Ecological Vineyards Governance Activities for Landscape's Strategies

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Structural analysis of selected areas and vineyard mapping

Responsible Partner

PP 10 Mediterranean Agronomic Institute of Chania

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Project Summary

ECOVINEGOALS promotes sustainability and resilience in the winemaking industry by encouraging the transition of intensive viticulture towards agroecological management systems that protect natural habitats and landscapes, while reducing chemical and fossil fuel inputs and harmful emissions. The project aims to enhance stakeholders' skills in participatory local governance, to strengthen transnational cooperation and provide specific transnational instruments to promote, support and manage the agroecological transition.

Expected results

- Sharing between partners in the ADRION countries of fundamental concepts and practices necessary for the transition from intensive viticulture management systems, towards agroecological management methods.
- Improvement of the participatory local governance skills of decision makers and all other viticulture stakeholders, both public and private, to jointly develop and define strategies and plans aiming to protect natural habitats and rural landscapes.
- Transnational communication, cooperation, and exchange between regional authorities and civil society organizations concerning common objectives to protect vulnerable environments, to promote ecosystem services, to prevent or mitigate climate change, and to avoid social conflicts in land use.
- An increase in the number and quality of tools and strategies available to support the planning and management of the agroecological transition of viticulture systems in the region.

Partnership:

PP1- LP	**LAG EASTERN VENICE, VEGAL (IT)**
PP2	Autonomous Province of Trento, PAT (IT)
PP3	Chamber of Agriculture and Forestry of SIovenia, KGZS-Zavod GO (SI)
PP4	Research Centre of the SIovenian Academy of Sciences and Arts, ZRC SAZU (SI)
PP5	Agency for rural development of Istria Ltd. Pazin, AZRRI (HR)
PP6	Association for the promotion of employment, vocational training and education, INFORMO (HR)
PP7	Business Development Center Kragujevac, BDCKG (RS)
PP8	Foundation Business Start-up Center Bar, BSC BAR (ME)
PP9	Municipality of Bar, BAR (ME)
PP10	Mediterranean Agronomic Institute of Chania, CIHEAM MAICh (EL)

Associated Partners (APs):

General Union CISL Cultivators Venice (IT)
Bio district of production and biological community of central-eastern Venice - BIO VENICE (IT)
IAL - Innovation Learning Work S.r.l. - Social enterprise (IT)
AIAB-Italian Organic Agriculture Association (IT)
Agroecologiki SP (EL)
Municipality of Topola (RS)
Šumadija winemakers association (RS)
Ministry of Agriculture and Rural Development (HR)
Agroecology Europe (BL)

EXECUTIVE SUMMARY

This report presents the current progress and methodology of PP10 CIHEAM-MAICh in regard to the pilot areas structural analysis. For each demonstrative territorial area, an analysis of the fundamental structural characteristics from a geographical-environmental, political, economic and social point of view, was conducted. For each area any existing environmental, economic and social problems were identified, as well as the presence of any conflicts that might affect the wine sector, the population, or the territory. On the basis of the structural analysis of the pilot area, a minimum of 30 (thirty) companies were identified, and for these technical-productive and economic-managerial investigations were carried out through the use of a questionnaire.

Reference region for Greece is Crete (NUTS II – EL43) while the main demonstrative territorial areas selected are the Municipality of Archanes Asterousia, located in the Prefecture of Heraklion (NUTS III – EL 431) and the Municipality of Platanias, located in the Prefecture of Chania (NUTS III – EL 434),. Almost 80% (14,421ha) of all vineyards in Crete are found in the Heraklion prefecture, while1,557ha of vineyards are located in the area of Chania (Hellenic Statistical Authority - ELSTAT, 2018).

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1. INTRODUCTION

For each selected pilot area, an analysis of the fundamental structural characteristics of the territory, from a geographical-environmental, political, economic and social point of view, was conducted. For each selected area any existing environmental, economic and social problems were identified, as well as the presence of any conflicts that might affect the wine sector, the population, or the territory. On the basis of the structural analysis of the pilot area, a minimum of 30 (thirty) companies were identified, and for these technical-productive and economic-managerial investigations were carried out through the use of a questionnaire.

Reference region for Greece is Crete (NUTS II – EL43) while the main focus areas chosen are the Prefectures of Heraklion (NUTS III – EL 431) and Chania (NUTS III – EL 434). Two demonstrative territorial areas were selected within these focus areas, the Municipality of Archanes Asterousia, located in the Prefecture of Heraklion and the Municipality of Platanias, located in the Prefecture of Chania. Almost 80% (14,421ha) of all vineyards in Crete are found in the Heraklion prefecture, while1,557ha of vineyards are located in the area of Chania (Hellenic Statistical Authority - ELSTAT, 2018).

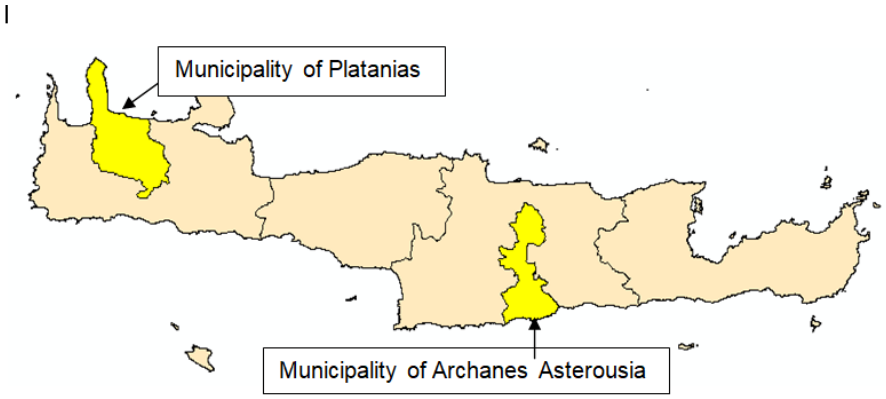

Figure 1. The demonstrative territorial areas, with the Municipality of Platanias (left), and the Municipality of Archanes (right) indicated.

This deliverable concerns the structural analysis of the focus areas of Heraklion and Chania, regarding the social, economic, political and landscape dimensions, while special attention has been paid to the demonstrative territorial (pilot) areas, the Municipality of Archanes Asterousia and the Municipality of Platanias. Furthermore, the geography and the environmental aspects of the pilot areas have been investigated and presented together with different elements of viticulture. The sum of this information will facilitate understanding of the environment and the multi-dimensional challenges faced by viticulture producers in the focus areas.

The report consists of seven chapters. The scope of the report is presented in the *INTRODUCTION*. The geography, geomorphology/landscape and natural areas of the pilot areas will be presented in the *ENVIRONMENTAL AND GEOGRAPHICAL AND ENVIRONMENTAL ASPECTS OF THE FOCUS AREAS*. The environmental

policies, landscape policies, and the Agroecology and participation policies will be investigated in the *POLITICAL CHARACTERISTICS OF THE FOCUS AREAS*. The economy of viticulture and wine tourism, and the economic structure of the pilot areas and the collective initiatives will be explained in the *SOCIO-ECONOMIC ANALYSIS OF THE FOCUS AREAS*. Viticulture production, cultivar and wine types, and the training systems in the pilot areas will be presented in *VITICULTURE IN THE FOCUS AREAS*. The selection of farmers and the information derived from interviews will be presented in *FARMER RESPONSES TO QUESTIONNAIRES*. Pilot area fragility in terms of environmental, political, socio-economic and viticulture issues will be presented in *FRAGILITIES IN THE FOCUS AREAS*. Finally, in CONCLUSIONS a general overview of this report has been made.

2. GEOGRAPHICAL AND ENVIRONMENTAL ASPECTS OF THE FOCUS AREAS

2.1 GEOGRAPHY

The island of Crete is the biggest island of Greece and is located in the Eastern Mediterranean region, and is located between the south part of the Aegean Sea and the Libyan Sea (Morianou et al., 2018). The total area of Crete is 8,335 sq. km, 6.3% of the total area of Greece (OECD, 2005).The demonstrative territorialarea of the Platanias Municipality is approximately 495 sq. km (NTUA, 2015) while the Archanes Asterousia Municipality is 335 sq. km (Municipality of Archanes Asterousia, 2015).

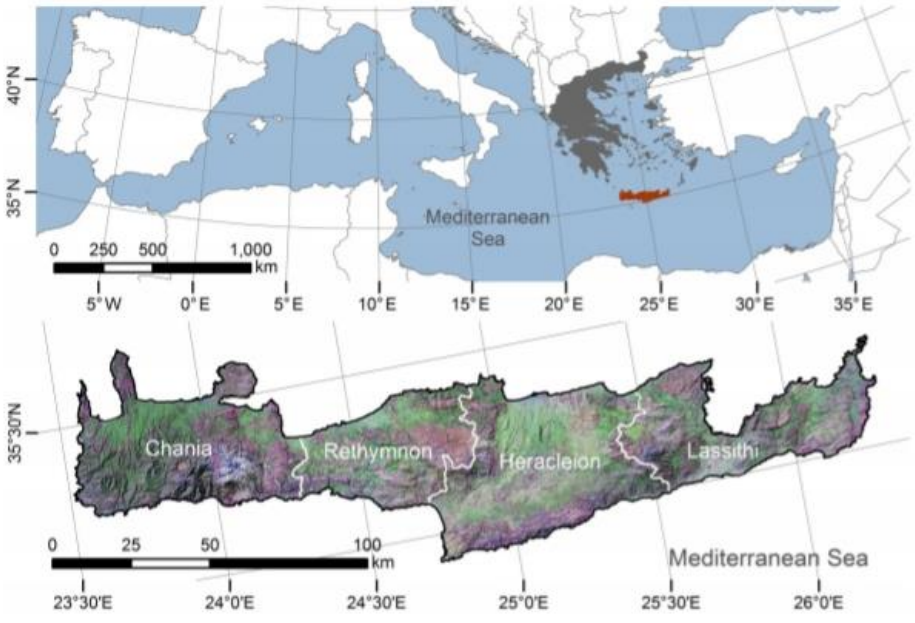

Figure 2. The island of Crete; Source: Panagos et al. (2017)

The island consists of three basic zones: the high zone, with altitude of 400 m, the middle zone with altitude of 200 m to 400 m and the low zone with altitude from the sea level to 200 m. These geographical zones have a direct impact on settlement

patterns, on the regional road system and the economic activities in each area (OECD, 2005).

2.2 GEOMORPHOLOGY / LANDSCAPE

Crete is characterized by a remarkably heterogeneous landscape. The areas chosen present a wide diversity of landscape features, including steep mountainous areas, hills, flat areas, coastal areas, natural grasslands, sclerophyllous vegetation, bare rocks and soils, forests and agricultural land (Karydas *et al.*, 2002). It is mostly mountainous, as mountains cover 49% of Crete's total surface. Its mean elevation is 482m and its highest peak, Mount Psiloritis, located in the focus area of Heraklion, is 2,456m (Morianou et al., 2018).

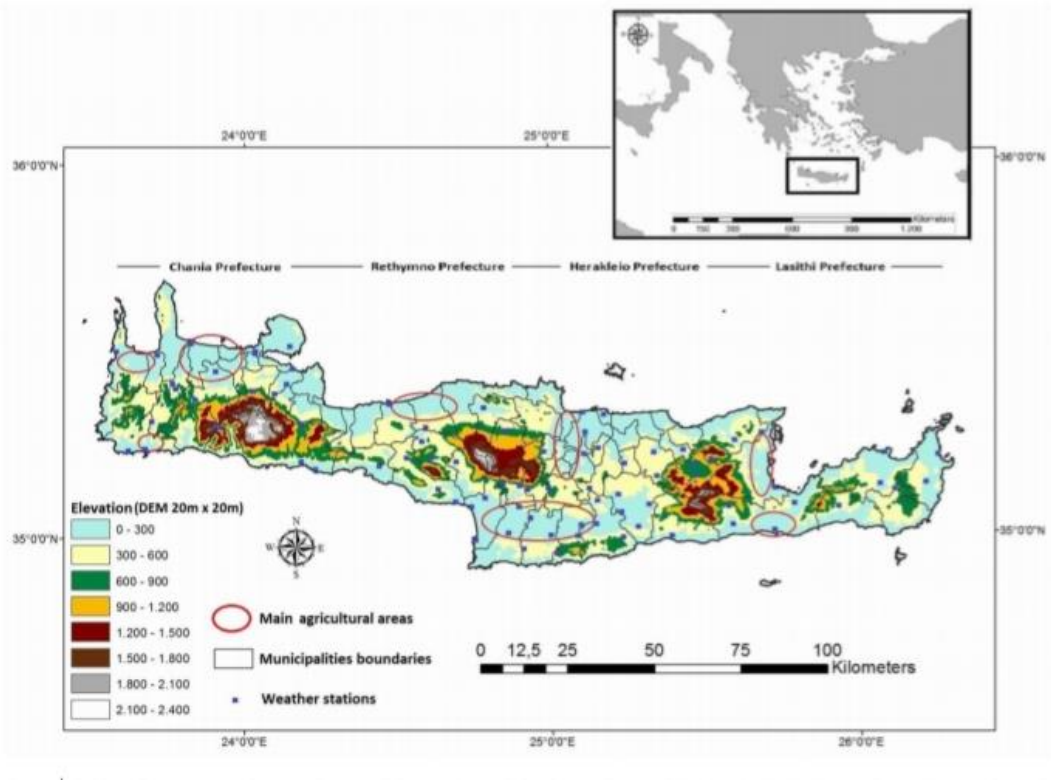

Figure 3.Main agricultural areas and Crete's elevation; Source: Morianou et al. (2018)

Regarding its flora, 46% of Crete is covered by natural grasslands and shrubs, while olive plantations constitute 23% of the total land, vines 2.6% and citrus 0.7%, with forest coverage of less than 4% (Panagos et al., 2017). Formerly greater areas were planted with vineyards, but many were replaced by olive trees during the 1990s and 2000s (Karydas et al., 2008). There have been major changes to the Cretan landscape and agriculture due to agricultural policy directions of European Union institutions (Nikolaidis et al., 2013).During autumn and winter, there is significant rainfall in Chania, located in the western part of Crete, and less in the eastern part of Crete which is drier (Morianou et al., 2018). The total agricultural land of the island is approximately 3,205 km^2 which is dominated by tree crops including olives, citrus

and avocado, vineyards and vegetables (Morianou et al., 2018).

Crete has few rivers, as a result of its small width, and all start from the mountainous central part of the island and most end in the Libyan Sea. Usually, they are dry in the summer and flow during winter months. The rivers are dispersed all across Crete, but there are some important rivers in the focus areas of the project.

Table 1.Corine Land Cover (CLC) codes

Level 1	Level 2	Level 3
1 Artificial Surfaces	11 Urban fabric	111 Continuous urban fabric
		112 Discontinuous urban fabric
	12 Industrial, commercial and transport units	121 Industrial or commercial units
		122 Road and rail networks and associated land
		123 Port areas
		124 Airports
	13 Mine, dump and construction sites	131 Mineral extraction sites
		132 Dump sites
		133 Construction sites
	14 Artificial, non-agricultural vegetated areas	141 Green urban areas
		142 Sport and leisure facilities
2 Agricultural Areas	21 Arable land	211 Non-irrigated arable land
		212 Permanently irrigated land
		213 Rice fields
	22 Permanent crops	221 Vineyards
		222 Fruit trees and berry plantations
		223 Olive groves
	23 Pastures	231 Pastures
	24 Heterogeneous agricultural Areas	241 Annual crops associated with permanent crops
		242 Complex cultivation patterns
		243 Land principally occupied by agriculture, with significant areas of natural vegetation
		244 Agro-forestry areas
3 Forests and Semi natural Areas	31 Forests	311 Broad-leaved forest
		312 Coniferous forest
		313 Mixed forest
	32 Scrub and/or herbaceous vegetation associations	321 Natural grassland
		322 Moors and heathland
		323 Sclerophyllous vegetation
		324 Transitional woodland-shrub
	33 Open spaces with little or no vegetation	331 Beaches, dunes, sand
		332 Bare rocks
		333 Sparsely vegetated areas
		334 Burnt areas
		335 Glaciers and perpetual snow
4 Wetlands	41 Inland wetlands	411 Inland marshes
		412 Peat bogs
	42 Maritime wetlands	421 Salt marches
		422 Salines
		423 Intertidal flats
5 Water Bodies	51 Inland waters	511 Water courses
		512 Water bodies
	52 Marine waters	521 Coastal lagoons
		522 Estuarties
		523 Sea and ocean

Source:https://land.copernicus.eu/eagle/files/eagle-related-projects/pt_clc-conversion-to-fao-lccs3_dec2010

The land cover classes of the demonstrative territorial areas are presented at Figure 3. In order to generate those figures Corine Land Cover was used. In the figures the codes at level 1 (111-142) describe the artificial surfaces, the codes at level 2 (211-244) describe the agricultural areas, the codes at level 3 (311-335) describe the forest and semi natural areas, the codes at level 4 (411-423) describe the wetlands and the codes at level 5 (511-523) describe the water bodies. The description of CLP codes is presented in Table 1.As it can be observed in Figure 3,

both at the Municipality of Platanias and the Municipality of Archanes Asterousia, there are no wetlands or water bodies, and the land of the municipality is covered by artificial surfaces, agricultural areas and forests and semi natural areas.

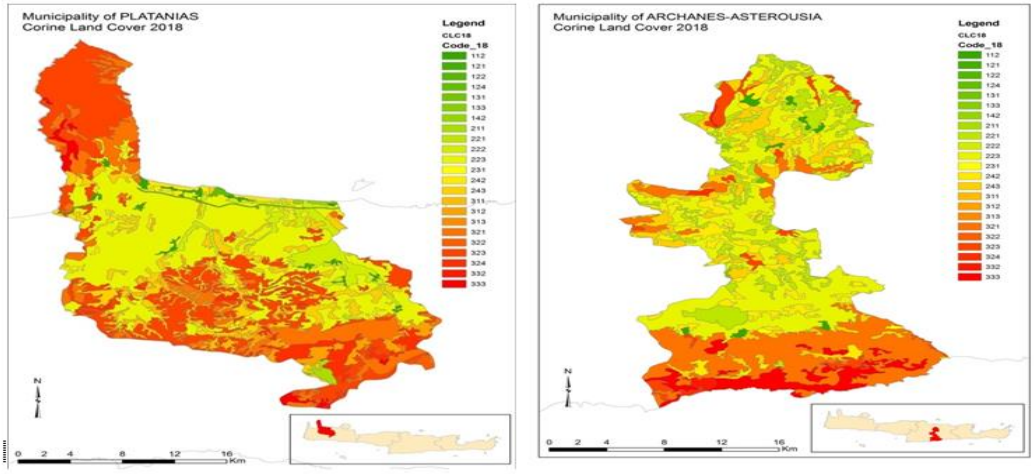

Figure 4. Land cover of Municipality of Platanias and Municipality of Archanes Asterousia.

2.3 NATURAL AREAS

In the pilot areas, there are two important national parks which are also considered to be landmarks of Crete, connected with its history, culture and natural beauty. Within the pilot areas, in Chania there is the Lefka Ori (White Mountains) Natural Park and in Heraklion there is the Psiloritis Natural Park. There is another natural park located in Sitia, on the eastern edge of Crete.

In the focus area of Heraklion, Piloritis Natural Park was added in the UNESCO geoparks list in 2001. It includes the Ida Range, the highest mountain of Crete, a place with cultural significance. Furthermore, the northern coastal zone of central Crete is included in its areas. Psiloritis National Park hosts many Cretan endemic species, and exhibits a rich variety of rock types. Regarding the landscape, it includes caves, gorges, fossil sites and fault surfaces. Thus, the Park can be interesting in terms of landscape, geology, endemic ecosystems and also the cultural-religious dimension.

In the focus area of Chania, the Lefka Ori Natural Park, which was declared a park in 1962, was one of the first Greek nature reserves. Inside its terrain, is the Samarian Gorge, the deepest gorge in Europe and one of the most famous natural sites of Greece. Furthermore, the Natural Park of the Lefka Ori includes the Mountain Desert of Lefka Ori and the shoreline of Sfakia. There many endemic species of both fauna and flora within the areas of the park, which has been included in the Global Reserve Network of Biospheres since 1981.

Figure 5.The Lefka Ori Natural Reserve; Source: https://www.georgioupolihotels.com/explore-white-mountains/

Table 2.Natura 2000 list

Regional Unit of Heraklion		Regional Unit of Chania	
NaturaCode	Name of the Area	Code	Name of the Area
GR4310002	Yuhta – Agia Irini Gorge	GR4340001	Gramvousa
GR4310003	Zeus Island	GR4340002	Elafonisos Island
GR4310004	Western Asterousia	GR4340003	Rhodopos Peninsula
GR4310005	Asterousia (Kofinas)	GR4340004	Elos- Topolia
GR4310006	Dikti: (Symi- Omalos)	GR4340005	Sougia- Lissos
GR4310009	Krouswnas	GR4340006	Agia Lake- Platanias
GR43100010	Yuhta Mountain	GR4340007	Therissos
GR43100011	Koupa	GR4340008	LefkaOri
GR43100012	Mesara Coast	GR43400010	Drapano
GR43100013	Asterousia Mountain	GR43400011	Fre- Tzitzifie- Nipos
		GR43400012	Asfendou
		GR43400013	Gaudos Island
		GR43400014	Samaria National Park
		GR43400015	Chrysoskalitissa
		GR43400016	Meterizia
		GR43400017	Gramvousa Peninsoula
		GR43400018	Agio Theodoro Island
		GR43400019	Kallikratis Gorge
		GR43400020	Agia Lake
		GR43400021	Rhodopos Peninsula
		GR43400022	Kournas Lake
		GR43400023	Southwest Gaudos and Gaudopoula
		GR43400024	Coastal Area of West and Southwestern Crete

Source: Retrieved from https://www.apdkritis.gov.gr/sites/default/files/anakoinwseis/natura2000_texnikos_odigos_final_19-03-2018_web-compressed.pdf

Natura 2000 is a network of European areas that cover the habitats, mainly core breeding and resting sites (European Commission, 2020) of most valuable and

protected species (European Environment Agency, 2020). There are55 NATURA 2000 areas in Crete including the mountainous areas which form the backbone of the island, but also coastal areas and islets that contain interesting ecosystems and a significant natural wealth. In fact more than 30% of the total area of the island is covered by Natura 2000 zones. Many of these areas are used for alternative tourism activities, such as eco-tourism, agrotourism, geotourism, cultural tourism and wine tourism. Furthermore, caving, trekking, climbing and gorge walking in mountainous areas, and sailing and diving in sea areas, are activities that many visitors enjoy. In Table 2, the list of protected Natura 2000 areas in the pilot areas is presented.

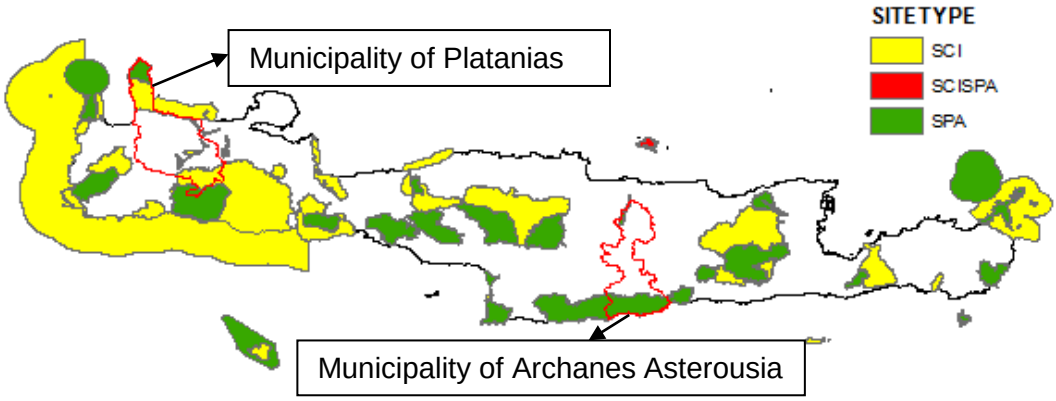

Figure 6.Natura 2000 sites in Crete and the demonstrative territorial areas

Natura 2000 sites are assigned either as Special Protection Areas (SPA), or Sites of Community Importance (SCI), or both. There are 25 SPA zones, 28 SCI zones and one zone assigned as both SPA and SCI. As can be observed in Figure 6, in the demonstrative territorial area of Municipality of Platanias there are both SCI and Spa Natura 2000 sites, while in the Municipality of Archanes Asterousia there are SPA Natura 2000 sites.

3. POLITICAL CHARACTERISTICS OF THE FOCUS AREAS

This chapter describes the political characteristics of the focus areas. It consists of three sub-chapters: 1) Landscape policy that includes Greek and European legislative initiatives for landscape protection, 2) Agroecology that includes initiatives for Agroecology in the pilot areas, 3) Participation policy that includes efforts to combat gender, disabilities and other kinds of discrimination and promote inclusivity, 4) the Common Agricultural Policy with emphasis on viticulture.

3.1 LANDSCAPE POLICY

The protection of the landscape has been the subject of legislation in Greece since 1938, following the passage of the “Emergency Law no.856” (Kyvelou and Gourgiotis, 2019), while one of the most significant national legislative initiatives was “Law 1469/1950” that introduced the delineation of areas as LONB (Landscapes of Outstanding Natural Beauty- Τοπία Ιδιαίτερου Φυσικού Κάλλους, in Greek) (Tsilimigkas et al., 2020). The European Landscape Convention (ELC), initiated by the Council of Europe in 2000, has influenced national authorities to integrate landscape planning into different policy sectors (Kyvelou and Gourgiotis, 2019). In

2016, a new law (4447/2016) proposed a four-step methodology, using Regional Spatial Plans (RSPs), as the main tool for landscape planning. As a result of RSP methodology, Landscape Zones can be defined as: 1) Landscape of International Value, 2) Landscape of National Value, 3) Landscape of Regional Value, and, 4) Particularly Degraded Landscape.

Landscape Categorization in the region of Crete revealed 11 Landscapes of International Value, 17 Landscapes of National Value, 9 Landscapes of Regional Value and 7 Particularly Degraded Landscapes (Kyvelou and Gourgiotis, 2019). A Regional Framework of Spatial Planning and Sustainable Development (RFSPSD) for Crete, which is now called the Regional Spatial Framework (Περιφερειακό Χωροταξικό Πλαίσιο), was first adopted in 2003 (Official Government Gazette OGG, 2003) and revised in 2017 (OGG, 2017).

European policies for nature conservationincludethe NATURA 2000 network (Migliorini et al., 2018). In Crete there are 55 areas assigned in the NATURA 2000 network, 9 in the focus area of Heraklion, and 17 in the focus area of Chania. These areas have been included in the European Natura 2000 Network under the Law N.N.3937 “Biodiversity conservation and other provisions”.

3.2 AGROECOLOGY

The concept of Agroecology, firstly used by Greek NGOs as an alternative to industrial agriculture, was introduced in Crete by the French organization “Terre & Humanisme” in 2016 (Migliorini et al., 2018). The “Agroecological Network of Greece” was created in 2016, aiming to promote Agroecology as a science, practice and movement in Greece. The main research stakeholder of agroecological practices is the Institute of Viticulture, Floriculture, and Vegetable Crops of the Hellenic Agricultural organization (ELGO-Demeter) which is located in Heraklion, one of the focus areas. Until recently, its main agroecological actions concerned olive farms, and aimed to promote more ecological production, more sustainable marketing channels and the preservation of agroecological balance. Other research stakeholders on the island are the Agroecology Lab of Hellenic Mediterranean University (Heraklion) and the Department of Sustainable Agriculture of the Mediterranean Agronomic Institute of Chania.

Furthermore, an adult education training program has been initiated by ELGO-Demeter, so that farmers may familiarize themselves with Agroecology and ecological agriculture. In Greece, there are no collective actions, by the Greek state or from society, towards Agroecology but there have been various collective initiatives regarding opposition to the use of genetically modified organisms in agricultural production, and there is permanent representation in the Greek Ministry of Agriculture, of the different groups and organizations working to promote agricultural biodiversity (Migliorini et al., 2018).

3.3 PARTICIPATION POLICY

Regarding social structure and mobility, a distinction can be made between the urban centers of Heraklion and Chania, and the rural mountainous areas of the interior. The interior of Crete is characterized by small rural communities with a restricted occupational and social mobility, and an enforced and strict gender dichotomy

(Terkenli, 2005). There are traditional and social structures where political authority and land ownership remains critical. In order to encourage participation, the Crete Operational Program, as part of the EU Regional Policy, was launched in 2014, including social inclusion as a thematic priority. At a national level the General Secretariat for Gender Equality launched the National Action Plan on Gender Equality and on 23-02-2016 there was an institutionalized cooperation with the Ministry of Rural Development & Food regarding the improvement of the situation of women in rural areas.

3.4 COMMON AGRICULTURAL POLICY

The Common Agricultural Policy (CAP), established in 1962, forms the cornerstone of European Union policies as it absorbs the 30% of annual EU budget (Pomarici & Sardone, 2020). Because of the importance of the wine sector in European Agriculture, the CAP included vertical wine policies from the very beginning. In the intervening years, EU wine policies have shifted from ensuring a strict quantitative control to enhancing the quality and international competitiveness of European wines (Corsinovi & Gaeta, 2017).

A very important part of the CAP regarding non-wine products are the direct payments to farmers in order to support their income stability based on cultivated land and production. On the other hand, there have been different sectorial policies for wine, including bans on new plantations and subsidies for permanent abandonment of wine-making vineyards (Pomarici & Sardone, 2020).

The latest version of CAP (2014-2020) includes three pillars of support for the wine sector (Pomarici & Sardone, 2020): 1) income support, 2) market measures and regulations regarding wine production and marketing, 3) access for wine sector actors to the resources of Rural Development Plans (RDP).

4. SOCIO-ECONOMIC ANALYSIS OF THE FOCUS AREAS

This chapter regards the socio-economic analysis of the focus and demonstrative territorial areas. It consists of two sub-chapters: 1) Socio-Economic structure of the focus and demonstrative territorial areas, including the economic characteristics of the Heraklion and Chania regional units, and the Archanes Asterousia and Platanias municipalities, 2) A collective initiative presenting the civic society actions in the focus and demonstrative territorial areas.

4.1. SOCIO-ECONOMIC STRUCTURE OF FOCUS AND PILOT AREAS

Crete, according to the Kallikratis Programme of 2011, is one of the 13 Greek regions, and consists of four regional units: Heraklion, Chania, Lasithi and Rethymno. The city of Heraklion is the capital of the region, and the total population of Crete is 682,928, constituting6.3% of the total population of Greece (Tsilimigkas et al., 2020).

The Cretan economy is primarily grounded in the tertiary sector and, especially, in tourism which is the main economic activity of the local population. Employees in the tertiary sector represent 70.7% of the total employed population, inhabitants working in the secondary sector represent 14.5%, while employees in the primary sector represent 14.7% (Tsilimigkas et al., 2020).

Unemployment in Crete was estimated to be approximately 11.7% in 2019, the second lowest unemployment rate in Greece (European Commission). In reference to our focus areas, an unemployment rate of 13.5% was reported for the Regional Unit of Heraklion, and 11.4 % for the Regional Unit of Chania (European Commission, 2019). Tourism and agriculture contribute strongly to both the Cretan economy and employment rates, however result in a highly seasonal employment market. There are approximately 40,000 people working in the agricultural sector in Crete, while in throughout Greece 462,000 people work in agriculture (ELSTAT, 2017).

Figure 7. Administrative and political map of Crete; Source: https://www.istockphoto.com/vector/administrative-and-political-map-of-greek-mediterranean-island-crete-gm913307510-251408858

According to ELSTAT (2017), the Greek GDP (Gross Domestic Product) was 180,218 million euro, while the regional GDP for Crete was 9,095 million euro. The focus area GDPs were 4,362 million euro for the Heraklion regional unit and 2,336 million euro for the Chania regional unit. In Crete the GDP per capita was 14,366 euro, while for Heraklion it was 13,977 euro and forChania14,676 euro (ELSTAT, 2017).Cretan Agriculture GVA (Gross Value Added) is 9.53% of the total Greek agricultural GVA (Region of Crete, 2012). The predominant sector of Cretan GVA is the tertiary sector followed by tourism services (Region of Crete, 2012).

Table 3. Cultivated areas in Crete and the pilot areas in 2018

	Total cultivated agricultural and fallow land	Crops on arable land	Garden area	Areas under trees (compact plantation)	Vines (grapes and raisins)	Fallow land
Crete	274.410,60	21.494,30	6.108,20	197.167,60	18.085,50	31.555
Heraklion	131.641	10.452,50	2.793,40	91.619,40	14.421,10	12.354,60
Chania	56.529,40	3.428,40	1.618,40	47.809,60	1.557,70	2.115,30

Source: ELSTAT (2011-2018) derived by https://www.statistics.gr/el/statistics/-/publication/SPG06/-

Cretan agriculture and agriculture in the pilot areas consist of different types of plantations. The Hellenic Statistical Authority- ELSTAT (2018) provides information about the allocation of the main cultivations in Crete, Heraklion and Chania. The cultivated areas are categorized as: 1) Arable Crops, 2) Vegetables, 3) Trees

(compact plantation), 4) Vines (grapes and raisins), and, 5) Fallow land. Tree cultivation is the most common category in Crete and Heraklion, followed by vines. In Chania, tree cultivation is again the most common, followed by “areas under trees” is the biggest category followed by crops on arable crops and vines. The different categories of cultivated land in Crete and the pilot areas are presented in Table3 and visualized in Figure8.

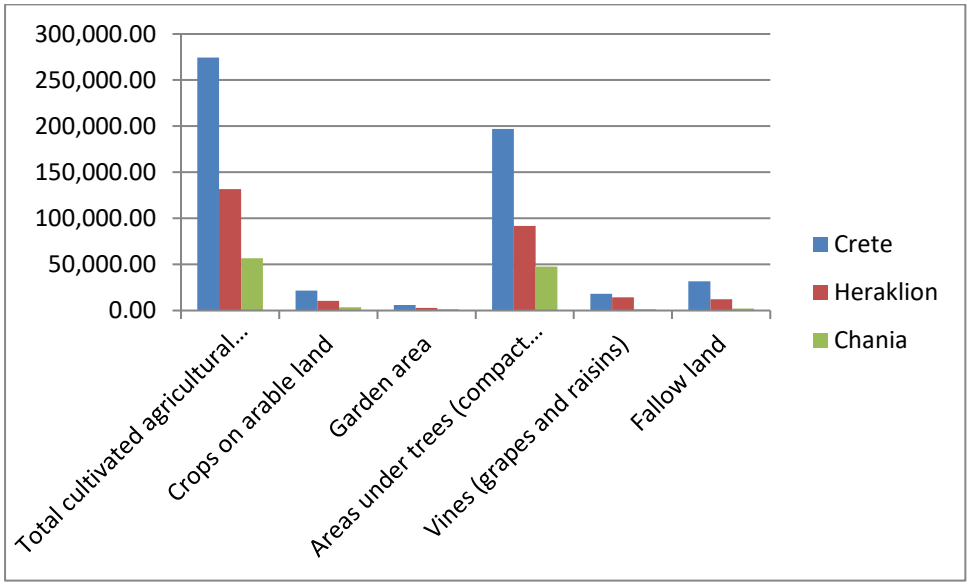

Figure 8.Cultivated areas in Crete and the pilot areas in 2018

In the pilot area of the Archanes Asterousia Municipality the largest part of the population (54.14%) is occupied in the primary sector. The main occupations are either in animal production or olive tree cultivation. Animal production mainly concerns sheep and goats. The majority of the total area of the municipality is occupied by various cultivations (57.16%), followed by pastures (39.75%), residential use (1.15%) and forests (1.09%).Viticulture is also an important economic element of the municipality as 70% of all Cretan wineries are located in the Archanes Asterousia Municipality.

Platanias Municipality has a population of approximately 16,900 according to the 2011 census (NTUA, 2015). The biggest economic sector in the Platanias Municipality is services, representing more than 59% of all economic activity, followed by agriculture (30%) and manufacturing (10%). The economically active population is 38.54% while the rest is non-active, with 38.54% being pensioners.

4.2 COLLECTIVE INITIATIVES

Social movements concerned with environmental protection have arisen since the 1980s. The main initiatives focused on organic agriculture, and were started by amateur farmers who experimented with organic cultivation, biodynamic agriculture and natural farming (Migliorini et al., 2018). There are a number of social networks that are active in Greece regarding either organic or ecological agriculture, such as the “Association for Organic Agriculture in Greece”, the “Ecological Practice Lab”, the “Rea-Scientific Society for Organic Agriculture” and “Aegilops- Network for biodiversity and ecology in agriculture”. “Agroecologiki SP- Agricultural Research &

Development" is a company which delivers services regarding Agroecology, regenerative and organic farming, agroforestry and integrated agriculture.

There are two major cooperation and synergy networks operating in the winemaking sector within the pilot areas. In the focus area of Heraklion which is the center of bottled wine production (Interreg Europe, 2017), Wines of Crete emerged as the main promoter of local wines. Furthermore, it inspired the creation of the Chania – Rethymno Winemakers' Network. Thus, wine-makers in both focus areas promote their wines, locally and globally, through these cooperative bodies. Other social initiatives in the focus areas are concerned with gender equality. Associations working for gender equality include the "Union of Women's' Associations of Heraklion Prefecture" and the "Union of Cretan Women". Women in rural areas have also formed women's cooperatives with objective the enhancement of their social status, economic independence and mobility (Gidarakou, Xenou & Theofilidou, 2000). There are women's cooperatives in both the prefecture of Heraklion and Chania.

The demonstrative territorial area of Archanes Asterousia Municipality is home to various collective and cooperative initiatives (Municipality of Archanes Asterousia, 2020). Since 2011 PELITIS, a farmers' initiative for protecting and preserving local varieties, has been active in the municipality, cooperating with local farmers and promoting alternative methods of cultivation. The municipality is also home to various cooperatives, including the women's cooperatives of Archanes "Melistalakti" and "Vasileion Glykasmos", the Rural Cooperative of Archanes, which operates the biggest packaging plant for table grapes, and the Union of Rural Cooperatives of Peza.

5. VITICULTURE IN THE FOCUS AREAS

This chapter investigates different aspects of viticulture in the selected focus areas. It consists of three sub-chapters: 1) Extension in hectares, which mainly includes the evolution of areas covered with viticulture, 2) Viticulture Production 2) Local varieties and wine types, which includes the varieties grown in Crete, the local wines and Cretan PDO wines, 3) Vine training systems in pilot areas, where the systems adopted by farmers in focus areas will be explained, and, 5) Wine tourism.

5.1 EXTENSION IN HECTARES

Greek vineyards, in 2018 (ELSTAT), covered a total area of 89,245 ha, of which, 52,628 ha produced winemaking grapes, 23,625ha table grapes, and 5,308ha raisins. The ECOVINEGOALS project in Greece will focus its attention on the region of Crete, where two focus areas of Chania and Heraklion, have been selected. Crete is the administrative region with the second largest vineyard areas in Greece (18,085 ha), which is comparable with those of the region with the most extensive areas of vineyard, the Peloponnese (19,546 ha), and Crete has the greatest area of wine-making vineyards (8,622 ha) while the Peloponnese has 8,592 ha.

The Region of Crete consists of four regional units (Heraklion, Chania, Rethymno, Lasithi). Heraklion is a significant focal point for wine-making research, as it is the Greek regional unit with both the greatest areas of vineyards (14,421 ha) and of wine-making vineyards (6,133ha). The second largest vineyard areas in Crete occur in the Regional Unit of Chania, which has 1,557ha of total vineyard area, and

1,490 ha of wine-making vineyards.

Table 4. Total Viticulture surface area in Greece, Crete and pilot areas

Year	Greece	Crete	Heraklion	Chania
2011	76.509,7	9.083,6	4.699,1	1.612,9
2012	114.834,9	22.174,6	16.873,9	1.590,1
2013	111.510,8	22.129,7	16.853,8	1.589,6
2014	93.845,3	19.692,4	15.584,4	1.557,7
2015	94.722,8	19.516,1	15.425	1.557,7
2016	91.131,2	18.962,2	15.011,9	1.557,7
2017	90.360,9	18.384,6	14.804	1.557,7
2018	89.245,9	18.085,5	14.421,1	1.557,7

Source: ELSTAT (2011-2018), derived by https://www.statistics.gr/el/statistics/-/publication/SPG06/-

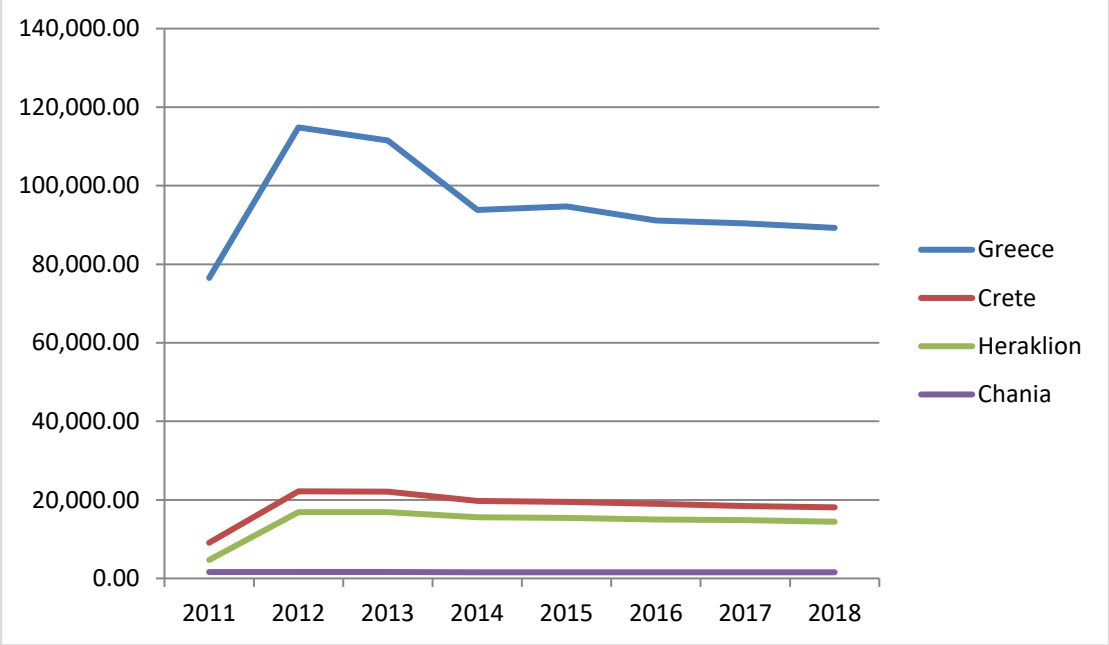

Figure 9. Total Viticulture surface area in Greece, Crete and pilot areas; Source: ELSTAT (2011-2018), derived by https://www.statistics.gr/el/statistics/-publication/SPG06/-

The evolution of Greek viticulture (in terms of hectares) is presented in Table 4 and visualized in Figure 9. The first years of the last decade saw a rapid increase in the total hectares of cultivated vineyards, but after 2013, the total area decreased. In 2018, the total areas of cultivated vineyards are still larger than those of 2013. Regarding the focus area of Heraklion, there were major changes, as the hectares of cultivated vineyards were expanded by more than 300%, from 4,699 ha in 2011 to 14,421 ha in 2018. On the other hand, in Chania there was a small decrease from 1,612 ha in 2011 to 1,557 ha in 2018. Heraklion during these years followed the national trend for increased cultivation while Chania went against the trend.

As presented in Figure 9, the rate of the increase in areas of viticulture was greater at a national level than in either Crete or Heraklion, while in Chania there was a small decrease. On the other hand, the slope of the decrease, after 2013, is

smaller in Crete and Heraklion than occurred at a national level. Chania's regional viticulture areas have remained relatively stable during these last 8 years, while the changes in Heraklion, Crete, and at a national level were greater.

In Table5 the evolution of the viticulture areas in Heraklion and Chania is presented. Area for the cultivation of wine grapes have slightly decreased in both Heraklion (from 3,343 hectares in 2011 to 3,060 hectares in 2018) and Chania (from 1,537 hectares to 1,519 in 2011 hectares in 2018). There was an increase in table grape cultivation area in Heraklion (from 1,356 hectares in 2011 to 2,580 hectares in 2018) and a decrease in Chania (from 39.7 ha in 2011 to 11.4 ha in 2018). In the ELSTAT data base there is no relevant information regarding areas used to cultivate raisin grapes for 2011. In 2012 there were 12,028 hectares of raisin grapes cultivated in Heraklion and 21.5 hectares in Chania, while in 2018 there were 8,780 hectares cultivated in Heraklion and 26.8 hectares cultivated in Chania.

Table5. Evolution of the viticulture surface area in the pilot areas (hectares)

	Wine-making grapes		Table grapes		Raisins	
Year	Heraklion	Chania	Heraklion	Chania	Heraklion	Chania
2011	3.343	1.573,2	1.356,1	39,7	-	-
2012	3.335,5	1.532	1.508,2	36,6	12.028,2	21,5
2013	3.359,8	1.531,5	1.506	36,6	11.998	21,3
2014	3.050,8	1.519,5	2.568,5	11,2	9.965,1	26,8
2015	3.245,3	1.519,5	2.679,9	11,4	9.499,8	26,8
2016	3.163,5	1.519,5	2.669,9	11,4	9.178,5	26,8
2017	3.112,3	1.519,5	2.698,3	11,4	8.993,4	26,8
2018	3.060,4	1.519,5	2.580,2	11,4	8.780,5	26,8

Source: ELSTAT (2011-2018) derived by https://www.statistics.gr/el/statistics/-/publication/SPG06/-

Regarding organic viticulture, there were 4,283 ha of organically cultivated viticulture, and 1,204 ha in transition towards organic certification (Ministry of Rural Development and Food, 2019). Organic vineyards at 2014 represented 1.08% of the total organic cultivated areas (Sdrolias et al., 2014). One important part of ecological viticulture is the use of "green manure" which is an ancient technique that enriches the soil nitrogen content by plowing nitrogen-rich plants into the soil. There are different motives for the adoption of organic agriculture, but among the most important is that it provides a solution to the negative ecological, social and economic effects of industrial agriculture (Brčić-Stipčević et al, 2011).

5.2 VITICULTURE PRODUCTION

Viticulture and winemaking have been very important elements of Greek and Mediterranean civilization since ancient times. Furthermore, wine is considered one of the three elements of the so-called Mediterranean Diet “Holy Triad”, which consists of olive oil, wine and wheat (Cannon, 2005). Thus, winemaking is an essential dimension of Greek culture, and Cretan wine culture is multi-faceted, complex and interesting. The oldest Cretan wine-making unit dates back 4,000 years back, the date of the oldest discovered wine pressing chamber, which was discovered at the pilot area of Archanes. Cretan wine constitutes 20% of the total Greek wine production at 950,000 hectoliters while 70% of Cretan production comes from the area of Peza (IIG AGENCY, 2011) in the pilot area of the Archanes Asterousia Municipality.

Figure 10. Wine tourism locations; Source: http://www.winesofcrete.gr/cretewines/en/Article/TheIsland/Map_995.html

According to ELSTAT (2016), the total number of vineyards in Greece was 97,792; regarding wine-making enterprises, there were 24,077 (22,165 ha) quality wine producers and 57,297 (23,014 ha) other wine producers. The total number of vineyards in the region of Crete was 25,454, while the numbers for Heraklion and Chania are 13,103 (9,555 ha) and 3,766 (0,884 ha) respectively. In Heraklion there were 2,767 (1,557 ha) quality wine producers and 5,660 (2,200 ha) other wine producers, while in Chania there are 67 quality wine producers (0.278 ha) and 3,676 other wine producers (809 ha). Wines with quality certification are considered as quality wines (Vlahos, 2020). These enterprises exert various impacts on the local economy and society, such as the provision of employment, family income,

contribution to total business activity and the exports of the regional unit, in addition to the cultural and habitual aspects of wine consumption.

There has been a significant increase, from 2011 to 2017, in grape production in the Cretan pilot areas according to the data published by ELSTAT. The increase concerned grapes for wine, table grapes and raisins. The total amount of wine grapes produced was 2,197.4 tons in 2011 and 75,744 tons in 2017 in Heraklion, and, 1,325.4 tons in 2011 and 14.757 tons in 2017 in Chania. The total amount of produced table grapes was 923.6 tons in 2011 and 37,814 tons in 2017 in Heraklion, and, 50.2 tons in 2011 and 446 tons in 2017 in Chania. The total amount of raisins produced was 2.5 tons in 2011 and 7,832 tons in 2017 in Heraklion, and, 0 tons in 2011 and 349 tons in 2017, in Chania. The increase in grape production is presented in Table 6.

Table 6. Evolution of grapes production in the pilot areas (tons)

	Wine-making grapes		Table grapes		Raisins	
Year	Heraklion	Chania	Heraklion	Chania	Heraklion	Chania
2011	2.197,4	1.325,4	923,6	50,2	2,5	0
2012	4.530,1	1.317,7	1.905,7	56,1	1.232,4	4,7
2013	4.842,3	1.284,3	1.971,9	56	1.243,3	4,9
2014	6.975	1.508,2	3.6730	36,9	1.771	39,9
2015	6.859,9	1.489,2	4.393,6	29	1.539,2	40,3
2016	7.733,9	1.485,3	4.095,6	35,4	990,8	37,7
2017	75.744	14.757	37.814	446	7.832	349

Source: ELSTAT (2011-2018) https://www.statistics.gr/en/statistics/-/publication/SPG06/2011

5.3 LOCAL VARIETIES AND WINE TYPES

Wine is an important element of Greek culture, and since ancient times wine has been used for rituals and entertainment. Regarding Crete, viticulture and winemaking have been at the core of its cultural life since 2,000 BC (Marangou, 1999). There are a large number of wine and grape varieties cultivated in Greece. More specifically, Cretan grape varieties have an ancient history, and there is archeobotanical evidence of the existence of grapevines in Crete more than 8,000 years ago (Myga-Piateq & Rahmonov, 2018).

In Crete, the local wine types are Vilana, Vidiano, Thrapsathiri, and Malvazia di Candia are used to produce white wine, while Kotsifali and Liatiko grapes are used to produce red wine. Vilana, also called the white star of the island, produces aromatic, light wines with a refreshing acidity, and is used to make the PDO Peza and Sitia wines. Vidiano wine has a unique apricot aroma, a rich body, and a creamy taste. Thrapsathiri produces rich flavored wine that is popular among the local population of Crete, and also used to make PDO Sitia. Liatiko red wine has a sweetness that is characteristic of the PDO Sitia and Dafnes sweet red wines. Malvazia di Candia, a clone of Malvazia, is highly aromatic, and used to enrich both sweet and dry Cretan wines.

Regarding the types of wine produced, of the 33 PDO wine zones in Greece, 4 are in Crete, with three being in the regional unit of Heraklion (PDO Archanes, PDO Dafnes, and PDO Peza). From the north-central part of Heraklion there is PDO

Archanes which is a full-bodied dry red wine produced from the Kotsifali and Mandilari grape varieties. This PDO wine has very old roots in history as it is near the Knossos archaeological site, at Vathipetro where a Minoan wine press has been excavated, and is close to Mount Yuhtas, one of the most sacred grounds in antiquity. From the western part of Heraklion, there is PDO Dafnes which is a dry red and a sweet red wine produced from 100% Liatiko grapes. Presently there are eight wineries producing PDO Dafnes wines. From the central part of Heraklion there is PDO Peza, consisting of a dry red wine from the Kotsifali and Mandilari varieties, and Vilana grapes for the dry white.

5.4VINE TRAINING SYSTEMS IN THE FOCUS AREAS

In order to survey the most popular training system in the pilot areas, the data from the farmer questionnaires were utilized. Most farmers that produce wine grapes (more than 95%) use double cordon de royat, or single and double guyot. Most farmers that produce table grapes use the pergola training system. These training systems have been chiefly used on the advice of local agronomists. Very few farmers (approximately 2%) use the goblet which is the traditional Mediterranean training system. These farmers are mostly traditional farmers who cultivate grapes for personal, and non-commercial reasons.

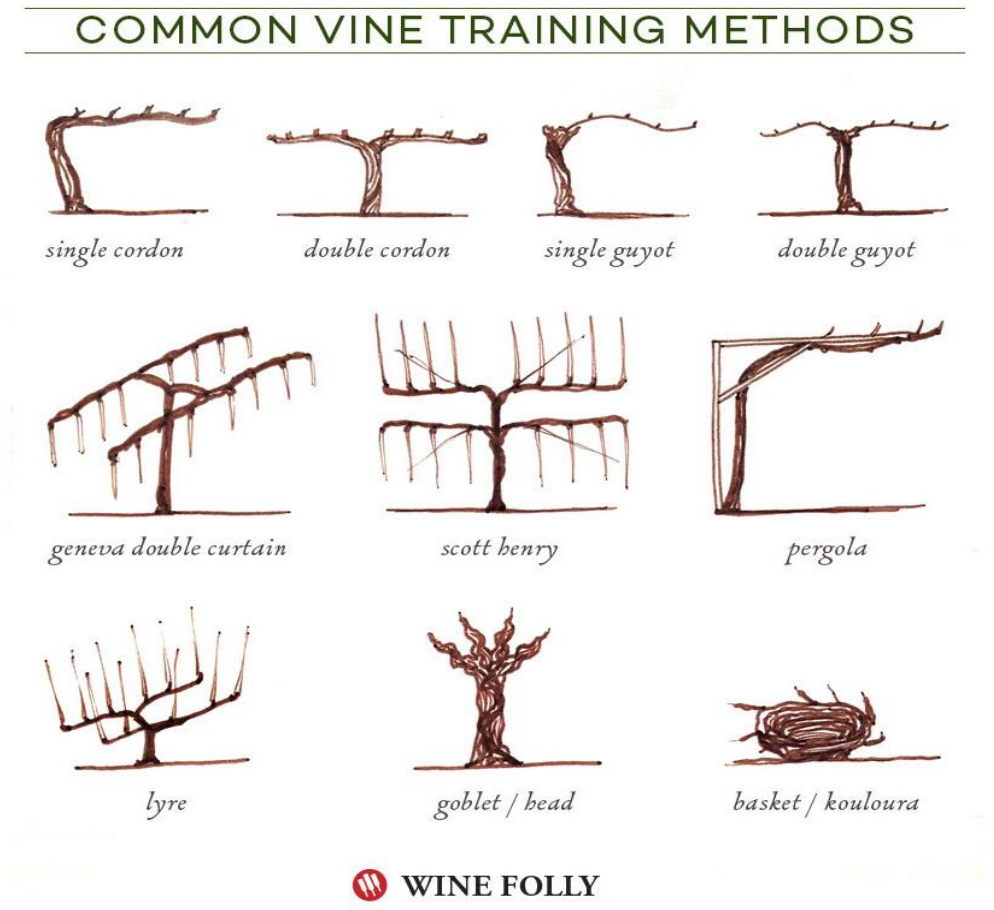

Figure 11. Common vine training methods; Source: WINE FOLLY

(https://winefolly.com/deep-dive/grape-vine-training-methods-illustration/)

5.5 WINE-TOURISM

In Crete generally, and in the pilot areas particularly, there is considerable tourist activity, in the city of Chania, Palaiochora, Kasteli-Kissamos in the Regional Unit of Chania, and in the city of Heraklion, Matala and Hersonissos in the Regional Unit of Heraklion (Briassoulis, 2003). Moreover, wine tourism in Crete is an integrated part of both touristic experience and local wine production. There are currently 31 wineries available for visiting, including monastic wineries such as the Winery of the Agia Triada Monastery. Thus, the local cultural landscape, regarding both religious and gastronomic traditions, is merged with the physical and natural dimensions of the Cretan landscape through Wine Tourism, and visitors can partake in a multifaceted authentic Cretan experience. The “Wine Roads of Heraklion” is one of the most important wine tourism offerings in Greece (Stavrinoudis et al., 2014).

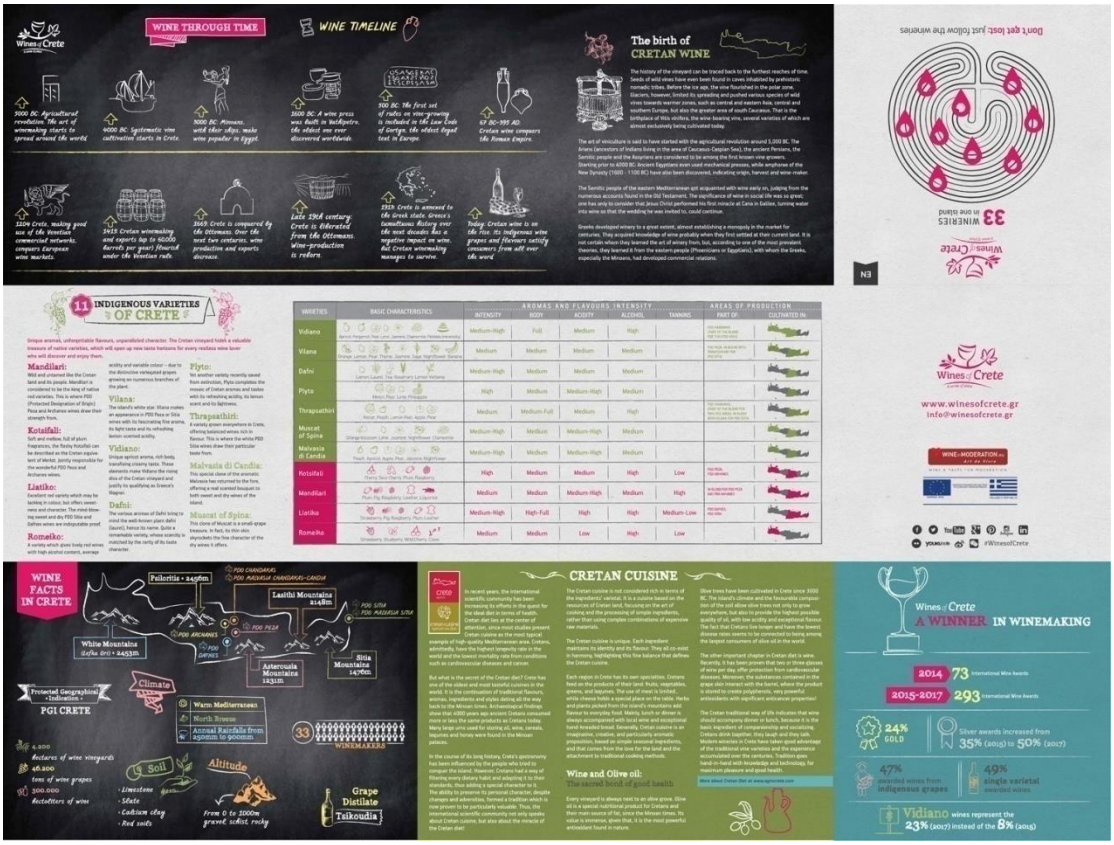

Figure 12. Cretan Local wines and culture

6. RESPONSES OF THE FARMERS TO THE QUESTIONNAIRES

All the data collected from the farmers are presented in the Annex (named “Data Collection-MAICh)”. The column ‘Value of sales’ has not been completed because farmers and wineries did not want to share this information about their businesses.

By October 2020, 8 questionnaires had been administered in person by Sotiris

Pilafidis at a location chosen by the farmer. Winemakers invited Sotiris to their winery while farmers preferred to do the interview at the local café of their village. At the beginning of November, when the national lockdown of Greece was announced, Sotiris transitioned the questionnaire into an online version using Google Forms and then sent emails to all of the winemakers of Crete. Only 3 questionnaires have been filled in online so far. The rest of the questionnaires were applied by a telephone interview. The telephone interview was the preferred method by all the farmers during this period of uncertainty and restricted movement because of the COVID-19 epidemic.

At the end of each questionnaire the farmers were requested to state any specific problems of a technical or other nature that they face as vineyard farmers and also their expectations from the ECOVINEGOALS project. The vast majority of the farmers answered they don't expect much from this project as they have come to learn that national and European project benefits usually don't reach them. Only 2 farmers mentioned that they expect and hope that this project will sensitize farmers to environmental protection practices and lead to reduced pesticide inputs, as pesticide misuse and overuse is a real problem in the local communities. The specific problems of viticulture in Crete raised by the farmers were as follows:

1. The extreme fragmentation of the Cretan vineyards creates increased fuel costs and makes the execution of everyday inspections and treatments difficult.
2. Organic farmers have difficulty to find and buy quality organic fertilizers and/or quality compost and manure to fertilize their vines according to ecological and organic directives.
3. There is a lack of cooperation between farmers and between farmers and local authorities. This was strongly emphasized by extrovert farmers/winemakers who feel that they are in a disadvantaged position and lose opportunities because of this general lack of cooperation.
4. The non-existence of organizations and cooperatives increases the cost of viticulture and renders farmers dependent on wholesale buyers and merchants who artificially inflate prices.
5. There is a complete lack of extension services and support by specialized agronomists for the farmers, both governmental and private. Farmers are alone and make decisions arbitrarily or based on hearsay, with the only motivation maximum potential profit.
6. The absence of an impartial objective governmental counselling body of agronomists for each area to provide timely advice for vine treatments according to the prevalent conditions causes many problems. Specifically farmers rely on agronomists who also work as suppliers of agrochemicals for "free" advice, but these agronomists frequently misdiagnose diseases and oversell agrochemicals and fertilizers because that is their only source of income. The wrong advice frequently creates problems in the vineyards, such as toxicity from over fertilization or excessive spraying with pesticides that can result in needless expense and environmental pollution.
7. The effect of the microclimate of each viticulture area has not been studied properly, which leads to increased inputs and renders production inefficient and harmful to the environment. Only very experienced vineyard farmers are able to sustainably cultivate vineyards.

8. Almost all of the farmers reported that the wood fungal diseases caused by the *Esca* complex and *Eutypalata* cause huge problems in Cretan vineyards and seriously reduce the life expectancy of the vines. They mentioned that abandoned vineyards and farmers who don't take proper measures contribute to the spread of these fungal pathogens and create problems over large areas.
9. During the last 10 years a new formidable enemy for viticulture has appeared, the *Empoasca Spp* leafhoppers that, if not properly treated, can destroy the produce of the vineyard in the critical last weeks before harvest.
10. One winemaker and vineyard owner whose vineyard is in an area dominated by grape table production strongly suggested to us that there should be a separate research and identification of the methods used in winemaking grapes versus table grape production. He mentioned that the many of the practices used for table grape production are unethical and highly detrimental to the environment. When we attempted to survey more table grape producers, they were almost universally unwilling to share information about their practices.
11. Researchers at the Greek National Agronomical Research Institute ELGO-Demeter informed us about the problems caused by viruses and viroids present in the vines of local Cretan grape varieties that are propagated and sold by local nurseries. They noted that local varieties are also frequently mislabelled and often grafted onto unsuitable rootstocks, which creates problems in the development of the vines. They also reported that Cretan soils generally have heavy nematode infestations which are rarely addressed correctly.
12. The decline in the area planted with vineyards during the last 40 years and their replacement with olive groves came up many times in discussions with farmers and stakeholders. In particular Professor Kampourakis at the Hellenic Mediterranean University mentioned that some areas that were traditionally wine producing have completely replaced all vineyards with olives. This conversion has been driven by the high cost of vineyard production and maintenance, and the unpredictability of vineyard production compared to olive oil production. Another important reason is the lack of funding and counselling to support viticulture, whereas olive production has received considerable governmental and European funds for expansion. In the last 20 years the prices for table and wine grapes have steadily decreased, and this, in combination with lack of funding to support viticulture, has driven grape farmers abandon cultivation, leading to a radical change in the character of traditional viticulture areas. Areas that used to be completely covered by vineyards are now olive orchards with only a few fragmented small vineyards.
13. Knowledge of what constitutes Agroecology is lacking even among organic farmers. However many knew of and had applied some of the good practices we described (canopy management, hand harvest, mulching pruning residues, bio-stimulants, precision watering, traditional elements like stone dry walls, mating disruption, soil fertility monitoring).
14. Farmers are finance-driven producers. They focus on making maximum profit and are not willing to experiment and try new methods without proof that it will result in either increased profits or a reduction in production

costs. Funding programs would be the only motivation to adopt ecological practices.

15. Wine tourism offers an alternative income for winemakers who open their wineries and vineyards for events, visits and tours.
16. There are very few examples of horizontal transfer of knowledge between farmers. This is a critical process for lifelong learning and rural development that should be reinforced by trained facilitators.

7. FRAGILITIES IN THE FOCUS AREAS

This chapter presents a review of all fragilities identified in the focus areas, by research in published data and local news reports. These fragilities are concerned with environmental, political, socio-economic and local viticulture problems.

7.1 ENVIRONMENTAL FRAGILITIES

Climate change affects both natural and anthropogenic systems throughout the whole island. The Lefka Ori Nature Reserve, a natural park with a great variety of endemic species, many of which exist in the alpine and sub-alpine zones that are threatened by climate change (Kazakis et al., 2007). Climate change scenarios have revealed a major threat to high-altitude ecosystems and the conservation of plant biodiversity is a priority (Kougioumoutzis et al., 2020).

Climate change also affects water supplies by creating insufficiencies within the current reserves (Koutroulis et al., 2013). Overall, Crete suffers from a shortage of water, and its groundwater supplies are declining (Menegaki et al., 2007). This could significantly affect agriculture as 83% of Cretan water resources are used for agriculture, while only 36% of Cretan agricultural land is irrigated (Menegaki et al., 2007).

Another threat to Cretan ecosystems could be from invasive species (Garcia-Barros et al., 2002). Crete, and especially the pilot area of Chania because of the presence of the Lefka Ori, hosts a great variety of endemic species and its ecosystem could be vulnerable to invasion that could threaten local biodiversity (Bardsley and Edwards-Jones, 2007). Regarding, overall biodiversity risk, Crete has been identified as a “hot-spot” for biodiversity endangerment (Medail & Quezel, 1997).

The combination of urbanization, land abandonment and a Common Agricultural Policy regime has resulted in the latent transformation of rural systems with significant effects on the spatial distribution of agricultural land use for arable crops, vegetable, vineyards, tree crops and fallow land (Zambon et al., 2018). These have resulted in more simplified and homogeneous systems, that are less functional and more ecologically fragile (Zambon et al., 2018).

In the pilot area of Heraklion, land degradation affects the socioecological ecosystem of the Asteroussia Mountains (Detsis et al., 2017). Between the periods of the mid-1950s to the 1980s and the mid-1980s to 2010, land degradation of Crete became worse and the sustainability of the grazing system has been less satisfactory (Cosmas et al., 2016).

Thus, there are different environmental fragilities in both pilot areas. Such issues can be land degradation, climate change, preserving endemic species and the shortage of water supplies. These issues may be local, affecting mainly the pilot areas, or regional when the whole island is affected.

7.2 POLITICAL FRAGILITIES

Governance institutions in Crete are far more efficient than the Greek average, and levels of satisfaction with these institutions among the Cretan population are higher than for the rest of Greece (Papadakis et al., 2018). On the other hand, through a combination of qualitative and quantitative research approaches, different governance threats and insufficiencies were traced for issues such as sustainability, regional governance and innovation (Papadakis et al., 2018). Regarding regional policies there are low levels of satisfaction levels recorded from citizens towards the application of agricultural policy in the Region of Crete, in areas such as public institution' procedures and export policies (Papadakis et al., 2018).

The political issues regarding participation, which were presented in the previous sub-chapter, can be considered as a major fragility of the area. Social immobility and exclusionary institutions (Terkenli, 2005) can negatively affect different segments of the population, with regards to gender, special needs etc. There are European and national initiatives towards the resolution of these issues, but local initiatives such as women's cooperatives could answer some problems.

Extension structures have an important role in agriculture as transmitters of scientific knowledge to farmers. In Crete, there are major insufficiencies in the extension services offered, particular those that concern organic agriculture, and a lack of coordination between research institutes, extension agencies and farmers (Österle et al., 2016). Organic agriculture is the main alternative and ecological agricultural practice. The lack of support for organic agriculture and Agroecology resulting from these insufficiencies in governance is a potential threat to the future more widespread implementation of agroecological practices.

The pilot areas of Heraklion and Chania, while significantly better than other Greek regional units in terms of governance and efficiency, would benefit from initiatives to address a variety of political challenges concerning sustainability, institutions and participation issues. The challenges in these pilot areas are not different from the political challenges that exist in the whole Region of Crete.

7.3 SOCIO-ECONOMIC FRAGILITIES

Both, Heraklion and Chania are strongly dependent on tourism, and thus this constitutes two strong potential threats to the overall economy and wine sector. A tourism failure, as has happened during the present covid-19 pandemic, would deprive the local population a major source of employment and business opportunities. Furthermore, the seasonality of tourism can result in various problems such as difficulty in gaining access to capital, low return on investment and consequent high risk, overuse of facilities at certain periods and underuse at others (Andriotis, 2005). A more balanced development involving year-long tourism could reverse this vulnerability.

Despite the fact that Crete enjoys a number of economic competitive advantages, there is still insufficient coordination between the primary, touristic and service sectors (Papadakis et al., 2018). This leads to economic losses, as Crete does not efficiently utilize its local products. This could be fixed by regional efforts to promote and highlight local traditions and their significance.

There is a great distrust of local farmers towards agronomists, whether they are public servants who are perceived as bureaucrats, or private individuals who are perceived as seeking to profit at the expense of the farmers' interests (Österle et al., 2016). This distrust, combined with the insufficiency of extension services noted in the previous chapter, threatens the successful application of Agroecology in the pilot areas.

One other fragility, regarding Agroecology, is the absence of relevant information about the practice of Agroecology. The vast majority of the inhabitants of the region are unaware of this social environmental movement. This could be considered a fragility regarding the project's aim. On the other hand, the presence of ELGO-Demeter in Heraklion and the Agroecology Network can act neutralize this disadvantage. The Agroecology movement can also benefit from the generally positive attitudes towards organic cultivation.

Thus, both of the pilot areas suffer from the socio-economic fragilities that also threaten the whole region. These fragilities regard the pilot areas economic vulnerability towards tourism, the lack of proper promotion of local natural and cultural advantages, and the absence of agroecological awareness.

7.4 VITICULTURE FRAGILITIES IN FOCUS AREAS

In addition to the information gathered from scientific literature and by interviewing farmers and stakeholders, some aspects and issues affecting Cretan viticulture were gleaned from agricultural news sites and magazines.

The oncoming climate change has already seriously affected viticulture in Crete, especially the prolonged droughts and the unpredictable rainfalls. The local organizations of vine and olive farmers, in collaboration with the local government administration organized an educational event and discussion in an effort to face this problem entitled Olive cultivation in Crete under conditions of climatic change ("Η Ελαιοκαλλιέργεια στην Κρήτη σε συνθήκες κλιματικής αλλαγής") in 2018.

Retired professor of viticulture, Manolis Stavrakakis emphasized the serious complications climate change is creating for Cretan vineyards. He described how the average yearly temperature had increased by 1,5°C during the period 1990-2010, in comparison to the average temperature during the period 1970-1990. This has had a direct effect on viticulture by inducing the development of latent buds 5-12 days earlier, with grape maturation being completed 7-12 days earlier than formerly. The aromatic properties of grapes are also negatively affected by the increased temperatures. ("Μανόλης Σταυρακάκης για την αναμπέλωση: «Ποτέ δεν είναι αργά» - Ποιο το μέλλον της σουλτανίνας" 2020)

Vineyards face serious problems with fungal pathogens of the wood, viroids and other pathogens that shorten the life expectancy of the vines and necessitate replanting. These problems are deeply rooted in the methods of replanting used in

vineyards during the 1980s. Grape phylloxera decimated the self-rooted vineyards of Crete during the early 1980s, threatening viticulture with extinction. As a response ill-planned hasty replanting of the vineyards with phylloxera-resistant rootstock took place. Unfortunately, the rootstock used was not certified and not free from pathogens. Cretan vineyards have faced serious problems and reduced life-spans since then, according to the journalist and vineyard farmer Vardakis ("Η αμπελουργία «πεθαίνει» και το κράτος «νίπτει τας χείρας του»" 2018).

In 2016, the National Agronomical Research Institute ELGO-Demeter drew up a plan to completely restructure Cretan viticulture to correct for and solve the above-mentioned issues, but unfortunately this plan was never put into practice. In 2018 the Farmer's Association of Crete suggested that a meeting be arranged of all the stakeholders, under the guidance of local administration authorities and researchers in order than decisive measures be taken ("Στο... συρτάρι η πρόταση της Κρήτης για την αμπελουργία" 2018).

An average of 10% of the total area of vineyards on Crete is being abandoned every year. This means that about 1,800 ha of vineyards are replaced or abandoned on the island each year. Prices for fresh wine grapes are as low as 0.25 euro per kilo, a fact that makes viticulture unappealing to a lot of people ("Αμπελουργία Κρήτης: Κομβική η φετινή χρονιά - Ίδιες τιμές, στο ήμισυ η παραγωγή" 2020).

In 2018 the Greek ministry of Agriculture officially decided that local Greek vine varieties be archived, protected and propagated by the national agronomical institutes. This was done in an effort to conserve the national vine biodiversity and improve and promote Greek vine varieties ("Προωθούν ντόπιες ποικιλίες αμπέλου με πολύτιμα στοιχεία", 2018).

The pilot application of "smart agriculture" in 1,000haof vineyards in the area of Korinthia showed very promising results, especially in relation to plant protection. Specifically, plant protection sprayings could be reduced up to 80% while irrigation water use could be reduced by up to 20%. Precision agriculture technologies should certainly be applied to Cretan vineyards too (ypaithros.gr 2017).

The new Greek Minister of Agriculture in 2020 empowered the role of the National Association of Vines and Wines in an effort to expand the wine sector of Greece ("Αναγνώρισε ο Βορίδης την Εθνική Διεπαγγελματική Οργάνωση Αμπέλου και Οίνου," 2020.).

An important problem faced by Cretan farmers is Grape phylloxera (*Daktulosphairavitifoliae*) that is an insect pest that eats the roots of vines and withers the plants' leaves. Grape phylloxera, almost destroyed European viticulture, and provoked the most radical switch in viticulture practices of the last two centuries. Grape growing changed from the use of self-rooted *V. vinifera* plants to shoots grafted onto partially-resistant American non-*Vitis vinifera* spp. or hybrids used as rootstocks. It is generally accepted that the insect was unintentionally introduced into Europe at the end of the nineteenth century through infected plant material from North America to fight oidium (powdery mildew), the fungus that threatened European vineyards in the 1850s (Tello et al. 2019).The first incident of phylloxera in Greece broke out in Pylaea, Thessaloniki, around 1898. Gradually, the blight of phylloxera spread through the vineyards of northern Greece which, together with the vineyards of Epirus to the southwest, were most afflicted("1898 - Phylloxera in

Greece"). In 1977 when phylloxera was first observed in the Cretan vineyards, the reverse countdown for the almost complete destruction of Cretan vineyards started. By 1985 an organized effort of vineyard replanting with Greek vine varieties grafted on resistant American rootstock started and resulted in the modern Cretan vineyards seen today, but these rootstock are not without problems and many of the replanted vineyards are facing problems arising from the root stocks. ("ΠΑΤΡΙΣ - ΑΡΧΕΙΟ ΗΛΕΚΤΡΟΝΙΚΗΣ ΕΚΔΟΣΗΣ" 2008.)

8. CONCLUSIONS

This deliverable investigates the structural characteristics of the pilot areas regarding their environmental-geographical traits, viticulture production aspects, the European and national political initiatives and the socio-economic situation. Through this analysis, the main characteristics of the pilot areas regarding these issues were traced, alongside different fragilities and vulnerabilities resulting from environmental, social, economic and political issues.

Crete is a mountainous island, located in the Eastern Mediterranean, with significant agricultural areas where mainly olive trees are cultivated. There is significant rainfall, especially in the focus area of Chania, but generally there is a shortage of water in the island, particularly at the Eastern end. Both focus areas include national parks rich in endemic fauna and flora. There are multiple Natura 2000 zones intending to protect the landscapes and biodiversity of the island. Crete is one of the 13 Greek regions. The policies adopted relating to the scope of the projects are regional, national and European, and concern landscape, Agroecology awareness, and participation. There are various legislative efforts, European projects and national initiatives designed to protect the environment and landscape, promote Agroecology and inclusivity in the focus areas. The economic structure of the island is characterized by its strong dependence on tourism, while agriculture provides a significant proportion of total employment. There are different social initiatives like winemaking producers associations, organic agriculture associations and women's cooperatives. Viticulture in the pilot areas has increased, when the total areas under cultivation in 2011 and 2018 are compared. A small proportion of these areas is under organic cultivated. There are different local wine types made from varieties such as Vilana, Vidiano, Thrapsathiri, Liatiko, Kotsifali and Malvazia di Candia, and 4 PDO zones. Local farmers mostly use double cordon de royat, single and double guyot schemes for vine training.

Data collection revealed a distrust of the respondents towards the effectiveness of European projects and various problems of Cretan viticulture, including fragmentation, cultivation cost problems, diseases like *Eutypalata*, and viruses.

A review of relevant literature and local newspapers was conducted to investigate the fragilities of the focus areas. The main environmental fragilities are land degradation, climate change, endemic species endangerment, and a shortage of water. These issues can be interconnected, such as the effect of climate change on water supplies. The main political fragilities are governance malfunctions, with a special focus on environmental and agricultural policy, and issues regarding participation and social mobility. The main socio-economic fragilities concern the economic dependency on tourism and the consequent vulnerabilities, the lack of coordination between the touristic and primary sector and the lack of Agroecology awareness. Climate change, viruses and prices are the main problem for viticulture.

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