

Agroforestry and the CAP: a land use system to be promoted to fulfil Sustainable Development Goals

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Abstract

Agroforestry understood as the deliberately integration of woody vegetation in at least two vertical layers on land, with the bottom layer providing an agricultural product (such crops or forage/pasture which may be consumed by animals) is gaining popularity in different statements to be promoted as sustainable land use practice or system. Main advantages of agroforestry are related with the better use of the resources, starting by radiation, which allows to increase productivity while reducing negative environment impacts. Different international organizations are also pointing out the relevance of agroforestry for climate mitigation and adaptation. In this paper the main reasons for considering agroforestry as sustainable land use system is discussed under the umbrella of the United Nations Sustainable goals.

Keywords: resource optimization use, perennials, ecosystem services

1. Introduction

Individuals, societies and governments in the European Union have numerous high level societal goals. One of the most comprehensive frameworks for considering these goals is the Sustainable Development Goals which is a collation of 17 goals which encompass environmental, social and economic aspects of human well-being (United Nations, 2015). Based on reviews of the literature and as discussed by Mosquera-Losada *et al.* (2016b), agroforestry can play a key role in at least nine of these goals, which are being mainstreamed in the EU's internal and external policies.

Agroforestry, defined as the deliberately integration of woody vegetation an agricultural product in at least two vertical layer has different practices, known as silvoarable, silvopasture, hedgerows and riparian buffer strips, homegardens and forest farming (Mosquera-Losada *et al.* 2009).

The aim of this study is to review the role of agroforestry in Europe to fulfil the Sustainable Development Goals and place them in the last high level documents launched by the Commission such as Cork Declarantion.

2. Materials and methods

The paper was carried out by reviewing the Sustainable Development Goals and a series of papers to identify examples and good practices linked to agroforestry that fulfil sustainable goals, but also through the evaluation of documents available in the FAO, ICRAF, EURAF and European Commission documents.

3. Results and Discussion

The European Commission agreed through 7th Environment Action Programme (EAP), to step up its efforts to protect our natural capital, stimulate resource-efficient, low-carbon growth and innovation, and safeguard people's health and wellbeing as indicated the Executive Director of the European Environment Agency, Hans Bruyninckx in the conference "last Europe's Response to Sustainability Challenges delivering the 2030 Agenda" (EEA 2016). Three priorities have been detailed by Mr. Bruynincks on behalf of the European Commission:

1. Priority Objective 1: natural capital (SDGs 6 (clean water and sanitation), 14 (life below water), 15 (life on land));
2. Priority Objective 2: resource-efficient, low-carbon economy (SDGs 7 (affordable and clean energy), 8 (decent work and economic growth), 9 (industry, innovation and infrastructure), 11 (sustainable cities and communities), 12 (responsible consumption and production), 13 (climate action));
3. Priority Objective 3: risks to health and wellbeing (SDGs 2 (Zero hunger), 3 (good health and well-being)).

Agroforestry is directly or indirectly related to these three priorities linked to different sustainable development goals (SDGs).

Priority 1 dealing with natural capital and linked to water quality is clearly promoted by agroforestry. Agroforestry practices have the capacity to explore deeper soil layers than treeless areas, therefore a huge amount of living roots able to uptake the excess of nutrients applied by farmers when fertilizing and recycling them within the system providing and increasing fertility. Moreover, tree roots are able to increase water infiltration avoiding runoff and nutrient losses linked to soil erosion, improving water quality and soil fertility. Life of land is improved through the promotion of plant biodiversity linked to the agroforestry establishment (Buttler *et al.* 2009). Biodiverse plant decomposition can be associated to the creation of microhabitats at belowground level enriching the biodiversity of microorganisms and invertebrates linked to those specific microhabitats, improving soil health, stability and organic matter (Rois *et al.* 20107).

Priority 2 associated to resource-efficient and low-carbon economy is linked to SDGs 7 affordable and clean energy through the use of renewable energy. Tree and shrubs are able to produce higher amounts of biomass with better calorific quality than herbaceous vegetation. This woody biomass can be used as renewable energy contributing to low carbon economy linked to circular but also bioeconomy frameworks. The introduction of woody perennials in a tree-less system increases the productivity per unit of land, and, if adequately managed, the amount of products, contributing therefore to the increase of employment and economic growth (SDG 8). Innovation promotion is key to the agroforestry concept where different value chains have to be linked to infrastructure and industry creation (SDG 9) associated to the different products of the agroforestry practices and systems. Agroforestry is also supporting SDG 11 (sustainable cities and communities) mainly to the homegarden agroforestry practice. There are associations of communities in urban and periurban areas on which woody perennials (usually fruit trees) are usually linked to vegetable production in households. This food has an enormous value if produced in a huge amount of houses as it will reduce the pressure on agricultural lands and the need of costly transport from an economic and environment point of view. Moreover, homegardens have a therapeutic value for citizens. Producing vegetables by urban and periurban citizens will contribute to SDG 12 as it will conduct to a responsible consumption and production that will improve the recognition of farmers and the role they play. Agroforestry has been recognized as one of the most powerful tools to mitigate and adapt climate change, so one of the most simplest and useful forms to fight against climate change (Mosquera-Losada *et al.* 2016). Agroforestry practices mitigation facilities are based on the capacity they have to sequester carbon and to avoid carbon releases. Woody perennials combined with herbaceous vegetation are more prone to use more light than treeless systems, therefore to sequester more carbon stored in glucose molecules from photosynthesis, translocate it to roots, that, when decomposing, are the main source of soil organic carbon (Mosquera-Losada *et al.* 2008). On the other hand, agroforestry, in areas with high fire risk, can definitively reduce carbon emissions to the atmosphere as a fire risk prevention tool. Silvopastoralism, the combination of grazing animals in forest and shrublands, is able to reduce

fuel in both areas, while using this fuel as a valuable feed resource during shortage periods. The use of this agroforestry practice should be promoted to avoid carbon release to the atmosphere, but also to avoid loss of human beings when uncontrollable big fires appear (i.e. Galicia in 2006 with almost one hundred thousand hectares fires in three days or Portugal in 2017 with more than fifty thousand hectares fired in four days).

Priority 3 is associated to risks to health and wellbeing. SDG 2 linked to Zero hunger can be supported by agroforestry as this technique allows a better and increased use of the light therefore the obtention of multiple products. But also, Agroforestry allows farming systems being more resilient when catastrophic events appears (floodings, frosts, unusual extreme heats), therefore ensuring the production during difficult times. Moreover, the capacity of agroforestry recycling nutrients, and the promotion of the adequate combination of species reduces fertilizer (soil fertility is better maintained by the increase of organic matter and the uptake of nutrients from the bottom to the upper soil layers) and herbicide and pesticides needs (Homar-Sánchez *et al.* 2014), improving healthy food production and therefore linked to the good health and well-being that should be promoted as SDG 3.

Besides the SDG there are other large number of European level initiatives including the Pan-European Biodiversity and Landscape Strategy (PEBLDS, 2015), the European Convention on Landscapes, and the European Climate Change Programme (ECCP) Mosquera-Losada *et al.* (2016a) that would be benefited by the implementation of agroforestry practices

Most recent CAP drivers highlighted by the European Commission are Cork 2.0 and UN goals. The Cork 2.0 Declaration launched in September 2016 was established by different policy actors included EURAF and strongly support the participation of all type of farmers dealing with agricultural and forestry lands as key actors to develop a sustainable agriculture, the recognition of traditional heritage agricultural systems, the inclusion of forestry within the EU agrarian policy, the need of enhancing ecosystem services from agriculture, the reduction of the impact of climate change through mitigation and adaptation and highlighted the importance of the extension of integrated systems (Cork Declaration 2016), among which agroforestry has to play role.

The recent Cork 2.0 Declaration in September 2016 identified other policy initiatives (where agroforestry can play a key role) such as recognition of traditional agricultural systems, the consideration of forestry within EU farm policy, and the need to enhance ecosystem services from agriculture whilst reducing the impact of climate change.

4. Conclusion

Agroforestry is a key tool to be fostered to fulfil the SDG proposed by the European Commission, including preservation of natural capital, resource-efficient, low-carbon economy and improving health and well-being.

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