



Agroforestry for Livestock Farmers: Synthesis of System Descriptions

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1 Context

Integration of trees with livestock production can be a sustainable way to increase the productivity of land and to provide greater ecosystem services and environmental benefits than disaggregated agricultural and woodland systems. However, very little data are available regarding silvopastoral agroforestry systems and there is lack of knowledge on how such systems are constructed and managed, and how they perform in relation to farm profitability and delivering public goods.

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 in relation to a Participative Research and Development Network (PRDN) that focuses on agroforestry for livestock farmers (Work-package 5). The PRDN has the following objectives:

- i. to identify examples of the best practices, key challenges and innovations to address challenges identified by the stakeholder groups within the PRDN. This has been addressed by eight initial stakeholder reports available through the “agroforestry for livestock farmers” webpage of the AGFORWARD project (AGFORWARD, 2016).
- ii. to describe and explain the key inputs, outputs and ecosystem services flows for case studies,
- iii. to agree within the PRDN, the key innovations or improvements in knowledge needed in order to promote adoption of high value tree systems. This has been addressed by Hermansen et al. (2015).
- iv. to agree and implement within the PRDN an experimental protocol to develop and test proposed innovations at existing experimental plots and through on-farm experiments. This has been addressed by Hermansen (2015);
- v. to provide and promote guidelines for farmers on how to establish economically viable agroforestry practice in livestock systems.

This report addresses objective “ii” in that it synthesizes the key inputs, outputs, and ecosystem service flows outlined in eight system description reports (Table 1). The reports cover three sectors (poultry, pig- and ruminant systems) as each has its own specific user-groups and constraints. The descriptions provide a database for further analyses and can provide inspiration for livestock farmers who are considering establishing new agroforestry systems.

Table 1. Eight system description reports focused on agroforestry for livestock farmers provide the basis for this report

Bestman M (2015). System Report: Agroforestry for Organic Egg Production in the Netherlands. November 2015. 9 pp. http://www.agforward.eu/index.php/en/agroforestry-for-poultry-systems-in-the-netherlands.html
Bondesan V (2015). System Report: Agroforestry for Free-Range Pig Production in Veneto Region, Italy. December 2015. 16 pp. http://www.agforward.eu/index.php/en/free-range-pigs-with-energy-crops-italy.html
Kongsted AG, Hermansen JE (2015). System Report: Agroforestry for Free-Range Pig Production in Denmark. October 2015. 7 pp. http://www.agforward.eu/index.php/en/free-range-pigs-integrated-with-energy-crops.html
Luske B (2015). System Report: Agroforestry for Ruminants in the Netherlands. November 2015. 9 pp. http://www.agforward.eu/index.php/en/fodder-trees-for-cattle-and-goats-in-the-netherlands.html
Mosquera-Losada MR, Domingues NF, Fernandez-Lorenzo JL, Gonzales-Hernandez P, Rodrigues AR (2016). System Report: Fodder Tree Evaluation in Galicia, Spain. January 2016. 8 pp. http://www.agforward.eu/index.php/en/agroforestry-with-pigs-in-galicia-spain.html
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Smith J, Gerrard C (2015). System Report: Agroforestry for Ruminants in England. October 2015. 12 pp. http://www.agforward.eu/index.php/en/agroforestry-with-ruminants-uk.html
Smith J, Gerrard C, Westaway S (2016). System Report: Poultry Agroforestry in the UK. February 2016. 11 pp. http://www.agforward.eu/index.php/en/Poultry-systemUK.html

2 Overview of systems

Eight systems have been described: there are two poultry agroforestry systems which focus on egg production (Table 3), three systems including pigs, and three systems including cattle (Table 3).

Table 2. Overview of the key provisioning, regulating, and cultural services associated with two poultry-based agroforestry systems

Livestock species and country	Tree species	Ecosystem services			Reference	
		Provisioning		Regulating		Cultural
		Livestock products	Tree products			
Poultry						
The Netherlands	Fruit trees, willow	Eggs	Fruit (table and juice)	Shelter for hens, biodiversity, reduce nutrient leaching,	Diversified jobs	Bestman (2015)
UK	Native broadleaves and conifers	Eggs	Wood chips for bioenergy	Shade and shelter for hens, functional biodiversity, N-fixation	Jobs, diversified landscape	Smith et al. (2016)

Table 3. Overview of the key provisioning, regulating, and cultural services associated with three pig-based and three ruminant-based agroforestry systems

Livestock species and country	Tree species	Ecosystem services				Reference
		Provisioning		Regulating	Cultural	
		Livestock products	Tree products			
Pigs						
Italy	Poplar, willow, chestnut	Pork meat	Timber, woodchips for energy or for bedding-rooting material	Reduce risk of nutrient leaching, shade and shelter for pigs	Jobs (alleviate abandonment of land), diversified landscape	Bondesan (2015)
Spain	Mulberry	Pork meat	Feed (proteins)	Reduce temperature fluctuations, carbon sequestration, biodiversity	Jobs	Mosquera-Losada et al. (2016)
Denmark	Poplar and willow	Pork meat	Woodchips for energy or for bedding-rooting material	Reduce risk of nutrient leaching, shade and shelter for pigs	Diversified landscape	Kongsted and Hermansen (2015)
Ruminants						
France	Ash, white mulberry, walnut, wild cherry	Milk, meat	Feed (leaves) , wood chips (bioenergy) timber	Shade and shelter for livestock, nutrient cycling, nitrogen-fixation	Diversified landscape	Novak and Emile (2015)
The Netherlands	Willow, alder	Milk	Feed (leaves) , wood chips (bioenergy)	Drainage, shade, N-fixation, biodiversity	Jobs, diversified landscape	Luske (2015)
UK	Willow, poplar, hazel, alder	Meat, milk	Feed (leaves), wood chips (bioenergy)	Shade and shelter for livestock, nutrient cycling, nitrogen-fixation , functional biodiversity	Jobs, diversified landscape	Smith and Gerrard (2015)

3 Degree of maturity and commercialization

The systems described represent different degree of practical implementation.

In relation to poultry production, the Netherland case study comprises a commercial organic enterprise where fruit trees have been planted in the required outdoor area. Because the owner has had difficulties in managing the fruit trees for fruit, the proposed innovation is to use willow as an alternative tree crop (Bestman 2015). The UK system represents also a well-developed commercial system for “woodland egg” production, where the presence of trees results in either a price-premium or the ability to secure specific contracts with wholesalers and/or retailers. The specific system described is investigating the importance of the type of trees and how to maintain an efficient under-storey sward (Smith et al. 2016).

The agroforestry pig system in Denmark focuses on a relatively-large commercial organic pig farm (Kongsted and Hermansen 2015), although only very few pig farmers have implemented trees in the foraging area. The focus on this farm is to investigate strategies to reduce nutrient leaching from the area and search for opportunities to make use of the tree products in a profitable way. The Italian system (Bondesan 2015) represents a commercial system for a relatively-small free-range pig farm. The described system has been established at two research and demonstration units where the focus is on tree protection from the sows and growers, respectively, and to document the possible practical management and production results. In Spain the work is focusing on a novel way to find supplemental feeds for high quality pig production in forest areas where chestnut and oak trees are dominant (Mosquera-Losada et al. 2016).

Considering the ruminant systems, the systems in the Netherlands represent the most developed, being practiced at a commercial organic dairy farm and where a particular achievement seems to be the impact of willow and alder on drainage of wet soil, which in fact increase utilization of the grass sward (Luske 2015). The ruminants systems in UK (Smith and Gerrard 2015) and France (Novak and Emile 2015) represent experimental systems for research and demonstration with focus on type of trees and the layout, management and type of under-storey, and the productivity and potential of leaves for feed.

4 Conclusion

Eight livestock agroforestry systems have been described in detail in a way that can be easily used by practitioners and agricultural advisors and thus serve as inspiration and background material for livestock farmers who want to establish agroforestry systems. The reports describe practical management issues and challenges as well as perceived public benefits.

5 Acknowledgements

The AGFORWARD project (Grant Agreement N° 613520) is co-funded by the European Commission, Directorate General for Research & Innovation, within the 7th Framework Programme of RTD, Theme 2 - Biotechnologies, Agriculture & Food. The views and opinions expressed in this report are purely those of the writers and may not in any circumstances be regarded as stating an official position of the European Commission.

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