periods when rural populations have collapsed through disease, war or the rise of urbanisation, marginal farming areas tend to be be abandoned; the introduction of new technologies, or new regulations may change how the land is managed.

The last century (perhaps last two centuries) has been one of these periods of rapid change in disturbance patterns. In Britain Oliver Rackham considered that the period 1950-1980 to have been particularly damaging in terms of loss of semi-natural features – hedges, meadows, coppices, field trees – with corresponding losses for the biological and cultural heritage associated with these features. These processes may have been slower to take hold in parts of eastern and central Europe, but they are still a significant threat. The challenge then is how we should respond.

What do we want to keep?

Not all aspects of traditional landscapes and lifestyles are worth preserving. Rural workers should not have to face the hardships that characterised many societies in the past. In Britain, the gamekeeper's gibbet (on which dead predatory birds and mammals were displayed, to show he was doing his job) could still be seen in the 1980s, but is no longer acceptable.

Other new 'traditions' may be created that quickly come to be valued: the community of the little village in Transylvania, Karacsonyfalva, invented in 1992 there own festival of roasting chestnuts: people dress in beautiful old local clothes, there is plenty of their folk music, good food, "huzar" horse riders, and the festival has become very popular since.

In the same way, we should look at the legacy of species, assemblages and landscapes that we have inherited, decide which we value and why, then explore how we may maintain or modify them through conservation strategies. For example, high forest management has become commonplace over the last 200 yrs to the point where it is 'traditional', but we may value more, in many places, aspects of the earlier forms of open woodland that it has replaced.

Successful future strategies will require an understanding of why and how change occurs.

Understanding the causes of change

Landscapes, rural communities and local economies were much more tightly bound together in the past. Now the viability of a local grazing regime may be determined by policies and practices set far away, perhaps in Brussels as part of Common Agricultural Policy regulations, or New York under World Trade negotiations. We may sometimes be able to amend these discussions to favour the sorts of management we wish to see, but a common problem with top-down devised instruments and policies is that they do allow for local variations and conditions.

It was once normal for children to follow in their parents' footsteps in terms of where they lived and worked, what lifestyle they might expect; now they are more aware of possible alternatives and there is an increasing move towards towns and cities, making maintenance of traditional management more difficult. For example, in Estonia the division of the ownership of wood-pasture land amongst different individuals, who now live and work in cities, leaves some areas to be grow up and shade out the meadow flora. The 'over-the-fence' village gossip will rarely now be effective in encouraging coordination of efforts, but the internet, facebook groups, webcams etc. might provide a way in which a new generation can be brought back in touch with their landscapes.

Other changes result from the new pressures on the environment. Eutrophication, from agricultural fertilizers, power stations and traffic is increasingly recognised as a factor in woodland flora changes across Europe and was highlighted in a recent study of woods in the Czech Republic. Climate change will affect trees, woods and the species in their surroundings both directly and through consequential effects of rising temperatures or changing rainfall patterns on farming. Increasing populations of ungulates and the spread of large carnivores will also have implications for whether we can maintain past assemblages of plants and animals as they were, even if we manage to maintain the broad patterns

of trees and openness in the landscape. If some species are inevitably going to increase/decrease how and where should we best be guiding such processes?

Multiple futures for wooded rural landscapes

We should not pretend that, we or anyone else, can devise a single blueprint for the future of wooded rural landscapes; and even if we could it would, like most plans, 'not survive the first contact with the enemy'. Future landscapes, like those of the past, will be the result of interactions between top-down regulations and bottom-up community reactions; between well-designed management regimes and unexpected events; between the idiosyncracies of a particular land-manager and her/his particular location. What works here, may not work there! However, there are some things that we can do to improve our chances of handing on more of our legacy from the past.

- Identify and change unhelpful policies/laws. This may require sustained and concentrated effort but is otherwise relatively straightforward and can then have long-term benefits. We do however need to be prepared for unexpected consequences.
- Document and celebrate what these landscapes have provided and look for ways of adding value to/reducing the costs of the outputs from these systems. Just as we have come to appreciate the biodiversity values associated with traditional landscapes, so they may be providing other ecosystem services that should be recognised and which may then provide an alternative income or a justification for public funding, alongside the physical outputs of food or timber. Arguments that might be used, in particular circumstances, include:
    - Premium branding of products from a landscape may provide extra income;
    - New techniques/machinery (e.g. small tractors) that may make it easier/cheaper to maintain traditional landscapes;
    - Showing how some characteristics of past landscapes – trees for shade for example; greater mineral content of forage in semi-natural vegetation; tree fodder availability in summer droughts – might become more relevant to future conditions of climate change and reduced external inputs;
    - Promotion of tourism/recreation, perhaps through using external funds to develop the necessary infrastructure;
    - Contributions to soil/water catchment protection, although it will be necessary to show that this will be at least as good as alternative more intensive land-uses.
- Make more use IUCN category V designation: at times nature conservation groups have been dismissive of this designation in favour of 'wilder' categories, but it would seem very appropriate for many areas of Europe. Designations can help to give areas a distinctive identity, a brand, that helps with recognition, support, funding etc.
    - "A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values."

- Look for novel ways in which these landscapes can evolve, as they have in the past, into new forms that fit better future socio-environmental conditions, but retain rich biological and cultural legacies. What elements can be maintained, by adjustments to modern farming and forestry, or through the current fashion for 'rewilding'? What education/changes in attitudes amongst managers/regulators/conservationists are needed and how these might be encouraged? Are new policies and regulations needed?

Conclusion

The indications are that the next century will be a turbulent one, in both social and environmental aspects. Wooded rural landscapes have provided local communities with a buffer against such turbulence in the past, but their survival now depends on them having relevance to a much wider national and often international community. There are lessons from their past for the future, but it needs collaboration of environmental, social and political scientists to provide the best opportunities to make the most of those lessons, in order to maintain and create new wooded rural landscapes.

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Permanent grassland: a challenge for the current and future CAP

Permanent grassland in the current period

Permanent grassland is a key component of the Common Agricultural Policy (CAP) for many reasons: its value is widely recognised as a factor to maintain a good environmental status, in agronomical terms it is linked to unique productive systems and in socio-economical terms it is fundamental to keep agricultural activity in areas with risk of abandonment. All these needs can be addressed in different ways and with different measures, but are basically achieved by maintaining the grassland in place.

As a "common" policy, the CAP has to consolidate different needs and objectives which are sometimes diverging. In case of permanent grassland, the relevant provisions are legal definitions and management.

The issue of the definition is particularly challenging, as the negotiations during the past reform and on the current "Omnibus" Regulation (a Regulation which will bring changes to several basic acts) clearly showed.

The current definition of Permanent Grassland in direct payments (Article 4(h) and (i) of Regulation (EU) No 1307/2013) is in continuity with the previous one and is based on two key features: the concept of "permanent" leads to a necessary distinction with land in rotation (temporary grassland, for which there is no restriction to conversion). On the other side direct payments are granted to farmers for their activity: at least farmers have to maintain their land in good conditions, while permanent grasslands are often located in marginal areas where the activity can be minimal or inexistent.

Once a parcel is classified as permanent grassland because it complies with the legal definition, the environmental protection is strictly linked to its maintenance. In the definition there are no criteria on the quality of the grassland for environmental purposes. However, a very important difference to the previous definition (Article 2© of Regulation (EC) 1120/2009) is the explicit introduction of the following references:

- "...[permanent grassland] may include other species such as shrubs and/or trees which can be grazed..." linked to the predominance of the grass (more than 50% at the level of the agricultural parcel),

- "...land which can be grazed and which forms part of established local practices..." where grasses are not predominant. Member States may identify these areas according to recognised practices which can be used to graze livestock (as traditional in character and commonly applied) and/or practices which are important for conservation of Natura 2000 habitats. This option was implemented in 10 Member States.

Compared to a situation where non-herbaceous plants were basically excluded, with these specifications both eligibility to payments and protection have been extended to more semi-natural grassland, recognising the key role of bushes and trees as part of the agricultural activity, providing contribution to a better ecological status. In particular, in order to clarify which non herbaceous plants could be included in eligible areas, the notion of "shrubs and trees which can be grazed" was introduced.

After the entry into force of the Regulations, the intense legislative interpretation phase and the Member States choices led to the current situation.

A Court of Justice Case in October 2014 (case C-47/13) clarified the concept of rotation, defining that sowing and ploughing of arable land covered by grasses is not considered as a rotation in case the next crop is grass, even if of another species. This means that a parcel covered by grass is counted against the five years also if it is ploughed and reseeded: when classifying parcels in their Land Parcels Information System (LPIS), Member States have to include also more intensive grassland, normally managed for production purposes. This raised particular issues in some countries where the definition was differently interpreted in the previous period, with consequent political pressure from farmers and administrations.

The classification of leguminous crops was also subject to discussion: such crops could be either classified as grasses or other herbaceous forage (leading to become permanent grassland after five years) or as an arable crop (subject to crop diversification if present for more than 75% of the arable land at farm level). Such crops are very important for environmental purpose in the context of greening and particularly present in Mediterranean environments. The opinions from Member States and stakeholders in this case where very different, depending on the aspect they preferred to privilege between production (e.g. for dry fodder), agronomical management or environment. The final landing of such interpretation was in continuity with the previous period, where pure leguminous crops were considered as a distinct arable crop (and not as grasses), keeping such areas classified as arable land after five years. However this had an impact in terms of crop diversification for farms with a high share of leguminous crops.

Beside the legal definition issues, in the CAP post 2014 the management tools were also adapted, especially after the introduction of greening.

Following the CAP reform with the introduction of greening, the distinction between arable land, permanent grassland and permanent crops became more important. That's why the Commission and the Member States increased the efforts to classify the distinction of agricultural land into these 3 categories within the LPIS. This allows the administration to better support farmers in complying with the rules and to correctly declare their aid. It also allows checking compliance or monitors the performance of the measures related to permanent grassland.

The new rules set in Articles 9 and 10 of Regulation (EU) No 640/2014 aimed to clarify the eligibility management. In order to take in account the presence of ineligible features and simplify the management of the eligible area calculation, two tools were used: in Article

9 a density threshold of 100 trees per hectare was introduced in the legislation and enlarged, as in the previous period it was based on 50 plants (set in a guidance document). In Article 10 the new concept of pro-rata system was introduced to "deduct" ineligible features, giving the possibility for the national administrations to avoid a precise mapping of trees and shrubs in mixed parcels. Such tools were set out for simplification purposes, but together with the introduction of landscape features in ecological focus areas, aimed also to find a balance between recognising valuable local wooded pastures and the need to reward farmers for their agricultural activity.

Finally, also the revised rules on the minimum activity requirements to be carried out by farmers on agricultural areas played a role, especially on marginal land. These requirements were previously managed through good agricultural and environmental conditions (GAEC 4) in cross compliance.

Member States choices on these different requirements shaped the overall composition of permanent grassland at EU level. Some of them interpreted in slight different ways the common definition using the existing flexibility. What appears from the first analysis, is that the choices were mostly driven by administrative factors, sometimes linked on the feasibility of new approaches (for instance mapping capabilities in LPIS or complexity of the control system).

The implementation of other parts of the CAP also plays an important role: choices on agri-environmental-climate measures provide the possibility to better target specific situation, the new environmentally sensitive permanent grassland designation increased the protection of valuable grassland in Natura 2000 or other areas, while the continuity of the greening ratio mechanism aimed to maintain permanent grassland, with different results across Member States.

After the operational beginning of the reform, once rules and choices were established, the discussion linked to permanent grassland management is not yet finished: in the ongoing Omnibus negotiation the Council and the Parliament asked again major changes to the system on the rotation definition, the classification of certain arable land uses in relation to permanent grassland, consider as eligible also trees which are source of non-forage animal feed (fruits of oaks, chestnuts) and not only when grazed. The most important request coming from Member States is also to leave them flexibility in applying the new adapted definition, while for the Commission it is important to continue having a common EU approach.

In the meantime, the first policy analysis and evaluations on the current period are available: information gathered from Member States through institutional consultation, preliminary results from the greening review after one year and the ongoing greening evaluation shows that the situation on the ground is different between Member States. The absolute level of the permanent grassland at EU level is quite constant in the last years, showing also that the ratio system, in place from year 2006, prevented to have major loss in the quantity of the grassland. At Member States and regional level fluctuations are possible, due to the complex mosaic of rules and choices implemented at national level: while 12 MS increased their permanent grassland compared to the previous period, in the others a decrease was found.

The future CAP: have your say

The reflections for the next period have already started. An extensive online public consultation took place between February and May 2017: more than 320 000 replies were

sent, showing the interest of the CAP and the agricultural sector in the public debate. The consultation provided useful insights on the state of the public debate on the CAP: the responders were from one side farmers or agricultural sector organizations, on the other side citizens and civil society, as well as national authorities. The most important issues expressed by the respondents were the farming sector viability and sustainability – environmental challenges.

On the side of the objectives, in the opinion of the respondents the most important are boosting investment, growth, employment, mitigating and adapting to climate change, strengthening the EU single market. Viable food production and healthy - quality products are very important, as well as more focus on environment. One important indication is also that the current CAP does not sufficiently address environmental issues, in particular in the opinion of citizens and organizations outside the agricultural sector. Respondents agreed to underline that an EU level CAP is still fundamental to realize the objectives of the agricultural policy, in particular when addressing environment and market uncertainties. In synthesis, the main conclusion is the need to reach a good compromise between competitiveness and environment, while there is a clear call for simplification and rationalization of the measures.

Beside the consultation, workshops were organized in DG AGRI in the first half of 2017 on environment, risk management, food and social issues with researchers, other stakeholders and all other interested DGs. The results will be taken in account in the reflections: regarding environment, key indications were on the importance of adapting to local conditions, training and advice for farmers, as well as reducing the knowledge gaps on environmental data and information. On the other side, no clear conclusions were provided on the balance between mandatory and voluntary measures.

The reflections on the future will continue in 2017 and 2018, taking stock of ongoing policy evaluations and of the parallel discussion on the financial framework: a Communication on the CAP is envisaged by the end of the year.

Materials on the 7 July conference (where the public consultation results were presented) are available at https://ec.europa.eu/agriculture/events/cap-have-your-say_en

The place for permanent grassland in the future CAP

Permanent grassland will continue to be a key component of the CAP in the next period, given the acknowledged importance of its role. As showed by the consultation, the need to achieve a right balance on both economical and environmental side is a key factor for the success of the next period. Permanent grassland, especially for the most valuable forms which include trees and shrubs, will continue to be a major challenge.

It is still too early to anticipate rules and management tools in the future policy: as for grasslands the most important and debated aspects are linked to legal definition and the resulting classification of the land, normally this is part of the basic and delegated regulations, which will be drafted and discussed starting at the earliest by end of 2018.

At the moment, gathering evidence on the results of the current legislative framework through evaluations, consultations and internal analysis is the most important activity carried out by the Commission. This information will be used in shaping the future CAP.

MICRO-RESERVES AS A TOOL FOR BIODIVERSITY CONSERVATION IN LATVIA: CHALLENGES AND OPPORTUNITIES

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2440 micro-reserves are established in Latvia, in order to ensure the conservation of the specially protected species and biotopes outside special areas of conservation, as well as in the special areas of conservation, if any of functional zones fails to ensure that. The development of micro-reserve network has caused conflicts between landowners, environmental non-governmental organizations and state authorities. To evaluate a performance of established micro-reserve system, 24 semi-structured interviews with certified experts in the field of protection of species and biotopes in Latvia were conducted. Overall, experts favourably evaluate the efficiency of established micro-reserve network. However, respondents highlighted five key conflict zones of micro-reserve system implementation: lack of scientific and analytical approach in planning of micro-reserve distribution; landowners' awareness and attitude towards biodiversity conservation; lack of initiative and contribution from state authorities in micro-reserve system development; amount and methods of funding; communication problems between state authorities and private landowners. Subsequently, three possible recommendations to tackle these challenges in Latvia are proposed: development of voluntary strategies next to regulatory mechanisms; investment in monitoring and research on conservation of the specially protected species; reassessment of micro-reserve borders according to contemporary knowledge in biodiversity conservation.

Keywords: biodiversity conservation, micro-reserves, private landowners, protected areas

Oral presentation

INNOVATIVE AND SUSTAINABLE INTENSIFICATION OF INTEGRATED FOOD AND NON-FOOD SYSTEMS IN EUROPE

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Introduction. SustainFARM is a trans-European project (FACCE Surplus ERANET) that aims to enhance agronomic, environmental and economic performance of traditional and innovative farming systems where trees, crops and livestock are integrated in different ways at different scales (plot-field-farm). Such systems allow maximizing return from land, making use of products currently unexploited and providing environmental benefits that positively feedback on biomass production. Hence, they enable the development of a more resilient and productive agriculture in light of fluctuating socio-economic and environmental conditions.

Methods. SustainFARM has *adopted* an innovative case-study approach, consisting of a network of locally relevant sites across a range of agro-climatic zones in Europe. There are nine case-study systems being studied, which provide data for modelling the environmental and economic performance of integrated systems. In Poland there are two case study farms: multifunctional farm in Warmińsko-Mazurskie with short rotation coppice willow belt along grassland parcel, used for horses grazing and farm in Opolskie with alley cropping silvoarable system, where fruit trees are intercropped with vegetables. A key part of the project are local stakeholder platforms that allows co-generating technology, relevant at the local scale, to address productivity issues and enhance valorization of woody components, residual wastes and co-products from integrated food and non-food systems.

Results and conclusions. The analysis conducted showed IFNS farms efficiency reduced mainly due to low prices of farm products, low demand and limited support for biomass crops and horticultural production.

Keywords: integrated system, non-food farm products, agroforestry, sustainability, modelling, efficiency

Oral presentation

BUILDING AGROFORESTRY NETWORK IN POLAND – FIRST EXPERIENCES

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Despite some progress since 90's in recognizing importance of wooded rural landscape in Poland (including National Programme for the Augmentation of Forest Cover; Program of the Conservation and Sustainable Use of Biodiversity, Polish Ecological Focus Areas within Rural Development Program 2014-2020) there is still lack of legislation supporting planting trees on farms, both high value timber as bioenergy species (e.g. SRC) while protective measures with regard to traditional agroforestry systems are often not adequate nor clear. Being aware, that interdisciplinary collaboration is crucial in agroforestry and favors development and implementation of innovative ideas in agriculture, Polish Agroforestry Association (OSA) has been established in 2015 to support sustainable rural landscapes in Poland with the special attention paid to woodland rural landscape. OSA represents also the interests of Polish agroforesters in wider European discussions, including activities performed within European Agroforestry Federation. Moreover, since 2017 Regional Agroforestry Innovation Network (RAIN) group is being created in Poland as a link to other national networks within the framework of Horizon2020 project AFINET (Agroforestry Innovation Network). The aim of the project is to create EU reservoir of knowledge on agroforestry, summarize the most relevant practices and train end-users. So far, based on first interviews with stakeholders, our first experiences indicate that there is a big gap between potential for growth of agroforestry systems in Poland and the actual state of target rural areas. On the one hand, Polish farmers identify number of options for agroforestry involving these ones covered by payments for organic farming however encounter different barriers of administrative and economic type. On the other, unfavourable area structure of Polish agricultural holdings, the prevalence of poor quality soils on rural areas and lack of skills and knowledge discourages from farming and investing in maintaining wooded rural areas. The results of the first RAIN meeting will be presented, including positions adopted by Polish farmers, advisors, foresters, agronomists and decision-makers.

Keywords: agroforestry, networking, stakeholders, participatory approach, wooded rural landscape

Poster

THE LISIA GÓRA RESERVE IN RZESZÓW: PROTECTING FOREST SUCCESSION OR RESTORING WOODED PASTURE?

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One of the most valuable elements of the Rzeszów "green infrastructure" is the forest nature reserve Lisia Góra established in the 1930s on the left side of the Wisłok river valley. Its major purpose was preserving the population of old oaks *Quercus robur*, with numerous specimens considered as monumental trees. Following the overwhelming, but unsubstantiated, narrative that the Lisia Góra oak stand is a remnant of the ancient Sandomierska Forest, the applied protection measures aimed to sustain (and if necessary – restore) the close canopy high forest habitat. However, there are strong factual premises indicating that neither the origin of the stand was correctly defined nor was its conservation management adequate to secure efficient protection of oaks.

The objective of the study was to detect and assess changes of the reserve's vegetation with respect to the history of land use during the last 250 years. Based on such analysis the guidelines for an optimal conservation strategy could be formulated.

The analysis of land use changes was based on the comparison of three Austrian Military Surveys (late 1700s, 1850s, and 1870s) as well as the 20th century topographic maps. Plant communities were identified with the phytosociological Braun-Blanquet method. Degree of naturalness of vegetation was also assessed using indicators available in literature. These studies were compared with previous ones carried out 15 years ago. Age of oaks was assessed according to tree rings.

The study of land use changes indicates that part of land situated on a loess upland, from late 1700s to the 1870s was used as cropland. In the same time, the floodplain and the lower part of the valley side were mainly grassland with scattered trees and shrubs, which in the lowest part of the valley had turned to riparian forest by the end of that period. The first evidence of "true" forest developed in the upland comes from the 1930s' maps. That is where most of the monumental oaks grow. Both "forest restoration" planting and spontaneous succession after the reserve designation have led to substantial changes in the character of the plant community. The original discontinuous canopy dominated by large oaks has been filled by numerous young trees, particularly sycamore maple, which, with developing abundant shrub and undergrowth layer (e.g. elderberry, bird cherry, hornbeam) have led to disappearance of the herbaceous layer and total loss of oak regeneration.

The study proves an urgent need for the change of the reserve status – from forest reserve to landscape reserve – enabling active conservation aimed at restoring the semi-open character of the area, necessary to recover rich herbaceous vegetation, to promote oak regeneration, and to revive the landscape's aesthetic value.

Keywords: aesthetic values; conservation management; landscape history; nature protection; restoration management

Oral presentation

THE EFFECTS OF FORESTRY TREATMENTS ON MICROCLIMATE, REGENERATION AND BIODIVERSITY

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There is a paradigm shift in Central Europe from the traditional forestry systems towards continuous cover forestry that provides diversification of the feasible management practices. However the effects of these management types on forest site conditions, natural regeneration and biodiversity are still not completely examined though it is very important both for ecological and management purposes.

To fill this scientific gap, the effects of five different forestry treatments belonging to rotation system (preparation cutting, clear-cutting, retention tree group) and to transitional forestry (gap creation, control) were studied in a mature temperate sessile oak – hornbeam forest in Northern Hungary on microclimate, soil, regeneration and biodiversity of plants, ground beetles, spiders and enchytraeid worms. The experiment was established in 2014 following a complete block design with six replicates, and the measurements are continuously taken.

In this presentation the preliminary short-term responses will be summarized. Air and soil temperature were highest in the clear-cuts, but retention tree groups had very similar thermal pattern. The increase of soil moisture was the highest in the gaps and it is also detectable in the clear-cuts. The responses of different animal groups on the treatments were strongly decreased with their mobility: for enchytraeid worms strong, for ground beetles intermediate for spiders weak treatment effect was detected. For plants, the processes were relatively slow, in clear-cut species richness, while in gap cover increment was characteristic. Based on this short observation period we can conclude that fine scaled timber production like gap creation or irregular thinning had only moderate effect on forest site that could maintain the forest biodiversity.

Keywords: forest management, biodiversity, microclimate, regeneration

Oral presentation

IMPORTANCE AND UTILIZATION OF OBSOLETE VARIETIES AND LANDRACES OF APPLES (*MALUS DOMESTICA*), PEARS (*PYRUS COMMUNIS*) AND CHESTNUT (*CASTANEA SATIVA*) PASTURES FOR PRESERVING VALUES OF THE CULTURAL LANDSCAPE IN SLOVAKIA

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The paper presents a report regarding a project of implementing the mapping and preservation of old cultivars and landraces of *Malus domestica*, *Pyrus communis* and occurrence of true service tree (*Sorbus domestica*) individuals in the White Carpathians region within the project called The White Carpathians´ Fruit Treasure. The leading investigator of the project was the State Nature Conservancy of the Slovak Republic in cooperation with Slovak and foreign specialists. The primary aim was the terrain mapping and conservation of this rare natural and cultural heritage in situ by establishing the gene pool. In the field, from the total of 2553 individuals we have recorded 158 obsolete and 33 landraces of apples and 57 obsolete and 36 landraces of pears. 174 individuals of *Sorbus domestica* were also found. Implementation of various educational and promotional events for the public, such as conferences, courses, exhibitions, tasting, workshops, environmental education, etc. were complementary activities to the project. European chestnut (*Castanea sativa*) is a marginal nut crop and it is not a forest-forming tree species in Slovakia. Nevertheless, chestnut trees in the Modrý Kameň area have been planted in private vineyards and orchards since the 16th century. Currently, the health status as well as chestnut production has significantly declined as a result of enormous dying out of chestnut individuals infected by the fungus *Cryphonectria parasitica*. Mapping of chestnut individuals and assessing the chestnut biocultural value in traditional landscape types were principal objectives of another project carried out in the southern part of central Slovakia (Modrý Kameň region). The natural values were represented by the high nature value (HNV) farmlands and European plant biotopes. The cultural values related to chestnuts were represented by historical farm buildings in the vicinity of chestnuts scattered in the countryside. We have identified and positioned 101 individuals and 123 area formations (46 ha) of chestnuts within the broader study area in the field. They grow here on mountain slopes at the altitudes of 228 to 448 m ASL in different agro-silvo-pastoral systems. It follows from the results that chestnuts support the value of the traditional landscape type with meadows and pastures. Chestnuts most frequently occurred in the extensively used CLC patches with pastures and with heterogeneous agricultural areas – "Land principally occupied by agriculture, with significant areas of natural vegetation", in a parallel coincidence with the HNV farmlands and European plant biotopes and with the local occurrence of protected bat species. Here, chestnut trees formed wood pastures in the past and owing to insufficient management, they are currently sprouting. These landscape fragments along with historical farm buildings have a potential to be used for agro-tourism activities in this marginal region.

Keywords: obsolete varieties and landraces, chestnut, cultural heritage, mapping

Oral presentation

THE RESTORATION OF WOODED PASTURES. THE CASE OF THE PARK OF THE APENNINE LANDSCAPE OF MOSCHETA (TUSCANY)

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The area around the abbey of Moscheta, founded in 1037 by the Benedictine monk San Giovanni Gualberto, founding father of the Vallombrosian order, is a significant example of the historical role of the monasteries in the forestry and pastoral management of the Apennine environments.

The Moscheta valley still presents a landscape characterized by the presence of wooded pastures, monumental chestnut groves and beech trees, oak, maple and cherry trees, with obvious signs of pollarding, a traditional practice linked to the activity of grazing in the woods. Although the area is inserted in a SCI Natura 2000, the Managing Istitution (Unione Montana dei Comuni del Mugello) decided to develop a management plan for the conservation and restoration of historical landscape in order to create the Park of the Apennine Landscape of Moscheta. The activity has been carried out by the Laboratory for landscape and Cultural Heritage (CULTLAB) of the School of Agriculture of the University of Florence. The area has also been included in the National Register of Historical Rural Landscapes of Italy, a national list managed by the Ministry of Agriculture Food and Forestry Policies. The list is also the first step for applying for the UNESCO World Heritage List and the Globally Important Heritage Systems program of FAO.

The restoration plan was based on an in-depth evaluation phase, applying the VASA Approach (Historical and Environmental Method Approach), tested in various study areas in the past decade and today officially used in the criteria for the inscription in the National Register. This methodology is based on the comparison between the same landscape in different years and it does not evaluate only the land uses change, but it takes into account also the landscape structure and the mosaic. Indeed, through this kind of approach it is possible to identify what can be considered an element of identity of the landscape, its emergencies, its vulnerability. In the case of Moscheta the starting date of multi-temporal analysis was 1832, the year of publication of the General Tuscan Land Registry, which showed, in this area, the presence of 89 land uses, more than 40 of them had trees in the form of wooded pasture or arable land with trees.

The overall aim of the actions planned by the Management Plan is to restore as many as possible of these land uses, to give back to the territory the wealth of the nineteenth-century landscape mosaic, which proved to be the richest among those analyzed with VASA methodology. The management plan prescribes also the recovery of some historical land uses as wooded pastures, through various restoration actions. The research plan has selected four study areas to experiment the recovery of the traditional practice of pollarding.

Keywords: wooded pastures; traditional practice, restoration, multi-temporal analysis, management plan

Oral presentation