System Description:
Silvoarable Agroforestry in Greece

Project name	AGFORWARD (613520)
Work-package	4: Agroforestry for arable farmers
Specific group	Silvoarable Agroforestry in Greece
Deliverable	Contribution to Deliverable 4.10 (4.1): Detailed system description of a case study system
Date of report	10 February 2016
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Contents

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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 contributes to Objective 2, Deliverable 4.10: "Detailed system description of case study agroforestry systems". The detailed system description includes the key inputs, flows, and outputs of the key ecosystem services of the studied system. It covers the agroecology of the site (climate, soil), the components (tree species, crop system, management system) and key ecosystem services (provisioning, regulating and cultural) and the associated economic values. The data included in this report will also inform the modelling activities which help to address Objective 3.

2 Background

Agroforestry is a traditional land use system in Voio, northwestern Greece, in which farmers integrate agricultural production with high value tree species on the same area of land. In this way they ensured a steady economic return each year irrespective of weather conditions. The area is characterized by fast growing species (poplars) and walnuts planted inside or at the edges of small farms where dry beans and cereals are cultivated or pastures are established for grazing.

Poplars (black or hybrids) are widely-spaced in arable lands with good soils and are sometimes irrigated with water from artificial canals coming from a local river. However the most common practice is the establishment of poplars along watercourses or around arable fields, cultivated with vegetables or other crops resulting in traditional silvoarable systems. Poplars are used for timber production but also serve as boundary markers and wind breaks (Papanastasis et al. 2009). Another silvoarable practice, well adapted to irrigated farms and river bank areas, is the use of black poplar growing along the boundaries of the vegetable gardens. In addition to diversifying the income of the farmer, black poplars serve for soil conservation, create wildlife habitats and enhance the landscape. Any decrease in vegetable production due to the shade is compensated by increased protection from the winds. Schultz et al. (1987) argues that this practice should be promoted because it provides timber, which is in short supply in Greece.

Walnut is combined with grapevines, cereals, lucerne, vegetables or dry beans resulting in traditional silvoarable systems (Mantzanas et al. 2006). The species is widely used in Greece. According to Papanastasis et al. (2009) walnut is a commonly cultivated tree species in the sub-Mediterranean and mountainous Mediterranean zones of the country. It is planted in arable lands either in pure stands or more commonly within arable fields or on their borders, alone or in mixture with other trees. It is usually combined with several crops, especially vines and cereals. In the former case it makes typical silvoarable; in the latter typical agrosilvopastoral systems are created that include

livestock grazing after the harvest of the cereals. It is rarely used to establish pure silvopastoral systems. Walnut trees are used for nut production, high quality timber, and fuelwood.

3 Update on field measurements

Field measurements described in the research and development protocol (Mantzanas et al. 2015) began in early May 2015 and will continue until the end of 2016. All measurements have been and will be conducted by researchers from the TEI Stereas Elladas in collaboration with Aristotle University of Thessaloniki, Greece.

4 System description

Table 1 provides a general description of the silvoarable agroforestry system.

Table 1. General description of silvoarable agroforestry systems in Greece

General description of system	
Name of group	Silvoarable agroforestry in Greece
Contact	Kostas Mantzanas
Work-package	4: Agroforestry for arable farmers
Associated WP	None
Geographical extent	Traditional silvoarable systems can be found all over Greece and cover about 1 million hectares (Papanastasis et al. 2009) but modern systems are rare and are mostly experimental. An example is the research site located in the village of Sisani, Voio, Western Macedonia, Greece.
Estimated area	The total area of the research site is about 400 ha.
Typical soil types	Lithosols – Campisols
Description	Agroforestry is a traditional land use system in Voio, in which farmers integrate agricultural production with high value tree species on the same piece of land. The area is characterized by fast growing species (poplars) and walnuts planted inside or at the edges of small farms where dry beans and cereals are cultivated or pastures are established for grazing.
Tree species	Poplar (*Populus nigra* and various hybrid clone); walnut (*Juglans regia*) and cherry (*Prunus avium*)
Tree products	Wood for fruit packages Fruits from walnut and cherry trees
Crop species	Grapevines, cereals, alfalfa, vegetables, and common beans
Crop products	Crops can be harvested on an annual basis
Animal species	Sheep
Animal products	Milk and meat production
Other products	Possibility for intercrops with aromatic plants
Regulating services	Trees provide a microclimate which protect from frost and extreme temperatures Trees can promote nutrient cycling and increase carbon storage
Habitat services and biodiversity	Many animal species can use the trees and the edges for habitat resulting in increased biodiversity
Cultural services	The modern silvoarable practice may improve the quality of crop production and reduce the management cost.
Key references	See end of report

Descriptions of the case study systems are provided in Table 2. The two systems (walnut trees intercropped with beans and cherry trees intercropped possibly with aromatics) are managed by a farmer. The total area that the farmer cultivates is 2 ha including the above systems. The bean cultivation is very labour intensive from the preparation of the plot (from mid-April) until the bean harvest (mid-November). All this work is done by the farmer in order to reduce the costs of production.

Table 2. Description of the specific case study system

Specific description of site	
Area	1 ha (trees were established in March 2015)
Co-ordinates	40°26'10.56''N and 21°29'39.56''E
Site contact	Kostas Mantzanas
Email	konman@for.auth.gr
Example photograph	

Figure 1. Planting of beans between walnut

Aerial photograph of systems

Figure 2. Aerial photograph showing the layout of the walnut-bean system

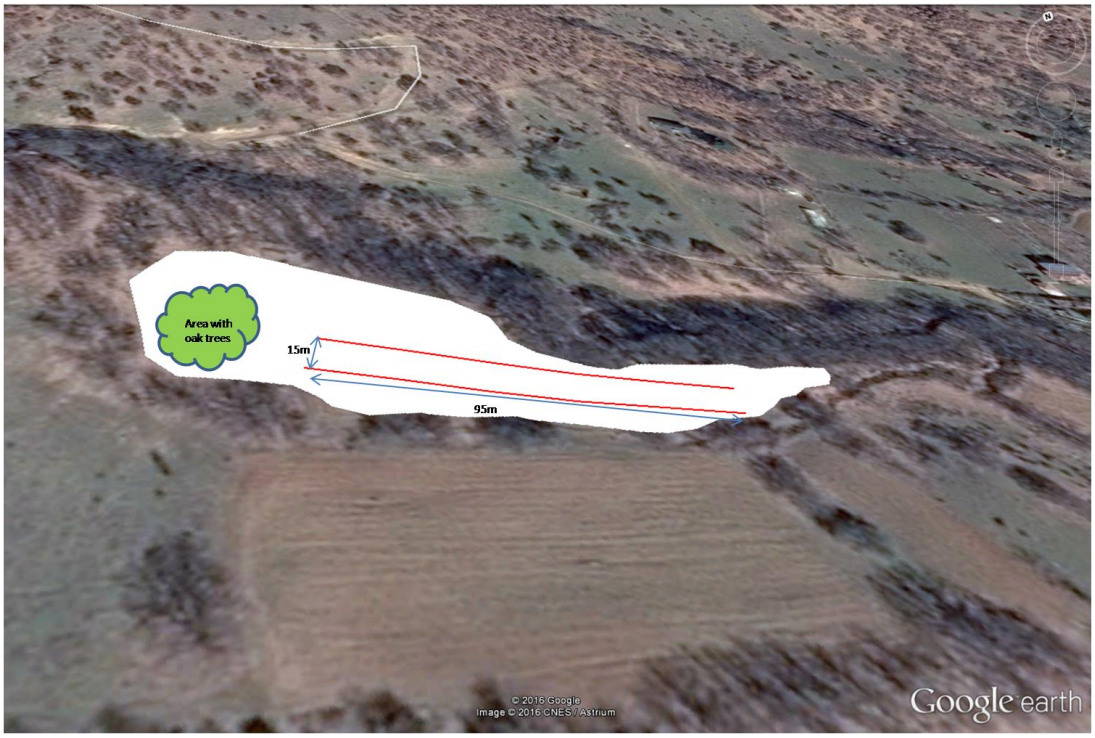

Figure 3. Aerial photograph showing the layout of the cherry trees plantation

Climate characteristics	
Mean monthly temperature	12.9°C
Mean annual precipitation	508 mm
Details of weather station	Hellenic National Meteorological Service, Station of Kozani, Data from 1955-1997
Soil type	
Soil type	
Soil depth	Approximately 0.7 m
Soil texture	Sandy silt
Additional soil characteristics	pH: 5.58 Organic matter: 3.73%
Aspect	Northwest – Southeast
Tree characteristics	
Species and variety	Walnut (*Juglans regia*) Wild cherry (*Prunus avium*)
Date of planting	Early spring 2015
Intra-row spacing	5 m
Inter-row spacing	15 m
Tree protection	None
Crop understory characteristics	
Species	Common beans (*Phaseolus vulgaris*)
Management	Conventional arable crop management with ploughing
Typical crop yield	1-1.5 t ha^{-1}
Fertiliser, pesticide, machinery and labour management	
Fertiliser	None
Pesticides	None
Machinery	Need for tractor access in crop alleys to allow soil preparation
Manure handling	None
Labour	Trees: replacement of dead trees and tree line management for weed protection Crops: the management and harvesting of crops is done by hand
Fencing	None, but is necessary in order to protect trees from livestock and wild animals

5 Description of tree component

The research site comprises two arable plots. There is a 0.6 ha site planted with walnut trees (*Juglans regia*) at the end of March 2015 which is intercropped with common beans. There is also a 0.4 ha site planted with cherry trees (*Prunus avium*) and it will be intercropped with aromatic plants (spring period).

In the 0.6 ha plot, three tree rows were established with an inter-row distance of 15 m (Figure 2). The tree distance within the row is 5 m. In total, 54 walnut trees were planted .The mean height of trees was 0.50 m and the mean diameter (at a height of 20 cm) was 15 mm at the establishment phase.

In the 0.4 ha plot, two rows of cherry trees were established at the same inter-row (15 m) and intra-row (5 m) distance as the first plot. In total 40 trees were planted. The mean height was 2 m and the mean diameter (in a high of 20 cm) was 20 mm at the establishment phase. During the first year of

the establishment only 20 cherry trees were survived. The main reason was the soil moisture during the planting phase. The soil depth is about 50 cm and although the soil was wet at planting in March 2015, the months after tree planting were very dry. The dead trees will be replaced in March 2016.

6 Description of crop component

The 0.60 ha plot was intercropped with common beans (*Phaseolus vulgaris*), which were sown on 15 May 2015 and they were harvested on 10 November 2015 (Figure 1). The yield was 1000 kg ha^{-1}, lower than the average for the area which is about 1500 kg ha^{-1}. The lower yield was probably due to a lack of fertilizers and pesticides application. It was the farmer's decision to not use any fertilizer and pesticides. The second plot will be planted with roses in the spring of 2016.

7 Acknowledgements

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8 References

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