Challenges and potential innovations to improve the resilience European wood-pastures


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European (Grazed) Wood Pastures

200,000 km² in EU-27

Plienninger et al. Biol Conserv
Although ecological and socioeconomical contexts vary enormously among regions, European agroforestry systems share a common challenges, the low economic profitability because they are usually relegated to less productive lands.
AFFECTED by the LOST OF TRADITIONAL PRACTICES

They are currently threatened by either

* **Land intensification**, what causes progressive lost of trees
* **Extensification/abandonment**, what results is an excessive thick and lost of their potential productive.
Ten national stakeholder groups (> 250 participants): farmers, NGOs, companies, private and public technical staff, consumers, researchers and policy makers.

Joint discussion and face-to-face interviews, with semi-structure questionnaires
Low profit-earning capacity

- Deficient use of acorns
- High stocking rate -> Lack of tree regeneration - soil degradation
- Unawareness of ecological services
- A whole image of the dehesa complexity is missing
- Ecosystem services are unknown
- Scarce communication
- Lack of an unique official definition of dehesa

Animal health and welfare

- Wildlife competition for forage resources
- Abandonment of traditional uses (fallow & stubble)
- Sanitary criteria and administrative requirements
- Difficulties for getting permission: pruning ...
- Ignorance of dehesa and farmers’ needs
- Excess of permission for transhumance
- Lack of efficient green accounting systems for multipurpose systems
- Excess and slowness of bureaucracy

Tree layer conservation

- Livestock TB re-infestation by wild animals
- Sudden oak mortality
- Tree and Acorns pest
- Over-aging of trees and lack of regeneration
- Lack of adapted fodder crops

Forage resources

- Excessive dependence of external fodder purchase
- Strong seasonality on pasture availability
- Lack of solid support for dehesa tree regeneration
- No fluid communications among stakeholders and policy makers
- Dehesa only recently perceived as a cultural legacy

Low public acknowledgment of dehesa values

Administrative constraints

- Difficulties for getting permission: pruning ...
- Ignorance of dehesa and farmers’ needs
- Excess of permission for transhumance
- Lack of efficient green accounting systems for multipurpose systems
- Excess and slowness of bureaucracy

Agrarian Policy

- Lack of specific measures for agroforestry systems
- No regional or national programs for dehesa conservation
- Farmer associations represent poorly to breeders
- Dehesa only recently perceived as a cultural legacy

Governance

- Frequent changes of regulations
- Farmer associations represent poorly to breeders
- Dehesa only recently perceived as a cultural legacy
- No regional or national programs for dehesa conservation

Fishbone or Ishikawa diagram that summarizes main constraints for Spanish dehesas identified by stakeholders
Semi-structured questionnaires: Evaluation of services and disservices for agroforestry
Work route

SEMI-STRUCTURED QUESTIONNAIRES: PRIORITIZATION OF POTENTIAL INNOVATIONS
FACE TO FACE DISCUSSION: AGREEMENT FOR FIELD TEST OF INNOVATIONS PROPOSED
Main Concerns and Challenges

1. Low profitability of HNCV as a key constraint for the future sustainability
2. New system design and management for new challenges and socio-economic context
3. To reconcile grazing livestock with tree layer conservation and regeneration
4. More efficient use of local forage resources to increase the fodder autonomy of the farms
5. Cost efficient herding, including technology to improve the efficiency of herding
6. Animal production and Livestock health in extensive semi-natural systems.
7. Conservation of non-productive features, veteran trees and tree species diversity.
8. Public acknowledgment of the cultural value and the ecosystem services provided by HNCV agroforestry
9. Extension was seen as critical issues in southern countries.
10. Maladapted policy measures for extensive and multipurpose HNCV agroforestry.

Although most of stakeholder groups acknowledged the importance of ecosystems services provided by HNCV agroforestry, they demanded mostly research focused to solve their daily management problems and to increase their profitability.
<table>
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<th>Bio-region</th>
<th>Country</th>
<th>System</th>
<th>Main concerns</th>
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<tr>
<td>Mediterranean</td>
<td>Portugal</td>
<td>Montado: grazed open oak woodlands</td>
<td>Possible negative consequences of shrub encroachment of woodlands on cork yield and quality</td>
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<tr>
<td></td>
<td>Spain</td>
<td>Dehesa: grazed and intercropped oak woodlands</td>
<td>Low profitability, marked seasonality of fodder resources and deficient tree regeneration</td>
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<td>Italy</td>
<td>Grazed oak woodlands in Sardinia</td>
<td>The lack of forage availability and quality</td>
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<td>Greece</td>
<td>Grazed valonia oak woodlands</td>
<td>Oak regeneration and poor pasture understory yield/quality</td>
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<td>Atlantic</td>
<td>France</td>
<td>Bocage agroforestry in Brittany (hedgerows integrated with grassland and arable land)</td>
<td>Decrease of hedgerow density and their reduced importance in farming management and ecological services</td>
</tr>
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<td></td>
<td>UK</td>
<td>Wood pasture and parkland</td>
<td>Re-instituting tree management, balancing the prevention of infilling with natural regeneration</td>
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<td>Continental</td>
<td>Romania</td>
<td>Grazed wood pastures and grasslands with ancient non-productive trees in Transylvania</td>
<td>Conservation of veteran non-productive trees and of tree species diversity. Need of economically and socially viable strategies to increase tree regeneration</td>
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<td></td>
<td>Germany</td>
<td>Flood plain meadows with tree hedgerows</td>
<td>Hedgerows abandonment</td>
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<td>Hungary</td>
<td>Grazed wood pastures and grasslands with ancient non-productive trees</td>
<td>Infilling of abandoned wood-pastures, and lack of public awareness of their nature and cultural values</td>
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<td>Boreal</td>
<td>Sweden</td>
<td>Wood pastures and grazed forests devoted to reindeer husbandry</td>
<td>Adaptation of forest operations to reindeer husbandry</td>
</tr>
</tbody>
</table>
The way forward: Innovations proposed

1. Farm profitability
   - Branding better HNCV products: improving knowledge of customer and tax-payer interests.
   - Product diversification. Surveys to assess the willingness to pay a premium price for agroforestry products.
   - Quality of tree products.

2. System design and management
   - Design and management of the system to new multiple practices: developing modular models of hedgerow systems
   - Innovative tree species which can resist livestock.
   - Livestock management: species, races and stocking rates.

3. Tree protection and regeneration
   - Protecting trees: Wide range of methods for protecting trees from livestock.
   - Less browser livestock races
   - Grazing calendar

4. Pasture quality
   - Fodder crops: e.g. legume-rich pastures and winter forages adapted to shade.
   - Adapted silviculture: e.g. selection of forage tree/shrub species

5. Grazing systems and cost efficient herding
   - Selection of specific livestock breeds
   - Holistic grazing (intensive fast-rotational grazing)
   - Location of facilities (e.g. watering points, supplementary fodder, salt)
   - GPS collar technology and “invisible fencing”

6. Animal production and Health
   - Control of access to water points and supplementary food
   - Design of hedgerows to improve shelter

7. Nature conservation
   - Choice of livestock species and breed
   - Methods for fire control
   - Improved understanding of the effects on soil carbon
   - Methods of soil protection

8. Extension
   - The use of pilot farms
   - Encouragement of local state officials in extension activities

9. Policy and governance
   - Payment for historical landscapes
   - New co-operative models for developing agroforestry
Innovations for HNV agroforestry: some examples

**System design, renewal**

Adaptations of forest management to promote better conditions for reindeer husbandry: soil scarification, no planting with Lodgepole Pine, more and harder pre-commercial thinning and thinning, and forests with longer rotation periods in some areas.

Three-dimensions adaptive design and management of hedgerows to promote ecosystem services (by comparing different bocage structure: age, density, size of hedgerows).

Renewal of hedgerows, with valuation of the potential of harvested biomass and different harvesting methods to finance new tree protection.
Innovations for HNV agroforestry: some examples

Integrating grazing livestock with tree layer conservation and regeneration:

Cost-efficient protectors for tree regeneration, included virtual fencing and GPS-based devices, and management practices compatible with tree regeneration.

<table>
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<th>Cost-efficient methods for tree regeneration</th>
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<tr>
<td>Grazing exclusion</td>
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<tr>
<td>Nursery shrubs</td>
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<tr>
<td>Natural protectors (pruned branches)</td>
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<td>Artificial wire thorny shelters</td>
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<td>Chemical organic repellents</td>
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<td>Design of comprehensive strategies (social participation)</td>
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</tbody>
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![Images of protective structures and grazing livestock]
Innovations for HNV agroforestry: some examples

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<tr>
<th>Pasture quality / Fodder Autonomy</th>
<th>Grazing schemes. Cost-efficient Herding</th>
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<tr>
<td>Overcome strong seasonality of “natural” forage resources: <em>Legume rich permanent pastures; Woody Forage Banks</em></td>
<td>Cost-efficient herding. Technology: Invisible fencing; GPS tracking; Multipurpose GPS collar</td>
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<td>Increase pasture productivity and quality</td>
<td>More efficient and even use of extensive forage resources</td>
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<td>Restoration of degraded pastures / disturbed areas</td>
<td>Livestock species</td>
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[Diagram: Pastoreo Rotacional]
Innovations for HNV agroforestry: some examples

**Smart GPS collars**

Virtual fencing & Remote shepherding (negative stimulation: ultrasonic and electric signals)

Protection of regeneration (inexpensive RFID (Radio Frequency IDentification) tags)

Livestock Diseases Control (e.g. transmission of tuberculosis by wild ungulates and animals such as wild pigs that cohabit with livestock) by keep the domestic animals from drinking in the same ponds as the wildlife.

Animal reproductive males without human supervision is also a demanded functionality provided by the collar, since matings will be detected, recorded and transmitted to a remote server storage.
Innovations for HNV agroforestry: some examples

Valuing traditional and new marketable products:

Branding strategies to communicate to consumers the high quality and low (or positive) ecological footprint of wood-pasture products.
TO CONCLUDE & GO FORWARD

(i) Elaboration of innovative techniques for the long term production of timber and non-timber agroforestry products;

(ii) Integrated analysis of economic and environmental values to incorporate recreational and ecosystem values in public policy;

(iii) Modeling and predictive tools to create integrated systems of support for decision making;

(iv) Elaboration of policy proposals to reinforce the public environmental goods and services provided by agroforestry of high nature and cultural value; and

(v) Development of effective institutions and governance structures to help value and manage silvopastoral systems.
Acknowledgement

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