Milestone 2.2 (MS3)
Innovations to be examined for High Nature and Cultural Value Agroforestry

AGFORWARD Project: 613520
Work-package group 2: High Nature and Cultural Value Agroforestry
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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 compiles the main results produced by the ten stakeholders groups created in AGFORWARD to promote ten European agroforestry systems of high nature and cultural value (HNCV). Stakeholders groups held their respective national meetings in the period May-November 2014, in which an open debate was initiated to identify the main challenges faced by each agroforestry system with a view to increase their resilience, profitability, and the supply of wider social and environmental benefits. The stakeholder groups also proposed some potential innovations that could be examined during the project.

This report, created during December 2014 and January 2015, attempts to identify the principal innovations that will be examined across the HNCV agroforestry systems during the remainder of the project. Although ecological and socioeconomical contexts vary among sites, these systems share some common challenges. This report describes these challenges and identifies areas for research using a common framework of nine areas (profitability, system design, tree protection and regeneration, pasture quality, grazing systems, animal production, nature conservation, extension, and policy and governance).

2 Initial stakeholder meetings

The scientific partners in work-package 2 have supported the creation of a participatory research and development network (PRDN) formed by different stakeholders with an interest in a range of agroforestry systems of high nature and cultural value (HNCV). The participatory research and development network comprises 10 stakeholder groups created across Europe in 2014. The stakeholder groups include farmers, breeders, foresters, landowners, representatives of regional and national associations, agricultural services companies, extension services, nature-related NGOs, local action groups, policy makers and scientists. Many of the organisation representatives, but not exclusively, operate at a regional scale.

The objectives for the stakeholder groups are:

i. to identify main constraints and challenges for the promotion/conservation of agroforestry systems of high nature and cultural value,
ii. to propose management innovations to improve the productivity, sustainability, marketing of the products, governance of HNCV agroforestry systems,
iii. to identify ongoing innovation practices initiated by participants and organisations,

iv. to establish a network of sites to test the proposed innovations. Ideally the network should include both experimental and demonstration sites to test scientific hypothesis at the former and to evaluate the feasibility and profitability of proposed innovations at the latter, and
v. to organize and participate in dissemination activities including field visits.

Each stakeholder group held at least one meeting with an open discussion on the main concerns and challenges for the respective agroforestry system. At each meeting, stakeholders also completed a standard questionnaire which sought to rank their assessment of the positive and negative issues associated with the agroforestry system being considered.

An initial report has been prepared by each partner, which has been reviewed by the co-ordinator of the AGFORWARD project and is available on the AGFORWARD website (Table 1). The web address is: http://www.agforward.eu/index.php/en/FarmerNetworks.html. These reports provide a good snapshot of the perception of the positive and negative aspects of the HNCV agroforestry systems, and potential innovations and experiments to be undertaken in collaboration with farmer and/or organizations members. The characteristics of the stakeholder groups is also summarised in Table 2.

Table 1. References for the ten stakeholder reports on high natural and cultural value agroforestry

Crous-Duran J, Amaral Paulo J, Palma J (2014). Initial Stakeholder Meeting Report: Montado in Portugal. 4 September 2014. 12 pp. Available online: http://www.agforward.eu/index.php/en/montado-in-portugal.html

Moreno G (2014). Initial Stakeholder Meeting Report: Dehesa farms in Spain. 17 September 2014. 19 pp. Available online: http://www.agforward.eu/index.php/en/dehesa-farms-in-spain.html

Pisanelli A, Camilli F, Seddaiu G, Franca A (2014). Initial Stakeholder Meeting Report: Grazed oak woodlands in Sardinia. 15 October 2014. 9 pp. Accessed online: http://www.agforward.eu/index.php/en/grazed-oak-woodlands-in-sardinia.html

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Tsonkova P, Mirck J (2014). Initial Stakeholder Meeting Report: Agroforestry in the Spreewald Flood Plain, Germany. 20 October 2014. 8 pp. Available online: http://www.agforward.eu/index.php/en/agroforestry-in-the-spreewald-flood-plain-germany.html

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Table 2. Characteristics of the ten stakeholder groups and their initial meeting

Country	Scientific Partner	System	Date of Meeting	Location of Meeting	Number of attendant	Reported by (and contact)
Portugal	ISA	Montado (grazed oak pastures)	24 July 2014	Observatório do Sobreiro e da Cortiça, Coruche	22	Josep Crous-Duran, Joana Amaral Paulo and João Palma Contact: jcrous@isa.ulisboa.pt joanaap@isa.ulisboa.pt
Spain	UEX	Dehesa (grazed oak pastures)	30 May 2014	Forestry School of the University of Extremadura in Plasencia	80	Gerardo Moreno Contact: gmoreno@unex.es
Italy	CNR-ISPAAM	Grazed oak woodlands in Sardinia	9 July 2014	Foresta Demaniale di Monte Pisanu (Bono), Sardinia	15	A. Pisanelli, F. Camilli, G. Seddaiu and A. Franca Contact: a.franca@cspm.ss.cnr.it
Greece	TEI	Valonia oak silvopastoral systems	29 July 2014	Pegadia, Xeromero, Western Greece	25	Anastasia Pantera Contact: pantera@teiste.gr
Germany	BTU	Spreewald flood plain	16 Oct 2014	Spreewald Biosphere Reserve, Burg, Brandenburg	5	Penka Tsonkova and Jaconette Mirck Contact: jmirck@gmail.com and penka.tsonkova@b-tu.de
Hungary	NYME	Wood pasture	29-30 Aug 2014	Fajsz, Bogyiszló, Hungary	17	Andrea Vityi and Anna Varga Contact: varga.anna@gmail.com and vityi.andrea@emk.nyme.hu
Romania	UBB	Wood pastures in Southern Transylvania	12 June 2014	ADEPT, Saschiz	5	Tibi Hartel Contact: hartel.tibor@gmail.com
France	INRA	Bocage agroforestry in Brittany	26 Nov 2014	Plouguenast Municipality, Brittany	42	Claudine Thenail, Valérie Viaud and Hongtao Hao Contact: Claudine.thenail@rennes.inra.fr Valerie.viaud@rennes.inra.fr
UK	CRAN	Wood pasture and parkland	23 Sep 2014	The View Visitor Centre, Epping Forest, Essex	10	Matthew Upson and Paul J. Burgess Contact: m.a.upson@cranfield.ac.uk
Sweden	EFI (and SLU)	Wood pastures and reindeer	1-2 Oct 2014	Åkroken and Tulleråsen, County of Jämtland	6	Staffan Berg, Torgny Lind, Erik Valinger Contact: erik.valinger@slu.se and staffan.berg@efi.int

3 Concerns and challenges and potential innovations

Based on the ten reports a spreadsheet (Annex A) was produced to summarise the challenges identified by the different stakeholder groups. The challenges were grouped under nine topics: farm profitability, system design and management, tree protection and regeneration, pasture quality and fodder autonomy, grazing schemes and cost-efficient herding, animal production, nature conservation, extension, and policy and governance. Each of these topics is briefly discussed below.

3.1 Farm profitability

Each stakeholder groups considered the low profitability of wood pastures as a key constraint for the future sustainability of the system (Table A.1). Potential innovations (Table B.1) were identified in three areas:

- *Branding HNCV products*: the idea of a Dehesa trademark and certification of animal products, and improved knowledge of customer and tax-payer interests. This was of interest in Portugal, Spain, Greece, and Hungary. It was proposed that empirical studies could be undertaken to analyse consumer behavior towards products and services provided by agroforestry systems. The objectives could be:
    - To identify agroforestry derived products and services and new demands and emerging products,
    - To assess the willingness to pay a premium price for different products and agroforestry services, and
    - to identify mechanisms to promote efficient marketing of agroforestry products and ecosystem services
- *Product diversification*: the idea of new acorn-derived products in Greece, and *Phlomis fruticosa* as ground vegetation was of interest in Greece and Spain. To address this, could require the collection of primary data through focus groups, interviews and short surveys that will be organized with consumers of these products and services. This could help with, for example, the valuation of new acorn-derived products in Spain and *Phlomis fruticosa* as ground bed in Greece.
- *Quality of tree products*: the assessment of the effect of management practices such as debarking intensity and height on cork quality was seen as a potential area for research in Italy.

3.2 System design and management

System design and management was seen as a challenge by each stakeholder group except the UK (Table A.1). Potential innovations (Table B.2) were identified in three broad areas:

- *Design and management of the system to new multiple practices*: the consultative process for long-term planning between Sami and foresters in Sweden was seen as an innovation.
- *Tree layer management*: innovative tree species which can resist livestock, the rejuvenation of windbreaks, the renewing of encroached and abandoned wood pastures were innovations in Portugal, Hungary, and Germany. The management of open young tree stands that enable reindeer movement and herd control in Sweden was a potential innovation
- *Livestock management:* the selection of appropriate stocking rates in relation to forage resources and to the CAP was seen as potential innovation in Italy and Romania.

3.3 Tree protection and regeneration

How to reconcile grazing livestock with tree layer conservation and regeneration was a common concern for each stakeholder groups except Italy (Table A.1). A wide range of methods for protecting

trees from livestock were proposed ranging from the use of dead branches to innovative systems involving GPS and sensors wore by cattle (Table B.3).

Potential innovations to reconcile grazing with trees (cost-efficient protection of saplings) could include field tests of different protectors such as dead branch shelters, thorny and/or nursery shrubs, artificial thorny protectors, visual deterrents, chemical organic repellents, and low-cost fencing. Other measures could be based on grazing adaptation such as grazing exclusion, periodical grazing, and reduction of stocking rates.

3.4 Pasture quality

Another concern raised by stakeholder groups in Spain, Italy, Romania, Hungary and Sweden was the need for more efficient use of local forage resources to increase the fodder autonomy of the farms (Table A.1).

Potential innovations (Table B.4) to increase pasture productivity and quality and to ensure a better seasonal distribution could include:

- fodder crops (included legume-rich pastures) adapted to shade and tree competition,
- adapted silvicuture for forest grazing, browsing and pannage such as early thinning, selection of forage tree/shrub species, and adapted pruning and pollarding, and

3.5 Grazing systems and cost efficient herding

More efficient and even use of forage reesources, including technology to improve the efficiency of herding was identified in seven of the stakeholder groups (Table A.1). Potential innovations (Table B.5) include changes in the grazing scheme such as holistic grazing (intensive fast-rotational grazing), location of facilities (e.g. watering points, supplementary fodder, salt) and selection of specific livestock breeds (e.g. buffalo in Romania). Use of grazing regulation techniques and the use of GPS and ”invisible fencing” were also potential innovations (Table B.5)

Invisible fencing comprises of burying a loop of insulated wire in grazing areas which interacts with a collar fitted to each animal. When the animal approaches the wire, an audible warning is issued, followed by a mild electric shock if the animal continues to approach the wire. Multipurpose GPS collars can also be used to improve the efficient use of natural resources while reducing biotic risks and management costs. GPS collars equipped with negative-stimuli devices will extend the virtual fencing paradigm with new, high-value uses, such as the prevention of contagious diseases from wildlife to livestock (exclusive access to watering points and supplementary food), the protection of scattered young trees in wood pastures (using inexpensive RFID tags), livestock health control (by automatic analysis of hourly movements), and even use of forage resource (by automatic analysis of grazing time per area).

3.6 Animal production

Livestock health, including access to water and provision of shelter, was identified as a challenge in Portugal, Spain, Greece, Romania, France, and Sweden (Table A.1). Control of access to water points and supplementary food, and design of hedgerows to improve shelter were possible innovations (Table B.6).

3.7 Nature conservation

Stakeholders highlighted the public acknowledgment of the cultural value and the ecosystem services provided by high nature and cultural value agroforestry as a key issue (Table A.1). However, there were concerns regarding the conservation of veteran non-productive trees and tree species diversity, and issues such as matching of stocking-rate with soil conservation measures. Methods for fire control, an improved understanding of the effects on soil carbon, and methods of soil protection were potential innovations (Table B.8).

3.8 Extension

Extension was seen as critical issues in Portugal, Spain, Greece, and France (Table A.1). The use of pilot farms and encouragement of local state officials in extension activities was identified as a potential area of work in France (Table B.7).

3.9 Policy and governance

Maladapted policy measures for extensive and multipurpose HNCV agroforestry systems were identified as constraints by most partners (Table A.1). The presence of trees and other semi-natural features often hampered the eligibility of land for single farm payments the parcels. Some interventions were proposed in some countries (Table B.9).

4 Data collection and experimental activities

In this sedction, the promotion of agroforestry systems of high nature and cultural value is discussed in terms of closing the knowledge gap and in terms of planned experiments.

4.1 Closing knowledge gap

At the end of December 2015, the project needs to provide a report with a detailed description of systems studied in WP2. The description have to include systems components and structure of the agroforestry systems, and their marketable products, regulating and supporting ecosystem services, socio-cultural value and, if available, economic value. The report should be mostly based on existing knowledge, revisiting previous results, including non-published data and experience from the established network.

Additionally, to complete a common database, some field works could be needed to fill gaps of knowledge. The role of trees on pasture understory production, on soil carbon storage and on other ecosystem services such as biodiversity or nitrate leaching, are basic parameters useful to support the conservation on extensive wood pastures and other HNCV agroforestry systems. Common (low-time and low-resources consuming) protocols would be develop for quick assessment of these parameters. Where data are already available in the literature or produced in previous projects, field works would not needed. In the following table, these tasks are listed.

Table 3. List of tasks for the description of the HNCV agroforestry systems (Deliverable D2.4, for December 2015).

Task	Partners (willing to contribute) In **bold** the partner leading the task
1. Detailed systems description, recording existing data on components and structure, socio-economical context, management practices, and products	**UEX**, ALL
2. Effect of tree canopy on pasture production (comparison of pasture production beneath and out of the canopy cover)	**UEX**, NYME
3. Monitoring carbon storage data (partners should take soil samples beneath and out of the canopy cover; soil analysis could be centralised in UEX laboratory, Spain)	**UEX**, NYME, ISA
4. Biodiversity assessment	**UEX**, UBB
5. Other Ecosystem Services	To be determined
6. Compiling and providing data (physical and economic data) for models in WP6.	**ISA,** CRAN

4.2 Planned experiments

Table 4 describes some of the planned field experiments prioritised by the partners. Demonstration and trial plots without replication are not included. Note that the list will continue to develop during the project and a close discussion will be initiated to agree, where possible, a set of common set of protocols and methodologies.

Table 4. List of field experiments agreed by partners. Partners in bold will lead the task the specific experimental work writing a first draf protocol and if neccesary centralising sample/data analyse.

Experimental Topic	**Specific Experimental Work**	**Partners involved (Lead in bold)**
System design/management: refers to conservation of specific elements, as native species, veteran trees, reintroduction of formely used species, hedges and windbreaks conservation and/or rejuvenation	Shift from single model of novel hedgerow to modular models and progressive management techniques. Rebuilding connections between hedgerows and scattered farms across the landscape.	**INRA**, BTU
	Combining crop rotation management, pasture management and 3 dimensional design and management of hedgerows to avoid soil erosion.	**INRA**
	Renewing encroach-abandoned wood pastures	NYME, EFI
	Effect of different understory management options on cork growth/calibre and cork quality	**ISA,** UEX
Tree regeneration: cost-efficient protection of regenerate	Seeding combined with dead branch/wood, mulches (e.g., Ramial Chipped Wood), thorny and/or nursery shrubs	**UEX**, ISA, BTU, UBB, INRA, NYME
	Artificial thorny protectors	**UEX**, NYME
	Mix of specied for "auto-protection	**INRA**
Livestock management: cost-efficient herding, optimisation of fodder resources use, and halting system degradation	Viability and cost-effectiveness of "invisible fencing"	**CRAN**, UEX
	GPS collar, equipped or not with negative-stimuli devices	**EFI**, UEX
	Holistic or grazing (intensive fast-rotational grazing) to improve soil and pasture quality and protect tree regeneration	**UEX**, CNR, BTU
	Effects of grazing exclusion on the vegetation structure, biodiversity and wildfire	**CNR,** NYME, UBB
Fodder resources	Selection of species/varieties of legume pastures adapted to shade and tree competition	**CNR**, UEX, TEI, ISA
	Selection of double-cropped winter-forages (e.g. Triticale) adapted to shade and tree competition	**UEX**
New products	Questionnaire to assess the willingness to pay a premium price for different AF products (e.g. acorn-derived products) and services (e.g., biodiversity, historical/aesthetic landscapes).	**UNEX,** BTU, INRA, NYME
	Questionnaire to identify mechanisms to promote efficient marketing of AF products (e.g. human consumption of acorns in different products)	**UNEX**, ISA**, U**BB,
Conservation	Ramial wood chips and other organic mulch	**UEX**, CNR, INRA
	Adoption of optimal livestock species in wood-pastures to halt soil degradation and to reinforce biodiversity	**UBB,** NYME, CNR
	Testing the openness of local communities to value/protect ancient trees on WP	**UBB**, NYME
Governance	Favouring the design (and diffusion) of a model of cooperative (e.g. skills and machines pool) for re-developing HNCV agroforestry	**INRA**, EFI

Table 5. Relation of experimental works to be done by each partner

Partner	Specific experimental work
UEX	• Seeding combined with natural protectors • Artificial thorny protectors • Invisible fencing OR GPS collar, equipped or not with negative-stimuli devices • Holistic or rotational grazing • Selection of species/varieties of legume pastures AND double-cropped winter-forages • Ramial wood chips and other organic mulch • Questionnaire to assess willingness to pay premium prices for new agroforestry products • Questionnaire to identify mechanisms to promote knowledge and efficient marketing of agroforestry products
ISA	• Seeding combined with natural protectors • Questionnaire to identify mechanisms to promote knowledge and efficient marketing of agroforestry products • Selection of species/varieties of legume pastures adapted to shade and tree competition • Effect of different understory management options on cork growth and quality
CNR	• Effects of grazing exclusion • Holistic or rotational grazing • Adoption of optimal livestock species for halting system degradation and for biodiversity conservation • Selection of species/varieties of legume pastures • Ramial wood chips and other organic mulch
TEI	• Questionnaire to assess the willingness to pay premium prices for new AF products • Selection of species/varieties of legume pastures
UBB	• Seeding combined with natural protectors • Effects of grazing exclusion • Adoption of optimal livestock species for halting system degradation and forbiodiversity conservation
NYME	• Renewing encroach-abandoned wood pastures • Artificial thorny protectors • Seeding combined with natural protectors • Effects of grazing exclusion • Testing the openness of local communities to value/protect ancient trees on wood pastures • Questionnaire to assess the willingness to pay premium prices for new agroforestry products
BTU	• New models and management practices to rebuilding hedgerows/windbreaks • Holistic or rotational grazing • Seeding combined with natural protectors • Questionnaire to assess the willingness to pay premium prices for agroforestry products • Testing the openness of local communities to value/protect ancient trees on wood pastures
INRA	• Seeding combined with natural protectors • Plantation of mix of specied for ”auto-protection” • New models and management practices to rebuilding hedgerows • Favouring the design (and diffusion) of a model of cooperative re-developing of HNCV agroforestry
CRAN	• Viability and cost effectiveness of GPS and invisible fencing
EFI	• GPS collar, equipped or not with negative-stimuli devices • Renewing encroach-abandoned wood pastures • Seeding combined with natural protectors • Favouring the design (and diffusion) of a model of cooperative re-developing of HNCV agroforestry

5 Acknowledgement

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Annex A Challenges identified

Table A.1 Summary of stratified challenges identified by stakeholder groups

Themes	Challenges	PT	ES	IT	GR	RO	HU	D	F	UK	SW
Farm profitability	Branding HNCV agroforestry product. Trademark. Valuing product		x		x	x	x	x		x	
	Product diversification. New products		x		x	x					
	Halt abandonment				x	x		x			
	Access to tree products						x	x			
	Quality of tree products (e.g. cork quality vs management)	x									
	Green Accounting System. Economical Evaluation of ES & Ecological footprint	x	x					x			
System design & management	Design and management of the systems to (new) multiple purposes. Synergies among three components (tree, pasture and livestock). Adaptive design of hedgerows			x				x	x		x
	Tree layer management. Three dimensionnal design and management (layers, width, connections)	x			x	x	x	x	x		x
	Livestock management.	x		x		x		x			x
	Infrastructures for livestock transport. Transhumance		x								x
Tree protection & regeneration	Reconciling grazing with trees (cost-efficient protection of saplings)	x	x		x	x	x	x		x	
	Tree species diversity. Native species	x				x	x	x	x		x
	Tree decay (pests, diseases and wildfire), and fruit losses	x	x					x		x	
Pasture quality / fodder autonomy	Overcome strong seasonality of “natural” forage		x				x				x
	Increase pasture productivity and quality		x	x		x					x
	Restoration of degraded pastures / disturbed areas										x

Table A.1 (continued) Summary of stratified challenges identified by stakeholder groups

Themes	Challenges	PT	ES	IT	GR	RO	HU	D	F	UK	SW
Grazing schemes and cost-efficient herding	More efficient and even use of extensive forage resources		x		x	x		x			
	Livestock species					x				x	
	Cost-efficient herding. Technology		x				x			x	x
Animal production	Genetic selection. Docility & Browsing behaviour. Local races		x							x	
	Diversification (Geese, Turkeys, Red Deer …)		x								
	Livestock Health (water quality, reinfection from wild fauna, sheltering …)	x	x		x	x			x		x
	Control of Predators/wildlife animals			x		x					x
Nature conservation	Soil Protection. Stocking rate matching to forage resources and soil capacities.	x	x	x					x		
	Organic matter and Soil carbon Sequestration		x	x						x	
	Fire Control			x							
	Cultural landscapes			x		x	x				
	Protection of ancient trees			x		x	x				
	Biodiversity conservation			x		x	x		x	x	
Extension	Public research centre		X								
	Maintenance of local knowledge	x	x						x		
	Encouraging local state officials in extension activities	x			x				x		
Policy and governance	Specific Measures & Grants (CAP). Long Term Regulations. Comprehensive	x	x	x	x		x	x	x		
	Support to extensive pastoralism		x	x		x					
	Social Participation. Operational groups.		x	x		x	x	x			
	Public / Communal pastures					x					
	Associationism		x			x	x				
	Land ownership. Grazing allowed					x	x	x			x

Annex B. Summary of innovations proposed by stakeholders groups

Table B.1 Innovations related to farm profitability as proposed by stakeholder groups

Farm profitability	PT	ES	IT	GR	RO	HU	D	F	UK	SW	Proposed Research	Innovation?
Branding HNCV agroforestry product. Trademark. Valuing product		x x		x		x					Dehesa trademark Certification of animal husbandry products Improved knowledge of customer and tax payer interest (Questionnaires: protocol ready)	Yes
Product diversification. New products (tannins, dyes, aromatic, medicinal, mushrooms, firewood, biomass)	x x	x		x							New acorn-derived products Promote knowledge on human consumption of acorns in different products Phlomis fruticosa as ground bed	Yes
Halt abandonment												No
Access to tree products						x						No
Quality of tree products (e.g. cork quality vs management)	x										Assessment of cork quality respect to management practices: debarking intensity, height …	Yes
Green Accounting System. Economical Evaluation of ES & Ecological footprint												Yes

Table B.2 Innovations related to system design and management as proposed by stakeholder groups

System design and management	PT	ES	IT	GR	RO	HU	D	F	UK	SW	Potential innovations	Innovation?
Design and management of the systems to (new) multiple purposes. Synergies among three components (tree, pasture/crop and livestock) Adaptive design of hedgerows			x					x		x	Consultative process between Sami and foresters for the long-term planning Shift from single model of novel hedgerow to modular models and progressive management techniques. Development of appropriate management frameworks for silvopastoral systems aimed at promoting synergies between grazing animals, pasture and trees	Yes
Tree layer management Three dimensional design and management (layers, width, spatial connections)	x					x	x	x		x	Innovative [tree] species able to resist to livestock Windbreaks rejuvenation Renewing encroach-abandoned wood pastures Open young stands that enable reindeer movements and herd control Rebuilding connections between hedgerows and scattered farms across the landscape. Anchoring new plantations on remnants of old hedgerows. Linking the design of ground structure and vegetation layers; use of forest plough to facilitate bank making if necessary.	Yes
Livestock management			x		x						Appropriate stocking rate. Stocking rate matching to forage resources and to CAP	Yes
Infrastructures for livestock transport. Transhumance												Yes

Table B.3 Innovations related to tree protection and regeneration as proposed by stakeholder groups

Tree protection and regeneration	**PT**	**ES**	**IT**	**GR**	**RO**	**HU**	**D**	**F**	**UK**	**SW**	**Potential innovations**	**Innovation?**
Reconciling grazing with trees (cost-efficient protection of saplings)	x	x x x x			 x 	 x x x 	x x				Dead branch - Deadwood shelters Artificial thorny protectors Tree guards, e.g. Tubex Thorny and/or Nursery Shrubs Chemical organic repellents Planting of new structures	Yes
				x	x x						Grazing management/exclusion Periodical grazing	
						x	x		x		Fencing (cost-efficient structures) Invisible Fencing for livestock exclusion	
Tree species diversity. Native species					x	x		 x		x	Protection of native tree species. Avoidance of exotic tree species as e.g. Pinus contorta. Plantation of mix of specied for mutual protection, and of species that can be conducted in high stem or medium stem. Reintroduction of formerly used species like Fagus sylvatica. Bank making (forest plough) and/or use of mulches (e.g., Ramial Chipped Wood) and seedings to reinforce natural regeneration of trees	Yes
Tree decay (pests, diseases and wildfire), and fruit losses		x									An adequate silvo-environmental management practices for pests and diseases control	Yes/No

Table B.4 Innovations related to pasture quality and fodder autonomy as proposed by stakeholder groups

Pasture quality and fodder autonomy	**PT**	**ES**	**IT**	**GR**	**RO**	**HU**	**D**	**F**	**UK**	**SW**	**Potential innovations**	**Innovation?**
Overcome strong seasonality of "natural" forage resources		x		x		x					Fodder crops: cereal varieties adapted to shade and tree competition Forest grazing and pannage Retaken of pruning trees for acorn production & fodder	Yes
Increase pasture productivity and quality		x			x					x	Pastures rich in legumes adapted to oak shade and grazing pressure Adapted silviculture for grazing. Need of early thinnning	Yes
Restoration of degraded pastures / disturbed areas										x	Equipment for re-establishment of lichens at the disturbed area harmful	Yes

Table B.5 Innovations related to grazing systems and cost efficient herding proposed by stakeholder groups

Grazing schemes and cost efficient herding	**PT**	**ES**	**IT**	**GR**	**RO**	**HU**	**D**	**F**	**UK**	**SW**	**Potential innovations**	**Innovation?**
More efficient and even use of extensive forage resources		x		x	x						Fast-intensive rotational grazing Best practice and solution of forest grazing and pannage Grazing regulation	Yes
Livestock species					x						Cattle and buffalo instead of sheep in wood-pastures.	Yes
Cost-efficient herding. Technology		x x x				x			x x	x x	Facilities location GPS herding Virtual/Invisible fencing Grazing and herding technology	Yes

Table B.6 Innovations related to animal production challenges proposed by stakeholder groups

Animal production	PT	SP	IT	GR	RO	HU	GE	F	UK	SW	Potential innovations	Innovation?
Genetic selection. Docility & Browsing behaviour. Local races												Yes
Diversification (Geese, turkeys, red deer …)	x										Extensive turkey production under montado.	Yes
Livestock health (water quality, reinfection from wild fauna, sheltering …)		x						x		x	GPS collars. Control of access to water point and supplementary food. Control of Animal health. Monitoring herd position Design of the structure and location of novel hedgerows for enhancing sheltering.	Yes
Control of Predators												Yes

Table B.7 Innovations related to extension as proposed by stakeholder groups

Extension	PT	E	IT	GR	RO	HU	D	F	UK	SW	Potential innovations	Innovation?
Public research centre												No
Open school; maintenance of local knowledge	x							x			Pilot Farms (economically healthy) Favouring the design (and diffusion) of a model of “cooperative of skills and machines pool” for re-developing bocage agroforestry.	Yes
Encouraging local state officials in extension activities								x			Building bottom-up projects involving local state officials (e.g. for the design of “a cooperative kills and machines pool”).	No

Table B.8 Innovations related to nature conservation as proposed by stakeholder groups

Nature conservation	PT	ES	IT	GR	RO	HU	D	F	UK	SW	Potential innovations	Innovation?
Soil protection; stocking rate matching to forage resources and to CAP		x			x			x			Rotational herding Combining crop rotation management, pasture management and 3 dimensional design and management of hedgerows to avoid soil erosion.	Yes
Organic matter and soil carbon sequestration		x						x			Ramial wood chips and other organic mulch	Yes
Fire control			x								Effect of grazing exclusion on the wildfire behaviour. Low input techniques of firebreaks management	Yes
Cultural landscapes								x			Compare to former models of novel hedgerows: reintroduction of banks, reconnection of hedgerows between farms and across the landscape, reintroduction of high stem pruned trees, reintroduction of species (*e.g.* Fagus sylvatica).	No
Protection of ancient trees					x						Testing the openness of local communities to value/protect ancient trees on wood pastures	No
Biodiversity conservation			x		x			x			Effects of different livestock on the vegetation structure and biodiversity 3 dimensional design and management of hedgerows to favour biodiversity: favouring connection between hedgerows, habitats with mulches and left cut branches, dense tree covers, edge grazing (without trampling) by livestock... Effect of grazing exclusion on the vegetation structure and biodiversity	No

Table B.9 Innovations related to policy and governance as proposed by stakeholder groups

Policy and governance	**PT**	**ES**	**IT**	**GR**	**RO**	**HU**	**D**	**F**	**UK**	**SW**	**Potential innovation**	**Innovation?**
Specific measures and grants, and long term regulations							x	x			Payment for historical landscapes Proposals for a specific status of the hedgerows of high and medium stem trees in the 2nd but also 1st pillar of the CAP to support their maintenance.	Yes
Support to extensive pastoralism												No
Social participation and operational groups			x					x		x	Dialogue with forestry companies and forest owner associations for long-term planning to reduce negative impact of modern silviculture to reindeer pastures Organizing participatory field works for plantation. Strategies for improving the communication and sharing knowledge	No
Public / Communal pastures												No
Creation of associations		x									Creation of National Federation of Dehesa Associations	No
Land ownership. Grazing allowed												No