Title of the proposal:

Land system dynamics in the Mediterranean basin across scales as relevant indicator for species diversity and local food systems

Project acronym:

DIVERCROP

Proposal ID: 10905

List of participants:

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<tr>
<th>Participant n°</th>
<th>Participant organization name</th>
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<tr>
<td>1</td>
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<td>9</td>
<td>Scuola Superiore Santa Anna, Pisa</td>
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B2: Project summary suitable for web publishing

The DIVERCROP project aims to highlights interactions between current dynamics of the Mediterranean agricultural practices, species diversity and local food systems at multiple spatial scales. The main assumption is 1) that the current land use dynamics in Mediterranean area may enhance, in many cases, situations of land use pattern diversity (inside agricultural areas with changes in agricultural practices, in perirurban situations with the competition between agricultural and urban uses or in semi-natural areas used by extensive farming systems), and 2) this diversity is an indicator of places where, on one hand, evolutions of the couple ecosystems/agricultural systems could be the foundations of a new sustainable agriculture and, one other hand there is an ability to develop local food systems (an homogenous area of monospecific agriculture isn’t usually in favor of the new farming systems integration). So, an assessment of the land use diversity processes and related changes occurring on the Mediterranean area (e.g. intensification, extensification, urbanization and land abandonment) and their drivers (geographical, agronomical and socio-economic) will be carried out. From this framework, we will evaluate how these changes impact the agricultural and species diversity at different spatial scales, and how this measure of diversity allows to locate areas that should potentially experience an enhancement of local food systems. In order to better focus our analysis, we will concentrate this project on the Western part of the Mediterranean Basin (WMB) where we will develop and test a methodology to connect the local and the regional scales in a feedback process. The project is composed of the following steps:

- An assessment of the current spatial agricultural dynamics, competition between agriculture and other land uses and between different agricultural management practices, from which the main drivers will be carried out at the WMB scale.
- An identification of local drivers of territorial dynamics in terms of governance and stakeholders’ behavior, through studying specific case studies sampled according to spatial trends and management drivers.
- The development of a multi-scale model that investigate the consequences of local and regional land system changes on agricultural practices and species diversity, and on the spatial capabilities for cities to enhance local food systems.

In order to address our scientific and technological ambitious objectives, DIVERCROP gathers a multi-disciplinary team of researchers from different fields covering both spatial quantitative approaches including planning sciences, landscape ecology, landscape agronomy and biophysics and qualitative approaches such as sociology and human geography.

B3: Scientific quality of the project

3.1 Concepts and objectives

a) Relevance of the proposal to the topics addressed by the call

DIVERCROP fits directly into the aims of the call as it is focused on the core relations between land use dynamics and sustainable agriculture, through studying farm and land systems with their correlative species diversity. In addition, an assessment of relations between these dynamics and food systems will be brought at the Mediterranean level, in order to make available databases and knowledge for policy makers and researchers. The relation between different scales, from the local scale to the large regional scale (WMB - see figure 3) is central in DIVERCROP, as we acknowledge the fundamental linkage between large scale and local drivers in shaping different types of farming systems and influencing their sustainability.

b) Background and State of the Art in the field

Current land use and land cover changes (LULCC) have been related to different environmental impacts, such as biodiversity loss (Haines-Young, 2009), soil organic carbon loss (Edmondson et al., 2014) or soil redistribution patterns (Debolini et al., 2013). At the same time, the alteration of the ecosystem functioning can impact on the well-being of human societies (MEA 2005). Changes in land use and land cover can result from local competition between different uses within the agricultural sector. In this case, changes affect the dominant practices, e.g. traditional family farming vs. corporate agriculture (Bontkes and Keulen, 2003) or intensification of agricultural activities (Temme and Verburg, 2011). On the other hand, LULCC can act between agricultural and other land use types like urban sprawl, in particular on coastal areas (Salvati et al., 2012). These main changes are not independent and act in a feedback chain: disturbance of traditional agriculture surrounding urban areas due to cities expansion leads to the
development of a market-oriented agriculture further away from the cities, while these developments disturb ecosystems in rural areas (Benaoun et al., 2014). In order to support sustainable land management, an overall understanding of the feedback mechanisms and on the human-environment interactions at this level is needed (Foley et al., 2005). However, no integrated tool exists at a regional level to assess the overall impact of these interacting and multi-scale changes on the agricultural diversity and ecosystem functioning they depend on. Developing such a tool that integrates the farm and local levels (e.g. yields, agricultural plot patterns, species diversity, stakeholders’ activities), the landscape level (e.g. water flow regulation, tourism, fire vulnerability, habitat conservation) and the regional level (e.g. food security, carbon sequestration, regional planning) would make it possible to test nested policy scales and highlight areas that require specific regulation (Hibbard and Janetos, 2013). In this context, the Mediterranean basin appears as a highly relevant case-study for assessing what type of environmental and agricultural analysis would help reconciling human needs in terms of land demand for food production, habitat space and ecosystem long-term functioning. Environmental challenges are indeed particularly exacerbated in the Mediterranean basin which is one of the 34 global hot-spots of biodiversity and presents some environmental and socio-economic specificities (Médail and Quézel, 1999). From an agricultural perspective, the Mediterranean basin has a long history in terms of production of food, fodder and fiber for the provisioning of rich civilizations. In parallel, it has also delivered many typical land uses and landscapes after sometimes strong reshaping of the environment (e.g. terraces and irrigation canals, hedgerows, agro-silvo-pastoral systems) (Pinto-Correia and Vos, 2004; Blondel, 2006). For these reasons, the current agricultural systems and the complementarities between crops are pretty complex and inherited from a long history of agricultural and cultural purely Mediterranean traditions (Zeder, 2008). In this context, several agricultural practices are known to provide food production and while they are desirable for a good functioning of ecosystems. Some of these agricultural practices were traditional in the past, and have been abandoned in favor of more economically profitable ones during the 20th century (Pinto-Correia and Vos, 2004). Silvo-pastoralism, agroforestry and organic farming are among them. They often sustain biodiversity and are still currently used on both sides of the Mediterranean basin (Bugalho et al., 2011). Nowadays, agriculturists look at agroforestry and organic farming with a renewed interest, as recent studies have shown how it could potentially enhance the production and diversify the farmers’ incomes and the resistance of farms and production to climate change (Daoui and Fatemi, 2014). Besides agroforestry, organic farming and silvo-pastoralism, innovative practices targeting soil conservation and its ability to retain water, and that rely on functional agro-biodiversity, increasingly appear to be more sustainable than conventional high-input practices (Francia-Martinez et al., 2011).

At the same time, the Mediterranean basin is characterized by a scarcity condition for agriculture (poor and shallow soils, steep slopes and a dry summer), a limited availability of resources, mainly water, and a complementarity of different and complex agricultural systems (Caraveli, 2000). This region also presents some particularities in its social organization, such as the low level of entrepreneurship in some hilly/mountain marginal regions, mainly characterized by traditional extensive farming systems (Petanidou et al., 2008), a property structure based on family lands considered as a heritage more than as a production factor and a low level of taxes on land ownership (Otero et al., 2013). Finally, from an environmental perspective, the Mediterranean climate offers unique conditions for a rich biodiversity to coexist, while future climate changes are expected to lift species climatic suitable conditions northward (Ruiz-Labourdette, et al., 2013). The Mediterranean Basin is projected to become increasingly dry and warm, while inter-annual climate variability is also expected to increase particularly during the summer (Giorgi & Lionello 2008). The combined effects of a changing climate and land-use patterns are likely to impact on ecosystems and the services they deliver.

There are currently two main approaches for assessing relations between LULCC and correlated agricultural and natural diversity. On the one hand, at a broad scale often rested on extrapolations of a set of values and functions that may ignore the precise functioning and feed-backs between local dynamics of ecosystems (Costanza et al. 1997). On the other hand, the assessments centered on a located ecosystem or on a small field-study (e.g. the spatially-explicit biological model of Polasky et al. 2008), which is able to highlight complexity of relationships between ecosystems or between ecosystems and society, but which are not easily usable at the public policy scale. Formally, the first studies on LULCCs were mostly based on the diachronic analysis of land cover dynamics through satellite images or aerial photos, or complementary data such as agricultural census or surveys, and focused mainly on the relative impact on landscapes (Lambin, 1997). Researchers then became increasingly involved in explaining the drivers of these changes and at the same time in simulating possible future scenarios (Veldkamp, 2009). In these studies, the focus was more on land cover as a proxy of land use, while the type of management, the farming intensity or the complexity of the landscape were barely considered. Recent advances on land use studies highlighted the coupling of empirical local studies on land use
change and multi-scale modeling as a major need for research in this field (Rounsevell et al., 2012). In a planning perspective, the issue at stake is the integration of two approaches aiming to provide significant levels of precision in a tool usable at the policy level (MEA, 2005). In particular, in the last few years, following the increasing availability and quality of land use data, the development of more sophisticated methodologies and the increasing interest in the management of different land uses, LULCC studies have tended to combine the concepts of land use and management through land systems (Verburg et al., 2013). In this case, the geographical unit for modeling and predicting future changes is not directly the land cover or the land use, but a more complex type of classes that combines land use and its management through various possible indicators (e.g. population density, irrigation systems, agricultural inputs). The aim of this system approach is to consider the world as a complex system where natural/environmental and human/socio-economic components are fully integrated and considered at the same time (GLP, 2005). Human actions and behaviors have been recognized as the main drivers in determining and forcing current land system dynamics, thus research needs to directly integrate human components within LULCC modeling, as well as possible feedback on how humans have adapted land systems (Veldkamp, 2009).

In terms of local food systems, more than 50% of people on earth are living in urban areas and, following FAO prospective, this share may reach 86% in developed countries in 2050 (FAO, 2011). So, in the current global context, characterized by foodstuffs price volatility, land competition and urban growth, food security and ecological intensification of agricultural systems are issues at stake (Morgan, 2009; Deverre and Lamine, 2010; Renting and Wiskerke, 2010). We are experiencing a “new food equation” (Sonnino, 2014) that tend to regionalize food systems to feed the city and reconnect food production sites with consumption areas to increase food independence. But this challenge requests to think the local production system and the food consumption patterns. From a scientific point of view, after the first supporting moment of local food networks, followed by a sharp criticism of the craze of “all local” (Baker, 2011), we are now witnessing the emergence of research questions about the articulation of the various food production scales (Watts et al., 2005) and territorial planning of the agri-food system or “urban food system” (Wiskerke and Viljoen, 2012).

On another hand, the DIVERCROP links directly to progresses achieved in some of the most recent European level research projects, mainly FP-7th projects. There is VOLANTE i visions of Land Use Transitions in Europe, and Farm-Path-Transitions in Agriculture: Pathways for the Regional Sustainability of Agriculture in Europe. In regard to the complexity of food systems, and the complexity of present situations, DIVERCROP will learn from the results of TRANSMANGO - Assessment of the impact of global drivers of change on Europe’s food security, GLAMUR - Global and local food chain assessment: a multidimensional performance-based approach. And also, it will relate directly to the work developed in SALSA- Small Farms, Small Food Businesses and Sustainable Food Security, an ongoing H2020 project coordinated by members of the DIVERCROP team.

c) Aim, objectives and hypotheses

The first scientific objective of the DIVERCROP project is to analyze the land system dynamics in the Mediterranean Basin and to identify their main drivers at different scales. Results aimed are a modeling of land system changes and their effects on environmental patterns as a result of agricultural practices and species diversity in agricultural landscapes. In a second step, the link between identified environmental patterns and the capacity of the agricultural systems to contribute to the local food system of cities is investigated. The DIVERCROP project provides an opportunity to carry out field studies and stakeholders group analysis to elicit data on the complex relations between land use and local food systems. Specific conceptual models and tools that may be used to investigate the functioning of Mediterranean land systems will be developed. These will combine different approaches and scales and aim to develop existing research which so far has mainly carried out at European level, whilst not considering the Mediterranean basin as a whole and unique system. Technically, it is still complicated to work on all the Mediterranean countries, not least by the geo-political situation which makes it difficult for some data collection or field work. We have therefore chosen to focus on the Western part of the Mediterranean Basin (WMB), assuming that the land system dynamics observed at this level, and the

1 We define as Land system a combination of land use, land management and territorial practices, which will give more complete information about the landscape structure than the classical land cover classes. This approach considers the landscape as the result of natural/environmental and human/socio-economic components that are not separable one from the other (Turner II et al., 2007). Farming system: a decision-making unit comprising the farm household, cropping and livestock systems that transform land, capital and labor into useful products that can be consumed or sold (Fresco and Westphal, 1988). Local food system: an homogenous area where foods are produced, processed and retailed within a defined geographical area (Kneafsey et al, 2013).
methods developed to reveal it, are close to the rest of the basin and represent a readily generalizable knowledge basin as a whole. In terms of technological objectives this will lead to the conceptualization of a spatial tool that will allow integrating our new knowledge on land use dynamics in order to discuss contrasted socio-economic scenarios, environmental planning and agricultural policies and be able to derive recommendations for an adaptation of future policies to the WMB. Our social aim is to propose knowledges that allow to support sustainable land uses dynamics in spatial food planning strategies.

Formally, our main assumptions is that agricultural and species diversity are mainly related to spatial dynamics of the surrounding socio-ecological systems (local level) and to the main ecological and anthropogenic trends at higher scales (WMB level), linked to landscapes composition and socio-ecological dynamics. In this sense a multi-scale approach is needed in order to highlight the existing land system trajectories of changes.

Figure 1 illustrates a conceptualization of the multi-scale approach we aim to implement.

The data driven analysis grounds a characterization of land systems at WMB level. This source makes it possible to study relationships between land systems and species diversity. It enables to make a typology of land systems and to sample study areas around WMB. These sampled case study areas give rise to study articulation between global (WMB) and local (municipalities) levels. In this perspective, we will apply a new methodological framework: successive loops of up-scaling and down-scaling in which the interface between local and global is kept under focus.

The link between the local and the global is done primarily through the identification and understanding of farm systems and of the local ability to develop food systems, and the way they are reacting to global drivers of change. The linkage will also be done through the participatory work, as the local stakeholders will be confronted with the global drivers produced at WMB scale, and will need to refer to them in their visions and pathways for the territory. Finally, some scenarios at WMB scales will be built and mapped applying knowledges of local reactions of people and land systems on WMB land use patterns, species and food demand (figure 2).

Summarizing, we aims to answer to the following questions: How are the current land systems in the Mediterranean basin adapted for preserving the highest species diversity and favor agricultural sustainability? What are the main organization forms of land and food systems at local level? How can they be adapted to the enhancement of local food systems?
3.2 Quality and effectiveness of the scientific project, and associated work plan

a) Overall strategy

Beyond the relations between WP’s, research teams involved in the program will participate to the key WP, the final (WP5) which connect results of others WP. In addition, our field studies sampling will locate a case study in each country present in the program. However, each team will be more involved in WP disciplinary closed and a significant part of the consortium is a head of one WP. For the temporal organization of the program, the high level of complementary between WP generates some parallelism. Our project will start by the comprehensive database building (WP1). Some data-bases are already available (as GlobeLand30 data base) and permit to start working early in the WP2 and WP3. WP4 will start after, in a mutual and feed-back methodology of working in order to test with stakeholders global indicators produce before. Finally, the WP5 will take the food system issue as a way to build an integrative model of dynamics, between agricultural sustainability (land systems and correlated species indicators) and city feed needs. At the end of each WP, a collective paper on a peer-review journal will focus of the most relevant WP results.

b) Overall work plan and project target objectives

The DIVERCROP project will bring together researchers from different disciplines in order to answer complex research questions about current Mediterranean land use dynamics: how the diversity notion enables to characterize land system dynamics (to enhance sustainable agriculture) and to assess the ability to develop local food systems? The main target objective is to produce an integrated indicator of this diversity, usable at local level (cities scale) and generalizable at the WMB level. Following Metzger et al. (2005), our work area will be focused on the Mediterranean Environmental zones i.e. Mediterranean South, Mediterranean North and Mediterranean mountains restraints to WMB countries (figure 3).

Figure 3: the WMB according to the Environmental Stratification of Europe (Metzger et al. 2005)

The rational of our work plan is to integrate different scientific points of view and different spatial and temporal levels starting from an overall analysis for the WMB and feed-back chains with lower scales, in order to identify the main land system trajectories and their associated local food systems. In order to bridge the gap between scales from the local and landscape ones to the regional one and to integrate local drivers for the highlighted dynamics, we will select as local case studies relevant territories that represent at best the different types of dynamics observed over the WMB. In each of these territories, participative approaches will be performed with local stakeholders, identifying farming system dynamics. The local case studies will be the base for proposing possible future alternative scenarios at WMB level, according to the local stakeholders’visions.

c) Methodology

The DIVERCROP project will integrate different methods coming from geography, agronomy, ecology and land use change sciences. The whole project will be developed with a multi-scale approach, going from the regional to the local level and then upscaling again the final results at WMB level as a level of a desirable public decision. Results will be an assessment and a mapping of diversity indicators that will highlight places where there may be social stakes to manage trend of land use pattern, in order to
support an enhancement of sustainable agriculture and correlated local food systems. We will start from a comprehensive database and remote sensing tools already available in our consortium (see WP1 description). The integration of some additive land or food supply characteristics from other databases (as Corine Land Cover, national census or a new classification specially adapted to the complex Mediterranean land systems i see Malek & Verbug, forthcoming) will be tested. From this database, land systems dynamics and their drivers will be characterized using statistical modelling and spatial analysis (WP2). In addition, the relations between land systems and species diversity will be studied embedding knowledges from ecological literature and available data (WP3). This modelling enables us to make a typology of main land systems that characterize the land diversity in Mediterranean area, and, then, to sample a set of case studies capturing the diversity of land systems in WMB. Each national participant of the project (six countries) will pilot a case study, representative of a land system dynamics. In case studies, two elements will be studied in a participative approach: 1) particularities of farm systems (to give a depth of sampling aspects) and 2) the ability of local stakeholders to react at global drivers, in order to study possible future land use pathways (WP4). Finally, an indicator of local ability to develop food systems will be built and mapped at WMB scales, in order to be support for a the decision-making level (WP5).

d) Innovative approach

The multi-scale approach of farming and local food systems is one of the main novelties of the project, considering that a review of the existing literature has shown there is still no method to link these different levels while, at the same time, the linkage is needed to integrate regional policies and local vision from stakeholders. Progress in the analytical capacity for upscaling and downscaling will contribute to enhance the science-policy interface and produce practice relevant results. Relating the diversity of the farming systems to the diversity of species in the particular context of the Mediterranean region is also going behind the state of the art and bringing focus to the particular character of Mediterranean agriculture, from where learning can be taken to other regions of Europe. In addition, we will produce a method to integrate local stakeholders’ vision on the scenario proposal based on our case studies analysis. This multi-actor methodology, once it will be validated during the DIVERCROP project can be used as a standard for studies on land and local food system dynamic assessment at local level. Finally, this project will introduce a dynamic representation of both socio-economic and ecological mechanisms into the assessment farm and local food systems diversity. This will lead to an improved understanding of the role of land use and land management change in the ability to develop food system enable to feed cities and also in the underlying biodiversity-agriculture interactions. With a focus on the longer-term sustainability of agro-ecosystems to provide services to society, the modelling tool will allow to identify scenarios that characterize more sustainable land systems explicitly taking into account the role of agrobiodiversity.

e) Description of the work packages

The DIVERCROP project is organized in six complementary WPs: (WP0) coordination; (WP1) comprehensive database building; (WP2) land system dynamics and their drivers at WMB scale; (WP3) effects of land system on species diversity, (WP4) land system dynamics assessment at local scale and (WP5) effects of land systems on local food systems and scenarios of food systems change at WMB.
WP N° 0  

**Project management and coordination**

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(Ordinators: Claude Napoléone INRA and Marta Debolini INRA)

The DIVERCROP program will be scientifically coordinated by two complementary researchers: Claude Napoléone, economist, and Marta Debolini, agronomist. Beyond the general organization of the logistic of the project, the coordination will be focused on enhancing jointswork between each research team and the collective academic production (international meeting on results and scientific publications). The management will rest on a steering committee which will be composed of WP leaders, the annual meeting and on a website as, both, a support of communication between researchers and a support of dissemination of works and results. In addition, the management will pay close attention to the collective publications, adopting a publication plan at the beginning of the program. For a most complete description of the project management, see point 4.1) on this section.

WP 1  

**Comprehensive database building**

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(Ordinators: Claude Napoléone INRA, Alberte Bondeau CNRS and Tiziana Sabbatini SSSA)

In order to obtain a comprehensive and integrated analysis of land system dynamics for the WMB, we will combine databases existing at national and regional level into a homogeneous comprehensive database for the WMB. We will start from a database already available in our research team (GlobeLand30 see http://www.globallandcover.com/GLC30Download/index.aspx) as the primary source of information for land use analysis. This database describes the whole WMB area by ten land use classes and with 30 meters accuracy. In addition, we will make use of the Sentinel-2 satellite images with the specific purpose to produce a more detailed classification of agricultural and land systems and to retrieve other variables linked with biophysical conditions of the locals (e.g. vegetation indices, drought indices). We will complete this information with the FAO land use, agricultural market and food supply databases and more refined national ones when they exist (e.g. Eurostat). In particular, national agricultural census and the existing data at the municipality level are others important sources of data at the regional scale, and they can produce relevant information about land management and practices in order to build land system typology on WP2. Recent work including some of the project participants (ANR DAUME: 2011-2015) has assessed the effectiveness of remote sensing tools for mapping main land use dynamics in areas that are lacking more extensive databases (Marraccini et al., 2015).

**Task 1.1: Building proxies to fill local information gaps.** In the case of the retrieved information should result insufficient to a proper characterization of the WMB land and food systems, we will refer to the published studies. To this end, we will review the available scientific literature on farming practices and food supply characterization by implementing some of the spatially explicit approaches under development by the land change science community (Young and Lutters, 2015; Margulies et al., 2016).

**Task 1.2: Data integration in the WMB comprehensive database.** We will process the databases gathered with this WP to foster the elicitation of the contextual (embedded) information (Karl et al., 2013). To this end, we will test different regular grids to identify the most relevant mesh sizes to be used as spatial units to coordinate heterogeneous sources of data. These spatial units could complement the existing (administrative) land units, such as the region and the municipality; with the aim to leverage the knowledge discovery at multiple scales (cf. Rizzo et al., 2013).

**WP Deliverables:** a comprehensive and complete database of geographical, bio-physical and socio-economic data on the WMB (D1.1), at the municipality level due in month 12. This result, besides to be the fundamental input for the following phase of the DIVERCROP project, will be a relevant source for many other research projects in the area and for institutions focused on Mediterranean basin.

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2 Water bodies, Wetland, Artificial Surfaces, Tundra, Permanent snow and ice, Grass lands, Barren lands, Cultivated land, Shrub lands and Forests
Information and databases retrieved from WP1 will be used to characterize existing land systems. Knowing that there is no available diachronic database on land use change for the whole WMB, we will choose a comparative method to assess drivers of changes: each type of land system will be located in the WMB and the land patterns on a surrounding buffer will be measured. For each type of land systems, correlations between changes of land patterns and a set of socio-economic characteristics will be statistically estimated\(^3\). First of all, a characterization of the existing agricultural systems will be carried out, considering a series of variables describing the land use but also the agricultural and land management. This characterization will produce a typology of land system through statistical classification method, such as hierarchical classification, regression tree or cluster analysis (e.g. Debolini and Guerif, 2015). The spatial scale of the analysis will be the smallest possible considering the available data collected on the WP1. Most likely, it will be the municipality level: at this scale we can obtain a relevant amount of data from national agricultural census and local database about agricultural productions and their management. Aggregating variables, we will obtain a complete and comprehensive characterization of the land systems on the WMB level and at the municipality scale, in order to have at the same time a fine spatial resolution and the spatial planning level. This classification will be carried out for the existing database about current land system, in order to obtain relevant dynamics in the study areas and understand the changing processes in act on the Mediterranean basin. To improve our analysis of land system patterns and processes, we will perform a complementary typology based on the comparison of the regular spatial grids selected in WP1. These fictive land units will allow to add multiscale and spatially explicit levels of analysis so as to compare the various region of WBM on all the available geographical information. Eventually, these units could be handled with landscape ecology metrics (e.g., fragmentation, diversity) to characterize the land system structure to inform policy-making and planning (cf. Leitão and Ahern, 2002). At the same time, a set of variables will be selected as drivers of agricultural dynamics, and they will be tested through a statistical modeling approach. Variables will be both economic, e.g. the agricultural cash-flow, land and product prices, geographical and morphological e.g. urban pressure, distance to the main cities and topography, and agro-pedoclimatic, e.g. soil and climate characteristics and production capacity. In the case of lacking data, some proxies for the proposed variable will be tested. The explanatory factors will be tested through advanced machine learning algorithms, such as random forests and stochastic gradient boosting methods in order to obtain statistical relations that could be applied for predicting future land system dynamics. To ensure the saliency results for supporting agricultural policy-making, we will include also variables capable to express the farm level decision making (e.g., Vitali et al., 2012). This will improve, for instance, handing the farming systems so as to characterize the baseline and to explore the promotion of specific production frameworks. In this sense, we could focus on the diffusion (baseline) and promotion (scenarios) of organic farms (e.g., Albertazzi, 2014), or the introduction of innovative landscape level agroecology practices (Wezel et al., 2009) such as the agroforestry or the crops-livestock territorial integration (e.g., Moraine et al., 2016).

WP Deliverables: D2.1- A report on the land systems classification and mapping on the WMB level and at municipality scale (or according to the better spatial scale obtained from the database building on WP1), due in month 15; D2.2- In same time (month 15), a report on the identification of possible case studies representative of main typical land system for the whole Mediterranean area, where the local analysis developed on the WP4 will be carried out. We plan to identify local case studies according to the main land system types, distributed on each partners' countries, in order to take advantage from the local knowledge of the partners involved and ease the network building with local stakeholders. D2.3- A report on the statistical analysis of land trajectories and possible drivers obtained through statistical regressions, due in month 21; P1- A collective paper on drivers of land system trajectories in WMB is expected at the end of the WP2.

We will assess the possible impacts on biodiversity of the previously identified land systems. This combines the use of existing models, building indicators from literature review, and analyses of currently collected biodiversity data in agricultural systems. Especially we will confront the biodiversity indicators provided by the models to the information gained from the site-level data and literature review about the expected benefits of multifunctional mixed land systems on biodiversity. Simple tools for quantifying the impact of land use on terrestrial biodiversity have been made possible thanks to the on-going building and maintenance of several global databases. One example is the IUCN Regional Red List of Threatened Species which provides the extent spatial data about species and the description of their threats, among other those related to the agricultural system (farming landscape, intensification, pesticide use, etc.). Visconti et al. (2016) demonstrated the interest of using such extinction risk indicator. The Red List contains several endemic species of the Mediterranean basin, present sometimes on only a very narrow extent area, with identified threats related to agriculture. We will focus on such species for assessing the impact of the WP2 indicators on their extinction risk (or on their recovery potential in case of a biodiversity-friendly scenario). Another example is the PREDICTS database (Hudson et al., 2014) which reports the responses of diversity either to a difference in land-use type and practices of management agroecosystems (e.g. meadow, crops, etc.) or along a gradient of land-use intensity or other human pressure. It contains 28,735 species from 284 studies on sites founded in the literature, the Mediterranean hotspot being well represented (6% of the studies and 5.4% of the sites). Newbold et al. (2015) analyzed this database to quantify local biodiversity responses to land use and related changes. However, they focused on the change from an uninhabited world to a human-dominated world. In this WP, we want to consider the human-made land systems that sustain a high biodiversity, in some cases higher than the one of the natural ecosystem.

**Task 3.1: IUCN Regional Red List.** We will select species present (sometimes endemic) in the Western Mediterranean Basin and which are threatened by land system dynamics (including agricultural practices). Following the method used in Visconti et al. 2016, we will determine, for each species, the red list index corresponding to the land system indicators of WP2. We will consider different spatial scales according to the specificities of the land systems pattern and dynamic, WMB-wide spatial maps of indicators-driven aggregated Red List Indexes will be developed by determining the weights of the species-specific Red List Indexes (Butchart et al., 2007).

**Task 3.2: Literature.** We have already performed a literature research on the impact of land system and farming practices (Hervé, 2014) on biodiversity in Mediterranean agro-ecosystems with a focus on French agricultural systems. We will extend this analysis to all agricultural systems of the WMB. We will pay a particular attention to the studies reporting on systems/practices which, by sustaining functional biodiversity, support the ability of the agro-ecosystem to deliver multiple ecosystem services. We will investigate the literature to identifying cases where the response of site-level diversity to the measures of anthropogenic change can be modelled using generalized linear mixed effects models (R lme4 package, Bates et al. 2013, R core team, 2013), as done by Newbold et al. (2015) with the PREDICTS database.

**Task 3.3: French Agricultural Observatory.** The French Ministry of Agriculture has initiated in 2011 the Agricultural Observatory of Biodiversity (OAB, scientific coordination: Natural History Museum, University of Rennes, CNRS laboratory LADYSS, http://observatoire-agricole-biodiversite.fr/presentation). Its interest comes from the fact that observations are made by farmers in the usual farming environments with the help of simple protocols. Four animal categories are considered: earthworms, terrestrial invertebrates, bees, butterflies, and the specificities of the practices are reported along the biodiversity results (Synthetic result available on line in 2014). We will access and process the data available for the French Mediterranean departments. We will investigate if such data allows the identification of significant relationships between any farming system and a biodiversity indicator for the four categories investigated.

**WP Deliverables:** D3.1 - Report on the impacts of the land system indicators on biodiversity, due in month 18; D3.2 - Report on Literature due in month 18; D3.3 Building of a spatialized database on an indicator of relationships between farming system and biodiversity, due in month 21.
The goal of this WP is to analyze farm systems at the local scale, to characterize local dynamics in case-studies sampled through the assessment of the farm systems that are characteristics of each case-study area. Further, this WP will identify and assess what are their strengths and potentials in face of the main drivers of change, which have been identified at regional scale in WP2 (Task 4.1). Secondly, this WP has the goal to develop, in interaction with local stakeholders, possible future pathways for these farming systems to adapt and respond to these drivers, from climate change to policy orientations (Task 4.2).

**Task 4.1: Local farm systems.** In each case study, we will characterize the particularities and dynamics of farm systems and the main changes taking place, at the farm and at the territorial levels. This will be done through farm based surveys and data-driven analysis combined with interviews to key-informants (farmers' representatives in professional organizations, technicians from agricultural administration, policy decision makers, local food traders…), so that we identify network relations and the functioning of socio-ecological processes, such as farm operations, inputs and practices, farm connections with different forms of collective action (professional organizations, cooperatives, farm-to-farm formal and informal networks…), commercialization of farm output, with special attention to local food chains, participation in quality schemes/green labels, etc. This will improve the analysis developed at regional scale with more detailed data and assess potential future change, both from existing database and interviews with local actors.

**Task 4.2: Participatory approach.** After this land system analysis, a participatory approach will be developed in sampled case study areas. An evaluation of the possible engagement of the local stakeholders will be done prior to the launching of this work, so that consistency within all case studies is secured. This work aims to discuss possible future territorial scenarios, both of the local farming systems and of the rural territories they are part of. This participatory work will be centered on the stakeholder visions, and will be based on already existing and tested methods (Lardon, 2013). The visions and pathways identified with the stakeholders will then be used to enrich and built the scenarios for future local food system improvement, which will be generalized at the regional scale (WP5). The aim here is to progress to a more focused definition of visions and pathways for the future, which will be targeted within the boundaries of the regional and global changes. With this step, it is also expected that the project will contribute to a higher awareness and empowerment of the local stakeholders, in relation to the drivers of change their territory is subject to, and the possibilities for them to define and follow their specific pathway, in accordance with the potentialities and constrains of their territory.

**WP Deliverables:** D4.1- Methodological training for project participants, for farm system analysis and for the participatory work. This will be developed and validated with the pilot cases, and will be available at month 12. D4.2- Report on farm systems characteristics, potentialities and threats, for all case studies, and on visions for change, and possible pathways, for all the case study areas where the participatory work is applied, due in Month 24. A common publication of this comparative work will be prepared for the next year. D4.3- Report on the possible adaptation pathways for the local areas to increase resilience of farm systems, land management and local food systems, due Month 27.
The WP5 is mainly focused on periurban areas, where various land systems meet, and its purpose is twofold. First, to point out the existing good practices and also the lock-in processes to reconnect food production and food consumption, in order to integrate this goal into urban food planning, both at regional and at local scales. Recent results of members of DIVERCROP program show that it is possible to recognize which periurban farmland is oriented local markets (i.e. local food system) and which one is dedicated to global foodstuff supply (Wacher et al., 2014; Filippini et al., 2014), from a GIS analysis combined with a regulations and socio-economic analysis. A method to map agricultural areas more suitable to be inserted in a local food system have been developed (Sanz Sanz et al., in press). This methodology will be previously applied at local scale in Avignon urban area in the project Aliville (Participative prospective for the relocalisation of urban agro-food system) conducted by Claude Napoléone and Esther Sanz Sanz. In this project, a similar analysis will be performed for the local food systems of the case studies (tasks 5.1 and 5.2) and results will be up-scaled to the regional level by assessing a connection index at WMB scale (task 5.3). The aim is to assess the ability of land systems to promote local food systems and to build a framework enhancing food planning at both local and regional level.

Second, we will make an overall and final assessment of the work developed by each single working package, in the six case studies. Our goal is to connect the assessments concerning land systems dynamics (WP2), species diversity (WP3) and food systems organization (WP5), in order to upscale results to WMB level through a statistical modeling approach. Working all project members together (task 5.4), we will draw up several scenarios of land systems dynamics and their repercussion of both species diversity and local food systems.

**Task 5.1: Local food supply.** First, following the results of the WP4 (deliverable 4.3) and WP2 (deliverable 2.3) combined with data from various national statistical institutes, we will map at municipality scale, in six case studies, local food production, quantity and type of farming.

**Task 5.2: Local food chain.** Secondly, and based of fieldwork conducted by WP4 (task 4.1), we will map existing local food commercialization chains of local food production, characterizing the social organization of local food systems and highlighting innovations.

**Task 5.3: Connection index.** Thirdly, we will assess possibilities to reconnect urban areas to their peri-urban agriculture, starting from the assumption that agricultural diversity enable to enhance likelihood to have or to develop a local food system. Using the methodology built on the Sanz's thesis (Sanz et al., in press), we will assess a connection index at the WMB scale, between agriculture and urban areas, in order to locate two types of peri-urban agriculture: those where local food system may be enhanced and those where conditions to develop local food system are the worst (in a public policy perspective). We will assess, for case studies, the connection between local land systems dynamics (WP4), species diversity (WP3) and local food systems, as a tool for stakeholders working on food planning.

**Task 5.4: Integrated model.** Finally, and working all project members together, we will develop a model basin-wide for analyzing the synergies and the trade-offs between land systems dynamics at global level (WP2), species diversity (WP3) and local food systems (WP5). Model simulations will inform policy makers about the sustainability level of each choice about agriculture and improvement of local food systems.

**WP Deliverables:** D5.1- Local food systems mapping, for all case studies, following the results of the WP4 (deliverable 4.3), in month 28. D5.2- Report on the possibilities to reconnect urban areas to their peri-urban agriculture based on the study cases and extended to the WMB scale, due in month 30. D5.3- A land systems mapping at WMB level, due in month 36.
### f) Deliverables list

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<tr>
<th>N°</th>
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<th>WP n°</th>
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### g) Timing (Gantt)

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**WP** = Work Package; **Task** = Task; **Participants** = Participants; **Year 1** = Year 1; **Year 2** = Year 2; **Year 3** = Year 3
B4: Project implementation

4.1 Management structure and procedures

To improve the synergy between participants and disciplines, we have chosen to co-ordinate the program itself, as every WP. In addition, the project coordinators and facilitators of WPs will form a steering committee whose mission will be to discuss continuous key decisions involved in managing the program. This board will be regular temporality (quarterly) and may meet as much as necessary. It will work with video-meeting by a procedure which was successfully used in the management of DAUME program. In terms of organization of the project, a general annual meeting will be organized. The first one (kick-off) will be at the end of T1 and it will be focused on the structural organization of the research group and on the mutual knowledge of all the partners involved. The second meeting will be at T5 and it will be focused on the update of the research development from each WP. Finally, a final conference will be organized at the end of the project ad it will be structured as an international conference open not only to the research partner, but also to other research groups interested on the subject and to the related discussion. Each meeting will be organized on a two-day base and in a different country involved in the partnership. The logistic organization of the meeting will be in charge to the local partner. Besides these three general meetings, more narrow contacts will be organized through the participants of each WP. In particular, one or two (depending on the total duration of the WP) together-working sessions will be scheduled during each WP. In case of difficulties for identifying a place or date for these working sessions, a video-meeting network will be provided by the coordinators. Formally, the DIVERCROP project will be coordinated at two levels. On one hand, on the administrative side, the program will be coordinated by Claude Napoléone. Economist, he works on the drivers of land use and policy regulation of land uses and land tenure. He was director of the UR Ecodéveloppement from 2008 to 2013 and he has different experience on participating to international research program. On the other hand, at scientific level, the coordination of the program will be shared between Claude Napoléone and Marta Debolini, both from the INRA (respectively UR Ecodéveloppement and UMR EMMAH). Marta Debolini focuses her research on land system modeling, multi-temporal analysis of agricultural landscapes and spatial statistic. She participates to different international programs and she was awarded by Columbia University for her post-doc project on Land management and land use conflict resolution in peri-urban areas: A geo-agronomic perspective Moreover, given the involvement of INRA in several international projects, there are facilities for administrative tasks, logistics and it can provide the needed administrative staff and support.

4.2 Individual participants

**Partner 1 - Coordinator: INRA (Ecodéveloppement) – France.**

The French National Institute for Agricultural Research (INRA) produces scientific knowledge and works for economic and social innovation in the areas of food, agriculture and the environment. INRA has established partnerships with a wide range of players on varying levels i.e. academic, economic, associative and regional i.e. all around the world through its capacity for leadership, coordination, communication and knowledge transfer. All play a part in defining the directions of the Institute. These alliances make INRA an organization that conducts targeted research in a variety of scientific disciplines: life sciences make up the majority of the Institute’s work (68% of INRA’s scientific expertise), followed by environmental sciences and processes (12%), ecological engineering, ecotechnologies and biotechnologies (8%), and finally economic and social sciences (8%) and digital sciences (4%). In the DIVERCROP project, the INRA team is composed by researchers from three main research units: EMMAH (Avignon), UR Ecodileveloppement (Avignon) and the UMR Métafort (Clermont-Ferrand).

**Role of partner in the project:** contributions to the INRA team project will be distributed in all actions of the DIVERCROP program. First, overall coordination will be ensured by Claude Napoléone and Marta Debolini that have both an experience of program coordination and know personally many members of this program. Then a number of WP will be co-coordinated by a member of the INRA team, chosen according to the importance of its experience in the proposed actions (WP1 by Claude Napoléone WP2 by Marta Debolini and WP3 by Sylvie Lardon). Formally, the INRA team will therefore participate at the database creation at the WMB level, with the making available the large-database management tools and human resources existing in the Ecodéveloppement unit. It will then participate at the analysis of these databases by leveraging statistical approaches already developed on similar situations (see Marraccini et al. 2015). In addition, the INRA team will develop local analyzes (WP4) mobilizing skills already proven (see Lardon and Loudiyi, 2014). Finally, the multi-scale modeling will be the task for which the consistency of the team may be the most important. Consistency inherent to the experienced practice of
interdisciplinarity between most of team members (in DAUME program, for instance) and proximity thematic processed by each of them (land use change, Mediterranean agriculture issues).

- Marta Debolini is a researcher at INRA that focuses her research on land system modeling, multi-temporal analysis of agricultural landscapes and spatial statistic. She participates to different international programs and she was awarded by Columbia University for her project on land management and land use conflict resolution in peri-urban areas: A geo-agronomic perspective.

- Laurence Delattre is an assistant professor in Economics at Lille University, France. Her research interests are mainly related to land use changes and public land use regulations. She analyses the drivers and impacts of decisions concerning land use in various situations of competition for land, and with respect to sustainable development issues. She participated to the European project CLAIM and to the ANR project DAUME.

- Sylvie Lardon is a senior scientist at INRA and associate professor at AgroParisTech. She is co-responsible of two Masters Degrees in territorial development. She carries out research on territorial engineering, in partnership with agricultural actors, socio-economic organizations and policy-makers. Her research focuses mainly on the development and use of qualitative spatial models to build shared visions and improve actors' participation in territorial projects. In a research-education-action platform, she opens the way to new modes of governance of territories and the accompanying of the stakeholders in the change. Since 2004, she has edited more than ten books on these topics and she has supervised eight PhD students (two ongoing). Since 2007, she has co-organised the four winter or spring schools in Landscape and Territory Agronomy at SaintAnna School for Advanced Studies (Pisa, Italy). She is co-responsible of the WP on territorial perspective for the French ANR DAUME Project 2011-2015 and of the WP Partnership and co-building principles for the Era-Net Rutragri TASTE project 2013-2017.

- Michel Moulery is an engineer in Information technology and spatial analysis. He has additional skills in geographic database building, Geographic Information Systems (GIS), remote sensing (Landsat and SPOT data), landscape analysis using landscape metrics and statistics (R). He participated to the ANR DAUME project 2011-2015 where he has co-managed a working group on landscape dynamics. He works also in the Claim EU FP7 Project 2012-2015.

- Claude Napoléone is a senior scientist centered on regional science issues. After a practical experience in land policy in agricultural and state institutions, his researches were devoted to interactions between agricultural areas and urban sprawl and a valuation of housing driver's location in order to assess location effects on agriculture and nature. Formally, his research fields are land use drivers and tools for public management of land use change, economics and politics of land use change, natural and agricultural resources management, interdisciplinary analysis of anthropogenic influences on natural and agricultural spaces. He was the head of the INRA research team Ecodéveloppement from 2008 to 2013 and he has different experience on participating to international research programs (EU FP7 CLAIM) and on coordinating of national research program (Bio-2M in DIVA2 program, OTM in DGUHC program, program Du marché foncier à la lecture paysagère in "Politique Publique et Paysage" program, "Étude des interactions entre dynamique des prix fonciers et stratégies des acteurs en Périurbaninois PIREE program, "Evaluation des vulnérabilités en zone périurbaine sensible aux incendies de forêt" a French program devoted to the risk analysis, ANR DAUME project 2011-2015).

- Esther Sanz Sanz works currently as a planner in the development of tools to integrate peri-urban agricultural land use in urban planning by the means of landscape metrics and indices. In this field, her research focuses on spatially-explicit modelling of agriculture under urban influence at town and regional levels. She is a 3rd year PhD student in urban studies (EHESS, France) and geography (UAM, Spain) and she holds a master and B.A. in architecture and urban planning (UPM, Spain) as well as a master in social sciences and territorial development (EHESS, France). She has more of ten years of professional experience as an architect and urban planner, and has participated in several development programs.

- Leonith Hinojosa (PhD, University of Manchester) has an interdisciplinary background that combines Economics and Human Geography. She is a research fellow at the Earth and Life Institute, Catholic University of Louvain. Over the last 10 years, her research has covered a wide range of topics in Ecological Economics and Development Geography. Her recent projects have focused on the dynamics of land use change and its linkages with social resilience to environmental and economic change, socio-environmental conflicts and water security. She is currently undertaking research on these topics in the French and Austrian Alps, Ecuador and Peru.

- Elodie Valette is a senior researcher at CIRAD (Agricultural Research for Development) and a senior visiting fellow at IFPRI (International Food Policy Research Institute), Washington D.C. Her research interests address (1) the exacerbated land use competition in urban areas, and (2) the analysis and design of integrated planning tools for urban agriculture management in the Mediterranean. She conducts a geographical analysis of land issues, focusing on the well-known insecure land situations of urban farmers and their strategies to go beyond it. Current studies include (1) analysis of farmer strategies focusing on land-use decisions and contribution to land governance, (2) public policies analysis (housing,
agriculture, land) and the evaluation of their impact on urban agriculture, and specifically on land use and land tenure. She is co-responsible of the ANR DAUME Project 2011-2015 focusing on the sustainability of urban agriculture in the Mediterranean.

- Rosalia Filippini (31 years old) after the Master Degree in Economy from the University of Parma (Italy) in 2009, in 2011 she was at European Commission in DG Agriculture and Rural Development as trainee, working on the mid-term evaluation of rural development programs. From 2012-2015 she has done a joint PhD in Landscape Agronomy between the Scuola Superiore Sant’Anna in Pisa (Italy) and AgroParisTech (France). Her PhD work concerned the integration between the periurban farming system and the local food system, adopting a multiscale perspective. She is now in post-doc at UMR Météorô AgroParisTech. Her research interests are related to the analysis on periurban farming systems, local food systems with specific concerns on the impact on territorial dynamics of the different stakeholders.


Partner 2: University of Évora – Portugal

ICAAM (www.icam.uevora.pt) is the major research unit in the University of Évora. The mission of ICAAM is to develop research to assess and support the sustainability of Mediterranean agriculture and related ecosystems, from field to policies. ICAAM research is grounded in an interdisciplinary and multilevel systemic approach to agriculture and rural territories, as well as associated processes and impacts in the environmental, social and economic dimensions. Research contributes to three main research strands: 1) Efficiency in the use of production factors; 2) Agri-food products quality and added value; 3) Ecosystem integrity and landscape multifunctionality. In the context of the complexity of Mediterranean production systems and their territorial integration, research progresses through methodological innovation and, beyond interdisciplinary, also transdisciplinarity, based on close interaction with practitioners at different scales. The recent independent international evaluation stressed that ICAAM candidates itself to lead the transition of traditional agricultural science to the new challenges posed by the new European agricultural policy context.

Role of partner in the project: the University of Évora will provide expertise related to farm system dynamics and relation to the food system at the local scale, as well as participatory methods to assess linkages and functioning of these systems which results in the co-lead of WP4 and a participation in WP1 and WP2. Building on an extensive background in landscape ecology, farm system evaluation and the relation to the land manager this team will contribute to the assessment of farm system dynamics at the local scale. Also it will contribute to assess the capacity of different farming types for contributing to the local food system and for coping with the sustainability of their local region. The University of Évora team will also participate in communication and dissemination activities, feedback processes, project meetings and workshops.

- Teresa Pinto-Correia has been working in recent years in the assessment of farm management typologies and the factors leading to stronger or weaker articulation between farm management and services provisioning. Particular work has been developed on novel farm management paradigms and their resilience levels, as well as their capability to provide multiple services in different ways. This field of work is strengthened with the analysis of the combination between attitudes and behavior in farmer choices, making it possible to grasp tensions, conflicts, and targeted policy needs, for each farm system and farmer type. Further, she has experience on participatory methods for the discussion of agriculture scenarios and policy needs, integrating different stakeholders at different scales, linking research to practice.
- Nuno Guimaraes is a Biophysical Engineer, MSc. in Geographic Information Systems and Science, PhD researcher in Environmental Sciences. Research on landscape modelling, landscape evaluation, fire management, landscape change and related drivers, and disturbance effects in Mediterranean agro-forestry systems at multiple scales.

- Sérgio Godinho is a PhD researcher in Interdisciplinary Landscape Management; He has published mainly using the montado ecosystems as a case study for understanding the effects of agro-forestry management, landscape changes and socio-economic drivers on the biodiversity values, with 6 published papers in ISI recognized journals and 1 book chapter as a co-author. The main scientific interests are: Landscape Ecology, Landscape Change Analysis, Remote Sensing, Statistical Modelling, Data Mining, and Biodiversity Conservation. He has also participated in the project âLIFE Monfuradoöproject (Life03 NAT/P/00018).


**Partner 3: CNRS/IMBE – France**

The Institut Méditerranéen de Biodiversité et d’Ecologie marine et continentale (CNRS-IMBE), established in 2012, aims to develop new approaches for science-based integrated management of biodiversity and ecosystems. With 260 staff members organized in 14 research teams, CNRS-IMBE combines basic and applied biological field research with new approaches of modelling ecosystem processes at the continental scale. CNRS-IMBE's current research potential covers the domains of biodiversity, evolutionary biology and ecology, and human-environment relationships. CNRS-IMBE provides crucial expertise for the monitoring and analysis of biodiversity to local, regional and global stakeholders in the public and private sector. Involving its main developer, Dr Alberte Bondeau, contributes the development and application of the widely recognized terrestrial ecosystem/hydrology model LPJmL, Dr. Cécile Albert contributes to the integration of landscape ecology and land use change modelling, Prof. Wolfgang Cramer contributes the implementation of the model-based approach into the context of ecosystem service assessments.

**Role of partner in the project:** CNRS/IMBE will contribute to all the WP of the project and participate to the co-ordination of WP3.

- C. Albert (CNRS), PhD 2009, is working at the interface between functional ecology, landscape ecology and dynamic modelling. She is mainly interested in looking at how landscape changes modify species habitat network. Supervision of doctoral and post-doctoral students: 1 PHD student currently.
- A. Bondeau (CNRS), PhD 1992, has a long experience of vegetation modelling. She conducted the first implementation of agriculture within a dynamic global vegetation model. She is a co-leader of the transverse work package âintegrated modellingâwithin the Labex OT-Med where she concentrates on the understanding and the modelling of sustainable agricultural systems in the Mediterranean under global change, using ecosystem services assessment for that purpose (2 post-docs and 2 Phd students currently working on that topic). 58 Publications.
- W. Cramer (CNRS), scientific director of IMBE, PhD 1986, has worked on mechanistic modelling of ecosystems at the regional and global scale throughout his career (120+ publications). More recently, he has focused on interdisciplinary questions concerning the human-environment issue and more specifically the use of ecosystem services as paradigm. He has been a contributor to the IPCC in many roles and co-chairs the Future Earth project ecoSERVICES

Partner 4: Institut Polytechnique LaSalle Beauvais-ESITPA – France

LSB is a top-ranking French engineering school founded in 1854, which focuses in the field of life sciences (agriculture, food and health, geology). There are currently around 2,500 students in LSB going from bachelor to PhD levels in the two campuses of Beauvais and Rouen. Two research units of LSB are involved in the DIVERCROP project: PICAR-T and HydrISE. PICAR-T (UP 2012-10-103) is an interdisciplinary research unit, which aims to understand and manage the innovation processes in rural areas and in local food systems. Three associate professors of PICAR-T are involved in the DIVERCROP project (17 man-months): Elisa MARRACCINI (landscape agronomy), co-coordinator of WP2 and contributing to WP2, WP4 and WP5. Anne COMBAUD (geography and GIS science), contributing to WP1. Hanitra RANDRIANASOLO-RAKOTOBE (economy), contributing to WP2. HydrISE (UP 2012-10-102) deals with the interactions Soil-Environment in connection with the current environmental and social issues e.g. climate change, agricultural inputs and industrial activities on the ecosystems. Three associate professors of the HydrISE are involved in DIVERCROP (3 man-months) in WP3: Michel-Pierre Faucon (Plant Ecology), David Houben (Soil Science) and Anne-Maimiti Mercadal-Dulaurent (Agroecology).

Role of partner in the project: LSB will contribute to all the WP of the project and participate to the coordination of WP2. Building on an extensive background in landscape agronomy, farming system evaluation geography and agro-ecology, the contributions of LSB team will be the following:

1. Contribution to the state of the art and the theoretical framework of the project (WP1, WP2, WP3, WP4, WP5)
2. Contribution to the methods (WP1, WP2, WP3, WP4, WP5)
3. Contribution to the results at the WMB level (WP1, WP2), and collaboration with partner 8 for an Italian case study (WP3).

- Combaud Anne (37 years-old), Associate Professor in Geography. She is dean of agronomy and animal department of LSB. She has received in 2008 a PhD from Burgundy University (France) in physical and historic characterization of the wine-making territories in Burgundy. Her main research interests are agricultural land use changes and spatial analyses of landscapes. She has published 7 papers in peer-reviewed journals and has supervised 3 MSc internships.
- Dulaurent-Mercadal Anne-Maimiti (31 years-old), Associate Professor in animal ecology and agroecology. She has received a PhD degree from Bordeaux 1 University (France) in functional and community ecology in 2010. Her main research interests are ecosystem services rendered by plant diversity, especially pest regulation and fertility. She was involved in the URTICLIM and P-CLIM international projects. She has published 9 papers in peer-reviewed international journals.
- Faucon Michel-Pierre (33 years-old), Associate Professor of plant ecology and agroecology. He has a PhD from Université libre de Bruxelles (ULB) in plant ecology and biogeochemistry (2010). His main research interests are on soil-plant interactions and their implication in biodiversity conservation, ecological engineering, and agroecology. He is/was coordinator (3) and partner (5) of height French research projects and partner of an international project on fêoopper flora. He is author of 23 papers in peer-reviewed international journals. He supervised 2 PhD students and 7 MSc.
- Houben David (32 years-old), Associate Professor in soil science and biogeochemistry. He holds a PhD from Université catholique de Louvain (Belgium) in Agronomical Science and Biological Engineering (2013). His main research interests include the management of the soil resource which encompasses a
better understanding of soil-plant interactions and the impact of the application of plant litter and renewable amendments on both nutrient and contaminant availability in soils. He was involved in five national or international projects. He has published 15 papers in peer-reviewed international journals. He has supervised 1 PhD student and already supervised 6 MSc students.

- Marraccini Elisa (36 years-old), Associate Professor in Landscape Agronomy and member of the PICAR-T research unit. She has received in 2010 a PhD from AgroParisTech (France) and Scuola Superiore Sant'Anna (Italy) in Agronomy and Environmental Sciences. Her main research interests are integrated farming system assessment, agricultural land use changes, participatory and multi-scale approaches. She was involved in the FP6 ENDURE NoE and ANR-DAUME international projects. She has published 12 papers in peer-reviewed international journals. She has supervised 2 PhD students (one ongoing) and 3 MSc (one ongoing) and 2 BSc internships.

- Randrianasolo-Rakotobe Hanitra (40 years-old) is an Associate Professor in Economics. She has received a PhD from the University of Versaille (France) in 2002. Her main research interests are Lock-in, path dependence issues and economic change through innovations. She is involved in the RMT Erytage dealing with farming sustainability and the ITE Genesys with green and open Innovation. She has published 15 papers in peer-reviewed journals. She is supervising 5 and already supervised 3 MSc internships.


Partner 5: Institut National de la Recherche Agronomique - Tunisie

The INRAT is part of the National System of Agricultural Research hosted and coordinated by IRESA. The INRAT is the historical institution of this system. The institute, which celebrated its centenary in 2013, develops agronomic research about plant and animal productions, protection of plants, horticulture and market gardening. The rural economy is present in the INRAT research since 1971. Agricultural economists and researchers are grouped in a laboratory since that date. Research on these fields includes the economy and farm management, agricultural policy and food economy. The land issue was also the focus of some researchers, as evidenced by some of their publications on public or collective lands, on privatization processes or on peri-urban agriculture.

Tunisia competition over natural resources, in particular soil resources, is becoming increasingly exacerbated, especially in suburban areas. Furthermore loss of high agronomic quality soil increases each year, especially surrounding main cities in the country's coastal regions. However, the precise knowledge of these losses and especially the current processes and drivers that explain such dynamics are poorly studied, making it difficult to identify leverage actions to enhance public regulations and to reduce the negative effects on soil resources or the ability of land system to produce food or environmental services. The work planned in the DIVERCROP project are expected to provide a database on land uses in the western of the Mediterranean basin and conduct comparative analyzes on drivers that explain dynamics of land use changes in different regions.

Role of partner in the project: The Tunisian team will contribute most directly to WP1, 2, 4 and 5, in order to benefit from the others groups' contribution on understanding the current land use change phenomena and will participate at analysis of others project partner countries. Beyond the whole program interest, analytical works at the local level about drivers of the land use dynamics and changes will be undertaken.
Partner 6: Laboratoire RNAMS – Algeria.

The team ADDYME (Planning, Development, Dynamics of Earth and Environment) belongs to RNAMS Laboratory. The team listed its shares in a context emphasizing the concept of sustainable development, considered under the double aspect of man's relationship with nature and with the dynamics of space, while ensuring rational management of resources Natural and ecosystem conservation. Its expertise spans the life sciences, human sciences and engineering sciences, applied to the management of natural resources and societies, water and agriculture, as well as land. ADDYME The team also provides training through research (graduate students and post-graduate Master, state engineer, Magister and Doctorate). His themes are included in a multidisciplinary approach: Urban Management and Sustainable Development; Biodiversity, ecology and management of wetlands High Plains of Constantine; Cities, territories and Environment.

Role of partner in the project: The Algerian team will contribute at WP4 and 5 and organize the field studied sampled in the country.

- Bouchemal Salah, professor, he chairs the Scientific Advisory Board since 2007. He was Head of RNAMS Laboratory and currently leads the research team ADDYME. His major concern is life in the countryside and their upheavals and thorough investigations into the peasantry. It was followed by several publications on these aspects, as well as his involvement in group work particularly in the context ANR kind of international projects as such ANR DAUME 2011-2015, by focusing on the peri-urban agriculture in Africa, to share their responses to the socio-economic vulnerabilities and their integration into markets. On aspects related to human relations to his environment, he led several national projects, CNEPRU type, like the one that focused on the development of the Algerian steppe, and the asset management of the environment, or by integrating with a research team belonging to the Centre for Research on the Dry Areas (CRSTRA Biskra).

- Abdelkader KHIARI is professor at the University Larbi Ben M'hidi in Oum El Bouaghi. He is the head of the RNAMS laboratory. Ha has a Phd in geology sciences and work on natural hazards, water flows and the environmental planning. He has coordinated many research projects and has some academic publications on international peer journals.

- ADAD Mohamed Cherif, professor at the University Larbi Ben M'hidi in Oum El Bouaghi, he is an architect and urban planner and Head of the Faculty of Earth Sciences and Architecture. He has participated in several research projects, type CNEPRU, and is a member of ADDYME team partner INRA/Ecodéveloppement team in DAUME sustainability project of Urban Agricultures in the Mediterranean. He has to his credit several publications including those of three books on the issue of housing in the Saharan zone, design and architecture, and the relation cities habitat. He has conducted several field surveys in the context of occasional work. He was the initiator of several formations within his institution and scientific events, as has supervised a large number of students belonging to different levels include.

- Ouassila BENDJABALLAH, architect and urban planner, she is teacher-researcher since 2004 at the University Larbi Ben M'hidi in Oum El Bouaghi, at the Institute of Urban Management Techniques and the Faculty of Earth Sciences and the Architecture, she is a member of ADDYME team partner in the project ANR/DAUME sustainability of urban Agricultures in the Mediterranean. His works has been published in
2013 in Cahiers Agriculture. His research has allowed him to have a thorough knowledge of the problems of land ownership in Algeria and understand the use of strategies or devolution of land available to owners in suburban areas.

- Sihem Boucherit, teacher-researcher in the Faculty of Earth Sciences and Architecture, University of Larbi Ben M'hidi in Oum El Bouaghi, urban architect and is preparing a doctoral thesis in urban planning. In her research, she focuses mainly on the analysis of practices and operating strategies of collective action of the state, and their impact on the city. She currently leads the Master works in Architecture and Project Management, with concern interest on topics dealing with the city, its dynamics and its mutations. She is a member of ADDYME team of natural research laboratory resources and management sensitive environments and participated in the research project DAUME Sustainability of Urban Agricultures in the Mediterranean (2011-2014), his contribution has been to achieve interesting work understanding the impact of public policies (urban and agricultural) on the vulnerability of suburban farmland in Constantine, analysis of configuration and sets of actors involved in the sustainability of suburban farmland and identification mutations in peri-urban areas.


**Partner 7: Malta College of Arts, Science and Technology – Malta**

MCAST is the leading entity responsible for the provision of further and higher vocational education in Malta and provides undergraduate courses in various scientific and engineering sectors. Research will be conducted within the Applied Environmental Sciences Research Group (AESReG) based at the Laboratory of Terrestrial Ecology at the Institute of Applied Science (IAS). The Institute is found within recently built facilities at the new MCAST Campus and includes fully-equipped science research laboratories. AESReGis coordinated by two principal investigators, both of whom are senior lecturing staff at IAS. The group also collaborates with a number of local practitioners working within the environmental sector in Malta and that have broad industry experience. Members of AESReG have experience in participating in international research projects and concurrent research activities carried out by the group focus on multidisciplinary aspects relating to the fields of natural resources management and agro-environmental sustainability. The objective of the research group includes 1) to address environmental and sustainability issues of concern to the Maltese and European environment, and 2) to develop a research partnership with local and international authorities and organizations in the environmental sector. Research carried out by the AESReG mainly falls within the following two research themes:

**Thematic area 1 – Long-term environmental monitoring and sustainability studies:** This thematic area focuses on multidisciplinary research relating to the fields of natural resources management, the environment and agriculture. Research is intended to inform management practices and to develop basic and applied aspects of science relating to the environment. Members of the research group have several years of practical and research experience in the following aspects of environmental management: local and landscape-scale ecological studies; ecological restoration projects; sustainability of resource use; climate change modelling and adaptation studies; and environmental policy.

**Thematic area 2 – Agro-environmental research:** The second research theme relates to agro-environmental issues, including: reducing agricultural waste; reducing the carbon footprint of the farming sector; increasing carbon sequestration; conserving biodiversity; sustainability in agriculture and adaptation to climate change. Research carried out under this thematic area can be applied to the development of new eco-friendly practices and technologies for agriculture. A central theme for AESReG within this thematic area is the development of a working relationship with industrial partners, including relative government departments, agricultural companies and NGOs.
Role of partner in the project: MCAST will be participating in the comprehensive building exercise, carried out within WP1. Experience from other projects and from research within AESReG has already been important for building a local database of land use and land cover maps, and other socio-economic and agricultural statistics at the municipality and national scale that may be used for the assessment and mapping of land systems diversity. Through the participation within WP1, the research group will be able to work with other partners to combine data at the Mediterranean basin level, and for the development and utilization of statistical techniques to characterize land systems and their drivers and their dynamics (WP2). MCAST will contribute to studies investigating the impact of land systems on species diversity at local and regional scales (WP3). Being the only small island state within the project Malta presents a special case study for the DIVERCROP project. Agricultural land in Malta, though rich in agricultural biodiversity at crop level but also in naturally occurring species, is often subject to direct and indirect pressures resulting from the limited amount of land in Malta and competition with other land uses. Within this context, and through the use of existing data and information obtained from other WPs, MCAST will also contribute to WP4 and WP5 by contributing data about land system dynamics, including information obtained through interviews with key stakeholders and through participatory approaches.

- Mario V Balzan (31 years old), Senior Lecturer in the Environment and Sustainability at the Institute of Applied Sciences, Malta College of Arts, Science & Technology (MCAST). He holds a Ph.D. in Agrobiodiversity from the Institute of Life Sciences of Scuola Superiore Sant’Anna, Pisa, Italy. Past research investigates biodiversity-ecosystem function relations in agricultural landscapes, pollination ecology, the assessment and mapping of ecosystem services, and habitat management for maintaining ecosystem services in agro-ecosystems. He has participated in the FP7 project SOLIBAM, the ERDF project SIMBIOTIC, and is currently a member of the management committee of COST Actions FA1105 (Biogreenhouse) and a workgroup leader in FA1307 (SUPER-B). He is a Principal Researcher of the Applied Environmental Sciences Research Group (AESReG) at MCAST and the project coordinator for the research group’s participation in the ongoing HORIZON 2020 project Enhancing ecoSysteMSERVicesAppping for poLicy and Decision mAking (ESMERALDA).

- Eman Calleja is a Senior Lecturer in Environment and Sustainability at the Institute of Applied Sciences, Malta College of Arts, Science & Technology (MCAST). Prior to joining MCAST, he was a Research Fellow with the Islands and Small States Institute, University of Malta, carrying out research on the impact of climate change on European islands. He is an interdisciplinary scientist, having a background in ecology, agriculture and more recently in rural geography. Dr Calleja obtained a PhD in Plant and Environmental Sciences from the University of Warwick (UK) in 2011, following a three-year PhD fellowship funded by DEFRA (UK). His PhD research focussed on climate impact studies and forecasting probabilistic projections of climate change. Prior to starting his PhD, he worked for the Maltese ministry for agriculture on various agricultural issues, including drafting legislation and policy. He also represented Malta at an international level and on EU fora on numerous occasions during his 10-year stint with the government. He is also an ecologist, having previously obtained an MSc in ecology and environmental management from the Mediterranean Agronomic Institute of Chania, Crete, and has worked for over fifteen years as an environmental consultant for various private and public organizations and NGOs. Dr. Calleja is a Fellow of the Royal Geographical Society (UK). He is a Principal Researcher of the Applied Environmental Sciences Research Group (AESReG) at MCAST, and a member of the management committee of COST Actions ES1106 (EURO AGRIWAT) and CA15113 (SMIRES).

Partner 8: Universidad Politecnica de Madrid - Spain

The Technical University of Madrid (UPM) is the oldest and largest Spanish technical university. UPM offers most of engineering disciplines as well as Architecture, Computer Science and Geodesy & Cartography. UPM is a member of more than 10 European Technology Platforms UPM has 220 Research Groups, 5 RD Institutes and 10 RDI Centres. The activity of the Research Group Architecture, Urbanism and Sustainability covers a wide range of topics, including a research line focused on Sustainable Urbanism and Agrarian Systems in which practical tools and methods to integrate periurban agrarian areas in urban and territorial planning have been developed. GIAU+S is also responsible for the management of one of the main databases in Spanish language about Good urban practices on sustainability, linked to UN Habitat. The GIAU+S will incorporate an external member from the Group of International Economics and Development of the Universitat Politècnica de València (Olga Moreno), whose academic profile complements that of GIAU+S researchers in the field of patterns of change of farming systems (see below)

Role of partner in the project: UPM will collaborate with the database building (WP1) by providing expertise with agricultural statistics (eg. Agricultural censuses) and socioeconomic data sources. This team will also participate in WP3, analysing a local case study of periurban agriculture strongly affected by the urban sprawl. Olga Moreno and Marian Simon will contribute to the coordination of WP5.

Jose Fariña Tojo is Dr Architect and holds a Law degree. Full-time Professor, he has been in charge of different research projects funded by the Ministry of Housing and other institutions. He was responsible for the National White Paper on Sustainable Urbanism. Currently he collaborates in different national R+D research projects suchs as « Urban lessons from the housing bubble: dimensions, costs and benefits from the Spanish urban growth 1990-2006 » and « Functional resilience of urban areas. The case of Madrid urban area »

Olga Moreno is an Assistant Professor at the GEID es of the Universitat Politècnica de València. She has participated in several national projects and is currently collaborating with one 7FP project (TRANSMANGO, Assessment of the impact of drivers of change on Europe’s food and nutrition security) and one H2020 project (SALSA small farms, small food businesses and sustainable food security). Her research has addressed the processes of farm differentiation in several farming systems in Spain and their implications for the rural territories, combining social research methodologies and statistical information. More recently, her work has focused on the connections between periurban agriculture and local food systems.

Marian Simon Rojo, architect, is Adjunct Professor at the Department of Urban and Regional Planning (Faculty of Architecture, UPM) and member of the GIAU+S. Between 2012-2014 she coordinated a 3 years R&D project Periurban Agrarian ECosystems in Spatial Planning financed by the Ministry of Science and Innovation. She participated in the European COST Action TD1106 Urban Agriculture Europe (UAЕ), coordinating WG1ïî Urban Agriculture definitions and Common Agricultural Policy.

Partner 9: Scuola Santa Anna, Pisa – Italy

SantAnna School of Advanced Studies (SSSA, founded in 1987) is a public university institute - with special autonomy - working in the field of applied sciences. SSSA aims at experimenting innovative paths in research and education. Due to its international nature, education of excellence and scientific community, SSSUP established itself as a reference both in Italy and abroad, ranking tenth (and first in Italy) in the 2016 ranking of the 150 best young universities in the world compiled by the Times Higher
Role of partner in the project: The SSSA will mainly contribute to WP1 and WP2. First, contributing to the coordination of WP1 mobilizing the know-how on remote sensing data collection and database managing. In addition, the SSSA team will leverage the own expertise on landscape level analysis of agricultural data in Mediterranean areas to ensure the consistency between the data management and the statistical approaches developed in WP2. Second, SSSA will participate to the WP2 to identify the variables needed to address the characterization of theoretical influence of cropping systems on spontaneous vegetation. To this end, the SSSA team will interact also with Nicola Silvestri (University of Pisa, and affiliated to the Institute of Life Science of SSSA) to improve the identification of proxies capable to account for the farm level characteristics in the farming system typology that will be developed by the WP2 leaders. In addition, the SSSA team will also contribute to support the model development (WP3) as well as to management of local case studies (WP4) thanks to the experience of co-management in previous projects with most of the DIVERCROP members (e.g., for the DAUME project) and to the land system assessment fostered in WP5.


Anna Camilla Moonen: PhD, full time researcher in agroecology and assistant professor at SSSA. Her research areas involve management of agrobiodiversity and farm management for development of sustainable cropping systems. She mainly works on arable cropping systems, but recently extended her works also on olive groves and vegetable systems. She deals also with the study of agroecosystem services with conceptual and experimental approaches to address agrobiodiversity related to weed control, pest control and soil fertility. C. Moonen has coordinated and participated to several research project financed either by the MiPAAF or by the EU (e.g., coordinator of Work Package 2 for the KBBE_2012 Project QUESSA http://www.quessa.eu/).

Davide Rizzo: PhD, is an agronomist and fixed-term contract researcher with extensive experience in landscape level characterization of agricultural practices (e.g., crop sequences, fertilization, irrigation). He collaborated to several regional studies and a European FP7 project addressing the development of support tools for the territorial policy-making (LogistEC http://www.logistecproject.eu/).

Nicola Silvestri: PhD, is a full time researcher at Department of Agriculture, Food and Environment - Pisa University. His research activity has been focused on the evaluation of cropping system sustainability and the use of indicators, modelling and GIS in studies on a regional scale. He coordinated many research projects in collaboration with the LandLab `Scuola Superiore S.Anna, such as the study of alternative cropping system within the Nitrate Vulnerable Area of the Massaciuccoli Lake catchment (2008-2011; founded by the Tuscany Region) and a GIS data-base implementation on the soil use, the quality of waters and the farms typology within the park& borders (2012-2013; founded by Regional Park of Migliarino - San Rossore - Massaciuccoli). Dr. Silvestri will be mobilized by the SSSA thanks to his expertise on the project topics, in particular of WP2. He does not participate to the funding requirement because his principal affiliation is UniPI, though he will be joined to the scientific valorization based on the project outputs.


4.3 Consortium as a whole

To propose possible planning options at Mediterranean level, must crossing the limit inherent to national or partial analysis. In this sense, the DIVERCROP project will have a transnational impact, because it will give an overall planning tool for the whole Region. The importance of the Mediterranean spatial level is also confirmed by the recent programs of the European Union (for instance the INTERREG MED Program 2014-2020, which pointed out the southern European Region as a specific sub-area on the European Union in order to implement specific local programs) or for specifically dedicated institutions like Plan Bleu. The project will take advantage from the existing expertizes of the research team involved and from the previous studies already carried out by the research teams on the same area. In particular, some of research teams involved in the DIVERCROP project was already partner on the DAUME/ANR project (http://www1.montpellier.inra.fr/daume/) aimed to analyze the integration of agriculture within Mediterranean urban systems. Moreover, the INRA, the University of Oum El Bouaghi in Algeria and the INRAT in Tunisia are part of the Foncimed network, a multi-disciplinary and inter-institutional Mediterranean network for exchanges and comparisons of experiences on land issues. The INRA and the CNRS/IMBE are currently involved on the Labex OT-MED, an excellence research network focused on global change and natural hazards in the Mediterranean basin and semi-arid regions of Sahel. Finally, the INRA, La Salle Beauvais-Esitpa, la SSA and the University of Evora are involved in training programs about Landscape and Territory Agronomy.

4.4 Risks and contingencies

One of the main research challenges will be to work in a region where data availability is not homogeneous or where the data are available but not always spatially explicit. The potential risk in this sense is to have different kind of data and different data resolution among the various countries around the WMB. One of the possible related difficulties is to produce heterogeneous results among the different countries involved. In particular, the European countries have usually a standardized database for land cover and very similar standards for national agricultural census, which will be available at Municipality level. Otherwise, southern Mediterranean countries not always have the same level of standardization and sometimes the access to existing data is not linear. In this sense, it is very important the experience from local partners which have the direct knowledge about the availability and the access possibility to the different database. In terms of stakeholders’ involvement, the presence of local research partners is a fundamental insight. Moreover, most of the partners already participate to international programs involving local farmers or public institution, so the stakeholders’ involvement could be facilitate from this previous experiences. Among the WMB countries, Morocco will be the only one not participating to the project. Last, the multi-scale analysis on such a large area and with such accuracy level (land systems) is a major challenge. This is the heart of our project and we have reduced the risk by starting elements, knowledge or tools mastered by participants and using an intermediate level (landscapes). Promote constant interaction between WP will also participate in minimizing the risk of the production of non-recoverable knowledge to other analysis scales.
B5: Impact

5.1 Expected results and their impacts

The main expect result for the DIVERCROP project is a comprehensive multi-scale model of land systems changes and their correlated food systems. In this sense, the project will supply a new vision on the WMB changes based on the land system approach extended on a large scale, giving an easy readable tool, namely a map of land systems and food systems indicator. This can have an impact on future research on the same area, as a base for other studies in different disciplines. In terms of innovation, the proposed methods aim to analyze changes in terms of landscape practices, which are information not still used for this kind of studies. The social aim is to identify appropriate spatial planning strategies for enhance agricultural sustainability and food systems on this area, given its scarce natural resources (e.g. water resources, soil organic matter), its vulnerability to climate change and its cultural and natural specificities, and proposing possible future land uses and territorial scenarios. This type of global planning doesn’t currently exist. However, it’s a social stake that can generate international agreements and our project is supported by the Plan Bleu organization5.

5.2 Spreading excellence, exploiting results, disseminating knowledge

Scientific publications on peer reviewed international journals will be produced both from the different WP and in a comparative way between the case studies and between different WPs. During the project development, the partial results will be presented in international conference organized by the main scientific networks and organization interested on the subjects of the DIVERCROP project, such as IALE (International Association for Landscape Ecology), ESA (European Society of Agronomy), IFSA (International Farming System Association) and GLP/Future Earth (Global Land Project). Moreover, a final scientific project conference will be organized in order to present the main findings of DIVERCROP to the scientific community. We also plan to disseminate our results among the local and regional stakeholders involved in landscape management and planning. In particular, a participative workshop will be organized with local stakeholders for each case study, in order to validate the proposed scenarios but also to discuss possible improvement in terms of local policies. Further, we will organize a final workshop with regional stakeholders, in order to identify planning options aimed to preserve the good functioning of ecosystems. Finally, all members of DIVERCROP program are active in some Mediterranean networks (like Foncimed on land use) and our final meeting will be based on open invitations to generate an international conference on Mediterranean land use changes issues.

5.3 Mobility and training

A training course will be organized during the first year of the project for the methodology developed for the local case studies, to give the conceptual and methodological framework for analyzing farm systems changes and trajectories. And it will give the principles and tools for the participatory approach with local stakeholders. This training school could follow the previous similar experiences organized by some of the DIVERCROP partners (first to fourth spring school in Landscape and Territory Agronomy at Sant’Anna School for Advanced Studies) and will benefit from the high number of the consortium partners involved in education. This training opportunity will be opened not only to DIVERCROP partners, but also to Master and PhD students from the whole Mediterranean area and to others partners of the Mediterranean network. Moreover, the DIVERCROP project is an important opportunity for the PhD students and post-doc involved because it allows to improve their network and to exchange with different researchers from various disciplines. In this sense, an annual seminar of the young researchers (PhD and post-doc) involved in the project or in other projects of the ARIMnet2 program will be organized in order to present their progress on the studies and to improve the transdisciplinary discussion.

B6: References used


5 http://planbleu.org/fr/le-plan-bleu


34. Metzger et al. (2005). A climatic stratification of the environment of Europe; Global Ecology and Biogeography 14, 549-563

35. Moraine et al. (2016). A social-ecological framework for analyzing and designing integrated crop-livestock systems from farm to territory levels. Renewable Agriculture and Food Systems, in press


41. Polasky et al. (2008). Where to put things? Spatial land management to sustain biodiversity and economic returns. Biological Conservation, 141; 1505-1524


B7: Ethics issues

Relations between land use change, producing agricultural areas, biodiversity and food systems are the core of relations between societies and nature: each public choice about urban extension affects capabilities of sub-urban agriculture to feed the city, each change in agricultural practices affects surrounding ecosystems. In this context, the ethical question clearly arises when one is dealing with arbitration between land uses, especially on a large scale like the WMB. Indeed, if we consider agricultural production (yield) and other services provided by the natural environment (specific biodiversity, carbon storage, water...), there is no a priori optimal solution that does not involve a trade-off: each type of choice affects all services but in directions that may be different (increase crop yields can reduce biodiversity, select a public regulation scale has implications for equity, etc.). Our work, through the identification of trade-offs, on one hand, and through the assessment of consequences of each choice at different scales of public action, on second hand, allows regulators and societies as a whole, to improve their future decisions resting on the potential consequences.

B8: Resources to be committed (scientific justifications of required funds)

Participant 1: INRA – France (Coordinator). The requested funds are relatively limited given the size and responsibilities of the INRA team in the program (115 000 euros). One temporary staff will be provided through 10 man-months for a postdoctoral grant. The remaining expenditures focused on the inherent logistics program coordination and various WP. In addition, in this budget, the coordinator will cover the program meeting expense over the three years (38 000 euros).

Participant 2: University of Évora - ICAAM – Portugal. Considering the overall participation of the University of Evora and the project length the total budget is of 50 000 euros mainly justified by the personnel costs (one post-doc positions will be opened to support the development of the WPs where the University of Evora participates, but mainly focused on WP4, where the University of Evora is co-lead), travel and conferences, and other costs that include Open Access registration for all scientific publications, English revision costs and acquiring of bibliography. Other costs include 2.000 euros for equipment acquisition (that includes one portable computer) and consumables.

Participant 3: CNRS/IMBE – Aix-en-Provence – France. The requested funds (a total of 65.000 €) are mainly related to one temporary staff who will work for the WP3 tasks: a Post-Doc position will be hired for one year, with a cost of 44.733 €. Other costs include the gratifications for two Master 2 students (2 students * 6 months * 550 € = 6.600 €) who will analyses data within WP3, travel (3 * 1.000 € for the internal workshops of the program and 2 * 1.500 € for two international congress), a laptop for the Post-Doc (2.000 €), publications costs (2.000 €), functioning (3.000 €)

Participant 4: Institut Polytechnique LaSalle Beauvais - Esitpa (LSB) – France. Considering the overall participation of LSB and the project length the requested budget is of 22.000 euros mainly justified by the personnel costs (two MSc internship positions will be opened to support WP2 where LSB is co-leader and WP4 where LSB participates), travel and mission costs, which will support on the one side to participate (at least three researchers from LSB) to the three meetings scheduled during the project (kick-
off, intermediate and final) and on the other side to contribute to the two PhD and summer schools organized by the DIVERCROP consortium. Two short missions for WP3 and 4 are also expected.

**Participant 5: INRAT, Tunisie.** To carry out this research, in addition to the contributions of the researchers involved in the program, the recruitment of a young fixed-term contract researcher is required to drive the work on field-study areas including the harvesting of information, conducting surveys and data analysis. In addition, the Tunisian team will host a PhD student who will be enrolled in the graduate school of INAT in Rural Economy (Mohamed Elloumi is a member). This thesis will be done in co-direction with one of the member teams of DIVERCROP. For the achievement of its works in the DIVERCROP program, the Tunisian team need a sufficient budget to cover needs of a PhD scholarship for a student who will be on the INRAT, recruitment of a fixed-term contract for the duration of the project (up to DT 1500 per month for a 36 months period) and financial resources for missions correlated with the program or purchasing supplies, small equipment and materials as well as means for the organization of research workshops and seminar in Tunisia.

**Participant 6: University Larbi Ben M'hidi, Algeria.** The team ADDYME, as Algerian research team, is in kind rules. So, no funds are required in the program. However, team members will devote 10 man/month to the program and the Algerian case study, the team ADDYME will organize an international meeting on DIVERSCROP topics and results for an amount of 3000 euros, will allocate 5 500 euros for travel and subsistence of own researchers and others (others members of the DIVERSCROP program involved in a work in Algeria) and 1 500 euros for temporary staffs.

**Participant 7: Malta College of Arts, Science and Technology (MCAST), Malta.** Personnel Budget: 26600 ú. The proposed budget will be used to cover for coordination and research duties carried out by lecturing and research staff at the Institute of Applied Sciences (MCAST). MCAST will participate in data collection, analysis and reporting and dissemination as indicated above. Equipment: 1400 ú to provide funding for land use data (including satellite imagery, ortophotos, etc). Travel Budget: 6000 ú. 3 years with 1 000 ú/year for travel expenses for internal workshops of the program (3000 ú). Two international congresses with 1500 ú each (3000ú). Other expenses: 5000 ú to cover for end of project audited financial report.

**Participant 8: Spain.** The Spanish research team will be reinforced with the enrolment of a post-doc researcher for 18 man-months (non-permanent staff: 43.000 ú) who will assist with WP4 and WP5. 10.000 euros are requested for travelling costs, from which 9.200 ú will be allocated to cover expenses related to the attendance of different members of the research team to international meetings and workshops within the project, and another 800 ú for those travels and expenses related to specific meetings for internal coordination between UPM and UPV. 1.500 euros will be needed for purchasing supplies necessary to develop the research. Other costs include 4.000 ú to organize a multidisciplinary workshop with researchers engaged in projects connected with the approach of DIVERCROP, as well as three workshops with local stakeholders for the case study (WP4). Another 1.500 ú will be allocated (year 2 and 3) for the edition and printing of dissemination material in Spanish. Overheads (20%) account for 15.000 euros.

**Participant 9: Italy.** SSSA will participate throughout the project, with a major contribution in the first period. In particular, the major share of the funds required by this team concerns the recruitment of a fixed-term contract researcher that will deal with the management of the database building (WP1) and analysis (WP2), as well as by contributing to the model development (WP3) and local case study management (WP4). The other funds will cover the participation to the project meeting as well as the support to the local case study management and the purchase of materials for the database building and management.