

Work-package group 2: High Nature and Cultural Value Agroforestry

Specific group: Dehesa farms in Spain

Date of meeting: 30 May 2014

Date of report: 17 Sept 2014

Location of meeting: University of Extremadura, Plasencia, Spain

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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 describes one of about 40 initial stakeholder workshops to address objective 2. Further details of the project can be found on the AGFORWARD website: www.agforward.eu

The specific focus of this report describes the development of one stakeholder group within a participatory research and development network (PRDN) focused on agroforestry systems of high nature and cultural value (HNCV). The objectives for the PRDN were:

- i. to identify main constraints and challenges for the promotion/conservation of dehesas and other 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.
- v. to organize and participate in dissemination activities that would include field visit to experimental/demonstration sites.

The specific focus of this report is the development of a stakeholder group focused on the Iberian dehesa, one of the largest agroforestry systems in Europe. The initial meeting was held on 30 May 2014 in Plasencia at the Forestry School of the University of Extremadura. From the discussion initiated among stakeholders, together with the responses given to a semi-structured questionnaire, this report describes a categorised list of constraints and opportunities, and a prioritised number of proposals of innovations to be tested by the PRDN in the course of the AGFORWARD project. The report concludes with some specific agreements for this participatory research.

2. Description of system

The Iberian dehesa is an agroforestry system of High Natural and Cultural Value (HNCV) and is the main land use in the South Western Iberian Peninsula (Fig 1). It is an agrosilvopastoral system originating from clearing of evergreen woodlands where trees, native grasses, crops, and livestock interact positively under specific management. At present, dehesas occupy 2.3 million hectares in Spain and 0.7 million hectares in Portugal, where they are called “montados”. Dehesas result from a simplification, in structure and species richness, of Mediterranean forests and shrublands, and are attained by reducing tree density, eliminating matorral (shrubland) cover, and favouring the grass layer by means of grazing and crop culture. Dehesas are characterized by the rearing of traditional livestock breeds at low stocking densities and careful exploitation of evergreen oaks. Dehesas are among the best preserved low-intensity farming systems in Europe, and in them the integration of traditional land-use and biodiversity conservation is considered an exemplary land use management. However the system faces multiple ecological and socio-economic constraints that are threatening long-term persistence.



Figure 1. Dehesa system

3. Work-plan

The activities are organized as follow.

- a. The initial workshop to discuss the main concerns, challenges and innovations for dehesa systems (Fig 2). The workshop served to learn about stakeholders' worries, thoughts, needs and proposals. Although the facilitators (UNEX) had a set of issues prepared for the discussion, the workshop flowed in a very open way. New topics emerged that had not been realized before. A categorized list of innovations that need to be tested was produced. Stakeholders willing to contribute with sites for testing innovations were identified.
- b. The semi-structured questionnaire, once adapted to the national and system-specific context, was used to compile information from a broader collective of stakeholders. This included some open questions and a list of items to be prioritized. Following the Spanish qualification system, responders should give a rate from 0 to 10 to each item, with 5 being qualified as negative and above 5 as positive (0 means very negative and 10 very positive). Face to face questionnaires were filled during the workshop. Others were filled later on-line. For this purpose different stakeholders were contacted by e-mail. Questionnaires allowed us to identify cases of ongoing innovative practices being conducted by farmers, and to "recruit" other possible collaborators.
- c. A mailing list has been created and used to disseminate results of the workshop and questionnaire and to ask for voluntary revision of the reports. The mail list has been also used to prioritize innovations within the categorized list of innovations produced in the stakeholder meeting.
- d. Dissemination day(s): ideally to be done in some of the farms participating in the innovations tests, during years 2015-2017.

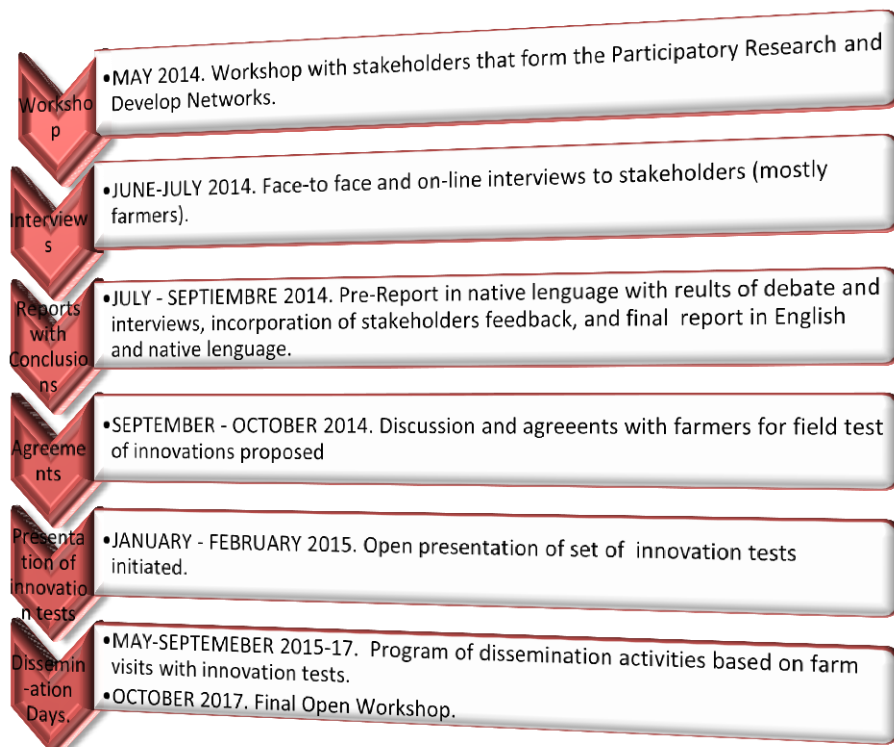


Figure 2. Schematic of the work-plan for the participative research and development network

4. Stakeholders' meeting

Stakeholders have a pivotal role in the AGFORWARD project. One hundred and sixty-nine individual stakeholders were invited for a first meeting. The meeting was envisaged as an open-door day for people interested in the development and conservation of Iberian dehesa systems. The meeting, was held on 30 May 2014 in the Forestry School (University of Extremadura) at Plasencia. The participation was very high (> 90 stakeholders) indicating the great awareness of farmers and society in relation to the conservation of the dehesa system. The attendees included farmers, breeders, foresters, landowners, representatives of their associations (regional and national level), agricultural service companies, extension services, nature-related NGOs, local action groups, and policy makers.



The schedule for meeting included different techniques of social participation, such as Ishikawa or fishbone diagrams, to allow joint discussion of the current difficulties and challenges of dehesa and other extensive silvopastoral systems and to compile proposals of innovation (Table 2). From the discussions consistent proposals of participatory research to evaluate on-farm innovative practices emerged. Farmers were told that the definitive set of experiments to be supported by the AGFORWARD project would be decided by late 2014, and of the importance of the ongoing discussion through e-mail and personal interviews. Participants formed the first nucleus of a Participatory Research and Development Network for the dehesa of SW Spain that communicates mostly by means of a mailing list (agf_dehesas@googlegroups.com).

Table 1. Schedule for the day

10:00 - 10:30	Reception
10:30 - 12:00	The future of dehesas: open discussion in three small groups animated by Fundación Entretantos (experts on participatory dynamics).
12:00 - 12:30	Coffee break: face to face introductions
12:30 - 13:00	Presentation of AGFORWARD project: Gerardo Moreno (Team coordinator)
13:00 - 14:30	Proposals of innovations: animated open discussion in a single large group to define main lines, ideas and proposals for participatory research to innovate.
14:30 - 16:30	Lunch
16:30 - 18:00	Participation in AGFORWARD: how each farmer can help and benefit from the participatory research and steps to become an experimental farm.
18:00 - 18:30	Conclusions and appointments

5. Stakeholders' perception of agroforestry

The questionnaires completed by the participants (n = 78) highlighted the stakeholders' view of agroforestry (n= 41 give a personal definition of agroforestry). Most of the definitions included terms such as mixed system, integrated biosystem, production system, ecological system, agrosystem, agricultural holding, and diversity (Table 1). At a first glance, respondents had the perception that agroforestry combines different components within the farm, but rarely mentioned any degree of interaction among components.

Table 2. Some of the definitions of agroforestry provided by the participants

<p>"Wood pastures" (Alfonso García Cobaleda; breeder and dehesa landowner) or</p> <p>"Rangelands" (Fernando Llorente Arrebola; farmer and breeder);</p> <p>"Farms where trees not only are present but are an essential part of the economy" (Laura García Pierna; Technical manager at Global Nature, a national NGO);</p> <p>"Livestock and agriculture sharing a natural space" (Agustín Torres Becedas; breeder and farmer)</p> <p>"Land with cultures and trees that produce fruits and/or wood, cork or biomass" (Emilio Bravo Arrobas; agronomist and farm manager);</p> <p>"Farm that integrates trees, livestock and pastures or fodder crops in the same land unit to concile the maximum productivity with ecological sustainability" (Jose Andrés Estevez Leo; manager of agricultural holding);</p> <p>"An agrosystem that harmonizes, at the same time and land unit, different uses and products of high quality, favoring biodiversity and other ecological services" (Jesús Valiente López; Technical manager at ADENEX, a regional nature conservation NGO);</p> <p>"An agricultural holding that conserves and values the forestry, cultural, ethnographical and natural legacy" (José Luis Moreno Ruiz; director of a forest services company)</p>
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The respondents rarely included terms concerning nature conservation or biodiversity in the definition, though later in the specific questions these values are rated as very positive (Figure 1). Specifically landscape aesthetics, soil conservation, climate buffering, biodiversity and carbon sequestration were the best rated. Other aspects, such as animal welfare, tree regeneration, animal production, originality and interest of the system and tourism received also very positive rates. By contrast, respondents had a more negative perception for aspects concerning the daily management and economy of the agroforestry systems. Some of them are administrative burden, subsidy and grant eligibility, difficulties for mechanization, taxes, problem of cash flow, the need for multiple skills and labor costs (Figure 3).

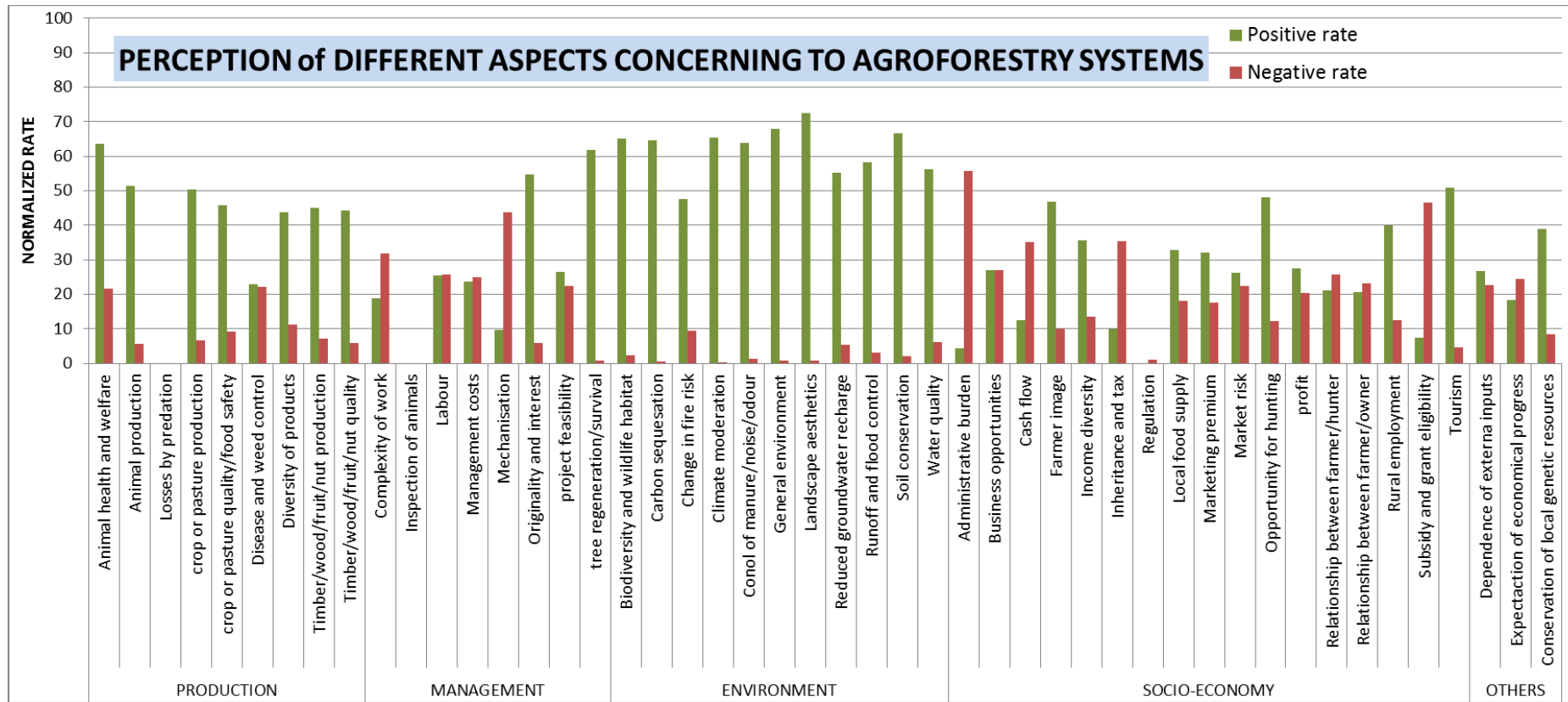


Figure 3. Positive and negative rates given by respondents (n= 78) to 48 aspects concerning agroforestry systems, grouped in 5 fields, production, management, environment, socio-economy and others. Each respondent prioritized the negative and the positive aspects (up to 5 in each case). From here a final score was computed and normalized to the scale 0-100.

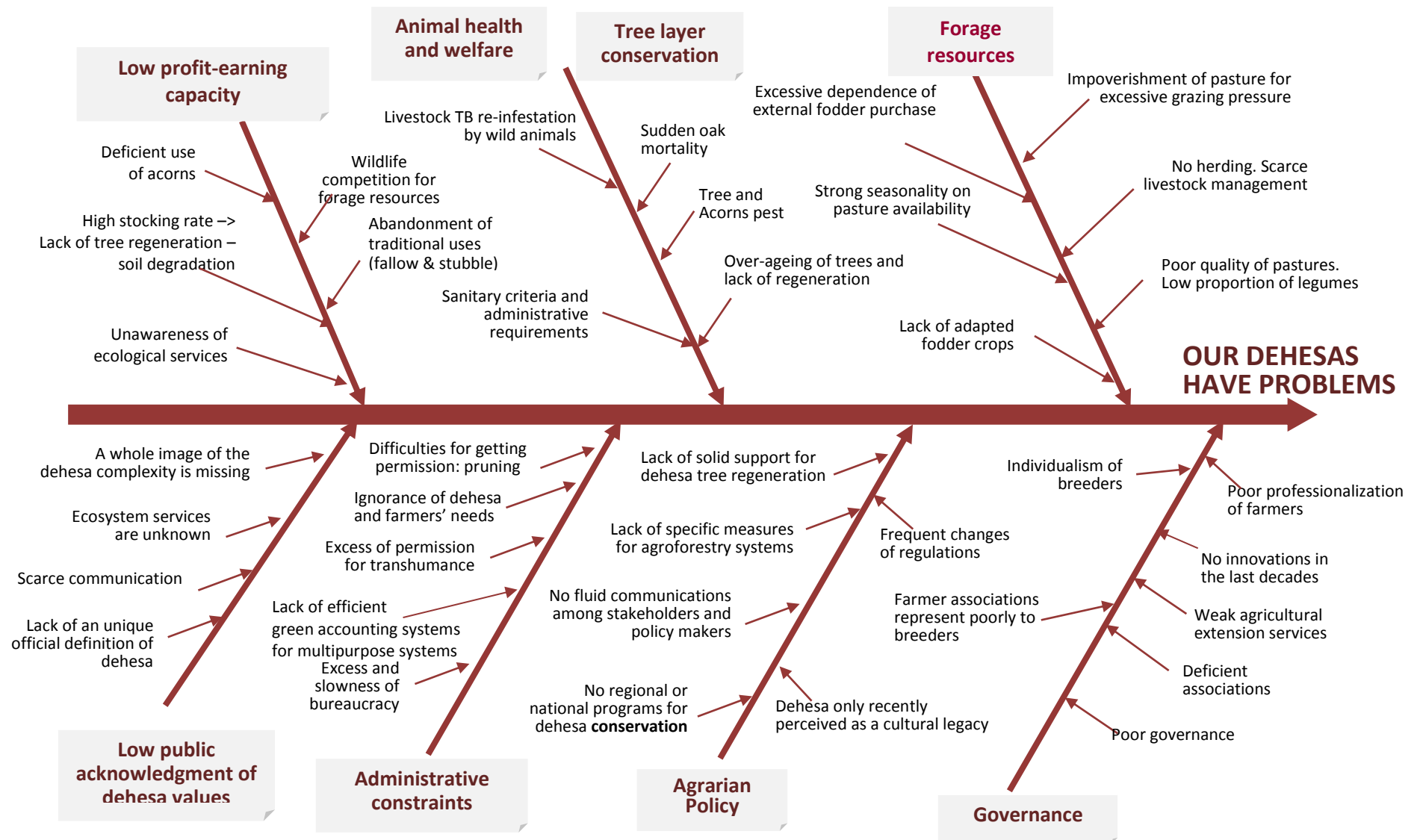


Figure 5. Fishbone or Ishikawa diagram that summarizes main constraints for Spanish dehesas identified by stakeholders

7. Potential innovations for participatory research



Figure 6. A conceptual map with the most repeated ideas raised by the participants

Most participants stressed the need for studies to explore new opportunities for dehesas and other agroforestry systems and high natural and cultural agroforestry systems, and expressed their willingness to collaborate with the University of Extremadura within the AGFORWARD project. In addition, farmers requested a platform for the exchange of knowledge, experiences and ideas, and for a better governance structure and for best adapted measures to support multiple dehesa management practices and to grant the provision of public ecosystems services and the conservation of the natural and cultural legacy.

Although most of them acknowledged the importance of ecosystems services provided by dehesas, they demanded mostly research focused to solve their daily management problems and to increase the profitability of dehesas, with emphasis on soil fertility, improvement of pasture productivity and quality, grazing regimes and regeneration of the tree layer. They also referred repeatedly to the importance of enhance the integrated management and exploitation of the dehesas, by diversifying

the production activities and valuing different products, by gaining forage autonomy and internalization of the materials cycle, and favoring the cash flux along the year.

After producing the long list of proposals, during the afternoon debate, the group came together again to discuss which proposals could be afforded by the AGFORWARD project and the PRDN. UEX team noted that new research projects and funds will be necessary to afford some specific topics in-depth e.g. pests and diseases of trees, and it was stressed that the PRDN established should play a prominent role to find funds for this research.



Then we designed a methodology to prioritize the pre-selected proposals. Below we commented the ideas proposed grouped by themes, and then we present the results of the prioritization process.

Profitability of dehesa farms

- Dehesas remain only in areas with harsh climate and/or poor soils, which determines the low productivity of the pastures and the low profitability of the farms via livestock production. To increase the profitability, pasture productivity and quality has to be improved through coupling **grazing regimes, fertilization and sown of shade-adapted fodder crops and legume pastures**. To reinforce **the productive role of the trees** is also important. All these targets must be accompanied by the increase in soil organic matter.

An experience of reference could be the Terra Prima Project (Portuguese montado) that made possible the payment by carbon sequestration with the sown of biodiverse pastures rich in legumes.

- Development of a **Green Accounting System** adequate for complex systems as dehesas and other High Natural and Cultural Value agroforestry systems, where the value of ecosystem services should be included.
- **Evaluation of ecosystem services** associated to different silvopastoral systems and practices through cost-benefit analysis, what requires pricing ecosystem services such as carbon sequestration, biodiversity, water quality, landscape aesthetic ...

The Global Nature Foundation proposed its demonstrative dehesa farm as case study and expressed its willingness to collaborate in the compilation of data and further dissemination activities.

- The creation of a **Dehesa trademark** for a plethora of high quality foods and materials produced in the dehesa, and to make more visible for consumers the relation among the product and the productive systems and the public ecosystem services associated to these products.

Regeneration and protection of trees

- To find out how to **reconcile grazing with tree regeneration** seems crucial for the persistence of dehesas at mid-term. The role of wild animals, especially games, for tree regeneration need also to be explored.

The dehesa farm “Las Corchuelas” located within the National Park of Monfragüe was offered to explore different alternatives for tree regeneration with the presence of livestock and abundant game.

- The use of new plant shelters are proposed to save money and labor, such as the use of thorny shrubs or artificial spiny protectors.
- The company “Protector Erizo” (www.protectorerizo.com) has recently patented a new shelter that could be tested in some farms of the PRDN (Figure 7).



Figure 7. New thorny protectors for young trees in dehesas and other silvopastoral systems

- The plantation of inoculated and mycorrhized seedlings with Bohemian truffle (*Pisolithus tinctorius*; a powerful root simulator) could perform much better and cope with summer drought.
- The company “Viveros la Dehesa” (www.viverosladehesa.com) offered plants to be tested in farms with different kind of soils. **New oak pruning regimes** (e.g. criteria applied to stimulate acorn production) **should be explored to accomplish with the demand of new products, the economical context and with the state of the trees.** The importance of tree pruning for the acorn production at short-, mid-, and long-term remains mostly unknown.
- The **sudden oak death** should be now a priority for Forest Research Centers and Programs in SW Iberian Peninsula. The use of chemicals as chlorine dioxide and phosphites as foliar sprays, and soil liming need to be tested. Some legumes cultivated in dehesas, such as *Lupinus* sp, have been suggested as reservoirs of *Phytophthora cinnamomi* what needs more scientific evidences.



Forage resources

- To find **economical sources of proteins for animal feeding in dehesa is essential**, to avoid the soya-maize binomial.
- Sowing of **rainfed pastures rich in legumes** that persist (self-sown) under ecological and grazing conditions of dehesas. Local species and varieties need to be explored, selecting those best adapted to tree shade.

The Spanish company, based on Extremadura region, ASEDAGRO Asesoramiento y Desarrollo Agropecuario) offered multiple farms for the collaboration.

- To biologically control **acorn pests** through adaptation of grazing schemes.
- The use of **forage shrubs** to be used as a forage source for summer and winter periods is also propose as alternative to pruning and pollarding trees what has become too expensive and possibly harmful for the over-ageing tree population.
- The partial **cultivation of dehesa** to produce fodder should be readopted, and therefore selection of best adapted cereal and legume crops species to tree shade is a challenge. The use of stubble fields should be also recovered.



Animal production

- The genetic of livestock races is important for **selecting the races best adapted** to pasture seasonality, docility, browsing behaviour (low preference for young trees) ...
- **Livestock diversification** to optimize resources use and market opportunities: geese, turkeys and red deer are mentioned.
- Increase the **fertility ratios**. Semen quality evaluation and breeding bull illnesses.
- To reduce parasite load providing high quality water to livestock by **mobile troughs**. Allowing cattle access to dams/water holes results in rapidly deteriorating water quality causing a lower intake of water and higher potential to impact on animal health.
- Livestock health with special focus on the tuberculosis **re-infestation by wild animals** in drinking water points and areas of supplementary fodder provision. Mapping illnesses focuses and tracking possible infestation pathways.

Herding schemes

- **Matching stocking rates to forage resources availability and not to subsidies rules.**
- To recover some traditional practices as **overnight livestock folding** to improve soil and pasture quality.
- Grazing under the **Holistic Management** rules (managed fast rotational grazing)
Three farms willing to collaborate were identified
- **Precision grazing** by designing calendars for location of facilities (complementary fodder supplementation, water for drink, salt mineral blocks).
- **GPS herding** to assist precision grazing, protection of tree regeneration, control of livestock re-infestation by wild animals, monitoring livestock health. While the implementation of GPS to follow and analyze animal's activity is technically solved, the application of negative/positive stimuli to drive animal behaviour is still a big challenge.

Product diversification

- **Valuing new and old products** of dehesas and other similar agroforestry systems of high natural and cultural value.
- Using **sweet acorn oak genotypes** (with low tannin content) to produce high quality foods such gluten-free flavors, cakes, ice-creams, horchata (vegetal milk), oils rich in unsaturated fatty acids, ... Grafting oak was an old practice that needs to be recovered and updated.
The company "Biocream" (www.biocream.es) that produce organic creams and beverages has recently patented the horchata made with ground acorn, and is willing to collaborate with AGFORWARD project to explore consumer preferences and health benefits.
- Silviculture for **highly regarded edible mushrooms** as king bolete (*Boletus edulis* and others), Caesar's mushroom (*Amanita caesarea*), *Amanita ponderosa*, *Terfecia arenaria* ... which grow commonly in dehesas
- **Valuing of firewood and by-products** such as pruned branches and shrub understory.
- Managing and valuing **other dehesa products** such as oak honey (bees fed with oak honeydew), manufactured cork, aromatic and medicinal plants, natural tannins and dyes, etc.

Policy and governance

- **Specific regulations** for dehesas and other agroforestry systems.
- **Bureaucracy simplification** and centralization of dehesa administration.
- **Full eligibility of wood pastures** for Pillar I CAP payments.
- Public payment for **high cultural and natural values** of dehesa
- The need for a national federation of dehesa farmers was stressed and for that the creation of PRODEHESA was proposed to strength communication with policy makers from local to UE level.
- Acknowledgement of dehesas and extensive livestock husbandry as the subject or rural development plans.

Research and extension

- Creation of a **public research program** on dehesa and other silvopastoral systems.
- The need for a **permanent school** for dehesa managers.



Many of these ideas cannot be examined in AGFORWARD due to limitations of funding and skills, but participants were encouraged to work for new funds and links to work on specific areas of interest.

Some of the ideas that were judged to be outside the scope of the AGFORWARD project were:

- Tree health, and more specifically Sudden Oak Death.
- Genetic selection and livestock diseases
- Link among types of forage resources and meat and cheese quality.
- Payment by ecosystems services.
- Professionalization of farmers.

Some participants proposed studies comparing the profitability of extensive vs intensive livestock rearing and to discern the most critical needs of extensive livestock rearing to be more competitive and profitable. Most of the participants agreed that, by increasing the profitability of the dehesa farms, many of the open challenges would have an easy solution (because farmers would invest more in the farm). They also agreed that the payment for public ecosystems services provided by their dehesas would make them more profitable. However, most of them were very skeptical regarding the establishment of such payments in the near future. Moreover, some of them pointed out that the presence of high nature value in their dehesas had detrimental consequences for their economy because they have more limitations dictated by national and regional environment agencies. Although addressing these concerns is beyond the capacity and scope of AGFORWARD project, participants were informed that AGFORWARD could conduct (i) economical evaluation of

the innovations to be tested and (ii) some level of evaluation of ecosystem services provided by HNCA versus to monopastures, assuming the collaboration of PRDN members.

8. Prioritization of innovation proposals

Given that participants suggested a large number of topics and innovations to be explored in the AGFORWARD project and considering the large participation in the workshop, the discussions held during the stakeholder meeting were insufficient to select the 4-5 main innovations to be explored. It was therefore decided to prepare a form to be filled on-line by PRDN members to prioritize among the whole list of proposals. The list of proposals was created taking into account both the ideas raised during the stakeholder meeting and those noted in the questionnaires. Finally, a total of 54 proposals, grouped in 11 thematic blocks were listed and submitted by e-mail to PRDN members for their prioritization (see Annex 4). The groups of proposals were:

Forage autonomy and Improvement of pastures		Soil protection
Pastoral management	Protection of the trees	Ecosystem services
Livestock productivity	Productivity of the trees	Governance
New products	Market	Policy

We received 43 responses, with selected innovations to improve tree protection and regeneration as the most demanded, followed by ideas to improve pastoral management and to increase forage autonomy (Figure 8).

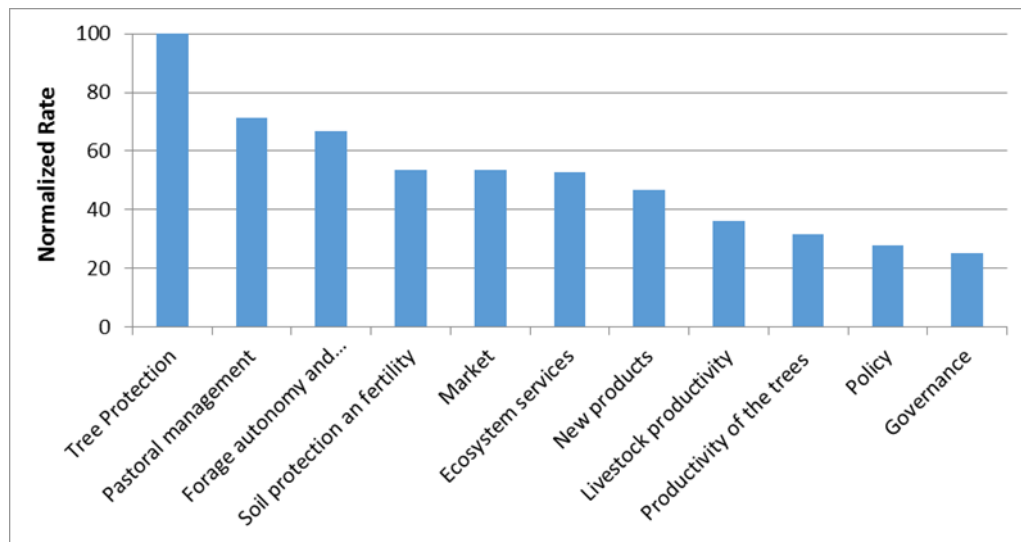


Figure 8. Prioritized list of themes that demand more innovations by stakeholders (n=43).

Regarding the specific measures, the most voted was the study of measures to prevent sudden oak death, which however cannot be studied in AGFORWARD project and deserve a specific multidisciplinary project that is being designed by national agencies. The following high-ranking proposals are listed in Table 4 and the whole list is in Table 5.

Table 3. The most highly ranked innovation proposals as indicated by the stakeholders (n=43).

Order	Thematic group	Innovation proposed	Normalized score
1	Tree protection	Prevention of sudden oak death	100.0
2	Tree protection	Tree regeneration: nursery shrubs	86.0
3	Tree protection	Tree regeneration: artificial thorny protectors	66.7
4	Tree protection	Tree regeneration: mycorrhized plants	65.6
5	Forage autonomy	Sown pastures rich in legumes	63.0
6	Pastoral management	Intensive rotational grazing	55.5
7	Forage autonomy	Fodder crops: triticale with double use	43.1
8	Marketing	Dehesa trademark	42.3
9	Tree protection	Tree regeneration: chemical and natural repellents	40.9
10	Pastoral management	Precision grazing – facilities	39.9

Table 4. Proposals of Innovations compiled in the Stakeholder Meeting and from the questionnaire. The proposals were grouped in 11 thematic groups and scored to prioritize them.

Innovations proposed	Normalised rates
Forage autonomy and Improvement of pastures	66.9
Fertilization	35.1
Sown pastures rich in legumes	63.0
Fodder crops: Legumes	37.8
Fodder crops: local varieties	27.8
Fodder crops: triticale with double use	43.1
Fodder crops: selection of best adapted to tree shade	27.2
Forage banks: shrubs	36.5
Pastoral management	71.4
Intensive rotational grazing	55.5
GPS herding	36.8
Overnight livestock folding	38.9
Precision grazing - Facilities	39.9
Transhumance	35.3
Tree Protection	100.0
Tree regeneration: artificial thorny protectors	66.7
Tree regeneration: mycorrhized plants	65.6
Tree regeneration: chemical and natural repellents	40.9
Tree regeneration: nursery shrubs	86.0
Prevention of sudden oak death	100.0
Curative measures for sudden oak death	28.0
Other pests and diseases	25.8
Shifting dense forest to dehesas	36.5
Productivity of the trees	31.6
Genetic selection to produce more acorns	26.7
Genetic selection of precocious oaks	21.5
Genetic selection to produce sweet acorns	14.5
Grafting procedures	10.7
Pruning schemes	18.0
Soil protection an fertility	53.7

Increase soil organic matter by cropping	28.9
Increase soil organic matter by herding	38.7
Increase soil organic matter with ramial wood chips	25.6
Livestock productivity	36.2
Animal fertility	20.5
Genetic selection of most productive animals	24.1
Genetic selection of most docile animals	24.8
Livestock health	16.8
Control of re-infestation with wild animal	24.4
Livestock welfare	14.9
New products	46.8
Valuing biomass	34.7
Aromatic and medicinal plants	22.0
Sweet acorns for human nutrition	32.0
Poultry husbandry	16.0
Honey / Mushroom	26.8
Public Ecosystem services	30.8
Ecosystem services	52.7
Landscape - Culture	36.2
Carbon sequestration	26.6
Biodiversity	37.1
Ecological footprint	22.0
Governance	25.1
Governance and Associations	17.4
Dehesa holding database and map	12.7
Public perception of dehesas values	13.4
Market	53.5
Tourism	25.5
Organic production	33.6
Food quality - Forage quality	27.0
Dehesa trademark	42.3
Green accounting - Payment for ecosystem services	26.3
Policy	28.0
Full eligibility of wood pastures	16.8
CAP payment for Comprehensive management agreements	15.5

Starting from this list, we have initiated the discussion with the farmers that offered their farms for testing different innovations. Some of the experiments agreed were:

1. Comparison of methods for tree regeneration that includes the study of nursery shrubs, artificial thorny protectors, chemical organic repellents and mycorrhized plants.
2. Comparison of fodder crops that include cereal varieties and pastures rich in legumes, with special focus on the selection of varieties adapted to oak shade.
3. Comparison of fast-intensive rotational grazing versus regular grazing aiming the soil and pasture improvement and the control of acorn pests.
4. The potential of facilities location for a better use of forage resources.
5. To explore the consumer acceptance for some new acorn-derived products and the interest of creating a dehesa trademark.

9. Conclusions

In this first phase of the project we aimed (i) to present the project to the potential stakeholders, (ii) to learn the stakeholder perception of agroforestry systems, and more specifically those of High Natural and Cultural Value, (iii) to compile a prioritized list of innovations that could help to improve the profitability and sustainability of dehesas, and (iv) to conform a Participatory Research and Development Network to test the proposed innovations and disseminate the results. This has been achieved thanks to the large and active participation of stakeholders in the first open meeting, to the responses to the questionnaires and to the comments back by PDRN members to the first draft of this report.

The discussion showed that dehesas can produce diverse high quality products and provide important ecosystems services. However, the low current profitability of the dehesa holdings, associated to the progressive degradation of soil, pasture and tree layer, endanger the persistence of this HNCA system. To overcome these difficulties the PDRN has identified a large list of innovations that could eventually reinforce the economical, ecological and social sustainability of dehesas. Finally these innovations have been prioritized and a set of them have been proposed to be tested and economically evaluated in cooperating farmers and companies.

10. References

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