BENEFITS AND CONSTRAINTS ASSOCIATED TO AGROFORESTRY SYSTEMS: THE CASE STUDIES IMPLEMENTED IN ITALY WITHIN THE AGFORWARD PROJECT

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Introduction

The Common Agricultural Policy (CAP) recognized that the establishment of agroforestry (AF) systems should be encouraged because of their high ecological and social value (EU Reg. 1698/2005). Traditional AF systems are still present in Europe, especially in Mediterranean countries (Mosquera-Losada et al. 2012). During the last decade, innovative practices have been investigated (Dupraz et al. 2005) in order to demonstrate both the profitability (Graves et al. 2007) and the environmental sustainability (Palma et al. 2007) of AF systems.

Within the FP7 European research project AGFORWARD – www.agforward.eu - the Participatory Research and Development Network (PRDN) methodology has been applied to different typologies of AF systems across Europe. The PRDN is a research method that strongly involves stakeholders (SHs) and, in this case, it was aimed to better understand and further develop the functioning of AF systems enabling research activities to respond to problems and opportunities as identified by local SHs.

In Italy the PRDN was implemented to assess perceptions of three AF systems, including grazing, each representative of the rural environments in particular regions:
 i) High Natural and Cultural Value Agroforestry Systems, in Sardinia region, with a focus on scattered oaks mixed with permanent or temporary pastures or intercropped with cereals and/or fodder crops;
ii) Agroforestry for High Value Systems, in Umbria region, with a focus on olive orchards intercropped with wild asparagus and grazed by poultry;
iii) Agroforestry for Livestock Farmers, in Veneto region, with a focus on organic free-range pigs combined with short-rotation coppice with poplar and willow growing for biomass production. This paper shows the main findings emerging from the use of the PRDN methodology in these case studies.

Material and methods

Three workshops (WS) were organized between June and September 2014, in Sardinia, Umbria and Veneto with 13, 13 and 22 participants, respectively. In each WS, SHs included representatives of: a) farmers who have already experienced AF systems or farmers willing to start a new AF project; b) professional associations, farm advisors, local policy makers; and c) AGFORWARD researchers.
In the first phase of each WS, participants were invited to talk about their experience and knowledge and to reflect upon the challenges and issues of current AF systems and practices in order to bring information about their opinions and priorities (qualitative data). Then, SHs were invited to fill a questionnaire in which several issues concerning benefits and constraints of AF systems were reported. The list of issues was grouped in the following categories: production (animal health and welfare, qualitative and quantitative productions of crops, animal and trees, etc.), management (mechanization, complexity of work, management cost, etc.), environment (biodiversity conservation, climate mitigation, landscape value, etc.) and socio-economy (income diversity, market opportunity, subside and grant eligibility, etc.). WS participants were

asked to rank each issue with positive or negative score from 1 to 10 according to their perceptions of how AF performs on each issue (quantitative data).

Data analysis
The key issues and challenges identified by SHs were analyzed as qualitative data to highlight the research topics to be addressed, and quantitative data was added by analyzing the responses to the questionnaire. As regards to the latter, the level of importance of an issue was expressed as Very Important (VI) when the score ranged between 1 and 4, Important (I) (5-7), Less Important (LI) (8-10), and Not Important (NO) when no answer was given. Different weights were assigned to each score: VI = 4; I = 3; LI = 2: NO = 1
The frequency of answers per each score class was calculated as well as the total score obtained from the sum of the frequency multiplied by the value of the relative score class. This analysis was performed in order to assess: i) the differences among the positive and negative total scores by categories of AF issues calculated in relation to the total number of participants (Kruskall-Wallis test, $P \leq 0.1$); ii) the differences among the positive and negative total scores by categories of issues calculated for each SH group, 24 farmers, 17 policy-makers, 7 researchers (Kruskall-Wallis test, $P \leq 0.05$); iii) the difference among the positive and negative scores related to each issue within the group ($\chi2$ test, $P \leq 0.1$).

Results
Key issues and challenges
According to the SHs, AF systems with grazing need to be further investigated to optimize the interactions among animals, pasture characteristics and trees species. Pastures should comprise a wide variety of palatable species, of both legumes and grasses, to guarantee a balanced and high quality feed for different animal species and physiological status (piglets, sows, chickens, lambs, sheep, etc.).

SHs claimed that appropriate management strategies such as stocking rate have to be modified to match the available resources, thus guaranteeing pasture quality, production and persistence. Tree varieties, tree spacing and density need to be modulated to allow both the natural regeneration of the woody species and the long-term pasture maintenance. SHs emphasized the need to adopt measures to control the negative impact of wild fauna on grazing animals. They felt that extensive management of silvopastoral systems produces high-quality products which meet consumers' demand, but that these systems have higher management costs, requiring a higher sale price than products from conventional agriculture (i.e. intensive livestock farming). SHs would thus appreciate labelling strategies to certify the AF origin of the products and, in turn, to justify the higher price. For small-scale farms, the development of local slaughtering and meat processing facilities would retain the value added close to the farm. Improvement of the local supply chain should consider the market channels used for smallholder production, the marketing problems faced by farmers and the opportunities to improve the quality and quantity of AF products.

SHs highlighted the need to implement communication tools (such as technical papers, seminars, demonstrative events, etc.) to share and increase knowledge on the adoption and management of AF systems. Farmers expressed the need for assistance in field-trials, complaining that the bureaucratic complexity of the CAP discourages them from applying for the grants available to establish new AF systems within the Rural Development Programmes of Italian Regions that implemented the measure 8.2 for the establishment of AF systems (Basilicata, Marche, Puglia, Umbria and Veneto).

Stakeholders' perceptions of AF systems
The positive and negative SHs' perceptions related to the four categories of issues (production, management, environment, socio-economy) are reported in **Table 1**. Positive and negative perceptions significantly differed only for the management category. The positive and negative perceptions of AF category issues (production, management, environment, socio-economy) were not statistically different among the three SHs groups (farmers, policy makers and researchers). When the positive and negative perceptions of the groups were analyzed within each issue category, significant differences were found for some AF issues.

Table 1. Differences between the positive and negative perceptions of SHs on AF issues by macro- categories (Kruskall-Walls test, P≤ 0,1)

Category of issues	Positive perceptions	Negative perceptions	
	Sum of weighted scores	Sum of weighted scores	X^2
Production	82.3	64.8	0.111
Management	57.7	85.2	0.009
Environment	68.3	56.0	0.122
Socio-economy	59.7	58.9	0.986

Regarding the positive perceptions (**Table 2**), farmers assigned higher scores to crop and pasture quality and business opportunities connected to the product diversification, while researchers assigned higher scores to the production of timber, wood and other goods, the conservation of biodiversity and wildlife habitat, the possible marketing premium related to AF products and the possibility to get subsides and grants within the EU CAP. Policy makers showed an intermediate perception concerning these issues.

Table 2. Weighted scores attributed by farmers, policy makers and researchers on the positive perceptions of AF issues (test χ^2, P≤0.1)

Issues	Farmers	Policy makers	Researchers		
	Weighted score	Weighted score	Weighted score	P	Weighted average
Crop or pasture quality/food safety	2.21	2.00	1.71	0.0863	1.97
Timber/wood/fruit/nut production	1.63	2.00	3.00	0.0212	2.21
Biodiversity and wildlife habitat	1.58	2.53	2.86	0.0900	2.32
Marketing premium	1.13	1.41	1.71	0.0591	1.42
Subsidy and grant eligibility	0.08	1.06	1.14	0.0185	0.76
Business opportunities	1.92	1.00	1.00	0.0860	1.31

Regarding the negative perceptions (**Table 3**), farmers perceived the loss of stock by predation and mechanization as the main negative aspects; policy makers highlighted the negative impact of management costs while researchers perceived the tree regeneration as the most relevant constraint.

Table 3. Weighted scores attributed by farmers, policy makers and researchers on the negative perceptions of AF issues (test χ2, P≤0.1).

Issues	Farmers	Policy makers	Researchers		
	Weighted score	Weighted score	Weighted score	P	Weighted average
Animal health and welfare	1.87	1.53	1.86	0.0544	1.75
Losses by predation	2.42	1.41	1.14	<0.001	1.66
Timber/wood/fruit/nut quality	1.04	1.12	1.43	<0.001	1.19
Management costs	1.50	2.71	1.43	0.0059	1.88
Mechanisation	2.29	1.76	1.14	0.0647	1.73
Tree regeneration/survival	1.91	2.53	3.29	0.0229	2.58
Market risk	1.79	1.71	1.86	0.0543	1.78

Discussion

The key issues and challenges perceived by the SHs participating at the WS can be summarized as follows:

the need to improve management skills, focusing on optimizing synergies among the components of the systems and increasing qualitative and quantitative productivity of the systems;

the need to enhance the economic value of AF products, through the identification of viable and marketable AF products and the implementation of a value chain for AF products;

the need to raise SHs' awareness of AF systems by communication and sharing of knowledge among SHs and educational training for farmers, students and professionals.

In relation to the SHs' perceptions of positive and negative aspects of AF systems, the study highlighted that SHs consider AF systems as multifunctional systems able to guarantee both qualitative and quantitative production of various goods, respecting the environment, especially the biodiversity conservation.

Nevertheless, some constraints such as the higher management costs and the mechanization problems, in comparison to conventional agriculture systems, still negatively affect farmers' willingness to adopt AF systems.

Moreover, differences, among the three WSs, which were not analyzed at this stage, will need to be further detected.

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