



Research and Development Protocol for Wood-pasture Systems in Southern Transylvania, Romania

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1 Context

The AGFORWARD research project (January 2014-December 2017), funded by the European Commission, is promoting agroforestry practices in Europe that will advance sustainable rural development. The project has four objectives:

1. to understand the context and extent of agroforestry in Europe,
2. to identify, develop and field-test innovations (through participatory research) to improve the benefits and viability of agroforestry systems in Europe,
3. to evaluate innovative agroforestry designs and practices at a field-, farm- and landscape scale, and
4. to promote the wider adoption of appropriate agroforestry systems in Europe through policy development and dissemination.

This report contributes to the second objective. It contributes to the initial research and development protocol ([Milestone 10; \(3.3\)](#)) for the participative research and development network focused on agroforestry systems of high nature and cultural value.

2 Background

Transylvania is a multi-ethnic region of Romania, inhabited by Romanians, Hungarians, Saxons and other ethnic groups. Furthermore, Transylvania itself has different cultural regions, according to the ethnic groups and cultures as well as to the bioclimatic and geomorphological conditions dominating each specific region. The landscape structure and its elements can be best understood from a social-ecological perspective. The southern part of Transylvania is a cultural landscape which developed under about eight centuries of Saxon governance. Wood-pastures are typical components of these traditional cultural landscapes (see Hartel et al. 2013).

It is estimated that there are over 7000 hectares of wood-pastures in Southern Transylvania. The dominant trees on wood-pastures are the oaks (*Quercus robur*, *Q. petraea*) and the pear (*Pyrus communis* and in lesser extent *P. pyraeaster*) (Hartel et al. 2013). The average extent of each area of wood-pasture is about 100 hectares. The preliminary surveys carried out on satellite images suggest that this region of Transylvania is the richest in wood-pastures from all the other regions of Romania with similar geomorphological conditions (Hartel et al. *unpublished data*).

Ancient trees are typical components of the wood-pastures of Southern Transylvania. Wood-pastures containing ancient trees cover over 4000 hectares in this region (Moga et al., *unpublished data*). The number of oaks with at least 400 cm trunk circumference exceeds 700. This high number of ancient trees is another distinguishing feature of Southern Transylvania wood pasture systems. Wood-pastures and ancient trees are sensitive to land use change, therefore, it is assumed that their common occurrence in southern Transylvania reflects social-ecological stability over centuries.

Research shows that the number of ancient trees in wood-pastures is positively related to the area of the wood-pasture (larger wood-pastures being more likely to be older, as it is suggested by historical maps). Furthermore, there was a significant negative association between the number of the ancient trees and the forest cover around the wood-pastures and the number of sheepfolds in the wood-pastures. These negative associations can be best explained through the origin of the

wood-pastures (those surrounded by forests being likely younger) as well as the overall negative attitude of the shepherds towards the large, often hollowing trees (Moga *manuscript in prep.*).

Wood-pastures and their ancient trees are now under threat due to rapidly changing land use and the removal of the ancient trees. It is therefore of crucial importance to recognize their multiple values (economic, ecological, aesthetical, historical and cultural) and to develop formal and informal policies in order to assure their long term social-ecological sustainability.

The meeting with members of the ADEPT organization, as well as other persons with expertise in wood-pastures and farming systems from Southern Transylvania in association with Babes-Bolyai University highlighted a number of crucial challenges related to the persistence and condition of the wood-pasture systems from Southern Transylvania. These were:

- Reintroduction of the traditional cattle and buffalo grazing,
- to find solutions for tree regeneration in wood-pastures while grazing management is maintained,
- to find solutions for the persistence of the large, ancient trees,
- to control the excessive shrub removal, and
- to find solutions for maintaining the community-level value of the wood-pastures (these wood-pastures were communal goods in the past, while in the recent years parts of it are rented individually).

3 Objectives

The stakeholder meeting identified three research questions to address the mentioned challenges related to the wood-pasture systems in southern Transylvania:

1. to explore economically and socially viable strategies to increase tree regeneration on wood-pastures,
2. to explore the effect of different livestock on the vegetation structure and biodiversity, and
3. to explore the attitude of local communities towards ancient trees and find formal and informal solutions to allow their persistence.

4 System descriptions

The research protocol focuses on southern Transylvania in Romania. This region is rich in wood-pastures. Relevant descriptions of the social-ecological system are presented in Fischer et al. (2012), Hartel et al. (2014), Hanspach et al. (2014) and Milcu et al. (2014). Wood-pasture systems from this region are also described by Hartel and Moga (2010), Hartel et al. (2013), Hartel et al. (2014), and Sutcliffe et al. (2014). An example system is described in Table 1.

4.1 History of wood-pastures

Most of the wood-pastures of this region originate from the clearing of previously closed woodlands in the 18th and 19th centuries. The density of the trees is important from the policy perspective (for example the 100 tree per hectare threshold sometimes used in the Common Agricultural Policy). Historical documents from 1888 report that about 13 oaks per hectare for one large wood-pasture in this region, the trees being exclusively oaks originated from previously closed woodland (Oroszi, 2004). Currently the average number of the trees/hectare is about seven (if calculated from the

‘representative’ sites of the wood-pastures, i.e. where there are still trees) or about four (if calculated for the whole wood-pasture) (n=42 wood-pastures, Hartel et al. 2013). Moreover, the rough proportion of oak trees is only about 50-60%, the rest of the trees being represented mostly by pear and apple trees (these being planted in the past century).

Table 1. Description of an example wood-pasture system in Southern Transylvania

Site characteristics	
Area:	393 ha (Rupea wood-pasture, Figures 1 and 2)
Co-ordinates	46.014686°N; 25.225916°E (the centre of the wood-pasture)
Site contact:	Tibor Hartel
Site contact email address	hartel.tibor@gmail.com
Soil characteristics	
Soil type	Brown forest soils and podzolic clay, argilo-aluvial podzolic soils with clay and aluvial regosoils. These soil types are typical for oak forests; the Rupea wood-pasture is an ancient oak wood-pasture which was more closed woodland in the past.
Soil depth	No information available.
Soil texture	-
Tree and shrub characteristics	
Tree species	Dominated by <i>Quercus robur</i> and <i>Quercus petraea</i> , pear (<i>Pyrus communis</i> , and in lesser extent <i>P. pyraeaster</i> (Annex 2)
Planting date	The oaks may originate from the previously closed woodlands. The oldest trees can have up to 400 years. The pear trees were planted in the 19 and 20 th centuries.
Understorey characteristics	
Species	Grass
Coverage	Complete
Additional details	Grass managed by grazing
Livestock characteristics	
Species	Cattle and sheep. Currently there are ca 50 cattle and ca 400-500 sheep (Annex 2). This numbers will likely increase in the future, as the grazing is increasing in the whole region (Figure 1).
Stocking density	
Climate data	
Mean monthly temperature	8.2°C
Mean annual precipitation	650-700 mm
Details of weather station	Weather station from Sighisoara-Dumbraveni.



Figure 1. Main features of the oak wood-pasture presented in Table 1. A) Sheep grazing; using the oak as shelter against the extreme sun. B) Cattle grazing. C) Ancient oak (estimated age: *ca* 300 years) recently cut. D) Pond made by cattle and buffalo activity; these ponds are extremely important for the yellow bellied toad (*Bombina variegata*) an endangered European amphibian. In the back the largest oak of this wood-pasture (*Q. robur*, circumference of the trunk: 740 cm). E and F: concrete drinking trough for livestock; these vessels and their surroundings are also crucial habitats for the above mentioned yellow bellied toad. Figure F shows a reproductive adult (the through contained eggs and larvae as well). All pictures were taken in the middle of May, 2015 (author: T. Hartel).



Figure 2. The ancient oak wood-pasture characterized in the Table 1.

Source of the maps: <http://mapire.eu/hu/maps/>

The history of the wood-pastures from this region suggests that the tree density per hectare is continuously changing. Many foresters still considers the wood-pastures of these regions as degraded forests; this attitude is rooted in the above mentioned historical change: foresters perceived the transformation of closed woodland into more open pastures as a deterioration of these woodlands. The current structure of the wood-pastures is recent, and it seems to be difficult to find a land use historical baseline for setting a policy for the tree density in these wood-pastures other than the closed woodlands.

4.2 Grazing management

The traditional grazing system was characterized by cattle, buffalo, horse, pig and in less extent sheep and goat (Dorner, 1910). In the communist-socialist period the number of sheep increased while after 1989 (when the communism collapsed) the number of cattle and buffalo decreased and the sheep number remained high (Figure 3).

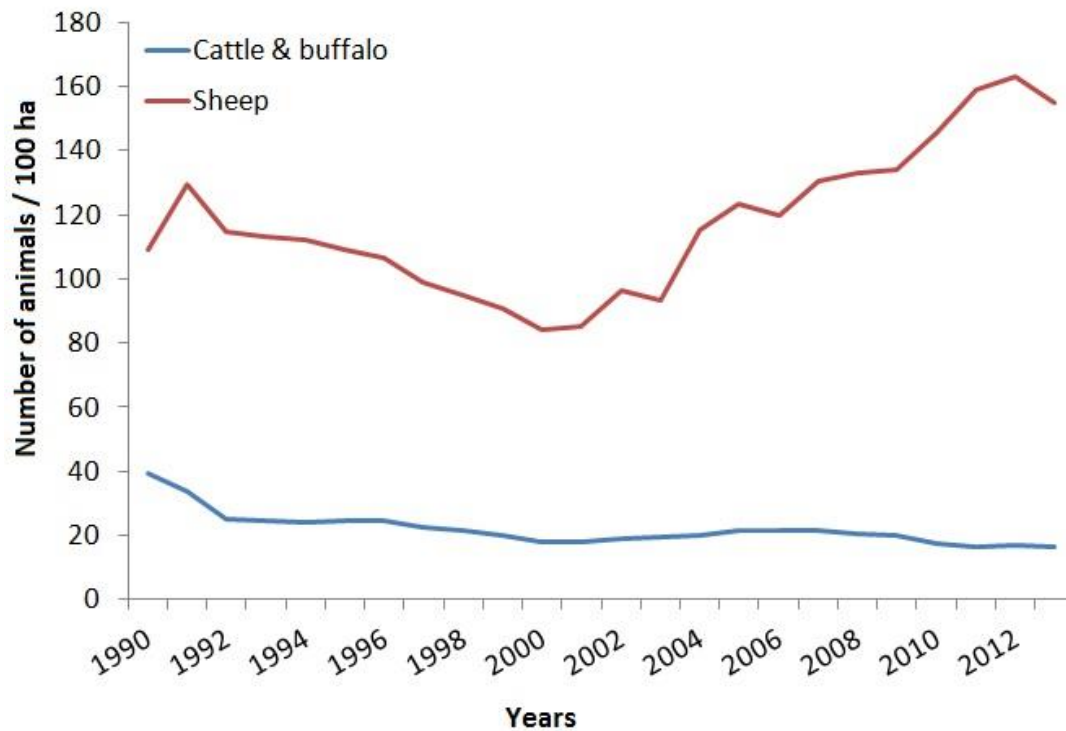


Figure 3. The average number of livestock per 100 hectare of pasture in four counties from the study region. The situation from 1990 is representative for the communist period (this collapsed in 1989). Source: Romanian Statistical Institute (2015).

5 Study design

Before detailing the study design for the objectives mentioned above, it is important to highlight that if the research is to be relevant in this fast-changing social-ecological system, then it should not be purely experimental and technical but it should also incorporate local communities (e.g. the stakeholder group). This is because wood-pastures and local communities were tightly connected for centuries (wood-pastures and woodlands being communal goods) and these traditional links are now changing due to the diversified aspirations and interests of the people (the local communities are more likely to express opinions than ever before). Many local initiatives which fail to account for the local social capital and the diverse aspirations and interests of the people have been unsuccessful in this region. Examples of such failures include: stealing fences used to protect trees, stealing planted trees, illegally and irresponsibly burning pastures, cutting trees, and a lack of any motivation to be engaged with tree establishment.

5.1 Tree regeneration in wood-pastures

This research will assess (i) the social, economic and institutional aspects for regenerating trees and (ii) based on the previous assessment, use the local knowledge in combination with expert knowledge to develop a tree regeneration strategy for wood-pastures in Transylvania. The research has a pilot character, and its novelty lies in its holistic character. Figure 4 presents moments from a management activity targeting the clearance of shrubs and young (hornbeam) trees from an ancient wood-pasture of our study area. The cleared shrubs were used for fencing the oak saplings in the wood-pasture.



Figure 4. Clearing hornbeam and thorny shrubs which developed around the ancient oaks in the Breite wood-pasture reserve within an educational project targeting every school from the town of Sighisoara (11 educational institutions, 2009). These were then used to fence the young oaks which were maintained. The educational activity was organized by the custodians of this reserve which in those times was the Mihai Eminescu Trust. This project had obvious mixed benefits; however, the concept could be better understood, adjusted and expanded.

The pictures presented in the Figure 5 present oak trees regenerating in grazed wood-pasture, the oaks being protected by thorny shrubs. These and similar field experiences on the wood-pasture systems in Southern Transylvania suggests that there is no need to completely cease the grazing in order to allow tree regeneration. Tree regeneration can be promoted either by mindfully ceasing the clearance of thorny scrubs in certain parcels or assuring some minimal conditions for them to develop. Thorny scrubs will decrease grazing intensity (livestock will avoid it, naturally, relative to areas without thorny scrubs) while allowing oaks to regenerate acting as nurse for them. After some years, the scrubs can be removed while maintaining the oaks. The process can be repeated for other

parts of the pasture. Another way to assure tree regeneration using the thorny shrubs is the use of shrub fences around the trees as presented in Figure 4.



Figure 5. Oak regeneration in wood-pastures in the protection of thorny shrubs. This natural process could be used to mindfully promote the regeneration of the trees on pastures. Currently thorns occur accidentally on the pastures (so does the tree regeneration), as there is no policy which promotes their maintenance.

The conceptual framework of the proposed pilot study targeting the regeneration of the trees in the wood-pastures of Transylvania is presented in Figure 6. This research is framed through a social-ecological perspective, in order to simultaneously assess the perceptions of multiple stakeholders and perspectives around the tree regeneration as well as to find a consensus across these perspectives.

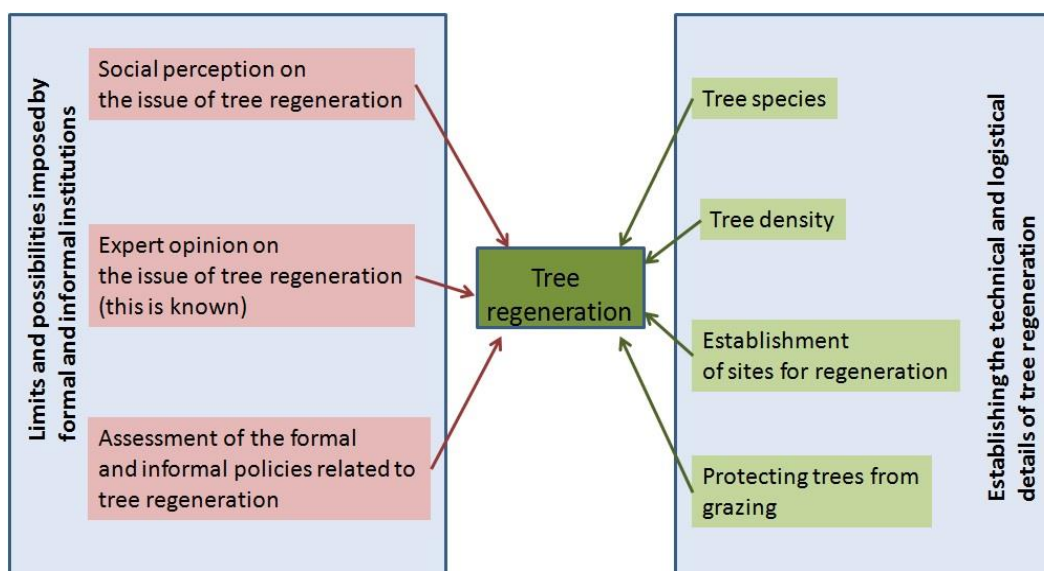


Figure 6. Research framework proposed to assess the social-institutional limits and possibilities for regenerating trees in the Transylvanian wood-pastures. The research initially addresses the social perception on the tree regeneration issue, including the expert opinions, and the formal and informal policies around the tree regeneration in wood-pastures. The second component of the research will explore the technical, logistical and tree species related aspects of the tree regeneration. This will also be based on stakeholder's engagement.

The pilot study proposes maximum two wood-pastures belonging to one or two local communities: one wood-pasture would be grazed by sheep (and/or goats included), and the other one traditionally by cattle and/or buffalo. These livestock have contrasting impact on the vegetation and will likely necessitate two different approaches in protecting the regenerating trees. The study is built on a series of participatory workshops, in order to assess every aspect highlighted in the Figure 5.

5.2 Effect of grazing management on the vegetation structure in wood-pastures

This research will contrast the vegetation structure in sheep- and cattle/buffalo grazed wood-pastures. It will explore i) the various incentives (social and financial) for using a certain livestock type for grazing by farmers and ii) the influence of the grazing livestock on the vegetation structure on wood-pastures.

The social aspect of the research will be conducted in a few number of villages (up to five representative communities), using stakeholder meetings. The themes explored by each focus group will be:

- the rationale behind selecting sheep or cattle for grazing i.e. is this driven by economic incentives, market possibilities for the products, or other types of monetary incentives?
- potential personal preferences for certain livestock types,
- the potential conflict situation between the preferred and ‘incentivised’ livestock types,
- the potential conflict situation generated by grazing with a certain livestock type in the community e.g. it is well known that the sheep herds causes a lot of conflicts within the local communities because they often enter in privately owned lands, such as hay meadows. The cattle herding is different, and is better perceived by the majority of the locals.

The ecological part will assess the impact of grazing with different livestock on the vegetation structure. While finding sheep grazed wood-pastures is relatively easy, the assurance of an adequate number of cattle and buffalo grazed wood-pastures (without any sheep influence) will be more difficult. Explanatory variables taken in account for such an assessment are described in Table 2.

Table 2. Description of some of the physical and biological parameters to be assessed

Component	Description
Tree and understorey component	Structural heterogeneity of the pasture (i.e. scrub, tree cover in the study plots) Number of plant species Number of plant species indicating high nature value land Number of habitat directive species Richness of plant functional groups Biomass production across a year Vegetation cover in different seasons
Livestock component	Density of the livestock per hectare in each wood-pasture Recent changes in the livestock number in each wood-pasture
Soil component	Soil type Soil moisture
Landscape component	Terrain Landscape structure around the study plots
Climate	Solar radiation

5.3 Assessment of the ways how locals value ancient trees

This research has an objective to assess the potential social capital around the maintenance of the ancient trees in wood-pastures. More specifically, it will address the different value systems around the ancient trees. This research will involve semi-structured interviews and is proposed to target up to six villages which have ancient trees on wood-pastures. The research also draw on the insights recently gathered on 120 interviews assessing the knowledge and attitudes of the rural inhabitants towards the wood-pastures and big trees from this region (Hartel, *unpublished data*).

The assessment will target individuals and is propose to be conducted at the homes of the people and/or “walking interviews” (that is, in situ interviews in the wood-pastures). Pictures with ancient trees from this region also will be used (see Figure 7, for example). The semi structured interviews will cover the following main themes (Table 3).



Figure 7. Examples of interviews carried out by T. Hartel (*unpublished information*) in order to assess the traditional ecological knowledge and attitude of people towards wood-pastures and ancient trees from southern Transylvania.

Table 3. Description of some of the social themes to be assessed

Component	Description
Social component	<ul style="list-style-type: none"> • Knowledge of people about the existence of ancient trees in their region. • Different value types associated by the rural people to these trees (e.g. cultural, aesthetic, economic values) • Extent at which people tolerate the ancient trees, and the dead trees • Perception of locals about the origins of the ancient trees on pastures • Perception of locals about the possible age of the ancient trees • Perception of locals about the main threats to the ancient trees • Perception of locals about ways and possibilities to protect the ancient trees • Existence of stories, legends regarding the ancient trees from this region

6 Acknowledgements

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