AMERICAN UNIVERSITY OF BEIRUT

SUSTAINABLE DEVELOPMENT OF COASTAL LANDSCAPE HERITAGE: THE CASE STUDY OF ANFEH-HRAICHE

by
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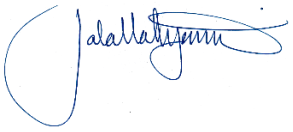

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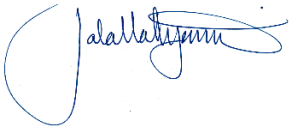

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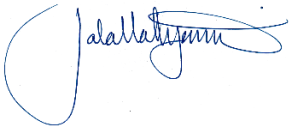

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ABSTRACT
OF THE THESIS OF

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Lebanon's Mediterranean shore is more than 210 km long, the coastal plain extends to a width of half a kilometer, narrowing in the central part, widening in the northern and southern extremes. Historically, towns and cities established in the coastal plain thrived as centers of commerce and trade having access to coastal rivers, streams, and coastal agriculture. For centuries, Lebanese coastal landscapes were a rich overlay of natural and cultural heritage, rural and urban, marine, and terrestrial, a repository of bio-cultural diversity. Twentieth century unregulated urban growth, commercial and industrial activities is incrementally fragmenting and destroying the integrity of coastal cultural landscapes.

Anfeh, a town of 6,000 inhabitants in the Koura district, exemplifies the diversity of coastal landscapes. Along with its natural extension in Hraiche, Anfeh's coastal landscape has been continuously settled since the Bronze age (Early and middle bronze age), to include archaeological monuments, historic churches and monasteries, saltpans (salinas), and olive groves. This outstanding landscape character and rich natural and cultural heritage of coastal Anfeh-Hraiche has placed them on the UNESCO tentative World Heritage List.

Anfeh-Hracihe's cultural landscape and biocultural heritage is threatened directly by industry, tourism, and real estate development; and compromised indirectly by the prevailing limited understanding of cultural landscape heritage by state organizations and the public is of monuments and archaeological sites only.

In this thesis we argue that a holistic approach can integrate cultural and natural heritage, mediate environmental health while providing for local livelihoods. The research asks whether a holistic ecological landscape design approach can guide sustainable development of the Anfeh-Hraiche bio-cultural heritage in coastal Lebanon to address the fragmentation and deterioration of coastal ecosystems. Applying the methodology of the ecological landscape design the research expands beyond the municipal boundaries of Anfeh-Hraiche, to explore natural and cultural resources of the larger context, the coastal Koura district. Research of the regional context then serves as a foundation for reconceptualizing the coastal landscape of Anfeh-Hraiche and designating the rich coastal landscapes with its natural, semi-natural and cultural components, Ecological Landscape Associations, that are thereafter reintegrated into the conceptual design model proposed. Landscape connectivity is ensured through a network of linkages cultural and natural to protect the natural and cultural character of the coastal landscape.

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CHAPTER 1

INTRODUCTION

1.1. Overview

1.1.1. Lebanese Coastal Landscapes

Lebanon's Mediterranean shore is more than 210 km long, it includes the shoreline and continental shelf, the coastal plains and the foothills (Badreddine, 2018). The coastal plain is generally stretching within a 500 m width, narrow in the central part but widens in the North and South. "Lebanon's territorial sea extends 12 nautical miles from the coastline and is part of Lebanon's maritime domain" (CAMP, 2002). During the French Mandate, the maritime domain was protected by the legally binding decree no. 144/S of 1925, defined as "the combination of coast and sea, including the seabed and the seafloor". This legal status ensures the protection of seafront and public rights to access it (Rainey, 2015). In 2003, a study done by Dar Al-Handasah & IAURIF shows that the coastal landscape accounts for "8% of the country's surface area, but contains 33% of the total built-up area and hosts 55% of the overall Lebanese population". (Dar Al-Handasah & IAURIF, 2003 as cited in CAMP, 2002).

The coastal landscape is ecologically sensitive and culturally diverse, the meeting of both terrestrial and marine ecosystems. The traditional landscape mosaic is rich in biodiversity, with floral and faunal habitats in natural, semi-natural and agricultural landscapes. And yet, the Lebanese coast is threatened predominantly by unregulated urban expansion (Makhzoumi et al., 2012). Historically many Lebanese

cities were established along the coastline. Twentieth century unregulated urban growth, commercial and industrial activities became increasingly dominating.

The coastal landscape's marine and terrestrial ecosystems are under threat. The public maritime domain is increasingly privatized by tourist and leisure uses and appropriated by unregulated urban growth. Many of these violations occurred during the Lebanese civil war (1975-1990). Hundreds of residential and commercial establishments were constructed on the seafront without legal permits (MOE/UNDP/ECODIT, 2011). Records and statistics of the Ministry of Public Works and Transport (MOPWT), show that the total area of licensed developments in the public marine domain was about "876,000 m² operated by 94 private establishments and/or individuals before 1975" (Ibid). Many unlicensed entities expanded up to "3.2 million m² invading the public maritime domain" (during the civil war and after 2001) (Ibid). The responsibility for these violations were shared between "government agencies 66.5%, municipalities 22% and fishing ports 11.5%" (MOPWT, 2003; as cited in MOE/UNDP/ECODIT, 2011). In addition, many examples of non-physical heritage are dying out because of the disruption of economic structures and rapid changes in lifestyles. (UNESCO,1989; as cited in ICCROM, 1990)

1.1.2 The Coastal Landscapes as Cultural and Natural Heritage

The International Council on Monuments and Sites (ICOMOS) defines cultural heritage as:

> "An expression of the ways of living developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expressions, and values, that is often expressed as either intangible or tangible and can be distinguished within the built environment (for example, monuments, townscapes); in the natural environment (for example, forests or valleys); or as artifacts." (ICOMOS, 2002, p.21).

ICOMOS continues to define cultural landscapes as: “particular landscapes that reflect interaction over time between people and their surroundings.” (ICOMOS, 2004; as cited in ICCROM, 1990).

There is considerable overlap between the definition of ICOMOS and that of the United Nations Educational, Scientific and Cultural Organization (UNESCO). UNESCO’s recognized cultural heritage as featuring both tangible and intangible heritage (UNESCO 2003; as cited in ICCROM,1990).

Historically, successive civilizations have contributed a rich and diverse cultural heritage that includes settlements, buildings, and their landscapes. Starting from Neolithic times through the Phoenicians, Lebanon has been conquered by the Assyrians, Greeks, Romans, Persians, Arabs, the Crusaders, Ottomans, and the French. This cultural diversity is reflected in the many layers of tangible and intangible heritage that reveal itself through its various festivals, music styles, literature and lore, cuisine, and architecture, including world-renowned World Heritage sites and historic urban cores. (IEG, 2019).

The cultural heritage of the Lebanese coastal zone consists of large inhabited urban centers with long settlement history (Tripoli, Beirut, Saida, Tyre) or stand-alone mounds characterized by a unique topography like : “ancient tells of Sarafand, Jiyye, Tell al-Burak, and Tell al-Maashu” (CAMP, 2002).The historic coastal environment includes many cultural resources like: “olive oil production complexes of the Late Roman period, ancient necropolis, old harbors, traditional town and village cores, vernacular architecture, cultural landscapes, natural and historical landmarks, as well as historic battlefields” (tangible heritage) (Ibid). Moreover, the coastal cultural heritage

incorporates intangible traditions, vernacular customs and practices, folklore, and oral history (intangible heritage). (Ibid)

Many disasters and intermittent conflicts caused serious damages to Lebanese heritage. For instance, the civil war and the 2006 war between Lebanon and Israel damaged many cultural sites and worsened the degradation of monuments and archaeological sites. Moreover, the effect of the Syrian war in 2011 with its associated security risks and the competing needs of Syrian refugees in Lebanon strained municipal capacity to plan and manage their cultural heritage. Furthermore, the rapid and unmanaged urban sprawl around Lebanon's historic cities played a huge role in affecting these sites. (AICS, 2015; IEG, 2019).

1.1.3 Anfeh-Hraiche Case Study Profile

Anfeh, a town of 6,000 inhabitants, is located on the Northern Lebanese coast of the Koura district, along with its natural extension Hraiche (what municipality? Town?) bounding it from the North. Although there exist clear municipal boundaries between the two towns, they are inseparable when calling on one without mentioning the other due to a clear presence of a natural, agricultural, religious, and archeological continuity between the two. When Anfeh is called due to it being the mostly known (popular between the two), Hraiche is immediately referenced throughout the entire research. The two coastal towns are located between Chekka from the South and Al-Qalamoun from the North, bounded by the hills of Barghoun, Zakroun, Qalhat and Balamand form the East. The two towns and their municipal landscapes embody Lebanese natural and cultural coastal heritage.

Anfeh has been continuously settled since the Bronze age (Early and middle bronze age). Anfeh is historically rich in Greco-Roman and medieval archeological remains, and late Byzantine period and the Medieval/Crusades period, churches, convents, and monasteries. Accumulated habitation layers include early contributed variations in the town's naming respectively "Ampi, Ampa, Trieris and Nephin" (Awad, 2009; Panayot Haroun, 2015). However, Anfeh is best known for its ancestral Salinas, traditional pans for salt extraction. Anfeh's coastal agriculture is mainly of olive trees, is extensive. The natural coastal landscapes, archaeological sites, Salinas and agricultural lands, provide a diverse habitat for wild fauna and flora as does seasonal water courses. Biodiversity in Anfeh includes many endemic species. The landscape is diverse and the ecology complex, a living example of *biocultural diversity* (Awad, 2009). The landscape of Municipal Anfeh-Hraiche is a living example of biocultural diversity, a concept that acknowledges the interdependent, complex, and symbiotic relationship between biodiversity and cultural landscapes that co-evolved with human presence across history (Maffi & Dilts, 2014).

1.1.4. The Challenge facing the Cultural Landscape of Anfeh-Hraiche

Today, Anfeh holds two sites that are on the UNESCO tentative list of World Heritage "Ras al-Qalaat promontory and Ras el-Mlelih Promontory" while Hraiche holds the third site "Ras Al Natour promontory" (UNESCO, 2019) both towns are under a cultural threat infiltrating their boundaries form neighboring municipalities. Like the rest of Lebanon's coastal landscape, Anfeh's biocultural heritage is under threat. Three are herein discussed:

1.1.4.1. Direct threats from industry, tourism and real estate development:

> “Urbanization covers 40% of the Lebanese coastal landscape, comprising large industrial and commercial units, seaside tourists' resorts, sea embankments, and dumpsites” (CAMP, 2002).

Many industrial facilities exist on the coast to benefit from quick shipping towards their destinations, from which 20,000 units are found on unclassified industrial zones or without legal permits. Thus, the industrial sector is considered a significant pollution source, a hazard to human health, and posing a threat to the maritime domain & biocultural diversity. Chekka's cement production plant located on southern boundary of Anfeh, is discharging chemicals known as “asbestos” in the sea and other particulates that travels through the air polluting it and are hazardous to human health and nature. This industrial plant is also causing a major threat to " Ras el-Mlelih " promontory (placed on the UNESCO World Heritage indicative list), located at the southern extremity of the town of Anfeh. Known as the "Cape of Salinas" this promontory carries the most ancient salinas of Anfeh originally carved in natural rock cavities and possibly belonging to the Phoenician period (UNESCO, 2019).

Real estate developers target the coastal zone for implementing large-scale development projects to generate profits. Unfortunately, many projects are successful in bypassing the Environmental Impact Assessment (EIA) and end up damaging the existing environmental conditions of beaches and other natural resources. (MOE/UNDP/ECODIT, 2011).

In Anfeh & Hracihe there exist currently two huge resorts Las Salinas (built in Anfeh during the civil war between 1986-1988 then expanded in

1994) and Marina Del Sol (built in Hraiche during the 1990's). These resorts which dominate the coastline with their private jetties and wave breakers, are putting pressure on the existing old fishing port "Al Nhayreh port" ("Nhayreh" is a seasonal stream that passes right through the port to reach the sea) known for its artisanal fishing practices and disrupting the circulation of fishermen passing in their feluccas.

Ras Al Natour promontory is an area of 1,000,000m² of the largest salinas located in Anfeh's natural extension Hraiche (placed on the UNESCO World Heritage indicative list). This area contains the largest concentration of salt pads in the country and possibly in the Middle-East, clustering around the historical monastery of "Deir Al-Natour's". Unfortunately, only 11 families are still working in these salinas, while salt extraction is considered a rare and valuable intangible heritage skill (part of the social heritage) (UNESCO, 2019). The last functional grids of salinas are in danger of being replaced by a private real estate project proposed by AL DAIR HOLDING & NATOUR DEVELOPMENT (under Malia Group) which was trying to represent their massive project as natural and ecologically friendly. This project holds "an area of 800,000 m2 and is constituted of two hotels, residential villas, a resort, a shopping mall, a jetty and other associated facility". (Malia, 2018; Ayoub, 2018).

1.1.4.2. Indirect threats resulting from misconceptions of the biocultural heritage:

The significance of Anfeh lies not only in its rich archaeological heritage, not only its unique Salinas and agricultural landscape, but in that it is an example of biocultural diversity, and valuable landscape heritage. Unfortunately, the prevailing understanding of heritage by state organizations and the public is of monuments and archaeological sites; traditional urban and rural landscapes are often forgotten (CAMP, 2002). Moreover, there exist a poor understanding among the public of the interlaced links between biodiversity and cultural landscapes, which affects the collective decision of the later in maintaining and sustaining biocultural diversities/ heritage (Raygorodetsky, 2013 as cited in Maffi & Dilts, 2014).

Also, land-based communities (Indigenous peoples) that inherited an evolved knowledge, practice and values over millennia are under threat from different existent pressures that are both internal (socioeconomic & environmental conditions) and external (society, modernization and market integration) (Kodirekkala, 2017). In addition, there exist a lack of conceptual or methodological agreement on how to integrate biocultural diversity and its common threats into research agendas also, limited are the tools and guidelines that exist to sustain it through conservation and management approaches. Furthermore, Limited financial resources prevent the implementation and sustainability of biocultural-diversity-based initiatives by groups of interest, as well as their integration into global strategies and actions (Maffi & Dilts, 2014).

1.1.4.3. Threat from outdated current planning regulations:

Anfeh witnessed many huge zoning changes including regulations, laws and decrees that were issued by the state legalizing maritime public property. Easing the sprawl of touristic complexes and industrialization to the coast. According to the National Physical Master Plan of the Lebanese Territory (NPMPLT) "The coastal site of Anfeh, with its Phoenician wall, its salinas, and stones, should be enlisted as a historical heritage, as well as natural heritage (Reserve)" (DAR - IAURIF, 2005). The maps of the NPMPLT of the Northern shores of 1998 classified the promontory of Deir Al-Natour (including the salinas, and olive orchards) as a "natural site" (Natural Park) with partial protection (Zone P2). This homogenous vision of the Lebanese coast, especially the part of the Koura coast, was distorted in 2006 when the government of President Tammam Salam approved the general detailed master plan for the part of Anfeh and Hraiche area, as part of the Decree No. 3478 of May 12, 2016 which canceled every previous design contrary to the current decree while classifying the beach area as a touristic zone (Zone E) (Bou Aoun, 2018).

1.2. Thesis position

1.2.1. Research Questions

This thesis investigates the coastal landscape heritage and biocultural diversity in Municipal Anfeh and its natural extension Municipal Hraiche. The thesis applies an ecological approach to address at once natural and cultural components of the coastal landscape, to assess the pattern of landscape transformation and to explore alternative approaches for sustainable development of the cultural landscape. The hypothesis we

propose argues that a holistic ecological landscape approach can expand the focus on cultural heritage in Anfeh and Hraiche towards protection and/or sustainable management of natural resources to guide any future development. The holistic methodology of ecological planning and design proposed we shall demonstrate has the potential to incorporate ecologically sensitive, environmentally sustainable, and socially just future design strategies. The thesis asks:

Can the application of the ecological landscape approach guide sustainable development of bio-cultural heritage in coastal Lebanon, in Anfeh and its surrounding?

The primary line of inquiry asks the following questions:

1. Can an ecological landscape methodology be applied to conceptualize the cultural landscape of the Anfeh region to valorize biocultural diversity, and as tangible and intangible heritage?

2. Can an ecological landscape strategic framework challenge the construction of a real estate development project while it allocates better strategies for the local economy, protects its social heritage, and creates jobs opportunities?

3. Can ecological landscape strategies address deterioration of the coastal ecosystems and improve the management of natural resources towards improved environments health

4. Can the holistic ecological approach overcome planning limitations imposed by, on the one hand, municipal boundaries, and on the other, biological, and cultural resources, marine and terrestrial.

Adopting this approach to the coastal context of Anfeh can create first a holistic reading of the physical setting, identifying the threats then proposing an integrative, strategic, and conceptual model for the protection of the existing coastal biodiversity. This model would then be ecologically sensitive, economically profitable and in synergy with the agricultural and cultural uses of the community and inspire design directions and recommendations.

1.2.2. Research Significance

This thesis investigates the complex identity of Anfeh and Hracihe's coastal landscape heritage of Northern Lebanon. Anfeh and Hraiche were chosen due to their richness in land resources, productive landscapes (Agriculture, Salt harvesting), cultural heritage (tangible and intangible), history, archeology, tourism, ecology, and biocultural diversity. Furthermore, having such great land values requires a sustainable development strategy to protect them. Such a strategy is missing in Lebanon, hence, Anfeh, Hraiche and all other coastal towns with rich coastal landscape heritage are threatened directly by the uncontrolled urban encroachment on the coast, and indirectly due to the limited knowledge that state agencies and local communities possess of heritage landscapes and the ways to safeguard them. This thesis challenges the identified threats and tries to provide both design guidelines and decision support for a sustainable land management of the coast while benefitting the local economy and protecting the social heritage and biocultural diversity. This project would then act as a reference for other case studies where sustainable development of coastal landscape heritage and ecological land management are required to eliminate threats.

1.3. Thesis Methodology

The research methodology applies the principles of the Ecological Landscape Approach over the case study of Anfeh and Hraiche's coastal landscape heritage, using the Ecological Landscape Associations (ELAs) (Makhzoumi and Pungetti, 1999) a method known for adopting a holistic framework, while studying various processes and relationships between different components of an ecosystem, without separating them as well as, observing their evolution.

First, I will study the general context bounding Anfeh and Hraiche by generating the ELAs for the surrounding municipalities of Chekka, Barghoun, Zakroun, Qalhat, Deir Al-Balamand and Qalamoun. To create the ELAs it is necessary to gather a lot of maps and data beforehand and create others inside a Geographic Information System (GIS), for this project I used ArcMap. Some of the gathered data include: "Lebanese army maps of 1962, aerial photography of 2021, land use maps, geology and soil maps from the National Council for Scientific Research (CNRS), Digital Elevation Model (DEM) from the United States Geological Survey (USGS)", some of the created data by employing ecologically advanced GIS mapping tools include: "Aspect map, Hillshade map, Hydrology map, and Slope Analysis". After finalizing the ELAs, I quantize the data and visualize them through pie charts and in detail through vertical bar charts. Afterwards, I analyze each and indicate if there exist any threats that might be affecting Anfeh and Hraiche, then I extract a conclusion.

Second, I will be zooming into Anfeh and Hraiche's boundary, to identify threatened sites and propose an integrative, strategic, and conceptual model for the protection of the existing coastal biodiversity. Moreover, I will propose design

guidelines (or design intervention) inspired by the ELAs and set zoning regulations that ensures a sustainable development of the coastal landscape heritage.

Finally, I will conclude by specifying how this research could be used as a reference for other coastal case studies in Lebanon and around the world, within an aim to protect biocultural diversity/heritage and sustaining it. As well as extracting main lessons learned from this research that could inspire other projects of similar contexts.

CHAPTER 2

LITERATURE REVIEW & METHODOLOGY

2.1. Literature Review

2.1.1. Summary

To evaluate the landscapes of Municipal Anfeh and Hraiche, it is essential to understand their unique identities and explore the relationship with the larger context. Both *cultural coastal landscapes,* Anfeh and Hraiche are a living proof of people-environment co-evolving, one shaping the other. These coastal towns host many archeological monuments and hold many cultural traditions that were passed on from one generation to another. Being also located on the Mediterranean coast, a biome described as a hotspot for *biodiversity* (IUCN, 2008) (both terrestrial and marine), means that the natural environment is as a value as the cultural one, a landscape unique *visually* and offering scenic views to the sea. A new title (or knowledge) could then be introduced (or used) to describe their undeniable interconnection and symbiosis between *biodiversity* and *cultural landscapes'* evolution, referring to the concept of *biocultural diversity* (add references).

The complexity of the Anfeh-Hraiche landscape dictates a methodology that can address the complexity of Mediterranean biocultural diversities in coastal landscapes. E*cological landscape planning/design approach* (Makhzoumi and Pungetti 1999; Makhzoumi et al., 2012) is one such approach that offers a flexible holistic reading of the physical setting at various scales by creating a smart grouping of the complex natural, semi-natural and cultural layers into *Ecological Landscape Associations* (ELAs). This allows planners and designers to build an integrative and dynamic

ecological understanding of the site, that can identify trends of landscape transformation and accordingly guides their planning/design process and conceptual strategy sensitively.

2.1.2. Cultural landscapes

In 1925, Carl Sauer defined cultural landscape as: “The cultural landscape is fashioned from a natural landscape by a culture group. Culture is the agent, the natural area the medium, the cultural landscape the result.” (Sauer, 1925; as cited in UNESCO World Heritage Centre, 2003).

In 2000, Parks Canada provided a modern definition to Cultural Landscape, one that was described as extremely relevant in term of subject and spirit to World Heritage: “An Aboriginal cultural landscape is a place valued by an Aboriginal group (or groups) because of their long and complex relationship with that land. It expresses their unity with the natural and spiritual environment. It embodies their traditional knowledge of spirits places, land uses, and ecology.” (Parks Canada, 2000; as cited in UNESCO World Heritage Centre, 2003).

The natural Mediterranean landscape evolves as a multivariate function of independent initial and driving ecosystem condition factors on their dependent soil and biotic variables. The dominating control of man has increased through historical times, seen through agro-pastoral, hunting, gathering, and burning activities in the Upper Pleistocene, have transformed these functions into anthropogenic biofunctions. The cultural Mediterranean landscape was then developed by introducing man-made cultural objects as dependent variables in the latter (Naveh, 1982)

The Mediterranean bioclimatic area experienced a long and intense duration of human-induced disturbance. No other bioclimatic areas have suffered as much as this one from the unfortunate combination of a fragile ecosystem and a long history of land abuse and neglect, all of which have had negative consequences for the land and its inhabitants. The denuded Mediterranean uplands, on the other hand, have demonstrated the resilience and soil-building capacities of native vegetation in a more striking way than any other region. Perhaps nowhere else has it been more clearly illustrated that the people of this area have the ability to not only destroy their ecosystem and deplete their flora and fauna, but also to reclaim them with enough motivation and expertise, using their biological productivity and maintaining their organic and cultural diversity (Naveh and Lieberman, 1994; Naveh, 1998a; as cited in Naveh & Carmel, 2008). Simultaneously, the risks of new neo-technological landscape despoilment are becoming more evident in this region's highly urbanized, touristic, and industrialized areas (Naveh & Dan, 1973; Naveh, 2009).

In their detailed and lucid account of the ecological past of European Mediterranean landscapes, Grove and Rackham (2001) correctly claimed that the prevalent "ruined landscape theory" in the Mediterranean is oversimplified and should not be taken as is. Mc Neill (1992) named these "skeleton ecosystems" in his study of the environmental past of the Mediterranean mountains, implying that there is no way back from their current human-caused destruction. Humans have been treated as "sculptures of Mediterranean landscapes" by Blondel and Aronson (1999). Using several examples, they succeeded to demonstrate how long-term human colonization of the Mediterranean basin had significant effects on the distribution and dynamics of many species, as well as existing biodiversity. As part of their research, they found out

that organisms can evolve life history traits in response to human-induced habitat changes, aligning their finding to the long-term human disturbance of evolutionary significance that was mentioned earlier (Naveh and Lieberman, 1994; Naveh, 1998a; as cited in Naveh & Carmel, 2008). Moreover, if those organisms are subject to strong selection pressures, such as natural and semi-natural human activities of intensive vegetation management and land uses, these can have significant physical implications and evolve even within a few generations (Naveh & Carmel, 2008).

Landscape is the result of human–environment coevolution; it is both a tangible consequence of shaping and an intangible mechanism of making sense of one's surroundings through common meanings and values (reference). The concept of landscape has been adopted by a wide variety of disciplines over the course of its creation, each adding an extra layer of significance. The multiplicity of cumulative meanings currently associated with the term 'landscape' contributes to the word's ambiguity and attractiveness. By examining alternate, cross-cultural interpretations of landscape, anthropologists, archaeologists, and cultural geographers are gradually questioning the arbitrary, anthropocentric Western understanding of landscape. Landscape is viewed as a 'distinct cultural idea' in the resulting body of work, an empirical term closely linked to concepts of place, identity, and heritage. It entails the world being formed collectively over time, in accordance with mutual values and social norms (Makhzoumi, 2009).

If we embrace the concept of culture as encompassing explicit and implicit social patterns of behaviour, encapsulating conventional, historically obtained, adopted ideas and corresponding values, then landscape is one of these systems. As with culture, landscapes are collectively owned by a particular community, traditions, beliefs, and

values, and thus constitute its collective heritage. The term 'heritage' is used here to refer to an all-encompassing definition that includes landscape, traditions, and identity narratives in order to mediate our connection to the past. Landscapes will then encode values and imprint memories on places, transforming them into sites of historical and cultural identity. A landscape-centered approach to heritage acts as an archive of the past and a framework for the future, it allows historical insights to be applied to vernacular, archaeological, and traditional sites where they are used in heritage interpretation, planning, and management (Ibid).

> "By recognizing 'cultural landscapes', we have, almost for the first time, given ourselves the opportunity to recognize places that may well look ordinary but that can fill out in our appreciation to become extraordinary; and an ability of some places to do that creates monuments to the faceless ones, the people who lived and died unrecorded except unconsciously and collectively by the landscape modified by their labours. A cultural landscape is a memorial to the unknown labourer" (Fowler, 2001; as cited in UNESCO World Heritage Centre, 2003).

2.1.3. Biocultural Diversity as Heritage

The Mediterranean biome, which is rich in biodiversity, is generally recognized as a global priority for conservation. This biome is considered as one of the most endangered of Earth's thirteen terrestrial biomes, occupies just 2% of the planet's land surface, but home to over 20% of all plants. Given that this biome has a favorable atmosphere for living and agriculture, only 4.3% of it is officially protected, so it seems difficult to expand that region (Mimica, 2017).

There is a new consensus in the field of planning about the value of biodiversity conservation outside of protected areas, especially in Mediterranean ecosystems, where the environment and coastal conditions make them highly desirable human habitats. They are ideal for agriculture, have pleasant climates, and have picturesque landscapes

that attract tourists. Protected areas, on the other hand, are surrounded by a rural or semi-rural matrix that, in some cases, supports high levels of biodiversity in regions where traditional practices have developed over centuries, such as the European Mediterranean. This rich matrix is under pressure from industrial high-intensity agriculture and urbanization. Biodiversity is related to the structure of a cultural landscape that demands to be remembered in these areas. The paradigm of "biocultural diversity" has been proposed then by the UNESCO and the Convention of Biological Diversity (CBD) to understand the links between cultural and biological diversity in an integrated system at the landscape level (Ibid).

Biodiversity consists of the biological living ecosystem of planet earth, at different levels, "genes, species, and habitats," and is currently threatened globally by human actions. Throughout human history, the diversity of developed cultures, languages, and societies indicated a fundamental expression of a potential life's evolution. Hence, cultural diversity is interdependent with biodiversity under co-evolutionary processes of human life adaptation to certain places and specific environments. Nowadays, the symbiotic relationship of both biodiversity and cultural landscapes, is seen through a unified complex domain concerning the heterogeneity of life's natural and cultural sides, referring to the modern concept of "biocultural diversity" (Maffi & Dilts, 2014).

Human societies tailored different cultural practices as part of their appropriate position and role in the ecosystem to survive different environmental conditions ("their ecological niches"). They succeed in doing so by developing the necessary knowledge of local species, as well as recognizing present relationships of existent ecological entities, and deciphering the systematic functions of ecology while respecting nature by

learning the sustainable usage of its resources. Hence, indigenous stewardship contributed to the preservation of local biodiversity by providing sustainable management measures of existent natural resources. Cultural knowledge is passed from generation to another through practical teachings and language, known as “Traditional Environmental Knowledge (TEK)”. TEK has given communities a sense of place while shaping their different ways of life, moreover, granting them “psychological and spiritual needs” as well as serving them necessary materials for survival. As part of the major cultural diversity portion of the world, Indigenous communities, through constant innovation, conserved their TEK and maintained a direct dependence on their local environment. Environmental degradation is particularly a major problem threatening place-based communities. It hinders their subsistence pattern, deprives them from their personal and social identities and jeopardize their structure, organization, and durability of their society. Simultaneously, Indigenous communities around the world are facing many stresses “social, economic, and political” which are leading to environmental degradation. As a result of these stresses, these groups are often displaced from their traditional lands, alien value structures and modified ways of life are introduced, “traditional knowledge and local languages are lost”. This type of radical change creates an unsustainable relationship with the environment (Ibid).

Supporting local communities and Indigenous peoples’ resilience is seen as an environmental imperative and a human right. Biocultural diversity studies provide the required understanding of the different links between biodiversity and cultural landscapes. Multiple factors that take into consideration these spatial trends and evaluate the maintenance or loss of biocultural diversity have been identified through “global and regional mapping” of these diversities The TEK and the state of linguistic

diversity can be linked to biodiversity indicators to provide us with an overview of biocultural diversity around the world. Additionally, many projects conducted worldwide are refining the conception of local connections between language, culture, and the environment. Simultaneously, Indigenous peoples around the globe have been engaged in a variety of efforts to rehabilitate their landscapes (Ibid), in a variety of ways which include:

1- Protection of sacred landscapes, communal gathering spaces, culturally significant species.
2- Reintroduction of locally adapted seeds and landraces.
3- Sustaining the communal “eco-cultural health”.
4- Documentation and revitalization of “traditional languages and knowledge”.

2.1.4. Visual Landscapes & Psychological well-being

Psychological and mental well-being has strongly and recurrently been directly related to contact with natural elements for decades. It has always been believed by many cultures and architects, perhaps most notably Olmsted, the renowned landscape architect, that nature brings “tranquility and rest to the mind” (Ulrich, 1979).

"Biophilia" is the theory portraying the relationship between humans and natural systems, as well as the human response to the natural environment. The term was first defined and described by Harvard biologist Prof. Edward O. Wilson as "an innate and genetically determined affinity of human beings with the natural world", hence, humans possess a desire to commune with nature and are drawn to it, have an affinity for it, a love or a craving (Griffin, 2004; Wilson, 1986; Wislon 1993).

Frederick Law Olmsted, the father of landscape architecture, went beyond biophilia and questioned the benefits of natural scenery on the human mind. He further explained that natural scenery "employs the mind without fatigue and yet exercises it; tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body, gives the effect of refreshing rest and reinvigoration to the whole system" (Olmsted, 1865; as cited in Kaplan, 1995)

This theory becomes more valid when Ulrich started his research on visual landscapes and psychological wellbeing (Ulrich, 1979). He proved that people who were shown urban scenery in his study reflected lower levels of psychological wellbeing (sadness and anger) than those who were shown natural scenes. The group that was shown natural scenery reflected a consistent pattern of improvement in their wellbeing and had higher positive feelings (playfulness and carefree) (Ulrich, 1979).

Moreover, Ulrich was able to document physiological changes over the human body in response to stress recovery caused by natural scenery. These changes were represented by a "lower blood pressure" and a "reduced muscle tension" (Ulrich et al., 1991). He then discusses the effect of the "psycho-evolutionary theory" and its impact on the emotional arousal responses to natural configurations and content, which induce recovery and restoration (Ibid). Restoration processes can be achieved whether in a passive or active situation.

The notion of psychological and mental wellbeing generated through visual landscapes has been used as an argument in favor of future addition of city parks, urban forestry, and the inclusion of urban fringe wilderness areas. This "nature tranquility hypothesis" has been tested thoroughly, and as it turns out, exposure to nature increases

positive affects in human communities, meaning an increase in feelings of affection and friendliness. In opposition, urban scenes have been proven to majorly increase sadness, as well as consistently (although not as significantly) aggravate feelings of anger and aggression. Therefore, when it comes to land management and the efficient use of land resources, this idea of the correlation between nature exposure and psychological well-being should be kept in the mind of the designer. (Ulrich, 1979)

2.2. Methodology

2.2.1. Ecological Landscape Planning/Design Approach

Mediterranean coastal littorals hold both terrestrial and marine ecosystems; these traditional landscape mosaics are rich in biodiversity. They host of floral and faunal habitats in natural, semi-natural and agricultural in coastal landscape, invite the use of bio-cultural diversity, because traditional management practices are at the heart of Mediterranean biodiversity. The coastal landscape in Anfeh exemplifies a cultural landscape that is rich in biocultural diversity. Using the holistic landscape approach was proven to be successful in the sustainable planning of coastal littorals, because it is responsive to the biocultural diversity that is characteristic in these landscapes and because it addresses the needs of people and the conservation of natural and cultural heritage (Makhzoumi et al., 2012).

Accordingly, the methodology of ecological landscape design (Makhzoumi and Pungetti, 1999) has been applied to the area of study to understand the natural and cultural landscape of the larger context and its biocultural diversity through specific ecological landscape associations which then help in determining trends in landscape transformation of the coastal landscape of Anfeh. The methodology offers a holistic

reading of the physical setting of the targeted site, that serve as a basis for proposing an integrative, strategic, and conceptual model for the protection of the existing coastal biocultural diversity. This model would then be ecologically sensitive and in synergy with the agricultural and cultural uses. (Makhzoumi et al., 2012)

Makhzoumy and Pungetti (1999) propose the ecological landscape design paradigm to investigate the role of landscape architecture in shaping future landscapes that are sustainable, ecologically sound, and influenced by the place of natural and cultural heritage. It directs landscape design and planning should be ecologically, culturally, and aesthetically appropriate. Appropriateness stems from a designer's understanding of the limitations and possibilities of existing ecosystems and resources, whether natural, semi-natural, or cultural. The framework incorporates input from ecology and architecture, both of which are seen as offering parallel and complementary approaches to landscape research and design, despite their methodological differences. Ecology's empirical and informative nature as a science, aids in the task of comprehending current landscapes, while design's intuitive and visionary problem-solving abilities can suggest alternate paths for future landscape creation. The paradigm's four key components are an ecological conception of landscape, alternative principles and goals, ecological landscape design, and a new landscape design approach, all of which are based on the convergence of ecology and design (marrying ecology to design) (Figure 1). The framework is open-ended by nature, allowing for innovative expansion and growth. Information obtained from an ecological understanding of landscape enables for alternative design methods, which in turn allows for better assimilation of ecological knowledge, thanks to the cybernetic input that connects the components of the paradigm.

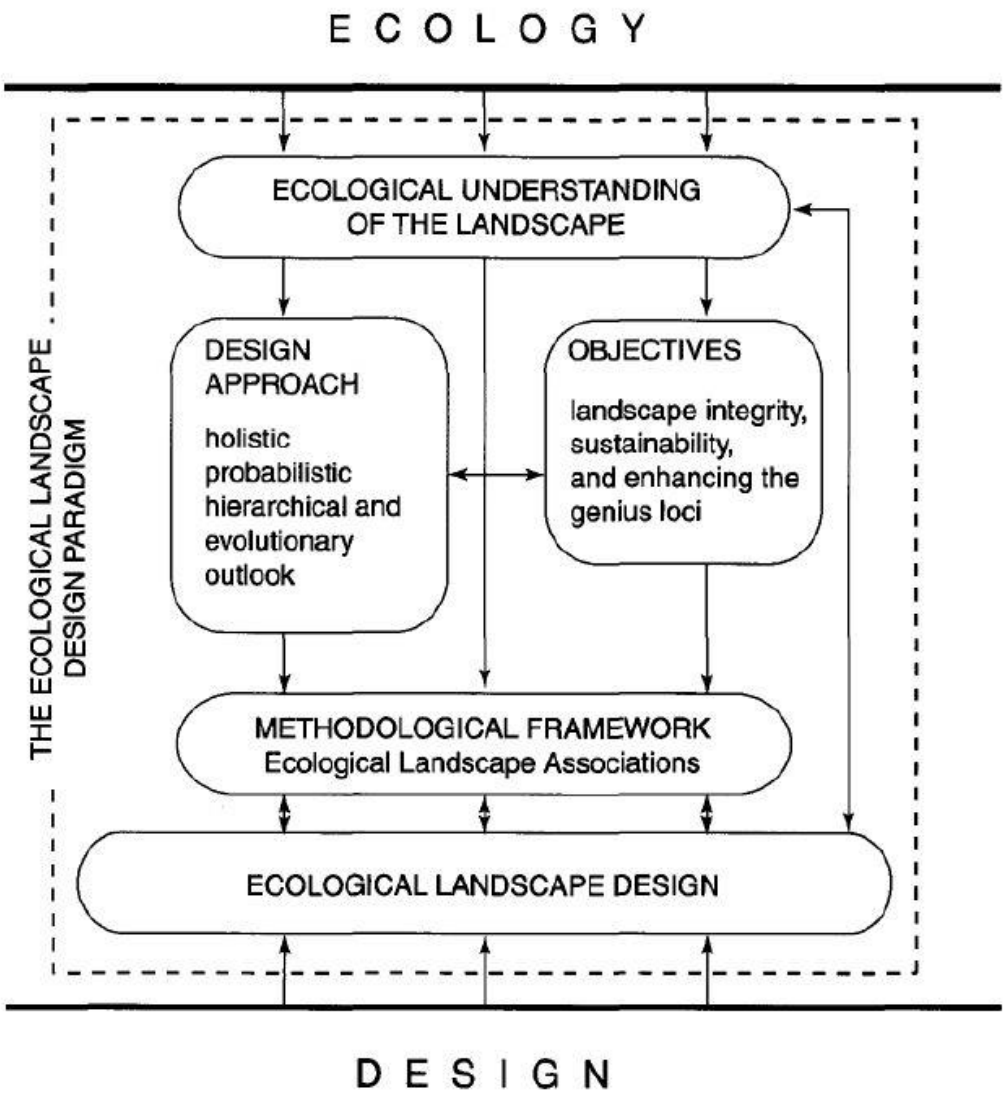


Figure 1: The ecological landscape design paradigm (Makhzoumi and Pungetti, 1999)

Landscape ecology, a branch of modern ecology deals with interrelationships between man and his open and built-up landscapes (Forman and Godron, 1986; Naveh and Lieberman, 1990). The ecological landscape planning approach integrates human-related, socioeconomic, and ecological processes to create a practical and sophisticated approach, appreciated by scientists and disciplines related to the landscape and the environment (Farina, 1998; as cited in Makhzoumi & Pungetti, 1999).

Landscape ecology focuses on land as an object by using a spatial and an eco-systematic approach, with a limited extent to its aesthetic perspectives. In addition, it operates by looking at the landscape as a whole, without delving into its internal details, which surpasses the usual distinction between rural and urban areas, and instead provides an intermediate view of the landscape, in which both rural and urban scenes are intertwined. As suggested by Zonneveld and Forman (1990), landscape ecologists are mainly required to think of landscapes from three different yet mostly overlapping perspectives: first is the visual and artistic aspect of the landscape; second, the chorological aspect, which looks at map patterns through time and the main qualities and attributes of the land; third, the ecological aspect, which sees the landscape as a fully functional ecosystem, and combines the two artistic and chronological views.

2.2.2. Ecological Landscape Associations (ELAs)

Design in the sense of an ecological understanding of the landscape emerges from a holistic understanding of two main sources: natural systems' self-organizing characteristics and cultural systems' spiritual, symbolic, and imagistic structures. Landscape integrity will ultimately be compromised unless the design process can recognize and isolate the complex interplay between natural, semi-natural, and cultural elements of the landscape. Nor will it succeed in contributing to the development of new places. (Makhzoumi & Pungetti, 1999)

Ecological Landscape Associations' approach is both a basis for understanding and a technique for designing the landscape (Makhzoumi, 1996b; as cited in Makhzoumi & Pungetti, 1999). It explores the dynamics of landscape processes and patterns as an open interaction platform, enabling the designer to comprehend the

landscape's inner workings, identify components, and decide which components to integrate into the landscape design. The interaction system creates a deliberate interplay between the various levels of the spatial hierarchy and the landscape's historical development over time. Resulting in the ability to incorporate ecological and cultural awareness into the design process (Ibid).

The term "association" refers to the integrative and interactive relationships that can be found between two or more landscape components, such as abiotic, biotic, and cultural (man-made or man-maintained) elements. The word "ecological" is used to indicate that the associations discovered are not solely visual, but are the product of a holistic, hierarchical, and evolutionary view of the environment (Figure 2).

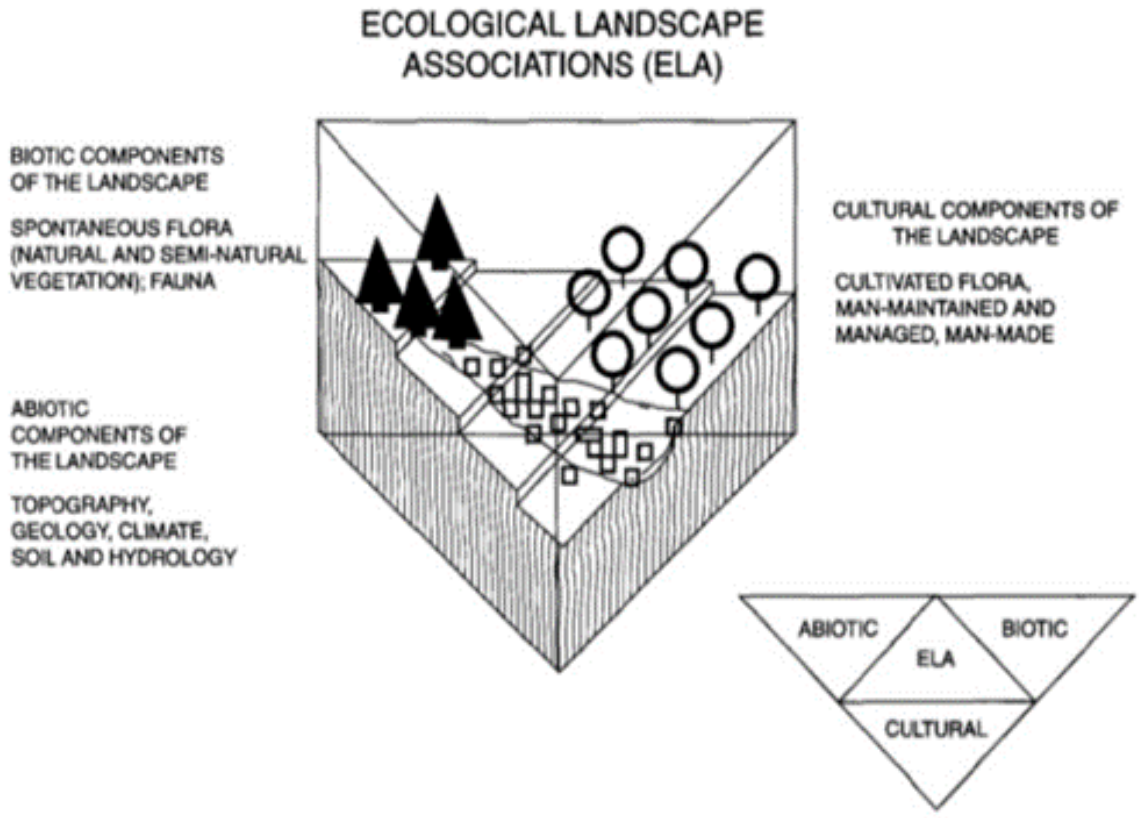


Figure 2: Schematic illustration of the Ecological Landscape Association methodology (Makhzoumi & Pungetti, 1999)

The methodology's holistic approach, interactive evolutionary context, and focus on hierarchical scale linking allow for a better understanding of the natural and cultural processes that shape landscape. Such knowledge and insight provide the designer with the knowledge and insight needed to create designs that are ecologically sound and uphold landscape integrity and sustainability. The ELA has shown that it can be used in a variety of ways. They can be identified at different levels of the spatial hierarchy (for example, landscape area, landscape types, landscape character zone, and landscape parcel), just like ecosystems. (Ibid)

The landscape designer gains an appreciation of natural and cultural landscape processes and how they have influenced the landscape through the process of locating the ELA. This knowledge is then incorporated into the design process, assisting the designer in ensuring the long-term viability of the landscape. The physical and sociocultural background, as well as the scope of the landscape design, determine the basic goals of landscape sustainability. Sustainability at the regional level is dependent on preserving biological diversity, retaining landscape heterogeneity, and safeguarding critical ecological processes (Ibid).

2.2.3. Sustainable Land Management & Land Resources

Traditional land management practices were used in Lebanon before the civil war, including terracing, controlled grazing, forest management, and others. These practices succeeded in protecting the existing natural land resources (including coastal lands). During the civil war (1975-1990), modern land management techniques were introduced, altering the natural and social make-up of the Lebanese lands, including the

general perception of natural resources. Until today, these land resources are being eroded due to unsustainable land management practices and inadequate urban regulations, both of which facilitated urban sprawl and industrialization at the expense of the existing natural landscapes (agricultural fields, forested lands, and natural lands of unique environmental significance) (MOE/UNDP/ECODIT, 2011).

According to the Food and Agriculture Organization of the United Nations (FAO), land resource is defined as "a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface including those of the near-surface climate, the soil and terrain forms, the surface hydrology (including shallow lakes, rivers, marshes and swamps), the near-surface sedimentary layers and associated groundwater reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activities(terracing, water storage or drainage structures, roads, buildings." (FAO, 1997; as cited in MOE/UNDP/ECODIT, 2011). Only a post-industrial symbiosis between nature and human development will ensure a sustainable future of resilient multifunctional biosphere ecosystems in the Mediterranean Region and elsewhere, as well as their biological and cultural diversity. To accomplish this, scientists and professionals must apply transdisciplinary mindsets, that function in collaboration with stakeholders and land users and employ a sustainable land management & land-use planning. Integrative ecological management practices would be effective in reversing more ecosystem destruction only if they aim for new post-industrial symbiotic relationships between nature and its biosphere ecosystems and the evolving global knowledge society, as part of the Mediterranean basin's sustainability revolution. (Naveh, 2009). Moreover, one of the most important aspects of sustainable urban

development is protecting the biocultural diversity of the Mediterranean landscapes which includes the mosaics formed by the natural, semi-natural and cultural layers of the landscape, marine biodiversity, the local self-reliance in food production. Finally, all initiatives focusing on urban agriculture, energy efficiency, high resource productivity and policies for containing sprawl, help in achieving a greener future for cities. (Makhzoumi et al., 2012)

2.3. Advanced GIS Mapping Tools for Ecological Applications

2.3.1. Summary

Having discussed the methodology that will be applied in this thesis, ecological landscape planning/design approach, we will also use a range of digital mapping tools. These tools are necessary to generate all the different complex layers of the landscape that acts as a backbone for visualizing and creating the "natural, semi-natural and cultural" ELAs which are employed by this approach, to facilitate the analysis process and understanding of such a complicated ecological system to planners and designers.

2.3.2. Digital Elevation Models (DEMs)

The United States Geological Survey website (USGS) is the science bureau withing the United States Department of the Interior. The USGS provides the Nation with scientific information to describe and understand the earth while minimizing the loss of life and property from natural disasters. It also manages different resources such as: "water, biological, energy, and mineral etc." and enhance, protect our quality of life (USGS, 2016).

USGS defines Digital Elevation Models (DEMs) as:

> Digital elevation models (DEMs) are arrays of regularly spaced elevation values referenced horizontally either to a Universal Transverse Mercator (UTM) projection or to a geographic coordinate system. The grid cells are spaced at regular intervals along South to North profiles that are ordered from West to East. The USGS acquires bare-earth elevation source data through the 3D Elevation Program (3DEP) and resamples the data to several National Map DEM products for the U.S. and territories. The DEM products include 2, 1, 1/3, and 1/9 arc-second layers, as well as 5-meter DEMs in Alaska and 1-meter DEMs in the conterminous U.S. The 2, 1, and 1/3 arc-second DEMs are logically seamless terrain surfaces in their respective areas of coverage and are produced from the highest quality elevation data held by the USGS (Ibid).

So DEMs are terrain elevation models devoid of vegetation and manmade features, they represent the elevation of the earth's surface through a digital image where each pixel contains an elevation value (3D computer graphics representation of elevation data to represent a terrain). Geographic Information System (GIS) like ArcMap can use DEMs for 3D surface visualization in ArcScene, generating contours, performing viewshed visibility analysis, drainage analysis and many more depending on the track followed by the researcher.

DEMs are the primary input for modeling or processes quantification targeting the earth's topography. They can be used across several areas of development (Croneborg et al., 2020), for example:

1- Water resources management, where the water flow can be determined by observing and analyzing the topography of earth's surface (watersheds, rivers, seasonal streams etc.).
2- Disaster risk management, in crisis situations that are directly linked to elevations and topography such as: "floods, tsunamis, coastal erosion, storms and tidal surges". Access to such elevation and slope maps would allow first responders to be prepared ahead of time of the crisis, to evacuate areas where floods would infill the landscape and save lives.
3- Infrastructure planning and mapping.
4- Road design and construction for transportation.
5- Urban development and environmental planning to assess construction.
6- Drainage and green landscaping.
7- Agricultural planting and irrigation strategies.
8- Ecological modeling to assess ecosystem flora and fauna.
9- Archeological applications such as predictive modelling, visibility and least-cost path analysis, (Herzog & Yépez, 2015); as well as its important role in landscape archaeology analysis by creating viewshed analysis, height profiles drawing and 3D representations (A & Maurizio, 2003).
10- Geological applications like seismic and coastal monitoring.

2.3.3. Hillshade, Aspect and Slope Analysis

After obtaining the DEM, from the USGS website and importing it into ArcMap, using the ArcToolbox, Raster Surface menu we can create many analysis maps like "HillShade, Aspect, Slope" and extract contour lines.

HillShade map: improve the three-dimensional appearance of the terrain by combining light and shadow patterns to construct a three-dimensional image of the surface making it easier to recognize landscape features(Buckley, 2019).

Aspect map: shows the topographic slope's direction of travel. They're usually measured in degrees North (GrindGis, 2017).

Slope Analysis map: GIS tools are typically used to produce this form of map, which depicts the area's sloppiness. The slope value is expressed as a percentage or as an angle (GrindGis, 2017).

2.3.3. Hydrological Analysis

To create the hydrology map, I used the spatial analyst tools, hydrology menu, Fill tool to fill sinks in a surface raster and eliminate small imperfections in the data of the DEM. Then, using the Flow Direction tool to generate a hydrological flow direction map to be used as a base for locating flow accumulation points. Finally, using the Flow Accumulation tool we can define the stream network system. Moreover, using the Stream Order tool we can identify the order of the streams. Using the Basin tool allows further the determination of the catchment area where the water is collected by the natural landscape (GeoDelta Labs, 2019).

2.3.4. Normalized Difference Vegetation Index (NDVI)

NDVI is used as an assessment for land-surface vegetation and as indicator of drought. To determine the density of green vegetation on a piece of land, an observation of the distinct wavelengths (colors) of visible and near-infrared sunlight reflected by the

plants is required. As seen through a prism, the spectrum of sunlight is composed of numerous different wavelengths. Certain wavelengths of the spectrum are absorbed while others are reflected as sunlight hits objects. Chlorophyll, a pigment found in plant leaves, absorbs a large amount of visible light (from 0.4 to 0.7 µm) for use in photosynthesis. The leaf cell structure, on the other hand, reflects near-infrared light well (from 0.7 to 1.1 µm). The greater the number of leaves on a plant, the more these wavelengths of light are affected (Levy, 2000).

The near-infrared and visible light reflected by plants are used to measure the NDVI. Healthy vegetation (to the left) absorbs part of the visible light and reflects the majority of near-infrared light that strikes it, while unhealthy or thinly scattered vegetation (to the right) reflects more visible light and less near-infrared light (Figure 3) (Ibid).

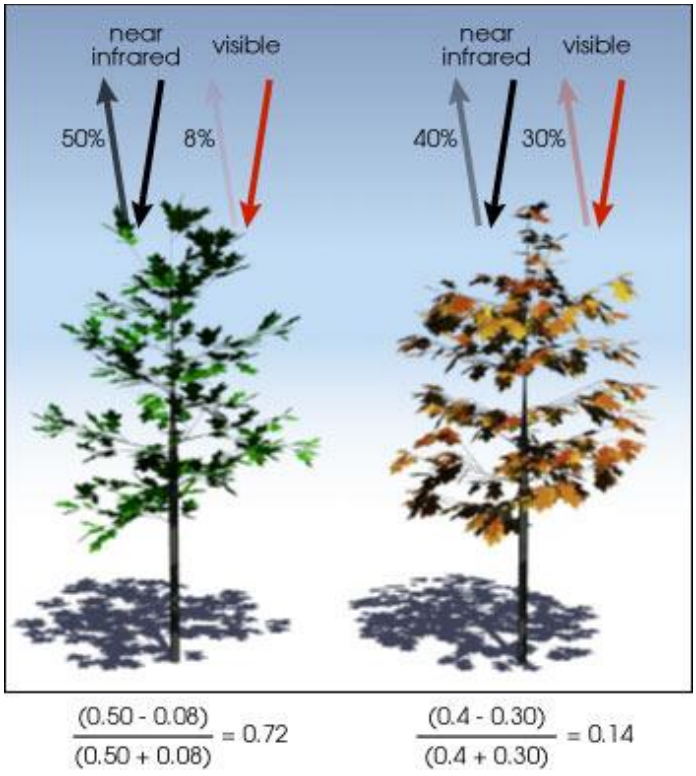


Figure 3: NDVI (Simmon, n.d.; as cited in Levy, 2000)

To quantify the density of plant growth on the Earth, almost all satellite Vegetation Indices use this difference formula: “Near-Infrared Radiation (NIR) minus Visible radiation (VIS) separated by Near-Infrared Radiation (NIR) plus visible radiation”. Hence, NDVI is the function of this formula, written mathematically as follows: “NDVI = (NIR - VIS) / (NIR + VIS)”. The NDVI value for a given pixel is always in the range of minus one (-1) to plus one (+1). When the NDVI value is zero, that means there exist no vegetation or a lack of green leaves, while a value closer to +1 (0.8 - 0.9) indicates a high density of greenery and green leaves (Ibid).

2.3.5. ArcScene

DEM allows to transition from ArcMap which is a two-dimensional (2D) mapping software into ArcScene a three-dimensional (3D) visualization software. This transition helps in recreating the site of study physically into a 3D model, providing an in-depth understanding of the site, overlaying any analysis layer on the original 3D model by making it float on the DEM. Animation in ArcScene is also possible (Figure 4) (Kennelly, 2003).

Figure 4: Anfeh-Hracihe 3D contextual model seen through ArcScene (Author, 2021)

2.3.6. Conclusion

In conclusion, Mediterranean coastal landscapes are complex ecosystems which holds natural, semi-natural, and cultural components, granting them additionally a rich biocultural diversity. To address these complex ecosystems, the Ecological landscape planning/design approach must be used to enables a flexible holistic reading of the physical setting at various scales. Here the advanced GIS mapping tools for ecological applications comes in handy to identify first the complex natural, semi-natural, and cultural layers then mapping them and finally grouping them into Ecological Landscape Associations (ELAs). This enables planners and designers to develop an integrated and dynamic ecological understanding of the site, help them in identifying patterns of landscape transformations and guiding their planning/design process and conceptual strategy in a sensitive manner.

CHAPTER 3

UNCOVERING REGIONAL TRENDS IN COASTAL LANDSCAPE TRANSFORMATION

3.1. Background: State of the Lebanese Coastal Landscape

A general understanding of the state of the Lebanese coastal zone is necessary to act as a reference for verifying the resulting ELAs and their conditions.

Natural coastal landscape: Nature in coastal Lebanon is threatened by land degradation. For instance, coastal woodlands are diminishing due to overgrazing, charcoal production, and urbanization, restricting their presence to few coastal enclaves, slopes close to rivers (Al-Kalb, Damour, and Awali rivers) and seasonal water streams. Only a few seascapes (combination of a coastal zone & sea) are protected in Lebanon; Tyre's Beach Reserve (in the South) and Palm Islands (to the North) are currently the only Marines Protected Areas (MPAs). Some river basins are also declared as areas under protection by a decree enacted by the Ministry of Environment.

The Regional Environmental Assessment (REA) of Lebanon's coastal zone identified 12 sensitive sites that should be conserved due to their unique ecological and landscape values. These sites include Akkar beach, dunes, and agricultural plains, Ras El-Cheqaa, Amsheet-Jbeil coastal scape, Nahr Ibrahim Valley, Nahr El-Kalb valley and river mouth, Damour agricultural plain, Rmeileh beach, Tyre beach, Iskandarouna, and Naqoura (CAMP, 2002).

The marine biodiversity includes hundreds of Mediterranean species like phytoplankton, algae, lichens, mushrooms, phanerogams, zooplankton, benthos, and 21 species of cephalopods, four species of turtles, and six marine mammals. Many of these

species originated from the Red Sea or the Indo-Pacific Ocean. The coast's chaotic urban sprawl of marinas and large tourism complexes poses a threat to this biodiversity, primarily when many of these projects are implemented without a prior Environmental Impact Assessment. Other threats are due to untreated wastewater discharges and agricultural effluents.

The Lebanese fisheries sector is weak, holding an average of 4,000 fishers based in the ports of Tripoli, Byblos, Jounieh, Beirut, Saida, Sarafand, Tyre, and Naqoura. These fishers are among the most impoverished communities in Lebanon, with a meagre monthly income, leaving them unable to improve their lifestyles or equipment. The consumption of fish in Lebanon is estimated to be 75 million U.S. dollars per year, while the national production accounts for only 7 million U.S. dollars (4,500 tons of fish) and is far below the internal consumption level. Therefore, Lebanon imports more than 10,000 tons of fish from the Gulf countries, Morocco, and Turkey (Ibid).

Semi-Natural Components of the Coastal Landscape:

The Southern agricultural plains are the largest going from Akkar Plain and Abu Ali Valley to the North (context of the study area), reaching Naqoura to Ghazieh in the South. The largest remaining natural zones are situated between Amioun and Jounieh to the North and between Tyre and Naqoura to the South. These agricultural or natural zones are threatened by permanent urbanization pressure. Moreover, due to the lack of a clear national policy guiding and supporting agriculture, existing agricultural plots are gradually replaced by industrial and human development. An example portraying this scenario lies in the South of Beirut, where the fields of citrus, bananas, and vegetables shrunk due to urban expansion (Ibid).

Touristic Entities of the Coastal Landscape: In Lebanon, real estate developers target the coastal zone for implementing large-scale development projects and making high-profit returns. To lease the public maritime domain for such a project (like marinas, tourism resorts and commercial facilities), a permit application is submitted to the MOWPT after being examined by the Higher Council of Urban Planning (HCUP), as well as by the Ministry of Environment (MOE). An Environmental Impact Assessment (EIA) is supposed to be secured, in order to respect the environmental conditions for protecting beaches and other natural resources by law (Article 2.20 of Law 690/2005 to safeguard the environment). The EIA process was fully integrated in 2002 as part of the permit submission to the MOPWT, but unfortunately many project proponents were able to bypass both MOWPT and MOE and secure their permits directly from the Council of Ministers (COM). Although many coastal projects get the approval for construction, they are still controlled by the EIA and many get downsized or even canceled due to public pressure or municipal decisions challenging the COM. (MOE/UNDP/ECODIT, 2011).

Industrial Entities of the Coastal Landscape: Many industrial facilities exist on the coast to benefit from faster transportation towards their destinations, from which 20,000 units are found on unclassified industrial zones or without legal permits. Thus, the industrial sector is considered a significant pollution source, a hazard to human health, and posing a threat to the maritime domain & biocultural diversity. Industries with the highest pollution levels include tanning and dressing of leather, Cement manufacturing, production of gas products, and fertilizers compounds manufacturing. Moreover, in the absence of preventive measures of air pollution and industrial wastewater treatment systems, alarming levels of pollution in the air, groundwater, or coastal waters were

observed near many industrial hotspots like Chekka's cement production plant (among the study zone) that discharges chemicals (asbestos) in the sea and other suspended particulate matter polluting the air, hazardous to human health and nature.

Other examples of industrial facilities include Selaata's fertilizers production plant that discharges phosphates and sulfates in the sea; Zouk Mosbeh-Zouk Mkayel tanning and leather dressing plant discharges bleaches and dyes in the sea; Dora contains an industrial area for petroleum storage and tanneries; Shoueifate, Ain Anoub, and Bchamoun industrial areas discharge wastewater to the sea through the Ghadir stream; Ghazieh coast and the Sayniq river contain tanneries and soap factories. (CAMP, 2002)

3.2. Overview of the Study Area: Anfeh-Hraiche Context

To study the biocultural diversity of Anfeh and Hraiche, it is necessary to analyze and understand the processes and trends that are impacting the larger context. Only then would it be possible to identify trends that are transforming the landscape of Municipal Anfeh-Hraiche. The context we shall explore includes 6 municipalities surrounding Anfeh and Hraiche (8 municipalities in total), to include Chekka, Barghoun, Zakroun, Qalhat, Balamand and Al-Qalamoun municipal boundaries (Figure 5).

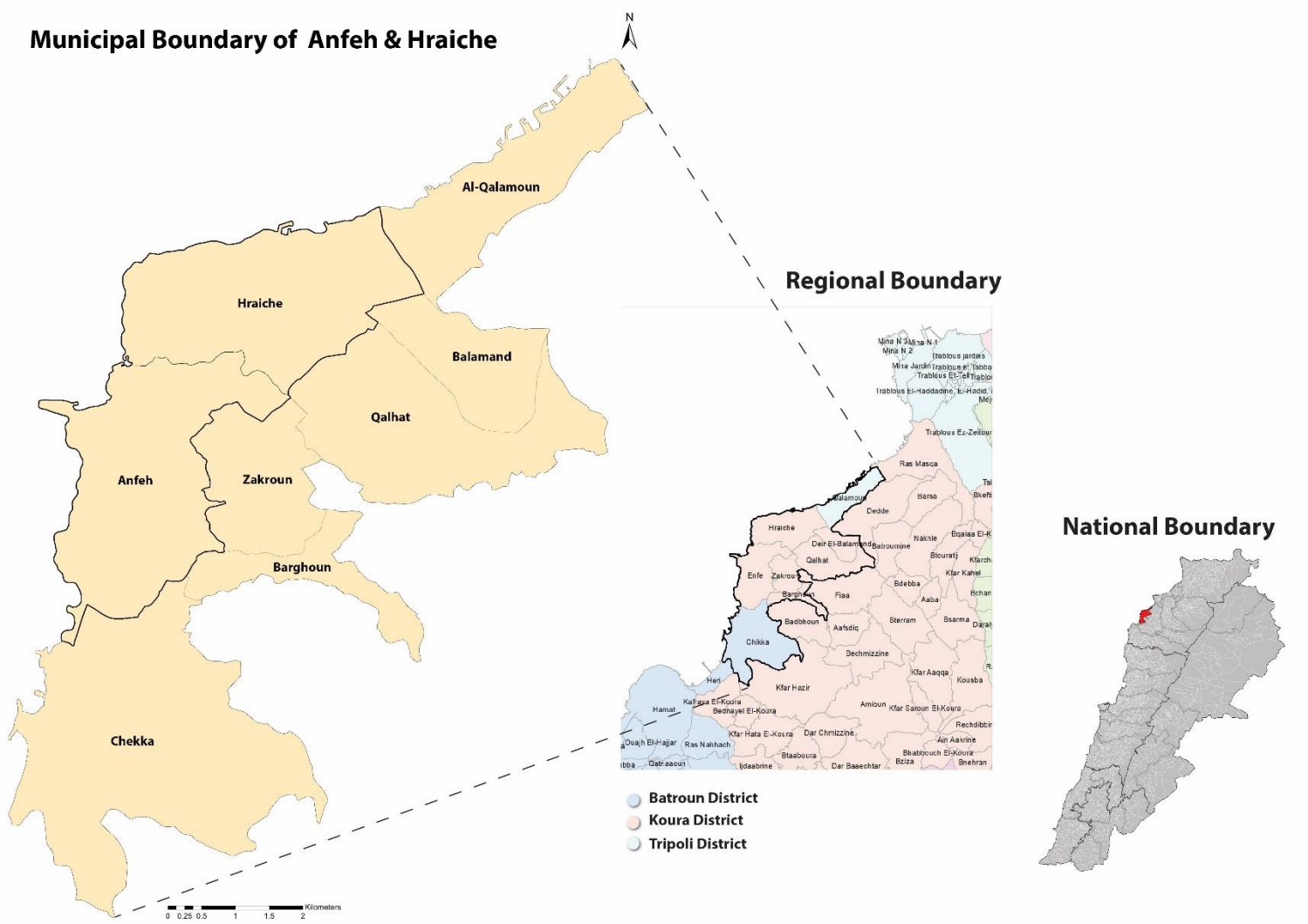


Figure 5: National, Regional, and Municipal Boundaries of Anfeh-Hraiche (Author, 2021)

3.3. Mapping the natural and cultural layers of the study Area

Applying the ecological landscape planning/design approach, I will be looking first at the mapped horizontal layers of the landscape, these include abiotic (topography, geology, soil, hydrology), biotic (landcover), and cultural (settlement density) components; second, binding the later layers vertically into meaningful categories of ELAs; third, by quantifying the obtained data and analyze it to extract the trends of landscape transformation for each municipality of the study area; finally concluding with the threat levels of the trends observed for each municipality and their effect on the biocultural diversity of the contextual landscape.

"Abiotic" components are recognized in ecology and biology as "non-living chemical and physical factors of the environment" that affect ecosystems and its resources are generated from the "lithosphere, atmosphere, and hydrosphere" (Diffen.com, 2021) (Figure 6).

Referring to the four maps that portray and analyze the topography of the context such as the DEM, the Hillshade, the Aspect and Slope analysis it is noticed that the coastal mountain range (or coastal hilltops) rise-up to 423 meters above sea level, leaving a relatively flat (0-10 % slope) and wide coast that narrows to the North allowing for a wide range of land uses. The coastal plains are bounded from the East by foothills which are sloping gently until becoming steep (20-30 % slope) once reaching the hilltops and are interrupted by many seasonal streams according to the hydrology map. Seasonal streams are "temporary waterways that cease to flow at some point in space and time along with their course". They are an important asset to agriculture, moreover they create green corridors for biotic migration and habitats for the existing biodiversity (Kaletová et al., 2019).

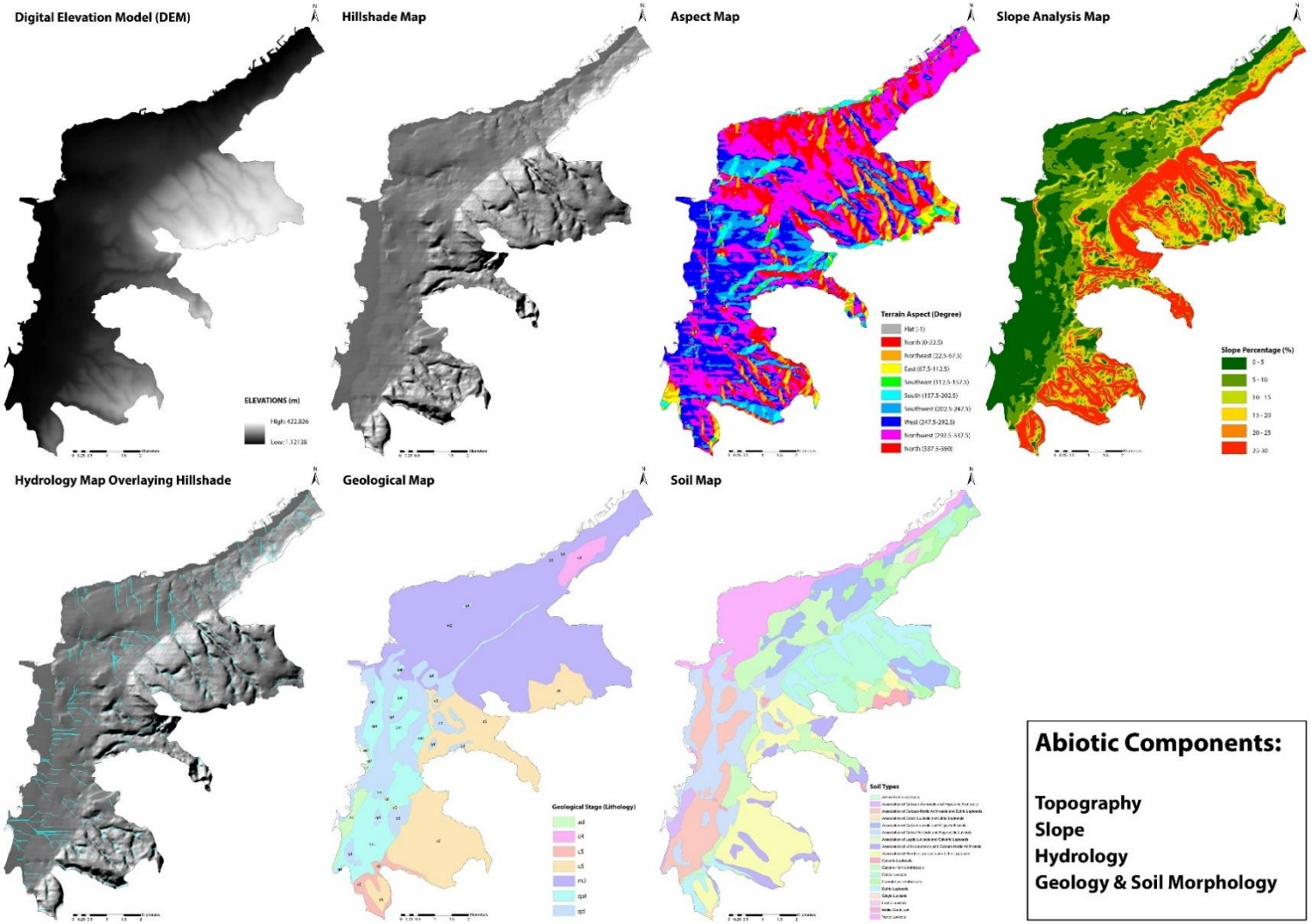
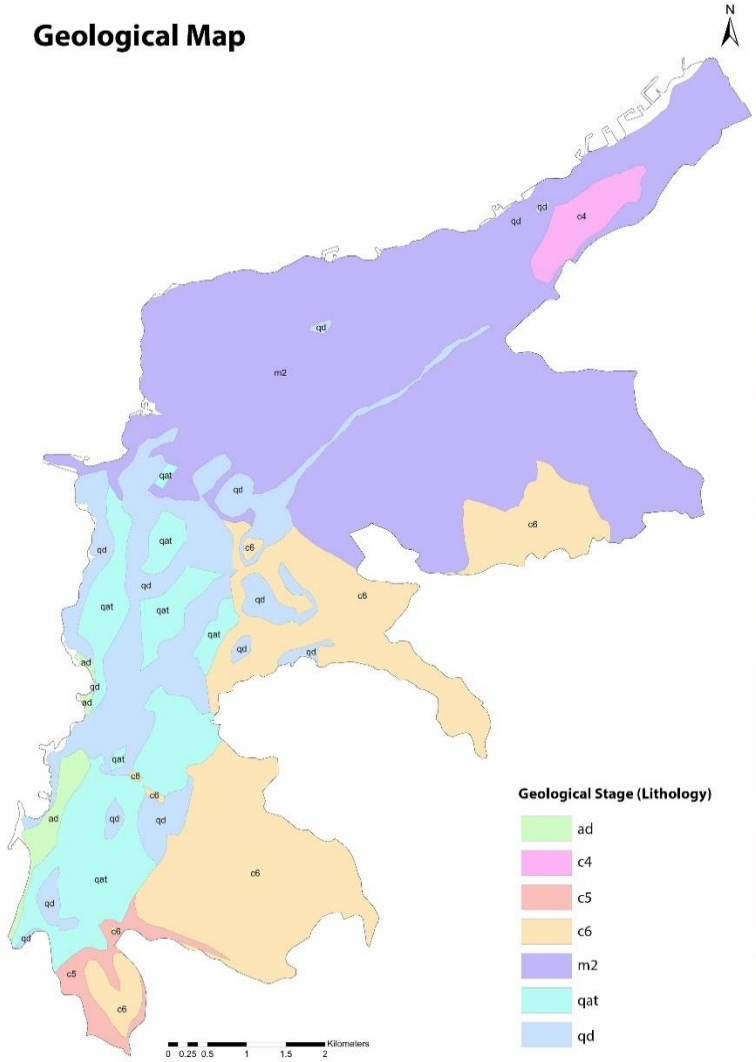


Figure 6: Abiotic Components (Author, 2021)

According to the Geological Map (Direction des affaires geographiques (Lebanon), 1945; Faour, 2004), the new soil map of Lebanon (Darwish et al., 2006) and The Food and Agriculture Organization of the United Nations (FAO) soils portal (FAO, 1974); both Geological and Soil map of the context were created.

It was found that (Figure 6): The Northern coastal plains, foothills, and hill tops of the study area, contain Limestone, Dolomitic Limestone and Sandstone. The Limestone provides abundance of Calcite making the soil alkaline,while the Dolomite provides some additional magnesium and calcium for plant uptake (PRO-MIX, n.d.) and the Sandstone provides essential nutrients a plant needs to thrive as well as allowing for easy water filtration and space for roots to grow (Dempsie, 2014). The later indicates that the soil found in this area will be fertile and would allow for agricultural activities.

The central and Southern coastal plains of the study area contain migrated weathered material, landslide deposits and sandstone. These deposits create soils that have a very shallow profile depth, are susceptible to erosion, often modified profoundly by human activities, including cutting and filling, manuring, and irrigated agriculture (Encyclopaedia Britannica, 2000). These deposits are extremely low in all essential nutrients most especially phosphorus, they create coarse textured soils of low water holding capacity, and rapid permeability (USGS, 2005). The Southern foothills, and hill tops of the study area contain Marly Limestone and Marl and Chalky Marl. Marl is used for the manufacture of cement (attracts quarries), also acts as a soil conditioner and a neutralizing agent of acid in the soil Plants thrive on them if given enough water and nutrients but are usually poor in plant foods, are well drained and quarried for cement production (Burkholder, 1996).



Geological Stage (Lithology)	Soil Types	Description & Significance	Percentages Over Study Area
Miocene (m2)	Vertic Luvisols, Calcaro-Hortic Anthrosols, Association of Calcic Luvisols and Regic Anthrosols, Calcic Luvisols, Eutric Leptosols, Cumuli-Luvic Anthrosols	Limestone, Sandstone. The Limestone provides abundance of Calcite making the soil alkaline, while the Sandstone provide essential nutrients a plant need to thrive as well as easy water filtration allowing roots to grow	47.10%
Senonian (c6)	Calcaric Leptosols, Association of Rendzic Leptosols and Lithic Leptosols, Calcaro-Hortic Anthrosols, Association of Lithic Leptosols and Calcaro-Hortic Anthrosols	Chalky Marl soils are considered as soil conditioner and acid soil neutralizing agent. Plants thrive on them if given enough water and nutrients but are usually poor in plant foods and are well drained	23%
Quaternary (qd)	Association of Calcaric Arenosols and Hypoluvic Arenosols, Association of Calcic Vertisols and Hypocalcic Luvisols	Landslide deposits, Sandstone and weathered material. They are extremely low in all essential nutrients most especially phosphorus. They are coarse textured soils, have a low waterholding capacity, and rapid permeability	13.70%
Quaternary (qat)	Association of Calcaro-Hortic Anthrosols and Eutric Leptosols, Calcaro-Hortic Anthrosols	Alluvium and Talus stream deposits in valleybottoms and rock waste derived from cliffs. These soils have a very shallow profile depth, are susceptible to erosion, often modified profoundly by human activities, including cutting and filling, manuring, and irrigated agriculture	11.40%
Cenomanian (c4)	Leptic Luvisols, Calcaro-Hortic Anthrosols, Association of Leptic Luvisols and Calcaric Leptosols	Limestone, Dolomitic limestone. A combination of calcium carbonate and magnesium carbonate and serves two purposes in the growing medium. Primarily, it neutralizes acids in the growing medium but also provides some additional magnesium and calcium for plant uptake	1.90%
Turonian (c5)	Eutric Leptosols, Association of Calcic Luvisols and Lithic Leptosols	Marly Limestone and Marl. Marl is used for the manufacture of cement. A soil conditioner and acid soil neutralizing agent	1.70%

Figure 7: Geology & Soil Study (Author, 2021)

"Biotic" components are "the living or once-living organisms" of an ecosystem, they can reproduce and are generated from the biosphere (Diffen.com, 2021). These components can be "spontaneous flora, natural and semi-natural vegetation and fauna" (Makhzoumi & Pungetti, 1999). The landcover map was created from the dataset of the land cover units, mapped in 2005 using IKONOS (satellite) and verified in 2010 by the CNRS (CNRS, 2021). "Biotic" components include not only spontaneous flora and fauna, but also cultivated landscapes. Agriculture these lands include "Olive groves, Citrus fruit trees, agriculture units and terraces, field crops, farmlands, protected agriculture (tents) and salinas" while for natural lands these include: "Oak and pine forests and scrublands". The NDVI analysis was used to assess the current condition of the vegetation. It was immediately remarked how the urban sprawl was affecting the vegetation near it as well as the quarries which show a more spreading damage to nearby landscape and vegetation.

The cultural components are those "man-made and man-maintained" (Makhzoumi & Pungetti, 1999). By analyzing the 1962 Lebanese army map (Directorate of Geographic Affairs, n.d.) and comparing it to the existing new urban footprint of 2021, the density map was created for the entire region. The map shows how different densities of urban sprawl, industrial entities with private ports and complex resorts with sea embankments are taking over the coast, also indicating the spread of material extraction sites (quarries) across the context.

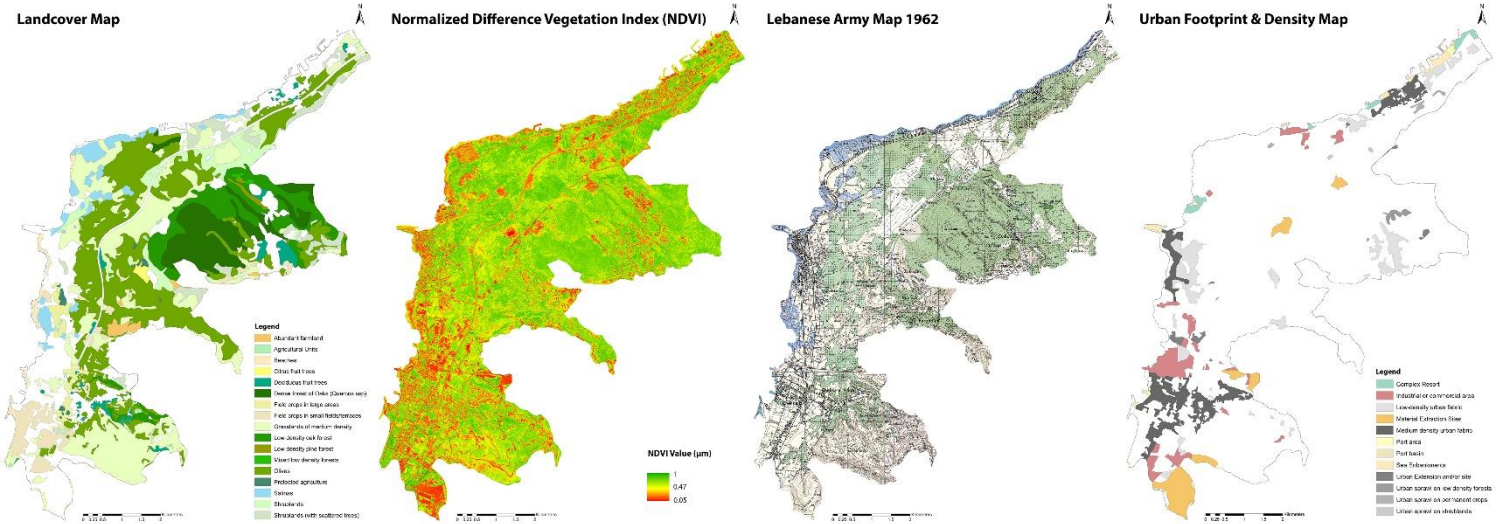


Figure 8: Biotic and Cultural Components (Author, 2021)

3.4. Mapping the Ecological Landscape Associations: Components of the Cultural Landscape

- Natural ELAs include (Figure 9):

ELA 1 – Coastline / Natural Coast:

The natural coast has almost vanished on both the North and Southern coastlines, only small patches remain towards the middle of the Southern coastline. The coast is mostly rocky (limestone) for this association, contains vermetid reefs and small littoral caves. The later also hosts habitats for the marine biodiversity which makes it ecologically valuable. (Trovato & Panayot Haroun, 2018).

ELA 2 – Coastal Plain / Scrublands:

A scrubland is "a land on which the natural vegetation is made of shrubs, herbs, grasses and geophytes"(ECstep, n.d.). Mediterranean scrublands are located on a proximity to seacoast, where they adapt to the ocean's wind and its salty air granting them endemic qualities (endemic species of plants), making them ecologically valuable. Some of the identified plants include:

> "***Narcissus serotinus*** L. , ***Arisarum vulgare*** subsp. ***veslingii*** (Schott) K.Richt, ***Anthemis palaestina*** Reuter, ***Echium glomeratum*** Poir, ***Enarthrocarpus arcuatus*** Lab, ***Ceratonia siliqua*** L., ***Paronychia echinulata*** Lam., ***Polycarpon succulentum*** (Del.) J. Gay., ***Polycarpon tetraphyllum*** L., ***Atriplex patula*** var. ***palaestina*** Eig, ***Halimione portulacoides*** (L.) Aellen., ***Sedum littoreum*** Guss, ***Euphorbia peplis*** L., ***Euphorbia peplus*** L., ***Frankenia hispida*** DC., ***Coridothymus capitatus*** (L.) Reich, ***Salvia verbenaca*** L., ***Scilla automnalis*** L., ***Glaucium flavum*** Crantz, ***Papaver dubium*** L., ***Plantago coronopus*** L., ***Limonium angustifolium*** (Tau) Dege, ***Limonium sieberi*** (Boiss.) Kuntze, ***Echinochloa colona*** (L.) Link, ***Polygonum equisetiforme*** Sib. & Sm, ***Polygonum maritimum*** L., ***Valantia hispida*** L, ***Valantia muralis*** L., ***Hyoscyamus albus*** L., ***Hyoscyamus aureus*** L., ***Parietaria cretica*** L."(Tohmé & Tohmé, 2015).

Moreover, they provide habitats for the existing biological diversity like sea birds and insects. This association seems to have a scattered pattern along the entire

coastal plain, it is noticeably less dense on the Southern plains while it holds a more connected pattern and generally denser on the Northern plains.

ELA 3 – Hillside / Scrublands:

This association is dominant on the scrubland's category, it is a lot denser than the one on the coastal plains. It is evident as large, connected patches near the Southern boundary, as well as to the Northern boundary while it scatters in small patterns towards the middle and North-eastern boundary of the context. These lands are characterized by a slope percentage that starts gently at 5% and reaches a steeper state at 30%. This association also hold many endemic species of plants and generates green corridors for the biological diversity of the context which makes it ecologically valuable and an important asset for the biodiversity.

ELA 4 – Coastal Plain / Woodland

A woodland is a "land covered with wood or trees, also known as forest" (Biologyonline, 2019). Only a very small patch of this association remains on the Northern coastal plain. This association is ecologically valuable for hosting bird habitats and acts as a green lung for nearby urbanization.

ELA 5 – Hillside / Woodland

This association is found as a small, scattered pattern on the South-eastern hillsides. This association is ecologically valuable for hosting bird habitats and acts as a green corridor for the biodiversity. This association is characterized by a steep slope with a percentage ranging from 15% to 30%.

ELA 6 – Hilltop / Woodland

This association is the most dominant of the woodland category, it is found on the North-eastern top hills as a large patch, its trees are mostly oaks while others are pines. This association is ecologically valuable for hosting bird habitats and creates many green corridors for the existing biodiversity.

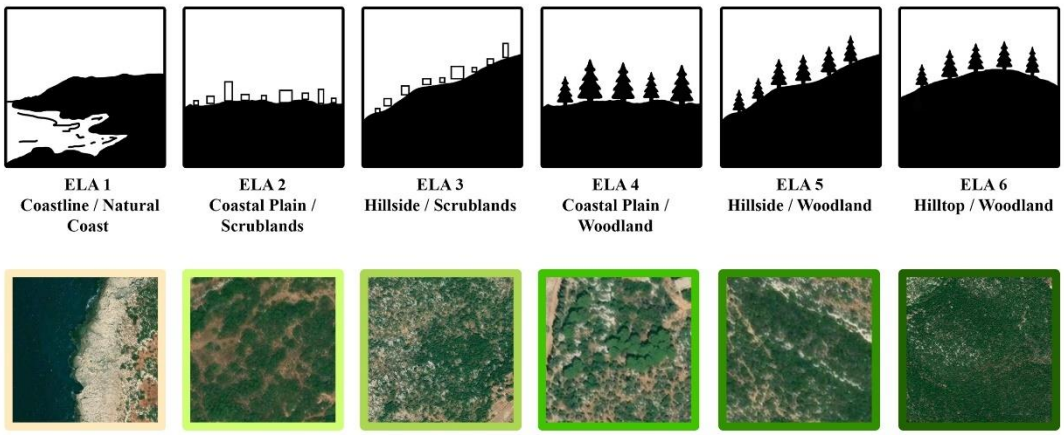


Figure 9: Natural ELAs

- Semi-Natural ELAs include (Figure 10):

ELA 7 – Coastal Plain / Agriculture

Agriculture in the Mediterranean is known for its “biocultural activities” which include crop farming, animal husbandry and a mixture of other activities. The Mediterranean climate conditions (erratic rainfall and mild temperatures) determines the region’s type of agriculture, which in this case allows for olive groves, citrus species, and other field crops to dominate and thrive on a fertile alkaline soil while influencing both the traditional and commercial side of agriculture (Chand, 2014). This association is evident in large, connected chunks along the entire coastal plain, but at certain areas they split leaving small patches of ramifications. This association is also part of the cultural heritage of the context and is ecologically valuable.

ELA 8 – Hillside / Agriculture

The irregular topography of the Mediterranean (mountain chains, hills) makes agricultural activities and farming difficult. Terraced landscapes (agriculture terraces) were then introduced as a solution to the later problem and a sustainable traditional solution of utilizing land efficiently, as this method saves both soil and water (annesleyb, 2011). This association is found on hillsides in large and small patches along the entire context, it's ecologically valuable and part of the cultural heritage of the context.

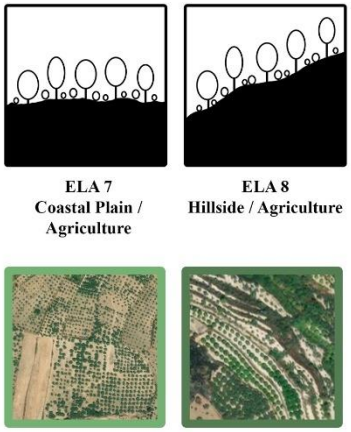


Figure 10: Semi-Natural ELAs

- Cultural ELAs include (Figure 11):

ELA 9 – Coastline / Salinas

On the low-lying Mediterranean coastal zone, man was inspired by salt crystals found in tide pools (or rock pools) containing brine (water strongly impregnated with salt), that drove him to create the first basic artisanal salinas (or salt pans) on the rocky coastlines where onshore winds prevail. The traditional salinas found on the regional context are constituted generally from large compartments that contain and distribute sea water to the smaller compartments (or crystallizers) where water evaporates, and salt crystals starts forming due to "sunlight, fluctuating temperature between day and

night and the coastal winds". Human presence is required to monitor the process along all stages of salt-making, that includes sweeping the compartments full of brine, stirring the salt when it appears and finally collecting and storing it in bags (a skill that is considered as intangible heritage). Salt is collected 4-5 times a year, the season starts from June and end towards September when it starts raining (Walmsley, 1999; History, heritage and civilization of Lebanon, 2021). Salinas were created in order to fulfil the needs of the local communities and for their important value in trading. The later are an important element of the cultural heritage identity of the Mediterranean basin; they hold a unique landscape allowing for soft tourism, as well as contributing to the Mediterranean biodiversity in creating feeding grounds and hosting habitats for seabirds and finally they are considered as a non-polluting industrial activity which adds to its sustainability (Petanidou, 2003). Traditional salinas are currently disappearing in the Mediterranean region due to the demand for industrializing and urbanizing prime lands where they currently exist (Walmsley, 1999). This association is located only on the North-western part of the context in small patches, it's ecologically and socio-economically valuable for its possibly to play an important role in the local economy when functional.

ELA 10 – Coastal Plain / Salinas

Historically, during occupation times salt extraction was prohibited (specifically during the Ottoman period) and huge fines were given to whoever is working in salinas, that led local communities to create salinas on the coastal plains between agricultural lands and olive groves to hide them from colonial troops and keep producing salt (Sehnaoui, 2004). This association is located in small patches on both the Western and

North-western coastal plains. This association is both ecologically and socio-economically valuable.

ELA 11 – Coastline / Urban Fabric

The urban fabric encroaches on the coastline, creating an artificialization of the natural coast. This association is found along the entire coast in small patches, that become denser towards the Northern coastline. This association is made of industrial entities, resorts, chalets, private ports, and sea embankments.

ELA 12 – Coastal Plain / Urban Fabric

This association is the most dominant on the urban fabric category, it corresponds mainly to urban settlements (towns) built on proximity to the sea historically and expanded with time on the coastal plain for its flat topography.

ELA 13 – Hilltop / Urban Fabric

This association is the least dominant among the urban fabric category, usually located at high elevations and includes residential entities.

ELA 14 – Foothill / Quarries

This association is characterized by the presence of a land rich in Limestone rocks, marl, clay, and chalky soils which makes principal ingredients that are used in cement manufacturing. This association is concentrated mostly on the Southern foothills of the context, and spreads in small, detached patches towards the Northern boundaries, threatening human life, the natural landscapes and the ecology of the region.

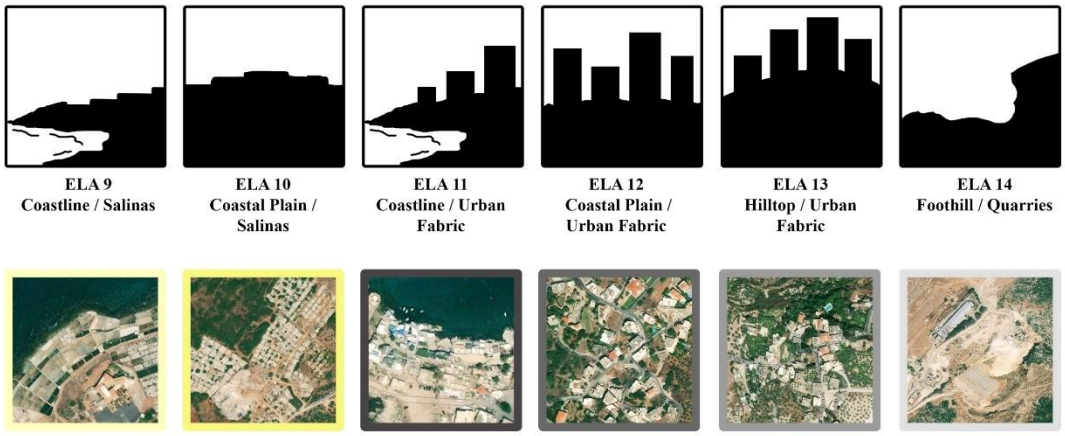


Figure 11: Cultural ELAs

3.5. Introduction of the application of ELAs to Anfeh Hreiche and the other municipalities

3.5.1. Municipal Anfeh

Anfeh is located approximately in the middle of the Western coastal plain of the study area, bounds Hraiche from the North. The coastal town belongs to the Koura District of Lebanon, has an area of 5 km² and a population of 6,000 inhabitants (Cityfacts, 2020). Anfeh is known for "Ras al-Qalaat promontory" which is said to be the old Crusade sea castle (fortress) of Anfeh (LEBANONUNTRAVELLE, 2020), and "Ras el-Mlelih Promontory" known for holding the first salinas dug in natural rocks which is threatened by industrial expansion spreading from Chekka; both sites are placed on the UNESCO World Heritage indicative list (UNESCO, 2019). Anfeh's settlement is historically rich in monuments and archeological remains as well as many religious entities such as churches, convents, and monasteries. Anfeh will be discussed in more detail in the 4th chapter.

Anfeh’s remaining natural coast features 2.64% of the total municipal boundary, the latter is almost fully occupied due to the haphazard urban expansion on both the coastline and the coastal plain, the urban fabric represents 23.10% of the municipality. The urban fabric is split into chalets, complex resorts, sea embankments, residential, commercial, and industrial entities. Scrublands exist in Anfeh on both the coastal plain and on hillsides, they make about 21.98%, they are in good condition according to the NDVI but they are threatened of being shrank due to urban expansion. Agriculture on coastal plains and agricultural terraces on the hillsides dominate in Anfeh they make about 45.37% of the municipal area, that indicates the importance of agriculture as part of the cultural heritage and identity of this town. The later include olive groves, fruit trees, farmlands, field crops, and protected agriculture. Urban expansion is also threatening to shrink these agricultural associations that are on proximity to the urban fabric of the town. Salinas exist on both the coastline and coastal plains of Anfeh, they make 6.06% of the municipal area and are threatened mainly by complex resorts, industrial entities and urbanization. Salt extraction remains an important socio-economic activity and a well-known cultural heritage of the town. A quarrying site exists on Anfeh’s foothills, representing 0.85% of the municipal area, it spreads North to Hraiche and if it remains active might threaten surrounding areas especially the natural components like the scrublands and human life ().

Trends of landscape transformation identified:

- Haphazard expansion of Urban, touristic, and industrial entities over the natural coast.
- Shrinking of both agricultural lands and scrublands due to urban expansion and densification (threat towards cultural landscapes).

- Threatened natural scrublands and human life due to quarrying activities.
- Salinas are threatened due to urban expansion, complex resorts and industrial entities taking over their land (threat towards cultural local economy and heritage).

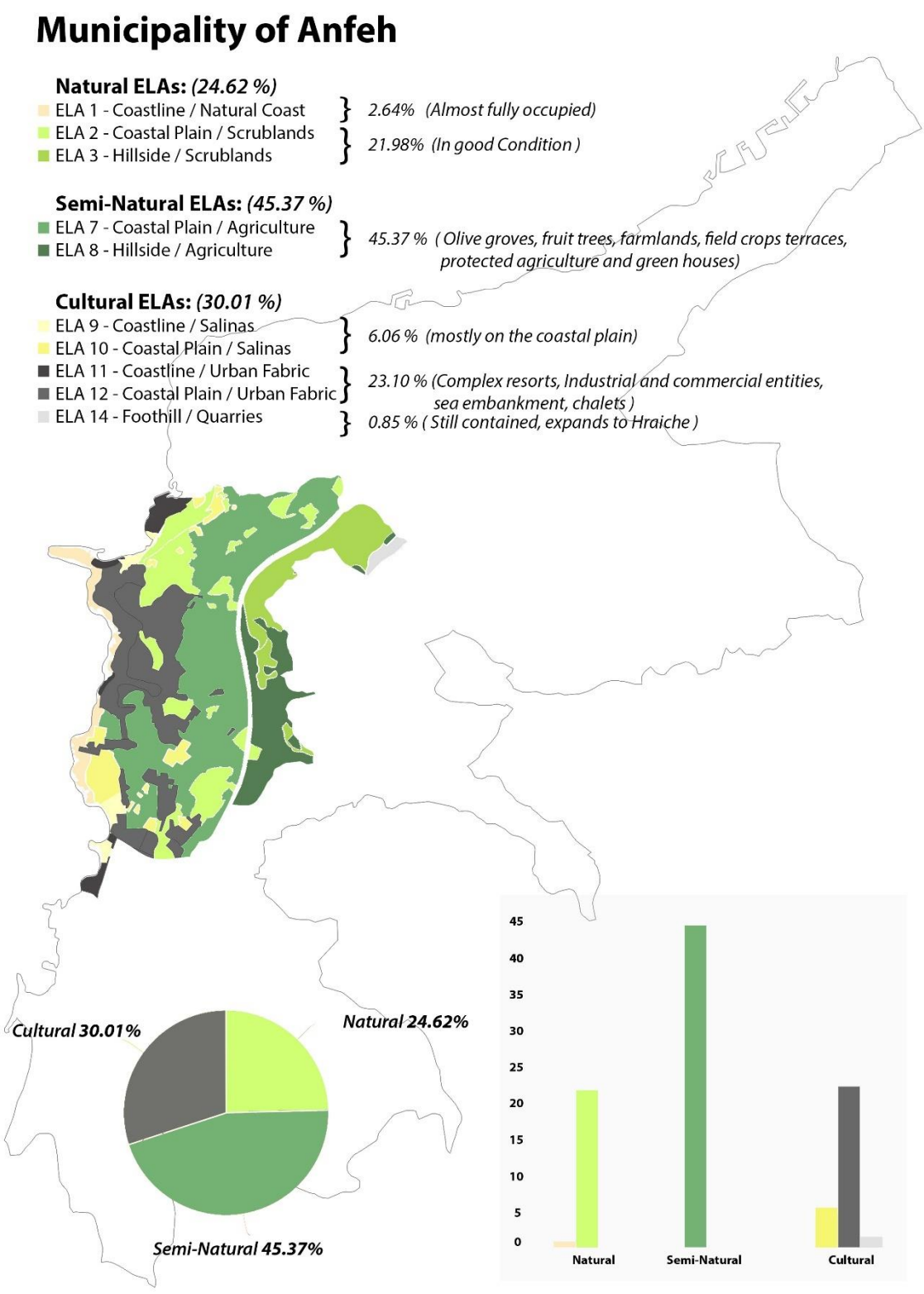


Figure 12: Municipal Anfeh (Author, 2021)

3.5.2 Municipal Hracihe

Hraiche is located on the North-western coastal plain of the study area, bounds Anfeh from the South (and is considered as the natural extension of Anfeh). The seaside rural town belongs to the Koura District of Lebanon, has an area of 4.746 km² and a population of 407 inhabitants (Cityfacts, 2020). Hraiche is known for Ras Al Natour promontory (placed on the UNESCO World Heritage indicative list) that contains both "Deir Al-Natour's" monastery and the largest salinas of the country (UNESCO, 2019). Moreover Hraiche holds large agricultural fields of olive groves were “Our Lady of Kharayeb” Church was built on the remains of a Melkite church from the Byzantine era (UOB, 2012). Hraiche is currently threatened by a Real estate development project that could takeover part of its natural coast and salinas (Malia, 2018; Ayoub, 2018), also many Industrial facilities are invading its territory (Association of Lebanese Industrialists, 2017). Hracihe will be discussed in more detail in the 4th chapter.

Hraiche’s remaining natural coast features 0.6% of the total municipal boundary, the latter is mostly dominated by coastline salinas and haphazard urban expansion on both the coastline and the coastal plain, the urban fabric represents 4.66% of the municipality which indicates that Hraiche is a rural town with a low population density and small settlements. The urban fabric is split into complex resorts, sea embankments, private ports, jetties, residential, commercial, and industrial entities. Scrublands exist in Hraiche on both the coastal plain and on the hillsides, they make about 44.21% (dominating the category of natural associations), they are in good condition according to the NDVI and might be threatened by future haphazard urban expansion. Woodlands also exist on both the coastal plain, and on the hilltops, they are minimal and make about 2.25% in Hraiche’s municipal boundary, but they expand outside the boundary to

the East to reach Qalhat and Balmand. Agriculture on the coastal plains of Hraiche, makes about 35.79% of the municipal area, that indicates the importance of agriculture as part of the cultural heritage and identity of this town. The later include mostly olive groves and fruit trees. Future urban expansion and densification could threaten the agricultural lands if they are not well protected by laws and zoning plans, but for the moment they are in good condition. Salinas exist on both the coastline and coastal plains of Hracihe, they make 12.10% of the municipal area and are threatened mainly by real estate development, complex resorts, industrial entities and urbanization. Salt extraction remains an important socio-economic activity and a well-known cultural heritage of the town especially near "Deir Al-Natour's" monastery. A quarrying site exists on Hraiche's foothills, representing 0.24% of the municipal area, it spreads South to Anfeh and if it remains active might threaten surrounding areas especially the natural components like the scrublands and woodlands, also it might affect human life.

Trends of landscape transformation identified:

- Haphazard expansion of Urban, touristic (complex resorts, jetties and sea embankments), industrial entities and real estate development over the natural coast and existing salinas.
- Shrinking of both agricultural lands and scrublands due to the low urban expansion and densification (threat towards cultural landscapes).
- Threatened natural scrublands, woodland, and human life due to quarrying activities.
- Salinas are threatened due to urban expansion, complex resorts, industrial entities and real estate development projects taking over their land (threat towards cultural local economy and heritage).

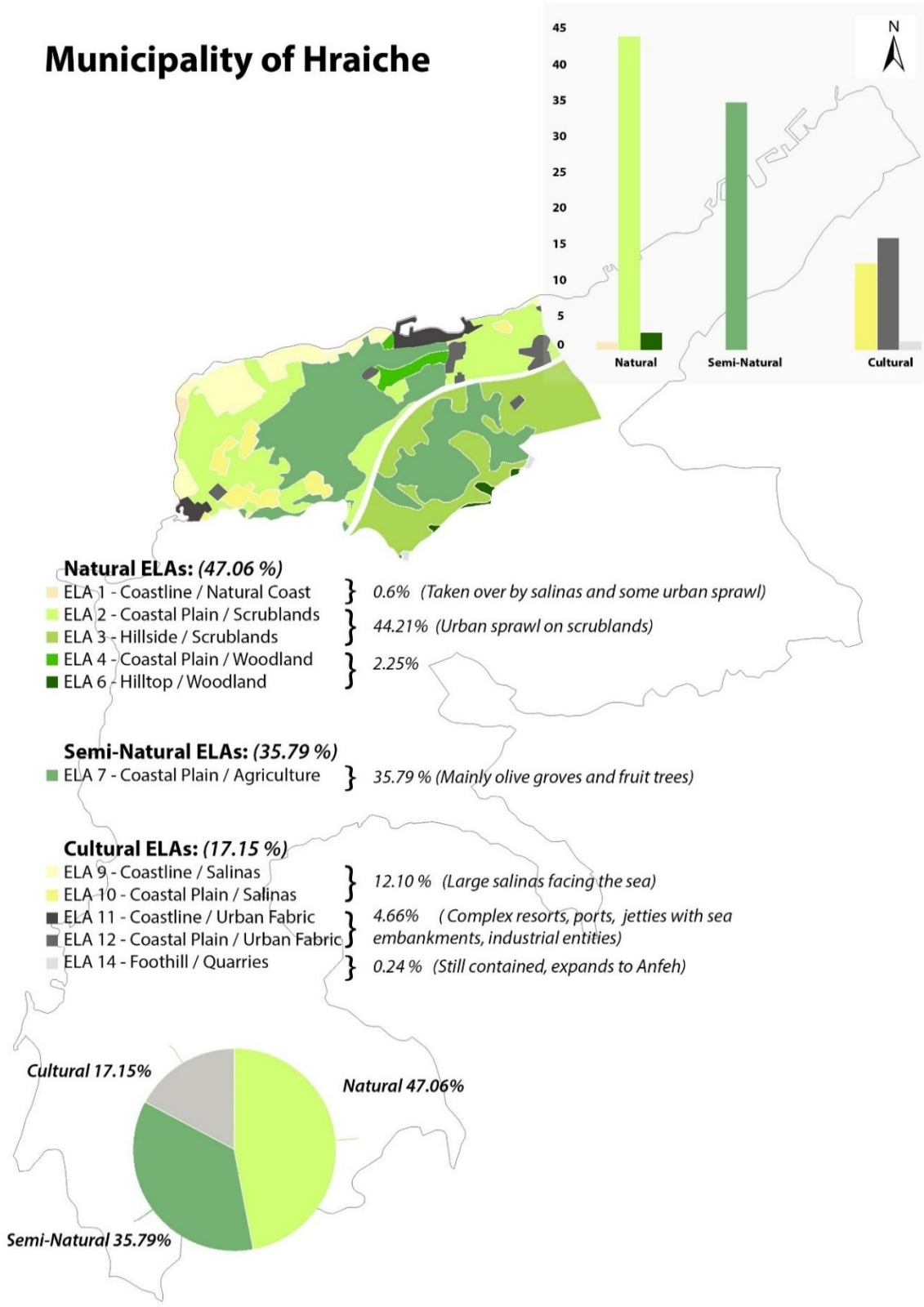


Figure 13: Municipal Hraiche (Author, 2021)

3.5.3 Municipal Al-Qalamoun

Al-Qalamoun municipality is located in the coastal plain north of Hraiche. The coastal town belongs to the Tripoli District of Lebanon, has an area of 3.461 km² and a population of 15,000 inhabitants with approximately 5,000 Syrian refugees (Nehmat, 2020). It is said that Al-Qalamoun has a history that spans for 5000 years, in which it was a village dependent on agriculture and salt extraction. It became a center of metal works due to the creation of its traditional handicrafts, metal works, hand crafted copper and brass shops by many metal workers who came from souk Al-Nahhasin in Tripoli and settled there near the coastal road. Still the town is famous for its olive oil, lemon, orange flower water, rose water and fish markets. Al Qalamoun is threatened by urban expansion, as well as by the sole focus on tourism where many resorts took over the natural cost and eliminated the remaining salinas (QALAMOUN MUNICIPALITY, 2016).

Al-Qalamoun's remaining natural coast features 0.003% of the total municipal boundary, the latter is fully dominated by urban sprawl targeting both the coastline and the coastal plain, the urban fabric represents 31.88% of the municipality. This dense urban fabric is split into complex resorts, sea embankments, private ports, jetties, residential, commercial, and industrial entities. Scrublands still exist in Al-Qalamoun on both the coastal plain and on the hillsides, they make about 37.4% (dominating the category of natural associations), coastal plain scrublands are pressured by urban expansion. Agricultural lands on the coastal plains and hillsides of Al-Qalamoun, make about 26.21% of the municipal area, that indicates the importance of agriculture as part of the cultural heritage and identity of this town. The later include mostly olive groves and fruit trees. The agricultural lands of the coastal plain are already shrinking due to

urban expansion and densification. Salinas exist on the coastlines of Al-Qalamoun, they make only 1.5% of the municipal area and are taken over by touristic resorts. The later indicates that the practice of salt extraction is vanishing as a cultural heritage and a previous identity of this town, also that the new economical focus is directed towards touristic resorts and industrial entities.

Trends of landscape transformation identified:

- Haphazard expansion of Urban, touristic (complex resorts, jetties, private ports and sea embankments) and industrial entities over the natural coast and existing salinas.
- Shrinking of agricultural lands and scrublands due to the dense urban sprawl (threat towards cultural landscapes).
- Salinas are almost lost due to urban expansion, complex resorts and industrial entities taking over the coastline (threat towards cultural local economy and heritage).

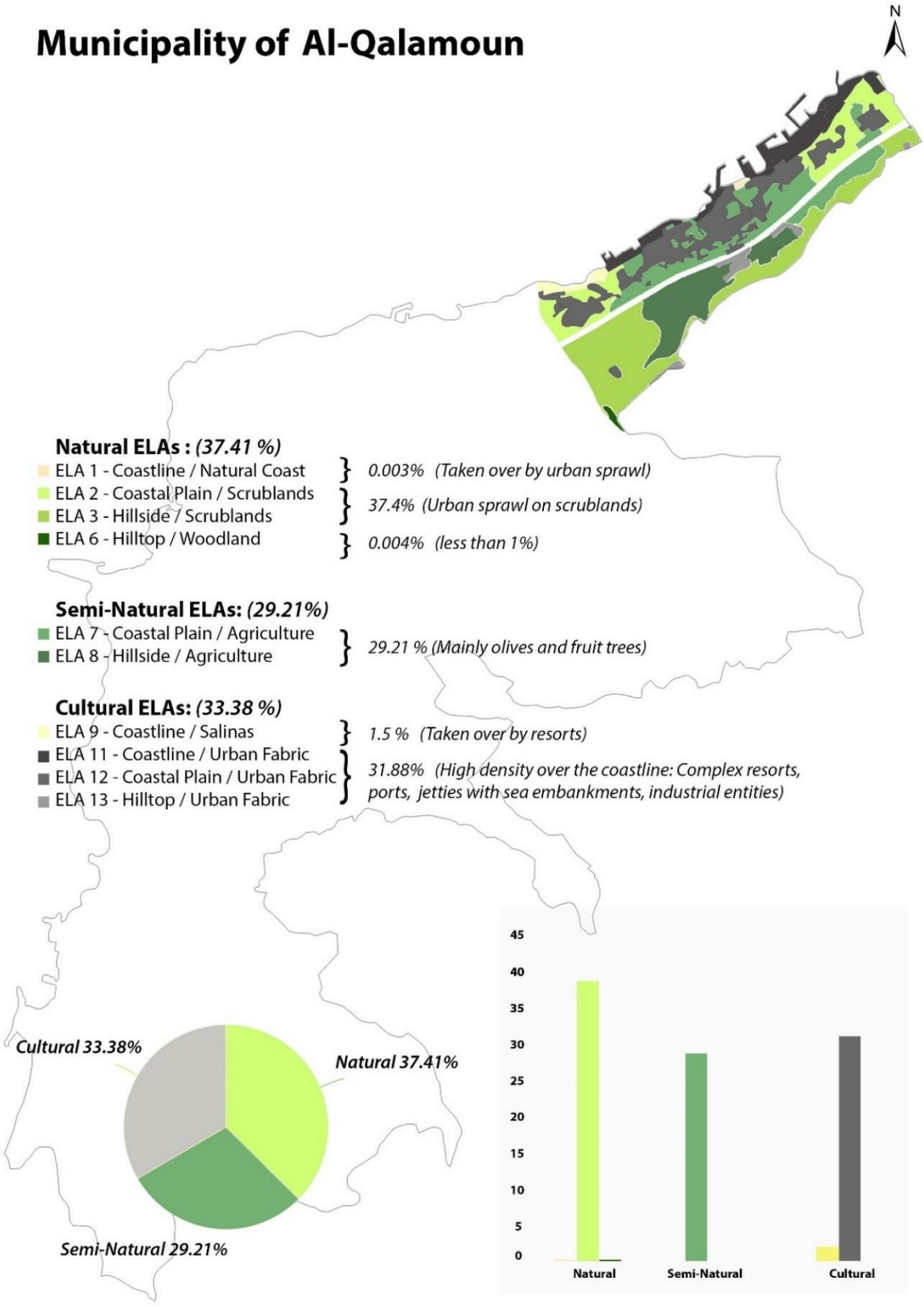


Figure 14: Municipal Al-Qalamoun (Author, 2021)

3.5.4 Municipal Balamand

Balamand is located on the North-eastern foothills of the study area, east of Hraiche. The village belongs to the Koura District of Lebanon, has an area of 1.939 km², an altitude of approximately 300 meters above sea level and a population of 65 inhabitants (Cityfacts, 2020). As part of the Greek Orthodox Church of Antioch, the Balamand monastery, historically known as "Belmont, Bellimontis ultra Mare, or Bellus-Mons" was found in 1157 by Cistercian monks in Balamand and was dedicated to the Virgin Mary and St George. The latter granted the area a unique religious identity for praying and contemplating, but during the 1970's the village became a complex of both religious and educational entities which includes the St John of Damascus Institute of Theology, the secondary school of Our Lady of Balamand and the University of Balamand that was founded in 1988 by the Orthodox Patriarch Ignatius IV of Antioch on the grounds of the monastery (Greek Orthodox Patriarchate of Antioch and All the East, 2019).

Balamand is rich in natural associations, its hilltop woodlands represent 72% (dominating this category) while hillside scrublands represent about 7.2% of the total municipal boundary. Both associations are threatened by quarrying activities on the foothills represented by 1.1% of the municipality. The hilltop, low density rural urban fabric represents 16.7% of the municipal area, the later consists of educational, residential, and religious entities. Hillside agricultural terraces make about 3% of the municipal area.

Trends of landscape transformation identified:

- The natural environment, more precisely the hilltop woodlands and hillside scrublands are threatened by a foothill quarry. The later might also threaten human life (quarry dust).

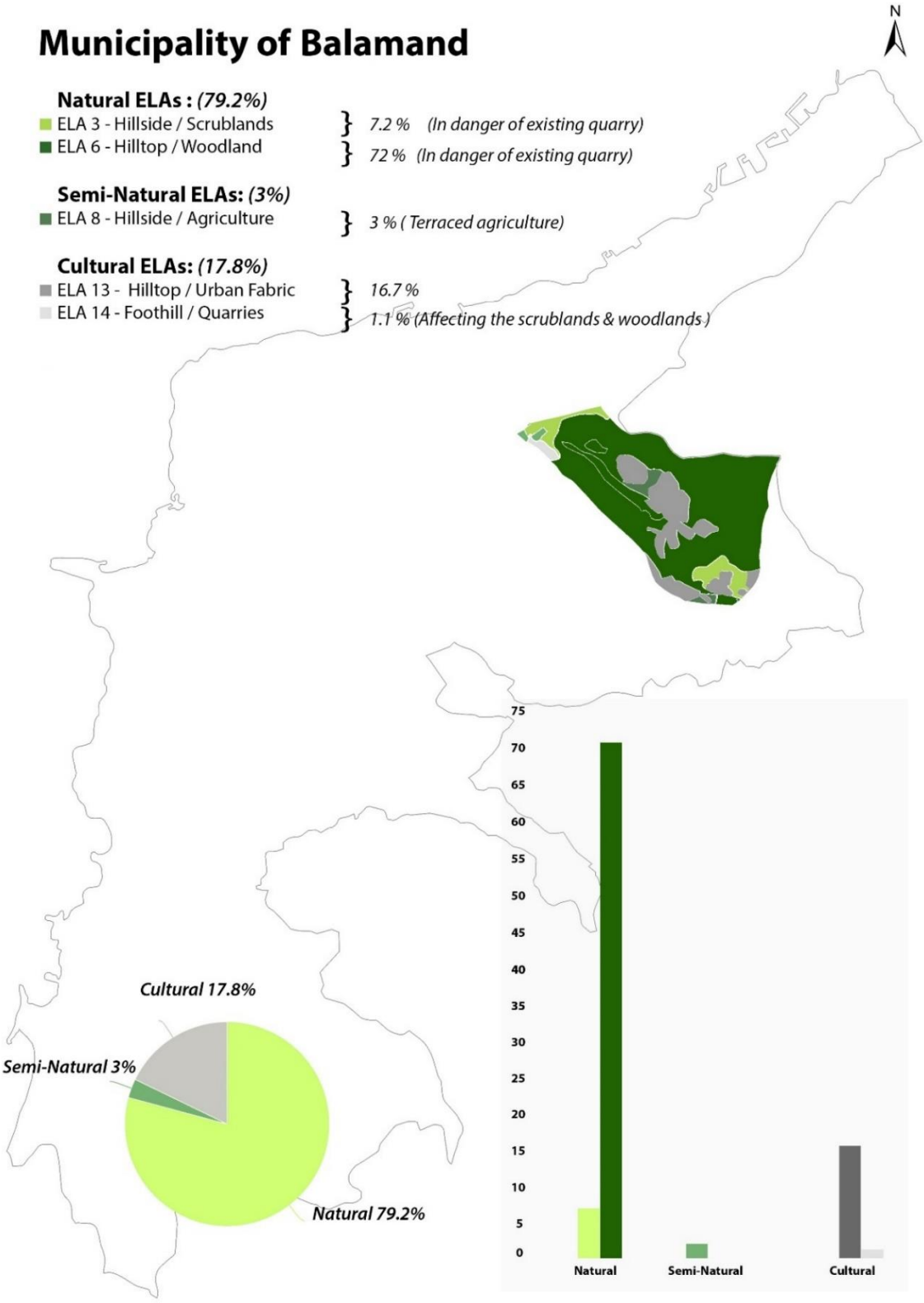


Figure 15: Municipal Balamand (Author, 2021)

3.5.5 Municipal Qalhat

Qalhat is a Greek Orthodox village, located on the Eastern foothills of the study area, bounds Hraiche from the East. The village belongs to the Koura District of Lebanon. It has an area of 4.679 km², an altitude of approximately 350 meters above sea level and a population of 855 individuals (Cityfacts, 2020). It is said that the village used to hold many castles from which its name is derived the name also means attacks and revolution. Qalhat was mentioned in Ramsees II messages in the third century BC, indicating that it dates back to time of the pharaohs. Many of the families abandoned the village during World War I and later during the Lebanese civil war, leaving their agricultural activities, “olives, vineyards, figs, lemon and honey”. Presently, the population has returned to the village, which is growing, urban sprawl encroaching on agricultural lands (National News Agency - Ministry of Information Lebanese Republic, 2015).

Qalhat is rich in natural associations, its hilltop woodlands represent 57.6% (dominating this category) while hillside scrublands represent about 10.4% of the total municipal boundary. Only the woodlands are threatened by quarrying activities on the foothills represented by 1.1% of the municipal area. The hilltop, low density rural urban fabric represents 6.7% of the municipal area. Hillside agricultural terraces make about 24.4% of the municipal area, that indicates the importance of agriculture as part of the cultural heritage and identity of this town. The later include mostly olive groves, vineyards and fruit trees.

Trends of landscape transformation identified:

- The natural environment, more precisely the hilltop woodlands are threatened by a foothill quarry. The later might also threaten human life (quarry dust).

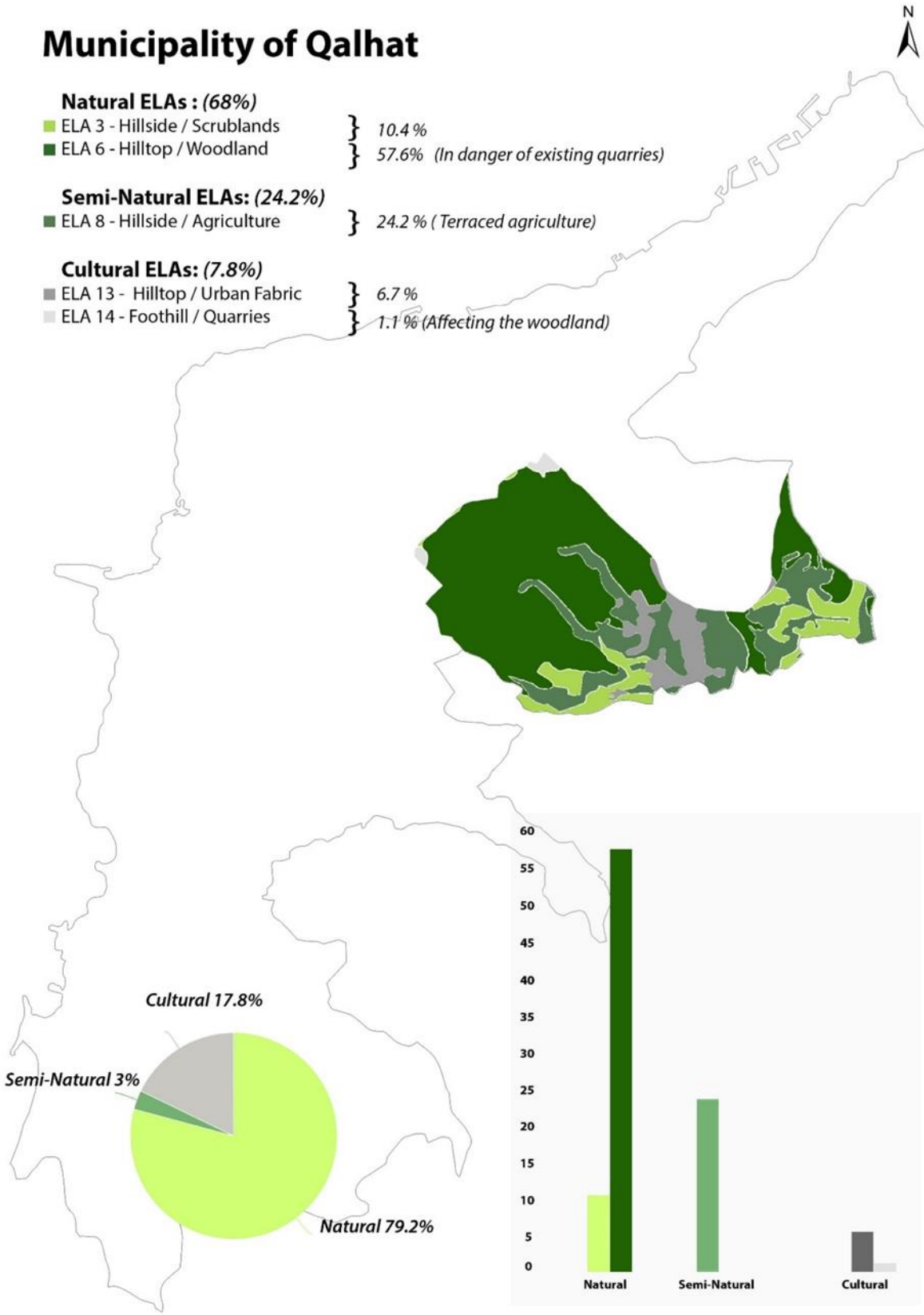


Figure 16: Municipal Qalhat (Author, 2021)

3.5.6 Municipal Zakroun

Zakroun is a Maronite village located on the Eastern foothills North of Barghoun, bounds Anfeh from the East. The village belongs to the Koura District of Lebanon, has an area of 2.199 km², an altitude of approximately 120 meters above sea level and a population of 215 individuals (Cityfacts, 2020). The villagers rely on agricultural activities like olive cultivation to produce olive oil, as well as orange picking and producing orange blossom water from its flowers (The Monthly Magazine, 2016). The environment of Zakroun is similarly threatened by industrial pollution from Chekka. The village is located at "3 km from the Cimenterie Nationale (cement factory), 6 km from the Holcim cement factory, 13 km from the phosphate fertilizer factory, 2 km from a quarry and 5km from another"(Melki, 2017). Moreover, a claim that the "Cimenterie Nationale" was seeking to change the designated zoning use to industrial in order to expand its quarries into Municipal Zakroun.

Zakroun is rich in natural associations, its hilltop woodlands represent 22% while hillside scrublands represent about 23% of the total municipal boundary. Both associations are threatened by quarrying activities on the foothills represented by 2% of the municipality. The hilltop, low density rural urban fabric represents 2.5 % of the municipal area. Hillside agriculture makes about 50.5% of the municipal area (terraced non-terraced lands and greenhouses), that indicates the importance of agriculture as part of the cultural heritage and identity of this town.

Trends of landscape transformation identified:

- The natural environment, more precisely the hilltop woodlands and hillside scrublands are threatened by a foothill quarry. The later might also threaten human life (quarry dust).

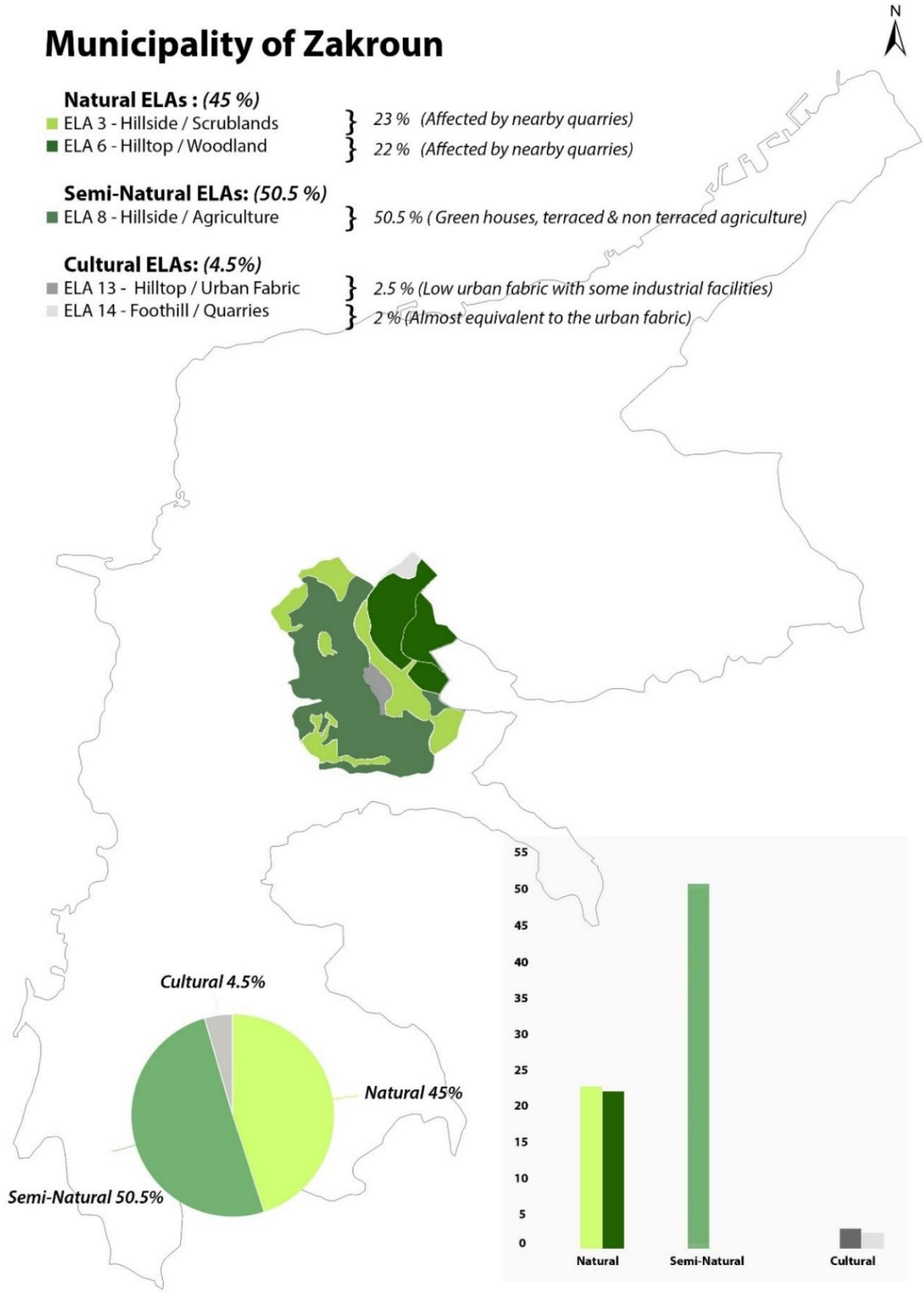


Figure 17: Municipal Zakroun (Author, 2021)

3.5.7 Municipal Barghoun

Barghoun is a small village, on the Mount Lebanon foothills, defines the eastern edge of the study area. The village belongs to the Koura District of Lebanon, has an area of 1.423 km² and a population of 166 individuals (Cityfacts, 2020). Its Northern boundary, contain some archeological remains near the existing olive groves, said to belong to a church from the 12th to the 14th century and dedicated to Saint Barbara. The sacred landscape is the site of pilgrimage and religious ceremonies on the 4th of December to celebrate Saint Barbra (LEBANONUNTRAVELLED, 2020). The village is under threat from industrial pollution generated from the Chekka complex (Melki, 2017).

Barghoun is rich in its agricultural associations both terraced and non-terraced which make about 67.5%, that indicates the importance of agriculture as part of the cultural heritage and identity of this town. Its hillside scrublands represent about 28.5% of the total municipal boundary. The later are in bad condition due to nearby quarries on the edges of the village's boundary. The hilltop, low density rural urban fabric represents 4 % of the municipal area. The village is currently threatened by pollution due to its proximity to Chekka.

Trends of landscape transformation identified:

- The natural environment, more precisely the hillside scrublands are threatened by quarrying activities. The later might also threaten human life (quarry dust).
- Industrial pollution threatening human life.

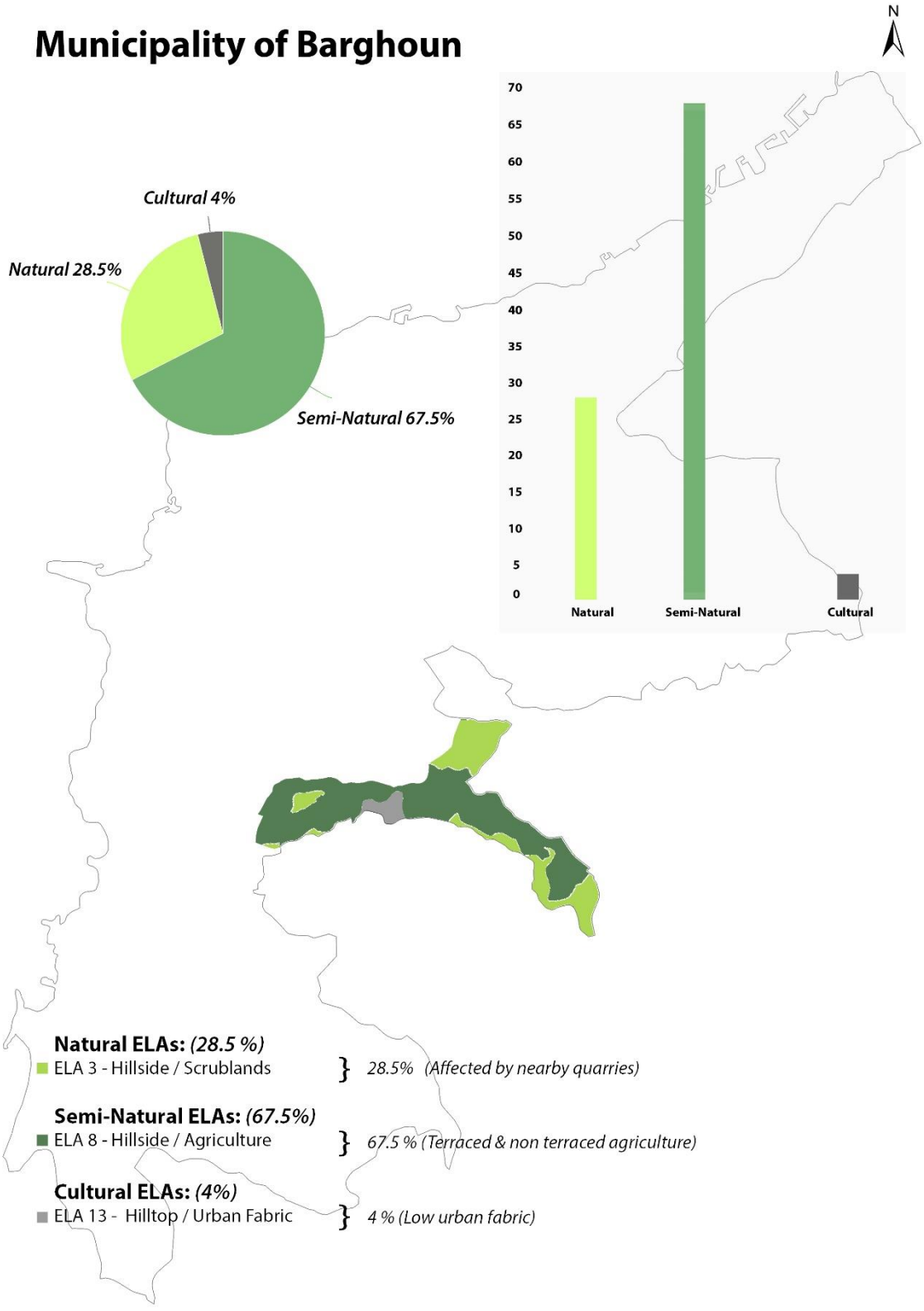


Figure 18: Municipal Barghoun (Author, 2021)

3.5.8 Municipal Chekka

Chekka is a large industrial complex and town located on the southern coast of the study area, it bounds Anfeh from the South. The town belongs to the Batroun District of Lebanon, has an area of 8 km² with a population of 16,663 individuals (Cityfacts, 2020). Chekka contains huge cement factories and quarries due to its "limestone rocky layers, phosphate nodules and chert bands" used in cement production (Walley, 1997; Kopetzky et al., 2019; as cited in Rom et al., 2020). In the past, the area used to be known for its agricultural plain and salinas (Public Works Studio, 2019).

Chekka's remaining natural coast features 0.8% of the total municipal boundary, the latter is almost fully occupied due to the haphazard urban expansion on both the coastline and the coastal plain, the urban fabric represents 23.79% of the municipality. This dense urban fabric is split into residential, commercial, private ports and industrial entities. Only 0.10% salinas remain in Chekka, which means that both the cultural heritage (tangible and intangible) and socio-economic layer of this municipality is almost erased in regard to the industrial trend that took over. Chekka is rich in its agricultural associations both terraced and non-terraced which make about 31.43%, that indicates the importance of agriculture as part of the cultural heritage and identity of this town. Four quarries exist on Chekka's foothills, they represent 9.18% of the municipal area and they play a major role in providing raw material for the cement production. Moreover, they threaten the natural layer and specifically the scrublands (31.9%) and woodlands (2.8%) cutting the green corridors, as well as threatening the biodiversity and human life.

Trends of landscape transformation identified:

- Haphazard expansion of Urban, and industrial entities over the natural coast and existing salinas.
- Shrinking of agricultural lands and scrublands due to industrialization and urban sprawl (threat towards cultural landscapes).
- Salinas are almost lost due to urban expansion, and industrial entities taking over the coastline (threat towards cultural local economy and heritage).
- Quarries and cement facilities threatening human life, coastal environment, natural land, and biodiversity.

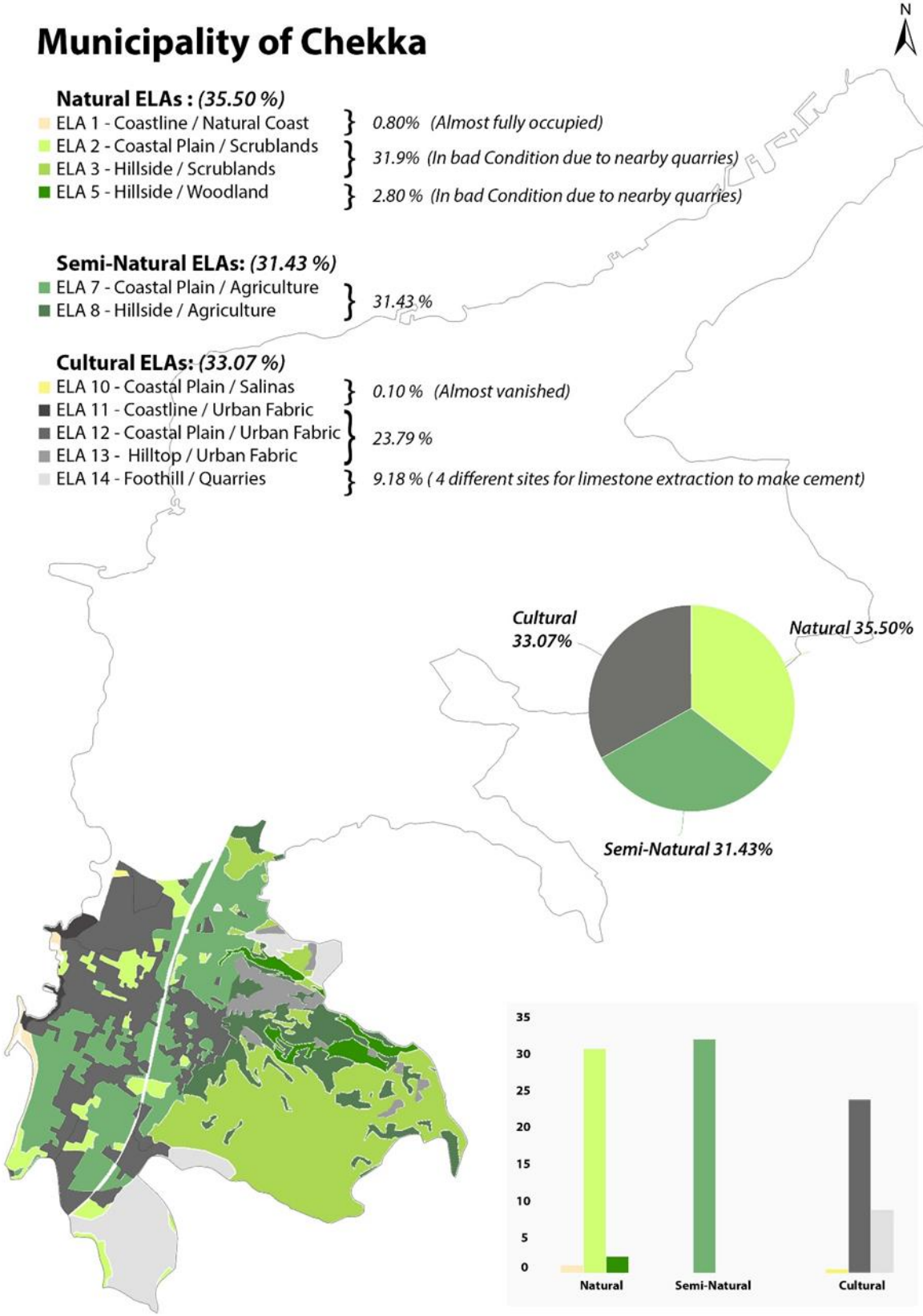


Figure 19: Municipal Chekka (Author, 2021)

3.6 Chekka's Industrial History

As part of a public gathering held by Public Works Studio (2019) concerning environmental threats targeting Koura, Chekka and Anfeh were introduced as natural coasts of Koura, regardless of which District they belong to administratively (Chekka belongs to the Batroun District while Anfeh belongs to the Koura district). It was then explained that prior to the cement manufacturing factories, the coast of Koura lived off the plain. Men worked in agriculture and fishing, while women worked in salinas (in Anfeh and Chekka) and cultivated olives and tobacco in the remaining towns of Koura. On the Lebanese coast, Anfeh and Chekka have the most abundant water resources due to their rich groundwater supply that originates in Tannourine. Extracting salt was the primary source of subsistence, and people would descend from mountain tops on mules with their tons of mountain goods in order to exchange them for salt (Public Works Studio, 2019).

The workshop tried to answer the following question: "how was the Koura coast and its hinterland transformed into a haphazard industrial zone, with factories and quarries?". This regional transformation had a catastrophic effect on the social, economic, and environmental levels of this area. Industries failed to provide a sustainable alternative to both agricultural and marine activities that acted as primary sources of revenue. As a result, available options have become increasingly limited over time (Ibid).

In 1929, Archbishop Antoine Arida and the Maronite Patriarchate formed the Lebanese Cement Company in collaboration with the Paris-based Société d'Entreprise et de Réseaux Electriques. The Company built Lebanon's first cement factory in 1931 on the coast of Chekka. Its production grew exponentially, from approximately 49,000 tons

in 1938 to 100,000 tons in 1940. About two decades after the Lebanese Cement Company began operations, another cement factory was founded on Chekka's coast: a subsidiary of Cimenterie Nationale (known as Al Sabeh), a family-owned company created by the Sehnaoui, Esseily, and Doumit families. The Ministry of Planning was not yet created, nor urban planning codes or land use rules in any of the towns around Chekka, or even at the national level, at the time. Launched under the French Mandate, the Lebanese Cement Company was linked to European interests and local allies. An article of Al-Nahda magazine (1937) discuss how the company extracts millions of tons of cement resources without paying any tax for the Lebanese treasury, moreover, it enjoys rights and immunity unknown to any other national company. The only laws that existed when the two companies were formed concentrated on controlling the quarrying and stone crushing sector (1935) and enforcing provisions on the cement industry (1938). But they lacked the holistic vision or planning needed to direct land use and choose industrial sites (Ibid).

The key reasons for investing in this region were its proximity to the sea, its Limestone rocks and soil quality consisting of clay. Limestone and clay are common materials used to manufacture cement (PCA, 2019). In the Chekka bay, all underwater springs are lined up along the axis formed by the Asfour valley (Figure 20), from the seashore up to 1800 m offshore. Both Asfour and Jawz rivers valleys gradually formed karst features along their course, establishing groundwater links with the earlier deep karst structure during the Messinian crisis (Figure 21). The availability of water is necessary as an energy source and as part of the production process, as well as closure to the sea provides an export port and ideal conditions for establishing and expanding companies. These factors contributed to an increase in industrial entities on Chekka’s

coast. In 1950, a fiber cement factory "Eternit" was built to produce asbestos panels and pipes, it later caused the death of a dozen of its workers due to lung cancer. Another cement factory “Société Libanaise des Ciments Blancs S.A.L.” was founded in 1961. These industries were directly supported by the Lebanese government, allowing them to expand while obtaining permits to transport cement, occupy the public maritime domain (against 1925 law defining the public maritime domain), invest in available water resources, establish customs office, and build private export ports (Ibid).

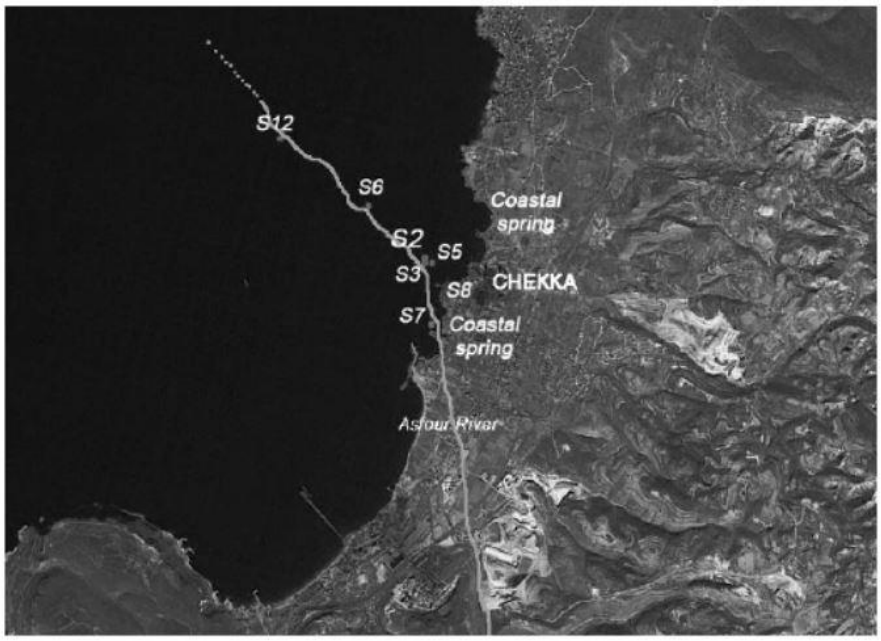


Figure 20: Location of the submarine springs in Chekka, Lebanon (Bakalowicz et al., 2007)

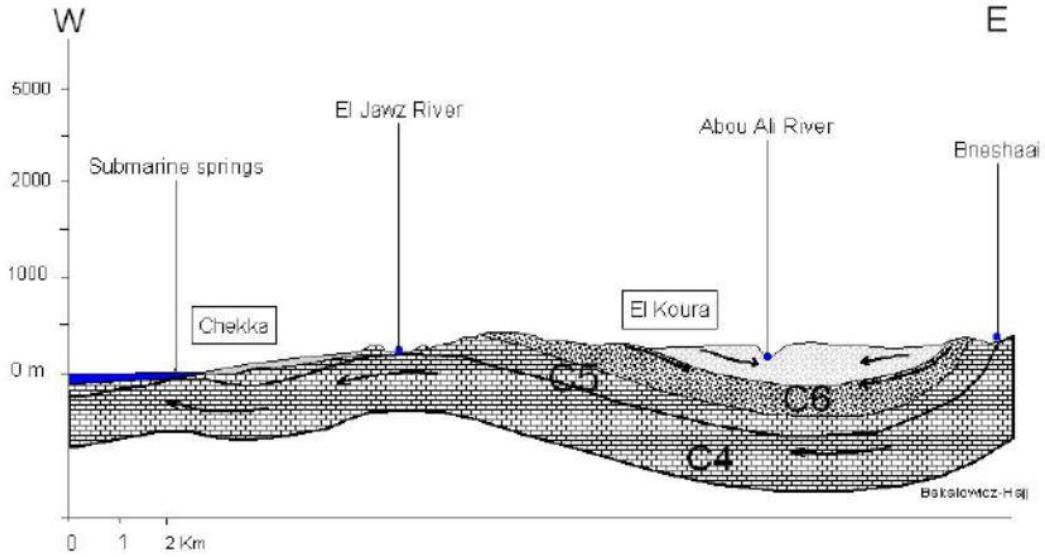


Figure 21: Hydrogeological scheme of Chekka submarine spring (Bakalowicz et al., 2007)

A claim that the Ministry of Industry took the decision to change the classification of Anfeh's Southern coast from a tourist zone into industrial, to construct tanks for storing gas in the parcel number 142 (LebanonPost, 2021).

3.7 Regional Biodiversity and Trends of Landscape Transformation

Biocultural diversity is behind the unique identity of the study area, biodiversity's link to culture was seen through the different ELA's extending beyond municipal boundaries and connecting the entire landscape of the area naturally, semi-naturally and culturally.

The escalating patterns of landscape deterioration are a significant contributor to the environmental crisis of the Mediterranean Basin (Naveh & Lieberman 1994; Naveh 2007; as cited in Naveh, 2009). These trends of landscape transformation were identified through: "the exponential growth of population; new land use pressures

caused by increasing tourism, industrialization and modern agriculture; the resulting need for open space; depopulation and land abandonment" (Ibid).

Unfortunately, the intertwined chain of contextual ELAs previously created, contains many trends of landscape transformation infecting other layers of the ecological landscapes, a current threat to the entire Lebanese coastal zone and specifically the study area threatening to demise its entire identity and biocultural diversity. These trends were seen to traverse the municipal boundaries and infect the context, that is why an analysis was done for each municipality independently in which a quantification of the data was done. The resulting trends of landscape transformation for each municipality were then identified and a threat level was allocated to each based on the analysis and the background check done before. The four municipalities of Anfeh, Hraiche, Al-Qalamoun and Chekka were considered to have hight threat levels (3 to 4 determined trends of landscape transformations) followed by Barghoun which was considered to have moderate threat levels (2 determined trends of landscape transformations) and finally Balamand, Qalhat, and Zakroun which were considered to have low threat levels (1 determined trend of landscape transformation) (Table 1).

Municipalities	Threat Levels
Anfeh	High Threat
Hraiche	High Threat
Al-Qalamoun	High Threat
Chekka	High Threat
Barghoun	Moderate Threat
Balamand	Low Threat
Qalhat	Low Threat
Zakroun	Low Threat

Table 1: Municipal Threat Levels (Author, 2021)

3.8 Conclusion

After generating the ELAs of all municipal boundaries and calculating their percentages in detail (Table 2) and generally (Table 3), the following allowed us to further understand the previously observed results of Table 1. For instance, if we look at the ELAs percentages of Anfeh, we can notice that although it shows a natural diversity (24.62%) the natural coast is almost 2.64 % which indicates that a trends of landscape threat could be affecting the coast; also, although the coastal town shows a rich cultural diversity (30.01%) quarries form 0.85% these as well would pose a threat to both the natural and cultural heritage and can even spread to nearby municipalities such as Hraiche. That's why an ecological landscape design/planning approach should be initiated in the towns with severe threat levels to serve them in withstanding the lying trends of landscape transformations located within or outside their municipal boundaries and invading the regional context.

Detailed ELAs (%) \ Municipality		Chekka	Barghoun	Zakroun	Qalhat	Balamand	Al-Qalamoun	Hraiche	Anfeh
Natural ELAs (%)	Natural Coast	0.8	-	-	-	-	0.003	0.6	2.64
	Scrubland	31.9	28.5	23	10.4	7.2	37.4	44.21	21.98
	Woodland	2.8	-	22	57.6	72	0.004	2.25	-
Semi-Natural ELAs (%)	Agriculture	31.43	67.5	50.5	24.2	3	29.21	35.79	45.37
Cultural ELAs (%)	Salinas	0.1	-	-	-	-	1.5	12.1	6.06
	Urban Fabric	23.79	4	2.5	6.7	16.7	31.88	4.66	23.1
	Quarries	9.18	-	2	1.1	1.1	-	0.24	0.85

Table 2: Detailed ELAs Percentages per Municipality (Author, 2021)

General ELAs (%) \ Municipality	Chekka	Barghoun	Zakroun	Qalhat	Balamand	Al-Qalamoun	Hraiche	Anfeh
Natural ELAs (%)	35.5	28.5	45	68	79.2	37.41	47.06	24.62
Semi-Natural ELAs (%)	31.43	67.5	50.5	24.2	3	29.21	35.79	45.37
Cultural ELAs (%)	33.07	4	4.5	7.8	17.8	33.38	17.15	30.01

Table 3: General ELAs Percentages per Municipality (Author, 2021)

CHAPTER 4

ANFEH – HRAICHE LANDSCAPE: URBAN TRANSFORMATION OF THE CULTURAL LANDSCAPE

4.1. Anfeh Case Study Profile

Anfeh has an area of approximately 5 km² and a population of more than six thousand. Known for being historically rich and religious, Anfeh has been occupied during three major periods: the bronze age period (Early and middle bronze age), the Late Byzantine period and the Medieval/Crusades period (Awad, 2009). The settlement had different names over history: "Ampi, Ampa, Trieris and Nephin" (Awad, 2009; Panayot Haroun, 2015). The Christian Byzantine as well as the Crusaders and the Orthodox created many churches, convents, and monasteries by the sea like "Saydet el-Rih" (one of the oldest churches in the Middle East), Deir Al-Natour and others (Awad, 2009). The coastal city is fourteen meters above sea level (Sanlaville 1977; as cited in Panayot Haroun, 2015) and has visible Greco-Roman and medieval archeological remains like "Al-Qalaa" (the Citadel located on the peninsula known as Ras Anfeh), basins, vaults, olive presses, tanks, quarry pipes and mosaic pavements (Panayot Haroun, 2015).

Anfeh had an important role in the economy of the Northern Levant since the late Bronze Age to the Ottoman period. The first salt ponds appeared in Anfeh during the Ottoman period, while some claim that salt-making was a Phoenician tradition (Panayot Haroun, 2015). Anfeh was known for its extensive production of the artisanal sea salt, due to its ideal coastal climatic conditions on the Mediterranean basin with long, warm, and dry

summers and favorable etesian winds (Petanidou, T. 2004; as cited in Trovato & Panayot Haroun, 2018). The salt or "White Gold" is then harvested through solar evaporation (Trovato & Panayot Haroun, 2018). The flower of salt is a more valuable kind of salt that is extracted twice per year only, because it requires a stable sea, accompanied by dry Northern wind for it to float on the surface of the water. It is identified by its thin shiny crystal form, and distinguished by its healthy formula low in sodium and rich in potassium (Mcharfiyeh, 2017). Anfeh's rocky peninsula gave it a strategic location on the sea with a large biodiversity, allowing for artisanal fishing (intangible cultural heritage and traditional) and the creation of a fishing fleet and a fishing community throughout the centuries. The fishermen embark from "Al-Nhayreh" port and used their knowledge and skills to make their living from the capricious seas surrounding the promontory there (Jansen van Rensburg, 2015).

4.2. History of Salt Economy

Hafez Jreij is an Anfawi (villager from Anfeh) environmental activist, known as the storyteller (hakawati in Arabic) of Anfeh’s salt production. In his booklet “Salt of Lebanon”, Jreij (n.a) describes the history of salt production and mentions the different challenges and battles witnessed through the years in order safeguard it. For instance, during the ottoman era the Turks monopolized salt according to an international agreement as of March 1862, imposing a harsh tax with a rate of 200%. Exceptionally, Habib Pasha El-Saad acting president of Mount Lebanon’s administrative council, allowed salt import during Ohannes pasha rule, that allowed the villagers of Anfeh, Batroun and the coast to re-

launch their salt production. Unfortunately, the Turks returned to banning the Anfawis from working in the salinas in 1914 and from transporting sea water in pottery vessels to their rooftops to evaporate the water and collect the salt. The villagers then resorted to smuggle the water to their homes during the night, this act led the Turks to destroy all the pottery vessels of the villagers (Hamzeh, 2019).

In the 1930's, during the French mandate salt production was banned again and the French authorities ordered to destroy all the salinas which led salt workers to protest in the village as an expression for their anger. After the independence, during the 1940s, the Anfawis returned to producing salt again and fixed their salinas by using cement. The archaeological sites in Anfeh were not yet classified. In the 1950's, legal regulations for salinas on the coast were created, so a decision was issued that required those who wanted to invest in salinas to declare their interest and pay a due in August of each year to the Ministry of Finance.

Jreij points out in his book that after the start of the Lebanese war, the area of salinas in Anfeh, Ras al-Natour, Qalamoun and Selaata were halved, gradually declining from one million square meters to half for several reasons, such as:

- The inability of salina owners to maintain and rehabilitate them
- Immigration out of Anfeh
- The trends of coastal/marine projects (such as resorts and marinas) after the war in the 1980's and the growing activity of real estate brokerage

- Many villagers were forced to sell their salinas under the influence of the pressuring economic conditions, the later affected mainly the working and middle class at that stage.
- The owners of the salinas located near the Chekka and Selaata factories, left them due to pollution that lowered the price of their salt

Engineer Gergi Sessine, a member of the Anfeh Neighborhood Heritage Commission, blames the interruption of Anfeh's salt production on both the state and political leaders, for the lack of support, which he attributes to economic conflict (Hamzeh, 2019). In 1972, a major part of Anfeh's coast was classified as touristic (zone E), even though it contained salinas capable of providing financial return to the town if protected by law. This encouraged people to sell their lands or undertake touristic projects rather than continue with salt cultivation (or extraction). The complex touristic resorts that exist today like Las Salinas and Marina del Sol, were established in the place of many salinas. Based on the historical narrative above, we identify three trends that threaten salt production in Anfeh and continue to transform the urban landscape of Anfeh, transform the traditional coastal landscape and compromise biocultural diversity in Lebanese Mediterranean littorals:

<u>First, the threat to salt production:</u>

In summary, the Lebanese state, by not supporting local production, has contributed to the eradication of the Lebanese salt production. For instance, after the war in 1994, the state exempted the owners of salinas from taxes to encourage national production, however it also signed a trade facilitation agreement with the Arab countries which allowed the

import of Egyptian salt without tax (cheaper than the local salt). On the other hand, the Ministry of Health during the era of the Minister Wael Abu Faour, issued a law based on outdated reports obligating the presence of fluorine in salt. So, according to Lebanese laws, the local salt did not conform to such specifications for its lack in fluorine (or fluoride).

Second, encroachment and pollution from the Chekka cement complex:

At the southern border of the town, there is the Ras el-Mlelih promontory a place for the residents' promenade, which was classified as a touristic area (zone E). This area became surrounded by factories, one of which is the national cement plant "Al Sabaa" of chekka's northern boundary. This plant contains concrete mountains and asphalt tanks, while if you look at the beach, you will see the remains of ancient salinas that had their glory back in the time, some were even carved in rocks. In addition, the cement plant throws concrete waste, and dirty wash water of their camions in the sea polluting it. Large storage gas tanks were constructed in the area during and after the civil war, due to their scarcity. The project was financed by a migrant who sent brokers during the war to buy the land at any cost. At first, gas tanks were installed, and ships came from the sea and emptied the gas into the tanks, then the pickups carry them to sell them to homes. When the war ended, gas tanks were converted into diesel fuel tanks. Now the tanks have been converted to asphalt. These tanks contain furnaces to facilitate the loading of liquid asphalt. The steam emitted from the heating is carcinogenic dioxin that affects the health of residents in the Ras al-Maleeh area.

Third, market-driven real estate development:

Jreij argues that this project is an “execution of Ras al-Natour area”, for that this area holds the largest salinas mosaic (with an area approximately around 175000 m2) which will be transformed into an enclave for the rich, just at the proximity of the ancient monastery. Jreij adds, that according to the project owners the project will be dedicated to Arab kings, princes, and senior diplomats. Also, the project will include an area of villas, pools and everything that meets their needs. Jerj explains that the waqf council of Deir Al-Natour, leased the land for 80 years. At first the contract was signed secretly, and when it was revealed publicly, oppositions were raised to deter it. The contract was extended three times, the first time it was for forty years, the second time for sixty years and finally the third time to eighty years. These extensions occurred as a result for the inability of the investors to implement their project for it being against the law.

4.3. Comparative Historical Development

A comparison was done between the development of Anfeh-Hraiche in 1962 and the current development of 2021, to unveil another dimension of threatening changes that might affect the future of these coastal towns (Figure 22). It was immediately noticed that:

1- Almost all salinas became non-functional, only two salinas remain active (the one near Deir El Natour and the one behind the fishing port).
2- Almost all wind turbines found along the coastline, and which were used to pump sea water into salinas, were removed and later replaced by non-functional ones for aesthetic purposes only (very few).
3- Suburban sprawl is currently invading the olive groves and fields.

4- Urban sprawl infiltrating the southern boundary of Anfeh coming from Chekka.

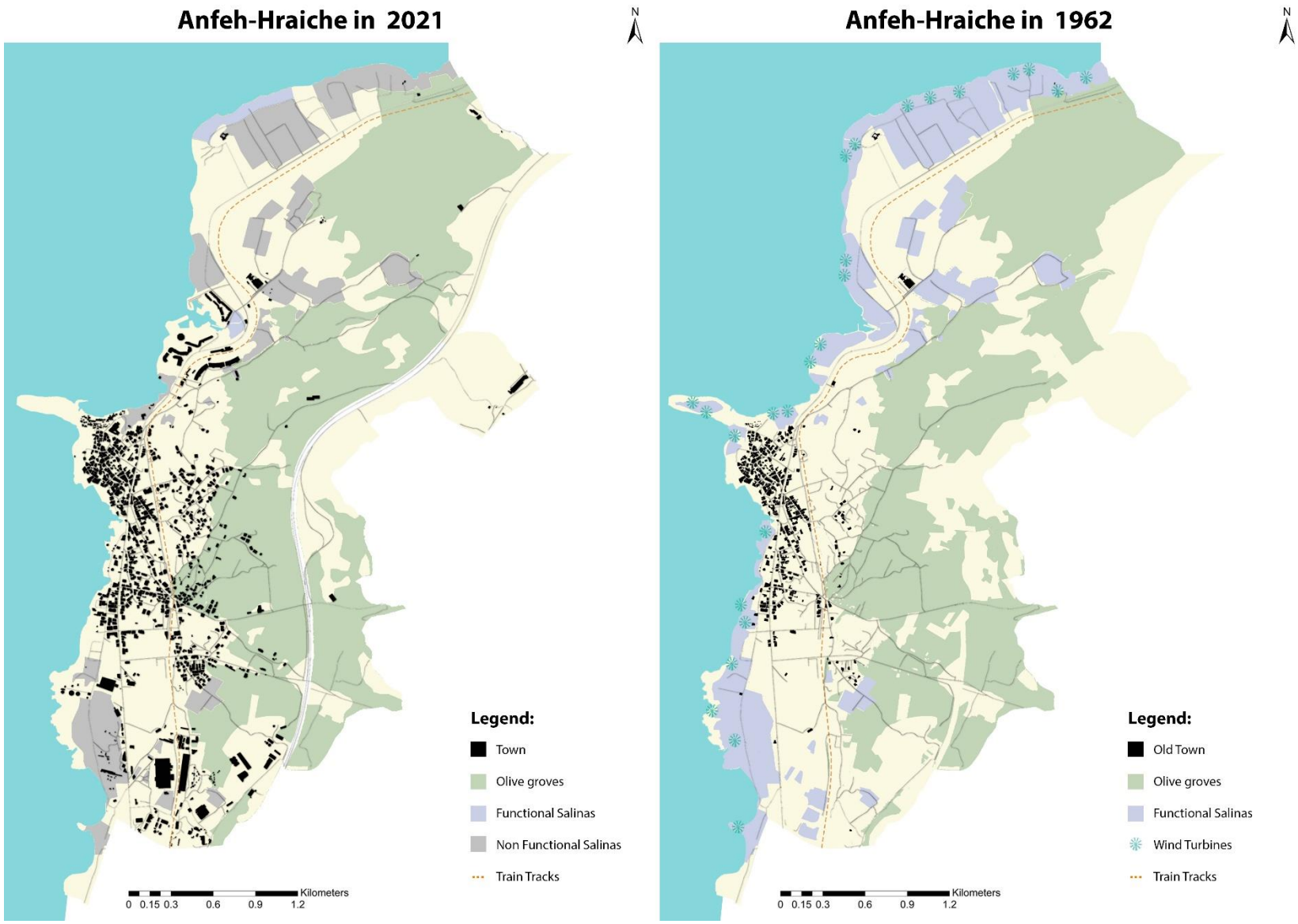


Figure 22: Comparative Historical Development of Anfeh-Hraiche (Author, 2021)

4.4. Anfeh-Hracihe ELAs & Landuse

The ELAs of Anfeh-Hraiche previously identified were described generally according to a larger scale. In this section, the same ELAs are introduced but some are divided in detail according to their types, such as the different types of available agriculture (olive groves, crops etc.), others were not shown on a zoomed-out level (such as specific archeological sites) (Figure 23).

The landuse was done on a zoom in level to justify the trends of landscape transformations analyzed before and to explore any additional scenarios that were not covered. It was noticed that (Figure 27):

1- Commercial and industrial entities are invading Anfeh from the South coming from Chekka.
2- Industrial entities are invading the coastline and affecting the existing salinas.
3- Resorts and chalets are invading the coastline (making part of the touristic and recreational activities depending on the sea)
4- Most religious entities (churches) are located within a proximity to the sea or have a visual connection with it.
5- Residential buildings are expanding away from the old town towards the olive groves.
6- Commercial entities are investing in foothill quarries.

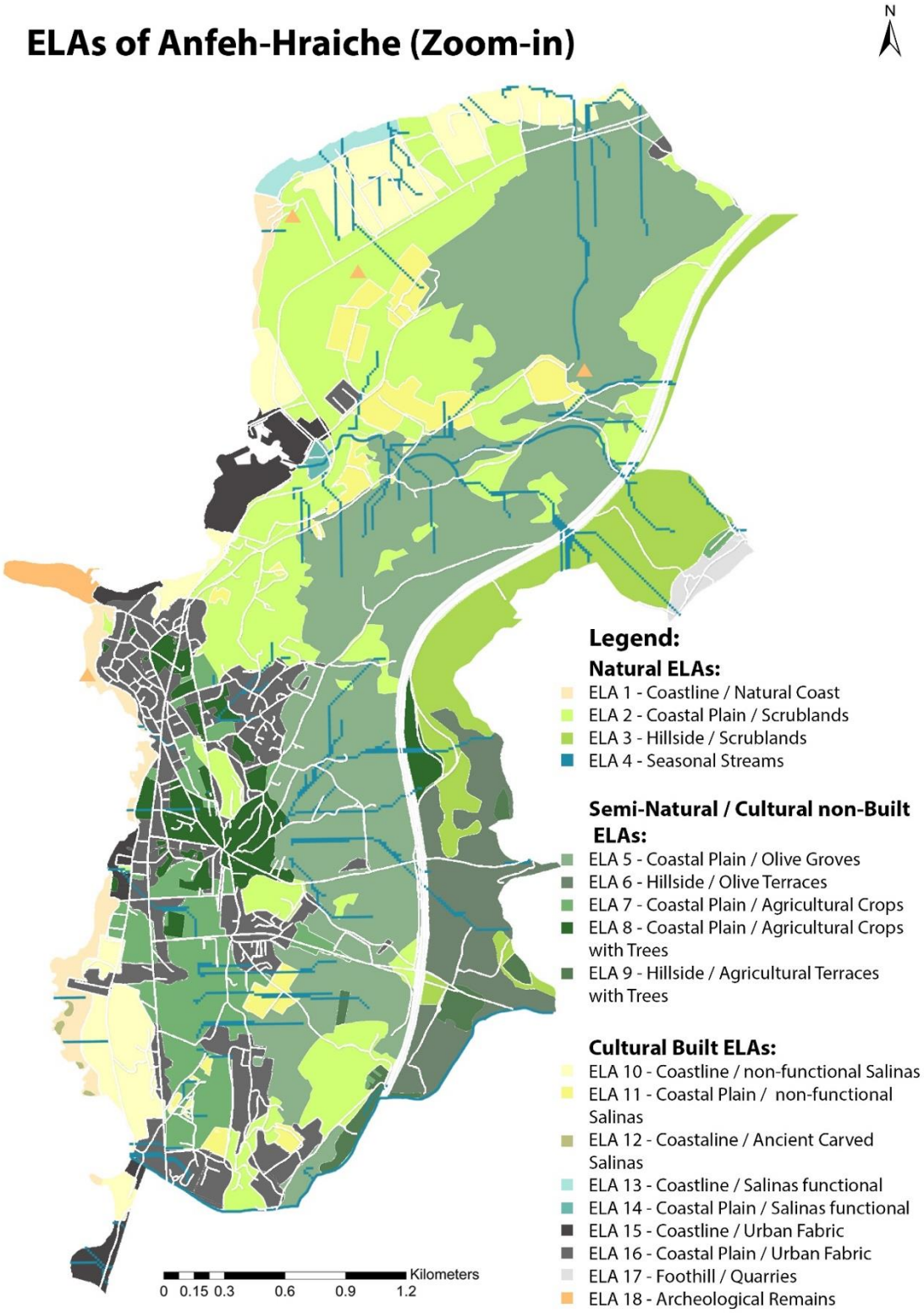


Figure 23: Detailed ELAs of Anfeh-Hraiche (Author, 2021)

CHAPTER 5

AN ECOLOGICAL LANDSCAPE CONCEPTUAL MODEL

5.1 The Threat to Coastal Cultural Landscapes

In April 26 of 2018, the Lebanese government granted authorizations for building two large-scale tourism projects, the first in Damour while the second was in Zouk Mikael. Both of the projects were going to occupy illegally the maritime public domain through decrees, despite the unanimous refusal of these projects by the Higher Council for Urban Planning (HCUP)(المجلس الأعلى للتنظيم المدني) (Farfour, 2018b).

Concerns then arose about the site of Deir el Natour, which for a decade was planned to be transformed into a large touristic complex. This is problematic because Deir Al-Natour is at once a natural and cultural heritage a living example of coastal cultural landscapes. Not only is the Deir Al-Natour landscape one of the last pristine coastal ecosystems, but in addition, it is the site of the last salinas on the Lebanese coast, remnants of the Anfeh-Hraiche capital of salt production (Bou Aoun, 2018). In May 16 of 2018, the HCUP refused the "Natour Development" project, proposed by Malia Group in the parcel no. 912 (waqf property parcel of the Orthodox monastery of Saydit el Natour in Hraiche). Nevertheless, this site remains in danger of falling victim to unregulated and market-driven planning decisions by the state (Bou Aoun, 2018).

Many master plans were proposed for Anfeh that were modified based on decrees that overrode affected the original decisions of both the National Physical Master Plan for the Lebanese Territory (NPMPLT) (الخطّة الشاملة لترتيب الأراضي اللبنانية) developed by the Council for Development and Reconstruction (CDR) (مجلس الانماء والاعمار), and the General

Master Plan of the Northern Beaches Area (GMPNB) (المخطط التوجيهي للشواطئ الشماليّة) developed by HCUP first in 1972. These decrees were issued through either political interference to take over the coast and invest in it via legislations, or decisions coming from the HCUP and from recommendations submitted by the municipality of Anfeh.

5.2 NPMPLT and the GMPNB

In the 1950s, a discussion started of a "National Development Plan", while the Ministry of Planning was being established. In 1962, the first urban planning law was issued, then withing the fifteen years preceding the civil war (1975-1990) eighty-two areas in Lebanon were planned. in 1977, during the civil war, the ministry of planning was abolished (Public Works Studio, 2018).

The "National Development Plan" was later reduced to the NPMPLT, and was approved on June 20, 2009 by the decree no. 2366. The NPMPLT orients town planning and provides land use guidelines in Lebanon, such as the protection of natural sites and indicating the cultural and built heritage. The latter decree binds all the ministries, administrations, municipalities, public establishments as well as the autonomous public services to adopt the NPMPLT guidelines in all matters related to the use or development of territories. That implies, that any decision that does not comply with the directives of the NPMPLT shall appeal to the State Council (مجلس الشورى) to revoke it (Public Works Studio, 2018; Bou Aoun, 2018).

Unfortunately, the decisions of the State Council in Lebanon are politically pressured, not allowing this legal body to accomplish its role as per the law. Moreover, this

pressured and weak status of the State Council was seen also through the Eden Bay project. This project was forcibly built, privatizing the natural coast of Ramlet al-Baida against the NPMPLT recommendations (which indicates the shore of Ramlet al-Baida as a protected zone), and despite two requests to suspend its execution license by the State Council (Farfour, 2018a).

The NPMPLT defines the coast as a subject of special attention, to avoid irreversible catastrophes of continuous urban sprawl, privatization of shores, and destruction of its remaining natural resources. As per the NPMPLT, thirty sites were defined as "exceptional sites" for their remarkable natural sites which hold "cliffs, sandy beaches, rocky capes, bays, natural shores etc."; Anfeh was one of these sites. The NPMPLT categories Anfeh's salinas as reserves (protected zone), and more generally considers its coast as an exceptional site that holds a natural shore of high ecological and landscape value, a coastal agricultural plain of national interest, and is also an exceptional natural entity (Bou Aoun, 2018).

Thus, the classification of Anfeh's salinas as reserves in the NPMPLT, follows the directives laid down by the GMPNB of 1998. The GMPNB which classifies the entire coastline and coastal plain surrounding Deir el Natour (including the salinas and all the surrounding orchards) as a "Natural Park with relative protection" (Zone P2). However, the plan does not specify details about the average area of subdivisions for all this zone, which is usually part of the adjoining zoning table. The latter indicates a harmonious planning vision, which intends to preserve this site entirely (not allowing for urban sprawl) and to classify it as a natural and cultural reserve for it's part of a collective memory as well as being ecologically rich. Deir Al-Natour's site is then considered as an important

environmental asset for it holds the last traces of undamaged coastal ecosystems. The site holds the last salinas of the Lebanese coast, which characterize the Anfeh-Hraiche area as a Capital of salt (Bou Aoun, 2018).

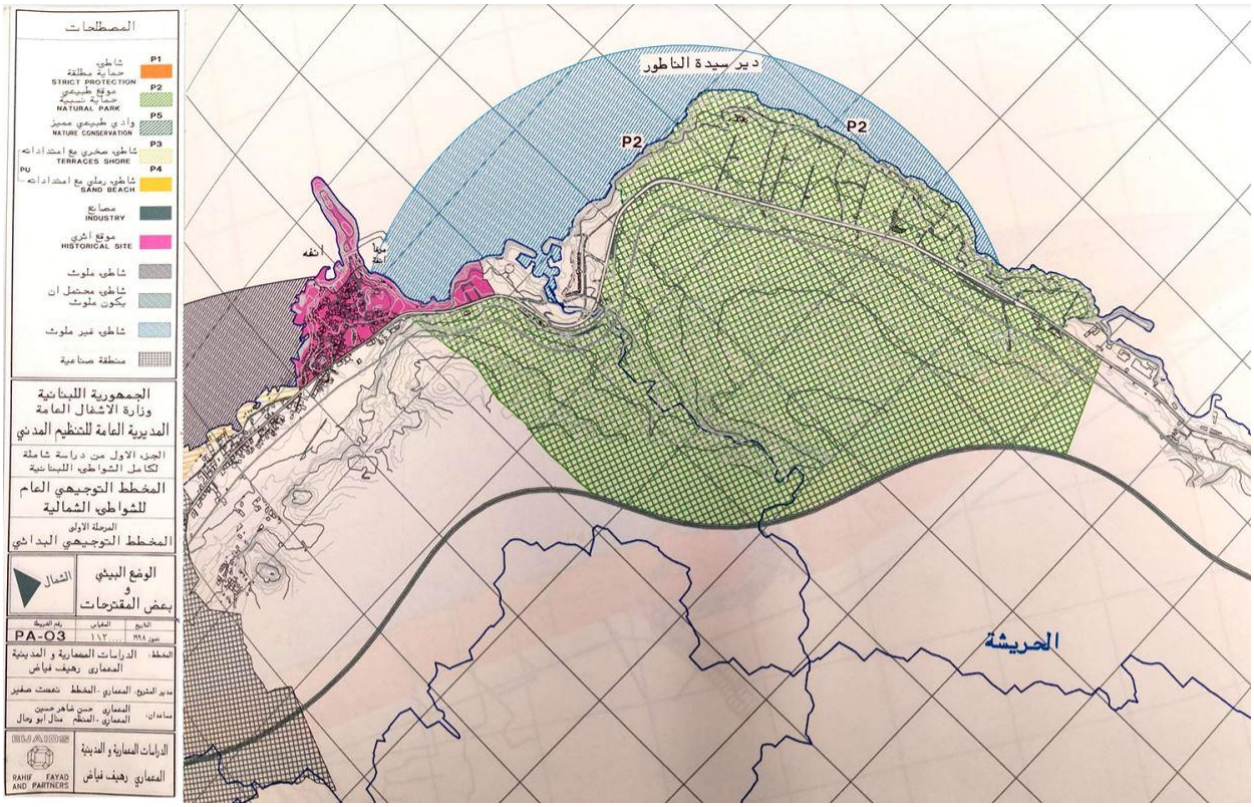
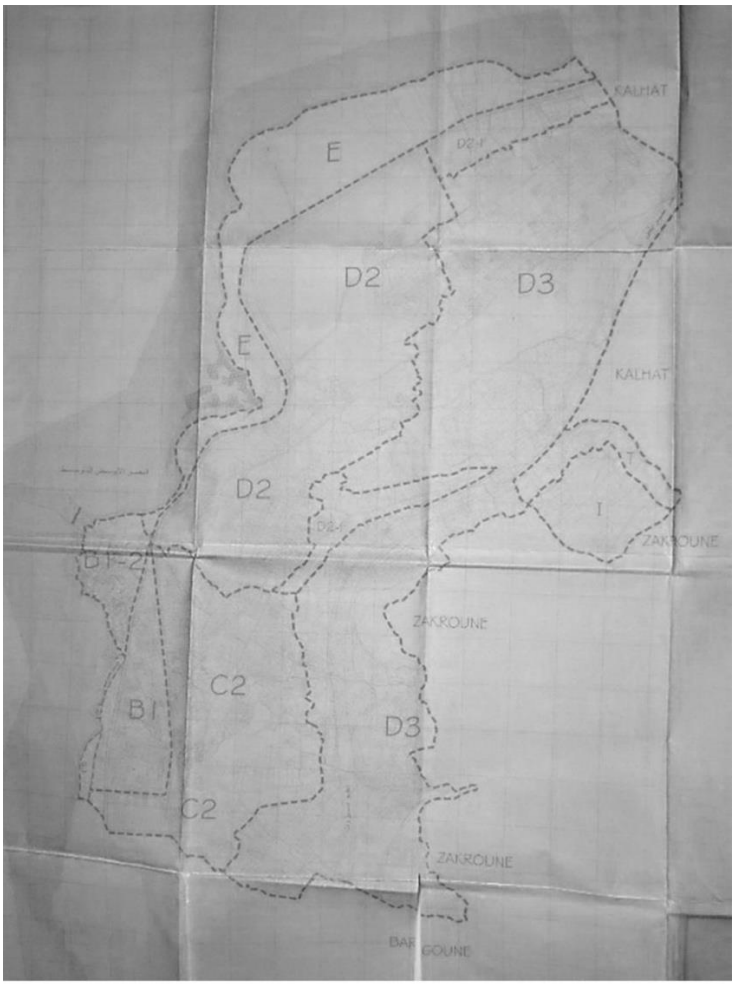


Figure 24: The General Master Plan of Northern Beaches (GMPNB) of 1998 (Bou Aoun, 2018).

5.3 The Anfeh-Hraiche Master plan of 2016

The current master plan sets the directives of land development (types of developments), including land use specifications and building guidelines (such as parcel size and limitations, exploitation factors and building heights). It divides the Anfeh-Hraiche sectors into 9 zones:

Zone B1 (surrounding of the old town, high density residential), zone B1-2 (old town, high density residential), zone C2 (mixed-use residential and commercial), zone D2 (first residential expansion), zone D3 (future residential expansion), zone T (industrial transition), zone I (industrial), zone E (touristic, including special residences, restaurants/services, and resorts), zone D2f (future residential expansion, follows the guidelines of the D2 zone).



13.5	3	1.5	50		3	3	13	13	300	15	15	600	B1
13.5	3	1.5	50		3		13	13	300	15	15	600	B1-2
11.5	3	0.90	30		3		15	15	400	20	20	800	C2
8.5	2	0.40	20		4		20	20	1000	25	25	1200	D2
7.5	2	0.30 0.25	15 * 10 **		4		20	20	1200	30	30	1500	D3
7.5	2	0.40	20		4		20	20	1200	30	30	1500	T
10	2	0.40	20		4		20	20	1200	30	30	1500	I
7.5	2	0.40	20		4		20	20	750	25	25	1500	E
7.5	2	0.40	20		10		30	30	3000	50	50	3000	
10	2	0.40	20		10		50	50	7000	70	70	7000	
													D2f

Figure 25: The master plan of Anfeh-Hraiche 2016 (General Directorate of Urban Planning, 2016)

Note 1: there exist a common system for the Industrial zone located between Anfeh and Chekka which is separated from this master plan and follows the decision of the HCUP according to the decree no.36 in 2006 (which I will not discuss).

Note 2: The difference between the 2016 master plan and the older plan of 2006, is that the zoning table contained a Zone D8 (area of olives, low density residential) instead of Zone D3 (future residential expansion) which replaced it. This change occurred when the municipality raised the concern of the residents who wanted to escape from the pollution of Chekka (South) and expand towards the olive groves and agricultural plain of Hraiche to the HCUP, but the residents were not able to build large homes due to strict building limitations on such a rich agricultural land. Hence, the new plan helped the residents to expand far away from Anfeh's old town towards Hraiche.

As an example of the impact of the 2006 master plan zoning is the fragmentation and degradation of olive agricultural landscapes that are an important part of the Anfeh Hreiche cultural landscape. zoning of 2006, for a parcel area of 5000 m2 a building of 2 floors could be built on an area of 100 m2 (FAR is equal to 2, total building area of 2 floors is 200 m2) which leaves a total protected area of 4900 m2 of olive groves (98% of olive groves are protected). In the new zoning of 2016, for a parcel area slightly bigger than 1500 m2 (FAR is equal to 15) a building of 2 floors could be built on an area of 225 m2 (total building area of 2 floors is 450 m2) leaving 1275 m2 of olive groves (85% of olive groves are protected); also, for a parcel area slightly smaller than 1500 m2 (FAR is equal to 10) a building of 2 floors could be built on area of 150 m2 (total building area of 2 floors is 300 m2) leaving 1350 m2 of olive groves (90% of olive groves are protected) (Figure 26).

To compare both zoning plans, I unify the general parcel area (by multiplying both parcel areas of 1500 m2 by 3.33 a ratio obtained by dividing 5000 m2 by 1500m2) (Table 4). Hence, the following table and diagram were created:

Master Plan Date	Zone	General Parcel Area (m2)	Building area (m2)	Total Building Area of 2 Floors (m2)	Remaining Olive groves (m2)
2006	D8	5000	100	200	4900
2016	D3	5000 *	750	1500	4250
2016	D3	5000 **	500	1000	4500

Table 4: Impact of Master Plans on Olive Groves (Author, 2021)

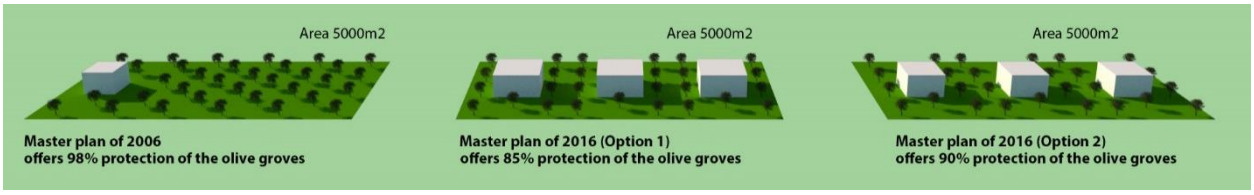


Figure 26: Master plans variation (Author, 2021)

That shows that the new master plan of 2016 widens the build area by splitting the agricultural plots and parcels. Hence, removing more olive trees and allowing more buildings to take over such an iconic agricultural area, altering its visual aspect and affecting its economical regeneration (like olive oil production).

On the 12th of May 2016, the government of Tamam Salam, acting Prime Minister, approved this new master plan of Anfeh-Hraiche according to the decree no. 3478, overriding the articles for this landscape by both the NPMPLT and the GMPNB. Moreover, this master plan cancels any previous plans contrary to the directives of this decree.

The critiques of the 2016 master plan I'll be discussing here are based on comments by engineer Gergi Sessine a member of the Anfeh and Neighborhood Heritage Commission in 2007 leveled against the 2006 master plan. Ironically, they apply to the master plan of 2016.

- Threat to Coastal Agricultural Landscapes

  Both master plans ignore the landscape continuity of the olive, thus undermining the functioning of the agricultural ecosystem that forms a large portion of the coast. The damage extends to livelihoods and economical regeneration coming from olive oil production. Additionally, fragmentation of olive landscapes that encircle Anfeh-Hreicheh will have a visual and spatial impact, transforming the character and the continuity of coastal rural cultural landscape.

- Overriding National Planning Directives

  Both master plans contradict national planning directives of the entire coastal zone facing the sea, by proposing it as a touristic zone (Zone E) acting against the directives and decrees set first by the NPMPLT and second by the GMPNB that classified it as a protected zone. Thus, violating the general framework orienting town planning and land use in Lebanon (illegal act done by the council of ministers).

- Undermining Archaeological Heritage

Claims that the archeological site of Ras al-Qalaat promontory is a protected area of cultural importance but fails to portray it on the official zoning map and in the table of guidelines, for it to be in sync with an old master plan according to the decree no.10 of 26/03/1973 that clearly states it. Both master plans fail to protect the salinas, as they still follow the guidelines of the zones in which they are located. Urban sprawl could affect these areas, but according to the master plan building in areas that contain salinas needs

the permission of the HCUP and the supervision of the ministry of environment (MOE). The HCUP and the MOE can increase the height of buildings in the plots to double, to stop their expansion over the salinas. The following isn't sufficient to protect the salinas because the built environment will interrupt their continuity and will affect salt production (a non-supported local production), also it would affect it's visual and physical landscape that connects the plain with the sea. Finally, salinas should have a proper zoning to protect them at all costs.

- Safeguarding Public Access to the Sea

Fails to provide a continuous public access along the entire coast of the maritime public domain which directly contradicts with the binding decree no. 144/S of 1925 which protects the latter. Although the approved master plan tries to qualify as a safeguard against projects that could destroy or deform the coast, by giving the final decision to the HCUP and by taking the prior approval of the State Council. The latter has already rejected the "Natour Development" touristic project, as well as it

binded the Council of Ministers (مجلس الوزراء) to refuse the project or otherwise its authorization would be illegal. Furthermore, as explained before both the State Council and the HCUP failed in stopping other illegal projects targeting the coast, which keeps the Anfeh-Hraiche coast in danger.

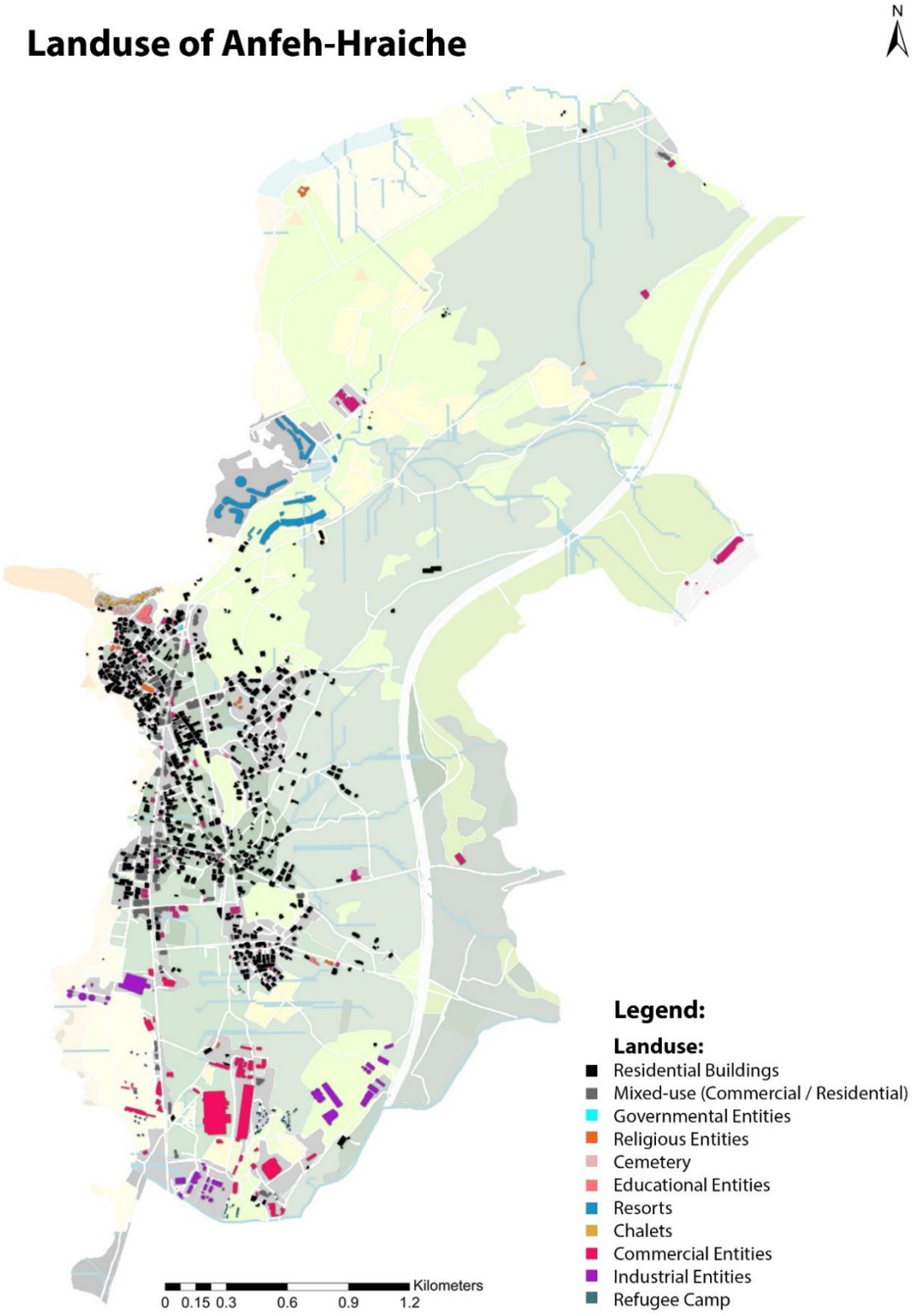


Figure 27: Landuse Map of Anfeh-Hraiche (Author, 2021)

To propose a framework for a sustainable urban development, I will revisit the ecological reading done in chapter 4, pick-up on identified problems/limitations that are compromising the integrity of the cultural landscape and impacting the quality of environment and life in Anfeh. I will also draw on the potentials recognized in chapter 4, both natural and cultural, tangible, and intangible heritage. These two tracks will inform definition of a future vision for Anfeh-Hraiche.

5.4 From Ecological Landscape Association to Landscape Character Zones

The first step towards an Urban Development Framework (UDF) is to convert the ELAs for Anfeh-Hraiche identified in chapter 4 into Landscape Character Zones (LCZs) (Table 5). LCZ mapping will generate an ecological landscape conceptual model that serves as the foundation for a sustainable urban development strategy that can complement and guide the current existing masterplan of 2016.

> Landscape character zones (LCZs), are mappable landscape, with almost homogeneous abiotic and biotic features delimited by distinct margins. (Makhzoumi & Pungetti, 1999). LCZs aggregate 1 or more ELAs into larger components that can thereafter form the building blocks of future planning. And because ELAs and LCZs are composed of smaller and larger ecosystems, they are sustainable in themselves as well as guiding future planning towards sustainable scenarios.

Eight LCZs were identified for the Anfeh-Hraicheh study area. In the following section, I will provide a brief profile of each (Figure 28).

Anfeh-Hraiche LCZ(s):

Zones	Landscape Character Zones	ELAs of Anfeh-Hraiche				
1	Natural Coast	ELA 1 - Coastline / Natural Coast				
2	Scrublands	ELA 2 - Coastal Plain / Scrublands	ELA 3 - Hillside / Scrublands			
3	Water Corridors	ELA 4 - Seasonal Streams				
4	Agriculture	ELA 5 - Coastal Plain / Olive Groves	ELA 6 - Hillside / Olive Terraces	ELA 7 - Coastal Plain / Agricultural Crops	ELA 8 - Coastal Plain / Agricultural Crops with Trees	ELA 9 - Hillside / Agricultural Terraces with Trees
5	Salinas	ELA 10 - Coastline / non-functional Salinas	ELA 11 - Coastal Plain / non-functional Salinas	ELA 12 - Coastaline / Ancient Carved Salinas	ELA 13 - Coastline / Salinas functional	ELA 14 - Coastal Plain / Salinas functiona
6	Old Town	ELA 15 - Coastline / Urban Fabric	ELA 16 - Coastal Plain / Urban Fabric			
7	New expansion	ELA 15 - Coastline / Urban Fabric	ELA 16 - Coastal Plain / Urban Fabric	ELA 17 - Foothill / Quarries		
8	Archeological sites	ELA 18 - Archeological Remains				

Table 5: Anfeh-Hraiche LCZs (Author, 2021)

Zone 1: Natural Coast

This zone constitutes the remaining non-disturbed natural coast of Anfeh and Hraiche. It is an area known for attracting many sea birds and linking the land to the sea, as well as providing natural habitats to the marine biodiversity. It holds then part of the coastline's natural coast (ELA 1). The natural coastal zone should be always accessible as it is part of the public maritime domain and should also be protected from any type of urban expansion for being an important ecological entity.

Zone 2: Scrublands

This zone constitutes the natural scrublands, ranging all the way from the coastal plains (ELA2) to the Hillsides. This area is known for hosting endemic plant species that are endangered. Some of the identified plants are: “halophyte plants (salt tolerant), bushes, weeds and mosses, and fields of myrtle specifically Myrtus Ugni a medicinal plant that is nearly extinct on the Lebanese coast and many more” (UNESCO, 2019). This zone should be protected for its rich biodiversity as well as it also provides feeding grounds and habitats for birds and other animals.

Zone 3: Water Corridors

This zone constitutes the seasonal water streams that reach Anfeh and Hraiche by flowing all the way from the hilltops surrounding the area. Some streams drain in the agricultural lands irrigating it (especially the olive groves), while others pass through the natural land and end up in the sea or get interrupted by urbanization affecting by that the natural water cycle. This zone should be protected as it provides a large ecological corridor for the existing biodiversity and is an important source of fresh water to irrigate the land naturally.

Zone 4: Agriculture

This zone constitutes all the different types of agricultural lands found in Anfeh and Hraiche.

These lands include rich coastal plains of olive groves (ELA 5), and hillside olive terraces (ELA 6) that when cultivated are used for creating olive oil. Also, other lands include coastal plain agricultural crops (ELA 7), agricultural crops mixed with trees (ELA 8) and hillside agricultural terraces with trees (ELA 9) usually planted by farmers or residents for

personal use. This zone should be protected as an important cultural heritage and for its socio-economic benefit.

Zone 5: Salinas

This zone combines both functional and non-functional salinas available in Anfeh and Hraiche. The majority of the salinas are non-functional and are located on the coastline (ELA 10) and on the coastal plain (ELA 11). There also exists ancient carved salinas on the coastline (ELA 12), while the remaining functional salinas (only two) one is located on the coastline (ELA 13) and the other one on the coastal plain (ELA 14). This zone should be protected for its cultural heritage and for its socio-economic benefit.

Zone 6: Old Town

This zone constitutes the old town of Anfeh identified according to the army map of 1926. The latter contains many old residential buildings and churches of historical, cultural and heritage importance. Also, the buildings embed a vernacular architecture and are situated at a proximity to the sea. The area then holds part of the coastline's urban fabric (ELA 15) and the coastal plain's urban fabric (ELA 16). The sea can be seen from within the narrow alleys between the buildings, and from churches' squares. This zone's heritage and cultural character should be protected.

Zone 7: New expansion

This zone constitutes the new urban expansion of the coastal town which includes new residential buildings, chalets, commercial, industrial, and touristic entities. The latter

expansion is taking over the coastline (resorts), polluting the entire town (industrial plants), destroying salinas, stressing agricultural plots, invading the fields of olive groves, and deforming the landscape through quarries. The area then holds part of the coastline's urban fabric (ELA 15), part of the coastal plain's urban fabric (ELA 16) and foothill's quarries (ELA 17).

This zone's expansion should be re-assed carefully, following sustainable design guidelines as it threatens the biocultural diversity of the entire area.

Zone 8: Archeological Sites

This zone constitutes all archaeological remains (ELA 18) found in Anfeh and Hraiche. These are distributed between different sites such as Ras al-Qalaat promontory known as the famous peninsular medieval fortress (crusader castle with trenches, rock cut chambers and cisterns), while others are less recognized, they include ancient quarries, ancient lime kiln (ancient oven used to burn limestone to produce lime for use in building as a mortar) and ancient settlement.

This zone should be protected by the master plan directly for its cultural heritage and for its socio-economic benefit (touristic).

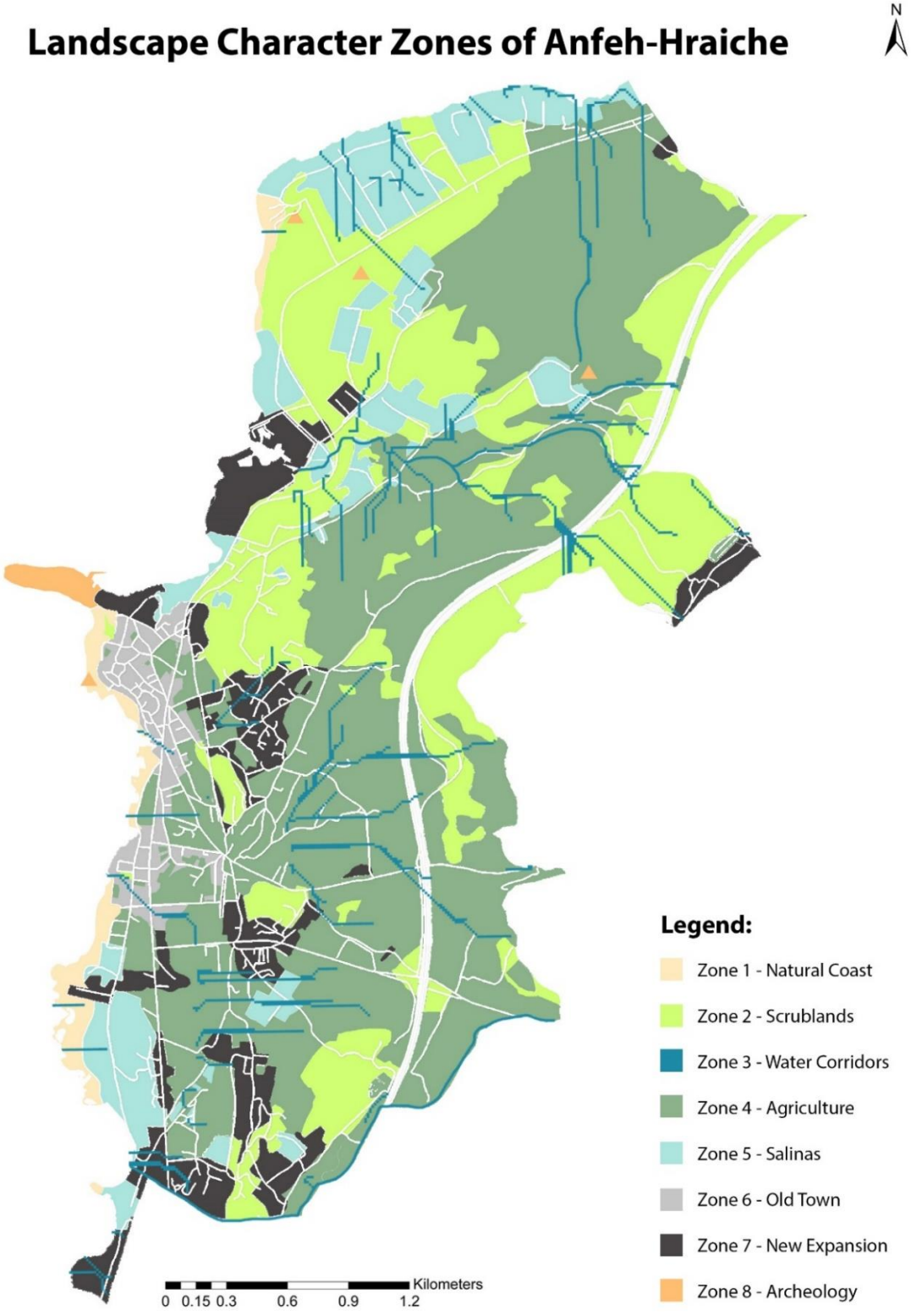


Figure 28: Identified LCZs of Anfeh-Hraiche (Author, 2021)

5.5 LCZs as defining the character of the Anfeh-Hreiche cultural landscape

The characteristics of the emerging pattern of LCZ distribution are:

a) Agriculture, namely olive cultivation, forms the largest share of the landscape. Although fragmented on the western edge by urban expansion, olive cultivations can be seen as forming three large clusters in the North, the center and to the south that are barely connected. This needs to be maintained to preserve the band that runs parallel to the coast, as productive.

b) Natural landscapes, namely Mediterranean scrublands, are the second largest component of the site. They serve as a protective buffer between olive cultivation and urban expansion. They are of value as a habitat to floral and faunal diversity. They need to be maintained.

c) Salinas are the second largest share of productive man-made landscapes (after the olive gorves), namely for salt extraction. The largest salinas are found to the North, while remaining salinas, including the oldest (carved in rocks) are found to the South. These need to be re-activated and protected from urban expansion.

d) The Historic Urban Core holds many heritage buildings and provides open views toward the sea, while new Urban expansion include residences expanding away from the old core towards the olive groves (these need to be controlled). The latter buildings should Follow the same vernacular architecture of the old town in the case of densification around the historic core. In the case where the sprawl cannot be controlled, many measure should be taken concerning construction:

- The design and typology of the urban fabric sprawl should be guided by strict sustainable regulations (closely monitored), while protecting the maximum number of olive trees in the construction site.
- The physical design of buildings should be ecologically integrated within the context (camouflaged) without harming the nature and disrupting the ecological continuity of green corridors.
- Setting limits for building heights to a minimum while making sure not to cut important visual access towards the sea (considering the sea view towards Ras El Natour from the Tripoli- Batroun highway).
- Limit the development along the Tripoli- Batroun highway.

Moreover, part of the new expansion LCZ include industrial entities (to be relocated away from residential areas and controlled for pollution), resorts (to be limited from interfering with the marine public domain) and quarries (to be banned)

e) Water corridors are a key to landscape continuity and should be recognized in future planning to protect against seasonal flooding and to ensure the ecological health of the cultural landscape mosaic.

f) Archeology, namely monuments, historical sites and religious entities should be constantly maintained, protected, easily accessed, and contain informatory signs.

5.6 The aim of the Anfeh Hraiche Urban Design Conceptual Model

The urban design conceptual model proposed (Figure 29) follows the aim of recognizing the biocultural diversity which defines the cultural landscape of Anfeh-Hraiche, protects it in future development so it continues to contribute to the local economy, ensures environmental health and enhances local pride in the natural and cultural heritage.

Through restating the problems that were generally identified on both the level of the existing land-use and on the level of the master plan (2016) in chapter 4 which are accordingly:

- Environmental and ecological degradation and the transformation of sustainable cultural landscapes into unsustainable urban development/growth
- Fragmentation of natural and cultural landscape mosaics and loss of their connectivity

I propose two guiding strategies to achieve the aim:

1. Strategies to protect and enhance the ecological integrity of the natural, semi-natural and cultural landscape formed by and incorporated into the ELAs and LCZs.
2. Establish linear connections and networks of connections that bind the landscape components and ensure a healthy environment.

The conceptual urban design model and the broad strategies provide a framework for future development that builds on the natural and cultural attributes of the cultural landscape while responding to the landscape transformation trends identified. This will guide future

projects concerning urban expansion, urban form, zoning, agricultural and natural landscape protection as well considering infrastructure towards an equitable growth of the local economy.

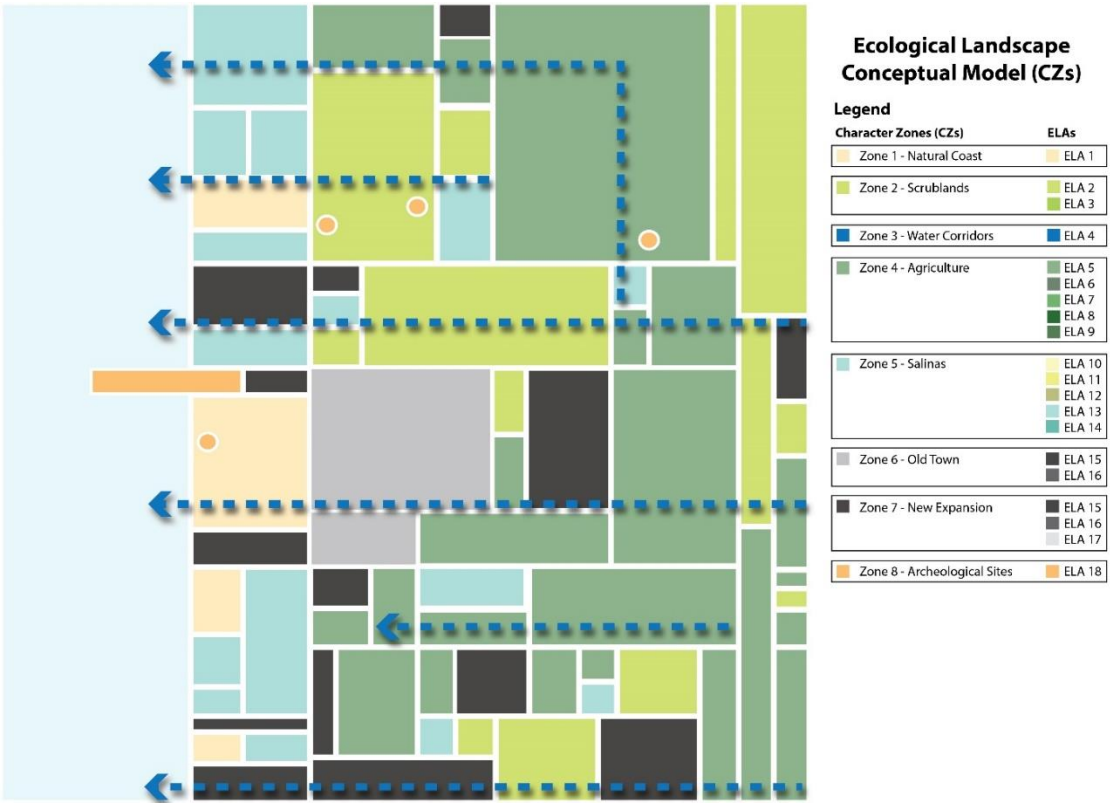


Figure 29: Ecological Landscape Conceptual Model (Author, 2021)

5.7 Urban Design Conceptual Model

The Urban Development Framework aim is to:

1. Protect and enhance the ecological integrity of the natural, semi-natural and cultural landscapes (Figure 30):

- Strategies for protection and adaptive reuse of salinas

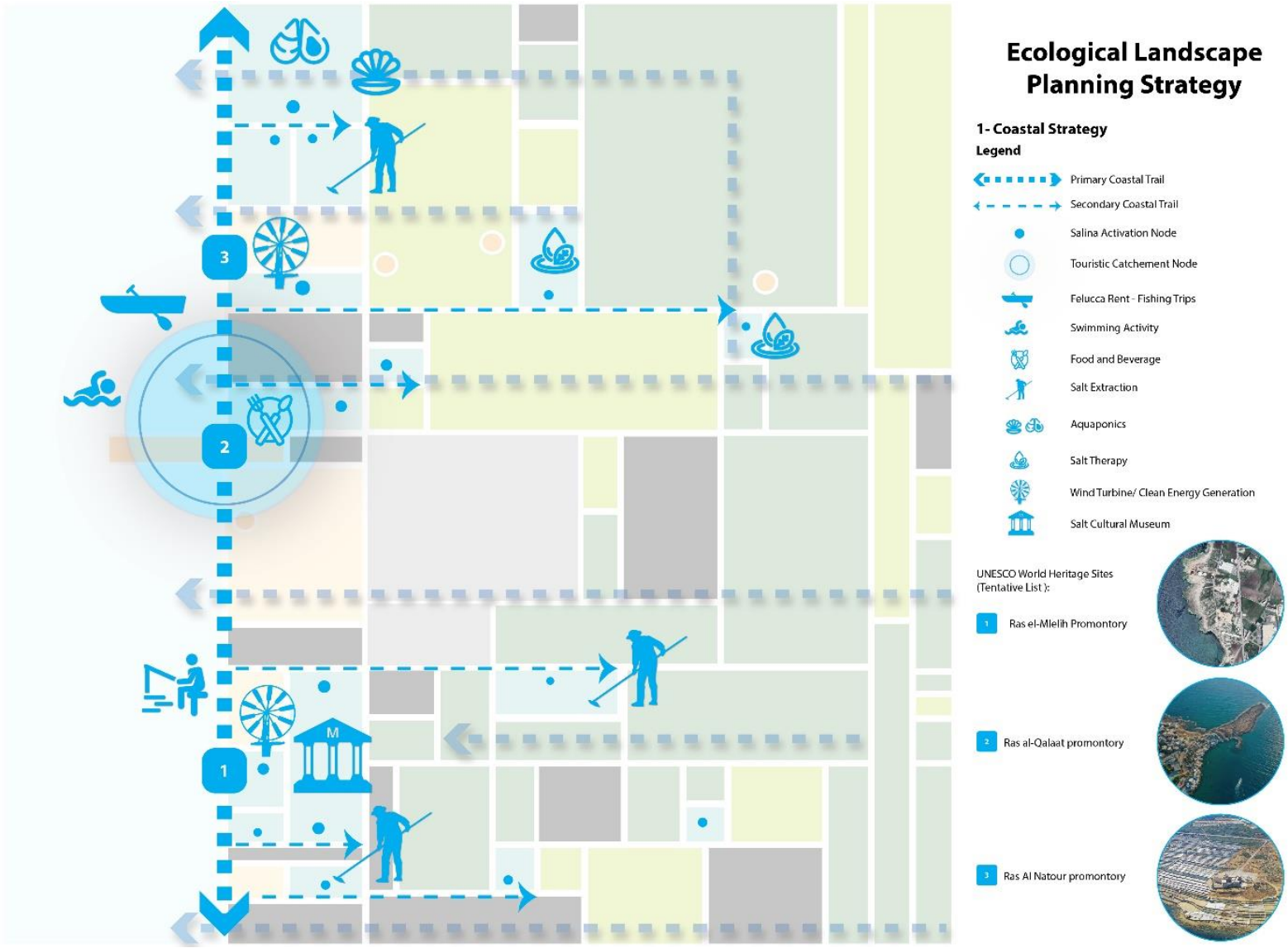


Figure 30: Coastal Strategy (Author, 2021)

- Relaunching salt extraction and production.
- Rehabilitating/ renovating destroyed salinas while granting them official state protection.
- Surveying salinas them to create their respective plans and investigate them for archeological remains.
- Adding a salt cultural museum in Ras el-Mlelih promontory which will act as a historical node and a featured landmark near the ancient carved salinas. The museum will provide VR (Virtual Reality) experiences showcasing the different stages of salt extraction to preserve the heritage, and host live activities for visitors to learn and practice salt extraction with expert salt workers from Anfeh and Hraiche.
- Training interested individuals and entrepreneurs to potentially join the field of salt extraction/ production and helping them starting their business accordingly.
- Allocating necessary markets to discharge the salt, as well as providing alternative markets such as cosmetics and therapeutic.
- Improving the marketing strategy for selling the salt such as creating an exceptional product design, showcasing the benefits

of this product as a national heritage emblem through creative ads.

- Re-installing micro wind turbines (ناعورة الهواء) for pumping sea water inland to salinas, while studying the added advantages of harnessing coastal air energy for generating clean-sustainable electrical power that can feed the town.
- Studying the potential of introducing aquaculture in inactive salinas (raising fish, mollusks, and oysters to provide additional economic benefit) or salt therapy (Figure 31 and 32).

Figure 31: The usage of abandoned salinas in polyculture of fish and mollusks (Fernando & Ruano, 2009).

Figure 32: Spa and salt therapy experience in the salinas of Castro Marim, Algarve, Portugal.(Germany, 2017)

- Strategies to protect the scrublands and enhance natural lands (Figure33):
  - Creating healing gardens within the scrublands of Deir el Natour, while having kiosks for selling medicinal plant products hand-made in town as the indicated scrublands already contain medicinal plants such as Myrtle shrubs.
  - Proposing a location for having a botanical garden than runs from the coast to the hills while indicating its endemic plant species and safeguarding them.

- Enhancing the botanical garden for it to become a bird sanctuary, that holds bird observation cabins.

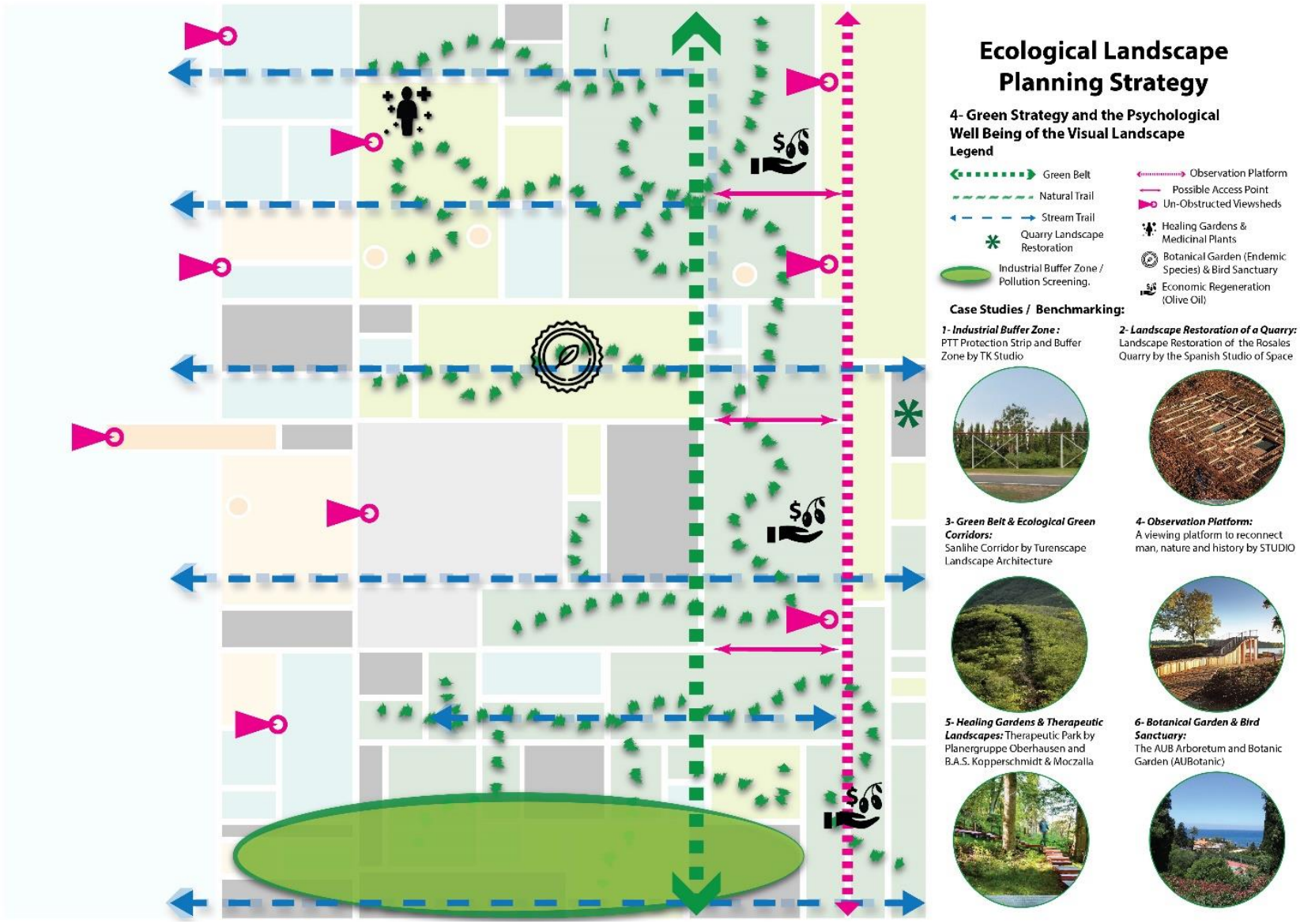


Figure 33: Natural Landscapes Strategy (Author, 2021)

- Starting a fauna/flora database that can be explored by visitors during a through QR code (Quick Response) scanning.
- Creating a green network (ecological corridors) of natural trails and stream trails ecological corridors. These corridors will offer a public promenade between olive groves (private owners of the land will benefit from extra subsidies if they participate in accepting the natural trails) and protect the existing biodiversity (Figure 34).
- Evaluating seasonal streams with water experts in terms of water catchment areas, improving the level of the water table, collecting fresh water and for agricultural usability and irrigation.
- Creating a main observation platform followed by secondary un-obstructed viewsheds towards the sea in natural settings or in the old town.

- Strategies to reclaim quarried sites and to fight pollution
  - Restoring the defected landscape of the foothills were many seasonal streams pass.
  - Improving air quality near polluted areas by introducing shelterbelts.

- Address unregulated urban development and landscape fragmentation

  a) Strategies at the urban scale (zoning):

  - Keeping Taht el-Rih area near Ras al-Qalaat promontory as the main touristic catchment node for reducing heavy tourism at other locations.

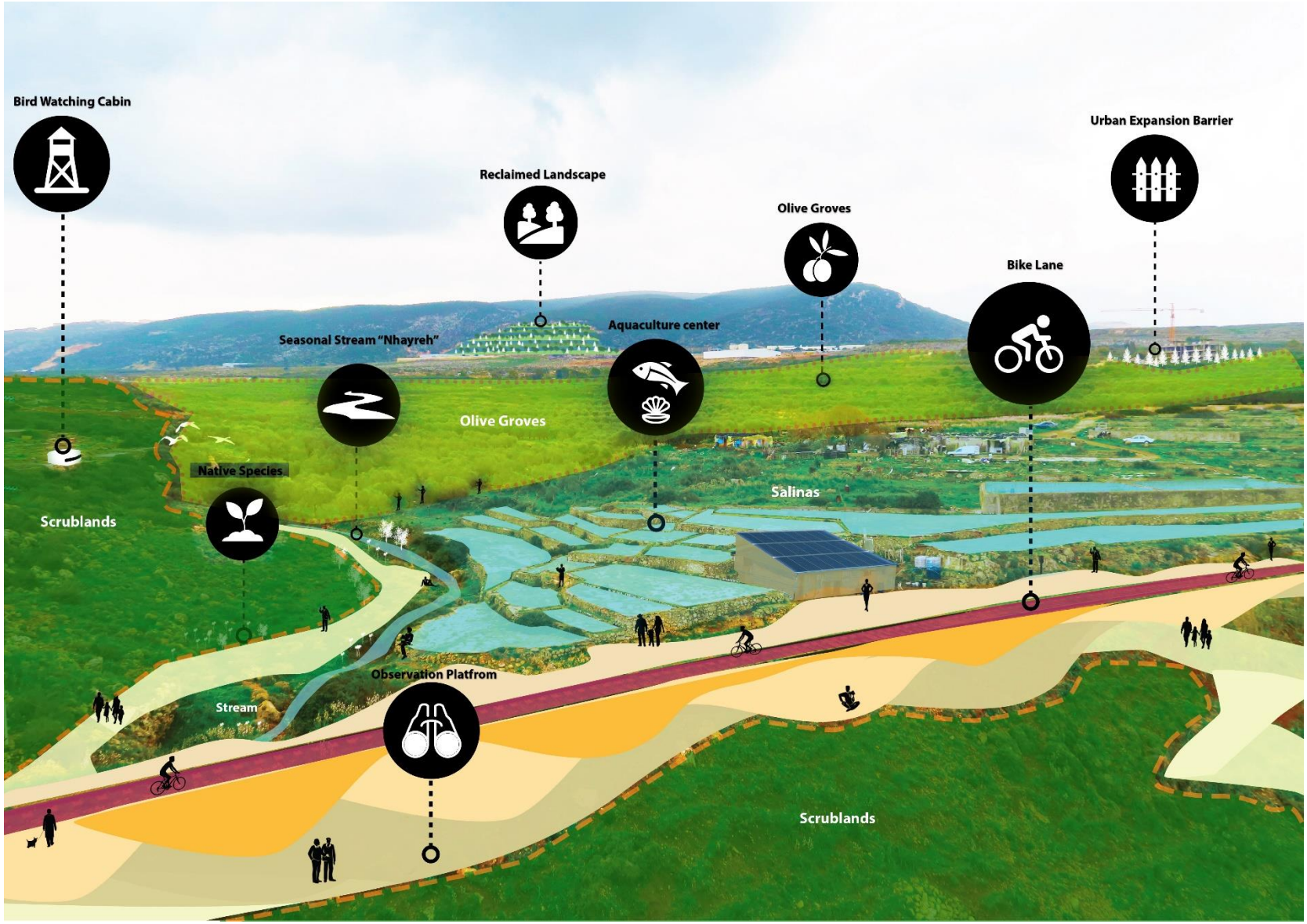


Figure 34: Symbiotic Ecosystem (Author, 2021)

- Stopping the invasion of industrial entities (coming from Chekka) to the residential zones of Anfeh and relocating them on a later stage away from this area. After their removal, utilizing their space for creating open green spaces and community gathering areas.
- Maintaining urban densification around the main nucleus / core of the existing old.

b) Strategies at the plot scale (protecting of olive trees)

- Interrupting urban sprawl towards olive groves by indicating a green edge/green belt that cannot be bypassed by urbanization and creates an additional connection with the context while protecting the olive groves (also economically beneficial for olive oil production).
- Offering subsidies to agricultural landowners and farmers (especially those possessing lands with olive groves) to revive local interest in agriculture and safeguard the groves and olive oil production (part of the agricultural heritage); also, allocating necessary markets to discharge the olive oil and other agricultural products.

- Zoning of the coast to include protected areas and commercial zones:
  - Proposing an un-interrupted primary public coastal trail along the entire coastline, linking the 3 UNESCO World Heritage Sites “1- Ras el-Mlelih promontory, 2-Ras al-Qalaat promontory and 3-Ras Al Natour promontory” (Figure 35).

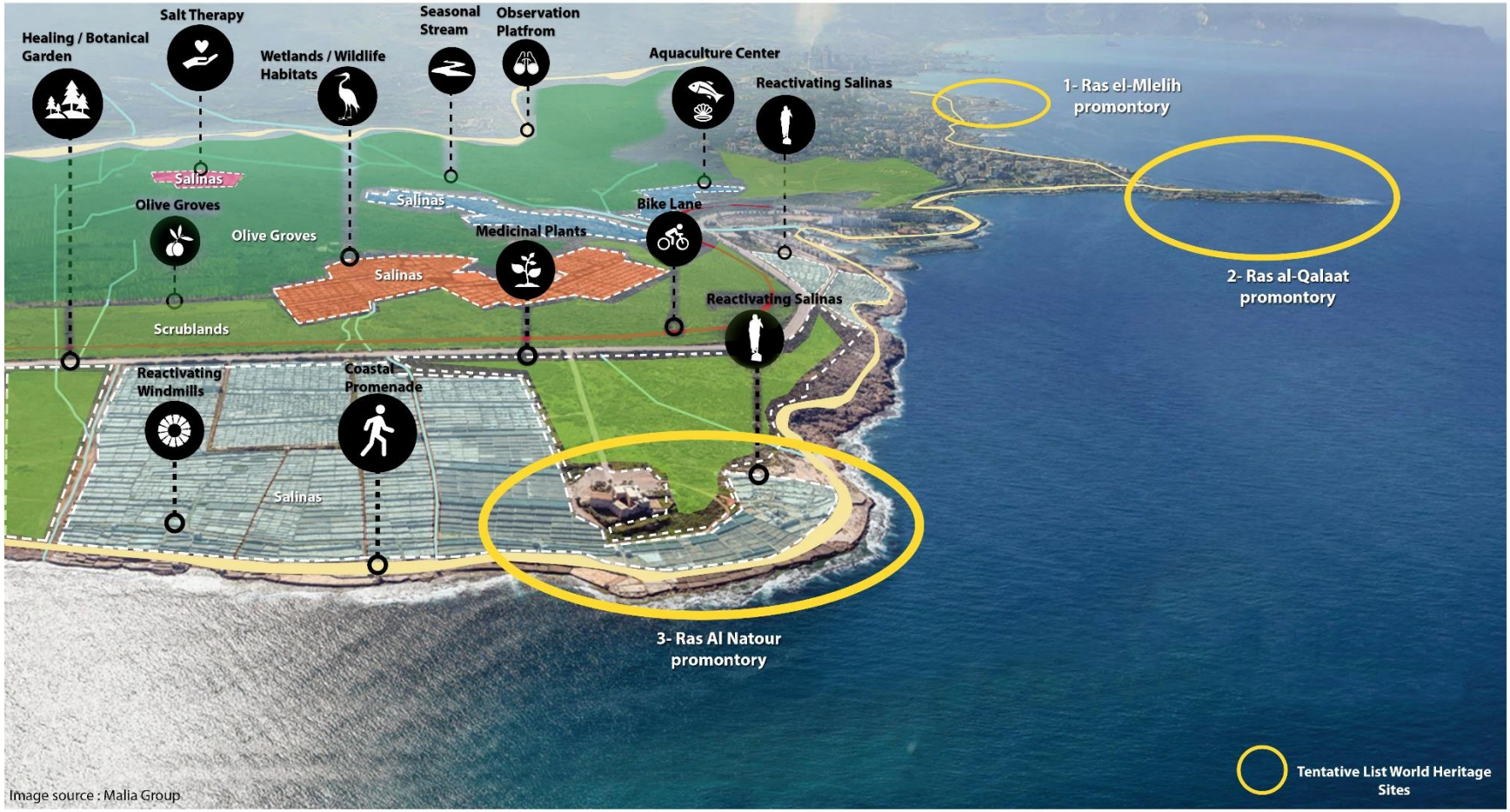


Figure 35: New Zoning for the Coast (Author, 2022)

- Destroying any barriers/ obstructions created by resorts confiscating the public maritime domain, all destruction fees should be paid by owners of the latter resorts.

2. <u>Establish linear connections and networks of connections that bind the landscape components and ensure a healthy environment:</u>

- Strategies recognizing and networking cultural heritage sites:
  - Creating a pilgrimage trail linking Anfeh to Balamand. The trail passes by the main religious entities (churches and covenants) such as "Saydet el-Kharayeb, Deir Saydet el-Natour, Saydet el-Rih, Saint Catherine, Saint Simeon, Mar Abda, Mar Georgeos and Deir Mar Youhanna" acting as historical and cultural landmarks (Figure 36).
  - Creating an archeological trail that is intertwined with the pilgrimage trail (due to their proximity) and includes the remaining archeological and heritage landmarks such as "Ras al-Qalaat, Ras el-mlelih, an ancient settlement, ancient quarries and an ancient lime kiln".
  - Protecting archeological sites directly by the master plan and by the laws of the Directorate General of Antiquities (DGA).
  - Providing AR (Augmented Reality) immersive visual experiences to showcase the historical significance and usage of these sites, as well as entertaining visitors by reviving these sites physically on their phones

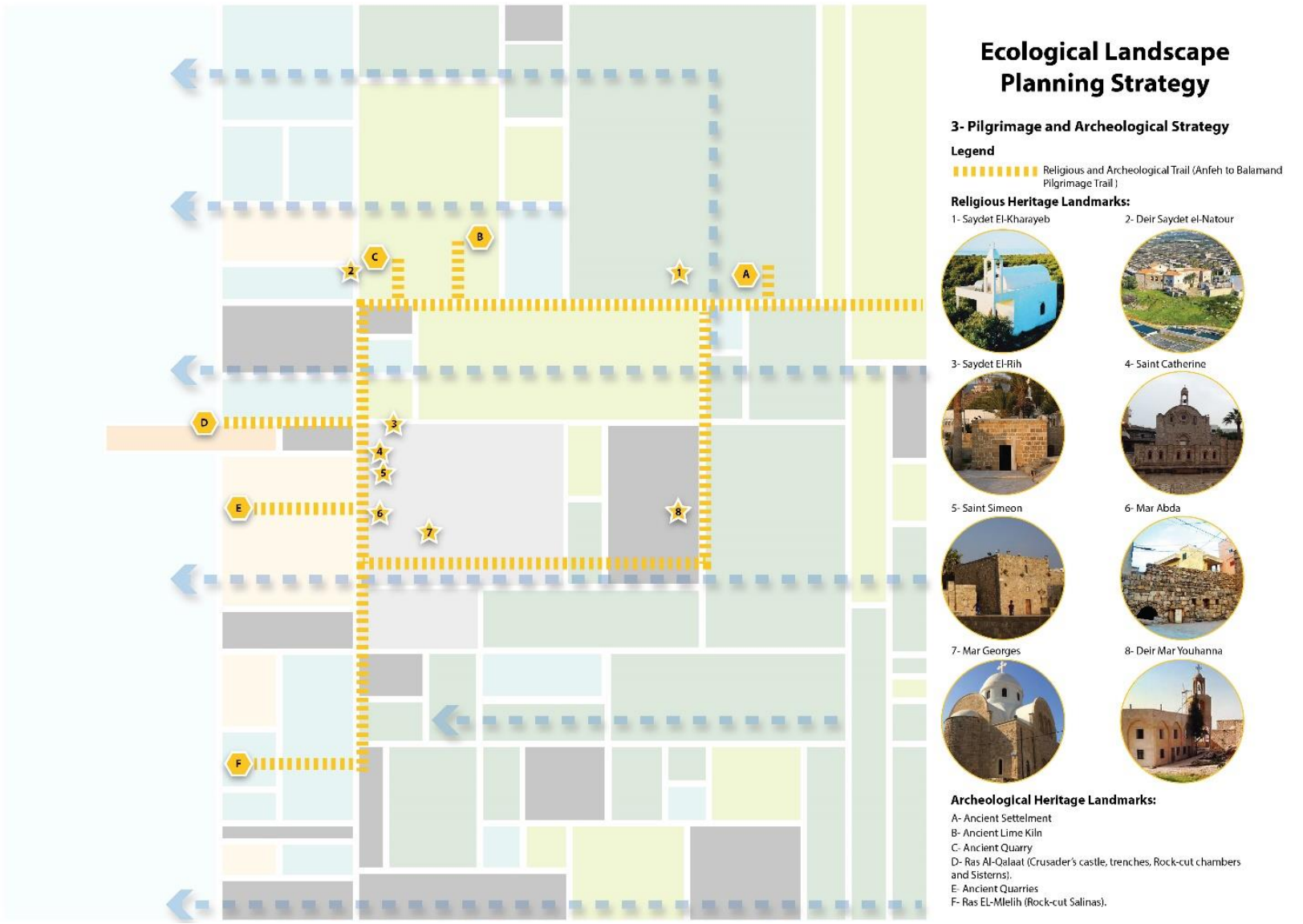


Figure 36: Archeological & Pilgrimage Trail (Author, 2021)

(An important step to start testing for gamification as part of light tourism purposes) (Figure 37).

Figure 37: Archaeologists see and smell the past with augmented reality (Engelking, 2015).

- The abandoned railways should be turned into a public continuous promenade that goes beyond Anfeh and Hraiche linking them to their context. The promenade should include bike lanes, recreational open spaces, gathering areas, green pockets, and buffer zones. Moreover, a detailed survey with elevation/level points of the abandoned track should be further assessed to allocate each of the propositions accordingly where possible. It is also mandatory to make the promenade fully accessible following ADA standards (Figure 38).

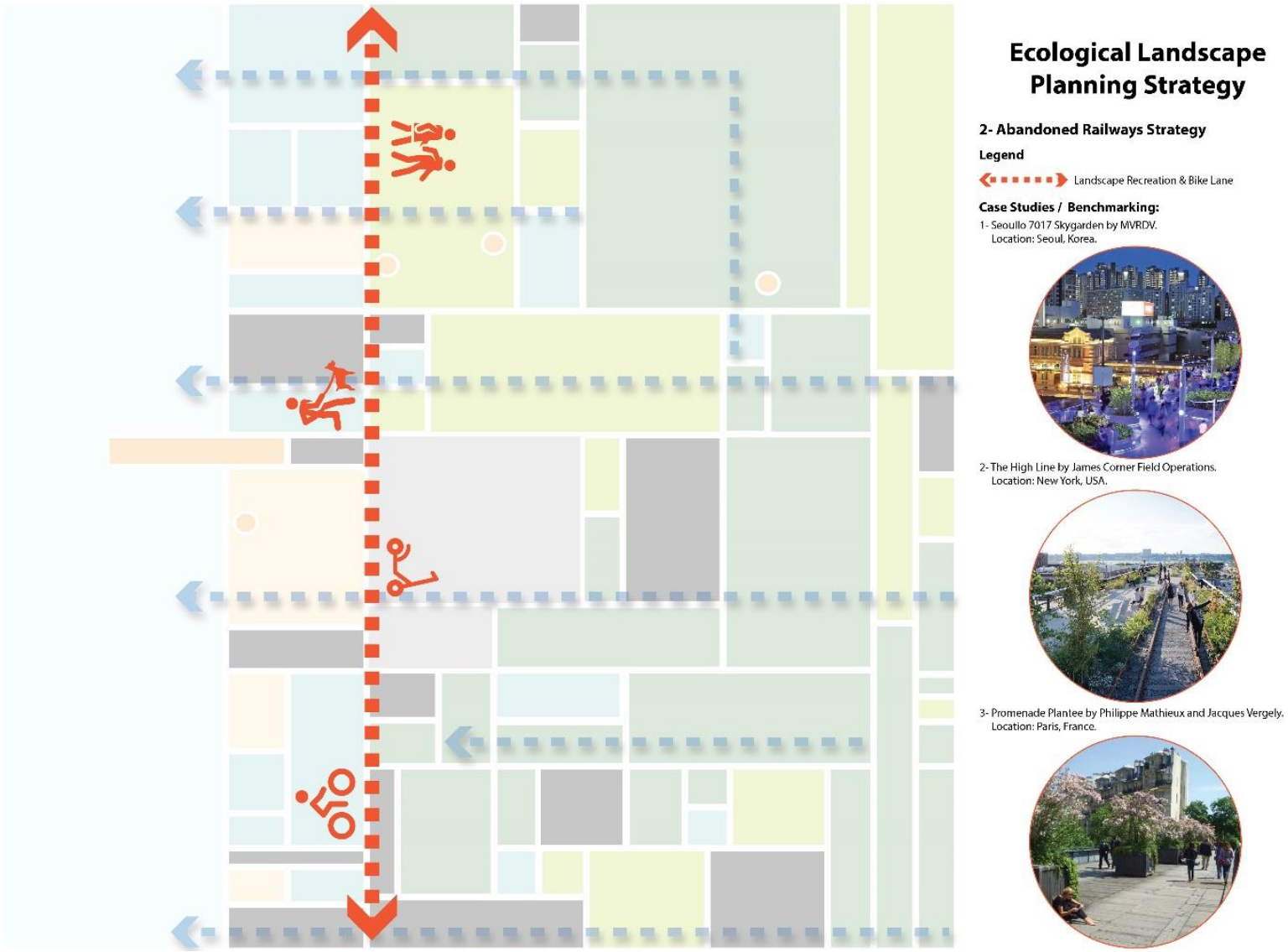


Figure 38: Abandoned Railway Strategy (Author, 2021)

CHAPTER 6

BATROUN-KOURA-TRIPOLI REGIONAL ECOLOGICAL MODEL

This thesis tried to answer the following question: “Can a holistic ecological landscape design/planning approach guide sustainable development of the Anfeh-Hraiche bio-cultural heritage in coastal Lebanon to address the fragmentation and deterioration of coastal ecosystems?”. Hence the methodology followed the holistic ecological landscape design/planning approach to tackle wo main challenges which are:

- The direct threats from unregulated urban expansion and privatization of the public maritime domain.
- The indirect threats by the prevailing limited understanding of cultural landscape heritage by state organizations and the public is of monuments and archaeological sites only.

The latter approach began by identifying first the horizontal layers of the regional landscape (abiotic, biotic, and cultural components) while utilizing advanced GIS mapping tools for ecological applications which acted as a base for the entire research. Second, it combined the previous layers vertically into Ecological Landscape Associations dividing them into 3 categories “Natural, Semi-Natural and Cultural ELAs”. The following allowed to visualize how ELAs expand beyond municipal boundaries and connect with the other ELAs of the regional context creating a homogeneous and continuous puzzle of ecological landscape components. The third step was to revisit the latest findings and start to identify

the trends of cultural landscape transformation on both the regional and municipal level, an example of the trends seen in Anfeh were:

1- Unregulated urban expansion
2- Shrinking of agriculture and scrublands
3- Threat to natural landscape (scrublands) from quarrying
4- Threat to salinas (salt pans) due to urban expansion

Moreover, this exercise allowed to set threat levels for all the studied municipalities each accordingly to their number of trends of landscape transformation; the results were as follow Anfeh, Hraiche, Al-Qalamoun and Chekka had high threat levels (three to four trends of landscape transformation), Barghoun had moderate threat levels (two trends of landscape transformation) while Balamand, Qalhat and Zakroun had low threat levels (only one trend of landscape transformation). These results were verified at the municipal level of Anfeh and Hraiche through a historical development and landuse analysis. The fourth step was to develop the ecological conceptual model to propose a vision followed by the strategic framework. I started first by criticizing the current master plan of 2016, and then showed how landscape character zones (LCZs) (which are smart groups of ELAs) can help in the mapping process to generate an ecological conceptual model serving as the foundation for a sustainable urban development strategy that can complements and guide the current existing masterplan of 2016.

Moreover, the urban development strategic framework aim was to:

1- Protect and enhance the ecological integrity of cultural landscapes by re-integrating LCZs as key natural, semi-natural and cultural components of the coastal cultural landscape.
2- Establish a network of linear connections and other visual connections that bind the landscape components and ensure a healthy environment.

The latter allowed to propose many strategies and different types of interventions that eliminates landscape fragmentation and pushes towards a healthy ecological environment. Finally, I proposed a regional ecological model that plays a crucial role in laying the steppingstones for achieving the sustainable development of the reginal coastal spread of Batroun-Koura-Tripoli. The regional ecological model strives to integrate modern development into the Batroun-Koura-Tripoli Region's existing landscape while retaining long-term sustainability, biological and landscape diversity, and boosting the region's landscape character. The model's ability to achieve these goals is determined by the individual components' properties, as well as their placement within the model and in relation to one another. Because the model's components, such as ELA(s), are a mosaic of ecosystems, they are self-sustaining and ecologically and culturally sound (Makhzoumi & Pungetti, 1999).

ELA(s) will act as the “building blocks” for the regional model, easing the maintenance of landscape integrity and sustaining its biocultural diversity while resolving threatening trends of landscape transformation. Hence, a protection of existing ecological processes in the Batroun-Koura-Tripoli Region. The general spatial pattern of the components inside the model also plays an important role in achieving the ecological

design goal. The proximity of two or more components, for example, is beneficial for biological diversity conservation, such as discovered green corridors, scrublands, seasonal stream links, salinas, agricultural lands and forests continuing beyond municipal boundaries. This adjacency not only ensures continuity of the landscape which is critical for the protection of the mentioned entities but in fact prevents its degradation. As a result, strategies of the urban development plan to protect the previously mentioned components (natural coast, scrublands, agriculture, seasonal streams etc.) would then extend to the regional context and use various incentives and disincentives to extend land use regulation and achieve sustainable ecological networks (Makhzoumi & Pungetti, 1999).

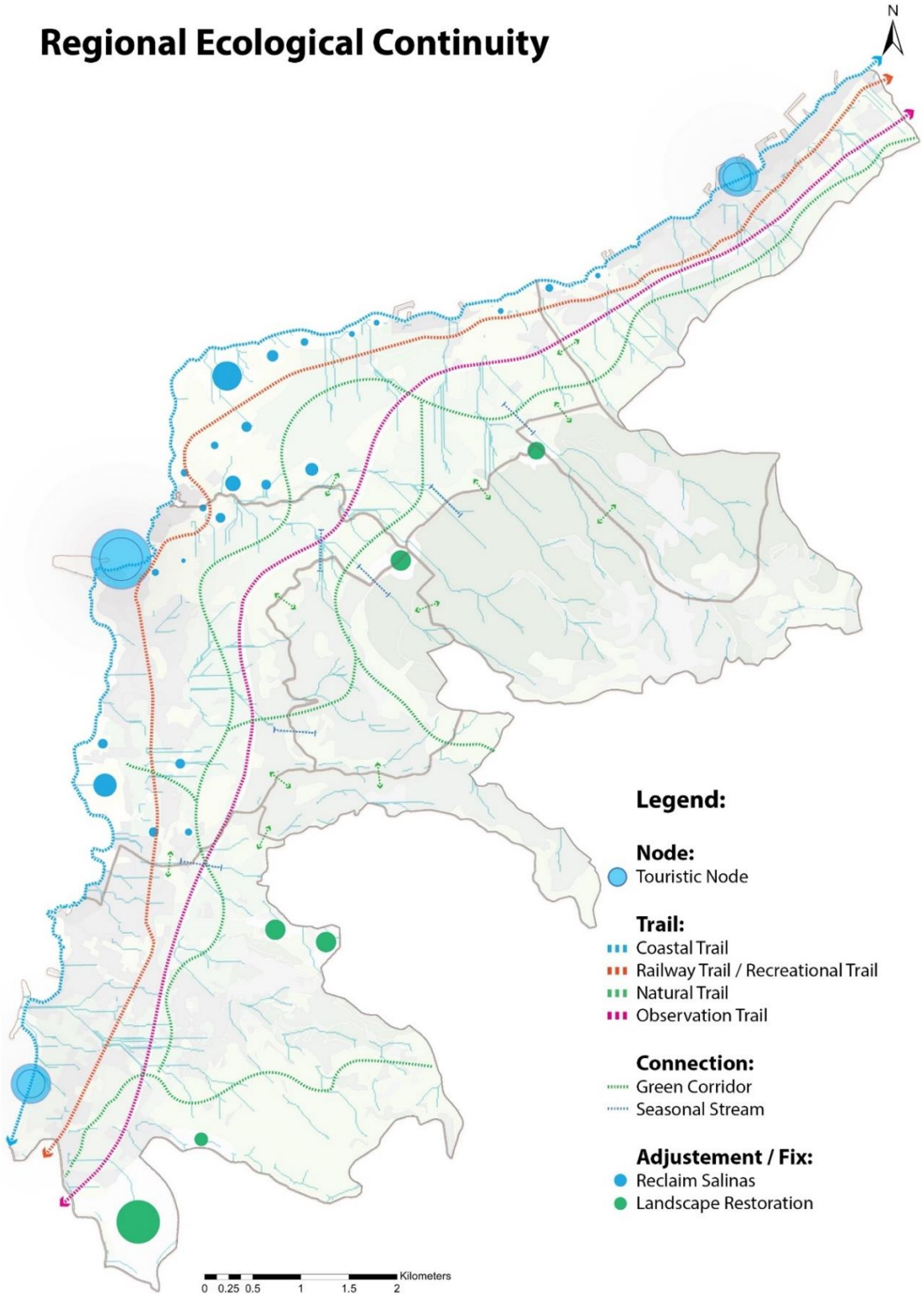


Figure 39: Regional Ecological Continuity (Author, 2021)

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