

Deliverable 1.2

Resilience indicators

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1. INTRODUCTION

1.1. Resilience in the agroforestry context

Extreme climate events, political conflicts, economic crisis, and/or pandemics (such as COVID-19), are some of the multiple factors influencing the primary sector of food production, such as the farmers. Crop diversification and the lower dependence of external production inputs can help the systems maintain their viability, not only environmentally but also economically. The Agroforest systems can be defined as the deliberate combination of woody perennials, agricultural crops, and/or animals, in some form of spatial arrangement or temporal sequence. There are several possible combinations, according to the plant species used, their distribution in the field and the management. The agroforest system aims to obtain ecological and economic benefits, increasing its resilience over time (FAO, 2015; AGFORWARD, 2015).

Resilience is defined as the capacity of an ecosystem to return to the pre-condition state following a disturbance, including maintaining its essential characteristics such as composition, structures, ecosystem functions, and process rates (Holling, 1973; Walker et al. 2004). Since resilience is a complex concept to be quantified, indicators are helpful to link resilience to the system evolution and to find alternatives to promote its adaptation or endurance to perturbations. In the frame of TRANSITION, resilience indicators can be classified into two groups. The first includes state indicators, which can be obtained at a large scale using remote sensing or European and national databases on land use and farm structures. Many of them are already available in the literature. The second is farm management-related indicators that encompass the ability of the farmer to adapt to various perturbations. As resilience indicators depend on farm structure, the socioeconomic environment of the farm as well as farmers' strategies and values, it will be required the interviews with farmers to deep into this topic.

1.2. Resilience within the TRANSITION project and the related work packages to this deliverable

Resilience agriculture in the Mediterranean is the main objective of the TRANSITION project. Despite the paramount indicator of resilience for the purpose of this project is

yield stability, this deliverable is to identify the resilience indicators of the agroforestry / systems considered in each region of the study. Obtaining information from different perspectives (such as stakeholders, farmers), TRANSITION wants to pave the way for further steps during the project execution. Moreover, TRANSITION works from the farm scale (“bottom-up”) and to policy levels (“top-down”). This deliverable belongs to the initial group of activities to improve understanding and increase the resilience of agricultural systems with innovative strategies. The resilience indicators reported in this deliverable were used in T1.4 and will be monitored in the on-farm research program (T2.5). Furthermore, the resilience indicators will be used as the basis for benchmarking and contrasting conventional innovative systems.

2. METHODOLOGY

There were 5 different countries involved in this task (**Fig. 1**). During the first year of the project, each partner arranged meetings and interviews according to the facilities of each region. The resilience indicators were obtained through participatory methods and a multi-actor approach following the previous deliverable D1.1. This activity was led by stakeholders experts on the topic, and farmers who already work with agroforestry, systems, and/or innovative crops. As far as possible, meetings and interviews were face-to-face, but due to the pandemic situation of COVID-19, some of the meetings were performed on-line.

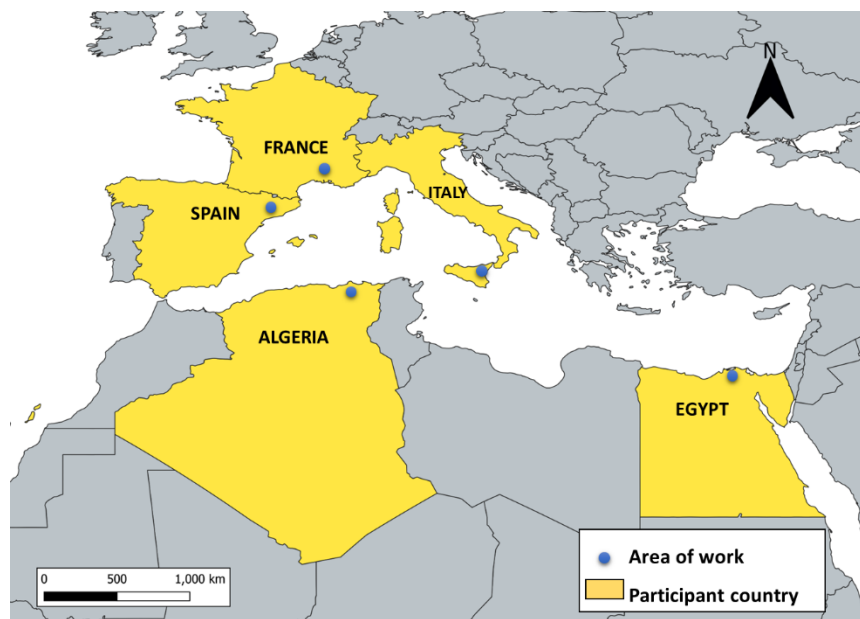


Figure 1. Mediterranean countries involved in the resilience indicators work. The area of influence is pointed in blue.

French partners, from INRAE, conducted semi-structured interviews with 18 farmers from 16 different farms between April and August 2022. They met 10 men and 6 women. INRAE partners selected farms located in the French Mediterranean climatic region and within a radius of 110 km from Avignon (the city where our institution is settled). They also conducted 3 interviews with representatives from organisms related to agriculture. With them, they focused on the barrier to expansion, the policy support for diversified systems and the notion of resilience.

Spanish partners from UVic-UCC performed two meetings with 6 stakeholders coming from different regions of Catalonia (Spain). The first session (February 2022) was online but the second one was face-to-face (May 2022). Resilience indicators were obtained during the second session by brainstorming followed by a group discussion to classify and prioritize the different indicators (scoring).

Italian partners from UNICT carried out 9 semi-structured interviews during the first year of the project.

Algerian partners from INRAA carried out a meeting on September 20th, 2021. Algerian stakeholder platform was formed by 15 members including farmers (region of North

Setif), training and technical institutes, farmer association representatives and university researchers.

Egyptian partners from SRТА-City conducted two meetings. The first involved 5 active stakeholders in agriculture (Table 1). The second one included a group of 24 undergraduate students for which the SRТА-City team organized an online training program for them from 12 to 16 September 2021.

Table 1 Partners involved in the resilience indicators, and the participatory methods performed to obtain the information

PARTNER NAME	COUNTRY	PARTICIPATORY METHOD
INRAA	ALGERIA	Meeting
SRТА-City	EGYPT	Meetings (Kano's survey model)
INRAE	FRANCE	Semi-structured interviews
UNICT	ITALY	Semi-structured interviews
UVIC-UCC	SPAIN	Meeting (brainstorming and scoring)

3. RESULTS & DISCUSSION

In this section, the summary of all the partners findings is shown. Detailed information can be consulted in annex section devoted to each of them.

A total of 66 indicators were obtained through the participatory methods, 36 were related to ecosystem services and 30 to socio-economic aspects. According to the indicator type, management related indicators exceeded quantitatively to socio-economic indicators. They were summarized and classified (**Tables 2 and 3**) to contrast the different interests among the participant countries. However, it must be said that they are interconnected, and their effect, in many cases, depends on inter-connections.

As mentioned above, yield stability is the main indicator of resilience for the TRANSITION purpose. However, the participatory exercises during the meetings and interviews showed that the stakeholders, the farmers, and the university students also consider other resilience indicators. A consensus was observed in the way that they define an indicator and the effect that they perceive in the agroforest.

Ecosystem service indicators show a higher consensus among the different countries. Most of them were related to soil characteristics and plant growth and species diversity.

All five countries coincided in the soil organic matter as a resilience indicator. The main soil organic matter effect was related to nutrient supply and water storage. Water-related indicators were also pointed out, such as soil water holding capacity, soil moisture and water management. Pest control was tackled through indicators related to biological control (sexual confusion, auxiliaries), pesticides based on plant extracts, and the presence of hawks and bats. External inputs were considered resilience indicators by Algeria and France. They highlighted the importance of reducing energy dependence to improve the system's autonomy.

Socio-economical resilience was addressed in several different indicators, which varied across the different countries. There was a total consensus on the incomes related indicators. They were addressed from total incomes per year, return of investments or broadening the offer of products and services to not depend on the yield productions. Resilience indicators related to the products offered and short circuits of commercialization were emphasized, but also were selected indicators as the market of the products, the consumer demands, and the use of certifications (*i.e.*, ecological). Autonomy by self-consumption or fewer loans were also considered. Rural areas' population was considered in different ways. People involved in the farm work (number of persons, age, training, and employment), agriculture-related companies (number and size), and the strengthen of social network in the region were considered as resilience indicators. Other socioeconomic indicators were also related to the population (age, training, certifications of accumulated yield, and subsidies)

Table 2. Summary of ecosystem services indicators to evaluate the resilience in agroforest systems in some countries of the Mediterranean basin.

INDICATOR NAME	COUNTRIES*					DEFINITION	EFFECT
	DZ	EG	FR	IT	ES		
Soil organic matter	X	X	X	X	X	Combination of plant and animal detritus, in the soil surface, at various stages of decomposition, cells and tissues of soil microbes, and substances that soil microbes synthesize.	Improvement of soil functions (structure, water holding capacity, water infiltration, organic carbon, and stability), soil health and fertility, allowing the storage and release of nutrients
Water availability	X	X			X	Water in the soil pores: the difference between the matrix potential -33kPa (field capacity) and -1500kPa (permanent wilting point) within an established depth. Irrigation access, as the water-saving irrigation techniques and the irrigation sources (superficial: dams or deep: wells, boreholes)	Storage of water available for plants and the significant agrochemical and energy intensification due to the irrigation
Pest control	X	X	X			Polluting pressure: the ratio between the treated surface and the UAA. Species records (i.e., presence or absence of bats, hawks). Biological control (sexual confusion, auxiliaries), plant-based pesticides.	Using biological control reduces the use of pesticides, thus, the threats to human health and ecosystems.
Crops diversity	X		X	X	X	Number of crops species (fruit and vegetable) cultivated in the parcel/ farm	Help to cope with pest attacks, climatic hazards and/or human mistakes, helping the system to maintain a basal production. Soil surface protection against soil erosion
Animal diversity	X		X	X		Number of species and breeds on the farm	Reduction of the economic risks for the farmer in front of years of poor harvests, fluctuating prices or changes in agricultural policies

Growing period		X	X			Seeding start dates	Agriculture – Seeding date (more than 15 days difference compared to the provincial average for the last 5 years)
External inputs dependence	X		X			Number of “products” introduced to the system, as fuel oil equivalent per ha, energy sources (photovoltaic, wind, biogas, etc.), vegetable oils, firewood	Increase of the autonomy of the production system, it saves stocks of non-renewable natural resources (oil, gas) and it limits the greenhouse effect
Land use management in and around the farm	X		X	X		Inside the farm is the set of techniques aimed to preserving the soil resource (i.e., no-tillage, perennial crops, mulching, grassing, or anti-erosion management,). Outside the farm is the land use type and management around the farm.	Enhances soil protection from the risk of erosion because of the quasi-permanent vegetation cover. The landscape can have a huge influence on the disturbances a farmer will undergo inside the field.
Value the local genetic heritage	X					The development of breeds and local varieties threatened extinction.	Increase and maintain the genetic base on which agricultural production is based
Animal growth (veterinary, forage)	X					Is expressed by the number of animals treated x number of treatments relative to the total number of livestock. Forage as food is also considered	Increasing the fodder autonomy enhances animal wealth fare, husbandry practices and quality production while decreasing the reliance on veterinary inputs.
Crop yield		X				Crop yield per crop in each management plan	Yield stability by comparing to 5 years of production
Frequency of climate disturbances			X			Short-term or temporary climate events of high intensity that can affect the productive system (single episodes and their whole dynamic).	Response capacity to climate disturbances. For instance, a pest attack will be much more damaging if the plants suffered from water stress before.
Plant growth			X			A hedgerow is an alignment of trees and/or scrubs.	Hedgerows may increase farm resilience if they are enough and well managed. Some benefits

							are windbreaker, wood provider, biodiversity habitat, water infiltration and depuration, etc.
Soil characterisation			X	X	Chemical analytics for the main soil properties related to plant growth (i.e., texture, organic matter, soil aggregation)	Providing nutrients and desirable soil characteristics to the plant growth and enhancing root development	
Floristic richness				X	The total number of plant species found in a given system or area	Diversity in type and quality of organic debris. Pollinators presence enhancement.	
C & GHG emission			X		Is the storage of organic carbon into the soil and the the emission of greenhouse gases in the atmosphere	Contributes to climate change increasing factors such as floods, droughts and heat	

*DZ: Algeria; EG: Egypt; FR: France; IT: Italy; ES: Spain.

Table 3. Summary of socio-economic indicators to evaluate the resilience in agroforest systems in some countries of the Mediterranean basin

INDICATOR NAME	COUNTRIES*					DEFINITION	EFFECT
	DZ	EG	FR	IT	ES		
Incomes	X	X	X		X	Incomes from the farm activity (direct, indirect and subsidies). Economical balance and return of investments	Having a sufficient income with low needs of subsidies is a key parameter to ensure a good capacity of adaptation.
Products diversification	X		X		X	Number and characterisation of the activities that generate incomes (direct products, by-products, services, and multi-activities).	The multifunctional farm enhances income stabilisation throughout the year, guarantees survival in front of economic constraints (changes in markets, input prices, premiums) and in the face of climatic hazards. Farmers contribute to the maintenance of

							space and landscapes, while they can also benefit from market services to the territory and its inhabitants
People and work	X		X	X	X	Workers involved in the farm (associates, employees, volunteers), amount of workload across the year (working hours per person per year) and number of agricultural sector companies (structure, type, and size)	Rural areas conservation: more and better job opportunities, a balanced workload increase/fix the population in rural areas
Short trade	X		X			Types, number, and distance of commercialisation circuits. Also involves the evaluation value of sales (directly, turnover, and local sales)	Reduce the amount of time transporting the products to sell. Ensures a constant market to sell the products. Strength the relationship between farmers and consumers into close contact. Decrease dependence on large markets whose fluctuating prices are decided elsewhere.
Social interaction	X		X			pooling of equipment and services, mutual aid, networking, and knowledge-sharing.	Collective work empowers the lever for local development through the improvement of the adaptative capacity, solidarity promotion, efficiency, economies of scale development and synergies strength.
Autonomy	X			X	X	This indicator involves fodder autonomy (cereals and fodder proteins), use of organic fertilizers (manure, urban compost), use of renewable energies and of agricultural and forestry origin produced on the territory (solar, oil, firewood), recovery of rainwater (irrigation and watering of animals), use	Better use of local resources and less dependence on suppliers from the upstream sector.

						of self-produced seeds and plants and products	
Population distribution and education	X			X		Farmers' age distribution and training	Helps to know the agricultural workforce, the succession to younger people and the agricultural training received by the farmer
Customer demand			X			The number of products demanded/ sold throughout the year.	A predictable demand for products facilitates crop planning.
Amount of loan			X			Money that the farmer gives back to the bank.	It indicates the degree of autonomy. The highest the loan is the higher necessity to make the system profitable.
Components of production (yield, price, and certificates)					X	Yield (t/ha) in agroforest System vs. yield (t/ha) in monoculture. Difference between cost production and the RRP, and selling percentage due to specialised labelling or certificate	Let to know the yearly variability of crop production. Determine economic benefit for a certain period of time. Increases consumer confidence and market price
Well-being				X		It's a positive state in all the aspects of life of a human being	Individuals with high levels of well-being are more productive at work and are more likely to contribute to their communities

*DZ: Algeria; EG: Egypt; FR: France; IT: Italy; ES: Spain.



5. CONCLUSIONS

Despite the cultural, socio-economical and/or agricultural differences among regions in the Mediterranean basin, there is a general agreement on fundamental interests of ecosystem services and socio-economic indicators. In the first case, soil -related indicators, showed that participants are conscious of the key role of organic matter, water availability, pest control to ensure the long-term maintenance of the agroforest systems. In the second case, economic independence (income, loans and self-consumption) and the population related indicators reflected the needs and interests of the participants.

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7. ANNEXES



ANNEX 1. RESILIENCE INDICATORS BY INRAA (ALGERIA)

Deliverable D1.2. Resilience indicators

Explanation of how the indicators were achieved: through interviews, questionnaires, KANO's Model, etc.

The first meeting of TRANSITION Local Multi-Stakeholder Platform of Algeria was held on September 20, 2021, after several individual phone calls with members, made in late August and early September 2021.

The TRANSITION Algerian stakeholder platform was formed by 15 members including farmers (region of North Setif), training and technical institutes, farmer association representatives and university researchers. The platform will be opened to new members in the future.

A presentation of the TRANSITION project, its main objectives and a brief description of the project's WPs and the various stages of implementation was made in Arabic to better communicate with farmers. Subsequently, information on the resilience was presented. For Algerian farmers, the resilience is new concept.

In the further pages, two tables filled out with the following information:

Classification of the type of indicators established: 10 socio-economic and 10 ecosystem services/state indicators or farm management-related indicators. Tables also contain a definition for each of the indicators established. Finally, tables allocate the effect of these indicators on the resilience of the system to adapt or endure perturbations.

Table 1. Ecosystem service indicators

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	Organic matter management	MR	Includes those agricultural practices that allow maintaining and increasing the amount of organic matter in the soil	Helps to improve soil structure, which allows to increase retention capacity and infiltration of water in the soil, and also increase the soil fertility, which allows storage and release of nutrients
2	Crops diversity	S	Is the presence of several plant species on the farm	This diversity, especially the hardy species adapted to the pedoclimatic conditions of the region, makes it possible to cope with parasitic attacks and climatic hazards. Because the monoculture induces economic, ecological and parasitic risks
3	Animal diversity	S	Is the presence of several species and breeds on the farm	The presence of livestock is a means of limiting the economic risks for the farmer, who can also cushion the hazards linked to years of poor harvests, fluctuating prices or changes in agricultural policies
4	Valorisation of the local genetic heritage	MR	This indicator underlines the effort made to develop breeds and local varieties threatened with extinction	The standardization of life, which is also taking place on a global scale, ultimately weakens agriculture because it reduces the genetic base on which agricultural



				production is based and ultimately opposes the diversity of systems and conditions of production
5	Forage area management	MR	Each environment has an optimum animal stocking level that balances forage needs and resources	Fodder autonomy is one of the main pillars of agricultural resilience. Fodder dependence is reflected in the large purchase of animal feed
6	Pesticides	MR	It is expressed by the polluting pressure defined by the ratio between the treated surface and the UAA	An ecologically sound agriculture must limit to the strict minimum the use of pesticides which constitute a threat to human health and to ecosystems, the use of biological control is encouraged (sexual confusion, auxiliaries), pesticides based on plant extracts)
7	Veterinary treatment	MR	Is expressed by the number of animals treated x number of treatments relative to the total number of livestock. *farms without livestock are not affected by this indicator	Reliance on veterinary inputs signals poor animal husbandry practices. Practices with low levels of antibiotics or hormones characterize a sanitary and zootechnical balance, a certain animal well-being and a quality of production
8	Soil resource management	MR	It is the set of techniques aimed at preserving the soil resource such as no-tillage, the presence of perennial crops, anti-erosion management, mulching and grassing of perennial crops	The soil must be permanently protected from the risk of erosion. the anti-erosion devices of a permanent or quasi-permanent vegetation cover induced by no tillage testify to a technical



				management responsible for the long term
9	Water resource management	MR	It is defined by the use of water-saving irrigation techniques as well as irrigation sources (superficial: dams or deep: wells, boreholes)	Irrigation induces a significant agrochemical and energy intensification; it is carried out at the cost of a significant levy on the water resource
10	Energy dependence	MR	It is expressed in fuel oil equivalent per ha, includes the use of all energy sources (photovoltaic, wind, biogas), vegetable oils, use of firewood	Reducing energy dependence is an objective and a consequence of the functioning of resilient agricultural systems. It is an objective because this reduction contributes to the autonomy of the production system, it saves stocks of non-renewable natural resources (oil, gas) and it limits the greenhouse effect

* S= State indicator

**MR= Management-related indicator

Table.2. Socio-economic indicators

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	Age of farmers	S	Defines the age class of farmers to show the trend of aging of the agricultural	The takeover of the farm by young farmers strengthens its resilience



			workforce and whether there is a succession to ensure the transferability of the farm	
2	Training of farmers	MR	This indicator relates to the agricultural training received by the farmer	Training is a guarantee of evolution and personal fulfilment
3	Collective work	MR	This indicator designates the pooling of equipment and services, mutual aid, networking	Participation in forms of collective work developed within the territory promotes solidarity, generates greater efficiency, develops economies of scale and synergies and thus constitutes a powerful lever for local development. The evolution of agricultural systems towards greater resilience is also facilitated when several farmers in the same territory walk in the same direction
4	Contribution to employment	MR	This indicator targets the creation of jobs on the farm and within the framework of a local network (group of employers)	The contribution to employment of an agricultural system can be assessed by the areas worked and the volume of production per worker
5	Services, multiactivities	MR	Concerns the services provided to the territory (snow removal, composting of household waste, recovery of urban sludge), agrotourism, educational farm, social integration practices	The multifunctionality of agriculture is a guarantee of its resilience. Farmers can contribute to the maintenance of space and landscapes; they can also offer market services to the territory and its inhabitants



6	Autonomy and enhancement of local resources	S	This indicator is translated by fodder autonomy (cereals and fodder proteins), use of organic fertilizers (manure, urban compost), use of renewable energies and of agricultural and forestry origin produced on the territory (solar, oil, firewood), recovery of rainwater (irrigation and watering of animals), use of self-produced seeds and plants	The search for and development of the autonomy of an agricultural system translates into better use of local resources and less dependence on suppliers from the upstream sector. The search for certain energy and seed autonomy is also a path that makes the agricultural system more resilient
7	Short trade	MR	This indicator is expressed by the value of direct sales compared to the value of turnover and local sales	Selling in short circuits relocates the economy because it brings farmers and consumers into close contact. It makes farmers less dependent on large markets whose fluctuating prices are decided elsewhere
8	Income per worker	S	This indicator is based on the deduction of the financing needs of gross profit of farm, and related this difference to the number of worker (family or partner), the result is compared to the national legal minimum wage	There is no resilience without earning a respectable income
9	Economic specialization rate	MR	This indicator is expressed by the percentage of turnover generated by the most important activity as well as the percentage of turnover purchased by the most important customer	A diversified farm is less fragile in the face of economic constraints (changes in markets, input prices, premiums) and in the face of climatic hazards. A monoproduction coupled with a single



				buyer thus combines the risk factors. Conversely, systems that are diversified in terms of production and/or customers are generally more resistant to economic downturns
10	Reliance on direct subsidies (assistance)	S	This indicator is expressed by all the aid (subsidies) related to the gross profit of the farm	No grant is forever. A farm dependent on public aid where more than 80% of the profit margin comes from direct aid is considered to be very sensitive to aid and its fluctuations

* S= State indicator

**MR= Management-related indicator



ANNEX 2. RESILIENCE INDICATORS BY SRТА-City (EGYPT)

Deliverable D1.2. Resilience indicators

Study area:

The selection of the study area was depending on how the innovative technologies could be applied in similar areas under the same climate change stress. The team selected Mutubas, Kafr El-Shikh (Graduates' villages' or as known as Mubarak project), where almost all the north Egyptian coast suffer the same environmental and agriculture problems.

Graduates' villages' or as known as Mubarak project is one of the reclamation projects initiated by the Ministry of Agriculture and Land Reclamation on 1987 for the extension of cultivated areas in Egypt. It's located in the north of Kafr El-Shikh governorate, North-western part of Lake Borullus. The main purpose of the project was to reduce the urgent need of the mounting unemployment among graduates. Through the Mubarak Project, the idle educated youth would be redirected to newly built settlements on the fringes of the Nile valley and the Delta, where they would till the land and establish new communities, attract investors and, as they went along, serve the nation with an expanding agribusiness sector (Adriansen 2009). Thus 3 villages were built and named after prominent sheikhs in the area. The first two villages, named after prominent sheikhs in the area as El-Aaref Bellah Ibrahim Dosooqi and Said El-Beddawi, were constructed in the mid-1990s; the third, El-Aaref Bellah Sidi Balkar, was opened in 2010 (Malm, 2013).

The study area climatic conditions are similar to those of the northern part of Egypt, it is rather arid to semiarid, where the rate of evaporation exceeds many times the rate of precipitation. The mean minimum air temperature varies from 6.2°C in February to 23.6°C in August. The mean maximum air temperature ranges between 17.4°C in January to 34.2°C in July. The relative humidity ranges from 51% in May to 76% in December. The total annual rainfall ranged between 38.1 - 190.8 mm. The evaporation attains the highest annual mean value (6.8 mm/day) at Tanta and the lowest value (4.2 mm/day) at Rosetta.

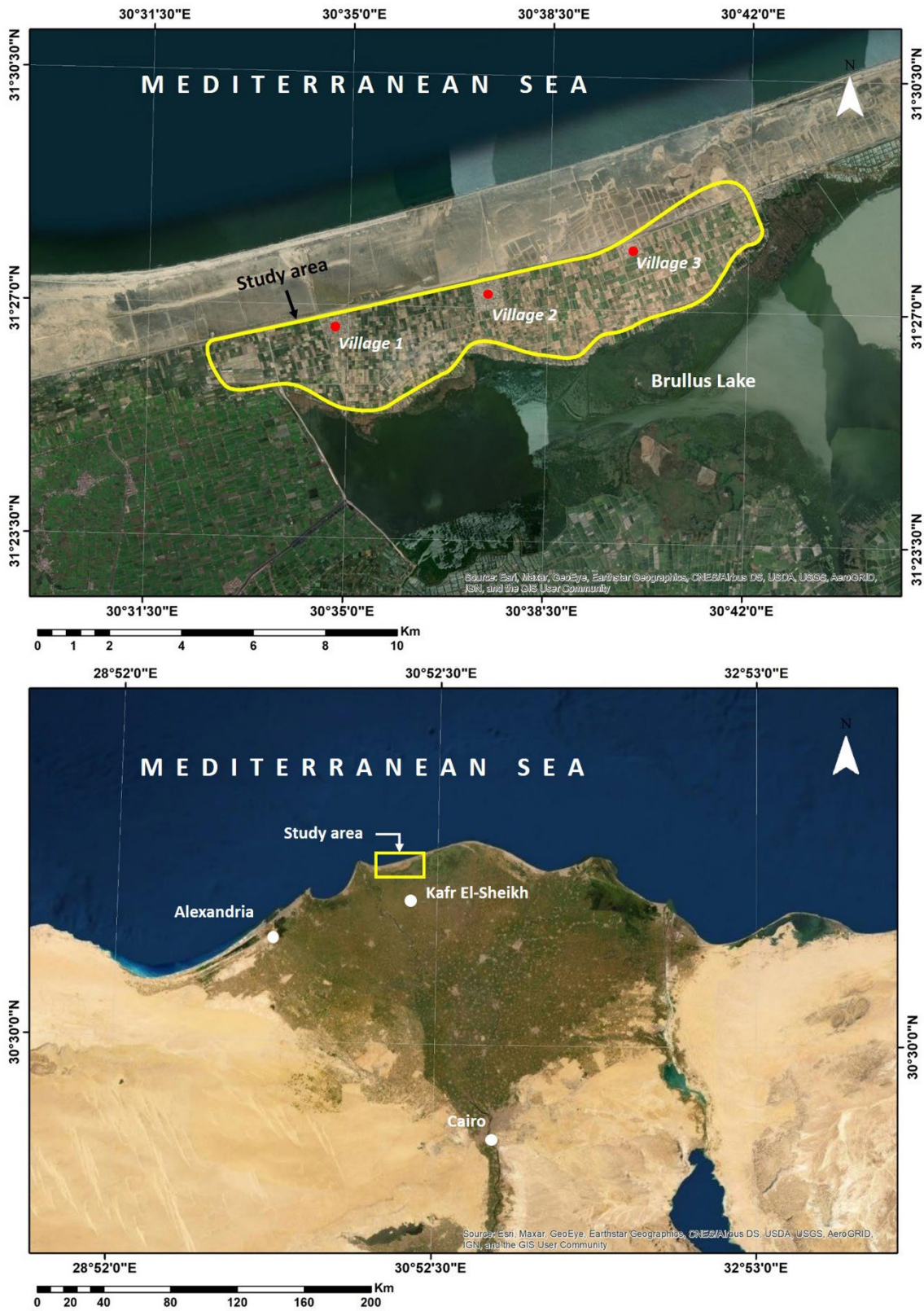


Figure 1. Study area

Explanation of how the indicators were achieved: through interviews, questionnaires, KANO's Model, etc.

The SRTA-City team established two different stakeholders group:

- I. The first group consist of five active stakeholders in agriculture (as shown in Table 1), to be engaged to identify resilience (indicators, innovative farming systems, technologies and barriers to implementation

Table 1. Stakeholders Groups

NO.	STAKEHOLDERS	SECTOR
1	Experimental farm of SRTA-City, Alexandria, EGYPT	Government/Research
2	Soil and Water Science Dep., Faculty of Agriculture, Alexandria University, EGYPT	Government/Education
3	Egyptian Khaleji Company for Land Reclamation, Alexandria, EGYPT	Private
4	Mutubas Agriculture Cooperation, Kafr El-Sheikh, EGYPT	Government/Policy
5	El-Bangar Agricultural Cooperation, Alexandria, EGYPT	Government/Policy

- II. The second stakeholders' group were 24 undergraduate students for which the SRTA-City team organized an online training program for them from 12 to 16 September 2021, titled with "Innovative Farming System Techniques – Egypt's Sustainable Development Goals 2030" Under **TRANSITION** project frame work.

Establishment of resilience indicators:

To identify the resilience indicators with a focus on local climate change impacts and needed responses, under the engagement agreements with stakeholders (identified in table 1) active in the study area. And to ensure analytical soundness of indicators, a full land resources survey with comparative study done on 2015, questioners, and Kano's Model survey and published literature reviews were conducted to generate a reference database of potential resilience indicators for each of the themes identified.

Questionnaires and Kano's Model:

The questionnaire (D1.1 TRANSITION) was conducted on the 3 villages covering the study area through Mutubas Agricultural Cooperation Unit, with 550 person out of 2190 person total population (25%). 19 families (95 person) sampled from village 1 which was opened in 2001. Village 2 was opened in 2009, 63 families (315 person) were questioned. And 28 families (140 person) were sampled in village 3 which was opened in 2013.

In summary:

- i. 100% suffers in the last 10 years from climate change effects as irregular long hot and cold days, late rainfall and some years with very few precipitation.
- ii. 100% suffers from new pests, and the say this is due to climatic changes.
- iii. 80% use fertilizes each year during cultivation, 17.27% depend on need and last time they were added and crop yield, while 2.73% rarely add due to financially difficulty to do so. 80% of population use pesticides each season, while 20% use them depending on the need.
- iv. Since 2020 they don't add top soil anymore to keep the root zone far from the saline water intrusion from the sea and this due to **The Sustainable Agriculture investments Project (SAIL), funded by IFAD, GEF and ASAP**. The project reconstructed irrigation and drainage canals which allowed the local farmers to start soil leaching requirements process and this will be clear later in the soil analysis summary sheet.
- v. 80% due to financial difficulties stopped their animal production
- vi. 70% stopped their farming systems (Fruit trees with forage or vegetables) due to financial problems
- vii. With the continuation of development projects in the region, but farmers suffer from low ROI of agriculture, due to the high prices of chemical fertilizers and manures and pesticides.



Figure 2. The Sustainable Agriculture investments Project (SAIL) for canals development

The Kano's survey model approach, is an analysis tool that enable understanding of how target groups responses to questions and new technologies. In our investigation, eight questions were asked (D1.1 TRANSITION project) to prioritize the system problems and local farmers need. Table 2 shows sorting of the feedback priorities and per reviews:

- i. Local farmers needs climate change adaptation strategies.
- ii. The increasing demands on fertilizers and pesticides due to the elevated prices of manures, because it comes from outside the region.
- iii. Local farmers and the Agriculture Cooperation Unit asked for training and pilot farm to teach them the new technologies, species and organic farming.
- iv. The demand on new crops for better crop rotation cycle from the soil conservation and ROI points of view.
- v. Financial aid to reestablish the mixed farming with animal production.
- vi. 80% of the local farmers stopped mixed farming (Fruit trees and other crops) because of financial problems.

Table 2. Kano's Model survey of the local farmers priorities

No. in Survey	Rank	Attribute	%
1	1	Climate change events	100
4	1	Chemical fertilizers and pesticides	100
5	1	Unconventional crop pattern	100
7	1	Technical support and training	100
2	1	Crop rotation	90
8	2	Animal production in innovative mixed farming system	55
3	3	Mixed farming	54
6	3	Organic farming, innovation and technology	40

Priority

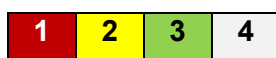




Figure 3. A and B: Deteriorated farming, C: Tomato cultivation and D: small wind break system as an adaptation strategy in the study area

In the following tables, it is shown the resilience indicators that were obtained during the participatory session. They are presented in two groups, first the Ecosystem service indicators (Table 1), and Socio-economic indicators (Table 2). At each table, each indicator is classified among State or Management-related indicators. Moreover, a definition of the concept is given, obtained during the participatory session. Finally, the effect of the indicator on the agroforest system is specified.

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Table 3. Ecosystem service indicators

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	Soil Carbon content	MR	OC content listed in the literature reviews and after the management plan implementation	OC increasing and stability
2	Soil moisture content	MR	Dryness cycle between irrigations	Irrigation periods
3	Growing period	MR	Seeding start dates	Agriculture – Seeding date (more than 15 days difference compared to provincial average for the last 5 years)
4	Crop yield	MR/ S	Crop yield per crop in each management plan	Crop yield compared to 5 years production
5	Pests	MR	Species records	Effectiveness of biological control

* S= State indicator

**MR= Management-related indicator

Table 4. Socio-economic indicators

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	ROI	S	Quality compared to price in the last 2 seasons	Economic improve

* S= State indicator

**MR= Management-related indicator



ANNEX 3. RESILIENCE INDICATORS BY INRAE (FRANCE)

Deliverable D1.2. Resilience indicators

1) Method used to identify the resilience indicators

We conducted semi structured interviews with 18 farmers from 16 different farms between April and August 2022. We met 10 men and 6 women. We chose farms located in the French Mediterranean climatic region and within a radius of 110 km from Avignon (the city where our institution is settled) (figure 1).

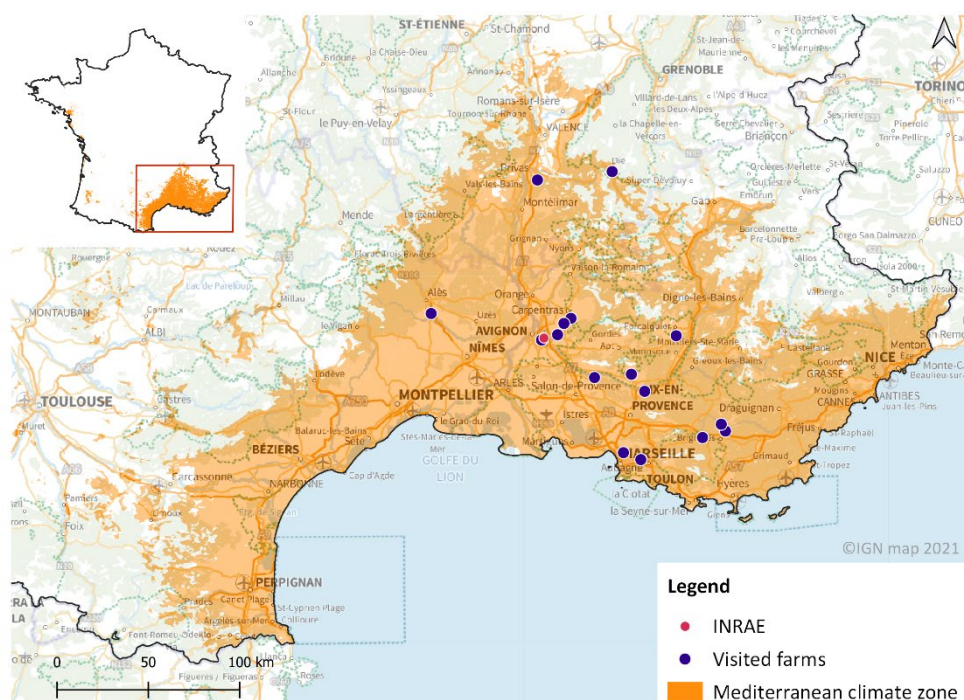


Figure 1: Location of the farms we visited

The average size of the farms we visited is 5.75ha. All of them have at least one field in agroforestry which combines market gardening and orchard whose average size is 2.5ha. They settled between 2008 and 2020. In 5 cases some fruits trees were already present in the field at the installation, they adapted the design of the system to the existing elements, but most of them planted the trees at their arrival or some years after.

The average number of vegetables that are grown is 34 and fruit tree is 11. Most of the farmers not only produce fruits and vegetable: 68% of them transform their products and 56% raise poultry. More than the half of them also receive little income from activities like hosting or teaching.

In order to minimise the number of solicitations of the farmers, the interview outline (annex 1) was built to gather data for several tasks of the project. Thus, the interview consisted in:

- a visit of the fields and the description of the objective and achievements of the farmer (M1.2);
- a discussion on the disturbances (M1.2) they went through and the barriers to expansion they have identified (D1.3);
- questions about their vision of resilience (D1.2);
- questions about their expectations concerning policy support to the highly diversified agroforestry systems (D4.3).

All the persons we met agreed on being recorded and allowed us to take pictures of their land. The audio material was integrally transcribed and relevant information were encoded in an excel sheet to facilitate the analyse.

The determination of resilience indicators could not be done directly during the interviews because resilience is an abstract concept that can be used in very different contexts (psychology, ecology agronomy, physics etc.) and the notion of indicator is not familiar to the majority of farmers. Thus, we deduced the indicators from the definition of resilience given by the farmers, the description of their reactions to the disturbances they went through, and a scientific literature review.

2) Resilience indicators

Resilience can be defined as the “capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al. 2004). Most of the scientific community agree on this definition, the formulation can differ but the notions of disturbance and of ability to maintain the identity of the system are always present in the definition (Dardonville 2021). Nevertheless, two contrasting views exist on how to evaluate it:

- Ecological approach of the resilience: considers that it exists tipping points in the dynamic of the ecological and biophysical parameters. If they are overpassed,

the identity of the system is irreversibly changed. Thus, being resilient is the capacity to not overpass these tipping points (Holling 1996). This vision implies to look at the stability of the system, to determine tipping points and measure static indicators to evaluate whether or not they overpassed the tipping point. A static indicator describes a given state of the system at a given moment.

- Engineering approach (Holling 1996) considers that changes can also occur step by step, sometimes the evolution is progressive and challenges the balance of the system. In this case being resilient is the ability to go back to an equilibrium or to find a new one. This vision will lead to study the dynamics of the system and to measure dynamic indicators. A dynamic indicator is an indicator that makes it possible to follow the evolution of the system through time: speed, initial and final states, standard deviation, equilibrium. It can be obtained from the combination of static indicators measured at different time.

Both approaches must be combined and the two types of indicators should be evaluated to explain and measure the resilience of agroforestry systems. The following tables (tables 1 and 2) present the resilience indicators identified by the farmers interviewed. Two types of indicators are presented: ecosystem services and socio-economic services. Within these two types, the indicators are cross-referenced according to the approaches outlined above and their dependence on human action:

- State indicator;
- Management related indicator;
- Static indicator;
- Dynamic indicator.

Table 1. Ecosystem service indicators. S: state indicator, MR: management related indicator, black: static indicator, blue : dynamic indicator

No.	Indicator name	Indicator type	Definition	Effect
1	Soil organic matter content	MR	Combination of plant and animal detritus at various stages of decomposition, cells and tissues of soil microbes, and substances that soil microbes synthesize.	Increase soil water holding capacity and nutrient availability.
2	Presence of hawks	MR	Evaluation of the presence or absence of hawks.	These birds can contribute to the regulation of vole that is a widespread and very damaging pest.
3	Presence of bats	MR	Evaluation of the presence or absence of bats.	Natural and free insecticide that may control the population of certain pests.
4	Cultivated diversity (species and varieties)	MR	Number of fruit and vegetable cultivated in the parcel.	With a high diversity, if one crop is victim of a pest, a climatic hazard or a human mistake there is a high probability that the other crops survived that make the whole system able to maintain a basal production.
5	Length and quality of hedgerows	S and MR	A hedgerow is an alignment of trees and/or scrubs.	The ecosystems services provided by hedgerow are plentiful (water infiltration, water depuration, wind breaker, wood provider, biodiversity habitat etc.) but it depends on how they are managed. Their presence may increase the resilience of the farm if they are enough and in a good state.
6	Number of external inputs and their quantities	MR	Number of “products” that are bought, exchanged or obtained for free by the farmer	Most of the farmers we met consider that sobriety and independency make them more

	(oil, electricity, water; organic matter etc.)		from another actor in order to realise its productive purpose.	resilient. Thus, the level of dependency to external key inputs is important to evaluate resilience.
7	Land use around the farm	S	Management and modification of the land around the farm.	The landscape can have a huge influence on the disturbances a farmer will undergo for instance pest attacks and water availability.
8	Frequency of climate disturbances (frost, drought, flood, hail)	S	Short term or temporary climate event of high intensity that can affect the productive system.	It is important to consider not only one single climatic disturbance but the whole dynamic of them. Indeed, for instance an attack of pest will be much more damaging if the plants suffered from water stress before.
9	Speed of change, initial and final states, standard deviation of indicators 1 2 3 4 5	S and MR		Estimation of the resilience using the dynamic paradigm.

Table 2. Socio-economic indicators S: state indicator, MR: management related indicator, black: static indicator, blue : dynamic indicator

No.	Indicator name	Indicator type	Definition	Effect
1	Diversity of rewarding activities (transformation, teaching, hosting etc.)	MR	Number and characterisation of the activities that generates incomes.	A good balance between different rewarding activities appears as very important to generate a basic income stable along the year.

2	Number of persons working in the farm	MR	Number of associates, employees, interns or volunteers working in the farm.	Determines the work force and being more than one person in the farm is a key parameter to preserve resting time and cope with human related problems.
3	Allocation of workload along the year	MR	Time spent to produce fruits, vegetables, to sell the products, to the administrative management of the farm.	Having a balanced workload allocation important to maintain the adaptation capacity.
4	Income along the year	MR	Money earned thanks to the activity of the farm.	Having a sufficient income is a key parameter to ensure a good capacity of adaptation.
5	Number or commercialization circuits	MR	Ways to sell the production.	A diversity of commercialisation circuits ensures a constant way to sell the production and generate income even if a customer decide not to buy the farm's products anymore.
6	Distance between the farm and the selling point	S	Distance the farmers has to drive to sell the product.	Spending a lot of time transporting the products to sell it can be detrimental to other activities.
7	Amount of loan	MR	Money that the farmer has to give back to the bank.	It indicates if the farm is more or less autonomous and can undergo a decrease in the income. The highest the loan is the highest is the necessity to make the system profitable.



8	Integration to network of farmers, advisers, trainers	MR	Group of people that interact and exchange information or knowledge.	Being in interaction with other farmers, advisors and participate regularly to trainings is an excellent way to improve the adaptive capacity.
9	Frictions between the workload required by the market gardening and by the fruit trees	MR	Moments when both fruits trees and market gardening require a workload higher than the working capacity of the farmer (and its team).	A high number of frictions can result in an under optimised management of the farm.
10	Customer demand of products along the year	MR	Amount of products sold along the year.	A predictable demand of products facilitates the crop planning.

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Written by Léa GARREAU for INRAE and AFAF in September 2022



Annex 1: Interview Outline

Allow time for a tour of the farm before the discussion. I work at INRAE in Avignon on a project that studies agroforestry systems in the Mediterranean context. This project is conducted in several countries (Italy, Egypt, Spain, Algeria and Greece) and aims to promote the transition of agriculture towards more sustainable practices.

To make it easier to listen and to transcribe what you have to say, I suggest that I record the interview if that is not a problem for you. [Pass the information and consent form, explain it and ask if there are any questions.]

During the interview feel free to tell me anything that comes to your mind, there is no right or wrong answer. I am interested in your particular experience and background. If there are any questions that are not clear to you, don't be afraid to let me know, and let me know if you would like any passages to be left out even if they are anonymised. Do you have any questions about the interview process?

A) General information

For this part, information can be collected during the tour of the farm. It may also be possible to draw a diagram, work with plans etc.

1. Describe your farm.
2. How did you come to set up agroforestry plots? Indicate the surface area of the agroforestry plots
3. How many woody species and annual species are present on the farm?
4. With the benefit of hindsight, would you have made different agroforestry management choices?
5. Are there any non-agroforestry plots on the farm?

If so, why?

6. What role do you expect your trees to play (agronomic / economic / environmental / social / aesthetic)?

If economic: what part of the profitability is linked to the tree?

7. When you installed the trees, did you receive financial aid and technical support from a structure specialised in agroforestry?

8. Have you implemented specific practices to host biodiversity?

If so, which ones and how did you come to implement them?

B) Definition of a satisfactory farm situation

9. Can you describe a situation in which you consider your farm to be satisfactory? Is it a situation that has existed/is currently existing?

Define the satisfactory situation in terms of economic, social, ethical, welfare, agricultural (mechanisation, rotation), agronomic (water use efficiency, soil quality etc.)

- If this situation has already been reached: what are the factors internal and external to the farm that have made this possible?
 - If this situation has already been reached and has been lost: what are the factors internal and external to the farm that can explain this?
 - If this situation has never been reached: what are the factors internal and external to the farm that can explain this (youth of the system for example)?
10. Are there any aspects of the definition of the satisfactory situation on which you might have to make concessions as the situation evolves? Which ones do you think you should not compromise on?

C) Exploring the notion of disturbance

11. What does the notion of disturbance mean to you?

If no notion, provide a definition: "a change in the environment or socio-economic conditions that cannot be anticipated"¹. Emphasise the unexpected aspect. Allow

¹ Urruty, Nicolas, Delphine Tailliez-Lefebvre, et Christian Huyghe. 2016. « Stability, Robustness, Vulnerability and Resilience of Agricultural Systems. A Review ».

time for discussion of the concept if the definition is provided to ensure that the person interviewed has a good grasp of the concept.

12. Which disturbances have you experienced?
13. What was/are your reaction(s) (adjustment of the system, adjustment of the steering of the system, adjustment of the objectives/definition of the satisfactory situation or no reaction)? *Here we are looking at whether the changes were aimed at restoring the pre-disturbance situation or achieving a more resilient state in the face of this type of disturbance*
14. What do you think limits/enhances the effects of disturbances on your farm?
If not mentioned: do you think that practices to accommodate biodiversity limit/enhance the effects of disturbances?
15. Do you think that agroforestry can be an advantage/disadvantage with respect to certain disturbances?
16. Do you think that the Mediterranean context can constitute an advantage/disadvantage with regard to certain disturbances?
17. What, in your opinion, could encourage the establishment of new agroforestry plots?
18. Which support (financial, technical or political) would you like to see emerge to encourage the transition to agroforestry?

D) Exploring the notion of resilience

19. What does the notion of resilience as applied to agroforestry mean to you?
If no concept, provide a definition: "The capacity of a system to absorb disturbances and reorganise itself in order to maintain its function, structure and interactions with the outside world. It represents the system's ability to cope with

Agronomy for Sustainable Development 36 (1): 15. <https://doi.org/10.1007/s13593-015-0347-5>.

*adversity*². Allow time for discussion around the concept if the definition is provided to ensure that the person interviewed has a good grasp of the concept.

20. What factors do you think can confer resilience on an agroforestry system? Relaunch on off-farm aspects as well (biological, physical, social, psycho, economic etc.)
21. In terms of resilience, do you think there is a difference between agroforestry systems and 'conventional' systems?
22. Do you think your farm is resilient? What makes you think so?
23. Is making your farm resilient one of your goals?
If so, what would you / have you / are you planning to do to make your farm resilient?

E) Introduction to the workshops (expectations, desires, what they might have already participated in)

24. Have you already participated in participatory workshops with other farmers? If so, which ones? Did you enjoy the format? Did you find it useful?
25. Would you be interested in participating in this type of workshop to discuss with other farmers your practices for resilience and your needs to develop sustainable farming systems in a Mediterranean context of climate change?
26. Do you know landfiles and would you be interested?
27. Do you know other people who are involved in agroforestry who might be interested in this project?
28. Are there any other things you would like to share that we did not mention during the interview?

² Perrin, Augustine, Rebecka Milestad, et Guillaume Martin. 2020. « Resilience Applied to Farming: Organic Farmers Perspectives ». *Ecology and Society* 25 (4): art5. <https://doi.org/10.5751/ES-11897-250405>.

ANNEX 4. RESILIENCE INDICATORS BY UNICT (ITALY)

Deliverable D1.2. Resilience indicators

Table1. Ecosystem service indicators

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	GHG emission	MR	Is the emission of greenhouse gases in the atmosphere	Contributes to climate change increasing factors such as floods, droughts and heat
2	Soil erosion	MR	Is a process of degradation caused by the impact of water and wind with a consequent loss of the upper layers of soil	Decreases the fertility of the soil
3	Soil organic matter	MR	Is the combination of plant and animal detritus at various stages of decomposition, cells and tissues of soil microbes, and substances that soil microbes synthesize.	Increase soil water holding capacity and nutrient availability
4	Carbon sequestration	MR	Is the storage of organic carbon into the soil.	Mitigation of carbon dioxide emission
5	Nitrogen balance	MR	Is the measure of the amount of nitrogen in the soil	A lack of nitrogen decreases crops yield, while an excess of it can be dangerous for the environment



6	Biodiversity	MR	Is the variety of all the forms of life	Contributes to the stability of food production thanks to a variety of ecological services such as soil fertility, recycling of nutrients, plant health and pest regulation.
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* S= State indicator

**MR= Management-related indicator

Table 2. Socio-economic indicators

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	Self-sustainability	S	Nothing is consumed other than what is produced by the self-sufficient individuals	People do not depend on external markets
2	knowledge	S	Is the awareness and the cognition of what happens	People act in respect of the agroecosystem
3	Reduction of unemployment	S	Referring to individuals who are employable and actively seeking a job but are unable to find a job	Increase the production of goods and services including tourism activities.
4	Well-being	S	It's a positive state in all the aspects of life of a human being	Individuals with high levels of well-being are more productive at work and are more likely to contribute to their communities

* S= State indicator

**MR= Management-related indicator



ANNEX 5. RESILIENCE INDICATORS BY UVIC-UCC (SPAIN)

Deliverable D1.2. Resilience indicators

Explanation of how the indicators were achieved: through interviews, questionnaires, KANO's Model, etc.

During the workshop, 6 stakeholders from different sectors of Catalonia (Spain) worked together to identify 28 resilience indicators using brainstorming and scoring. They were classified into two groups of indicators: 13 socioeconomic and 15 ecosystem services. In the last case, the indicators were classified according to the type of service that they provide.

In the following tables, it is shown the resilience indicators that were obtained during the participatory session. They are presented in two groups, first the Ecosystem service indicators (Table 1), and Socio-economic indicators (Table 2). At each table, each indicator is classified among State or Management-related indicators. Moreover, a definition of the concept is given, obtained during the participatory session. Finally, the effect of the indicator on the agroforest system is specified

Table1. Ecosystem service indicators to evaluate resilience in agroforest systems

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	Physic-chemical characterisation	MR	Chemical analytics for the main soil properties related to plant growth	Provide nutrients and desirable soil characteristics to the plant growth
2e	Soil organic matter content	MR	Is the combination of plant and animal detritus at various stages of decomposition, cells and tissues of soil microbes, and substances that soil microbes synthesize.	Increase soil water holding capacity and nutrient availability
3	Soil structure	MR	Organization of individual soil particles (clay, silt, sand, and in surface horizons, organic matter) into composite units or aggregates, and the associated pore space left between them.	Enhance root development
4	Soil water holding capacity	MR	The water amount between the matrix potential -33kPa (field capacity) and -1500kPa (permanent wilting point) within an established depth	Store water available to plants
5	Cultivated species richness	MR	The total number of crop species found in a given system or area	Soil surface protection during longer periods and indirect effect on reduction of soil erosion
6	Floristic richness	MR	The total number of plant species found in a given system or area	Diversity in type and quality of organic debris. Pollinators presence enhancement.

* S= State indicator

**MR= Management-related indicator

Table 2. Socio-economic indicators to evaluate resilience in agroforest systems

No.	Indicator name	Indicator type (S* / MR**)	Definition	Effect
1	Self-consumption	MR	Self-sufficiency percentage	People do not depend on external markets
2	Product price	S	Difference between cost production and the RRP	Determine gains or losses in a period of time
3	Production certificate	MR	Selling percentage due to specialised labelling or certificate	Trust from the markets in the process done
4	Nature tourism	MR	Tourism experiences centred on wild or natural environments (income per year related to tourism)	Extra income per year
5	Company structure, type, and size	MR	Number of agricultural sector companies Type and evolution of companies Working hours per year	Rural areas conservation (more and better job opportunities increase the population in rural areas)
6	Accumulated yield	S	Yield (t/ha) in agroforest System vs. yield (t/ha) in monoculture	Let to know the yearly variability crop production

* S= State indicator

**MR= Management-related indicators

ANNEX 6. PARTICIPATORY METHOD PROCESS BY COUNTRY

Partners from Spain (UVic-UCC, CTFC), Italy (UNICT), Egypt (SRTA-City), Algeria (INRAA), and France (AFAF, INRAE) worked at regional level in the tasks T1.2, and T1.4. The aim was to identify the strategies and technologies which should be prioritised in the subsequent data-gathering, research, and analysis activities of TRANSITION. The specific participatory methodologies (e.g., scoring schemes) defined in Task 1.1 were used.

To better describe the participatory process, a questionnaire was performed. The questions can be read at t). It was divided into three sections, according to the different activities reported in the MTI. The first describes the process to select the stakeholders and how the problems to achieve the gender equality. The second part is devoted to explaining how the innovative cultures, the agroforestry farming systems were selected. This section is further complemented in the annex II with the detailed description of the different systems selected at each region. Finally, the third section compile the information related to the selected indicators. The detailed information related to each indicator is summarised in the deliverable D1.2.

The information is presented with the answers of each region

A) Stakeholders' selection

1. Describe the process that you followed to select the stakeholders in your region.
2. Why did you select those people as stakeholders?
3. Who did you select as stakeholders?
4. Are those people representative of the current agricultural situation of your region?
5. Which kind of problems did you experience to select the stakeholders?
6. Which kind of problems did you experience in your region to achieve gender equality?

B) Pilot farms/demo sites selection

7. Describe the process to identify the demo sites in your region (e.g., bibliographical research, stakeholders' meetings, previous contact with the farmer)
8. Are the pilot farms representative of your region? Why?

C) Indicators selection

9. Please describe the process that was followed in your region to select the indicators (Environmental, socio-economical)

According to the project proposal, the selected indicators are those that you want to evaluate in the selected farms in the further activities of the project. The indicators that you selected, are still valid? If you have added more indicators to be studied, please describe why have you added them and list the new indicators.





Transition

Innovative resilient farming systems
in Mediterranean environments

Participatory method process followed by INRAA (Algeria)

A) Stakeholders' selection

1. Describe the process that you followed to select the stakeholders in your region.

The criteria adopted for the choice of stakeholders is to form a representative sample bringing together all the stakeholders involved in the agricultural sector while integrating the gender dimension.

2. Why did you select those people as stakeholders?

We have selected those people to form stakeholders group because those people belong to Agricultural sector with different backgrounds (Farmers, advisers, trainers, researchers, technicians and associations). They can give us their viewpoints about the resilience concept.

3. Whom did you select as stakeholders?

We selected farmers, advisers, trainers, researchers, technicians and associations as stakeholders.

The distribution of stakeholders is as the following:

1 male farmer (North region) (leader of association)

1 male farmer (south region) (leader of association)

1 female teacher (Training Institute)

1 male adviser (Training Institute)

3 male technicians (Technical Institute)

2 female engineers (Research Institute)

2 male's researchers (Research institute)

2 male teachers (University of Sétif, department of Agronomy)

4. Are those people representative of the current agricultural situation of your region?

Yes, they are representative because they represent all categories involved in agricultural sector.

5. Which kind of problems did you experience to select the stakeholders?

The problem that we found to select the stakeholders is equal distribution between agro-ecological zones and gender equality.

6. Which kind of problems did you experience in your region to achieve gender equality?

The problem found is that the participation of women is poor or absent compared to women in agriculture.

B) Pilot farms/demo sites selection

7. Describe the process to identify the demo sites in your region (e.g., bibliographical research, stakeholders' meetings, previous contact with the farmer)



The process followed to identify the demo farms is in the stakeholders meeting and direct contact with farmers and to try to form a representative group taking into account the location (agro-ecological zone) and the practice of agroforestry systems.

8. Are the pilot farms representative of your region? Why?

Yes, the pilot farms are representative because we have taken some criteria in the selection:

- Ownership of farms (land tenure): public farms, collective/individual farms and private farms,
- They are distributed in the three agro-ecological zone (mountainous, higher plains and lower plains);
- The specialized and diversified farms

C) Indicators selection

9. Please describe the process that was followed in your region to select the indicators (Environmental, socio-economical)

The list of indicators was developed based on the characteristics of the Algerian farm and its agro-ecological and socio-economic environment and the agricultural practices enabling them to overcome the various hazards they face.

For the agro ecological indicators we have taken into account the following aspect: diversity of the farms (plant and animal, the presence of local breeds/varieties), organisation of space (cropping patterns, dimension of plots) and farming practices (land works, fertilization, irrigation, MO management and energy dependency of farms)

For the socio-economic indicators, we have taken the following aspects (the services provided to the society: quality of products, employment, collective work, training, direct sale to the consumer) and the economic aspect (profitability, sensitivity to aids, solvency and efficiency of production process).

According to the project proposal, the selected indicators are those that you want to evaluate in the selected farms in the further activities of the project. The indicators that you selected, are still valid? If you have added more indicators to be studied, please describe why have you added them and list the new indicators.

The addition of other indicators can occur gradually by diagnosing these farms (their structure, their functioning and their dynamics over time).



MHS: Mixed horticultural systems

A) Stakeholders' selection

1. Describe the process that you followed to select the stakeholders in your region.

The group is composed of farmers, adviser and project managers. The selection process of farmers is described in the section B of this document.

For the adviser and the project managers, thanks to our pre-existing network and the help of the farmers we met, we identified 6 persons potentially interested by the project. They were contacted by email/phone or met in seminars to talk about the project and 4 of them accepted to participate.

2. Why did you select those people as stakeholders?

We selected those persons because they are expert in MHS and have different backgrounds.

3. Who did you select as stakeholders?

18 farmers (6 women and 12 men) selected by the process described below
1 (female) Project Manager Agriculture specialized in organic agriculture and agroforestry in an association,
1 (male) Project Manager Agriculture in a regional natural parc
1 (male) Project Manager Agroecology in a public administration
1 (male) adviser in a chamber of agriculture

4. Are those people representative of the current agricultural situation of your region?

They are not representative of the diversity of the agriculture of our region but are they are expert in the type of farming systems that we study (Mixed Horticultural Systems) and belong to both private and public sectors.

5. Which kind of problems did you experience to select the stakeholders?

The workload of the farmers, adviser, and project managers was very high in summer when we performed the interviews so it resulted sometimes hard to plan an appointment.

6. Which kind of problems did you experience in your region to achieve gender equality?

32% of the stakeholders are women that is representative of the observed ratio in French agriculture (30% of workers in agriculture are female). In this



sense, we managed to reach gender *equity* without major difficulties. However, given the very low number of MHS farms, we could not exclude any man farmer willing to meet us to reach *equality* in gender representation. The main problem to reach a 50-50 ratio in our sample is thus an under representation of women in the agricultural sector and the very small number of MHS farms which didn't allow us to exclude farms from our sample.

B) Pilot farms/demo sites selection

7. Describe the process to identify the demo sites in your region (e.g., bibliographical research, stakeholders' meetings, previous contact with the farmer)

We first identified around 40 MHSs located in the French Mediterranean climate zone thanks to our pre-existing network and to the data gathered by the French projects, SMART (<https://www.grab.fr/leprojet-smart/>) and ADMED (<http://ad-mediterranee.org/Carte>), that mapped different initiatives of MHSs in France. Among them, we eliminated farms that no longer existed (n=4) and primarily focused on farms where the fruit trees were older than two years so that farmers could share feedback on how the trees impacted farming practices. Those farmers were first contacted by email or phone to plan a visit of their plots and an in-depth interview. We completed our sample by snowball sampling: we asked the farmers who accepted to participate to suggest other potentially interested farmers to us. It helped us to reach new or less visible MHS.

8. Are the pilot farms representative of your region? Why?

We conducted semi-structured interviews with 18 farmers from 16 different farms between April and August 2022. This corresponds to 44% of the known MHSs of the research area. We met 12 men and six women. This sample size was sufficient to observe redundancy in the answers, indicating that no more interviews were necessary to draw robust conclusions. That's why we considered that the farms we chose are representative of the Mediterranean MHS but not of the market gardening or horticulture in the Mediterranean region as a whole.

C) Indicators selection

9. Please describe the process that was followed in your region to select the indicators (Environmental, socio-economical)

The determination of resilience indicators could not be done directly during the interviews because resilience is an abstract concept that can be used in very different contexts (psychology, ecology agronomy, physics etc.) and the notion of indicator is not familiar to the majority of farmers. In order to capture



the differences in farmers' visions of the notion of resilience, we followed an inductive approach based on interviews rather than questionnaires, to avoid orienting answers on the basis of a few prelisted options. Considering that farmers are not necessarily familiar with this notion, we identified three key elements of the definition of resilience that we used as entry points to build the interview outline: *disturbance*, *reorganization* and *function or identity maintenance* (Walker et al. 2004). Each interview began with a visit of the farm that constituted an icebreaker. It helped us to acquire an overview of the farm's structure and functioning and to understand the farmer's main objectives and motivations. The participants were then asked (i) to describe an existing or expected satisfactory state of their farm (i.e., *function or identity maintenance*), and (ii) to explain the disturbances they were subjected to (i.e., *disturbance*) and the associated reactions to adapt the system or not (i.e., *reorganization*). It was only after this first series of questions that we concluded the interview by asking them about their definition of resilience. This made it possible to access farmers' points of view on the different aspects of resilience without imposing our definition of this term.

All the people we met agreed to being recorded and allowed us to take pictures of their land. We spent approximately 2 hours with each farmer. The audio material was integrally transcribed and relevant information was encoded in an Excel sheet to perform a lexical analysis. The indicators were established from the definition of resilience given by the farmers, the description of their reactions to the disturbances they went through, and a scientific literature review

Participatory method process in Egypt (SRTA-City)

A) Stakeholders' selection

1. Describe the process that you followed to select the stakeholders in your region.

In the beginning the team agreed about the definition of the participatory approach that shall pave the way to the project goal. The agreed definition was:

"The participatory approach can be defined as a problem-solving or innovation design process in which the individuals responsible for the task actively engage and involve those directly impacted by the outcome of the work."

The team selected 2 different stockholder groups to reach the highest level of scientific, cognitive and societal impact. The first group was selected based on SRTA-City's partners list comprises a network of individuals, organizations, and institutions with extensive expertise and experience in various aspects of agriculture. Five active stakeholders were selected and directly communicated by phone to arrange a meeting for partnership agreement to increase the project's



visibility through promotional efforts prioritizing the sector's genuine needs as a starting point.. Two face to face and three online meetings with the selected stakeholders discussing and planning the goals of the project and further collaborations.

The second group of stakeholders consisted of 24 undergraduate students, who were provided with an online training program organized by the SRTA-City team from 12 to 16 September 2021. The training program, entitled "Innovative Farming System Techniques – Egypt's Sustainable Development Goals 2030," was developed within the framework of TRANSITION. The program's aim was not only to educate students about the concepts of sustainable agriculture resilience, but also to gather their insights and knowledge about mixed farming systems, resilience, and associated challenges as they are connected to the study area and similar rural areas. This approach was part of a social and participatory strategy, intended to maximize the project's impact.

2. Why did you select those people as stakeholders?

The selection of the stakeholder group was based on their **Expertise** in mixed farming agricultural activities can provide valuable insights and guidance. **Influence** with significant impact on the agricultural activities in question, such as farmers, government agencies, or industry associations. **Diversity** backgrounds, perspectives, and experiences to ensure that the project or initiative is inclusive and representative of the wider community. **History of working** with the team in research projects. In general, SRTA-City partners and stakeholders selection code depends on who possess the necessary knowledge, resources, and influence to contribute meaningfully to the project, their track record in initiatives, and their potential for collaboration and partnership.

3. Who did you select as stakeholders?

- 1 male executive director of SRTA-City research farm (Government/Research)
- 1 male chairman of Soil and Water Science Department, Faculty of Agriculture, Alexandria University (Government/Education)
- 1 male chair of the board of the Egyptian Khalej Company for Land Reclamation (Private)
- 1 male coordinator of Mutabas Agricultural cooperation (Government/Policy)
- 1 male coordinator of El-Bangar Agricultural cooperation (Government/Policy)

4. Are those people representative of the current agricultural situation of your region?

Yes, they cover different expertise in agricultural sectors, from education to private and public sectors.

5. Which kind of problems did you experience to select the stakeholders?

The team did not encounter any major problems or challenges in selecting the stakeholders for the project. Due to the well-curated pool of potential stakeholders, which greatly facilitated the selection process. Moreover, the team was able to leverage the expertise and network of SRTA-City to identify suitable



stakeholders with relevant knowledge and resources in the agricultural domain. Additionally, the team did not face any significant issues in dealing with farm owners, due to the frequent interactions of the Arid Lands Cultivation Research Institute, SRTA-City and farmers in their problem solving and services providing.

6. Which problems did you experience in your region to achieve gender equality?

The female workforce's large concentration in agriculture is marginal because women are a small minority in terms of agricultural land ownership in the country. According to the Food and Agriculture Organization, they make up only 5% while men comprise 95%. Women are often denied access to inheritance in Egypt, most particularly if it is land or other property. This practice is debilitating because financial asset ownership is essential for women to exercise agency and make decisions about their lives, pursue educational opportunities, finance entrepreneurial work, or simply have some financial security (<https://www.mei.edu/publications/millions-rural-working-women-egypt-risk-climate-change>). However, the responsible of the on-farm research and its management in the team is female, SRTA-City is trying to reach the gender equality ratio in research and development.

B) Pilot farms/demo sites selection

7. Describe the process to identify the demo sites in your region (e.g., bibliographical research, stakeholders' meetings, previous contact with the farmer)

The demo-site was selected based on the potential applicability of innovative technologies in similar regions facing comparable climate change pressures. The SRTA-City team identified Mutabas, Kafr El-Shikh (also referred to as Mubarak project or Graduates' villages) as an appropriate location, given the prevalence of environmental and agricultural challenges especially farming along the North Nile Delta coast and regions in the Western Coast with estimated impact for 792000 acres as shown in the map below. The team experience with the demo-site, previous studies and other running projects.

8. Are the pilot farms representative of your region? Why?

Yes, the research farm of SRTA-City offered comparable climatic and soil condition, ensuring that pilot results would be relevant and aligned with the study area. The flexibility of experiments design for agroforestry systems are there, with adopted species to mitigate climate change events, waste management's plants and trained employees.



■ Suggested impacted areas (1) - 227000 Acres
■ Suggested impacted areas (2) - Egypt Strategy 2030 Plan dedicated areas for Rangeland management - 565000 Acres

C) Indicators selection

9. Please describe the process that was followed in your region to select the indicators (Environmental, socio-economical)

- In the journey of defining resilience indicators with stakeholders and farmers interviews along the three village in the demo-site area to define resilience and resilience indicators, the team implemented two methods, the first method is preparing seven questions about resilience and it's potential. Those general questions were then coupled with questionnaires and KANOs survey model which is an analysis tool that enable understanding of how target groups responses to questions and new technologies. By merging these two approaches, it is possible to prioritize the resilience definition and the most critical indicators and determine the optimal allocation of resources and efforts for climate change resilience and adaptation strategies. This approach also ensures that the resilience indicators chosen are aligned with stakeholder and farmer needs and expectations, which ultimately improves the relevance and effectiveness of climate change resilience interventions in agriculture. The second implemented method to ensure analytical soundness of indicators, a full land resources survey with comparative study done on 2015, questioners, and Kano's Model survey and published literature reviews were conducted to generate a reference database of potential resilience indicators for each of the themes identified.
- The general asked questions:
 1. In your opinion, what does agricultural resilience mean?
 2. How do you perceive climate change impacting agricultural productivity in your region?
 3. What practices do you currently use to cope with the effects of changing weather patterns and environmental stressors?



4. Have you implemented any new practices or technologies regarding normal farming and mixed farming systems to increase your farm's resilience to climate change? If so, what were they and how have they worked?
5. How do you stay informed about the latest agricultural research and best practices related to climate change adaptation?
6. What kind of support or resources would you need to improve your farm's resilience to climate change?
7. Do you think there are any specific policy changes or interventions that could help farmers in your region better adapt to climate change?
 - After analyzing the results of the general questions, questionnaires and KANOs model survey, we agreed to define “Resilience” to share the same perspective as:

“The ability of farming systems to adapt and remain productive in the face of climate change”
 - 29 locations sampled in 3 depths (0 – 30, 30 – 60 and 60 – 90 cm) in the same locations sampled on 2015 to compare and full assessment for the study area.
 - Based on the stakeholders meeting, general questions, questionnaire, KANOs model survey and the soil survey and soil data comparative, the team invited the stakeholder to define the resilience indicators.
10. **According to the project proposal, the selected indicators are those that you want to evaluate in the selected farms in the further activities of the project. The indicators that you selected are still valid? if you have added more indicators to be studied, please describe why have you added them and list the new indicators.**

Still VALID

The selected variables were classified into socioeconomic and management-related indicators”

- **Socio-economic indicators:**
 1. Crop yield (Crop yield per crop in each management plan)
 2. ROI (Quality compared to price in the last 2 seasons)
- **Management-related indicators:**
 1. Soil Carbon content (OC content listed in the literature reviews and after the management plan implementation)
 2. Soil moisture content (Dryness cycle between irrigations)
 3. Growing period (Seeding start dates)
 4. Crop yield (Crop yield per crop in each management plan)
 5. Pests (Species records)

Participatory method process in ITALY (UNICT)

A) Stakeholders' selection

1. Describe the process that you followed to select the stakeholders in your region.

People active in agriculture at different levels were contacted to be involved in the project. Among them, 9 were interested and participated to the questionnaire through phone calls. We set a series of requirements that are in agreement with the aim of the project, such as resilience, multifunctionality, and sustainability in the environmental and social contexts. Through the analysis of the interviews, we selected 5 stakeholders who met the requirements, were representative of the initial group, and were willing to form the stakeholder group.

2. Why did you select those people as stakeholders?

In our selection process we took into account the representativity in terms of level of education, gender, and farm location. These people selected were interested in the project and they volunteer to participate.

3. Who did you select as stakeholders?

- 1 (female) Farmer, owner of a farmhouse.
- 1 (male) Farmer, trader. Owner of the pilot farm.
- 1 (female) Farmer.
- 1 (male) Farmer, trader of wine.
- 1 (female) Agronomist and farmer.

4. Are those people representative of the current agricultural situation of your region?

Our stakeholders are all farmers with high levels of education and very concerned about environmental and social topics and therefore interested to collaborate and share information and knowledge with us.

In general, not all farmers in our area are educated, but in the last decades, the agriculture sector has been involving younger and more educated people.

Our selection was representative of the current agricultural situation of our region in terms of farm location in fact, farms are spread in different areas of Sicily, and specifically province of Catania, Palermo and Enna.

5. Which kind of problems did you experience to select the stakeholders?

Considering that agroforestry is not common in our region, it was a bit difficult to find people interested in this topic. Many farmers were involved in activities related to agroforestry without an awareness of these systems.

6. Which kind of problems did you experience in your region to achieve gender equality?



Historically agriculture has been a sector practiced by men but in the last decades always more women have demonstrated interest. According to what was found in 2022 by “Assoesercenti Sicilia” it looks like that in Sicily the percentage of women who own an activity is of 24.35 % of the total activities and 31.25 % of them are in the agriculture sector. It is clear that the way to gender equality is still far but the statistics for the agriculture sector are promising.

In our case, we did not have specific problems reaching gender equality since our ratio is almost close to 1. Another aspect that we found in our interviews is that the females education level is higher than males.

B) Pilot farms/demo sites selection

7. Describe the process to identify the demo sites in your region (e.g., bibliographical research, stakeholders’ meetings, previous contact with the farmer)

As mentioned before, agroforestry systems are not very common in our region. The farms we selected as pilot farms are owned by farmers who have been involved in other collaborations with the research group. In Sicily, farms with water availability on-site usually grow citrus and other intensive fruit crops while the main rainfed tree crops are olive and almond. In our area, there are many farms that produce olives for olive oil but the planting density is too high and this does not allow to have other annual crops between the rows of trees. The chosen pilot farms meet all these requirements.

8. Are the pilot farms representative of your region? Why?

Pilot farms are representative of the rainfed tree farms in our region and therefore of the conditions that are suitable for the application of agroforestry.

C) Indicators selection

9. Please describe the process that was followed in your region to select the indicators (Environmental, socio-economical)

Socio-economic indicators

- 1) Self-sustainability
- 2) Knowledge
- 3) Reduction of unemployment
- 4) Well-being

Ecosystem services indicators

- 1) GHG emission
- 2) Soil erosion
- 3) Soil organic matter
- 4) Carbon sequestration



- 5) Nitrogen balance
- 6) Biodiversity

(These indicators are the same that we reported in the Deliverable D1.2).

Participatory method process in SPAIN (UVIC-UCC)

A) Stakeholders' selection

1. Describe the process that you followed to select the stakeholders in your region.

First, through previous contacts and research, a list of 30 potential stakeholders was created, among farmers, institutions, or companies related to the agroforestry and mixed farming systems. From them, 17 people were contacted by email or phone. Detailed information about the project was given and they were invited to participate in an online meeting (because of the COVID-19 restrictions). A total of 14 people (ratio women/men 4/10) confirmed their interest in participating in the first stakeholders meeting.

The first meeting was attended by 8 people. The project was presented and the aim of forming a group of stakeholders within the main activities to be done. A second stakeholders meeting was arranged with the people who accepted to become a stakeholder. It was organised 3 months later when the COVID-19 restrictions were reduced. A total of 5 people (ratio women/men 1/4) attended the meeting plus one other female person who asked for a summary of the session.

2. Why did you select those people as stakeholders?

To select the potential stakeholders, we considered the main agricultural activities in NE of Spain, the experience in the agricultural sector and the diversity in sectors (public, private, research institutes). During the first contact with stakeholders, moderators (UVIC-UCC) explained the aims of the project and the way to be involved in the project, and assistants were explicitly invited to participate as stakeholders. The decision of becoming part of the stakeholder group was taken by each person.

3. Who did you select as stakeholders?

- 1 female teacher at a farmers' school
- 1 male agroforestry farmer and technical advisor at a farmers' association
- 1 male cluster manager at the Catalan Wine cluster (a non-profit organization)
- 1 male forestry technician in the Department of Agriculture of Catalonia government
- 1 male innovative technician from the Association of Rural Initiatives in Catalonia region



1 female researcher of the Institute of Agrifood Research and Technology (IRTA), a research institute owned by the Government of Catalonia (she only participated in the first stakeholder meeting but after the second meeting, we had a parallel meeting with her)

4. Are those people representative of the current agricultural situation of your region?

Yes, they cover different expertise in agricultural sectors, from education to private and public sectors.

5. Which kind of problems did you experience to select the stakeholders?

Agroforestry and mixed farming systems are not the main activities in the region. This fact limited the number of people prone to be selected to participate in the project.

There were people who could not attend the meetings despite their interest in agroforestry systems. In one case, we had a parallel meeting to explain the activities done and the main outputs of the meeting.

6. Which problems did you experience in your region to achieve gender equality?

The agricultural sector is widely dominated by men. According to the last consultancy done by the national institute of Statistics in Spain (INE by the Spanish name), in 2020 only 27% of the farms were led by a woman. In the Catalonia region, only 24% of the farmers are women (https://www.ine.es/dynqs/INEbase/categoria.htm?c=Estadistica_P&cid=1254735570567). Gender inequality difficulted to find female women related/interested in agroforestry systems/mixed farming. To compensate for this fact, we considered also women with expertise in agriculture as researchers, teachers or technicians.

B) Pilot farms/demo sites selection

7. Describe the process to identify the demo sites in your region (e.g., bibliographical research, stakeholders' meetings, previous contact with the farmer)

During the stakeholders' meeting, images of different types of agroforestry and mixed systems were shown. Then, they were asked to participate in a brainstorming of the different systems they could know in the territory. After the brainstorming, each of them explained which agroforestry and/or mixed systems they knew. A list of 18 different systems was obtained. Within the stakeholders, we discussed the relevance of each of them and then they selected the 6 main systems.

The next step was to contact the farmers working in agroforestry systems. The stakeholders' group (5 participants) worked as a bridge. First, 30 farmers were contacted, and semi-structured interviews were performed face-to-face with 19 farmers at their farms from June to September 2022. We moved to the place of

each farmer to perform the interview and visit their fields. In some cases, the farmer explicitly declared his/her interest in becoming part of the selected field sites.

In all cases, we explained the use of their personal data, and we asked for permission to take photos and to become part of a dissemination database, in order to communicate them for future activities related to the project.

After finishing the interviews, the information was summarised. The final selection of the sites to be monitored considered the crops already growing in the region but also the innovative ones, the information obtained from the stakeholder meeting, and the farmers' inputs from the interviews.

8. Are the pilot farms representative of your region? Why?

The selected pilots are representative of the traditional crops in the region (vineyard, olive trees, and winter cereal), the natural vegetation (forest and Med-shrubs), and also innovative agricultural approaches (legumes and sainfoins). According to the last agricultural census 2020, olive trees and vineyards are the first and second woody crops in Catalonia region, respectively ([Idescat. Statistical Yearbook of Catalonia. Cultivated land. Woody crops. By type. Counties and Aran, areas and provinces.](#)). The same yearbook indicates that winter cereals occupy the largest surface in the Catalonia region.

Specifically, the selected pilot farms cover vineyards in altitude with cover crops rotation; kernza (*Thinopyrum intermedium*), a perennial cereal; winter cereal surrounded with olive trees, olive trees in rows with sainfoins in between; and vineyards with natural cover crops, borders without cultivation and promotion of Mediterranean vegetation, managed forest in the sloppy areas and in conjunction with olive trees with a natural cover crop.

Olive trees and vineyards are traditional crops, and their innovative aspect is the use of cover crops, natural or specific combinations of winter cereals or legumes. Selecting a vineyard in altitude lets us explore the adaptability of the plants to places where such crops were not grown previously, as part of their resilience to climate change. Winter cereal surrounded by olive trees aims to show the benefits of keeping the traditional crop combination, against big surfaces of cereals to facilitate the machinery work. Kernza is an innovative crop for the region and a potential crop in the context of climate change. Its perennial characteristics led to the multi-yield while increasing soil organic matter. Kernza can cover the soil surface avoiding runoff, limiting weed growth, and reducing the use of machinery.

C) Indicators selection

9. Please describe the process that was followed in your region to select the indicators (Environmental, socio-economical)

First, a bibliographical information search was performed. Then, during the stakeholders' meeting, the participants explained their concept of resilience and it complied with the definition proposed. Next, the concept of resilience indicators and the classification adopted in the TRANSITION project (socio-



economic indicators and ecosystem services indicators) were introduced and discussed among the participants. The attendees are then asked to mention the socio-economic indicators and ecosystem services indicators that they consider relevant for agroforestry and mixed systems in the Catalonia region. A total of 12 socioeconomic and 15 ecosystem services indicators were listed. Then, they discussed and voted to prioritize them.

Apart from the session, within the semi-structured interviews, farmers were questioned about their interests and the importance for them, about the resilience indicators.

Finally, we summarised both results and obtained a final list of 4 ecosystem services and 6 socio-economic indicators to be evaluated.

10. According to the project proposal, the selected indicators are those that you want to evaluate in the selected farms in the further activities of the project. The indicators that you selected are still valid? if you have added more indicators to be studied, please describe why have you added them and list the new indicators.

The selected variables were classified into socioeconomic and ecosystem services indicators. The data source comes through data collection [DB] from statistics from the Statistical Yearbooks of Catalonia, the Spanish National Institute of Statistics, and from information provided by the farmers [F].

Socio-economic indicators

- Self-consumption (% of self-sufficiency) [F]
- "Product price" (difference between product price and the PVP) [DB]
- Product certificates (% of sales due to the certificates/labels) [F]
- Nature tourism (presence/absence and incomes [€/year] associated with tourism) [F]
- Structure, type, and size of the agri-business (number agri-business; evolution of the agri-business type; working hours/year) [DB] [F]
- Accumulated year (annual yield [t/ha] in the agroforestry system vs. Annual yield [t/ha] in the crops under monoculture) [DB] [F]

Ecosystem services indicators

- Chemical characterisation of the soil (N, P, K, Ca, Mg, Na, K, pH, CE, and soil organic matter content)
- Physical characterisation of the soil (texture, aggregates stability, structure type and porosity, water holding capacity)
- Cultivates species richness (comparison against monoculture)
- Floristic richness (number of plant species per square meter)

Samplings were established according to each field size, after the harvest period. The sampling planning was developed for each demo site and was commented on with the farmer to confirm his agreement. The samples will be taken from 0-30 cm depth. A composite sample will be taken at each of the crops of every system.

ANNEX 7. SELECTION OF PRIORITY SYSTEMS, STRATEGIES, AND TECHNOLOGIES BY COUNTRY

ALGERIA

Algerian partners (INRAA) report 8 field sites to have the on-field measurements. The site descriptions are arranged by blocks of three farms per table

Farm details	FARM 01	FARM 02	FARM 03
ID name:	Khabbaba Abdelouahab	Sersour Salah	Laghmara Rabah
Municipality:	Mezloug	Bir Haddada	Ain Arnet
Province or Department:	Sétif	Sétif	Sétif
Country:	Algeria	Algeria	Algeria
Altitude (masl):	915	950	1009
Climate eco-region:	South Mediterranean Mixed Woodlands & Forests (PA23)	South Mediterranean Mixed Woodlands & Forests (PA23)	South Mediterranean Mixed Woodlands & Forests (PA23)
Rainfall (mm per year):	150	180	300
Temperature (mean annual °C):			
Soil main characteristics:	light and stony (poor in OM)	light, stony and calcarous (ppor in OM)	heavy, clayey (0,5% of OM)
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	Silvo-pastoral/mixed farming	Agropastoral/mixed farming	Agropastoral/mixed farming
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	monocropping	monocropping	monocropping
Year of establishment:	it dates from the colonial period, when it belonged to a French colonon, after independence it became a vacant property, then	it dates from the colonial period, when it belonged to 3 French colonon (Lizou, Michel and Stilla) , after independence it became a	it dates from the colonial period (1935), when it belonged to a French colonon, after independence it became a vacant property, then



Farm details	FARM 01	FARM 02	FARM 03
	nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it was attached to soflait (dairy farm company) of the GIPLAIT group.	vacant property, then nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it was attached to filiale verte (National Cattle Feed Office) of the ONAB group.	nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it was attached to soflait (dairy farm company) of the GIPLAIT group.
Trees on the farm:	Only forest trees: poplar, ash trees	olive, almond, apple, plum	only forest trees: Ash trees, aleppo pine and cypress
Trees arrangement:	N/A	5*5m	
Crops on the farm:	Meadows; cereal and forage crops	barley, oats, triticale, durum wheat,	Durum wheat, bread wheat, barley, oat, field peas, lentil and chickpeas
Animals on the farm:	Cattle	Sheep, bees	cattle
Other activities (agrotourism, proximity market, beekeeping, other):	N/A	yes	n/a
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	N/A	N/A	rotation practice, cereal-legume, spring tillage
Equipment fleet (ownership/ rent):	Ownership: tractors and accessories, combine harvester, baler wrapper, milk cooling tank, milking parlor, animal feed grinder tractors and accessories, combine harvester, baler wrapper, milk cooling tank,	tractors and accessories, combine harvester, mower, baler pick-up, animal feed grinder, Truck	tractors and accessories, combine harvester, forage harvester, wrapper, baler irrigation equipment, truck

Farm details	FARM 01	FARM 02	FARM 03
	milking parlor, animal feed grinder, Truck		
Machinery fleet (ownership/ rent):	ownership	ownership	ownership
Water resources (irrigation, dryland):	Yes	yes	yes
Land ownership (joint tenancy, sole ownership, community property, custody):	Yes	yes	yes
Knowledge and training in agriculture:	Yes: staff is composed from: engineers; technicians	Yes: staff is composed from: engineers; technicians	Yes: staff is composed from: engineers; technicians
Is farming the main activity:	Yes	yes	yes
Number of permanent workers in the farm:	7	10	9
Number of seasonal workers (non-family):	no	no	no
Number of family workers:	no	no	no
Resilience objectives of the system (technical, climatic, commercial):	The objective is the diversification of farming activities such as: construction of boreholes, sheep workshops, fattening of young bulls and lambs, partnership with private farmers for the production of potatoes and tomatoes	The objective is the improvement of cereal, olive and sheep production, increase of income	The objective is introduction of the practice of irrigation and the realization of a modern barn for 200 DC



Farm details	FARM 04	FARM 05	FARM 06
ID name:	Makhloufi Aissa	Chakchoukh Messoud	Chikh El Aifa
Municipality:	El Eulma	Beni Fouda	Ain Roua
Province or Department:	Sétif	Sétif	Sétif
Country:	Algeria	Algeria	Algeria
Altitude (masl):	980	843	966
Climate eco-region:	South Mediterranean Mixed Woodlands & Forests (PA23)	South Mediterranean Mixed Woodlands & Forests (PA23)	South Mediterranean Mixed Woodlands & Forests (PA23)
Rainfall (mm per year):	220	250	500
Temperature (mean annual °C):			
Soil main characteristics:	Clayey and Sandy-clayey and calcarous soil (poor in OM)	clayey	clay-loam (OM: mean)
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	Agropastoral/mixed farming	Agropastoral/mixed farming	agroforestry-silvopastoral /mixed farming
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	monocropping	monocropping	agroforestry
Year of establishment:	it dates from the colonial period, when it belonged to 3 French colonon, after independence it became a vacant property, then nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it was attached to filiale verte	it dates from the colonial period, when it belonged to a French colonon, after independence it became a vacant property, then nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it	it dates from the colonial period, when it belonged to a French colonon, after independence it became a vacant property, then nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it



Farm details	FARM 04	FARM 05	FARM 06
	(National Cattle Feed Office) of the ONAB group.	was attached to soflait (dairy farm company) of the GIPLAIT group.	was attached to soflait (dairy farm company) of the GIPLAIT group.
Trees on the farm:	olive and forest trees: aleppo pine and cypress	olive and forest trees: aleppo pine and cypress	olive tree, almond trees, apricot, apple, pear, peach, walnut, vine,
Trees arrangement:	10*10 for olive	10*10	n/a
Crops on the farm:	Durum wheat, bread wheat, barley, oat, triticale, Alfa-Alfa, lentil, olive tree, natural grassland	Durum wheat, bread wheat, barley, green barley, oat, lentil and chickpeas, triticale, vetch-oat, maize, sorghum	Durum wheat, bread wheat, barley, green barley, oat, lentil and chickpeas, triticale, vetch-oat, vetch-triticale, alfa-alfa
Animals on the farm:	cattle, broiler	cattle, sheep, broiler	Cattle, sheep, broiler
Other activities (agrotourism, proximity market, beekeeping, other):	n/a	n/a	n/a
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	rotation practice, cereal-legume, spring tillage	rotation practice, cereal-legume, spring tillage	rotation practice, cereal-legume, spring tillage
Equipment fleet (ownership/ rent):	tractors and accessories, combine harvester, forage harvester, wrapper, baler, irrigation equipment, Truck	tractors and accessories, combine harvester, forage harvester, wrapper, baler, irrigation equipment, Truck, milking machine	tractors and accessories, combine harvester, forage harvester (ensileuse), baler, irrigation equipment, Truck, milking machine
Machinery fleet (ownership/ rent):	ownership	ownership	ownership
Water resources (irrigation, dryland):	yes	yes	yes
Land ownership (joint tenancy, sole ownership, community property, custody):	yes	yes	yes
Knowledge and training in agriculture:	Yes: staff is composed from: engineers; technicians	Yes: staff is composed from: green from: engineers; technicians,	Yes: staff is composed from: green from: engineers; technicians
Is farming the main activity:	yes	yes	yes
Number of permanent workers in the farm:	8	13	15

Farm details	FARM 04	FARM 05	FARM 06
Number of seasonal workers (non-family):	no	no	(subcontract for picking fruit)
Number of family workers:	no	no	no
Resilience objectives of the system (technical, climatic, commercial):	Objective is introduction of direct seeding, calf fattening, apple tree planting	The objective is modernization of the barn and extension of the fodder area	modernization of poultry houses, laying hen batteries, construction of irrigation boreholes, increase in the number of cattle and sheep



Farm details	FARM 07	FARM 08
ID name:	Bouteraa Mahmoud	Tebbani Hakimi
Municipality:	El Ouldja	Sétif
Province or Department:	Sétif	Sétif
Country:	Algeria	Algeria
Altitude (masl):	905	965
Climate eco-region:	South Mediterranean Mixed Woodlands & Forests (PA23)	South Mediterranean Mixed Woodlands & Forests (PA23)
Rainfall (mm per year):	100	300
Temperature (mean annual °C):		
Soil main characteristics:	light, stony, calcareous and saline	loamy+calcareous
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	Agropastoral/mixed farming	agropastoral/mixed farming
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	monocropping	monocropping
Year of establishment:	It dates from the colonial period, when it belonged to a French colonon named Black and her daughter dépoulette, after independence it became a vacant property, then nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farms, but their appearance changes each time, there is a restructuring of the agricultural sector, where in 2016, it was attached to ACM of FRIGO MEDIT group.	1997 (This land belonged to it belonged to a French colonon named Dirou , after independence it became a vacant property, then nationalized by the State and took the name of "self-managed socialist estates with the launch of the agrarian revolution in the early 1970s , it becomes pilot farm (BOUKHRISSA), but after the restructuring of agricultural sector of 1987,this farm is divided into individual farms (EAI) and distributed to private farmers
Trees on the farm:	olive trees	only forest trees: yes, poplar, eucalyptus
Trees arrangement:	5*5	
Crops on the farm:	Barley, oat, lentil,	Durum wheat, association (triticale-oat, vetch-field peas), alfa-alfa, corn (silage)
Animals on the farm:	sheep	cattle



Farm details	FARM 07	FARM 08
Other activities (agrotourism, proximity market, beekeeping, other):	n/a	yes
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	rotation practice, cereal-legume, spring tillage	direct seeding, association of 4 forages, production of concentrate at farm
Equipment fleet (ownership/ rent):	tractors and accessories, combine harvester, baler, irrigation equipment, Truck,	2tractors and accessories, combine harvester, direct seeder, baler, irrigation equipment, Truck, milking machine
Machinery fleet (ownership/ rent):	ownership	ownership
Water resources (irrigation, dryland):	yes	yes
Land ownership (joint tenancy, sole ownership, community property, custody):	yes	yes
Knowledge and training in agriculture:	Yes: staff is composed from: green from: engineers; technicians,	yes: he has training in agriculture
Is farming the main activity:	yes	yes
Number of permanent workers in the farm:	9	1
Number of seasonal workers (non-family):	n/a	2
Number of family workers:	n/a	1
Resilience objectives of the system (technical, climatic, commercial):	the objective is construction of irrigation boreholes, partnership with an electricity company for the installation of solar panels over an area of 100ha (use of poles as a support for irrigation pipes, shelter panels (shade) for livestock, and use of the cultivated area)	the objective is the improvement of cereal production, increase of income



EGYPT.

Egyptian partners (SRTA-City) report 1 field site to have the on-field measurements. The site description is shown here below.

Farm details	SRTA-City Research Farm
ID name:	FARM-GM30
Municipality:	Borg El-Arab
Province or Department:	Alexandria
Country:	Egypt
Altitude (masl):	12
Climate eco-region:	North Saharan Desert Xeric Steppe and Woodlands
Rainfall (mm per year):	30 - 100
Temperature (mean annual °C):	10 - 35
Soil main characteristics:	Undifferentiated Quaternary deposits. Alluvial fans, wadi deposits, sand, gravel, recent coastal deposits. Typic Torriorthent and Lithic Torriorthent, Sandy loam to loamy sand texture. Gently undulating, shallow to moderate depth.
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	Agroforestry
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	intercropping
Year of establishment:	2005
Trees on the farm:	Jatropha, berries, figs, and olives
Trees arrangement:	5 x 5m
Crops on the farm:	Wheat, tomatoes, alfalfa, eggplants and potatoes
Animals on the farm:	N/A
Other activities (agrotourism, proximity market, beekeeping, other):	N/A
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	mulching, soil organic amendments, ground water desalination by organic materials
Equipment fleet (ownership/ rent):	N/A



Machinery fleet (ownership/ rent):	Rented
Water resources (irrigation, dryland):	Irrigation
Land ownership (joint tenancy, sole ownership, community property, custody):	sole ownership
Knowledge and training in agriculture:	Not knowledge nor training but the farmer has a technical assessment
Is farming the main activity:	YES
Number of permanent workers in the farm:	15
Number of seasonal workers (non-family):	5
Number of family workers:	N/A
Resilience objectives of the system (technical, climatic, commercial):	Organic fertilizers, salinity mitigation and pest control



FRANCE

French partners (INRAE and AFAF) 16 field sites. The system was selected as Mixed horticultural systems. However, a delay on the selection of the specific pilot sites have been experienced. They are waiting for the confirmation of willingness of one farm on which they will conduct the in-depth analysis plus 7 to 10 where they will have only part of the selected indicators.

The site descriptions are arranged by blocks of four systems per table

Farm details	FARM 01	FARM 02	FARM 03	FARM 04
ID name:	1	2	3	4
Municipality:	Avignon	Vezénobre	Pernes les fontaines	Le val
Province or Department:	Vaucluse	Gard	Vaucluse	Var
Country:	France	France	France	France
Altitude (masl):	30	102	100	222
Climate eco-region:	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests
Rainfall (mm per year):	752	949	713	735
Temperature (mean annual °C):	14.9	13.5	14.2	13.9
Soil main characteristics:	Fluvisol; Argilo-limoneuse	Fluvisol; Limono-sableuse	Calcosol; Argileuse	Fluvisol; Argileuse
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral / mixed farming):	Mixed horticultural systems	Mixed horticultural systems	Mixed horticultural systems	Mixed horticultural systems
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	NA	NA	NA	NA
Year of establishment:	2016	2010	2013	2019



Farm details	FARM 01	FARM 02	FARM 03	FARM 04
Trees on the farm:	Pommier; prunier; poirier; cerisier; pêcher; abricotier; plaqueminier; mandarinier; nectarinier	Pêcher; plaqueminier; pommier; poirier; prunier; cerisier; abricotier; asiminier	Pommier; figuier; olivier; prunier; noisetier; cerisier; noyer; pêcher; chêne truffier; plaqueminiers; autres	Pommier; pêcher; abricotier; figuier; prunier; pistacher; murier
Trees arrangement:	Lines	Lines	Lines	Lines
Crops on the farm:	Diversified vegetables	Diversified vegetables	Diversified vegetables	Diversified vegetables
Animals on the farm:	50 ducks	4 ducks	2 ewes	50 chickens
Other activities (agrotourism, proximity market, beekeeping, other):	No	Sale of timber	Training	Consulting
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	Living soil market gardening	NA	NA	Living soil market gardening
Equipment fleet (ownership/ rent):	Owner	Owner	Owner	Owner
Machinery fleet (ownership/ rent):	Owner	Owner	Owner	Owner
Water resources (irrigation, dryland):	River	River	NA	River
Land ownership (joint tenancy, sole ownership, community property, custody):	Rented	Owner	Owner	Owner
Knowledge and training in agriculture:	Yes	NA	No	No
Is farming the main activity:	Yes	Yes	Yes	No
Number of permanent workers in the farm:	3	1	2	3
Number of seasonal workers (non-family):	1	0	1	2
Number of family workers:	0	1	0	1
Resilience objectives of the system (technical, climatic, commercial):	Structuring Environmentalist/multidimensional	Piloting Multidimensional	Piloting Multidimensional	Piloting Multidimensional



Farm details	FARM 05	FARM 06	FARM 07	FARM 08
ID name:	5	6	7	8
Municipality:	Le thor	Peyrolles en provence	La treille	Mirmande
Province or Department:	Vaucluse	Bouches du Rhône	Bouches du Rhône	Drôme
Country:	France	France	France	France
Altitude (masl):	49	205	143-170	212
Climate eco-region:	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests
Rainfall (mm per year):	759	694	602	966
Temperature (mean annual °C):	15.3	14.1	15.0	13.0
Soil main characteristics:	Reductisol; Argilo-limono-sableux	Fluvisol ; NA	Lithosol; NA	Rendosol; Limono-argileux
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral / mixed farming):	Agroforestry (MHS)	Agroforestry (MHS)	Mixed horticultural systems	Mixed horticultural systems
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	NA	NA	NA	NA
Year of establishment:	2012	2018	2013	2011
Trees on the farm:	Pommier; noisetier; poirier; figuier; prunier	Abricotier; cerisier; figuier; prunier; pommier; poirier; plaqueminier; oliviers; agrumes résistant au froid; asiminier; cormier; amélanancier; cognassiers; jujubier	Prunier; abricotier; figuier; olivier; plaqueminier; noisetier; cerisiers; feijoa; amandier; jujubier; nashis; pêcher	Néflier; pêcher; cognassier; pommier; poirier; cerisier; noisetier; abricotier; prunier; plaqueminier; noyer; amandier; nectarinier; figuier
Trees arrangement:	Lines	Lines	Lines	Lines
Crops on the farm:	Diversified vegetables	Diversified vegetables	Diversified vegetables	Diversified vegetables
Animals on the farm:	0	0	120 chickens	18 chickens and 2 horses



Farm details	FARM 05	FARM 06	FARM 07	FARM 08
Other activities (agrotourism, proximity market, beekeeping, other):	No	Hosting	Training	Hosting
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	NA	NA	Living soil market gardening	NA
Equipment fleet (ownership/ rent):	Owner	Owner	Owner	Owner
Machinery fleet (ownership/ rent):	No machinery	Owner	Owner	Owner
Water resources (irrigation, dryland):	1 drilling	NA	NA	Springs
Land ownership (joint tenancy, sole ownership, community property, custody):	Owner	Owner	Rented	Owner
Knowledge and training in agriculture:	No	No	Yes	No
Is farming the main activity:	Yes	Yes	Yes	No
Number of permanent workers in the farm:	1	1	1.5	1
Number of seasonal workers (non-family):	0	0	1	NA
Number of family workers:	0	1	0	NA
Resilience objectives of the system (technical, climatic, commercial):	Structuring - Multidimensional	Structuring - Environmental	Structuring - Environmental	Structuring - Environmental



Farm details	FARM 09	FARM 10	FARM 11	FARM 12
ID name:	9	10	11	12
Municipality:	Die	Tourves	Ansouis	Pernes les fontaines
Province or Department:	Drôme	Var	Vaucluse	Vaucluse
Country:	France	France	France	France
Altitude (masl):	407	265	245	50
Climate eco-region:	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests
Rainfall (mm per year):	894	735	746	713
Temperature (mean annual °C):	12.2	13.0	13.3	14.2
Soil main characteristics:	Fluvisol ; Argileuse	Fluvisol; NA	Fluvisol; NA	Fluvisol; Limono-argileuse
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral / mixed farming):	Agroforestry (MHS)	Mixed horticultural systems	Mixed horticultural systems	Mixed horticultural systems
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	NA	NA	NA	NA
Year of establishment:	2008	2012	2010	2020
Trees on the farm:	Prunier; pommier; goumi; eleagnus; noyer; catalpa; yuzu; poivre de schichuan, cognassier; sureau; tea tree; figuier; aubépine; nashi; poivre de timut; citron	Févier d'Amérique; orme; eleagnus; prunier; molinia	Noyers; micocoulier; sorbier; olivier de bohème	Abricotier; pêcher; prunier; pommier
Trees arrangement:	Lines	Lines	Lines	Lines
Crops on the farm:	Diversified vegetables	Diversified vegetables	Diversified vegetables	Diversified vegetables
Animals on the farm:	0	20 chickens	400 chickens	600 chickens



Farm details	FARM 09	FARM 10	FARM 11	FARM 12
Other activities (agrotourism, proximity market, beekeeping, other):	Caterer	Training	No	No
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	Living soil market gardening	Living soil market gardening + rainwater collection	Living soil market gardening	NA
Equipment fleet (ownership/ rent):	Owner	Owner	Owner	Owner
Machinery fleet (ownership/ rent):	No machinery	No machinery	No machinery	Owner
Water resources (irrigation, dryland):	River	1 drilling + rainwater collection	1 drilling	2 drilling
Land ownership (joint tenancy, sole ownership, community property, custody):	Rented	Owner	Owner	Owner
Knowledge and training in agriculture:	No	Yes	No	No
Is farming the main activity:	Yes	No	Yes	Yes
Number of permanent workers in the farm:	1	1	1	1.37
Number of seasonal workers (non-family):	NA	0	0	NA
Number of family workers:	NA	0	1	NA
Resilience objectives of the system (technical, climatic, commercial):	NA - NA	Structuring - Environmental	Structuring - Environmental	Piloting - Multidimensional



Farm details	FARM 13	FARM 14	FARM 15	FARM 16
ID name:	13	14	15	16
Municipality:	Correns	Marseille	Forqualquier	Mallemort
Province or Department:	Var	Bouches du Rhône	Alpes de haute provence	Bouches du Rhône
Country:	France	France	France	France
Altitude (masl):	306	165	407	121
Climate eco-region:	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests	Northeastern Spain and Southern France Mediterranean Forests
Rainfall (mm per year):	735	602	804	682
Temperature (mean annual °C):	13.9	15.0	10.8	14.1
Soil main characteristics:	Calcosol; Argilo calcaire	Contient beaucoup de calcaire; NA	Calcosol; NA	Fluvisol; NA
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral / mixed farming):	Mixed horticultural systems	Mixed horticultural systems	Agroforestry (MHS)	Agroforestry (MHS)
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	NA	NA	NA	NA
Year of establishment:	2016	2015	2020	2013
Trees on the farm:	Poirier; olivier; pommier; pêcher; amandier; prunier; grenadier; cerisier; aubépine; arbousier; pistachier; murier noir	Cerisier; prunier; abricotier; figuier; pommier; poirier; arbousier; sureau; noisetier; naschi; pêcher; olivier; poivrier; feijoa	Pommier; cerisier; noisetier; amélanchier; prunier; pêcher; figuier; olivier; poivrier; eleagnus; cognassier; noyer	Cerisier; prunier; abricotier; pêcher; figuier
Trees arrangement:	Lines	Lines	Lines	Lines
Crops on the farm:	Diversified vegetables	Diversified vegetables	Diversified vegetables	Diversified vegetables
Animals on the farm:	240 chickens and 120 quails	170 chickens	0	0



Farm details	FARM 13	FARM 14	FARM 15	FARM 16
Other activities (agrotourism, proximity market, beekeeping, other):	No	Caterer	No	No
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	Living soil market gardening	Living soil market gardening	Living soil market gardening	Living soil market gardening
Equipment fleet (ownership/ rent):	Owner	Owner	Owner	Owner
Machinery fleet (ownership/ rent):	No machinery	Owner	No machinery	Owner
Water resources (irrigation, dryland):	3 drilling	water from a canal + 1 drilling	Water from a canal	2 drillings
Land ownership (joint tenancy, sole ownership, community property, custody):	Owner	Rented	Owner	Owner
Knowledge and training in agriculture:	No	No	No	No
Is farming the main activity:	Yes	Yes	Yes	Yes
Number of permanent workers in the farm:	2	3	1	2
Number of seasonal workers (non-family):	1	1	0	2
Number of family workers:	0	0	0	0
Resilience objectives of the system (technical, climatic, commercial):	Structuring - Multidimensional	Structuring - Environmental	Piloting - Environmental	



ITALY

Italian partners (UNICT) report 2 field sites to have the on-field measurements. The site descriptions are arranged shown in a single table here below.

Farm details	FARM 01	FARM 02
ID name:	FARM 01	FARM 02
Municipality:	Nicolosi	Nicolosi
Province or Department:	Catania	Catania
Country:	Italy	Italy
Altitude (masl):	660	960
Climate eco-region:	Adriatic Sea & Central Mediterranean Mixed Forests (PA19)	Adriatic Sea & Central Mediterranean Mixed Forests (PA19)
Rainfall (mm per year):	1060	1200
Temperature (mean annual °C):	14,5	12,5
Soil main characteristics:	Texture: sandy; soil classification: Xerandt typic (USDA, 2014)	Texture: sandy; soil classification: Xerandt typic (USDA, 2014)
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	agroforestry-silvoarable	agroforestry-silvoarable
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	Monocrop of olive trees	Monocrop of olive trees
Year of establishment:	2018	2018
Trees on the farm:	Olive trees	Olive trees
Trees arrangement:	6 x 6 (triangular)	5.5 x 5 (rectangular)
Crops on the farm:	Wheat, rye, fava bean, vetch	Wheat, rye, fava bean, vetch
Animals on the farm:	N/A	N/A
Other activities (agrotourism, proximity market, beekeeping, other):	Olive oil production, winery	N/A



Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	Cover crop	
Equipment fleet (ownership/ rent):	Ownership	Ownership
Machinery fleet (ownership/ rent):	Ownership	Ownership
Water resources (irrigation, dryland):	Irrigation	Dryland
Land ownership (joint tenancy, sole ownership, community property, custody):	sole ownership	sole ownership
Knowledge and training in agriculture:	High knowledge and training	High knowledge and training
Is farming the main activity:	Yes	Yes
Number of permanent workers in the farm:		
Number of seasonal workers (non-family):		
Number of family workers:		
Resilience objectives of the system (technical, climatic, commercial):	Technical resilience is pursued through the sustainable intensification of olive production by intercropping annual herbaceous crops. The commercial resilience is pursued through the diversification of the farm's production.	Technical resilience is pursued through the sustainable intensification of olive production by intercropping annual herbaceous crops.
Pictures (picture + description):	Fig 1 Rows of olive trees intercropped with vetch in march 2023 Fig 2 Rows of olive trees intercropped with fava bean in march 2023 Fig 7 Rows of olive trees intercropped with fava bean in may 2023	Fig 4 Rows of olive trees intercropped with wheat in march 2023 Fig 4 Rows of olive trees intercropped with wheat in may 2023 Fig 5 Rows of olive trees intercropped with rye in may 2023 Fig 6 Rows of olive trees intercropped with wheat in may 2023



SPAIN

Spanish partners (UVIC-UCC) reports 5 field sites to have the on-field measurements. The site descriptions are arranged by blocks of three farms per table

Farm details	FARM 01	FARM 02	FARM 03
ID name:	FARM 01	FARM 02	FARM 03
Municipality:	Argençola	Bràfim	Riner
Province or Department:	Barcelona	Tarragona	Lleida
Country:	Spain	Spain	Spain
Altitude (masl):	650	243	813
Climate eco-region:	Northeastern Spain and Southern, France Mediterranean Forests (PA20)	Northeastern Spain and Southern, France Mediterranean Forests (PA20)	Iberian Sclerophyllous and Semi-Deciduous Forests (PA20)
Rainfall (mm per year):	479	487	603
Temperature (mean annual °C):	19	16	13
Soil main characteristics:	Bedrock: the farm is located in the "Central Depression of Catalonia", specifically in the "Central Baisin - High Segarra". The morphology is extensive plains with fluvic sediments from the Pleistocene. The highest influence is on erosive instead of the deposition processes (ICGC 2021). Soil classification: Xerorthent typic (USDA, 2014). Texture Clay loam. pH 8.4. Soil depth <1m. Field is organised in level terraces.	Soils are classified as Petrocalcic calcirepts and typical carcxerepts (USDA, 2014). Soils developed from the weathering deposits rich in calcium carbonate in the base of mountains and in slight sloping slopes with a xeric moisture regime. From superficial to very deep, well drained, with medium textures and a variable content of coarse elements. They present many secondary accumulations of calcium carbonate in the form of nodules and/or coatings of the coarse elements that	Soils are classified as Typical Xerorthents and calcic Haploxerepts (USDA, 2014). Soils developed from rocks of different lithologies and the deposits from their weathering at the base of the mountains and in slight and moderate slopes with a xeric moisture regime. From shallow to deep, well drained, with medium textures and few coarse elements. They can present secondary accumulations of calcium carbonate in the form of nodules and/or



		give rise to a calcic and petrocalcic horizons. c: upon petrocalcic horizon. Slightly alkaline soil. Nitrates contamination vulnerable zone	coatings of coarse elements that give rise to a cambial horizon. a: on sandstones and shales. Moderately alkaline soil. Nitrates contamination vulnerable zone
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	agroforestry-silvoarable	Agroforestry-silvoarable	Agroforestry-silvoarable
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	Forest	Extensive cereal production	Cereal crops and abandoned lands
Year of establishment:	2017 both, trees and sainfoins	2006	2017
Trees on the farm:	Olive trees	Olive trees (>50 years old)	Vineyards
Trees arrangement:	5 x 15 m among olive trees	A line surrounding the crop field	Rows of vineyards with crop in the aisles
Crops on the farm:	Sanfoins (<i>Onobrychis bicifolia</i>) between the rows	Winter cereals	Winter cereal & cover crop
Animals on the farm:	N/A	N/A	N/A
Other activities (agrotourism, proximity market, beekeeping, other):	N/A	N/A	Rural tourism
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	No tillage, Sainfoins used as cover crop to improve fertilisation, recovery of abandoned plots	Windbreaks (olive trees) in three out of the borders of the cereal plot	Organic farming, use of cultivated cover crops among the wine trees. Reduced tillage
Equipment fleet (ownership/ rent):	N/A	Self ownership	Self ownership
Machinery fleet (ownership/ rent):	multiple ownership	Self ownership	Rent
Water resources (irrigation, dryland):	Dryland conditions	Dryland conditions	Dryland conditions
Land ownership (joint tenancy, sole ownership, community property, custody):	Sole ownership	Renting (57) and ownership (13 ha), aggragation of freelancers	Renting (society: 2 partners)



Knowledge and training in agriculture:	Not knowledge nor training but the farmer has a technical assessment	Agricultural technical engineer	Non-official formation (farming incorporation course, given by the regional administration)
Is farming the main activity:	NO	YES	YES
Number of permanent workers in the farm:	2	3	2
Number of seasonal workers (non-family):	1	2	Depending on the year's production
Number of family workers:	1	1	1
Resilience objectives of the system (technical, climatic, commercial):	The technical interest in the frame of the TRANSITION project. The plots are part of the recovering work of field sites that were abandoned during the second half of XX Century, and where the forest was growth. The farmer use of sainfoins as a cover crop to improve the soil fertility and reduce soil erosion.	The technical interest in the frame of the TRANSITION project. The crop combination is the traditional cereal - olive tree. During the last decades, the trees have been eliminated to create bigger areas of cultivation, increasing the soil lost by wind and water erosion	Changes in temperature and precipitation promote people looking for cropping areas in other altitudes. That is the case of vineyards in the Catalan region. The crop rotation in cultivated rows is also of interest as a resilient practice



Farm details	FARM 04	FARM 05
ID name:	FARM 04	FARM 05
Municipality:	Vic	Sant Quintí de Mediona
Province or Department:	Barcelona	Barcelona
Country:	Spain	Spain
Altitude (masl):	476	425
Climate eco-region:	Northeastern Spain and Southern, France Mediterranean Forests (PA20)	Northeastern Spain and Southern, France Mediterranean Forests (PA20)
Rainfall (mm per year):	680	548
Temperature (mean annual °C):	14	13,5
Soil main characteristics:	Soils are classified as Calcic Haplustepts and typical Calcicustpts (USDA, 2014). Soils developed from sandstones, loams and deposits from their weathering in the wider valleys of the interior mountain ranges. Moderately deep to very deep, well drained, with medium textures and few coarse elements. They present secondary accumulations of calcium carbonate in the form of nodules and/or coatings that can give rise to a calcium horizon. Nitrates contamination vulnerable zone	Soils are classified as Lithic Xerorthens and typical Calcicrepts (USDA, 2014). Soils developed from rocks of different lithologies, rich in carbonates, and their weathering deposits at the base of the mountain. Superficial or very superficial, well drained, with medium textures and a variable content of coarse elements. Some profiles can develop petrocalcic horizons from the dissolution and precipitation of the rocks that make up the original material. Moderately alkaline soil.
Type of system (agroforestry-silvoarable / agroforestry-silvopastoral /mixed farming):	Innovative crop	Agroforestry-silvoarable (silvopastoral in some specific moments)
Land use type before agroforestry or mixed farming system (monocropping/ forest/ natural vegetation):	Conventional agricultural practices	Abandoned land for 25 years
Year of establishment:	2020	2014
Trees on the farm:	No	Olives and vineyards
Trees arrangement:	N/A	Rows of vineyards with cover crop in the aisles & lines of olive trees combined with cover crop
Crops on the farm:	Kernza (<i>Thinopyrum intermedium</i>)	Cover crop composed of natural vegetation



Animals on the farm:	N/A	Sheeps (during 2 months in winter sheeps graze the aisles between the vineyards)
Other activities (agrotourism, proximity market, beekeeping, other):	N/A	Rural tourism
Description of innovative practices (fertiliser products, tillage, cover crops, etc.):	Innovative crop, a perennial cereal	The innovative aspect is the combination of olive trees with natural cover crop, managed forest and natural Mediterranean vegetation in the border of the vineyards. Moreover, the organic management of the vineyard
Equipment fleet (ownership/ rent):	Self ownership	Self ownership
Machinery fleet (ownership/ rent):	Rent	Self ownership
Water resources (irrigation, dryland):	Dryland conditions	Dryland conditions
Land ownership (joint tenancy, sole ownership, community property, custody):	Renting and ownership (25% of total land), limited society	Renting and sole ownership
Knowledge and training in agriculture:	Non-official formation	Agricultural technician and oenology
Is farming the main activity:	YES	YES
Number of permanent workers in the farm:	40	40
Number of seasonal workers (non-family):	40	40
Number of family workers:	1	NA
Resilience objectives of the system (technical, climatic, commercial):	The innovative interest in the frame of the TRANSITION project. The evaluation of a perennial cereal in its establishment to the Mediterranean conditions and the evaluation of the benefits for soil health	The technical interest in the frame of the TRANSITION project due to the complexity of the system. It includes forest, olive trees, vineyards and natural shrub vegetation. Furthermore, the effect of natural cover crops in the olive trees and the vineyards are of interest. The vineyards have organic fertilisation plus the natural cover crop

