

LIFE AROUND THE PLASTIC SEA

A research on the adaptations of greenhouse owners and immigrant greenhouse workers to desertification

Almería, Spain

May - October

2017



Utrecht University

Eline van Oosterhout - 4149890

Supervisor: Ruud Bosch

Life around the plastic sea

A research on the adaptations of greenhouse owners and immigrant greenhouse workers to desertification

Student

Eline van Oosterhout – 4149890

Utrecht University

Graduate School of Geosciences

Ba. Liberal Arts and Sciences, Human Geography

Email: e.r.vanoosterhout@students.uu.nl

Word count: 21.533

Supervisor

Ruud van Bosch

Human Geography and Planning – Education

Graduate School of Geosciences

Utrecht University

Heidelberglaan 3584CS Utrecht

The Netherlands

Phone: +31 30 253 3739

Email: r.m.m.bosch@uu.nl

Acknowledgements

During my three weeks in the Campo de Dalías I was lucky enough to meet many wonderful people who all proved themselves to be enormously eager to help me execute this research. Special thanks to all three professors at the University of Almería who shared their time and knowledge with me and welcomed me warmly into their offices. Especially Tere, who took me to the university's greenhouses and enthusiastically showed me around. I also want to thank the members of SOC-SAT, who made me feel welcome for three days in a row and whom I admire for their very important and hard work. I promise to treat all gathered information during my fieldwork with utter respect to the respondents whether they are known or anonymous.

I would like to express my thanks to my parents, trusting and encouraging, who supported me in every possible way. Your positive influence has been with me my entire life, as well as during this thesis, and for sure during the rest of my life and career.

Another very special thanks to Luis; without you my time in the Campo de Dalías would have been way less fun, and I would not have seen that many beautiful non-touristic spots and beaches. You made me feel at home right away and I am glad that I got to know you.

The amazing time I had in Almería is certainly based on the wonderful and broadening experiences I had, which I would never have wanted to miss and certainly contributed to a self-development that will surely be beneficial to my future researches.

I am very contented that with this research I was able to express my enthusiasm for these topics and this study direction. I loved finding myself in another situation and reality where I quite easily managed to operate.

Finally, I want to thank Ruud, who encouraged me to implement my creativity in this thesis, and who came up with some very helpful additions and possibilities to improve the research. I learned a lot, due to you including, during these couple of months.

Almería treated me very nicely. Muchas gracias por todo!

Abstract

The amount of greenhouses in the Campo de Dalías, Almería (Spain) have caused land degradation and desertification in the area over the past decades. This research examines the different adaptation strategies of both greenhouse owners and immigrant greenhouse workers to the development of desertification. A lot of research has been done on this area, although none of it used the combination of the two specific paradigms that are used in this research in order to explore people's livelihoods and strategies. By using this combination, a broad and at the same time deep insight in both groups' adaptations is retrieved, which leads to a unique outcome. Both groups have different assets, livelihood strategies, and desired livelihood outcomes, which influences their individual adaptations to drought. In order to obtain the data for this research, literature study and mainly qualitative methods were used. The research' conclusions combine both groups' interests and characteristics, which is helpful for improving the livelihoods and well-beings for both groups without letting one behind.

Key words: *Agriculture – Greenhouses – Desertification – Sustainability – Immigration – Conflicts – Violence – Poverty – Vulnerability – Well-being – Almería – Campo de Dalías*

TABLE OF CONTENTS

Acknowledgements

Abstract

Chapter 1: Introduction	1
Chapter 2: Theoretical Framework	3
2.1 Desertification	3
2.2 Adaptation Strategies	3
2.3 Dryland Livelihood Paradigm	4
2.4 Poverty, conflicts and violence	5
2.5 Sustainable Agriculture	6
2.6 Sustainable Livelihood Framework	7
Chapter 3: Case Study: Almería	9
3.1 Desertification	9
3.2 Socio-economic characteristics	13
a. Urbanization	14
b. Working immigrants	16
3.3 Sustainable agriculture	17
Chapter 4: Research Methodology and Methods	21
4.1 Research questions	21
4.2 Operationalization of core concepts	22
4.3 Research locations	22
4.4 Methods of data collection	24
4.5 Ethical considerations	26
Chapter 5: Conflicts, Violence and Poverty	29
5.1 Differentiations between workers' nationalities	29
5.2 Differentiations between the agricultural companies	31
a. Small and big companies	31
b. Regular and peak workers	33
5.3 Temporary labour conditions for greenhouse workers	33
a. Physical conditions in greenhouses	33
b. It's all about the money	35
5.4 Conflicts and violence in the Campo de Dalías	37
5.5 Influence of external actors on labour relations	38
Chapter 6: Adaptations to Sustainable Agriculture	40
6.1 Changes since the 1980s	40
6.2 Different kinds of adaptations to sustainable agriculture	42
a. Desalination plants	42
b. Organic farming	43
c. Rainwater collection, drip irrigation, hydroponics and recycling	43
6.3 Influence of external actors on sustainability	45
Chapter 7: Well-being, Vulnerability and Livelihood Assets	48
7.1 Livelihoods of immigrant workers	48
a. Vulnerability context	49
b. Livelihood assets	49
c. Structures and processes	52
d. Livelihood strategies	53
e. Livelihood outcomes	53

7.2 Livelihoods of farm owners	54
a. Vulnerability context	54
b. Livelihood assets	55
c. Structures and processes	57
d. Livelihood strategies	58
e. Livelihood outcomes	58
Chapter 8: Conclusions and Discussions	59
8.1: The research questions' answers	59
8.2 Main findings	61
a. Main findings: immigrant workers	61
b. Main findings: farm owners	62
8.3 Recommendations for policy and practice	62
8.4 Reflections on methodology	65
8.5 Discussions and suggestions	66
References	67
Annexes	72



Introduction

Drought is a worldwide problem with an increasing magnitude. According to the United Nations Convention to Combat Desertification (UNCCD, 2017), 1.8 billion people will experience absolute water scarcity by 2025, and by 2050 water demand will have increased by 50% compared to contemporary demand. Both water scarcity and drought are considered to belong to the most catastrophic disasters of all, causing both economic and ecological losses in the short- and in the long-term (UNCCD, 2017). Much of the environmental degradation is caused by numerous human activities. Examples are patterns of land-ownership and poor government planning on issues like irrigation (Postel, 1999). Such examples of mismanagements have led to a situation in which, by 2005, about 44% of global agricultural areas were located within drylands, according to the World Resource Institute (WRI, 2005). In Europe, and especially in the Mediterranean, both climate change and agriculture are playing important roles in the degradation of land (Camargue, 2006). Since the majority of the Mediterranean land is influenced by humans too, the need for proper water management has become required.

With a focus on Mediterranean located Spain, four contemporary problematic topics (drought, agriculture, sustainability and immigration) are intertwined in this research about livelihood vulnerability and choices of two groups of individuals. The research focuses on Spanish greenhouse owners on the one hand, and immigrants who work in agricultural greenhouses on the other. It aims to identify which adaptation strategies were chosen by each of these groups in order to survive and conquer drought. Both groups experience the drought effects on the agricultural sector, but have their focus on different aspects and interests. By examining the different strategies, interests and difficulties that each group experiences, this study hopes to contribute to the achievement of more sustainable agricultural practices, labour relations and livelihoods.

The fieldwork took place in the Campo de Dalías, a plastic greenhouse-covered area in the

province of Almería, Andalusia. Five different interviews were held ranging from working immigrants, a socialistic party and professors at the University of Almería. In addition, four extensive surveys were conducted by farmers of big agricultural companies located in the Campo de Dalías. Finally, to add understanding to the context, there were several conversations with locals during the three weeks of fieldwork that were not recorded.

The research consists of a total of 8 chapters. Following this introduction section, the second chapter explicates the theoretical framework, wherein definitions of general concepts are explained, and the two existing frameworks on which this research is build are discussed. Chapter 3 explores the province of Almería, the region in which the Campo de Dalías is located, via a case study. Chapter 4 reveals the methods that were used in order to implement the field research. Special consideration is given here to the ethical considerations that came into play. Chapter 5, 6 and 7 describe the outcomes of the fieldwork and present the results of the findings. Chapter 5 explores the extend to which the two groups, farm owners and migrants, have to deal with conflicts, poverty and violence. Chapter 6 examines their adaptations towards sustainabiliy. In Chapter 7, the livelihoods of both groups are being researched in order to discover their livelihood assets and strategies to obtain a better well-being and livelihood. Chapter 8 provides a discussion and conclusion to the research on basis of both the literature and the fieldwork results. It encloses both a reflection on the research and its results, and has suggestions for further studies.



Chapter 2: Theoretical Framework

This Chapter provides a research base to determine the literature-based facts, context and theoretical ground for this study. There are many already-existing theories and definitions to frame this research in Almería. Section 2.1 describes the definition for desertification. Part 2.2 provides information about different adaptation strategies. Part 2.3 introduces the Dryland Livelihood Paradigm and 2.4 examines how poverty, conflict and violence can be measured. Section 2.5 explains the definition for sustainable agriculture and 2.6 describes the Sustainable Livelihoods Framework.

2.1 DESERTIFICATION

According to the United Nations Convention to Combat Desertification (UNCCD, 2017), desertification is *‘the persistent degradation of dryland ecosystems by human activities, including unsustainable farming, mining, overgrazing and clear-cutting of land, and by climate change’*. Desertification can occur when trees and bushes are stripped away so that the soil is not bonded anymore. It can also occur if animals eat away topsoil and erode the topsoil with their hooves. The main cause of desertification in the region of Almería is, however, intensive farming, what makes nutrients in the soil depleted. According to the UNCCD (2017), drylands like the Almeria region, are already fragile and the impact on people, livestock and the environment can be devastating as they become even more degraded.

2.2 ADAPTATION STRATEGIES

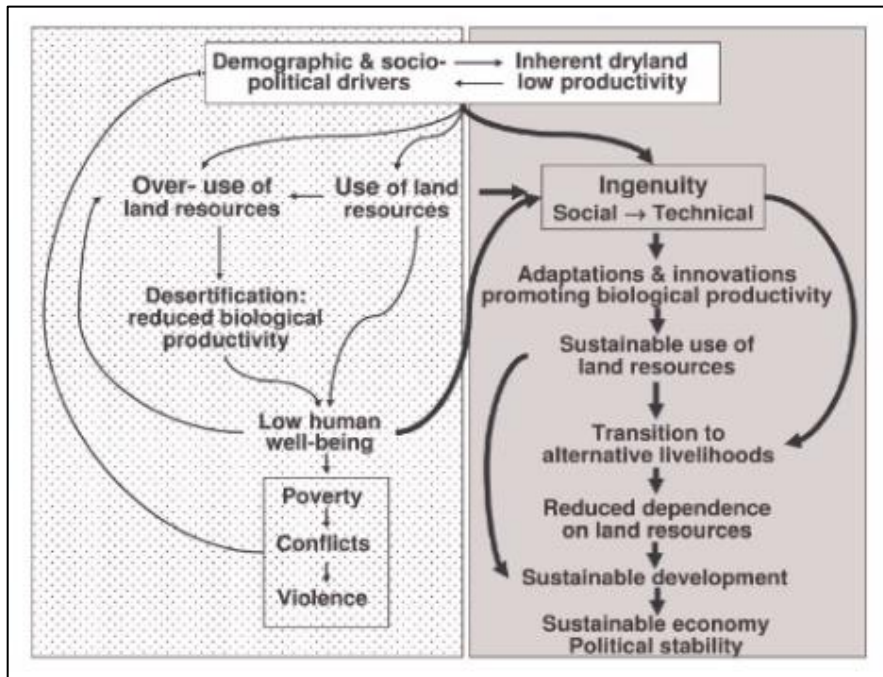
To find a clear definition of what adaptation is one has to find one that covers adaptation to desertification for people living on the concerned drylands. There appear, however, to be merely definitions of adaptation strategies to climate change rather than to desertification. To still make clear what is meant by adaptation in this research, the climate change definition is used as climate change contributes as well to arid circumstances in Almería.

According to the Intergovernmental Panel on Climate Change (IPCC, 2007), the definition for ‘adaptation’ is as follows: ‘*Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploit beneficial opportunities*’. According to Bradshaw et al. (2004), there are two levels on which adaptations occur: the individual farm scale and the regional and national farm scale. Changes in adaptation strategies on regional or national level do not automatically imply a similar change on an individual level. Farmers are neither clairvoyant (i.e., farmers cannot exactly predict the future weather and its economic outcomes) nor naïve (i.e., farmers do not change their current way of decision making), which means that farmers cannot be assumed to be the one or the other (Kandlikar & Risbey, 2000). Farmers’ adaptation strategies are getting influenced by many factors, such as their past decisions, their resources, the socio-political and cultural context, and their expectations of the future. Furthermore, farmers in industrialized countries have a richer set of adaptation possibilities than farmers in less industrialized countries (Gupta, 1998; Weber, 1994).

2.3 DRYLAND LIVELIHOOD PARADIGM

The Dryland Livelihood Paradigm (DLP) is built upon a previously made paradigm that was designed by several scientists working together on an integrative analytical framework. Their purpose was identifying problems and implementing opportunities in dryland areas. This previous paradigm is named the Dryland Development Paradigm (DDP). By use of the DDP, Reynolds et al. (2007) tried to examine the interaction between socio-economic and biophysical factors. This interaction is, however, inherently indeterminate and uncertain, which makes it difficult to establish robust scientific projections of land-cover and land-use trajectories since it does not involve people’s own explanation of their problems. It was for that reason that a more human-focused paradigm was being designed by Adeel and Safriel (2008), called the Dryland Livelihood Paradigm (DLP), which built upon the DDP. With the DLP Adeel and Safriel (2008) focussed on the poverty-degradation spiral that happens to occur quite often in dry areas. This paradigm, showed in Figure 1, aims to find linkages between desertification, environmental mismanagement, and loss of security in drylands and poverty. The DLP specifies two livelihood scenarios that are likely to occur in a specific region: 1) The first pathway exists of two options: low human well-being through desertification or directly due to use of land resources. It describes how a dryland community can fall into poverty, conflict and violence. The second one explains how a they remain steady on their production level by ingenuity and sustainability. The community eventually achieves a stable economy and political stability.

Figure 1: The Dryland Livelihood Paradigm.



Source: Adeel & Safriel (2008).

2.4 POVERTY, CONFLICTS AND VIOLENCE

According to the DLP, a low human well-being can lead to poverty, conflicts and violence if ingenuity is absent. Poverty can have two forms: relative or absolute (UNESCO, 2017). Relative poverty compares poverty to other members of the society and their economic status. If people are relatively poor, their economic status is below the standard economic status in their society. Absolute poverty is not about the better quality of life, but about simply being able to meeting the basic needs for living, such as food, water, shelter and clothes. Nevertheless, nowadays it is widely conceived that not only economic aspects (such as the right to have an income and to work) must be considered when defining poverty, but also social (access to education and health care), political (freedom of association, expression and thought), and cultural (the right to maintain one's own cultural identity and still be accepted and involved in a community's cultural life). This research focuses on both absolute and relative poverty, as the state of poverty differs widely among the two different groups of people: immigrant greenhouse workers and farm owners.

Serrat (2017) points out in his paper: *'People move in and out of poverty and the concept of vulnerability captures the processes of change better than poverty line measurements'*. The International Federation of Red Cross and Red Crescent Societies (IFRC, 2017) agrees with this by mentioning that vulnerability is most often associated with poverty. The IFRC (2017) defines vulnerability as *'the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard'*. They also state that the concept of vulnerability is relative and dynamic. A way to measure

someone's vulnerability and therefore poverty is by using the Sustainable Livelihood Framework (See: 2.6).

In Latin the term 'conflict' means 'to clash or engage in a fight' (Women Win, 2017). A classic definition of social conflict is '*the process of contentious interaction between social actors and institutions which mobilize with different levels of organization and act collectively in order to improve conditions, defend existing situations, or advance new alternative social projects*' (Cadarso, 2001). This classic definition is adopted in this research in order to elucidate conflicts in Almería.

Violence is defined by the World Health Organization (WHO) as '*the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation.*' (WHO, 2017). Furthermore, the WHO distinguishes three main types of violence: self-directed violence, interpersonal violence and collective violence. Both interpersonal violence (violence between individuals) and collective violence (violence committed by large groups of individuals) are being referred to in this research.

2.5 SUSTAINABLE AGRICULTURE

The definition of 'sustainability' is essential when aiming to find out how farmers and immigrants involved in farming activities adapt to desertification in order to achieve a sustainable future. The word 'sustainable' is derived from the Latin word *sustinere*, meaning 'to keep in existence' or 'long-term support' (Rigby & Cáceres, 2001). Sustainable agriculture is defined by the Food and Agricultural Organization of the UN (FAO, 2014) as '*improving the efficiency in the use of resources; conservation, protection and enhancement of natural resources; protection of rural livelihoods, equity and social well-being; enhanced resilience of people, communities and ecosystems; and responsible and effective governance*'.

Thus, according to the FAO (2014), governance, natural resources, rural livelihoods and ecosystems are a proper measurement of sustainable agriculture. Opinions vary on the exact difference between sustainable agriculture and organic farming (Rigby & Cáceres, 2001). Some people, like Lampkin (1994), believe that sustainability lies at the heart of organic farming and is one of the major factors determining the sustainability of specific production practices. However, according to Ikerd (1993), people immediately connect sustainable agriculture to organic farming. Every opinion seems variable and is certainly not universal. Moreover, it should be mentioned that the elusive nature of the word 'sustainability' implies that equating it to a word such as 'organic' (that is well defined in Figure 2) is quite a bold step (Rigby & Cáceres, 2001).

Figure 2: The principle aims of organic production and processing.

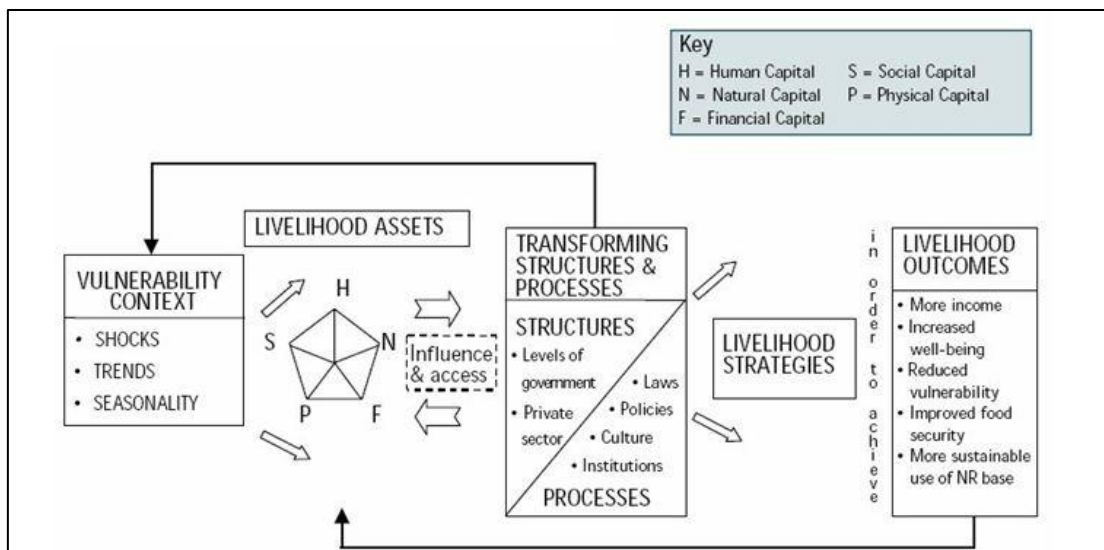
- To produce food of high quality in sufficient quantity.
- To interact in a constructive and life-enhancing way with natural systems and cycles.
- To consider the wider social and ecological impact of the organic production and processing system.
- To encourage and enhance biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals.
- To develop a valuable and sustainable aquatic ecosystem.
- To maintain and increase long term fertility of soils.
- To maintain the genetic diversity of the production system and its surroundings, including the protection of plant and wildlife habitats.
- To promote the healthy use and proper care of water, water resources and all life therein.
- To use, as far as possible, renewable resources in locally organised production systems.
- To create a harmonious balance between crop production and animal husbandry.
- To give all livestock conditions of life with due consideration for the basic aspects of their innate behaviour.
- To minimise all forms of pollution.
- To process organic products using renewable resources.
- To produce fully biodegradable organic products.
- To produce textiles which are long-lasting and of good quality.
- To allow everyone involved in organic production and processing a quality of life which meets their basic needs and allows an adequate return and satisfaction from their work, including a safe working environment.
- To progress toward an entire production, processing and distribution chain which is both socially just and ecologically responsible.

Source: International Federation of Organic Agriculture Movements (IFOAM) (1998)

2.6 VULNERABILITY AND WELL-BEING

As mentioned in Section 2.4, a good way to measure poverty and therefore vulnerability is by using the Sustainable Livelihoods Framework (Figure 3).

Figure 3: Sustainable Livelihood Framework.



Source: Knutsson, P., & Ostwald, M. (2006).

The Sustainable Livelihoods Framework (SLF) is developed by the British Department for International Development (DFID, 1999) in order to overview the relations of different livelihood opportunities and to organize the factors that constrain those opportunities (DFID, 1999; Serrat, 2017). The access to different livelihood assets differs between households. The five livelihood assets are: 1) *Human capital*: health, nutrition, education, skills and knowledge, working capacity and adaptation capacity. 2) *Social capital*: networks and connections, relations of trust and mutual support and understanding, shared behaviours and values, collective representation, common rules and sanctions, mechanisms for participation and decision making, and leadership. 3) *Natural capital*: land, water and aquatic resources, wildlife, biodiversity, environmental services, and natural products. 4) *Physical capital*: infrastructure (vehicles, roads, transport, secure buildings and shelter, water supply and sanitation, energy), tools and technology for production. 5) *Financial capital*: savings, remittances, credit and debt, wages, pensions.

Livelihood strategies and their outcomes do not only depend on capital assets: structures and processes are also of influence (Serrat, 2017). ‘Structures’ refer to the private sector organizations and the public that implement legislation and policy, deliver services and purchase and trade all kinds of goods. ‘Processes’ are laws, policies, regulations, agreements, societal norms and practices. Structures cannot be effective without the processes that implement policies, which makes policies very important to all aspects of livelihoods. The main problem with processes is nevertheless that processes can restrict the poor and vulnerable part of the society by framing their livelihoods, until the government adopts policies that are beneficial for the poor.

According to McGillivray & Clarke (2006), the definition of human well-being is ambiguous: *‘It lacks a universally acceptable definition and has numerous, and often competing, interpretations. As human well-being cannot be directly observed, it cannot be directly measured.’* By using the SLF the state of well-being can be somehow measured, which is an important factor in the DLP as well (See: 2.3). Livelihood strategies are being adapted in order to achieve outcomes such as an increased well-being and reduced vulnerability. All the livelihood assets therefore influence possible outcomes and outcomes influence the assets. In the Sustainable Livelihood Framework, shocks, trends, seasonality, structures and policies are all directly or indirectly connected to each other in this closely related mechanism.



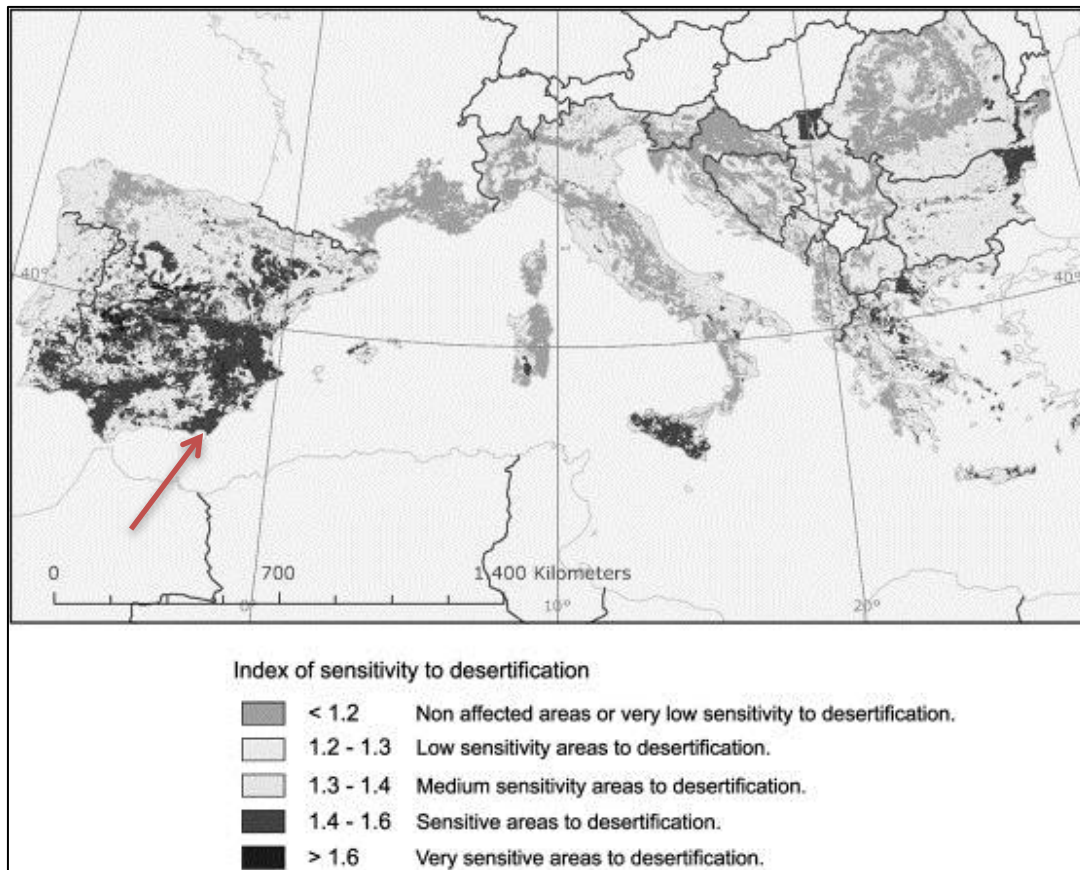
Chapter 3: Case Study: Almería

After having discussed the main concepts and frameworks in the Theoretical Framework, the concepts are being implemented on a specific case: a province in southern Spain called Almería. This area was chosen because of its combination of desertification, immigration, agriculture and sustainability. All concepts related to these four topics will be discussed in this Chapter, as well as the two frameworks that used for this research. In Section 3.1, causes for desertification are examined. Section 3.2 provides information about socio-economic characteristics (divided into urbanization and working immigrants) whilst finally the literature-based data on sustainable agriculture is explored in Section 3.3.

3.1 DESERTIFICATION

Almería is considered to be the driest province in the whole of Europe (Feoli, Perez-Gomez, Oyonarte & Ibáñez, 2017). The province largely depends on groundwater as main water source as a result of irregular river flows and a low amount of rain (Downward & Taylor, 2007). Almería deserves to be called ‘the sunniest province in Spain’ as it receives over 3000 sunshine hours per year on average. There already is a lot of research on the causes of the increasing drought in this area, most of which pointing at the major influence of the agricultural business on soil fertility. Agriculture was, however, not the only factor to reduce Almería’s soil fertility. Tourism and climate change affect the environment as well. Because drought is generally regarded as a natural phenomenon which can be exacerbated by human activities, desertification follows an extreme case of turning fertile land into less productive or even non-productive land, according to the European Union (EU, 2017). The drought that affects Almería will in this study be defined as *desertification* since human activities contributed to Almería’s land degradation (Puigdefabregas & Mendizábal, 2006). Figure 4 shows that the sensitivity to desertification in the Almería region is very high.

Figure 4: Index of sensitivity to desertification for Almería (red arrow).



Source: Barbero-Sierra et al. (2013).

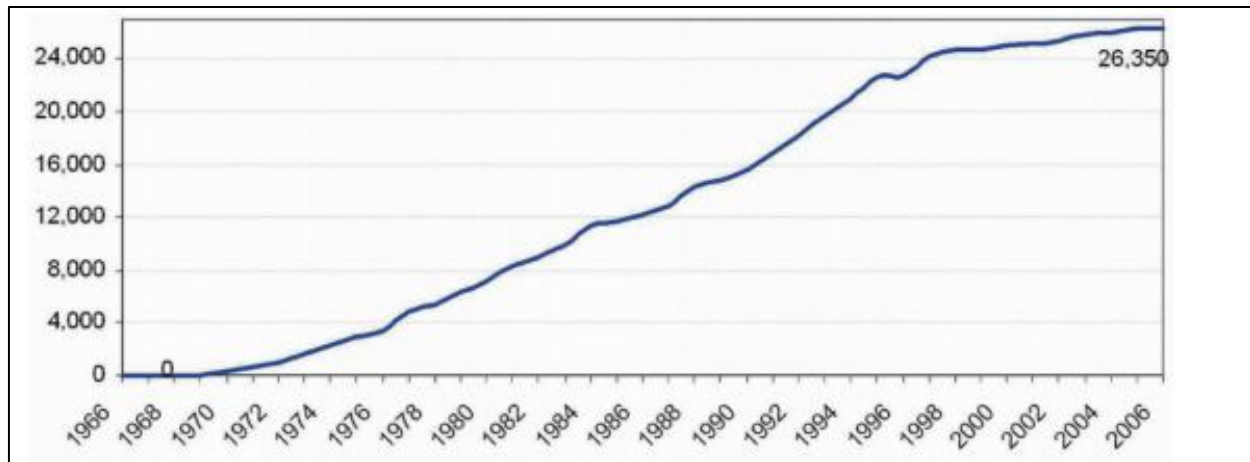
Desertification has in the first place been caused by the immense growth of the agricultural sector. Between 1950 and 1960, the drylands' landscape consisted of a typical Mediterranean agricultural system, whereby families each maintained small pieces of land (Dana, García-de-Lomas & Guerrero, 2011). Much changed during the 1970s. By 1979, a Spanish financial company publication spoke about the 'Almería miracle'. It verified that Almería's income had increased enormously between 1955 and 1975. For a long time Almería belonged to the lowest agricultural income of its region, but had risen to the very first place. Its growth rate was at that time seven times higher than Spain's average (Lorca, 2011).

Almería went through three main stages of transformation. The *first* transformation was from dry farming to irrigation. At first water came from superficial aquifers, which were relatively easy to reach. Nowadays irrigation water comes from much deeper aquifers, as well as from seawater that is desalinated, and the re-use of residual town waters and surface runoff water. The *second* transformation stage was based on protecting crops with cultivation on sand and windbreaks, which entailed an increase in the productivity and security of crops. The *third* stage of transformation was the construction of greenhouses. In 1962 the first plastic greenhouse was built at Roquetas de Mar, a small town in the province

of Almería (Downward & Taylor, 2007; Tout, 1990). This one greenhouse would be the beginning of the immense expansion of greenhouses all around the province. By 1985, already 11.400 hectares were covered under these plastics. As made visible in Figure 5, this increased to 26.350 ha of plastic in 2007. Where Almería was firstly regarded as the forgotten province, unremembered after the Moors got defeated in 1482, the province now rose out of her oblivion and put herself back on the map due to the plastic revolution, the electrical pump-fed irrigation and tourism.

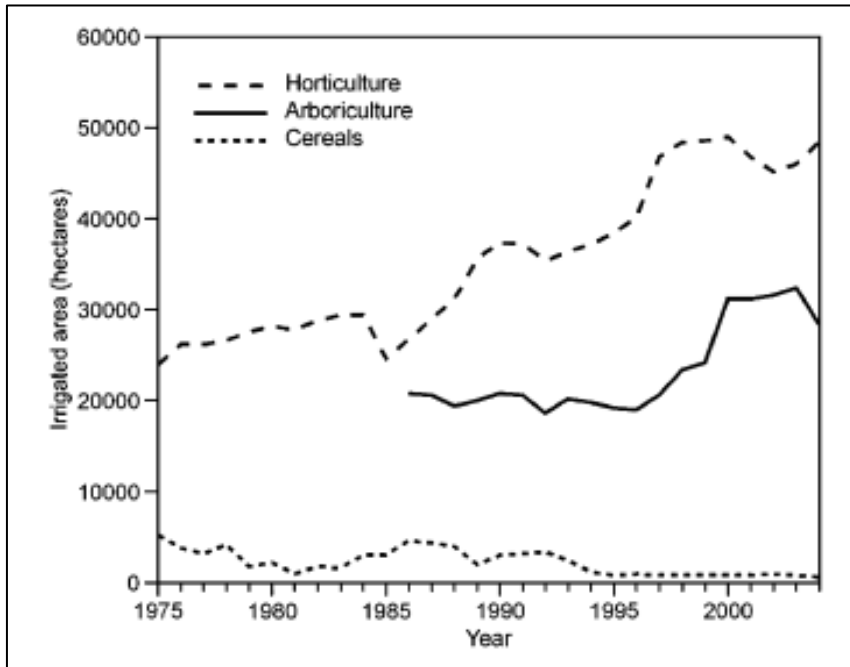
Pump-fed irrigation provides groundwater at any required volume whenever it's needed and requires minimal labour and economic costs. The easy availability of water from Almería's aquifers made its water inexpensive and seemingly inexhaustible, at least over a short time-scale. Farmers who had lived, at times, difficult lives saw new opportunities in plastic agriculture and a 'pump-for-profit' culture gradually emerged, based on pump-fed irrigation (Downward & Taylor, 2007). Farmers seldom saw the long-term impacts their way of farming had on the state of water in the province; as long as there was no notion of a decrease in water supply, there was no need to worry. Over the years the irrigated surface of Almería kept on increasing as more and more farmers switched to this agricultural way of producing their crops (Figure 6).

Figure 5: Evolution of greenhouse surface in Almería (ha).



Source: Lorca (2011).

Figure 6: Change in irrigated agricultural production in Almería, 1975–2004.



Source: Downward & Taylor (2007).

Governmental programmes and policies for the development of irrigation infrastructure in the 1950s and the 1960s were part of the framework of the so-called ‘colonisation policy’, which aimed to improve the productivity of the agricultural sector (Galdeano-Gómez, Aznar-Sánchez & Pérez-Mesa, 2011). The contemporary intensive agriculture, which also happens to be competitive and export-oriented, is probably not what this policy had meant to achieve. In fact, according to Galdeano-Gómez et al. (2011), from the 1970s onwards there was no governmental plan or policy for Almería at all.

The average acreage of a farm is currently 1.8 hectares and is mainly held by small family businesses that are members of bigger agricultural cooperatives (Giagnocavo, Gerez & Campos i Climent, 2014). The sector provides employment to 40,000 people and had a production yield of almost 3 million tons in 2012. It is nearly double the value of the entire production in Almería, which is 1.546 million euros. The big cooperatives, of which many farmers are member, count for more than half of all the crops of which 70% is being exported to other countries. The vast majority, 95%, of these crops are vegetables and fruits and all of it is produced in the 30,000 hectares of greenhouses that currently cover the dry surface of Almería.

Another contribution to the rise of Almería’s economy is tourism (Downward & Taylor, 2007; Tout, 1990). Almería had not been discovered by tourists for a long time. Since the construction of an airport and road improvements, however, access to the province has become much easier. The rise of tourism in the area has undoubtedly contributed to water-intensive developments. Hotels and houses with swimming pools have been built as well as

irrigated golf resorts. It is generally known that these golf resorts located in tourism areas had water deficits (García-Rubio & Guardiola, 2012). According to Downward & Taylor (2007), a tourist's water consumption is four times that of local inhabitants. A main form of tourism in Almería is geotourism. Geotourists are defined as 'tourists with special interest in spectacular landscapes and geological materials such as fossils and minerals' (Hose, 2007). This special interest tourism promotes the conservation and preservation of geosites, called 'geoconservation'. According to Hose (2007), Almería's drylands, which used to be film locations for many 'spaghetti westerns' in the 1970s, have now become tourist attractions. Accommodation in the area ranges from cheap hostels to luxury hotels and vehicles are available for rent in the main towns, like Almería. In addition does the improved infrastructure contribute to accessibility (Downward & Taylor, 2007; Hose, 2007). Almería's four main geotourism attractions can be reached within an one hour's drive of Almería town: 1. Cabo de Gata-Níjar Natural Park; 2. Sorbas Gypsum Karst Natural Park; 3. Tabernas Desert Natural Park; 4. The coastal belt, including the saltpans of Acosta and Cabo de Gata (Hose, 2007). The province's best developed and principal attraction is Cabo de Gata-Níjar Natural Park; a 30km long coastal strip with landscapes similar to that of north Africa. In 1987 this park was selected by UNESCO as biosphere and marine reserve. The area is being visited throughout the year due to its varied seasonal biodiversity. The coastal villages in this area often have a population of less than 5000 people, but annually host around 500.000 tourists a year.

It seems plausible that irrigated agriculture has reached an optimum in Almería and that the continued rise in irrigation over the past decades has led to a reduction in water supply. In the meantime, a new problem is slowly but surely coming into play. According to climate predictions for Spain, there will be an increase in temperature between 0.4 and 0.7 degrees every future decade, whilst the amount of annual rainfall is predicted to drop (Díaz, Weatherhead, Knox & Camacho, 2007). For Almería, the impact will be even greater; southern Spain will be hit harder than the northern part of the country. Due to the increase of average temperature a reduction in available water resources is certain, as will be the rise of the number of days with hot temperatures. Higher temperatures will increase water requirements for crops, and more torrential storms and droughts will appear. According to Díaz et al. (2007), all of these developments add to desertification. Desertification is, however, not an entirely new issue. In the past it already contributed to displacement of populations and to the collapse of large empires (Diamond, 2005). The Almeriense society does, of course, not account for an autonomous empire, but large-scale displacement might be a realistic future image. It remains the question whether the inhabitants of Almería will be in time to adapting their agricultural strategies to the desertification.

3.2 SOCIO-ECONOMIC CHARACTERISTICS

According to the Instituto Nacional de Estadística (INE, 2017), the province of Almería consisted of around 704.300 inhabitants in 2016; a significant increase compared to the

518.200 inhabitants counted in 2000. This is a major increase for a time span of 16 years. There are three main reasons behind this major increase. *First*, the country's export chances improved when Spain joined the European Union in 1986 (EU, 2017; INE, 2017). Combined with, *second*, Almería's plastic greenhouse revolution and, *third*, the influx of cheap foreign labour force from African countries, Almería became much more attractive to its inhabitants, who found investment opportunities within these developments (Werner, 2013). Whilst Almería displayed a negative immigration and population balance until the 1970s, and many farmers left the province to seek for better working circumstances in other parts of Spain, decline turned into growth.

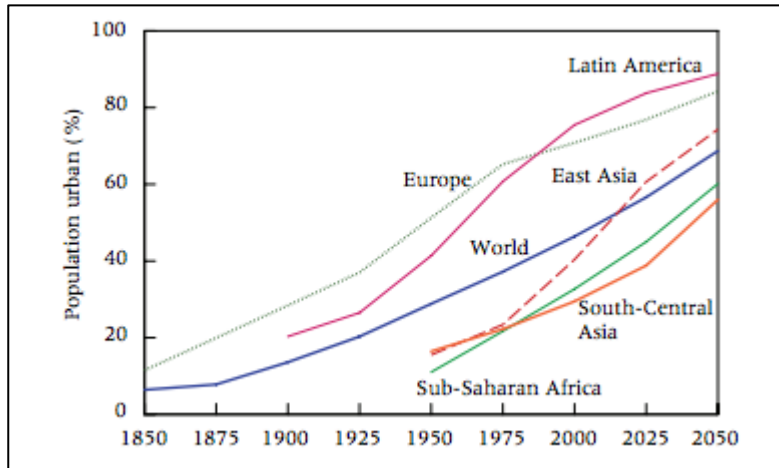
Migration seems an important factor for Almería's population growth. To define what exactly migration is, three different types of migration movements have been formulated by Brauch (2006) as a means of understanding peoples' mobility. The *first* type of migration is 'urbanization', whereby people move from rural to urban livelihoods. The *second* type refers to 'temporary internal displacements', caused by conflicts and natural hazards. The *third* type is a 'permanent North-South migration'. This can be regional, internal or international and may be voluntary (due to pull-factors) or forced (due to push-factors). This permanent North-South migration is often caused by environmental factors such as climate change, water scarcity and soil degradation, making people aim to seek better economic and human well-being.

As this research focuses on farmers and working immigrants on the drylands of Almería, the urbanization-type will first be highlighted to discover the reasons behind moving to urban areas within the province of Almería. Thereafter, information from literature research about working immigrants is collected to understand immigrant's motivations to work on the drylands of Almería, being part of the more permanent, North-South type of migration'.

a. Urbanization

Urbanization is not an entirely new development in human history. As visible in Figure 7, rural-urban migration has occurred many decades ago and is predicted to happen in the future even further.

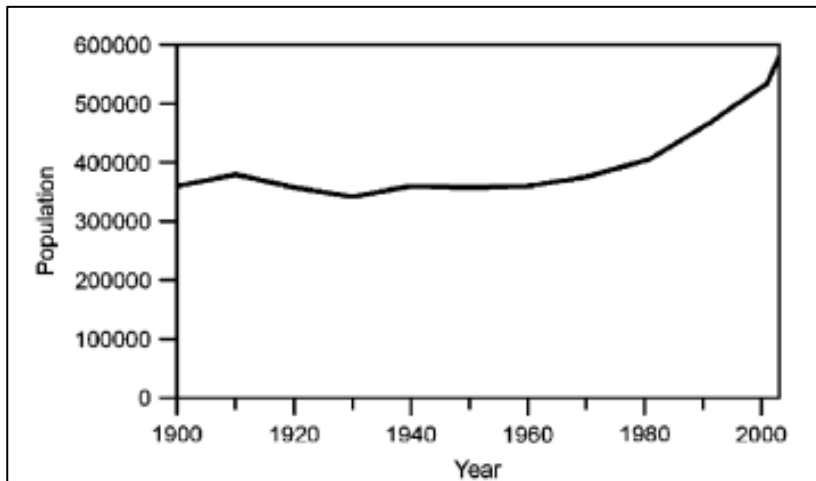
Figure 7: Urbanization for major world regions, 1850–2050: estimates and projections.



Source: Fox (2012).

A study on migration trends in Andalusia, the autonomous community that Almería is part of, describes how economic liberalization and freedom of movement were introduced in 1959 after the restricted labour and migration policies under the Franco Regime (Hoggart, 1997). Andalusians responded to this liberalization by massively moving to economically flourishing places all over Europe. Eventually, in the 1970s, many of those migrants returned to Andalusia but instead of moving back to their home villages, they settled down in Andalusia's main cities. Urbanization continued to be a characteristic of Spain's population trends those years. The main causes for rural-urban movements lay in the job insecurities and low wages within the agricultural sector (Hoggart, 1997). Also today, low wages and job insecurity still prevail in rural areas, even though agricultural productivity and crop yield have increased during the past decades. Despite the fact that the number of farm labourers has decreased by around 5% each year during the 1990s, improvements in agricultural productivity did not improve farm workers' income prospects (Rodero Frangillo & Romero Rodríguez, 1993; Secretaría General de Economía, 2005). In the 1990s, farm workers' incomes had fallen by around 5% a year, even though the Andalusian economy was getting stronger. Unfortunately for the drylands, this growth was focused on the major cities and the littoral. The population number of the province of Almería was increasing during the mid to late 20th century (Figure 8). Nevertheless, this growth was driven by urban growth; rural populations were generally declining (Hoggart, 1997).

Figure 8: Almería's population change 1900–2004.



Source: Instituto Nacional de Estadística (INE) (2017).

The emergence of urbanization leads to a decrease of fertile soil around cities and contributes to desertification. This is an unfortunate and well-known fact to date. Enne, d'Angelo, Madrau and Zucca (2002) state in their article that urbanization is one of the major causes of land degradation in coastal areas in the Mediterranean.

b. Working immigrants

Immigration rates of Spain have risen a sixteen fold between 1975 and 2005 (Brauch, 2006). The share of immigrants has increased from 2.5% up to 11.1% of the entire population. As mentioned earlier, during the 1960s and 1970s Almería lost many dryland inhabitants (Hoggart, 1997; Nadal, 1984). Nevertheless, farm enterprises continued to produce crops intensively and continued to need people to work for their businesses. This demand for workers made the rate of immigrant employment on Almeriense drylands grow (Hoggart & Mendoza, 1999). However, this was not the only reason for the growing demand for immigrants as farm workers. According to a national survey among parents living in rural areas, only a very low percentage of them wanted their children to work on their farms (Navarro, 1999). Instead, many of these parents encouraged their children to leave their home villages and seek jobs anywhere but in the farm business. Hiring immigrant workers from Africa turned out to be satisfying for farmers. As one farmer stated: *'Africans are good workers, and are used to the hard working conditions of farming. Africans have a good physical endurance, so they put up with hard agricultural tasks.'* (Hoggart & Mendoza, 1999). Combine this with their flexible time schedules and the low wages paid to farm workers, and the perfect worker presented itself. This "perfect" work field was, however, not that perfect for the immigrants themselves. Many expected immigrants to follow the path of the Spanish citizens: eventually leaving the drylands. However, their immigrant status and, therefore, the Spanish quota system for immigrant employment inhibited them to leave the region. This quota system set an annual allocation of work permits by province and

economic sector, depending upon trends of employment (Cachón Rodríguez, 1995). The first law that had been regulating immigrant rights in Spain passed in 1985 (Amuedo-Dorantes & De la Rica, 2007). This law had restricted entry criteria for immigrants who hunted for a job in Spain, such as short-lasting work and residence permits. Nevertheless, unskilled jobs have always been demanded within the farming sector (Cachón Rodríguez, 1995).

Spain's political agenda towards migrants has been seriously conditioned since its entrance to the European Union in 1986 (EU, 2017). Since being part of the EU, Spain uses a so-called 'police approach' to immigration (Agrela & Dietz, 2006). This approach reflects pressures at both European and national level: At European level, there is the increasing pressure to strengthen external borders, whilst at national level there is an even stricter approach. Spain's conservative government has introduced a very restrictive immigration law in 2001 (GRECO), which concerns 'security-inspired immigration control'. It is less directed at the integration of immigrants than the former immigration law, which was implemented by a socialist government. In 2000, one year before GRECO, another new comprehensive immigration law was introduced (LODLE), based on a visa system (except for immigrants with an EU-nationality) (LOC, 2015). This policy establishes a visa requirement to enter and to stay in the country for an intended purpose, and requires the necessity of a valid passport or travel document. The visa regime aims at both restricting illegal migration, and at providing for the needs of the Spanish labour market. Nowadays, Almería and Andalusia are used to the presence of immigrants. Castaño, Martínez and Perriáñez (2017) describe the function of Andalusia as following:

'Andalusia is constructed as a frontier for black and Muslim immigrants, as a stage in the journey of the survivors who have managed to cross the Mediterranean, and as a springboard for those incapable of surviving the region's precarious economic conditions, conditions that not only apply to foreign individuals but also to Andalusian-born emigrants.' (pp. 78)

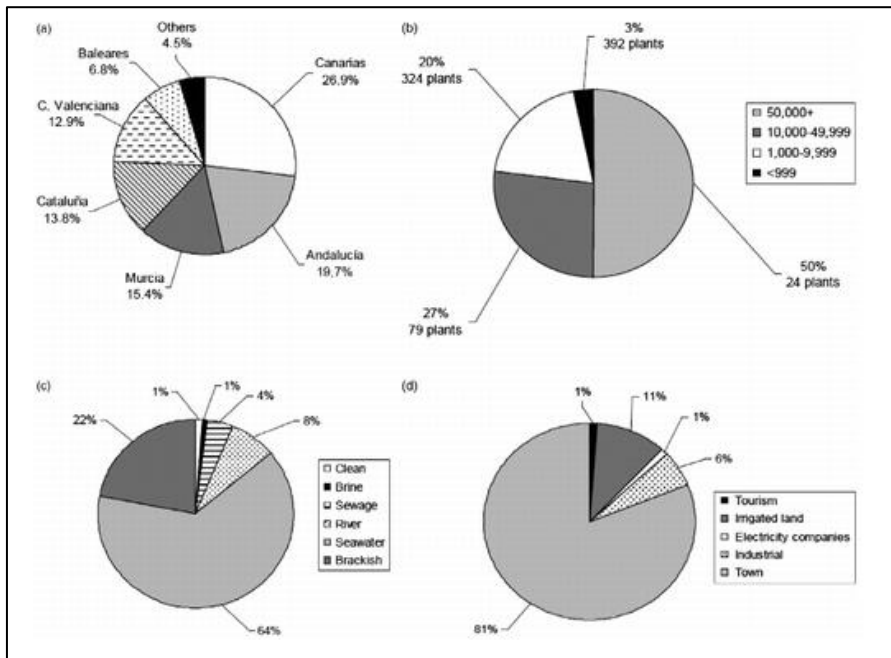
Since many of the immigrants are temporary workers in the agricultural sector, using the job as a way to travel to other European countries, the availability of migrant labour works as a magnet for other immigrants (Galdeano-Gómez et al., 2011). This is what makes the presence of immigrants structural for the Spanish residents of Almería.

3.3 SUSTAINABLE AGRICULTURE

In 2004, the newly elected Spanish government launched a new water policy programme named Programa AGUA (Actuaciones para la Gestión y la Utilización del Agua). Translated in English, this is 'actions for the management and the use of water' (Downward & Taylor, 2007). According to the government, Programa AGUA complied with the EU environmental legislation. Despite the fact that this programme aimed to save water through full-cost recovery, it recognized the need for desalination as well. Desalinating seawater and

pumping it in aquifers afterwards can help regulate water shortages in certain areas (Downward & Taylor, 2007). There were 21 proposed desalination locations, five of which would be located in Almería. Since the adaptation of Programa AGUA the amount of desalination plants has increased in Spain (García-Rubio & Guardiola, 2012). There were 819 desalination plants in operation in Spain in 2008, and in 2009 Spain was the fifth-ranking country by number of desalination plants. Despite all the efforts, the percentage of desalinated water used for agricultural purposes was only 11% compared to 81% for urban supply and a small 6% for industrial use (Figure 9d). The growing urban population and tourism sector are increasingly competing with the agricultural sector for already existing and future water resources (Downward & Taylor, 2007).

Figure 9: Desalination in Spain. (a) percentage of desalinated water per autonomous community, 2009. (b) Installed capacity in Spain by plant size, m³/day, 2008. (c) Installed capacity in Spain by raw water source, 2008. (d) Installed capacity in Spain by type of end user, 2008.



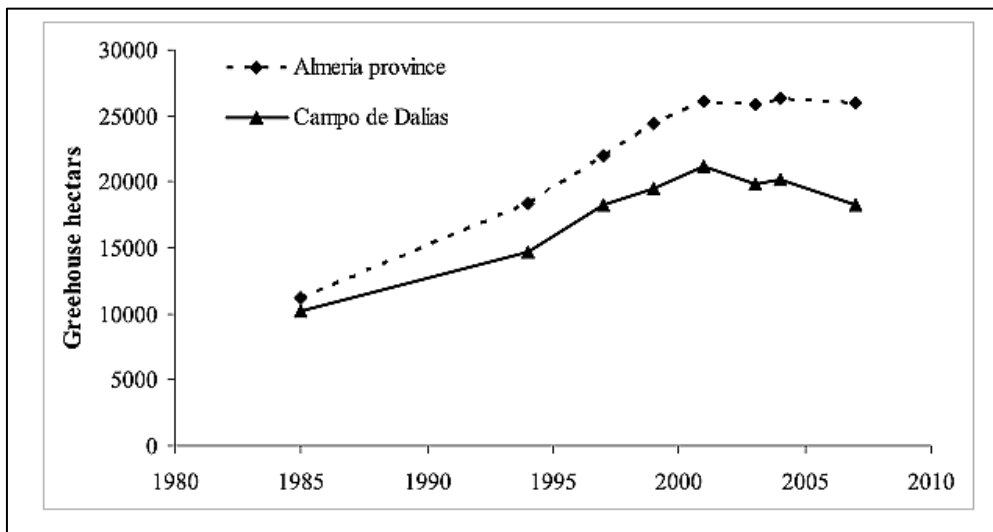
Source: García-Rubio & Guardiola (2012).

It remains difficult to generalise environmental impacts of desalination processes due to the geographical differences between Almeriense aquifers and their water budgets (Downward & Taylor, 2007). Also, the utility of an aquifer depends on its water quality: over-exploitation by pump abstraction may cause significant changes to water chemistry due to salinization. According to Downward and Taylor (2007), farmers have already adapted their crops to suit the water quality of their location in a better way. However, ultimately this will lead to a limitation of the range of crops types that can be grown there, and will influence the ability of the farmers to sell their crops for international compatible prices (Downward & Taylor, 2007; Galdeano-Gómez et al., 2011). There are, however,

environmental impacts of desalination that impossibly can be ignored (García-Rubio & Guardiola, 2012). *First*, salt banks arose near the Spanish coast after the dumping of extracted salt out of seawater. The size of these salt banks differs from dozens to hundreds of metres, and sometimes even to kilometres and affect marine ecosystems. *Second*, the pipes that transport salt water can have leaks that pollute the aquifers. *Third*, the process of desalination requires an enormous amount of energy producing a lot of CO₂ and NO_x.

Spain's national water policy programme seems to have points of improvement on sustainability. Almería is currently Spain's most efficient irrigation province (Galdeano-Gómez et al., 2011). It has an increasing application of water treatment, reuse and recycling techniques and a widespread use of drip irrigation systems. In addition, the area of plastic greenhouses has barely increased since 2000 as the crop productivity and resource efficiency have improved (Figure 10). Almeriense farmers are also more aware of the necessity to keep their environment clean nowadays due to the incorporation of the treatment of pests in crops and biological control techniques. Almería has even become the world's leading area using the Integrated Pest Management (IPM) system what has led to an almost total abolition of chemical remainders. Organic crop production accounted for almost 10% in the entire area in 2013. Furthermore, the effects of erosion by rain and winds have been reduced due to the presence of the greenhouses. Water usage has also improved, since the installation of different structures to harvest and store rainwater by farmers.

Figure 10: The growth of the amount of greenhouse hectares in Almería province and Campo de Dalías from 1980-2010



Source: Campra, Garcia, Canton & Palacios-Orueta (2008).

Another positive impact of the high concentration of horticultural activity in Almería is that it seems to have a positive impact to combating climate change: *first*, CO₂ gets increasingly absorbed by crops reducing its output, and *second*, the whiteness of the plastic cover on the greenhouses reflects radiation what causes a cooling effect (Galdeano-Gómez et al., 2011;

Campra, Garcia, Canton & Palacios-Orueta, 2008) According to the study of Campra et al., the plastic greenhouses have reduced temperatures in the Almería region by 0.75° from 1983 to 2006. Hence, even though the average temperature in southern Spain is predicted to increase in the future due to global warming (Díaz et al., 2007), the development of greenhouses might somehow withhold this.



Chapter 4: Research Methodology and Methods

This Chapter contains the thesis' research question and sub questions. It gives information about the location of the case study and explains the research methods that have been used. The intention of this Chapter is to make a link between the theoretical concepts discussed before and the research questions that have arisen. The first section presents the research question and sub questions. To further specify the research, Section 4.2 shows the operationalization of core concepts. Section 4.3 introduces the specific research locations that were used, followed by the research design and the methods of data collection, which are presented in Section 4.4. Finally, Section 4.5 will deal with some ethical considerations.

4.1 RESEARCH QUESTIONS

The principle research question of this thesis is:

How do different groups of people living on the drylands of Almería adapt to desertification?

To examine how local inhabitants react to desertification, three sub questions were formed. The three sub questions to support this research question are:

1. What are the causes for desertification in the drylands of Almería?
2. What are the population and migration changes on the drylands of Almería?
3. How do different groups of people perceive desertification on the drylands of Almería?

The first sub question aims to find the reasons for Almería becoming a desertified region, which is necessary to understand people's specific adaptations. The second sub question examines changes in population and migration movements within the area, and its possible links to the increased desertification. The third sub question aims at a more in depth exploration of people's perceptions of desertification, since one has to perceive something before being able to adapt to it.

4.2 OPERATIONALIZATION OF CORE CONCEPTS

This research focuses on the drylands of Almería, its local inhabitants, and how they adapt to desertification. As the drylands of Almería cover much area, and the research requires a more specific research region, the Campo de Dalías (also known as ‘the plastic sea’) was chosen. With selecting this area, the type of agriculture was also established: greenhouse farming. The Campo de Dalías has the biggest greenhouse density within Almería. It contains of 22.000 ha of greenhouses in total, and is located to the west of Almería city (Figure 11: orange arrow).

To specify the groups of local inhabitants, two different groups were selected to participate in this research: 1) greenhouse owners, and 2) immigrants involved in greenhouse activities. The choice for two groups derives from the limited time available for fieldwork and the aim to collect enough information on both groups. Despite the fact that there were only three weeks available for the fieldwork, the aim was to approach as many potential participants as possible. These two particular groups were chosen, because greenhouse owners and immigrant workers are both forced to deal with desertification in agricultural practices. The two groups nevertheless have a different perspective and perception to the desertification that is occurring right before their eyes. Farm owners have the need and responsibility to adapt their farm, where immigrants might be more passive. During the fieldwork it turned out to be difficult to get in touch with farm owners of smaller agricultural companies. In the end only four farmers of very big companies were surveyed.

The aim of the research is to eventually compare the different livelihood assets and strategies of both groups in the conclusion of this study. By comparing these, both the interfaces and barriers will be presented, and possible solutions that meet the interests of both groups might be found.

4.3 RESEARCH LOCATIONS

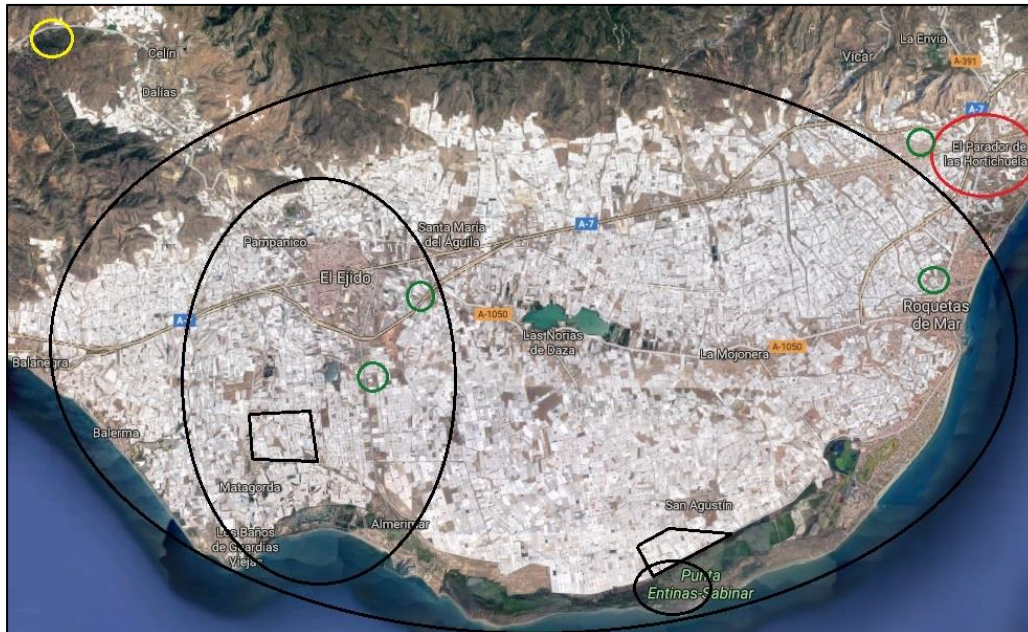
The specific research locations for this thesis were, as mentioned above, all situated in the Campo de Dalías (Figure 11 & 12).

Figure 11: The province of Almería, Spain with the orange arrow pointing at the Campo de Dalías (the plastic sea) and the red arrow at the university of Almería.



Source: Google Maps (2017).

Figure 12: Overview of the research locations in the Campo de Dalías.



Source: Google Maps (2017).

I stayed in El Pardor de las Hortichuelas (Figure 12: red circle), a small town from where I hired a bike or took busses to the different interview locations. For only one day I had a car at my disposal and two people took me to a remote inhabited area of small plastic houses

built by Moroccan immigrants (Figure 12: yellow circle). The black lines in Figure 12 encircle the areas in which the greenhouses of the four surveyed farmers are located. The green circles surround the locations of the four farmers' offices (Farm owners 1-4, 2017). The University of Almería and its research greenhouse are located just a little east from Almería city (Figure 11: red arrow).

4.4 METHODS OF DATA COLLECTION

The broad character of the research questions, connecting processes of desertification and migration to understanding adaption strategies of farmers and immigrant workers, required a descriptive nature of the research; mainly qualitative methods were used to collect data. These qualitative methods include semi-structured interviews, observation and photography. In depth interviews were held with three university professors who already had done much research on ground water, greenhouses, and migration, as well as with one respondent from a socialistic organization supporting immigrant workers. I also interviewed, three Moroccan greenhouses workers. Finally, four farm owners responded to a survey. This survey was fairly modest in size because of the limited amount of time in the busy schedules of the farm owners. The survey was at first intended to collect quantitative data. However, as the farm owners added information to their answers by talking, I would call these surveys semi-quantitative.

The surveys were prepared in English and Spanish and both languages were used when interviewing the farm owners. In my preparations to interview immigrant workers, I had surveys written in English, Spanish, French as well as Arabic. When the Moroccan migrant workers were interviewed it, however, appeared to be easier to ask them questions rather than using the survey, as two of them could not read and write properly and the third one preferred to talk much.

Next to the sources mentioned above, I spoke to many residents during the fieldwork. Spanish residents like my Airbnb landlord, but also with immigrants whom I met at different sites in the Campo de Dalías. When this study names 'Spanish inhabitants', the native Spanish population is meant. Furthermore, the professor who guided me along the university greenhouses provided me with very useful information as well.

Picture 1: Interviewing the three Moroccan immigrants in their residential area.



Source: Eline van Oosterhout (2017).

An overview of the respondents and used methods is presented in Table 1. The method that was used first was having semi-structured interviews with individuals from both groups. The semi-structured method was chosen for a number of reasons: *first*, it is necessary for the research that several topics are being discussed, such as the respondent's experience with and view on desertification, sustainability, conflicts, violence and poverty in the area. *Second*, due to the uncertainty of speaking the same languages sufficiently and understanding the respondents, the interviews should be structured somehow beforehand.

The other two methods were observation and photography. Observation defines walking, cycling and driving around on the drylands and in some of the towns and villages located in the Campo de Dalías, and looking at people and adjustments to the desertification that already had been made. Photography was an excellent addition to his method, as it was used for making pictures of notable curiosities and visible confirmations of what I had read in academic literature.

The first university professor I interviewed was a geologist, the second was a specialist in plant production and greenhouses in the province of Almería and the third was a human geographer with excellent knowledge on immigration and social security. Those three conversations were enormously helpful to get a more complete view of the problems and developments for this research. The interview with an employee from the socialistic organisation SOC-SAT (Picture 2) in Almería was enormously helpful. She shared, with the help of a German girl who translated some difficult Spanish words in English, her views on the relation between African immigrants and Spanish farm owners and on desertification in this area.

Picture 2: The painted wall in front of the SOC-SAT office ('Bread, work, roof, dignity').



Source: Eline van Oosterhout (2017).

Table 1: Overview of respondents

Interview 1	Antonio Pulido Bosch, geologist	04-09-2017, University of Almería
Interview 2	Louisa Gallardo Pino, agronomist	05-09-2017, University of Almería
Interview 3	Pablo Pumares Fernández, human geographer	07-09-2017, University of Almería
Interview 4	Maria Rodriguez	20-09-2017, SOC-SAT organization
Interview 5	3 anonymous Moroccan immigrants	15-09-2017, just outside the Campo de Dalías
Survey 1	Anonymous farm owner	09-09-2017, El Parador de las Hortichuelas
Survey 2	Anonymous farm owner	15-09-2017, El Ejido
Survey 3	Anonymous farm owner	15-09-2017, El Ejido
Survey 4	Anonymous farm owner	15-09-2017, Roquetas de Mar

Source: Eline van Oosterhout (2017).

4.5 ETHICAL CONSIDERATIONS

All participants of the two groups were told from the beginning, that the results would be fully anonymous. They were not obliged to write down or tell their names and all had the

freedom to stop the interviews whenever they would feel uncomfortable. Nevertheless, all four farm owners cooperated fully, albeit within a limited amount of time: approximately 10 minutes each. None of the companies had responded to the e-mails that I sent before I went to Almería to do my fieldwork, so I decided to try talking to the companies directly face-to-face. All companies had an office where I first explained the purpose of my research to their secretaries, and where I introduced myself briefly. After my introduction I always asked the secretary if I could speak to the *jefe* (boss) or *gerente* (manager) of the company. Altogether I tried 15 companies, of which 4 were willing to speak to me. Another notable ethical consideration is the choice of using data from “unofficial” conversations. Since these people are probably not aware of the fact that their words and information are sporadically used in this research, their names are omitted.

I noticed myself acting very polite when entering the offices of those big company buildings and when asking the secretary this favour. The transformation occurred automatically, without premeditation. Naturally, I did the same at the University of Almería and the SOC-SAT organization, but to a lesser extent, as the atmosphere was more informal.

The three Moroccan immigrants, who were hanging around their self-build plastic houses and plastic garages for their very old cars, lived quite far away from towns and from greenhouses they worked in. They were very willing to talk to me and to show their houses. They had much more time to share than the farm owners, as they were unemployed at that moment. It seemed that they were even relieved that someone from the outside showed interest in their situation. Before I went to Almería, the aim was to speak with more working immigrants, but this turned out to be much harder than imagined. Many of the Sub Saharan immigrants hung out on the streets in the towns, but seemed to be busy all the time. They were cycling, moving, or calling someone on the phone. Several times it was possible to have a short conversation with someone, but none of those times he or she worked in a greenhouse. Besides, several times I felt the urge to speak to someone in the streets but ethics withhold me from it. I thought that maybe this person would feel generalized or even discriminated in some way, by assuming that he or she works in a greenhouse when starting our conversation. It made me feel that working in green houses seems to be at the bottom of the hierarchy of jobs for migrants, which my Airbnb landlord confirmed by saying that he and his friends would never work there. On top of the fact that going to the slums where many immigrants live all by myself would be not such a good idea, I decided to go to the socialistic organization SOC-SAT to gather more information about the immigrants.

Because my research is interdisciplinary (combining desertification, agriculture, sustainability and immigration), and because I talked to many different people from different backgrounds and disciplines, I adapted to people I spoke to in different ways. Every time I interviewed or spoke with someone, I directed the explanation about my research to the discipline they worked in. So, when I spoke to the farm owners, I specified

my little speech on desertification, agriculture and sustainability, and when I talked to the SOC-SAT organization, I focused the speech on agriculture and immigration.



Chapter 5: Conflicts, Violence and Poverty

This Chapter presents the well-being, vulnerability and conflicts concerning greenhouse workers and agricultural company owners. At first, plan was to seek how individuals from the two different groups develop and co-exist according to the Dryland Livelihood Paradigm, but this paradigm happened to be less suitable for individuals as thought beforehand. The DLP provides fine information for whole populations and entire groups of people, but to define individuals' (indirect and direct) adaptation strategies to the desertification, the Sustainable Livelihood Framework happened to be more qualified. This because the livelihood assets and strategies of people differ so much that it should be incorrect to generalise the adaptations of a whole society in order to follow their general path on the DLP. Therefore the two main directions that can be followed in the DLP (the direction of low human well-being and the direction of ingenuity and adaptation) are used to get an overview of the two groups (working immigrants and farm owners) in Chapter 5 and Chapter 6. The SLF will be integrated in Chapter 7 for a more individual view on livelihood assets and strategies due to vulnerability and well-being.

5.1 DIFFERENTIATIONS BETWEEN WORKERS' NATIONALITIES

Bonds between immigrants with the same nationality in the Campo de Dalías are strong (Pumares, 2017). The greenhouse workers in this area can be generally distinguished in three groups: *first* there are Spanish workers, *second* there are eastern European workers, and *third* there are African workers (Pumares, 2017; Farm owners 1-4, 2017). Latin Americans also came to Spain in the hope of a better life and still live and work in the Campo de Dalías (Pumares, 2017), but this group seems to be smaller in the greenhouse sectors. Just like Latin Americans, for gypsies (who also live and work in the Campo de Dalías (Pumares, Personal communication, 2017)) the same applies; the four interviewed company owners did not mention any of those two groups as their employees. Now, there has to be taken into consideration that only four farm owners got surveyed, but stated can be that the groups of Latin Americans and gypsies are relatively smaller. Bigger agricultural companies need a lot of workers to keep their business going (Pumares, 2017). Despite the fact that Spanish people work for agricultural companies as well, the second

and third group are bigger (Pumares, Personal communication, 2017). As one interviewed company owner mentioned: *“During the summer the temperature in the greenhouses can become 50 to 60 degrees Celsius. Spanish people do not want to work here.”* (Company owner 2, 2017). The fact that he excludes the other workers in this statement means one of the two following options: *one*, he truly believes that immigrants do like working in those hot circumstances during summer, or *two*, the emotions of immigrant workers from Africa and eastern Europe do not even cross his mind. As the greenhouses are also referred to as the ‘white hell’ by its workers according to SOC-SAT (2017), it seems to be a miserable place for all of those who are inside. This term was developed not only because of the immense temperatures the inside of a greenhouse can reach, but also due to the often-poor labour conditions (See: 4.3a).

Eastern European greenhouse workers are most often Bulgarian or Romanian. Generally, this immigrant group is accepted the most by Spaniards in the Campo de Dalías, due to the belief that their working qualifications would be better, and they would integrate faster than Africans (SOC-SAT, 2017). This faster integration process is caused by having a similar culture to the Spanish one and, mainly for Romanians, the ability to learn Spanish faster. Especially Romanians got to work in the construction sector very soon because of their qualifications (construction work earns much more money than agricultural work), and some of them even created their own small enterprises after a while (Pumares, 2017). Naturally, eastern European immigrants are not the only workers that shift to other sectors; only they do comprise the biggest group. However, when the economic crisis hit Spain in 2008, the construction sector almost disappeared. It was the most affected sector with a loss of 2/3 of its labour force. Some people moved to other parts of Spain or even other countries hoping to find work, but the situation was more or less the same in entire Spain. People returned to Almería in response, but there were too many people for too few jobs (SOC-SAT, 2017). Certainly, the crisis did not only hit eastern European or Spanish people; also the African workers got hit and returned to Almería. The African group can be distinguished in two main groups (though the eyes of the Spaniards): the Moroccans and the Sub Saharan Africans. Spain used to invite many Moroccan people to Spain in the 80s and 90s to work as seasonal employees in the agricultural sector (SOC-SAT, 2017). Eventually, many of those seasonal workers decided to stay in Spain and over the years they built up stable social networks with each other. Besides, Moroccans have had a long history in Spain. As Maria Rodriguez from SOC-SAT describes:

“Arabic is intertwined in the Spanish language, buildings, food. Especially in this area, in South Spain, the Arabs have lived for a long time. Therefore, Moroccan people want to have a higher position than other immigrants. They demand it, they even fight for it.”

However, Spaniards generally do not like the Moroccans. For example, people with a Moroccan background sometimes tend to use quite different customs than Spaniards do and vice versa, which makes it more difficult to come to working agreements. Sub Saharan

immigrants mostly consist of countries such as Senegal and Guinea-Bissau (Pumares, 2017), and are usually better accepted in Spain than Moroccans (SOC-SAT, 2017). However, despite popular belief of acceptance, social interaction between native Spanish people and immigrants shows that acceptance levels are mainly imaginary. Maria Rodrigues (SOC-SAT, 2017) came up with the example of neighbourhood parties; when such parties are being organized, the entire neighbourhood is, in principle, invited. Yet everybody is silently aware that the immigrant residents of the neighbourhood are not welcome and therefore they avoid appearing on such occasions. Immigrants with different nationalities do not mix much either; they mostly form their own small societies which have narrow bonds (Pumares, 2017). Picture 3 shows some immigrants with different nationalities.

Picture 3: People with different nationalities at a local market in El Ejido.



Source: Eline van Oosterhout (2017).

5.2 DIFFERENTIATIONS WITHIN THE AGRICULTURAL COMPANIES

In order to distinguish the size varieties of companies and their different kinds of employment contracts, this Section *first* describes the variations within agricultural companies (small and big) and *second* it distinguishes contracts for greenhouse workers (regular or peak).

a. Small and big companies

As the economic crisis affected the greenhouse workers in 2008, the amount of farmers in the Campo de Dalías approximately remained the same (Pumares, 2017). The agricultural

business was not affected that much; savings from their customers who had less to spend on fruits and vegetables had the greatest impact.

The agricultural greenhouse companies in the Campo de Dalías differ between small family business, enormous companies and everything in between. The first expansion of the greenhouses in the 1960s was a result of Franco's regime: he decided to give unfertile land to Spanish people so that Spain could feed itself (Pumares, 2017). Many people therefore moved to the Campo de Dalías and started farming. Until the 1980s, only small family businesses existed, but since that period the traditional family companies started to expand (Lorca, 2011; Pumares, 2017). This second expansion was based on two main factors: the possibility to save water, and the expectation to enter the European economic community (Colectivo IOE, 1987; Pumares, 2017). Eventually Spain entered in 1986, although with some restrictions until the early 1990s (EU, 2017; Pumares, 2017). For the expansion, farmers started to need the helping hand of employees. Before the 1980s, a normal procedure for families and land owners who owned more land than their own family could manage was to outsource their remaining land to other families, called *medianeros* (Pumares, 2017; University greenhouse researcher, 2017). These medianeros would receive half of the profits and had a secure and stable job. After a few decades (during the 1980s) the land owning families finally started to receive the benefits of their hard work:

“They started to have savings, to have a better level of living and the children could follow their studies and they did not work so much in the property. Some of them started to buy another hectare, which made the family not enough to manage the farm by themselves. They needed salary workers.”(Pumares, 2017)

From this moment on, Medianeros were not sufficient enough for all the work on the expanding landed estate, and foreign workers were demanded to work in agricultural businesses too. This demand was the beginning of an inflow movement of mainly Moroccan workers (Pumares, 2017). An important notification is that Almería never really passed a proper industrial age. The transition from an agricultural to a service economy happened so suddenly that labour relations were either too traditional or too modern. This meant that good working conditions in the greenhouses were lacking and salaries were low. As they did not really pass the industrial age, farm owners were not used to salary systems. Nowadays, social and labour relations often differ depending the size of a company: small family businesses generally have good social relations with their workers, but their work conditions are worse. Big companies' social relations are often worse than their work conditions (SOC-SAT, 2017). As mentioned before, the amount of farm owners more or less remained the same (Pumares, 2017). According to three out of the four surveyed farm owners, people still stay in the Campo de Dalías to work. Few people seem to leave the area, and more arrive to create businesses or find a job in the agricultural sector (Farm owner 1-4, 2017).

b. Regular and peak workers

There are two kinds of workers: peak workers (*eventuales*) and regular workers (Pumares, 2017). Regular workers are far more secure; they work almost every month of the year, and a good change of contract extension for subsequent years. A regular worker gets paid frequently, and receives a normal contract. Peak workers are less secure than regular ones. These *eventuales* are only needed at certain times during the year (for harvesting and planting), and mostly only for a couple of days. Farm owners often refuse to make contracts for such short periods. Due to the fact that peak workers only work several short times a year, the six-month target that is developed by the Spanish government is hard to reach. The government implemented this target for foreigners who want to receive a legal status, and at least at the first years of their stay they need to reach this (Pumares, 2017; GAO, 2006). Unfortunately for the *eventuales*, greenhouse owners do generally not reckon the amount of days someone has already worked that year; when they need peak workers, they often hire the first willing person they run into. Working without contracts and security makes this organization amendable.

Another lack of organization has arisen due to the amount of companies in the entire province of Almería: around 26.000 in total, differing between small family business and gigantic companies (Pumares, 2017). In Almería there are so many farmers that the distribution of wealth is tremendously divided. This, combined with the fact that Campo de Dalías is an area where many different crops (all desirous for different treatments) are cultivated, led to the current absence of proper organization within the agricultural sector.

5.3 TEMPORARY LABOUR CONDITIONS FOR GREENHOUSE WORKERS

This Section aims to set out the labour situation and labour control systems within greenhouses. It discusses the physical conditions in greenhouses as well as the existence of poverty among the greenhouse workers.

a. Physical conditions in greenhouses

As mentioned before, many greenhouse workers refer to the greenhouses as the ‘white hell’, partly because of its hot temperatures. Of course, the labour conditions within greenhouses vary. There have, however, been complaints about the bad labour conditions in some of the greenhouses; for example, there is yelling as a form of violence from bosses to workers, sometimes all day long (SOC-SAT, 2017). Moreover, facilities in the greenhouses are frequently absent. Workers have to walk outside if they feel the need to go, or decide not to go at all. Especially for women, who account for about 20% of the greenhouse workers, this is miserable during their periods (SOC-SAT, 2017). It happens quite often that bosses count the amount of times their employees use the toilet and subtract these from their wages. Farm owners easily fire their workers, since it is quite easy for the owners to find and hire

new workers (SOC-SAT, 2017). This makes employees feel very replaceable and anxious to end up without money. As visible in Picture 4 and 5, many immigrants wonder around the greenhouses, eager to find a job. Farm owners have to perform minimal effort to replace a fired worker. The situation is, however, slowly changing. According to Pablo Pumares (2017), due to the economic recovery of the area and Spain in general, farmers are starting to experience more difficulties in finding (especially peak) workers. Sectors like the construction sector recover, which results in fewer people left for the agricultural sector than at the beginning of the economic crisis in 2008.

Pictures 4 & 5: African immigrants wondering around greenhouses.



Source: Eline van Oosterhout (2017).

However, confirmation of bad working conditions comes directly from the three interviewed Moroccans (2017). Their reactions to the question if they could describe working in a greenhouse differ from “*I don’t like it. The climate is not friendly and bad for the people who work in the greenhouses. It is the worst work.*” to “*We have no rights here. The price of the tomatoes is the most important thing.*” and “*There is not much security.*”.

The latter reaction points out a big reason for the bad working conditions. Pablo Pumares (2017) explained the problem of controlling the hours that farm owners fill in for their workers:

“There is control, but it’s difficult to control because there are many tricks to cheat. Some of them declare less hours, so when an inspector comes they just show them the hours they filled in. The inspectors can stay for the whole day, but yeah. It is difficult.”

The fact that there are so many greenhouses in the Campo de Dalías makes it extremely difficult to keep an eye on all actions in every greenhouse.

Besides, not only do the greenhouse workers have to work *in* the greenhouses; sometimes they are also needed *on top* of them (Picture 6). As visible, three men are spraying white paint on top of a greenhouse. Apparently, the sun in this area is so intense and so plentiful

with 6000 sun hours a year that this heat negatively affects the crops (Pulido, 2017). The white paint increases the greenhouses' albedo in order to decrease the strength of the sun (Campra et al., 2014). Altogether, the greenhouses in the Campo de Dalías have such powerful impact that the region's temperature gets to be reduced (Campra et al., 2008; Galdeano-Gómez et al., 2011). This work includes risks. *First*, the men are not wearing any kind of protection against breathing in the paint, and *second*, according to an anonymous native Spanish respondent (2017), the change of falling through the roof is real. This is yet another example of bad organization of working conditions for greenhouse workers.

Picture 6: Three greenhouse workers spraying white paint on top of a greenhouse.



Source: Eline van Oosterhout (2017).

b. It's all about the money

Since regular workers earn more money during the year than *eventuales*, they have more social security (Pumares, 2017). Regular workers receive their salary on a regular basis, which makes them able to afford proper housing and sometimes even save some money for the long-term. Unfortunately for peak workers, they are not sure about being able to finance a house, clothes or food. Good examples are the three surveyed Moroccan workers at their plastic self-built houses far away from urban areas: they miss a stable job, and money for food, clean water, and proper housing is absent (Picture 7 & 8). The fact that some immigrants are not able to meet their basic needs due to a lack of money makes their poverty absolute. According to SOC-SAT (2017), mainly younger immigrants tend to leave Almería to seek a better life in 'the promised land of northern Europe'. Almería remains a transition place for many immigrants. This does, naturally, not account for all: Immigrant 3 (2017) has lived in his plastic house for fifteen years already (Picture 8).

Picture 7 & 8: Not enough money for food and proper housing.



Source: Eline van Oosterhout (2017).

Only one of the four surveyed farm owners conceded the existence of poor people in the Campo de Dalías, of which he believed the majority to be illegal (Farm owner 3, 2017). Striking is the fact that three out of the four surveyed farm owners stated that poverty is absent. One farm owner stated that ‘agriculture is profitable and generates wealth’ (Farm owner 2, 2017). He could have been talking exclusively about the company owners without including other groups such as greenhouse workers. Another possibility is that the three owners did not want to admit the clearly visible existence of poverty in the area to protect their own businesses from being accused of poverty contribution. As Pumares (2017) noted, farmers minimally have to pay their greenhouse workers around six Euros per hour. Nonetheless, the reality often turns out to be that they pay them less, or write down less work hours (See: 4.3a). By denying the presence of poverty as if they do not notice any within their company or outside, they save themselves from accusation. Interestingly, farm owners happen to feel insecure on their own property sometimes, as some immigrants live in slums between greenhouses (Pumares, 2017). This somehow indicates the status of social relations between farm owners and immigrant workers and shows the awareness of farm owners on the existence of slums for poorer people.

5.4 CONFLICTS AND VIOLENCE IN THE CAMPO DE DALÍAS

Bonds between people with the same ethnicity are strong in the Campo de Dalías (See: 4.1). They help each other, and not only with labour relations related subjects (Pumares, 2017). For example, a Senegalese association in Roquetas de Mar was set up due to the need of evacuating deceased Senegalese back to Senegal. People were able to share the costs. Such needs and events make the communities very strong. There is not much contact between communities of different nationalities and only little violence (Personal communication, Pumares, 2017). However, there is a form of tension between Moroccans, Sub Saharans and gypsies, and in 2008 there even was a murder on a 28-year old Senegalese man, executed by a gypsy (Pumares, Personal communication, 2017; Lirola, 2014). The man would have tried to intervene in a clash between Roma (gypsy) and Senegalese families in Roquetas de Mar, was not appreciated. Clashes between different communities are mainly about job concurrence (Pumares, Personal communication, 2017). Nevertheless, an event as extreme as the one in 2008 remains exceptional.

Conflicts between farm owners and immigrant workers often concern bad work conditions and disagreements on the amount of work hours (Pumares, 2017). In the year 2000 such disagreements led to a big unfortunate conflict in one of the main towns in the Campo de Dalías: El Ejido. It obscured Almería's status, and put it on the map as bad example of social relations and exploitation of workers (Pumares, 2017). What happened was that the atmosphere in the Campo de Dalías was tense due to, among other things, immigrants' ideas of being treated unfairly and that they should earn more money. Also, farm owners were insecure about the market prices and their dependence on immigrant labour (Pumares, 2017). This eventually escalated in murder on two farmers, executed by one Moroccan man (ostensibly in self-defence) (Gertel & Sippel, 2014). Many demonstrations were organized as reaction, and only two weeks after the murder, a (apparently mentally disturbed) Moroccan man murdered a 22-year old girl at a local market in El Ejido. This unleashed many xenophobic and racist demonstrations and attacks (Pumares, 2017; SOC-SAT, 2017; Gertel & Sippel, 2014; Torns, 2000). Spaniards started to destroy the property and belongings of Moroccans, and at one point a group of youths entered a mosque in which they stole money and urinated on the Koran. The immigrants' response of the conflicts in El Ejido was to call an indefinite strike in order to demand new housing for the homeless-made people, the legalization of workers without permits, and compensation for the damage (Torns, 2000). The strike lasted for one week, after which the central and regional government agreed to the demands. However, the local government remained indifferent concerning the situation. After the events in El Ejido, only a third of the Moroccan workers got to work in the agricultural sector in the area; the rest was replaced by eastern Europeans, Sub Saharans and Latin Americans (Gertel & Sippel, 2014). Since the Spanish local government decided to pay less attention to immigrants and their problems, only one immigration-focused governmental office is left in the Campo de Dalías nowadays (SOC-SAT, 2017).

Similar to the fact that three of the four farm owners claimed not to be aware of poverty in the Campo de Dalías, even four out of four farmers were of the opinion that conflicts are a non-existing matter. *‘Everything is peaceful.’*, Farm owner 2 (2017) argued. The same accounts for their vision on violence: all four owners believed in its absence. According to Farmer 2, *‘Communities are being respected’*. As evidenced, these statements are not based on facts. Even nowadays, conflicts and violence are part of the relationship between Spaniards and immigrants (Immigrant 1-3, 2017). A good example of (mental) violence is one from SOC-SAT (2017):

“Lately, we were distributing flyers at a gas station here in this area and we gave some flyers to immigrants there. Their boss was there too and shouted that their workers immediately had to let go of the flyers. As petrified of fear all the immigrants let their flyer fall out of their hands on the ground, really like we were watching this movie. Very alienating and scary to see.”

Hence, the proof of violence and conflicts did not fade since the escalation in 2000, despite the fact that the four farm owners (and probably many more) deny this. Nevertheless, only farm owners of big agricultural companies were surveyed; smaller farms’ statements might differ.

5.5 INFLUENCE OF EXTERNAL ACTORS ON LABOUR RELATIONS

There are several actors that influence the relations between farm owners and immigrants today. *First* there is pressure from European crop importers on cooperatives formed by big agricultural companies. Half of the production in the Campo de Dalías is being exported to other, mainly European countries (Pumares, 2017). These exports are in the hands of a few big distributor companies in (among others) French, Swiss and Germany, which dominate the crop prices. The European distributors also execute power on labour and environmental conditions within the Spanish companies they buy crops from. Since Spanish companies got visited by European companies’ inspectors to control the arrangements, the Spanish began to complain about their different wishes and formula (for example of how products should be packed), and decided to organize themselves in very well prepared cooperatives that take care of the wishes of the distributors together. The European companies control labour relations, but this often turns out to be rather difficult (See: 5.3a). The University of Almería also collaborates with some Swiss distributors in order to improve social conditions within Spanish agricultural companies (Pumares, 2017). In return for their improved labour practices, the Spanish companies receive good publicity in Europe, as European distributors promise to put them as examples of good practices. Cooperatives get progressively conscious about labour relations this way.

Second, socialist syndicates give advice to immigrants. They aim to strengthen

consciousness on their rights in Spain and within their work sectors. Immigrants are welcome to visit the offices to gather information during the special information hours, or they can be addressed by syndicate members on the streets (SOC-SAT, 2017). Moreover, there are organized Spanish classes they can follow, and they receive information about the 'collective agreement'. The collective agreement is the result of a negotiation between two groups: the representatives of the workers (the syndicates), and the representatives of the agricultural companies. These two groups have come to an agreement that concerns 1) the '*manipulado*' (the buildings where fruits and vegetables are being packed) and 2) the '*convenio del campo*' (the entire land that is used for agriculture, e.g. olive tree fields and greenhouses), in order to create certain rules and therefore secure the workers' labour situation (SOC-SAT, 2017). After the one-week strike following the conflicts in El Ejido in 2000 (See: 5.4), the syndicates have agreed to monitor the correct operation of the collective agreement in the area (Torns, 2000). They sometimes organize strikes too, as instrument for immigrants to obtain better results out of the agreement when a company lacks the agreement's regulation (SOC-SAT, 2017). Strikes can be organized by a syndicate or by dissatisfied workers themselves, yet mostly with support of a syndicate. Altogether, the presence of immigrant workers has made the area much more formal than before (Pumares, 2017); there is pressure from immigrants to get contracts and papers, since they desire to get a legal status, and sectors like the agricultural sector have adapted to this pressure to some extent.

Third, the Spanish government should be an important actor in the farmer-workers relationship as well. The local government decided to pay less attention to immigrants in response to the conflict in El Ejido in 2000 (See: 5.4). Furthermore, Maria Rodriguez (2017) from the SOC-SAT organization mentioned a rather shocking current situation in El Ejido:

"There is a place in El Ejido where immigrants live with children and babies but without clean drinking water. This situation is very concerning, but somehow the government ignores this."

The exact reason for the local government's ignorance is unclear, but there might be a possible explanation. According to Pumares (Personal communication, 2017), the Spanish local government acts from a belief of equal access of social services to all residents, but without including special needs that certain groups like vulnerable immigrants need. The government has many constraints, particularly concerning housing. As housing policies are very weak and currently one of the biggest problems in Spain (Pumares, Personal communication, 2017; Akin et al., 2014), the government would make itself rather unpopular by giving special attention and help to housing for immigrants, especially if the immigrants are in an irregular situation.



Chapter 6: Adaptations to Sustainable Agriculture

This Chapter contains research results on the sustainability of the agricultural sector in the Campo de Dalías. As Chapter 5 was exploring the DLP's potential pathway to poverty, conflict and violence, this Chapter investigates the other potential pathway: the one to ingenuity and sustainable adaptations. This is done by examining early changes and adaptations in Section 6.1, explaining the different kinds of adaptations executed by farmers in the area in Section 6.2, and analysing the influence of external actors in order to make the greenhouses in the Campo de Dalías increasingly sustainable in Section 6.3.

6.1 CHANGES SINCE THE 1980s

The greenhouses in the Campo de Dalías experienced their second expansion during the 1980s (See: 5.2a). Farmers started to become conscious about water problems in Almería (Pumares, 2017), and according to Pulido (2017), working technicians in the area then already emphasized the unsustainability of the agricultural sector. The belief that water could be provided at any required volume any time was part of the 'pump-for-profit' culture. However, when farm owners came to worry about water decrease, they rapidly changed their irrigation system (in just a few years) from the traditional way of floating the greenhouse to the much more water-efficient drip irrigation system (Pumares, 2017; Pulido, 2017). By way of illustration: in 1977 the Campo de Dalías' area of greenhouses consisted of 9.000 ha. In 2017, this area is expanded to 22.000 ha (Pulido, 2017). Surprisingly, the amount of water used for irrigation has not changed since then, which means the system of drip irrigation has proved itself to be very efficient (Pulido, 2017; Galdeano-Gómez et al., 2011). Antonio Pulido (2017) is very positive about the current agricultural organization in Almería:

“The organization of the system of agricultural products is very good, probably one of the best in the world. We have a lot of Chinese people studying here, probably eager to learn about the water efficiency and how to improve agricultural activities. If you look at ways to

increase the production with a less quantity of water, people are good at it in Almeria.”

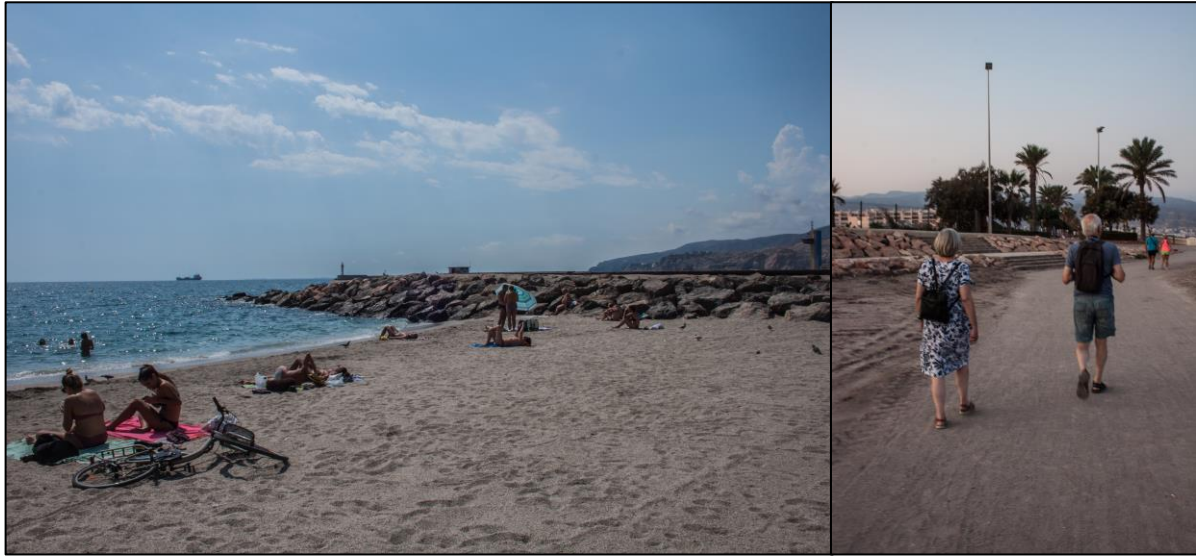
Despite the fact that several positive developments have been executed in order to improve the Campo de Dalías’ sustainability, Louisa Gallardo (2017) from the Almería University disagrees to the question whether Almería belongs to the most sustainable agricultural systems in the world:

“I still think that there are lot of possibilities to improve, but it’s not there yet. The thing is that there are different kinds of scientists and each one has different ideas. I think it’s good and people work very hard, but in relation to the use of nutrients there are many things that can be done to improve.”

Indeed, the area has more agricultural problems than water shortages; nutrients, such as nitrogen, cause trouble too (See: 6.2 & 6.3). However, a main water issue is the increasing salinity of this water. During the last fifteen years the salinity in the Campo de Dalías has increased enormously (Gallardo, 2017). Underneath the Campo de Dalías, there are two main aquifers: Felix and Gádor (Pulido, 2017). At first, farmers only used water from Felix. Due to the big demand for water, Felix got overused and Gádor became the new water provider. Unfortunately, the pipes between Felix and Gádor were not cemented, which made Gádor’s water (with a much higher hydraulic load) move to Felix. After several years, a ‘shower’ effect caused the water to fall back into Gádor (Pulido, 2017). The water quality had, however, already declined by then as trapped salt water from 6 million years ago intruded Felix during its period of overusing. As Felix’ water fell down into Gádor, Gádor’s water increased in salinity as well. Despite this, the immemorial trapped water does not influence the water quality solely; as the piezometric level became lower than the seawater level due to the amount of pumping, seawater intrusion increased the aquifers’ salinity as well (Pulido, 2017). This inescapable increase in salinity affects the farmers’ crops in an unfortunate way. Crops do not handle salinity on the long-term, except for tomatoes (Pulido, 2017; Pumares, 2017). The quality of other crops does decline, and eventually this leads to a limited range of crops types that can be grown. These are some of the main reasons for farm owners to become more conscious about sustainable farming.

The impact of tourism on water use in the area does not seem to be of significant importance, as the university professors did not mention this subject much while discussing sustainability. The amount of times that the word ‘tourism’ fell was in general particularly marginal. Nevertheless, the tourism sector grew enormously and indeed, the area seemed to be a popular holiday destination, even in September when the fieldwork took place (Picture 9 & 10). There are several touristic enclaves, although the area is limited because of the many greenhouses (Pumares, 2017). Geotourism is in demand too, and therefore several greenhouse businesses offer touristic excursions. However, according to Pumares (2017), the impact of tourism on water use is minimal.

Picture 9 & 10: Tourism in Almería (left) and Roquetas de Mar (right).



Source: Eline van Oosterhout (2017).

6.2 DIFFERENT KINDS OF ADAPTATIONS TO SUSTAINABLE AGRICULTURE

Since the development of consciousness among the farm owners, several changes were implemented in their companies. Some more efficient than others, but all adjustments are eventually contributing to a more sustainable agricultural system. Farm owners' adaptations appear to be influenced by other farmers' decisions enormously. Farm owner 2 (2017) mentioned in his survey that 'when there are more companions who have ecological crops, people wake up and do the same.'. According to Farm owner 3 (2017), there is much competition between companies in finding new formulas and improving existing ones in order to get the best results and profits. However, most farm owners establish the same adaptations, as same problems demand the same solutions (Farm owner 1, 2017).

a. Desalination plants

García-Rubio & Guardiola, (2012) stated that the government wanted to build five desalination plants in Almería, only there are two plants in the province nowadays (Farm owner 4, 2017). The government could possibly still be building the other two plants, or they (temporarily) stopped the construction as the plants are working at a rather small percentage (around 20%) of their full capacity (Gallardo, 2017; Pumares, 2017). The low capacity of the plants is somehow related to the farmers' reluctance to pay high prices for freshwater (Pumares, 2017; Pulido, 2017; Gallardo, 2017). The costs for desalinated water are twice the price of water from aquifers (Gallardo, 2017). Despite the high costs, only 11% of the desalinated water is purposed for agricultural practices beforehand (García-Rubio & Guardiola, 2012). The retaining of farmers willing to pay the costs is, nevertheless, slowly starting to change. The University of Almería organized a summer course in 2017 on water problems in Almería with invitations to specialists and farmers, and according to Pulido

(2017), farmers then mentioned to be willing to pay higher costs for the first time. Mind-sets are changing now that farmers are getting close to the ‘final countdown of seawater intrusion’ (Pulido, 2017). As Gallardo (2017) puts it: “*For them sustainability is not the major problem. They are more concerned about things affecting them directly economically.*” However, the fact that farmers are starting to look to the long-term profits of sustainable agriculture instead of only considering quick economic profits remains positive, despite their focus on money.

b. Organic farming

Farmers in the Campo de Dalías have also adapted their agricultural practices in an organic way. The four surveyed farm owners all had their own vision on the meaning of ‘organic’. Farm owner 3 (2017) wrote: ‘Least possible waste for a production demanded by the market.’ Both Farm owner 1 and 2 mentioned ‘respect and taking care of the environment’ where Farm owner 1 added ‘the use of natural fertilizers’ and ‘no pesticides’, and Farm owner 2 added ‘a healthy lifestyle’.

The *first* general organic adaptation is the use of natural fertilizers, although some are still combining it with former, non-biological fertilizers. The quality of the crops and a better production are the main reasons for Farmer 3 (2017). The *second* organic adaptation is reducing the use of pesticides. Almost all chemical pesticides have been eliminated nowadays as farmers adopted other options, like bio-pesticides (Pulido, 2017). According to Pumares (2017), the reduce in pesticides is both due to the increasing resistance of the bugs, and the use of predators. This *third* predator adaptation is called *lucha biológica* (biological fight). Farm owner 4 (2017) adopted this adjustment too: “*I am an organic farmer because of the money. For example, we use parrots to eat the bugs in the greenhouses so that they have predators.*” Not only birds can be used in the organic fight; also big bugs are deployed (Pumares, 2017). The predators are intended to eat the small bugs and worms affecting the crops. According to Pumares (2017), the *lucha biológica* has already spread to 90% of the greenhouses in the Campo de Dalías, ‘although some farmers are combining it with pesticides’.

c. Rainwater collection, drip irrigation, hydroponics and recycling

Another adaptation is the construction of giant bins for rainwater collection (Picture 11). Every company has its own bin, usually laying in between the greenhouses (Farm owner 4, 2017). Because rainfall is scarce in the area, annually around 200 mm (AEMET, 2017), this method is not enormously profitable, but sure adds to a positive change. Furthermore, as visible in Picture 12, farmers use the efficient drip irrigation method (See: 5.1). All greenhouses have adapted this system starting 30 years ago (Pumares, 2017; Thompson et al., 2007). Also, the use of hydroponics is one of the adaptations, as Farm owner 2 mentioned this during the survey. Hydroponics refer to a technique in which plants are

grown without using soil (Jones Jr., 2016). The plants' roots are pendulous in either a continuous mist of nutrient solution or a static aerated nutrient solution. The exact amount of greenhouses using this system in the Campo de Dalías is unclear, but according to Gallardo (Personal communication, 2017) 10% of all greenhouses in south-eastern Spain make use of hydroponics. According to Gallardo (2017), farmers find it easier to use soil, since hydroponics require a more complex form of management. Finally, there also is a regulation of plastic and crop recycling in the Campo de Dalías. Soft plastics, of which less modern greenhouses are made, persist the bright sun for approximately three years, according to the university greenhouse researcher (2017). Hereafter they need to be replaced. Previously, the plastics were burned or just left on the streets, but nowadays a special governmental truck team picks up the plastics for recycling. The same accounts for plant leftovers.

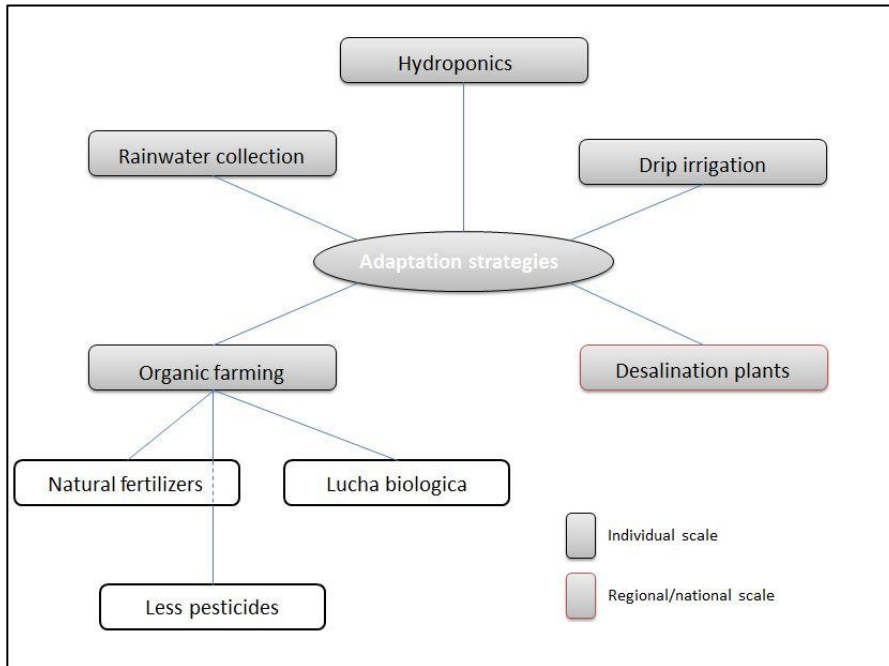
As visible in Figure 14, all strategies are eventually adopted at an individual scale, except for the implementation of desalination plants, which are national scaled implementations (Bradshaw et al., 2004).

Picture 11 & 12: Rainwater collection (left) and drip irrigation (right).



Source: Eline van Oosterhout (2017).

Figure 14: Farmers' different adaptation strategies to sustainable agriculture in the Campo de Dalías.



Source: Eline van Oosterhout (2017).

6.3 INFLUENCE OF EXTERNAL ACTORS ON SUSTAINABILITY

First, the University of Almería researches the improvement of agriculture and sustainability of greenhouses. It has its own greenhouses in the Campo de Dalías where several scientists, technicians and students work (Gallardo, 2017). Despite the fact that the scientists research hydroponics as well, their main interest is water management and in particular the use of nitrogen. Farmers tend to use large amounts of nitrogen and nutrients, but the redundant substances remain in the soil. This leads to lixiviation, whereby the nitrogen ends up in the groundwater underneath the Campo de Dalías, as the university greenhouse researcher (2017) explained. Nitrogen promotes the production of algae due to a lack of oxygen in the water, hence eventually water turns green and fish die. According to Louisa Gallardo (2017), there is no planning or any way of control on nitrogen use:

“There is no planning, no way of control. They just use recipes, standard recipes, and as a consequence there is being an increase over time in the levels of nitrogen in the major aquifers particularly in the Campo de Dalías. So at the moment we are focusing on that and we are trying to develop tools that farmers can adopt to improve their management of water.”

The tools Gallardo (2017) mentioned are both models and sensors. Farm owners are able to select a variety of data by use of models. They can enter variables like climatic data, the species, and its growing cycle. The output is the recommendation for the nitrogen

concentration of the nutrient solution. Besides, farmers get suggestions for the irrigation volume, so that water becomes less wasted. Sensors are being developed by the university to detect a crops' nitrogen level (Gallardo, 2017). There are two types of sensors: *First*, there is the optical sensor that measures the colour of the leaves. The greener the leaf, the higher the number that appears on the sensor (Picture 13 & 14). *Second*, there are sensors based on indirect measurement of chlorophene. Scientists have portable meters that distract juice from the plants and measure the amount of nitrogen. The University of Almería currently explores the threshold values for optimum nitrogen management.

Pictures 13 & 14: Portable optical sensors.



Source: Eline van Oosterhout (2017).

The interaction and information exchange between the University of Almería and farm owners in the area is strong. Scientists notice an increasing interest from the farmers in improving agricultural activities, and they are even starting to accept the costs that accompany the adaptations (Pulido, 2017; Gallardo, 2017; Pumares, 2017). However, sustainability is not their major problem (Gallardo, 2017). The possibility of being affected economically is of greatest concern, and many of them fear a yield decline if reducing the amount of pesticides. Long-term thinking still seems arduous for many farm owners, but is slowly getting required for their own good.

Professor Pumares (2017) mentioned an example of how to positively influence the consciousness of farm owners. He attended a colleague's book presentation where farm owners and members of cooperatives were invited as well, and noticed his colleague professor to speak kindly about the farm owners and their companies. Instead of becoming defensive, what mostly happens when criticism is expressed towards their work methods, farmers became critical on themselves and each other. This positive approach to raising awareness on sustainability seems to be very convenient.

Second, European importers influence sustainability in the Campo de Dalías by obligating agricultural cooperatives to implement certain environmental improvements (See: 5.5). In

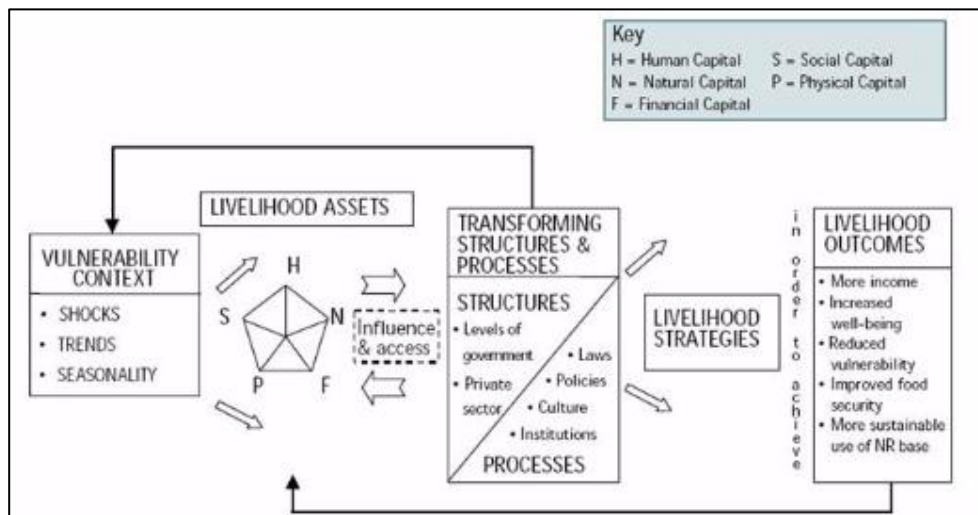
return, collaboration continues between cooperatives and European importers, and the cooperating companies are announced positively.

Third, the Spanish government certainly performs actions in order to improve the sustainability of the agricultural sector. An example is the construction of desalination plants. They also implemented the obligation of recycling plastics and crop leftovers, according to the university greenhouse researcher (2017). Despite their actions, they could do more. According to half of the surveyed farm owners, the government needs to improve its actions. As Farm owner 4 (2017) stated: “*They really have to take it more seriously and come up with solutions.*”

Chapter 7: Well-being, Vulnerability and Livelihood Assets

In this Chapter, the livelihoods of both working immigrants and farm owners are explored by use of the Sustainable Livelihoods Framework (Figure 15). All five components of the SLF will be examined: the vulnerability context, the livelihood assets, structures and processes, the livelihood strategies, and the livelihood outcomes. All these components influence and affect each other, and by putting all five of them apart the status of the individuals' livelihood in the groups gets clearer. Of course, generalizing all immigrants with different nationalities and situations in Section 7.1 would be incorrect. The same accounts for small family businesses and big agricultural companies in Section 7.2. Therefore, people's livelihoods are meant to be described as non-generalizing as possible.

Figure 15: The Sustainable Livelihoods Framework.



Source: Knutsson, P., & Ostwald, M., (2006).

7.1 LIVELIHOODS OF IMMIGRANT WORKERS

In this Section, the livelihoods of immigrant greenhouse workers are explored by describing the five components of the Sustainable Livelihoods Framework.

a. Vulnerability context

The vulnerability context consists out of three factors: shocks, trends and seasonal shifts. An example of a *shock* that harassed the immigrant greenhouse workers is the economic crisis, whereby many immigrants returned to the Campo de Dalías, hoping to find a job in the agricultural sector (See: 5.1). Due to the surplus of potential workers, and therefore the shortage of jobs, finding a job and earning money became inconvenient. Another shock were the riots during the El Ejido conflicts in 2000, when Spaniards destroyed belongings and property of Moroccans (See: 5.4). Where the Spanish government should protect vulnerable groups, the opposite occurs sometimes. Maria Rodriguez from SOC-SAT (2017), mentioned the existence corruption by describing how the police recently tore down an immigrants' camp. As result, the immigrants became homeless. *Trends* are more predictable than shocks, as shocks arise unexpectedly. Examples of trends within the working immigrant group are the forming of ethnic communities, and the farm owners' general convenience of which they can fire their workers. This ease increases (especially peak) workers' insecurity about money and savings. Getting and keeping a legal status in Spain whilst being an immigrant is a difficult and exacting trend too, as six months of the year need to be filled with working days (See: 5.2b). Again, this is most difficult for peak workers. However, the trend of greater convenience for eastern Europeans to ascend to better-paid sectors or to start their own businesses (See: 5.1), possibly makes a farm owner's dependency on Moroccans and Sub Saharans slightly higher. Furthermore there are *seasonal shifts*. In the Campo de Dalías, the main seasonal shift for working immigrants is the one of food availability, caused by the uncertainty of money that some immigrants experience. They have no job confirmation and certainty about money. Fortunately for them, employment opportunities are not bounded by seasons in the Campo de Dalías; due to all different crop species and their different harvest moments. This makes peak work available at all times during the year. In other parts of Spain, farm owners tend to cultivate one species, which makes the Campo quite unique in this sector (Pumares, 2017). Nevertheless, finding a proper job remains difficult for immigrants.

b. Livelihood assets

Defining the livelihood assets of immigrant workers leads to the awareness that many of their capitals are generally low. In order to clarify the methods of measuring their capitals, it is necessary to note that all five capital-results in 6.1b and Figure 16 were designed without model or use of a quantitative method. Figure 16 is purely an illustration of how the different capitals are related to each other. Now, their *human capital*, seen as the 'building block' of achieving livelihood outcomes (DFID, 1999), is not very extensive. Of course, background and education differs enormously between immigrant workers. One of the three Moroccan interviewees had an education history of primary and high school, while another only followed two years at primary school. Despite differences in education and knowledge, they still experience the same situation. When the workforce is stable, workers have the

opportunity to specialize in given tasks, improve their skills and therefore enhance productivity (Galdeano-Gómez et al., 2011). From a social perspective, according to Aznar-Sánchez et al. (2011), immigrant workers often experience difficulties integrating while being in precarious situations, which means that strengthening their knowledge and skills would help them integrate faster and settle down more easily. Syndicates offer trainings and courses for immigrants in order to let them learn the Spanish language and become educated about their rights. Fortunately for the immigrant workers, the Spanish health system entitles all residents in Spanish territory to full health coverage, whether they are legal or illegal (García-Armesto, Abadía-Taira, Durán, Hernández-Quevedo & Bernal-Delgado, 2010). This strengthens their human capital.

Immigrants' *social capital* is generally very high. This capital is important for people's sense of well-being through belonging, identity and honour (DIFD, 1999). Immigrants have strong bonds with individuals within their own ethnic communities, but bonds between workers and bosses are generally weak. This makes immigrants' networks and connectedness far more 'horizontal' than 'vertical'. Besides, relations with the Spanish population are mostly imaginary (See: 5.1). This results in an almost exclusive sharing of information and innovation between people with the same ethnicity, and scarcely beyond. With the support of their communities and often a syndicate, workers are sometimes able to obtain better results out of the agreement (See: 5.5). Immigrants often live far away from their families: about one third of the Moroccans, and an even higher percentage of Sub Saharans, live without their families (Pumares, Personal communication, 2017). A rather noteworthy business sector anticipated to this solitude by creating showgirl companies (with quite accurate names) like 'El Tomate' (Picture 15) and 'El Bio' (Picture 16). Immigrants are the biggest group to use this sector (Pumares, Personal communication, 2017).

Picture 15 & 16: Billboards for showgirls businesses.



Source: Eline van Oosterhout (2017).

The third capital is *natural capital*. Natural capital frequently shows very low, especially when immigrants have lived in the area for a short time. They generally do not own any land or property, and a proper house or clean water access is lacking for some too (See:

5.3b). The amount of natural capital, naturally, differs for everyone. Some own or rent an apartment or room, and others eventually buy their own piece of land for agricultural practices (SOC-SAT, 2017). When this occurs, strong horizontal networks might turn into weaker vertical social capital networks.

An immigrant worker's *physical capital* turns out to be generally quite low as well. By all means, this capital differs amongst every individual too. The ability to use affordable bus transportation is existent, although riding a bicycle can be dangerous regarding the absence of bike lanes. Bicycles are used to find jobs and get to work or to keep up social connections, according to an anonymous immigrant (2017) on the streets of Roquetas de Mar. Infrastructure includes secure shelter, water supply, and affordable energy too (which are all variable between immigrants) (DFID, 1999). Access to adequate sanitation, also part of physical capital, is lacking in some greenhouses (SOC-SAT, 2017), and residential areas, as visible in Picture 17. Another form of physical capital is the possession of producer goods, which does not genuinely account for immigrant greenhouse workers.

Picture 17: A primitive shower in the plastic house of a Moroccan worker.

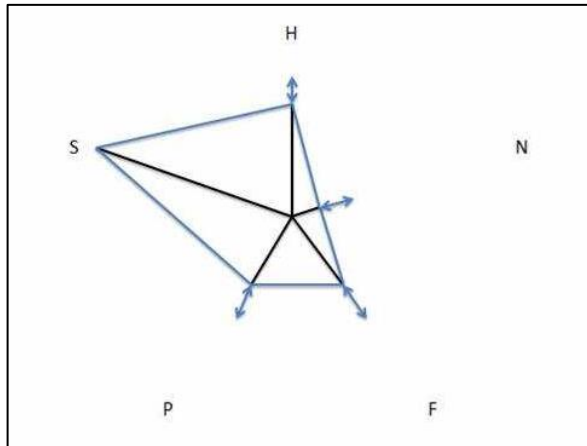


Source: Eline van Oosterhout (2017).

The last is *financial capital*. Financial capital consists, on the one hand, of savings. Some immigrants do not have the opportunity to save money, while others do. On the other hand, financial capital consists of regular inflows of money. This too differs, and moreover, a greenhouse worker's salary is usually low (SOC-SAT, 2017; Pumares, 2017). According to Pumares (Personal communication, 2017) some immigrants received money from their

families in their home countries to resist the economic crisis. They often send remittances to their families back home as well. Both flows influence the financial capital of immigrant workers, either negatively or positively.

Figure 16: Immigrants' livelihood assets.



Source: Eline van Oosterhout (2017).

As indicated in Figure 16, the livelihood assets of immigrants differ quite much. Potential strengthening for lower scoring capitals such as natural, financial and physical capital can be achieved through the influence of structures and processes in the area (See: 6.1c).

c. Structures and processes

After the conflicts in El Ejido in 2000, the Spanish government decided to pay less attention to the immigrants and their situations (See: 5.5). Furthermore, the local government sometimes tends to ignore inhuman situations, such as the slums in El Ejido where children and babies live without clean drinking water. On the contrary, private sector organizations like syndicates are actively helping the immigrants increase their knowledge. However, it should be a governments' responsibility in the first place to develop possibilities for immigrants, and help them increase their capitals and livelihoods. Another noticeable development is the influence of European distributor companies (See: 5.5). These companies have the power to set certain labour condition rules within Spanish agricultural companies. The conditions in greenhouses stay, however, hard to control. Yet, these changes are a starting point for increasing consciousness among farm owners. Some immigrants have had proper education, and their knowledge could be used in a better way than happens now. When those immigrants get the chance to climb up in the Spanish society and working sector and actually be of good use to it, Spain can enjoy them far more. Therefore trust and money are needed in the first place. Also, as farm owners (and therefore the agricultural sector) depend rather much on Moroccan and Sub Saharan greenhouse workers to maintain their level of producing (Pumares, 2017), the Spanish government could invest more in the assets of these workers. To begin with, they can start investing more in their human capital,

since this capital is required to be strong in order to make use of the other assets (DFID, 1999).

d. Livelihood strategies

According to the DFID (1999), people who are amply endowed with livelihood assets often make more positive livelihood choices. They are not being forced into one given strategy as they have access to a broad range of options. Working immigrants do not have many choices, as their assets do not spread widely. In order to achieve their main livelihood outcomes through strategies, they therefore predominantly need to strengthen their assets. Some immigrants earn too little to invest in the long-term, in spite of their will to save. Either they send remittances to their families and friends, or they spend it on basic needs such as food, water, and rent (See: 7.1b). For some who are able to save, the option to buy a piece of land appears. By doing this they invest in their natural capital. Other immigrants invest in their human capital by attending Spanish classes, and by gaining knowledge on their rights (SOC-SAT, 2017). With the help of syndicates, they occasionally organize strikes in order to improve their working circumstances or to demand a fair salary (financial capital). Physical capital is strengthened by investing in shelter (either renting rooms or building a “house” themselves), and in access to information. For example, the three Moroccan respondents all used a cell phone in order to gain information. Nonetheless, the latter requires electricity, and some immigrants lack full access to this. Concerning physical capital, immigrants often invest in bicycles or cars to be more mobile. Vehicles are, however, not only being bought, but also stolen (Immigrant 1, 2017). Social capital is generally strong, yet monotonous. As bonds within ethnic communities are very tight, connectedness between different nationalities lacks. When more immigrants would become closely connected, their demands and strategies could possibly be combined, and their impact would increase. Nevertheless, the DFID (1999) notes that a person’s human capital must increase first in order to improve of the other four assets, which means that the skills and knowledge of immigrants would have to be strengthened first.

e. Livelihood outcomes

Outcomes are the desired achievements. It remains difficult to determine those outcomes as an outsider without jumping to conclusions too fast, and the desired outcomes surely vary among all individuals. Nevertheless, there is a highly probable common theme: most working immigrants certainly seek for more income and a stable job in the first place as they earn little. Either they desire to stay and invest money in their current lives, or they aim for a life somewhere else. They possibly aim for an increased well-being as well, as a low well-being can stimulate poverty, violence and conflict (See: 2.3). However, most certainly they search for a reduced vulnerability. When a person misses money for healthy food, clean water and a proper house, this person’s vulnerability increases. Cycling on quite unsafe roads that are designed for cars is also rather perilous. Hence, since many of them

live rather dangerously, protection against the adverse effects of the vulnerability context (shocks, trends and seasonality) is lacking. As the DFID (1999) states: “*poor people’s livelihoods are to all intents and purposes unsustainable.*”. Indeed, people with high vulnerability are less likely to maintain the same way of living for a long time. Working immigrants generally do not care about the sustainability of the environment (Moroccan immigrants, 2017; SOC-SAT, 2017; Pumares, 2017). Their main focus lays on how to make money. When increasing their income, the possibility to invest this in better livelihood assets occurs. Their livelihood strategies then become broader, and their outcomes more as desired. Besides, if they would own their own piece of land or their own agricultural business they would experience the need to act sustainable in favour of their companies.

7.2 LIVELIHOODS OF FARM OWNERS

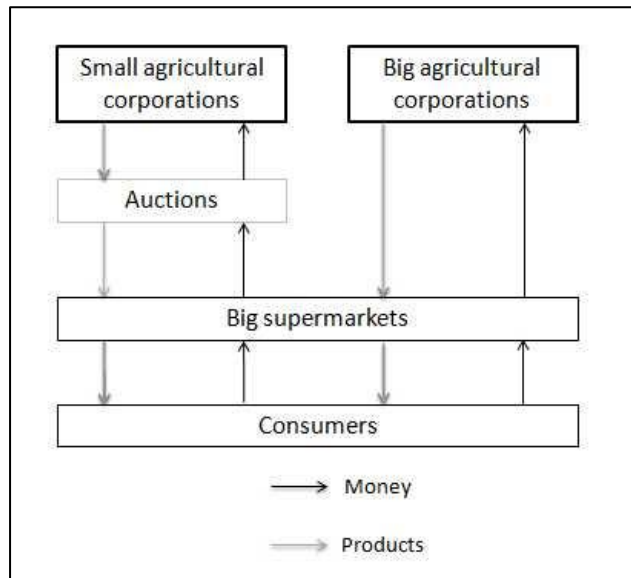
Farm owners in the Campo de Dalías are generally not classified as poor. Despite the fact that the SLF was developed for exploring the livelihoods of the poor in particular, the framework can be used for examining everyone’s livelihood (DFID, 1999).

a. Vulnerability context

The *shocks* that farm owners experienced were initially the realization of the water problem in the Campo de Dalías, and the conflicts in El Ejido in 2000. The economic crisis in 2008 did not affect the agricultural sector much, only slightly indirectly: people had less money to spend on agricultural products (Pumares, 2017). This is also the reason for the amount of farmers to stay more or less the same during the crisis. However, water shortages and the everlasting disagreements and conflicts between farm owners and their workers have become more like *trends*, as they developed and returned over the years. The same accounts for the salinization of groundwater. Another trend that influences farmers are the international conditions set by importers. Farm owners are part of a production chain (Figure 17). Mostly smaller family businesses are situated in the middle: big supermarkets all over Europe pay a certain amount of money for their crops at auctions (SOC-SAT, 2017). These European importers buy big amounts of fruits and vegetables at the same time without deliberating the price with the farm owner. This means that when a supermarket manages to pay a little for a lot, small farm owners are incapable of paying their workers according to the collective agreement, or at least they can hide behind that argument. Big corporations that are clustered in cooperatives are in a different situation: they are located at the very beginning of the chain, and do not depend on auctions (SOC-SAT, 2017). These bigger corporations can afford low prices once in a while, although this too fails to result in proper salaries for their workers. Another trend is the always-present fear for a reduced production; especially now that farmers are starting to adapt their production in a more sustainable way they dread a lesser yield (Gallardo, 2017). Despite this fear of reduced yield and profit, adaptation is necessary and positive for the long-term. Another trend that positively influence farmers’ vulnerability are technological improvements. The University

of Almería develops tools in order to improve a farmer’s water management, and tries to involve farm owners in its technological advances (Gallardo, 2017). Furthermore there are *seasonal shifts*. However, since farmers manage to regulate the environment (e.g. the temperature and the moisture content) in a greenhouse (University greenhouse researcher, 2017), these shifts are almost completely harmless. Furthermore, as many farmers cultivate different crop types, they do not depend on certain harvest months.

Figure 17: Production chain differences between small and big agricultural corporations.



Source: Eline van Oosterhout (2017).

b. Livelihood assets

Just like immigrants’ assets, farm owners’ assets and therefore Figure 18 are designed without use of any quantitative method and merely based on qualitative results. Farm owners’ individual *human capital* is usually high, as they have knowledge about their businesses, the agricultural sector, and the world in which they operate. In Spain, 90% of the children between three and sixteen years old follow their compulsory education in primary and high school (OECD, 2013). Therefore, most Spanish people are quite educated. The health system is easily accessible for Spanish inhabitants too (García-Armesto et al., 2010). External actors like the University of Almería inform farm owners about newly gained knowledge, and farm owners are usually aware of each other’s innovations and actions.

This knowledge is mainly due to farmer’s generally strong *social capital*. Since many farm owners are originally from Spain, many of their families and friends live nearby. A part of them, however, makes use of showgirls and prostitution either way (Picture 10 & 11) (Pumares, Personal communication, 2017). Just like immigrants, their networks and connectedness are particularly ‘horizontal’. Big agricultural companies often form

cooperatives together in order to be very well organized to fulfil the wishes of European supermarket importers (See: 5.5). Farm owners participate in ‘vertical’ patron/client relations too, as they collaborate with the European importers.

Another asset that is usually high for farm owners is their *natural capital*. People need a piece of land in order to function properly as farmer, variable between small and big. Furthermore, the greenhouses possess one very efficient quality: they protect the land from erosion by wind and rain (Galdeano-Gómez et al., 2011). Erosion protection happens to be part of natural capital as well (DFID, 1999). As a matter of course, farmers need water for their crops. Farm owners have access to water, but its quality has declined (Pulido, 2017; Gallardo, 2017; Pumares, 2017). In order to gain clean water from desalination plants, farmers need enough money, which is part of their (later examined) financial capital. Farmers, however, increasingly show interest in spending money on freshwater.

Farm owners need *physical capital* in order to keep their businesses running. For farmers in the Campo de Dalías, this asset seems to be generally high as well. They make use of modern highways, and can afford proper transportation. They have access to affordable energy, and some farm owners do not even use artificial light and heating anymore in terms of becoming more sustainable (Farm owner 3, 2017). Furthermore, they have access to communication, can afford clean drinking water and sanitation, and they own secure houses and buildings. Greenhouse frames and plastics, however, differ enormously (Pictures 18 & 19). Some are modern, with hard plastics and roofs that open automatically. More traditional greenhouses are weaker and contain cheap plastics that last around three years (University greenhouse researcher, 2017). These plastics are made of low polyethylene density, mainly due to its low price compared to other plastic materials.

Picture 18 & 19: Traditional greenhouse (left) and modern greenhouses (right).

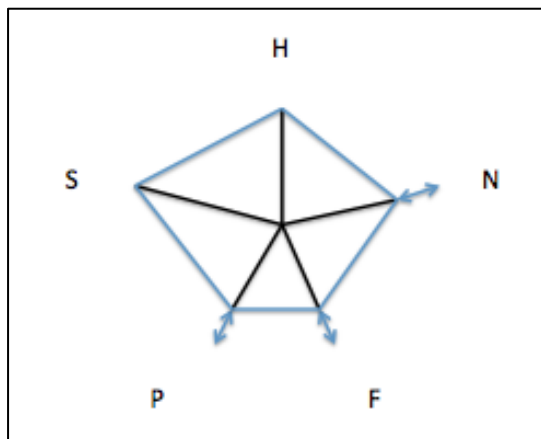


Source: Eline van Oosterhout (2017).

Besides infrastructure, farmers own producer goods. Especially big companies own machinery and other tools and equipment to increase their businesses’ functionality.

The last livelihood asset is *financial capital*. Big agricultural company owners usually make enough money to make an easy living. Farm owner 2 (2017) mentioned that ‘agriculture is profitable and generates wealth’. Big company owners can often afford to hire many employees (with low salaries), and all four surveyed farmers owned a big office and a fancy car. Smaller family businesses tend to do greenhouse work themselves, although they use employees often as well (Pumares, 2017). Every agricultural company, however, differs, just like their financial capital and the other four capitals differ. Despite the fact that farmers’ assets seem to be quite stable nowadays, there have been many suicides in the past as several farmers went bankrupt (Pumares, 2017). There is a favourable attitude towards the risks of getting loans from (rural or savings) banks for business investments, however only 15.3% of the farmers in the province of Almería states to have a high willingness of getting a loan (Garcia-Martinez, Parisi, Fernandez-Zamudio & Villar, 2010). There even seems to be a relatively positive attitude towards the risks of contracting a debt: 38.4% of the respondents in the research of Martinez et al. (2010) do not feel negative about the risks.

Figure 18: Livelihood assets of farm owners.



Source: Eline van Oosterhout (2017).

As indicated in Figure 18, livelihood assets of farmers in the Campo de Dalías are generally high. Their natural, financial and physical capital seem to fluctuate most, as the amount of landed estate, income and expenses, and type of greenhouse differs.

c. Structures and processes

External actors influence the livelihoods of farmers. *First*, there are the big European importers who make demands to which farmers must comply (See: 5.5). Farm owners must fulfil both environmental and labour conditions in order to keep selling their production to these European distributors. Question remains to what extend farmers adapt to these demands, as mainly labour conditions remain hard to control within greenhouses. *Second*, the University of Almería provides information on sustainable alternatives to agricultural practices (Gallardo, 2017; Pulido, 2017). The government itself could do more to help

farmers overcome the water shortage problem, according to the four surveyed farm owners (2017). *Third*, farm owners need to buy seeds, plastics, pesticides, fertilizers, and *lucha biologica* from specialized suppliers in order to continue farming. *Fourth*, farm owners can choose whether or not to get a loan (See: 7.2b). If they do so, they depend on banks as well.

d. Livelihood strategies

Since the notion that sustainability is an essential necessity to keep an agricultural business in the Campo de Dalías going with the same or an even higher profit as before, farmers started to adapt their greenhouses. Despite the fact that the environment is rather unimportant to them, and their main concern is money, they do increasingly change their ways of producing. Looking at the concerning assets, the natural, human, and financial capital are the three most gaining capitals for this adaptation. Natural capital increases directly due to better management of the environment, human capital increases as more knowledge is gained on sustainable agriculture, and financial capital increases in the long-term; if adaptations are not being executed, profit declines. Many farmers decide to save in order to expand their companies (Pumares, 2017). This is an investment in natural capital, and financial capital on the long-term as well. Modern greenhouses are more sustainable than traditional ones. With enough financial capital, farmers are able to invest in these; this reduces future costs such as substituting plastics after three years, and requires less attention as automatic roofs open when necessary (University greenhouse researcher, 2017). Investing in modern greenhouses is not possible for every farm owner; rich farmers can invest more easily than less wealthy farmers. It could be possible that this difference widens the gap between small family businesses and big companies. Another way to obtain more financial capital is by keeping the salaries of employees low, which is positive for the farmers, but negative for the workers. Furthermore, farm owners often refuse to invest in a proper working environment within the greenhouses (See: 5.3a).

e. Livelihood outcomes

As mentioned in Section 6.1e, it is difficult to determine the exact livelihood assets being an outsider. Stated can be, however, that farmers' priority outcome is 'having a good income' (Gallardo, 2017). All their adaptation strategies basically result from the fear of losing profit on the long-term, although this helps realizing the outcome of achieving a more sustainable resource base too. Furthermore, every starting farmer wants to decrease his or hers vulnerability. It took the first generation of farmers in the Campo de Dalías a few decades before finally making profit and reducing their vulnerability (See: 5.2a), but nowadays the farmer society is not known as vulnerable group. Anyhow, a farmer's still depends on factors like water quality, plant diseases, importers' requirements, and finance.



Chapter 8: Conclusions and Discussions

This final Chapter presents both the discussion and the conclusion of the research. It is the result of approximately four months of work, including literature review and fieldwork in the Campo de Dalías. In Section 8.1 the research' main findings are presented with an evaluation of the research question and sub questions. Section 8.2 discusses the main findings of the research, after which Section 8.3 gives suggestions and recommendations on policy and practice, based on these main findings. This section tries to combine the characteristics and interests of both groups: working immigrants and farm owners. Section 8.4 provides a reflection on the use of this particular methodology and type of respondents. The final Section 8.5 gives an honest view on the remaining knowledge gaps, to end with suggestions for further research.

8.1 THE RESEARCH QUESTIONS' ANSWERS

This first section provides the research' main findings combined with answering and evaluating the research question and sub questions, to start with the sub questions:

Sub question 1: What are the causes for desertification in the drylands of Almería?

In order to understand people's adaptations to desertification, one must know its causes. One of the main causes for desertification in the Campo de Dalías appeared to be the emergence and rapid growth of agriculture (See: 3.1). Particularly in the beginning of the expansion of the 'plastic sea', water use was enormous due to the 'pump-for-profit' culture, and a proper governmental plan or policy was absent. Despite the fact that water use has been stable since the early 80s (See: 6.1), overuse of water for agricultural practices has clearly taken its toll. The development of tourism contributed to desertification to some extent as well, although not immensely. Finally, climate change has made some impact too, and its impact will probably increase in the future.

Sub question 2: What are the population and migration changes on the drylands of Almería?

The two main migration flows towards the Campo de Dalías have been in the 1960s (when Spaniards came to work as farmers) and the 1980s (when foreign workers came to help) (See: 5.2 & 6.1). Nowadays, few farm owners seem to leave the area as agricultural sector appears to be profitable (5.2a). Immigrants, especially the younger ones, however, tend to leave to other parts of Europe. Almería is mainly a transition area (See: 3.2b & 5.3b). Many of its immigrants are temporary workers, using the agricultural work as springboard to travel to other European countries.

Sub question 3: How do different groups of people perceive desertification on the drylands of Almería?

In order to adapt to something, one has to perceive it at first. Farm owners seem to perceive desertification as an economic problem rather than as a natural problem; making enough profit is generally their main concern (See: 6.2a). Immigrant workers are certainly aware of the signs of desertification as these are inevitable to see all around the Campo de Dalías, but usually their main concerns are other issues like earning money (See: 5.3). Hence, both groups' perceptions of desertification turn out to be generally quite different since they have other interests.

To end this Section, the main research question is answered:

How do different groups of people living on the drylands of Almería adapt to desertification?

The outcome to this question differs between people from the two groups. For working immigrants the adaptation strategies are only indirectly related to desertification; they adapt to changes in the agricultural sector by following their bosses' adaptation decisions. For themselves, they do not seem to care about change (See: 7.1e). Following the Dryland Livelihood Paradigm, direct impacts of desertification on immigrant workers are ending up in a low well-being, and the experience of conflicts, emotional and physical violence, and poverty. Naturally, not all immigrants have the same experience and some of them manage to establish a personal transition to a better life. However, problems and solutions appear to be not directly linked to the desertification problem, but turn out to have much deeper and complex causes.

For farm owners, adaptation strategies concerning the desertification are mostly related to improving the sustainability of their greenhouses. In order to maintain their long term profits and economic revenues, they witness the importance of a responsible cooperation with the environment (See: 6.2a). Farm owners generally have become inventive; many of them adopted innovations that promote biological productivity, and are increasingly making use of land resources in a sustainable way. Despite the fact that many farm owners

integrate the adaptations in their businesses, these developments could take place at a much faster rate; many of the farm owners still partly depend on unsustainable resources.

8.2 MAIN FINDINGS

It is good to emphasize the importance of the Sustainable Livelihood Framework (SLF) for this research. In order to create a broad image of the effects of desertification for both groups, and to explore their ways of adaptation, the Dryland Livelihood Paradigm (DLP) was indispensable from the start. However, during and after the fieldwork, the relevance of the SLF came forward and eventually both frameworks were used in order to structure the research. This Section explains the main findings of both immigrant workers and farm owners.

a. Main findings: immigrant workers

The main findings of the research per group can be described along different categories within the Sustainable Livelihood Framework. Immigrant's livelihood assets appeared to be generally low, except for their social capital. Therefore, the strategy choices in order to sustain and improve their livelihood outcomes are limited, and their variety of capitals turns out to be the most notable. Despite the variations between immigrants, these are the most striking findings concerning foreign greenhouse workers:

Social capital: Immigrants usually have strong bonds with people with the same nationality, but not outside their ethnic communities. This makes their connectedness more 'horizontal' than 'vertical' (See: 7.1b). Furthermore, the eastern Europeans are usually the most accepted immigrants by native Spaniards due to their similar culture and ability to integrate faster (See: 5.1). Acceptation by the Spanish population is nevertheless mainly imaginary, as (small) conflicts between farm owners and immigrant greenhouse workers occur quite frequently. These conflicts mostly embody disagreements about labour conditions and working hours (See: 5.4). Conflicts between different immigrant communities do sometimes take place too.

Human capital: Actors that influence the human capital of immigrants the most are the socialistic organizations that provide information about an immigrant's rights, and the content of the collective agreement in Spain (See: 5.5 & 7.1d).

Financial capital: There is an essential difference between regular workers and peak workers, as peak workers have to struggle more in order to earn enough money and to become legal (See: 5.2b). Gaining (more) money seems to be the main outcome for all immigrants (See: 7.1e).

Physical capital: The quality of the roads in the Campo de Dalías is good, as are the prices of

public transportation (See: 7.1b). However, variations remain between an immigrant's means of transport (bike, car or bus). The quality of food, water and housing differ immensely too.

Natural capital: The fact that immigrant workers usually do not own land may explain their disinterest in sustainability (See: 7.1b).

Other important findings that do not fully relate to the five capitals are the influence of European importers on labour relations between farm owners and immigrants (See: 5.5), and the absence of the local government in strengthening and improving the immigrants' assets (See: 4.4 & 5.5).

b. Main findings: farm owners

All assets of farm owners are usually quite high. Therefore, for this group the results of how they shape their livelihood strategies appeared to be of greater interest. The current main desired outcomes for farmers in the Campo de Dalías are the revenue of more money, and adaptations to sustainability. These outcomes closely relate to each other as sustainable agriculture helps to prevent a decline in crop values in the long-term (See: 6.1 & 6.2a). Farm owners are starting to be aware of the importance of using freshwater from desalination plants and are gradually willing to pay for its relatively high costs. An important external actor that is helping farm owners in gaining knowledge on sustainable agriculture (mainly water management and nitrogen use) is the University of Almería (See: 6.3a). In addition, requirements of European importers force the bigger agricultural companies to watch the environmental impact of their companies (See: 5.5 & 6.3b). To comply with the demands of the big European importers (both environmental and labour-related), most big companies in the Campo de Dalías develop cooperatives with each other (See: 5.5). The Spanish government, however, seems to be lacking in its assistance to farm owners (See: 6.3c & 7.2c).

8.3 RECOMMENDATIONS FOR POLICY AND PRACTICE

This research aimed to interview as many different actors related to the two groups in order to receive an (as complete as possible) overall picture. It became clear that farm owners and migrant workers relate to each other in a totally contrasting way, and that combining the needs and belongings of such diverse groups is hard, yet defiant. Despite this challenge, it might be rather interesting to find both the interfaces and barriers between the interests and characteristics of the two groups. This research tried to combine social, sustainable, economic, and natural interest. In hindsight, this approach could be related to the 'landscape approach', which is gaining traction in the literature body on environmental management in developing contexts. This approach uses a specific area base for researching the coherence between different actors and interests, which results in different insights

than, for example, more traditional sectorial and project-based approaches would obtain.

Farm owners and migrant workers have some similar interests or characteristics that can be combined and extended with possible solutions (Table 2). *First*, immigrant workers need to strengthen their assets in order to implement better livelihood strategies for their livelihood outcomes (See: 7.1d). They especially require a high human capital to reinforce the other capitals. Farm owners, on the other hand, depend more or less on the availability of (mainly Moroccan and Sub Saharan) workers (See: 7.1a). A solution to both groups could be to invest in immigrants' (human) capital, for example by local governments. They could offer immigrant workers educational classes, or implement more regular contracts in order to increase their skills and knowledge (See: 7.1b). Immigrants could be involved in meetings, talks and discussions on improving their (human) assets and the bonds between them and their bosses. Immigrants will probably integrate better in local communities as well (See: 7.1b). Farm owners will have the advantage of hiring better skilled workers. Yet, the Spanish government as well as the European Union seem to be less occupied with the integration of immigrants than with restricting illegal immigration (See: 3.2b). Also the local government tends to ignore inhuman situations concerning immigrants (See: 5.5).

Second, immigrant greenhouse workers feel insecure about the amount of hours that are written down by their bosses and the amount of money they receive for their executed work (See: 5.3ab & 5.4). Furthermore, the often yelling and other factors make the work environment unpleasant (See: 5.3a). Farm owners, on the other hand, increasingly aim for using less pesticides and nitrogen (See: 6.2b). They would not want their workers to use too much. Besides, farmers tend to feel insecure on their own property (See: 5.3b). As it seems, both groups wish to be in control in and around the greenhouses in order to maintain peace, and to control the actions of the other group. The government, European distributors or workless unemployed immigrant could execute such controls. This last option generates new employment and strengthens immigrant's assets. Moreover, the organization of meetings for both groups at the same time can reduce both groups' insecurity and improve mutual trust.

Third, both groups want to become less economically vulnerable. Immigrants often receive too little money (See: 5.3ab & 5.4) and (smaller) farm owners who depend for crop sales on auctions use this dependency as a reason for not being able to pay their workers more (See: 7.2a). Both interests could be met by controlling the amounts of money that European supermarkets pay at auctions and perhaps by setting a certain bottom price to farmers' products. Farm owners need their crops to be decreasing in quality as little as possible to sell enough of their yield (See: 6.1), and good crop quality requires more freshwater. The Spanish government could somehow seek for a possibility to reduce the prices of freshwater, or enhance the promotion for water from desalination plants.

Building upon this there is a *fourth* interface. As immigrants aim for stable jobs and incomes (See: 7.1e), farmers desire to buy cheaper desalinated water (See: 6.2a & 7.2b). The

Spanish government and the University of Almería are excellent actors in studying possibilities of desalinating water on a smaller scale. As soon as this turns out to be possible jobs might become available for unemployed immigrants, whilst farm owners have the option to buy freshwater for lower prices.

Fifth, many immigrants still require proper housing (See: 5.3b). At the same time, farm owners increasingly desire the environment to be more sustainable for their own economic benefit, as they are gaining more awareness on this topic (See: 6.1, 6.2a, 6.3a & 7.2a). If the an external actor, like the government or the university, decides to start an investigation into the development of sustainable, good-quality housing of (for example) recycled plastics, both interests are being met.

Sixth, immigrant workers wish to receive better treatments during working hours (See: 5.3a). Farm owners most certainly like to be treated positively by researchers and other external actors. These findings were presented during a book presentation (See: 6.3b). An example of a very positive development complying to both interests could be exactly what happened during this professor’s book presentation on environmental impact: approaching farm owners in a positive way so that they become self-reflective and critical about themselves and other company owners. This approach does presumably not only create awareness among farm owners on their behaviour towards the environment, but might gradually change the labour relations between farm owners and their greenhouse workers when this subject is approached positively as well.

Table 2: Interfaces between immigrants and farm owners and their possible solutions.

	Characteristics/interests immigrant workers	Characteristics/interests farm owners	Possible solutions
1	Desire to strengthen assets	Dependent on (African) workers	Investment of immigrant’s (human) capital by local government
2	Insecure about hours and salary, find the working environment often unpleasant	Aim for less pesticides and nitrogen, insecure when being on own property	More control in and around the greenhouses (by unemployed immigrants)
3	Desire to be less economically vulnerable	Desire to be less economically vulnerable	Controlling auctions and promoting freshwater
4	Desire to have a stable job and income	Desire to use cheaper freshwater	Desalinating water on smaller scale
5	Desire proper housing	Desire a sustainable environment (increasingly)	Sustainable housing
6	Desire a better treatment	Desire a positive treatment	Approach farm owners positively

Source: Eline van Oosterhout (2017).

Despite the fact that new interfaces are appearing between the general diverging interests, one main barrier tends to remain: the different perspectives on workers' salary and work hours. This one difference is and remains the main cause for conflicts. Another governmental action that would probably cause barriers is giving immigrants a small piece of land in order to strengthen their natural capital. Anger would presumably rise amongst farm owners since it reduces the physical possibilities of expanding their business, and native Spanish residents would feel left behind. These pieces of land could, however, be located anywhere in Spain; not only in the Campo de Dalías where farm owners are likely to expand their companies.

However, there are several aspirations from the immigrants' side that not directly seem to bother farm owners or other Spanish residents:

First, the Spanish government could implement a less-than-six-months of workdays per year target for immigrants in order to become legal. This would help increase their social security. Despite an increase in social security and faster integration, the government's restrictive immigration policy does, however, not connect to this option.

Second, if more effort would be put in strengthening social bonds between different ethnic communities, the social capital of immigrants would increase further and they might even support each other when injustice occurs. However, this could bother farmers eventually.

Third, if the Spanish government or private organizations would promote the positive significance of savings, insurances and credit amongst immigrants, their financial capital could be strengthened and long-term incomes are likely to enhance. However, again, the Spanish government's immigration policy does not truly connect to this option.

8.4 REFLECTION ON METHODOLOGY

The main purpose of this research was to get better insights in adaptation strategies against desertification by farm owners and immigrant workers. To collect the information, mainly a qualitative research method was used. Semi-structured interviews were the main data source. Assembling mainly quantitative data might have led to a greater amount of respondents, but probably also to less profound information. Precisely this depth of data helped to answer the research question and provided a more complete picture of the complex reality in the Campo de Dalías.

If other actors had been interviewed and semi-surveyed instead of the three professors, the four big company owners, the three Moroccan immigrants, and the SOC-SAT employee, insights would probably have differed and viewed from different angles. When a trade union or corporation consisting of agricultural companies would have been interviewed, more data on farm owners' motives and decisions would have been collected. Furthermore, interviews

or semi-surveys with smaller agricultural companies would provide information about their views on the existence of conflicts, poverty and violence, and their adaptations to sustainable agriculture. It would also have been interesting to have spoken with a city councillor or an employee from the local government to obtain a broader view on their decisions to intervene at certain events or ignore them.

The apparent paradox that few people were interviewed, but much data was obtained, is due to the amount of small informal conversations during the fieldwork. It appeared to be easy and enjoyable to talk to different residents, and during three-week stay with the same landlord, many conversations led to proper information for this study.

8.5 DISCUSSIONS AND SUGGESTIONS

The fieldwork data was based on the information from three professors, one member of a socialistic organization, three Moroccan immigrants, four big company owners, and some unrecorded conversations. However, to understand the full story, much more research is needed. Especially interviews with smaller companies would be a great addition to the already collected data to clarify their views on the existence of conflicts, poverty and violence, and their adaptations to becoming a sustainable business. It would be interesting to investigate whether differences between small and big companies exist and what those differences include. Along with this addition, an interview with a governmental employee in order to get a more precise view of the policies and practices on immigration and sustainability would have given this research an even more full picture of the situation.

Ahead of the fieldwork, the research was mostly based on getting data according the Dryland Livelihood Paradigm. This means collecting information about conflicts, poverty, violence on the one hand, and about the transition to sustainable agriculture on the other hand. Only after the fieldwork, the Sustainable Livelihood Framework came more pronounced than before to investigate people's livelihoods and vulnerability. During the collection of data in the Campo de Dalías, more focus could have been given to the five aspects of the SLF in order to collect more precise data on these topics.

Despite the fact that this research made use of four main topics (agriculture, sustainability, immigration and desertification) and therefore became an interdisciplinary research, the basis still comes from social and geosciences. For further research, one can deepen and intensify the technical look, from natural sciences, in order to obtain a fuller picture of the technical side of sustainable agriculture.

REFERENCES

- Adeel, Z. & Safriel, U. (2008). Development paths of drylands: thresholds and sustainability. *Sustainability Science*, 3(1), 117-123.
- AEM (2017). Almería. *Agencia Estatal de Meteorología*. Retrieved at October 13 2017 from <http://www.aemet.es/es/eltiempo/prediccion/municipios?p=04>.
- Agrela, B., & Dietz, G. (2006). Nongovernmental versus governmental actors? Multilevel governance and immigrant integration policy in Spain. *Local citizenship in recent countries of immigration: Japan in comparative perspective*, 205-234.
- Aguilera, H., & Murillo, J. M. (2009). The effect of possible climate change on natural groundwater recharge based on a simple model: a study of four karstic aquifers in SE Spain. *Environmental Geology*, 57(5), 963-974.
- Akin, O., Montalvo, J. G., Villar, J. G., Peydró, J. L., & Raya, J. M. (2014). The real estate and credit bubble: evidence from Spain. *SERIEs*, 5(2-3), 223-243.
- Amuedo-Dorantes, C., & De la Rica, S. (2007). Labour market assimilation of recent immigrants in Spain. *British Journal of Industrial Relations*, 45(2), 257-284.
- Barbero-Sierra, C., Marques, M. J., & Ruíz-Pérez, M. (2013). The case of urban sprawl in Spain as an active and irreversible driving force for desertification. *Journal of Arid Environments*, 90, 95-102.
- Bradshaw B., H. Dolan, and B. Smit (2004) Farm-Level Adaptation to Climatic Variability and Change: Crop Diversification in the Canadian Prairies. *Climatic Change* 67(1) 119–141.
- Brauch, H. G. (2006). Desertification and migration: From Almeria I to Almeria II: Achievements and policy tasks. *In Address and paper for the International Symposium Desertification and Migration Almeria, Spain* (pp. 25-27).
- Rodríguez, L. C. (1995). Marco institucional de la discriminación y tipos de inmigrantes en el mercado de trabajo en España. *Reis*, 105-124.
- Cadarso, P. L. (2001). Fundamentos teóricos del conflicto social. *Madrid: Siglo XXI Editores*.
- Camargue, F. (2006). Drought in the Mediterranean: WWF policy proposals. *World Wildlife Fund*.
- Campra, P., Garcia, M., Canton, Y., & Palacios-Orueta, A. (2008). Surface temperature cooling trends and negative radiative forcing due to land use change toward greenhouse farming in southeastern Spain. *Journal of Geophysical Research: Atmospheres*, 113(18).
- Castaño, Á., Martínez, F., & Periañez, I. (2017). Andalusia at the crossroads of Europeanness: immigration as a performance of coloniality. *Patterns of Prejudice*, 51(1), 78-79.

- Clark, D. A. (2014). Defining and measuring human well-being in global environmental change. *Springer Netherlands*.
- Colectivo IOE (1987). Los inmigrantes de España. *Cáritas Española: Documentación Social*.
- Dana, E. D., García-de Lomas, J., & Guerrero, M. A. (2011). Almería. In plants and habitats of European cities. *Springer New York*, (pp. 1-21).
- DFID (1999). Sustainable livelihoods guidance sheets - Section 2. *Department for International Development*.
- Diamond, J. (2005). Collapse: How societies choose to fail or succeed. *Penguin*.
- Díaz, J. R., Weatherhead, E. K., Knox, J. W., & Camacho, E. (2007). Climate change impacts on irrigation water requirements in the Guadalquivir river basin in Spain. *Regional Environmental Change*, 7(3), 149-150.
- Downward, S. R., & Taylor, R. (2007). An assessment of Spain's Programa AGUA and its implications for sustainable water management in the province of Almería, southeast Spain. *Journal of environmental management*, 82(2), 277-289.
- Enne, G., d'Angelo, M., Madrau, S., & Zucca, C. (2002). Urbanization and desertification in European Mediterranean coastal areas: a case study in north-western Sardinia (Alghero, Italy). *Human Settlement Development, from Encyclopedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford, UK*.
- EU (2017). Spain: Overview. *European Union*. Retrieved at October 29 2017 from https://europa.eu/european-union/about-eu/countries/member-countries/spain_en.
- FAO (2014). Building a common vision for sustainable food and agriculture. *Food and Agriculture Organization of the United Nations*.
- Feoli, E., Pérez-Gómez, R., Oyonarte, C., & Ibáñez, J. J. (2017). Using spatial data mining to analyze area-diversity patterns among soil, vegetation, and climate: A case study from Almería, Spain. *Geoderma*, 287, 164-169.
- Fox, S. (2012). Urbanization as a global historical process: Theory and evidence from sub-Saharan Africa. *Population and Development Review*, 38(2), 295.
- Galdeano-Gómez, E., Aznar-Sánchez, J. A., & Pérez-Mesa, J. C. (2011). The complexity of theories on rural development in Europe: An analysis of the paradigmatic case of Almería (South-east Spain). *Sociologia ruralis*, 51(1), 55-56.
- García-Rubio, M. A., & Guardiola, J. (2012). Desalination in Spain: A growing alternative for water supply. *International journal of water resources development*, 28(1), 171-186.
- GAO (2006). Foreign workers: Informaiton on selected countries' experiences. *United States*

Government Accountability Office.

García-Armesto, S., Begoña Abadía-Taira, M., Durán, A., Hernández-Quevedo, C. & Bernal-Delgado, E. (2010). Spain: Health system review. *European Observatory on Health Systems and Policies.*

García-Martínez, M. C., Parisi, S. B., Fernández-Zamudio, M. A., & Villar, P. C. (2010). Trends in the adoption of greenhouse technology in mediterranean horticultural farms. *New Medit*, 9(3), 47-55.

Gertel, J. & Sippel, S. R. (2014). Seasonal workers in Mediterranean agriculture: The social costs of eating fresh. *Routledge.*

Giagnocavo, C., Gerez, S., & Campos i Climent, V. (2014). Paths to cooperative survival: Structure, strategy and regeneration of fruit and vegetables cooperatives in Almería and Valencia, Spain. *Annals of Public and Cooperative Economics*, 85(4), 624.

Google Maps (2017). Spain. *Google Maps.* Retrieved at November 1st 2017 from www.maps.google.nl.

Gupta (1998). Postcolonial developments: Agriculture in the making of modern India. *Duke University Press.*

Hoggart, K. (1997). rural migration and counter-urbanization in the European periphery: The case of Andalucía. *Sociologia Ruralis*, 37(1), 137.

Hoggart, K., & Mendoza, C. (1999). African immigrant workers in Spanish agriculture. *Sociologia Ruralis*, 39(4), 538-562.

Hose, T. A. (2007). Geotourism in Almería province, southeast Spain. *Turizam: znanstveno-stručni časopis*, 55(3), 259-276.

IFOAM (1998). basic standards for organic production and processing. *IFOAM Tholey-Theley, Germany.*

IFRC (2017). What is vulnerability? *International Federation of Red Cross and Red Crescent Societies.* Retrieved at October 22 2017 from <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/what-is-vulnerability/>.

Ikerd, J. (1993). Two related but distinctly different concepts: organic farming and sustainable agriculture. *Small farm today*, 10(1), 30-31.

INE (2017). Almería. *Instituto Nacional de Estadística.* Received at June 5th 2017 from http://www.ine.es/en/wel/faq_en.htm#3.

IPCC (2007). Climate change 2007: Working group II: Impacts, adaptation and vulnerability. *Intergovernmental Panel on Climate Change.* Retrieved at June 19th 2017 from https://www.ipcc.ch/publications_and_data/ar4/wg2/en/annexessglossary-a-d.html.

- Jones Jr, J. B. (2016). *Hydroponics: a practical guide for the soilless grower*. CRC press.
- Secretaría General de Economía (2005). Economic report on Andalusia. *Consejería de Economía y Hacienda*.
- Kandlikar, M., & Risbey, J. (2000). Agricultural impacts of climate change: If adaptation is the answer, what is the question?. *Climatic change*, 45(3-4), 529-539.
- Lampkin, N. H. (1994). Organic farming: sustainable agriculture in practice. *The economics of organic farming—An international perspective*, CAB International, Oxon (UK).
- Leighton, M. (2006). Desertification and migration. *Governing Global Desertification*. Ashgate, London, 43-58.
- Lirola, M. M. (Ed.). (2014). Discourses on immigration in times of economic crisis: A critical perspective. *Cambridge Scholars Publishing*.
- LOC (2015). Citizenship pathways and border protection: Spain. *Library of Congress*. Retrieved at October 29 2017 from <https://www.loc.gov/law/help/citizenship-pathways/spain.php>.
- Lorca, A. M. G. (2011). Agriculture in drylands: experience in Almería. In *Coping with Global Environmental Change, Disasters and Security* (pp. 921-934). Springer Berlin Heidelberg.
- WRI (2005). Millennium Ecosystem Assessment, Ecosystems and Human Well-Being: Desertification Synthesis. *World Resource Institute*.
- McGillivray, M., & Clarke, M. (2006). Understanding human well-being. *United Nations University Press*.
- Nadal, J. (1984): El Fracaso de la Revolución Industrial en España, 1814-1913. *Ariel*.
- Navarro, C. J. (1999). Women and social mobility in rural Spain. *Sociologica Ruralis* (pp. 222-235).
- OECD (2013). Spain: Education at a glance 2013. *OECD – Country note*.
- Postel, S. (1999). Earth policy. *Food and Agricultural Organization of the United Nations*. Retrieved at 23 October 2017 from <http://www.fao.org/DOCREP/006/Y4683E/Y4683E00.HTM>.
- Puigdefabregas, J., & Mendizábal, T. (2006). Desertification and migrations in the Western Mediterranean: Environmental outcomes of the inverse flow of people and capital. In *Paper for the 2nd International Symposium on Desertification and Migrations* (pp. 25-27).
- Reynolds, J. F., Smith, D. M. S., Lambin, E. F., Turner, B. L., Mortimore, M., Batterbury, S. P. & Huber-Sannwald, E. (2007). Global desertification: building a science for dryland development. *Science*, 316(5826), 847-851.

- Rigby, D., & Cáceres, D. (2001). Organic farming and the sustainability of agricultural systems. *Agricultural systems*, 68(1), 21-40.
- Rodero Frangillo, A., & Rodriguez, J. R. (1993). Sector agrario. *Estructura econdmica de Andalucía*, (pp. 285-321).
- Serrat, O. (2017). The sustainable livelihoods approach. In *Knowledge solutions* (pp. 21-26). Springer Singapore.
- Thompson, R. B., Martínez-Gaitan, C., Gallardo, M., Giménez, C., & Fernández, M. D. (2007). Identification of irrigation and N management practices that contribute to nitrate leaching loss from an intensive vegetable production system by use of a comprehensive survey. *Agricultural Water Management*, 89(3), 261-274.
- Tout, D. (1990). The horticulture industry of Almería province, Spain. *The Geographical Journal*, 156(3), 304-312.
- UNCCD (1994). Desertification. *United Nations Convention to Combat Desertification*. Received at May the 4th 2017 from <http://www.un.org/en/events/desertificationday/background.shtml>.
- UNCCD (2017). Land and drought. *United Nations Convention to Combat Desertification*. Retrieved at October 23 from <http://www2.unccd.int/issues/land-and-Drought>.
- UNESCO (2017). Poverty. *United Nations Educational, Scientific and Cultural Organization*. Retrieved at July 6th 2017 from <http://www.unesco.org/new/en/social-and-human-sciences/themes/international-migration/glossary/poverty/>.
- Vigil Diaz Telenti, S. (2014). Crisis and migration: The case of Senegalese migrants in Almería's agricultural sector. *Sixth Triennial Congress of the Belgian Political Science Association*.
- Weber, E. (1994). Production and pricing decisions in cash-crop farming: Effects of decision traits and climate change expectations. In *Farmers' Decision Making – A Descriptive Approach*. SJFI.
- Werner, D. (2013). Biological resources and migration. *Springer Science & Business Media*.
- WHO (2017). Definition and typology of violence. *World Health Organization*. Retrieved at October 22 2017 from <http://www.who.int/violenceprevention/approach/definition/en/>.
- Women Win (2017). Defining conflict/Post conflict. *Women Win*. Retrieved at October 22 2017 from <http://guides.womenwin.org/gbv/conflict/context/defining-conflict-post-conflict>.

ANNEXES

Surveys

Survey farm owner 1 – El Parador de las Hortichuelas

This research is about the greenhouses in de Campo de Dalías and the drought here. You would help me enormously if you would take 10 minutes to answer these questions. Thank you very much!

1. Where is/are your greenhouse(s) located?

Everywhere in the Campo de Dalías

- **Can you draw it/them on the map?**



2. What crops do you produce?

Tomatoes, peppers, aubergines, cucumbers, courgettes, melons, watermelons.

3. How many greenhouses do you own? ? greenhouses

On how many hectares? 450 hectares

4. For how long do you have this greenhouse company?

34 ~~months~~ years

5. The land here is dry. What do you think of this drought/do you have water problems with your company?

I do not have water problems with my company. But the use of too much water causes plant diseases.

6. Did you adapt your farm to the drought? Yes No
If yes, how? The use of desalination plants

“Nowadays 25-30% of the water we use comes from desalination plants.”

Sustainability is the idea that fruits and crops are produced in ways that do not use resources that cannot be replaced and that do not damage the environment.

7. Did you change anything to make your greenhouses more sustainable?

Yes No

If yes, what did you change?

Dripping irrigation

Collecting Rainwater

Biological control of plagues

If yes, since when did you change? 10 – 12 years ago

“Our company was one of the first with biological control.”

8. Do you produce your crops/fruit in an organic way?

Yes No

What does organic mean according to you?

No pesticides (according to the rules)

Natural fertilizers

Taking care of the environment

“We only use approved pesticides from other plants e.g.”

9. Can you tell something about the sustainability of other greenhouse companies?

Most of us are doing the same things. Same problems = same solutions.

10. Which nationalities do people who work in your greenhouse(s) have?

Moroccan, Romania, North-African, Spanish.

- Why did you choose for these people? Availability.

“We have around 12.000 workers.”

11. Do you notice any type of conflict in this area?

Yes No

If yes, between who?

Why?

12. Do you notice violence in this area? Yes No

If yes, between who?

Why?

13. Is there poverty in this area? Yes No

- If yes, which people are poor?.....

14. What do you think of the way the government handles drought/water problems in this area?

They are building desalination plants, which is good.

15. Where do you get your water for your vegetables/fruit?

From wells and desalination plants.

16. Have you noticed anything around people moving away from this area?

~~0~~ Yes 0 No

- **If yes, where did they go to?**
- **Why?**.....

17. Have you noticed anything around people moving to this area?

0 Yes ~~0~~ No

Do you know why they moved here?

Activity. Both for work and for creating new businesses.

“The crops need nitrogen to become bigger and potassium and calcium to become a sustainable crop that does not rot.”

Survey farm owner 2 – El Ejido

This research is about the greenhouses in de Campo de Dalía and the drought here. You would help me enormously if you would take 10 minutes to answer these questions. Thank you very much!

1. Where is/are your greenhouse(s) located?
- Can you draw it/them on the map?



2. What crops do you produce? Tomatoes, pepper.

3. How many greenhouses do you own? 2 greenhouses
On how many hectares? 150 hectare

4. For how long do you have this greenhouse company?
24 months / years

5. The land here is dry. What do you think of this drought/do you have water problems with your company?
With hydroponic crops and the dripping method drought is no longer a problem.

6. Did you adapt your farm to the drought? Yes No
If yes, how?
With hydroponic crops.

Sustainability is the idea that fruits and crops are produced in ways that do not use resources that cannot be replaced and that do not damage the environment.

7. Did you change anything to make your greenhouses more sustainable?

Yes No

If yes, what did you change?

We stopped using fertilizers and we now do organic farming.

If yes, since when did you change?

5 years ago.

8. Do you produce your crops/fruit in an organic way? Yes No

- What does organic mean according to you?

A healthy lifestyle and respect for the environment.

9. Can you tell something about the sustainability of other greenhouse companies?

When there are more companions who have ecological crops, people wake up and do the same.

10. Which nationalities do people who work in your greenhouse(s) have?

Spain, North Africa, East Europe.

- Why did you choose for these people?

Because of their availability.

11. Do you notice any type of conflict in this area? Yes No

No

If yes, between who?

Why? Everything is peaceful.

12. Do you notice violence in this area? Yes No

If yes, between who?

Why? Communities are being respected.

13. Is there poverty in this area? Yes No

- If yes, which people are poor?

Agriculture is profitable and generates wealth.

14. What do you think of the way the government handles drought/water problems in this area?

The government does not get rid of the drought, we are the farmers.

15. Where do you get your water for your vegetables/fruit?

From municipal water.

16. Have you noticed anything around people moving away from this area?

Yes No

- If yes, where did they go to?

- Why? On the contrary, the area is growing.

17. Have you noticed anything around people moving to this area?

Yes No

Do you know why they moved here? There is more work here.

“During the summer the temperature in the greenhouses can become 50 to 60 degrees Celsius. Spanish people do not want to work here.”

Survey farm owners 3 – El Ejido

This research is about the greenhouses in de Campo de Dalía and the drought here. You would help me enormously if you would take 10 minutes to answer these questions. Thank you very much!

1. Where is/are your greenhouse(s) located?
- Can you draw it/them on the map?



2. What crops do you produce? Cucumber, pepper.

3. How many greenhouses do you own? 1000 greenhouses
On how many hectares? 800 hectare

4. For how long do you have this greenhouse company?
22 ~~months~~ / years

5. The land here is dry. What do you think of this drought/do you have water problems with your company?

My company does not have water problems. I think we have to search for better solutions every day to combat the drought.

6. Did you adapt your farm to the drought? Yes No

If yes, how?

Dripping irrigation and water collection.

Sustainability is the idea that fruits and crops are produced in ways that do not use resources that cannot be replaced and that do not damage the environment.

7. Did you change anything to make your greenhouses more sustainable?

0 Yes ~~0 No~~

If yes, what did you change?

100% biological fight, no artificial light and no heating.

- If yes, since when did you change?

With the integrated fight we started 10 years ago.

“Worms in the greenhouses eat the crops. By ‘biological fight’ (*lucha biologica*) I mean that we use insects to eat the eggs of the worms.”

8. Do you produce your crops/fruit in an organic way? 0 Yes ~~0 No~~

What does organic mean according to you?

Least possible waste for a production demanded by the market.

9. Can you tell something about the sustainability of other greenhouse companies?

There is much competition between the companies to find new formulas and to improve existing ones.

10. Which nationalities do people who work in your greenhouse(s) have?

Spain, African, East-Europe.

Why did you choose for these people?

Because of their work.

“We use organic ways but also a little bit of fertilizer. Otherwise there is no good production and quality of the crops.”

11. Do you notice any type of conflict in this area? ~~0 Yes~~ 0 No

If yes, between who?

Why?

12. Do you notice violence in this area? ~~0 Yes~~ 0 No

If yes, between who?

Why?

13. Is there poverty in this area? 0 Yes ~~0 No~~

- If yes, which people are poor?

Mostly illegal immigrants

14. What do you think of the way the government handles drought/water problems in this area?

They need to improve.

15. Where do you get your water for your vegetables/fruit?

Of authorized wells.

16. Have you noticed anything around people moving away from this area?

~~0 Yes~~ 0 No

- If yes, where did they go to?

- Why?.....

17. Have you noticed anything around people moving to this area?

0 Yes ~~0 No~~

Do you know why they moved here?

They come with large populations from small mountain villages or inlands to find work here.

Survey farm owner 4 – Roquetas de Mar

This research is about the greenhouses in de Campo de Dalía and the drought here. You would help me enormously if you would take 10 minutes to answer these questions. Thank you very much!

1. **Where is/are your greenhouse(s) located?** Roquetas, Ejido, Vicar
 - Can you draw it/them on the map?



2. **What crops do you produce?** Tomatoes.

3. **How many greenhouses do you own?** ? greenhouses
On how many hectares? 100 hectare

4. **For how long do you have this greenhouse company?**
21 ~~months~~ / years

5. **The land here is dry. What do you think of this drought/do you have water problems with your company?**

There are many problems with water supply because of the drought.

6. **Did you adapt your farm to the drought?** Yes No

If yes, how?

By harvesting the rainwater.

“April, May, June, September and October are the months wherein the crops need more water. In those months the crops are very small.”

Sustainability is the idea that fruits and crops are produced in ways that do not use resources that cannot be replaced and that do not damage the environment.

7. Did you change anything to make your greenhouses more sustainable?

0 Yes ~~0 No~~

If yes, what did you change?

Formalize ecological cultivation.

If yes, since when did you change?

3 years ago (2014).

8. Do you produce your crops/fruit in an organic way?

0 Yes ~~0 No~~

What does organic mean according to you?

Natural, birds, predators, bumblebees.

9. Can you tell something about the sustainability of other greenhouse companies?

No.

10. Which nationalities do people who work in your greenhouse(s) have?

Spain, Nigeria and Morocco.

Why did you choose for these people?

Experience.

11. Do you notice any type of conflict in this area? ~~0 Yes~~ 0 No

If yes, between who?

Why?

12. Do you notice violence in this area? ~~0 Yes~~ 0 No

If yes, between who?

Why?

13. Is there poverty in this area? ~~0 Yes~~ 0 No

- **If yes, which people are poor?**.....

14. What do you think of the way the government handles drought/water problems in this area?

They really have to take it more seriously and come up with solutions.

15. Where do you get your water for your vegetables/fruit?

From the community of irrigators (wells) and from rain.

“I am an organic farmer because of the money. For example, we use parrots to eat the bugs in the greenhouses so that they have predators.”

“Every company has its own rain water reservoir, but the water supply from wells is shared with other companies that form a corporation.”

“There are two desalination plants in the province of Almería, but they are not really being used.”

16. Have you noticed anything around people moving away from this area?

Yes No

If yes, where did they go to?

Nijar.

Why?

Because the land here is very expensive.

17. Have you noticed anything around people moving to this area?

Yes No

Do you know why they moved here?

For economy reasons.

INTERVIEWS

Interview with Pablo Pumares (University of Almería)

P: Alright. Something that you probably already know is that African migration is very important for the agricultural sector. It is really essential, because the workers who work inside the greenhouses are a large part of the farm, so their role is essential.

E: Without the African workers it would not be so big?

P: It would probably require a big reorganization. One of the questions you have to consider is many of the expositions are very small. Traditionally it was only family workers, so the units of exploitation some decades ago was thought to be for the possibilities of a family.

E: In a greenhouse already?

P: Well in the beginning there were no greenhouses. They started to begin with some methods to grow the crops earlier such as the use of sand.

E: The use of sand?

P: In the beginning, in the fifties when they started, one of the main questions was the possibility to grow the crops before they were growing in Europe, in The Netherlands for instance. So we had the sun, which made the crops grow, but also with the sand, because the sand gives more heat to the crops. Building a greenhouse requires a big investment, because sometimes the soil is completely useless here, it's rock. So you have to build a new soil. Maybe natural or artificial, but it has to be new. So they started to do it. They took away the rocks and then they build a soil with some land, manure, and then sand. This is because the sand one the one hand it gives heat to the plants and also because of the salty water it helps the plant to resist the salt. So this was at the beginning and then afterwards they started building the greenhouses which was a way to make everything grow earlier and to control everything. Afterwards they changed very quickly and I don't know what are you studying?

E: Human geography.

P: Human geography. All the innovations here came quite rapidly you know, quite amazing how fast. Taken into consideration that there are a lot of farmers here, not just a big few companies but there are 26.000 companies.

E: 26.000 companies??

P: Yes, something like that.

E: In the Campo de Dalías only?

P: In whole Almeria, also in Campo de Nijar. But a very large number. Despite that, the innovations spread very quickly surprisingly. At the beginning of the 80s they started to be conscious about the problem with the water. Fortunately we have aquifers, otherwise I would have been different, but some aquifers became salty and we had reached our maximum for cultivation. Suddenly they change all the greenhouses in just a few years. They changed the system of watering the crops and in very few years they all changed into leaking, dripping watering. So you can calculate precisely the amount of water and you don't waste any water. Before it was a traditional system by floating you know. They changed it very quickly and therefore they saved a lot of water, what started a second expansion of the greenhouses.

E: And since when came immigrants to work in the greenhouses?

P: Exactly since this moment! This is a crucial moment. Until then it was basically the family who made all the labours in the greenhouses and even for the peak times of collecting the crops the neighbours had each other as a community, because all were aware of the importance of this, and they were cooperative. Until this moment families could manage a farm between one and two hectares, that was the average. But since this second expansion that was based on the one hand on the possibility to save water and also on the expectations to enter the European economic community. They entered it in 1986, although we had restrictions until 1992 or 1991. We could not export to the EU as a member, because we had a restriction period. But anyway, the expectations were there. And for this second expansion they needed more workers, salary workers. And then it became a movement of African migrants, mainly Moroccan at that time. Especially the 2nd half of the eighties when they became notorious. On the one hand there are the farmers that, at the beginning, were in very bad conditions. The work was really hard and the whole family had to help and was dedicated to that work. But after some decades they started to receive the benefits. They started to have savings, to have a better level of living and the children could follow their studies and they did not work so much in the property. Some of them started to buy another hectare, which made the family not enough to manage the farm by themselves. They needed salary workers. However, the conditions for the family workers were not very good. Then there was a possibility for foreign workers to come here. You have also to consider that also here in Almeria, we have never lived a proper industrial age. We have passed from an agricultural to a service economy, so labour relations are in some way traditional and in some way too modern. And this has been a problem in the labour relations, because traditionally the way that people settled down in the Almeriense community, some of the had some land and if they had more land than they could manage they gave the land to other families that worked on the land and got half of the profits. So half of the profits went to the owner and the other half to the other family. This has been the traditional way. As

the time went by, the Medianeros (half/half) could buy the land with their saved money. But in the 80s it started to be different. It was not the Medianeros who started to work on the land, but salary workers instead. There still were Medianeros but not as many as before. So then, because of the better level of life, the amount of greenhouses expanded and the conditions in the greenhouses were not that good. The family was used to work very hard but they were not used to the salary systems. They payed quite bad. You have to consider also that this agriculture is very intensive in labour, it is around 40 percent of the production, and an important investment is needed. Sometimes, for example, they had to take the rocks away to build a new greenhouse or to create a dripping system or to use pesticides. However, they have changed very quickly to biological ways.

E: Yes, well, do you know if immigrants have any idea of sustainability?

P: Well, it's something that they are not conscious of. I mean they have other problems. Some decades ago the use of pesticides was very intensive and people were not conscious of the health problems for the people both the owners and the people working there. But then the health systems and doctors started to see that there were increasing health problems and they spread awareness. Progressively there became consciousness of this problem and bit by bit it improved. On the one hand they started to see that they had been using pesticides for such a long time that the bugs became more resistant and the pesticides had to be stronger to kill them. Also there was a new possibility of using other bugs to eat the bugs and worms that affected the crops. So, for very few years there is a method of using these bigger bugs in a greenhouse to protect the crops from being eaten. It is called the 'lucha biologica', the biological fight. This has already spread to 90 percent of the greenhouses, although some farmers are combining it with pesticides.

E: Aren't those bugs dangerous to humans?

P: No. They are happy with them, because these bugs depend on the smaller bugs to stay alive and therefore it is a closed circle. And it has reduced the use of pesticides. It has been a success. It is very interesting, because these sort of innovations spread very quickly here. Once farmers know it is successful and sustainable from an economic point of view, it spreads rapidly.

E: Did the farmers come up with the idea of bugs themselves or did someone from outside the agricultural sector come up with it?

P: I am not sure, but it is not something that the farmers thought of. It must have been someone from the outside. Maybe from the university, because there is strong interaction between the university and the farmers and this is one of the things that is important to understand, the success of Almeria or the possibility to survive in a very competitive world. It is possible that it came from the university but not from the farmers. About the concern

of these environmental things: at the beginning the only thing farmers thought about was making profits to survive, I mean they run a lot of risks here. There have been a lot of suicides. It had happened quite a lot. Many of the farmers living here are not from here, they or their parents were Spanish immigrants and that is what we call now the first wave of immigration. These were plans of colonization and were implemented by Franco after the civil war of Spain. Spain was in a catastrophic situation. We have had the war, we had little technology and also we were in some way isolated until the late 50s from the rest of the world due to Franco's dictatorship in a world that had defeated the fastest movements in Europe. Then Franco established a plan of colonization by putting lands in labour that traditionally had been in labour and therefore were bad. Anyway, this would be a way for Spain to feed itself. Then they started a plan to give bad land to people and here was one of the places. So people from all over Spain came here to become a farmer. It was not very productive at the beginning but after some years it started to be successful.

E: Do you know if people nowadays still come to this area to start farm business?

P: Well it is still an area that usually receives immigrants, even Spanish people migrate to this area. It is very dynamic, but it is not so frequent now that people start business here.

E: And for tourism for example?

P: Well you have been there I guess, there are a couple of enclaves for tourists, mainly in Roquetas, but it is an enclave. Here, the area for tourists is very limited because of the greenhouses. All of the things related to the greenhouses are really interesting, I mean, for tourists also. There even are some greenhouse businesses that offer excursions for tourists. Nevertheless the tourism still is marginal.

E: Well I am going to a greenhouse with some people from this university that so research there next week.

P: Ah, that is very nice. Well there are big differences between greenhouses. You can find very traditional greenhouses which used to be low technological. But there also are very tall greenhouses and very modern with lots of mechanisms and they coexist now. But of course those more traditional ones are having more problems to survive. We are in a process of progressive concentration now. This difference also can be seen in the labour relations. The more traditional greenhouses that are managed by one family and that have some foreign workers have worse relationships. The personal relations can be okay but the conditions are worse because the margins are lower and the risks higher. Many of the farmers have to ask for loans to face the investments they have to do. If the crop goes bad and the market prices are not okay they can have troubles. And bigger business can organize and diversify the risks better. They can bet for more specific markets or products that give them more margins. I think that they are progressively growing better. But this is also a question to

have in mind. There are so many small farmers that the wealth is distributed for a lot of people. If you look at Murcia, our neighbour province, they are more traditional because they have better soils and also they have many big companies. So the organization is better in Murcia. There are fewer business and larger properties. But here in Almeria there are so many farmers and the wealth is distributed to so many people. Progressively I think well, the number of greenhouses is still growing here wherever they can find free land, even though that becomes harder and harder here.

E: So the number of greenhouses is growing but the number of greenhouse businesses is not?

P: Exactly. The surface of greenhouses is increasing. Now the problem is the the 'poniente' (western part of Almeria) that is already completely full. It therefore is called the plastic sea. The question now is where the farmers still can expand? They have tried the eastern part of Almeria but there are more problems with water and its quality. The problem now is that greenhouses are growing into the mountains, into the valleys. And there it is affecting the landscape. But on the other hand it is a way of living and it gets money for the people and for Spain. And you have heard about the unemployment problem of Spain, well this is a way of earn money. Therefore people will always try to build greenhouses for living.

E: Okay. I have another question. Some people write about conflicts in this area. Conflicts mainly with immigrants. Have you heard something on this topic?

P: Well, yes. There have been conflicts. For many different reasons. On the one hand because of the bad working conditions of immigrants. On the other hand, first most of the workers were from Morocco and some from Senegal, Guinea-Bissau, and some other African countries in West Africa. I think 85 percent from Morocco at the end of the 90s. They have quite different customs in Morocco, which makes work agreements difficult. Many of those first workers had nothing when they came here and in the greenhouse are two different workers. Some workers are working during most of the year, but that also depends on the size of the greenhouse. Maybe they stop 1 or 2 months during the summer. Therefore they have work for 10 months a year and they have quite a stable job and are more or less okay. Anyhow, there also are peak jobs and here is the big problem. The farmers have not been able to organize themselves, I mean, these peaks are not so clear. In Huelva, the South Western part of Spain, they produce a lot of strawberries and they perfectly know when the season is. In spring time it is strawberry time. This makes it very easy to organize the labour. Here in Almeria vary the peaks. We have a longer season and for the long-time workers that work 10 months a year a job at the same business the next year is very presumable. But the problem is with the peaks. They are not easy to organize, at least they have not been able to organize it properly. At the beginning of this century they tried to use the quota system to bring workers from other countries directly, but it did not work out very well. So traditionally when farmers need workers for peaks they go out and search for

available workers. Here is the problem. A worker who is in the exploitation for a whole year, they get their salary regularly and they have a normal contract, social security. But the peak workers that we call 'eventuales' can not have a contract for a couple of days. The amount of days differs. The thing is that sometimes they are not in a legal situation and they do not have social security. But when they are in a legal situation they need to be working legally, around 6 months a year to renovate their papers.

E: The government decided that they need to work 6 months a year?

P: Yes, at least at the beginning. But sometimes it is difficult with this peak work, it makes it difficult to get documented and afterwards it is difficult to keep their permits. It might happen that they did not work enough days. There has always been a lot of irregularity. When farmers need people to work in the greenhouses for peaks, they pick the people they find on that moment and they don't look at their permits or other things. Now the thing is that people here know that there might be work, but they do not know when and how much. There is a problem because they work occasionally and sometimes the farmers can abuse the situation. These workers may not have enough money to rent in an apartment. Some of them live in the old houses that belonged to the farmers during the exploitation. They are not properly built in many cases. But there are also many people that live in slums between the greenhouses. Something that explains the tension is that the farmers feel insecure in the greenhouses in some way. If you go inside for example during an excursion, you will see that there are just only greenhouses with small roads that lead to the greenhouses. You can imagine people that walk around there and women especially can think that they can be assaulted.

E: So the owners of the greenhouses are afraid that the workers can attack them?

P: Not their own workers, but the people that are living there and that they don't know. They know that they are living there and when the farmers walk outside the greenhouse with no defense they don't feel fine. Especially the women they feel afraid. You can imagine when it is starting to get dark.

E: Yes, I also have cycled through the greenhouses when it was getting dark and since there are no lanterns or lights at all there I did not feel quite comfortable either. Anyway, do you know if there are also conflicts between the immigrants?

P: Not usually. They usually do not mix between nationalities. So there is no mix between Moroccan and Senegalese people. Maybe the African migrants have a bit more relations especially depending on ethnic questions or language questions, but even then they have their separate associations.

E: So between the Moroccans for example, there are no conflicts?

P: Inside? No, not usually. In fact they have quite narrow bonds. They help each other. Sometimes the main reason to associate is not to claim labour relations. The beginning for example of the Senegalese association in Roquetas de Mar was because of the evacuation of the people who died. That is very expensive, so they came together to bind the efforts. They have a strong community.

E: Ok. And does it happen sometimes that violence occurs? That it does happen, for example, that farmers or women get violated when they are at the greenhouses? Or you don't know?

P: No, I don't know. But the urban legends say that. It is quite difficult to say, because when there has been one case, the story spreads to other places and it corresponds with the imaginary of the people. It is hard to say whether it is frequent or not. But it is something that is present. But whether it is real or not, the point is that the perception is there. And at the beginning of the year 2000 there was a big conflict in El Ejido.

E: What kind of conflict?

P: That was very important. It was a fight between Spanish and Moroccan people. The background is what I have been explaining to you, the tension that farmers feel. They depend on the migrant labour, of course, and they do not know how the market prices are going to be. They also have fears for immigrants while at their greenhouses and they think that the immigrants do not integrate and that sort of things. This was the context of the conflict and in this context it happened that one migrant murdered two farmers. There were demonstrations so the climate was very tense and just two weeks later another migrant murdered a girl in a local market in El Ejido. Just two weeks after the other murder. There was so much tension it was at their limits.

E: A young girl?

P: A young girl. Maybe 22 years old. At a market. It looked like he was trying to steal her purse and she overreacted and then he stabbed her with a knife. Afterwards it was said that this man had mental problems and this girl was very known in a small place like this, and the girl was very popular, and the reaction of the Spanish people was very violent. There were big demonstrations, they started to destroy the belongings of Moroccan people, the local NGOs, etc. The Moroccans got assaulted, so there were many big problems. The Moroccans started to reunite themselves, police came from everywhere. The point is that those images circulated and since then Almeria has been put as a bad example of social relations and of exploitations with workers. While probably with the intensive agriculture everywhere there is exploitation and there are bad conditions for workers. They can differ more or less but the point is that since then Almeria has been the example for that.

E: Yes, I have read thing about Almeria being the modern slavery of Europe.

P: It's always Almeria. There are many other places where this sort of things happen. Also from a point of view there has been a bad lecture for the local people because they encapsulated in some way. The immigrants thought that they had been mistreated and misjudged by the press and that the people did not know the roots of the problems. I think this is a bad lecture because it has made it difficult to react in a smart way. The immigrants just thought that the rest of the world was unfair and therefore they thought that this was a good development: finally they got attention. As I told you before, the industrialization did not pass here and labour relations are traditional. So they were not conscious that they were doing things badly, they were doing it like they were used to. Labour in agriculture has traditionally been very informal. The problem lies with the immigrants because they need papers. They need the work to be formal, which it was not traditionally seen. So in some way, sometimes when people say 'there is informal labour because they are migrants' it is not true, it is on the contraire. And in Spain there are several sectors that traditionally have been working in a very informal way, but the point is that in these sectors the possibility of people from other countries to come here without documents and without work and they could work there even though they did not have documents or permits to work. But to stay here, migrants need papers, I mean, they want to become legal, they are not in illegal situation because they want to. In fact, the presence of immigrants in different sectors has made these sectors become more formal.

E: So this area became more formal?

P: Yes, of course. Because there is a pressure from the migrants to get contracts and papers because they need to. First they need an offer to become legal, but to keep their permit, they need to be working legally, with a contract and social security. So this sector has adapted in some way to this. They always think it is too expensive for them, but they have to. So farmers are always trying to pay less than they should. There is an official agreement which says that the farmers have to pay around 6 euros per hour, but many times, especially the smaller corporations, pay less.

E: There is no control on this?

P: There is control, but it's difficult to control because there are many trick to cheat. Some of them declare less hours, so when an inspector comes they just show them the hours they filled in. The inspectors can stay for the whole day, but yeah. It is difficult. There is a certain formal agreement but also an informal agreement and they pay less. Maybe 5 euros per hour instead of 6. The conditions improved quite a lot due to the economic boom in Spain, before the economic crisis hit in 2008. Lots of people could legalize their situation and therefore they had more freedom to enter places in other sectors in which you could not

enter without permits. So by having their permits the possibilities spread for immigrants. Of course there are better paid sectors than agriculture and farmers had to try to keep their workers. So by this time most of the farmers were paying 6 euros and gave their workers social security. Unfortunately with the crisis it began to change. The better paid sectors, such as construction work, were in a boom before the crisis. It was almost impossible for the agricultural sector to compete with construction. But during the crisis there were a lot of workers that came back to the agricultural sector. And then the situation in here changed. So then the farmers found that there were lots of potential workers and they started to limit their conditions. But now the situation is tensed again as we are finally recovering. Farmers are starting to see more difficulties to find workers, specifically for the peak periods.

E: And why is that? The economic recovery?

P: Yes. It is just now, until now there were not many possibilities but now there are. You can still find differences between greenhouses though, usually the smaller and more traditional ones have more problems with labour conditions. In the comparatives, labour conditions between traditional and modern farms are different. Modern, big farms need a lot of workers, also Spanish ones, and usually they also have the official agreements, so that is a good accomplishment.

E: Do you know if nowadays people (both African and Spanish people) are moving out of this area?

P: Hm. Spanish people have gone abroad, just like migrants. They go to other countries. Especially the African workers, but for example we also have Romanians here. I told you about the 90s, then there were just African workers. But in this century Latin Americans started to come as well, such as from Ecuador, Colombia and Argentina mainly and a bit afterwards Romanians, in large numbers. Bulgarians also. Especially in the area of Roquetas.

E: To work in the greenhouses?

P: They work in the greenhouses, but the Romanians looked like they had better qualifications and they started working in the construction sector very quickly. They were very successful, they created their own small enterprises to construction, there were a lot of Romanians working in the greenhouses and in the construction sector. But with the crisis, when the construction sector almost disappeared, it was the most affected sector; they lost $\frac{2}{3}$ of their workers in Spain. In Almeria this was devastating, some enterprises had to close and it was a big problem. So some people went to other parts of Spain but there it was more or less the same. So many tried to go back to the greenhouses but people also migrated to other countries.

E: And during the crisis, the farmers in the Campo de Dalías stayed here? Or did the amount of farmers change?

P: The farmers stayed the same. Agriculture was not very affected by the crisis. Indirectly they were affected because people had less money to spend and wanted to save more.

E: And if it did not work out the farmers committed suicide.

P: You know, one of the ways to commit suicide was by drinking pesticides.

E: Oh that is very bad. Well it is cheap, you already have it.

P: It is what you have by hand.

E: Well I think I have a lot of information now. Maybe one last broad question. Do you think that if the water problem becomes less of a problem, that there will be less conflicts?

P: I am not sure about that because I am not a specialist. There are some desalination plants, but there are problems with them because they are too expensive.

E: So I've heard yes.

P: So they are not being used as much as they were expecting. There is much criticism on those plants.

E: But if the water becomes less of a problem one day, because maybe farmers are willing to pay more for clean water and there comes a clear solution, do you think that that might be related to less conflicts or problems in this area?

P: I am not sure, I mean water is conditioned in some ways. It makes the crops more difficult to keep growing. That is one of the reasons that the greenhouses are expanding to the mountains: there is more water than here. In the eastern part of Almeria there are also many greenhouses but there is still room for some more. The quality of the water in the eastern part is worse, much worse. In fact in the Western part, the Campo de Dalías, there is a large variety of products. There are many different peppers, cucumbers, tomatoes, lots of different products. While if you go to the eastern part there are just tomatoes. That is the only crop that resists the salt water. The North Eastern part, Campo de Nijar, is just tomatoes. You cannot grow anything else. The EU permits more tomatoes from Morocco than from here and that is a very sensitive development here because in the Campo de Nijar nothing else can be grow than tomatoes. In the Campo de Dalías they can grow other crops as well.

E: But if they use freshwater in the Campo de Nijar they can grow other crops. But the farmers have to pay more for that.

P: Yes. But I don't know if it will have an effect. People here are not conscious at all about the environment. It is terrible. But these last years they started to be a bit more conscious about it. Finally. We have started a wave in this sense, we are improving. It is not that you approve laws or that sort of thing. The point is the mentality and the mentality of people has started to change during the past 5 to 10 years. I was in a seminar in El Ejido, a book presentation by one of the economic professors here. The book was very friendly about farmers and so on, it was very nice for them. And they were invited, the farmers and members of cooperatives, and the book and presentation were very nice. And mostly those books are very critical and farmers become very defensive. But as the book was so nice for them, it was funny to see, the farmers became critical on themselves, especially on environmental issues. One has a neighbour that was doing that bad, and the other has seen this. And this is the beginning, this is the beginning to raise consciousness.

E: So that is indeed the way to do it.

P: Yes, this is the starting point. For me that was very positive. So in environmental problems we are further than in labour conditions. They did not criticize themselves about things related to labour conditions. But anyway we are working on a very small project with two big Swiss distributors who have been critics on labour conditions and so on, but what you have to know is that European distributors impose a lot of conditions, also to labour conditions, to buy products here.

E: Can you explain that?

P: Yes. When I was talking about the 2nd expansion of the greenhouses, one of the expectations was that the new market was going to be Europe and in fact during the 90s, the growth was based on the exploitation. Half of the production goes to other countries, mainly European countries. These exploitations are in the hands of a few big distributor companies in Europe. French, Swiss, German companies. Just a few. And they are the ones to fix the prices, they have the power. And they also fix the labour conditions. Farmers have to fulfill a lot of environmental but also social conditions. They are being visited by inspectors from these European companies and they have complained that each of these Spanish distributors has a different way and formula. Therefore to export, the big Spanish exporters have chosen to organize themselves in cooperatives. And the cooperatives they formed have a manager and are very well prepared in general and the most visible of these cooperatives are the big stallers where they manipulate and classify the products the way the distributor wants the products. For example, the distributor wants this in boxes of carton and these in square plastic boxes. So it is very well organized. And those who export have to fulfill the wishes. So in cooperatives everything is well organized. But it is difficult,

even though these companies organized themselves for exploitation, they tend to have better labour conditions, but in the greenhouses it is harder to control. But what I was talking about, to see if we can also start a mentality change about social conditions we are working in a small projects with these Swiss companies, because they want to see how this can improve and also to put examples of good practices. So they have chosen some companies that they are working with. We have been to them to see what they do, and those are the companies that probably are more conscious about this. And so the distributors want to improve the social relations in the agriculture and to check with their chosen companies what is done and how they can improve some aspects and also afterwards put them as example of good practices introduced by the rest of the sector. So I expect that this also could be a starting point. It is true that these cooperatives are more conscious.

E: The European companies or the Spanish cooperatives?

P: The selected Spanish companies that are cooperatives. The Swiss distributors want to improve is due to interviewing some selected companies and cooperatives that export a lot to the EU to see how they can start good practices. How it could be made possible. Because sometimes farmers say 'we cannot pay more' or 'it is too difficult' or 'we cannot afford this'. So these conversations are to see if there are options to put in real practice with the majority of the farmers.

E: Alright, I think we are over our time now, but thank you very much! You have helped me enormously.

Interview with Antonio Pulido (University of Almería)

E: Are the greenhouses in the Campo de Dalías sustainable according to you?

A: I am a geologist, I study groundwater. I have done research, especially in the Campo de Dalías, on the degradation of the water quality and water quantity. In hydrodynamic conditions there is seawater intrusion. But this is not true. Even if the physical conditions are too low there is seawater intrusion.

E: They use the seawater for groundwater, right?

A: Yes. They pumped water from the continent and the piezometric level became lower than sea level and the physical conditions move water from the sea to the continent. This provokes a mix between seawater and freshwater. And usually this is not good for the irrigation, but nevertheless the overexploitation in this area is very high for many years.

E: And nowadays they are using these big systems to get seawater out of the sea and desalinate it?

A: The desalination plants. They are very expensive. Farmers did first not accept to pay the costs until very recently. This summer we had a summer course on water scarcity in the area in July and we organized it with a lot of people with many specialties and also with farmers. In this summer course, for the first time in my life, I heard that they are willing to pay the costs.

E: Really? For clean water?

A: For desalinated water, yes. And in my opinion, this is because they start to be conscious about the problems. It is very close to the final countdown of seawater intrusion. And if they continue to reduce the water use from the aquifers in the Campo de Dalías for irrigation the efficiency will be increasing. In 1977 they used the same quantity of water as they do now, but only with 9000 ha of plastic greenhouses. Now there are 22.000 ha of greenhouses and they still use the same quantity of water, because the irrigation system is very efficient now.

E: So with the same amount of water?

A: They can irrigate and even with the increase in tourists in El Ejido, Aguadulce, Roquetas de Mar, they maintain the same quantity of water. These are very positive aspects. But for the systems, the amount of water and the infiltration in the aquifer Gádor, are the same even though it has a high variation at different places in the aquifer. Some places use probably 3 times the average amount of water. The organization of the system of agricultural products is very good, probably one of the best in the world. We have a lot of

Chinese people studying here, probably eager to learn about the water efficiency and how to improve agricultural activities. If you look at ways to increase the production with a less quantity of water, people are good at it in Almeria. Practically all the pesticides have been eliminated, they use biological stuff now.

E: Are many famers biological nowadays?

A: Yes, more and more. They are very conscious about the very big problems around pesticides on water and soils.

E: But do you know why especially this summer so many farmers became aware of the problem?

A: I think because of the evidences of water quality degradation. And for many years it was similar, because in 1977 the technicians working in this area said that the system in the Campo de Dalías was not sustainable.

E: In 1977 already?

A: Yes. And with 55.000 people living here then, there live 500.000 people now. So that's a big difference.

E: And now they see the problem?

A: The salinity of the water in aquifer Felix - with the wells at 300 m depth - reached 15,000 micro S / cm. Felix was a fantastic aquifer back in the days, until the piezometric level declined. In the rest of the more western probes Gádor was captured. The farmers replaced their pipes 20 years ago by others of 600 or more meters to reach Gádor, but without cementing in the Felix Gádor transition, which caused a feeding from Gádor - with much greater hydraulic load - to Felix. After several years the levels fell in Gádor and - by effect of "shower" - Felix returned some of the water received, already mixed with the salty one, through the annular space that existed between the wall of the sounding and the intubation. This fantastic water from Felix declined in quality as farmers detected that the salinity was increasing. For tomatoes it is not a problem, but for other crops it is. Do you know what Aguadulce is?

E: It is the name of the town where I am staying close to.

A: Yes but what does it mean?

E: Soft water?

A: Yes, freshwater. And the reason is that fishers in the boats could drink very good water into the sea. It was the main point of the system, in Aguadulce. But there are several tectonic units. There is Gádor and Felix. This was the system before nitrogen. Water came to Aguadulce with no connection with the coastal area aquifer. This area has only wetlands. Seawater intrusion was here, locally. The amount of bore holes increased, but they are now abandoned. In the wetlands you see the two small lakes, the aquifer is overexploited, it's something curious.

E: Do you know if much water goes to touristic attractions?

A: You mean for drinking water?

E: No more for golf courses, touristic attractions.

A: Oh, I don't think that there are a lot of golf courses here. But there are around 200.000 tourists in the Campo de Dalías. Now, look at this. The soil is not good around here. All the greenhouse soil is artificial. The positive things here are the sun, almost 6000 hours per year. That does not cost energy. And the climatic condition. But the rest is not very good. In the human period the level has increased more than 3 meters. Other grants are used as gravel. 30 years ago they took the sand from the beach, but it is forbidden to do that. So they found another solution: they destroyed big rocks from the Sierra Nevada to small stones and used it as a layer. Also, what is curious is the evolution of pumping. We have a small aquifer, Felix, where most greenhouses are built on, this aquifer is only 100 meters thin. At this period they pumped less than 10 million cubic meter, but this amount was increasing and there was salt water intrusion that was trapped from the period of marine sedimentation of this material a long time ago. So, over pumping in this surficial aquifer provoked degradation of the water quality. They reduced the pumping. They reduced it from almost 50 million cubic meter until 20 million cubic meter. Note, this was not present marine water, but salt water from 6 million years ago. So that is the reason why the pumping in Gádor is increasing. And in this basin for the exploitation of clays to build the greenhouses on small lakes emerged. You see, flamingo's need 20 centimeters of water to stand in and that was first the case with these lakes, but now there is 14 meters. Also there is the question what to do with agricultural activity and waste.

E: What happens to the plastic?

A: The plastics are recycled now. Before the recycling they were burned, not recycled. But burning was very dangerous because of the toxic gasses.

E: So for 20 of 30 years they recycle it?

A: Something like that. But the beginning was really crazy. Plastics everywhere. Plastic

plastic plastic. And many mosquitos.

E: And one last question since we run out of time, do you know why the farmers put white paint on the top of the greenhouses?

A: Because we have too much sun. It is to increase the albedo, de reflection. According to the NASA the Campo de Dalías has the highest point of reflectance. Now, look at these two artificial lakes. What did they do to reduce the problem? They pump this water with a big pipe to the sea. You need to use energy to pump the water to the sea. But at some points, unfortunately the water stays high. Some people's houses that are close to the lake are damaged by the water of the lake. So, what is the solution? Desalination plants, a lot of them. Thank you very much, I need to go now.

E: Ok, thank you very much.

Interview with Louisa Gallardo (University of Almería)

E: Can you tell me something about the project you are working on at the university?

L: Well basically we have this small group of four scientists. Then we have two technicians, but not paid by the university. We have contracts with and get some money from the government or by private companies. And then we have students. At the moment we have one phd student and some master students, they come and go. They are working in the sustainability of the greenhouses.

E: In this area?

L: Yes. We study for example hydroponics, but in particular the management of irrigation water. At the moment we are focusing on nitrogen, because there is a big problem with the contamination of aquifers, because the farmers of the greenhouses apply large amounts of nutrients and nitrogen with their fertigation system as you will probably know. There is no planning, no way of control. They just use recipes, standard recipes, and as a consequence there is being an increase over time in the levels of nitrogen in the major aquifers particularly in the Campo de Dalías. So at the moment we are focusing on that and we are trying to develop tools that farmers can adopt to improve their management of water.

E: What kind of tools are you developing?

L: We are basically working with two types of tools. Models, which is my research area. So, models, but very simple. So not the Dutch models that require a lot of computer skills and a lot of information. These are very simple so farmers can use it. You can see it on the web page I will send to you.

E: Ok, so this is to develop models for the farmers?

L: Yes. They can input some climatic data. They select the species, the growing cycle, and then they get the recommendations of the nitrogen concentration of the nutrient solution that they should apply for the optimum amount of nitrogen. The crop requirements of nitrogen, but also of irrigation. Because the nutrients here are applying concentration so we give recommendations of the volume of irrigation and also the concentration of nitrogen that the crops should have every week based on the climate.

E: Right. And do you know if farmers themselves are aware of the water problem in this area?

L: They are starting to. But it's not easy. For them sustainability is not the major problem. They are more concerned about things affecting them directly economically. Like for

example the reduce of the pesticides that they, if they don't follow the rules, the vegetables don't go into the market. So when something touches them directly they react, but if something happens on a more long-term basis it is not so easy. But the price of fertilizers is also increasing slowly. Currently we have an European project that is basically a project for technology transfer. We're going to have demonstrations of our tools for partners to become more aware of the problem and the solutions.

E: That is very nice.

L: Yes, and a research project we have is using sensors that detect the nitrogen levels of the crops.

E: And those sensors are located in the greenhouses?

L: Right, we use different types of sensors. One is optical sensors that measure the properties of light coming into the crop. Basically what they measure is the colour, the level of greenness. And also we use sensors based on indirect measurement of chlorophene. And then we do sub analysis, which for we need to do everything in the greenhouse. We have portable meters that distract the sap and we can measure the amount of nitrogen. At the moment we are developing the threshold values for optimum nitrogen management, so we are doing experiments with increasing levels of nitrogen to determine the threshold.

E: That is very nice. I have also read some papers about Almeria being one of the most sustainable agricultural areas in Europe. Do you agree to that?

L: No.

E: Why not?

L: Because I still think that there are lot of possibilities to improve, but it's not there yet. The thing is that there are different kinds of scientists and each one has different ideas. I think it's good and people work very hard, but in relation to the use of nutrients there are many things that can be done to improve. Otherwise I wouldn't have anything to do here. Farmers apply like six kinds of recipes and they are not looking at the crop or the climate.

E: They just take standard steps?

L: Yes, and that gives possibilities for the adaptation of the nutrients application to the crop requirement.

E: Do you know anything about the desalination plants that get water out of the sea and put desalted water it in the ground? I've heard that those are not very good for the climate as

well, but what do you think?

L: I think the salt goes back into the sea.

E: Okay. And do you think that it is a good development?

L: At the moment, the volume of water that they are producing is not very high. Because the plants are working at a very small percentage of their capacity, I would say like 20 percent.

E: Really?

L: Yes. It's quite complex. It is basically the farmers are reluctant to pay for desalinated water because it is much more expensive than water from the aquifers, like double the amount or even more. So they prefer to use the aquifer. It's an issue of costs and politics.

E: Ok. And in the aquifer the water is getting a little salt as well right?

L: Yes, the salinity is increasing a lot.

E: And that is not good for the crops.

L: No. In fact, in the west, where Campo de Dalias is, salinity has been increasing linearly in the last fifteen years. There are crops, like pepper, that are not the most profitable crops, that are now getting difficulties because of the salt.

I have to go to my meeting now. If you need anything you can send me an email. I will sent you one with the email address of my colleague who does research in our greenhouse.

E: Thank you very much, it has been really helpful.

Interview with Maria Rodriguez (SOC-SAT)

E: Do you know more or less the percentage of legal and illegal immigrants here in the Campo de Dalías?

M: That is very hard to say because the number fluctuates a lot. For the exact number you can take a look on the website of the government, but also that number is an estimate. I believe the total number of immigrants in this area is now around 4000. Also, what I know is that there are two types of (African) immigrants here. The first one is the all-known 'batera' group, the people who come here by boat. The second group is one that the government does not like to talk about. Well, everybody knows about it, but nobody actually talks about it. It is the group of immigrants that already lives in Spain, but they live in other places. And in order to get them to work, mostly in the agricultural sector, the government sends many of them to this area in busses.

E: Alright. A professor at the University of Almeria told me that nowadays, for the first time after the conflicts in El Ejido in 2000, people are becoming more restless and the atmosphere is a bit more tensed. Do you agree with this and why?

M: Well, I do not really know that. I know that the conflicts and violence in El Ejido in 2000 were also due to racism from Spanish people to immigrants. Also, between 2000 and 2005 the attention on immigrants became less because the Spanish government decided to pay less attention to them and their problems. Nowadays, there only is one governmental office left for immigrants and that is the one in Roquetas de Mar. After the crisis in 2008 everybody in Spain got affected. The high income people as well as the low income people. There were more people than agricultural jobs in this area and the wages were very low.

E: I read in the SOC-SAT folder that this organization occasionally organizes strikes with immigrants working in the greenhouses here. Can you tell me more about this? How do these strikes, for example, affect their working conditions?

M: We indeed help organizing the immigrants to fight for their rights. We try to inform them about their position in this area and greenhouse sector as much as possible and sometimes strikes come out of that. Even though that in most cases they come up with the idea of fighting back, which I think is very good. An example of a strike that turned out very well is the strike of the Tarifa Track. For your interest, in Almeria there is a collective agreement that has been negotiated between two groups: The first are the representatives of the workers, the syndicates. The two biggest syndicates in this area are the UGT and the CCOO. The other group consists of the representatives of the companies. Now, these two groups have come to an agreement about all the activity that takes place on 1) the 'manipulado', the buildings where fruits and crops are being packed, and 2) the 'convenio del campo', all the land that is used for agriculture. So that includes the greenhouses, the olive

tree fields, etc. The strikes that are being organized are an instrument for workers to get better results out of this agreement. If it concerns small scale farms the workers of that farm can protest in front of a greenhouse or governmental building to visualize their rights and point their finger to the enterprise(s) that violate the agreement. An example of a strike that turned out very well for the protesters was the one against BioSol, one of the biggest enterprises. It started with women who got fired. They eventually won the case, because even when BioSol tried to bribe them halfway the process they did not accept. The thing here was that Swiss importers, supermarkets, did not want any bad publicity related to these protests in Spain. They did not want to buy BioSols products anymore if the workers' conditions did not change. Therefore BioSol decided to give in and give the women their fair share. So this is an example of workers not giving up and getting what they deserve. SOC-SAT can help with that, but it's mainly the workers themselves.

E: What other things does SOC-SAT do to help the working immigrants?

M: Well, SOC-SAT is in the first place a multicultural organization. Immigrants work here in the office and campaign for other immigrants' rights. Here in the office, some work during the information hours as advisers. We also have an immigrant lawyer, some spokesmen, people who work in the women's department, etc. They are from Spain, but also from Sub Saharan Africa, Morocco, South America and East Europe, all kinds of places. Another thing that we (and therefore they) do is try to inform immigrants on the streets. We give them folders with information about their rights, talk to them and give them the address of our offices. So, the main things we do here are giving advice to foreigners, giving Spanish classes, inform immigrants on their rights and the content of the collective agreement, and campaign for everybody so that someone takes care of the rights of the workers. An example of what we do at the moment includes a situation in El Ejido. There is a place in El Ejido where immigrants live with children and babies but without clean drinking water. This situation is very concerning, but somehow the government ignores this. Therefore SOC-SAT is trying to make a proposal together with the immigrants who are living there to give to the government. The first step with these kind of actions is to give the immigrants dignity to step up to their oppressors. To let them know that they can fight back. But it's corrupt here. For example, 1,5 year ago the police tore down a camp where immigrants lived. They just destroyed it. SOC-SAT helped the homeless immigrants to make a camp in front of a government building and cooked meals for them. Also, many people living around the "new camp" opened their houses for them to let the immigrants clean themselves up and go to the toilet.

E: Wow, what contradictions in humanity. We have to move on to the next question I'm afraid. I interviewed some big farm owners about their knowledge of conflicts and violence in this area. They all claimed that those things do not exist here. Why do they say so, you think? Do they really not know or do they have other reasons?

M: Well, they know, but for example small farm owners claim that they can not raise the low wages they pay their workers. Visualize it as a spiral: small farms are in the middle of this chain. Big supermarkets from all over the EU to which small farm owners sell their crops pay a certain amount of money for it at an auction here. Therefore, they buy a big amount of vegetables or fruits and the farm owners have no saying in the amount of money they pay. So, if they do not pay that much money, the small farm owners can not pay their workers more. For big corporations it is slightly different. They are not in the middle but at the very beginning of the spiral. These big corporations can afford low prices for their crops every once in a while, which means that they still have profits at the end. Still, they do not pay enough money to their workers. You spoke to owners of those big corporations and they did not admit that conflicts and violence are present here. This is because they do not want to spread the word that they do something wrong here. If they themselves admit it, they can be charged easily. Anyhow, this problem does not only exists between Spanish farm owners and their workers. Sometimes immigrants earn enough money to buy some land and start their own businesses. They hire workers and the same thing can happen as what I just described.

E: Yes, about that, do you know if immigrants usually stay here or go to other areas or countries?

M: They mostly go to other countries. Almeria is a transition place. Young people tend to leave in particular, in search of a better life in the promised land of northern Europe. Especially after the crisis when there were no jobs and the wages were very low. Around the year 2000, many Moroccan people lived in Barcelona. Many of them came back to this area when the crisis hit, in search of a job in the agricultural sector. You know, in the 80s/90s, Spain invited many Moroccans to this country as they needed seasonal workers for the agricultural sector here.

E: Yes, just like in the Netherlands.

M: Exactly. And just like in other countries, such as the Netherlands, many of those seasonal workers decided to stay. Therefore, they have built up a stable network of compatriots in this region. Nevertheless there are good and bad networks. If you are lucky, you have family living here to connect with. If not, you can end up in a bad network.

E: Do you believe it is a free choice for them to work in these greenhouses?

M: No. Not at all. Although there is the collective agreement, greenhouse workers call the greenhouses a white hell.

E: Why exactly?

M: Because of the bad conditions, the violence, the yelling all the time. There are no toilets in the greenhouses, so for women it is even more difficult when they have their period. It happens often that their bosses count the amount of times they go to the toilet and subtract it from their wages. If they go too often, they can get fired easily. The workers feel very replaceable.

E: How many percent of the workers is feminine?

M: Around 20 percent. There are also sexual harassments during the work. And the work is hard. Therefore the percentage of women who work in 'semilleros', farms that grow seeds and small plants, is higher. This work is easier. However, we try to explain the workers that fighting their boss all together is the best option, but of course they find it scary to actually do so. Sometimes they come to SOC-SAT on their own initiative to fight back, but their boss can also threaten them to do not. Lately, we were distributing flyers at a gas station here in this area and we gave some flyers to immigrants there. Their boss was there too and shouted that their workers immediately had to let go of the flyers. As petrified of fear all the immigrants let their flyer fall out of their hands on the ground, really like we were watching this movie. Very alienating and scary to see.

E: Wow. That is something. Now, another topic. When I talked to some Moroccan immigrants and asked them about their interest and knowledge on sustainability here, it seemed like they could not care less. Do you know something about this?

M: Indeed, I believe that they could not care less. They need money and that is what matters for them. But still, the sustainability here is not good. Even though the EU tries this area to become more sustainable it is doubtful. Such as biopesticides, they are not as good as people claim them to be. Critical scientists are not happy about them. You should read some articles with this criticism on sustainability. Sustainability is a concept to make products more attractive to consumers. Still, it does not change anything.

E: My last question is about the difference between East European immigrants and African immigrants. How different is their integration?

M: Bulgarians and Romanians more or less have the same culture as Spaniards. So even though they came later than Africans, around the year 2000, they have less trouble with integration. Romanians, for example, learn the Spanish language quite fast. Also, it is noticeable that people from the same country cluster together in the same sectors. For example, Romanian women work a lot in the cleaning sector, while Latin Americans take care of old people, and other East Europeans work more often as supervisors. As you probably know, Moroccans have a very long history here in Spain. Arabic is intertwined in the Spanish language, buildings, food. Especially in this area, in South Spain, the Arabs have lived for a long time. Therefore, Moroccan people want to have a higher position than

other immigrants. They demand it, they even fight for it. They have a longer history and therefore better networks. This makes them able to demand more sometimes. Nevertheless, Spanish people do not like them. Sub Saharan Africans are more accepted than Moroccans. This does not mean that there is no racism though. Anyhow, the East European immigrants are the ones who are the most accepted, even though this acceptance is still imaginary. When Spaniards throw a public event like a street party, everybody knows that immigrants are not invited. Nobody says that they are being excluded, but the immigrants know they are not welcome there.

E: Thank you very much for this interview.

INTERVIEW WITH 3 MOROCCAN GREENHOUSE WORKERS (WORKER 1, WORKER 2, WORKER 3).

E: For how long have you lived in Spain?

W1: 18 years.

W2: 15 years.

W3: 1,5 years.

E: Where are you from?

W1+W2+W3: Morocco.

Why did you choose to live here?

W1: Close to work and life is better here.

W2: Better life.

Can you describe working in a greenhouse?

W1: I don't like it. The climate is not friendly and bad for the people who work in the greenhouses. It is the worst work.

W2: We have no rights here. The price of the tomatoes is the most important thing.

W3: There is not much security.

How is the contact between your colleagues?

W1: Neutral. Not nice but regular.

W3: Neutral. There is not really competition between us.

Are there conflicts between your colleagues?

W1: No, not between us.

Are there conflicts between your colleagues and your boss?

W1: Yes. It is always about money and work. There is no freedom.

Is there violence in this area?

W1: Yes, but only with words. And sometimes a little bit between colleagues as well.

Is there poverty in this area?

W1: Yes, of course. We have no money for the supermarket. And with the crisis in Spain it has become worse, there is no money for things.

W3: We have no money for food.

W2: Especially in the low seasons like today, we have no work.

Do you know anything about sustainability of the greenhouses you work in?

W1: *waves with his hand*

W2 and W3 want to show their self-built plastic house.

E: Can I make pictures of your houses and village?

W2+W3: Of course.

W1: Not of my car.

How many people live here?

W3: 10 Moroccan men.

W2 starts to tell about the village.

W2: There is some electricity here. I have a television, a fan, a radio. We get electricity from a lot of people. But there is no clean water here and to buy water is very expensive. We don't have money at this very moment. I built this house all by myself, bit by bit. It leaks inside when it rains, because everything is from plastic. I've had 15 years of primary and high school education in Morocco. When I came here, I came by boat with 60 other people. Many of them died. It was horrible. It cost a lot of money to buy a ticket for the boat. Sometimes when I lay in my bed I think about Adam and Hawwa (Eva). All people on earth come from the same two people, right. How is it possible that there is so much injustice and poverty then? It keeps me awake.

After seeing his house we walk around the corner, where W3's house is.

W3: I followed 2 years of education on primary school. I have a wife in Marrakesh *shows picture*. She is 3 months pregnant now. This is my house. I made it myself too. There is no food at the moment *shows empty fridge*.

