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Research Paper

Mediterranean land system dynamics and their underlying drivers: Stakeholder perception from multiple case studies

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HIGHLIGHTS

- Land system dynamics from seven Mediterranean case studies are discussed.
- Despite the diversity of contexts captured, transversal patterns were found.
- Data shows disconnection between expected and desired futures.
- Territorial actors can identify opportunities and actions towards desired futures.
- Embedding actors within dynamics enables to frame local actions as drivers of change.

1. Introduction

The influence of human use and management of natural resources has grown to the point that it becomes difficult to separate socio-economic from environmental components in land systems (Turner, Lambin, & Reenberg, 2007). Sustainability in these systems requires management strategies that secure the provision of goods and services without hindering their natural base. Management decisions, at every level, are influenced by people's perceptions within their opportunities and constraints (Fernandes, Guiomar, & Gil, 2019; Gorddard, Colloff, Wise, Ware, & Dunlop, 2016). Thus, local actors and institutions and how they interact with global trends through their rules and decisions can influence the outcomes of broad-scale dynamics (Magliocca et al., 2018; van Vliet, de Groot, Rietveld, & Verburg, 2015). Yet, there is an unbalance between studies that focus on global-scale issues and those targeting the regional and local scales (Ehrensperger, de Bremond, Providoli, & Messerli, 2019). People shape landscapes therefore, to understand changes in land systems, we need to understand why and how stakeholders make the decisions they do (Blondel, 2006; Martínez-Sastre et al., 2017; Muñoz-Rojas, Pinto-Correia, & Napoleone, 2019). In addition, a stronger focus at the local scale using transdisciplinary approaches can highlight how to push different land systems towards a sustainable development pathway (Zscheischler, Rogga, & Busse, 2017; Zscheischler, Rogga, & Lange, 2018).

The Mediterranean Basin has a variety of landscapes due to its diversified biophysical regions and social-cultural settings, and it is acknowledged as a biodiversity hotspot (Malek & Verburg, 2017; Muñoz-Rojas et al., 2019; Myers, Mittermeier, Mittermeier, da Fonseca, & Kent, 2000). Despite this heterogeneity, Mediterranean land systems face several common challenges (Muñoz-Rojas et al., 2019). Present

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concerns include water scarcity and water management (García-Ruiz, López-Moreno, Vicente-Serrano, Lasanta–Martínez, & Beguería, 2011; Iglesias, Santillán, & Garrote, 2018), land degradation (García-Ruiz, Nadal-Romero, Lana-Renault, & Beguería, 2013; Hill, Stellmes, Udelhoven, Röder, & Sommer, 2008; Mulligan, Burke, & Ogilvie, 2016), and urban expansion (Marraccini et al., 2015; Salvati, Gitas, Di Giacomo, Saradakou, & Carlucci, 2017).

Markets and public demand, (supra)national governance, and socio-demographic factors have been identified as important drivers of change in the Mediterranean basin (Debolini et al., 2018; Keyder & Yenal, 2011). In fact, there is a growing demand for products of added value for the Mediterranean region, such as olives and olive oil (Neves & Pires, 2018; Scheidel & Krausmann, 2011), grapes and wine, and other fruits and vegetables (Galanopoulos, Nilsson, Wajnblom, & Surry, 2009). The region is also characterized by highly variable land suitability and yield potential, due to its diverse edaphoclimatic characteristics, but also to differences in water availability, irrigation efficiency use (García-Ruiz et al., 2011; Iglesias et al., 2018), management of inputs, accessibility to technology, and labour-intensity, which in turn influence market competitiveness (Filippini, Lardon, Bonari, & Marraccini, 2018; Filippini, Marraccini, Lardon, & Bonari, 2014; Giannakis & Bruggeman, 2015; Malek, Verburg, Geijzendorffer, Bondeau, & Cramer, 2018). This results in a patch of trajectories among Mediterranean systems, ranging from intensification in the most productive areas to abandonment of marginal territories (Caraveli, 2000; Nainggolan et al., 2012). Despite the potential for diversity, many studies point towards homogenization of the landscape, with negative consequences for biodiversity and ecosystem services in general (Herrando et al., 2016; Morgado et al., 2020), including cultural value (Martínez-Sastre et al., 2017). In addition, the Mediterranean is among the regions that are most vulnerable to climate change (Cramer et al., 2018; Forzieri, Cescatti, e Silva, & Feyen, 2017; Iglesias, Mougou, Moneo, & Quiroga, 2011).

In defining development strategies, it is clear that panaceas are not suitable and there is a call for better linkage of science, policy, and practice (Ehrensperger et al., 2019; Ostrom, Janssen, & Anderies, 2007). A key point for achieving this integration is to successfully involve stakeholders and together understand what are possible sustainable paths (Rounsevell et al., 2012). Integrating local and scientific knowledge can increase the diversity, detail, and precision of scenarios (Reed et al., 2013), as well as provide insights pertinent to the management of landscapes (Martínez-Sastre et al., 2017). Engaging stakeholders in participative diagnosis and scenario building has shown to be useful in identifying local trends, priorities, alternative pathways and unveiling possible lines of action (Esgalhado et al., 2020; Verkerk et al., 2018). This study further tackles the challenge by carrying out a land system analysis involving territorial actors (i.e. with an explicit role in territorial development). In this research, we systematize and compare the findings from seven local case studies across the western Mediterranean basin, regarding possible pathways of development in response to current drivers of change. First, we identified the patterns of land system trajectories and their drivers across the Mediterranean. Next, we describe the desirable futures for territorial development and the actions needed to achieve them. Using the common features identified across all case studies we discuss the following research questions:

a) What are the perceived changes in land systems at the local level?
   a. What are the consequences of these changes?
   b. What are the perceived drivers of these changes?
b) Are these dynamics leading to what is perceived to be a sustainable future?

2. Methods

2.1. The case studies

Our analysis is based on 7 case studies from seven Western Mediterranean countries: Algeria, France, Italy, Malta, Portugal, Spain and Tunisia (Fig. 1, Table 1). The choice of the case studies was informed by a previous analysis of global changes at the whole Mediterranean scale (Fusco et al., 2019) together with expert knowledge. The local case studies were chosen to include diversity in terms of land system types and under varying global pressures.

The Algerian case study comprises two oasis-like regions, the El Qued and El Ghrous, where date grooves traditionally predominate. These two areas were considered as one case study because they border with the desert and have similar agricultural production and land systems. In Tunisia, the case study is the Haouaria Plain in the Cap Bon, where surface irrigation has for long been used to produce groundnuts and caraway in rotation with fodder crops for livestock. In the specific case of Malta, the average farm system size is very small, with diverse farming systems including livestock and horticulture. In Italy and Spain *peri*-urban areas were selected. The Italian case study comprises Pisa plain and part of Monte Pisano mountains, an area characterized by arable crops, mainly cereal production in the plain, and some specialized olive-growing in small farms on the slopes of Monte Pisano. The Municipalities San Martín de la Vega, Titulcia, and Ciempozuelos in Spain historically were important areas of horticultural supply of Madrid's urban centre. The Comtat Venaissin, in France, is characterized by a mosaic of very specialized, small-scale horti-fruticulture holdings, with diffuse and sprawled urban areas. In Portugal, Serpa, Mértola and Alcoutim municipalities are traditionally known for their rainfed agro-forestry farming system. The case studies represent different trajectories of development. In the cases of Algeria and Tunisia, there has been a rapid intensification of agricultural production aligned with irrigation technology and the export market (Amichi et al., 2015; Boualem Remini, 2011; Ferchichi, Mekki, Elloumi, Arfa, & Lardon, 2020). The case studies located in Italy, Spain and France are under different pressures for specialization, simplification, abandonment and conversion (Abad Aragón, 2014; Marraccini, Lardon, Loudiyi, Giacché, & Bonari, 2013; Polge & Debolini, 2018). In Malta, beyond the pressure from booming demography and urban sprawl, there is also the loss of a protectionist agrarian strategy with the entrance in the European Union (Atriga, 2018). The Portuguese case study has low and decreasing population density, whilst specific areas are gaining access to irrigation (Esgalhado & Guimarães, 2020).

2.2. Data collection

This study follows a qualitative approach, based on data from semi-direct interviews with territorial actors from all case-studies, and participatory workshops that followed the methodology of the Territory Game conducted in 5 of the 7 case-studies. The two methodologies are complementary as the territory game allowed to contextualize dynamics, some unveiled during the interviews. Further, we get individual and collective perspectives. The Territory Game was not implemented in the case-studies of Malta and Algeria due to logistic constraints, and institutional obstacles to participatory approaches in the case of Algeria. An overarching protocol of data collection, with common guidelines, key actors to involve, and key questions ensured the comparability across cases (see Appendix A for guidelines). In total, 189 territorial actors participated in the study, some cases both in the interviews and in the territory game (Table 2).

A total of 122 semi-structured interviews were performed using a common protocol. The number of interviews per case study vary due to different degrees of saturation and varying stakeholder engagement. The interviews were performed between September 2018 and July 2019. The script was developed to understand the perception of territorial actors regarding land system dynamics, focusing on 1) the perceived changes, 2) what is driving the described changes, 3) what are the desirable futures and 4) what changes need to occur in the present to achieve the desirable futures.

Therefore, in all case studies the following questions were posed:

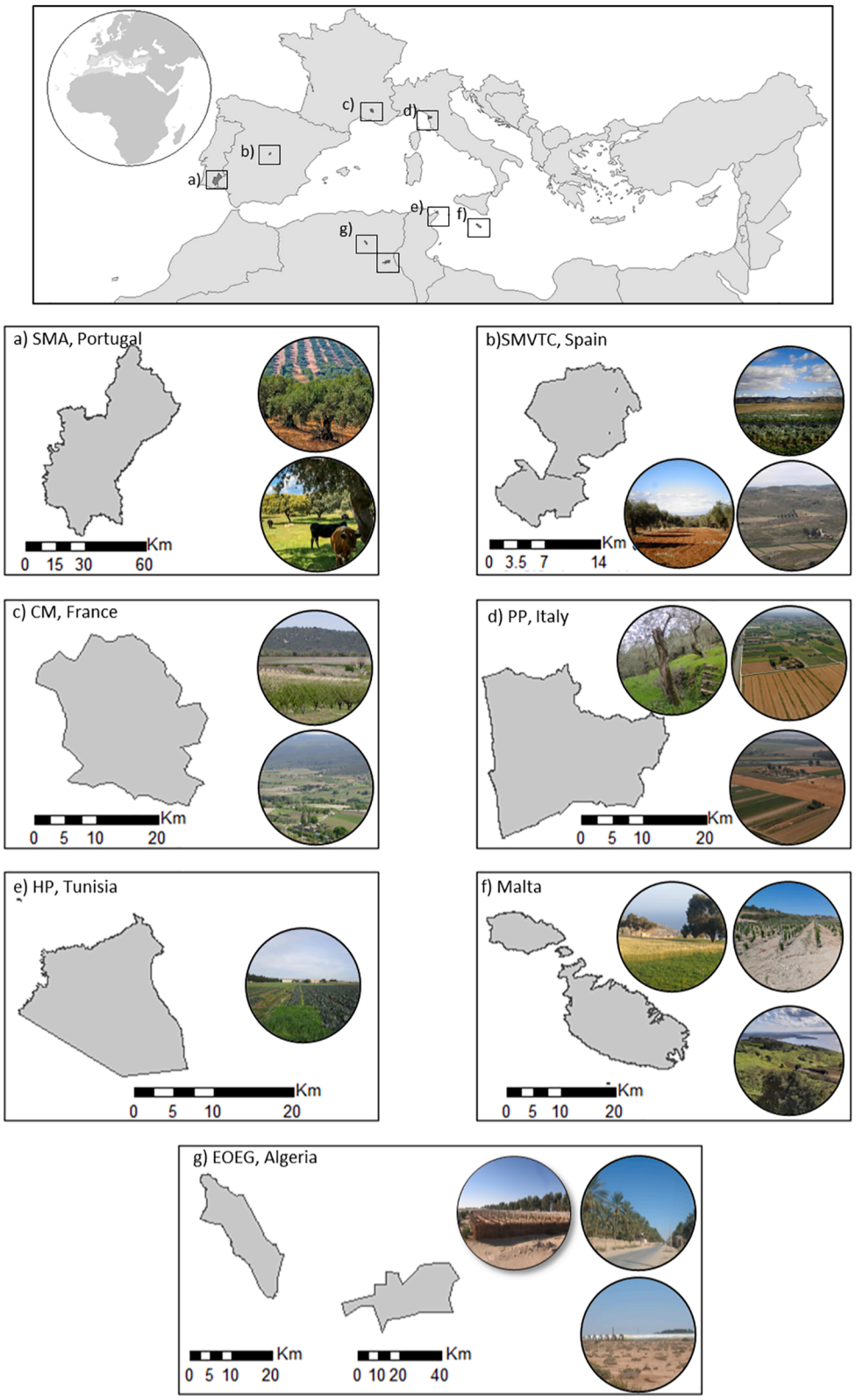

Fig. 1. Location of the case studies and pictures of main land systems.

1) Today what are the predominant land systems in this area?
2) Looking back 30 years, were these land systems the same? What changes occurred? What explains the changes that have occurred so far?
3) Do you consider that 30 years from now these land systems will be maintained? What changes do you foresee? What are the reasons of such changes?
4) If you could change the future, what would you like to see in 30 years? What you do not want to see? What actions ought to be implemented now, to secure the future you just described?

Table 1
Overview of the case studies.

Country	Case study		Area (km2)	Population density (n°/km2)	Average annual rainfall (mm)	Short description
Algeria	**El Oued**	**EOEG**	5457	12	75	Semi-arid, oasis-like areas with new access to irrigation technology
	El Ghrouss		245.3	66.9	200	
France	**Comtat Venaissin**	**CV**	512	136	400	Mosaic of small- scale horti-fruticulture alternated with diffuse urban areas
Italy	**Pisa plain**	**PP**	475	410	900	Peri-urban with arable crops and specialized olive-growing in the slopes
Malta	**Malta**	**M**	316	1 346	553.1	Very small farms, with diverse farming systems. Booming demography
Portugal	**Serpa, Mértola & Alcoutim**	**SMA**	2 974	8.3	342.6	Rainfed systems with new access to irrigation technology
Spain	**San Martín de la Vega, Titulcia & Ciempozuelos**	**SMVTC**	165.47	267	415	Peri-urban with important tradition of horticulture
Tunisia	**Haouaria plain**	**HP**	145	232	568	Traditionally based in surface irrigation with new access to irrigation technology

Table 2
Data collection strategy for each case study and number of actors involved.

	EOEG	CV	PP	M	SMA	SMVTC	HP
	Algeria	*France*	*Italy*	*Malta*	*Portugal*	*Spain*	*Tunisia*
No. interviews	40	15	9	11	22	15	10
No. participants in territory game	N/A	17	23	N/A	23	12	19
Types of actors involved:							
Individual farmer	30	4	4	1	2	4	4
Regional/local public administration	4	9	2	4	10	1	7
Farmers and producers' associations	2	6	5	2	11	3	3
Researchers	–	3	8	1	1	3	1
Environmental/ agricultural consultants	2	–	1	2	–	5	–
Transformation/commercialization sector	2	–	5	–	–	–	1
Conservation/development initiatives	–	3	1	–	–	2	1
Non-Governmental Organizations dedicated to agriculture, development and/or culture	–	–	–	1	4	–	1
General public	–	2	3	–	–	–	–
Local Action Groups	–	–	–	–	5	–	–
National/Natural park management	–	2	–	–	2	–	–
Irrigators organizations/ enterprises	–	–	–	–	3	1	–
National public administration	–	–	–	–	–	–	3
Plant nursery for agriculture	–	–	–	–	–	–	1
Agricultural experimental site	–	–	–	–	1	–	–

The participatory approach used is based on the Territory Game methodology (Angeon & Lardon, 2008; Lardon, 2013) that promotes the co-construction of visions for the future and the actions needed to achieve them. Following a game-like structure, the Territory Game uses a map of the territory as the board of the game, and info cards with contextual information on the territory (e.g.: protected areas in the territory, demographic data, land cover) for the actors to play and discuss (Table 2, Fig. 2). This methodology consists of 3 phases: i) diagnosis - the participants have to identify and draw the main dynamics of the territory, based on the topic of the info card they chose from the 2 to 3 cards (depending on the number of players and cards) they were given, and adding their knowledge. Each player ought to have its unique set of info cards, meaning in a game with 6 participants there are at least 12 different info cards. Within each throw, it is only allowed to debate the topic of the thrown card. All the other players are encouraged to add to the topic. Once the selected information has been drawn on the map, it is the turn of the next player to throw a card (Fig. 3). ii) Scenario - based on the previously identified dynamics, players imagine and draw a possible development for the territory in the long term. The scenario ought to be spatially explicit, and only discussed ideas can be drawn, and iii) action - the aim is to define a series of actions to be taken at present to meet the desired scenario or resist to an undesired one. Actions should be feasible and possible to implement at present. At each table there is a skilled facilitator (details in von Wehrden et al. 2019) to engage participants and encourage dialogue.

Each case study formulated a question to guide the territory game and chose the topics, design, and data to be included in the info cards. The game workshops lasted about 3 h. In CV the game was played with 17 players divided into 3 different tables; in PP and SMA the 22 and 23 respective participants were divided into 5 tables of 4 to 5 players; in HP there were 3 tables with 6 to 7 players, in SMVTC the participants were divided into 2 tables with 6 people each.

2.3. Data analysis

The results of each case study were reported in a standardized case study report. To help with the analysis, the reports were conceptually split into 1) identified changes, or trajectories, 2) drivers of change, 3) opportunities and constraints, 4) foreseen future, 5) desired future and 6) feasible actions. We performed a content analysis for each theme individually. The observed dynamics and the underlined drivers were interpreted and categorized based on the previous literature about land system changes, with particular reference to the Mediterranean area (Debolini et al., 2018; Geist & Lambin, 2002; Plieninger et al., 2016; Plieninger, van der Horst, Schleyer, & Bieling, 2014; van Vliet et al., 2015). Changes were therefore organized considering trajectories of increase in management intensity, specialization/simplification, the emergence of new land systems/expansion, diversification at the landscape and farm levels, contraction of agricultural land, and abandonment of traditional practices. The drivers associated with the trajectories were classified in political/institutional, economic, technological, demographic, socio-cultural, and environmental/geographical drivers. For

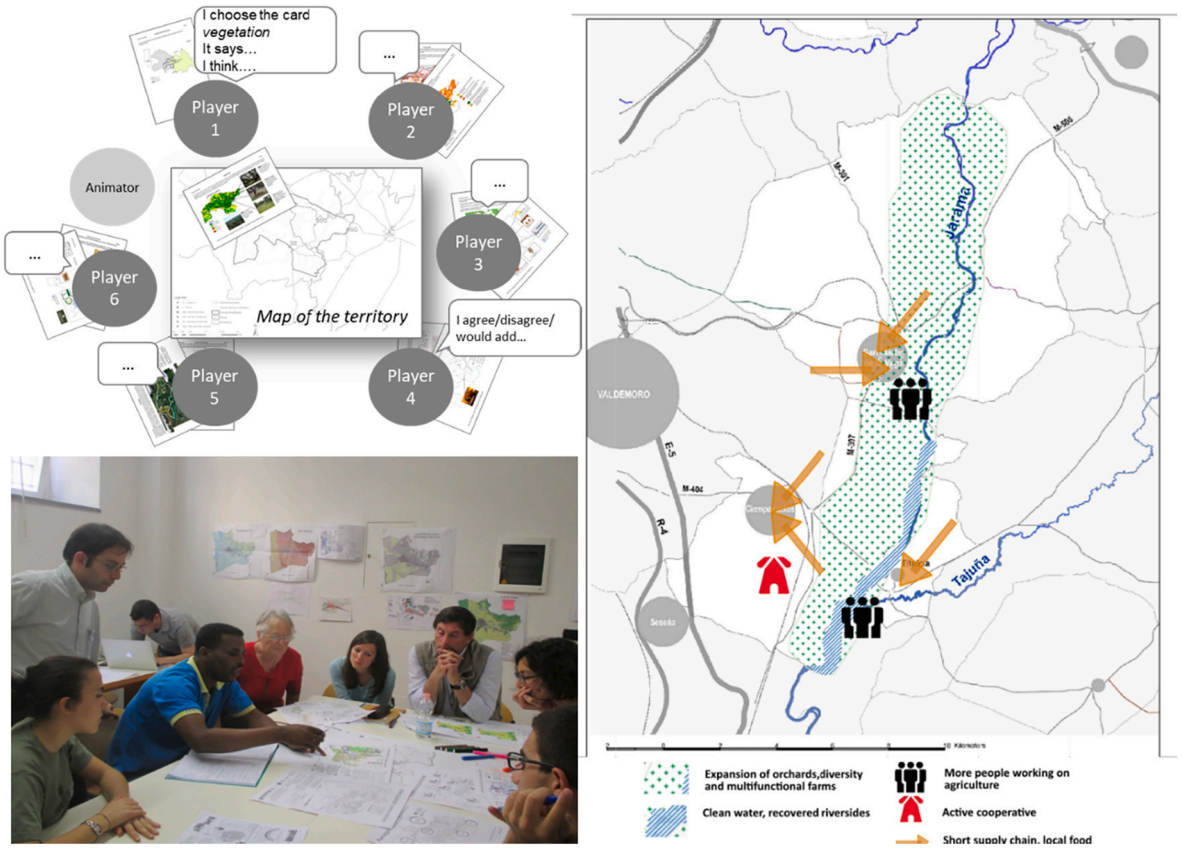

Fig. 2. How to play the territory game. The scheme on the left represents the diagnosis phase: the players have to choose amongst their cards a theme to discuss. At the end of the round, the selected information must be drawn on the map, resulting in a shared diagnosis. In the next step, actors are asked to imagine a future scenario. The graphic representation on the right is the result of the scenario phase from the Spanish case study. The photo on the left shows a discussion during a territory game of the Italian case study.

the remaining topics, we followed an open approach, and categories were created after an exploratory analysis (Saldaña, 2013). We synthesized how territorial actors described land system dynamics and desirable pathways in a framework matrix, where each line refers to a category, and each column to a case study (Gale, Heath, Cameron, Rashid, & Redwood, 2013; Ritchie & Lewis, 2003). This framework allowed to retain specific information for each case study while coding the data per overarching theme. As this research focuses on land systems patterns, we emphasize themes transversal to at least 3 case studies.

3. Results

3.1. Local dynamics and drivers

The collected data reflects dynamic territories albeit at different paces and magnitudes. Technological, political and economic drivers were prominent in all case studies as main drivers of change, although with different observed impacts at the local level (Table 3).

Agricultural intensification was the main trend described to affect the case studies, through increased management intensity, specialization and simplification of the systems. Identified forms of management intensification included mechanization, increased farm size and increased densities. In the case studies within an urban or *peri*-urban context (all but the SMA in Portugal and EOEG in Algeria), it was further reported the loss of agricultural land due to urban expansion, and also due to quarries and gravel pits expansion in SMVT. The territorial actors linked intensification and loss of agricultural systems with broad-scale policies, at a national or European scale, technology and mechanization of agriculture, and market pressure. In the case of Malta, the loss of the protectionism strategy when entering the EU in 2004 was thought to have pushed for an increase in production (and quality) to compete with the European market. The abandonment of traditional practices was described in all case studies. Degradation of the land systems was linked to the abandonment of traditional practices or intensification, aided by market demands, technological advances, mechanization, and policy support for determined practices. Conversely, social pressure and market niches were considered as drivers of specialization and creating an opportunity for organic production and quality labels, particularly for those crops that already have a market demarcation such as vineyards and olive production. At the extreme, traditional systems are being replaced, and ultimately linked with the emergence of new land systems. The emergence of land systems was also related to technological advances and their implementation. Examples are the greenhouses in EOEG (Algeria) and irrigation infrastructures in SMA (Portugal) and HP (Tunisia).

Next to technology, also political incentives were deemed as relevant in the emergence/expansion of specific land systems. In EOEG (Algeria) participants claimed that APFA law (Algerian Agricultural Land Ownership Act) and PNDA funds (National Agriculture Development Plan) allowed for the fast development of greenhouses and horticulture. In Spain, the growth of rainfed cereal and especially the shift to irrigated industrial crops were thought to be due to the Common Agrarian Policy (CAP). In SMA, a stronger focus on livestock production (due to CAP incentives) created the unbalance and decline of the multilayers agroforestry system.

3.2. What will happen in the future?

There is a generally pessimistic perception of the development of the land systems if current trends remain unchanged. Commonly referred

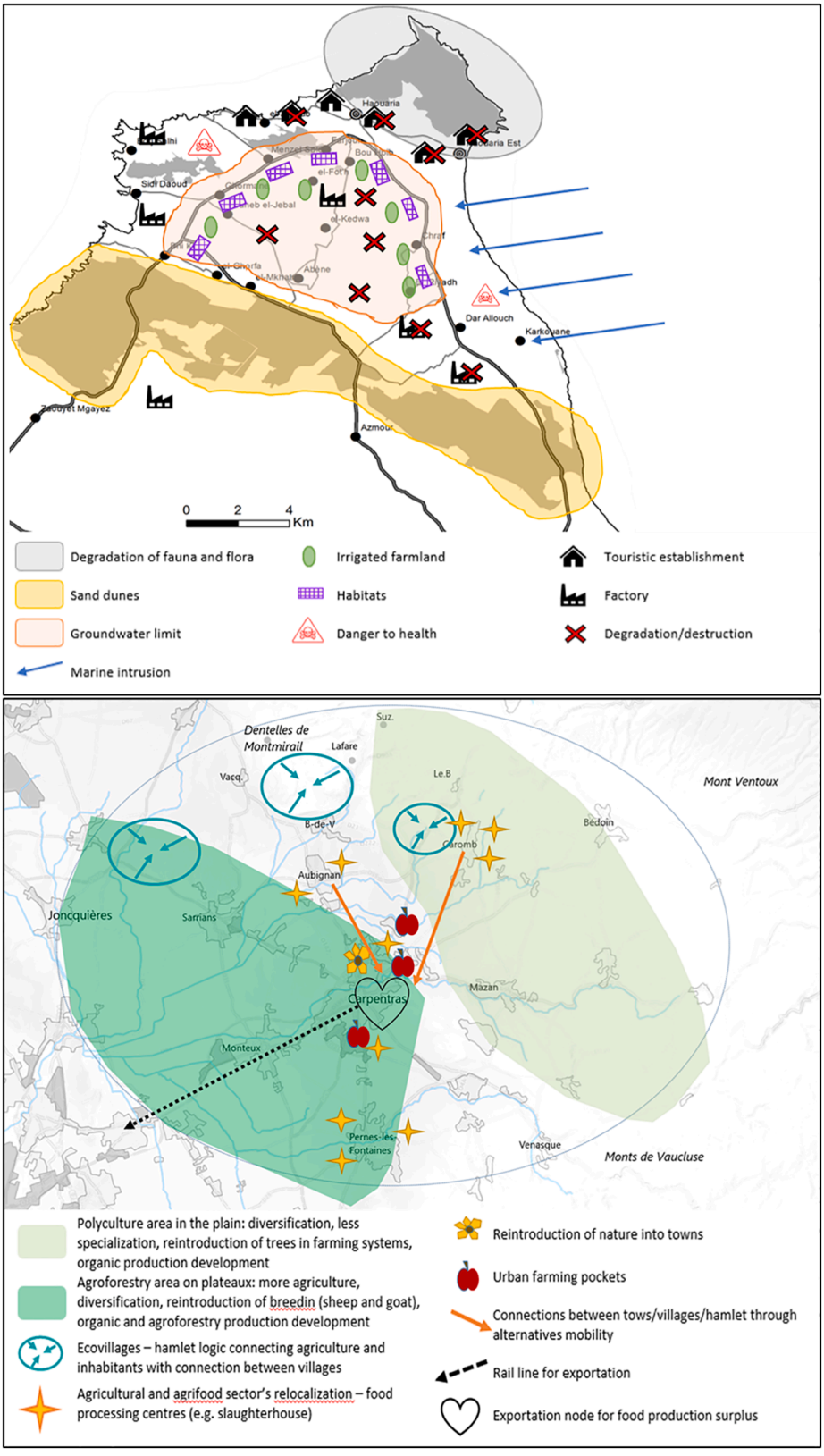

Fig. 3. Examples of scenarios drawn during the territory games. On top "What legacy have we left? The future of El Haouaria without improvement actions" from the Haouaria Plain (Tunisia). On the bottom "Generalization of diversification and relocalization" from the Comtat Venaissin (France).

Table 3
Main trajectories of change as identified by the stakeholders, and main associated drivers.

Trajectories of change	Drivers	EOEG *Algeria*	CV *France*	PP *Italy*	Malta	SMA *Portugal*	SMVTC *Spain*	HP *Tunisia*
Increase in management intensity	**Technological**	Mechanization; New/ different farming practices	Mechanization	Mechanization	Mechanization; New/ different farming practices	New/different farming practices		New/different farming practices
	Institutional and political			Political changes; Subsidies		Political changes; Subsidies	Political changes; Subsidies	
	Economic			Global trade				Global trade
Abandonment of traditional practices	**Technological**					Mechanization; New/ different farming practices		New/different farming practices
	Institutional and political	Subsidies	Subsidies	Political changes	Change in policies		Subsidies; Land tenure	
	Economic			Global trade; Low profitability	Global trade; Low profitability		Low profitability	Low profitability
	Environmental/ Geographical	Dependence of resource variability						
Contraction of agricultural land	**Institutional and political**		Land tenure	Spatial planning				
	Economic		Urbanization		Urbanization		Urbanization	
	Environmental/ Geographical		Climate risk					
	Demographic				Increasing population			
	Socio-cultural		Recreation & tourism					Recreation and tourism
Emergence/ Expansion	**Technological**	Mechanization; New/ different farming practices				New/different farming practices		New/different farming practices
	Institutional and political	Subsidies					Political changes; Subsidies	
	Economic		Global trade					Global trade
Specialization /Simplification	**Technological**			Mechanization				
	Institutional and political		Political changes; Subsidies	Political changes; Subsidies		Land tenure	Political changes; Subsidies	
	Economic		Global trade, Specialized labels	Global trade			Low profitability	
Diversification	**Technological**					New/different farming systems		
	Institutional and political			Subsidies				
	Economic		Global trade; Local food demand	Global market; Local food demand		Local food demand		
	Socio-cultural					Demand for ecosystem services	Recreation and tourism	

was the continuous and increasing pressure over natural resources, mainly regarding water and soil resources. We found a prevalent concern with the disenfranchisement of farmers and rural areas, due to increasing costs of production and continuing depopulation. In PP and CM, this was conjectured together with farm enlargement, with the disappearance of smaller and family farms. For instance, in HP actors feared the consolidation of a monopoly of agriculture activities by large companies. However, a path of innovation, adaptation, and diversification, was also prospected to the natural modernization and "evolution" of agriculture (M), or because actors and institutions will be forced to make decisions and shift into other directions (PP, SM). Such directions included creating quality label products (in CV, PP), promoting "alternative" production styles (in CM, HP) or seeking new agro-activities (as refer in HP).

When allowed to extrapolate on what *could* happen actors imagined both bleak and bright visions. The bleaker visions were related to a pessimist perception and inability to prevent the continuity of the current dynamics causing resource over-exploitation, aggravated by the effects of climate change. In these visions, the drivers affecting land systems dynamics will affect development in such a way that settlements and agricultural activities might, from a long-term perspective, become impossible in part or on the whole territory. However, the tendency was to create more desirable visions, built upon the found opportunities. The brighter visions did not focus on land systems *per se* but on the existence of a set of characteristics that could allow the territory to prosper. These included the active preservation of natural resources and land systems (all case studies), with a greater emphasis on water and soil resources that were the most feared to be overexploited. Incentives to transformation and offer of local/regional transformation facilities were described in PP, SMA, SMVTC, and HP cases. Education of the population on food and consumption was considered in CV, PP, SMA, SMVTC cases. Governance arrangements that enable cooperation and organization of producers and of actors across the food value chain were described for the CV, PP, SMA, SMVTC, HP cases.

3.3. What can be done to attain the desired future?

We found a transversal discourse regarding what are the main perceived threats to a desirable future. These are inadequate rural development and agrarian policies, a bias towards global market and poor resource management. Opportunities tend to be more diverse and case-specific and strongly affected by cultural and traditional aspects of each production system.

Public policies were a predominant topic across case studies. In M, PP and SMA public policies were perceived as both a threat and an opportunity. European support to agriculture was identified as a promoter of new crops and production techniques, as well as important in contributing to farmer's livings. At the same time, European policies were thought to have been designed without considering the specificities of the Mediterranean including the local biophysical and socio-cultural contexts. As consequence, they are often ill-adapted, hampering production results and the environment (i.e. draining natural resource such soil and water in a short to medium term). Examples of unfit policies identified by actors included timings for shrub clearing, thought as harmful to apiculture and local fauna in general, high tree density, incompatible with soil characteristics in re-forestation projects, lack of policies that foresee multifunctional systems, subsidies to certain crops with no territorial context, i.e, favouring of crops often not compatible with local edaphoclimatic characteristics on the long run, but made profitable due to subsidies. The need for locally adapted management, including flexibility in national and/or European measures was deemed as a necessary action by all case studies.

Markets come across as an ambiguous force. In all case studies the globalized market was considered as a threat, pushing for intensification of production, homogenization of the landscape. Contrasting, markets and labels were also thought of as an opportunity to create value for Mediterranean products, in particular in products already with added value (e.g.: wine in CV, olive oil in PP and SMVTC). A growing demand for local products and new consumption habits that creates opportunities for local chains were also recognized (in CV, PP, SMVTC, M). In PP, SMA, SMVTC and HP, actors found opportunities in their traditional systems due to their adaptation to local conditions, their historic and cultural value. Additionally, traditional and more diverse land systems were identified to increase touristic appeal. High production costs, land abandonment, and overall depopulation of rural areas, with a potential loss of local knowledge, were considered potential threats for the maintenance of traditional systems.

In the case studies of M, SMA and SMVTC, the value of natural resources and ecosystems was explored, and actions towards their valorisation were considered essential for sustainable farming. In all the European case studies, the preservation, or even restoration of traditional land systems was called for, and related to the expressed wishes of diversification, multifunctional land systems and diverse landscapes.

Greater investment in the commercialization and transformation sectors were also deemed important for desirable agricultural development. In particular, it came across as relevant the definition and establishment of niche markets, and promotion of specific quality labels (avoiding saturation and confusion between consumers). A wider offer of local/regional transformation facilities to create a local dynamic was also argued for. To achieve stronger local food chains (i.e. products produced in the territory that are in grand part transformed, sold and consumed locally) collective actions, that include farmers in the management and commercial decisions, were considered necessary. To push for and operationalize land and farming decisions that foster locally adapted management, the integration of other territorial actors such as local action groups, development associations and public institutions at different governance levels, was also considered.

In all case studies, there was a call for strengthening the social capital of rural areas through a set of collective actions between local stakeholders at different governance levels. In short, to achieve desirable futures, different case studies actors suggested: i) Creating incentives to connect people to the territory, by improving rural living conditions and access to land for new entrants or farmers with no tenure; ii) Protect agricultural land from urbanization through territorial planning, iii) Create or improve extension services to better inform and serve farmers, so that these can prefer "good practices". iv) Ensure that schemes and funds in place do not favour ill-adapted or unsustainable practices over good practices; v) Encourage cooperation amongst farmers so they can organize and better commercialize their products; vi) Strengthen the local market by investing in transformation, storage, and organized commercialization. This ought to be accompanied by the easiness of placing products in the local market, easing procurement impositions, and increasing awareness of consumers towards local products.

4. Discussion

We present new insights on Mediterranean land system dynamics based on data from seven case studies across the West Mediterranean Basin. As expected, we found a diversity of contexts, opportunities and threats that are specific to the territories. Nonetheless, there are transversal dynamics and drivers of change between these territories. Further, there are several similarities between the desired futures described by the territorial actors of different case studies. The patterns highlight that, despite the diversity of contexts and land systems covered, there are common characteristics that need to be considered when defining policy strategies for the Mediterranean region (Head et al., 2017; Pinto-Correia & Vos, 2004).

4.1. How are land system changes perceived at the local level?

The main dynamics identified fit with those described at the basin level (Fusco et al., 2019), with the overall tendency for intensification

and loss of traditional practices and systems. As described in other studies, we found agricultural and socio-economic development policies to be the main drivers of these trends (Debolini et al., 2018; van Vliet et al., 2015). In Europe, land use decisions are strongly influenced by the CAP that represents 30% of the European Union budget (Lomba et al., 2020; Pe'er et al., 2020). What our study shows is that this perception is well established across several Mediterranean countries, including those outside the European context. The call for a rethinking of agriculture policies in semi-arid regions such as the Mediterranean is not new (Caraveli, 2000; Carmel & Naveh, 2002; Fragoso, Marques, Lucas, Martins, & Jorge, 2011; García-Alvarez-Coque, 2002; Palacín & Alonso, 2018). The concern with natural resources misuse and depletion is supported by the recorded trend of increasing aridity in the Mediterranean region (Raymond, Ullmann, & Cam, 2013), well-documented land and water resources degradation (García-Ruiz et al., 2013; Guerra, Pinto-Correia, & Metzger, 2014; Hill et al., 2008; Mekki, Ghazouani, Closas, & Molle, 2017; Mulligan et al., 2016), and homogenization of landscape and loss of multifunctionality (Amichi et al., 2015; Neves & Pires, 2018). The current discussion around CAP post-2020 seems to indicate that efforts are already in place to reconcile production with other valued characteristics of agrarian land systems (Lomba et al., 2020; Pe'er et al., 2020). This can be an opportunity for the Mediterranean region as it can be a reply to many of the concerns expressed in the results of the present study.

Next to policies, also market pressure under globalization was found to be an important driver of intensification and specialization. Mediterranean agricultural systems are under growing pressure to increase production (García-Ruiz et al., 2011, 2013; Hill et al., 2008; Iglesias et al., 2018; Mulligan et al., 2016). This demand comes not only from a growing population but also from the growing popularity of Mediterranean products. The demand, the attributed value, the technological innovation, and the policy support for these crops, have permitted their expansion. In some cases, novel production strategies require high water inputs. This has sparked a debate on the role of water and irrigation in Mediterranean agriculture under climate change and the sustainability of increasing water dependency in an already arid region (Fader, Shi, von Bloh, Bondeau, & Cramer, 2016; García-Ruiz et al., 2011; Iglesias, Garrote, Flores, & Moneo, 2007; Kassam et al., 2012). Water scarcity, together with a preference for exportation of specific commodities (Keyder & Yenal, 2011; Scheidel & Krausmann, 2011; Yang, Wang, & Zehnder, 2007) can increase dependency on imports and aggravate food security issues, with a higher concern in the Middle East and North Africa region (Lacirignola, Adinolfi, & Capitanio, 2015; Omidvar, Ahmadi, Sinclair, & Melgar-Quiñonez, 2019; Wright & Cafiero, 2011; Zdruli, 2014). Global and regional disruptions, such as the one we are currently facing with COVID-19 pandemic situation, further highlights the drawbacks of the reliance on a specialized global market and the lack of food sovereignty. At the local level we identified several initiatives to deal with production issues by bridging production and transformation with consumption (eg. Farm to fork; Slow food; km0). Such initiatives are often associated with niche markets and labels/certifications, creating opportunities for local products and more sustainable production practices. Although most of these strategies can create added value to the production side inducing sustainable productions prices, an unsolved secondary effect is accessibility. For example, valorisation of products through certification can make them more expensive and accessible only to a few consumers (Berti & Mulligan, 2016; DeLind, 2011; West & Domingos, 2012). If such strategy is enlarging and gaining momentum, the next challenge is how to support local food systems that are democratic (Berti & Mulligan, 2016; Bloom & Hinrichs, 2011).

Although territorial actors emphasized the importance of drivers of land system change that are not influenced by their preferences, they have also highlighted the importance of local stakeholders and the potential for change that can be promoted by their organization and collective actions. Therefore, further studies that analyse the actions and reactions to global drivers by farmers, local organizations and local administration are important (Pinto-Correia & Azeda, 2017; van Vliet et al., 2015). Locally led action is capable of change, and therefore of being a driver towards desirable futures (Pellicer-Sifres, Belda-Miquel, López-Fogués, & Boni Aristizábal, 2017). Thus, it ought to be considered in research, and empowerment for action of local actors should represent a priority for sustainability policies.

4.2. Are these dynamics leading to what is meant to be a sustainable future?

The main findings of the present research show that the most often described dynamics are not leading to a sustainable future. Despite the specificities of each case study, the common points for a sustainable future are the persistence of traditional diverse systems and practices, protection of natural resources, stronger local food systems and coordinated actors. This common thread converges in many points with the Sustainable Development Goals (United Nations, 2015), and the sustainability regime complex in general. Weak links between governance levels have been shown to hinder the operationalization of policies and implementation of activities (Gomar, Stringer, & Paavola, 2014), which can explain the disconnection found between the expected and the desired futures.

Traditional systems were thought to be advantageous to the development of the territory. Their long-term persistence can be seen as a sign of their well-adeptness to local conditions. Nonetheless, current pressures are testing their resilience. Management decisions have been shown to be important drivers of traditional systems degradation (Bugalho, Caldeira, Pereira, Aronson, & Pausas, 2011; Martínez-Sastre et al., 2017; Zdruli, 2014) and often backed up by CAP or national policies (Amichi et al., 2015; 2017). Undoubtedly, some traditional practices are outdated and incompatible with today's standards of living (Navarro & Pereira, 2015). Yet, there is knowledge melded into traditional systems that ought to be seen and seized to create long-term resilience and adaptiveness in agricultural systems (Gómez-Baggethun, Reyes-García, Olsson, & Montes, 2012). It would be naïve to defend that the preservation of traditional systems would solve the current problems affecting the Mediterranean, but it would also be negligent to ignore the knowledge they hold. A sensible start would be to tackle the found common perception of inflexible and market-oriented policies. Food production is not the only outcome of Mediterranean agriculture, and strategies that recognize all goods and services provided by farming systems can contribute to foster sustainable practices in accordance with territorial characteristics (Lomba et al., 2020; Muñoz-Rojas et al., 2019). In the European context, agricultural habitats cover approximately half the European Union surface and constitute habitats for many-valued species (Batáry, Dicks, Kleijn, & Sutherland, 2015), and their conservation depends on agricultural management.

4.3. Methodological shortcomings and benefits

Due to logistic or institutional constrains we were not able to undertake participatory workshops in all case studies. In addition, some bias might derive from working with stakeholders given the predisposition of the most engaged actors to participate. To reduce these limitations, we have used a mixed mode method. We interviewed territorial actors, including actors with expert knowledge, undertook participatory workshops (when possible) and developed a triangulation of the data retrieved by these different sources. Ultimately, it was possible to achieve a transversal overview of main dynamics and issues. The many convergences found across the case studies indicate that there is room for a shared pathway of development, focused not only on production but also in safeguarding the ecological and cultural values in the Mediterranean basin. It is relevant to note this willingness at the local level, because as already different authors have pointed it out (Grasso & Feola, 2012; Head, Marples, & Simpsom, 2017; Malek et al., 2018), the orchestration of agricultural and environmental management strategies

at a supranational level will be needed, to safeguard ecosystems and agriculture in the Mediterranean Basin.

Finally, by working with participative methodologies such as the Territory Game, we are not only adding richness to the characterization achieved by the individual interviews, but we are also promoting a collective reflexion moment. The territorial actors were invited not to be a passive bystander but to think of themselves as capable of driving changes and organizing local actions to meet the desired development path or resist to an undesired one.

5. Conclusion

The Mediterranean region includes a very diversified set of farming systems that are a result of centuries of adaptation to its socio-economic and biophysical characteristics. We found such understanding well-rooted in the perception of territorial actors of seven different case studies in Portugal, Spain, France, Italy, Malta, Algeria and Tunisia. Mediterranean traditional systems are well adapted to produce under arid conditions but cannot be sustained in a path of intensification as the one occurring at a global scale. Most of the changes identified go towards an increase in production with environmental and social costs. The main drivers considered to explain this pathway are global and thought as out of reach by territorial actors. Yet, there is no difficulty in identifying desirable futures towards sustainable agriculture in the Mediterranean context; therefore, actors know what they want and identify actions that might move the land system dynamics to this direction. Embedding territorial actors within land system dynamics enables to frame local actions as possible drivers of change empowering territorial actors for their role in grassroots movements. Without enhancing the piloting of new approaches and promoting well-rounded multi-scale governance of Mediterranean agriculture it is not possible to verify the region capacity to solve current pressing challenges. The disruptions felt during Covid-19 pandemic highlight the susceptibility of a globalized society to global and regional threats. Not vouching for an isolationist future, vulnerabilities are likely to be reduced if local needs are secured and local dynamics properly embedded into regional and (supra)national strategies.

CRediT authorship contribution statement

Catarina Esgalhado: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing. **Maria Helena Guimarães:** Conceptualization, Writing - original draft, Writing - review & editing. **Sylvie Lardon:** Conceptualization, Writing - review & editing. **Marta Debolini:** Investigation, Writing - review & editing. **Mario V. Balzan:** Investigation, Writing - review & editing. **Sabine C. Gennai-Schott:** Investigation, Writing - review & editing. **Marian Simón Rojo:** Investigation, Writing - review & editing. **Insaf Mekki:** Investigation, Writing - review & editing. **Salah Bouchemal:** Investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. – Common guidelines

Interviewees:

- Administration representatives,
- Technicians from cooperatives and agricultural organizations and
- Farmers considered key informants by the community.

You can use snowball sampling to assure that no key informant is left out. This technique implies asking in the end of the interview suggestion about with whom you should also talk about this subject.

One recommendation on the selection of the interviewees: We are looking for informants that can provide a perspective at the scale of the case studies; therefore be careful on the selection of informants to decrease the chance of mixing a broader perspective with particularities of one or a few individuals. Along the interviews, you can also double check with the interviewee (from time to time) if a certain pattern is particular or common.

The interviews should be done with the presence of the map of the case study area with sufficient information (e.g. location of the main cities and administrative boundaries) for interviewees immediately understand the localization of possible elements they want to add to the map. The objective is to accompany the interview with the possibility of localizing the farms systems and possible elements that explain changes. Further, a second map should be given to the interviewees for them to draw the desirable futures.

Part I: Farm systems characteristics

Question 1: Today what are the **main** farm systems in this area? To have a good picture you should also ask about:

- Ownership of the land
- Size of the properties and if they are big or small in relation to the overall system
- Is it intensive or extensive systems or both and what is the most frequent
- Academic level of the farmers (average, since you are not asking an individual but trying to get an idea of the set)
- Gender proportion
- Farming practices (Organic or not organic / certified or not, …)
- How the "actors" organize themselves (cooperatives…)
- What are the mains products obtained in these systems? What are the relevant infrastructures for these products?

Question 2: Looking at the agriculture policies do they have or had an important impact on the current farming systems?

Part II: Recent changes in the farm systems

Question 3: Looking 30 years back, were this farm systems the same? What changes occurred? What explains the changes that occurred so far?

Question 4: Our colleagues in DIVERCROP developed this map [you should have WP2 maps with you] that shows the current farm systems. You also see the changes that were identified in this area? Does something surprise you on this map information?

Part V: Projections to the future

Question 6: Do you consider that in 30 years from now these farm systems will be maintained? What changes do you foreseen? What are the reasons for those changes?

[For the last question, you should provide a new map where the idea is to represent the vision of the interviewee.]

Question 7: If you could change the future, what would you like to see in 30 years' time? What you doṅt want to see? The same farm systems? Others? Different combinations or different relevance levels?

Question 8: What are the constrains and the enabling factors for the visions

References

Abad Aragón, L. D. (2014). Gobernanza en Espacios periurbanos a través de la iniciativa Europea LEADER. El caso de la Comarca madrileña de Las Vegas. *Anales de Geografia de La Universidad Complutense, 34*(1), 9–32. https://doi.org/10.5209/rev_AGUC.2014.v34.n1.45190.

Amichi, F., Bouarfa, S., Lejars, C., Kuper, M., Hartani, T., Daoudi, A., et al. (2015). Des serres et des hommes : Des exploitations motrices de l'expansion territoriale et de l'ascension socioprofessionnelle sur un front pionnier de l'agriculture saharienne en Algérie. *Cahiers Agricultures, 24*(1), 11–19. https://doi.org/10.1684/agr.2015.0736.

Angeon, V. V., & Lardon, S. (2008). Participation and governance in territorial development projects: The "territory game" as a local project leadership system. *International Journal of Sustainable Development, 11*(2–4), 262–281. https://doi.org/10.1504/ijsd.2008.026505.

Atriga National Agricultural Policy for the Maltese Islands 2018–2028 Final 2018 Malta.

Batáry, P., Dicks, L. V., Kleijn, D., & Sutherland, W. J. (2015). The role of agri-environment schemes in conservation and environmental management. *Conservation Biology, 29*(4), 1006–1016. https://doi.org/10.1111/cobi.12536.

Berti, G., & Mulligan, C. (2016). Competitiveness of Small Farms and Innovative Food Supply Chains: The Role of Food Hubs in Creating Sustainable Regional and Local Food Systems. *Sustainability, 8*(7), 616. https://doi.org/10.3390/su8070616.

Blondel, J. (2006). The 'Design' of Mediterranean Landscapes: A Millennial Story of Humans and Ecological Systems during the Historic Period. *Human Ecology, 34*(5), 713–729. https://doi.org/10.1007/s10745-006-9030-4.

Bloom, J. D., & Hinrichs, C. C. (2011). Moving local food through conventional food system infrastructure: Value chain framework comparisons and insights. *Renewable Agriculture and Food Systems, 26*(1), 13–23. https://doi.org/10.1017/S1742170510000384.

Boualem Remini, R. K. (2011). Impact of the water table razing on the degradation of El Oued palm plantation (Algeria) mechanisms and solutions. *Geographia Technica, 1*, 48–56.

Bugalho, M. N., Caldeira, M. C., Pereira, J. S., Aronson, J., & Pausas, J. G. (2011). Mediterranean cork oak savannas require human use to sustain biodiversity and ecosystem services. *Frontiers in Ecology and the Environment, 9*(5), 278–286. https://doi.org/10.1890/100084.

Caraveli, H. (2000). A comparative analysis on intensification and extensification in mediterranean agriculture: Dilemmas for LFAs policy. *Journal of Rural Studies, 16*(2), 231–242. https://doi.org/10.1016/S0743-0167(99)00050-9.

Carmel, Y., & Naveh, Z. (2002). The Paradigm of Landscape and the Paradigm of Ecosystem - Implications for Land Planning and Management in the Mediterranean Region. *Journal of Mediterranean Ecology, 3*(2002), 35–46.

Cramer, W., Guiot, J., Fader, M., et al. (2018). Climate change and interconnected risks to sustainable development in the Mediterranean. *Nature Clim Change, 8*, 972–980. https://doi.org/10.1038/s41558-018-0299-2.

Debolini, M., Marraccini, E., Dubeuf, J. P., Geijzendorffer, I. R., Guerra, C., Simon, M., et al. (2018). Land and farming system dynamics and their drivers in the Mediterranean Basin. *Land Use Policy, 75*, 702–710. https://doi.org/10.1016/J.LANDUSEPOL.2017.07.010.

DeLind, L. B. (2011). Are local food and the local food movement taking us where we want to go? Or are we hitching our wagons to the wrong stars? *Agriculture and Human Values, 28*, 273–283. https://doi.org/10.1007/s10460-010-9263-0.

Ehrensperger, A., de Bremond, A., Providoli, I., & Messerli, P. (2019). Land system science and the 2030 agenda: Exploring knowledge that supports sustainability transformation. *Current Opinion in Environmental Sustainability, 38*, 68–76. https://doi.org/10.1016/j.cosust.2019.04.006.

Esgalhado, C., Guimarães, H., Debolini, M., Guiomar, N., Lardon, S., & Ferraz de Oliveira, I. (2020). A holistic approach to land system dynamics – The Monfurado case in Alentejo. *Portugal. Land use policy, 95*. https://doi.org/10.1016/j.landusepol.2020.104607.

Esgalhado, C., & Guimaraes, M. H. (2020). Unveiling Contrasting Preferred Trajectories of Local Development in Southeast Portugal. *Land, 9*(3), 87. https://doi.org/10.3390/land9030087.

Fader, M., Shi, S., von Bloh, W., Bondeau, A., & Cramer, W. (2016). Mediterranean irrigation under climate change: More efficient irrigation needed to compensate for increases in irrigation water requirements. *Hydrology and Earth System Sciences, 20*(2), 953–973. https://doi.org/10.5194/hess-20-953-2016.

Ferchichi, I., Mekki, I., Elloumi, M., Arfa, L., & Lardon, S. (2020). Actors, Scales and Spaces Dynamics Linked to Groundwater Resources use for Agriculture Production in Haouaria Plain. *Tunisia. A Territory Game Approach. Land, 9*(3), 74. https://doi.org/10.3390/land9030074.

Fernandes, J. P., Guiomar, N., & Gil, A. (2019). Identifying key factors, actors and relevant scales in landscape and conservation planning, management and decision making: Promoting effective citizen involvement. *Journal for Nature Conservation, 47*, 12–27. https://doi.org/10.1016/j.jnc.2018.11.001.

Filippini, R., Lardon, S., Bonari, E., & Marraccini, E. (2018). Unraveling the contribution of periurban farming systems to urban food security in developed countries. *Agronomy for Sustainable Development, 38*(2), 1–15. https://doi.org/10.1007/s13593-018-0499-1.

Filippini, R., Marraccini, E., Lardon, S., & Bonari, E. (2014). Assessing food production capacity of farms in periurban areas. *Italian Journal of Agronomy, 9*(2), 63–70. https://doi.org/10.4081/ija.2014.569.

G. Forzieri A. Cescatti e Silva, F. B., & Feyen, L. Increasing risk over time of weather-related hazards to the European population: A data-driven prognostic study The Lancet Planetary Health 1 5 2017 e200 e208 10.1016/S2542-5196(17)30082-7.

Fragoso, R., Marques, C., Lucas, M. R. R., Martins, M. B. B., & Jorge, R. (2011). The economic effects of common agricultural policy on Mediterranean montado/dehesa ecosystem. *J. Policy Model., 33*, 311–327. https://doi.org/10.1016/j.jpolmod.2010.12.007.

Fusco, J., Marraccini, E., Debolini, M., & Hospitaliers, S. (2019). Intensification, periurbanization and specialization of agriculture as significant short-term land system dynamics in the Mediterranean basin (pp. 122–134). Colloque SAGEO 2019, Clermont-Ferrand, 13-15 november. https://doi.org/10.5281/zenodo.3564776.

Galanopoulos, K., Nilsson, F. O. L., Wajnblom, E., & Surry, Y. (2009). Fruit and vegetable production in the new millennium. Will Mediterranean production satisfy increasing European demand? *Outlook on Agriculture, 38*(3), 235–242. https://doi.org/10.5367/000000009789396784.

Gale, N. K., Heath, G., Cameron, E., Rashid, S., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology, 13*(1), 117. https://doi.org/10.1186/1471-2288-13-117.

García-Ruiz, J. M., López-Moreno, J. I., Vicente-Serrano, S. M., Lasanta–Martínez, T., & Beguería, S. (2011). Mediterranean water resources in a global change scenario. *Earth-Science Reviews, 105*(3–4), 121–139. https://doi.org/10.1016/J.EARSCIREV.2011.01.006.

García-Ruiz, J. M., Nadal-Romero, E., Lana-Renault, N., & Beguería, S. (2013). Erosion in Mediterranean landscapes: Changes and future challenges. *Geomorphology, 198*, 20–36. https://doi.org/10.1016/j.geomorph.2013.05.023.

Geist, H. J., & Lambin, E. F. (2002). Proximate Causes and Underlying Driving Forces of Tropical. *Bioscience, 52*, 143–150. https://doi.org/10.1641/0006-3568(2002)052.

Giannakis, E., & Bruggeman, A. (2015). The highly variable economic performance of European agriculture. *Land Use Policy, 45*, 26–35. https://doi.org/10.1016/j.landusepol.2014.12.009.

Gomar, J. O. V., Stringer, L. C., & Paavola, J. (2014). Regime complexes and national policy coherence: Experiences in the biodiversity cluster. *Glob. Gov., 20*, 119–145. https://doi.org/10.1163/19426720-02001008.

Gómez-Baggethun, E., Reyes-García, V., Olsson, P., & Montes, C. (2012). Traditional ecological knowledge and community resilience to environmental extremes: A case study in Doñana. *SW Spain. Global Environmental Change, 22*(3), 640–650. https://doi.org/10.1016/j.gloenvcha.2012.02.005.

Gorddard, R., Colloff, M. J., Wise, R. M., Ware, D., & Dunlop, M. (2016). Values, rules and knowledge: Adaptation as change in the decision context. *Environmental Science & Policy, 57*, 60–69. https://doi.org/10.1016/J.ENVSCI.2015.12.004.

Grasso, M., & Feola, G. (2012). Mediterranean agriculture under climate change: Adaptive capacity, adaptation, and ethics. *Regional Environmental Change, 12*(3), 607–618. https://doi.org/10.1007/s10113-011-0274-1.

Guerra, C., Pinto-Correia, T., & Metzger, M. J. (2014). Mapping Soil Erosion Prevention Using an Ecosystem Service Modeling Framework for Integrated Land Management and Policy. *Ecosystems, 17*(5), 878–889. https://doi.org/10.1007/s10021-014-9766-4.

Head, J. W., Marples, K., & Simpsom, J. (2017). Mediterranean Agriculture, Ecology, and Law: Creating a New Non-state Actor to Counteract Agro-ecological Collapse in the Mediterranean Basin. *Mediterranean Studies., 25*(1), 98–146.

Herrando, S., Brotons, L., Anton, M., Páramo, F., Villero, D., Titeux, N., et al. (2016). Assessing impacts of land abandonment on Mediterranean biodiversity using indicators based on bird and butterfly monitoring data. *Environmental Conservation, 43*(1), 69–78. https://doi.org/10.1017/S0376892915000260.

Hill, J., Stellmes, M., Udelhoven, T., Röder, A., & Sommer, S. (2008). Mediterranean desertification and land degradation: Mapping related land use change syndromes based on satellite observations. *Global and Planetary Change, 64*(3–4), 146–157. https://doi.org/10.1016/J.GLOPLACHA.2008.10.005.

Iglesias, A., Garrote, L., Flores, F., & Moneo, M. (2007). Challenges to manage the risk of water scarcity and climate chnage in the Mediterranean. *Water Resources Management, 21*(5), 775–788. https://doi.org/10.1007/s11269-006-9111-6.

Iglesias, A., Mougou, R., Moneo, M., & Quiroga, S. (2011). Towards adaptation of agriculture to climate change in the Mediterranean. *Regional Environmental Change, 11*(SUPPL. 1), 159–166. https://doi.org/10.1007/s10113-010-0187-4.

Iglesias, A., Santillán, D., & Garrote, L. (2018). On the Barriers to Adaption to Less Water under Climate Change: Policy Choices in Mediterranean Countries. *Water Resources Management, 32*(15), 4819–4832. https://doi.org/10.1007/s11269-018-2043-0.

Kassam, A., Friedrich, T., Derpsch, R., Lahmar, R., Mrabet, R., Basch, G., et al. (2012). Conservation agriculture in the dry Mediterranean climate. *Field Crops Research, 132*, 7–17. https://doi.org/10.1016/j.fcr.2012.02.023.

Keyder, Ç., & Yenal, Z. (2011). Agrarian Change under Globalization: Markets and Insecurity in Turkish Agriculture. *Journal of Agrarian Change, 11*(1), 60–86. https://doi.org/10.1111/j.1471-0366.2010.00294.x.

Lacirignola, C., Adinolfi, F., & Capitanio, F. (2015). Food security in the Mediterranean countries. *New Medit, 14*(4), 2–10.

Lardon, S. (2013). Developing a territorial project. The 'territory game', a coordination tool for local stakeholders. Research Results FaçSADe (38). Sciences for Action and Development, INRA.

Lomba, A., Moreira, F., Klimek, S., Jongman, R. H., Sullivan, C., Moran, J., et al. (2020). Back to the future: Rethinking socioecological systems underlying high nature value farmlands. *Frontiers in Ecology and the Environment, 18*(1), 36–42. https://doi.org/10.1002/fee.2116.

Magliocca, N. R., Ellis, E. C., Allington, G. R. H., de Bremond, A., Dell'Angelo, J., Mertz, O., et al. (2018). Closing global knowledge gaps: Producing generalized knowledge from case studies of social-ecological systems. *Global Environmental Change, 50*, 1–14. https://doi.org/10.1016/J.GLOENVCHA.2018.03.003.

Malek, Ž., & Verburg, P. H. (2017). Mediterranean land systems: Representing diversity and intensity of complex land systems in a dynamic region. *Landscape and Urban Planning, 165*, 102–116. https://doi.org/10.1016/J.LANDURBPLAN.2017.05.012.

Malek, Ž., Verburg, P. H., Geijzendorffer, I. R., Bondeau, A., & Cramer, W. (2018). Global change effects on land management in the Mediterranean region. *Global Environmental Change, 50*, 238–254. https://doi.org/10.1016/j.gloenvcha.2018.04.007.

Marraccini, E., Debolini, M., Moulery, M., Abrantes, P., Bouchier, A., Chéry, J. P., et al. (2015). Common features and different trajectories of land cover changes insix Western Mediterranean urban regions. *Applied Geography, 62*, 347–356. https://doi.org/10.1016/j.apgeog.2015.05.004.

Marraccini, Elisa, Lardon, S., Loudiyi, S., Giacché, G., & Bonari, E. (2013). Durabilité de l'agriculture dans les territoires périurbains méditerranéens: Enjeux et projets agriurbains dans la région de Pise (Toscane, Italie). *Cahiers Agricultures, 22*(6), 517–525. https://doi.org/10.1684/agr.2013.0658.

Martínez-Sastre, R., Ravera, F., González, J. A. A., López Santiago, C., Bidegain, I., & Munda, G. (2017). Mediterranean landscapes under change: Combining social multicriteria evaluation and the ecosystem services framework for land use planning. *Land Use Policy, 67*, 472–486. https://doi.org/10.1016/J.LANDUSEPOL.2017.06.001.

Mekki, I., Ghazouani, W., Closas, A., & Molle, F. (2017). Perceptions of groundwater degradation and mitigation responses in the Haouaria region in Tunisia. *Groundwater for Sustainable Development, 5*, 101–110. https://doi.org/10.1016/j.gsd.2017.05.001.

Morgado, R., Santana, J., Porto, M., Sánchez-Oliver, J. S., Reino, L., Herrera, J. M., et al. (2020). A Mediterranean silent spring? The effects of olive farming intensification on breeding bird communities. *Agriculture, Ecosystems and Environment, 288*, Article 106694. https://doi.org/10.1016/j.agee.2019.106694.

Mulligan, M., Burke, S., & Ogilvie, A. (2016). Much More than Simply "Desertification": Understanding Agricultural Sustainability and Change in the Mediterranean (pp. 427–450). https://doi.org/10.1007/978-3-642-16014-1_16.

Muñoz-, J., Pinto-Correia, T., & Napoleone, C. (2019). Farm and land system dynamics in the Mediterranean: Integrating different spatial-temporal scales and management approaches. *Land Use Policy, 88*, Article 104082. https://doi.org/10.1016/j.landusepol.2019.104082.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature, 403*(6772), 853–858. https://doi.org/10.1038/35002501.

Nainggolan, D., de Vente, J., Boix-Fayos, C., Termansen, M., Hubacek, K., & Reed, M. S. (2012). Afforestation, agricultural abandonment and intensification: Competing trajectories in semi-arid Mediterranean agro-ecosystems. *Agriculture, Ecosystems & Environment, 159*, 90–104. https://doi.org/10.1016/J.AGEE.2012.06.023.

Navarro, L. M., & Pereira, H. M. (2015). Rewilding Abandoned Landscapes in Europe. In Ecosystems (Vol. 15, pp. 900–912). Springer-Verlag. https://doi.org/10.1007/s10021-012-9558-7.

Neves, B., & Pires, I. M. (2018). The mediterranean diet and the increasing demand of the olive oil sector: Shifts and environmental consequences. *Region, 5*(1), 101–112. https://doi.org/10.18335/REGION.V5I1.219.

Omidvar, N., Ahmadi, D., Sinclair, K., & Melgar-Quiñonez, H. (2019). Food security in selected Middle East and North Africa (MENA) countries: An inter-country comparison. *Food Security, 11*(3), 531–540. https://doi.org/10.1007/s12571-019-00935-w.

Ostrom, E., Janssen, M. A., & Anderies, J. M. (2007). Going beyond panaceas. Proceedings of the National Academy of Sciences of the United States of America, 104(39), 15176–15178. https://doi.org/10.1073/pnas.0701886104.

Palacín, C., & Alonso, J. C. (2018). Failure of EU Biodiversity Strategy in Mediterranean farmland protected areas. *Journal for Nature Conservation, 42*, 62–66. https://doi.org/10.1016/j.jnc.2018.02.008.

Pellicer-Sifres, V., Belda-Miquel, S., López-Fogués, A., & Boni Aristizabal, A. (2017). Grassroots social innovation for human development: An analysis of alternative food networks in the city of Valencia (Spain). *Journal of Human Development and Capabilities, 18*(2), 258–274.

Pe'er, G., Bonn, A., Bruelheide, H., Dieker, P., Eisenhauer, N., Feindt, P. H., Lakner, S. Action needed for the EU Common Agricultural Policy to address sustainability challenges People and Nature February 2020 1 12 10.1002/pan3.10080.

Pinto-Correia, T., & Azeda, C. (2017). Public policies creating tensions in Montado management models: Insights from farmers' representations. *Land Use Policy, 64*, 76–82. https://doi.org/10.1016/j.landusepol.2017.02.029.

Pinto-Correia, T., & Vos, W. (2004). Multifunctionality in Mediterranean landscapes–past and future. In R. H. G. Jognmam (Ed.), *The new dimensions of the European landscape* ((4th ed.,, pp. 135–164). Springer (The Netherlands).

Plieninger, T., Draux, H., Fagerholm, N., Bieling, C., Bürgi, M., Kizos, T., et al. (2016). The driving forces of landscape change in Europe: A systematic review of the evidence. *Land Use Policy, 57*, 204–214. https://doi.org/10.1016/j.landusepol.2016.04.040.

Plieninger, T., van der Horst, D., Schleyer, C., & Bieling, C. (2014). Sustaining ecosystem services in cultural landscapes. *Ecology and Society, 19*(2), art59. https://doi.org/10.5751/ES-06159-190259.

Polge, E., & Debolini, M. (2018). Assessing sustainable intensification at landscape scale: four case studies in Europe. In 13th European International Farming Systems Association (IFSA) Symposium, Farming systems: facing uncertainties and enhancing opportunities, 1-5 July 2018, Chania, Crete, Greece. (pp. 1–17). Chania, Greece: International Farming Systems Association (IFSA) Europe.

Raymond, C. M., Singh, G. G., Benessaiah, K., Bernhardt, J. R., Levine, J., Nelson, H., et al. (2013). Ecosystem Services and Beyond : Using Multiple Metaphors to Understand Human – Environment Relationships. *BioScience, 63*(7), 536–546. https://doi.org/10.1525/bio.2013.63.7.7.

Reed, et al. (2013). Participatory scenario development for environmental management: A methodological framework illustrated with experience from the UK uplands. *Journal of environmental management, 128*, 345–362.

Ritchie, J., & Lewis, J. (Eds.). (2003). Qualitatibe Research Practice: A guide for Social Science Students and Researchers. Journal of Social Intervention: Theory and Practice (Second, Vol. 14). SAGE Publications. https://doi.org/10.18352/jsi.39.

Rounsevell, M. D. A., Pedroli, B., Erb, K.-H., Gramberger, M., Busck, A. G., Haberl, H., et al. (2012). Challenges for land system science. *Land Use Policy, 29*(4), 899–910. https://doi.org/10.1016/J.LANDUSEPOL.2012.01.007.

Saldaña, J. (2013). In *The coding manual for qualitative researchers* ((2nd ed.).). Sage. https://doi.org/10.1017/CBO9781107415324.004.

Salvati, L., Gitas, I., Di Giacomo, T. V., Saradakou, E., & Carlucci, M. (2017). Sprawl matters: The evolution of fringe land, natural amenities and disposable income in a Mediterranean urban area. *Environment, Development and Sustainability, 19*(2), 727–743. https://doi.org/10.1007/s10668-015-9742-y.

Scheidel, A., & Krausmann, F. (2011). Diet, trade and land use: A socio-ecological analysis of the transformation of the olive oil system. *Land Use Policy, 28*(1), 47–56. https://doi.org/10.1016/j.landusepol.2010.04.008.

Turner, B., Lambin, E. F., & Reenberg, A. (2007). The emergence of land change science for global environmental change and sustainability. *Proceedings of the National Academy of Sciences, 104*(52), 20666–20671.

United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development* (Vol. 16301). https://doi.org/10.7551/mitpress/9780262035620.003.0011.

van Vliet, J., de Groot, H. L. F. F., Rietveld, P., & Verburg, P. H. (2015). Manifestations and underlying drivers of agricultural land use change in Europe. *Landscape and Urban Planning, 133*, 24–36. https://doi.org/10.1016/j.landurbplan.2014.09.001.

Verkerk, P. J., Lindner, M., Pérez-Soba, M., et al. (2018). Identifying pathways to visions of future land use in Europe. *Regional Environmental Change, 18*(3), 817–830. https://doi.org/10.1007/s10113-016-1055-7.

von Wehrden, H., Guimarães, M. H., Bina, O., Varanda, M., Lang, D. J., John, B., et al. (2019). Interdisciplinary and transdisciplinary research: Finding the common ground of multi-faceted concepts. *Sustainability Science, 14*(3), 875–888. https://doi.org/10.1007/s11625-018-0594-x.

West, H. G., & Domingos, N. (2012). Gourmandizing Poverty Food: The Serpa Cheese Slow Food Presidium. *Journal of Agrarian Change, 12*(1), 120–143. https://doi.org/10.1111/j.1471-0366.2011.00335.x.

Wright, B., & Cafiero, C. (2011). Grain reserves and food security in the Middle East and North Africa. *Food Security, 3*(S1), 61–76. https://doi.org/10.1007/s12571-010-0094-z.

Yang, H., Wang, L., & Zehnder, A. J. B. (2007). Water scarcity and food trade in the Southern and Eastern Mediterranean countries. *Food Policy, 32*(5–6), 585–605. https://doi.org/10.1016/j.foodpol.2006.11.004.

Zdruli, P. (2014). Land resources of the Mediterranean: Status, pressures, trends and impacts on future regional development. *Land Degradation & Development, 25*(4), 373–384. https://doi.org/10.1002/ldr.2150.

Zscheischler, J., Rogga, S., & Busse, M. (2017). The adoption and implementation of transdisciplinary research in the field of land-use science-A comparative case study. *Sustainability (Switzerland), 9*(11). https://doi.org/10.3390/su9111926.

Zscheischler, J., Rogga, S., & Lange, A. (2018). The success of transdisciplinary research for sustainable land use: Individual perceptions and assessments. *Sustainability Science, 13*(4), 1061–1074. https://doi.org/10.1007/s11625-018-0556-3.