

AMERICAN UNIVERSITY OF BEIRUT

THESIS
BEST STRATEGIES TO SUPPORT FARMERS IN
TRANSITIONING FROM TOBACCO TO THE
CULTIVATION OF HVMAPS: A CASE STUDY IN
LEBANON

by
SABRINA KHURSHED ULMASOVA

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submitted in partial fulfillment of the requirements
for the degree of Master of Science
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of the Faculty of Agricultural and Food Sciences
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ABSTRACT

OF THE THESIS OF

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Medicinal and aromatic plants, besides being used in health and wellness industries, create an aesthetically pleasing scenery affecting the senses of vision (seeing the flowers), smell (smelling the flowers), sound (hearing the bees, birds), and taste (eating the plant-based products). Despite the multitude of benefits farmlands can offer, and the money flows it can attract, there are not always local policies, aimed at incentivizing farmers to provide such landscapes (Ciani 2014, Hatan, Fleischer et al. 2021). Allocation of agricultural land for the provision of organoleptic experiences on a farm will have a substantial multiplier effect on other ecosystem services (Simpson 2011). It is expected that when the current tobacco fields are converted into perennial herbal farmlands both for production and recreation, people will visit the farms for fun, solace, education and shopping. They could go plant gathering as a leisure and tourism activity, take therapeutic walks and practice meditation with plant-based essential oils, prepare local cuisine, discover regional customs, attend festivals, and share local history (Al-Obaidi, Desa et al. 2022). They would support the neighborhood economy and value chains by paying for experiences, services, and artisan goods. Measuring stakeholder desire to participate is crucial to develop workable policy frameworks for such entrepreneurship in agricultural settings. It is useful to know if a piece of land would be better kept to supply additional ecosystem services or allocated for direct provisioning ecosystem services only (Simpson 2011). It is also necessary to understand visitors' feelings and perceptions of the aesthetic qualities of a landscape since it refers to its worth, relative to other values, resources, and human desires (Estruch-Guitart Vicent and Valles 2017).

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
ABSTRACT	5
ILLUSTRATIONS	9
ABBREVIATIONS	10
INTRODUCTION & AIM OF THE STUDY	11
BACKGROUND AND ISSUE STATEMENT	13
A. History and Socio-Political Background of Tobacco Cultivation in Southern Lebanon	13
B. Tobacco Industry in Lebanon Today	15
C. Environmental Impacts of Tobacco Farming.....	17
LITERATURE REVIEW	19
A. Tobacco Farming in South Lebanon and in Aytaroun.....	19
B. Lebanese Agriculture Sector Challenges	22
C. High-Value Medicinal and Aromatic Plants (HVMAPs) as a Substitute for Tobacco Crops	24
D. Typology and Morphology of Selected HVMAPs	26
1. Zaatar/Oregano (<i>Origanum syriacum</i>).....	26
2. Marjoram (<i>Origanum majorana</i> L.)	28
3. Saffron (<i>Crocus sativus</i> L.).....	29
4. Sesame seed (<i>Sesamum indicum</i> L.)	31

5. Sage (<i>Salvia officinalis</i>).....	32
6. Lavender (<i>Lavandula sp.</i>)	34
E. Ecosystem Services (ES) of Selected HVMAPs	35
F. Cultivation of HVMAPs and its Spillover Benefits in the Example of Agritourism 39	
H. Lebanon’s Policy and Regulatory Framework on HVMAPs	41
METHODOLOGY	44
A. Step 1: Literature Review	45
B. Step 2: Social Media Investigation	46
C. Step 3: Review of Case Studies/Best Practices on Strategies Supporting Farmers in their Transition to Alternative Crops.....	47
1. Greece (East Mediterranean)	48
2. China (Asia).....	49
3. Bangladesh (South Asia)	50
4. India (South Asia).....	51
D. Step 4: Understanding the Level of Public Appreciation of the HVMAP Landscapes.....	55
E. Step 5: Conversations with the Supply Chain Actors / Key Informant Interviews	60
F. Step 6: Feasibility Study/Crop Costs Comparison of HVMAP Cultivation versus Tobacco Farming	64
DISCUSSION.....	69
A. Potential Economic Benefits of Transitioning to HVMAPs.....	71
B. Potential Environmental and Ecosystem Benefits of Transitioning to HVMAPs .	72
C. Potential Socio-Cultural Benefits of Transitioning to HVMAPs.....	73

D. Uncertainties and Limitations	73
CONCLUSIONS	74
REFERENCES	75

ILLUSTRATIONS

Figure

1. Tobacco Supply Chain in Lebanon, (Alaouie, Branston et al. 2022)	17
2. Map of South Lebanon Administrative Districts	20
3. Tobacco Leaves Drying in a House in Aytaroun.....	20
4. <i>O. Syriacum</i> Blooming	26
5. <i>Origanum majorana</i> , Beirut Arab University Garden.....	28
6. Saffron Cultivated in Lebanon, 2021, Al-Ahad News.....	29
7. Saffron fields in Iran	30
8. Sesame Blooming	31
9. Blooming Sage in Greece (Solomou, Giannoulis et al. 2021).....	34
10. Lavender Shrubs in Hamana, Lebanon.....	34
11. Instagram Poll Results	58
12. Instagram Poll Results	59
13. Instagram Poll Results	60

ABBREVIATIONS

(if not available, delete this page)

CAP – Common Agricultural Policy

ES – Ecosystem services

EU – European Union

FAO – Food and Agriculture Organization of the United Nations

FCTC – Framework Convention on Tobacco Control

HVMAP – High-value medicinal and aromatic plants

IFAD – International Fund for Agricultural Development

LARI – Lebanese Agriculture Research Institute

MAP – Medicinal and aromatic plants

MoA – Ministry of Agriculture

MoE – Ministry of Environment

MoF – Ministry of Finance

MeProLand – Middle East Partnership for Productive Landscapes

PPP – Public Private Partnership

CHAPTER I

INTRODUCTION & AIM OF THE STUDY

The foundation of ecosystem management in recent years has been the concept of ecosystem services. Utilizing this concept is meant to assist in the creation of tools and policies that integrate social, economic, and ecological views (Wani and Sahoo 2021). The history of this concept establishment in the field of sustainable development goes back to the 1990s, when the relationship between ecological and economic system was theorized (Braat and de Groot 2012). Natural and cultivated landscapes provide a vast amount of goods and ecosystem services, such as food (*provisioning*), storm and flood protection (*regulating*), habitat for pollinators (*supporting*), and recreational and aesthetic regions (*cultural*) (Simpson 2011). They, therefore create numerous opportunities for the rural communities to source their livelihood from these ecosystem services.

The present study aims to analyze whether cultivation of high value medicinal and aromatic plants (HVMAPs) as a viable substitute to switch from tobacco farming. It therefore attempts to review the best practices from across the world, where policy frameworks and institutional strategies were supportive of the transition to alternative crops. The study also attempts to evaluate the level of public appreciation of the herbal and HVMAP landscapes for agricultural and therapeutic, recreational tourism. Therefore, deciding on specific public interventions and resource allocation requires decision-makers to better understand the monetary values of the goods and services provided by a given landscape (Estruch-Guitart and Valles-Planells 2017). The study attempts to measure the economic costs and benefits of production of selected native

Lebanese HVMAPs versus tobacco farming in the case study area of Aytaroun, South Lebanon.

CHAPTER II

BACKGROUND AND ISSUE STATEMENT

Long-term unbalanced exploitation of natural landscapes for the economies of scale production, with the use of harmful agrochemicals, short fallow periods, and mono-cropping leads to degraded soils, depleted forests, and irreversible health impacts (Shepard 2013). One of such soil-degrading crops that was intensively supported for economies of scale production for centuries - is tobacco leaf. Albeit steadily declining in high-income countries with the provision of incentives for switching to other crops, its production intensively shifted to lower-cost production environments in low- and middle-income countries (Chaaban 2014). The transnational tobacco businesses continued to advance their global tobacco production thanks to lax environmental restrictions and a lack of rural development strategies (Chaaban 2014).

A. History and Socio-Political Background of Tobacco Cultivation in Southern Lebanon

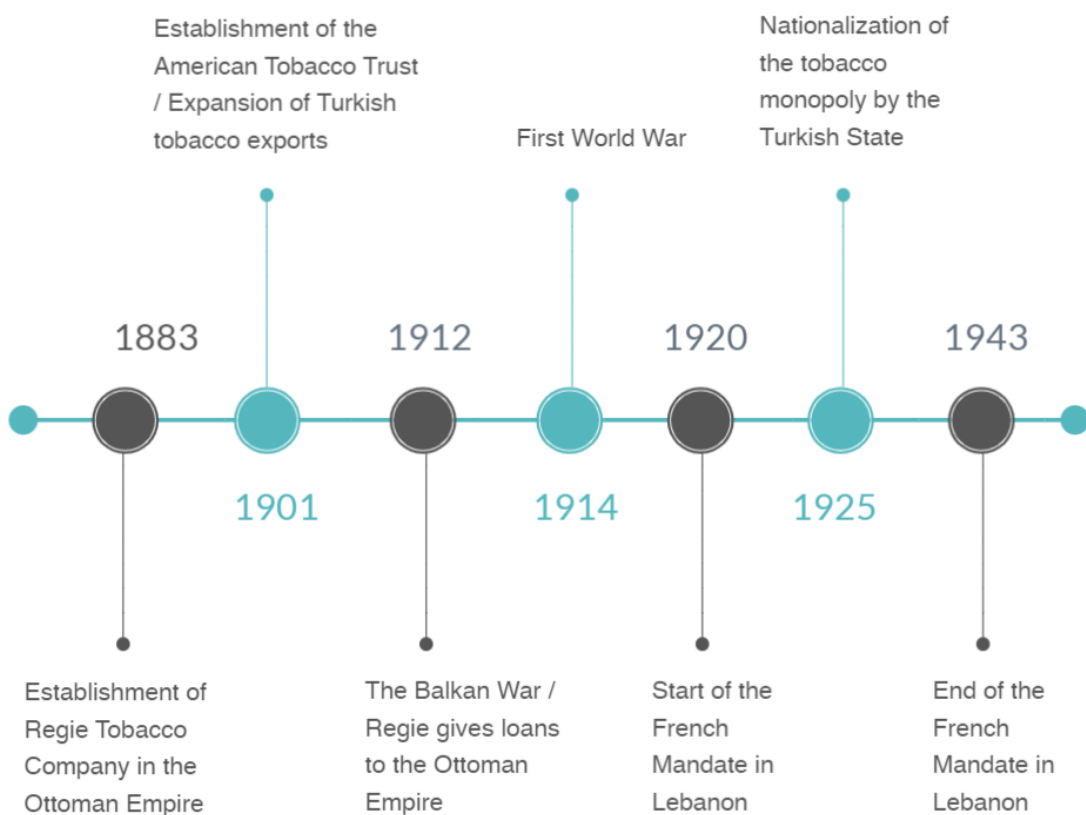
In Lebanon, tobacco has been grown since the nineteenth century, when the Ottoman Empire began to become more and more integrated into the global economy. Tobacco was first introduced by European traders into the Ottoman Empire, and in the sixteenth century, it gained popularity in agriculture (Birdal 2010). Tobacco has developed into a lucrative crop to farm for the home market and later for the international market due to its addictive characteristics. However, as a result of the Ottomans' extensive foreign borrowing to keep pace with Western military and scientific advancements, the state finally had to use the income from the important industries to pay off its obligations to the foreign creditors (Salti, Chaaban et al. 2014).

The Ottoman Public Debt Administration (OPDA) and the Régie Tobacco Company played a role in the penetration of Western imperialism into the Ottoman Empire, and the expansion of foreign trade which resulted in greater foreign investment in the tobacco sector. The main purpose of the OPDA was to collect taxes to pay the shares of the foreign bondholders (Birdal 2010). A group of European banks came together to construct the Régie Tobacco Monopoly Company, which was not only the largest firm in the nation but also the largest foreign investment. It held the tobacco monopoly for 42 years, from 1883 to 1925, when the contract was dissolved and the Turkish Republic was founded (Birdal 2010, Hathaway 2019). Empirical research reveals that similar to the Ottoman Empire, numerous peripheral nations in debt in the middle and late 1870s and early 1880s were forced to sign debt settlement agreements that involved power imbalances in favor of the creditors (Birdal 2010). Furthermore, from the 1920s until 1943, the French mandate, which depended on the political support of local landowners, disturbed pre-existing agrarian arrangements by enhancing feudal control over agricultural and pasture fields. A small class of merchants, bankers, and landlords continued to hold sway in Beqaa, the North, and South Lebanon under the French mandate, which also supported the "pattern of economic activity in which agriculture and industry had become more and more subordinate to banking and trade" (Hamade 2014). Today Regie is a commercial public institution and has exclusive rights to carry out the following activities (Alaouie, Branston et al. 2022):

- ✓ domestic leaf purchasing of locally grown tobacco;
- ✓ manufacturing and distribution of tobacco products in Lebanon;
- ✓ export/import of tobacco leaf and tobacco products;
- ✓ overseeing an anti-smuggling unit.

History of tobacco industry in the Ottoman empire and modern Lebanon

Table 1 History of Tobacco Industry Development in the Middle East



B. Tobacco Industry in Lebanon Today

Approximately 3.2%, or about 9,000 hectares, of Lebanese agricultural land was used for tobacco growing in 2014. The majority of these tobacco-growing areas were in the South, and they were cycled with crops including **okra**, **fava beans**, **sesame seeds**, **wheat**, and **thyme** (Salti, Chaaban et al. 2014). According to FAO census data from 2010 and the Ministry of Agriculture data, tobacco fields averaged 1.4 ha in size, with

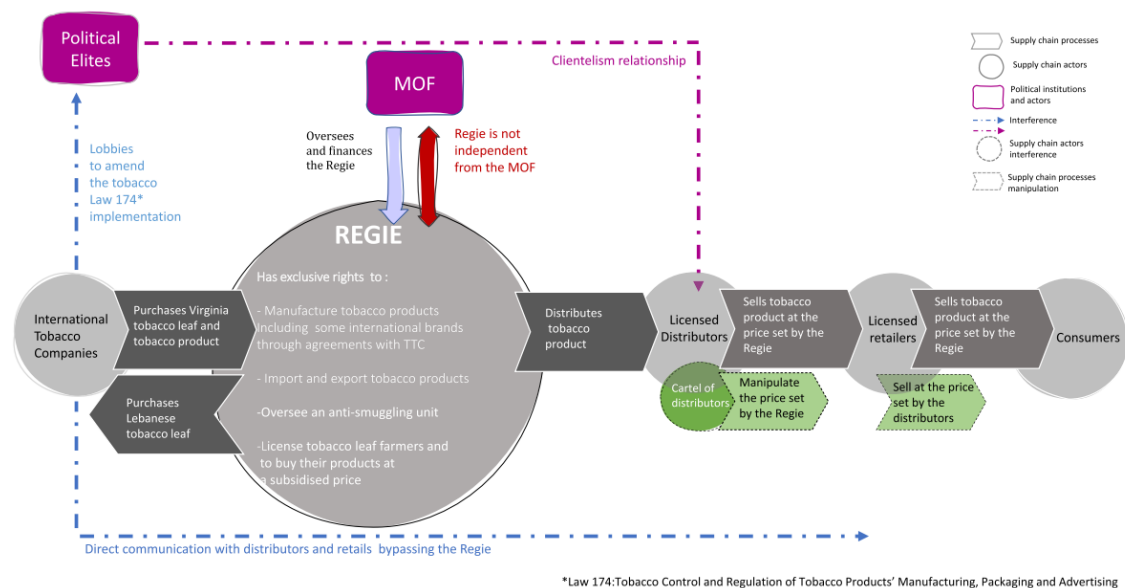
tobacco serving as the primary crop for 86% of farmers in Aytaroun (Hamade 2014). Other crops grown for domestic consumption came in second (44.5%), followed by olive trees and hard wheat (Hamade 2014). Around 20.3% of those who grew tobacco grew nothing but tobacco, even though the benefit from tobacco production was less than that of other crop production, making Lebanon one of only five countries in the world in 2014 where more than 1% of the agricultural land was farmed with tobacco (Hamade 2014).

When it comes to the demand side of tobacco products, their consumption has low income elasticity due to the addictive nature. A study by Birdal concluded that tobacco was one of the goods least affected by the economic crisis, yet it affected the budget of the poor (Birdal 2010). According to a study by Salti, Chaaban, and colleagues, tobacco expenses account for 2 to 3% of the poorer parts of Lebanese society, having a negative impact on their quality of life (Salti, Chaaban et al. 2014). Higher socioeconomic groups exhibited less of an inclination to smoke and were more likely to positively respond to smoking control measures, while smokers were becoming poorer as they continued to smoke (Saleh, 2020). Moreover, in Lebanon, tobacco products are more affordable than in the neighbouring countries such as Jordan, West Bank and Gaza, Turkey and Egypt (Saleh 2020).

The Regie Tobacco Company, a state-run monopoly, is currently in charge of importing and exporting tobacco goods as well as providing subsidies to tobacco producers in Lebanon. The Regie's finances are under the direct jurisdiction of the Ministry of Finance. Thus, the public treasury directly affects the company's net profits, costs, and losses. Additionally, local politics and private developers' involvement in local affairs are tied to national politics, both as a reflection of and a participant in those affairs

(Soliman 2004, Alaouie, Branston et al. 2022). The tobacco subsidy takes the form of a Price Support Program (PSP) that sets a pre-determined price and a quota for quantity produced for licensed tobacco farmers (Salti, Chaaban et al. 2014). According to Alaouie, Branston et al., transnational tobacco companies have used the Lebanese market as an entry point for legally and illegally exporting tobacco products into neighboring countries, preying on the Lebanese government's unwillingness or incapacity to control smuggling in the absence of adequate policies (Alaouie, Branston et al. 2022).

Figure 1 Tobacco Supply Chain in Lebanon, (Alaouie, Branston et al. 2022)



C. Environmental Impacts of Tobacco Farming

Without a doubt, tobacco production has negative effects on the environment that extend well beyond the immediate farm environment, disrupting a variety of ecosystems (Leppan, Lecours et al. 2014). The tobacco plant requires a lot of herbicides and fertilizer, which flow off into rivers, ground waters, and deplete nutrients from the soil (Lecours, Almeida et al. 2012). Farmers report that after continuous tobacco cultivation the soil becomes hard, dries up quickly, or does not drain easily. The natural smell of the soil disappears and the soil colour changes. Authors warn that these indicate the loss of soil

organic matter, changes in soil chemical composition, and a weaker water-holding capacity (Shepard 2013, Akhter, Buckles et al. 2014). Tobacco crops deplete soil nutrients by taking more nitrogen, phosphorous and potassium than other major crops (Salti, Chaaban et al. 2014, Redwan 2018, Alaouie, Branston et al. 2022). Other environmental impacts also include severe deforestation in areas where tobacco was flue-cured or smoke-cured (Lecours 2014, Saleh 2020). Another significant disadvantage of this crop is that it offers no reusable residue after harvesting neither for the soil nor for livestock and poultry. The plant residues are instead required to be cut and burnt to reduce tobacco diseases and weeds before the onset of another planting season (Lecours, Almeida et al. 2012).

CHAPTER III

LITERATURE REVIEW

A. Tobacco Farming in South Lebanon and in Aytaroun

Southern Lebanon consists of seven administrative areas: Saidon, Tyre, Jezzine, Nabatieh, Bint-Jbeil, Marjeyoun, and Hasbaya. In the beginning of 2000, the estimated population of the seven administrative areas was 554,500, with an average household size of 4.8 persons (Soliman 2004). In May 2000, southern Lebanon was freed from Israeli rule, which had been in place since 1978. According to reports, the occupation has led to significant soil degradation and immigration, preventing development in the region. According to estimates, more than two-thirds of the people who lived in the formerly occupied area have now left (Soliman 2004). The southern region of Lebanon's residents currently face severe economic conditions, with one-fourth of households earning less than \$200 per month. The region still bears the scars of Israeli occupation, including minefields, uncultivated arable lands that typically correspond to mined zones, abandoned agricultural lands, deforested areas, enormous scorched fields, and desolate land and structures. Few connections between southern farmers and buyers and distributors outside of their region severely restrict the possibility of added value (ESCWA 2010). Because of their ongoing financial insecurity and reliance on the production of subsidized tobacco, these farmers have neglected other crops and failed to take any agricultural investment projects. Additionally, the region lacks access to sanitary facilities and water resources. Villages in the south are most affected by the

water deficit, both for potable water needs and irrigation needs (only 10% of farmland is irrigated) (Soliman 2004).

Figure 2 Map of South Lebanon Administrative Districts

The country is climatically diverse and cannot be classified as purely arid or humid. Telesca et. al. refer to the region as both humid and arid (Telesca, Shaban et al. 2019). Around 70% of the country can be classified as humid or semi-humid, yet there are areas, such as Aytaroun, that have been experiencing a decrease in rainfall quantities (Shaban and Houhou 2015). Aytaroun is a village in Southern Lebanon, in the caza of Bint-Jbeil, 125 kilometers from Beirut and on Israel's northern border. The origin of the village's name is Itruma, which translates to "the lovely smell." Due to the Israeli

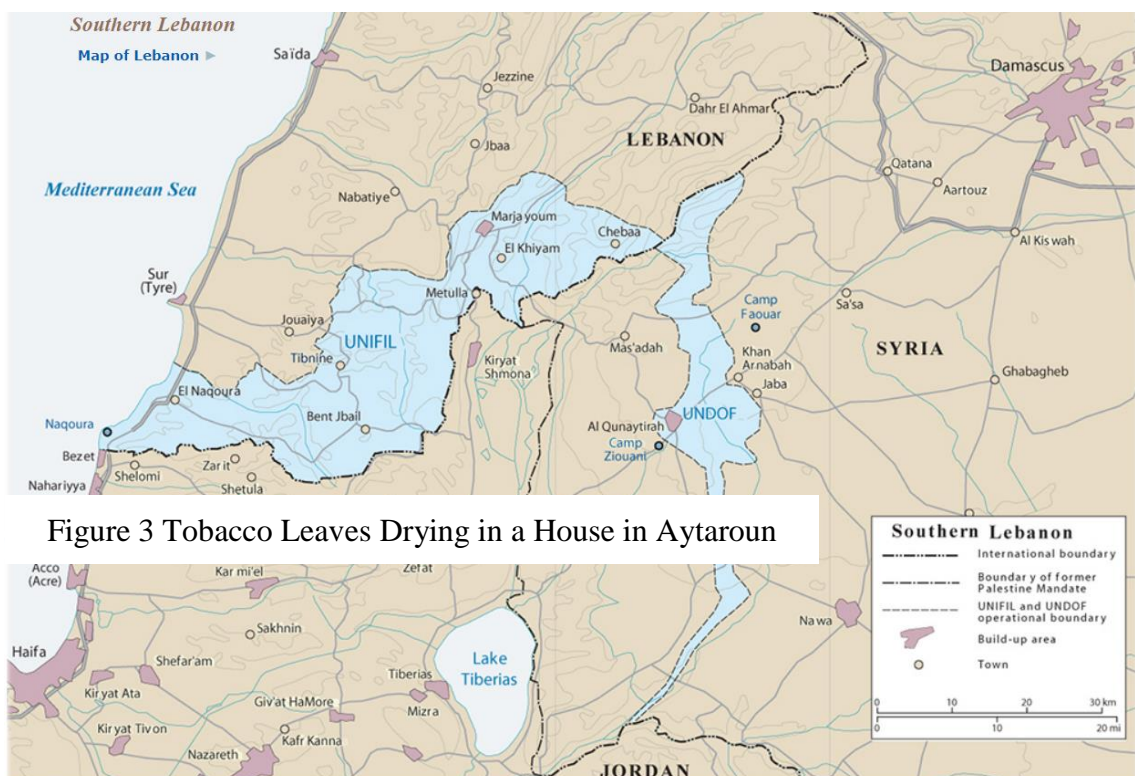


Figure 3 Tobacco Leaves Drying in a House in Aytaroun

occupation and multiple conflicts with Israel, it suffered from displacement on numerous occasions, as did the majority of Southern villages. However, despite the widespread phenomenon of rural flight across the nation and region, most citizens always returned to their communities.



Here, small-scale family farming is best exemplified by inland tobacco production. With only a small amount of outside labor hiring, every member of the household with a tobacco license participates in the various stages of production (Soliman 2004). The tobacco

farmers obtain their licenses and sell their tobacco to the state-owned tobacco monopoly “Régie Libanaise des Tabacs et Tombacs” (Haidar 2019). For Lebanese capitalist farmers who owned enormous tracts of land, citrus and banana production was once very profitable. Large-scale citrus output was exported to the Gulf and nearby nations. However, the citrus value chain has evolved into an elderly and generally poorly competitive subsector of Lebanese agriculture as a result of several production-related, marketing-related, and regulatory constraints (Haidar 2019). Between 1950 and 1986, the region lost over half of its agricultural workforce due to rising rural migration, mostly brought on by conflict, and a reduction in rain-fed agriculture. The South only had 0.38 dunum/capita of irrigated lands and 0.17 dunum/capita of rain-fed agriculture,

which is why new technologies were not implemented. Land ownership must have at least 10 dunum/capita in order to embrace sophisticated agricultures (Haidar 2019).

B. Lebanese Agriculture Sector Challenges

The agricultural sector is one of the pillars of the Lebanese economy, contributing USD 1.8 billion to total GDP and employing 4% of the Lebanese labor force in 2018 (IDAL, 2020). The agricultural industry in Lebanon has a number of difficulties, including land fragmentation, a dearth of effective cooperatives, and inadequate extension services. Despite being a significant source of revenue in rural areas, the sector still uses archaic methods and practices (IDAL, 2020). Additionally, the national institutional setup's complicated structure and the dispersion of the socio-political system result in poor governance (MoA 2020). Smallholders face markets with major deficiencies or inadequacies added by constraints to access basic input, such as fertilizers, insecticides, and credit (Lutz and Tadesse 2017). Poor vertical integration of actors along the value chain, poor horizontal organization, and a lack of trust in cooperatives and farmers' organizations all contribute to missed opportunities that otherwise have promising potential (MoA 2020).

Two commodity support programs—tobacco and wheat—that are both run independently of the MoA and that pay out after the harvest season are the main sources of funding for agricultural production in Lebanon. A quota-based tobacco program is run by the MoF's Department of Tobacco Control, which ensures purchases of tobacco from growers with a quota of 4 dunums (0.4 ha). In addition to overseeing wheat imports, silos, and the milling industry, the MoET also manages a program to benefit wheat farmers (MoA 2020). Trade policy is the second significant way of involvement in the industry

after production subsidies. The IDAL Agri-Plus program offers local farmers export subsidies for their food as well as other incentives to increase product quality, packaging, marketing, and promotion (IDAL 2020, MoA 2020). Fruits and vegetables, raw tobacco, spices, live sheep, and other processed and semi-processed foods make up over 20% of all exports (MoA 2020).

Interestingly, the amounts of unmanufactured tobacco exports have risen by 14.7% between 2013 and 2019 (IDAL, 2020). And only starting from 2020, with the COVID-19 pandemic, the LBP devaluation and banking crises, local production farmers have severely felt the financial burden and lack of profitability of growing tobacco. Particularly small-holder

growers who constitute the majority of farmers in Lebanon, have been experiencing difficulties accessing agricultural inputs (seeds, fertilizers, pesticides, and fuel). Most of these inputs are imported, and thus are priced in dollars, while the sale of most agricultural products happens in the local currency (Souhad Abou Zaki 2022). Moreover, due to the monopoly of tobacco industry by “Regie Libanaise des Tabacs et Tombacs”, and it is the only buyer of tobacco leaf grown by the farmers. That is why the farmers have no choice but to sell their harvest at very low prices. Due to Regie's subsidies, tobacco farmers in Lebanon are struggling and trapped in a cycle of debt. However, research indicates that



Table 2 Most Exported Agricultural Products in Lebanon, 2020

if given the opportunity and alternatives, farmers would prefer to abandon their tobacco farming practices (Saleh 2020). During the interview, the head of Aytaroun Cooperative, Mr. Hussein Ibrahim also referred to the triple rise of cost of raising tobacco leaf, excluding the cost of labour. “With the Lebanese pound devaluation, it has been three times more expensive to grow tobacco, and this is excluding the cost of labour” – he said.

C. High-Value Medicinal and Aromatic Plants (HVMAPs) as a Substitute for Tobacco Crops

The constant focus of scientific investigation in sustainable agriculture is managing agricultural landscapes, considering the web of environmental services and people's livelihoods. Leppan et al. provide a thorough evidence base for policy actions to switch from traditional non-lucrative crops to alternative economically viable alternative solutions (Leppan, Lecours et al. 2014). Creative suitable approaches to transitioning from tobacco farming are necessary to allow ecosystem restoration while ensuring the farmers can sustain themselves and their households. Research shows that deteriorated saline lands, particularly calcareous ones, can be exploited for salt-tolerant high-value medicinal and aromatic plants (HVMAPs) by using proper planting and other management strategies (Dagar 2014). Dagar et al. also suggest that adding perennial medicinal and aromatic plants to the productive landscapes could help capture some of the economic and ecological benefits (Dagar, Singh et al. 2014). Other studies show that plant biodiversity (including taxonomic, functional and phylogenetic diversity) promotes the functionality of ecosystems (e.g. primary **production, decomposition, nutrient cycling, trophic interactions** and so on) and consequently supports a broad range of ecosystem services (Wani and Sahoo 2021). The same source mentions the importance

of switching monoculture plantations to various tree species for supporting higher biodiversity of other creature groups and delivering a variety of ecosystem goods and services (Wani and Sahoo 2021). Cultivation of a combination of perennial HVMAPs could also stimulate sectors like tourism, restaurants, wellbeing, Spa, transformation industry, food, pharmacy, cosmetic, perfume, distilleries, and retail (IFAD 2008). They can offer two to three times the on-farm economic returns as compared to essential food crops (IFAD 2008). Because they provide solutions and therapeutic effect to various health problems, their value is skyrocketed and the demand for them moves in the same direction (Al-Obaidi, Desa et al. 2022). Combining MAPs with farming systems based on fruit trees also increases soil fertility. Some are able to provide a sort of conservation agriculture with little input since they are naturally adapted to poor soils and little rainfall (Kashyap, Dagar et al. 2014, Karam, Noun et al. 2016, Nisrine, Jihad et al. 2016). A significant source of income for the marginalized farmers in vulnerable isolated areas might come from the large-scale cultivation of these plants.

The scientific community and rural entrepreneurs in Lebanon have also been exploring the use of HVMAPs and alternative medicine practices (Karam, Noun et al. 2016, Nisrine, Jihad et al. 2016). In Lebanon and neighbouring countries the local knowledge of medicinal plant uses and consumption dates back to thousands of years. The natural populations of Lebanese medicinal and aromatic plants have been under constant strain, which raises concerns about the potential destruction of their habitat (Nisrine, Jihad et al. 2016, Talhouk, Itani et al. 2017). There is a large group of underused crops that could be an alternative to tobacco farming. It is the group of aromatic plants, mainly of the Lamiaceae family, which are used as condiments, spices and flavors (Breidy 2013). Among these are such as sage, marjoram, saffron, lavender, sesame seeds

however, the one most thoroughly investigated is zaatar (*Origanum syriacum*) (Breidy 2013, Karam, Noun et al. 2016, Redwan 2018).

D. Typology and Morphology of Selected HVMAPs

Many herbal spices are renowned for being superior providers of antioxidants in nature. The main antioxidants found in spices are phenolic chemicals, and there is a direct correlation between a spice's total phenolic content and its antioxidant effects. Antioxidant capabilities can be found in essential oils, oleoresins, and even aqueous extracts of spices (Shylaja and Peter 2004).

1. Zaatar/Oregano (*Origanum syriacum*)



Figure 4 *O. Syriacum* Blooming

Zaatar/Oregano (*O. syriacum*) is a plant with a wide range of temperature resistance but the ideal temperatures range between 18 and 22. In order to boost the content of essential oils, it prefers sunny locations. In South Eastern Europe, where oregano cultivation first began, the herb prefers well-drained soils

(Atallah 2006, Solomou, Giannoulis et al. 2021). It is a drought-tolerant plant that requires no nutrients, although it responds well when potassium, nitrogen, and phosphorus are added. When planting and during the drier months between June and September, irrigation is required in a calculated "medium" quantity of 16 liters every two

weeks per 10 dunum of land (Atallah 2006). In another source it is also mentioned that “medium” irrigation was the most proper irrigation level for *O. syriacum* (Alwafa, Mudalal et al. 2021). Studies also show that air-drying is the best for preserving the aroma, flavor, and color compared to oven- and freeze-drying (Atallah 2006, Alwafa, Mudalal et al. 2021). Finally, its flowering begins in June and the seed production takes place in August (Solomou, Giannoulis et al. 2021).

It is mostly grown in the south of Lebanon, where water resources are few and farmers' livelihoods are heavily dependent on income from monocultures of tobacco (Hamade 2014, Nisrine, Jihad et al. 2016). Besides the traditional aromatic (culinary) and human medicinal use of *O. syriacum* many other potential uses have been published for this species. It was also tested as a substitute to tobacco crops in Aytaroun (Hamade 2014, Leppan, Lecours et al. 2014, NIRAS 2020). After being dried, ground, and combined with other ingredients, zaatar blooms and leaves are frequently eaten. Zaatar's robust essential oil concentration is what gives it its distinct and pleasing aroma (Alwafa, Mudalal et al. 2021). Its essential oil has shown to control plant diseases, namely a strong antifungal activity against *Aspergillus niger*, *Fusarium oxysporum* and *Penicillium* species (Atallah 2006). Other recent studies confirmed that essential oil and extracts from *O. syriacum* have the potential to be used as natural preservatives in the food industry (Alwafa, Mudalal et al. 2021). Zaatar's medicinal properties have long been understood, and it was first utilized in Chinese medicine before being used in ancient Egypt to embalm mummies (Shylaja and Peter 2004). The largest markets for herbal spices are in Europe and North America, and oregano is the most consumed herb in these two countries (Shylaja and Peter 2004).

Despite the potential for significant farmer income, HVMAP cultivation initiatives in Lebanon are still relatively modest (Nisrine, Jihad et al. 2016). The total zaatar cultivated area in 2016 was estimated not to exceed 20 ha. The reason for this was reported to be the anecdotal belief that wildy harvested zaatar is tastier and has stronger health benefits than the cultivated one (Nisrine, Jihad et al. 2016). There is no scientific evidence on the qualitative differences between wild and cultivated zaatar (Skoula and Kamenopulos 1997). One advantage of growing this plant is that it helps preserve species, especially when the pace of wild population decline exceeds the rate of natural regeneration (Nisrine, Jihad et al. 2016).

2. *Marjoram (Origanum majorana L.)*

Originally from the Mediterranean region and a favorite garden plant.

Branching stems with opposing, hairy oval leaves and tiny spike-like flower clusters. The plant has square, branching stems



Figure 5 *Origanum majorana*, Beirut Arab University Garden

that are covered in ovate, hairy, gray-green leaves with a strong perfume. It has tiny, tubular flowers in shades of white or pastel pink with gray-green bracts and blooms between June and August. Although it has strong drought resistance and works well in ordinary, dry to medium, well-drained soils in full sun, it struggles to overwinter. Marjoram is frequently used to season meat and vegetable dishes, sauces, and salads. It

can be used fresh or dried. It has historically been grown in Lebanon for domestic usage.

Similar to zaatar, the therapeutic value of marjoram has also been known since antiquity, in Chinese and Egyptian medicine (Shylaja and Peter 2004). Its consumption vary according to the local food habits. Marjoram is the most sold herb in Germany (Shylaja and Peter 2004).

3. Saffron (*Crocus sativus L.*)



Figure 6 Saffron Cultivated in Lebanon, 2021, Al-Ahad News

The iris family (Iridaceae) has a stemless perennial plant known as saffron that is primarily grown in the Mediterranean and southwestern Asia. Depending on the weather, it normally blooms in the fall between mid-October and the end of November. Saffron has no smell while it is fresh, but as it dries, it develops its distinctive aroma. The ideal soil for growing saffron is one that is loose, friable, low-density, well-

watered, and well-drained (Ríos and Andújar 2016). Saffron is cultivated in warm regions with summer droughts, which corresponds to the Mediterranean Climate Type. Saffron, which grows underground with its onions in the winter, can withstand temperatures as low as -18C. In Greece, where there is an average annual precipitation of 500 mm, and in Spain, where there is an average annual precipitation of 400 mm, it is



Figure 7 Saffron fields in Iran

grown using irrigation techniques. The best conditions for saffron cultivation occur during the dry summer months following a wet spring. Saffron prefers strong, direct sunshine when it is maturing. As a result, the best places to cultivate saffron are on slopes that receive direct sunshine (Coskun, Gok et al. 2017). The soil needs to be entirely free of weeds, plowed to a depth of 25 to 30 cm, and then allowed to rest for a few weeks or the entire winter. The soil needs to be entirely free of weeds, plowed to a depth of 25 to 30 cm, and then allowed to rest for a few weeks or the entire winter (Ghorbani 2007). Before planting, the soil should be cleared of pests to prevent fungus, and hand sowing is advised. Saffron quality and yield are influenced by soil and climate conditions, planting dates, seed/corm rates, planting depths, corm sizes/weights, crop densities, fertilizer management, weed control, growth regulators, harvest, and post-harvest management (Nisrine, Jihad et al. 2016). It was extensively used in ancient cultures (Assyria, Egypt, Greece, and Rome) as a dye for wool, silk, and hair, among other things.

Today, saffron is used as a coloring agent mostly in the food and beverage industry. For example, in **Spain** saffron is used to flavor soft drinks and other beverages, whereas in **Italy** is added to liquors and in **Greece** is used in the preparation

of alcoholic distillates. In the USA, saffron tinctures are used to flavor alcoholic beverages such as "Strega," a highly alcoholic beverage that is also known as "saffron gin," and "Boonekamp," a unique bitter brandy (Ríos and Andújar 2016). Since ancient times, this highly prized plant has been used mostly as a condiment and a dye, making it the most expensive plant. Studies in the last decade (Ríos and Andújar 2016), have uncovered an unknown therapeutic potential thus giving an added value to saffron. The usage of various byproducts, such as petals, could increase the value and economic appeal of *Crocus sativus* in the case of its potential as an antidepressant and anti-anxiety agent. Iran has been a significant supplier of saffron to the global market, albeit occasionally its quality has lagged behind that of Spain. Another major saffron producer is India (approx. 30 tonnes per annum valued at US\$20 million) (Raina, Agarwal et al. 1996).

4. *Sesame seed (Sesamum indicum L.)*



Figure 8 Sesame Blooming

One of the oldest oilseed crops in existence, sesame (*Sesamum indicum L.*), is thought to have its roots in India. Tropical and subtropical climates are where it primarily flourishes. Sesame has a wide range of applications, including direct food consumption and uses as a component in cosmetic and pharmaceutical products (Rahman, Bhattarai et al. 2019). Sesame is

mostly grown in tropical and subtropical climates, particularly between the 25° north and south latitudes, and needs roughly 625 to 1100 mm of rainfall per year. Throughout

the growing season, the sesame plant needs a temperature range of 25 C to 37 C for the most production. The best soil for growth is fertile soil with a medium texture.

As consumers' health awareness raises sesame's value increases in line with the growing demand. In 2018 the global market value of sesame was estimated at US \$6.5 billion. It is expected that by 2025 the global sesame seed market will reach US \$17.77 billion (Rahman, Bhattarai et al. 2019). Lebanon produces a maximum yield of 3.4 tonnes/ha. Small plot trial harvest data generally shows very high yields. Although there is a small difference between the research yield and typical yields in larger-scale farming, it does show the crop's genetic potential (Rahman, Bhattarai et al. 2019). Another source also reported that relatively higher sesame seed yield productivity is reported in Lebanon (3.29 tons·ha⁻¹) (Teklu, Shimelis et al. 2022).

5. *Sage (Salvia officinalis)*

Numerous nations plant sage (*Salvia officinalis*), a perennial woody shrub with elongated leaves, a woody square stalk, and tiny flowers (Solomou, Giannoulis et al. 2021). It blooms from May to July and has grayish-velvety leaves and blue to violet flowers. The plant is native to the Mediterranean Basin and has naturalized in other nations across the globe. For the treatment of a variety of ailments in traditional medicine, such as inflammation, diarrhea, gastrointestinal discomfort, diabetes, and other ailments. The species is popular for culinary use in Mediterranean cuisine and grown for its ornamental beauty as well as a forage for honey bees¹. Another use of sage is the application of non-distilled sage extracts and essential oils to control

¹ <https://www.bau.edu.lb/Research-Center-for-Environment-and-Development/Projects-BAU-Herbal-Garden-for-Lebanese-Medicinal-and-Aromatic-Plants>

phytopathogenic bacteria and fungi, for a sustainable, environmentally friendly agriculture (Zaccardelli, Pane et al. 2020). April marks the start of flowering and lasts until the first ten days of May. Sage may grow in a range of soil conditions, although it favors medium-textured, well-drained calcareous soil with a pH of 6.2–6.4 and planting distances of 5–10 cm. The inputs needed for sage are minimal: water, nitrogen, phosphorus, and potassium. Application of nitrogen fertilizers “N” and “P” at 80 kg N/ha and 60 kg P/ha in irrigated crops were found to be sufficient for sage growth and fresh yield (Rioba, Saidi et al. 2014). Irrigation is required only at the time of planting and then the crop is grown under dry conditions (Solomou, Giannoulis et al. 2021, Tilaye, Girma et al. 2021).

The yield in dry leaves is around 1000 kg/ha during the establishment year and increases to approximately 4000 kg/ha from the second year onward, when it is harvested under the two-crop harvesting system. After the second year, the production of essential oils can reach up to 75 kg/ha (Solomou, Giannoulis et al. 2021, Tilaye, Girma et al. 2021).



Figure 9 Blooming Sage in Greece (Solomou, Giannoulis et al. 2021)

6. Lavender (*Lavandula sp.*)

Lavender (*Lavandula sp.*) is perennial shrub-like medicinal and aromatic plant of



Figure 10 Lavender Shrubs in Hamana, Lebanon

20 – 60 cm height (Nisrine, Jihad et al. 2016). The plant has numerous branching stems and opposing, hairy leaves that are 2–6 cm long with a distinctive gray-green color. The principal

generating regions for *Lavandula* species are in Europe, the Middle East, Asia, and Northern Africa. They are primarily of Mediterranean origin (Giannoulis, Evangelopoulos et al. 2020). From spring until autumn, lavender can be planted,

however it has been said that planting in the fall results in more blossoms the following year. A study conducted in Turkey and in regions with a Mediterranean climate also revealed that the annual yield (at the productive year of the crop) varied between 5,570 kg and 14,990 kg ha⁻¹. The following study conducted repeatedly confirmed this finding (Giannoulis, Evangelopoulos et al. 2020).

One of the most crucial qualities of aromatic-medicinal plants is essential oil. It has been discovered that using bio-stimulants may boost the output of flowering shoots and the production of essential oils by 20%, allowing farmers to pay their establishment costs early and increase their revenues (Gül, Kart et al. 2016, Giray, Kadakoğlu et al. 2019, Giannoulis, Evangelopoulos et al. 2020, PAKDEMİRLİ 2020). In summary, countries in the Mediterranean region with similar soil-climatic characteristics can grow lavender as a dynamic crop with low inputs (Giannoulis, Evangelopoulos et al. 2020).

E. Ecosystem Services (ES) of Selected HVMAPs

The diversity of HVMAPs (including taxonomic, functional and phylogenetic diversity) can promote the functionality of ecosystems, such as production (*provisioning ES*), decomposition (*supporting ES*), nutrient cycling (*regulating ES*), trophic interactions (*cultural ES*) and so on and consequently supports a broad range of ecosystem services (Wani and Sahoo 2021). The benefits of provisioning and cultural ecosystem services can be reaped through cultivation of a combination of HVMAPs, since it stimulates sectors like tourism, restaurants, wellbeing, Spa, transformation industry, food, pharmacy, cosmetic, perfume, distilleries, and retail (IFAD 2008). Native plants are crucial components that can be used in gardening or landscape design to produce attractive and distinctive plant displays for visitor appeal in botanic gardens

and urban theme parks, serving as a vital tool for promoting environmental awareness of biodiversity issues (Krigas, Karapatzak et al. 2022). The necessity for in-depth research is expanding along with the demand for healthier food products. Thus, it has been investigated to incorporate diverse aromatic herbs with culinary and/or therapeutic uses in various traditional food products. Due to the availability and affordability of MAPs as sources of bioactive compounds and natural antioxidants with established pro-health effects, it can have a variety of impacts when added to food formulations. These activities range from improved physiological functionality of enriched products to higher storage stability. Aromatic herbs and their derivatives can be utilized in place of synthetic preservatives and antioxidants due to their strong antioxidant activity (Filipčev 2020). Greek herbs such as oregano, basil, thyme, and rosemary are excellent sources of antioxidant compounds and can be substituted for salt in many recipes (Tomou, Skaltsa et al. 2022). Phytochemicals, botanicals, or phytobiotics, often known as flavorings or zoo-technical additives, are really utilized as feed additives. They come from hundreds of plant species that belong to approximately 100 plant groups. Different groupings (classes) of phytochemicals, including mono- and sesquiterpenes, phenylpropanoids, flavonoids, iridoids, and others, make up their active ingredients. Their chemistry and primary functions differ ranging from antibacterial, antioxidant to immunomodulatory agents in the gastrointestinal system. Moreover, there is distinction between them used as feed additives and as pharmaceuticals (Franz, Baser et al. 2020).

Traditional Mediterranean cuisine includes a significant amount of MAPs, which are used as herbal teas, culinary accents, and condiments or spices. Prior studies showed that this diet is associated with a longer life expectancy and a lower risk of major conditions like cancer, type 2 diabetes, and cardiovascular diseases (Tomou, Skaltsa et

al. 2022). Moreover, the MAPs employed in Greek cooking have a variety of traditional applications that support the preservation of food in Greece (Tomou, Skaltsa et al. 2022).

According to Solomou, Giannoulis et al., medicinal and aromatic plants, based on their use, can be divided into the following groups (Solomou, Giannoulis et al. 2021):

- a) Raw material group—for essential oil extraction (*provisioning ES*)
- b) Culinary spices group (non-leafy parts)—used for flavoring/seasoning (*provisioning ES* & *cultural ES*)
- c) Culinary herb group (leafy or soft flowering parts)—used for flavoring/seasoning (*provisioning ES* & *cultural ES*)
- d) Medicinal group—many synthesized medicines are patterned after plant extracts which provide the basis of modern drugs (*provisioning ES*)
- e) Miscellaneous—MAPs as ingredients of cosmetics, dyes, disinfectants, insect repellents, etc. (*provisioning ES*, *cultural ES*, *regulating ES*, *supporting ES*)

	Provisioning	Regulating	Cultural	Supporting
Zaatar	<ul style="list-style-type: none"> • Medicine • Culinary use • Food & beverage industry • Cosmetics 	<ul style="list-style-type: none"> • Essential oil produces secondary compounds that provide protection against nematodes and pests • Controls parasites in hens 	<ul style="list-style-type: none"> • Culinary use • Folk medicine • Cultural tourism for Lebanese manakeesh/pizza 	<ul style="list-style-type: none"> • Essential oil protects the Pine Woods from pine wilt disease • Increases egg production in hens, efficiency, and

				<p>persistence of lay²</p> <ul style="list-style-type: none"> • Natural alternative to antibiotics
Saffron	<ul style="list-style-type: none"> • Medicine • Culinary use • Food & beverages industry • Use as a condiment • Textile coloring 		<ul style="list-style-type: none"> • Saffron picking tours 	
Sage	<ul style="list-style-type: none"> • Treatment of inflammation, diarrhea, gastrointestinal pains, diabetes • Culinary use • Grown for ornamental beauty 	<ul style="list-style-type: none"> • Allelopathic effect, i.e. it releases a chemical compounds affecting the development of other plants and microorganisms • Control of fungi and bacteria in 	<ul style="list-style-type: none"> • Folk medicine • Culinary use • Ornamental beauty 	<ul style="list-style-type: none"> • Forage for bees • Improves hens' egg shell quality • Reduction of heat stress³

² Harrington, D., et al. (2020). Application of aromatic plants and their extracts in the diets of laying hens. Feed Additives. P. Florou-Paneri, E. Christaki and I. Giannenas, Academic Press: 187-203.

³ Ibid.

		plants/natural fungicide		
Lavender	<ul style="list-style-type: none"> • Bee-glue production during spring 			<ul style="list-style-type: none"> • Beekeepers utilize these plants in honey, pollen
Sesame	<ul style="list-style-type: none"> • Pharmaceutical properties • Anti-bacterial • Anti-oxidant • Anti-inflammatory • Flour for baking • Feed for poultry & livestock • Food industry • Culinary use 			

F. Cultivation of HVMAPs and its Spillover Benefits in the Example of Agritourism

Agricultural tourism or “*agritourism*” is a subset of rural tourism, that is intended for diversification and balancing of agricultural income. It is considered an innovative way of diversification in agriculture where agricultural landscapes provide multiple functions (Arru, Furesi et al. 2019, Arru, Furesi et al. 2021). It is a specific form of tourism with a strong environmental component (Mahaliyanaarachchi, Elapata et al. 2019). The commonly agreed feature of agritourism is that the farms provide recreational services to its visitors. In simple terms, it is a holiday spent on farm (Arru,

Furesi et al. 2021). However, there are a myriad of ways this form of tourism is described given the specific values and use of its attributes by people.

Although we are accustomed to thinking of agricultural landscapes as primarily used for food production, they have a wide range of economic and environmental advantages. It is commonly known that agriculture also yields non-market products, some of which have benefits for the general public, in particular, biodiversity and landscape amenities (Hatan, Fleischer et al. 2021). In many European countries, these advantages that farms and forests may offer in addition to their traditional role in production are now acknowledged (Aznar, Marsat et al. 2007). One of the advantages of the so-called multi-functionality of farmlands in rural areas has been the opportunity to profit from tourism.

According to several ideas, multifunctionality and diversification at the farm level are the best paths to rural economic growth from the standpoint of development. These routes have emerged because of the immediate economic gains that diversity offers as well as further rippling effects on regional economic growth (Ahmadzai 2022). Medicinal plants offer economic benefits as well as the improvement of the conservation status of neighboring ecosystems and local species because of their significant contribution to local, regional, and national economies (Solomou, Giannoulis et al. 2021). Expansion of tourism is important for boosting local economies. Countries like China, for instance, agree on enhancing their visitor experiences through landscape planning and rural development initiatives (Wang, Watanabe et al. 2022). At the same time, literature review shows that quite little time and space is devoted in academic research to studying people's impression and feelings after returning from rural tourism (Knapik 2020).

Agritourism makes it possible for tourists to participate in workshops like milking, breeding animals, harvesting plants, etc. in farm businesses whose primary goal is to sell farm products to consumers. Farmer's markets, flower shows, street stalls, horseback riding, antiques, tractor tours, agri-fairs, agri-museums, bicycle excursions, shopping, cooking classes, teaching local cuisine, and rural training facilities are typical examples of potential agritourism activities (Ataberk, Meriç et al. 2014). It is suggested that through agritourism the farmers in Aytaroun could market their own products, including the products from HVMAP. It would allow them to diversify and increase their incomes. In some cases, their volume of agricultural production would also increase, and traditions would be preserved. It would also have improved their landscapes and life quality and conditions.

Some literature shows that agritourism contributes positively to the socio-economic development of the rural communities in Lebanon in many ways (Aznar, Marsat et al. 2007, Despotović, Joksimović et al. 2017, Arru, Furesi et al. 2019).

H. Lebanon's Policy and Regulatory Framework on HVMAPs

Despite the alluring advantages that HVMAP farming can bring about, such as: lessening the strain on natural resources; providing a sizable source of income, especially for marginalized farmers in remote places (Nisrine, Jihad et al. 2016, Tomou, Skaltsa et al. 2022), it is neglected at the national level and lacks government support as far as providing potential marketing strategies for the harvest and by-products. Nisrine, Jihad et al. (2016) mention that in Lebanon only few of the HVMAPs are managed through adequate regulations, while cultivation efforts of some of them is still limited despite a promising potential of revenue for the farmers (Nisrine, Jihad et al. 2016). As

a matter of fact, there is only one legislation issued by the Ministry of Agriculture of Lebanon that regulates the harvesting and exportation of selected species such as Zaatar (*Origanum syriacum*) L. and Sage (*Salvia fruticose*) (Ministerial Decision 340/1 issued in 1996 and updated in 2012 as per ministerial decision 179/1). According to this law, harvesting takes place for two major purposes: a) for home usage in rural regions for conventional culinary use, and b) for applications in folk medicine. Trade is permitted in specialized markets and within small communities. Although most local paid collectors are women and children, several HVMAP species are bought by traders from their hands. Among these species are Zaatar (*Origanum syriacum* L.) and Sage (*Salvia fruticosa* Mill).

As for tobacco control in Lebanon, aside from Law 174, no other national policies or laws that address all effective tobacco control policies, such as taxation, control of illicit trade, preventing industry interference, plain packaging, national tobacco control prevention programs, and cessation programs, are in place. Although the evidence-based draft Decree was created in 2011 and amended in 2016, industry involvement and lobbying prevented the political will to ratify it.

On the other hand, when looking at the National Agriculture Strategy (NAS) of Lebanon, there is political will and the road is being paved toward supporting farmers in their change and innovations. Below is the extract from the NAS:

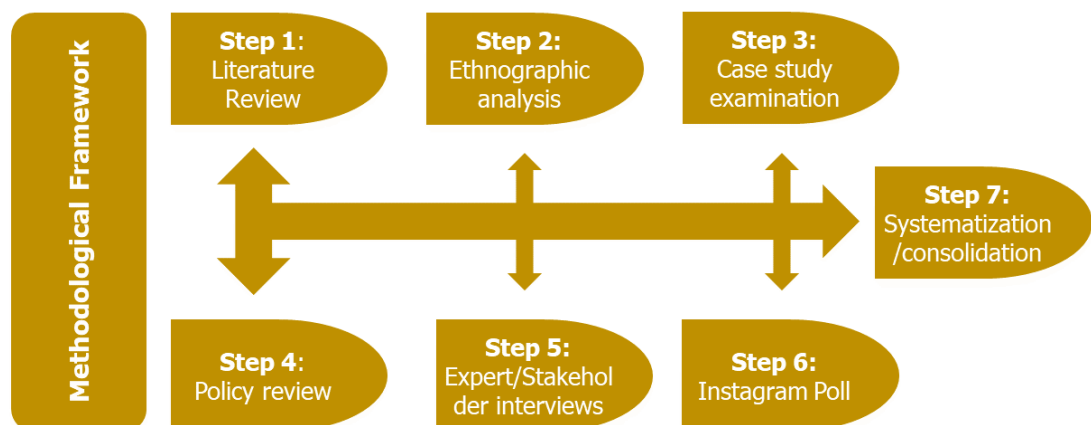
“Programme 3.4 of the National Agriculture Strategy Support agricultural exports and access to new markets. Priority interventions include: developing export infrastructure and setting export mechanisms (including subsidies, participation in international expo) to access new markets according to international food standards; facilitating access to market information on the agrifood value chains (via market

*studies, intelligence, client prospection, identify windows of opportunities). This programme will reduce information asymmetries along the agrifood value chain because of better market information, facilitating access to new markets and identifying windows of opportunities for selected values chains and high added value crops such as cherries, grapes, apples, avocado, citrus, and high added value niche and traditional products such as **thyme** and **other aromatic plants**, and honey... etc) to export Lebanese products” (MoA 2020).*

*“**Programme 4.2:** Promote sustainable use of natural resources (soil, pastures, forests and fisheries), reducing environmental and natural resource degradation because of more sustainable farming, food processing and logistics practices (e.g. smart agriculture, organic farming), better skilled and more aware operators. Interventions will foster sustainable forest management allowing timber and wood production, **valorisation** of non-timber forest products such as aromatic and **medicinal plants**, sustainable rangeland management, protecting forests from pests and fires, developing marine fishing, encouraging related opportunities for **agro- and eco-tourism**” (MoA 2020).*

CHAPTER IV METHODOLOGY

The mixed method technique and design of this thesis research paper are presented in this chapter. This thesis responds to the following question: “**Can cultivation of high-value medicinal and aromatic plants for provisioning and cultural ecosystem services be a viable alternative to tobacco farming?**”. To make sure the research is based on principle questions like “what is this research for?” and “who is this research for?” the methodological framework consists of: a) literature review; b) case study examination; c) ethnographic observation and artefact analysis; d) policy review; e) expert/stakeholder interviews; f) Instagram poll/survey; g) “design thinking” based consolidation.



In trying to find appropriate answers to this question, this research follows a logical sequence. As a first step, investigation through literature review was undertaken to better understand the background and history of tobacco farming in Lebanon and in Southern Lebanon in particular. Then, as the next step, social media pages of the case study area – Aytaroun were investigated to study the community’s agricultural activities through the pictures posted and quotes and hashtags used, their agriculture highlights, their feelings

about growing tobacco. This step followed by identifying relevant case studies and cross comparing them using a set of criteria; followed by policy review to understand where Lebanon stands in terms of its policy availability and preconditions for change. It is then attempted to have a dialogue with the relevant direct stakeholders on the issues and proposed new vision of agriculture and agritourism in Aytaroun, to get a sense on how feasible a transformation could be. As part of the big picture, it is also attempted to examine through an Instagram survey “how the Lebanese people see herbal landscapes and what is their level of appreciation of such a recreational tourism destination hypothetically created in Aytaroun village. And lastly, all the pieces of the puzzle are consolidated into the Theory of Change (ToC) canvas based on “design thinking” approach.

A. Step 1: Literature Review

To better understand the background and history of tobacco farming in Lebanon, for my literature review, I used: peer-reviewed articles through a standardized literature search on keywords, such as: “tobacco farming”, “medicinal and aromatic plants”, “draught-resistant”, “Mediterranean”, “set aside”, “valuation of ecosystem services”, “cultural ecosystem services” and “agritourism”. I use the AUB electronic databases, including Elsevier eBooks, Emerald Journals, Google Scholar, ScienceDirect, and Scopus. I also use a general Google search to identify relevant books, NGOs’ and Development Agencies’ reports, as well as the ICARDA, IFAD, UNDP, UNEP, and UN FAO websites for facts and figures, and relevant case studies. I also visit additional sources referenced in the literature I reviewed.

B. Step 2: Social Media Investigation

The literature about tobacco farming in Lebanon pointed me to the village of Aytaroun in South Lebanon which has a history of tobacco farming since 1920s. I investigated the current farming practices in Aytaroun through my review of social media posts, pictures, Instagram hashtags, comments and post captions. The social media review led me to the following keyword patterns: “growing tobacco”, “God bless tobacco”, “tobacco season” with the pictures provided below. These pictures show and their captions show that that despite the non-lucrative nature of tobacco farming the small-holder farmers still engage in this crop cultivation for their livelihood. I then looked for additional information on Aytaroun, its history, ecological attributes and the possibility to introduce more sustainable crops as a substitute to tobacco. For this literature search I used keywords: “Aytaroun climate”, “Aytaroun agriculture”, “Aytaroun landscapes”. At the same time, I searched for the high-value medicinal and aromatic plants (HVMAPs) that can be grown in Lebanon, using keywords: “medicinal plants Lebanon”, “aromatic



plants Mediterranean”. As I was getting different literature, it became clear that there isn’t sufficient information on the use of HVMAPs for agri-tourism in the Arab Mediterranean region.

C. Step 3: Review of Case Studies/Best Practices on Strategies Supporting Farmers in their Transition to Alternative Crops.

For this literature search, to find relevant case studies, I used the following keywords: “payment for ecosystem services”, “set-aside schemes”, “incentives for farmers to switch crops”, “crop transition policies”, “transition from monocrop” AND/OR “diversification with medicinal and aromatic plants”. This search showed that there is lack of, and sometimes non-existent, studies about the effective strategies and

impacts of transitioning from tobacco to HVMAPs, let alone in the Arab Mediterranean countries. I therefore, focused on finding articles discussing cases where prolonged mono-cropping practices were diversified with alternative cropping, not necessarily with HVMAPs. For instance, case studies in China and Bangladesh discuss the transition from rice mono-cropping to alternative vegetable and legume crops in response to the government's diversification strategy.

1. Greece (East Mediterranean)

MAPs have a long history of use and are crucial for understanding the connection between food and health, cultural heritage, and culinary delight. The ability of food systems to contribute to environmental sustainability is a major concern for the Greek scientific community and the government. The way that food is produced and the importance of dietary practices further identify the traditional Mediterranean diet as a sustainable diet paradigm (Tomou, Skaltsa et al. 2022). The Greek government has endorsed the "Strategic Development Plan for the Cultivation, Processing, and Marketing of MAPs" which outlines all the measures and actions aimed at the competitive development and implementation of MAPs cultivation in Greece. Moreover, it prescribes measures for their processing and marketing, and is used by the government to promote large-scale cultivation of MAPs (Tomou, Skaltsa et al. 2022). It is expected that MAP farming will contribute to the preservation and protection of the arbitrary and unmanageable collection and the economic development of nations through the manufacture of items with "high added value."

Greece is one of the examples, where best practices can be learned from, where MAPs are an important natural resource and where the Common Agricultural Policy (CAP) has played a key role in augmenting MAP cultivation and production (Solomou,

Giannoulis et al. 2021). The most important cultivations for their medicinal and economic properties are those of Sage (*Salvia sp.*), Thyme (*Origanum sp.*), and Ironwort/Mountain Tea (*Sideritis sp.*) (Solomou, Giannoulis et al. 2021, Krigas, Karapatzak et al. 2022, Tomou, Skaltsa et al. 2022). There is increase in total acreage of the cultivated area of MAPs and the interest in the development of this sector is growing, where oregano takes the highest share of cultivated area, organic (40%) (Tomou, Skaltsa et al. 2022). The main destinations where Greek MAP products get exported to are: Switzerland, Germany, Canada, the USA, and Russia.

2. China (Asia)

This case study by Liu, Tang et al. (2021) analyses the Chinese farming systems which maintain a high crop diversity with a value over 7 at national scale and a stable value over 4 at county level. The purpose of this study was to give recognition to crop diversity as a policy tool to promote sustainable agriculture development. The study draws attention to the timing of two important agricultural policies, that is, the household responsibility system (HRS) and the agricultural tax abolition (ATA) launched by Chinese government in 1980 and 2003, respectively (Liu, Tang et al. 2021). Other factors include: cultivated land area, labour force, irrigation, increased consumption of non-food products and decline in the consumption of staple foods. It also stresses that crop diversity in China is influenced by the choice made by farmers and natural conditions. By entrusting the choice of crops and cropping systems to individual households, the increasing prices of selected agricultural commodities, and relaxing restrictions on the trade of agricultural products, China's food supply received a substantial boost in recent decades. On the contrary, when conditions favour crop

specialization, crop diversity decreases (Liu, Tang et al. 2021). From a policy-making perspective, the resilience conferred by crop diversity deserves greater attention in the development of agriculture throughout the country and in promoting both crop specialization and crop diversity. This study argues that to balance nutrition, boost climate resilience, and stop environmental damage, agricultural production systems must diversify their crops. It has become clear that maintaining a high crop diversity in agroecosystems can improve yields, biodiversity, and ecosystem services while allowing for more sustainable land management (Beillouin, Ben-Ari et al. 2021, Liu, Tang et al. 2021). China's food supply has increased significantly in recent decades because of letting households choose their own crops and cropping systems, boosting prices for some agricultural commodities, and reducing trade restrictions on agricultural goods.

3. *Bangladesh (South Asia)*

The consumption pattern in Bangladesh is changing in favor of non-rice crops including protein-rich foods like fish, meats, fruits, vegetables, and spices. These non-rice crops and cuisines are in high demand and bring more profit (Azad 2022). Therefore, the higher demand and greater profitability of non-rice crops are expected to offer adequate incentives to farmers to diversify their portfolios of crop production at the farm level. The Government of Bangladesh (GoB) consistently tries to promote agricultural diversification in addition to market forces. To speed up the diversification of farms away from rice production, the GoB has developed and implemented several policies and projects, including the National Agricultural Policy, National Agricultural Mechanization Policy, the Northwest Crop Diversification Project (NCDP). To boost

economic growth through high-valued crops and non-crops like fruits and spices, the NCDP project was put into action in 61 sub-districts of the 16 districts of northwest Bangladesh between 2001 and 2009 (Akhter, Buckles et al. 2014, Azad 2022). However, despite the political will and relevant policies in place, as well as the profitability of non-rice crops, Bangladeshi farmers continued to grow a limited variety of them. The profitability of non-rice crops, as determined by a benefit-cost ratio greater than one, was highly alluring, but it did not persuade the farmers to diversify the crops they grew on their fields (Azad 2022). The paper concludes by recommending that incentives for diversification at the overall level be channeled through the promotion of value-added products in agroecological zones where specific crops have some comparative advantages.

4. India (South Asia)

It was shown that crop diversity could boost agricultural income and food security in India (Kashyap, Dagar et al. 2014). Under the influence of diverse domestic policies, technologies, structural reforms, and globalization, the rural economies of India have undergone rapid structural transformations in the manner and structure of their agricultural production. This case study by Kaur, Singla et al. (2021) reveals the contract farming as one of the various alternatives to diversify agriculture towards new high-value crops, which can also pave the way for new avenues of employment. Contract farming is one agricultural system intervention that has the potential to significantly improve incomes and employment in agriculturally underdeveloped regions and put the local economy on a dynamic path of growth and development in order to break the chains of low productivity and unstable production. It is stated that

even if they were put under contract farming, small and marginal farmers would not be able to deal and negotiate with major customers on their own. The government should promote group contracts through lending and extension in order to make contract farming inclusive and efficient for farmers. By promoting contracting, the Farmer Producer Companies (FPCs) could play a significant role in helping contract farming achieve its goals of increasing farmer income and diversification (Kaur, Singla et al. 2021). The study showed that, in comparison to crops grown by non-contract farmers, the crops introduced by the three firms' contract farming had been able to bring farmers under their control, diversify their farming in terms of the introduction of new crops, grow a greater number of crops in a year, and create more employment opportunities. In Indian Punjab, the introduction of a new chicory contract crop led to adjustments in the cropping pattern, especially during the rabi season since the newly introduced chicory crop was able to provide contract growers with more than double the net returns as compared to the traditionally cultivated wheat crop (Kaur, Singla et al. 2021). However, contract farming has to be better controlled in order to capitalize on its benefits and improve local livelihoods (Kaur, Singla et al. 2021).

Summary of Case Study Overview				
Country	Greece	India	China	Bangladesh
Climate type	Mediterranean/Sub-tropical	Continental	Tropical, desert, mountainous, coastal	Tropical
Case Study Description	Cultivation of MAPs for its ecological benefits	<ul style="list-style-type: none"> • Crop diversification and employment generation in rural Punjab 	Crop Diversification	Crop Diversification
Public Policies	<ul style="list-style-type: none"> • Common Agricultural Policy (CAP) with specific crops selected for augmentation • “Strategic Development Plan for the Cultivation, Processing and Marketing of MAPs in Greece”. • 	<ul style="list-style-type: none"> • Crop diversification policy • Farm employment generation 	<ul style="list-style-type: none"> • Two turning points in crop diversity change at national level; • Household Responsibility System (HRS) in 1980 • Agricultural Tax Abolition (ATA) in 2003 • Individual households are entrusted to choose their own crops; 	<ul style="list-style-type: none"> • Crop diversification from rice to non-rice crop cultivation
Mechanisms	<ul style="list-style-type: none"> • “Release” policy, i.e. decoupling of subsidies from production • Conversion to area subsidies based on historical production • The strategic plan describes all the measures and actions aimed at competitive development, implementation, marketing and processing 	<ul style="list-style-type: none"> • Contract Farming Act 2020 – Farmers Agreement on Price Assurance and Farm Services Act 2020 • The quality, grade and standards for pesticide residue, food safety standards, good farming practices, and labour and social development standards 	<ul style="list-style-type: none"> • Diversification • Intensification/specialization • Cultivation of sugar beet and chicory instead of wheat 	<ul style="list-style-type: none"> • Contract farming • Promotion of value-added crops in agro-ecological zones;

	<ul style="list-style-type: none"> • Organic cultivation of oregano reaches around 40% of the total cultivated area of Greece • Greek National Dietary Guidelines prescribing MAPs instead of salt; 			
Institutional Infrastructure	<ul style="list-style-type: none"> • Network of Social Farms • European Medicines Agency (EMA) • Hellenic Ministry of Agriculture 	<ul style="list-style-type: none"> • High number of agricultural cooperatives, however, no HVMAP cooperative specifically • Agriculture Credit Cooperative and Milk Union • Agriculture Development Cooperative • Agriculture Chamber • Agriculture Sales Cooperatives. 	<ul style="list-style-type: none"> • Farmers' Union • Farmer Producing Companies (FPCs) to encourage contract farming with small farmers 	<ul style="list-style-type: none"> • NGOs and NGO memberships to foster crop diversification process
Challenges	<ul style="list-style-type: none"> • Climate change exacerbating the extinction of wild species of HVMAPs 	<ul style="list-style-type: none"> • Access to local and international markets by lavender farmers; • Inability to negotiate the prices with the local merchants. 	<ul style="list-style-type: none"> • Need to regulate contract farming • No spill-over effects on the communities • Gender discrimination • Unequal pay for males and females 	<ul style="list-style-type: none"> • Insufficient incentives, such as poor irrigation systems, lack of input supply, poor market structure, price variation; • National consumption patterns heavily rely on rice; • Fear to try new crops;

D. Step 4: Understanding the Level of Public Appreciation of the HVMAP Landscapes

Despite the wealth of advantages, farmlands can bring and the financial flows they can draw, there are not always municipal regulations designed to encourage farmers to create such landscapes (Ciani 2014, Hatan, Fleischer et al. 2021). Allocation of agricultural land for organoleptic experiences in a farm can have a substantial multiplier effect on other ecosystem services (Simpson 2011). Therefore, landscape beautification need to be well managed, in order to utilize the landscape service for tourism and recreation (Afiyanita and Kaswanto 2021).

In this step of the research, it was imagined that an organized HVMAP farming exists for the visitors to come for leisure, recreation, or education purposes (Al-Obaidi, Desa et al. 2022). Their payments for experiences, services and handcrafted products would flow to the local economy and the associated value chains.

People are more and more interested in natural, plant-derived products and going back to farm, which also means mitigation of the countryside depopulation (Cortegano, Cogliandro et al. 2020, Al-Obaidi, Desa et al. 2022). I am particularly interested to investigate the potential of HVMAP fields with a specific depth in the “cultural ecosystem service”, what types of plants and how valuable would they be for recreation and how much they can add to the Lebanese rural economies.

For this, I referred to the study by Wang, Watanabe et al. (2022) that bases on visualization techniques and explores users’ emotions (Wang, Watanabe et al. 2022). I realized that people’s landscape preferences and their willingness to pay (WTP) are important to be considered. These results are due to the fact that individuals take into

account other considerations than the aesthetic aspect in formulating their WTP (Aznar, Marsat et al. 2007).

I applied the method of “stated preference”, since it focuses on change involving both negative and positive impacts on the landscape. It assumes that there is no related market for landscapes, but that a hypothetical market can be constructed. What was really important for my research, is the inclusion of non-use values when evaluating a given landscape (Bostan, Fatahi Ardakani et al. 2020). I sought to understand people’s level of appreciation and their willingness to visit the potential HVMAP landscape in Aytaroun were evaluated through:

- An online poll on Instagram with the question “*Would you be willing to visit this site?*” was conducted to measure people’s appreciation of the potential medicinal and aromatic plant-based agri-tourism site in Aytaroun village.
- A picture of the potential agri-tourism site in Aytaroun was presented to the attention of the Instagram followers of the Environmental and Sustainable Development Unit (ESDU) account. The **ESDU Instagram account** has some 4,833 followers and 499 relevant posts.
- 150 people were targeted by the poll. They were asked to choose an option of their WTP based on a hypothetical scenario of a HVMAP landscape in Aytaroun village in the South of Lebanon. The payment options were selected based on the market rates at the time of the Poll.
- The Poll was anonymous and no names or credentials were revealed/disclosed. After the poll was closed and the usernames of the respondents collected by the ESDU Instagram account manager, they were

replaced by pseudonyms for the purpose of analysis. No usernames or any other information about the Poll participants were disclosed.

- The following questions and answer options were posted on an Instagram anonymous poll, using collage visualization method, to understand the level of appreciation of the landscape’s aesthetic qualities:

Question	Answer Options
What kind of feelings does this picture cause you?	<ul style="list-style-type: none"> • Happiness & Joy • Boredom & Indifference • Serenity & Tranquillity • Hatred & Negativity
How much time would you be willing to drive to this destination?	<ul style="list-style-type: none"> • Maximum 1 hour • Maximum 2 hours • Maximum 3 hours • It doesn’t matter, I want to recreate in such an area
If you were asked to pay a contribution fee for the maintenance of this landscape, in the range of how much would it be?	<ul style="list-style-type: none"> • 50,000 – 150,000 (LBP) • 150,000 – 250,000 (LBP) • 250,000 – 350,000 (LBP) • It doesn’t matter, what matters is such a place exists and I recreate there

Method of visualization: the actual real-time Aytaroun village picture was laid over with medicinal and aromatic plant images to illustrate a potential herbal agri-tourism site. The sound of nature, bees, and butterflies were applied to the image to activate the senses of the viewers for their better imagination of the experience in the proposed site.

This knowledge can help decision-makers in two ways: on the one hand, to define the objectives of public interventions and resource allocations; on the other hand, to inform and make people aware of the values of various benefits provided by a landscape. Bostan et al. argue that to evaluate the people’s appreciation and valuation of the specific

ecosystem services in a given landscape, the choice experiment method (CEM) and the contingent valuation method (CVM) as examples of “Stated Preferences Methods” can be applied. Such assessment of the various ecosystem services can take use of the values in national accounts, paving the way for more significant and potent support in the creation of financial assistance, incentive programs, and subsidy policies (Bostan, Fatahi Ardakani et al. 2020). Since the aesthetic enjoyment of the environment influences where people choose to engage in recreational activities, aesthetic values are frequently strongly tied to recreational ecosystem services (Wang, Watanabe et al. 2022).

The poll results revealed that people, in fact, experience predominantly “serenity and tranquility” and “happiness and joy” when seeing the marjoram blooming fields presented to them as a form of collage. Out of the 150 people, 88 people responded that they feel serenity and tranquility, and 62 people responded that they feel happiness and joy.

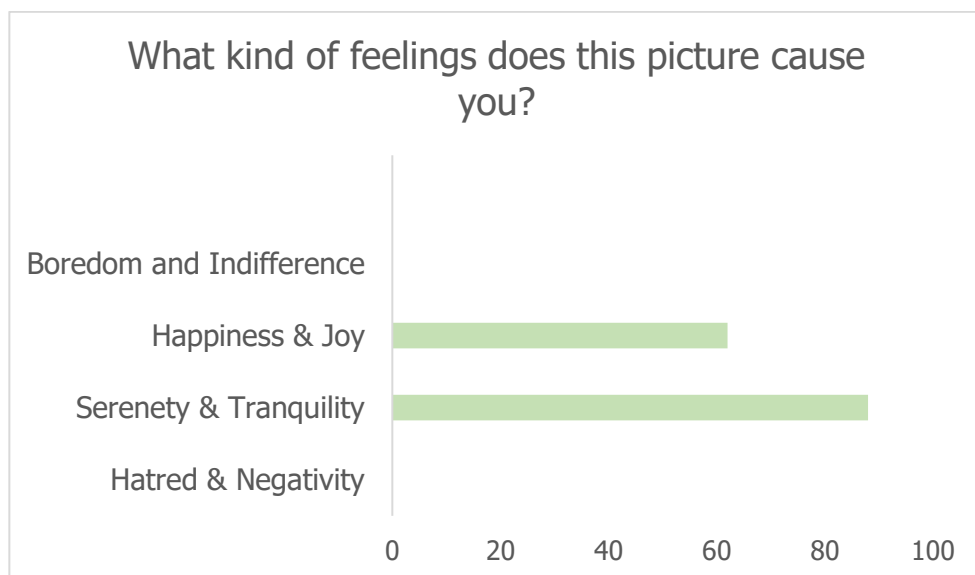


Figure 11 Instagram Poll Results

Moreover, there were almost equal number of responses on the driving time between “max 2 hours” and “it doesn’t matter”, meaning that people are sincerely eager and willing to dedicate their time to see the blooming sesame fields. In fact, more people do not mind driving a distance of any length (56 people) to spend their leisure time in a herbal landscape, while almost same number of people (55 people) prefer to drive maximum two hours to this destination.

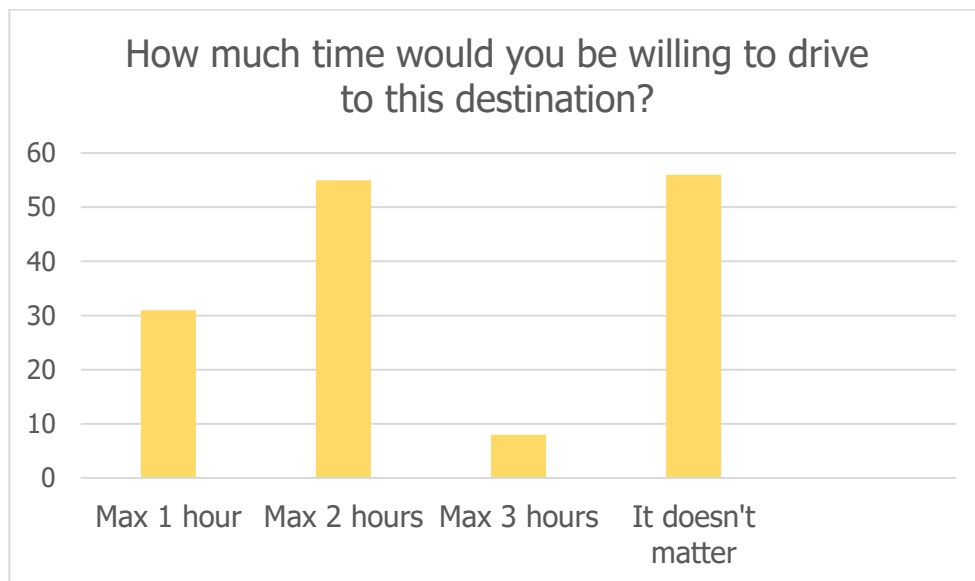


Figure 12 Instagram Poll Results

And lastly, most important factor determining how willing people would be to contribute to the preservation or maintenance of this hypothetical herbal destination in Aytaroun, Southern Lebanon – is the actual amount they would be willing to contribute with. Interestingly, people were willing to pay between 350,000 and 450,000 (Lebanese Lira) or the amount didn’t matter to them and they would pay anyway. The results of this poll match with the study in Iran on people’s willingness to pay, where people were willing to pay any fee provided that the pasture landscape would be maintained and preserved, and they would be able to come and spend time there (Eskandari-Damaneh,

Noroozi et al. 2020). Out of the 150 respondents, 42 responded they would be willing to pay 350,000 to 450,000 (Lebanese Lira), and 46 responded that it did not matter to them (Figure 12).

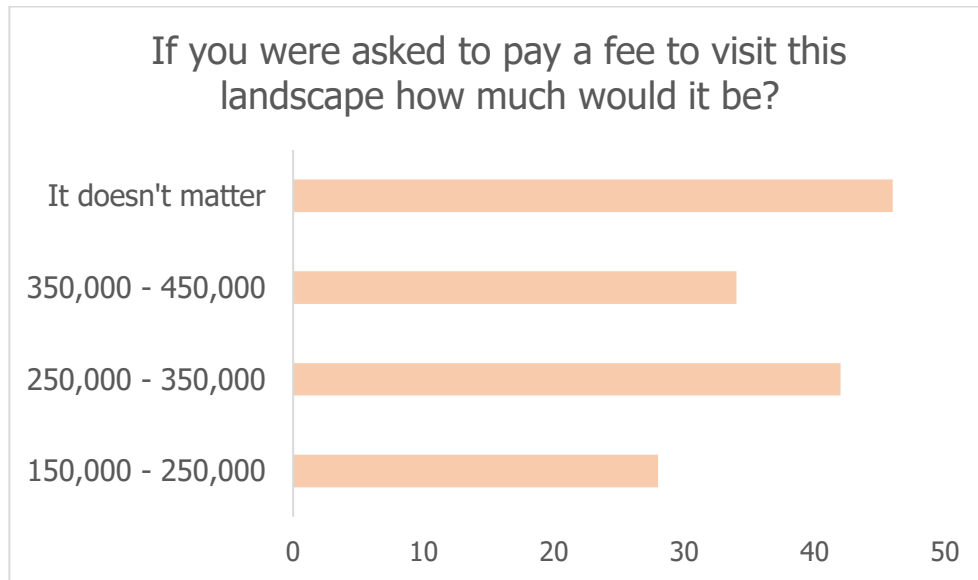


Figure 13 Instagram Poll Results

E. Step 5: Conversations with the Supply Chain Actors / Key Informant

Interviews

I also conducted informal interviews with the relevant actors in the supply chain in order to better understand their motivation to grow or sell tobacco. The following informal interviews were conducted:

No.	Supply Chain Actor	Topic/Issues
1.	Tobacco products distributor/Owner of tobacco products distribution licence	<ul style="list-style-type: none"> • Cost of the tobacco seller license • Revenues and profits from selling tobacco products • Process of distribution

2.	Local farmer/Woman who had been growing tobacco since 20 years	<ul style="list-style-type: none"> • Cost of growing tobacco per 10 dunum • Revenues and profits from growing tobacco per 10 dunum • Living costs in Aytaroun • Coping mechanisms during COVID-19
3.	Head of Aytaroun Cooperative	<ul style="list-style-type: none"> • The history of establishment of Aytaroun Cooperative • Its membership and activities • Potential engagement in HVMAP cultivation • Costs of cultivating zaatar
4.	Agricultural products retailer	<ul style="list-style-type: none"> • Past profitable fruits and vegetables grown in Lebanon • Current agri-production trends: avocado, bananas, berries, etc.

In addition to literature review for studying of the facts about the herbal crops and cultural heritage, it was necessary for me to observe personally how local people talk about those plants. There is an urgent need for documentation of traditional knowledge related to cultural heritage of Lebanon (Attieh 2011). These informal interviews were conducted using personal connections, and even though, the obtained information is anecdotal, it was important to understand what are some general rumors and perceptions of people from the case study area and nearby. For the purpose of not disclosing personal identities, names of the interviewees are fictional.

The **tobacco products distributor** – Mr. Ali mentioned that “*the distributor’s and retailer’s licenses were precious and it was a highly profitable business.*” According to Ali, in the far past the licenses used to cost between 20,000 and 30,000 US Dollars, while today their price reaches around 120,00 US Dollars”. He also explained that due to the sanctions implications by enforcement of the Caesar Law⁴,

⁴ <https://home.treasury.gov/news/press-releases/sm1072>

tobacco products get smuggled to Syria through Lebanon, and this made it profitable for the Lebanese tobacco products businessmen until recently. *“It has become no longer so easy to smuggle tobacco products into Syria, since the law enforcement has become stricter.”* – said Mr. Ali.

The **local farmer** – Mrs. Fatema from the village of Al-Ksaibe (near Nabatiyeh), grew tobacco for 20 years and knows everything about this crop and its farming. Mrs. Fatema mentioned that in the past tobacco used to cost 10 to 18 US Dollars per kilo when selling to Regie. In 2022, due to the Lebanese Pound devaluation versus US Dollar, the price dropped to 4.5 US Dollars. *“Fertilizers and pesticides became so unaffordable that this crop is no longer lucrative, while zaatar/oregano remains a viable alternative for its production isn’t costly.”* – said Mrs. Fatema.

Mr. Hussein Ibrahim, the **Head of Aytaroun Cooperative**, rather mentioned that *“tobacco farming is being replaced by the attempts of cultivating cumin, anees seeds, zaatar/oregano and sesame seeds.”* Mr. Hussein admitted that one of the main problems of scaling up crop cultivation in Aytaroun is peoples’ and farmers’ lack of trust in cooperatives. *“The modern culture of individualism versus collectivism combined with lack of patience and trust make it hard to organize crop cultivations in a proper manner”* – said Mr. Hussein. At the same time he admitted that nowadays farmers are willing to grow alternative crops, since they no longer see tobacco farming as a financially satisfying business. Moreover, the farmers in Aytaroun reported to have wasted their effort, money and time on growing tobacco, since Regie purchases it at a lower price compared to the previous years. Mr. Hussein admitted that if there is access to markets and technical and financial support to help them cultivate alternative crops, they would be willing to abandon cultivating tobacco. This, in fact, corresponds

with the previous studies of farmers' perceptions and opinions about tobacco growing. In a survey of several countries around the world, 41% of tobacco producers claimed they would transfer to another crop provided specific economic circumstances were present, such as the availability of acceptable loans and a market guarantee for the new crop (Geist, Chang et al. 2009).

Mr. Mohammad who is the **fruits and vegetables retailer** in the Southern Lebanon also shared valuable information on the agricultural production and retail trends in Lebanon. According to Mr. Mohammad, the most profitable and trendy fruit to grow and sell was avocado and his company has been profiting well on this crop. Other fruits he mentioned were banana, citruces, cactus fruit and berries.

Moreover, during my trips to the southern villages of Lebanon such as **Hebbarieh, Bent Ejbil, Ain Qenia, Kafar-Chouba, Chebaa**, I observed some of their daily practices and habits using specific medicinal and aromatic plants. I observed how zaatar/oregano is an essential ingredient in everyday breakfast of the people along with the delicious locally grown olive oil. Among the different HVMAP varieties, the main were the zaatar/oregano, summac, sesame seeds, sage as well as mint were the most commonly used. During my visits, I generally asked the local people questions like "*what is the most valued herb/medicinal and aromatic plant in your village?*" and their answers usually confirmed my observations. In **Kafar-Chouba** people appreciate summac, zaatar, and sage the most. Older women tend to make it their source of livelihood selling these MAPs along with *kishek* (dried yogurt and bulghur mixture). There isn't a well-organized enterprise or system of selling these goods, but rather through personal connections and word of mouth on demand. In **Chebaa**, though, people happen to be more opportunistic and market their goods more widely to the

neighboring villages. In **Ain Qenia**, I found that among the drooze people I visited, to my question “*what do you think of tobacco cultivation in Lebanon?*” they replied “*it is culturally unacceptable for us to grow such a crop that is unhealthy for the nature and people*”.

Across the villages of Southern Lebanon, as for the patterns of small-scale cultivation of herbs and aromatic plants for subsistence farming, similarities were found due to the dishes commonly cooked and the popular knowledge of the plants’ medicinal properties, while differences were found in their perception and practices of tobacco farming.

F. Step 6: Feasibility Study/Crop Costs Comparison of HVMAP Cultivation versus Tobacco Farming

The use of MAP and alternative medicine practices have been gaining popularity among the scientific community, farmers and entrepreneurs in Lebanon (Karam, Noun et al. 2016). Attempts to evaluate the ecosystem services and functions, such as through cost-benefit analysis, could help justify the suitable strategies related to the cultivation of the selected HVMAPs (Wani and Sahoo 2021).

Among the studied MAPs in Lebanon is *Origanum syriacum*, which is considered relatively water-efficient. Its irrigation requirement for water is 16 liters every two weeks (Atallah 2006). In the current case of feasibility assessment of the Lebanese Oregano/Zaatar, a project cycle of 5 years is taken. In Lebanon, among all MAPs, Zaatar/Oregano (*O. syriacum*) has always been in high demand due to the dietary habits and its cultural value (Solomou, Giannoulis et al. 2021). Numerous studies have attempted to calculate the economic costs and advantages of producing zaatar in many

ways, such as a spice, a tea and herbal infusion, a raw food, and an essential oil. These studies demonstrate that the essential oil has the greatest potential for economic gain (Atallah 2006, Alwafa, Mudalal et al. 2021). For instance, a study by Atallah showed that Comparing NPVs and BCRs of the three scenario projects, the “zaatar essential oil” scenario had the highest NPV (562,301.5 USD) and BCR (5.1993) followed by the “raw zaatar” scenario in the second position (NPV=88,625.15 USD; BCR=1.9369) and the “zaatar herbal tea” scenario in the third position (NPV=35,928.5 USD; BCR=1.0791) (Atallah 2006).

Similar to Zaatar/Oregano (*O. syriacum*), other herbs and spices, such as Lavender, Marjoram, Saffron, Sage, Sesame, which can be annual, biennial or perennial plants, are highly valued and favoured among cooks, holistic healers and commercial users (Ríos and Andújar 2016). Their leaves, stems and seeds of which (fresh or dry) are primarily used for flavouring foods and beverages (Shylaja and Peter 2004). The essential oils extracted from tender stems, leaves, and flowering tops are used in cosmetics, perfumeries, and toiletries as well as for flavoring liquors, soft drinks, beverages, and pharmaceutical preparations. Herbal spices are recognized to possess nutritional, antioxidant, antibacterial, and therapeutic characteristics in addition to their function as flavouring agents. Some herbs are also utilized as garnishing spices in various food recipes due to their appealing foliage (Ríos and Andújar 2016, Rahman, Bhattarai et al. 2019).

The above-mentioned selected HVMAPs that are native to Lebanon and have a high potential to be a good alternative to tobacco growing, as literature shows, were taken for a brief feasibility assessment. These plants are considered of high value in the market due to their medicinal, nutritional and aesthetical properties. In addition, they

were numerous mentioned by the Lebanese farmers as potential lucrative crops during my informal meetings and encounter with farmers at MAP-related workshops and

Characteristics of the selected HVMAPs			
Botanical name	Common name	Perennial/Biennial/Annual	Plant part used as spice
Origanum majorana	Marjoram	Perennial	Leaf, floral bud
Origanum syriacum	Zaatar/Lebanese Oregano	Perennial	Leaf, flower
Lavandula stoechas L.	Spanish Lavender	Perennial	Leaf, stem, floral bud
Salvia officinalis	Sage	Perennial	Terminal shoot, leaf
Crocus sativus L.	Saffron	Perennial	Stigma
Sesamum indicum L.	Sesame	Perennial	Seeds

conferences.

The cost of cultivating each of the chosen HVMAPs in comparison to producing tobacco is shown in the table below with crop cost estimates. Numerous studies on tobacco cultivation demonstrate that the expenses of growing tobacco are significantly higher than those of other crops (Hamade 2014, Redwan 2018). This is a result of the labor-intensive process of cultivating tobacco, which results in inadequate compensation or discrimination based on gender and age. When bamboo crop cultivation was compared to tobacco crop cultivation in Kenya, it was discovered that, at farm-gate pricing, the annual estimated income from bamboo farming was four to five times higher than that of tobacco on the same amount of land (Kibwage , Netondo et al. 2014).

In order to test if growing HVMAP instead of tobacco would be feasible considering the potential economic, ecological, and social benefits, a crop cost comparison has been conducted as part of this research.

The comparison of crop costs below provides encouraging figures for prospective net gains. The figures were calculated using a 1 ha farm and considering Lebanese Lira pricing that was converted to US Dollars using the exchange rate in January 2023. Among the chosen HVMAPs, Zaatar/Oregano is still the crop with the highest yield of money. Similar to what (Alwafa, Mudalal et al. 2021) concluded in their study, that the Zaatar/Oregano market is profitable. It quickly recoups its investment, continues to produce for seven years, harvests on average every 40 days, and is resistant to pests and illnesses (Alwafa, Mudalal et al. 2021).

Sage (*Salvia officinalis*) and Marjoram (*Origanum majorana L.*), with potential annual net profits of up to \$300,650 and \$343,650, respectively, come in second and third position. In the best case scenario, where there are two or three harvests, these values are accurate. Next with a net profit of up to \$270,650 annually is Lavender (*Lavandula sp.*). Its need for a suitable irrigation system accounts for its lower profit potential.

Crop comparison in terms of feasibility, profitability and ecological sustainability (exch. rate as of Jan 2023: 1 USD = 45,000 LBP)

10 dunum = 1 hectare	Zaatar	Marjoram	Saffron	Sage	Lavender	Sesame	Tobacco
No of harvests per year	0 - 3 times	0 - 2 times	1	0 - 3 times	1	1	1
Use of pesticides/nitrogen fertilizers (kg/ha/year)	Manure/Compost	Manure/Compost	0	80kg (N); 60kg (P)	0	0	(3 * 50kg) 150
Cost of pesticide/fertilizers or organic manure (USD/ha/year)	\$2,250	\$2,250	0	\$500	\$2,250	0	\$2,000
Cost of seedlings for planting (USD/ha)	\$8,000 – \$10,000	\$8,000 – \$10,000	\$15,000	\$8,000 – \$10,000	\$10,000	\$25	
Use of water (barrel/ha/year) 1 naqle (400,000 Lebanese Lira) = 20 tanks	18	18	0	15	18	15	15
Cost of water/drip irrigation (USD/ha/year)	\$1,600	\$1,600	0	\$1,350	\$1,600	\$500 - \$1,000	\$1,350
Use of labor (man-days/ha/year)	250	250	300	250	50	100	300
Total cost of labor (USD/ha/year)	\$2,500	2,500	\$3,000	2,500	\$500	\$100	\$3,000
Yield per season (kg/ha)	4,000 – 20,000	7,000 – 20,000	1.2 – 1.7	7,000	5,000 – 15,000	800	1,500 – 1,800
Price for raw/dried herb (USD/kg)	\$6 - \$9	\$6 - \$9	\$2,000 - \$10,000	\$10 - \$15	\$15 - \$19	\$4	\$5
APPROX. TOTAL NET IN USD	Up to \$523,650	Up to \$343,650	Up to \$14,000	Up to \$300,650	Up to \$270,650	\$2,925	Up to \$2,500

CHAPTER V

DISCUSSION

The international FCTC article 17 prescribes “*diversification of tobacco farming*” and has been in force since 2005 (Geist, Chang et al. 2009). In countries where transition already happened and tobacco farming has declined significantly, the strategy was to harvest the revenues from tobacco farming and to invest it into transition to alternative crops. While state agricultural policies combined with international development aid was the approach to supporting the transition in other countries. Literature evidence shows that even in communities with a long history of cultivating tobacco, adjustments did not necessarily hit the livelihoods of people (Geist, Chang et al. 2009). Studies in several tobacco-producing countries show that the annual net incomes of non-tobacco farmers were higher than those of tobacco farmers (Lecours 2014, Kaur, Singla et al. 2021). This phenomenon across countries took place due to several reasons: subsidies/investment, technical assistance, infrastructure, and a guaranteed buyer of the harvested crop (Leppan, Lecours et al. 2014). In order to support local farmers in effectively transiting from tobacco cultivation to alternative crops, while responding to various demands in challenging market conditions, it is helpful to learn some lessons from countries that put in place supporting agricultural policies.

The **European Union (EU)** has recently been changing its agricultural policy model, placing multi-functionality and diversification at the center of their paradigm within their Common Agricultural Policy (CAP). One example of such a measure is the agri-environmental support scheme (Ahmadzai 2022). In **Balkan countries**, for instance, also the improvement of economic indicators is being achieved by restructuring agricultural product introducing high-value crops, modern farming technologies, as well

as water conservation measures (Rudić, Nikolić et al. 2019). In **China** sustainable rural development is targeted through balancing crop diversification and crop specialization, where both are applied as policy tools where relevant. From the viewpoint of food security and livelihood, crop diversification in China also was crucial, in order to promote intensive farmland use (Liu, Tang et al. 2021). In **India** contract farming was one of the various alternatives to diversify agriculture towards new high-value crops from intensive monocrops of rice and wheat (Kaur, Singla et al. 2021). Rice and wheat monocrops, similarly to tobacco crop, have caused severe ecological destructions, such as soil degradation, groundwater overexploitation. The study results showed that, in comparison to crops grown by non-contract farmers, the crops introduced by the three firms' contract farming had been able to bring farmers under their control, diversify their farming in terms of the introduction of new crops, grow a greater number of crops in a year, and create more employment opportunities.

Learning from the reviewed case studies, as well as from the economic and ecological costs and benefits analysis in this research, it is meaningful to summarize the value of ecosystem services provided by the HVMAPs versus tobacco.

	Provisioning	Regulating	Supporting	Cultural
Tobacco	Low	Low	Low	Low
Marjoram	High	High	High	Medium
Zaatar/Oregano	High	High	High	High
Sage	High	High	High	High
Saffron	Medium	Medium	Medium	High
Sesame	Medium	High	High	High
Lavender	High	High	High	Medium

In addition to being mostly high in value of *provisioning, regulating* and *supporting* ecosystem services, there is a public interest in spending leisure time in such landscapes, including the willingness to pay. This means that even when people aren't familiar with any or all of the HVMAPs, they are willing to invest their time and money to explore such herbal landscapes. Moreover, the economic incentives for the cultivators are high, given the perennial nature of the HVMAPs and the interest in the market for the HVMAP-based products. It becomes evident that there is an urgent need to diversify tobacco cultivation with additional, high-value crops, which are more climate-resilient, and ecosystem-friendly. Some key determinants of crop diversification to take into consideration would be: cultivated land area, choice of farmers and their socio-economic conditions, local natural conditions, labor force, irrigation, rising non-food product consumption, declining consumption of staple foods (Liu, Tang et al. 2021). It is therefore essential for the Lebanese policymakers to employ the national agricultural zoning policy, in view of these determinants in order to maintain a high crop diversity in the Southern region of Lebanon.

A. Potential Economic Benefits of Transitioning to HVMAPs

HVMAP farms and the products derived from them may offer a creative means of diversifying rural livelihoods and a replacement for the conventional, less lucrative tobacco crops. Growing HVMAPs is a significant source of income, particularly for small-scale farmers who can improve their standard of living through this industry (Solomou, Giannoulis et al. 2021). Zaatar, sage, marjoram, saffron, lavender, and sesame seeds can be a successful crop and a source of income diversification, as the research review shows. According to some research, high-value small-scale crops increased farm

revenue by more than 35%, boosting the amount of food consumed per person in such households (Beillouin, Ben-Ari et al. 2021, Azad 2022). In addition to creating job possibilities, diversification can boost earnings and sales.

But to move away from a conventional farming system and toward a more varied cultivation of HVMAPs, it will be necessary to pay close attention to the markets and the possibilities of offering farmers extension services and technical support. To improve the efficacy of such agricultural systems, it is necessary to consider the suggestions and opinions of experts in this domain.

B. Potential Environmental and Ecosystem Benefits of Transitioning to HVMAPs

Through its integration in agroforestry and combination with fruit trees, medicinal and aromatic plant crops can also aid in the restoration of damaged soils and the mitigation of the effects of climate change (Korwar, Prasad et al. 2014). They can be the key element of conservation and low-input agriculture and present a chance to support stability and health of agro-ecosystems since, they are naturally adapted to poor soils and little rainfall (Nisrine, Jihad et al. 2016). It could be a workable option for the agricultural villages in the southern Lebanon that lack access to natural resources, especially water, if it is proven and effectively implemented in practice (Hamade 2014). Diversification of crops, as a strategy, also has studied ecological benefits. Scientific evidence shows that yields in monocultures decline due to soil degradation and populations of soil-living pathogens. More importantly, supporting and building a strong lobby among producers to switch to ecological, more advantageous cropping is crucial to achieve a change (Redwan 2018).

C. Potential Socio-Cultural Benefits of Transitioning to HVMAPs

The knowledge of local folk medicine and its applications became scarce and restricted to a small number of people in remote village communities in Lebanon as "modern" medical procedures became more prevalent. However, cultural practices are varied and rich, and this has influenced how MAPs are used in different ways across generations (Karam, Noun et al. 2016). In fact, the survey done within the framework of this study, showed that people would like to visit the herbal fields also for cultural reasons. Lebanese people are proud that best quality Sesame seeds grow in Southern Lebanon and are willing to pay to preserve such cultural heritage agricultural landscapes. Therefore, cultivating areas with diverse crops of both nutritional and cultural value could include native medicinal and aromatic plants (Mustafa, Mabhaudhi et al. 2021).

D. Uncertainties and Limitations

This study evaluated different strategies of transitioning from monocrops to more sustainable alternative crops, including such as HVMAPs. There has been sufficient information on the benefits of crop diversification in general, however, little has been found per se about the diversification of monocrops with the HVMAP crops. It is still necessary to understand where such diversification or HVMAP crop specialization worked and whether it truly turned out to increase the socio-economic conditions of the farmers, as well as strengthened the ecosystem services.

CHAPTER VI

CONCLUSIONS

Globally, shifting away from local staple foods toward intensive crops dictated by the industrialized economies has shown to lead to monocrops negatively impacting the ecosystem services. This study involving qualitative and quantitative syntheses demonstrate the increasing popularity and the promising potential of HVMAPs for strengthening the ecosystem services, including the *provisioning* and *cultural* ecosystem services. Diversifying tobacco cropping with HMAPs like zaatar/oregano, sage, marjoram, lavender and sesame seeds appears to return high profits, in addition to being culturally preferred by the farmers. Since crop diversity changes are driven by agricultural policies and marketing pressures, it is necessary to ensure that farmers are provided with: a supportive environment, access to credit and market, infrastructure, technology, and sound governance so that they seize their opportunities during the transformation phase. International development aid programs supporting holistic approaches to agro-biodiversity and farmers' livelihoods, could be an entry point where a Public Private Partnership (PPP) involving the Ministry of Finance, Regie, the Aytaroun Cooperative and the Ministry of Agriculture, could be feasible.

Moreover, since in Lebanon the MAPs sector is mainly occupied by women, an intermediary civil society organization protecting the female contractors' rights in contract farming would be crucial to help the small-scale farmers to be equally paid.

REFERENCES

- Afiyanita, H. and Kaswanto (2021). "Evaluation of urban landscape visual quality based on social media trends in Bogor City." IOP Conference Series: Earth and Environmental Science **622**(1): 012022.
- Ahmadzai, H. (2022). "Hope for Change: Is Diversifying Production Portfolios an Ideal Strategy to Boost Farming Efficiency in Afghanistan?" Progress in Development Studies **22**(1): 7-31.
- Akhter, F., et al. (2014). Breaking the dependency on tobacco production: transition strategies for Bangladesh. Tobacco control and tobacco farming. Ottawa, Cairo, Montevideo, Nairobi, New Delhi, Anthem Press: 139 - 189.
- Al-Obaidi, J. R., et al. (2022). Integration of medicinal plants into comprehensive supply chains: The threats and opportunities of environmental devastation. Environmental challenges and medicinal plants: Sustainable production solutions under adverse conditions. T. Aftab. Cham, Springer International Publishing: 487-512.
- Alaouie, H., et al. (2022). "The Lebanese Regie state-owned tobacco monopoly: lessons to inform monopoly-focused endgame strategies." BMC Public Health **22**(1): 1632.
- Alwafa, R. A., et al. (2021). "Origanum syriacum L. (Za'atar), from Raw to Go: A Review." Plants (Basel) **10**(5).
- Arru, B., et al. (2019). "Recreational Services Provision and Farm Diversification: A Technical Efficiency Analysis on Italian Agritourism." Agriculture **9**(2): 42.
- Arru, B., et al. (2021). "Economic performance of agritourism: an analysis of farms located in a less favoured area in Italy." Agricultural and Food Economics **9**(1): 27.
- Ataberk, E., et al. (2014). "Agritourism potential of greenhouse enterprises established at Dikili-Kaynarca region in Izmir, Turkey." tourismos **9**(1): 253-264.
- Atallah, S. S. (2006). Production, postharvest and economic potentials of Origanum syriacum as a new crop in Lebanon-by Shadi Salim Atallah.
- Attieh, L. (2011). "A quest for authenticity: ecotourism potential in Kafarhamam, Southern Lebanon." Tourism in an Era of Uncertainty Rhodes Island, Greece 27–30 April 2011 **46**.
- Azad, A. K. (2022). "Determinants of Crop Diversification in Bangladesh: An Econometric Analysis." Asia-Pacific Journal of Rural Development **31**(2): 195-217.
- Aznar, O., et al. (2007). Tourism and landscapes within multifunctional rural areas: the French case. Multifunctional Land Use, Springer: 293-303.

Beillouin, D., et al. (2021). "Positive but variable effects of crop diversification on biodiversity and ecosystem services." Glob Chang Biol **27**(19): 4697-4710.

Beillouin, D., et al. (2021). "Positive but variable effects of crop diversification on biodiversity and ecosystem services." Global Change Biology **27**(19): 4697-4710.

Birdal, M. (2010). The political economy of Ottoman public debt: Insolvency and European financial control in the late nineteenth century, Bloomsbury Publishing.

Bostan, Y., et al. (2020). "A comparison of stated preferences methods for the valuation of natural resources: the case of contingent valuation and choice experiment." International Journal of Environmental Science and Technology **17**(9): 4031-4046.

Bostan, Y., et al. (2020). "A comparison of stated preferences methods for the valuation of natural resources: the case of contingent valuation and choice experiment." International Journal of Environmental Sciences and Technology: 4031 - 4046.

Braat, L. C. and R. de Groot (2012). "The ecosystem services agenda: bridging the worlds of natural science and economics, conservation and development, and public and private policy." Ecosystem Services **1**(1): 4-15.

Breidy, J. (2013). "Assessment of the status of Plant Genetic Resources for Food and Agriculture (PGRFA) in Lebanon."

Chaaban, J. (2014). Determinants and likely evolution of global tobacco leaf demand. Tobacco control and tobacco farming. Separating myth from reality. London, New York, Anthem Press: 13 - 27.

Ciani, F. F. a. F. D. a. A. (2014). "Strengthening the sustainability of rural areas: the role of rural tourism and agritourism."

Cortegano, M., et al. (2020). Benefits of Aromatic and Medicinal Plants for Farming/Forest Systems: Multifunctionality, Ecosystem Services and Social Benefits, Plant-Based Medicinal and Cosmetic Products, European Commission.

Coskun, M., et al. (2017). "Climate Characteristics of Safranbolu (Karabuk) and Saffron Cultivation." International Journal of Geography and Geology **6**(3): 58-69.

Dagar, J. (2014). Greening salty and waterlogged lands through agroforestry systems for livelihood security and better environment. Agroforestry systems in India: livelihood security & ecosystem services, Springer: 273-332.

Dagar, J. C., et al. (2014). Agroforestry systems in India: livelihood security & ecosystem services. New Delhi, Springer India.

Despotović, A., et al. (2017). "Rural areas sustainability: agricultural diversification and opportunities for agri-tourism development." Transcultural Studies **63**(3).

ESCWA (2010). "Best Practices and Tools for Increasing Productivity and Competitiveness in the Production Sectors: Assessment of Zaatar Productivity and Competitiveness in Lebanon."

Eskandari-Damaneh, H., et al. (2020). "Evaluating rural participation in wetland management: A contingent valuation analysis of the set-aside policy in Iran." Sci Total Environ **747**: 141127.

Estruch-Guitart, V. and M. Valles-Planells (2017). "The economic value of landscape aesthetics in Albufera Natural Park through the analytic multicriteria valuation method." International Journal of Design & Nature and Ecodynamics: 281 - 302.

Estruch-Guitart Vicent, V. and M. Valles (2017). "The Economic Value of Landscape Aesthetics in Albufera Natural Park through the Analytic Multicriteria Valuation Method." International Journal of Design & Nature and Ecodynamics **12**(3): 281 - 302.

Filipčev, B. (2020). The effects of aromatic plants and their extracts in food products. Feed Additives. P. Florou-Paneri, E. Christaki and I. Giannenas, Academic Press: 279-294.

Franz, C. M., et al. (2020). Chapter 3 - Herbs and aromatic plants as feed additives: Aspects of composition, safety, and registration rules. Feed Additives. P. Florou-Paneri, E. Christaki and I. Giannenas, Academic Press: 35-56.

Geist, H. J., et al. (2009). "Tobacco growers at the crossroads: Towards a comparison of diversification and ecosystem impacts." Land Use Policy **26**(4): 1066-1079.

Ghorbani, M. (2007). THE ECONOMICS OF SAFFRON IN IRAN, International Society for Horticultural Science (ISHS), Leuven, Belgium.

Giannoulis, K. D., et al. (2020). "Lavender organic cultivation yield and essential oil can be improved by using bio-stimulants." Acta Agriculturae Scandinavica, Section B — Soil & Plant Science **70**(8): 648-656.

Giray, F. H., et al. (2019). "Rural tourism marketing: Lavender tourism in Turkey." Ciência Rural **49**.

Gül, M., et al. (2016). "Determining Costs and Profitability of Lavender Farms in Isparta Province of Turkey." Journal of Essential Oil Bearing Plants **19**(3): 686-692.

Haidar, A. H. (2019). Changes in the Lebanese agrarian labor regimes in Lebanon after the Syrian crisis.

Hamade, K. (2014). Tobacco leaf farming in Lebanon: why marginalized farmers need a better option. Tobacco control and tobacco farming. Beirut, Anthem Press: 29 - 60.

Harrington, D., et al. (2020). Application of aromatic plants and their extracts in the diets of laying hens. Feed Additives. P. Florou-Paneri, E. Christaki and I. Giannenas, Academic Press: 187-203.

Hatan, S., et al. (2021). "Economic valuation of cultural ecosystem services: The case of landscape aesthetics in the agritourism market." Ecological Economics **184**.

Hathaway, J. (2019). The Arab Lands under Ottoman Rule: 1516–1800, Routledge.

IDAL (2020). Agriculture sector in Lebanon. 2020 FACTBOOK, IDAL Invest in Lebanon.

IFAD (2008). The role of high-value crops in rural poverty reduction in the Near East and North Africa. NENA Division, IFAD.

Karam, N., et al. (2016). Opportunities and limitations in medicinal and aromatic plants' markets and research in developing countries: Lebanon as a case study. Therapeutic medicinal plants. From lab to the market. Boca Raton, London, New York, Taylor & Francis Group, LLC: 107 - 130.

Kashyap, S., et al. (2014). Soil conservation and ecosystem stability: natural resource management through agroforestry in Northwestern Himalayan region. Agroforestry systems in India: livelihood security & ecosystem services, Springer: 21-55.

Kaur, P., et al. (2021). "Role of Contract Farming in Crop Diversification and Employment Generation: Empirical Evidence from Indian Punjab." Millennial Asia **12**(3): 350-366.

Kibwage , J. K., et al. (2014). Substituting bamboo for tobacco in South Nyanza region, Kenya. Tobacco control and tobacco farming. Ottawa, Cairo, Montevideo, Nairobi, New Delhi, Anthem Press: 189 - 211.

Knapik, W. (2020). "Stimulators and inhibitors of the development of social care and support for the elderly in Poland." Journal of Rural Studies **76**: 12-24.

Korwar, G., et al. (2014). Agroforestry as a strategy for livelihood security in the rainfed Areas: Experience and Expectations. Agroforestry systems in India: Livelihood security & ecosystem services, Springer: 117-154.

Krigas, N., et al. (2022). "Prioritizing Plants around the Cross-Border Area of Greece and the Republic of North Macedonia: Integrated Conservation Actions and Sustainable Exploitation Potential." Diversity **14**(7): 570.

Lecours, N. (2014). The harsh realities of tobacco farming: a review of socioeconomic, health and environmental impacts. Tobacco control and tobacco farming Ottawa, Cairo, Montevideo, Nairobi, New Delhi, Anthem Press: 99 - 139.

Lecours, N., et al. (2012). "Environmental health impacts of tobacco farming: a review of the literature." Tobacco Control **21**(2): 191 - 196.

Leppan, W., et al. (2014). Reframing the debate on tobacco control and tobacco farming. Tobacco control and tobacco farming. Ottawa, Cairo, Montevideo, Nairobi, New Delhi, Anthem Press: 247 - 271.

Leppan, W., et al. (2014). Tobacco control and tobacco farming. Separating myth from reality. London, New York, Anthem Press.

Liu, Z., et al. (2021). "Why can China maintain a high crop diversity? A spatial-temporal dynamic analysis." Progress in Physical Geography: Earth and Environment **46**(2): 217-231.

Lutz, C. and G. Tadesse (2017). "African farmers' market organizations and global value chains: competitiveness versus inclusiveness." Review of Social Economy **75**(3): 318-338.

Mahaliyanaarachchi, R., et al. (2019). "Agritourism as a sustainable adaptation option for climate change." Open Agriculture **4**(1): 737-742.

MoA (2020). Lebanon National Agriculture Strategy. Beirut, Lebanon, Ministry of Agriculture of Lebanon: 63.

Mustafa, M. A., et al. (2021). "Building a resilient and sustainable food system in a changing world – A case for climate-smart and nutrient dense crops." Global Food Security **28**: 100477.

NIRAS (2020). Gendered value chain study: barriers and opportunities, UNDP.

Nisrine, K., et al. (2016). "Opportunities and limitations in medicinal and aromatic plants' markets and research in developing countries: Lebanon as a case study." Therapeutic medicinal plants, from lab to the market: 107-128.

PAKDEMİRLİ, B. (2020). "Economic importance of medicinal and aromatic plants in Turkey: the examples of thyme and lavender." Bahçe **49**(1): 51-58.

Rahman, A., et al. (2019). Market analysis of sesame seed, Lisbon: University of Australia.

Raina, B. L., et al. (1996). "Changes in pigments and volatiles of Saffron (*Crocus sativus*L) during processing and storage." Journal of the Science of Food and Agriculture **71**(1): 27-32.

Redwan, Z. (2018). "Alternative crop for tobacco farming in Lebanon - an effective tool to change and educate on tobacco environmental and economical impact." Tobacco Induced Diseases **16**(1).

- Rioba, B. N., et al. (2014). "Effects of nitrogen, phosphorus and irrigation regimes on growth and leaf productivity of sage (*Salvia officinalis* L.) in Kenya."
- Ríos, J. L. and I. Andújar (2016). "Saffron crocus (*Crocus sativus*): From Kitchen to Clinic." Therapeutic Medicinal Plants: 77.
- Rudić, Ž., et al. (2019). "Achieving sustainable irrigation development in agricultural areas of Serbia with limited water resources." Outlook on Agriculture **48**(2): 126-135.
- Saleh, R., Nakkash, R., Harb, A., El-Jardali, F. (2020). Prompting government action for tobacco control in Lebanon during COVID-19 pandemic. K2P COVID-19 series. Beirut, Lebanon, Knowledge to Policy (K2P) Center.
- Salti, N., et al. (2014). "The Economics of Tobacco in Lebanon: An Estimation of the Social Costs of Tobacco Consumption." Substance Use & Misuse **49**(6): 735-742.
- Shaban, A. and R. Houhou (2015). "Drought or humidity oscillations? The case of coastal zone of Lebanon." Journal of Hydrology **529**: 1768-1775.
- Shepard, M. (2013). Restoration agriculture, Texas, US: Acres, 2013.
- Shylaja, M. R. and K. V. Peter (2004). The functional role of herbal spices. Handbook of Herbs and Spices. K. V. Peter, Woodhead Publishing: 11-21.
- Simpson, D. R. (2011). "Allocating land for an ecosystem service: a simple model of nutrient retention with an application to the Chesapeake Bay Watershed " Canadian Journal of Agricultural Economics: 259 - 280.
- Simpson, R. D. (2011). "Allocating land for an ecosystem service: a simple model of nutrient Retention with an application to the Chesapeake Bay watershed." Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie **59**(2): 259-280.
- Soliman, A. M. (2004). "Regional planning scenarios in South Lebanon: the challenge of rural–urban interactions in the era of liberation and globalization." Habitat International **28**(3): 385-408.
- Solomou, A. D., et al. (2021). Ecological Value, Cultivation and Utilization of Important Medicinal Plants (Sage, Oregano and Sideritis) in Greece. Medicinal Plants. H. M. Ekiert, K. G. Ramawat and J. Arora. Cham, Springer International Publishing: 869-895.
- Souhad Abou Zaki, L. D., and Amin Salam (2022). Addressing Food Insecurity in Crisis-Stricken Lebanon. LCPS. Beirut, Lebanon, Lebanese Centre for Policy Studies.
- Talhok, S. N., et al. (2017). Important plant areas in Lebanon. Beirut, AUB NCC.
- Teklu, D. H., et al. (2022). "Genetic Improvement in Sesame (*Sesamum indicum* L.): Progress and Outlook: A Review." Agronomy **12**(9): 2144.

Telesca, L., et al. (2019). "Analysis of heterogeneity of aridity index periodicity over Lebanon." Acta Geophysica **67**(1): 167-176.

Tilaye, M., et al. (2021). "Cost benefits Analysis of Sage (*Salvia officinalis*) variety: SAGE-1 for herbal production."

Tomou, E. M., et al. (2022). "Sustainable diets & medicinal aromatic plants in Greece: Perspectives towards climate change." Food Chem **374**: 131767.

Wang, W., et al. (2022). "Exploring Visualisation Methodology of Landscape Design on Rural Tourism in China." Buildings **12**(1): 64.

Wani, A. M. and G. Sahoo (2021). Forest ecosystem services and biodiversity. Spatial Modeling in Forest Resources Management: 529-552.

Zaccardelli, M., et al. (2020). "Sage Species Case Study on a Spontaneous Mediterranean Plant to Control Phytopathogenic Fungi and Bacteria." Forests **11**(6): 704.