

AMERICAN UNIVERSITY OF BEIRUT

LAND COVER/ LAND-USE CHANGE IN THE RURAL-  
URBAN CONTINUUM: A CASE STUDY IN THE SHUF  
REGION, LEBANON

by  
MAYA BASSAM ZEID

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for the degree of Master of Science  
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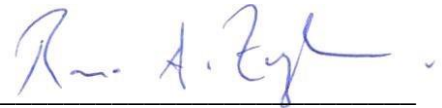
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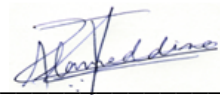
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# ABSTRACT OF THE THESIS OF

Maya Bassam Zeid

for

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Title: Land Cover/ Land-Use Change In The Rural-Urban Continuum: A Case Study In The Shuf Region, Lebanon

A significant change is being observed in the world's land cover layer. Rural areas are undergoing a rapid transformation as they are developing. The following research paper will be discussing the different spatial rural-urban (Rurban) forms and models indicating the rural-urban linkages. This work describes the land cover change in the rural-urban continuum in the Shuf district and 3 Shuf villages (Baakline, Gharifeh and Batloun). Gonçalves et. al, 2017 and the Finnish classification methodologies were adopted to derive and typify the typologies and define the regional classes of the 3 Shuf villages. Geographic Information System (GIS) was used to map and analyze the land cover transformations occurring in the 3 Shuf villages (Baakline, Gharifeh and Batloun) between 1998, 2010 and 2017. Based on the GIS analysis, we observed a decrease in the agricultural and natural element covers and an increase in the urban cover. Thus, the predominant types of spatial formation in the rural urban continuum (RUC) of the selected areas of Shuf are Urban Implosion and Rural Urbanization. The 3 villages fall within the Intermediate Zone class and the rural heartlands areas.

Keywords: Rural-Urban Continuum, Rural-Urban Linkages, Rural-Urban Regional Classification, Land Cover and Land Use Change

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## ABBREVIATIONS

LULC: Land Use Land Cover

RUC: Rural-Urban Continuum

GIS: Geographic Information System

CNRS: Center National de Recherche Scientifique Liban

CDR: Council of Development and Reconstruction

KM<sup>2</sup>: Kilometer Square

%: Percentage

# CHAPTER I

## INTRODUCTION

The world's land cover is changing significantly (Baeza et.al, 2020).

Urbanization is taking over surrounding lands leading to a change in these lands' spatial forms, while rural areas are undergoing a change in their land cover as they are developing. The haphazard development and the spatial reformation of rural areas (such as the increase in population, development of residential and commercial areas, and the need for vital facilities like educational institutions, jobs, entertaining activities, etc...) are changing the landscape. The urban is penetrating through the rural leading to the difficulty of differentiating between the rural and urban settings (Husseini, 2020).

Urban areas are not only restricted to cities; towns and small villages fall within the urban form (Roberts, 2016). According to Rignall and Atia (2017), identifying borderlines between the urban and the rural is difficult. Thus, new rural-urban settlements are observed due to the interconnections and linkages of both settlements (Adell, 1999). These linkages between rural and urban areas indicate the presence of the Rural-Urban Continuum (RUC). This RUC has its own characteristic and spatial models. A new spatial form was presented to define the RUC. This form addresses the different aspects of the rural and the urban spatial forms. It includes aspects such as population, capital flow, facilities and social relations within the two spatial forms (Friedmann & Douglass, 1978; Ndabeni, 2016).

The Middle East, including Lebanon, is undergoing a rapid change in its land cover (Martine, 2010; Gharios et.al, 2016; Masri et.al, 2002). In Lebanon, Al Shuf district is known for its history as well as its physical and natural environments. This

paper seeks to identify, describe and analyze the land cover change in the town of Baakline and the villages of Gharifeh and Batloun.

## CHAPTER II

### LITERATURE REVIEW

#### **A. The Rural-urban Debate/ Planetary Urbanization**

The rural-urban debate is becoming a significant issue and is being discussed in many countries. Rural areas are undergoing rapid transformations around the world. The flow of capital resulted in the formation of new models of land use and land cover that reshaped definitions, needs and dependences of cities, urban centers, towns and villages creating new forms of urbanization (Brenner and Schmid, 2015; Rignall and Atia, 2017; Mughal, 2018). These new urban forms resulted in the launch of a new age. This new “Urban Age” dialogue was initiated decades ago by the United Nations. (Brenner and Schmid, 2015). In his book “La Révolution Urbaine” Lefebvre (1970) mentioned the urbanization of society. His main thesis is that industrialization has resulted in urbanization taking over agricultural lands and thus affecting the agricultural production (Lefebvre, 1970). This is affecting towns and villages, which are being dominated by cities. Moreover, the change that urban settlements are facing is affecting the urban sustainability as well as the rural planning (Feng et.al, 2021). Hence, the haphazard development and the increase in population that the urban settlements are witnessing are affecting their urban sustainability. In addition to that, the rapid change and growth the rural is facing is affecting its planning since this growth is taking over the agricultural and natural lands.

Brenner and Schmid, (2015) suggested a planetary urbanization theory that breaks through the urban/non-urban divide, and where urban forms are no longer restricted to cities (Khatam and Hass, 2018). These new urban forms enhance the

linkages between both rural and urban settlements.

## **B. Rural–Urban Linkages**

The interaction between rural settlements and urban ones leads to the formation of new types of rural-urban settlement (Adell, 1999). Akkoyunlu (2015) underscored the important role rural-urban linkages play in improving the local economy of both areas. According to the author, a deep study of these linkages contributes to better understanding the livelihoods in these areas (Akkoyunlu, 2015).

## **C. Rural Transformation Processes**

The rural is changing. According to literature, this change is the result of three processes, which are: *Rurbanization, Rural urbanization and urban implosion.*

### ***1. Rurbanization***

Rurbanization is the increase in population and the diffusion of urban activities into the rural areas (Kolhe and Dhote, 2016). Rurbanization is driven by the migration of city citizens to the rural villages. This process leads to the formation of the rurbanization model.

### ***2. Rural Urbanization***

As for Rural Urbanization, it consists of the expansion of the urban fringes on the agricultural lands. Roberts (2016) states that the change in livelihoods, modernization of lifestyles and the rural-urban migrations are what characterize this process. He asserts that this rural urbanization process is the result of push and pull

factors including political instability, land tenure and better economic opportunities (Roberts, 2016). These factors push residents away from rural and pull them towards the urban settlement. Table 1 describes the push and pull factors.

	External Factors	Local Factors
Push Factors	<ul style="list-style-type: none"> <li>• Modernization of Agriculture</li> <li>• Land Grabbing</li> <li>• Large Scale Commercial Farming</li> <li>• Famine</li> <li>• Diaspora Buying up Property</li> <li>• Climate Change</li> </ul>	<ul style="list-style-type: none"> <li>• Over Population</li> <li>• Land Disputes</li> <li>• Security Issues</li> <li>• Responsibility</li> <li>• Violence Against Women</li> <li>• Seasonality of Income</li> <li>• Water and Land Rights</li> <li>• Fragmentation of Land Ownership</li> <li>• Demographics</li> </ul>
Pull Factors	<ul style="list-style-type: none"> <li>• Access to Business Networks</li> <li>• Access to Medical Service</li> <li>• Higher Education</li> <li>• Stepping Stone to National and International Migration</li> <li>• Better Internet</li> </ul>	<ul style="list-style-type: none"> <li>• Higher Standards of Living</li> <li>• Access to Capital</li> <li>• Employment Opportunities</li> <li>• Better Health Care</li> <li>• Family</li> <li>• Access to Services</li> <li>• Education</li> <li>• Political and Religious Freedom</li> </ul>

Table 1. Push and Pull Factors (Roberts, 2016)

### 3. Urban Implosion

Finally, the third process is the *urban implosion*. It is the development and the expansion of the rural villages regardless of the city (Qadeer, 2004). Increase in population growth results in the development of towns and villages (Qadeer, 2004).



This increase in population cannot be part of the urban economy as it is produced by rural areas (Rignall and Atia, 2017).

According to Rignall and Atia (2017), capital is flowing towards land-based investments instead of the financial markets. Therefore, land is being commoditized for residential, commercial and industrial purposes rather than its main agricultural purpose. Rural areas are developing new functions and activities that support towns and cities. These areas are becoming important markets that create new job opportunities and provide cities a wide range of services including economic, environmental, and recreational services (Roberts, 2016).

#### **D. The rural-urban continuum (RUC)**

The interconnection of the urban and the rural areas is growing more and more around the world (Muhyiddine and Miskiyah, 2017). The urban and the rural are not defined based on specific criteria; hence their definitions vary with time and change from one country to another (Roberts, 2016). According to the Organization for Economic Cooperation and Development (OECD), the rural-urban continuum is “the intermediate region located between predominantly urban and predominately rural areas” (Gonçalves et.al, 2017). Anthropocene and the flow of capital affect the ways landscapes and their uses change and the rate of this change that varies from one area to another.

#### ***1. Anthropocene***

Steffen et al, (2011) were the first to introduce Anthropocene as a concept. This concept is used to understand the relationship between humans and their environmental

surrounding. The way humans are changing the environment is resulting in a new urban fabric. This new urban fabric whether it was rural (towns and villages) or urban (cities) affects global environmental change (Pelling et. Al, 2010).

Population is a main factor in describing urban areas. The growing population in rural areas directly affects the existing populations infrastructure and result in a change in their land use and settlements to resemble the urban fabrics (Roberts, 2016). Qadeer (2004) stated that such areas have high population densities. However, he also indicated that population does not define urban areas as he gave the example of the rural area of the lower valley of the Nile in Egypt that has a higher population than that of urban areas (Qadeer, 2004).

## ***2. Flow of Capital***

Another factor driving the RUC is the flow of capital. According to Leincheke and Soleck (2005), the transitional flow of capital and ideas enhanced urban development. Therefore, the poor economic conditions present in rural areas are pushing the people there to move to cities looking for better jobs, seeking a change in their economic conditions leaving behind their agricultural lands. Such movement resulted in the formation of new spatial forms that are neither rural nor urban.

## **E. Rural-Urban Continuum Spatial Models**

### ***1. Desakota Model***

Scholars conceptualized *Desakota*, a new urban model, due to extended urbanization expanding on rural lands in the vicinity of cities. Desakotas' are characterized by an increase in labor market as well as an increase public transportation

to facilitate the movement from and to city centers. According to Adell (1999), such models can be seen in corridors joining town centers to city centers. Gonçalves et al. (2017) mentioned that the Desakotas' concept is unclear as the authors stated that these corridors are not clearly defined.

Moreover, the interesting part in this model is the change in land use, which affects the landscapes of both rural and urban areas (Gonçalves et al., 2017 and Pelling & Mustafa, 2010). Changes in landscapes disturb the distribution of ecosystem services. The following figure represents the Desakota model with its 5 major regions:

1. Major cities
2. Peri-urban regions are areas surrounding cities. These regions have daily traveling distance from and to the city center.
3. Desakota regions; are areas settling near the corridors that connect small and intermediate towns to city centers.
4. Densely populated rural areas.
5. Sparsely populated frontier region.

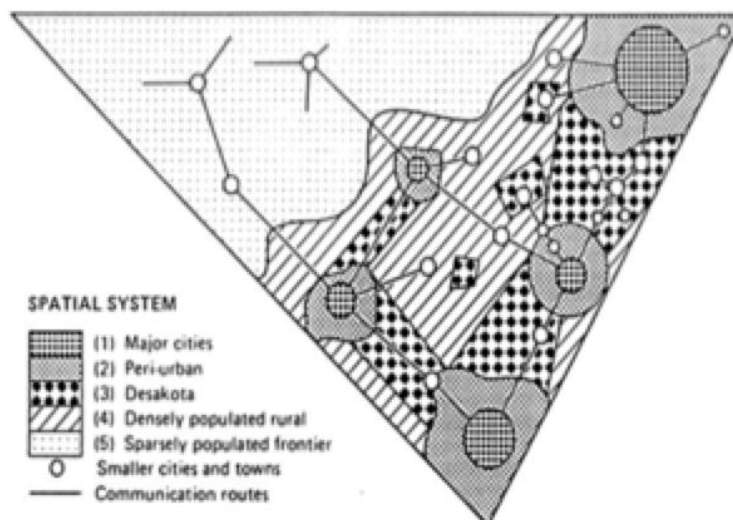


Figure 1. Desakota Model. Source: McGee, 1990 cited by Sheng Wu and Sui, 2016.

## ***2. Ruralopolis Model***

Qadeer (2000) was first to introduce the Ruralopolis model as another Rural-Urban Continuum Spatial Model. According to Qadeer (2004), the rural regions are facing a significant increase in population similar to that in urban areas, which will affect the infrastructure of the rural and will lead to unexpected changes in landscapes due to the change in land use and in the settlement system. This resulting settlement arrangement does not fit the urban pattern or the rural one; it is a new settlement form that is known as Ruralopolis (Qadeer, 2000). This new form has an agrarian economy characterized by a high population density, extended bands of villages, an increase in services and facilities and an extra pressure on land (Qadeer, 2000). The author states that Ruralopolis is a rural form that is linked to cities and that is rural in terms of economic activities unlike the Desakota that is under the urban influence (Qadeer, 2000).

## ***3. Rurbanization Model (Rurban)***

The increase of population and the allocation of urban activities are known as *Rurbanization*. Rurbanization results in the Rurban areas that are an additional Rural-Urban Continuum Spatial Model. Kolhe and Dhote (2016) mentioned that Rurban areas are large rural settlements. They are villages in rural areas that have urbanized centers (Kolhe and Dhote, 2016). The authors clarified that these centers are managed by rural bodies, but have urban characteristics (Kolhe and Dhote, 2016).

## **F. Middle East Urbanization**

The Middle East region is facing a rapid increase in population that results in a massive urban transition (Martine, 2010). Economic migration is a major cause towards the growth of urban settlements. Due to services and job opportunities available in cities and due to the high residential costs present in the urban centers, the rural residents will migrate towards the urban fringes thus leading to the formation of urban sprawls.

Moreover, lack of adequate land governance also impacts urbanization of the Middle Eastern rural areas. Thus, agricultural lands are being transformed into urban areas due to the absence of the governmental control. To illustrate this point, the agricultural lands in Al-Mansouria in Egypt became illegal villas and compounds since the government failed in taking proper measures (Badawi, 2011; as cited by Masoumi et.al, 2018).

As for KSA, the government supported urban expansion in Riyadh by decreasing the sizes of agricultural lands to enhance urban development (Gamboa, 2008). Due to this action, agricultural lands are no longer sufficient and thus the city lost its agricultural character (Gamboa, 2008).

In addition to that, this transformation is not only based on political and management issues, however it is also based on the socio-economic drivers that play a major role in shaping the rural-urban continuum. Such drivers can be social like facilities, social interactions and new lifestyles or economic such as better job opportunities present in these areas rather in the rural settlements or both factors combined together. Hence, low costs of lands and its closeness to urban centers made it an attractive place for rural migrant. In this case they would stay within the rural context and make use of urban activities and services. The relocation of rural migrants

encouraged opening of schools and universities. New local businesses and other services helped in the urbanization of such areas (Debolini et.al, 2015; Salem et.al, 2018; Masoumi et.al, 2018).

In some Arab countries, urbanization came as a result of a sudden change in the economic condition of a country or extraction and benefit of natural resources and not only because of conflicts and poor government. For example, the development of the Arabian Gulf was due to the oil boom in Gulf's countries especially in UAE and Qatar (Oukhzame et.al, 2021).

### **G. The Case of Lebanon**

Lebanon, like any other region in the world, is undergoing a continuous change in its urban-rural areas. Gharios et.al (2016) noted a change in property usage and landscapes among these changes. This land use change impacted most the agricultural lands (Masri et.al, 2002). The four following different periods affected the urbanization process in Lebanon (Davie, 2002).

The first urbanization form was during the Ottoman Empire. Self-regulating local government directed the process of urbanization during this period of time. This process went on smoothly during this time. Thus, immigrants did not disrupt this process or the socio-economic balance (Davie, 2002).

The second urbanization process was during the French mandate. The country lacked a specific master plan for its urban development during this mandate. In this period, rural migrants left their villages to live in the city's sidelines resulting in an urban sprawl (Davie, 2002).

The third urbanization wave in Lebanon was during the civil war. According to Davie (2002) this period was made up of two parts the Lebanese civil and the Israeli invasion. The war period led to the urban expansion of Choueifat, Dora and Ajaltoun suburbs among others due to the movement of the capital's inhabitants towards these areas. However, the Israeli invasion of 1982 led to the development of Beirut suburbs because of the movement of southern residents towards these suburbs.

The fourth wave was after the civil war. The aim of urban development plans was to reconstruct the capital. These spatial changes impacted the land cover and land use in Lebanon (Davie, 2002). However, minimal studies have been done on identifying the factors that shaped these transformations. Thus, there is a lack of studies on the rural-urban continuum in Lebanon. The continuous urbanization is causing many problems such as environmental issues in the peri-urban areas.

Land use has shifted from agricultural purposes to industrial and residential ones. Market prices changed the land values to fit the real state demand (Masri, Khawlie & Faour, 2002). This presents the need for a reviewed planning system. The Lebanese unclassified land is open to exploitation. Highest levels of urban growth areas are observed in Beirut. Different patterns of sprawl are observed in Lebanon. Nabatiyi, Baalbak and Zahle represented a ribbon sprawl; whereas, Saida and Beirut exemplified a low-density sprawl. A low-density sprawl represents the extension of low-density peripheral land use, while a ribbon sprawl take place on lands surrounding and close to major roads. Some cities such as Jounieh, Sour and Tripoli combined both the ribbon sprawl and the low-density one in their developing process (Faour, 2015).

Due to this undefined sprawl, the Council for Development and Reconstruction (CDR) established a new land classification plan. The Lebanese urban areas were

placed under five categories. First, the capital Beirut and Mount Lebanon are classified as central urban areas. Second, Tripoli is categorized as the capital of North. Third, Tyre and Baalbak are classified as historical cities. Last but not least, Jbeil and Saida are categorized as gate cities. Finally, Nabatiyi, Shtoura and Zahle are classified as city poles. Regarding the rural, it is undergoing a direct transformation and these areas are divided into local points present in villages and small towns. Such villages and towns surround central cities (Council of development and Reconstruction, 2005).

This paper will study the land cover changes in the Shuf district focusing on Baakline town, Gharifeh and Batloun Villages. The Shuf district was studied because its land cover is affected by its location and microclimate that enhances its agricultural and natural element cover. Even though the Shuf has no urban center, its closeness to Beirut led to its urbanization. The district is made up of many towns and villages. The following 3 were chosen to represent these towns and villages. *Baakline* town is known for its historical character and is also undergoing a rapid urban implosion leading to the degradation of agricultural lands in the town. *Gharifeh* is a Lebanese rural village well known for its agricultural lands and olives plantation. Today, this village is developing haphazardly. *Batloun* is another village known for its agriculture (mainly fruits such as apples and grapes) and is also developing but at a slower rate than that of Gharifeh, knowing that Batloun is next to the touristic village Barouk. This gives it more value since tourists will be passing through it to reach Barouk.



## CHAPTER III

### METHODOLOGY

The main goal of this paper is to answer the following research questions and determine the forms of the spatial transformations taking place in the 3 chosen villages and the form of development the villages have undergone. The table below presents the research questions, objectives, methods used and the hypothesis developed.

<b>Research Questions</b>	<b>Objectives</b>	<b>Methods</b>	<b>Hypotheses</b>
<b>How did the land use and land cover change over time in the villages in Shuf?</b>	Map land cover changes in 3 Shuf villages.  Typifying the RUC elements	GIS Analysis  Gonçalves et.al (2017) methodology  (Authors classified different forms of spatial transformation according to a set of dimensions)	New spatial forms have evolved in rural areas influenced by the penetration of urban dynamics into the countryside causing a significant change in land use from agriculture to services, real estate speculation and other forms of rent
<b>What are the different types of spatial formation in the rural-urban continuum in the selected areas of the Shuf?</b>	Define the regional classes of the spatial formation in the 3 Shuf villages.  Classify the RUC (Intermediate Zone and Rural areas).	Finnish Environment Institute (The Institute studied the spatial classification of the rural and urban and proposed new criteria for classifying the RUC)	The predominant types of spatial formation in the RUC of the selected areas of Shuf are Urban Implosion and Rural Urbanization. The 3 villages fall within the Intermediate Zone (IZ) class and the rural heartlands areas.

*Table 2.* Research Questions, Objectives and Hypotheses

## **A. Study area**

### ***1. The Shuf District***

The Shuf district, spread over 481 square kilometers is located in the Mount Lebanon governorate. The Shuf stretches from the Mediterranean Coast of the Western sides to the heights of the Barouk Mountains (2,000 meters above sea level). It is bordered by the Alay district from the north, by the West Bekaa district from the east, by the Saida and Jezzine districts from the south and by the Mediterranean Sea from the west (Mosleh & Hafez, 2017).

Beiteddine is its administrative center. This village is the historic core of the Republic of Lebanon and the capital of the Emirs of Mount Lebanon (Mosleh & Hafez, 2017). Moreover, Christians and Muslims, predominantly Druze, inhabit the Shuf region. Power struggles caused violent clashes among the sects, which resulted in the displacement of Muslims and Christians leaving behind their towns, villages and homes.

The Upper Shuf area falls with the rural region in Lebanon (Mosleh & Hafez, 2017). Agriculture is a main economic activity in the Shuf. The region's location and microclimate diversity enhance the production of a wide variety of crops (Mosleh & Hafez, 2017). Thus, around 50% of cultivated Shuf regions are covered by olives and around 38% of Shuf cultivated regions is covered by fruit trees such as grapes, apples, oranges and many others (Hani, 2015).

The Shuf region is also known for being the home of the "Al-Shouf Biosphere Reserve". This Reserve is the largest in Lebanon; it includes the Maassir Al Shuf, Ain Zhalta and Barouk cedar forests (Mosleh & Hafez, 2017). Even though urban

development is taking over in the Shuf; it is still dominated by agricultural and natural cover.

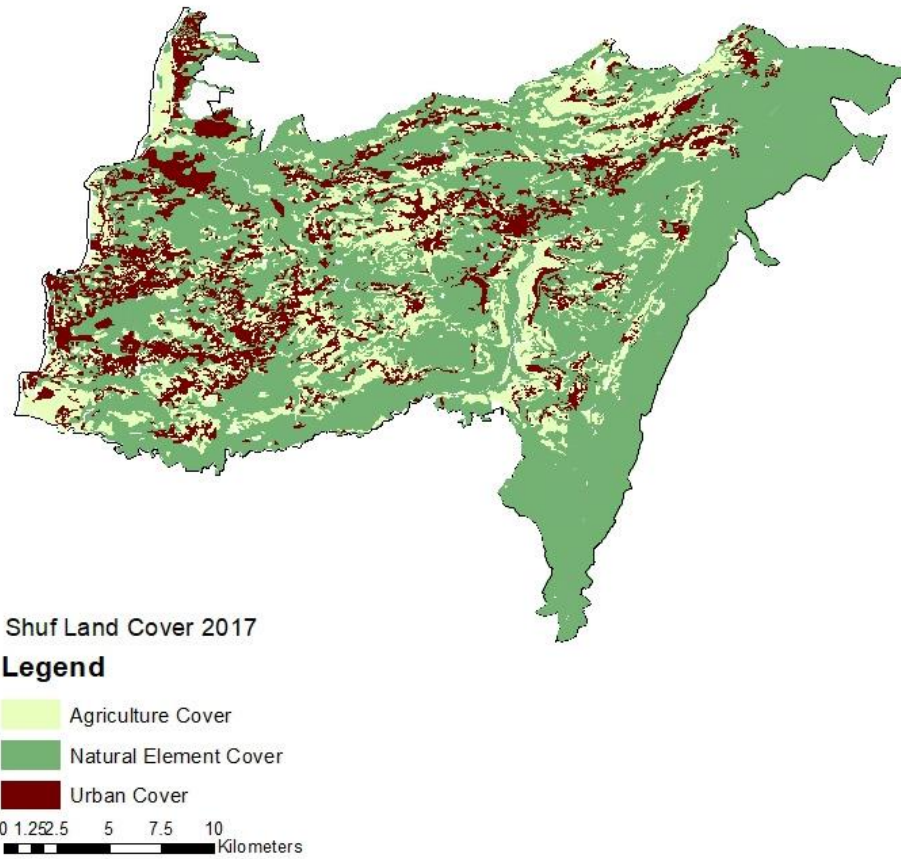


Figure 2. The Shuf's Land Cover (GIS, 2017)

## 2. *Baakline Town*

Baakline town is one of the 9 villages of The Federation of Shuf Souayjani Municipalities. It is one of the biggest of all Shuf areas with a population of almost 30,000 persons, who are mostly Druze with a small Christian minority. The town is situated on seven green hills with an altitude that reaches almost 950 m at its peaks. It is best reached either from Damour - Beiteddine road, or through Jezzine - Mokhtara road, and it is 45 km away from Beirut. It is separated from Deir el Qamar by a large valley that reaches the Damour areas.

Baakline Town has its old unique history. The villages' remnants were found there in wooded areas and are characterized by the religious background of its ancient sites such as cemeteries. The town is also known for the production of oil, soap, and distinctive handicrafts. The most important fact the Town has witnessed was in the 12th century when Maan Emirs resided in Baakline, which made it their capital until the early 17th century. However, and due to water shortages in Baakline, Emir Fakhreddin II moved to Deir el Qamar, which became their capital instead of Baakline.

Baakline used to have an agricultural economy with greens mountains and valleys especially those of olive trees, pines, figs, vineyards, and grains. Those used to be irrigated through many water sources and springs at the village. However, the town is witnessing a change in its landscape due the urbanization taking place.

### ***3. Gharifeh Village***

Gharifeh village is another one of the 9 villages of The Federation of Shuf Souayjani Municipalities. It is located in the Mount Lebanon governorate, and more precisely in the Shuf district. It is home to 8,260 inhabitant. Its elevation ranges from 525m above sea level to 950m above sea level. It is 48 km away from Beirut using the Debbieh-Saadiyat road and 53 km using Baakline-Damour road.

The first settlements in the village started in 1204 A.D. when people coming from the South, the Bekaa, and nearby villages settled in that location due to the presence of olive trees dating from the Roman times, as well as the presence of the Al Heri River. These people later became the local villagers, as they started working in the lands of the landowning families to make a living. They then depended on the agriculture as they planted fruit trees, wheat and olives. In the late 19th century, the

village earned its current name: Gharifeh. According to Anis Freiha (1972), and as stated in his book *A dictionary of the names of towns and villages in Lebanon*, Gharifeh has Aramaic origins and means "to scoop", and the reason behind this name is the considerable amount of olive oil produced, which people have to scoop in order for them to use it. At that time, the village flourished and was considered the "bank of the Shouf", as locals worked in the trade of local products like fruits, olives, olive oil, and wheat products. Many springs were present, in addition to artesian wells that helped in the irrigation of the agricultural fields. This situation attracted more people to come and settle in the village.

#### ***4. Batloun Village***

Batloun village is another village located in the Mount Lebanon governorate, and more precisely in the Shuf district. This village is a part of the Shuf Cedar Reserve Biosphere. It has an average elevation of 1080m above sea level (Rachid, 2007). It has around 3500 inhabitants and it is 45 km away from Beirut using the Deir El Qamar-Damour road. The village spreads over 5.5 square kilometers in Shuf district.

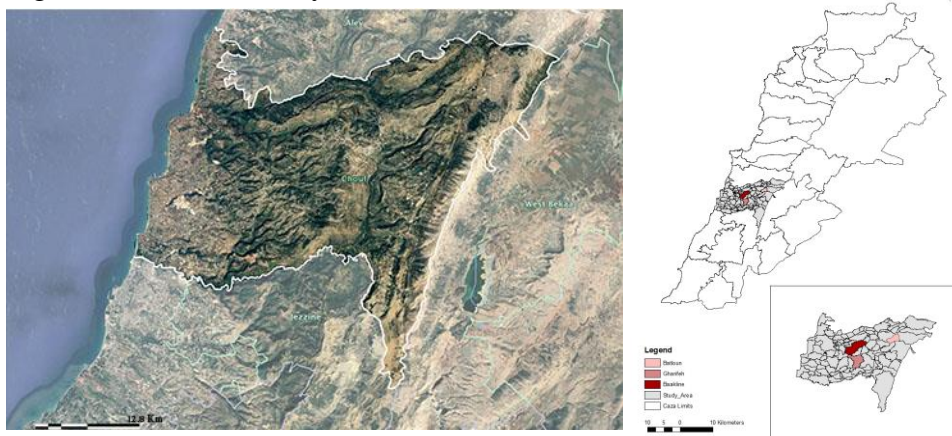
Batloun is famous for its natural resources including water, agriculture and natural element cover. It serves as a main commercial market for its surrounding villages. Its geological cover, such as slopes, availability of water, and soil, affected agricultural lands' distribution (Rachid, 2007). Rachid (2007) mentioned the presence of 2 agriculture methods followed in the village: irrigated and non-irrigated agriculture. Irrigated agricultural lands spread through the Barouk riverbanks and Sakiyi springs and includes fruit trees (mainly apples, figs, cherries, and mulberries); whereas the non-

irrigated agriculture cover the remaining agricultural lands and consists of olives and vineyards (Rachid, 2007). Like any other village is Shuf, Batloun is undergoing a change in its land cover. Thus, grasslands and unproductive lands are replacing agricultural lands (Rachid, 2007).

Forests are an important aspect in the village. Oak forests dominate the natural cover of Batloun with some other pine and mixed forests including shrublands and herbaceous vegetation.

The village is divided into 2 parts: Lower Batloun (Batloun el Tahta) and Upper Batloun (Batloun el Fawqa). Lower Batloun is the built up area along the river while the upper part of the village consists of the built area along the main road of Batloun and away from the river (Rachid, 2007).

Figure 3 shows the study area.



*Figure 3.* Study Area (Shuf District, Baakline, Gharifeh and Batloun) (Google Maps, 2017 and GIS)

## **B. Typifying the RUC regional classes**

To achieve the goal of this study, understanding different RUC forms and their characteristics is needed. Gonçalves et al (2017) indicators and dimensions will be adopted to typify the 3 chosen villages in Shuf (rural, peri-urban and urban) and forms

of development these villages have undergone. Gonçalves et al (2017) classified different forms of spatial transformation that exists in the region surrounding Lisbon metropolitan area according to a set of indicators and dimensions basing their classification on the Corine land cover.

Dimension	Indicator
Mobility	Travel time in public transport to the municipality (min) Modal split by bus (%) Modal split by metropolitan (%) Modal split by train (%)
Identity and Lifestyle	Change in resident population between 2001 and 2011 (%) Location coefficient – complex families Location coefficient – isolated single-family house Rejuvenation index change (%)
Natural Elements	Percentage of area occupied by green elements (%) Percentage of area classified as Natura 2000 (%) Largest patch index of elements with natural value Number of patches with natural value
Land Cover	Percentage of area occupied by agro-forestry systems (%) Percentage of area occupied by farmland mosaic (%) Percentage of area occupied by other artificial surfaces (%) Total urban-rural edge (km)
Economic Activities	Company specialization index, based on data tables from the Ministry of Economy and Employment (Portugal) Employment diversification index, based on data tables from the Ministry of Economy and Employment (Portugal) Location coefficient – employment in Agricultural Sector Business space/warehouse rental price index (industry) (€/m <sup>2</sup> ) (confidential)
Spatial Functions	Dwellings for habitual residence without wastewater drainage (%) Buildings not served by municipal solid waste collection (%) Population density in urban areas (inhabitants/hectare) Centrality potential

*Table 3: Dimensions and Indicators (Gonclaves et al, 2017)*

Due to lack of data, and the absence of an urban center in the study area some of these indicators are not applicable to the study area; the use will be limited to the following indicators and dimensions:

<b>Dimension</b>	<b>Indicator</b>
Land cover (1998-2017)	% of area occupied by forests % of agricultural land % of abandoned agricultural land % of area occupied by shrubs % of area occupied by urban cover
Population	Population Change
Mobility	Travel time needed to reach Beirut in public or private transportation

*Table 4: Typologies Indicators and Dimensions*

The following data will be acquired from the analysis of GIS maps and municipalities' databases. The land cover dimension is used to understand the change in the land use layer of the Shuf district as well as that of the 3 villages. Mobility is important to measure the time needed from each village to reach Beirut (main urban center) in public or private transportation. In order to determine the drivers that reshaped the rural-urban continuum (RUC) and their impact, literature and its relation to the history of the villages taking into consideration factors affecting this history will be used.

### **C. Classify the RUC in Shuf District**

The Department of Geography of the University of Oulu and the Finnish Environment Institute in cooperation with the Ministries of employment, economy and agriculture and in Finland (2013) created the geographical information-based area classification system that will be adopted in this paper to determine the types of rural-urban transformations occurring in 3 Shuf villages (Baakline, Gharifeh and Batloun).



The Finnish Environment Institute studied the spatial classification of the rural and urban taking into consideration the complex areas lying between both. This institute proposed new criteria for classifying the RUC. These different classification levels are as follows and are represented in figure 3. Level 1: Rural Urban dichotomy

Level 2: Rural-Urban gradient that includes rural areas, core urban areas and the intermediate zone (IZ) of both rural and urban core areas. This gradient is considered to be the rural-urban continuum.

Level 3: Regional Classes that includes the IZ divisions which is the subject of interest in this thesis.

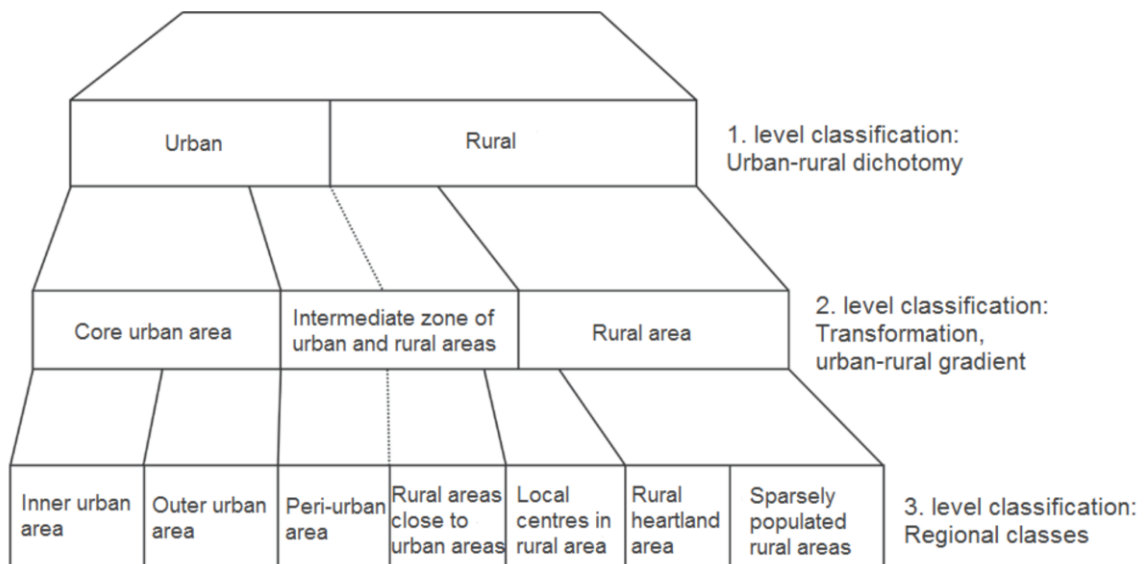


Figure 4: Rural Urban Classification Levels (Finnish Environmental Institute, 2013)

#### D. Data Limitation

The American University of Beirut provided the GIS Shapefiles used in this thesis. These were developed by the Centre National de Recherches Scientifiques (CNRS) of Lebanon and were available for the years 1998, 2010, and 2017. These dates are pertinent to the analysis, because 1998 is close to the end of the Lebanon war, and

2017 represents the current times. 2010 is used here as an intermediate date, also reflecting changes that occurred right after the 2006 Israeli war on Lebanon as well as the financial crash of 2008, which was associated with a sudden increase in global and local food prices.

The CNRS classified the data (agricultural cover, natural element cover and urban cover) according to the Corine Land Cover/Use Class Description. However, after analyzing the data it was found that the 1998 land cover layer is not reliable and contradicts the data of 1994, 2010 and 2017. Among the issues with the 1998 layer is the misleading urban cover data, which prevents accurate analysis. This was also mentioned by Husseini (2020), while she was studying the RUC of North Lebanon. Hence, 2 sources of data are available regarding the urban cover of Lebanon. The first is from the urban dataset whereas the second is from the LULC cover. Unfortunately these datasets do not match. The analysis of the data, enriched with Husseini's findings indicated that for the special case of urban areas, the "Urban Evolution" data set from CNRS is more reliable than the LCLU "urban cover classes" (also produced by CNRS).

### **E. Urban Covers' Data Comparison**

The urban dataset presented by the urban layer contradicts the urban dataset presented by the LULC in 1998. The following graphs are used to compare the urban layer dataset of the Shuf district urban evolution to that presented by the LULC 1998. The 1994, 2005 and 2013 dates are chosen from the urban dataset because they are the closest to those presented in LULC layers (1998, 2010 and 2017).



Graph 1: Urban Data Comparison

Lebanon witnessed four different urbanization waves mentioned by Davie (2002) in the literature review section indicating the increase in the urban cover of the country. Moreover, MOE/UNDP/ECODIT (2011) mentioned that the strain in the natural and agricultural covers in Lebanon is due to the fast rate of urbanization the country has undergone. This contradicts the dataset the LULC 1998 present. However, after analyzing the data it was found that the 1998 land cover layer is not reliable.

In addition to that, the urban cover of Shuf District in 2005 was 8.84% (urban dataset), which is less than that of 1998 (14.23%) obtained from the LULC dataset. This confirms the validity of the urban dataset since Lebanon is witnessing a fast rate of urbanization as presented in the literature review. However, a decline is observed in the urban cover of the LULC dataset between 1998 and 2010 contradicting the urban cover of Lebanon.

Therefore, the urban cover of the 1994 urban dataset will replace that of the 1998 in the LULC dataset.

As for the natural cover, in 2010 it witnessed an increase in its area to decline again in 2017 indicating the presence of misleading issues with this layer. Thus, urbanization is taking over the natural cover (Ecodit, 2011). Accordingly, the difference

between both datasets will be added to the natural cover. This was also done by Hussieni (2020) while she was studying the land cover change of North Lebanon. In addition to that, 2010 data is misleading. Husseini (2020) mentioned that as well. Even though, 2010 data is presented, however, the emphasis will be on 1994 and 2017 in the discussion. The resulting results will be used in the remaining study.

## CHAPTER IV

### RESULTS AND DISCUSSION

The Shuf, and like any other part of Lebanon, is experiencing a change in its land cover. This land cover is divided into 3 usages: the agricultural cover, the natural element cover and the urban cover. This section presents the results obtained from each usage and its analysis in the Shuf district, Baakline town, Gharifeh village and Batloun village.

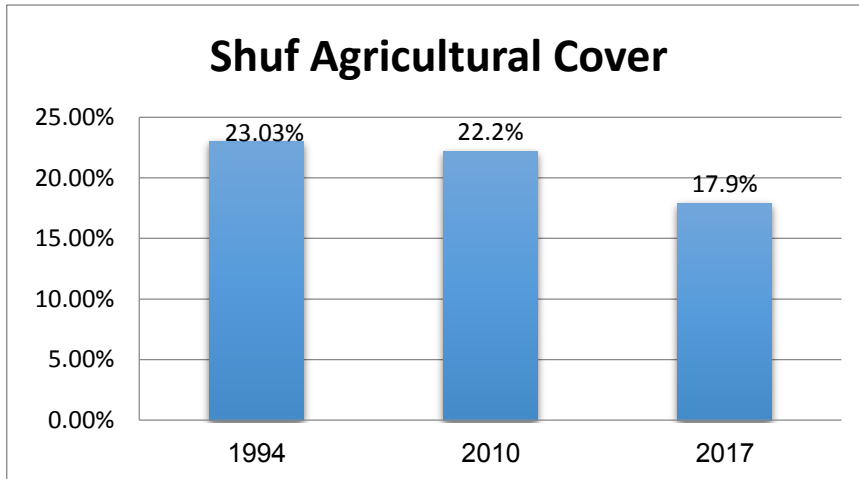
In addition to research and literature review, it is imperative to mention that I am personally connected to the Shuf district and the 3 studied villages. I was born and raised in the studied areas.

#### **A. The Agricultural Cover**

The agricultural land cover includes the following layers: olives, vineyards, fruit trees, field crops, citrus, bananas, protected and abandoned agriculture.

##### ***1. The Shuf District***

The Shuf is well known for its agriculture however; it is undergoing a rapid and haphazard development and urbanization. The graph below presents the agriculture cover results obtained from GIS in the Shuf district between 1994, 2010 and 2017.



*Graph 2: Shuf Agriculture Cover in 1994, 2010 and 2017*

In 1994, agricultural cover covered 23.03% of the total Shuf area. This agricultural cover decreased to 22.2% in 2010 and 17.9% in 2017. In accordance with tables 5 above, the agricultural cover decreased to cover 95.29 km<sup>2</sup> in 2017 after it was 110.83 km<sup>2</sup> in 1994. The Shuf district is known for its olives, olive oil production and soap production in addition to fruit trees and field crops. Farmers make their living from the agricultural cover's production by delivering it to urban centers.

Similarly, Chamling and Bera (2020) studied the land cover change in Buhtan between Bengal foothill region between 1987 and 2019 and reached similar results in the land cover's change. Thus, agriculture revealed a significant decrease in Bhutan (Chamling & Bera, 2020). The maps below present the agricultural cover of the Shuf in 1994, 2010 and 2017.

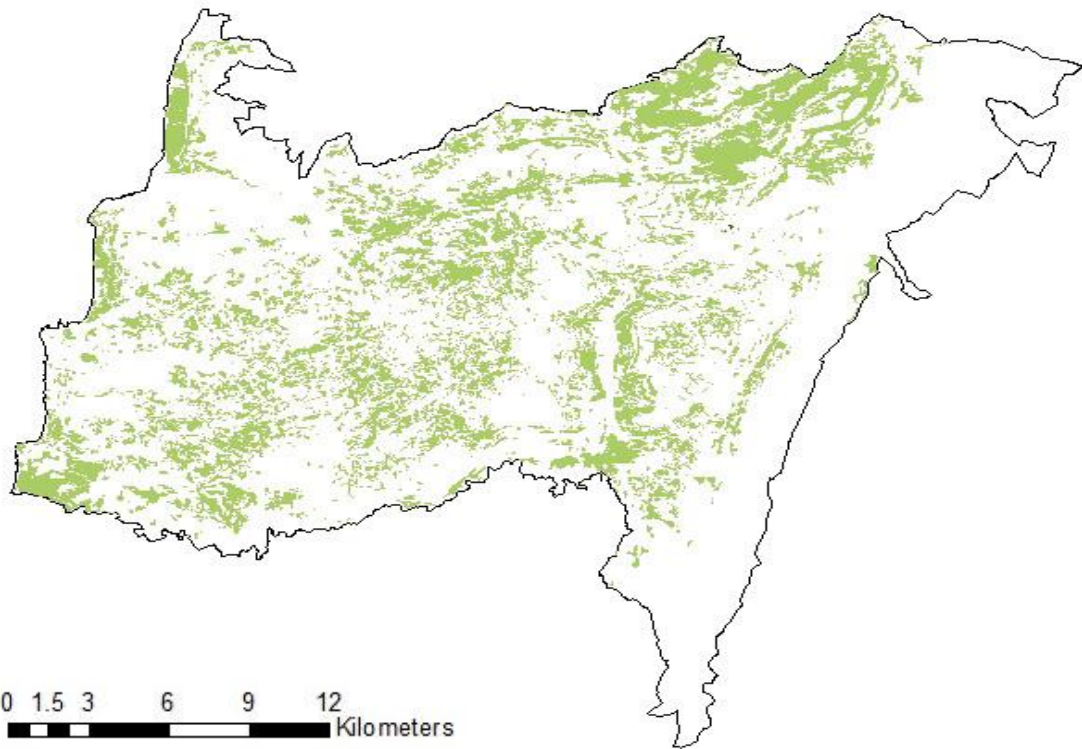
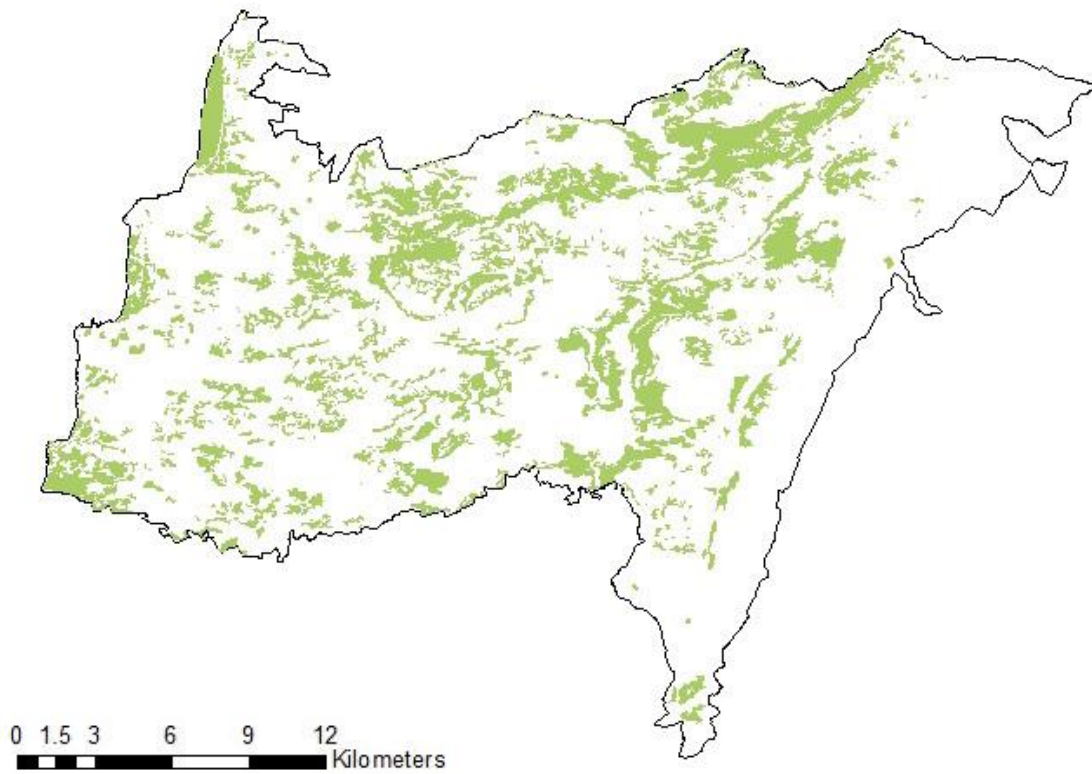
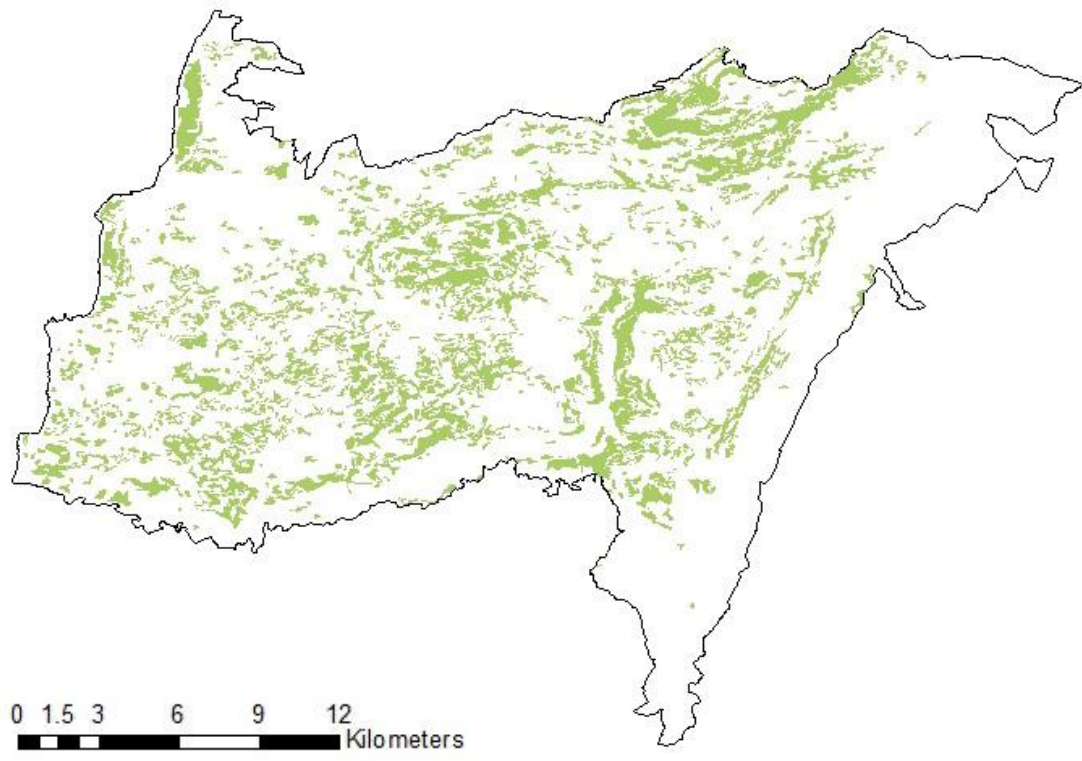


Figure 5: The Shuf's Agriculture Cover 1994



*Figure 6: The Shuf's Agriculture Cover 2010*

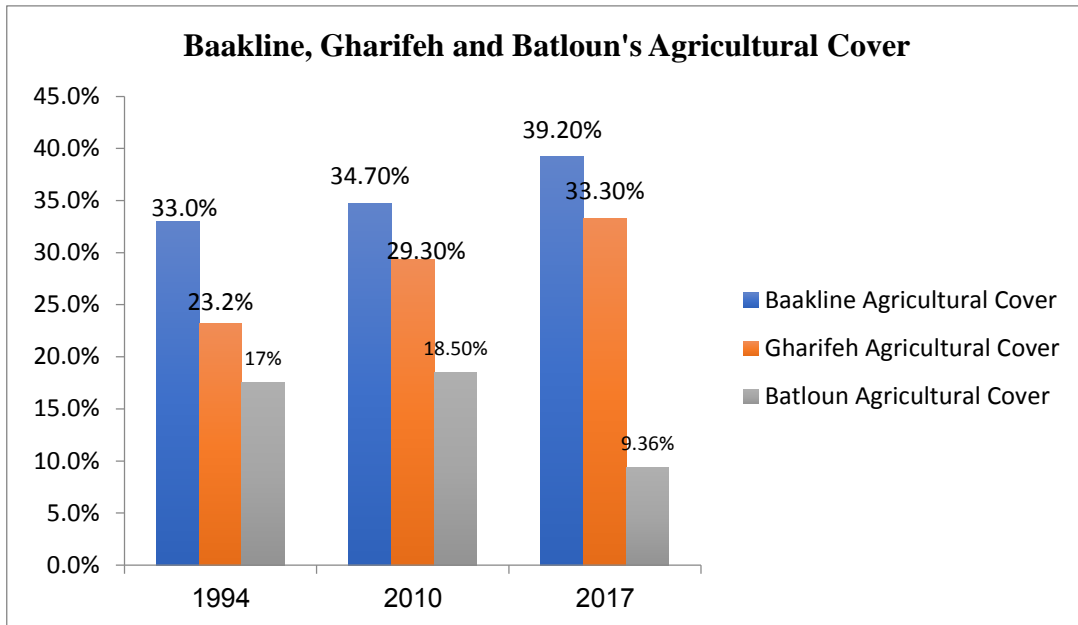


*Figure 7: The Shuf's Agriculture Cover 2017*

## ***2. Baakline Town, Gharifeh and Batloun Villages***

The agricultural land cover of Baakline town, Gharifeh and Batloun villages includes the following layers: olives, vineyards, fruit trees, field crops in small, medium and large fields, protected agriculture and abandoned agriculture. These layers have changed over years. Tables 6 and 7 and 8 are relevant to Baakline, Gharifeh and Batloun as they show the agricultural cover in the 3.





*Graph 3: Baakline, Gharifeh and Batloun’s Agriculture Cover in 1994, 2010 and 2017*

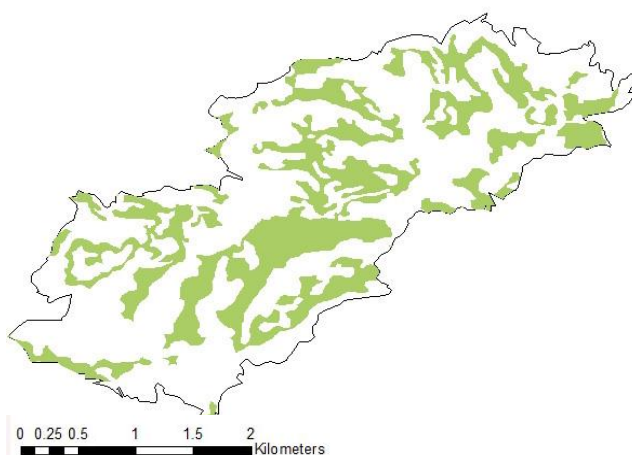
In 1994, agriculture covered 33% of Baakline’s area, 23.2% of Gharifeh’s area and 17.48% of Batloun’s area. In 2010, this cover increased to 34.7% in Baakline, 29.3% in Gharifeh and 18.5% in Batloun. The agricultural cover further increased in 2017 to occupy 39.2% of Baakline’s area and 33.3% of Gharifeh’s area, whereas it decreased to cover 9.36% of Batloun’s area.

Olive’s occupancy has increased in Baakline and Gharifeh between 1994 and 2017 due to olives financial benefits, as olives don’t need considerable care relative to other crops. Similar trends have been repeated elsewhere in the Mediterranean, indicating that this is a regional phenomenon, and confirming the trends we observe. For instance, an increase in olive plantations was observed in Spain due to the financial benefits olives can bring to farmers with low income; thus, olives can be sold as olives as food, olive oil, soap and wood for heating (Infante-Amate, 2000). Fruit trees were

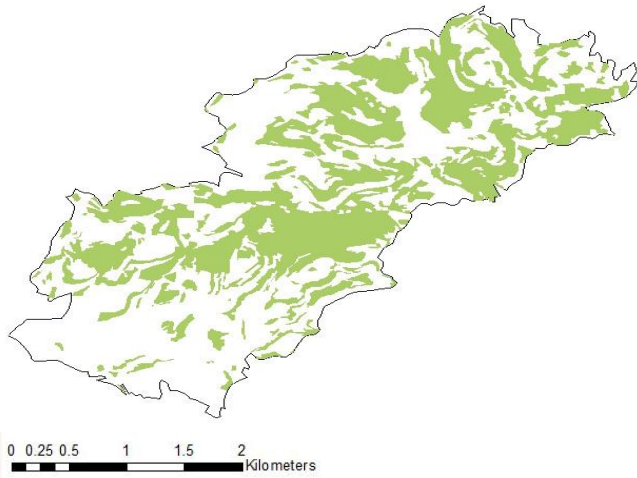
under less care than needed in both villages and thus its cover decreased from 1994 till 2017 due to less interest of present generations in maintaining fruit trees and enhancing fruit production. However, in Batloun, current generation interest in field crops rather than fruits have resulted its increase between 1994 and 2017. This is attributed to the drive for quick profits. Field crops are seasonal and do not need the time fruit trees need to grow, start producing fruits and give financial benefits. Hence, fruit trees are long-term plantation (Schaffer, 2021).

As shown in the literature review section, Lebanon as well as the Mediterranean region are witnessing an increase in the urban cover, which is taking over the agricultural, and the natural elements' covers (Martine, 2010; Gharios et.al, 2016 and Masri et.al, 2002). Based on the above, it can be noticed that agriculture is still an important aspect in the Shuf district and its villages. Even though, the decrease in the agricultural cover in Shuf is minimal over the years (1994-2017), a notable increase in the same cover is observed in Baakline and Gharifeh. Hereunder are the maps of the agricultural cover in Baakline, Gharifeh and Batloun in 1994, 2010 and 2017.

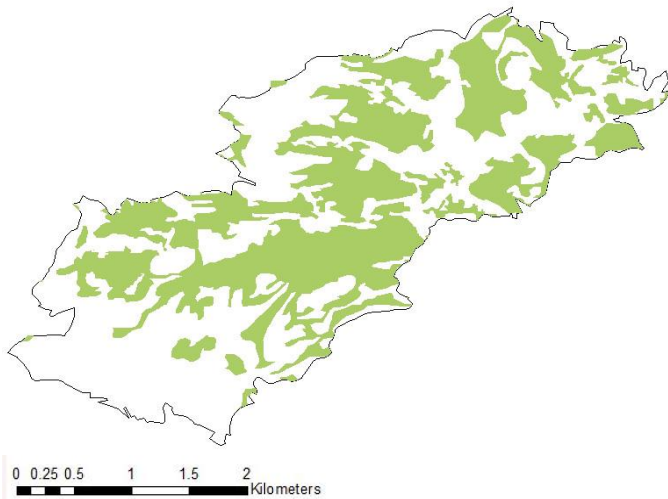
#### Baakline Maps



*Figure 8: Baakline's Agriculture Cover 1994*

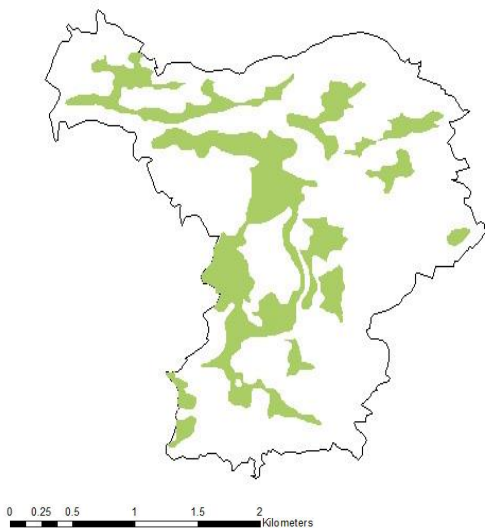


*Figure 9: Baakline's Agriculture Cover 2010*

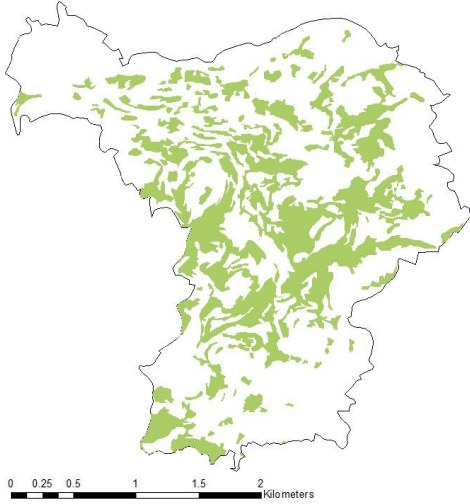


*Figure 10: Baakline's Agriculture Cover 2017*

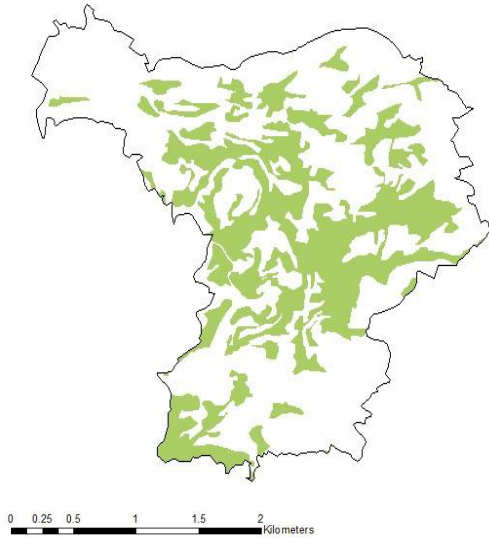
**Gharifeh Maps**



*Figure 11: Gharifeh's Agriculture Cover 1994*

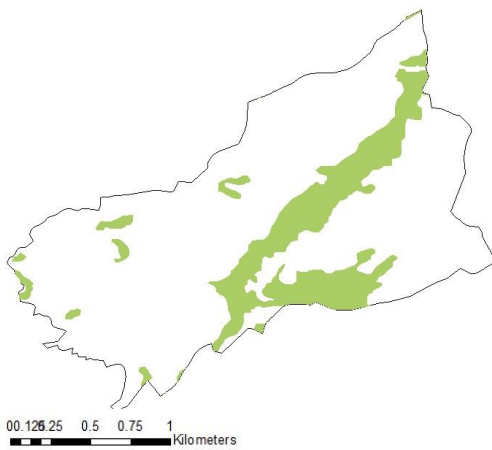


*Figure 12: Gharifeh's Agriculture Cover 2010*

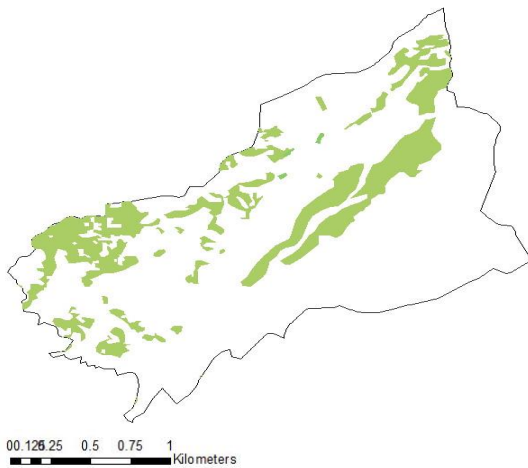


*Figure 13: Gharifeh's Agriculture Cover 2017*

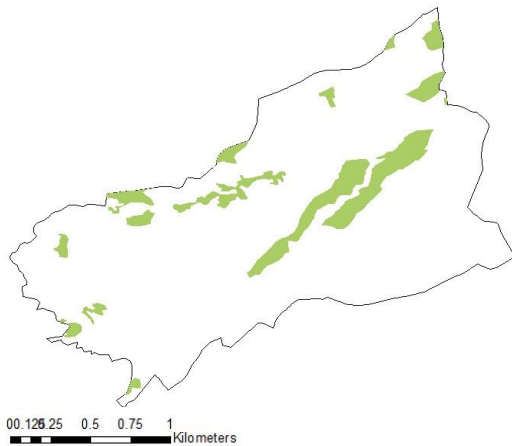
### Batloun Maps



*Figure 14: Batloun's Agriculture Cover 1994*



*Figure 15: Batloun's Agriculture Cover 2010*



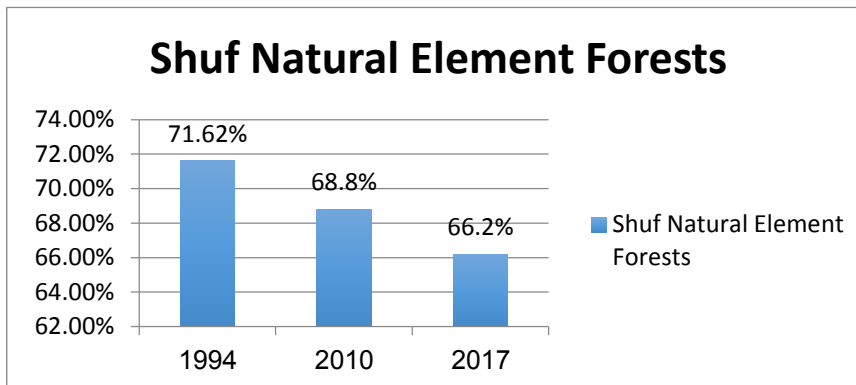
*Figure 16: Batloun's Agriculture Cover 2017*

## **B. The Natural Element Cover**

Natural element cover in the Shuf district and its villages includes the following aspects: oak, pine, mixed and cedars forests in addition to shrublands, herbaceous vegetation and grasslands.

## 1. The Shuf District

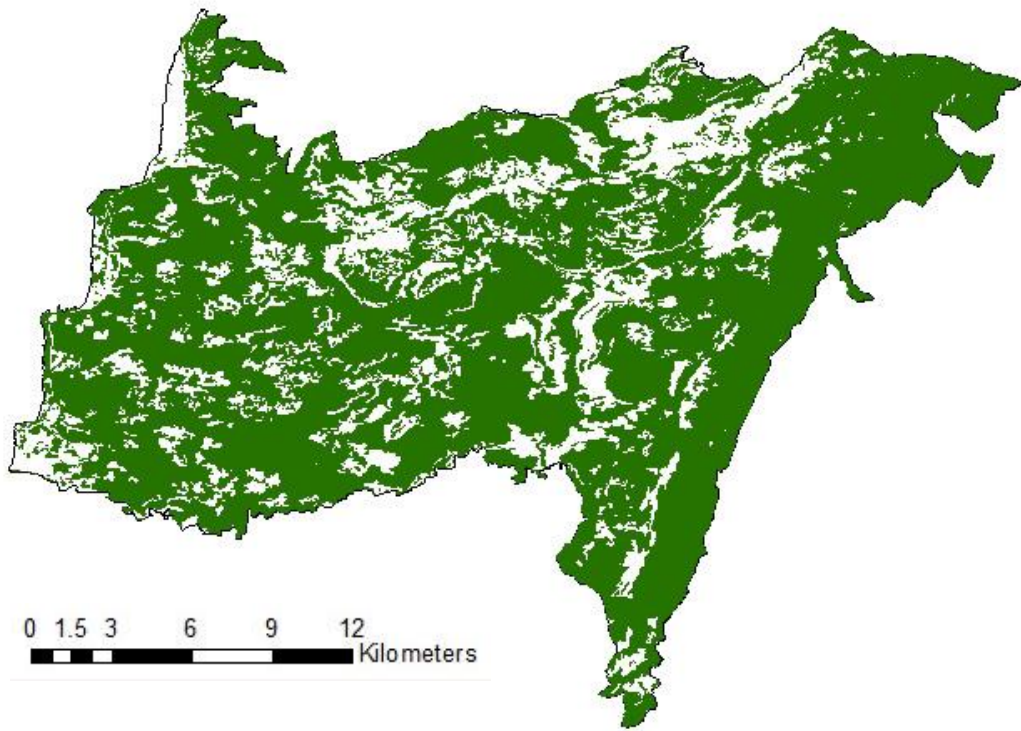
Further to the agricultural cover and its developments, the Shuf district is well known for its greenery. Graph 4 presents the natural element cover results obtained from GIS analysis in the Shuf district between 1994, 2010 and 2017.



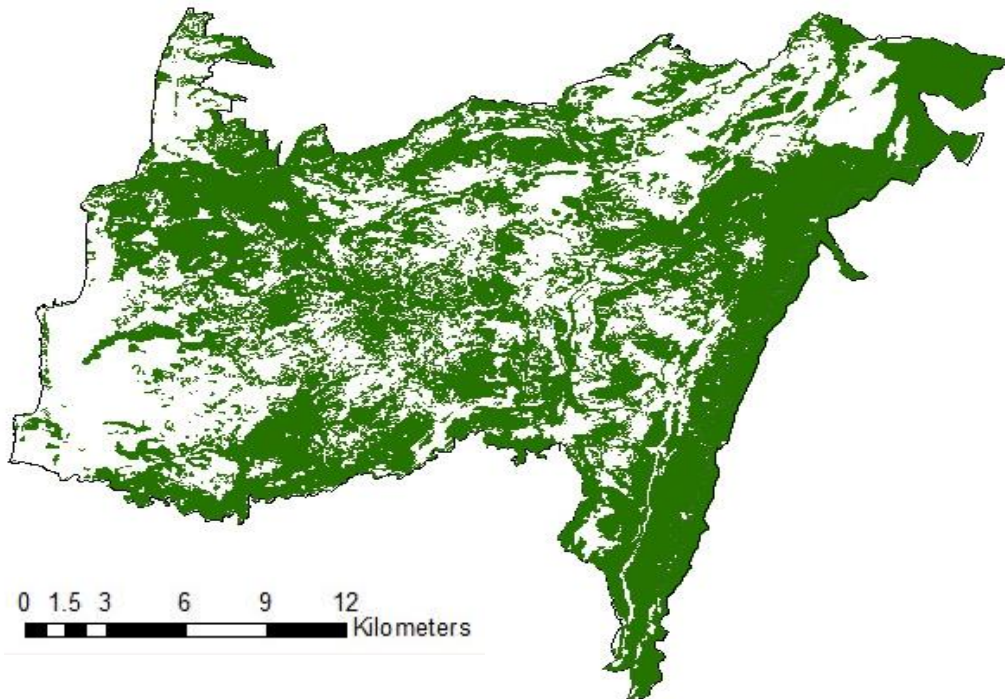
Graph 4: Shuf Natural Element Cover in 1994, 2010 and 2017

In 1994, natural elements units covered 71.62% to total Shuf area. This natural cover decreased to 68.8% in 2010 and 66.2% in 2017.

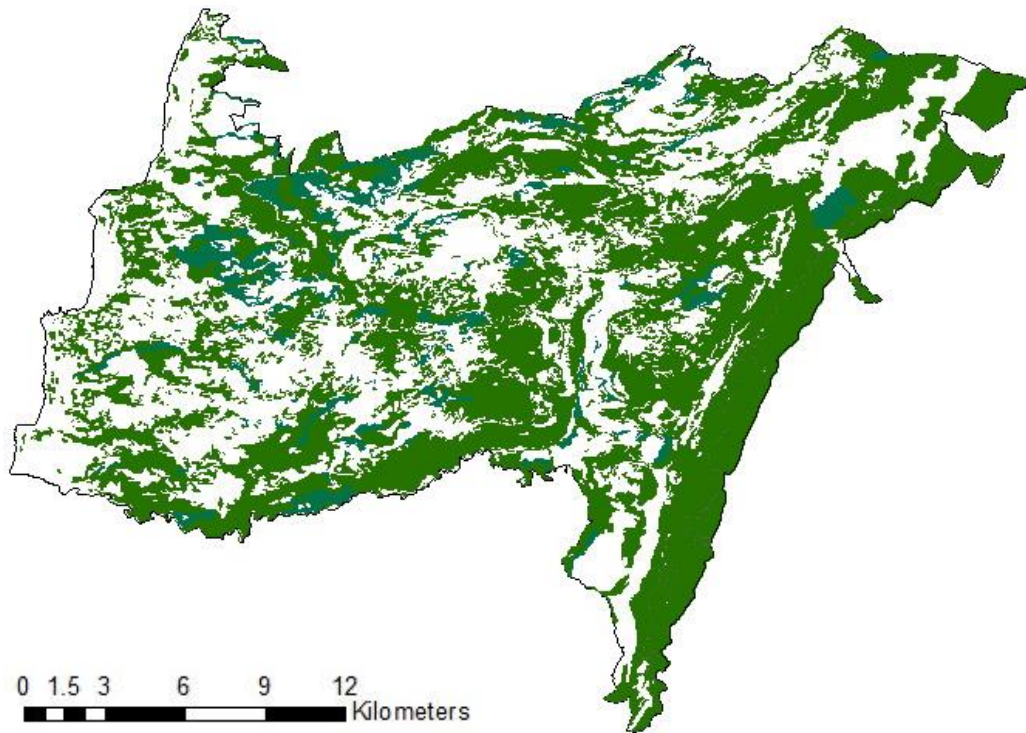
Fires, firewood needs and the urban expansion over the natural element cover resulted in its decrease between 1994 and 2017. This was not only observed in Lebanon, however, this issue was addressed also in different parts of the world. For instance, shrublands and mixed forests were taken over by fires in Turkey resulting in the decline in its area (Bilgili & Saglam, 2003). The maps below present the natural element cover in the Shuf district in 1994, 2010 and 2017.



*Figure 17: Shuf Natural Element Cover 1994*



*Figure 18: Shuf Natural Element Cover 2010*

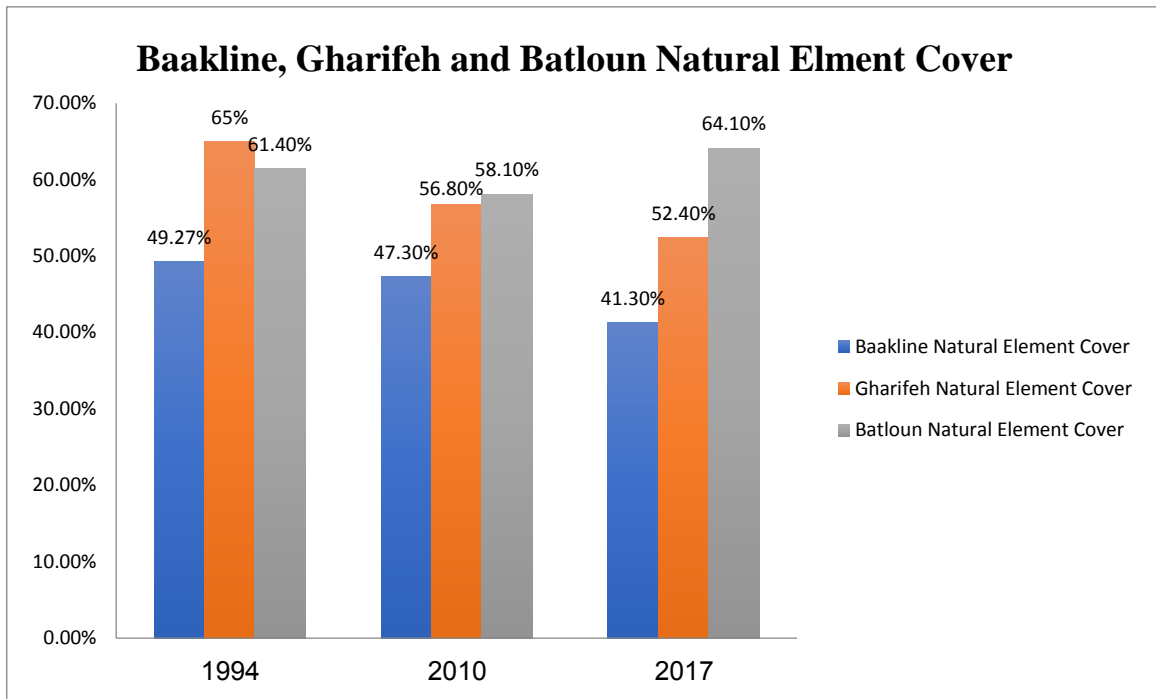


*Figure 19: Shuf Natural Element Cover 2017*

## ***2. Baakline Town, Gharifeh and Batloun Villages***

The natural element cover of Baakline town, Gharifeh and Batloun villages include the following layers: oak forests, pine forests, mixed forests, herbaceous vegetation, shrublands and grasslands. This natural element cover has changed over years. Graph 5 presents the natural element cover in the 3 villages.





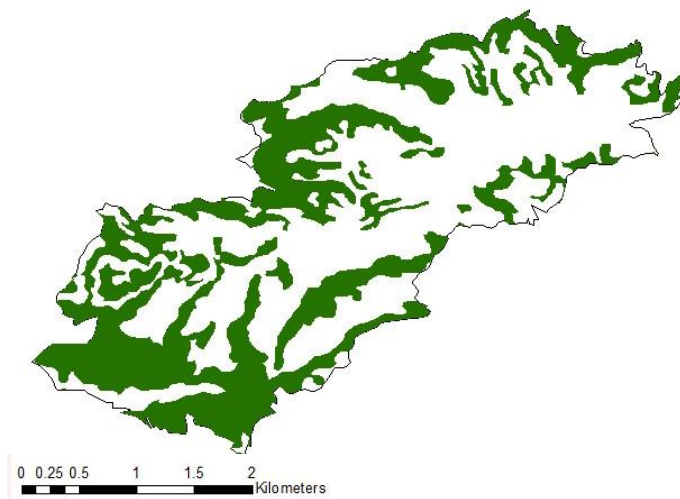
*Graph 5:* Baakline, Gharifeh and Batloun’s Natural Element Cover in 1994, 2010 and 2017

In 1994, natural element covered 49.27% of Baakline’s area, 65% of Gharifeh’s area and 61.4% of Batloun’s area. In 2010, this cover decreased to 47.3% in Baakline, 56.8% in Gharifeh and 58.1% in Batloun. The natural element cover further decreased in 2017 to occupy 41.3% of Baakline’s area and 52.4% of Gharifeh’s area, whereas it increased to cover 64.1% Batloun’s area. The need for firewood, fires and the urban expansion affected mostly Baakline and Gharifeh’s oak and mixed forests in addition to Batloun’s oak forests. As for Batloun, oak forests observed a decrease in its area. However, it is important to mention that the mixed forests increase in Batloun is questionable therefore it is possible that 1994 oak and pine forests were observed as mixed forests.

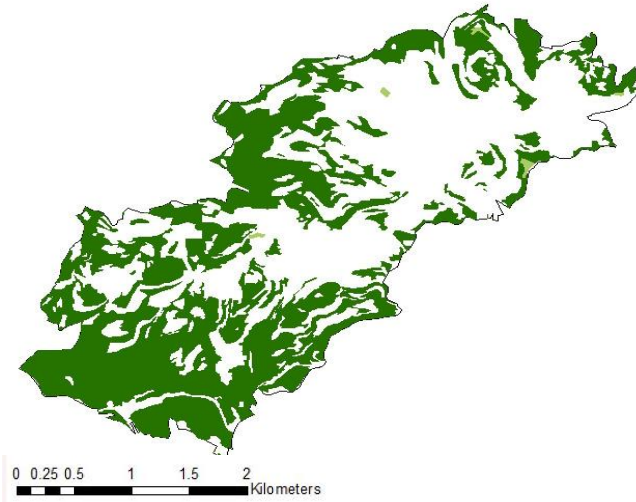
The decrease in the natural element coverage in the Shuf district and its villages confirms land cover changes and urbanization is taking over the natural cover (Ecodit,

2011). But this takeover happens mostly on lower level (ecologically speaking) lands such as shrublands than on pine forests, which have economic importance. Finchaa, a city in Ethiopia, witnessed similar changes in its land cover. The urban growth and expansion resulted in the decline of the natural cover (Dibaba et. Al, 2020). According to Chamling and Bera (2020), human settlement expansion is a main factor in the natural cover's decline of Bhutan as well. Even though, the decrease in the natural element cover in Shuf is minimal over the years (1994-2017), Shuf and its village is still known for its greenery. The maps below present the natural cover of Baakline, Gharifeh and Batloun in 1994, 2010 and 2017.

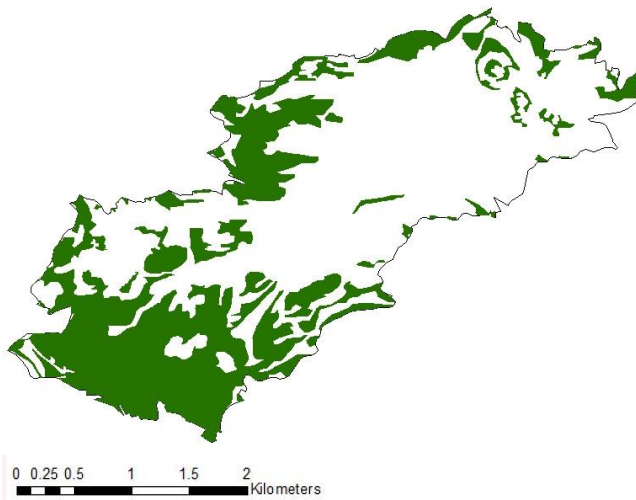
#### Baakline Maps



*Figure 20: Baakline Natural Element Cover 1994*



*Figure 21: Baakline Natural Element Cover 2010*



*Figure 22: Baakline Natural Element Cover 2017*

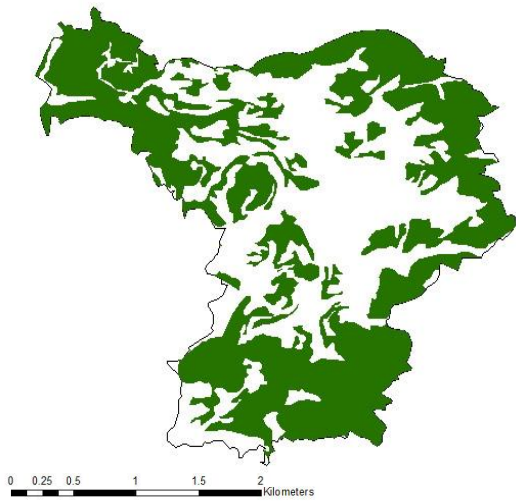
Gharifeh Maps



*Figure 23: Gharifeh Natural Element Cover 1994*

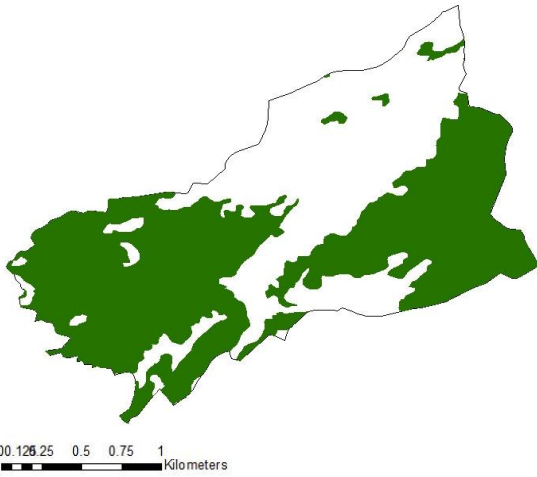


*Figure 24: Gharifeh Natural Element Cover 2010*

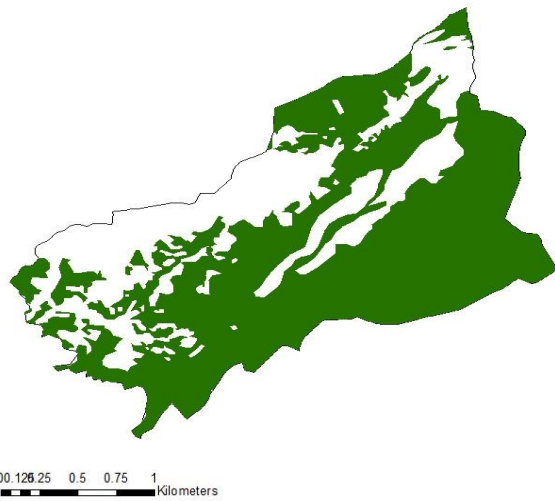


*Figure 25: Gharifeh Natural Element Cover 2017*

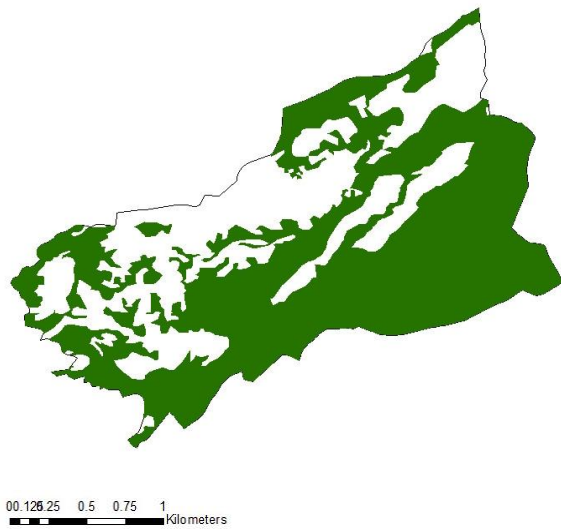
Batloun Maps



*Figure 26: Batloun Natural Element Cover 1994*



*Figure 27: Batloun Natural Element Cover 2010*



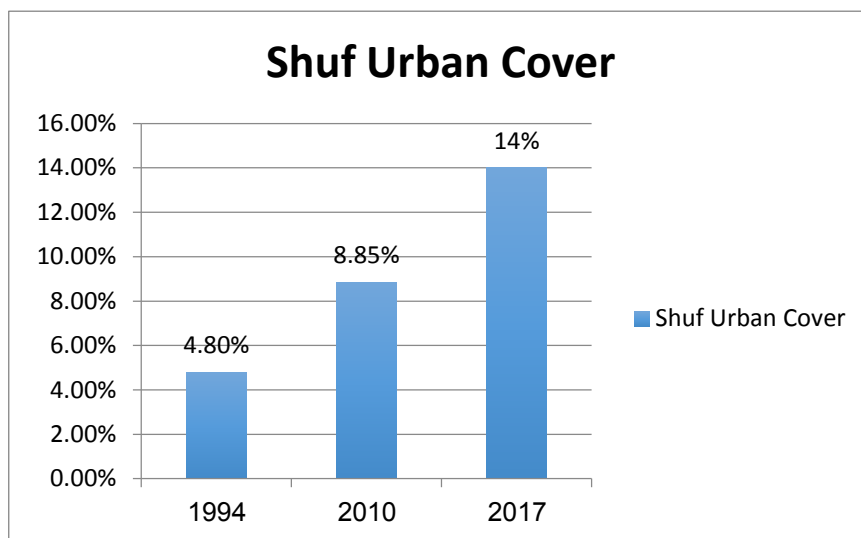
*Figure 28: Batloun Natural Element Cover 2017*

### C. The Urban Cover

As mentioned in the literature review and according to Davie (2002), Lebanon has undergone rapid and haphazard urbanization. The urban cover includes the following aspects: urban vacant lands, urban extension or construction sites, green urban spaces, industrial or commercial sites, urban fabric and urban sprawl.

#### 1. The Shuf District

Graph 6 indicates the Shuf's urban cover in 1994, 2010 and 2017.



Graph 6: Shuf Urban Cover 1994, 2010 and 2017

In 1994, urban units covered 4.8% to total Shuf area. This urban cover in increased to by almost 50% to become 8.85% in 2010, which then became 14% in 2017. In Shuf, according to the municipalities of the studied villages, urban planning is taken into consideration and therefore urban sprawl is decreasing. The following maps present Shuf's Urban cover in 1994, 2010 and 2017.

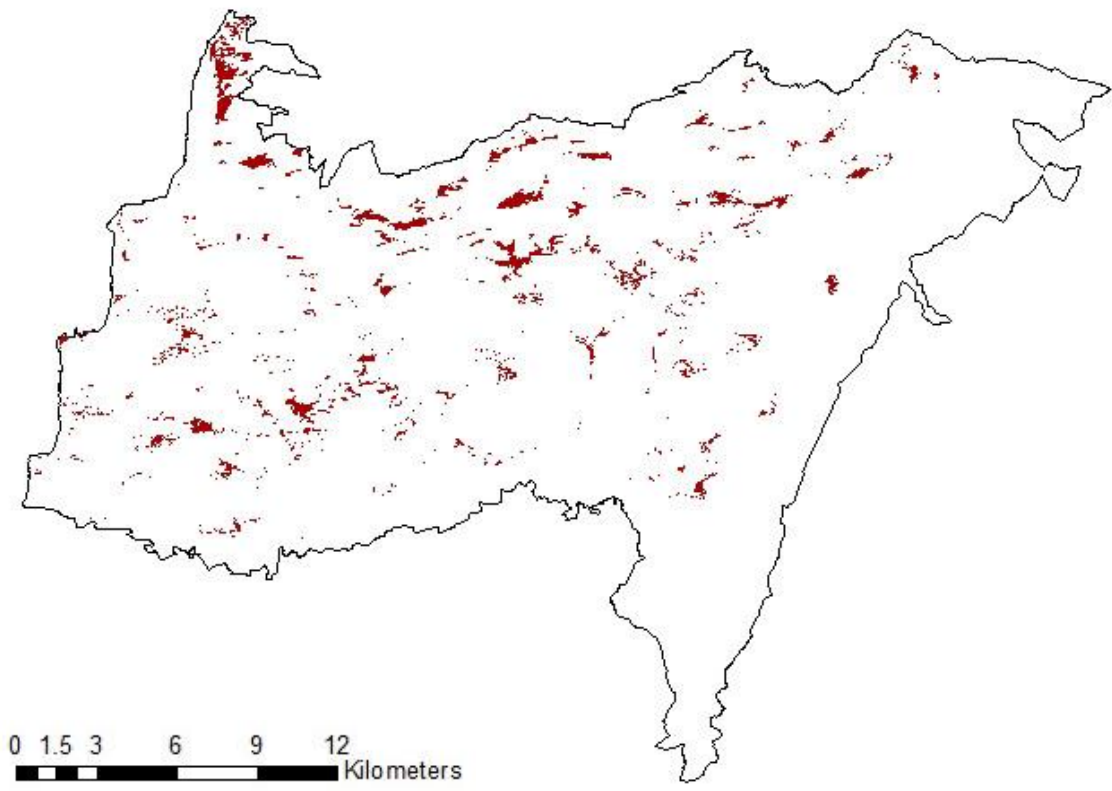


Figure 29: Shuf Urban Cover 1994

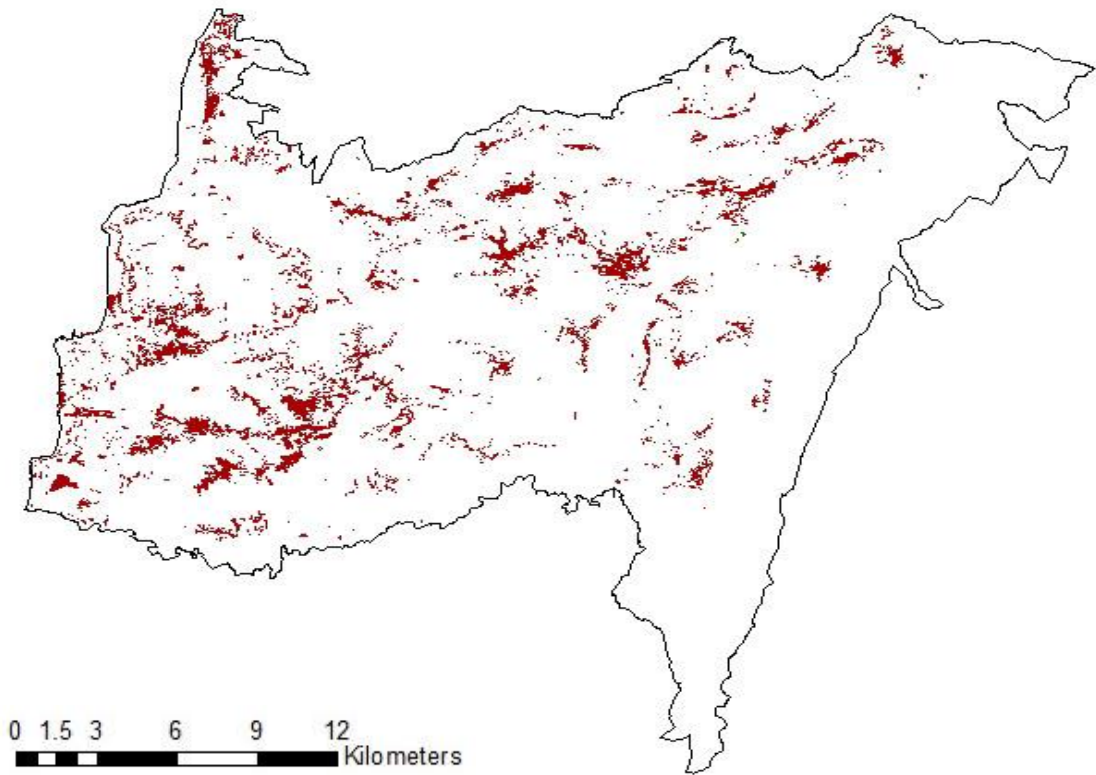
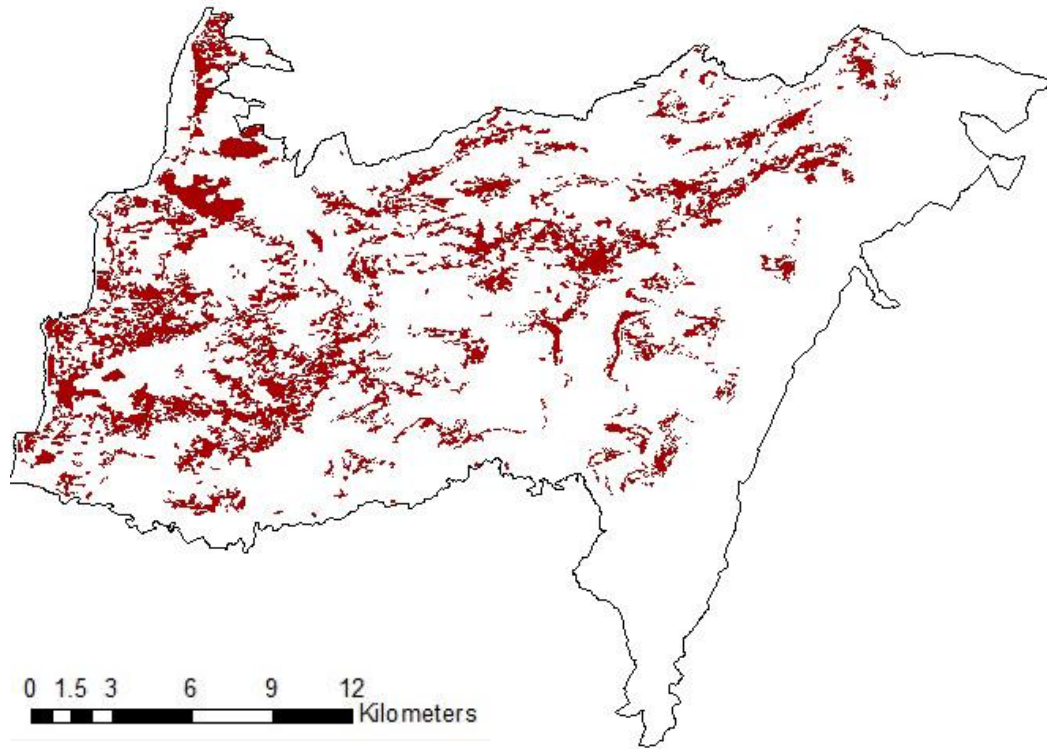


Figure 30: Shuf Urban Cover 2010

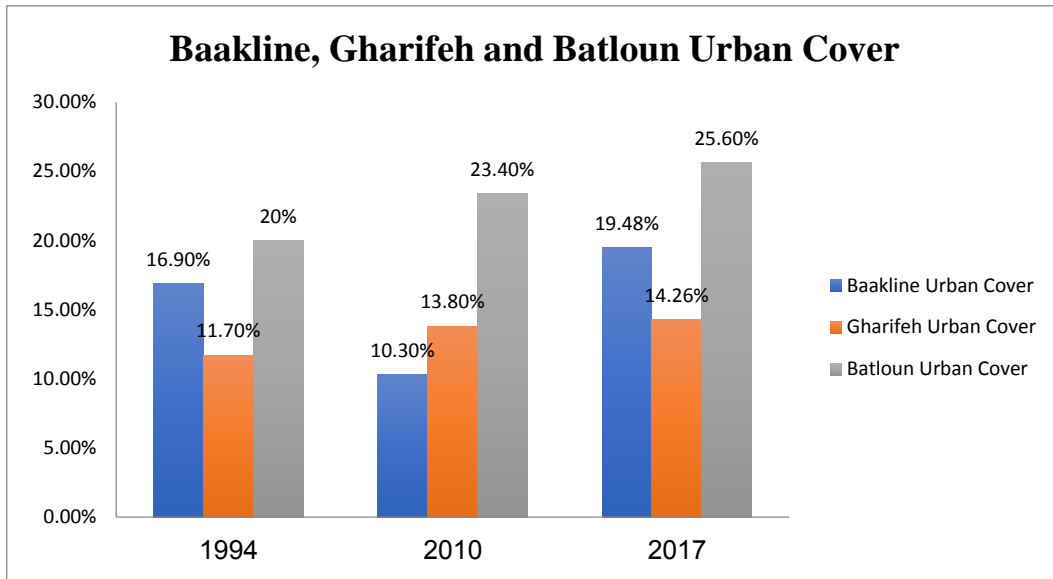


*Figure 31: Shuf Urban Cover 2017*

## ***2. Baakline Town, Gharifeh and Batloun Villages***

The urban cover of Baakline town, Gharifeh and Batloun villages include the following layers: urban sprawl, urban fabric, urban extension or construction areas and industrial and commercial sites. This urban cover has changed over years. Graph 7 shows the urban cover in the 3 villages.

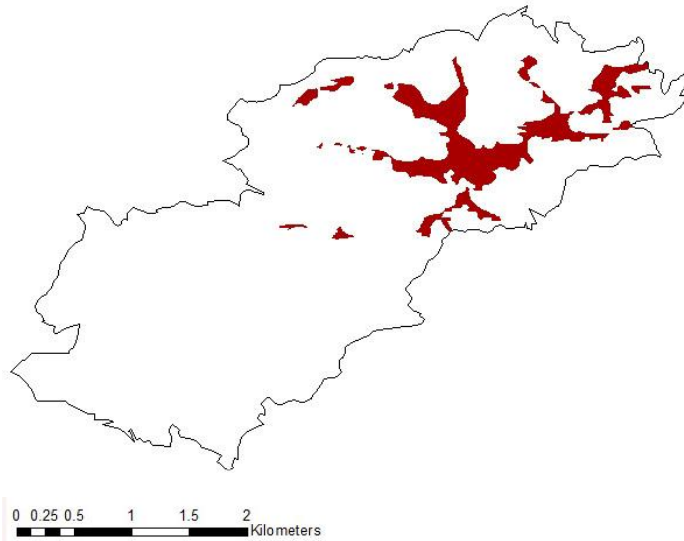




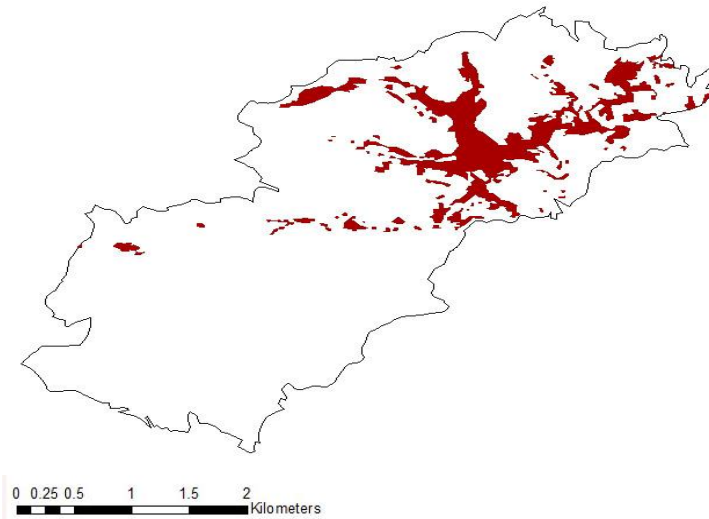
*Graph 7: Baakline, Gharifeh and Batloun's Urban Cover 1994, 2010 and 2017*

In 1994, urban areas covered 16.9% of Baakline's area, 11.7% of Gharifeh's area and 20% of Batloun's area. In 2010, this cover decreased to 10.3% in Baakline, whereas it increased to 13.8% in Gharifeh and 23.4% in Batloun. It further increased to cover 19.48% of Baakline's area, 14.26% of Gharifeh's and 25.6% of Batloun's area in 2017. It is important to mention that the urban sprawl in 1994 in the 3 villages became urban fabric in 2017. Hence, the growth in urbanization happened in the urban sprawl's area as well as in the natural elements' cover since the natural elements' cover observed a decrease in its coverage between 1994 and 2017. Urban growth is a touching different places in the world. Taking the example of China-Myanmar, the infrastructure development expansion led to the city's deforestation (Aung et.al, 2020). Similarly, For Bhutan witnessed a similar change in its land cover between 1987 and 2019, as the urban cover increased taking over the natural and agricultural cover and thus resulting in their decrease (Chamling & Bera, 2020). The maps below present the urban cover in Baakline, Gharifeh and Batloun in 1994 and 2010 and 2017.

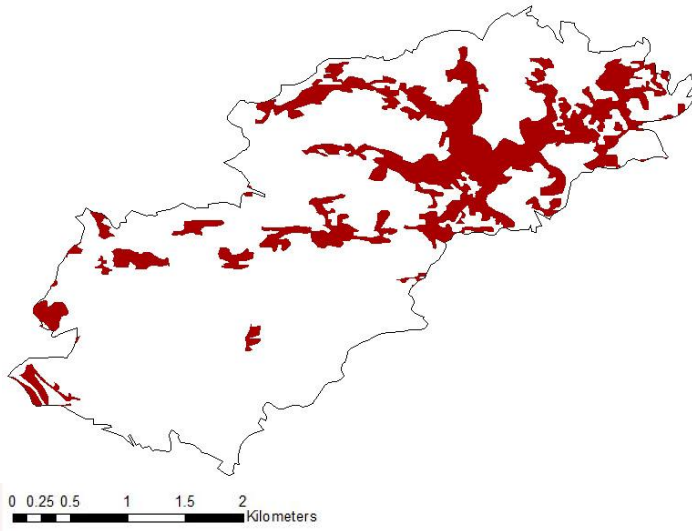
Baakline Maps



*Figure 32: Baakline Urban Cover 1994*

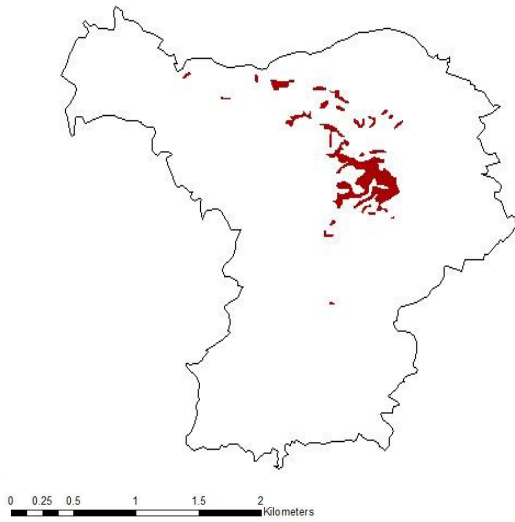


*Figure 33: Baakline Urban Cover 2010*

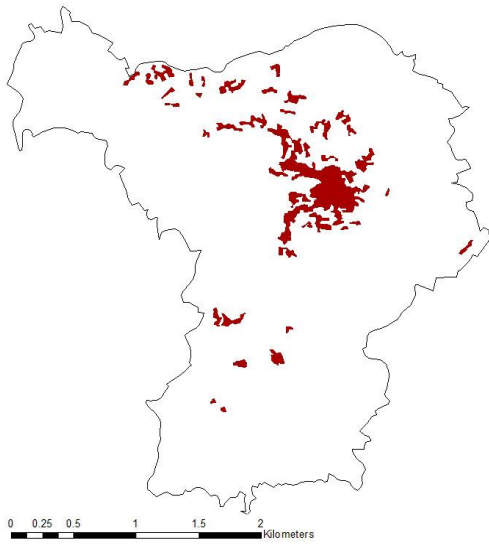


*Figure 34: Baakline Urban Cover 2017*

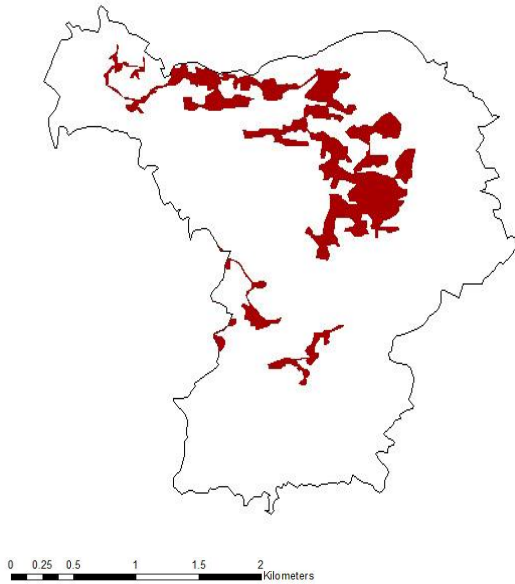
#### Gharifeh Maps



*Figure 35: Gharifeh Urban Cover 1994*



*Figure 36: Gharifeh Urban Cover 2010*



*Figure 37: Gharifeh Urban Cover 2017*

Batloun Maps

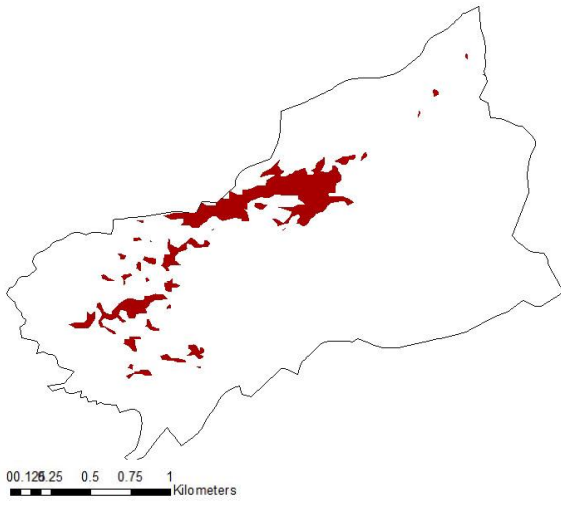


Figure 38: Batloun Urban Cover 1994

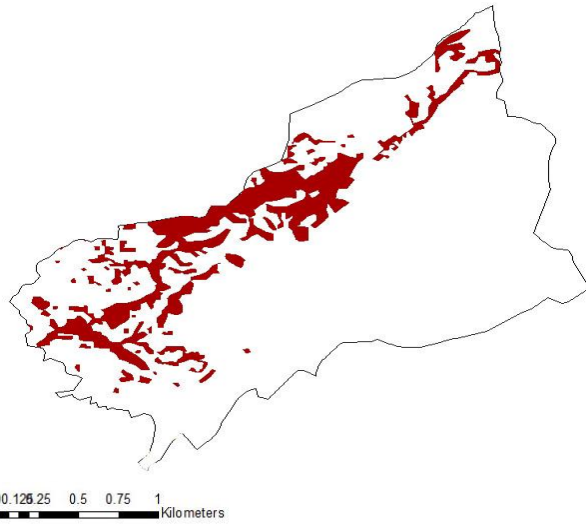


Figure 39: Batloun Urban Cover 2010

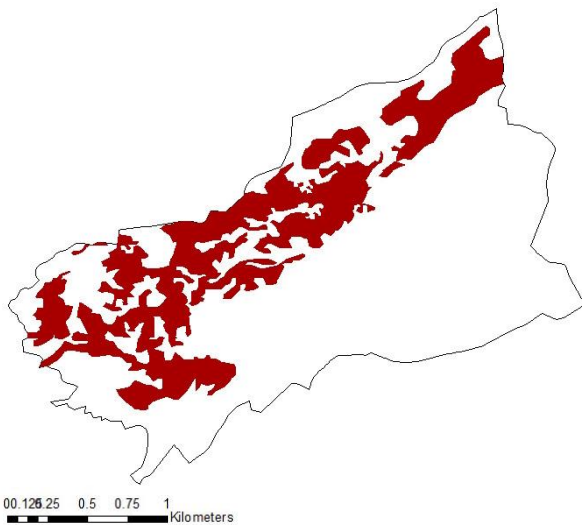


Figure 40: Batloun Urban Cover 2017

Moreover, the change in the urban cover is due to population increase and villages' expansion. Based on the CNRS population's shapefile, the population has increased in the 3 villages between 1994, 2010 and 2017. Baakline's population in 1994 was 11,200 that increased to 21,752 in 2010 and 30,000 in 2017. Gharifeh as well experienced an increase in its population. Thus, in 1994 the Gharifeh's population was 4,000 to become 6,897 in 2010 and 8,260 in 2017. As for Batloun, its population in 1994 was 1,500 that increased in 2010 to 2,811 and 3,500 in 2017. Population increase was not only observed in Lebanon, however, this issue was addressed also in different parts of the world. As an example, the increase in population in Kathmandu district and the haphazard urban development results in the change the land cover is witnessing; authors stated that forests and agricultural lands are becoming urbanized leading to a change in the land cover of Kathmandu district (Li et. al, 2020).

Another indicator mentioned in Gonçalves et al (2017) is mobility. Mobility is the times needed from each village to reach the capital Beirut in private and public transportation. To start with Baakline, 45 minutes is needed to reach Beirut via private transportation and around 1 hour public transportation. Public transportation (busses) is available every 15 minutes as the busses pass by Baakline's main road. As for Gharifeh and Batloun, public transportation is not available; hence private shuttles are needed to Baakata or Baakline to catch the buses. Regarding private transportation, 45 minutes is needed to reach Beirut from Gharifeh via Saadiyat road and around 1 hour from Batloun via Kfarnabrakh – Deir El Qamar road.

Based on the land cover analysis (% of agricultural lands, % of forests and % of urban cover), population and mobility indicators and dimensions chosen from Gonçalves et.al (2017) indicators, it is concluded that the 3 villages (Baakline, Gharifeh

and Batloon) are within the rural context. Hence, the GIS analysis used and according to Gonçalves et.al (2017) the first hypothesis mentioned in *Table 2*. Research Questions, Objectives and Hypotheses is validated. Thus, new spatial forms have evolved in rural areas influenced by the penetration of urban dynamics into the countryside causing a significant change in land use from agriculture and natural element usage to urban usages.

## CHAPTER IV

### CONCLUSION

Therefore, the penetration of urban areas into rural areas takes place through the enhancement of transportation and communications infrastructures, which encourages non-agricultural workers to reside in rural areas or in small urban areas due to its feasibility. These enhancements promote investments in such areas. The easy exchange of services and goods between both rural and urban settlements will lead to a social life in the rural similar to that in the urban (Bahn et.al, 2021).

Moreover, local incomes and overseas money transfer can link rural and urban people. Many families rely on a diversified livelihood, embedded in rural and urban areas and generated by a group of people sharing same resources but involved in various economic activities (Bahn et.al, 2021). The authors mentioned the example of “a large rural family in Egypt or Morocco may have some relatives employed abroad and others working in Cairo or Casablanca – remittances that can then be saved and invested for their agricultural enterprise ”.

As for the Finnish Environment Institute (2013) land classification, it is important to mention that this methodology was not applied in its details due to the absence of an urban center in the Shuf district. However, and according to the Finnish Environment Institute (2013) land classification figure, Baakline town is classified within the Intermediate Zone (IZ) since it has a population of 30,000 inhabitant (>5000 average in the last 3 years) and it serves as local center in rural areas. As mentioned in the sections above, Baakline has been a local center in the Shuf district since the Maan Emirs resided in the town making it their capital until the early 17th century. Gharifeh and Batloun, unlike Baakline, are a part of the rural areas, and are within the rural



heartland areas due to their dense population and intensive land use. A change in their land cover is observed leading to decrease in agriculture and natural element cover and an increase in the urban cover over time. The above, validates the second hypothesis included in *Table 2*. Research Questions, Objectives and Hypotheses is validated. Hence, the predominant types of spatial formation in the RUC of the selected areas of Shuf are Urban Implosion and Rural Urbanization. The 3 villages fall within the Intermediate Zone (IZ) class and the rural heartlands areas.

Finally, Shuf, and like any other district in Lebanon, is undergoing a change in its land cover. This change was seen in the presented results and analysis. Although Shuf is developing haphazardly, a difference between the rate of development between its towns and villages is observed. Based on the literature review, the 3 studied villages are within urban implosion rural transformation model mentioned in the literature review section, thus Baakline, Gharifeh and Batloun are expanding within the rural village itself regardless of the city (Qadeer, 2004). Moreover, land is being urbanized rather than being planted leading to a decrease in its agriculture and increase in its land-based investments (Rignall and Atia, 2017).

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