Mapping of Urban Agriculture for Land Use Planning in Almada, Portugal

Diploma Thesis

Presented to the Faculty of Environmental Sciences, Landscape Planning
Czech University of Life Sciences

Author: Caitlin E. Pohle
Supervisor: Vojtěch Barták, CULS
Consultant: Particial Abrantes, ULISBOA

2015

Diploma Thesis Author's Declaration

I hereby declare that I wrote this diploma thesis independently, under the direction of Vojtěch Barták,. Additional information was provided by Patricia Abrantes, Ph.D. researcher at the University of Lisbon, Center of Geographical Studies (CEG) and Institute of Geography & Spatial Planning (IGOT). I have listed all literature and publications from which I have acquired information.

Acknowledgements

Support for this dissertation was provided by students and professors of the University of Lisbon CEG-IGOT and through the involvement with the AgriMet-MOD project. Patricia Abrantes acted as the consultant through the CEG-IGOT, UL and AgriMet-MOD, providing a considerable amount of support by coordinating interviews providing data and materials as well as additional project guidance.

Additional thanks to Ines Fontes and Eduardo Gomes for participation in the interview procedure and translation if interview questions and answers.

Abstract

Urban agriculture is a budding topic of exploration within the field of urban planning, especially in more recent years in reaction to Agenda 21 and other policy initiatives which encourage urban green space and other sustainable practices in city planning and development. While an abundance of literature and studies which explore the social and environmental role of agriculture in urban settings, typologies, practices and implementation of urban agriculture are available; there is minimal information on the actual quantitative measure of agricultural land use within urban settings and indicators of the land use change. In fact; considering many sites for urban agriculture are independently organized regardless of zoning, there is no way for municipalities to measure the actual extent of this type of land use. This was found to be the case in the municipality of Almada, Portugal.

The purpose of this study is to create a methodology to identify and quantitatively measure the amount and locations of agricultural land use within a set urban boundary which can be easily replicated in various locations internationally. Qualitative interview methods are used with stakeholders to create a profile of UA typologies in the study area. The resulting data has the potential to be used in conjunction with other available data (i.e. demographic data and zoning

maps) in order to make land use change predictions and zoning decisions among other uses. The case study performed in Almada, Portugal applies the land use identification methods followed by an analysis comparing the agricultural land use map with demographic and municipal zoning maps as well as local information which may be indicative of land use change.

KEY WORDS

Urban agriculture, Land use change, Satellite imagery, Qualitative research, Mapping, GIS, Lisbon, Portugal, Landscape planning

TABLE OF CONTENTS

1. INTRODUCTION

Although agricultural land use in cities and urban food gardens are by no means a recent phenomenon, the study and municipal implementation of urban agriculture (UA) and agricultural land allocation in cities is more recently a popular topic which is gaining the attention of urban planners and municipal leaders internationally. Following more recent initiatives such as Agenda 21 (Beatley, 2000), planners have begun to focus on the use of urban agriculture as multifunctional landscapes (Renting et al., 2009) for sustainable urban planning.

The study of urban land use in regards to land allocation and land use change is critical in order to provide urban planners and municipal entities with the information necessary to more accurately plan for urban development and land preservation (Cengiz, 2013). Research on trends in UA by the Food and Agriculture Organization of the United Nations (FAO) (2007) identify that throughout history urban land use change (LUC) is highly reflective of economic and demographic change with regard to agriculture as demand for access to fresh food and resources in urban settings increases. The mapping of UA is important in order to quantify the amount and locations of existing agricultural land use within a specified urban boundary. This information can be used in collaboration with social, ecological and economic information from the area in order to use UA as a tool for sustainable planning, identify needs for zoning changes, and more accurately plan for local land use.

The purpose of this study is to create a methodological framework to identify agricultural land use and define the indicators and driving forces of agricultural LUC in specific urban settings. It is important for the methods to be simple, effective, efficient and low cost in order to have the ability to be applied in various urban areas internationally. Replication of the study would thus create a database of existing urban agricultural locations which can be available for public use. The GIS data of existing agriculture can then easily be compared with other maps which display the various land use change indicators (i.e. demographic maps, soil maps, zoning maps). The results can be used as a tool for planners and decision makers to clearly identify agricultural land use in comparison to zoning in order to implement best practices for regulation and protection of agricultural land in urban areas.

Although there are many driving forces which contribute to changes in agricultural land use, the primary interest of this study are indicators related to social and demographic change. The purpose of this focus is to relate UA uniquely to individual urban populations. When considering the functions of UA, the defining features are the relation and integration of the agricultural land use and food systems into the local social, economic and ecological structure which makes UA so widely diverse globally(Van Veenhuizen, 2006). In order to identify the driving forces of agricultural LUC, it is necessary to gain information about the population who are served by and

who are implementing the UA. In addition to the mapping component of this study, one-on-one interviews are conducted to gain qualitative and quantitative information from stakeholders including local farmers and municipal entities. This will provide unique site specific information about UA which would be otherwise unobtainable (user demographics, cultures, methods, purpose, economic activity, scale of production, land tenure etc.) in each study region.

Based on the literature review, a methodological strategy for the study was developed consisting of a threefold approach.

1. Identification and mapping of existing agricultural land use using high resolution imagery in ArcGIS followed by a process to confirm the accuracy of the land use identification
2. One-on-one interviews with stakeholders (i.e. local farmers and municipal leaders)
3. Comparison of demographic data, municipal zoning and actual agricultural land use in Almada using maps created in ArcGIS

The developed methodology is applied as a case study in Almada, Portugal. The Lisbon Metropolitan area is a keystone study area for urban agriculture; large amounts of land within the city create a mosaic of agricultural land use. This specific abundance of agriculture, especially within the Almada municipality, inspires many questions about the purpose of the UA. Research in this area aims to identify the unique functions and features of agricultural land use and driving forces of LUC.

The output of this study provides information which can be used for spatial planning in Almada, but also creates a replicable framework for future studies which will allow for the creation of a database of agricultural land use in urban areas internationally. The replication of the study in individual areas will then clearly identify agricultural LUC in that location. Results also contribute to the further development of definitions and typologies relating to urban agriculture based on identified indicators. The intent is not to make conclusions or predictions about future land use change, but to provide a tool which when used in conjunction with other information has the potential to influence the decisions of land use planners and encourage the implementation and regulation of UA.

2. AIMS

The aim of this study is to create a methodological framework to identify agricultural land use and the indicators and driving forces of agricultural LUC in urban settings.

3. Review of Literature

The goal of the literature review is to create a deeper understanding of the concept of UA internationally and provide the background and tools for the methodology of the following study. Through the review of studies, articles, reports, conference proceedings and other relevant documents pulled from databases such as Science Direct, Google Scholar, municipality websites, as well as books, journals and scholarly publications; the literature review seeks to define the concept of UA and the various typologies. In doing so it will a) explore the role of UA and driving forces of agricultural LUC in urban settings throughout history b) consider expert findings of agricultural LUC indicators and c) discover case studies using best practices to create methodological framework.

3.1 Defining Urban Agriculture

In order to conduct this study, it is important to have a full understanding of the concept of UA and to explore the differences in structure and functionality around the world. Most generally; as it implies, UA is agriculture which takes place in or around urban areas. Agriculture can be considered *the production of food (horticulture, aquaculture, arboriculture, and poultry and animal husbandry) and non-food products*[1] *including the pre- and post-production processes*[2] (Smit, Nasr, & Ratta, 1996b). J. Smit et al. (2001) consider more complex definitions of UA for the United Nations Development Programme (UNDP) and simply sum it up to *"the agriculture that happens to fall within or at the edge of a metropolitan area, perhaps adding its relationship to urban populations"*. Because there is such diversity in urban settings, agricultural practices and populations served; it is necessary to dig deeper in defining the phenomenon and typologies thereof. Luc Mougeot, considered to be one of the world's foremost experts in UA, defines it as:

"an industry located within (intraurban) or on the fringe (periurban) of a town, a city or a metropolis, which grows or raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area"(Mougeot, 2000).

[1] Non-food products are considered agricultural products including medicinal produce as well as production of fuel material, wood, animal feed, and other items not edible by humans.

[2] including processing, packaging, distribution, marketing and recycling (Spricigo & Filippi, n.d.)

Mougeot's definition of UA is used widely among peers in related scholarly literature. The primary elements of this and other definitions are a) the locality to an urban area and b) the production of agricultural resources. Considering Mougeot's definition of UA, typologies can be defined based on factors such as (Mougeot, 2000):

- scale of production,
- size and location of farm,
- products produced,
- destination of products,
- economic activity

When considering the functions of UA, however, the defining features are actually the relation and integration of the agricultural land use and food systems into the local social, economic and ecological structure; this make UA so widely diverse globally (Van Veenhuizen, 2006). Though the definition has changed over time and varies globally, several key elements remain consistent among UA definitions and typologies(Smit et al., 1996b):

- the location in which urban agriculture occurs,
- the types of activities included under urban agriculture,
- the legality and type of land tenure under which the urban agricultural activities occur,
- the stages of production included in urban agriculture,
- the scale of urban agricultural activities,
- the purposes of the activity,
- the types of groups involved in agricultural production in urban areas

The multifunctionality of UA can make land use change predictions difficult and defining typologies a complex task. The extent of UA can of course be related to the physical conditions such as the location, soils, climate, altitude etc. but the primary driving forces of agricultural land use and LUC, according to Van Veenhuizen (2006), are related to the involved stakeholders and social, economic and cultural conditions.

"Urban agriculture is generally characterised by closeness to markets, high competition for land, limited space, use of urban resources such as organic solid wastes and wastewater, low degree of farmer organisation, mainly perishable products, high degree of specialisation, to name a few. By supplying perishable products such as vegetables, fresh milk and poultry products, urban agriculture to a large extent complements rural agriculture and increases the efficiency of national food systems."(Van Veenhuizen, 2006)

The identification of unique classifications and ability to understand the multiple functions of UA will make planning for agricultural land use in various urban settings more adaptable to the population served (FAO, 2007).

3.1.1 URBAN VS RURAL

Although both urban and rural agricultural practices fall under the same general definition serving the ultimate purpose of producing food and other goods for people; there is a wide range of features which distinguish the two categories of agricultural land use from one another. The specifics in the definition of an "*urban area*" vary between countries due to the diversity of characteristics which distinguish urban and rural areas. Land use changes and population growth make urban boundaries unclear as cities overlap multiple municipalities. Due to these differences, each country in the United Nations has unique classification systems to define urban areas. Overall, criteria are generally based on population size of localities (Portugal for example considers an urban area as "agglomerations of 2,000 + inhabitants"). Some systems include the socioeconomic structure of the population to help determine the urban areas, for example in the situation of heavily industrialized areas this is the case in Romania, Austria, and Slovenia. Other countries have distinctions based on space between housing units (France, Sweden, and Reunion) (Dijkstra & Poelman, 2014). The US Census Bureau broadly defines an urban area as a densely developed geographic territory of residential, commercial, and other nonresidential urban land uses with a population of at least 2,500 (although more specific criteria is ultimately used to technically distinguish UAs in the census). "*Rural*" therefore is defined as "all population, territory and housing which are not included in the urban area" (U.S. Census Bureau, 2011).

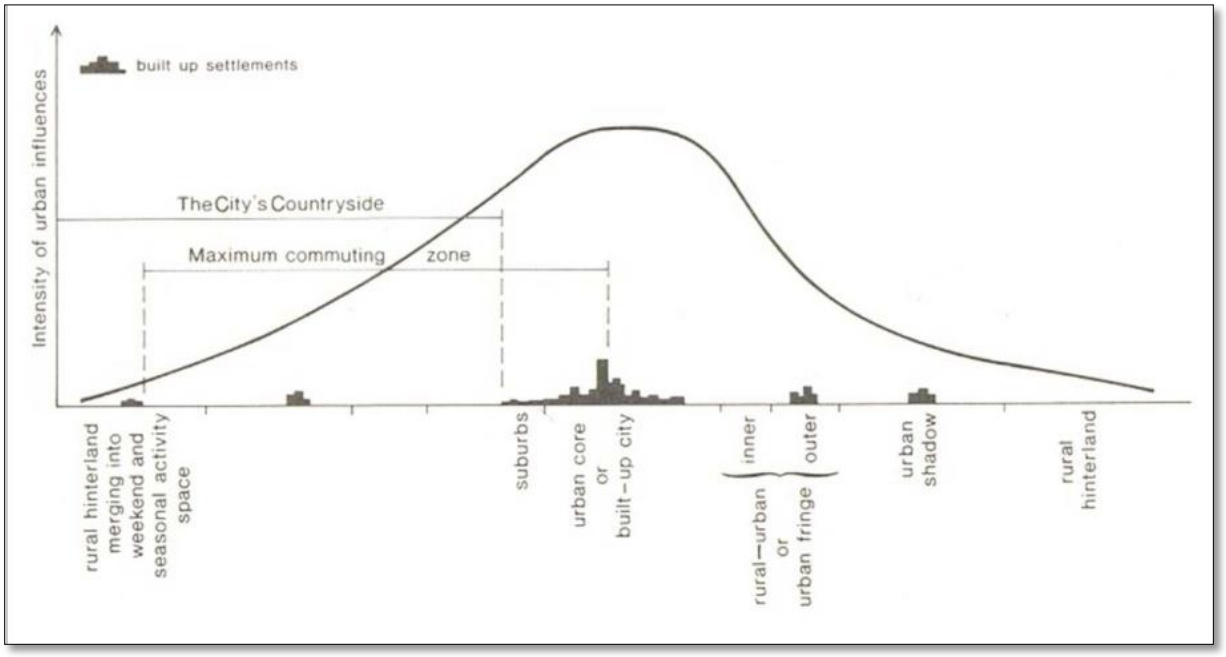
Urban and rural areas although defined separately by governing bodies often blur together in reality, especially due to urban growth and sprawl[3]. The spaces found between the urban and rural settings are transformed by migration from the inner city core outward to vacant land causing sprawl. The areas formed are most commonly referred to as *suburban* and *peri-urban*, but have also been classified further using the *terms rurban, rural urban interface, urban-fringe*, or *banlieue* (Madaleno & Gurovich, 2004). These areas are often fragmented and highly susceptible to land use change due to population growth and other urban influences. Peri-urban areas are not only a transition zone between urban and rural areas in a spatial context, but they are also in transition over time. The once rural areas are likely to become part of the urban area and contain urban features such as transportation routes, built-up commercial areas, residential housing, industries and services in addition to non-urbanized land with agriculture, livestock, pastures, forests, parks and nature reserves (Madaleno & Gurovich, 2004). Peri-urban agriculture (PUA) is UA taking place on the periphery or peri-urban area of a city or metropolis. As defined by Zasada (2012), PUA is *"agricultural land-use in proximity to, and under the influence of, nearby urban areas. Distinguished from agriculture in rural areas, PUA reflects the spatial framework conditions of peri-urban areas brought about by adapting the mode of farming activity being carried out."* Agricultural practices are common in these peri-urban areas due to

[3]Urban sprawl is the physical conversion of open, non-built areas for settlement purposes (EEA 2006)

the proximity of available land to the urban center. Peri-urban agriculture in many cases, and for the purposes of this paper, is considered a subcategory included in UA and often grouped together as urban and peri-urban agriculture (UPA).

FIGURE 1

The form of the regional city, intensity of urban influences to urban fringe communities
Source: (Zasada et al., 2007 ex. Bryant & Johnston, 1992)



Madaleno and Gurovich (2004) compare the differences between "rural" and "urban" agriculture. The key differences are summarized as:

1. The urban farming population is more diverse in background, farm type, experience, farming objective and views
2. UA has wide range of participating groups from individuals, families, organizations etc.
3. UPA is characterized by a high level of land tenure insecurity compared to rural farms. Rural farms are also more likely to receive government support and protection.
4. urban environments are more likely to experience rapid changes to land use
5. UPA experiences competition with other land uses in conflicting spaces
6. Objectives of urban farmers are diverse focusing less on food production and profit but more on the social benefits resulting as well in variety of crops and items produced as well as methods of production.
7. Farms in urban locations have more direct interactions with markets and consumers than rural farms.

3.1.2 TYPOLOGIES OF URBAN AGRICULTURE

In efforts to classify UA typologies, researchers and scholars select single or multiple criteria on which to base their definitions. There are also different levels of classification. According to the FAO (2007) common determinants depend on location, main crops produced/ animals raised, degree of market-orientation, and scale or intensity of production. Mougeot (2000) goes a little further, considering also city zone, site location, production system, time allocation, and product destination. Other important conditions which may also be considered more specifically within these criteria are land ownership, farmer type, objectives, types of activities etc. Many researchers chose to use the multiple criteria approach which used two or more determinants upon which to base classification.

The result of a single criterion approach is a more simple way of defining areas for broader level of analysis. Based on city zone, UA can be divided into two commonly used categories using proximity to the urban center as the determinant; *intra-urban* and *peri-urban*. Intra-urban agriculture includes various types of agriculture taking place within the city limits. As already noted, peri-urban agriculture takes place on the periphery or outskirts of the city where land is more susceptible to change over time (FAO, 2007). There have been a range of definitions among authors describing the peri-urban zone which remains a blurry line and according to Stevensen et al. (1996) cited by Mougeot (2000), depends on the reach of the urban influences. Others based the boundary on travel time from farm to market or people to farm.

Using site location, proximity to the homestead may serve as a determinant. *On-plot* or *off-plot* location of activity is used to types such as backyard, kitchen, balcony and rooftop gardens (FAO, 2007). According to Mougeot (2000), other authors consider "development status of site (built-up vs open-space), modality of tenure/usufruct of site (cession, lease, sharing, authorized or unauthorized - through personal agreement, customary law or commercial transaction); the official land- use category of the sector where UA is practiced (residential, industrial, institutional, etc.)".

Vegnon et al., (2002) created a classification system using the single criterion approach based on production systems:

- *specialized production systems* devoted to a single crop or animal: rice, vegetables, fruit, fish, shrimp, chicken;
- *mixed production systems*, which combine two activities (two main crops or mixed crop animal);
- *hybrid production systems*, which combine more than two main activities (crops and/or animals).

The multiple criteria approach allows a more detailed and localized method for identifying typologies. Further classification of UA typologies depend primarily on physical, ecological and social features (FAO, 2007).

Several authors such as Guillem et al. (2012) and Moustier and Danso (2006) base classifications on the farmer's social and economic objectives:

- *socially-oriented* urban farming: leisure, recreation, community-based, subsistence-oriented, often with greater variety, subsidized
- *economically-oriented* urban farming: market-oriented, entrepreneurial, which can be family-based or in (micro-)enterprises, with often one dominant commodity

Madeira da Silva & Monte (2012) cite the work of Matos (2010) which uses four types of criteria (objectives, aim population, implementation area and grown products) to define urban farm typologies. The findings identify the following trends:

- *Social or community urban farm* for occupational therapy and social interaction are aimed toward underprivileged population and inactive ages. Implemented in green spaces, urban parks and urban farming areas. Products are grown for consumption and sale.
- *Leisure urban farms* are used for enjoyment, physical activity and social engagement and contact with nature, aimed toward inactive population (age or physical/ mental disablement), use is for individual consumption.
- *Pedagogical gardens* are used for environmental education. The population is interested in the connection of man to land and use is for personal consumption
- *Dispersed urban farms* occupation and subsistence based farms for the underprivileged population usually on public land. Produce is used for personal consumption and sale.
- *Allotment gardens* are parcels of land characterized by the division of garden property utilized by multiple families and individuals with in larger shared space (Clavejo, Drescher, Dongus, & Holmer, 2003). The organization of allotment gardens can be by government entities, associations, or by individuals. They are a type of UA which as pointed out by Batista & Matos (2013), can be in the "in between" spaces of buildings or urban infrastructure and are often occupying land illegally.

A different approach to creating UA typologies can be to classify based on the farmer type rather than farm type Mougeot (2000) lists the criteria for classifying urban producers as: *city zone, site location, tenure modality, socio-economic status, production system, scale of production, time allocation, and product destination.* Drechsel, Moustier and Danso (2006) use the socio-economic profiles of farmers to classify farmer typologies in East Africa. Criteria include location (urban or peri-urban), Outlets (home, urban market or export), farm size, products, intensification (inputs per ha), gender, and limiting factors. The four farmer typologies are defined as:

1. *Subsistence home intra-urban farmers (intra-urban and peri-urban areas)*: Urban residents farming at home or at other locations near the city for the primary purpose of subsistence (personal/ family consumption).
2. *Family-type commercial farmers (intra-urban and peri-urban areas)*: Family run commercial farms selling products to markets to subsidize income.
3. *Urban and peri-urban agricultural entrepreneurs (intra-urban and peri-urban areas)*: Larger scale farms often using salaried labour. Entrepreneurs make an investment in the infrastructure of their farms and typically have additional outside sources of income.
4. *Multi-cropping peri-urban farmers (peri-urban areas)*: Share many of the characteristics of rural farmers except for having a greater influence from the city in relation to production outlets with a growing share of marketed output; sources of incomes, including agricultural and non agricultural; level of intensification; and specialization.

TABLE 1

Summary of Typology of Socio-Economic profiles. Source: Moustier and Danso (2006)

	Home subsistence farmers	Multi-cropping peri-urban farmers	Family-type commercial farmers	Entrepreneurs
Location*	U	P	UP	P
Outlets	Home	Home + urban markets	Urban market	Urban market + export
Objective	Home consumption	Home consumption and income for subsistence	Income for subsistence	Additional income Leisure
Size	Usually < 100 m^2	Usually > 5000 m^2	Usually < 1000 m^2	Usually > 2000 m^2
Products	Leafy vegetables, cassava, plantain, maize, rice, goats and sheep, poultry, fruits,	Staple food crops, local vegetables	Leafy vegetables, temperate vegetables Poultry (Sheep) (Milk)	Temperate vegetables, fruits, poultry, livestock, fish
Intensification (inputs/ha)	2	1	2 to 3	4
Gender	F	F + M	F + M	M
Limiting factor	Size	Access to inputs Fertility	Size, land insecurity, access to inputs, water and services, marketing risks	Technical expertise, marketing risks

3.2 URBAN AGRICULTURE THROUGHOUT HISTORY

Although the concept of UA as a tool for sustainable land use planning has more recently come to the attention of decision makers and planners internationally, the practice of urban food gardens is something which can be traced through history. Agricultural land use in and around

urban settings changes continually in relation to social, political and economic fluctuations. Historically, settlements are naturally formed around the most fertile land in order to provide food for the population. As settlements expand into urban regions, they begin to occupy that fertile arable land with infrastructure, continually pushing agriculture farther out to rural areas (Batista & Matos, 2013). Agriculture in urban settings is an important phenomenon to be researched considering that it performs unique functions and serves different purposes in comparison to rural agriculture creating a complimentary system (Mougeot, 2000). One of the primary defining features of UA in comparison to rural agriculture is its tie to the local community and integration into the urban system.

The use of urban allotment gardens for economic stimulus has been implemented by governments during times of economic depression to increase food security and by individuals, families and social groups to supplement economic resources and function as an outlet for social interaction and activity. There is a pattern of increased UA during war time and economic depression and decrease during economic prosperity (Batista & Matos, 2013). During the Industrial Revolution in the 18th century allotment gardens were primarily implemented by ad hoc entities or individuals to supplement income or support families who had moved to the inner city from rural areas. Allotment gardens became a government tool for economic security in the 19th century and then in the 20th century became more popular as a means of self-sufficiency and sustainability (Batista & Matos, 2013).

After the UN's 1992 Agenda 21 for sustainable development, presented at the 1992, United Nations Conference on Environment & Development Rio de Janerio, Brazil; many municipalities began implementing plans for sustainable development (Drescher, 2001). Agenda 21 is a dynamic program setting forth initiatives confronting global environmental and social issues and promoting international cooperation to develop strategies of sustainable development (UNCED , 1992). "Promoting sustainable agriculture and rural development" is one of the priorities of the Agenda 21 initiatives. Also addressed in Agenda 21 and as well as in the European Model of Agriculture are the benefits of its multi-functionality of which makes the concept attractive to urban planners (Renting et al., 2009). Agriculture in and around urban settings not only provides local food production, but also provides a range of social, economic, environmental and aesthetic benefits (Zasada, 2011).

3.3 Impacts of Urban Agriculture

The impacts of UA are multidimensional and can be considered on a macro-scale impacting social, economic and ecological health globally or on a micro-scale level making impacts on local communities and individual persons or households. Although implementation of UA has a

wide range of benefits through the social process of participating in agricultural work, results of economic impetus, and increased green spaces; there are also risks local populations related to agriculture in urban spaces. Proper planning for UA must consider the benefits and risks in order to reduce and mitigate negative impacts.

3.3.1 MULTIFUNCTIONAL BENEFITS

The *multi-functionality*[4] of UA refers to the ability of the single practice to provide multiple services to the community and environment. Multifunctional agriculture in urban settings has the potential to provide economic stimulus, increase food security and nutrition, social welfare, social inclusion, and environmental education while increasing biodiversity, improving water cycles and protecting natural resources and soils. This explains why it is used as a tool for sustainability both by planners and independently by citizens. (FAO, 2007). According to Lovell (2010) the functions of UA which should be supported planners include: production, energy conservation, waste management, biodiversity, microclimate control, urban greening, economic revitalization, community socialization, human health, cultural heritage, and education (Lovell, 2010). Mougeot (2000) after all, concludes that the greatest defining feature of UA is related to this multifunctionality; the role of UA is integrated into the fabric of the urban economic, social and ecological system.

3.3.1.1 SOCIAL

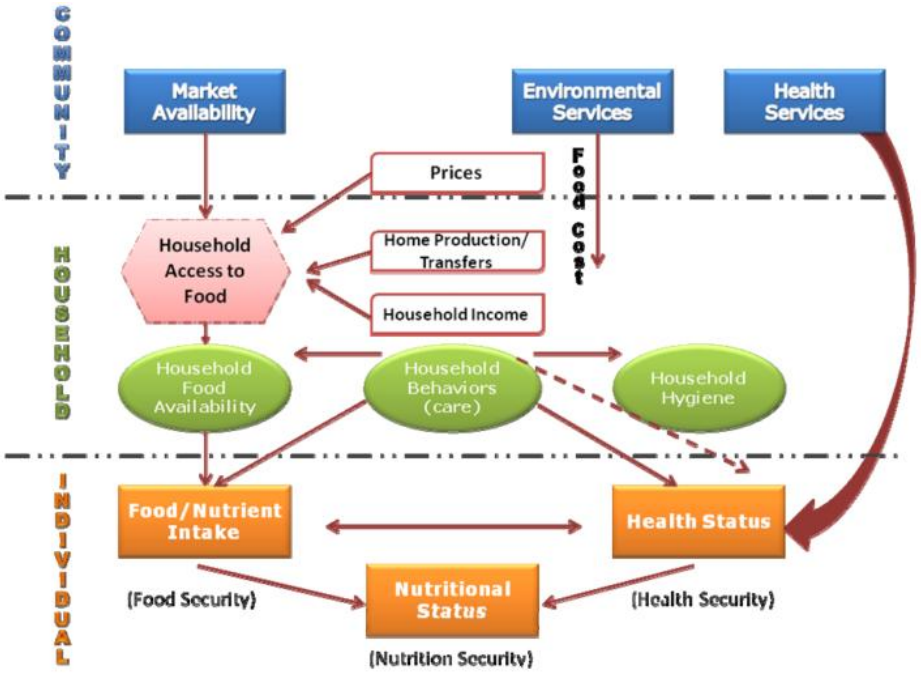
Rapidly increasing populations especially in urban areas are increasing demands for land and creating competition for agricultural land use. Consequently agricultural land in and around cities are lost in the competition between industrial, commercial and residential land use. As a result there is an increasing need for food to be imported to urban areas causing pressures on agriculturally productive land and the environment; not to mention negative impacts on the urban infrastructure caused by increased traffic from shipping. The loss of agricultural land in and around cities finally results in increased food prices and decreased quality, availability and variety. The social impact of this results in urban food shortages and insecurity causing malnutrition and other harm to human health. Low income and disadvantaged communities are especially impacted. According to the UN-HABITAT (2001), malnutrition is increasing in urban areas and nearly 32% of the world's population in 2001 was living in irregular settlements

[4] "Multifunctionality is usually defined as the multiple roles or objectives that society assigns to agriculture, including economic, social and environmental roles". (Cai & Yang, 2006)

without access to sufficient access to basic human needs such as food, shelter, water and sanitation, with expectations for this to increase with population growth over the next 30 years (UN-HABITAT, 2001).

FIGURE 2: DETERMINANTS OF FOOD, NUTRITION AND HEALTH SECURITY

Source: (Cohen & Garrett, 2010) adapted from UNICEF, 1998.



The use of UA offers some relief by providing the opportunity to involve disadvantaged communities in food production, providing fresh perishable goods and increasing food availability within the city.. According to the FAO (2007), households participating in UA achieve greater nutritional status and food security than non-participating households of the same socio-economic status. On a community level, UA provides an outlet for social interaction, physical activity, preservation of culture, and education. Social policies related to UA are aimed at poverty reduction, economic development, environmental management, integration of disadvantaged population groups, and promotion of participatory governance in cities (Van Veenhuizen, 2006)

3.3.1.2 ECONOMIC

UA has the potential to make economic impacts on individual households as well as at a larger scale by providing jobs and economic stimulus. "*Market-oriented agricultural production*

systems have the capacity to absorb workers from other urban sectors when needed." (FAO, 2007). Although the majority of UA takes place informally, it was estimated that before the year 2000, 800 million people were participating in urban farming which was providing direct income to approximately 100-150 million (Mougeot, 2000), (FAO, 2007). An estimated 200 million urban residents produce food for the urban market, providing 15 to 20 percent of the world's food (Van Veenhuizen, 2006). Food generally travels between 1,500 and 2,500 miles from the farm to the consumer (Halweil, 2002). Localizing food has the ability to decrease market prices and keep profits within the local economic system while encouraging other microenterprises (Van Veenhuizen, 2006).

On the household and individual level, UA practices have the ability to provide savings on food expenses and income from sale of surplus crop and livestock production, production and sale of food and products, and production and sale of agricultural inputs (ie. compost, animal feed or organic waste) (De Zeeuw & Dubbeling, 2009). Household production of food reduces expenses freeing up income for other necessities. Economic benefits at the household level also include self employment, exchange of economic goods and savings on health expenses.

3.3.1.3 ENVIRONMENTAL

Expanding urban areas are causing damage to natural ecosystems in and around cities. Rich soils are paved over; pollutants are released into the air, water and soil; and biodiversity is reduced due to the construction of urban infrastructure, industry and human habitation. Implementation of UA has the ability to increase green spaces in cities creating permeable surfaces, improving water cycles, increasing biodiversity and preserving soils and other natural resources (Smit, et al., 1996a).

Urban greening, revitalization and microclimate control: Use of vacant or degraded urban areas for agriculture contributes to urban revitalization and increases green spaces which require minimal public maintenance. UA increase the amount of vegetation and green space in cities which contributes to wind protection, humidity control, and shade to help maintain a more natural microclimate and reduce heat island effect (Lovell, 2010). Additionally, urban vegetation has the ability to improve climatic conditions by increasing humidity, lowering temperatures, capturing dust and gasses, absorbing sunlight and increasing permeable surfaces (Deelstra & Girardet, 2000). According to Moglia (2014), increased urban green spaces combined with the reduction of transportation for produce can potentially have realistic impacts on global warming (Moglia, 2014). Deelstra and Girardet (2000) support this by explaining that plants have the highest capacity to capture CO_2 during the growth phase; agricultural crops are primarily kept in

this stage of production. This means that agricultural land can capture more CO_2 per square surface area than natural systems such as tropical forests.

Waste reduction, nutrient cycling and water cycling: Urban waste can be reduced by producing fresh food and therefore reducing packaging, production and use of mulch and compost from organic waste, and recycling of reusable items in the agricultural production process. Use of biological and organic waste on farms cycles nutrients back into the soil. Increased urban green space allows rainwater and run-off to permeate through soils rather than evaporating which decreases pressure on urban drainage systems and soil erosion from run-off (Deelstra & Girardet, 2000).

Increased biodiversity and environmental awareness: Improved biodiversity is a result of increased beneficial insect population, birds, plants and animals supported by agriculture and soil (Smit et al., 1996a). UA sites can serve as locations for environmental education and create a social bond with the environment through food production.

3.3.2 Risks

Along with the many benefits of UA, lack of planning and knowledge in healthy and sustainable agricultural practices within urban settings can create hazardous conditions leading to environmental problems and risks to human health. According to the FAO (2007) health risks involved with poorly implemented UA include:

- contamination of drinking water by residues and agrochemicals due to improper use of fertilizers, pesticides and fungicides,
- contamination of crops by uptake of heavy metals in contaminated soils, water, and air due primarily to pollution,
- transfer of human disease through produce and attraction of disease carrying animals due to accumulation of agricultural byproduct and standing water,
- transmission of diseases to people due to proximity to livestock,
- health risks related to improper handling of agrochemicals

3.4 Planning for Urban Agriculture

Following the presentation of Agenda 21 at the Rio Earth Summit in 1992, UA became a popular topic as a multifunctional land use integrating agriculture into urban planning as a social and ecological tool for sustainability. Local Agenda 21 cities are required to set initiatives including

activities which reduce its ecological footprint[5]. Most generally UA suffers from political constraints regulating land use and conflicts arise with uncertainty of property rights, lack of support services, organization, technology and representation for farmers (Deelstra & Girardet, 2000). It is important to plan for the integration of UA in order for proper implementation to achieve the multifunctional benefits sustainably and avoid risks to human, environmental and social health.

Planning for UA can take place on an international level, starting with initiatives such as Agenda 21 and continue on a regional level with local agendas. Figures 2 and 3 list the steps of sustainable planning for UA on the international and regional level.

FIGURE 3

Summary of proposed tasks for planning and promoting UA at an international level. Source: (Smit et al., 1996c)

International Level Tasks to Promote UA
• Develop international agreements and priorities to create common research methods • Conduct international surveys to compare industries by similar climate zones and economies. Comparing farming systems, subsector economics, environmental impacts, the role of women, and nutritional impacts in different cultures, for example, can contribute valuable information. • Retrofit existing and new projects to include urban agriculture. • Identify organizational models for urban agriculture. • Develop regional and global networks

FIGURE 4

FAO recommended steps for sustainable planning for UA by government or non-government bodies. Source: (Food and Agriculture Organization of the United Nations (FAO), 2007)

Steps for Sustainable UA Planning
• formally accepting UA as an urban land use; • the creation of a conducive policy environment; • enhancing the security of access to vacant open urban spaces; • supporting the establishment and strengthening of urban farmer organizations; • enhancing the productivity and economic viability of UA by improving access of urban farmers to training, technical advice and credit; • taking accompanying measures that ensure that the health and environmental risks of UA are reduced (farmer training on health risks and related management practices, zonification, quality control of irrigation water and products, etc.).

[5] *"The sum of all land and water required to meet material consumption and waste discharge of a defined population is that populations' ecological footprint on the earth." (Deelstra & Girardet, 2000).*

3.5 Land Use Change and Agriculture

Land use is defined by Maitima et al. (2004) as "the human use of the land (for example, small-scale agriculture, grazing, wildlife reserves or industrial zones)". Therefore, *land use change* is when "the use of a particular land is changed from one to another over time, (e.g., from natural vegetation/ forest to cultivation; cultivation to grazing or from swamp to cultivation)" (Maitima et al., 2004). LUC in urban and peri-urban areas is heavily influenced by population growth, migration of population into urban centers and sprawl causing urban influence on rural land. In Europe, at least 2.8% of land experienced a change in use between 1990 and 2000, including a significant increase in urban areas (Commission of the European Communities, 2006). According to the United Nations Population Fund (2007), the world population in 2007 was estimated approximately 6.6 billion and expected to increase to over 9 billion by 2050 (UNFPA, 2007). In 2007, nearly 50% of the population resided in cities which is expected to increase to two thirds of the population by 2030 (Batista & Matos, 2013). Meanwhile; rural populations are decreasing and predicted to decrease by 28 million by 2030 (UNFPA, 2007). The shift of population from rural to urban and peri-urban areas results in a loss of agricultural work force as they shift into manufacturing and services jobs. Peri-urbanization[6] causes competition for land on the urban fringe and property values increase resulting in a loss of agricultural land (UNFPA, 2007). Competition with industrial, energy and domestic uses of water and other resources also has an impact on agricultural land use (De Zeeuw & Dubbeling, 2009).

Increasing urban populations and limited diversity of employment opportunities results in a shift in the locus of poverty from rural to urban settings; De Zeeuw and Debbeling (2009) refer to this as the "*urbanization of poverty*". The urban poor are especially vulnerable in times of economic crisis. They are the first to lose jobs and with food as 60-80% of household expenses, the urban poor are especially vulnerable to food shortages and raising food prices resulting in malnutrition (UNFPA, 2007). These conditions are only amplified in developing countries, areas of natural disaster and economic crisis. "Food production in the city is often a response of the urban poor to inadequate, unreliable and irregular access to food, and the lack of purchasing power" (FAO, 2007). The implementation of UA provides food subsistence to households as well as moderate levels of additional income, ability to trade goods and absorb some of the population of unemployed urbanites. In response economic crisis and social need, agricultural sites are *spontaneously* (unplanned by municipal entities and sometimes on illegally occupied public or private land) formed on open land to supplement income and food security primarily in low income communities while also providing community recreation, cultural preservation and environmental education. Spontaneous inner city and urban fringe agricultural sites are often

[6] Peri-urbanization is the shift of rural areas into urban settlements often without displacing most of the rural residents. (UNFPA, 2007)

post-industrial landscapes, vacant lots, road sides, parks and other empty spaces (McClintock, 2010).

3.5.1 INDICATORS

UA practices are a response to economic crisis and food shortages by urban dwellers especially the urban poor; but also an adaptation of city life providing fresh food and products, social interaction, physical activity and ability to participate in environmental sustainability within the city setting. It is necessary to identify who the users of UA are and why in order to understand changes in land use. *Indicators of LUC* are specific observable and measurable characteristics which can be used to estimate changes in land use. These indicators taken by themselves are meaningless without further knowledge of the setting. LUC indicators are highly dependent on the local setting, which is why it is necessary to conduct further research within the study area to identify the local drivers of LUC (Dale & Kline, 2013).

Based on similar studies and literature, common indicators of agricultural LUC and sustainability have been identified in order to provide guidance for the field research. Stakeholder interview questions will seek to identify related indicators. Indicators have been classified into social, economic, political and environmental factors influencing agricultural land use.

FIGURE 5

Indicators UA sustainability and LUC (based on Danso et al., 2003; Gutzler et al., 2015; FAO, 2007; Dale & Kline, 2013)

Social	Economic	Political	Environmental
• Acceptability • Employment • Disposable family Income • Inclusion of disadvantaged community • Poverty • Population change • Culture	• Productivity • Economic viability • Market prices • Value of land • Value of produce	• Land security • Support/ subsidies • Protection of people and property • Environmental policy	• Soil quality and land suitability • Water availability • Climate conditions • Pollution

4. Characteristics of Study Area

In Portugal approximately 60% of the population resides in the suburban regions of Lisbon and Porto (Nadia, Jan, Isabel, & Duarte, 2011). *Urban expansion* is the transformation of land from natural or agricultural to industrial and urbanized areas which often results in irreversible damage to the natural resources, soils and ecosystems in the area (Cengiz, 2013). Agricultural land in Portugal has been decreasing since the 1950's and most rapidly after joining the European Union in 1986. It had the highest percentage of LUC among 24 European countries (9.8%) with significant decreases in the rural and agricultural population (Jones, et al., 2011). This LUC can be credited to multiple factors including migration to inner cities and urban expansion, changes in government support, subsidies and land use policy, as well as economic and demographic changes leading to abandonment of agricultural land. According to agricultural statistics reported by the 2009 Instituto Nacional de Estatística (INE), the active working population in Portugal's agricultural sector was reduced from 48% in 1950 to less than 5% in 2001 (Cancela, 2009).

The introduction of allotment gardens into Lisbon city planning was presented in 1997 by landscape architect Ribeiro Telles (Batista & Matos, 2013). His proposal of recreational and productive corridors has been implemented into the 2006 Plano Verde de Lisboa. Recent master plans in Lisbon include sustainability measures outlined in the Plano Verde including initiatives for urban allotment gardens, green structure areas, and water cycle improvements.

Image 1

Horticultural Park Chelas: July, 2014

In 2009 the Camara Municipal de Lisboa (CML) initiated a project which would reorder 16.19 ha of existing urban farms including the horticulture park of Chelas, the urban farms at Quinta da Granja and Jardim da Graça, projects for two farming and gardening lands in Telheiras, and also the horticultural parks in the Vale do Rio Seco, Ajuda and Ameixoeira (Diário de Notícias,

2010). These originally spontaneous agricultural sites are now legal and regulated by the Lisbon municipality. Despite this, urban allotment gardens in Lisbon have been reduced from 304 ha in 1987 to approximately 84 ha today (12 ha are organized municipal parcels). The Urban Allotment Parks Program (2011-2017) has set the goal of 20 additional allotment gardens in Lisbon by 2017 (Mata, 2014).

I. Madalino (2003), categorizes 5 types of farmed spaces in Lisbon Metropolis:

1. *Home gardens*: take place in the yards of residential properties of urban and peri-urban settings (typically 50 m²- 1ha).
2. *Peri-urban farms (quintas):* middle class activity of farming for business or recreation including vineyards, flower culture and horsebreeding along with traditional animal and vegetable farming. Farms ranging from 5 to hundreds of hectares
3. *Pedilogical Gardens:* are primarily for the purposes of environmental education and social inclusion for disadvantaged and underprivileged populations taking place on school grounds, museums, prison yards and municipal gardens/ farms.
4. *Shifting Farmed Plots:* market oriented farms and agricultural plots specializing in vegetables, spices and herbs often take place primarily in peri-urban settings but also on public land in urban settings.
5. *Public Farm Land:* large and small farm plots taking place in the municipal RAN and REN zoned areas

4.1.1 PHYSICAL

The Almada Municipality of metropolitan Lisbon, is approximately 72 sq km. It is located on the south bank of the Tagus River, connected by bridge across from Lisbon's municipal center. The natural landscapes of Almada are influenced by the urban and industrial growth spreading from Lisbon's urban center. Once an agriculture dependent economy (pre-1960), Almada shifted to depend on intense industrial and port activities through the 1990's and is now focused on tourism, services and public administration (Lopes, 2009). The geological profile of Almada is defined due to its proximity to the Atlantic Ocean and Tagus River. The western coast of Almada is 13 km of steep bluffs and beaches making up the Costa de Caparica. The northern border of Almada is part of the Tagus River Estuary. The rich geological profile, climate and geomorphic characteristics in Almada make the area ecologically diverse with natural resources.

Rich soils, biological diversity and the Mediterranean coastal habitat are valuable ecological features which define Almada. The municipality enforces a strict ecological framework which is designed to protect the land and natural resources within the region. The Reserva Agrícola

Nacional (RAN) and Reserva Ecológica Nacional (REN) are areas of land legally protected by the municipality as part of its Master Plan. The RAN is protected and preserved land restricting non-agricultural use (Decree-Law No. 73/2009 of 31 March). Protected areas are designated based on landscape characteristics (such as quality of soil, climate, morphology and social characteristics) which provide high potential for agricultural production. The objectives of the RAN are to protect soil and other natural resources, support development and sustainability of agriculture, and contribute to regional planning and the connectivity of the Fundamental Nature Conservation Network in Portugal (Entidade Nacional da Reserva Agricola Nacional). The REN covers areas of land which are of ecological importance, protecting water and soil resources and reducing the risk of landslides, flood, and erosion (coastal areas, riparian zones and sloping areas). 6% of the Almada territory is protected under the municipalities RAN designation and about 35% under REN (Câmara Municipal de Almada, 2007) *(See appendix 9-C & 9-D).* Municipal laws protect the RAN and REN areas from further development and only allow land use changes after a procedure of votes and public hearings which offer municipal members, land owners and residents to have a say in the decision.

The current master plan (2008 PDM) in Almada has approximately 265 ha of land zoned for agriculture although it is clear without making any technical analysis that there is an abundance of agricultural land which exists outside of the areas zoned for agricultural use.

IMAGE 2

Agriculture in Almada: July, 2014

4.1.2 SOCIO-ECONOMIC

The Almada municipality has a resident population of approximately 172,000 which fluctuates by approximately 1,000 residents annually (Instituto National de Estatistica (INE), 2014).

According to Soulard, et al. (unpublished), there are three types of small scale subsistence agriculture existing in the Lisbon Metropolitan area:

1. *Traditional*: Primarily family farms carried out by land owners or farmers on private plots waiting for construction. Subsistence is used to compliment income and activity.
2. *Unplanned:* This type of agriculture is related primarily to the elderly and unemployed, usually taking place on vacant lots, public land, transportation routes and other restricted areas often without the consent or knowledge of the land owner. Primarily taking place in suburban areas such as the Almada municipality.
3. *Planned:* Agricultural parks and community gardens (*hortas urbanas*) planned by the municipality, often originating from unplanned gardens. Demographics of farmers are diverse in age and socio-economic background.

4.1.3 MUNICIPAL

Preservation of the natural ecological structure and agricultural land is a high priority in Portugal. "The Portuguese law ("Decreto Regulamentar" nº 11/2009, 29 of May), recognizes agriculture as a compatible activity within the green infrastructure"(Cancela, 2009). Additionally, ("Decreto Regulamentar" nº 9/2009, 29 of May) mentions that the green infrastructure within urban perimeters comprise public or private green spaces of collective use, with the functions of:

a) Regulation of the urban hydrological cycle;

b) Improvement of air quality;

c) Biodiversity conservation.

Despite initiatives encouraging agricultural land use for sustainable urban planning, implementation and regulation of UA is difficult due to issues determining land ownership in many municipalities; this is the case in Almada. Although the Almada Municipal Master Plan [*Plano Director Municipal* (PDM)] distinguishes zoning, there is no system of land registry and cadastre in Almada (Camões, 2014). As a result land occupation and use of vacant or public land for agricultural purposes is common but difficult to track.

The Almada PDM is a tool for territorial planning and the regulation of development. "The PDM establishes the model of spatial organization of the municipal territory, based on soil classification and occupancy parameters, takes the form of the development and planning policy municipality strategy, which integrates the options provided in instruments of territorial management framework national and regional." (Câmara Municipal de Almada, 2009). The initiation process of the most recent Almada PDM began in December, 2008.

Although the municipality has land designated as RAN in its PDM and it is clear that agricultural land use is abundant in the area, there is minimal research available on the phenomenon of UA and the actual extent of agricultural land use and land use change in the Almada region. The case study seeks to fill the gaps in research on agricultural land use and LUC in the Almada municipality.

5. METHODOLOGY

Step 1: Mapping existing agricultural land use

a. determination of visual indicators of agricultural land use,
b. identification of agricultural land use through visual analysis using satellite aerial imagery,
c. vectorization of agricultural sites in ArcGIS, and
d. confirmation of LULC through field observations and use of Google Earth street views.

Step 2: Conduct one-on-one stakeholder interviews

a. determine indicators of LUC
b. identify key stakeholders (local urban farmers, land owners, municipal entities)
c. write and translate interview questions
d. contact stakeholders and conduct interviews
    - Since farmers are unknown and unregistered site visits are necessary to conduct interviews.
    - For municipal entities, contact and permissions must be gained.

Step 3: Comparison of results

a. Acquire map data related to LUC indicators (demographic maps, municipal zoning maps, etc.)
    - Make connections with local entities to acquire data (universities, municipalities, and organizations)
b. Compare vectorized agricultural maps to indicator maps and zoning maps
c. Analyze interview results in comparison to maps

5.1 DEVELOPMENT OF THEORY AND APPROACH

Since the goal of this study is to develop a methodology which can be applied to various cities internationally for the identification of agricultural land use and indicators of land use change within urban boundaries, it is important to make a simple framework for which the methods can be followed using minimal technology and cost. The results should produce a vectorized map layer clearly identifying agricultural land use in the defined study area. Site visits and interviews will confirm land use and help to identify potential trends in land use change (LUC). The resulting information; using geographic information systems (GIS) as a tool, can be used to make valuable comparisons with other datasets (such as demographic, environmental and zoning maps) which may have influences on LUC.

Because the development of methodology its self is one the critical goals of this study it is important to consider other studies with similar initiatives. Although there are many techniques of land use identification, at different levels of efficiency and accuracy, most methods require a strong technical background and understanding of data models and GIS. It is important for the study methodology to have the ability to be replicated at low cost by a variety of people from different educational backgrounds (students, interns, volunteers, NGO or government employees). For this reason, a manual method of land use identification was selected. Based on comparisons made by Castilla et al. (2008), manual visual interpretation done by an individual has advantages to computer automated (or semi-automated) image classification methods. Although remote sensing can be used to identify land cover, it has disadvantages. Findings show that manual interpretation allows for a higher level of accuracy as a human interpreter has the ability to consider multiple criteria, use additional knowledge and consult other sources for imager confirmation. Taylor and Lovell (2012) value these abilities of an interpreter to consider the context and make inferences stating "It may be the only suitable strategy for identifying such a diverse and fine-scale urban land use as urban agriculture, particularly at the scale of the home garden. Manual photo interpretation has the advantage of identifying real world objects rather than the image objects extracted in object-based classification approaches." (Taylor & Lovell, 2012).

The identification and mapping of agricultural land use is a beneficial tool for land use planning in and of itself however, additional information is gained through qualitative information and quantitative data obtained through one-on-one interviews. By gaining information about the farmer's objectives, market orientation, farm types, farming practices, land tenure and yield along with their demographics, a farmer profile can be created and driving forces of land use change can be identified. Farmer profiles in relation to farm typologies can be linked to the UA land use identification maps.

5.2 MAPPING AND IDENTIFICATION

1. Synthesis of Maps
    a. Acquisition of GIS data
        i. 2014 High Resolution World Imagery from Esri, ArcGIS Online (Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community),
        ii. Almada 2009 PDM data generated by CM Almada; obtained from Universidade de Lisboa, Instituto de Geografia e Ordenamento do Território (IGOT-UL)
        iii. Demographic data for Almada, 2011 census publicly available through the INE website, mapas.ine.pt
        iv. Proposed horticultural park sites data generated by CM Almada; obtained from Universidade de Lisboa, IGOT
    b. Identification of existing agricultural sites within the Almada region by systematically visually scanning the high resolution world imagery for 2014 at a scale of 1:25,000- 1:12,500 and 1:1,200- 1:1,500 in ArcGIS. A new layer "Identified agricultural Land Use" with polygons outlining the agricultural sites is created.
    c. Site confirmations using Google Earth and field observations
2. Analysis
    a. Comparison of Almada 2014 agricultural land use map to the 2009 Almada PDM, RAN and REN zones
    b. Comparison of Almada 2014 agricultural land use map to census data maps (unemployment and population)
    c. Comparison of Almada 2014 agricultural land use map to CMA planned horticultural sites

5.2.1 VISUAL LAND USE INDICATORS

Methodology for the mapping component of this study was developed based on case studies performed using satellite imagery in ArcGIS to identify land use patterns. Taylor & Lovell (2012) describe methods of identification in their study "Mapping public and private spaces of UA in Chicago through the analysis of high-resolution aerial images in Google Earth". In this study Google Earth high-resolution aerial imagery is used to identify cropping patterns indicating agricultural land use. "Visual indicators of food garden[s] were determined to include

combinations of the following: an orthogonal garden layout, vegetation planted in rows or in beds separated by paths, and bare earth or mulch between individual plants or rows of plants. Food gardens are visible from above as clear crop rows are planted" (Taylor & Lovell, 2012). Other visual indicators include:

- geometric field and road patterns on the landscape,
- traces produced by livestock and mechanical equipment,
- drainage and water control patterns (Anderson et al., 1976),
- hedgerows separating plots,
- agricultural equipment on the site (Taylor & Lovell, 2012),
- use of intensive horticulture structures (shade netting, tunnels, glass houses, nurseries),
- and structures for storage, processing and handling (Avenant & Collett, 2013).

5.2.2 VISUAL ANALYSIS

These indicators are used as grounds for the manual identification of agricultural land use. Using the most up to date high-resolution satellite imagery from ArcGIS Online, visual analysis was conducted by scanning the study area at a scale of 1:25,000 - 1:12,500. According to Kellogg & Veatch (1934), there are six characteristics which should be used to interpret land features in satellite images: size, shape, shadow, tone or colour, pattern and texture. World imagery acquired through ArcGIS Online is the best option for aerial imagery since the satellites are frequently updated, base maps are free, and it provides aerial and satellite imagery of 1 meter resolution or better for most parts of the world (Esri, 2013) (*see appendix A for Esri Satellite World Imagery coverage map*). Using the 2014 aerial imagery of Almada, Portugal, cropping patterns begin to become apparent for larger sites at a scale of 1:25,000 - 1:12,500. The highest clarity of detail can be seen at a scale of 1:1,200 - 1:1,500.

By visually scanning the study site in a grid pattern at a scale of 1:25,000-1:12,500, large agricultural sites (commercial farms and allotment gardens) were identified. The study site is then scanned again at a closer scale to identify smaller sites (home gardens, vacant lot gardens and dispersed urban farms). During this step, special attention is paid to known areas of agricultural land use and areas classified as RAN, REN, or agricultural zoning. Site confirmation using Google Earth is necessary during the identification process (*see section 5.2.4.1*) in order to help clarify areas in question. Some areas of brush, vacant land or grass appear to linear patterns in the soil or onsite debris which can be confused for cropping patterns and agricultural materials.

FIGURE 6

Map analysis of satellite images in ArcGIS using visual indicators to identify agricultural sites.
Left image: Scale 1:25,000 **right image**: Scale 1:2,000

5.2.3 VECTORIZING

Vectorization of the site locations is done by creating a shape file and drawing polygons which trace the boarders of all identified agricultural sites from the raster image. For the purpose of this study it is only necessary to identify the locations and total area of agricultural land. For this reason it is not necessary to divide plots by property lines. By vectorizing the sites in GIS it is possible to make measurements of total land area or site specific land area. The results are then one layer which can be compared to other maps such as the cities master plan or demographic maps.

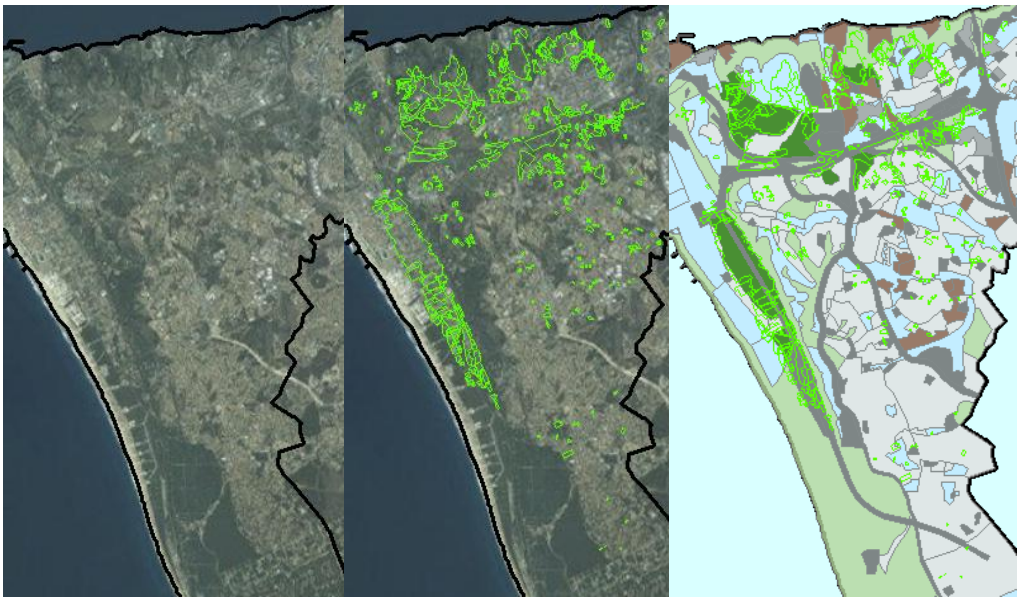


FIGURE 7
Map vectorization- Identified agricultural sites are traced using the polygon construction tool in ArcGIS10. Left: Aerial imagery of Almada Middle: Vectorized UA layer over aerial image Right: UA Layer

5.2.4 SITE CONFIRMATION

In order to confirm accuracy of mapping methods it is necessary to rely on a process which can be used to verify the actual LULC. Using Google Earth allows for immediate confirmation in areas where higher resolution is available or street views are available. Google Earth also offers a tool to view historical images in the case of plots which are in the earlier stages of productivity. Field confirmations are used to confirm both processes of computer analysis. Visiting the sites is the most accurate way of confirming the actual LULC.

5.2.4.1 GOOGLE EARTH CONFIRMATION

During the process of site identification and vectorization, there are varying levels of clarity in the images resulting in difficulty interpreting the visual indicators for some sites. For example dry land with apparent cropping patterns in the soil may be agricultural land or arid grass land. Vacant lots with debris, natural vegetation, grassland, off season agricultural sites, and pastures are often difficult to distinguish and require further confirmation. The advantage of using Google Earth for verification is that it is free and immediately available during the process of visual analysis and vectorization. The ability to "street view" in Google Earth allows for different perspectives and closer ground level views of the area in question. It is especially helpful in identifying home gardens in residential areas. The disadvantage of using Google Earth is that the date of imagery varies based on location so it is necessary to pay close attention to this when analyzing inconsistencies. When there is inconsistency in images between ArcGIS and Google Earth, the most recent image should be considered more highly. Although the "street view" setting allows a dynamic way of viewing the land, views are often blocked by fences, vegetation and other barriers.

FIGURE 8

Home garden site identified in ArcGIS at a scale of 1:1,250, verified using Google Earth "street view".

5.2.4.2 Field Confirmation

Field observations or "ground-truthing" (Taylor & Lovell, 2012) was done by car on several occasions to discover and confirm agricultural sites in Almada. The best method of doing this would be using paper maps printed from ArcGIS containing the areas in question in conjunction with a GPS system (GPS systems are commonly available on phones and mobile devices). Field observations hold the highest level of accuracy and lead to the selection of sites for one-on-one interviews.

5.3 Interview Methodology

In order to identify the driving forces of agricultural LUC related to social indicators, personal interviews with local urban farmers and municipality members must be conducted. By developing a greater understanding of who the urban farmers are, we are able to make a profile of UA users which will help support the social indicators of LUC. The interviews will identify valuable qualitative and quantitative information about the farmers that would otherwise be impossible to obtain. A multi-criterion approach is used in order to identify the correlations between land use patterns and various indicators. The criteria for this study depend on the population served in relation primarily to location and scale of agricultural production. Some of the key indicators are:

- land tenancy status (ownership, lease, verbal agreement or illegal occupation of the land),
- scale of production,
- farmer's purpose (income, food supplement, social, enjoyment, health benefits, employment etc.),
- ability to access the land and other resources,
- employment status,
- desire to continue farming in that specific location,
- desire and ability to expand farm area, and
- costs and benefits related to farming the area.

Interview questions for the farmers were formulated to identify these indicating factors. Other indicators which can be identified by communication with the municipality include: political changes, social and political values of agriculture/ landscape ecology/ economic stimulus/ land use, food availability, availability of open land, support for agriculture, support for low income communities, development plans, and legality of land occupation.

One-on-one interviews have been conducted with key stakeholders in order to create a guided discussion about agriculture taking place within the urban setting of Almada. Key stakeholders for this project were identified as the farmers holding plots at agricultural sites identified during the identification and mapping process. Members of the Almada municipality are also valuable stakeholders, they have the ability to influence land use and can provide additional information about municipal plans and political influences on UA. Questionnaires are administered to the farmers and municipal leaders in the form of a one-on-one verbal interview conducted in Portuguese by Ph.D. students from the University of Lisbon and working with the AgriMet MOD project and translated using "Google Translate". Interviewees at farm sites are selected based on availability and willingness to participate during the site visits.

5.4 Composition of interview questions

Interview questions were written in collaboration with the AgriMet project, based on prior knowledge of the study area. Prior knowledge was obtained through studies of agriculture in the greater Lisbon metropolitan region conducted by AgriMet, information publicly available through the municipality and the literature review.

A questionnaire for the famers was developed with a mixed format of closed ended questions collecting quantitative demographic information and open ended interview questions focused on gathering qualitative information about the land, agricultural activity and the farmer's perspective and outlook on farming in the Almada region. The goal of the questionnaire is to identify the primary motivational purpose of faming activities and measure the approximate extent of the farming property, produce output and economic stimulus to the farmer/ famer's family and surrounding community.

Interviews will also be held with several members of the Almada municipality and will be somewhat tailored specifically to each interviewee depending on their position. Municipality interview questions were formed based on both the literature review and responses from the farmer interviews. The goal of the municipality interviews is to:

a. understand political climate of UA in Almada,
b. evaluate level of support for farmers,
c. clarify level of political involvement in various types of UA (independent/ spontaneous, private, and public gardens),
d. identify political drivers of agricultural land use change, and
e. understand the zoning regulations.

6. RESULTS

Agricultural land use is abundant in Almada and can be observed in traditional and nontraditional forms throughout the city. Without knowing anything about UA in Almada, one might pass by agricultural sites without thinking twice. Crop fields and garden plots can be seen on hillsides, between buildings and along side roads and with closer observation it becomes apparent that these sights are privately organized by the community. Upon further investigation of the Almada PDM and interviews with farmers and municipality, it was found that many of the agricultural sites are not planned by the municipality yet fall on public land or are on land which the property owner is unknown. Interviews with the gardeners and the municipality in conjunction with maps pinpointing the existing UA locations reveal a valuable level of insight on the drivers for agricultural land use and LUC in the area. The results section will both analyze the advantages and disadvantages of study methods as well as describe the resulting findings from Almada, Portugal.

6.1 UA IDENTIFICATION

Over all, the manual identification of agricultural land use using satellite imagery was a successful process allowing for accurately pinpointed locations of agricultural land use within the urban and peri-urban settings of Almada, Porgtugal. The method of identification; using visual indicators to identify agricultural land use through the use of high resolution satellite images in ArcGIS, proved to be affordable and efficient but with varying levels of accuracy. Identification of agricultural land where clear visual indicators or multiple indicators are present proved to be accurate when confirming land use. Difficulties arose at sites where there were little or no indications of land use present. Large areas of open land and vegetation (grasslands, pastures, prairies, mono-crop fields, vacant land, and bare or unused farmland etc.), were especially difficult to type of land use. In these cases, the Google Earth confirmation process is not helpful because further knowledge of the land is required. Cropping patterns can be seen from the satellite view but from ground level the land has no visual indication of agricultural land use. It is beneficial to have outside knowledge of the area, conduct a site visit for field confirmation or to confirm site identification with a local consultant who has additional knowledge of the area.

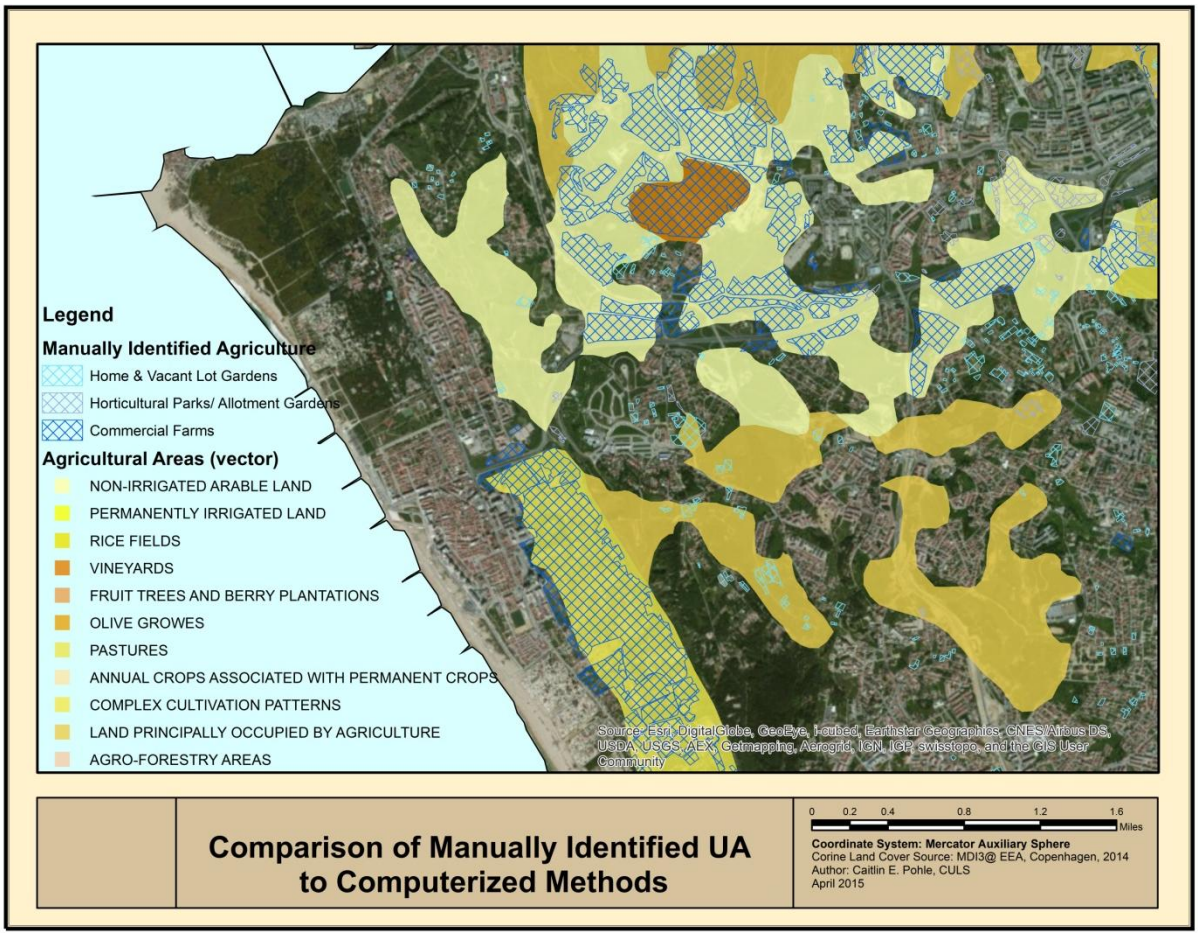


FIGURE 9

Comparison of results from manual land use identification methods to computerized methods of agricultural land cover identification.

Compared to maps using computerized methods of identification, the agricultural maps of Almada which this study produced more precisely identify small-scale urban farms, vacant lot gardens and allotment gardens; many of which would be unidentifiable using alternate methods. For these garden types, the visual indicators were most clear and confirmation methods proved most accurate. The advantage of manually identifying the sites is, in fact; the human ability to think critically. Manual site analysis allows for the consideration of multiple indicators and the ability to give hierarchical weight to indicators; for example, the presence of crops, farm equipment, livestock, and byproduct are clear indicators of agricultural land use where as the geometric patterns and textures which are typically used for computerized identification can often be misleading. Field patterns, field roads and hedgerows separating plots as solitary indicators can be easily misinterpreted. Although computerized land cover maps have their advantages, they produce results which generalize areas of land cover and are unable to produce results which accurately identify and quantify current land uses. *Figure 9* shows a comparison of

computerized results for corine land cover from 2006 to the manually identified agricultural land use produced by this study.

6.2 Analysis of Maps

The map layer of UA in Almada can easily be compared in ArcGIS to zoning and demographic data in order to make inferences about trends in agricultural land use and can be used when planning for future land use. The purpose of this study is not to make those inferences or predictions about land use change in the area but to provide the information in order for interested parties who might in turn use the data for making predictions or land use decisions. For the purpose of presenting how the information can be used, the resulting map of current agricultural land use in Almada (generated by this study) has been compared to maps displaying population and percent of unemployment by parish (*See appendix 9-G & 9-H*).

Through communication with IGOT -UL and the municipality of Almada, GIS data was acquired for the 2009 Almada PDM as well as site locations for the proposed horticultural parks in Almada. Based on these maps, there are some trends that are visible; the most obvious is the agricultural land use in comparison to the RAN land (*See appendix 9-C*). This expresses the value and importance of municipal protection of prime agricultural land. Expected trends based on the stakeholder interviews on the other hand are not necessarily reflected in the maps comparing demographic data with the agricultural land use Interviews with the farmers would lead one to believe that the majority of agricultural land use would take place in areas where there are higher rates of unemployment; this does not appear to be the case based on the unemployment rates in Almada parishes. The unexpected results could be due to multiple factors

6.3 Site Analysis and Interviews

The first set of sample of interviews took place on July 29 and August 1, 2014. 14 farmers were willing participants at 5 different agricultural sites within the Almada municipal boundaries *(see appendix 9-E)*. The goal of the farmer interviews is to understand the demographics of the population using different types of urban and peri-urban agriculture in the Almada area as well as to gain a greater understanding of the relationship between the community and agricultural land use by identifying driving forces for UA LUC. This information will provide a tool for land use planning and an increased understanding of the agricultural land use in Almada. This small sample has provided insight on the indicators of UA typologies and effectiveness of the interview questions and techniques.

6.3.1 Farmer Demographics

Results of the case study have revealed an interesting data set which will provide insight to guide the development of continued studies in the area. Of the 14 participants interviewed all but 2 are male. All farmers were between the ages of 50 and 78 except one farmer who is 38. All except 3 farmers live within a 10 minute walk of the farm plot (2 have onsite dwellings). Most of the farmers are retired or unemployed and 3 are employed as full time farmers.

6.3.2 Farmer Objectives

When presented as an open ended question, the respondents listed their primary objectives for faming the land as hobby, produce production for consumption and produce production for sale. 50% listed hobby as a primary objective and 43% listed personal consumption. 36% of the farmers considered crop sale to be a primary objective; with 90%-100% of their produce sold to warehouses and intermediate buyers who sell to local markets and groceries. 50% of the gardeners who were surveyed claim to spend 35 or more hours working in the garden each week, the other half spend between 5-25 hours gardening per week.

6.3.3 Land Tenure

The most astounding finding revealed through the sample interview process is that none of the farmers have any type lease or binding property agreement for their tenancy on the land. Some of the farmers have verbal agreements with the property owner but most of the sites are occupied on land which is owned privately or by the municipality. The Almada municipality on the other hand has no way of documenting land ownership in a cadastral system; therefore, there is no way of determining property rights (Camões, 2014). According to Patricia Abrantes PhD, Researcher CEG-IGOT, UL who studies agricultural land use and LUC in Lisbon with the AgriMet-MOD project, the city technically has no way of distinguishing between public and private land without a cadastral system. *Unplanned allotment gardens, vacant lot gardens* and *urban farms* are common in Almada along road sides, vacant plots and empty spaces between urban infrastructure.

6.3.4 Locations

Of the fourteen farmer interviews in Almada, eight of them took place near the Bosch industrial site which is near the Almada Forum shopping center in the parish of Fiejo. The plots are mostly

roadside along R. Antonio Calado. The nearest metro is Pragal station, which is across the highway A38. Interview 10 is located in the Trafaria parish. It is a larger property alongside the A38 as well. The other five interviews took place in Costa da Caparica. *(see appendix 9-D for interview locations)*

6.3.4.1 BOSCH COMMERCIAL PROPERTY

The allotment gardens near the Almada Forum where eight of the fourteen interviews were held are on land owned by the neighboring Bosch factory (interviewee 1, 3, 4, 5, 6, 7, 8, and 9). This property is approximately 5.6 hectares, each individual garden plot varies in size but most appear to average around 100 square meters. Eight of the fourteen farmers interviewed in the sample were farmers occupying land in this area. Although most of the farmers on the Bosch property have been there for 4-5 years, three of the respondents claimed to have been occupying the land for long amounts of time (15 and 34 years, the other was unsure how long he had been there but stated that it had been a long time). Two of the farmers said they heard about the site from others who were already farming there. During their time of occupancy only one farmer reported a conflict with the land owner requesting that farmers leave ten years prior.

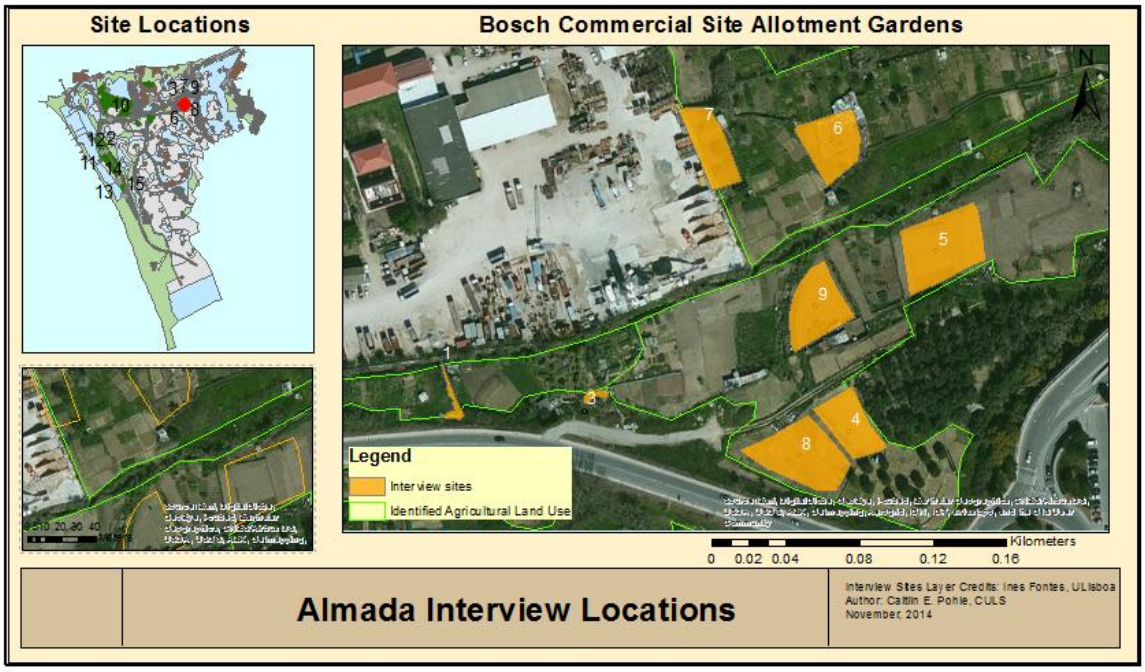


FIGURE 10

Bosch Factory property surrounded by unplanned allotment gardens. Interviews number 1, 3, 4, 5, 6, 7, 8, and 9 took place at this site and their garden plots are indicated.

The farmers interviewed at the Bosch site have small plots with moderately low yield and are all *subsistence farmers*; meaning they are growing food for personal consumption only and share produce with friends and family. Surprisingly, the farmers here commute longer than farmers interviewed at other locations; two of them commute 5 minutes or less, three have a 10 minute commute, and two of them commute almost an hour to get to this site. Since the farmers here are working for personal consumption and hobby they tend to spend fewer hours per week at the site compared to farmers at other locations, three of the farmers are working at this site 25-40 hours per week and the other five are working between 5-15 hours per week. The other six farmers who were interviewed at urban farms reported full time work (40 hours or more); some of them reported 80-105 hours per week working at their gardens.

IMAGE 3

Interview site 1- Land surrounding an industrial site (Bosch factory) near the Almada Forum

6.3.4.2 COSTA DA CAPARICA AND TRAFARIA

Five interviews took place at the urban farms of Terras de Costa which is a vast amount of land divided into large plots, often with residences on site. Interviews 11, 12 and 2 are pictured above (*see figure 12*) are in the northern part of Costa da Caparica. Interviewee 2 reported that 90% of the produce from the 4 ha property is sold at market through an intermediary seller. Interviewee 11 sells 100% of the production for commercial sale from the 9 ha property through an intermediary who resells to supermarkets such as Lidl and Pingo Doce. The other (interviewee 13) said their family helps to farm the 1 ha land and it is no longer used for market sale and instead supplements 100% personal produce consumption for the family which generally classifies them as *home subsistence farmers* although they don't exactly fit the profile according

to (Parrot, Moustier, & Bon, 2010). Interviewees 2 and 11 can be classified as *multi-cropping peri-urban farmers* according to the "summary of typology of UA socio-economic profiles" (*see Table 1*). The farm located in Trafaria, Onda Parque (interviewee 10) *(see figure 11)* is a 50 ha farm where the interviewee works approximately 105 hours per week. He has been occupying the land with a verbal agreement with the owner for 7 years. He said that the land was abandoned before he occupied it. He now has 3 employees and other temporary workers who produce staple crops for 100% sale at MARL market. Since his main objective is income, he can be classified as an *entrepreneur farmer.*

FIGURE 11

Interview sites 11, 12 & 2 taking place in Costa da Caparica (Terras de Costa) and Trafaria (Onda Parque)

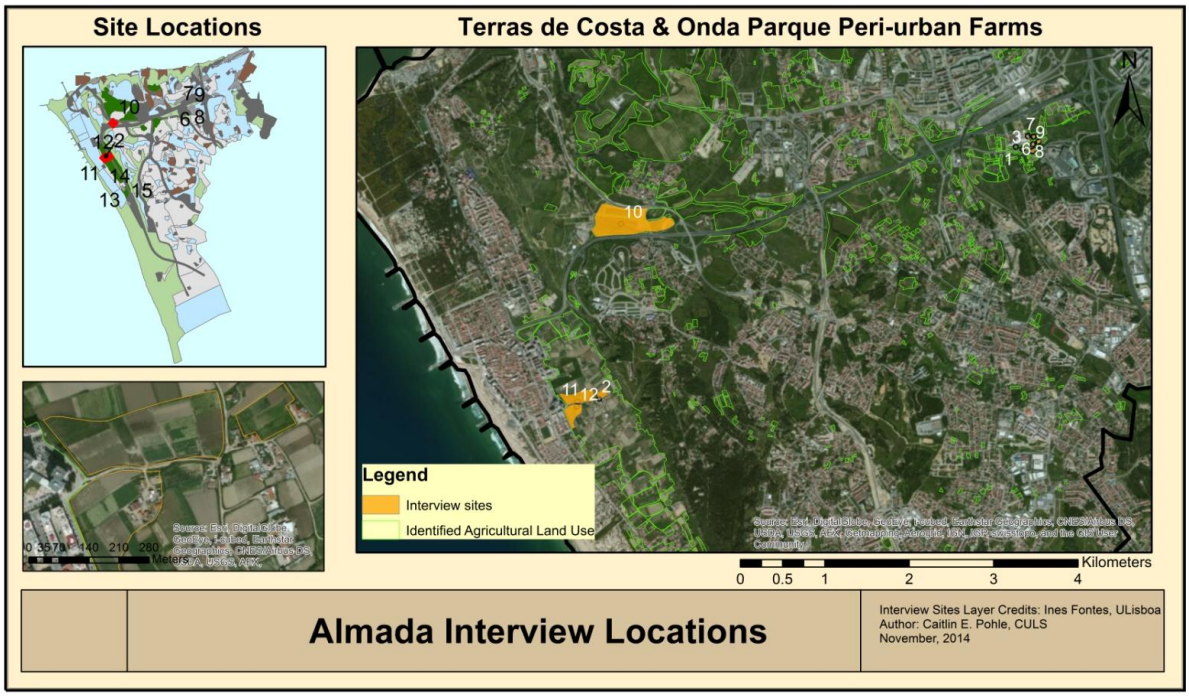


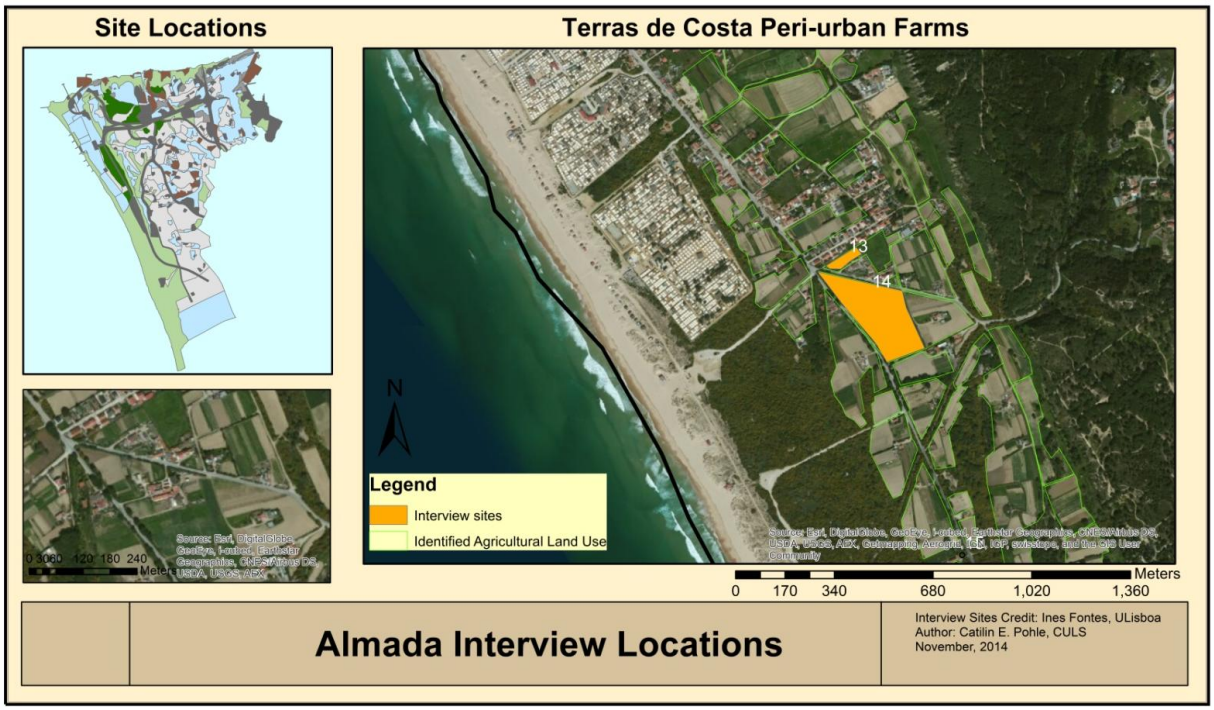
IMAGE 4

Interview site 10 at Onda Parque in Trafaria

The agricultural sites for interviewee 13 and 14 are similar farm layouts to the others at Terras de Costa in Costa da Caparica. Each interviewee has large plots which are within close proximity to their residence. They are full-time farmers who employ family members and use 100% of produce for commercial sale. Both of the farmers inherited the land and have lived there for their entire lives. They can be considered *multi-cropping peri-urban farmers* or *family type commercial farmers*.

FIGURE 12

Peri-urban farms of Terras de Costa in Costa da Caparica. Interview sites 13 & 14



6.3.5 MUNICIPALITY INTERVIEW

Tânia Camões, who works in the Urban Management Division for the Municipality of Almada participated in an interview on August 5, 2015. Although she did not have the answers to all of the interview questions, she was able to provide some insight on the municipal awareness and control over urban gardens and spontaneous agriculture in Almada. She confirmed that the municipality does not keep a land cadastre record at this time, however she reported that there is a system for land exchange and sale which takes a process of 20 days to convert a land use permit. She says that times of economic crisis people lose expectation that the land will sell. Agricultural practices on the vacant property provide some economic impetus for the owners. Vacant lots are often requested for the use of urban gardens. According to Dr. Tania, the municipality has received three requests per week since 2013 for the temporary access to water on vacant lots in Almada in order for them to be used for food gardens. The municipality is aware of and allows the illegal occupation of public land because she says there is nothing that can be done. She also says the municipality is interested in the use of land for agriculture because it is a healthy service which keeps the ground clean. She was unaware if there were any conflicts with the occupation of public land by gardeners, only that the occupation of large parcels of land by many different users is prohibited. There are several community gardens organized by the municipality and she was of the understanding that participants are not required to pay for the use of the garden plots.

6.4 CLASSIFICATION OF TYPOLOGIES

Based on all of the information gathered through the literature review and interviews, three categories of UA became apparent in Almada based on the scale of production, market orientation, and farmer objective. These typologies are identifiable in the maps based on visual indicators including size, shape and location of plot (*see table 2*). (*see appendix 9-F for map of UA classification types*)

1. *Residential & vacant lot gardens:* Residential gardens (on lots with dwellings) and more commonly found, vacant lot gardens (on empty or abandoned property) are typically implemented one family, individual or household on private property. Vacant lot gardens are found specifically on empty lots zoned typically for residential use but without construction or abandoned construction. The gardens are implemented either by land owners who cannot afford to build on the property and would not benefit from selling it

or by gardeners who are occupying the land (with or without consent of the owner). Production is typically for personal use and sometimes a small amount for sale and trade.

2. *Horticultural parks/ allotment gardens:* Planned horticultural parks and unplanned allotment gardens take place typically on public or occupy private property. They are found on the sides of roads, between buildings and on empty space around industrial and commercial lots. Multiple farmers from different backgrounds gather on one property which is divided amongst them. Farmers are typically unemployed or retired and participate in UA for enjoyment and food subsistence. Allotment gardens gradually expand into neighboring vacant land as word of mouth spreads the knowledge of the land use. Production is primarily for personal consumption and trade.
3. *Peri-urban Farms:* Commercial farms consume larger areas of land with owned, occupied or inherited by individuals, families or businesses which produce goods for public sale, most frequently one or several staple crops. Commercial farmers gain income from farming practices and are therefore more likely to make investments in farming structures and equipment.

TABLE 2: ALMADA FARM TYPE CLASSIFICATIONS

Classification	Characteristics	Visual indicators
Residential & vacant lot gardens	➢ Single plot of land occupied by a family or individual ➢ Leisure & subsistence of food and income ➢ Land owned or occupied	➢ Medium-small sized plots with or without the presence of construction often divided from other plots by a fence or barrier ➢ Residential areas ➢ Geometric perimeter ➢ Often grid-lick cropping patterns
Horticultural parks/ allotment gardens	➢ Multiple plots occupied by individuals or families ➢ Leisure & subsistence of food ➢ Land occupied ➢ Public or private land ➢ Typically unemployed/ retired	➢ Large- medium sized areas made up of multiple small sized plots divided internally by vegetation or manmade barriers ➢ Presence of small structures, tools, and equipment ➢ Mosaic of cropping patterns with no specific perimeter shape ➢ Often surrounded or hidden by vegetation with access paths to plots ➢ Often located near main transportation routes
Peri-urban Farms	➢ Single or multiple plots of land owned or occupied by individual, family or	➢ Large areas of land ➢ Usually taking place on the periphery of the city or peri-

	company ➢ Subsistence of income ➢ Land owned or occupied ➢ Use of employed labor	urban setting ➢ Linear cropping patterns ➢ Often single crop plots with low diversity in texture or color ➢ Presence of equipment, trucks, structures, and/ or livestock ➢ Perimeter which usual fills all available space

7. DISCUSSION

The results of the Almada case study successfully provide information about UA in the area while testing the methodology and providing input for methodological development in future studies. The maps created for this study are a visual representation of the existing agriculture in the Almada municipality. Based on these maps, it appears that the majority of the agricultural land use lies within RAN and REN areas and areas zoned for green farm structure and green zone structure. This implies that the urban farms are developed on land with high quality soil, and also implies that the agricultural land use is recognized and even somewhat supported by the municipality.

Based on the interviews, it seems the municipality is not interested in evicting the farmers who illegally occupy the land for agricultural use and although there is little support for the farmers they are able to benefit from farming the plots without conflict. Many of the farmers have been occupying the land for a lifetime but about 50% of the farmers interviewed started occupying the land for agricultural use within the last 10 years. All of the respondents who farm the land for personal consumption are retirement aged and unemployed. These respondents stated that their purpose for farming the land was for both food production and leisure. This expresses that the use of small scale UA is both an economic and social tool for this demographic in Almada.

As part of its Lisbon's "Green Plan", the municipality of Almada has proposed 26 sites for horticultural parks within the municipality (*see appendix 9-H*). Many of these plans take place in areas with existing agricultural land use. The data for these site locations is used as an example how this study can be used for planning land use (*see appendix 9-J*). This map shows a .5km service area around the proposed horticultural parks compared to unemployment distribution and existing UA.

7.1 FURTHER STUDIES

This report has described the initial steps of methodology for a study which aims to create a quantitative data base of UA land use within cities internationally while using qualitative interview methods to create a profile of UA users and typologies. The Almada case study resulted in the output of two sets of information which can be used by researchers in further studies as well as by multiple stakeholders for land use planning.

The methodology for the mapping process has the potential to be used in further studies to identify various types of land use. For example, along with mapping agricultural land it may be beneficial to map and classify areas of open space or vacant land in the same way. This could be used in conjunction with the maps of agricultural land use in order to plan for future UA land use and zoning.

Although the qualitative interviews resulted in information which was highly beneficial for creating a profile of UA users and identifying trends, a larger and more diverse interview sample would be ideal. Although there is no standard for qualitative interviews, ideally 10% would be a representative sample. This can be determined by estimating the number of farmers based on the area of agricultural land identified in the mapping process or by quantifying the amount of land held by the interviewees compared to the total amount. The larger and more spatially divers the interview samples are, the more reliable the findings will be. This is especially true in the case of land tenancy, in order to obtain more information about land tenancy for example. It may be beneficial use an additional method of research using a larger survey to obtain more quantitative information such as demographics and land tenancy.

Conducting this study internationally poses the disadvantage of a language barrier. The importance of correspondents in the study location must be stressed as the one of the most important elements of success in this study by assisting in ability to communicate with stakeholders as well as providing local information and acquiring data.

8. CONCLUSION

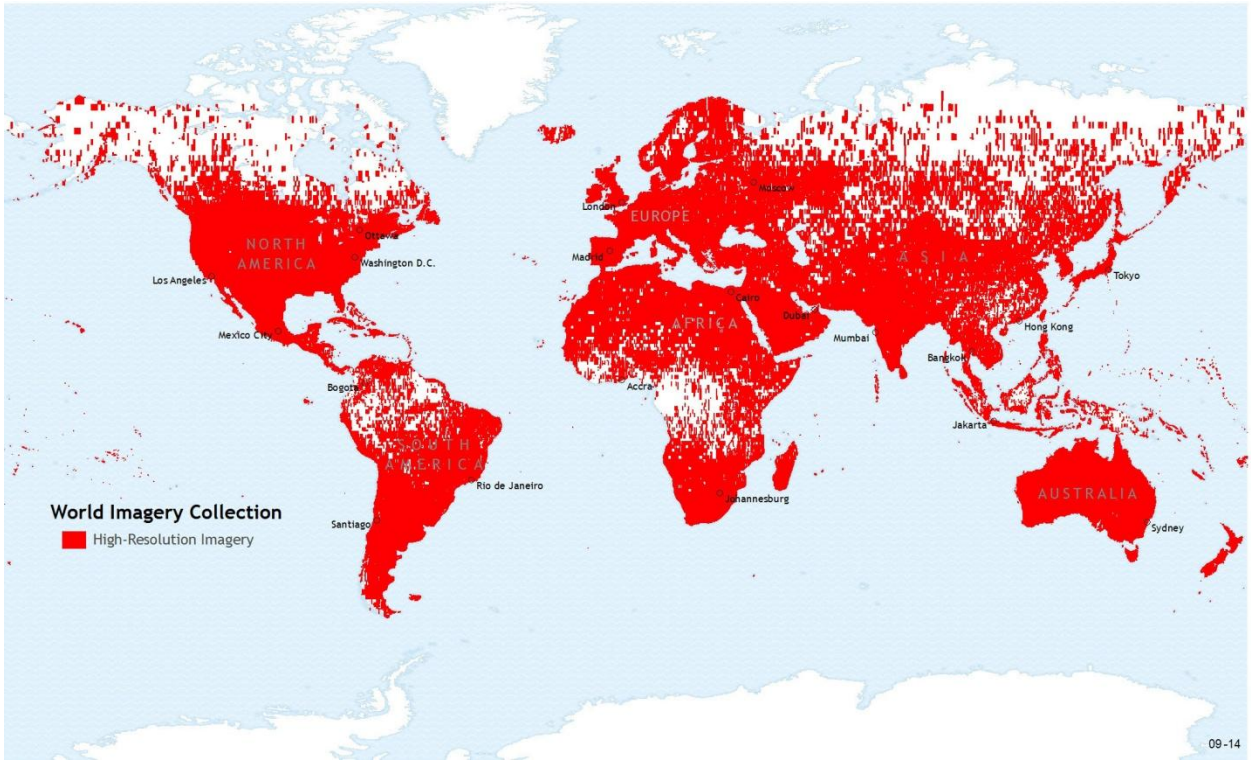
UA is used as a mechanism by city dwellers to provide local access to fresh food and economic stimulus and an outlet for recreational and social activity among other benefits. On a larger scale, UA and allotment gardens are beneficial to the urban framework by increasing green space in cities and providing an ecological service through water filtration and soil preservation. Recent initiatives have recognized the multifunctional benefits of UA and policy makers have worked UA into the agendas for sustainable urban planning on local and international levels. In order for UA to be used as a tool in urban planning to improve city life, food security and environmental sustainability it is necessary to first realize the extent of existing agricultural land use and plan for proper implementation and regulation. Because UA is phenomenon which commonly occurs spontaneously and without planning and frequently without permission or contracted tenure of

land, the planning, regulation and quantification of UA can be difficult. This study provides a technique of mapping and quantifying the extent of agricultural land use in city setting which has the ability to be applied to cities internationally.

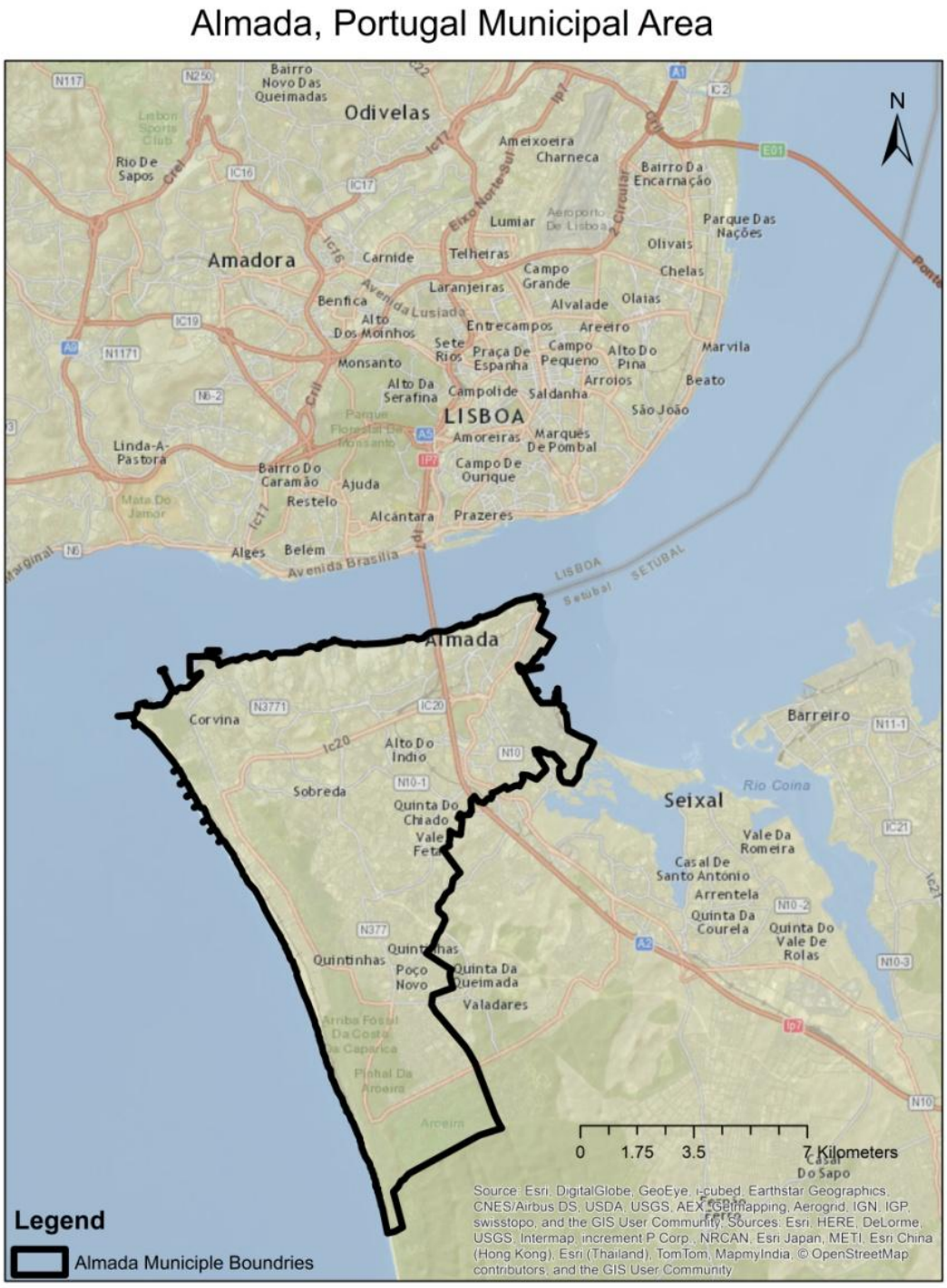
The application of the combined mapping and interview methods provides both a quantitative data set of current agricultural land use and qualitative information providing information about demographic of UA users. The resulting information has the potential to be used for land use planning and predicting LUC. Replication of this study in the same study area over time will provide evidence of agricultural LUC and with the replication of interview methods, clear drivers of agricultural LUC can be identified.

APPENDIX

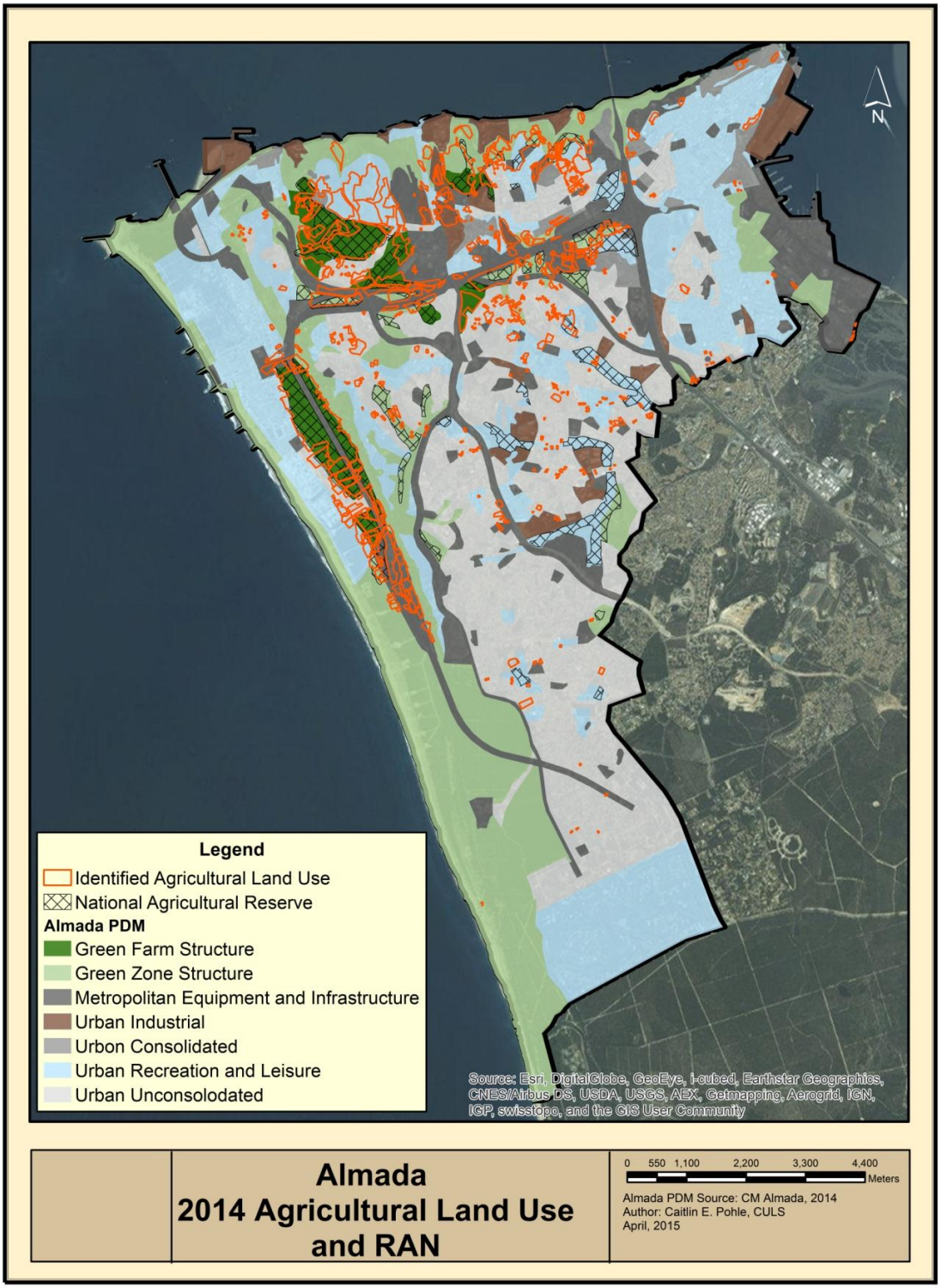
APPENDIX 0-A: WORLD COVERAGE MAP OF HIGH RESOLUTION SATELLITE IMAGERY FROM ESRI, ARCGIS SOURCE: *(Esri, 2013)*



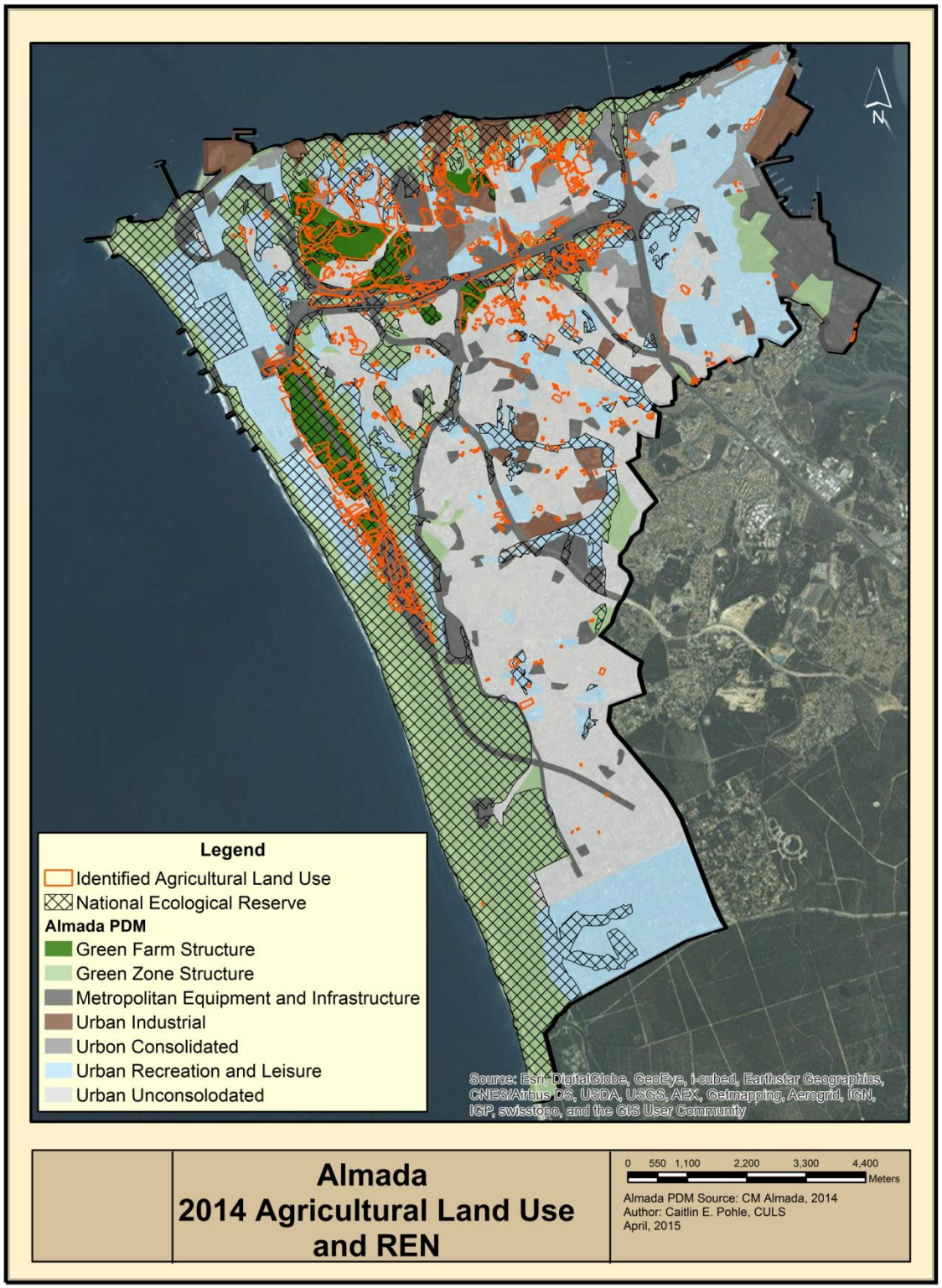
APPENDIX 0-B: CASE STUDY SITE LOCATION



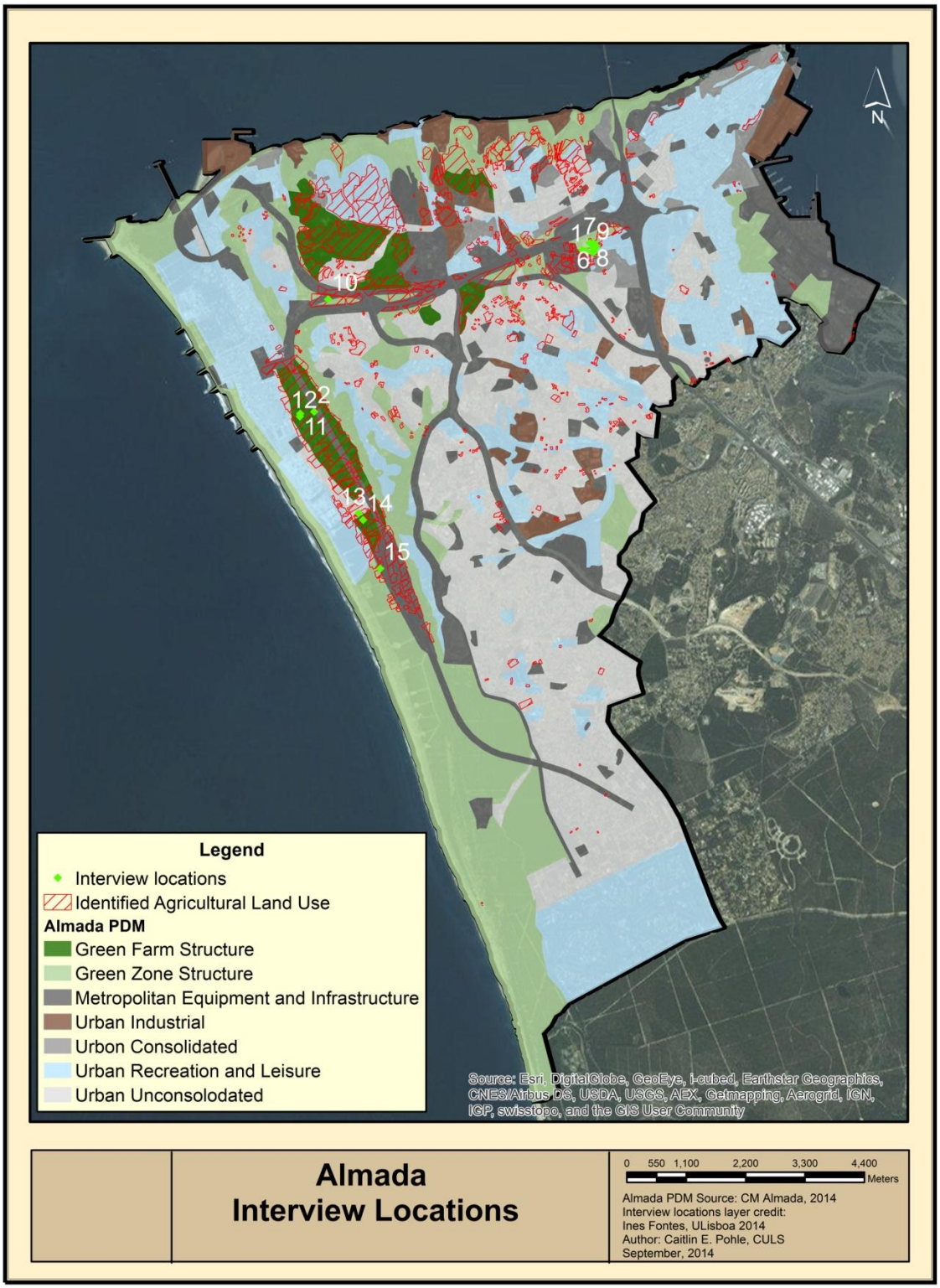
APPENDIX 0-C: IDENTIFIED AGRICULTURAL LAND USE IN COMPARISON WITH THE 2009 ALMADA PDM RAN



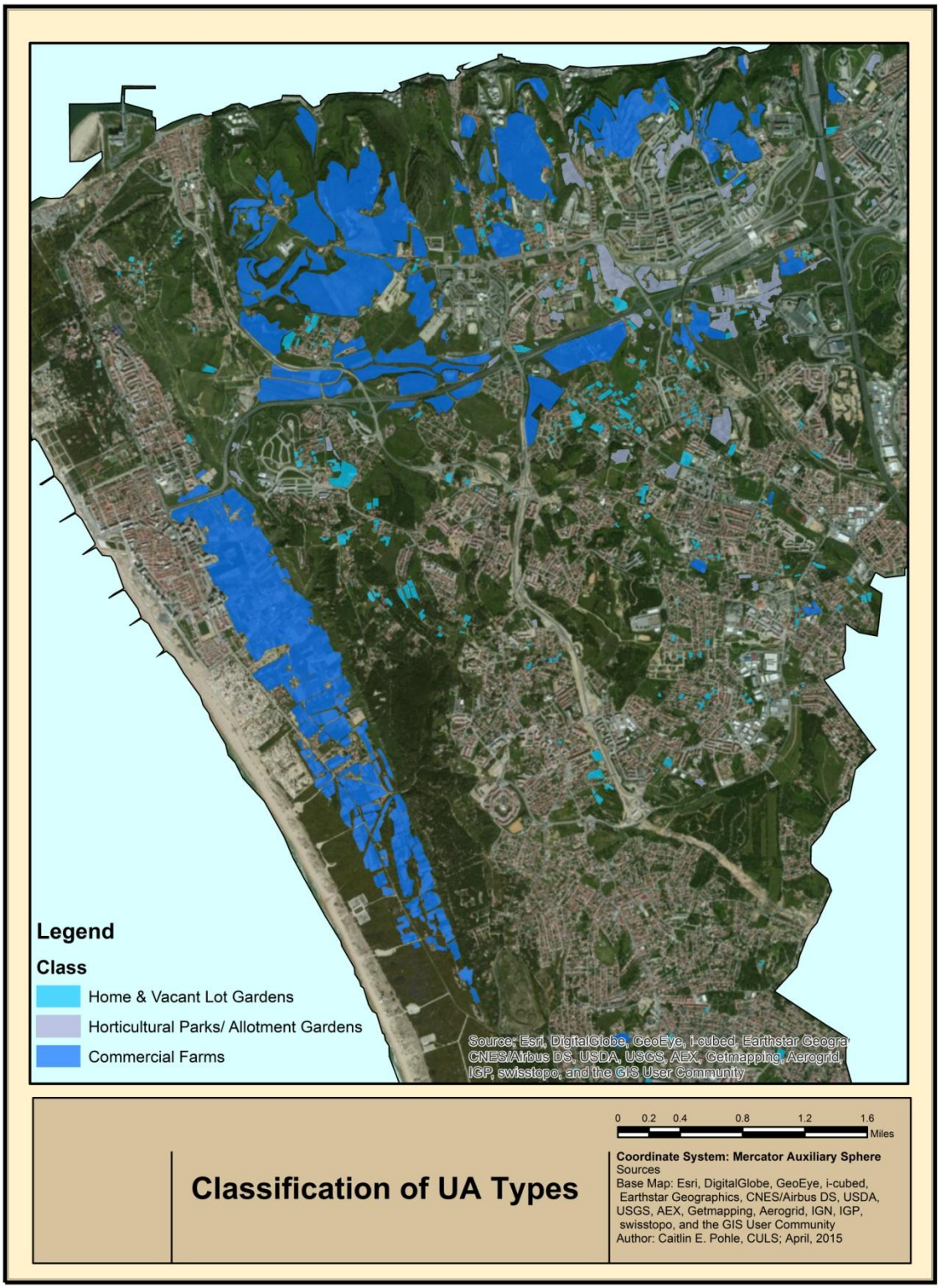
APPENDIX 0-D: IDENTIFIED AGRICULTURAL LAND USE IN COMPARISON WITH THE 2009 ALMADA PDM, REN



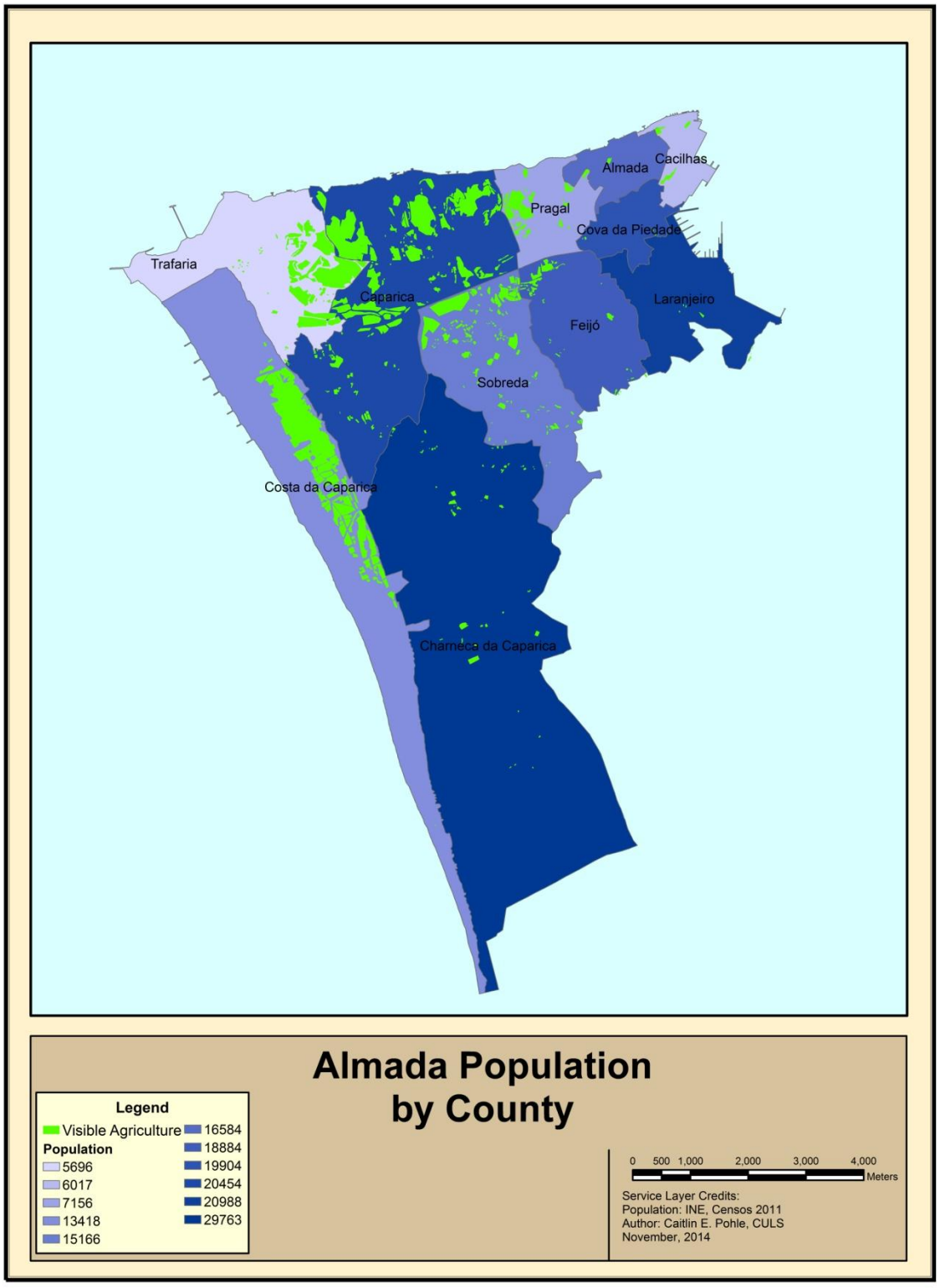
APPENDIX 0-E: INTERVIEW LOCATIONS



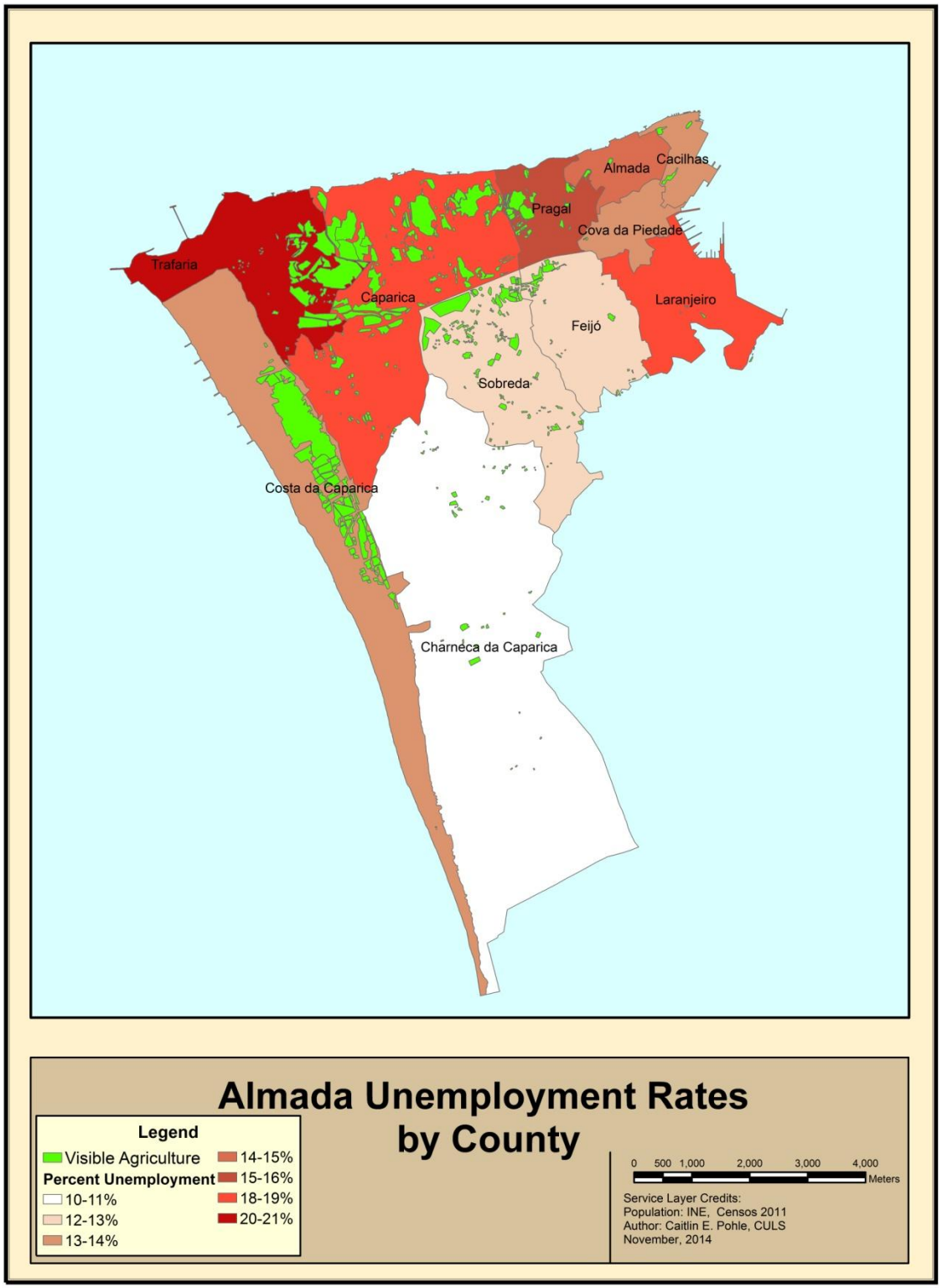
APPENDIX 0-F: CLASSIFICATION OF UA FARM TYPOLOGIES



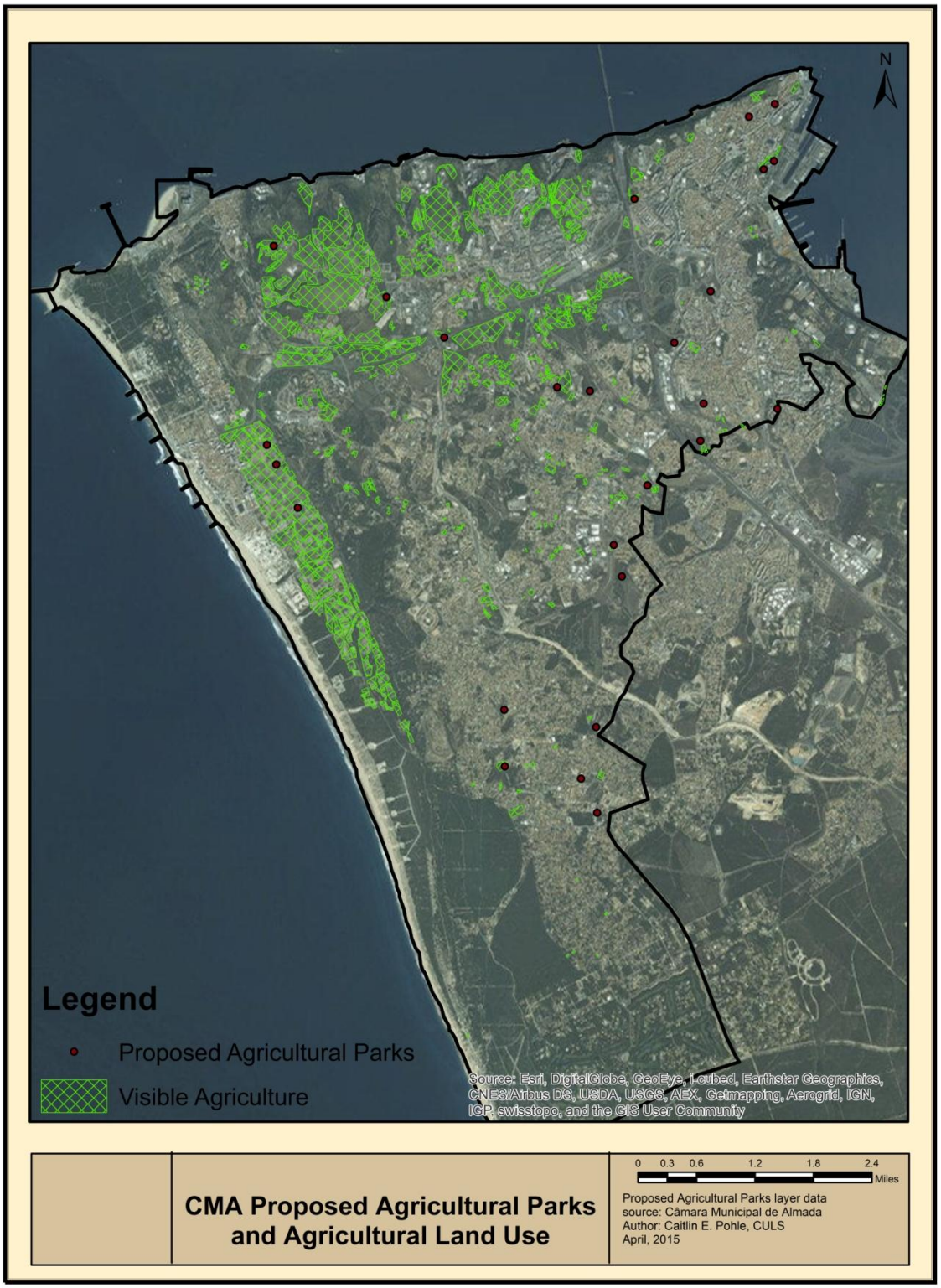
APPENDIX 0-G: COMPARISON OF POPULATION DISTRIBUTION TO AGRICULTURAL LAND USE



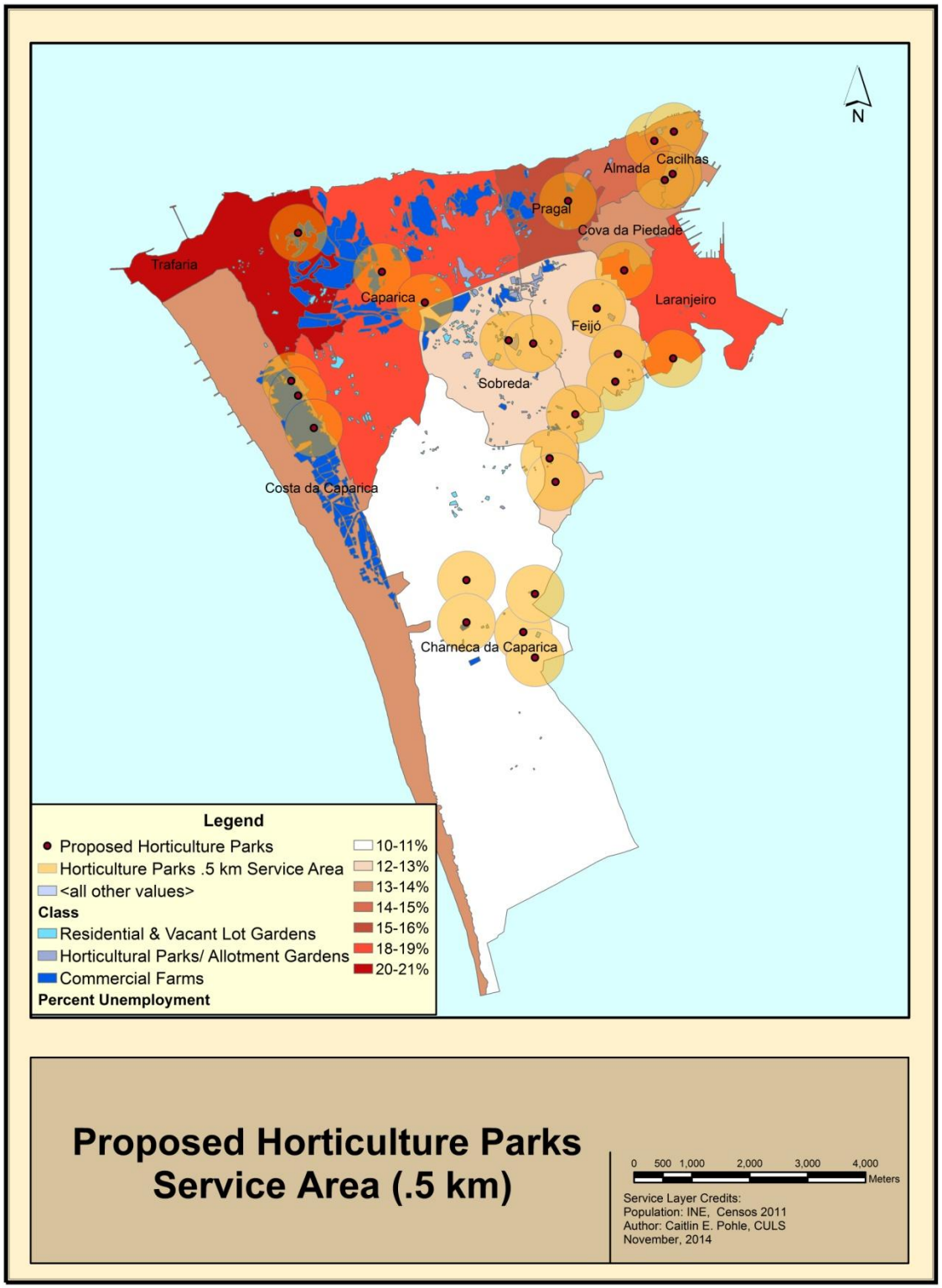
APPENDIX 0-H: COMPARISON OF UNEMPLOYMENT DISTRIBUTION TO AGRICULTURAL LAND USE



Appendix 0-I: Proposed Horticultural Parks



APPENDIX 0-J: .5 KM SERVICE AREA OF PROPOSED HORTICULTURAL PARKS IN RELATION TO UNEMPLOYMENT



APPENDIX 0-K: MUNICIPALITY INTERVIEW QUESTIONS

Extent

1. Is the municipality of Almada aware of the extent of urban agriculture in the region? Is there any system in place in order to track agricultural land use in Almada?
2. How many urban agricultural sites or community food gardens in Almada are planned by the municipality? Why and how does it work? How many total hectares?
3. Is there an estimate of total agricultural land use in Almada (public, private and occupied land)?
4. Has there been a noticeable change in the amount of agricultural land use in Almada over the past 5-10 years (public, private or occupied land)?
5. Does the municipality plan to work with local farmers in order to implement a local network of sustainable farming and food trade? Are there/will be local famer's markets held by the municipality or community.
6. Approximately what percentage of produce distributed in Almada is grown locally?
7. What other locations is produce most commonly imported from?
8. Are there recent records of what percentage of the Almada population receives income from agricultural activities?

Regulation/ Support

1. Is there any public outreach to communicate with local farmers?
2. What are the regulations for use of the agricultural gardens which are planned by the municipality? Is there rent paid for land tenure?
3. What type of support does municipality provide to farmers operating on land within the city boundaries? Are there subsidies available for agricultural land owners?
4. Have there been any problems with use of public land for agricultural purposes? If so what problems have occurred?
5. How does the municipality view occupation of public land for agricultural purposes? 6.Are there any future plans to regulate, encourage or discourage agricultural use on public land? Land Tenure 1.How is land purchased in Almada?
2. What records are held on land tenure?
3. Is there any land cadaster system in Almada?
4. How is land use regulated in Almada?

Zoning and PDM

1. How and for how long are the RAN and REN areas protected against development?
2. Is there any protection for agricultural land that does not lie within RAN or REN zoning?
3. How has the municipality incorporated urban agriculture into its Environmental Plan for sustainability or other? How have these plans been implemented?
4. What level of priority does agricultural land have on the PDM and why?
5. Are there any plans to change zoning in order to increase or decrease agricultural land use?
6. What have the major influences been on land use change in Almada in the past 5-10 years? Is this different from prior years?
7. Are/were there any conflicts on LU (agricultural to urban land, others?)

Meeting with Dr. Tania Camões in the Municipality of Almada - September 5, 2014.

1. **Private gardens in urban areas will:**

- Since 2013 there are 3 requests per week for use of lots for gardens;

- There is a request for use of water on a temporary basis. To use the urban gardens. Are individual requests. Unsolicited applications;

- The process of legalization of these processes is an average of 20 days. Since the input process to the verdict;

- These situations occur in permits conversion. People lose sales expectation by the crisis;

- Such instances are very prominent in lots (lots that had no urbanization project in its entirety);

- All of these cases are in areas plots;

- There is an economic reason and age of their owners, have no expectations of sale. And for these works as a source of income.

- The municipality is interested in this practice because it keeps the grounds clean. The municipality fomented their practice;

- Just do not allow the processes when they are recreational areas or very large properties (for having many owners);

- There may be conflicts but unaware (inspection department will know)

2. **Cies p urban gardens managed by munic ú í pio:**

- There is a map of urban gardens (in the municipal gardens). A set of urban gardens, conducted by Eng Catarina are provided;

- The camarárias gardens almost certainly are not paid. The council provides training to people. The award criteria are the income.

3. **Urban gardens in areas of serv will ã o:**

There is the phenomenon of urban gardens in areas of servitude pathways (s fertagu, track) though the municipality is unable to control this phenomenon.

Interview guide
Interview Date: _____
Interviewer Name: _____
Location (place, district, parish, if possible coordinates): _____
Institute of Geography and Spatial Planning -
University of Lisbon
Interview farmers
Within the research project Agrimet - contribution to the construction of a decision support analysis model in spatial planning and land use - we intend to analyze agricultural activities, its relations with the city, the major changes taking place and their future. Please help by answering the following questions:
1) General characterization of the interviewee
Age _____
Gender_____
Nationality
Education level _____
Occupation (if active or unemployed or retired. If unemployed or retired
What you did before) _____

Page 2

Live in the city? Or other? How long it takes to move to the garden
_____
2) Horta
Owner? Also leases? Why? _____
_____
Tenant or are occupied lands. The lands are public or private? Has the idea
Who belongs, has agreement verbal or written
_____
Garden the size _____
Have some space in your home where you have a garden? _____
_____
Do you know what type of soil falls within the PDM, if there are restrictions _____
_____
3) Agricultural Activity
Type the farmer: Main activity; Part-time and how many
hours a week dedicated to the activity? What is the main source of income? _____
_____
because he wanted to start the activity, when it started and how he learned? _____
_____
If production is for self or in part? As in%? And what makes the
surplus? Would you like to sell? And that proposals have to drain the product eg
markets networks of partnerships
_____
_____
What produces (at%)? What changes crops in the last 5-10 years? _____

_____
Income (estimate?) (Because it is still here. Costa Caparica) _____

Page 3

Percentage of production in the irrigation system? What is the origin of water? _____
_____
Proportion of family labor and non-family: himself; family (which family) ___
_____
When he came here? Why? _____
(How chose the site? Purchase / lease / verbal agreement? How long
here it is? If agriculture had here? Conflicts (problems) have been generated by
being here or do you think it could generate? What support have the camera or
parish or other entities (ever had problems with these entities?)
_____
Have previous experience in agriculture and where? _____
_____
What is the main objective to work in this garden? _____
_____
Production for personal or family consumption _____
Production for sale or trade _____
Recreation / leisure _____
Social integration _____
Other? (Which) _____
Above all, what is the greatest benefit of this garden for you? _____
__Se You sell or exchange your product,
_Onde Sell? (Public market, on the road between community members, other)
_____

Page 4

_Recorre The US grants or has enlisted? For what? (Land of the Coast) _____
_____
Or in the case of informal gardens: there is some kind of organization formed to them
support? Which Are? _____
What is approximately the percentage of food consumed weekly,
produced from a plot of land or marketed from plots
nearby? _____
4) Perspectives
What are the major difficulties (for the case of gardens "occupied" if the
difficulty comes from the municipal administration, what kind of access to land should be
given?) _____
How do you see the future related to the activity (10-20 years)? _____
Want to expand the property / activity? Why? How? _____
Land purchase / lease? If yes, sell to urbanize? to sell
agriculture? Leave the children? Rent? _____

What are the main barriers or difficulty? _____
If you want to diversify crops? _____
And if EU funds run out? What strategies? _____
Thank you for collaboration

Guião de entrevista

Código do inquérito:

_____

Data da entrevista: _____

Nome do entrevistador:_____

Localização (lugar, bairro, freguesia, se possível coordenadas): _____

Instituto de Geografia e Ordenamento do Território - Universidade de Lisboa

Entrevista aos agricultores

No âmbito do Projecto de investigação AGRIMET – contributo para a construção de um modelo de análise de apoio à decisão em ordenamento do território e uso do solo - pretende-se analisar as actividades agrícolas, as suas relações com a cidade, as principais mudanças em curso e o seu futuro. Pedimos a sua colaboração respondendo às seguintes perguntas:

1) Caracterização geral do entrevistado

Idade _____

Género _____

Nacionalidade _____

Nível de instrução _____

Profissão (se activo ou desempregado ou reformado. Se desempregado ou reformado o que fazia antes)_____

1

Mora na cidade? Ou outro? Quanto tempo demora a deslocar-se até à horta _____

2) Horta

Proprietário? Também arrenda? Porquê? _____

_____

Arrendatário ou são terras ocupadas. As terras são públicas ou privadas? Tem ideia a quem pertence, tem acordo verbal ou escrito _____

_____

Dimensão da horta _____

Tem em sua casa algum espaço onde tenha uma horta?_____

_____

Sabe em que tipo de solo se insere no PDM, se há restrições _____

_____

3) Actividade Agrícola

Tipologia do agricultor: Actividade principal; Actividade a tempo parcial e quantas horas por semana dedica à actividade? Qual a principal fonte de rendimento?_____

_____

porque quis iniciar a actividade, quando iniciou e como aprendeu?_____

_____

Se a produção é para autoconsumo ou apenas em parte? Quanto em %? E o que faz ao excedente? Gostaria de vender? E que propostas tem para escoar o produto e.g. mercados, redes de parcerias _____

_____

O que produz (em %)? Que alterações de culturas nos últimos 5-10 anos?_____

_____

Rendimentos (estimativa?) (porque ainda está por aqui. Costa Caparica)_____

Percentagem da produção em sistema de irrigação? Qual a origem da água?_____

Proporção de trabalho familiar e não-familiar: o próprio; a família (que familiares)___

Quando veio para aqui? Porquê?_____

(Como escolheram o local? Compra/arrendamento/acordo verbal? Há quanto tempo aqui está? Se já havia aqui agricultura? Que conflitos (problemas) têm sido gerados por estarem aqui ou que acham que se poderão gerar? Que apoios têm da câmara ou da freguesia ou outras entidades (alguma vez tiveram problemas com estas entidades?)

Tem experiência anterior e em agricultura, onde?_____

Qual é o principal objectivo para trabalhar nesta horta?_____

Produção para consumo pessoal ou familiar _____

Produção para venda ou comércio _____

Recreação/ lazer _____

Integração social _____

Outro? (qual) _____

Acima de tudo, qual é o maior beneficio desta horta para si?_____

__Se você vender ou trocar o seu produto,

_Onde vende? (mercado público, na estrada, entre os membros da comunidade, outro)

_Recorre a subsídios da EU ou já recorreu? Para quê? (terras da Costa)_____

_____

Ou no caso das hortas informais: há algum tipo de organização constituída para lhes dar suporte? Quais?_____

Qual é aproximadamente a percentagem de alimentos que consome semanal, produzida a partir da sua parcela de terreno ou comercializada a partir de parcelas vizinhas?_____

4) Perspectivas

Quais as maiores dificuldades sentidas (para o caso das hortas "ocupadas" se a dificuldade vem da administração municipal, que tipo de acesso à terra deveria ser dado?)_____

Como vê o futuro relacionado com a actividade (10-20 anos)?_____

Pretende expandir a propriedade/actividade? Porquê? Como?_____

Compra de terras/ arrendamento? Se sim, vender para urbanizar? vender para agricultura? Deixar para os filhos? Arrendar?_____

Quais são os principais entraves ou dificuldade?_____

Se pretende diversificar culturas?_____

E se os fundos comunitários acabarem? Que estratégias?_____

Obrigado pela colaboração

APPENDIX 0-O: FARMER INTERVIEW RESPONSES

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
Date of interview	**29-Jul-14**	**29-Jul-14**	**31-Jul-14**	**31-Jul-14**	**31-Jul-14**	**31-Jul-14**	**31-Jul-14**	**31-Jul-14**	**31-Jul-14**	**1-Aug-14**	**1-Aug-14**	**1-Aug-14**	**1-Aug-14**	**1-Aug-14**
Name of Interviewer	**Pedro**	**Gracinda Marques (tlm 964 647 369)**	**José Nunes (tlm 963 401 173**		**Pedro Soares Barata (tlm 962 502 851)**		**João Ferreira Covas**	**Adelino Semedo (tlm 964 798 212)**	**Welcome**	**Mr. Antonio (tlm 963 717 000)**	**Ricardo Pinto (tlm 919 796 158)**	**Américo (tlm 966 126 658)**	**Vitorino**	**John Carvalho (tlm 936 068 212)**
Location (place, neighborhood, parish, if possible coordinates)	**Next to Forum (Bosch)**	**Costa de Caparica**	**Next to Forum (Bosch)**	**Next to Forum (Bosch)**	**Next to Forum (Bosch)**	**Next to Forum (Bosch)**	**Next to Forum (Bosch)**	**Next to Forum (Bosch)**	**Next to Forum (Bosch)**	**Onda Parque**	**Costa de Caparica**	**Quinta da Bica. Costa de Caparica**	**Costa de Caparica**	**Near Praia da Mata**
General characterization of the interviewee														
Age	60	70	50	56	54	51	78	64	71	54	34	70	69	62
Gender	M	F	M	F	M	M	M	M	M	M	M	M	M	M
Nationality	Cape Verde	Portuguese	Portuguese	Cape Verde	Cape Verde	Portuguese	Portuguese	Cape Verde	Cape Verde	Brazil	Portuguese	Portuguese	Portuguese	Portuguese
Level of education	9 years	4 years	4 years	Not have	1st year	Higher Education	3.ºano	4.ºAno	4.ano	3.ºano	12.ºano (frequency higher education)	4.ºano	Not have	9.ºano

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
Profession (whether active or retired or unemployed. If unemployed or retired, what did before)	Refurbished - Cleaning Ship LISNAVE	Reformed - worked in agriculture	Unemployed - in the civil Construction Builder	Unemployed - worked in cleaning in hospital	Unemployed (worked as a bricklayer and carpenter) has but little allowance)	Senior Officer of the Navy	Reformed. Worked in the trade for 20 years	Disability pension.Stripper	Reformed (500euros).Worked in LISNAVE	Farmer (now healthy routine)	Farmer	Reformed.Farmer	Reformed.Farmer, Civil Construction	Farmer
Live in the city? Or other? How long does it take to move up to the garden	Laranjeiro - Bus - 10 minutes	Lands of Costa	Feijo - 10 minutes	Laranjeiro - 10 minutes	Trafaria (50 minutes)	Laranjeiro, 3-4 minutes	Peace Park - 5 minutes	Cova da Moura - 1 hours	Monte da Caparica - 1 hours	Monte da Caparica - 5 minutes	3 minutes	1 minute	Live here. 1 minute	Live within the property
Horta														
Owner? Also leases?Why?	Ceded by owner (but not paying rent)	Not pay income	Is City Hall	Busy - City Hall					Rent free	Unpaid income, has verbal agreement with the owner				

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
Tenant or are occupied lands. The lands are public or private? Any idea who owns, has verbal or written agreement	Has verbal arrangement (but not paying rent)	Private (but not paying rent)	Busy	Do not know	Rent free	The House - do not pay income	Belongs to Bosh	Rent free				Occupied		
Dimension of the garden	Very small	4000 hectares	100m2			12 feet wide			Small	50hectares	9 hectares	8 acres	1 hectare	20 hectares
Have some space in your home where you have a garden?		Yes (lives near the agricultural land)	Not have	Not have (lived in a building)	Not have	Not have	Do not		Do not					
Know what type of soil is within the PDM, if there are restrictions														

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
Agricultural Activity														
Type of farmer: Main activity; Part-time and how many hours per week devoted to the activity? What is the main source of income?	Full time (35/40 hours per week)	Full time	Full time (unemployment)	10 hours / week	10 hours / week	6 hours / week	15hours / week	25 hours / week	5 hours / week	105horas / week	12hour day	7-12 hours / day	8hours / day.Full time	8-12 hours / day
Because he wanted to start the business, and how you learned when you started?	From 5-8 years		Since small (started operations in this portion 4 years ago)	Since 4 years in Cape Verde	Since the age of 7 in Cape Verde	Relaxation / 3 years ago	1980, because it always made agriculture. L earned very little	since 4 years, because like	It is an income support	Since 7 years.Learned in apamha rice in Brazil	For taste, professional output			
	Interviewed 1	**Interviewed 2**	**Interviewed 3**	**Interviewed 4**	**Interviewed 5**	**Interviewee 6**	**Interviewed 7**	**Interviewed 8**	**Interviewed 9**	**Interviewed 10**	**Interviewed 11**	**Interviewed 12**	**Interviewed 13**	**Interviewed 14**
If production is for self or only in part?As a%? And what does the surplus? I would like to sell?And you have to drain the proposals eg product markets, networks, partnerships	Only for self (if it were larger, but sold)	90% for sale	Consumption (100%) (not sell)	It's all for consumption, you can not sell, is little	Only for consumption, had sold more	Consumption (only)	Autoconsumption	Own consumption, I would sell	100% consumption. Would not want to sell because unpaid work	Everything for sale; MARL is the largest buyer, markets ..	Everything for sale	For sale 100% (some use)	Consumption . It is no longer	Sell all
What yields (in%)?That changes in cultures over the past 5-10 years?	Sugarcane (80%) Remaining: beans, corn, tomatoes, cabbage, bay leaves)	Cauliflower, Portuguese cabbage, hearts, broccoli (once produced carrots, turnips and carrots)	Beans, tomatoes, cabbage, peppers, onions)	Cabbage, corn, sugar cane	Sugarcane, corn	Beans, tomatoes, sprouts	Tomato, cabbage, turnip greens, turnips, tomatoes	Pumpkins, cabbages, sugar cane, lettuce, tomato	Cob, beans, potatoes	Corn, broccoli, cauliflower, cabbage heart, Lombard, turnip, turnip	Horticultural, turnip, leek	Heart kale, leeks, broccoli, potatoes	Corgete, green beans, corn, Portuguese kale, cabbage	Cabbage, lettuce, green beans
	Interviewed 1	**Interviewed 2**	**Interviewed 3**	**Interviewed 4**	**Interviewed 5**	**Interviewee 6**	**Interviewed 7**	**Interviewed 8**	**Interviewed 9**	**Interviewed 10**	**Interviewed 11**	**Interviewed 12**	**Interviewed 13**	**Interviewed 14**
Income (estimate?) (Because it is still here. Costa Caparica)		Do not know / no answer								90-120 thousand euros / year	20-60mil / year	Do not know / no answer		No answer
Percentage of production in the irrigation system?What is the origin of the water?	100% stream	Hole 100%	100% spring	100% spring	100% spring	Brook (100%)	100% of the brook		100% of the brook	Hole and brook	Hole 100%	Hole 100%	Hole 100%	Hole 100%
Proportion of non-family labor and family: himself;family (that family)	Only the very	The own and Nephew (full time)	It is the only one in the family	The own and the Husband (50%, 50%)	It is the only working	the único	It is the only	Only the very	It is the only	Only it 3 more employees and sporadic workers	Single (has 3 employees)	1 son and 3 more employees	Children help sometimes	1 employee 2 more children full time
When he came here? Why?	5-8 years	Since birth	By a friend who occupied a neighboring land, 4 years ago	5 years	A friend told him to occupy the land. It is not long ago, do not know how long		Since 1980	4 years ago	15 years ago, worked closely and came here	2006	2008, through grandparents who gave them the land	Since birth	10-12 years	Since birth

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
(How to chose the site? Purchase / Lease / verb agreement How long have here? If there were farming here? What conflicts (problems) have been generated by being here or do you think it could generate? What support have the camera or the parish or other entities (ever had problems with these entities?)	Because he knew the person who was next to the property and asked him if he wanted to use the big chunk of land	Here since birth (never felt problems)	4 years	There was no agriculture, never had problems	It had been agriculture and then left, never had problems	Friends who had already told him „ agriculture since 1974	There was agriculture (there was a sugar plantation)	They never told him anything	Do not know who is the earth, never had problem	When he reached the ground was abandoned, had no type of planting	Municipality of Almada, wanted to take possession of the land	It was the great grandfather - by inheritance - the House wanted to occupy this ground four years ago.	Lived here, it was the father who was already here	Fossil Cliffs.Rent free, was the grandfather, since the nineteenth century.
Have previous experience in agriculture and where?	Yes, Cape Verde	Since birth (this place)	Yes, since small	Yes, Cape Verde	in Cape Verde	Already had experience in irrigation	Since he was born in Vila Franca de Gaia	Yes, in Cape Verde	apredeu in Cape Verde	In Brazil, since the seven years	Yup	Yes always	Since birth	Since birth

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
What is the main objective to work in this garden?	Hobbies	Market for sale	To have and have occupancy horticultural products	Produce and consume to occupy time	Occupy the time and take the products of the earth	Occupy time	Autoconsumption	Occupy time, produce agricultural products for self-consumption	Occupy time	Working full time	Full time work			Yield
Production for personal or family consumption					100%		100%							
Production for sale or trade										100%	100%	100%		100%
Recreation / leisure														
Social integration														
Another? (Which one)														
Above all, what is the biggest benefit of this garden for you?	Hobbies	Yield			Occupy time									
If you sell or exchange your product,			Does not sell											

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
If you sell or exchange your product,			Does not sell											
Where to sell?(Public market, on the road between community members, other)		Sells the intermediary who sells to markets, hypermarkets		Does not sell	Does not sell		Not sale	Does not sell	Does not sell		Intermediate to LIDL, Pingo Doce.	Stephen Luis Salvador		Warehouses and MARL
Uses EU subsidies or already appealed?For what? (Land of the Coast)		Diesel subsidy for (over 12 years)	Does not use	Do not					Do not	Do not	Do not	Just for Agricultural Diesel		Tractor for 20 years and agricultural diesel
Or in the case of informal gardens: there is some kind of organization formed to support them?What?			No											

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
Which is approximately the percentage of food you consume weekly, produced from its parcel of land or marketed from neighboring plots?	Almost all	In the summer has to resort to the market	Most are from the garden (90%) because the market buying potatoes	Most strip of land plot	the Majority	Tomatoes do not buy	Most	Get more of the garden than market purchase	Most	Everything for sale	Sell all	Almost everything for sale, Some for consumption	Do not purchase anything	Sells almost everything it produces
Perspectives														
What are the major difficulties encountered (for the case of the "occupied" gardens is the difficulty comes from the municipal administration, what kind of access to land should be given?)	Never felt pressure to leave		Never had problems	Nobody ever said anything		Never had problem	10 years ago appeared Bosh representatives who said they had to leave			It is very friendly owner		The House tried to occupy the land		Never had problems

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
How do you see the future related to the activity (10-20 years)?	Yes, even die	To death	At the same site	Yup	Plan to leave shortly	Maybe he's still here	Power up	Here in agriculture	Making agriculture	In the same place doing agriculture	In the same place to work	this terrain to death	In the grounds	Here in this property
Want to expand the property / activity?Why? How?	Yes, but would have to be in another space (as this site does not have the possibility to expand the property (since they are already occupied land)	Do not				Do not	Do not		Yes i would	Would increase the property to increase prdução	Yes, in order to have greater rednimento	Do not	Do not	No room for growth
Land purchase / lease? If yes, to urbanize sell? sell to agriculture? Leave the children? Rent?														

	Interviewed 1	Interviewed 2	Interviewed 3	Interviewed 4	Interviewed 5	Interviewee 6	Interviewed 7	Interviewed 8	Interviewed 9	Interviewed 10	Interviewed 11	Interviewed 12	Interviewed 13	Interviewed 14
Land purchase / lease? If yes, to urbanize sell? sell to agriculture? Leave the children? Rent?														
What are the main barriers or difficulty?														
If you want to diversify crops?														Do not
And if EU funds run out? What strategies?		No												

WORKS CITED

Anderson, J. R., Hardy, E. E., Roach, J. T., Witmer, R. E., & Peck, D. L. (1976). A Land Use And Land Cover Classification System For Use With Remote Sensor Data. *A Revision of the Land Use Classification System as Presented in U.S. Geological Survey Circular 671*, *964*, 41.

AgriMe/MOD, n. (n.d.). *AgriMet*. Retrieved September 1, 2014, from AgriMet-MOD: http://agrimet.ul.pt/

Batista, D. S., & Matos, R. S. (2013). Urban Agriculture: The Allotment Gardens as Structures of Urban Sustainability. In D. M. Ozyavuz (Ed.), *Advances in Landscape Architecture* (pp. 457-512). Rijeka, Croatia: InTech. Retrieved July 1, 2014, from http://www.intechopen.com/books/advances-in-landscape-architecture

Beatley, T. (2000). *Green urbanism: learning from European cities.* Washington, D.C.: Island Press.

Cai, J., & Yang, Z. (2006). Economic Impacts of Agriculture in Peri-urban Beijing. In R. Van Veenhuizen, & R. Van Veenhuizen (Ed.), *Cities farming for the future: Urban agriculture for green and productive cities* (pp. 252-258). RUAF Foundation.

Câmara Municipal de Almada. (2007). *Estrutura Ecológica Municipal*. Retrieved September 14, 2014, from Almada Informa: http://www.m-almada.pt/portal/page/portal/AMBIENTE

Câmara Municipal de Almada. (2009). *Plano Director Municipal*. Retrieved November 5, 2014, from Camara Municipal de Almada: http://www.m-almada.pt/

Camões, T. (2014, September 5). CMA, Divisão de Gestão e Administração Urbanística 3, Chefe de Divisão. (P. Abrantes, Interviewer, & E. Gomes, Translator) Almada, Portugal.

Cancela, J. (2009). *Urban Agriculture in City Planning Process. Eperiences From Portugal.* Lisbon: ISOCARP.

Cengiz, A. E. (2013). Impacts of Improper Land Uses in Cities on the Natural Environment. In M. Özyavuz (Ed.), *Advances in Landscape Architecture* (pp. 19-52). InTech. Retrieved September 14, 2014, from http://www.intechopen.com/books/advances-in-landscape-architecture

Clavejo, M. T., Drescher, A., Dongus, S., & Holmer, R. J. (2003, December). Allotment Gardens for Philippine Cities. *Urban Agriculture Magazine*(11), 29-31. Retrieved from http://www.ruaf.org/sites/default/files/Allotment%20Gardens%20for%20Philippine%20Cities_1.pdf

Commission of the European Communities, 2006. Thematic Strategy for Soil Protection, Available from: www.ec.europa.eu/environment/soil

Deelstra, T., & Girardet, H. (2000). Urban agriculture and sustainable cities.*Bakker N., Dubbeling M., Gündel S., Sabel-Koshella U., de Zeeuw H. Growing cities, growing food. Urban agriculture on the policy agenda. Feldafing, Germany: Zentralstelle für Ernährung und Landwirtschaft (ZEL)*, 43-66.

Dijkstra, L., & Poelman, H. (2014). A harmonised definition of cities and rural areas: the new degree of urbanisation. *Regional and Urban Policy*. European Comission. Retrieved April 06, 2015, from http://ec.europa.eu/regional_policy/sources/docgener/work/2014_01_new_urban.pdf

Drescher, A. (2001). *The integration of Urban Agriculture into urban planning – An analysis of the current status and constraints.* University of Freiburg. Wageningen: CTA. Retrieved July 23, 2014

De Zeeuw, H., & Dubbeling, M. (2009). *Cities, food and agriculture: Challenges and the way forward* (No. 3). *Agriculture, Food and Cities* (p. 36). Retrieved from http://www.ruaf.org/sites/default/files/Working paper 3 Cities Food and Agriculture.pdf

Entidade Nacional da Reserva Agricola Nacional. (n.d.). *Reserva Agricola Nacional (RAN)*. Retrieved April 15, 2015, from Direcao Geral de Agricultura e Desenvolvimento Rural (DGARDR): http://www.dgadr.mamaot.pt/ambord/reserva-agricola-nacional-ran

Esri. (2013). *ArcGIS REST Services Directory: World Imagery*. Retrieved April 12, 2015, from ArcGIS Online: http://services.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer/0

FAO. (2007). Profitability and Sustainability of Urban and Peri-urban Agriculture. *Agriculrural Management, Marketing and Finance Occasional Paper, 19*, 1-83. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).

Guillem, E. E., Barnes, a. P., Rounsevell, M. D. a, & Renwick, a. (2012). Refining perception-based farmer typologies with the analysis of past census data. *Journal of Environmental Management*, *110*, 226–235. doi:10.1016/j.jenvman.2012.06.020

Gutzler, C., Helming, K., Balla, D., Dannowski, R., Deumlich, D., Glemnitz, M., … Zander, P. (2015). Agricultural land use changes – a scenario-based sustainability impact assessment for Brandenburg, Germany. *Ecological Indicators*, *48*, 505–517. doi:10.1016/j.ecolind.2014.09.004

Instituto National de Estatistica (INE). (2014, June 16). *Territorial Statistics*. Retrieved 2015, from Instituto National de Estatisticas Statistics Portugal: http://www.ine.pt/

Halweil, B. (2002). *Home grown: The case for local food in a global market*. (T. Prugh, Ed.)*Worldwatch Paper* (pp. 5–79).

Jones, N., de Graaff, J., Rodrigo, I., & Duarte, F. (2011). Historical review of land use changes in Portugal (before and after EU integration in 1986) and their implications for land degradation and conservation, with a focus on Centro and Alentejo regions. *Applied Geography*, *31*(3), 1036–1048. doi:10.1016/j.apgeog.2011.01.024

Kellogg, C. E., & Veatch, J. O. (1934). Agricultural Land Classification and Land Types of Michigan. *The Journal of Land & Public Utility Economics*, *10*, 322. doi:10.2307/3139182

Laviscio, R. (2014). *COST Action Urban Agriculture Europe: Cultural dimension of urban agriculture.* Politecnico di Milano, Department of Architecture, Built Environment, and Construction Engineering A.B.C. London: COST Action UAE. Retrieved July 11, 2014, from http://www.urbanagricultureeurope.la.rwth-aachen.de/files/stsm_report_raffaella_laviscio_.pdf

Lopes, N. (2009). *Energy and Environmental Introduction to Almada.* City Council of Almada, Division of Studies and Environmental Management. Almada: Cama Municipal de Almada. Retrieved July 11, 2014

Madaleno, I M (2003) Farming and other land uses in Lisbon Metropolis, Portugal. Optimization ofLand for Agriculture in City Areas. Fourth RUAF/UMP electronic conference. Leus- den: Resource Centre for Urban Agriculture & Forestry, 1–10. (www.ruaf.org/conference)

Mata, D. (2014). Urban Allotment Gardens in European Cities - Future, Challenges and Lessons Learned. *Lisbon's Green Plan Action: Towards a Green City* (pp. 1-5). Lisboa: Camara Municipal de Lisboa. Retrieved July 23, 2014, from http://www.urbanallotments.eu/fileadmin/uag/media/Lisbon/2-GVSF-CML-paper_COST-LNEC_FINAL.pdf

Matos, Rute Sousa (2010), A Reinvenção da Multifuncionalidade da paisagem em Espaço Urbano – Reflexões, (Tese de Doutoramento em Artes e Técnicas da paisagem), Évora. Universidade de Évora: Instituto de Investigação e Formação Avançada

McClintock, N. (2010). Why farm the city? Theorizing urban agriculture through a lens of metabolic rift. *Cambridge Journal of Regions, Economy and Society*, 191–207. Retrieved September 13, 2014, from http://cjres.oxfordjournals.org

Mougeot, L. J. (2000). Urban Agriculture: Definition, Presence and Potentials and Risks. In M. D. N. Bakker (Ed.), *Growing Cities Growing Food: Urban Agriculture on the Policy Agenda* (pp. 1-49). Wielinger, DE: Deutsche Stiftung für Internationale Entwicklung, Zentralstelle für Ernährung und Landwirtschaft. Retrieved July 23, 2014, from http://www.ruaf.org/sites/default/files/Theme1_1_1.PDF

Moustier, P., & Danso, G. (2006). Local economic development and marketing of urban produced food. In R. v. Veenhuizen (Ed.), *Cities farming for the future: urban agriculture for green and productive cities* (pp. 171-206). Leusden: RUAF Foundation, IDRC and IIRR.

Nadia, J., Jan, d. G., Isabel, R., & Duarte, F. (2011). Historical review of land use changes in Portugal (before and after EU integration in 1986) and their implications for land degradation and conservation,. *Applied Geography, 31*(3), 1036-1048. doi:10.1016/j.apgeog.2011.01.024

Parrot, L., Moustier, P., & Bon, H. D. (2010). Sustainable urban agriculture in developing countries. A review. *Agronomy For Sustainable Development, 1*(30), 21-32.

S. Freire, T. S. (2009). Recent urbanization and land use/ land cover change in Portugal- the influence of coastline and coastal urban centers. *Journal of Coastal Research*(56), 1499-1503. Retrieved July 7, 2014

Soulard, C., Valette, E., Coline, P., Patricia, A. C., Anthopoulou, T., Ouassilla, B., . . . Paoli, J.-C. (unpublished). Periurban Agroecosystems in the Mediterranean: diversity, dynamics and drivers.

Taylor, J. R., & Lovell, S. T. (2012, August 25). Mapping public and private spaces of urban agriculture in Chicago through the analysis of high-resolution aerial images in Google Earth. *Landscape and Urban Planning*, pp. 57-70.

U.S. Census Bureau. (2011, August 24). Urban Area Criteria for the 2010 Census. *76*, 53030. Bureau of the Census, Department of Commerce. Retrieved from wais.access.gpo.gov

UNCED . (1992). Agenda 21. *United Nations Conference on Environment & Development* (pp. 1-351). Rio de Janero: United Nations .