Agroforestry in Europe
Practice, research and policy

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10) Universidad de Santiago de Compostela, Spain; 11) AGROOF, France

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Agroforestry in Europe: Practice, Research and Policy

Content

1. The **practice** of agroforestry in Europe
2. Some **research** from the AGFORWARD project
3. Some important **policy** issues

The Practice of Agroforestry

Reclaimed arable land on the Vallevecchia farm in the Veneto region of Italy is flat, open, and exposed with few trees

The Practice of Agroforestry

The landowner explained that they are practising agroforestry by planting tree rows on every third drainage ditch, e.g. every 90 m


Integrating commercial production of organic oats with organic apples in Eastern England with 27 m alleys

Farming in the Pontben catchment in Wales

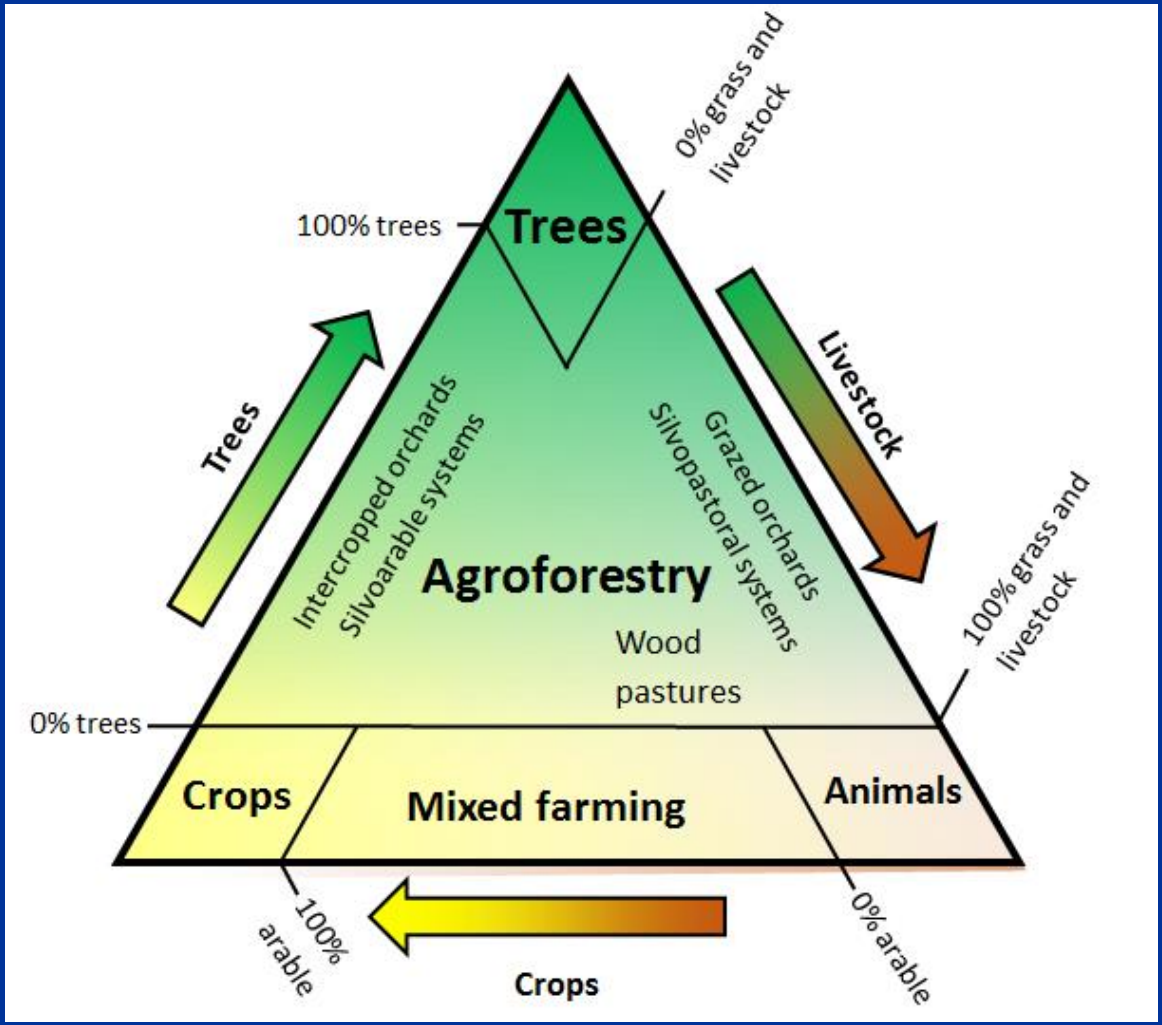
Sheep and wild cherry trees in Galicia

Chicken amongst trees in the UK

Montado and cattle in Portugal

Agroforestry:

the deliberate integration of woody vegetation with **pasture (consumed by animals) or an agricultural crop**

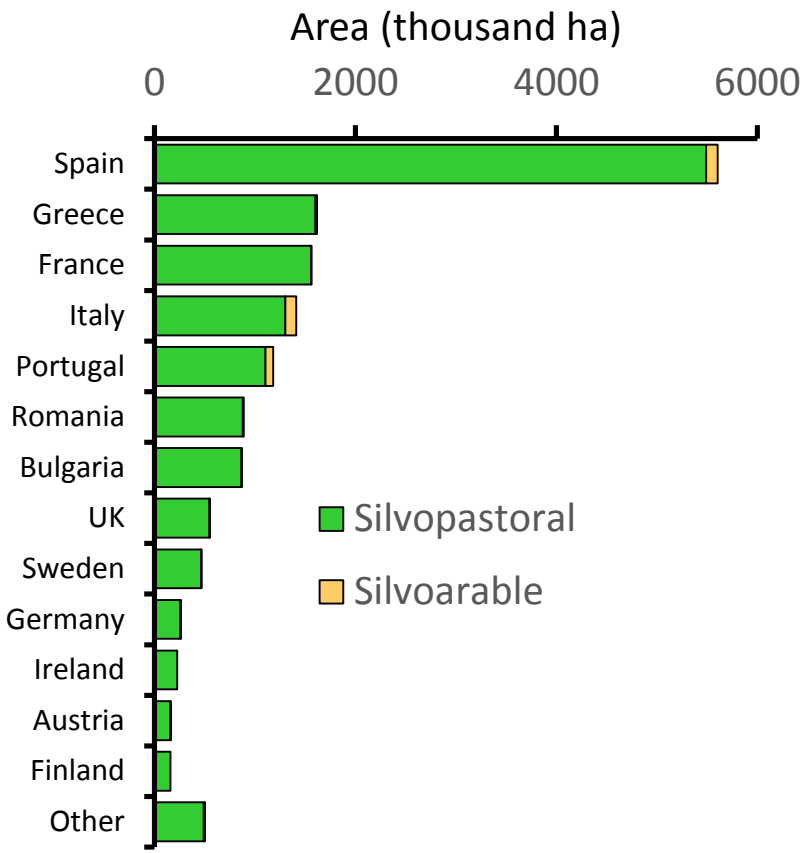


The woody species can be **evenly or unevenly** distributed or occur on the border of plots.

Agroforestry types

Silvopastoral	Silvoarable			
				
Combining trees and shrubs with forage and animal production	Widely spaced trees and shrubs inter-cropped with annual or perennial crops			

Extent of agroforestry in Europe



Area of agroforestry: Using LUCAS data:15.4 Mha (3.6% of total area and 8.8% of agricultural area) (den Herder et al. 2017) (excludes 1.8 Mha of homegardens).

Five agroforestry types

Silvopastoral	Silvoarable	Hedgerows, windbreaks and riparian buffer strips	Forest farming	Home-gardens
				
Combining trees and shrubs with forage and animal production	Widely spaced trees and shrubs inter-cropped with annual or perennial crops	Lines of trees/ shrubs bordering farmland to protect livestock, crops, and/or soil and water quality	Forested areas used for harvest of speciality crops	Trees/ shrubs with veg. in urban areas (1.8 Mha)

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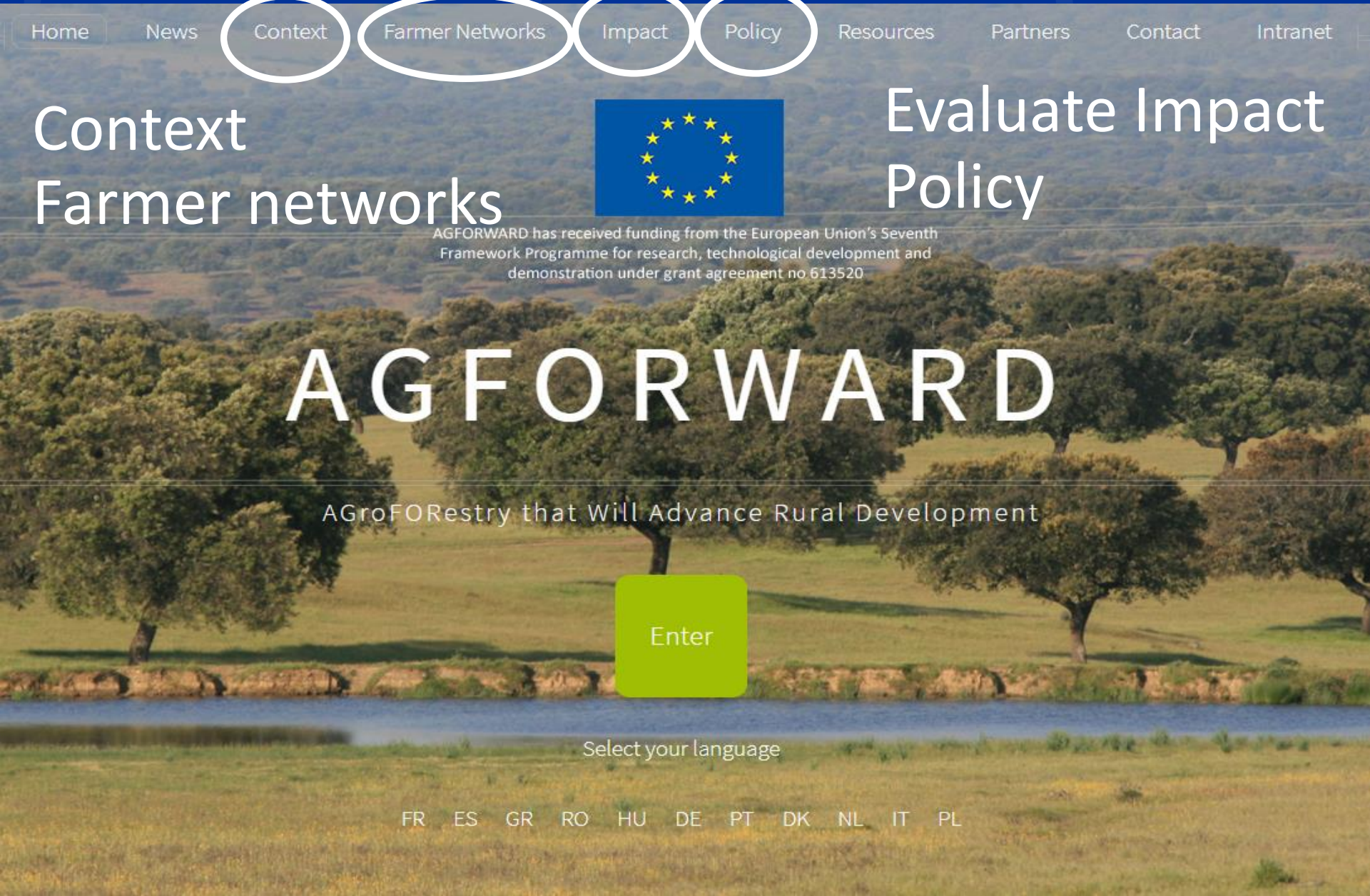
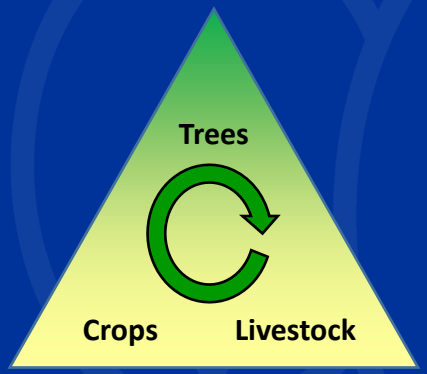
www.agforward.eu describes the outputs

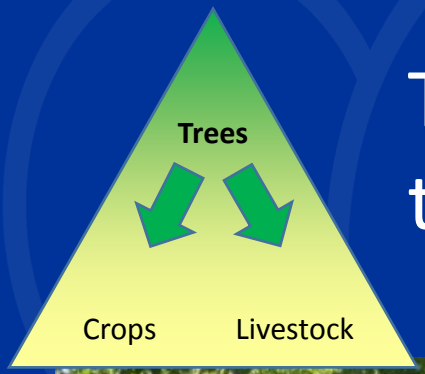




Ten Farmer networks: high nature and cultural value agroforestry

Use of GPS and adapted forest management with reindeer in Sweden

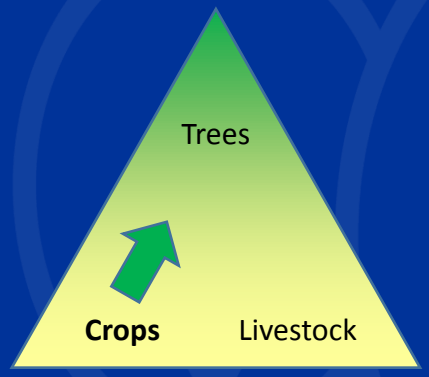
Effect of tree density on livestock carrying capacity in Iberian wood pastures



Ten farmer networks: agroforestry for tree systems like walnut and apples

Beneath walnut trees in Spain, grazing with sheep (relative to mowing) and intercropping legumes (relative to unfertilised grass) increased carbon storage and tree diameter growth

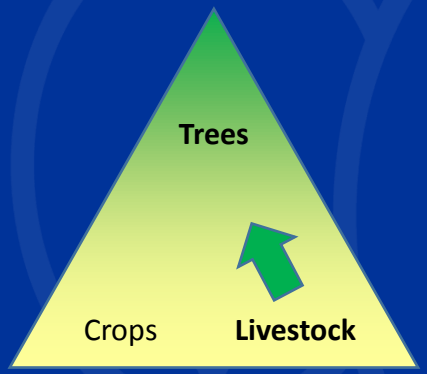
Sheep in cider apple orchards in the UK and France can reduce mowing costs



Eleven farmer networks: agroforestry for arable systems

Benefits of fescues & legumes, wild flowers and mulches in tree rows

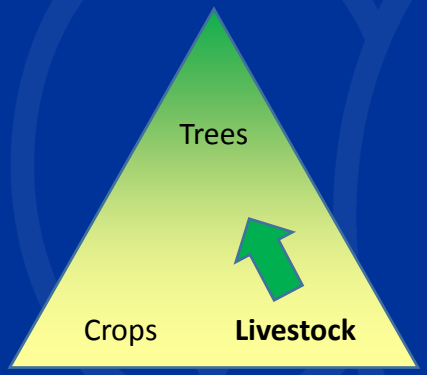
Shelter benefits on crop yields in Germany



Nine farmer networks: agroforestry for livestock systems

Tree fodder with dairy cows in France

- Establishment of a tree fodder database describing its nutrients for livestock
- Crude protein can reach 220 g/kg in black locust, chestnut, white mulberry, and ash. White mulberry and ash, which also have high digestibility, could be included in cattle diets (Emile et al. 2017)

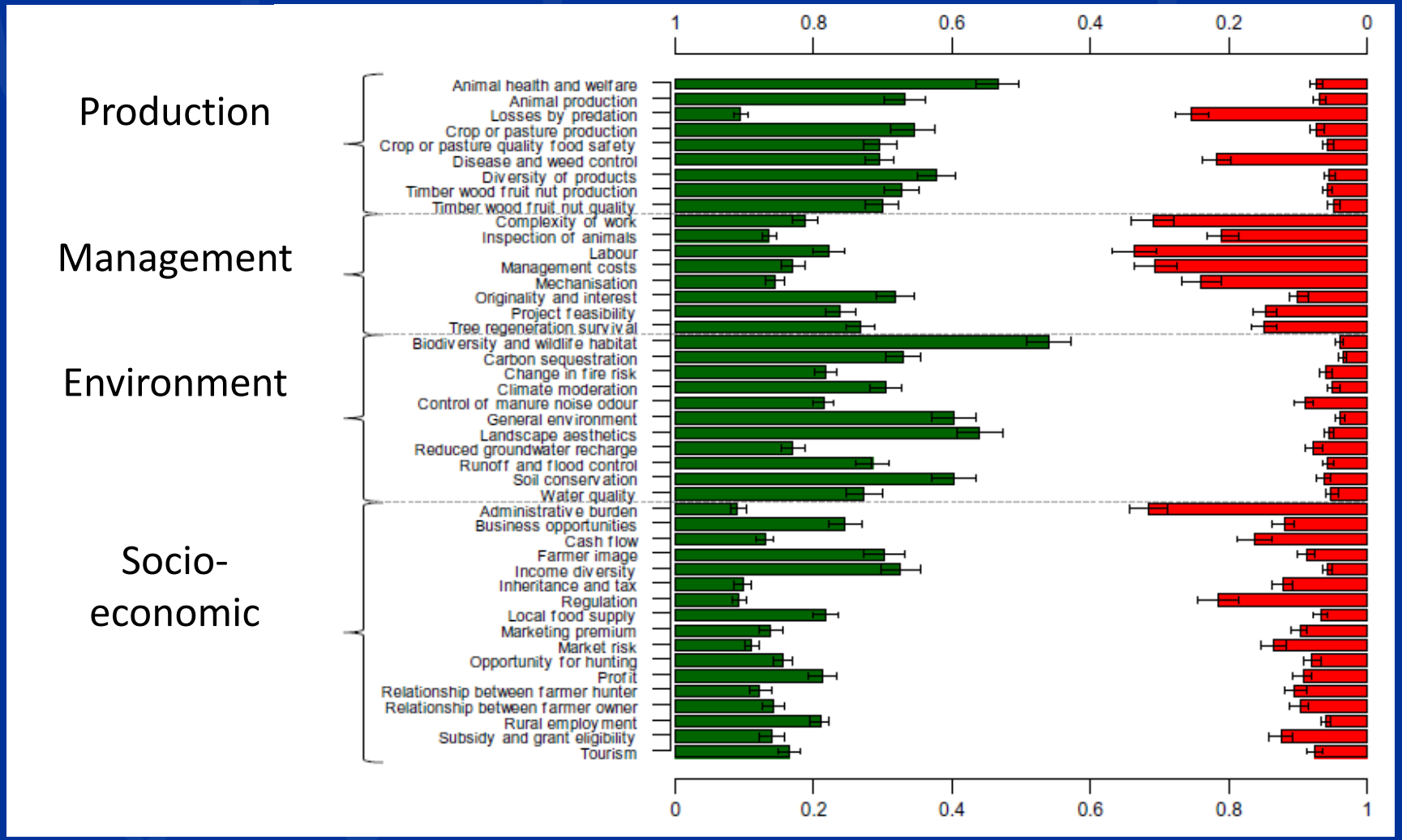


Nine farmer networks: agroforestry for livestock systems

Woodland eggs in the UK

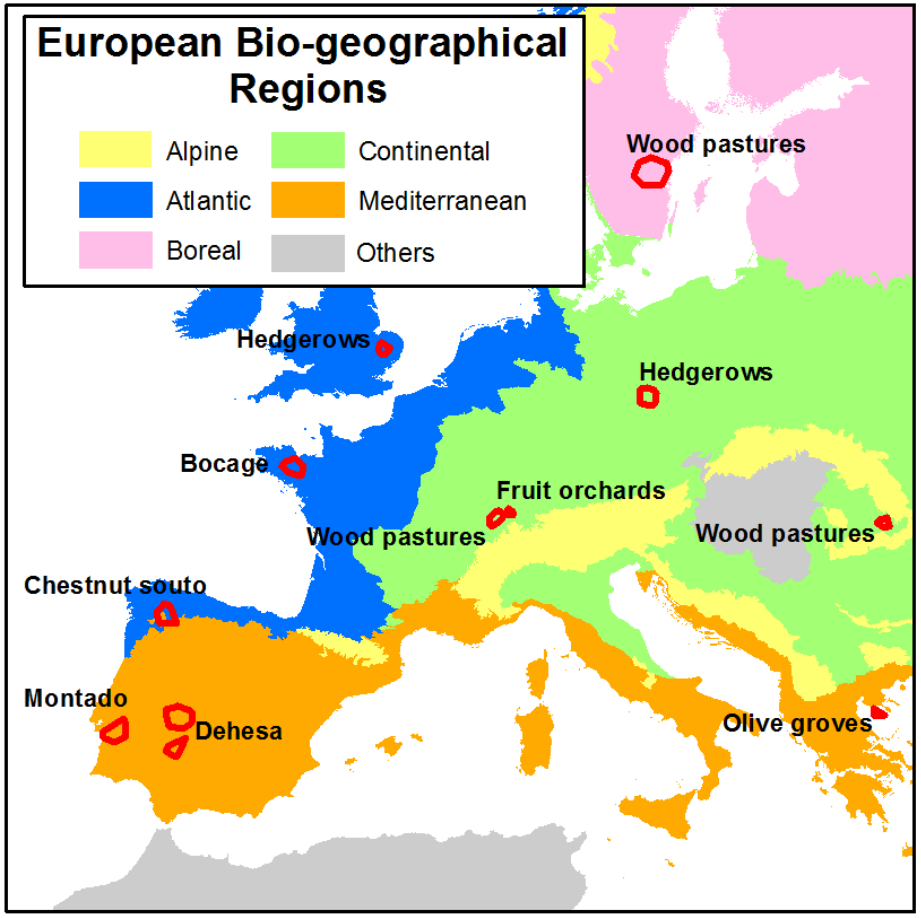
Tree cover makes chickens use their range area more evenly, with more even distribution of mature. Less feather pecking damage is seen. Less waterfowl are seen in the free-range area which can be a risk for transmitting avian flu

Farmer's opinions of the positives and negatives



Positive and negative perceptions of agroforestry (Garcia de Jalon et al. 2017) based on 30 stakeholder groups (comprising 344 stakeholders) on the positive (green bars on the left, bottom axis) and negative issues (red bars on the right, top axis) related to selected agroforestry systems across Europe.

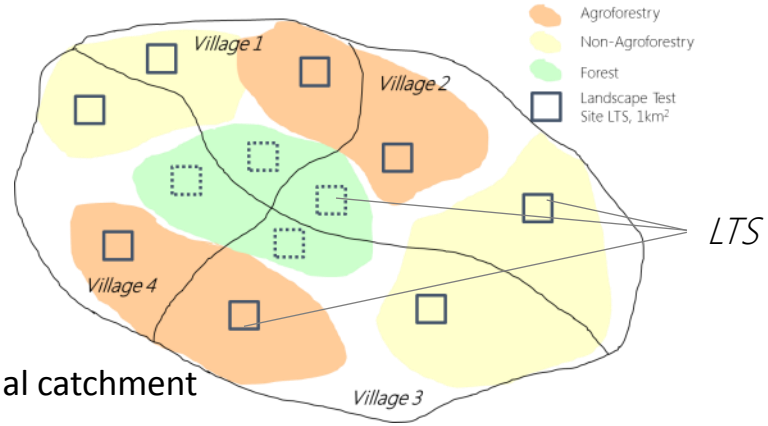
Modelling the impact of landscape agroforestry in twelve European regions



Kay et al. (2017) Agroforestry Systems

Twelve case study regions in Europe

- Atlantic (3)
- Mediterranean (4)
- Continental (4)
- Boreal (19



Social catchment

- **Landscape Test Sites** (LTS), 8-12 x 1 km²
  - Habitat mapping
  - Modelling biophysical benefits
- **Social catchment**, 50–200 km², 5–6 municipalities
  - Public Participation Geographic Information System (PPGIS)
  - Deriving socio-cultural benefits

Does European agroforestry provide **biodiversity and biophysical** benefits?

Fruit Orchards, Central Europe

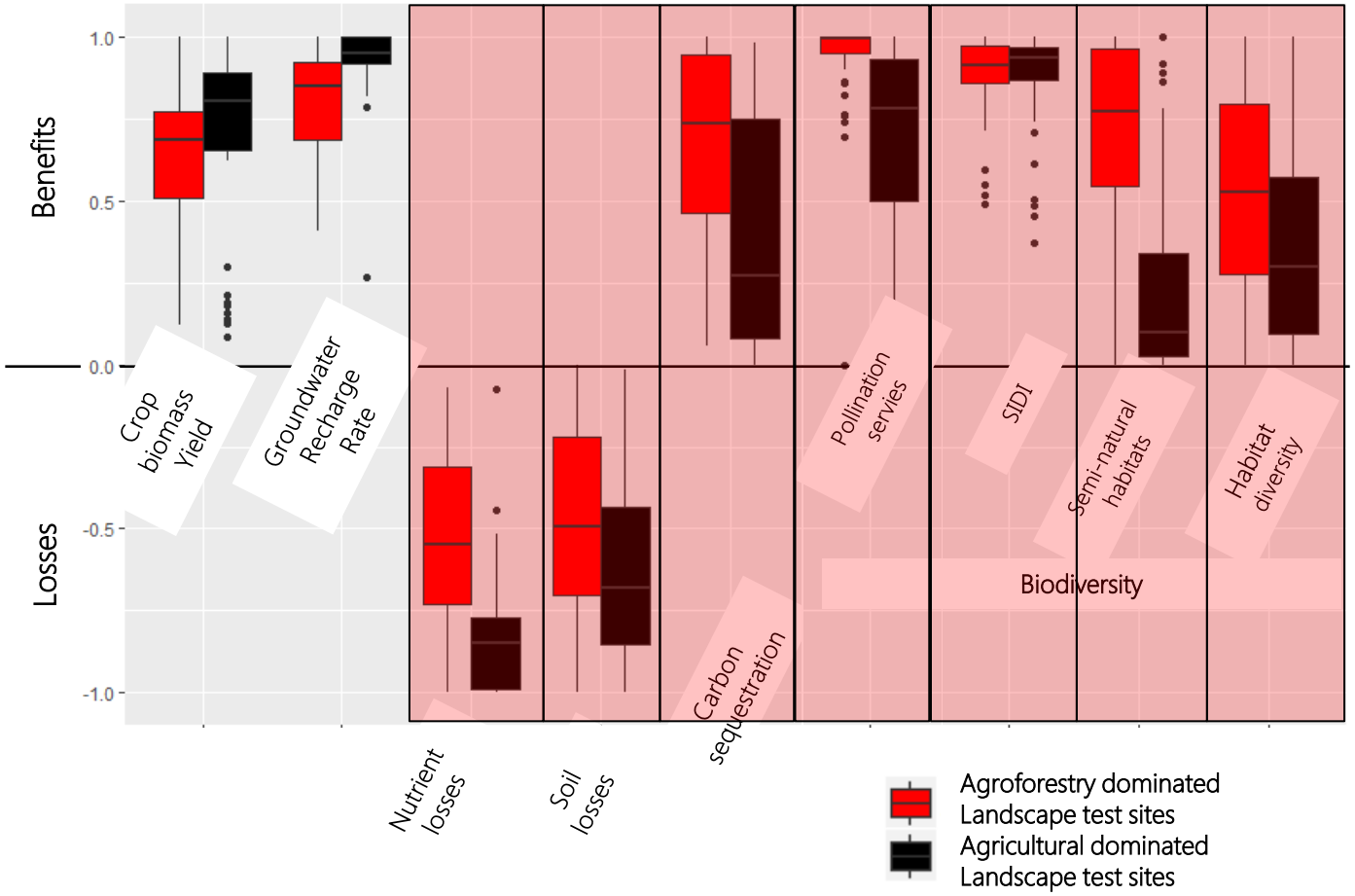
AF - LTS

NAF - LTS

Modelled Ecosystem Services

- Biomass yield
- Groundwater recharge rate
- Nutrient retention
- Soil preservation
- Carbon sequestration
- Biodiversity
  - Functional biodiversity (Pollination)
  - Habitat diversity

Yes!- Agroforestry enhances biodiversity and biophysical ecosystem services



Agroforestry dominated landscapes

- better nutrient retention
- higher carbon sequestration
- higher soil preservation
- higher pollination services
- higher proportions of semi-natural habitats

Agricultural dominated landscapes

- higher annual crop biomass yields
- higher groundwater recharge rates

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Review of current policy and recommendations to support uptake

Extent and Success of Current Policy Measures to Promote Agroforestry across Europe

Project name	AGFORWARD (613520)
Work-package	8: Agroforestry Policy Development
Deliverable	Deliverable 8.23: Extent and success of current policy measures to promote agroforestry across Europe
Date of report	29 September 2016 (small corrections: 8 December 2016)
Authors	Rosa Mosquera-Losada, Jose Javier Santiago Freijanes, Andrea Pisanelli, Mercedes Rois, Jo Smith, Michael den Herder, Gerardo Moreno, Nina Malignier, Javier Ruiz Mirazo, Norbert Lamersdorf, Nuria Ferreiro Domínguez, Fabien Balaguer, Anastasia Pantera, , Antonio Rigueiro-Rodríguez, Pilar Gonzalez-Hernández, Juan Luis Fernández-Lorenzo, Rosa Romero-Franco, Anja Chalmin, Silvestre Garcia de Jalon, Kenisha Garnett, Anil Graves, Paul J Burgess
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Approved	Paul Burgess (30 September 2016)

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How can policy support the uptake of agroforestry in Europe?

Project name	AGFORWARD (613520)
Work-package	8: Agroforestry Policy Development
Deliverable	Deliverable 8.24: How can policy support the appropriate development and uptake of agroforestry in Europe?
Date of report	7 September 2017
Authors	Maria Rosa Mosquera-Losada, Jose Javier Santiago Freijanes, Andrea Pisanelli, Mercedes Rois, Jo Smith, Michael den Herder, Gerardo Moreno, Norbert Lamersdorf, Nuria Ferreiro Domínguez, Fabien Balaguer, Anastasia Pantera, Vasilios Papanastasis, Antonio Rigueiro-Rodríguez, Jose Antonio Aldrey, Pilar Gonzalez-Hernández, Juan Luis Fernández-Lorenzo, Rosa Romero-Franco, Nic Lampkin, Paul J Burgess
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Reviewed	Paul J Burgess (7 September 2017)

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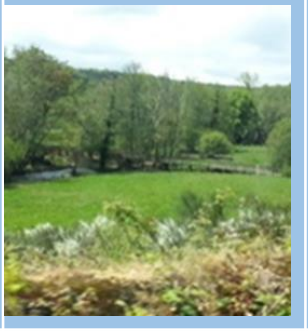
Mosquera-Losada et al. (2016 and 2017)

Designating between agroforestry on agricultural land and on forest land

Agroforestry on agricultural land			Agroforestry on forest land		Urban areas
Silvopasture	Hedgerows, windbreaks and riparian buffer strips	Silvoarable	Silvopasture	Forest farming	Home gardens
					
Wood pasture Meadow orchards Grazed orchards		Alley cropping	Forest grazing		Allotments, Gardens

(Mosquera-Losada et al. 2017)

Farmers want to ensure that maintain Pillar I payments in the Common Agricultural Policy

CAP	Agricultural land	Forest land	Urban area
Pillar I – direct payments	Payments for farmers who maintain land in good agricultural and environmental condition	No payment	No payment
Pillar II – Rural Development	Up to 27 measures that can support agroforestry including one "agroforestry" measure		

Some summaries of policy recommendations

Recommendation 5

In Pillar I, because of the environmental and societal benefits of trees on farms, agroforestry on arable and pasture land should be fully eligible for direct payments

Some summaries of policy recommendations

9. **In Pillar II, t**he current 27 measures linked to agroforestry should be grouped together in one place
11. Given the increasing risk of forest fires, there should be support for silvopasture (forest grazing), within the agroforestry measure
12 Result-based payments can be delivered if agroforestry is implemented at a farm-scale

Summary: Agroforestry in Europe: Practice, Research and Policy

1. The practice of agroforestry in Europe is more important than you think
2. Farmers recognise the animal welfare, soil conservation, carbon, and biodiversity benefits, and administration as a constraint
3. There are policies that can be implemented to support joined-up effective land-use use

References

AGFORWARD (2016). AGFORWARD website. www.agforward.eu

Burgess PJ, Crous-Duran J, den Herder M, Dupraz C, Fagerholm N, Freese D, Garnett K, Graves AR, Hermansen JE, Liagre F, Mirck J, Moreno G, Mosquera-Losada MR, Palma JHN, Pantera A, Plieninger T, Upson M (2015). AGFORWARD Project Periodic Report: January to December 2014. Cranfield University: AGFORWARD. 95 pp. http://www.agforward.eu/index.php/en/news-reader/id-27-february-2015.html

Cannell MGR, van Noordwijk M, Ong CK (1996). The central agroforestry hypothesis: the trees must acquire resources that the crop would not otherwise acquire. Agroforestry Systems 34: 27-31.

den Herder, M., Burgess, P.J,., Mosquera-Losada, M.R., Herzog, F., Hartel, T., Upson, M., Viholainen, I. and Rosati, A. (2015). Preliminary stratification and quantification of agroforestry in Europe. Milestone Report 1.1 for EU FP7 Research Project: AGFORWARD 613520. (22 April 2015). 57 pp

den Herder, M., Moreno, G., Mosquera-Losada, R.M., Palma, J.H.N., Sidiropoulou, A., Santiago Freijanes, J.J., Crous-Duran, J., Paulo, J.A., Tomé, M., Pantera, A., Papanastasis, V.P., Mantzanas, K., Pachana, P., Papadopoulos, A., Plieninger, T., Burgess, P.J. (2017) . Current extent and stratification of agroforestry in the European Union. Agriculture, Ecosystems and Environment 241: 121–132.

Emile JC, Delagarde R, Barre P, Niderkorn V, Novak S (2017). Evaluation of the feeding value of leaves of woody plants for feeding ruminants in summer. 19th EGF Symposium on "Grassland resources for extensive farming systems in marginal regions: major drivers and future scenarios", Alghero, Sardinia (Italy) Grassland Science in Europe, vol 22, 548-550.

EU DG Agri (European Commission Directorate-General for Agriculture and Rural Development) (2014). Guidance document on the land parcel identification system under articles 5, 9, and 10 of Commission Delegated Regulation (EU) 640/2014: Claim Year 2015

Fagerholm N, Torralba M, Burgess PJ, Plieninger T (2016). A systematic map of ecosystem services assessments around European agroforestry. Ecological Indicators 62: 47–65.

Fagerholm, Nora, Elisa Oteros-Rozas, Christopher M. Raymond, Mario Torralba, Gerardo Moreno, and Tobias Plieninger. 2016. “Assessing Linkages between Ecosystem Services, Land-Use and Well-Being in an Agroforestry Landscape Using Public Participation GIS.” *Applied Geography* 74 (August). Elsevier Ltd: 30–46. doi:10.1016/j.apgeog.2016.06.007.

Fagerholm, Nora, Mario Torralba, Gerardo Moreno, Marco Girardello, Felix Herzog, Stephanie Aviron, Paul Burgess, et al. 2017. “European Cross-Site Analysis of Place-Based Ecosystem Services in Multifunctional Rural Landscapes.” Submitted.

García de Jalón, S., Burgess, P.J., Graves, A., Moreno, G., McAdam, J., Pottier, E., Novak, S., Bondesan, V., Mosquera-Losada, M.R., Crous-Durán, J., Palma, J.H.N., Paulo, J.A., Oliveira, T.S., Cirou, E., Hannachi, Y., Pantera, A., Wartelle, R., Kay, S., Malignier, N., Van Lerberghe, P., Tsonkova, P., Mirck, J., Rois, M., Kongsted, A.G., Thenail, C., Luske, B., Berg, S., Gosme, M., Vityi, A. (2017). How is agroforestry perceived in Europe? An assessment of positive and negative aspects among stakeholders. Agroforestry Systems. DOI 10.1007/s10457-017-0116-3

Graves, A.R., Burgess, P.J., Palma, J.H.N., Herzog, F., Moreno, G., Bertomeu, M., Dupraz, C., Liagre, F., Keesman, K., van der Werf, W. Koeffeman de Nooy, A. & van den Briel, J.P. (2007). Development and application of bio-economic modelling to compare silvoarable, arable and forestry systems in three European countries. Ecological Engineering 29: 434-449.

References

Hermansen J (2015). Synthesis of the Research and Development protocols related to Agroforestry for Livestock Systems. Milestone Report 22 (5.3) for EU FP7 Research Project: AGFORWARD 613520. 2 October 2015. 5 pp. http://www.agforward.eu/index.php/en/synthesis-of-the-research-and-development-protocols-related-to-agroforestry-for-livestock-systems.html

Hermansen JE, Kongsted AG, Bestman M, Bondesan V, Gonzalez P, Luske B, McAdam J, Mosquera-Losada MR, Novak S, Pottier E, Smith J, van Eekeren N, Vonk M, Burgess PJ (2015). Agroforestry Innovations to be evaluated for Livestock Farmners. Milestone 5.2 (MS 21) for EU FP7 Research Project: AGFORWARD 613520. 10 pp. http://www.agforward.eu/index.php/en/agroforestry-innovations-to-be-evaluated-for-livestock-farmers.html

Kirby, K.J. (2003). What might a British forest-landscape driven by large herbivores look like? Report No 530. English, (530), pp.1–53.

Mirck J, Cirou E, Camilli F, Crossland M, Dalla Valle C, Fernandez Lorenzo JL, Ferreiro-Dominguez Lorenzo N, Gonzalez-Hernandez P, Gosme M, Hannachi Y, Herzog F, Howlett S, Jäger M, Mosquera Losada MR, Moreno G, Pantera A, Paris P, Pisanelli P, Rigueiro Rodriguez A, Smith J, Tsonkova P, Vityi A, Wartelle R, Wolfe M, Burgess PJ (2015). Agroforestry Innovations to be evaluated for Arable Farmers. Milestone 4.2 (MS15) for EU FP7 Research Project: AGFORWARD 613520. 11 pp. http://www.agforward.eu/index.php/en/agroforestry-innovations-to-be-evaluated-for-arable-farmers.html

Kay S, Crous-Duran J, Garcia de Jalon S, Graves A, Palma JHN, Roces-Diaz JV, Szerencsits E, Weibel R, Herzog F (2017). Landscape-Scale Modelling of Agroforestry Ecosystems Services: A Methodological Approach." Submitted.

Kay S, Crous-Duran J, García de Jalón S, Graves A, Ferreiro-Domínguez N, Moreno G, Mosquera-Losada MR et al. (2017). "Spatial Similarities between European Agroforestry Systems and Ecosystem Services at the Landscape Scale." Agroforestry Systems. doi:10.1007/s10457-017-0132-3.

Mirck J, Burgess PJ (2015). Synthesis of the Research and Development protocols related to Agroforestry for Arable Systems. Milestone Report 16 (4.3 for EU FP7 Research Project: AGFORWARD 613520. (1 October 2015). 13 pp http://www.agforward.eu/index.php/en/synthesis-of-the-research-and-development-protocols-related-to-agroforestry-for-arable-systems.html

Moreno G, Berg S, Burgess PJ, Camilli F, Crous-Duran J, Franca A, Hao H, Hartel T, Lind T, Mirck J, Palma J, Amaral Paula J, Pisanelli A, Seddaiu G, Thenail C, Tsonkova P, Upson M, Valinger E, Varga A, Viaud V, Vityi, A (2015a). Innovations to be examined for High Nature and Cultural value Agroforestry. Milestone 2.2 (MS 3) for EU FP7 Research Project: AGFORWARD 613520. 20 pp. http://www.agforward.eu/index.php/en/innovations-to-be-examined-for-high-nature-and-cultural-value-agroforestry.html

Moreno G, Aviron S, Berg S, Bertomeu M, Bustos P,Cáceres Y, Escribano M, Franca A, Gaspar P, Hartel T, Juárez E, Lind T, Mantzanas K, Mesías FJ, Mirck J, Pacheco Faias S, Palma JHN, Pantera A, Papadopoulos A, Papanastasis V, Paulo JA, Popa R, Porqueddu C, Pulido F, Rákosy L, Seddaiu G, Thenail C, Tomé M, Tsonkova P, Upson M, Valinger E, Varga A, Viaud A, Vityi A, Burgess PJ (2015b). Synthesis of the Research and Development protocols related to High Nature and Cultural Value Agroforestry. Milestone Report 4 (2.3) for EU FP7 Research Project: AGFORWARD 613520. 16 October 2015. 22 pp http://www.agforward.eu/index.php/en/synthesis-of-the-research-and-development-protocols-related-to-high-nature-and-cultural-value-agroforestry.html

References

Mosquera-Losada, M.R., Santiago Freijanes, J.J., Pisanelli, A., Rois, M., Smith, J., den Herder, M., Moreno, G., Malignier, N., Mirazo, J.R., Lamersdorf, N., Ferreiro Domínguez, N., Balaguer, F., Pantera, A., Rigueiro-Rodríguez, A., Gonzalez-Hernández, P., Fernández-Lorenzo J.L., Romero-Franco, R., Chalmin, A., Garcia de Jalon, S., Garnett, K., Graves, A., Burgess, P.J. (2016). Extent and success of current policy measures to promote agroforestry across Europe.Deliverable 8.23 for EU FP7 Research Project: AGFORWARD 613520. (8 December 2016). 95 pp.

Mosquera-Losada, M.R., Santiago Freijanes, J.J., Pisanelli, A., Rois, M., Smith, J., den Herder, M., Moreno, G., Lamersdorf, N., Ferreiro Domínguez, N., Balaguer, F., Pantera, A., Papanastasis, V., Rigueiro-Rodríguez, A., Aldrey, J.A., Gonzalez-Hernández, P., Fernández-Lorenzo, J.L., Romero-Franco, R., Lampkin, N., Burgess, P.J. (2017). Deliverable 8.24: How can policy support the appropriate development and uptake of agroforestry in Europe? 7 September 2017. 21 pp. http://www.agforward.eu/index.php/en/how-can-policy-support-the-uptake-of-agroforestry-in-europe.html

Pagella T, Kmoch L, Leudeling E, Mulia R, Sinclair F (2014). Agroforestry from Mediterranean Partner Countries: Report on possible technology transfer from Mediterranean Partner countries to European countries. (Eds. M den Herder and P.J. Burgess). Deliverable for EU FP7 Research Project: AGFORWARD 613520. 35 pp. http://www.agforward.eu/index.php/en/agroforestry-in-north-africa.html

Palma JHN (2015). CliPick: Project Database of Pan-European Climate Data for Default Model Use. AGFORWARD 613520. 10 October 2015. 22 pp. http://www.agforward.eu/index.php/en/clipick-project-database-of-pan-european-simulated-climate-data-for-default-model-use.html

Palma J.H.N, Graves A.R., Bunce R.G.H., Burgess P.J., de Filippi R., Keesman K.J., van Keulen H., Liagre F., Mayus M., Moreno G., Reisner Y., Herzog F. (2007) Modelling environmental benefits of silvoarable agroforestry in Europe. Agriculture, Ecosystems and Environment 119, 320 – 334.

Pantera A, Burgess PJ, Corroyer N, Ferreiro-Domínguez N, Fernández Lorenzo JL, González-Hernández P, Graves AR, McAdam J, Moreno G, Mosquera Losada MR, Rigueiro Rodríguez A, Rosati A, Upson M (2015a). Innovations to be examined for Agroforestry for High Value Tree Systems. Milestone 3.2 (MS 9) for EU FP7 Research Project: AGFORWARD 613520. 14 pp. http://www.agforward.eu/index.php/en/agroforestry-innovations-to-be-examined-for-high-value-tree-systems.html

Pantera A, Mosquera Losada MR, Ferreiro-Domínguez N, Fernández Lorenzo JL, González-Hernández P, Rigueiro Rodríguez A, Corroyer N, McAdam J, Rosati A, Moreno G, Graves A, and Burgess PJ (2015b). Synthesis of the Research and Development protocols related to Agroforestry for High Value Tree Systems. Milestone Report 10 (3.3 for EU FP7 Research Project: AGFORWARD 613520. (2 October 2015). 10 pp. http://www.agforward.eu/index.php/en/synthesis-of-the-research-and-development-protocols-related-to-agroforestry-with-high-value-trees.html

Reisner, Y., R. de Filippi, F. Herzog, and J. Palma. 2007. “Target Regions for Silvoarable Agroforestry in Europe.” Ecological Engineering 29 (4): 401–18. doi:10.1016/j.ecoleng.2006.09.020.

Rois Díaz, M., Lovrić, N., Lovrić, M., den Herder, M., Graves, A.R., Pisanelli, A., Mosquera Losada, M.R., Ferreiro Rodríguez, N., García de Jalón, S., Vityi, A., Varga, A., Burgess, P.J. (2017). Environmental and socio-economic framework conditions of agroforestry in different regions in Europe. Deliverable Report 1.3 for EU FP7 Research Project: AGFORWARD 613520. (10 April 2017). 100 pp.

Torralba, M., Fagerholm, N., Burgess, P.J., Moreno, G., Plieninger, T. (2016). Do European agroforestry systems enhance biodiversity and ecosystem services? A meta-analysis. Agriculture, Ecosystems and Environment 230: 150-161.