MedBEESinessHubs

MedBEESinessHubs Project C_A.1.2_0035

WP3: The bee waggle dance - collecting information for business clusters on the honeybee products

O3.1 Existing situation analysis (study reports) on the economic potential of honeybee handcrafting

ACTIVITY 3.1.2: *Regional study on the economic value of networking around the honeybee products: Case of Lebanon*

Responsible Partner: Chamber of Commerce Industry & Agriculture in Zahle & Bekaa / PP3

Date of Submission: July 19, 2022

Subcontractor: Dr. Ghassan Srour & Dr. Elias Wehbe

This document has been produced with the financial assistance of the European Union under the ENI CBC Mediterranean Sea Basin Programme. The contents of this document are the sole responsibility of the the Chamber of Commerce, Industry and Agriculture of Zahle and Bekaa – PP3 and can under no circumstances be regarded as reflecting the position of the European Union or the Programme management structures. The project total budget is €1,110,609.71 and the amount of €999,548.74 (90%) is co-financed by the European Union (ENI CBC Med Programme 2014-2020).

Table of contents

List of figures

Liste of tables

Liste of annexes

Intoduction

This study of beekeeping sector in Lebanon will assist decision makers in the formulation of plans for developing a more economically robust honey industry. The development of this report occurred as part of "Mediterranean Bee Hubs in support for sustainable economic prosperity in deprived rural areas" (MedBEESinessHubs), co-funded by the EU under the ENI CBC MED. It was developed jointly through consultation with key informants, and an analysis of beekeeping sector actors (beekeepers, suppliers, cooperatives, …) in which the industry sits.

This report over 11 chapters is divided into three parts: the first part including the first five chapters and presenting an overview of the beekeeping sectors in terms of specific characteristics, floras related to this sector, recent statistics collected from the Lebanese MOA and the employment level induced by this sector, in addition to a SWOT analysis addressing advantages and disadvantages of Lebanese beekeeping sector. The second part, consists of an assessment conducted with Lebanese beekeeping actors in order to have an updated overview of the beekeeping sector in Lebanon, this assessment is to identify constraints that need to be addressed and also opportunities for value adding within the industry. While the final part, treats beekeeping product portfolio, marketing and packaging, services based on the honeybee, honey in the local/ traditional gastronomy and finally the needs and expectations of the local honeybee MSMEs and the people in building up a bee-business.

In conclusion, the following report identifies the key actors and functions within the Lebanese honey industry, highlights their strengths and constraints, and identifies opportunities to improve the industry's productivity and profitability.

1. The beekeeping unique characteristics in the Lebanon – an overview

Beekeeping is an integral component of agriculture, rural development, and national economic development and plays a critical role in conservation of ecosystems over the world (Aiyeloja *et al.*, 2015; Akinmulewo *et al.*, 2017). Bees are a barometer of the health of natural ecosystems, pollinators of forests, horticultural and agricultural crops (Mujuni *et al.*, 2012), and they are also kept for their marketable products. Such products include honey, which is used for both food and medicinal purposes (Pathare *et al.*, 2015; Eteraf-Oskouei & Najafi, 2013), wax, propolis, royal jelly, and pollen.

Globally, it is estimated that animals are able to pollinate most of the flowering plants (around 87.5%) (Ollerton *et al.*, 2011), and the western honey bee Apis mellifera L. (Hymenoptera: Apidae) is the main animal pollinator (Hung *et al.*, 2018), playing a vital role in not only maintaining plant biodiversity but also sustaining the most critical agricultural productions. In fact, of the 100 crop species that provide 90% of the world's food, over 70 are pollinated by bees. The honey bee is the most widespread managed pollinator in the world.

This crucial role of A. mellifera is also because the anthropic activities and climate change significantly reduced the number of other animal pollinators (Goulson *et al.*, 2015; Potts *et al.*, 2010; Winfree *et al.*, 2009), while A. mellifera is predominantly farmed worldwide, and according to FAO data (FAO/STAT 2020), the numbers of beehives in the world increased by 13.6% in the last decade.

Lebanon, which is considered a hotspot for biodiversity in the Mediterranean Basin (Médail & Quézel, 1997; Myers et al., 2000), is characterized by the coexistence of plants with diverse biogeographical origins and a large number of narrow endemic taxa. It is considered a key area of geological activity and climatic changes and recognized as a melting-pot of human cultures. The combination of geological variation and altitude ranging from 0 to 3000 meters, along with strong climatic variation among different slopes, created a marked heterogeneity in the ecological forces acting on the evolution of plant differentiation. Its floristic richness is estimated at 2612 vascular plant taxa, of which 108 are endemic to Lebanon (Tohmé & Tohmé, 2004, 2011, 2014).

In this context, Lebanon is one of the countries in the world where bees can find natural sources of nectar all year long. As a result, Lebanon's honey is one of the best in the world. Honey production in Lebanon is predominantly mountain poly-floral honey, which means they feed on a variety of blossoms in the same space, which is also relatively uncommon and adds more health benefits to the honey. While orange blossom honey is produced in citrus groves, usually at lower altitudes along coastal zone in winter and spring. Mountain Honey is exported in small amounts to the region, but its quality can compete internationally. Total annual honey production vary between years since production is dependent on climatic changes, it stands at around 3800 tons in 2021, of which only 14 Tons is exported with an average sales price of 12.36 $/kg and varying from 1 to 23 $/kg. This makes Lebanese honey among the most expensive honeys in the world marketplace competing with other expensive honeys from New Zealand and the EU. Despite this production, Lebanon imported in 2021, 92 tons of low-priced honey (Source: Trade map. www.trademap.org)

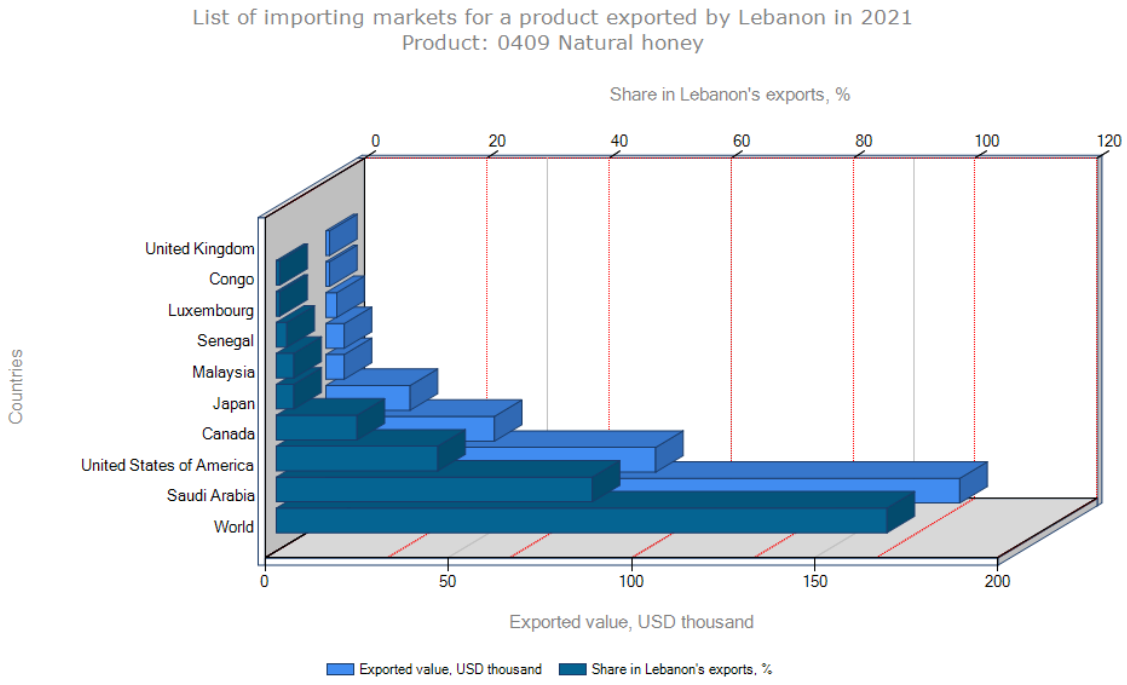


Figure 1 : List of importing markets of Lebanese Honey in 2021 *(Source: COMTRADE)*

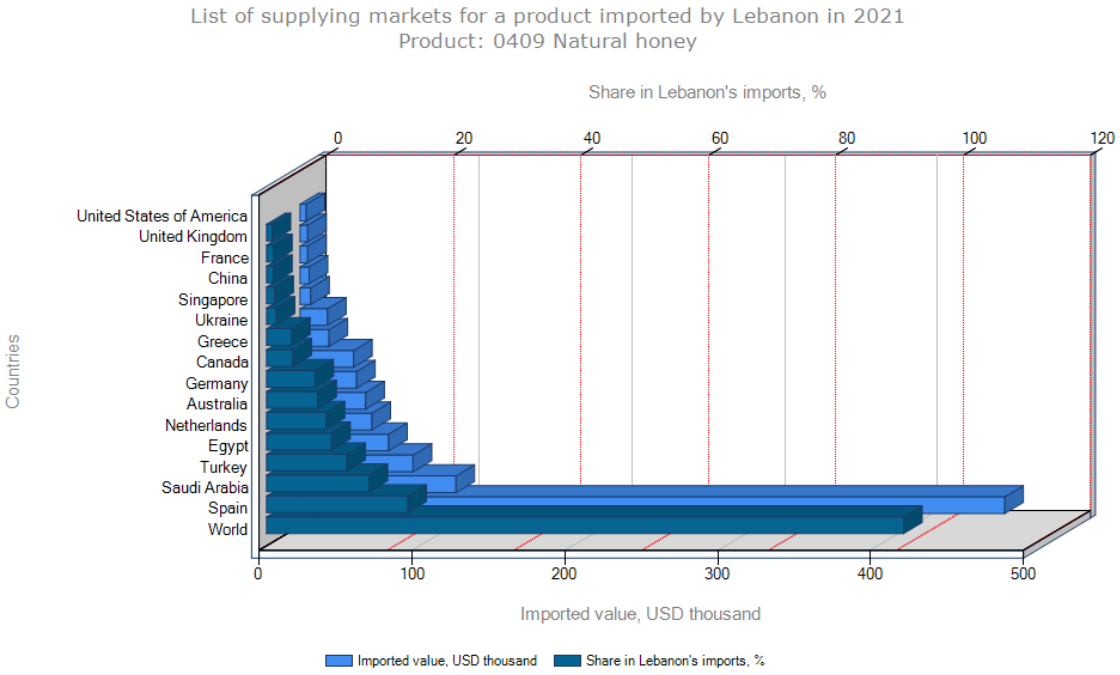


Figure 2 : List of supplying markets for Honey imported in Lebanon *(Source COMTRADE)*

In addition, some initiatives were conducted by an active beekeeping cooperative in Mount Lebanon such as exporting an important quantity of swarm beehives to Qatar in 2019 but some diplomatic crisis between Lebanon and Qatar interrupt the flow of swarm in 2020 & 2021.

Professional beekeepers in Lebanon try to profit from the variation in biodiversity, temperature and altitude by moving their beehives from coastal zone in winter & spring to medium altitude then to high altitude in the summer and produce different kind of Honey and reduce the risk of climatic changes on the hive productivity. Recently, the economic crisis that occurred reduced significantly the transhumance practices for many beekeepers.

According to the Lebanese Ministry of Agriculture, the number of beekeepers and beehives doubled in the last 10 years from the end of 2011 to 2021 (from 5,546 to 10,825 beekeepers & from 194,520 to 384,704 beehives).

2. The flora and the ecosystem that supports the bees

The Lebanese flora is a typical eastern Mediterranean flora, characterized by mild winters and dry summers with some exceptional fluctuations. The forest vegetation is characterized by evergreen species mainly. Beside the Lebanese Cedar (Cedrus libani), the emblem of the country, many conifers exist such as Pinus pinea, Pinus brutia, Pinus halepensis, Juneperus excelsa, Juneperus oxicedrus, juneperus dupacea, Abies cilicica, Cupressus sempervirens.

In addition to conifers, forest trees include different species of oak and other species; Quercus caliprinos, Quercus infectoria, Quercus libani, Quercus cerris, Quercus coccifera, Salix libani, Ceratonia siliqua, Cercis siliquastrum, Prunus mahaleb, Prunus dulcis, Acer tauricolum, Pyrus syriaca, Acer syriacum Boiss. & Gaill, Pistacia palaestina/Terebinth, Rhus coriaria, Pistacia lentiscus, Arbutus andrachne, Crataegus azarolus.

In the last five years, several fires occurred and destroyed many wild areas that are self-restoring, where possible, from the lowest stratum.

The country is characterized by this biodiversity richness due to its topographic and climatic diversity going from coastal zones up to more than 3000 m OSL. These different climatic zones and biotope, gives the beekeeper the option of transhumance more than once a year in order to profit and produce diversified types of honey up to three seasons a year. In fact, flowers of nectariferous and melliferous plants are present in the country starting from Mid-February until late October with a great variability from a region to another.

Some data concerning the wild nectariferous/melliferous plants are collected, but this field needs to be explored and evaluated better. This eventual evaluation helps to assess the potential of the country for all beekeeping activities, the appropriate beehives density for each region, the best transhumance for better production, the needs for the domestication of some wild species etc, ...

As well, a melissopalynology is highly needed in order to characterize the honey of each geographical location stated by producers and sellers with the objective of protecting the Lebanese

honey and for better marketing and commercialization. Thus, honey consumers can link the organoleptic characteristics of the honey to a given location.

In Lebanon, most probably, more than 200 species are of great importance for bees and beekeepers (Annexe I). Some wild melliferous plants are cited in the table below.

Table 1 : Seasonal flowering of melliferous plants in Lebanon.

Most important fall flowers	
 Inula viscosa	 *Ecballium elaterum*
 Ceratonia siliqua	 *Urginea maritima*
 Eryobotria japonica	 *Carthamus tinctorius*

Most important Spring flowers

 Salvia triloba	 Origanum Syriacum
 Citrus	 Quercus caliprinos
 Quercus infectoria	 Lavendula stoechas
 Alcea cetosa palmata	 Origanum ehrenbergii

Centaurea iberica

Cistus salviifolius

Rhus coriaria

Trifolium repens

Most important summer flowers	
	

Opuntia ficus-indica	Cichorium intybus
 Foeniculum vulgare	 Mentha microphylla
 Myrtus communis	 Eryngium heldreichii
 Stachys ehrenbergii	 Pimpinella tragium

 Marrubium libanoticum hermonis	 Berberis libanotica

See the list of melliferous plants in Lebanon in Annexe I.

3. The beekeeping sector in Lebanon in numbers

There are 10825 Lebanese householders who are pursuing beekeeping and owning 417,233 beehives (MOA, 2020). Beekeepers are distributed all over the Lebanese territory exception for two purely urban areas (Beirut & Tripoli). The distribution of beehives and beekeepers in the remaining 22 Lebanese' Caza shows a big difference in numbers between different areas.

The Minieh – Daniyeh and Jbail Caza counted the highest number of beehives and covered respectively 19.44% & 12.86% of the national number of beehives. While, the highest number of beekeepers was observed in Hermel and Akkar which represent each approximatively 12% of the total number of national beekeeper number (Figure 3).

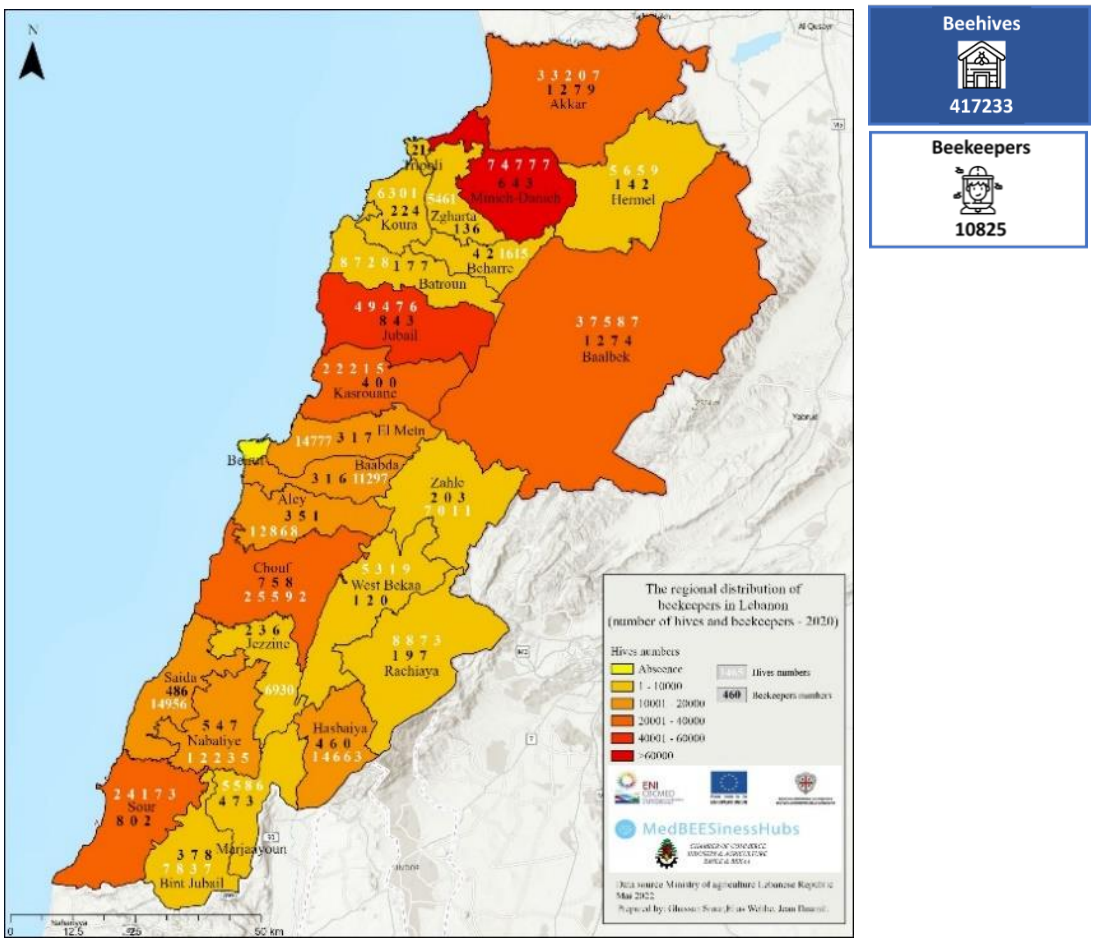


Figure 3: Distribution of beehives & beekeepers in Lebanon (Source : MOA 2020)

Throughout the study Beekeepers were classified into five categories:

1)- Hobbyist beekeepers: This type of beekeepers having between 1 & 10 beehives and constitute 25.66% of the national beekeepers' number own around 4% of the national beehive's livestock.

2)- Family scale beekeepers: This category is predominant in Lebanon (57.76% of the total number of beekeepers) and owning the highest part of the national beehive livestock (42%). Beekeepers who possess 11 to 50 beehives provide a supplemental income to the family and keep bees as a sideline business. Generally, they practice this activity without transhumance which lead to just one harvest per year.

3)- Medium scale beekeepers: Keeping 51 to 150 beehives, beekeepers in this category try to get 3 harvests per year on moving bees from coastal areas to intermediate mountain in spring season and to high altitude in the summer. This category which represents 13.57% of national beekeepers and owning 30% of the national beehives number depends on family labor and employs seasonal unskilled workers during transhumance & harvesting period

4)- Large scale beekeepers: Representing 2.76% of the total number of beekeepers in Lebanon and 18% of the total beehives number in Lebanon. Beekeepers in this category own between 151 to 500 beehives and manage beehives with family members or skilled employee paid monthly. Beekeepers in this category tried to benefit the most from temperature and altitude variability to move their beehives from one location to another in order to harvest honey at least 3 times per year. Beside honey production, different products of the hive are produced such as: propolis, Royal Jelly, Swarm & sometimes queens.

5)- Big scale beekeepers: Retaining more than 500 beehives. This category represents the lowest percentage in term of national beekeeper' number but owning 18% of the total beehive's livestock.

Currently, Beekeeping practice is undertaken by standard wooden beehive while few numbers of beekeepers adopt the plastic beehives and consider it very expensive when looking at short-term expenditure, and didn't endorse efficient productivity. As well, some current research studying the efficiency of polyester beehives are actually in progress.

In addition to pollinating cultivated and wild plants, the honey production is certainly the most important services of the bees. Honey yields have varied a lot not only from year to year, but also from one region to another or from one caza to another. The national Honey Yield are generally low in Lebanon, in comparison to European country, about 10 Kg per hive per annum and a variation from 2 to 20 kg was noted by beekeepers. Three consecutive years (2018-2019 & 2020) were considered quite bad years in terms of harvest for beekeepers of Honeydew Honey in all regions of Lebanon while 2021 was exceptional for a great harvest.

Variations in honey harvests from one region to another and from year to year are generally due to various factors. Climatic conditions, presence nearby, of a honeydew honey, the colony density and the type of beekeepers, all these factors have a major influence. Moreover, there are many other influences, largely unknowns, contribute as well to these large fluctuations.

Two types of Honey are produced in Lebanon: Uni-floral Honey mainly the orange blossom Honey and/or eucalyptus Honey (produced in small quantities) and the Poly-floral Honey such as Honeydew Honey, Multi-floral honey produce during summer & Mountain Honey (Jurdi) which is the predominant type.

In Lebanon, in addition to the indigenous breed *Apis mellifera syriaca*, many non-endemic bee races are also present. The bee *Apis mellifera ligustica*, *Apis mellifera caucasica* originating from the high valleys of the Central Caucasus, Georgia is the "central homeland" for the subspecies. *Apis mellifera carnica* originating from Carinthia and Slovenia and the Buckfast breed, obtained by crossbreeding and selected by brother Adam in the Benedictine monastery of Buckfast in Devon (Great Britain). The import of queen bees induced a change of the characteristics of the indigenous breed.

The beekeeping sector in Lebanon includes a number of key services providers:

- **The beekeeping department at the MoA**: Collects statistical data of beekeepers in Lebanon and designs the national strategy for this sector.
- **Honey testing Laboratory (HTL):** There are 6 labs to test Honey in Lebanon from which three are private and three related to public sector LARI, IRI & QCC (at the chamber of commerce in Tripoli). Where QCC is, the only lab approved by honey exporters.

- **Beekeeping equipment and hive sellers**: different stores exist all over the Lebanese territory and supply beekeepers needed materials. Some are importers of equipment while others play the role of intermediary between importers and beekeepers. Local businesses are manufacturing boxes and frames using materials existing in the market and local labor.
- **Universities:** All universities teaching agriculture or veterinary science consider in their academic curriculum the beekeeping sector. As well, they conducted research in this domain.
- **Beekeeping cooperatives, Bee Associations & Syndicates**: 75 bee cooperatives were accessed at national level during the study with respectively 13 in Bekka & Baalbek Hermel governates, 19 in Mount Lebanon, 24 in the South & Nabattiye governates & 19 in the North & Akkar governorates. Despite this high number, just few are working actively to help beekeepers in the area of their implementation. One bee association was identified in Lebanon (A.P.I.S. Apiculture Protection and Improvement Society) as a very active association and it is spreading at national level. As well, three Syndicates existed: one grouping Lebanese beekeepers and two other regional in the south & Bekka region.
- **Lebanese Standards Institution (LIBNOR):** It's a public institution attached to the Ministry of Industry, it has issued national standards for honey production related to purity and freshness, for local production or for imported honey in order to improve the competitiveness of the honey sector with international produce.
- **Artificial insemination center for queen bees (AI):** The first artificial insemination center for Queen bee in the Arab world was created in 2016 to improve bee populations and increase honey production in the region.
- **Wax foundation facilities (WFF)**: Distributed all over the Lebanese territory (two in the north, two in Mount Lebanon & three in the south) with the aim of sterilizing, treating and recycling all-natural beeswax from beekeepers.

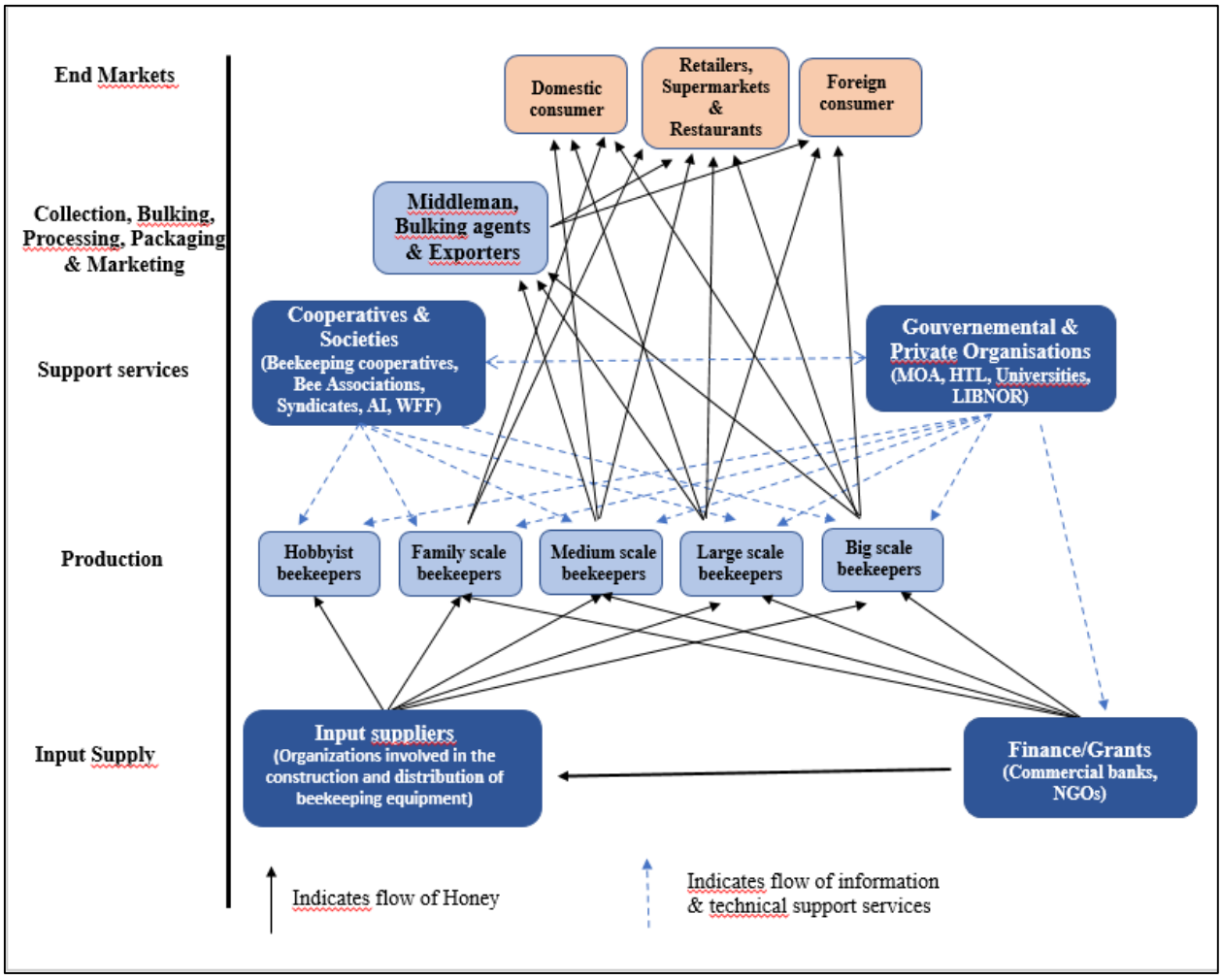


Figure 4 : Lebanese Honey Value Chain Map

4. Beekeeping economic figures and employment in rural regions

Recent statistical data collected from MoA indicate that the number of bee colonies in the country has significantly increased by approximately 50% during the last decade, from 190,000 honeybee colonies in 2010 to more than 350,000 in 2020. (Figure 4).

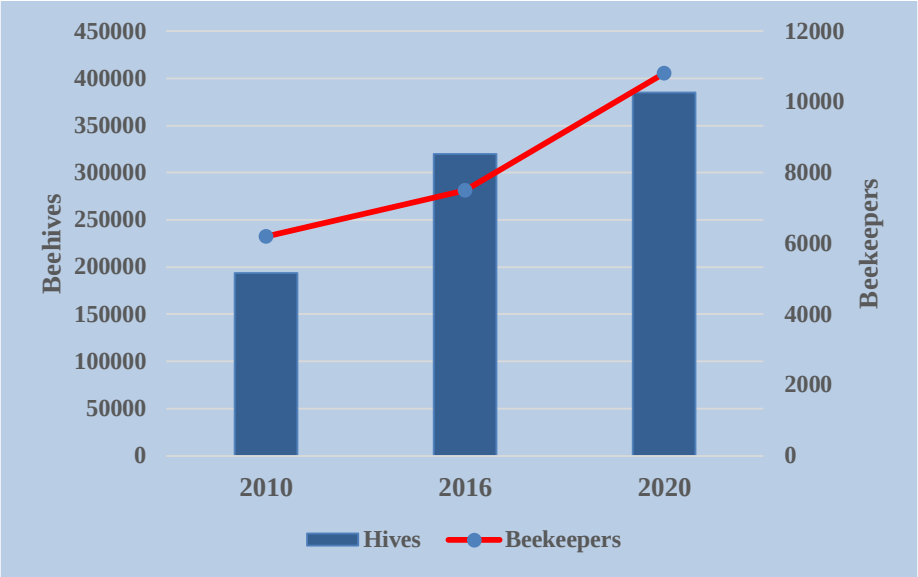


Figure 5 : Evolution of the number of beehives & beekeepers in Lebanon *(Source: MoA)*

This sector therefore helps in increasing the income of a big number of families. Recently, Lebanon's shortage in U.S. dollar and the collapse of the Lebanese pound exacerbated challenges facing beekeepers who have to secure dollars from the black market to purchase their needed materials. For example, one kg of honey used to sell between 37,000 & 45,000 Lebanese pounds (25 to 30 dollars) prior to the dollar crisis, but the price now stands at 280,000 Lebanese pounds, or 10 dollars when calculated at the black-market rate. Domestic consumer considers the price in Lebanese pounds too high while beekeepers have already lost 15 to 20 dollars per kg in profit. Therefore, this economic crisis will affect negatively the evolution of the sector. On the other hand, a significant decline was reported by many beekeepers in the average annual yield of honey per colony from 1990 till now, which is a great challenge for beekeeping industry. This decline in honey yield per colony can be attributed to many factors, the most important of which are scarcity of bee forage due to the evolution of urbanization or the overgrazing by small ruminants mainly at high mountains and overstocking honeybee colonies above the carrying capacity of available

forage area. As a result, beekeepers are subjected to low financial returns from their honeybee colonies.

In most cases, the success in beekeeping depends on the availability of sufficient bee forage in terms of both quality and quantity of nectar and pollen grains. Hence, beekeeping is more dependent on the existing natural resource conditions of an area than any other livestock activities. In areas where beekeeping is not suitable, other improved management skills and advanced technologies alone cannot make beekeeping successful. For this reason, availability of adequate bee forage is considered to be one of the most important elements in beekeeping industry. In many areas of Lebanon, bees and beekeepers suffer from seasonal drought in the summer and cold weather in the winter, which causes a shortage of bee forage. These conditions drive many beekeepers to move their colonies from one area to another for the search of better nectar and/or pollen sources and to avoid severe weather conditions. However, this often leads to a concentration of a large number of bee colonies in limited areas, regardless of honeybee colony population density and the actual carrying capacity of the areas. In this regard, there is no directive to guide or determine the number of colonies to be placed per unit area, nor has it set out the minimum distances between two adjacent apiaries to minimize competition caused by the overlapping of foraging ranges and subsequent declines of productivity of colonies. As a result, overcrowding and resource completion are very intense. Honeybee density per square kilometer over Lebanon ranged from 9 to 206 beehives per km^2 (Figure 5).

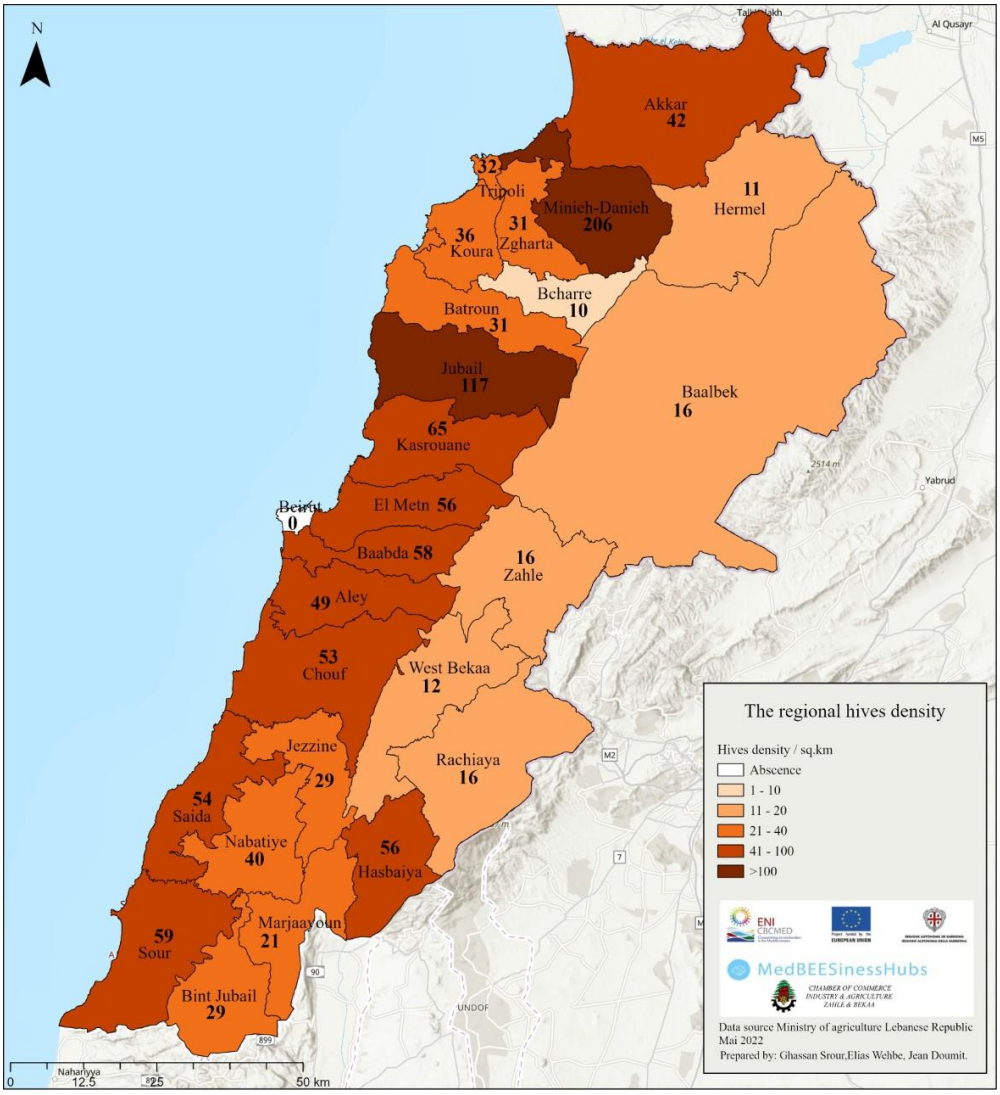


Figure 6 : The density of beehives per square kilometer in Lebanon

The average density in Lebanon today is 40.75 colonies per km². We observe however, large differences from one Caza to another: the highest density was recorded in Minnieh Danniyeh with 206 colonies per km², the lowest in Bcharre Caza with 10 colonies per km². Between these two extremes, the difference amounts to a factor of 196.

As illustrated in the map representing the density of beekeepers in the Minnieh Danniyeh Caza (Figure 6): they are concentrated in some villages and practice sometimes transhumance all year round outside their village of origin and sometimes for very long trip searching pastures in other Caza.

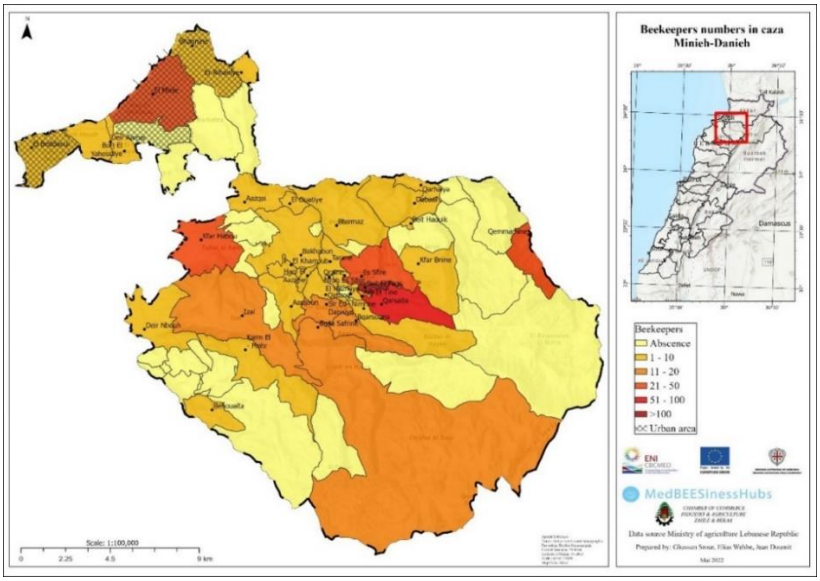


Figure 7 : Map representing beekeepers' distribution in Minnieh Danniyeh Caza

See maps of beekeepers' and beehives' distribution in 25 Caza in Lebanon in Annexe II & III.

Honeybee hive density per square kilometer in Lebanon was extremely high and maybe comparable to the density in Korea and not comparable to any other countries (Table 1).

Table 2: Average beehive density (30 years mean value) of different regions of the world *(Source: Ghosh & Jung 2016)*

Region	Hive density (per km^2)	
	Agricultural Land	Land
Europe	7.31	1.56
Australia & NZ	0.17	0.09
Americas	0.80	0.25
USA	0.70	0.29
Asia	1.21	0.64
Africa	1.27	0.54
Republic of Korea	65.96	11.67
India	5.54	3.03

Results collected from the MoA show that Family scale beekeepers and hobbyist beekeeper are predominant categories in Lebanon (Figure 7). These results are similar in almost all the Caza in Lebanon (Figure 8)

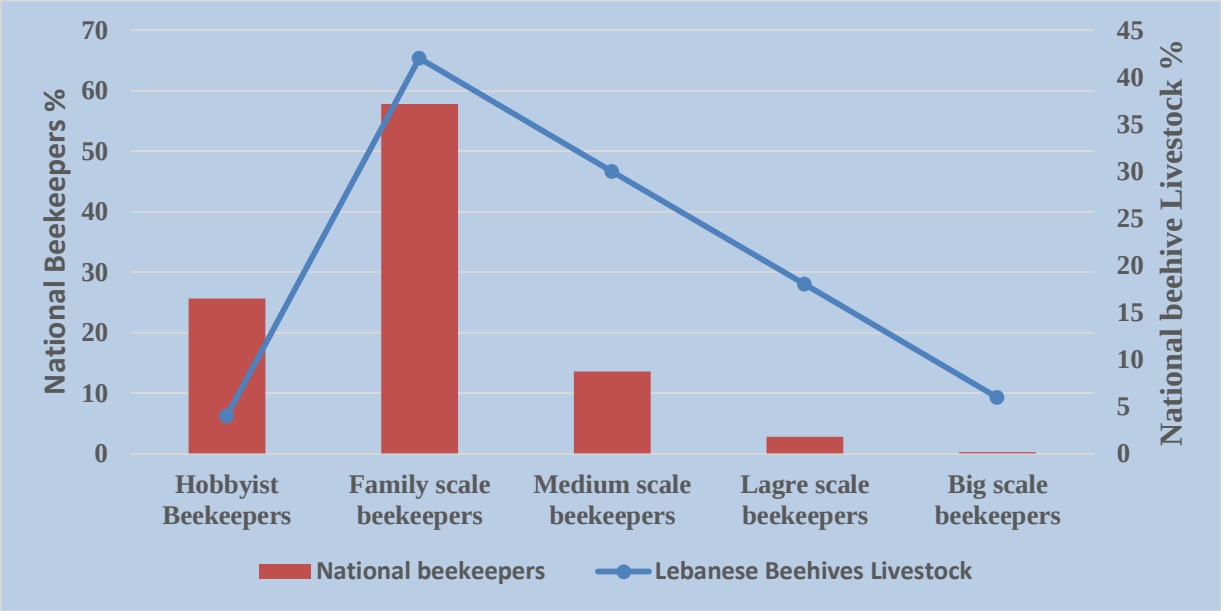


Figure 8 : Distribution of beekeepers and beehives among beekeeper's categories in Lebanon

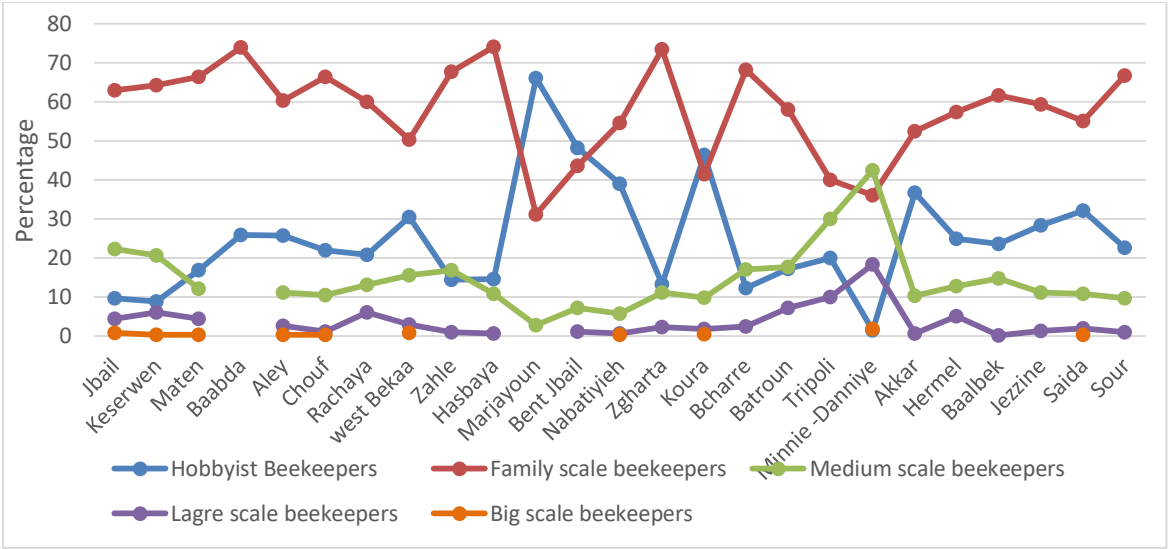


Figure 9 : Distribution of beekeeper's categories in percentage among Caza in Lebanon

5. A SWOT analysis of the beekeeping sector in the region

Strength	**Weakness**
- **Honey Price**: the price of mountainous Lebanese honey is generally among the	**-Size**: Most beekeepers are hobbyist and small with relatively low profitability

highest in foreign markets especially in the gulf countries - **Bee pasture**: Lebanon is known to have one of the richest biodiversity of melliferous plants. - **Honey quality**: Lebanese honey is mostly produced form a wide collection of wild species in the mountains that gives it high quality. - **National governmental support**: The ministry of agriculture, LARI, IRI, and QCC have plans to provide services for beekeepers (laboratory testing facilities, diseases control) - **National Non-governmental support**: International Agencies, International NGOs and Local NGOs have implemented several projects to develop the beekeeping sector (quality control, capacity building of beekeepers, cooperatives, packaging and marketing, Queen rearing center, bee pasture) - **Standardization**: LIBNOR has set stricter honey standards to ensure quality - **Direct sale**: Most of beekeepers sell their production directly to consumers and get all the profit. - **Labor**: For most of beekeepers (hobbyist and small) beekeeping is a family business without or with minimum labor cost. - **COVID**: This epidemic affected positively the demand on honey. - **Cooperation and communication**: Several WhatsApp groups of beekeepers are established to facilitate cooperation.	**-Pesticides**: High use of pesticides, especially on coastal areas is fatally damaging bees and reducing honey production **-Inputs**: high cost of beekeeping inputs that lead to high-cost production (sugar, candy, treatments) **-Low selling price**: Due to economic crisis that hit Lebanon that reduced the purchasing power, beekeepers are obliged to sell at low prices with very low profit margin **-Lack of exports**: Due to diplomatic crisis with some Gulf countries, export decreased drastically. **-Import of low-quality cheaper honey:** several importers are importing low quality honey, sometimes relying on trickery ways. **-High cost of transportation:** The increase of fuel prices world-wide has inhibited some beekeepers from practicing their usual transhumance plans. **-Low consumers awareness**: Most of Lebanese Consumers have low awareness about honey quality, criteria, standards and norms. **-Lack of online marketing:** The great majority of beekeepers do not profit from online marketing advantages **-Stagnant yield of honey**: medium to large scale farmers are suffering from difficulties in selling their honey production **-Low Productivity:** hobbyist and small beekeepers, are characterized by relatively low productivity. **-Climate variation**: The climate variation from a year to another is causing a fluctuation in terms of honey productivity, and therefore an economic instability. **-Dwindling of bee pastures:** Wild aromatic plants harvesting, forest fires, intensive grazing by ruminants, forest tree cuttings, and relatively high density of beehives is causing a lack of bees' pastures in several Lebanese regions **-Lack of pollen origin test:** Lebanese laboratories are not equipped with pollen origin test equipment **-Lack of disease identification LAB**: Lebanese laboratories are not providing Diseases identification labs **-High cost of tests**: Available test are provided at high cost **-Non-registered brands and unbranded honey**: Most of the Lebanese honey production is unbranded and/or brands are not officially registered.
<u>Opportunities</u> - **Inter-organizational cooperation:** private and public sectors can cooperate easily to boost the sector production and profitability	**<u>Threats</u>** **Low quality Honey import**: The high marketing capacity of low-quality honey importers, mainly their online marketing expertise.

(CCIAs are involved in honey business, NGOs, Cooperatives, Union of Cooperatives, Universities, Ministry, LARI, IRI...) **-Potential for export boosting**: to Arab countries, EU countries, and to create a large base of Lebanese consumers abroad due to the large Diaspora if Lebanese honey is given an Identity **-Increase Local market**: Take advantage of the increasing demand on honey during COVID19 epidemic to raise awareness about Lebanese honey healing characteristics. **-The phenomenon of returning to agriculture:** The recent phenomenon of returning to agriculture due to the economic crisis would be taken as a chance to exploit and to expand bee pasture areas by planting aromatic and melliferous plants.	**Lack of honey import regulations**: the entry of low honey quality together with honey trade fraud are threatening the Lebanese honey production **Risk of beekeeper withdrawal**: small beekeepers with low profitability are working unsustainably and might retreat **Risk of more severe pasture dwindling**: Risk of fire has decreased recently in the country, and the small ruminant rearing has increased which is threatening bee pasture. **High cost of varroa mite treatments**: the high cost of varroa mite treatment might cause to spread this disease on large scale among beehives. **Absence or lack of enforcement of laws concerning the import and use of pesticides**: The use of herbicides and insecticides by farmers and some municipalities will damage severely the beekeeping sector. **Lack of policies:** Since the policy presented by bee association and syndicate doesn't approve yet.

6. Assessment of the beekeeping sector in Lebanon

6.1. Methodology

This study has been conducted to define a good perception of the beekeeping sector in Lebanon where a participatory approach including qualitative and quantitative methodologies was adopted. Two surveys, with researcher-administered method, the first one targeting beekeepers at national level and the other heads of beekeeper' cooperatives were carried out between March & April 2022. On the other hand, interviews were undertaken with others key informant and actors of the beekeeping value chain such as: retailers, associations, syndicates, …

Beekeepers were randomly selected (263 beekeepers), with 10 to 15 beekeepers in each of the 24 Caza (Figure 9) no data were collected from Beirut and Tripoli Caza due to the absence of beekeepers in such urban area. The data were obtained using pre-tested structured questionnaires (with a combination of closed-ended with restricted-choice & open-ended questions) to collect required data on: 1)- Socio-economic characteristic of the respondents (Age, gender, year of experience in beekeeping, educational level, main source of income, …) 2)- Apiary' Management methods & employment, 3)- Productivity & challenges & 4)- Future prospects & value chain linkages. As well, a survey targeting active beekeeper' cooperatives were executed in order to assess 1)- Experience & role of the cooperative, 2)- linkages with stakeholders, 3)- Previous & Current funds & 4)- Future prospective of the cooperative.

Further to data collection, descriptive statistics was used to describe qualitative variables while some statistical test such as chi-square were also employed to test association between qualitative variables. Means were separated using least square significant difference whenever they statistically significant at ($p< 0.05$) the analysis was undertaken by spss 16.00 statistical analysis software. The bee data of Lebanon was integrated in a Geographic Information Systems (GIS) for mapping and spatial analysis purposes, maps and plans were made based on Deir Ez Zor Levant projected Coordinate system the local reference system of Lebanon. Both raster and vector Geospatial data types were employed.

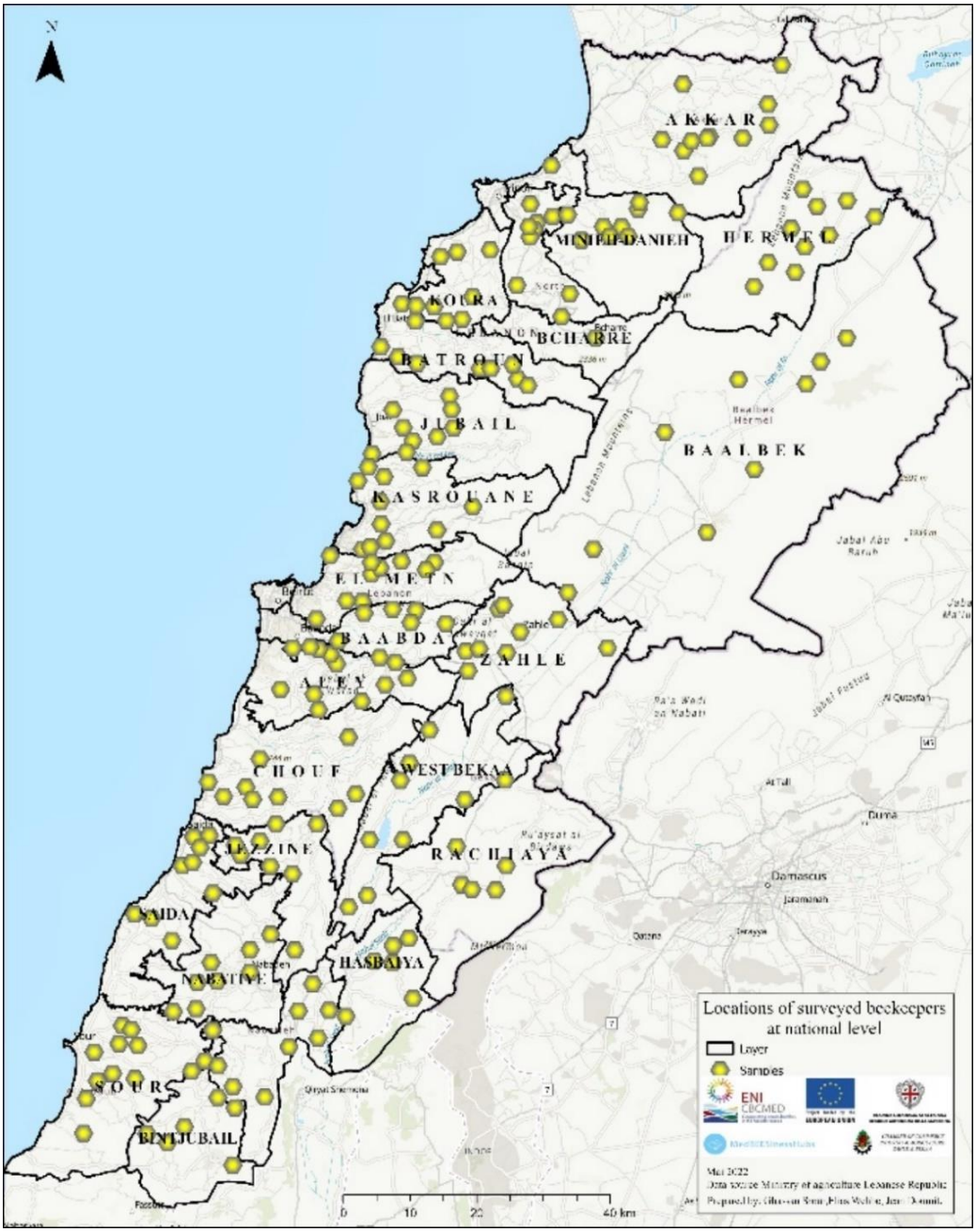


Figure 10 : Distribution of surveyed beekeepers in Lebanon

6.2. Results & discussion

6.2.1. Socioeconomic Profile of beekeeping sector in Lebanon

- **Sex and age of the respondent:** From the total of 263 beekeepers sample respondents were interviewed to generate qualitative and quantitative data based on beekeeping activity just 3.8% are Female and 96.2% were male. Some of male respondents confirm that women family labor force play in important role in apiary activities even in the field or for honey extraction & packaging process. This indicates that beekeeping activities are mainly performed by men although it could be done by any sex composition of the respondents. The average age of the sample respondents were 50.83 years ranging from 20 to 85 years. While the average experience of interviewees was 21.92 year ranging from 1.5 to 61 years.
- **Education Status of the Respondents:** Education is an important and one entry point for fast transfer of knowledge on improved beekeeping. Moreover, educational level of the farming households may have significant importance and determining the type of development and extension service approaches. Based on educational status of the sample beekeepers 2.3% of the respondents have not attended any education while 40.8 and 21.5% attended Intermediate School and secondary school, respectively, and 35.4% reach University level. Based on the study, the illiterate one limits the effectiveness of the product in improved bee keeping activities while University one can open opportunities for development.
- **Beekeeping Practice in the Study Area:** Beekeeping in the study area has been practiced alone or as sideways with other agricultural & non-agricultural activities (employment or free-lancer). Based on the study, there were 39.2% of the respondents their livelihood depends only on this sector, which indicate the level of professionalism of this sector in Lebanon. By depending on their level of economic status, two type of bee hives have been used by the sample beekeeper in the area, these were wooden Langstroth hive, and modern plastic bee hives adopted by 3 over 263 assessed beekeepers; as mentioned above a R&D project conducted by NGO in collaboration with university is studying the efficiency of polyester hive. Despite the high number of cooperatives (75 in total) existing at national level (see paragraph 3), only 31.6% of the respondents confirm their adherence to cooperatives, associations and/or syndicates. All types of beekeepers were represented in this study with different proportions

family scale beekeepers & medium scale beekeepers constituted the main categories of the respondents with respectively 43.3% & 34.2% (Figure 10).

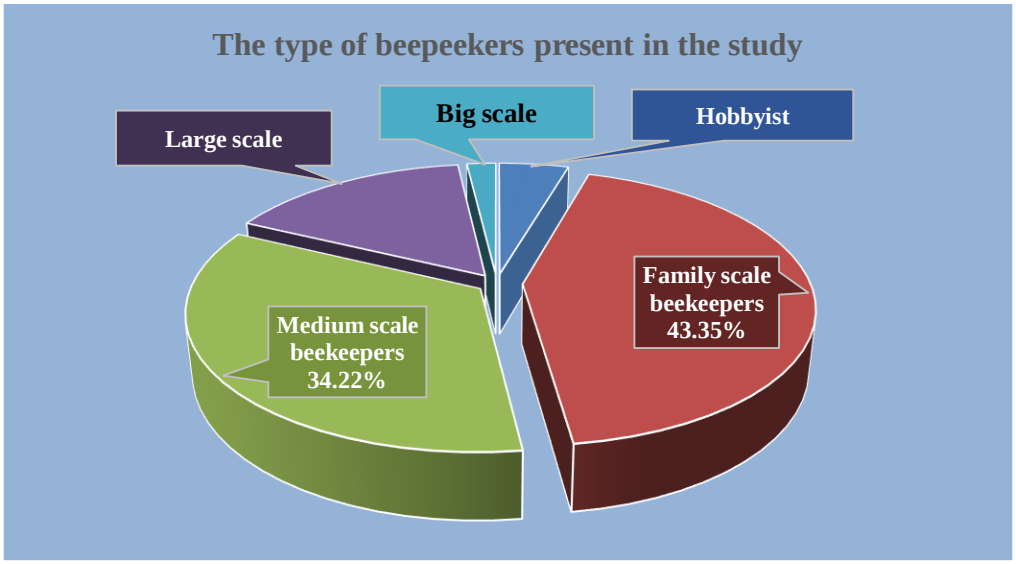


Figure 11 : Type of surveyed beekeepers

Results combining the type of beekeepers with the educational level of the respondents (Table 3) shows that the professionalism in this sector isn't related to the type of beekeepers ($p>0.05$)

Table 3 : Relation between type of beekeepers & educational level

	Illitrate	Elementary	Secondary	University	$\chi 2$	p value
Hobbyist beekeepers	1	6	0	3		
Family scale beekeepers	2	50	22	39		
Medium scale beekeepers	2	35	24	29	12.716	0.270^{ns}
Large scale beekeepers	1	15	8	18		
Big scale beekeepers	0	0	2	3		

*^{ns} non significant; *p<0.05*

Despite that the uncontrolled import of queen bees induced a change of the characteristics of the indigenous breed, 39.2% of the respondents consider that indigenous breed is more productive and resistant to climatic variation and will not introduce any foreign breed to their

apiaries. While, the remains respondents tried to introduce new breeds (purchase abroad or locally) in order to increase their production.

Table 4: Relation between Queen type and Beekeeper types & Region.

		Baladi Queen	Hybrid or Foreign Queen	χ2	p value
Beekeeper Type	**Hobbyist beekeepers**	7	5	14.355	0.005*
	Family scale beekeepers	54	59		
	Medium scale beekeepers	33	57		
	Large scale beekeepers	9	33		
	Big scale beekeepers	0	5		
Region	**Akkar**	13	5	16.112	0.013*
	North	18	38		
	Month Lebanon	31	35		
	Nabatiyeh	11	31		
	South	9	23		
	Bekaa	13	17		
	Baalbek – El Hermel	8	10		

*^{ns} non significant; *p<0.05*

As shown in the table 4, a significant relation exists ($p<0.05$) between the type of queen reared and beekeeper type where medium, large scale & big scale beekeepers tend to purchase foreign breed of queen in order to enhance their productivity. On the other hand, the adoption of foreign queen different significantly between Lebanese region ($p<0.05$), we noted the importance of rearing foreign queen in the North, the South and Nabatiyeh Governate.

- **Knowledge of the beekeepers:** The level of education of the respondents is very high since 80% of the sample beekeepers are aware about the artificial insemination of the queen but 57.7% of all interviewees knew of the presence of a Lebanese AI center. Queen rearing, by using the grafting process, were practiced by 54% of the respondents where some of them continue the process to produce fertile queen in a nucleus, but for others new queen is introduce

unfertile to new swarm. In addition, only 11,5% of the interviewees adopt natural swarming. Only 8 over 263 beekeepers don't supplement beehives during winter or fall period where some of them don't feel the need by moving their hive to rich pasture areas during these seasons (Chouf or Jezzine caza where loquat trees exist in abondance) and others search to reduce at maximum the cost of feeding inputs.

- **Communication:** Some beekeepers profited and still profiting from NGO's programs targeting beekeeping sector. Most Lebanese beekeepers tend to get knowledge and solving beekeeping problems by asking each other. Consultancy services in this regard are missing and not paid. Another way to get solutions to their problems is through groups of WhatsApp. Also, beekeepers are using it for marketing their beehive products (Honey, Swarm, …). This way is indeed active and effective especially if the group has skilled beekeepers and experts where some of them are, from Beekeeper associations and syndicates.
- **Inputs & Transportation cost**: Transportation is considered very important to facilitate carrying the beehives from one pasture to another, but currently, because of rising fuel prices, the cost of transportation leads to an increase of a beekeeper's investment cost and reduce partially the transhumance of beehive for many Lebanese beekeepers. In addition, the apiary running cost became very expensive such as feeding honey bee during cold season which consist an important input for this sector.
- **Financing:** The financing of Lebanese honey value chain is very important to analyze in order to build this vital economic sector and encourage the actors of the honey chain to strengthen their roles in the chain. The following chart (Figure 15) and analysis present the importance of this subject to the whole chain. 93.5% of the interviewees found the money to start business from their "personal savings", this high percentage indicates the high returns of honey business. It is noticed that 4.9% of the interviewees could start a business by taking loans from MFIs (Bank Loan or MSE loan), 0.8% were encouraged by NGO to start their business via grants and finally 0.8% entered into co-partnership with investors which highlight how this sector try to catch investors, but this type of financing remains very marginal.

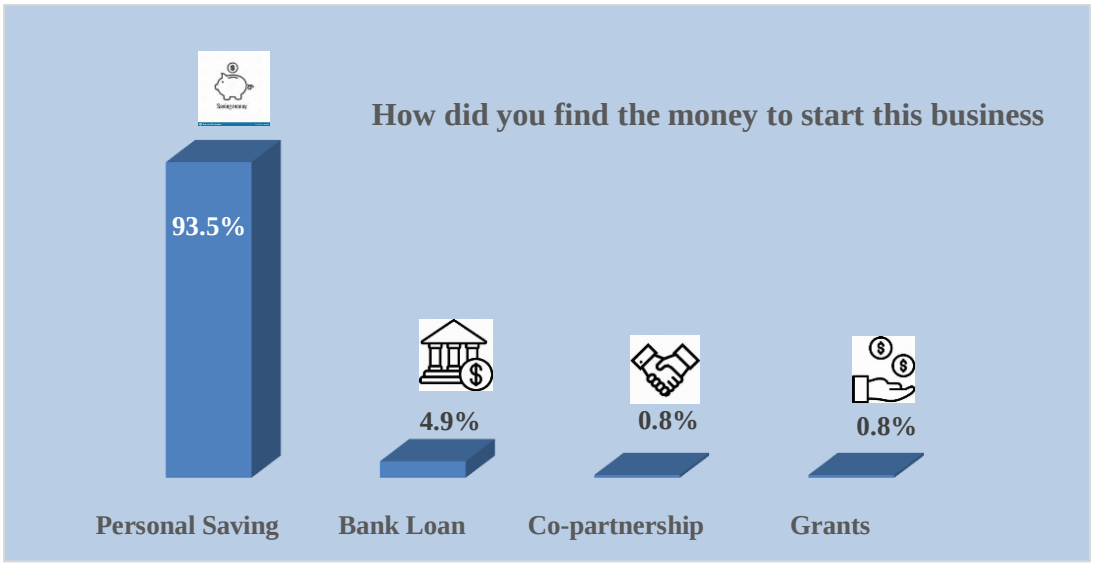


Figure 12 : Type of money for startup beekeeping business in Lebanon

6.2.2. Practices, products and productivity of beekeeping sector in Lebanon

- **Transhumance practices:** Results shows that only 24% of respondents (63 over 263 interviewees) are sedentary beekeepers and leave hives in the same place and do not move them throughout year. The bee's harvest radius in this type of beekeeping does not exceed 2-3 kilometers, this limits the production of the apiary. On the other hand, 76% of the surveyed beekeepers were pastoral or transhumant beekeepers (Figure 11) aim to move hives from site to site from 50 km to 150 km depending on the rate of flowering in melliferous regions in order to fetch a good amount of quality honey, Figure 12 show that beekeeper in some caza move their hives to long distance while others traffic short distance. The flowering period of the plants mentioned in the list (Table 1) varies according to the species; it spreads over the whole year from January until December.

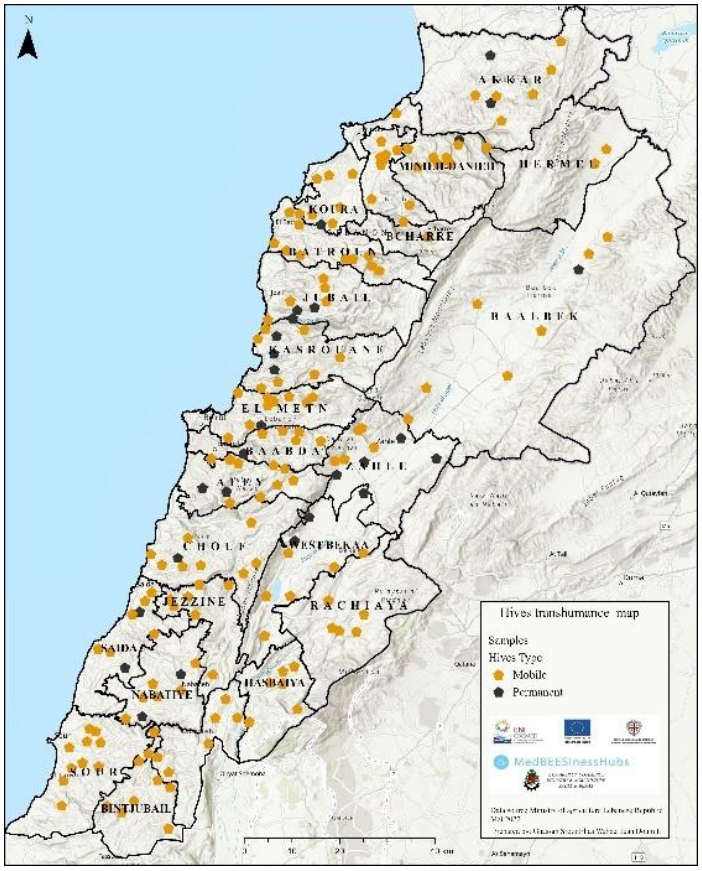


Figure 13 : Type of transhumance for surveyed beekeepers

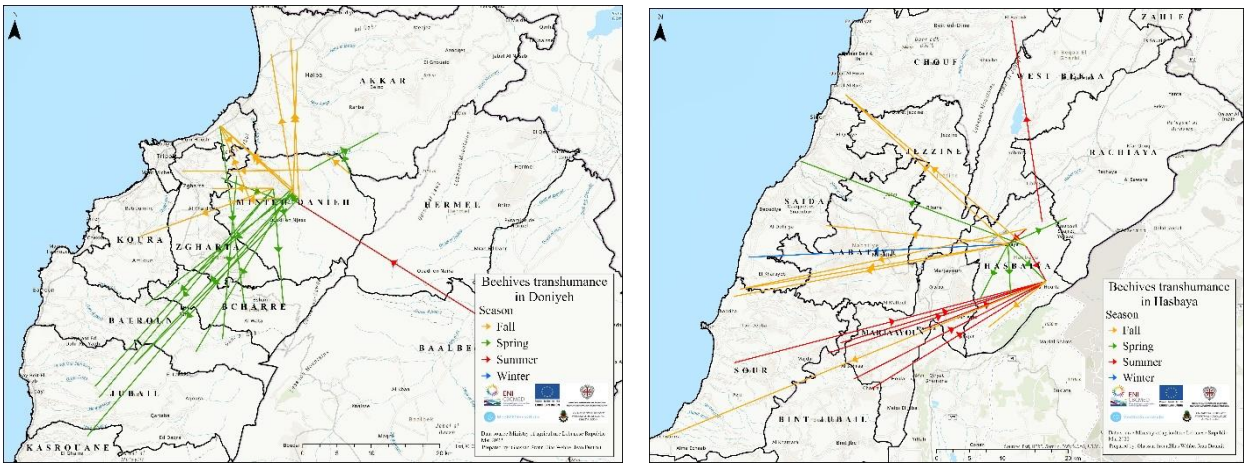


Figure 14 : Map showing the transhumance in Minnieh Danniyeh & Hasbaya Caza

The figure 13 based on the high-density agglomeration method demonstrate that migratory beekeepers move from coastal zone in fall & winter, searching mainly banana plants, orange

gloves, Carob & loquat; to intermediate mountainous altitude in spring where honeydew plants are abundant; and to high mountain in the summer to profit from wild nectariferous plants.

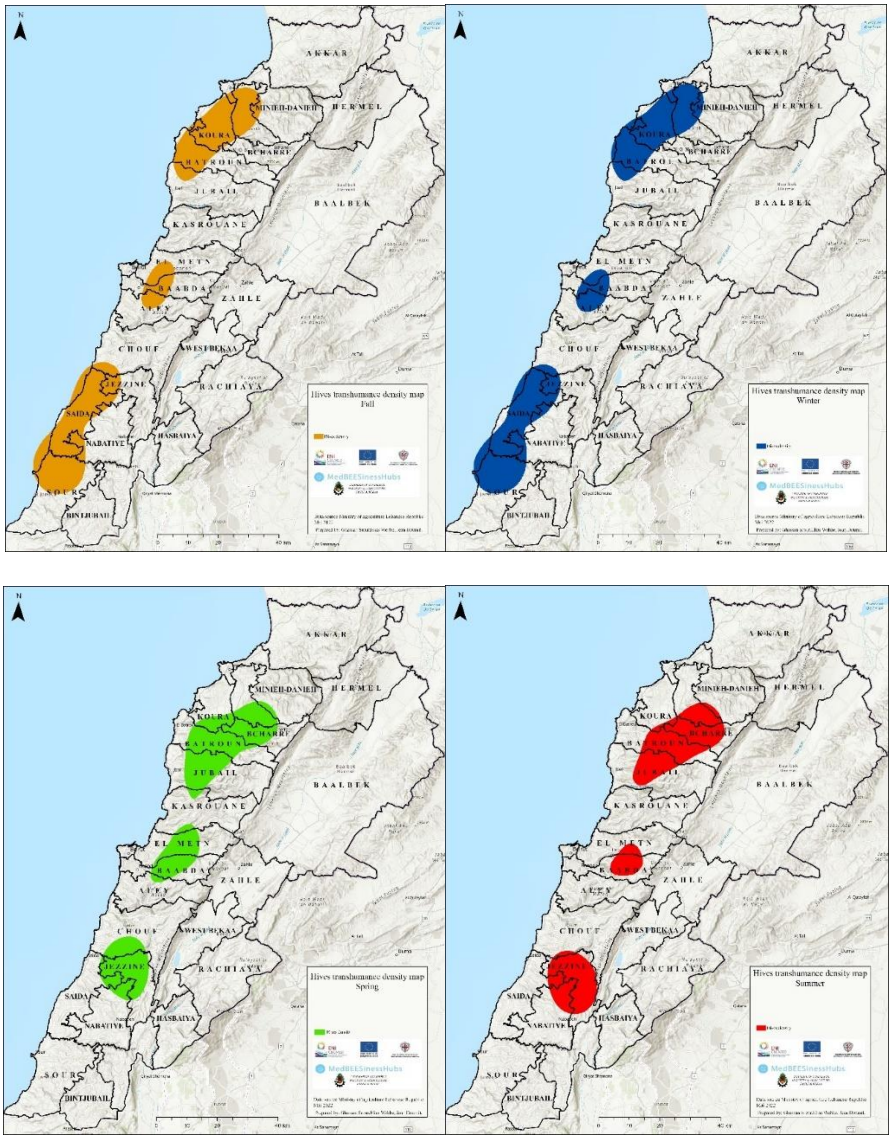


Figure 15 : Movement of beehives upon season in Lebanon.

When practicing transhumance, 7% of surveyed beekeepers aim to harvest 4 types of Honey, 3 types & 2 types of honey was produced by 19% & 39% of interviewees beekeepers respectively, While, 35% of surveyed beekeepers try to move their beehive in order to avoid winter loss by reducing the negative effect of cold weather induced during winter and profiting from flower blooming in the coastal zone to enhance hive population (Figure 14). Only one

beekeeper from Mont Lebanon over 263 surveyed beekeepers installed part of his hives near Polleniferous plants specifically Corn in Bekka region searching pollen harvesting.

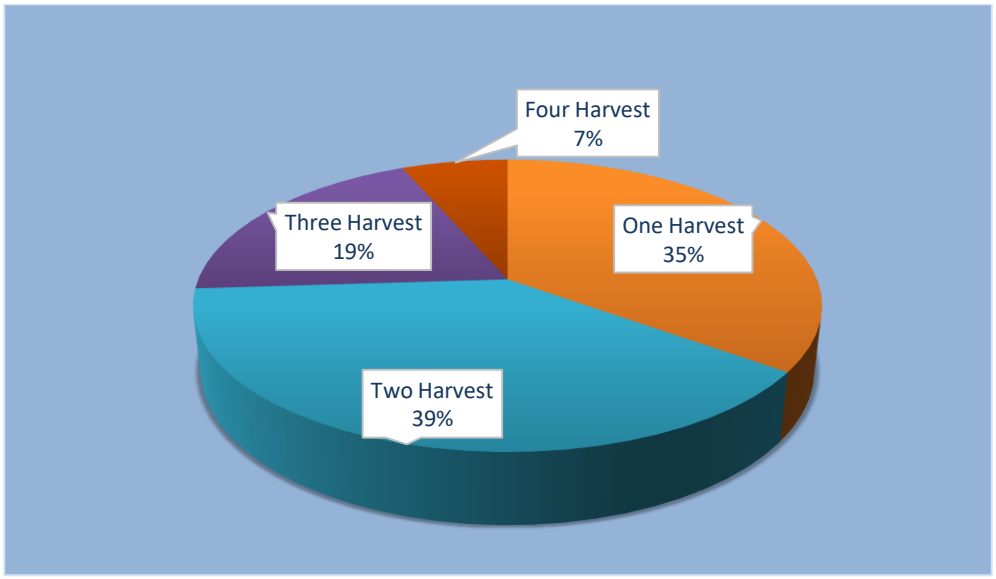


Figure 16 : Type of honey harvest per year by migratory beekeepers

- **Types of Bee Products Supplied by Beekeepers:** Concerning bee products supplied by beekeepers (Figure 16), 19.4% of surveyed beekeepers produced and marketed only honey, while 80.6% produced and/or marketed honey and other bee products by the following percentages: 76%% bee wax, 36% bee pollen (dry or fresh), 15.25% propolis, 3.4% bee queen production, 31.60% royal jelly, 1/263 bee venom.

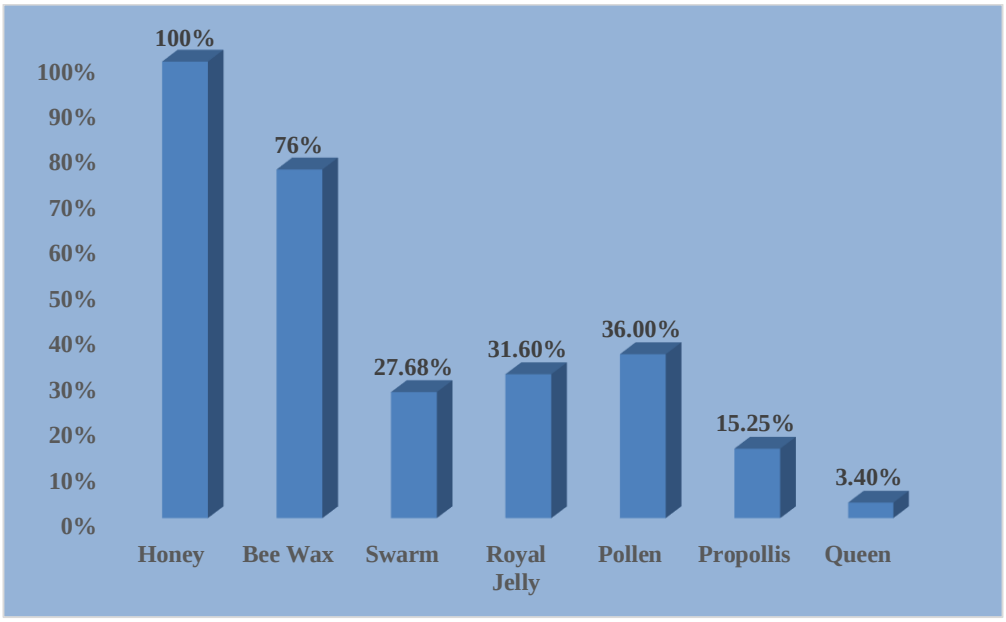
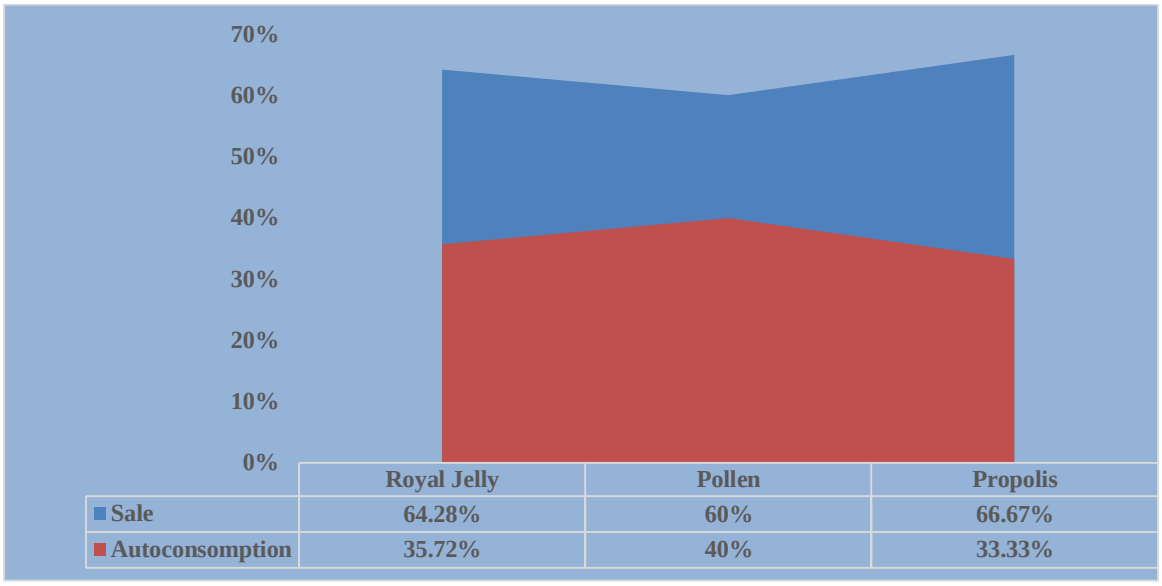


Figure 17 : Types of bee products supplied by surveyed Beekeepers

Among the famously used hive products, honey is the one that leads the list; hence, it is known that the beekeeping sector is essentially interested in the production and marketing of honey, in the second position is the bee wax, a very high percentage of beekeepers who have been surveyed produce bee wax, and almost all of the production is for hive recycling purposes. As well Lebanese beekeepers try to diversify their production and avoid loss in Honey production due to climatic variation, by producing successively pollen, Royal Jelly, swarm, propolis and queens.

Royal Jelly and propolis are sold directly to consumers or auto-consumed by beekeeper' family, while pollen, in addition to selling it directly to consumers in frozen or dry forms and auto-consumed by beekeeper' family, it can be used to produce bee candy also (Figure 17).



	Royal Jelly	Pollen	Propolis
Sale	64.28%	60%	66.67%
Autoconsomption	35.72%	40%	33.33%

Figure 18 : Market distribution of some types of bee products supplied by surveyed Beekeepers

Since the surveyed population has a relatively high educational level, we observed that they are very well aware of the nutritional and therapeutic values of the other hive products such as bee pollen and especially fresh bee pollen, propolis, royal jelly, and bee venom, but this last product is poorly produced in Lebanon due to the difficulties encountered in its production and harvesting. For instance, bee venom requires specific devices introduced to the entrance of the hive that cause a weak electric field and stimulates the bees to release the venom on the device. Furthermore, their conservation is very delicate and require specific market unavailable actually at domestic market. Moreover, the pharmacological benefits of this product are recently discovered, and it is still unknown to the public.

- **Annual Honey Production per Hive:** Annual honey production per hive in Lebanon is variable from one place to another, between years; the results observed for 2021 indicate that the average honeydew Honey production or Oak honey was 13.28 Kg/hive and ranging from 3 to 28 Kg where only 17.5% of apiaries produce more then 20kg/hive; note that Honeydew Honey production was extremely low between 2017 and 2020. The average Mountainous Honey was 7.78 kg/hive and variable from 1.5 to 20 kg/hive. The mean quantity produced by hive placed in coastal zone on orange tree was 5.66 Kg/ hive varying from 1 to 15 Kg.

Despite, the fact that the quantity of Honeydew Honey harvested in 2021 was considered high for beekeepers. Findings show low honey production in Lebanon in comparison to European countries; this may be due to Varroa mites' infection and bee poisoning by insecticides mainly in coastal area and overgrazing induced by ruminants in high altitude and climatic changes.

6.2.3. Employment, marketing channels and value chain actor linkage of the beekeeping sector in Lebanon.

- **Employment:** Lebanese honey actors' seasonal employees range from 1-3 (40%) while 60% of interviewees said that they do not need employees during the peak season of honey. Permanent employment was observed for some large-scale beekeepers and big scale beekeepers; further to economic crisis in Lebanon, beekeepers try to reduce at maximum employment in order to diminish the cost of inputs.
- **Marketing channels:** The majority of the domestic produced honey and other bee products are marketed locally. As mentioned earlier, production is generally low. Economies of scale remain a key issue to address, as it affects the marketing of honey and its by-products. Honey is usually sold to individuals through price negotiations, 75.6% of surveyed beekeepers sell all their production directly to consumer, 19% of the respondents try to sell part of their honey production to wholesalers or retailers the proportion is variable from 5 to 90% and depend on the marketing strategy of each beekeeper. Local exhibitions & social media constitutes each a market for only 2.7% of the surveyed beekeepers, note that exhibitions decreased during COVID-19 pandemic; while 97.3% of surveyed beekeepers showed a positive impact of the pandemic; in fact, honey and propolis demand increased due to their medical properties which can boost the immune system to fight the virus. 2 over 263 beekeepers note an export initiative of small quantity of their products to GCC countries. Most of the honey is sold with minimum packaging. The packaging consists of a standard food jar. Some beekeepers developed a logo but still for almost of them it is not officially registered.

  In order to gain confidence, some of the surveyed beekeepers (35.4% of the respondents) proceed to test their honey but others weren't interested in such services despite of their knowledge about the benefits of such services, only 25.4% of the respondents don't know of the presence of honey testing laboratories in Lebanon.

- **The value chain actors' linkages:** In order to study linkages between the value chain actors many questions were designed and their results are illustrated in the figure 20 below.

  The majority of beekeepers have a strong linkage with consumers which confirm that a big part of honey marketing goes through direct sale, as well communication between beekeepers is important and facilitated via WhatsApp groups. Beekeepers depends also on suppliers who provide them with materials and equipment. Active Beekeeping' cooperatives and associations are considered for some respondent very essential mainly for selling products or it provide services for them. Minor linkages were observed between beekeepers and other actors such as: The MoA where beekeepers are registered but don't have daily contact with, rare are beekeepers who sell their product to cosmetics firm and weak linkage was noticed with handicraft makers and tourism services. This service can play an important role to improvement of the apiculture sector in Lebanon.

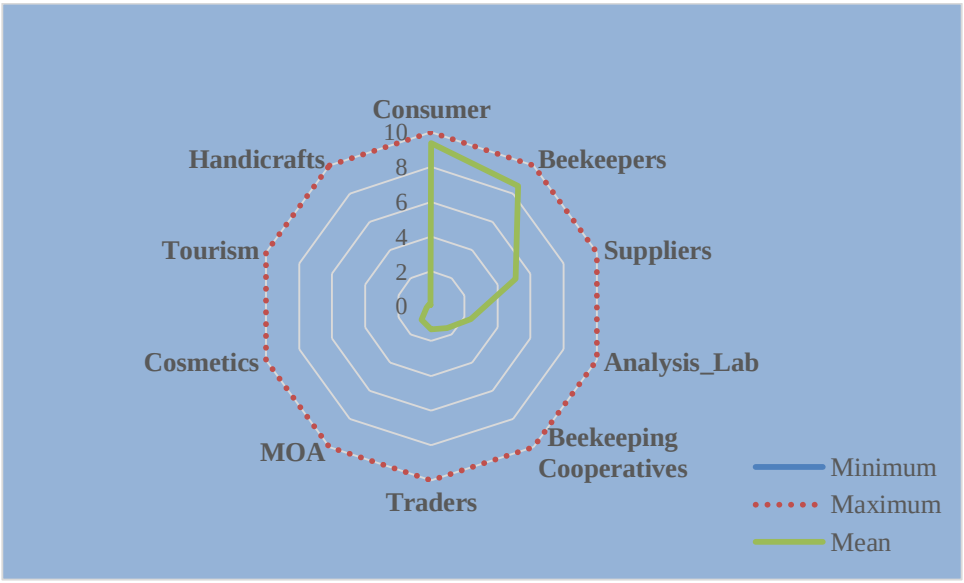


Figure 19 : Value chain actor linkages

7. The Lebanese product portfolio on honeybee products and the honey types available

Lebanese honey is one of the most well-known honeys in the world mainly the mountain honey. The secret of high quality of Lebanese honey is that it is so pure, raw, possess special flavor and unprocessed and does not undergo any type of chemical or physical treatment. Multi-floral Honey

has anti-bacterial properties that inhibit infectious diseases, especially when compared to other types of honey.

Honey is produced by honeybees mainly from the nectar of flowers and honeydew. There are different types of Lebanese Honey, depending on which plants/trees the bees feed on and their location in Lebanon. Two big families of Honey are predominate in Lebanon' Mountains: poly-floral Honey and orange blossom honey.

- **Citrus blossom honey:** Lebanese bees feed on citrus trees when blossoming during April - May, this type of crops is grown in the coastal zone of Akkar plain or in the South extended from Saida to Sour. Orange blossom honey fetches the lowest price in the market (8 to 10 USD/kg). Consumers in southern Lebanon appreciate a lot this type of Honey but only at national level. This type of Honey crystallizes early (after 5 month) and is mainly used for culinary or cosmetic purposes.
- **Honeydew Honey:** Honeydew is a product of sap-sucking insects left on the plant for bees to collect, we can find in Lebanon the oak, cedar and juniper Honeydew. Black Oak Honey is the very famous product and it is produced in significant quantities by beekeepers presented at intermediate altitude (from 400 to 850 m. altitude) from northern to southern Lebanese border where there is a natural wealth of oak trees and wild medicinal plants such as thyme, sage and oregano that make the perfect pasture for this bees, exception made for those present in Bekaa Valley where oak tree due to climatic conditions (the absence of humidity during summer season) cannot produce honeydew. This type of honey is one of the most nutritious kinds of honey because of its exceptionally high mineral content, it's richer in pollen, meaning richer in amino acids, as well as enzymes and flavonoids, which are the antibacterial, and antioxidant agents found in honey. Harvested in June the Black Oak Honey is not affected by crystallization and its price in domestic markets vary from 10 to 15 USD/kg, very appreciated by consumers in GCC countries.

  The production of cedar and juniper Honeydew is very limited in quantity in Lebanon due to the fact that cedar & juniper forest are concentrated in very small area.
- **Mountain Honey "Jerdi":** This type of honey is harvested during September in the highlands at elevation 850m and above and its taste is variables between region and depends directly on

the wild vegetation existing in each region, in Chebaa and Jabal El Ckeikh mountains bees forage on thistle blossoms such as eryngo and globe thistle while in other regions wild flowers and thistle blossoms are dominants. The demand of this honey is high for its quality, it is rich in pollen and thus highly nutritious, as it is characterized by low sucrose content and milder sweetness. Sold at higher price (13-15 USD/kg), some beekeepers avoids the production of the Jerdi honey because its very sensitive to crystallization and many consumers, believe and vehemently argue that honey crystallization is a sign of honey adulteration with sugar and corn syrup, while Honey crystallization, is a natural process that occurs due to many factors such as the nectar source, the ratio of different sugars found in honey and the presence of sediments that might stay in honey after honey extraction which helps initiate the process.

- **Eucalyptus honey:** This type of Honey is produced in small quantity in Lebanon, harvested during May-June and it isn't specific to a region but related to area where eucalyptus trees are available such as: Akkar plain, Month Lebanon, … Efficient to treat allergies and asthmas the price of this honey vary from 10 to 12 USD/kg.
- **Multiple-flowers Honey:** Lebanese bees feed on different flowers of different floral plants in intermediate altitude ranging from 400 to 850 m. The quality and the characteristics of this type of honey change from region to other. For example, in south Lebanon bees' food mainly on Trefoils plants to produce this type of Honey while in other region this type of honey isn't produced. Harvested between July- August this honey is sold between 10 and 12 USD/kg.

  Many beekeepers in Lebanon initiate the production of non-honey products such as: propolis, royal jelly, pollen, venom.

- **Propolis:** Recently, some beekeepers start to produce Lebanese propolis where the demand of such produce increased during COVID-19 pandemic due to its characteristic to boost immune system. In general, it is used as apitherapy, for preparations of cosmetic soap, … and food and beverage additives. Beekeepers try to collect propolis by placing plastic nets or grids or nets with a mesh diameter of 2 to 4 mm on top of the beehive and the bees seal them. In Lebanon, the plastic net is placed on the beehive at the end of the bee season (in autumn) when the bees prepare for overwintering. The net filled out with propolis is taken out and is placed in the freezer. After rolling the net, the propolis falls and can be easily harvested. Beekeepers sold

generally raw bee propolis, propolis powder, or Propolis Tincture and rarely propolis capsules. The price of 30ml. tincture (60% propolis + 40% Alcohol) vary between 7 & 15 USD.

Some studies are conducted in Lebanon aiming to compare the total phenolic contents, antioxidant activity, and cytotoxicity to cancer cell lines of Lebanese propolis (Kabani *et al.*, 2022)

- **Royal Jelly:** The production level of royal jelly in Lebanon is not uniform because some apiaries collect honey only some others Honey and royal Jelly in marginal quantities. Royal jelly can be collected in Lebanon during the 5 Months from April to September. For beekeepers with special skills in royal jelly production and colony management, maximum 500g of royal jelly can be collected. The commercial production of royal jelly requires a methodical approach, good organization and precise timing, constant attendance is essential. Royal jelly production requires expertise and patience and demands considerably more time than the commonly required for the production of other bee products. The royal jelly is harvested and stored in freezers before being sold at 1.5 to 2.5 USD/g. Actually, the demand of fresh Royal jelly in domestic market is very weak due to the weak purchasing power of customers, the royal jelly market is segregated into food & beverages, healthcare, dietary supplements and cosmetics. Beekeepers need to be trained in royal jelly collection methods, so that they will be aquentained to produce royal jelly in commercial way.
- **Pollen**: Pollen is becoming increasingly popular among humans. They are similar to superfoods, commanding a premium in various marketplaces throughout the world. They are high in nutrients such as proteins, enzymes, antioxidants, and many more. Bee pollen is a valuable commodity with numerous applications. It is picked when the blossoms are still plentiful and fed to bees during difficult months such as winter or summer for apiaries located at intermediate altitude in Lebanon, in order to increase brood production because it is high in protein.

  Collecting pollen has become more popular over the past several years in Lebanon. Lebanese Beekeepers use pollen traps to capture pollen during spring & summer period at coastal zone on citrus blossom and at intermediate altitude on a wide variety of wild plants. As well, some beekeepers move their hives to the Bekaa valley to harvest Corn pollen. It is also worth noting

that pollen quality varies according to location, meteorological circumstances, plant kind, bee type, and soil type. They also differ in terms of weight, color, size, and shape. Pollen contains about 200 compounds and is high in protein, accounting for 22.7 percent of the total.

To avoid mold growth and deterioration, Lebanese beekeepers dry the pollen by using air drying to reduce its moisture; while, pollen used in beekeeping is refrigerated rather than dry soon after gathering then used to prepare Candy or introduced directly to wax frames.

Most Lebanese beekeepers gather and sell pollen to supplement their income and during difficult seasons, it also serves as a supplement for bees. The price at domestic market varies from 15 to 25 USD/Kg.

- **Venom:** Honey bee venom is a product of secretory activity in the body of the bee. It is used in the pharmaceutical industry, and more recently it became popular in the beauty industry too, which branded it as a natural Botox. In Lebanon, beekeepers can collect bee venom during the spring-summer season. Recently, some beekeepers start to produce bee venom but this product is still limited for research purposes where many researchers did studies highlighting the therapeutical role of this product. If developed, the production of venom can constitute a good potential as supplementary income for beekeepers in the future.

8. Marketing and packaging

The Lebanese honey market is rich in Poly-floral honeys. Lately, there is significantly weak demand for honey, due to the weak purchasing power of customers. This demand gap has affected the prices and profit of beekeepers, who are now selling honey around 10 to 15 USD/kg, while before Lebanese economic crisis was around 30 USD/kg; note that producer bulk prices of honey range from 7 to 8 USD per kg. Advertising and marketing via social media such as WhatsApp and Facebook of low-quality honey (artificial/adulterated honey) make worst the situation. which has the potential to reduce domestic sales due to price competition or lack of buying potential of Lebanese consumer induced by economic crisis.

There is very little marketing activities undertaken, because honey is generally sold as soon as the beekeeper produces it. Imported honey is sold in grocery stores for approximately 5 USD per kg, but despite its lower price, consumers prefer the local honey because of its quality and authenticity.

Despite the fact that Lebanon produces less than its requirements at present, there is no national marketing strategy in place to stimulate the demand for honey. Most of the honey produced by the beekeepers is sold directly to customers through price negotiations. Most of the honey is sold in raw form, with minimum packaging in a classic type of glass jars. There are some brands that control the honey market in Lebanon. The sector is rather dominated by small producers and cooperatives that usually sell directly to their clients or in farmers' markets and regional exhibitions. Many beekeepers developed label for their products but for most of them it not registered at the Ministry of Economy and Trade.

From the other hand, some beekeepers and commercial suppliers/bulking agents developed attractive label for their products taking into consideration international standard (nutrition fact, product name, net quantity, manufacturer's address, bar code, …). In addition, they offer whole range of products (all type of Lebanese honey and non-honey products such as: pollen, pure royal jelly,) with many size (going from 100g to 1 kg) designed to serve direct consumer, retailers, hotels and restaurants as well international markets and they promote their products via social media or via their own website. Some producers sell their product directly by renting spaces in big malls in Beirut as well one of commercial agent's posses his own store in Beirut specially dedicated to selling honey and non-honey products.

Figure 20 : Photo of the packages of some brands of honey in Lebanese market

As shown in the figure 21 below and demonstrate in the paragraph 6.2.3., the flow of honey for the majority of beekeepers is via direct sale with an unbranded classic glass jar. Branded honey is sold by small retailers, minimarkets and supermarkets. Some beekeepers sell directly to foreign consumers during local exhibitions or through exporting their products targeting GCC markets or

Lebanese diaspora. Part of beekeepers prefer wholesalers or commercial suppliers/bulking agents who targeted with their Branded or unbranded honey local markets or export markets, mainly QCC countries as well over past years new foreign markets were opened such as Canada, USA, … Actually, a project implemented by NGO and local community in Mouth Lebanon is targeting Lebanese diaspora.

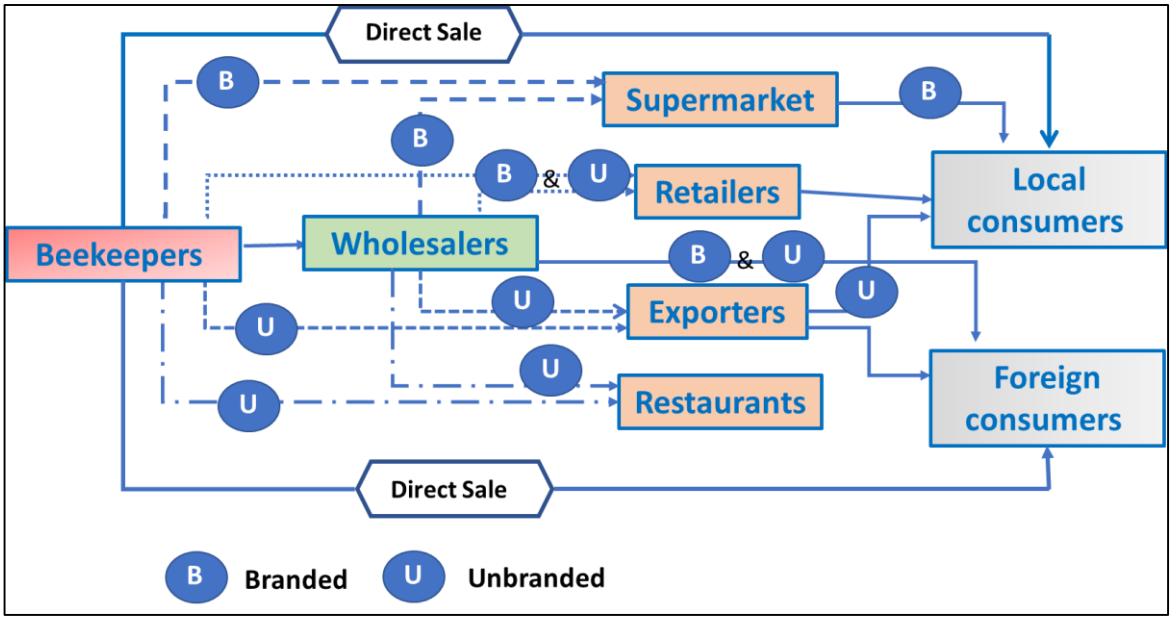


Figure 21 : Honey market actors & their linkages in Lebanon

9. Regional tourism products and services based on the honeybee

In addition to honey, the main product of beehives, the beekeeping could have other great potential sides in the medical and touristic field.

In addition to beehive products, honey, pollen, wax, propolis..., several attractions emerge for eco-tourists who adore nature and healthy ecosystems, for educational tourism mainly for young students, for healthy treatments with beeswax products, as well as entertainment tourism at fairs and honey festivals in several regions in the country showing and commercializing honey, propolis, artisanal wax products, cosmetics.

Lebanon is known to have numerous biosphere with a remarkable biodiversity. Chouf biosphere has introduced the beekeeping tourism within its touristic program, showing the tourist and the naturalists the beehives with some educational explanation about the beekeeping sector, the bees and the honey.

Other biospheres, have the potential to introduce easily this service among their touristic services, that can help the sector a lot by raising awareness among Lebanese consumers about types and benefits of honey and enhance the honey marketing.

These other reserves can follow as well, and introduce the apitourism by offering the services of visiting apiaries, observing the honey bee colonies in their natural environment, they can start to establish a sort of apiculture museum with educational purposes, they can perform honey tasting activities, establish wax artisanal workshops and apitherapy centers. Besides providing to visitors the knowledge and familiarization with the importance of bees in nature, the apitourism would boost the marketing of Lebanese honey and create an excellent "image de marque" among Lebanese and foreign tourists.

To note, that the word "a'asal" which means honey is already attractive in the world of gastronomy and used in the names of food and beverage coffee shops, *i.e.* "shay w a'asal" (tea and honey), "Kashta w a'asal" (cream and honey).

So far, some festivals are organized; the most important is the honey festival in mayfouk (Caza Jbeil). Some beekeepers participate in the festival of Jbeil for typical traditional Lebanese products that was organized for the first time with the support of Mediterranean Institute of Bari. In hasbaya

as well, a fair for the typical traditional Lebanese food is organized at the end of summer, during which some beekeepers exhibit their production. Finally, another fair is organized in the south suburban of beirut (ardi) where honey is exhibited by some beekeepers.

It is important to note, That the university of balamand has established the bee museum in which glass beehives were present with an educative purpose to explain the life cycle of the bee and its importance to students and visitors. The problem was that this project needed high maintenance cost.

Finally, establishing several National honey days; (*i.e.* National Quercus honey day, National Mountainous honey day, National citrus honey day, National spring honey day, National Summer honey day...) by the national authorities like the ministry can help efficiently in boosting the apitourism. As well, local authorities in different regions (mouhafaza or caza) can organize local honey festivals to help in boosting this sector.

Practically, the ministry did great job to boost other agricultural value chains such as the Lebanese wine that has resulted in giving our wine a great reputation and it boosted the sector and increased the production. A similar effort can be done to boost the Lebanese honey sector.

10. Honey in the local/ traditional gastronomy

For most of Lebanese consumers, honey is not just a food, they consider it as natural medicine and remedy for throat pain and cough calmer, a high quality natural healthy food that boost immunity. Mixed to royal jelly, it is used by several men to prevent prostate and/or during prostate treatment.

Honey is used with tisane which is highly consumed in winter, and with fruit cocktail and cream (kashta), either at home or in fruit cocktail shops that are present everywhere and very common in the country.

Honey as well is rarely used in some Lebanese sweets such as "semesmieh" and some cake-like sweets (sfouf) instead of sugar and sugar syrup as healthy sweetener, and many other recipes such as mafroukeh, nammoura, banana jam.

11. Needs and expectations of the local honeybee MSMEs and the people in building up a bee-business

In order to access the constraints in this sector, a series of questions were selected some out of control by the beekeepers and others directly related to apiary' management, answers were ranked from 0 to 10 where 10 is considered as problematic. According to the result of this survey, the major constraints that hinder apiculture sub sector in Lebanon are indicated in Figure 18 below.

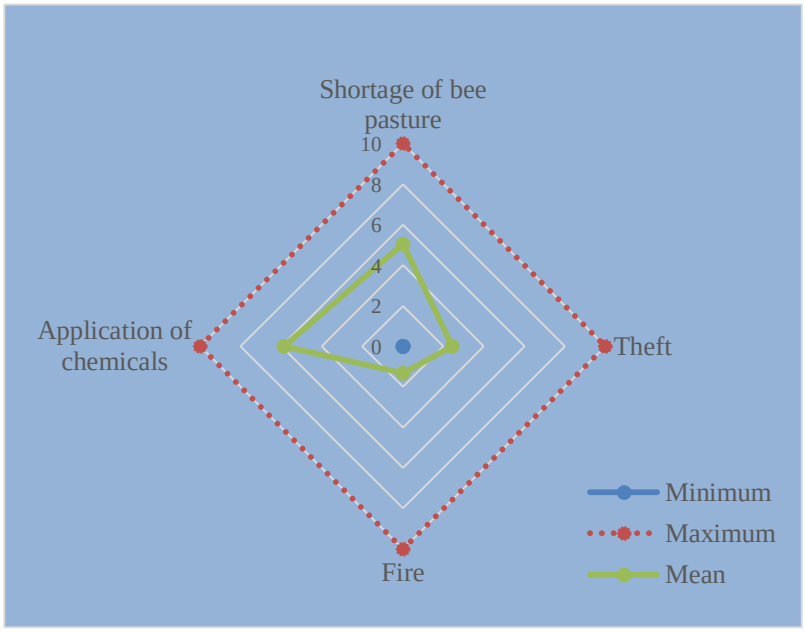


Figure 22: Major constraints of surveyed beekeepers

One of the major constraints of apiculture is the application of chemicals such as fungicides, pesticides and herbicides which hinder the productivity and production of honey bee colonies. Surveyed beekeepers graded an average 5.86/10 with a variation from 0 to 10, 16.3% of surveyed respondents place their hives in safe area and far from chemicals application while 53.7% of them had big concern about the application of chemicals, this was mainly observed at coastal zone when citrus farmers apply chemicals for Valencia species when others species of citrus are blooming or they spray herbicides in their orchards; in addition beekeepers presents at intermediate altitude are worrying when municipalities and neighborhoods use herbicides. Therefore, focus should be given to those chemicals, which are not harmful to honey bees and the application should not match with flowering seasons to minimize the poisoning effect on honey bee.

Shortage of bee pasture leads a devastating problem that retards the production and productivity of honey bee colonies especially during the dearth period. This constraint had a mean value of 5/10 and ranging from 0 to 10 where 14.8% of respondents don't suffer from this problem 33.9% ranked this constraint 8/10 and above. The high percentage observed for shortage of bee pasture is due to many factors such as the increase of urban area compared to green area, the overgrazing of ruminants which touch the melliferous & polleniferous plants mainly at high altitudes and the high density of beehives in some areas (orange orchards at coastal zone and oak forest at intermediate altitude).

A different type of problem came forward in the study is the theft of bee boxes/colonies. Theft of bee colonies occurred and more or less it was faced by remarkable number (55.1%) of respondents. Even though beekeepers put extra protective measures in place to secure and track hives, losses are still prevalent. These acts do not only threaten the viability of honey bee populations for beekeeping, but discourages beekeepers to keep bees in certain areas. Often these are areas with ample quality forage critical for honey production and the vitality of colonies used for crop pollination. Apiaries protected from fire are 65.8% in fact they try to clean the location in order to reduce risk of fire in their apiaries.

Prevalence of Pest and Predator: The prevalence of pests and predators are interesting with life of bees. Varroa destructor, Nosema, European foulbrood, Sacbrood disease, Ants, Bee eater birds, and Wasp & Hornet cause devastating damage to honey bee colonies and products within a short period of time. Surveyed beekeepers apply efficient chemicals to treat Varroa destructor such as Apivar, Amivar, formic acid, oxalic acid, … previously provided for many beekeepers by the MOA and recently by FAO, 94.8% of the surveyed beekeepers confirm that they didn't receive lately any aid to treat varroa and consider that treatment efficiency ranged between 80 to 97%.

The prevalence of Nosema was noted by some respondents mainly in south Lebanon, 25% of respondents rank 1 & 2 over 10 of its presence, when identified, some beekeepers try to apply chemicals as curative treatments while others apply thymol, apple' vinegar & chamomile as preventive treatments.

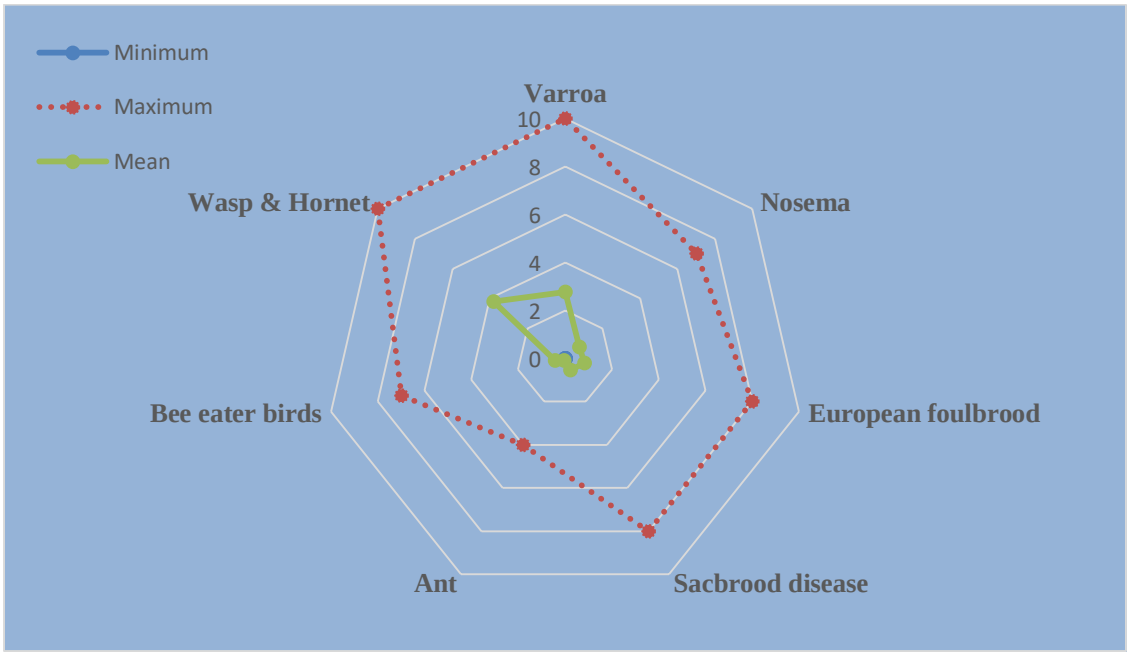


Figure 23 : Prevalence of Pest and Predator for surveyed beekeepers

European Foulbrood & Sacbrood disease were absent for 65% and 72.2% of the surveyed beekeepers respectively, their presence in some apiaries provided them an average rank of 0.8 & 0.5 over 10 respectively. Some surveyed beekeepers in south Lebanon use preventive treatment to European foulbrood by using antibiotic which can leads to the detection of antibiotic residues in harvested honey beside the appearance of resistance to antibiotic treatment, awareness should be taken to explain the effect of antibiotic use as preventive treatment.

The effect of Ant and Bee eater birds was considered very marginal for surveyed beekeepers While wasp & hornet can reduce productivity in some cases and ranked in average 3.8/10 but ranging from 0 to 10; 29.3% of respondents confirm the absence of wasp & hornet in their apiaries generally they represent beekeepers at high altitude, while beekeepers of coastal zone and intermediate altitude represent 45% of the surveyed beekeepers and ranked 5 and above over 10. To avoid the effect of wasp & hornet, some beekeepers installed wasp traps others used chemicals.

Beekeeping sustainability in Lebanon: 85.4% of surveyed beekeepers shows an interest to improve their business. This result is considered good indicator for the sustainability of the beekeeping sector in Lebanon, but financial concern is the only handicaps for sustainability. Some beekeepers highlighted the needs for technical assistance such as training or direct aid (Only 32.6%

of beekeepers received direct aid from states or development agencies) while the majority of respondents have a serious concern about the policies in apiculture sector mainly to protect local production of honey from Adulterated honey, beehive losses due to chemical application, and the overharvest of wild plants, …

Finally, Lebanese economic crisis had a direct impact on this sector, this fact was confirmed by all surveyed beekeepers. Where 45% considered that the impact induces directly a high cost of inputs which leads to higher the production cost, others 36% noted that in addition to previews impacts, the marketing aspect becomes more problematic.

Conclusion

This report aims to offer an overview of the beekeeping sector in Lebanon and highlights the role of this sector for rural development.

Lebanon is characterized by a biodiversity richness due to its topographic and climatic diversity going from coastal zones up to more than 3000 m above sea level. This fact, permit to consider Lebanon one of the countries in the world where bees can find natural sources of nectar all year long and the mountainous poly-floral Lebanon's honey one of the best in the world due to its health benefits. During last 10 years the number of beekeepers and beehives doubled this indicator is considered important for development in rural areas. The Lebanese economic crisis induced lately will affect negatively this sector due to the reduction of benefits and the high cost of production.

The abundance of melliferous and nectareous plants gives the beekeeper the option of transhumance more than once a year in order to profit and produce diversified types of honey up to three seasons a year.

The recent phenomenon of returning to agriculture due to the economic crisis induced in Lebanon would be taken as a chance to exploit and to expand bee pasture areas by planting aromatic and melliferous plants as well to the expansion of number of youth beekeepers.

Five types of honey is produce at national level, in addition to non-honey products such as propolis, pollen, royal jelly and some initiative where found about venom production which is considered very promising as well some beekeepers developed very attractive brands which can compete at national and international markets.

Some initiative should be taken in the future to promote eco-tourism linkage with this sector and to enlarge the range of recipes made from honey.

The following recommendations have been identified to improve the beekeeping industry's competitive position, productivity and profitability:

- Access to finance remains a key challenge especially to beekeepers and small-scale processors who are main actors in the sector. This situation became worst with the enlargement of economic crisis in Lebanon

- Increasing the skills and technical capacity of farmers needs to be a key priority in increasing the productivity and profitability of the honey industry. There is a significant number of untrained beekeepers who could not only benefit their livelihoods through a deeper knowledge and understanding of beekeeping but would also less likely exacerbate current pest and disease issues.
- Increasing women's engagement in beekeeping must be emphasized through targeted training and mentorship programs.
- The venom and propolis market currently remain untapped despite great potential for increased profits for actors at various stages in the value chain. Building capacity for institutions to process venom and propolis and produce value-added products needs to be highlighted.
- An analysis of cooperative models to find applicable strategies; and, strategies to encourage genuine engagement by communities need to be identified and implemented.
- Assistance with marketing strategies and linking processors and packers to high value markets will enable higher returns and greater profitability in the industry. Such strategies will cover some of the loss in profit induced by the Lebanese economic crisis.
- Increasing the capacity of apiculture staff within the MoA to support farmers and other relevant stakeholders is necessary for industry development. Current capacity for apiculture staff to produce high quality queens, provide training to new beekeepers, support existing beekeepers, provide technical support for other dependent organizations, and manage day-to-day procedures is limited and demand for such services is strained.
- National strategy to eradicate varroa requires further analysis for feasibility, and its projected impacts on the industry need to be measured. Some restriction on movement of bees and hives should be undertaken to minimize risk of pests and diseases spreading, without creating a serious impediment to the industry's productivity.
- Current policies present at national level are weak or even unapplicable. There is a need to adopt the policy presented by bee association and syndicate which facilitate communication between different parties in the sector value chain and will enable a more efficient and effective flow of information and support industry cooperation and collaboration. Even limits the use of

herbicides and insecticides by farmers and some municipalities which damage severely the beekeeping sector

- Encourage the establishment of specialized laboratories for honey (determine botanical and geographical origins of honey) and disease testing will reduce the risk of hive losses and limit competitiveness persuaded by artificial/adulterated honey. This action will have direct effect on profitability of this industry.

To conclude, Lebanon has significant potential in creating a productive, profitable and viable honey industry. Employment and income-generating opportunities exist at various stages along the value chain. Emphasis needs to be on capacity building for beekeepers and supporting institutions, which would produce flow-on benefits along the value chain. Further strategies were identified to increase value-addition and competitive advantage throughout the industry.

References

Aiyeloja, A. A., Adedeji, G. A. and Emerhi, E. A. 2015. "Impacts of beehive stands' heights and hives' types on the ergonomics of honey harvesting in Port Harcourt, Nigeria," New York Science Journal, vol. 8, no. 4, pp. 23–27.

Akinmulewo, B. O., Oladimeji, Y. U. and Abdulsalam, Z. 2017. "Assessment of the profitability of improved apiculture in federal capital territory (FCT) abuja, nigeria," Journal of Sustainable Development in Africa, vol. 19, no. 2, pp. 24–37.

El Masry, A.N. 2010. Lebanese wild flowers, First part,

Eteraf-Oskouei, T. and Najafi, M. 2013. Traditional and modern uses of natural honey in human diseases: a review," Iranian Journal of Basic Medical Sciences, vol. 16, no. 6, pp. 731–742.

FAO/STAT (2020). Live animals. http://www.fao/faostat/en.

Goulson D, Nicholls E, Botías C, Rotheray EL (2015) Combined stress from parasites, pesticides and lack of flowers drives bee declines. Science 347:1255957

Hung K-LJ, Kingston JM, Albrecht M, Holway DA, Kohn JR (2018) The worldwide importance of honey bees as pollinators in natural habitats. Proc R Soc B Biol Sci 285:20172140

Kabani, D., Jaber, A., Ibrahim, G., Chebli, E. & Abdel-Sater, F. 2022. Lebanese Propolis from Different Regions: Phytochemical Screening, Antioxidant Activity and Effect against Cancer Cells. Journal of Apitherapy 9 (3) : 1-9.

Médail, F., & Quézel, P. (1997). Hot-Spots Analysis for Conservation of Plant Biodiversity in the Mediterranean Basin. Annals of the Missouri Botanical Garden, 84, 112-127.

Mujuni, A., Natukunda, K. and Kugonza, D. R. 2012. "Factors affecting the adoption of beekeeping and associated technologies in Bushenyi District, Western Uganda," Livestock Research for Rural Development, vol. 24, no. 8.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. Nature, 403, 853-858.

Ollerton J, Winfree R, Tarrant S (2011) How many flowering plants are pollinated by animals? Oikos 120:321–326.

Pathare, S., Ravikumar, P. and Mistry, A. 2015. "Promising pharmaceutical applications of honey: a review," World Journal of Pharmaceutical Sciences, vol. 4, no. 5, pp. 377–392.

Potts SG, Biesmeijer JC, Kremen C, Neumann P, Schweiger O, Kunin WE (2010) Global pollinator declines: trends, impacts and drivers. Trends Ecol Evol 25:345–353.

Tohmé, G., & Tohmé, H. (2004). Recherches sur le statut actuel des plantes endémiques du Liban. Archeology & History in Lebanon, 64-69.

Tohmé, G., & Tohmé, H. (2011). Nouvelles recherches sur la flore endémique et naturalisée du Liban. Lebanese Science Journal, 12, 133-141.

Tohmé, G., & Tohmé, H. (2014). Illustrated flora of Lebanon (2 ed.) CNRSL.

Winfree R, Aguilar R, Vázquez DP, LeBuhn G, Aizen MA (2009) A meta-analysis of bees' responses to anthropogenic disturbance. Ecology 90:2068–207.

Annexes

Annexe I- List of melliferous plants in Lebanon (Source El Masry 2010).

English name	*Scientific name*	Flowering period										
		J	F	M	A	M	Jn	Jl	Au	S	O	N
Annual Wing Head	*Pterocephalus plumosis*											
Arabian thistle	*Carduus pynocephalus arabicus*											
Artichoke cotton-thistle	*Onopordum cynarocephalum*											
Barbary fig	*Opuntia ficus-indica*											
Bastard cabage	*Rapistrum rugosum*											
Beautiful distaff-thistle	*Atractylis comosa*											
Bitumen pea	*Psoralea bituminosa*											
Blackberry	*Rubus*											
Blood-red everlasting	*Helichrisum sanguineum*											
Branching ironwort	*Sideritis pullulans*											
Bristly cephaliaria	*Cephalaria setosa*											
Bristly hollyhock	*Alcea cetosa palmata*											
Bristly hollyhock/Cretan woundwort	*Stachys cretica vacillans*											
Bur thistle	*Cirsium lappaceum hermonis*											
Carob	*Ceratonia siliqua*											
Cilician catmint	*Nepeta cilicica*											
Clustered eryngo	*Eringium glomeratum*											
Clustered Viper's-bugloss	*Echium glomeratum*											
Common chicory	*Cichorium intybus*											
Common Fennel	*Foeniculum vulgare*											
Common hemp-agrimony	*Eupatorium cannabinum indivisum*											
Common myrtle	*Myrtus communis*											
Common St John's-wort	*Hypericum perforatum*											
Cretan cistus	*Cistus creticus*											
Cretan eryngo	*Eryngium creticum*											
Cretan germander	*Teucrium creticum*											
Crown daisy	*Chrysanthemum coronarium*											
Curled horse fennel	*Hippomarathrum crispum*											
Damascus phlomis	*Phlomis brachyodon damascena*											
Doria-like groundsel	*Senecio doriiformis doriiformis*											
Downy-birdsfoot-trefoil	*Lotus cytisoides*											
Dwarf elder	*Sambucus ebulus*											
Ehrenberg's marjoran	*Origanum ehrenbergii*											
Ehrenberg's woundwort	*Stachys ehrenbergii*											
Eryngo knapweed	*Centaurea eryngioides*											

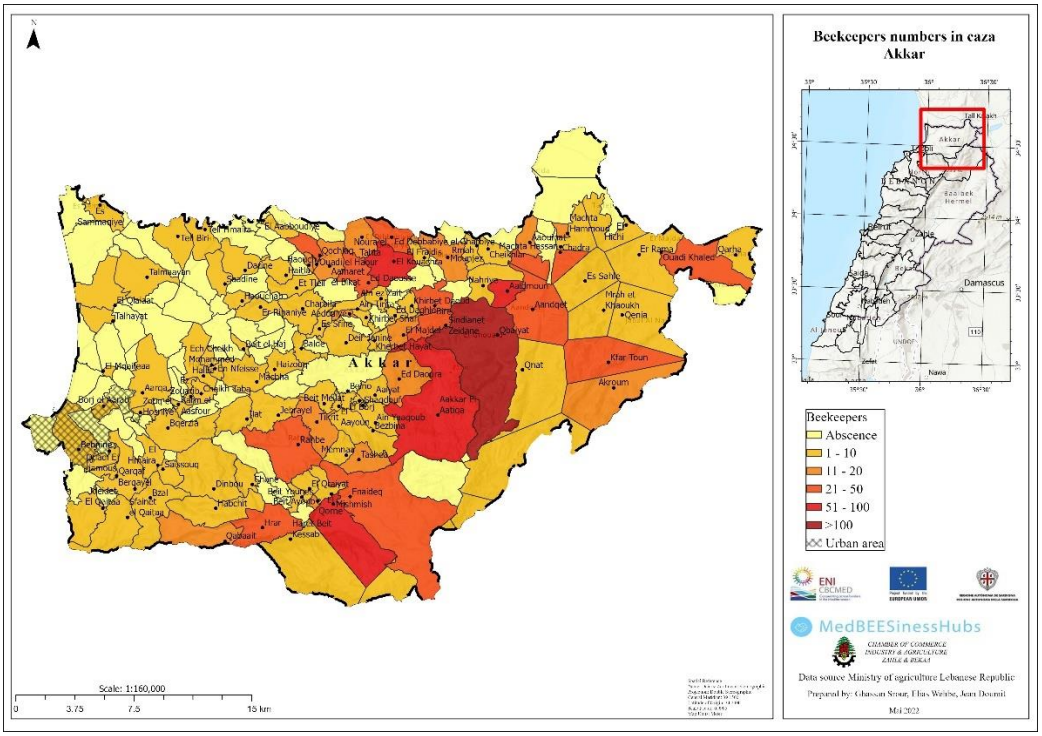
Falcate eryngo	*Eryngium falcatum*												
False acacia	*Robinia pseudo-acacia*												
False saw-wort	*Crupina crupinastrum*												
Felty germander	*Teucrium polium*												
Field bindweed	*Convolvolus arvensis*												
Fleecy sage	*Salvia microstegia*												
French lavender	*Lavandula stoechas*												
Gaillardot's milk-vetch	*Astragalus gaillardotii*												
Glaucous safflower	*Carthamus tinctorius*												
Gum dragon	*Astragalus gummifer*												
Hairy dorycnium	*Dorycnium hirsutum*												
Hairy Heliotrope	*Heliotropium hirsutissimum*												
Hedged mustard	*Sisymbrium officinale*												
Heldreich's eryngo	*Eryngium heldreichii*												
Hermon cousinia	*Cousinia hermonis*												
Hoary vetch	*Vicia canescens*												
Hoary ziziphora	*Ziziphora canescens*												
Honey-wort leaved saw-wort	*Serratula cerinthifolia*												
Horned sainfoin	*Onobrychis cornuta*												
Hybrid medick	*Medicago x varia*												
Iberian knapweed	*Centaurea iberica*												
Italian catmint	*Nepata italica*												
Jaffa cepharlaria	*Cephalaria joppensis*												
Large-branched spurge	*Euphorbia macroclada schyzoceras*												
Leafy-headed thistle	*Cirsium phyllocephalum*												
Leafy-headed thistle	*Cirsium phyllocephalum*												
Lebanese involucrate carline-thistle	*Carlina Involucrata libanotica*												
Lebanon barberry	*Berberis libanotica*												
Lebanon cousinia	*Cousinia libanotica*												
Lebanon ironwort	*Sideritis libanotica*												
Lebanon prickly-thrift	*Acantholimon libanoticum*												
Lebanon shrubby sage	*Salvia libanotica*												
Lebanon white-horehound	*Marrubium libanoticum*												
Lebanon white-horehound Hermon	*Marrubium libanoticum hermonis*												
Linden-tree	*Tilia silvestris intermedia*												
Lofty sison	*Sison exaltatum*												
Long-flowerd spur-valerian	*Centranthus longiflorus latifolus*												
Mountain ferulago	*Ferulago frigida*												
Mountain-spignel pink	*Dianthus libanotis*												
Muronate noaea	*Noaea mucronata humilis*												
Narbonne star of bethlehem	*Ornithogalum narbonese*												

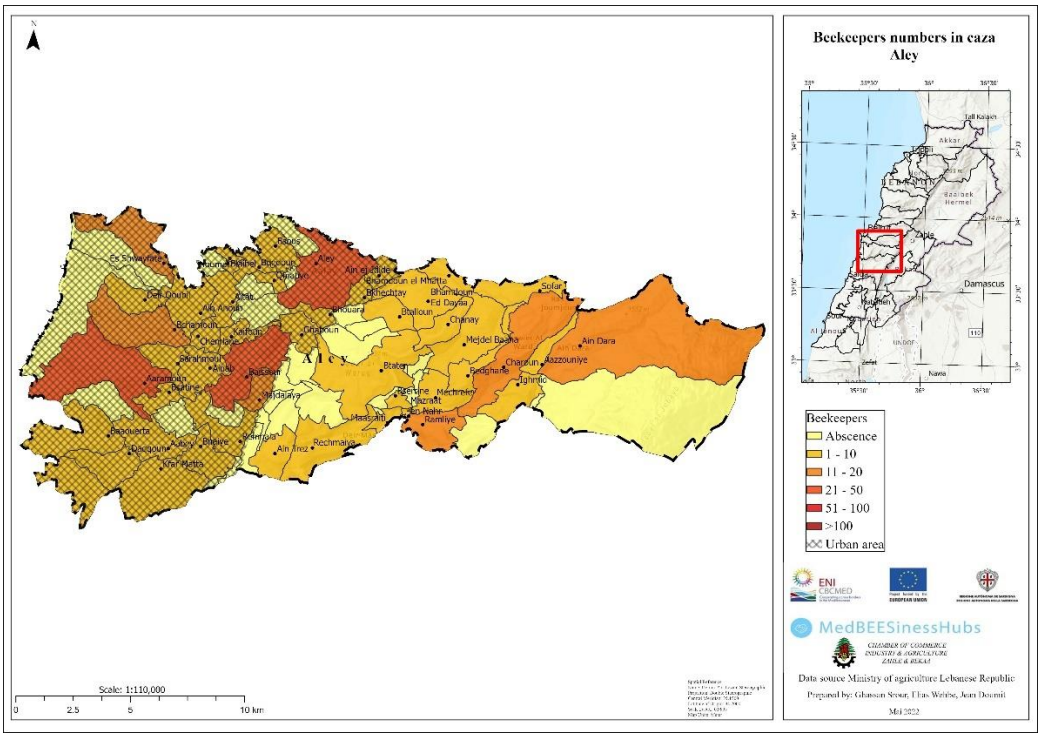
Narrow-leaved Viper's Bugloss	*Echium angustifolium*											
Nebrodi hound's-tongue	*Cynoglossum nebrodense*											
Nerved-calyxed woundwort	*Stachys neurocalycina*											
Nice mallow	*Malva nicaensis*											
Nummular-leaved honeysuckle	*Lonicera nummulariifolia*											
Oriental anarrhinum	*Anarrhinum orientale*											
Oriental curetum carline	*Carlina curetum orientalis*											
Oriental germander	*Teucrium orientale*											
Oriental self-heal	*Prunella orientalis*											
Pale knapweed	*Centaurea pallescens*											
Palestine scabious	*Scabiosa Palaestina*											
Palmate-pappused knapweed	*Centaurea cheirolopha*											
Phonecian rose	*Rosa phoenicia*											
Prickly asparagus	*Asparagus aphyllus*											
Rampion	*Campanula rapunculus spiciformis*											
Red-flowered milk vetch	*Astragalus cruentiflorus*											
Reuter's hawkweed	*Crepis reuteriana reuteriana*											
Rough smilax	*Smilax aspera*											
Rushy gum-succory	*Chondrilla juncea*											
Sage-leaved cistus	*Cistus salviifolius*											
Scentless balm	*Melissa inodora*											
Sea-squill	*Urginea maritima*											
Shaggy Germander	*Teucrium divaricatum villosum*											
Short-toothed oriental pink	*Dianthus orientalis brachyodontus*											
Shrubby knapweed	*Centaurea dumulosa*											
Shrubby ptilostemon	*Ptilostemon chamaepeuce*											
Shrubby rest harrow	*Ononis natrix*											
Slender safflower	*Carthamus tenuis*											
Slender-leaved vetch	*Vicia tenuifolia stenophylla*											
Small-leaved mint	*Mentha microphylla*											
Smyrna tamarisk	*Tamarix smyrnensis*											
Snowy woundwort	*Stachys nivea*											
Spanish oyster-plant	*Scolymus hispanicus*											
Spiked thymbra	*Thymbra spicata*											
Spiny caper	*Capparis spinosa canescens*											
Spiny rest harrow	*Ononis spinosa leiosperma*											
Spiny-broom	*Calicotome spinosa*											
Spray-flowered heath	*Erica manipuliflora*											
squirting cucumber	*Ecballium elaterum*											
St Barnaby's thitle	*Centaurea solstitialis solstitialis*											
Star thistle	*Carthamus glaucus*											

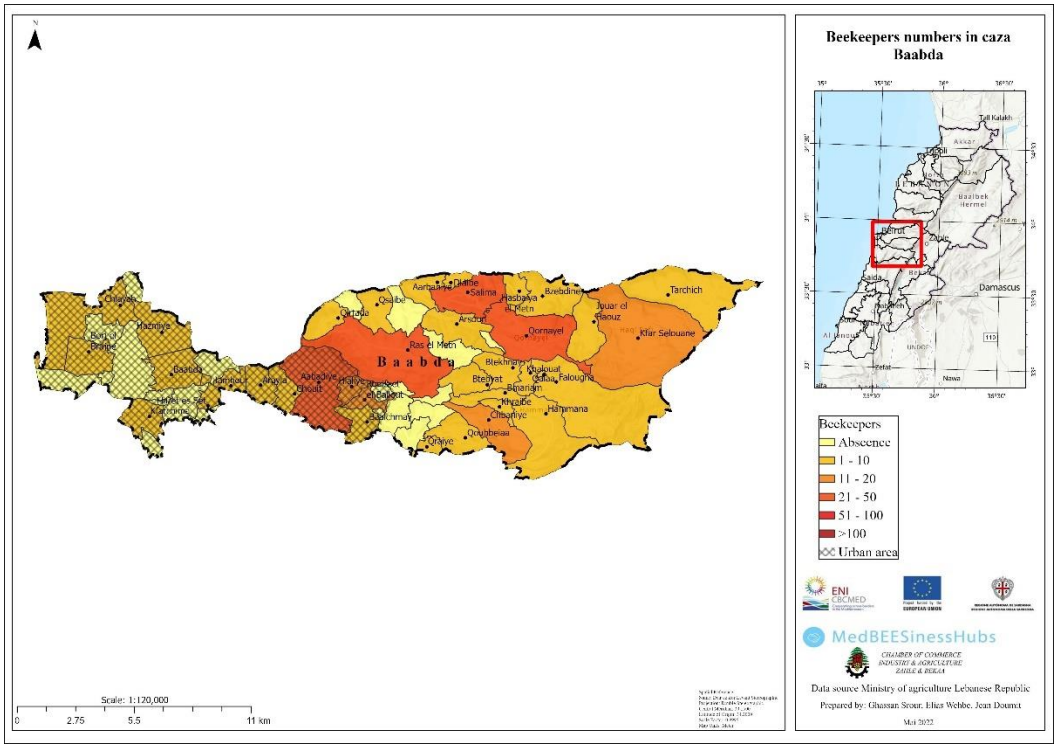
Star-haired cephalaria	*Cephalaria stellipilis*												
Stinking st John's wort	*Hypericum hircinum*												
Straight dorycnium	*Dorycnium rectum*												
Striose bugloss	*Anchusa strigosa*												
Summer savory	*Satureia thymbra*												
Sweet virgin's-bower	*Clematis flammula*												
Syrian broom	*Cytisus syriacus*												
Syrian ferulago	*Ferulago syriaca*												
Syrian marjoran	*Origanum syriacum*												
Syrian thistle	*Notobasis syriaca*												
Tanner's sumach	*Rhus coriaria*												
Thorny-broom	*Calycotome villosa*												
Thyme-leaved st John's-wort	*Hypericum thymifolium*												
Tragium burnet-saxifrage	*Pimpinella tragium*												
Transparent-bracted knapweed	*Centaurea hyalolepis*												
Trefoils	*Trifolium*												
Trionfetti's knapweed	*Centaurea triumfetti*												
Triquetrous scariola	*Scariola triquerta*												
Tuberous dandelion	*Leontodon Tuberosus*												
Twiggy asyneuma	*Asyneuma virgatum virgatum*												
Two-spined ptilostemon	*Ptilostemon diacantha*												
Various-spined cotton-thistle	*Onopordum heteracanthum*												
Viscous globe-thistle	*Echinops viscosus*												
Viscous globe-thistle	*Echinpos viscosus macrolepis*												
Viscous inula	*Inula viscosa*												
Viscous phlomis	*Phlomis viscosa*												
Viscous sage	*Salvia viscosa*												
Wavy thrift	*Aremeria undulata*												
Webb's scabious	*Scabiosa webbiana*												
Wedge-leaved savory	*Satureia cuneifolia*												
White eucalyptus	*Eucalyptus parramttensis*												
White wild leek	*Allium ampeloprasum leucanthum*												
White-horehound	*Marrubium vulgare*												
Wild cherry	*Prunus prostrata*												
Yellow cnicus	*Picnomon acarna*												

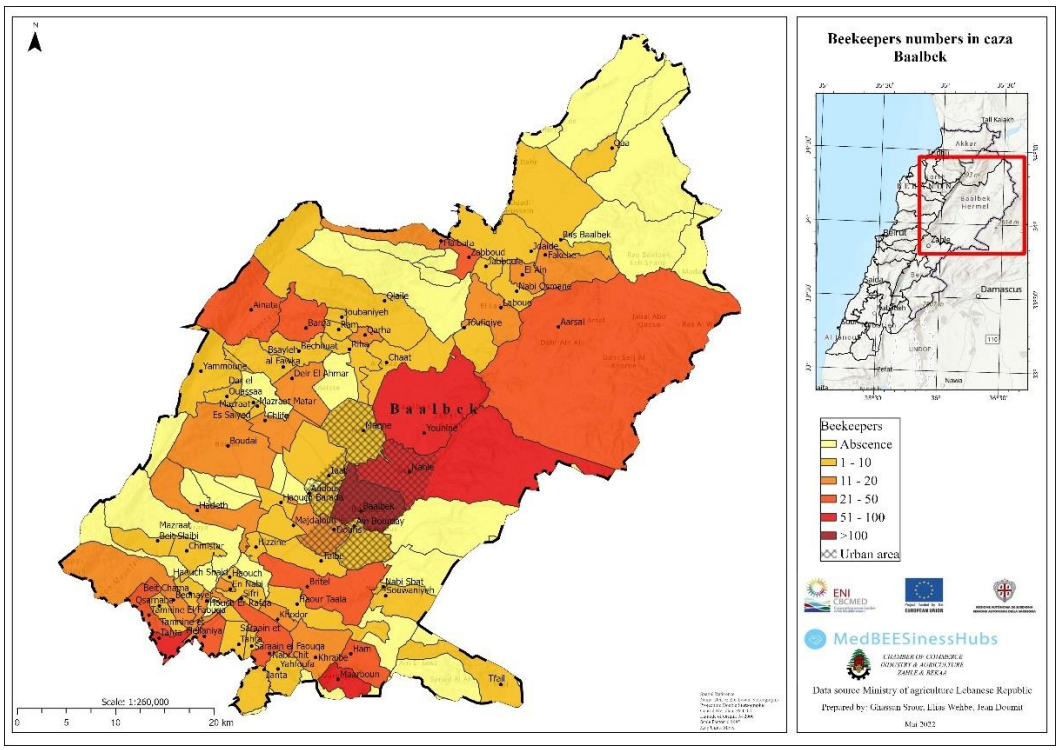
J: January; F: February; M: March; A: April; M: May; Jn: June; Jl: July; Au: August; S: September; O: October; N: November.

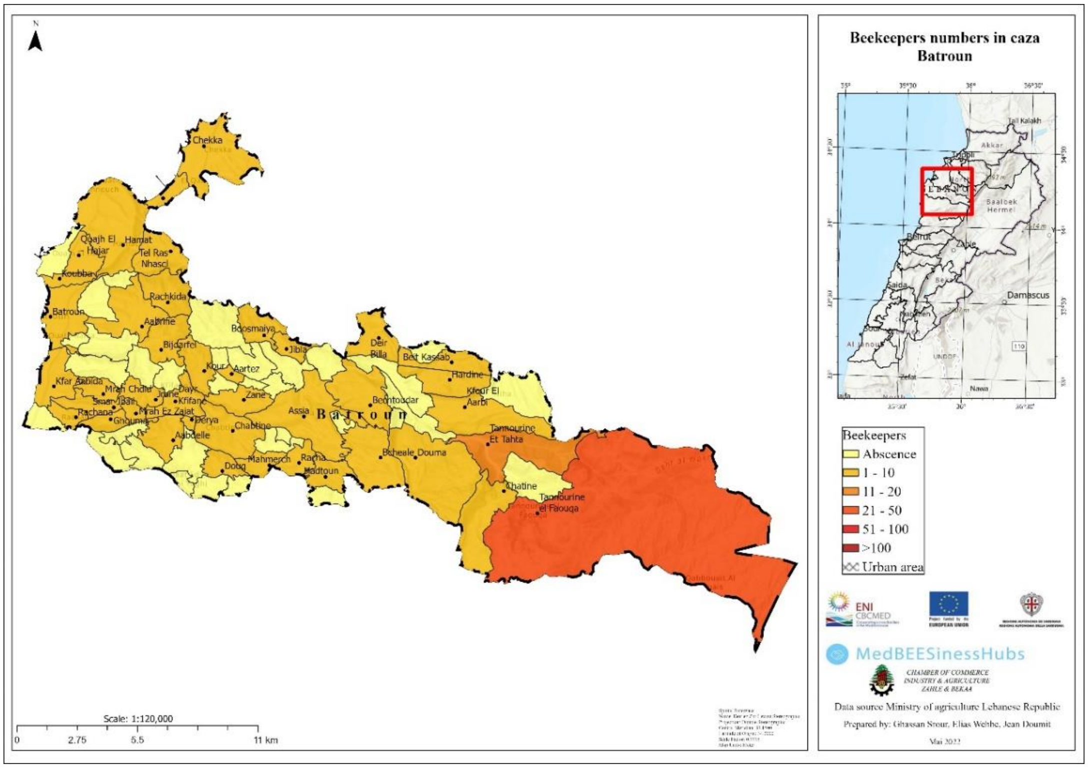
Annexe II- Map representing beekeepers' distribution in Lebanese' Caza

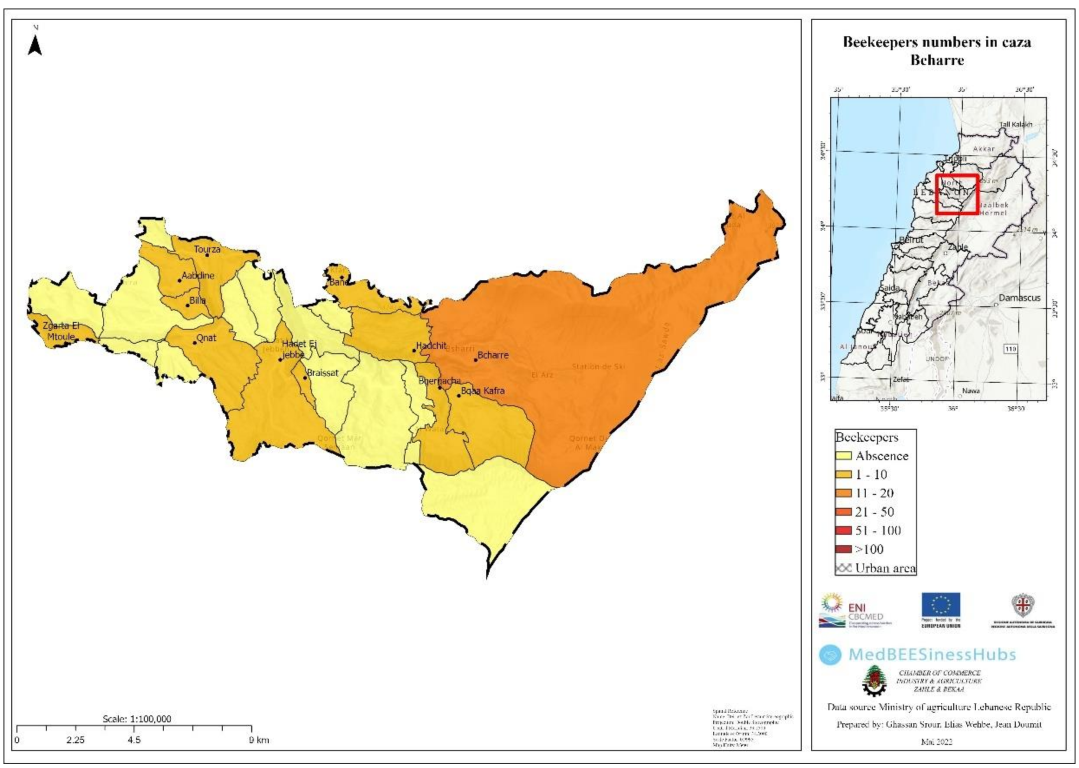


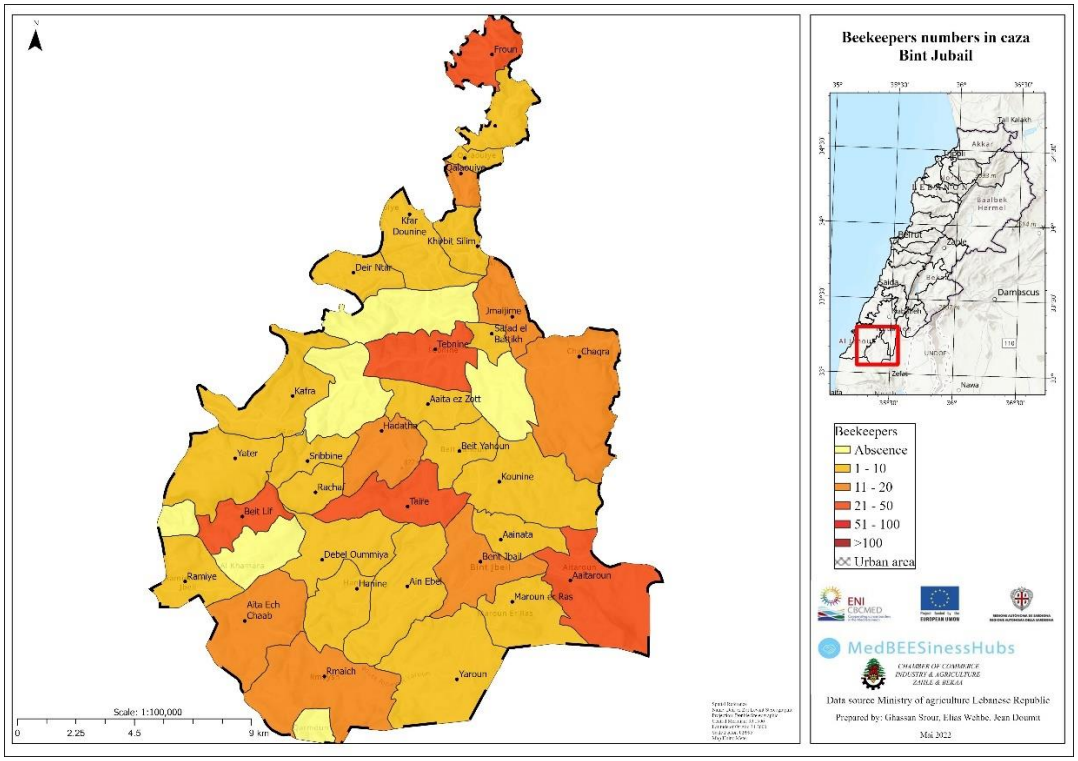


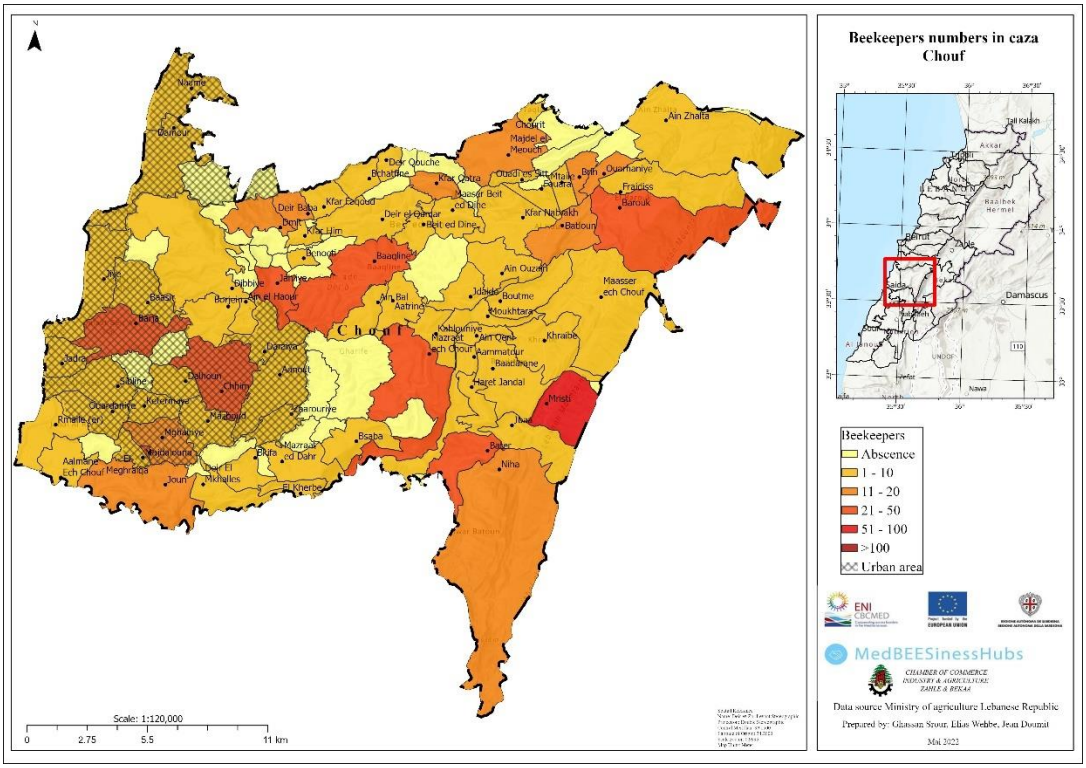

Beekeepers numbers in caza
Baabda
Baabda
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumet
Mai 2022

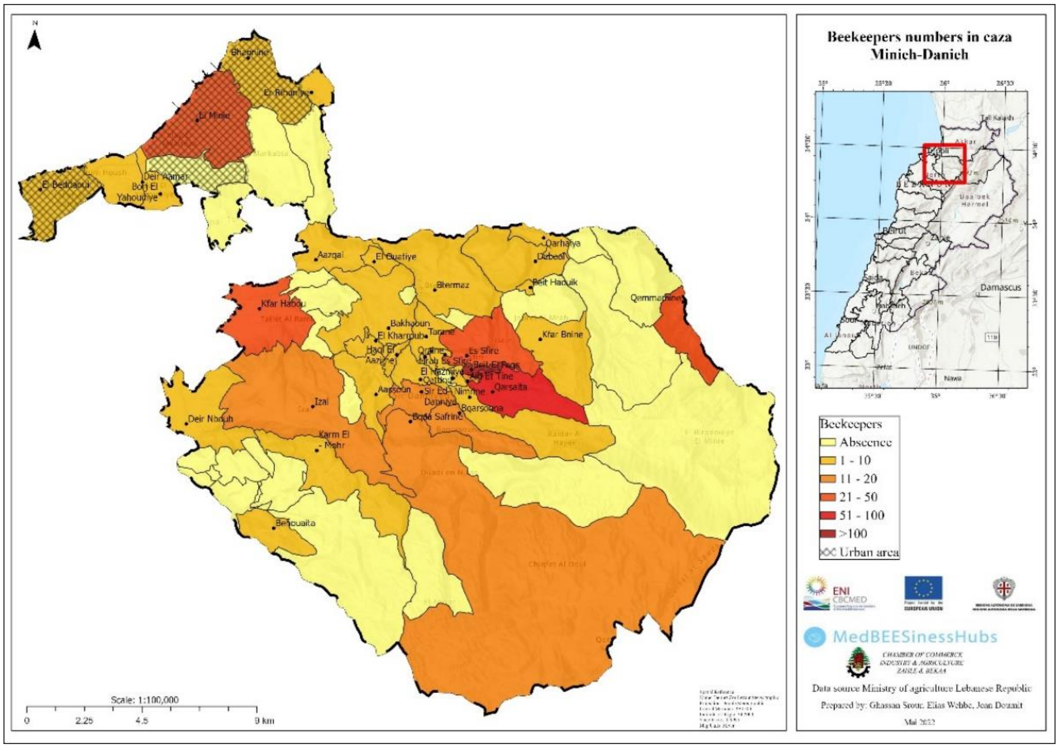

Beekeepers numbers in caza
Baalbek
Baalbek
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:260,000
0 5 10 20 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumet
Mai 2022

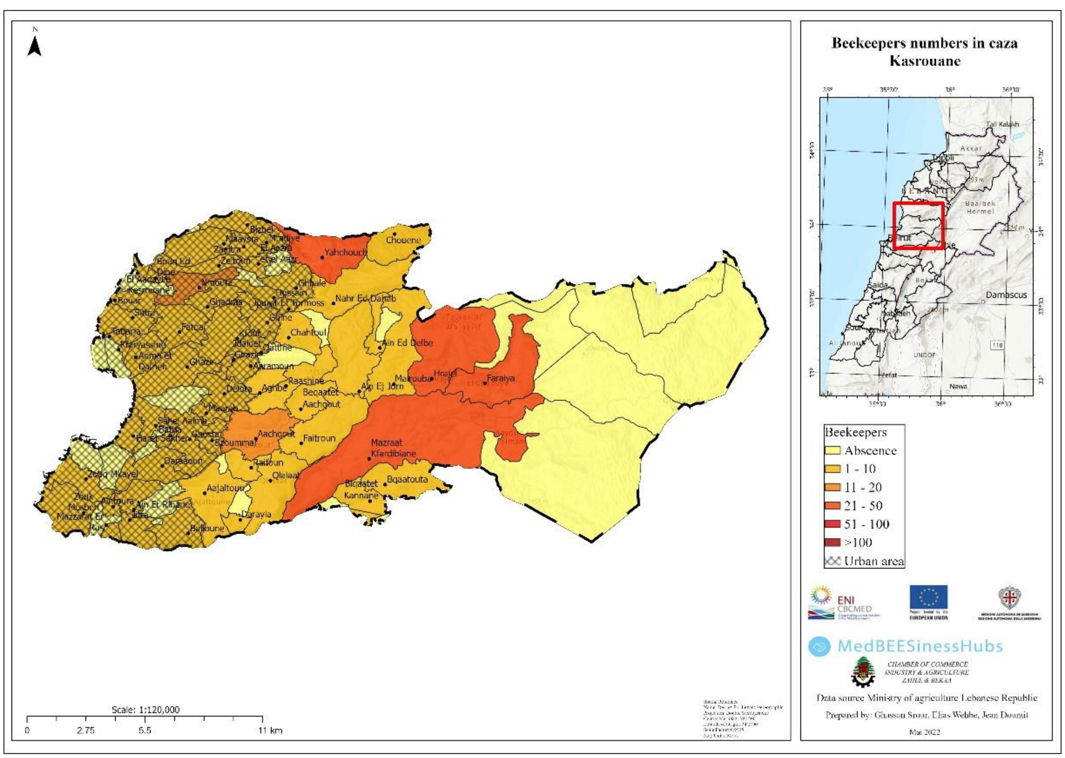

Beekeepers numbers in caza Batroun
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

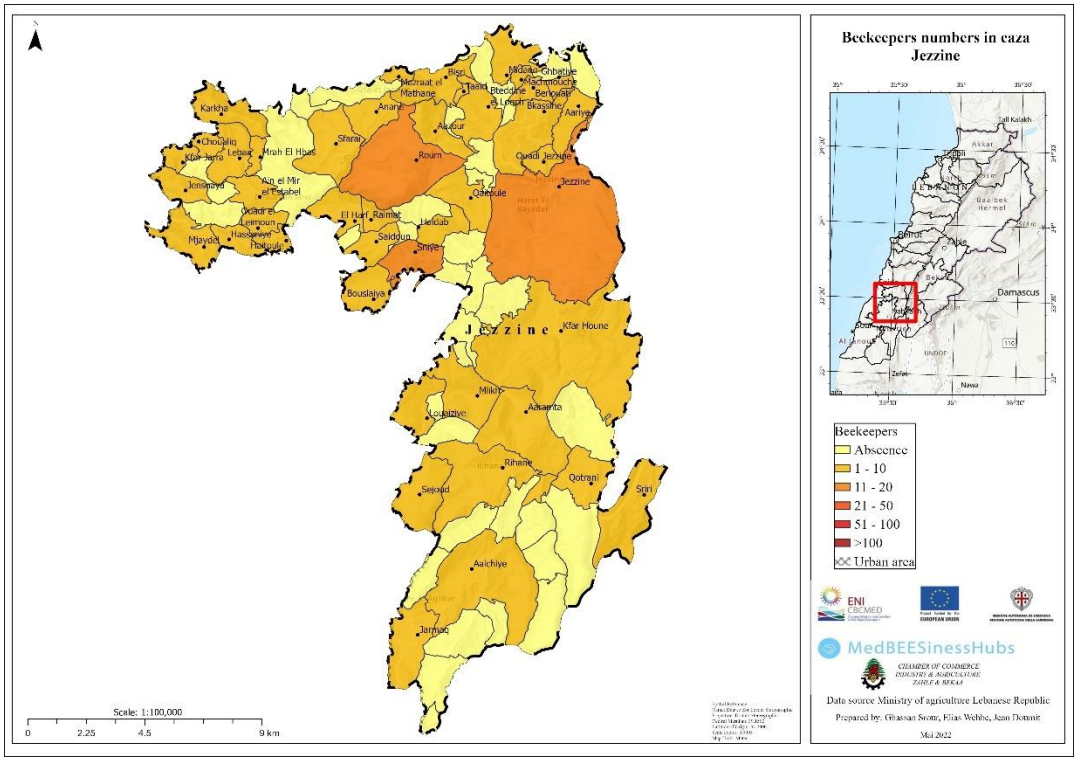

Beekeepers numbers in caza Bcharre
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:100,000
0 2.25 4.5 9 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

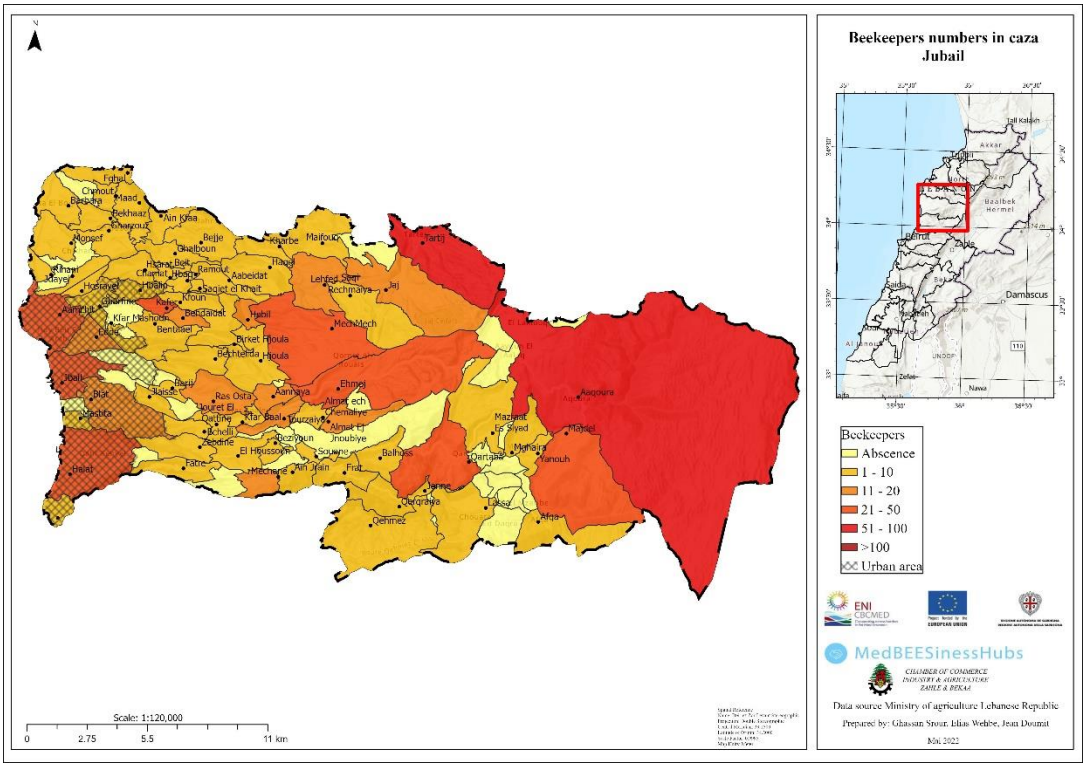

Beekeepers numbers in caza
Bint Jubail
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:100,000
0 2.25 4.5 9 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

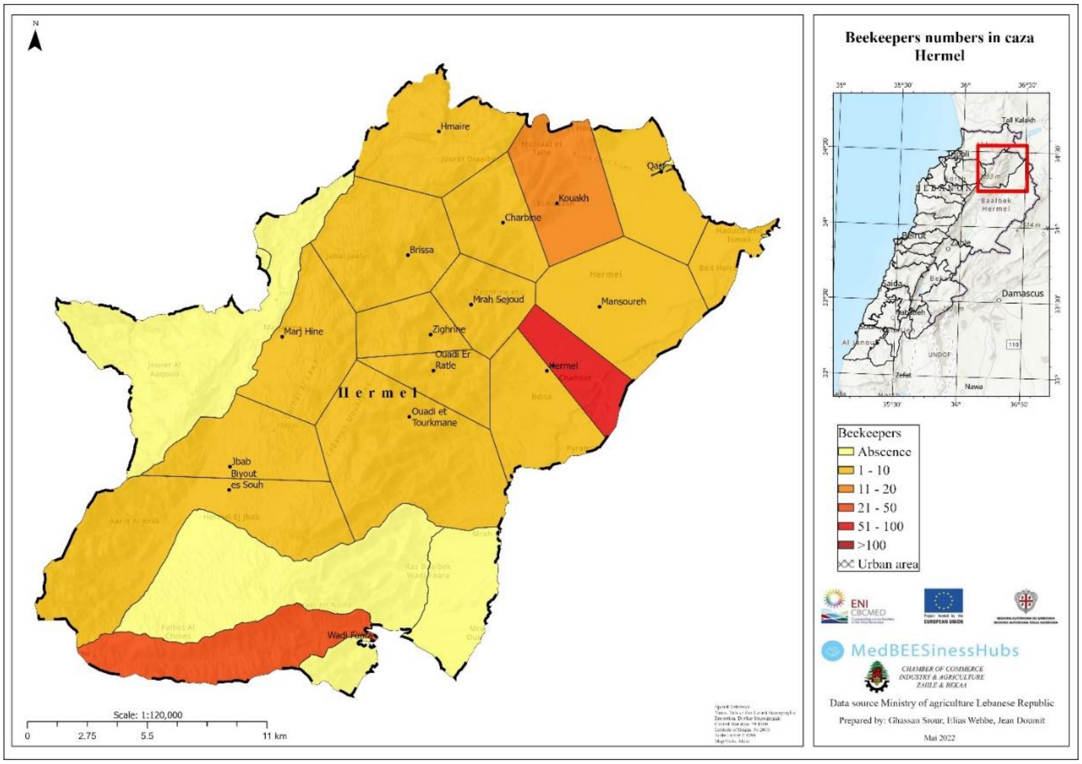

Beekeepers numbers in caza
Chouf
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

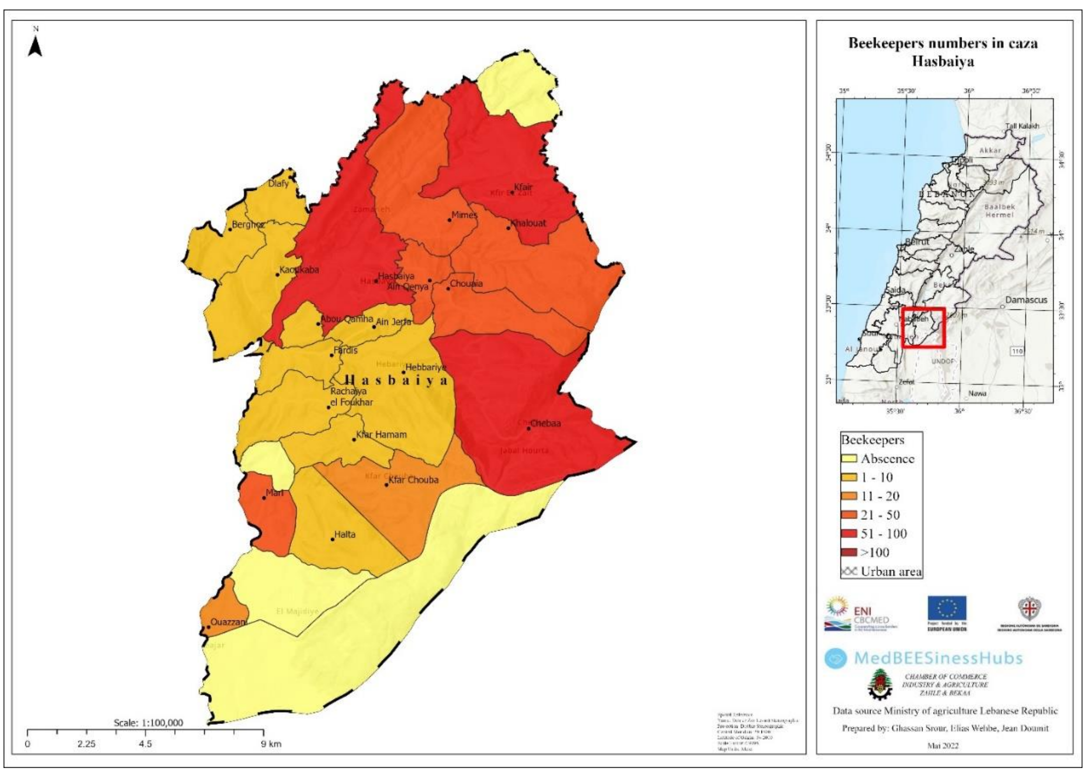

Beekeepers numbers in caza Minieh-Danieh
Beekeepers
Absecence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:100,000
0 2.25 4.5 9 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

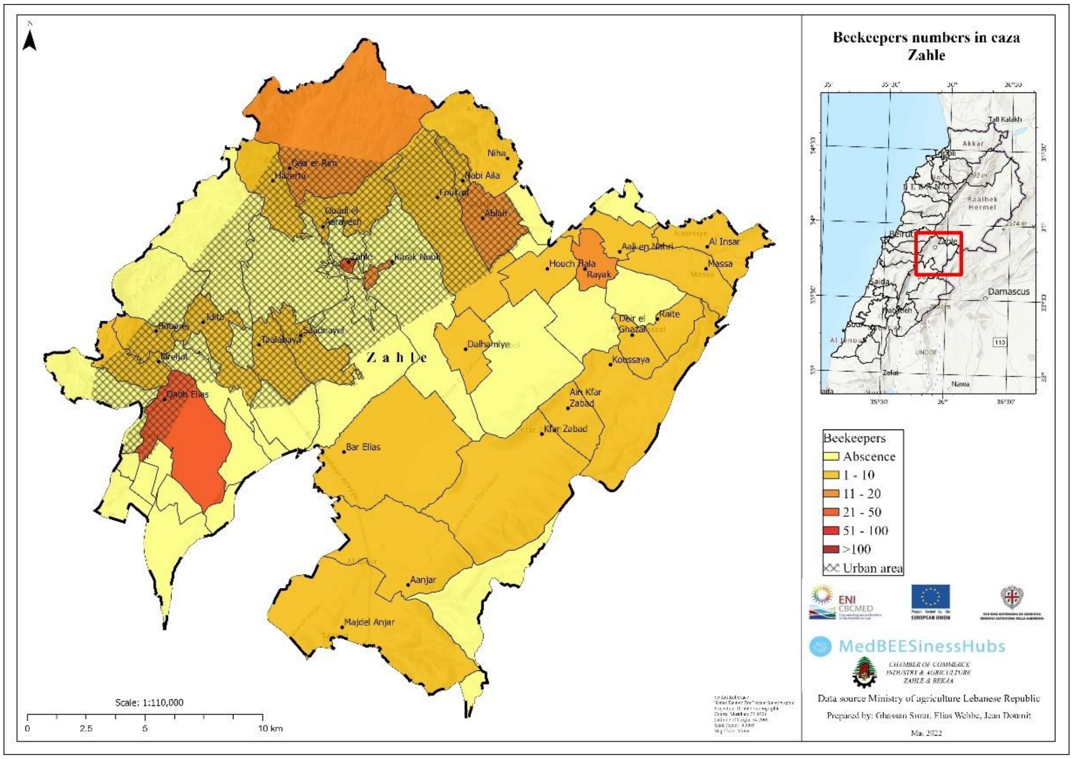

Beekeepers numbers in caza Kasrouane
Beekeepers
Absecence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

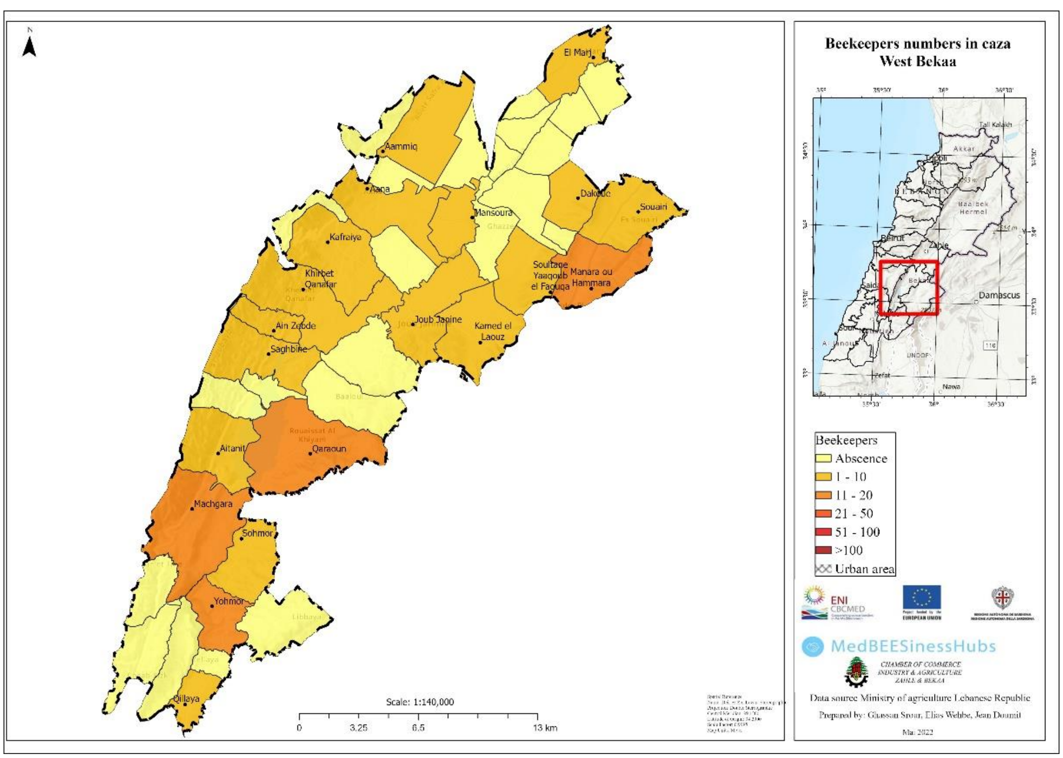

Jezzine
Kfar Houne
Beekeepers numbers in caza Jezzine
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:100,000
0 2.25 4.5 9 km
Damascus
Beirut
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

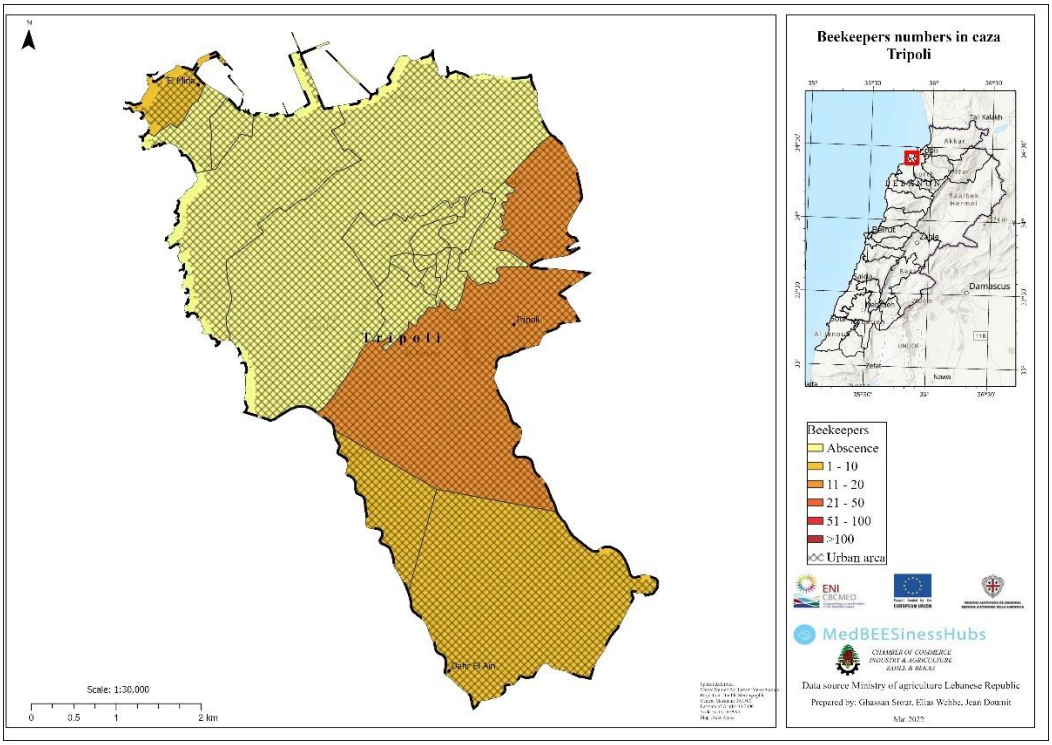

Beekeepers numbers in caza Jubail
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
Damascus
Beirut
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

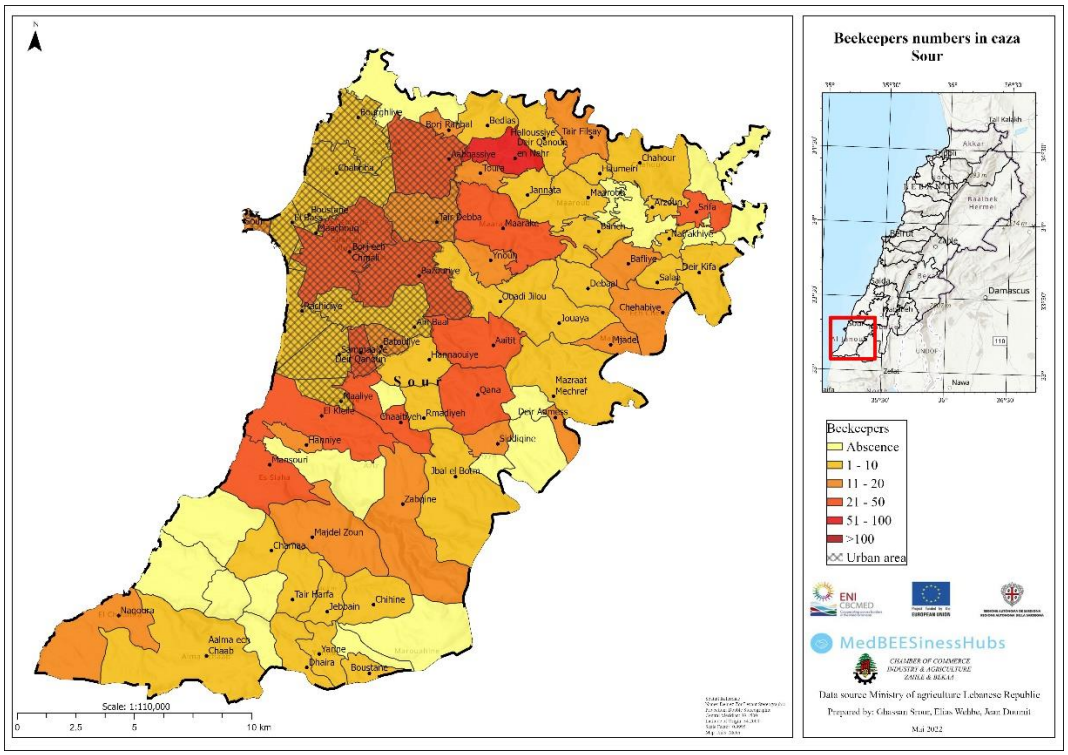

Beekeepers numbers in caza Hermel
Hmaire
Kouakh
Charbine
Brissa
Qasr
Hermel
Mansoureh
Mrah Sejoud
Zighrine
Marj Hine
Ouadi Er Ratle
Hermel
H e r m e l
Ouadi et Tourkmane
Jbab
Biyout es Souh
Wadi Fouara
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
MedBEESinessHubs
CHAMBER OF COMMERCE INDUSTRY & AGRICULTURE ZAHLE & BEKAA
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:120,000
0
2.75
5.5
11 km

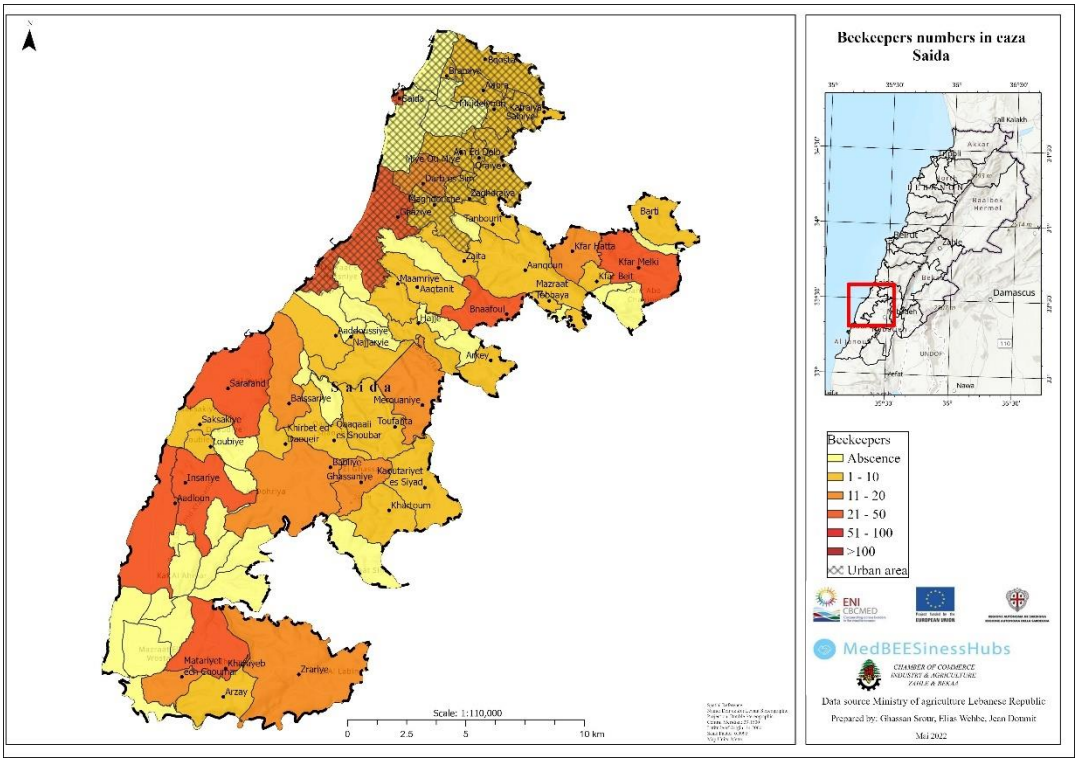

Beekeepers numbers in caza Hasbaiya
Dlafy
Berghoz
Kaoukaba
Kfair
Mimes
Khalouat
Hasbaiya
Ain Qenya
Chouaia
Abou Qamha
Ain Jerfa
Fardis
Hebbariye
H a s b a i y a
Rachaiya el Foukhar
Kfar Hamam
Chebaa
Mari
Kfar Chouba
Halta
Ouazzani
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
MedBEESinessHubs
CHAMBER OF COMMERCE INDUSTRY & AGRICULTURE ZAHLE & BEKAA
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:100,000
0
2.25
4.5
9 km

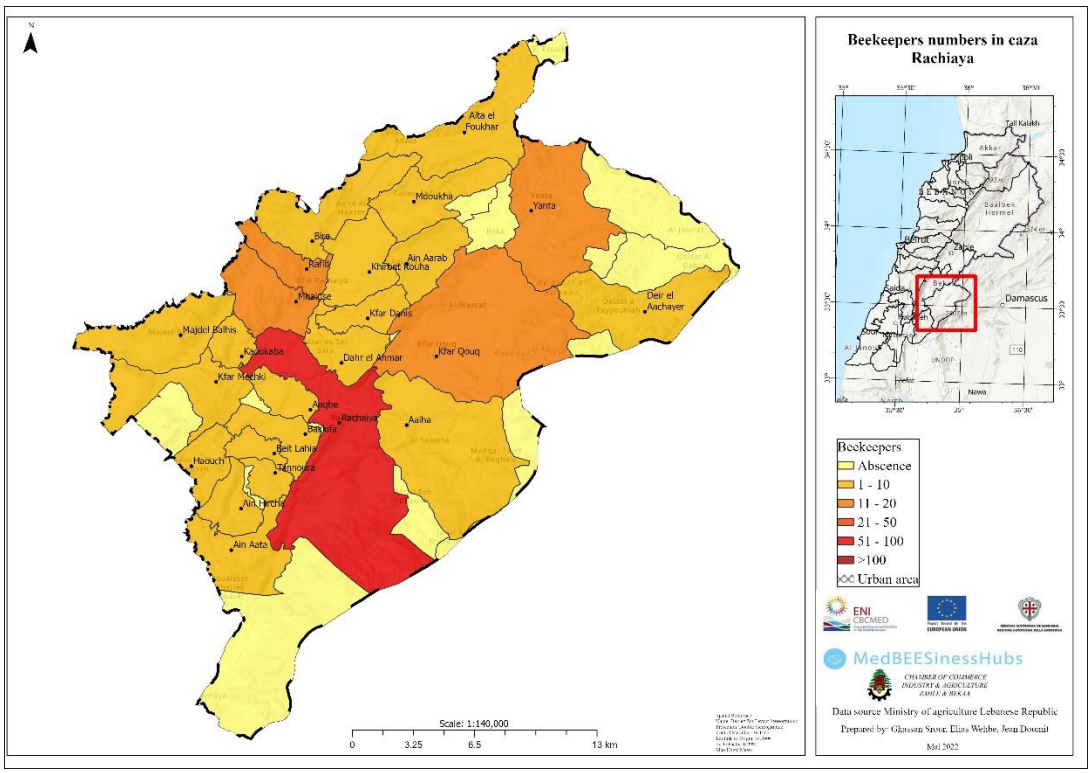

Beekeepers numbers in caza Zahle
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Z a h l e
Qaa er Rim
Hazerta
Nabi Aila
Niha
Ablah
Al Insar
Massa
Houch Hala
Rayak
Karak Nouh
Dalhamiye
Deir el Ghazal
Raite
Koussaya
Ain Kfar Zabad
Kfar Zabad
Bar Elias
Aanjar
Majdel Anjar
Taalabaya
Saadnayel
Chtaura
Qabb Elias
Scale: 1:110,000
0 2.5 5 10 km
MedBEESinessHubs
CHAMBER OF COMMERCE INDUSTRY & AGRICULTURE ZAHLE & BEKAA
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

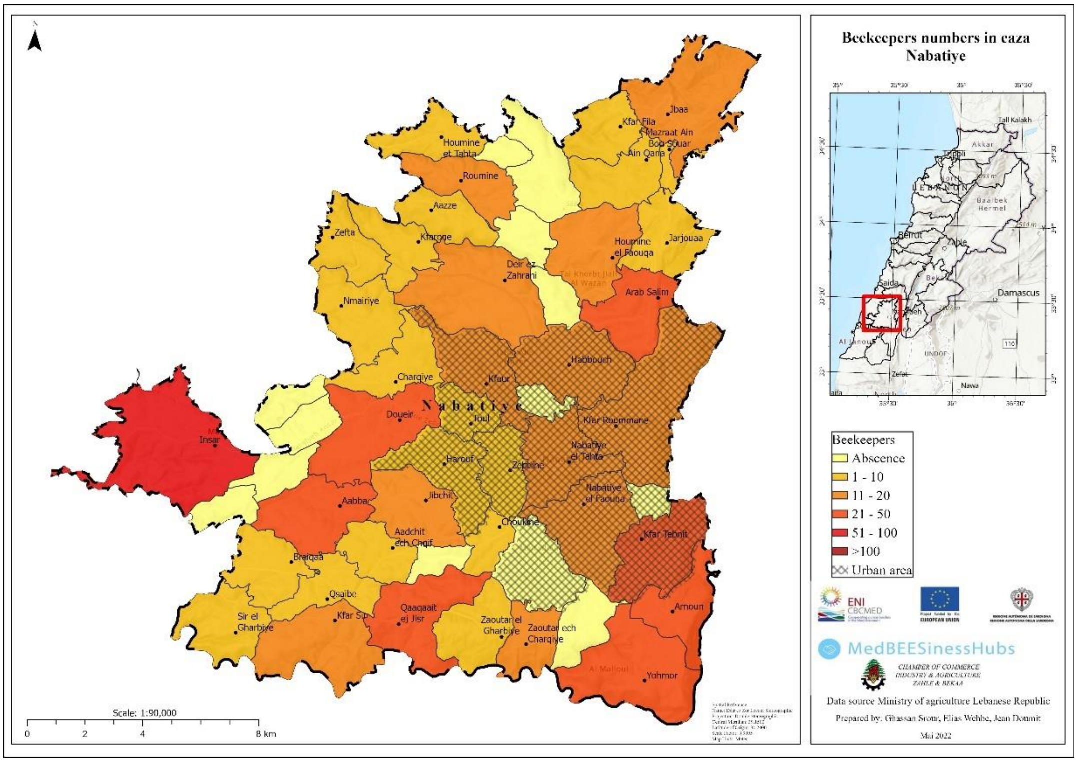

Beekeepers numbers in caza West Bekaa
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
El Marj
Aammiq
Aana
Mansoura
Dakoue
Souairi
Kafraiya
Khirbet Qanafar
Soultane Yaaqoub el Faouqa
Manara ou Hammara
Ain Zebde
Saghbine
Joub Jannine
Kamed el Laouz
Aitanit
Qaraoun
Machgara
Sohmor
Yohmor
Qiliya
Scale: 1:140,000
0 3.25 6.5 13 km
MedBEESinessHubs
CHAMBER OF COMMERCE INDUSTRY & AGRICULTURE ZAHLE & BEKAA
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

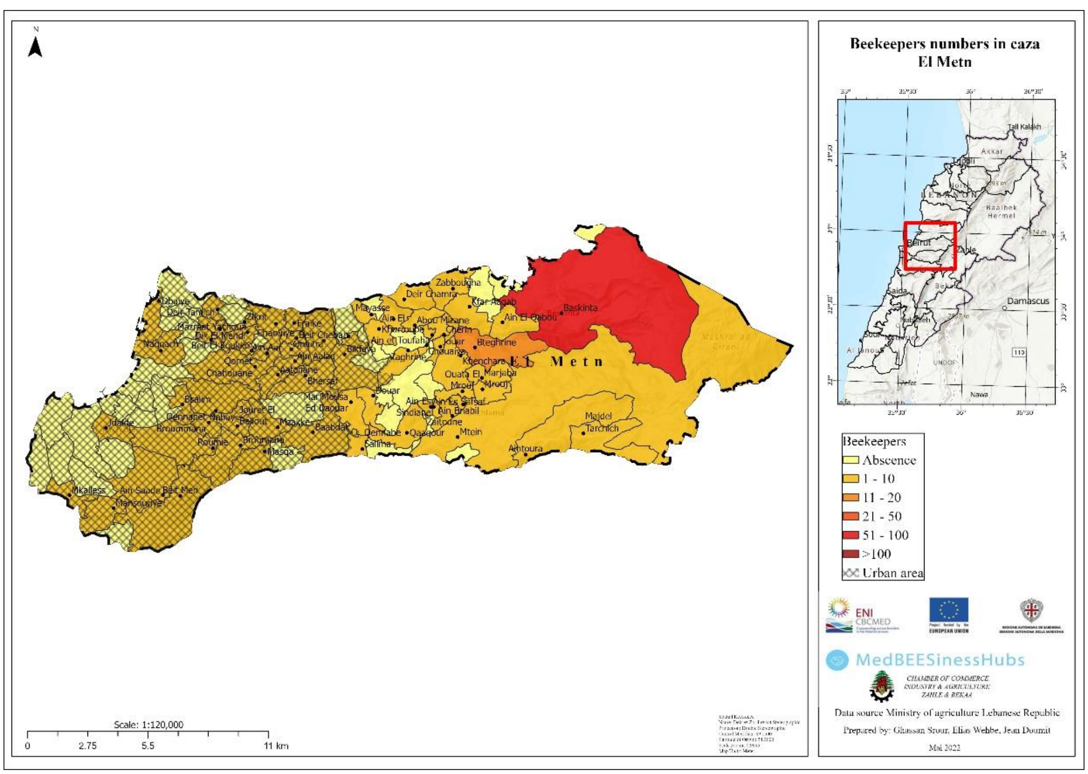

Tripoli
El Mina
Dahr El Ain
Scale: 1:30,000
0 0.5 1 2 km
Beekeepers numbers in caza Tripoli
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Damascus
Beirut
Nawa
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

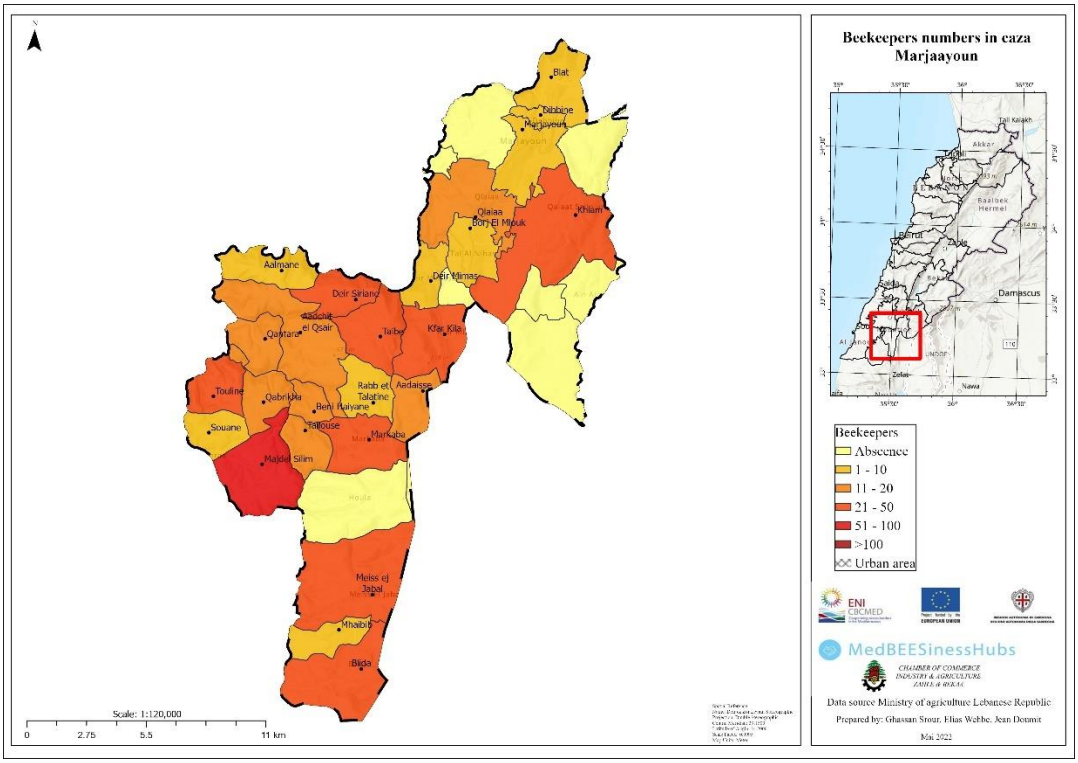

Sour
Scale: 1:110,000
0 2.5 5 10 km
Beekeepers numbers in caza Sour
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Damascus
Beirut
Nawa
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

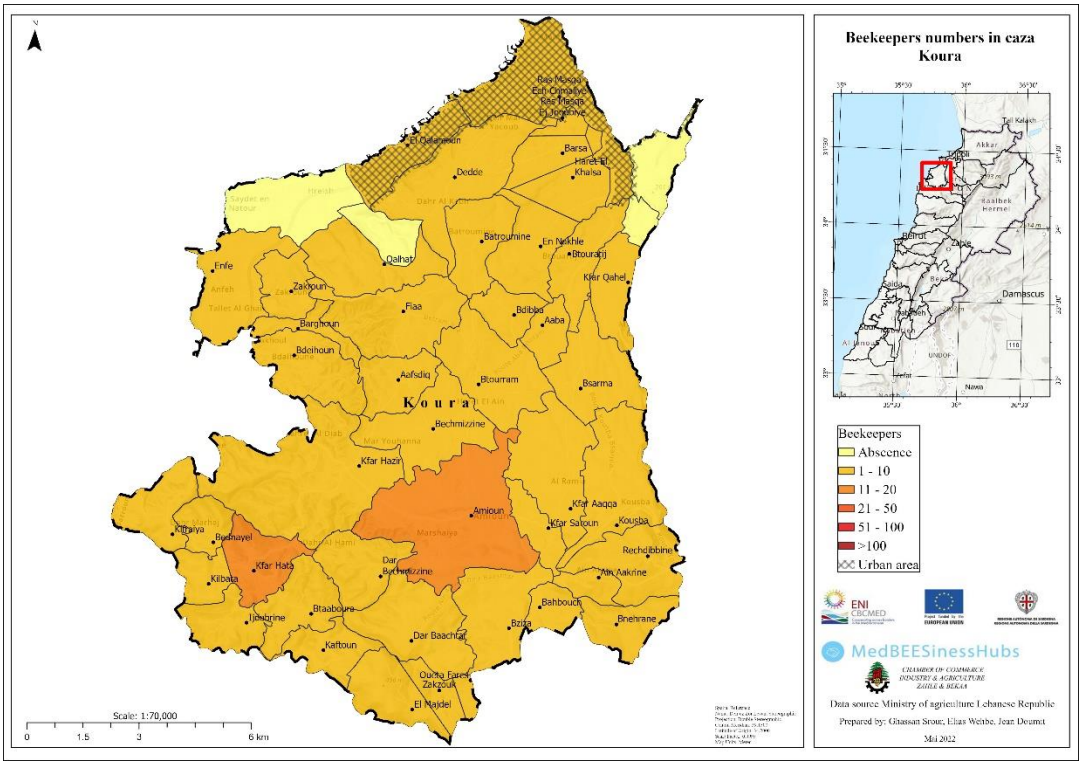

Beekeepers numbers in caza
Saida
Saida
Damascus
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:110,000
0 2.5 5 10 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

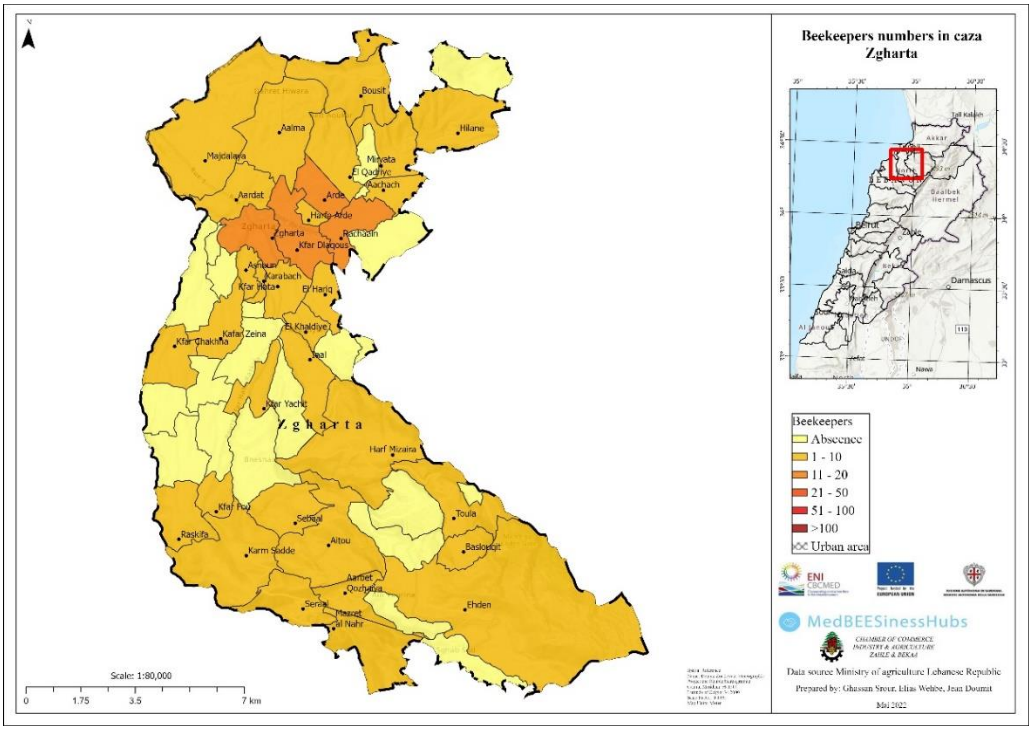

Beekeepers numbers in caza
Rachiaya
Damascus
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:140,000
0 3.25 6.5 13 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022


Beekeepers numbers in caza Nabatiye
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:90,000
0 2 4 8 km

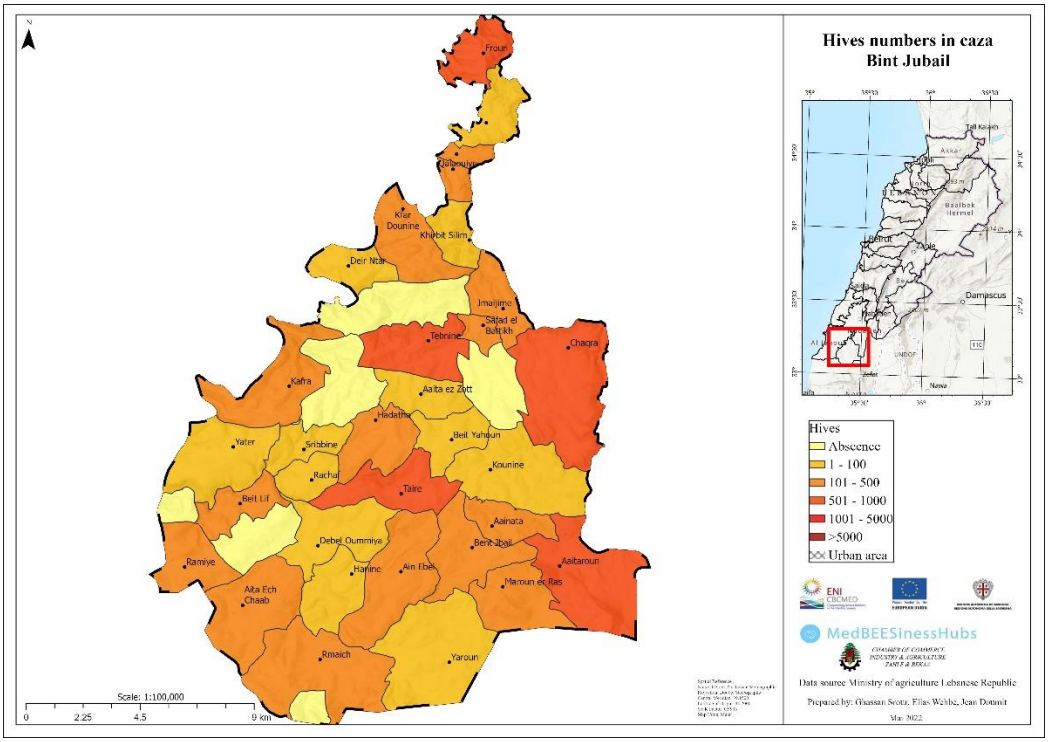

Beekeepers numbers in caza El Metn
Beekeepers
Abscence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:120,000
0 2.75 5.5 11 km

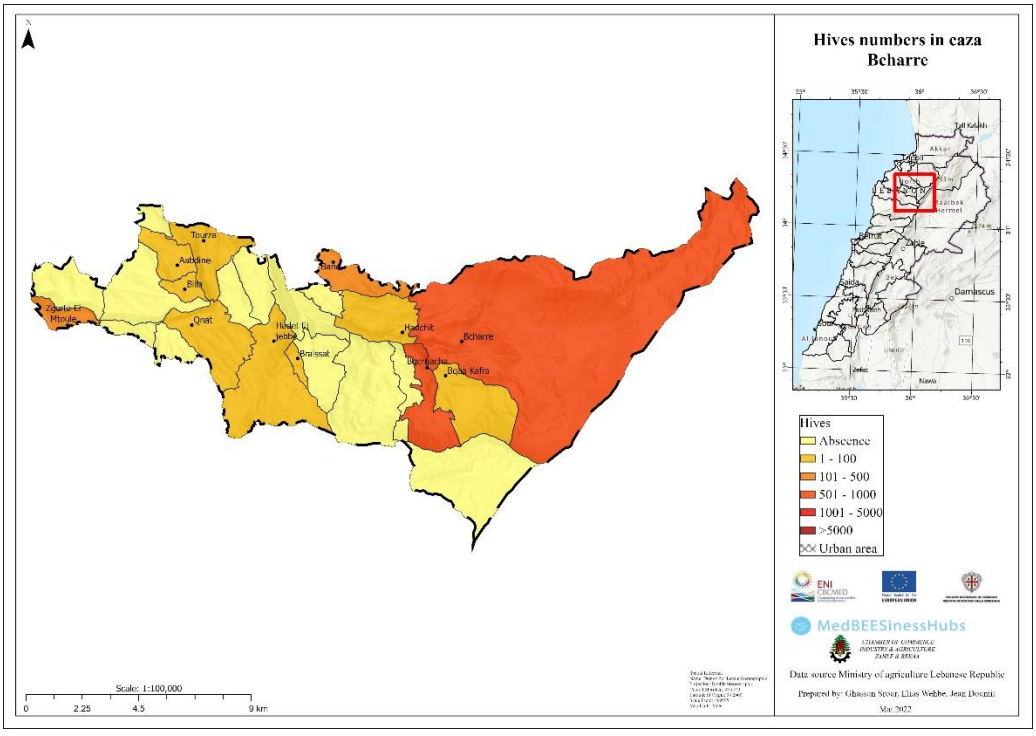

Beekeepers numbers in caza
Marjaayoun
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:120,000
0
2.75
5.5
11 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

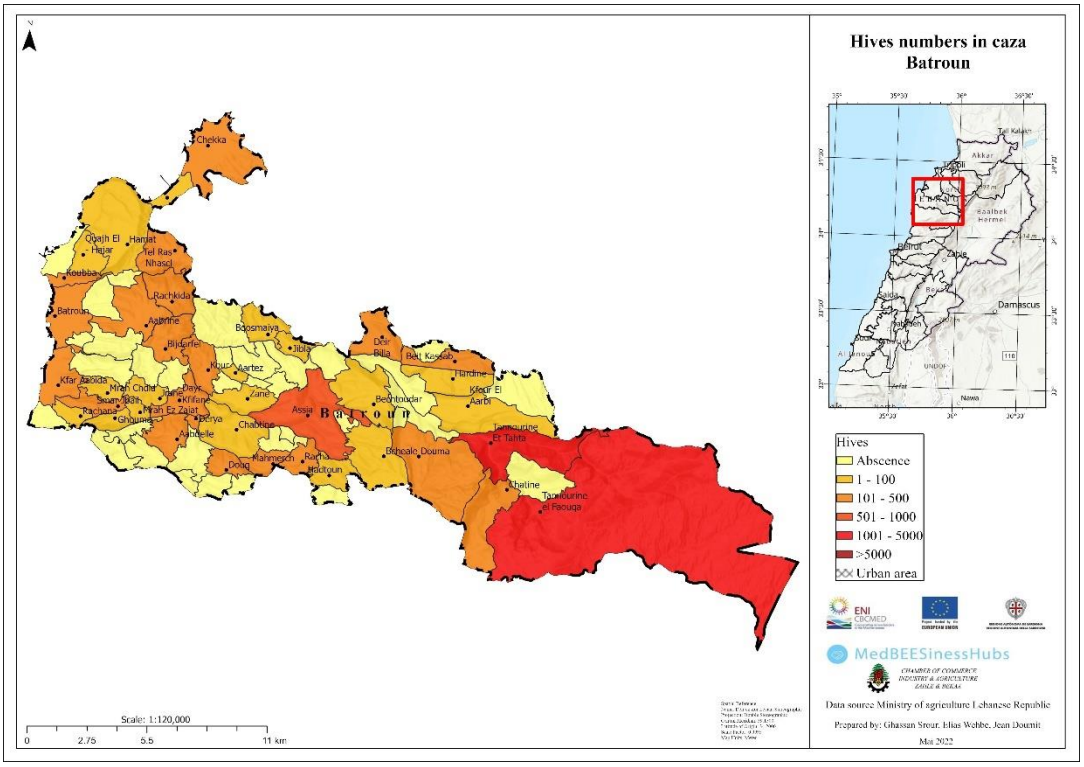

Beekeepers numbers in caza
Koura
Beekeepers
Absence
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
Scale: 1:70,000
0
1.5
3
6 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

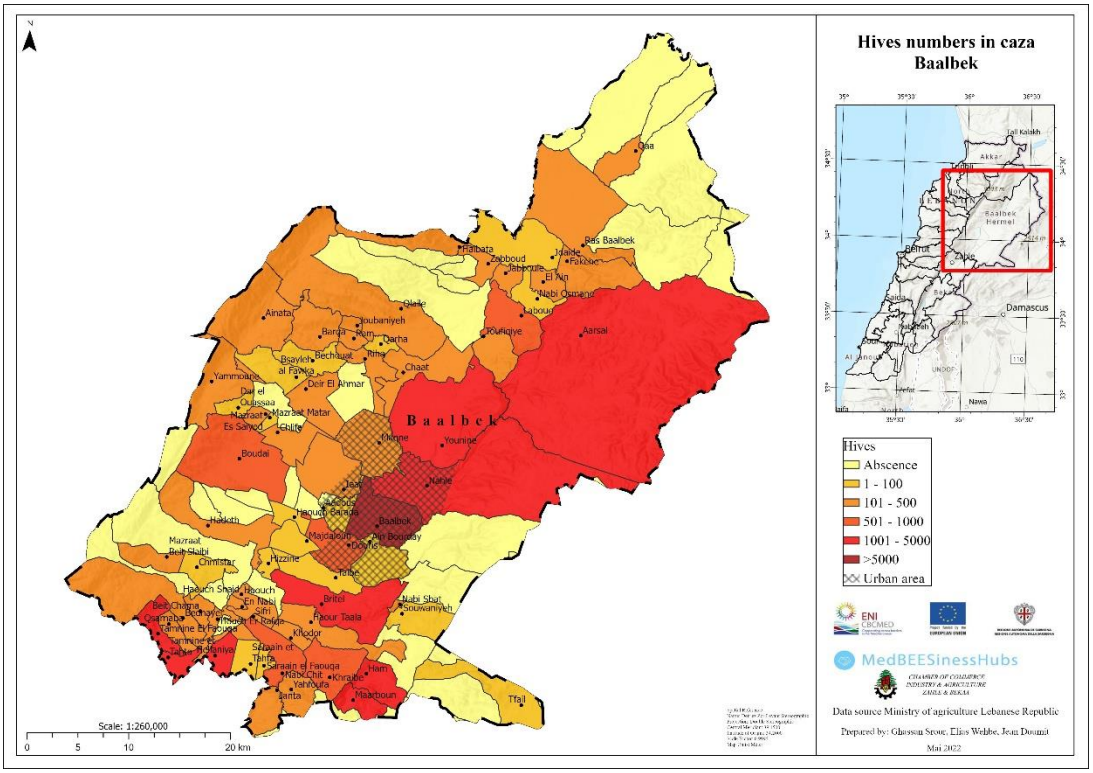

Beekeepers numbers in caza Zgharta
Bousit
Hilane
Aalma
Majdalaya
Miryata
El Qadriye
Aachach
Aardat
Arde
Harf Arde
Zgharta
Rachaiin
Kfar Dlaqous
Ayhour
Karabach
Kfar Hata
El Harig
El Khaldiye
Kfar Chakhna
Kafar Zeina
Ijdal
Mar Yacha
Zgharta
Harf Mizaira
Kfar Fou
Toula
Raskifa
Sebaal
Aitou
Basloukit
Karm Sadde
Aarbet Qozhaya
Ehden
Serhel
Mazraat al Nahr
Scale: 1:80,000
0 1.75 3.5 7 km
Tall Kalakh
Akkar
Baalbek Hermel
Beirut
Zahle
Saida
Damascus
Nawa
Beekeepers
Absecnce
1 - 10
11 - 20
21 - 50
51 - 100
>100
Urban area
MedBEESinessHubs
CHAMBER OF COMMERCE INDUSTRY & AGRICULTURE ZAHLE & BEKAA
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

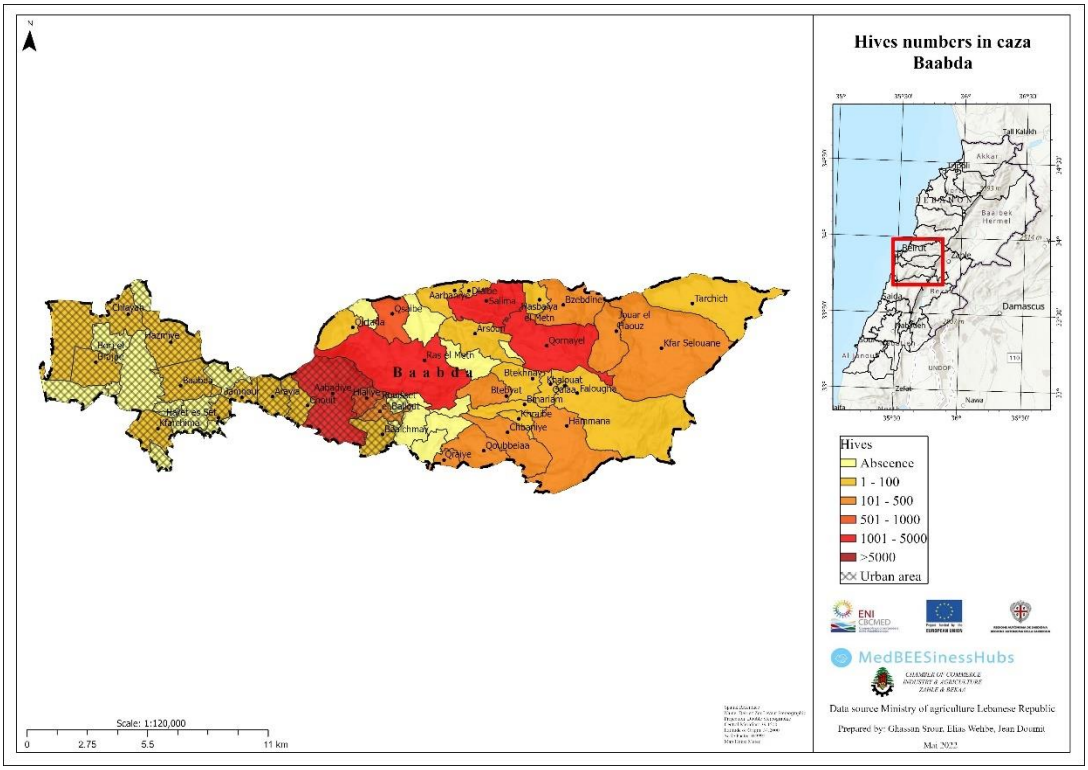
Annexe III-Map representing beehives' distribution in Lebanese' Caza

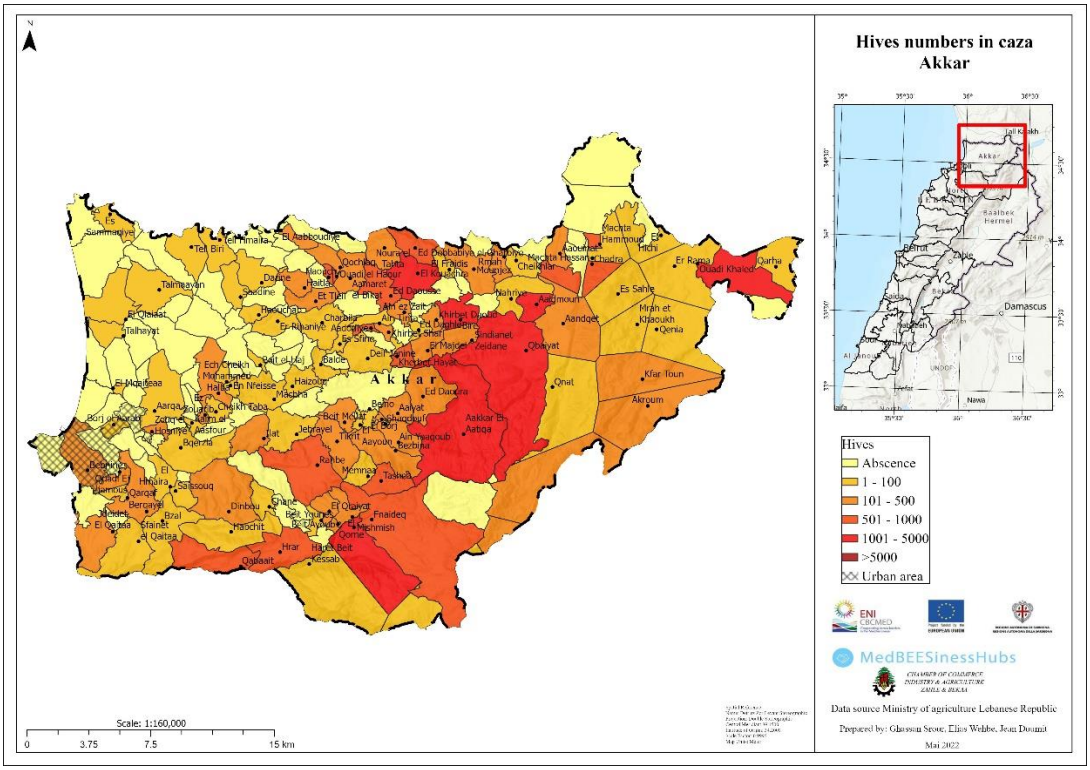


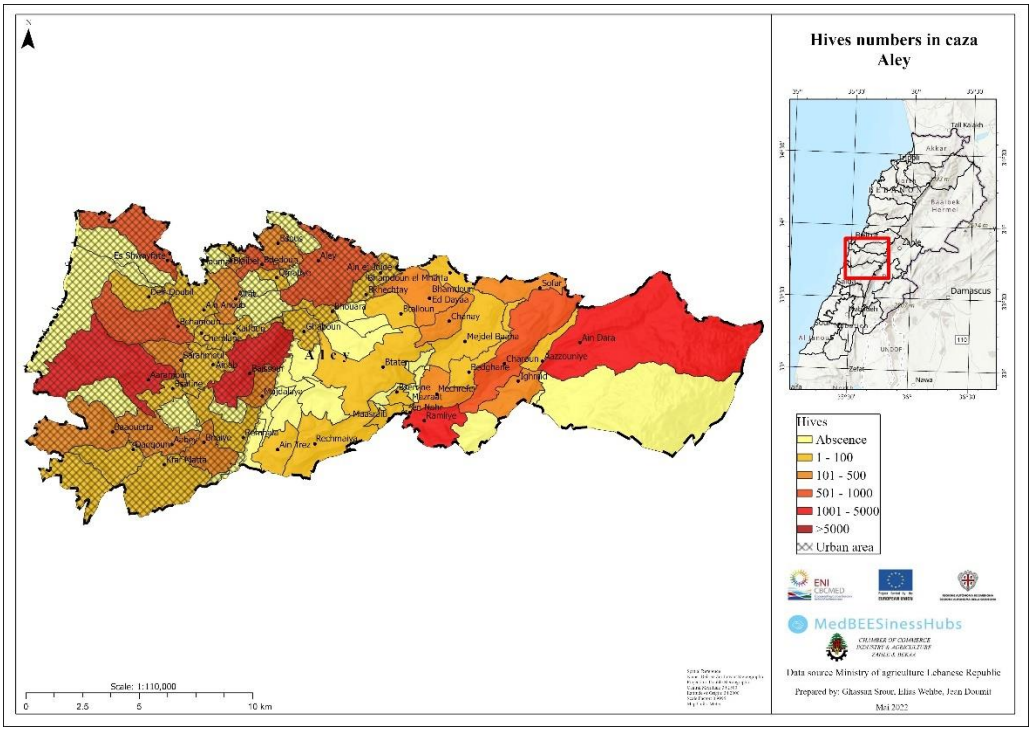


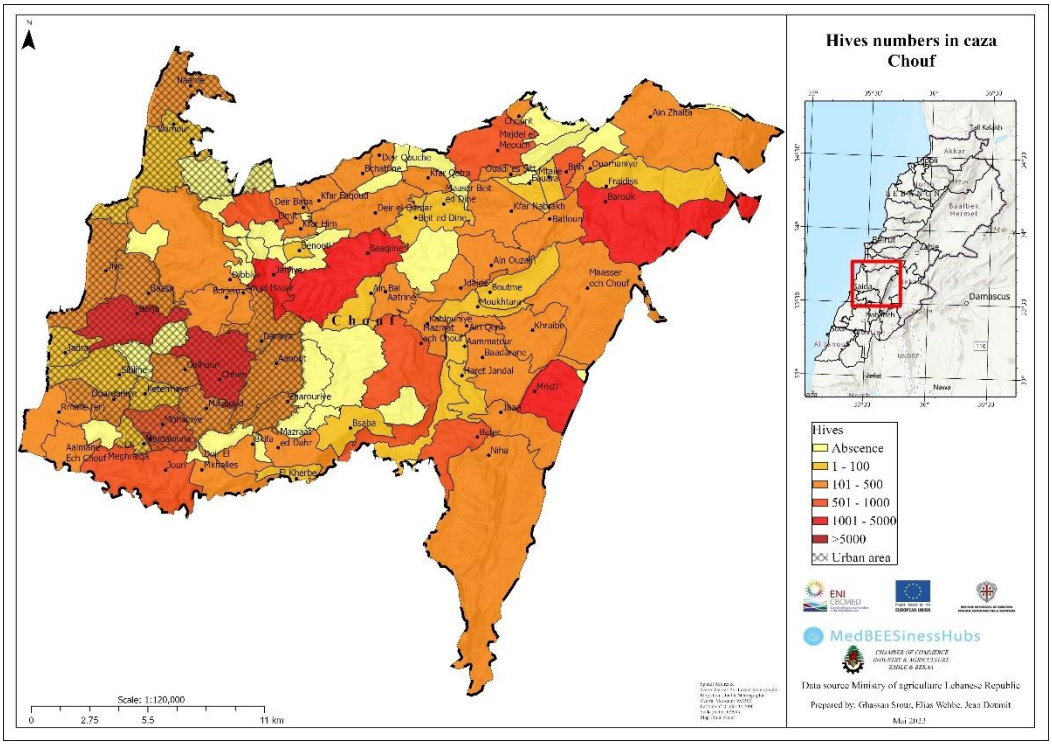

Hives numbers in caza
Batroun
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

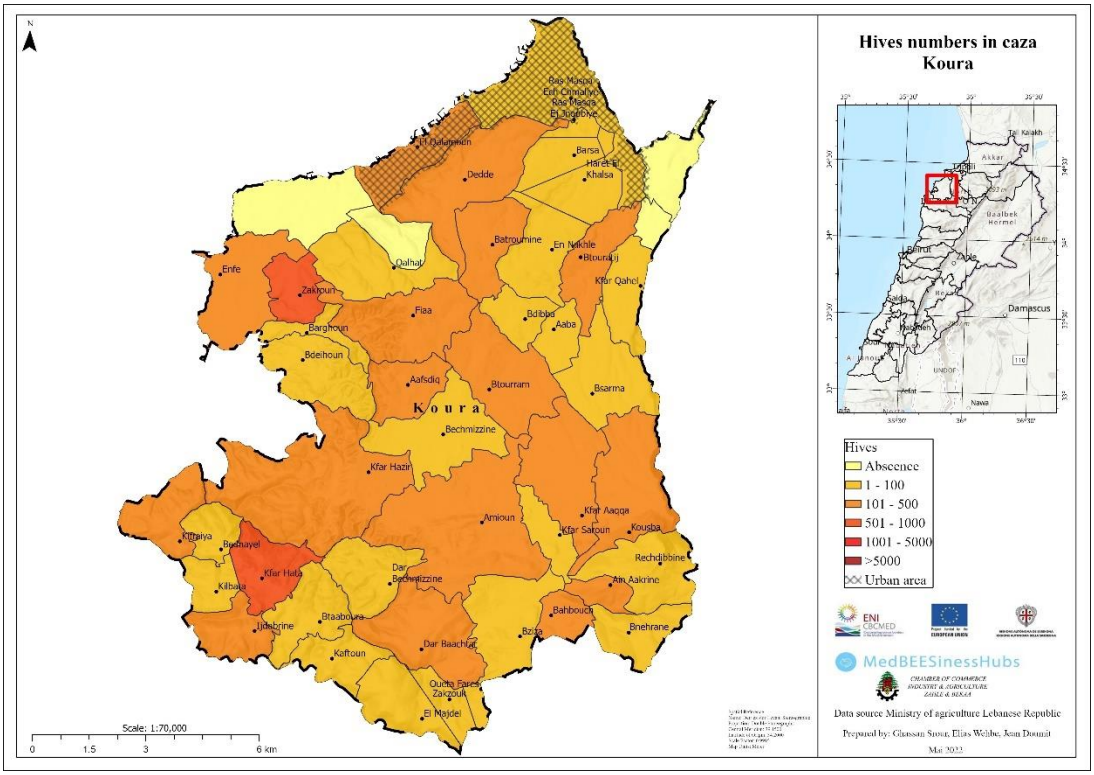

Hives numbers in caza
Baalbek
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:260,000
0 5 10 20 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

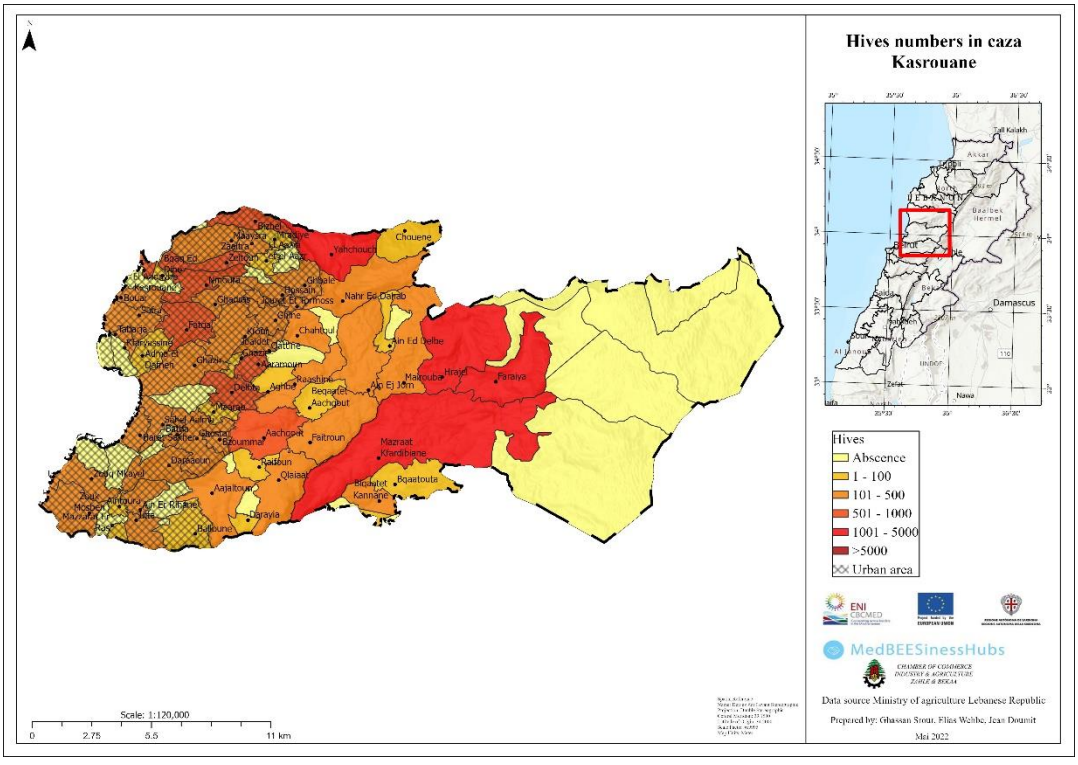

Hives numbers in caza
Baabda
Baabda
Hives
Absence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

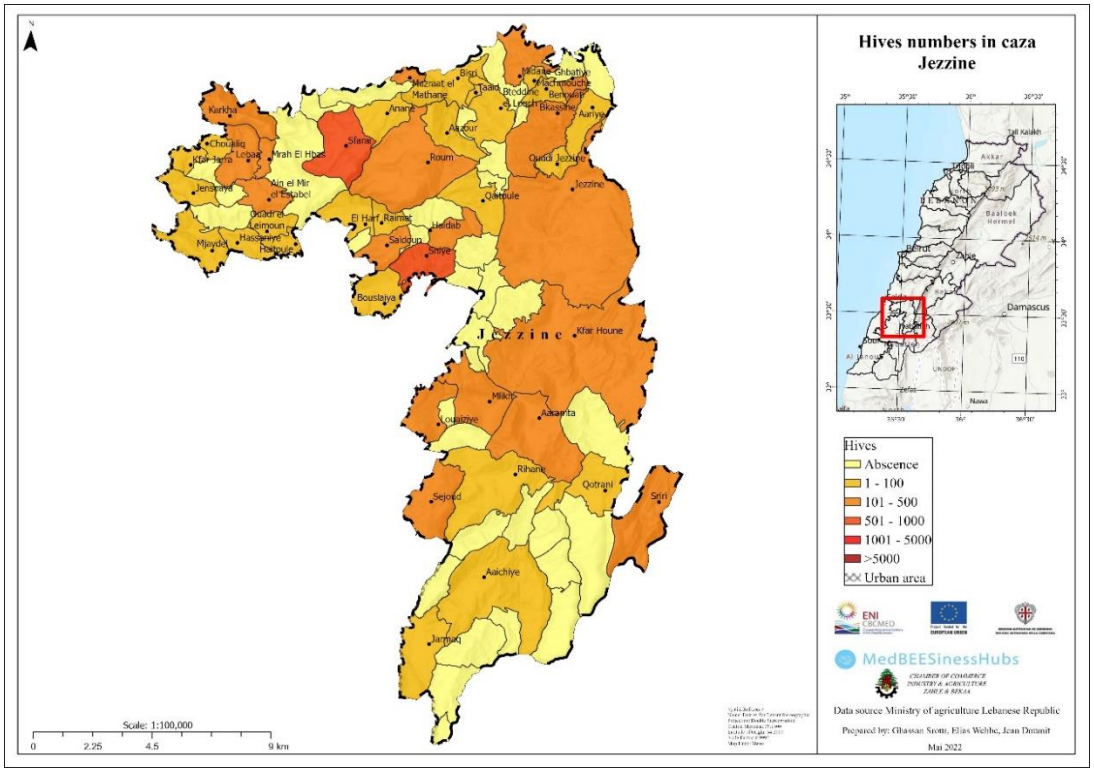

Hives numbers in caza
Akkar
Akkar
Hives
Absence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:160,000
0 3.75 7.5 15 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

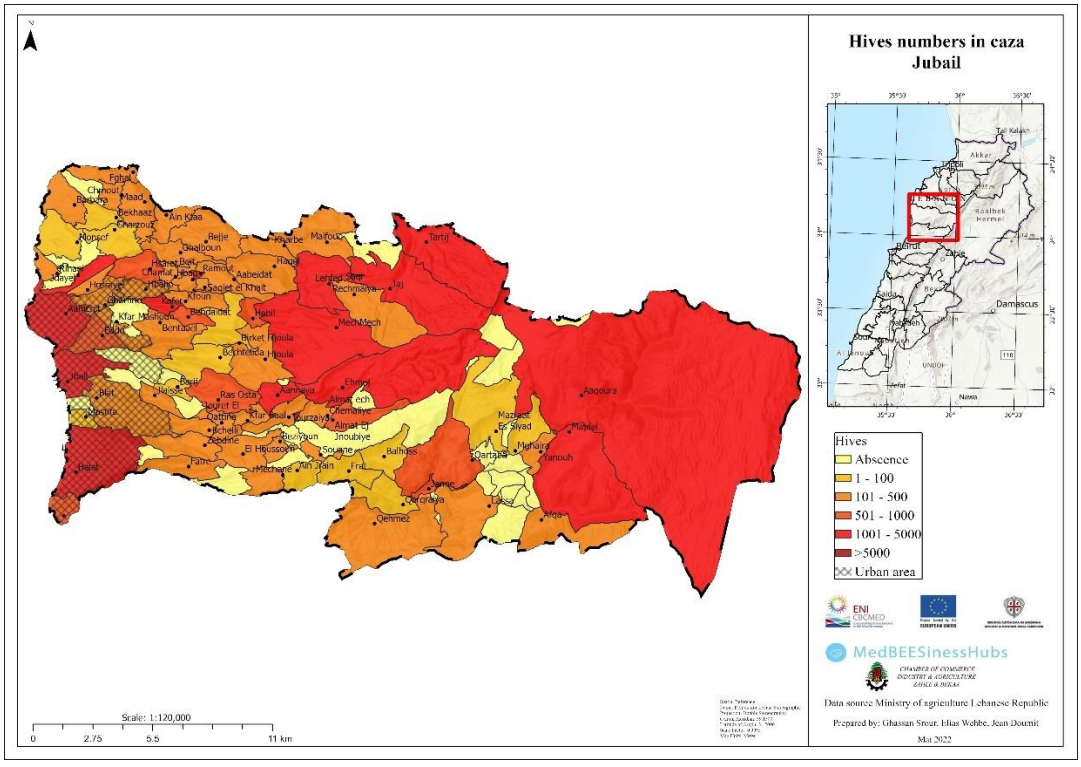

Hives numbers in caza
Aley
Aley
Damascus
Beirut
Hives
Absence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Donnit
Mai 2022
Scale: 1:110,000
0 2.5 5 10 km

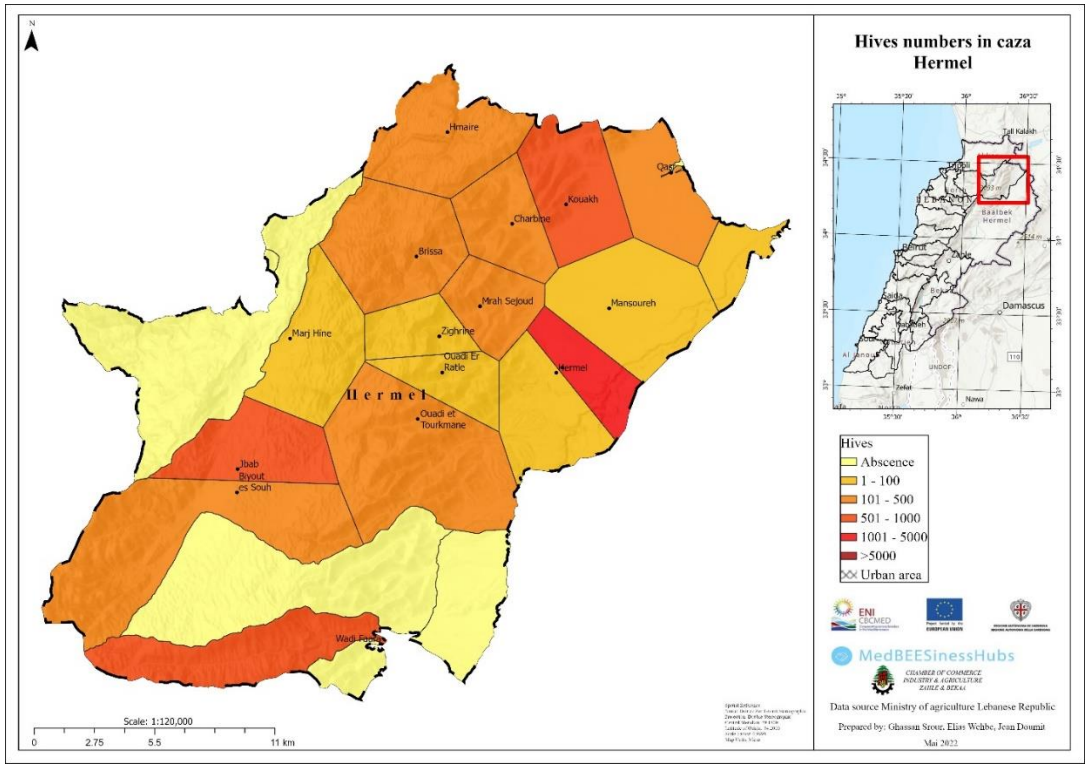

Hives numbers in caza
Chouf
Chouf
Damascus
Beirut
Hives
Absence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Donnit
Mai 2022
Scale: 1:120,000
0 2.75 5.5 11 km

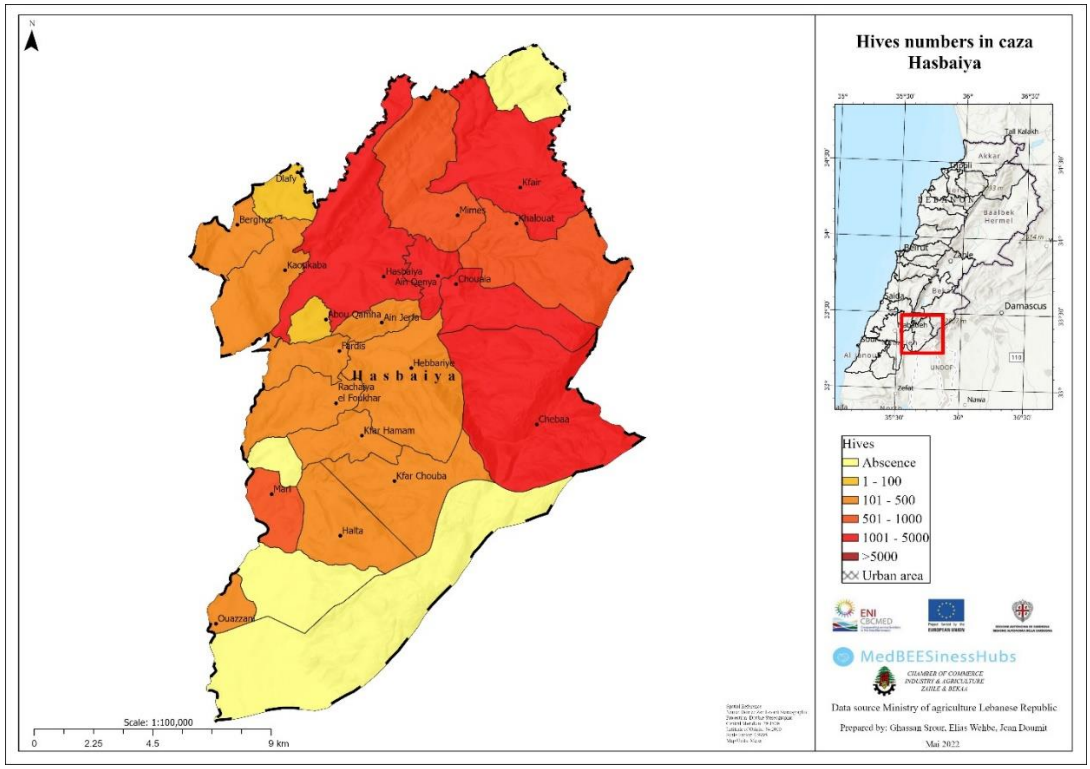

Hives numbers in caza
Koura
Koura
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:70,000
0 1.5 3 6 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

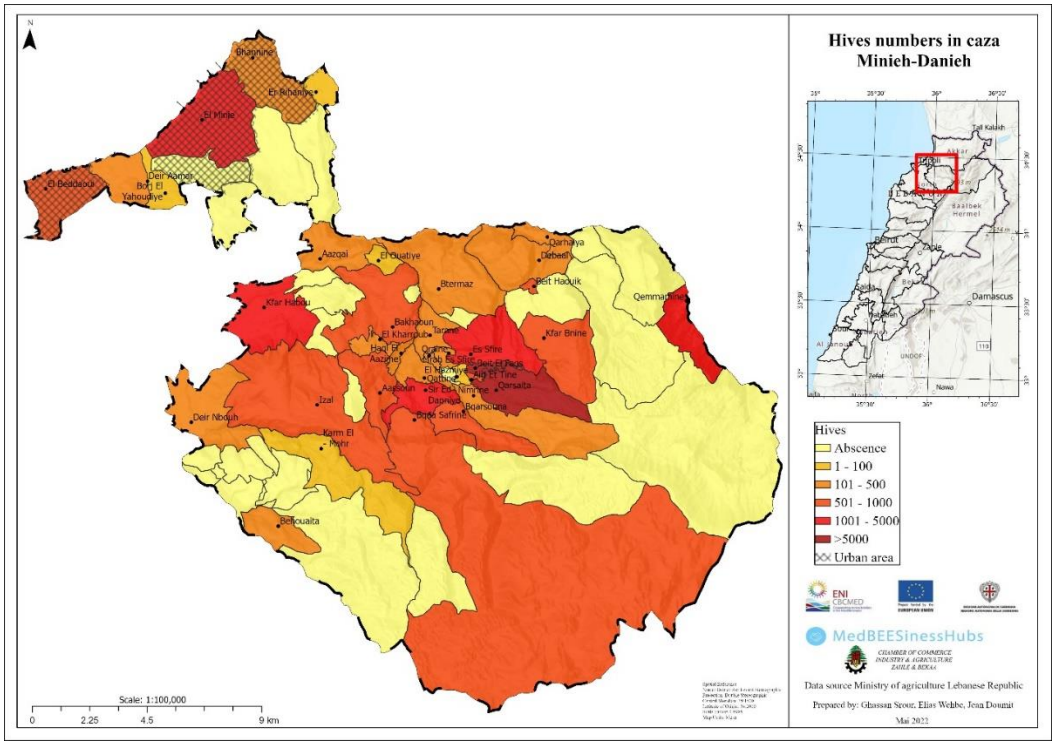

Hives numbers in caza
Kasrouane
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

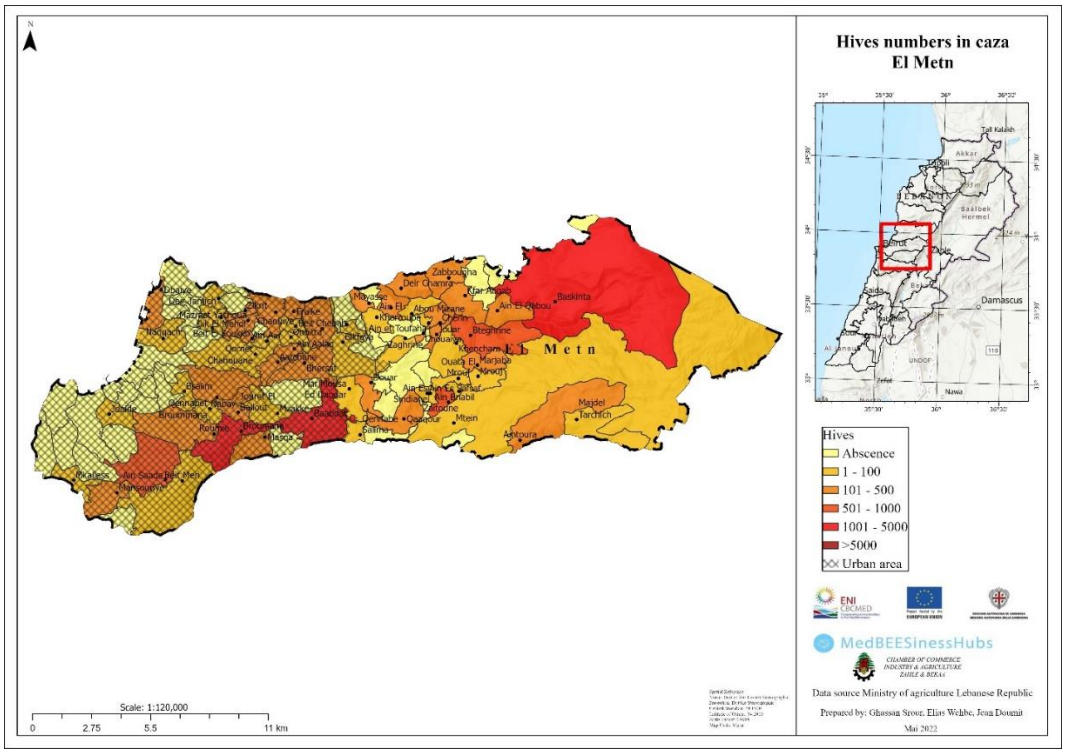

Hives numbers in caza
Jezzine
Jezzine
Kfar Houne
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:100,000
0 2.25 4.5 9 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Sreur, Elias Wehbe, Jean Doumit
Mai 2022

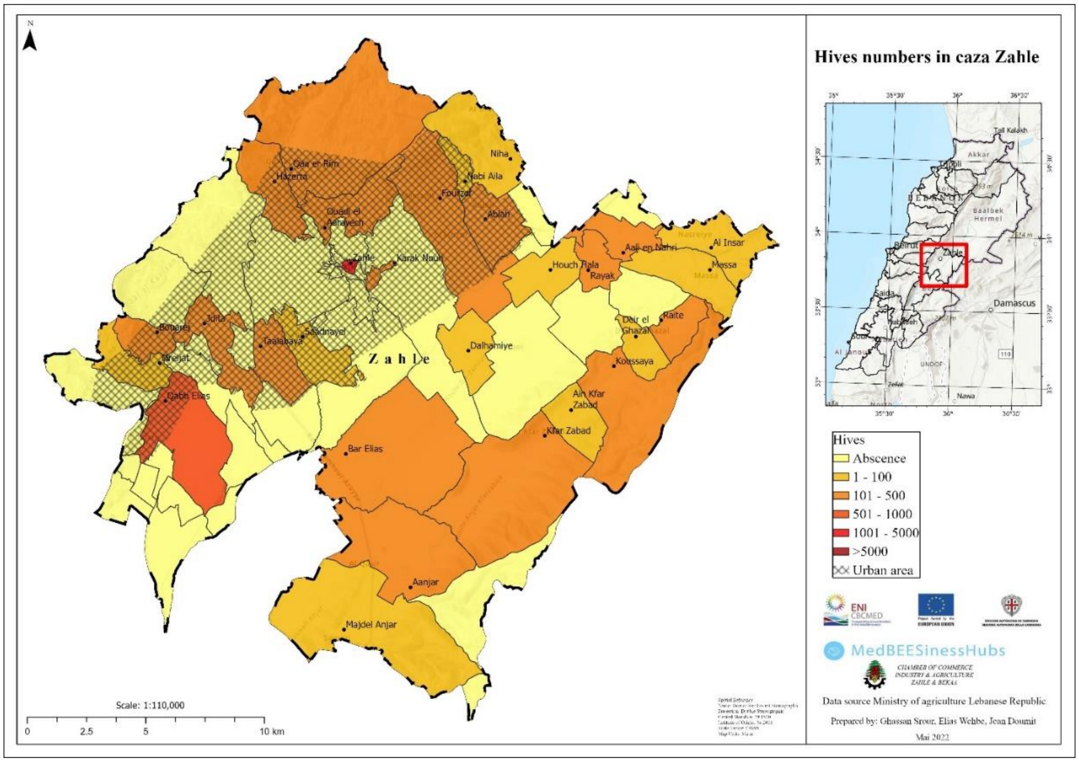

Hives numbers in caza
Jubail
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Sreur, Elias Wehbe, Jean Doumit
Mai 2022

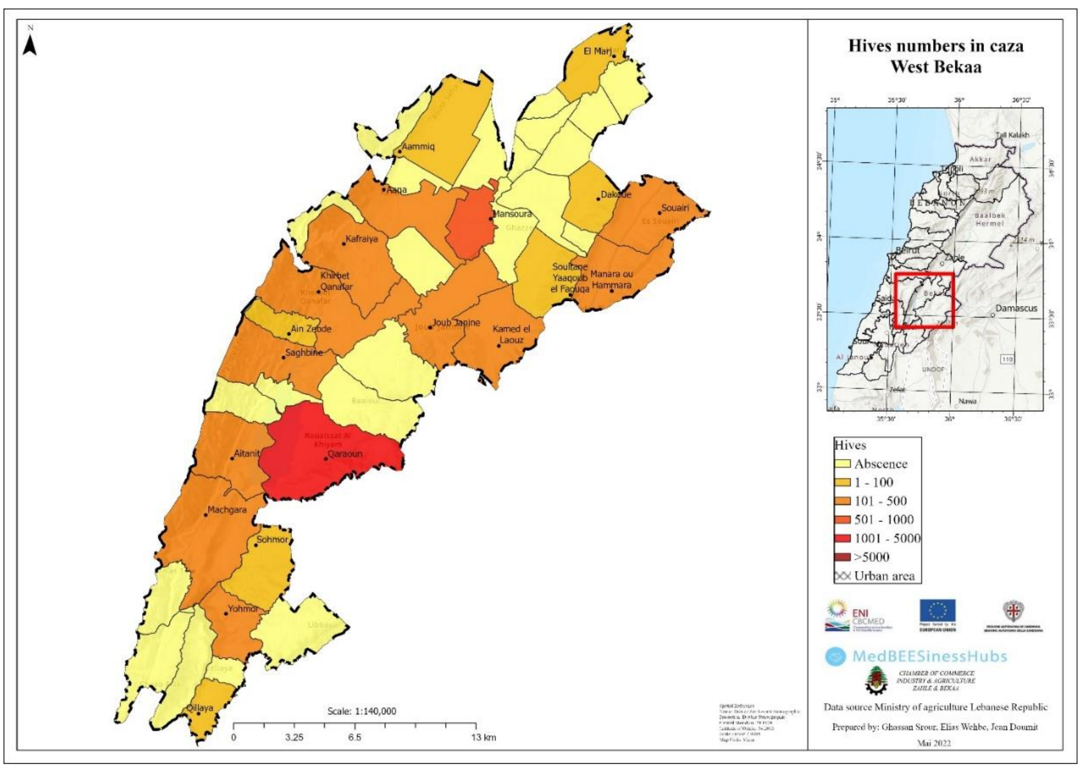

Hives numbers in caza Hermel
Hmaire
Qaa
Kouakh
Charbine
Brissa
Mrah Sejoud
Mansoureh
Marj Hine
Zighrine
Ouadi Er Ratle
Hermel
Ouadi et Tourkmane
Ibab
Bzyout
es Souh
Wadi Faara
Scale: 1:120,000
0 2.75 5.5 11 km
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

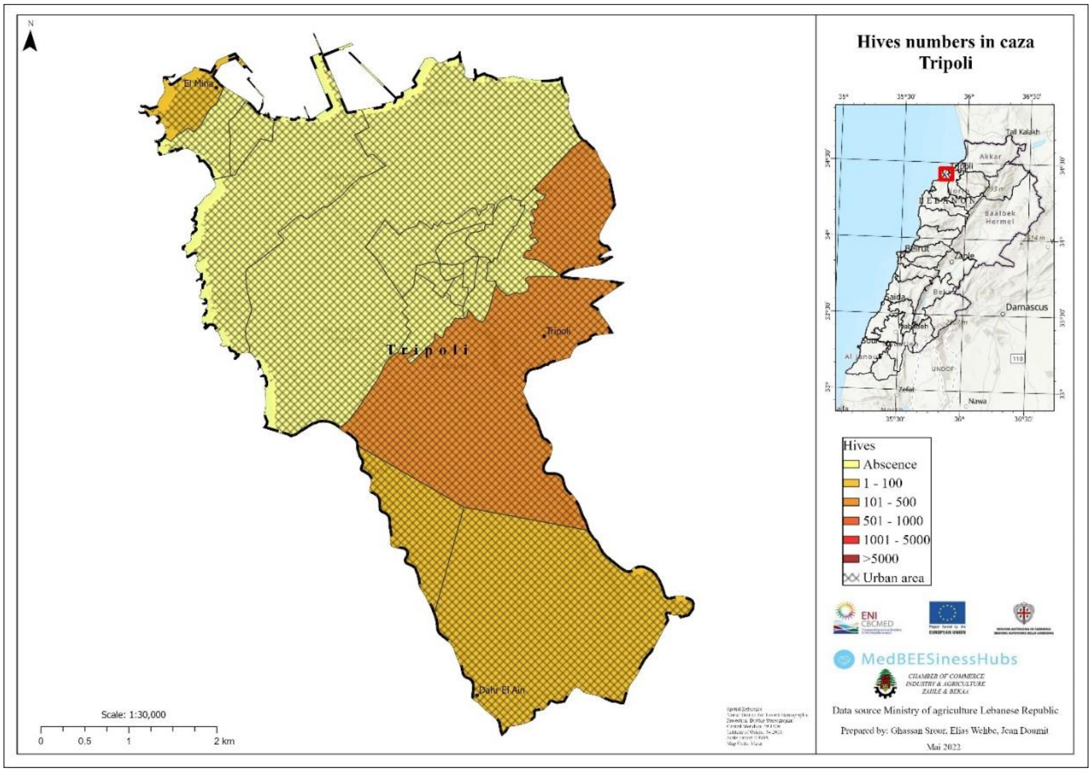

Hives numbers in caza Hasbaiya
Dlafy
Kfair
Berghoz
Mimes
Khalouat
Kaoukaba
Hesbeiya
Ain Qenya
Chouikia
Abou Qamha
Ain Jerjir
Fardis
Hebbariye
Hasbaiya
Rachaiya
el Foukhar
Chebaa
Khir Hamam
Kfar Chouba
Rihan
Halta
Ouazzani
Scale: 1:100,000
0 2.25 4.5 9 km
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

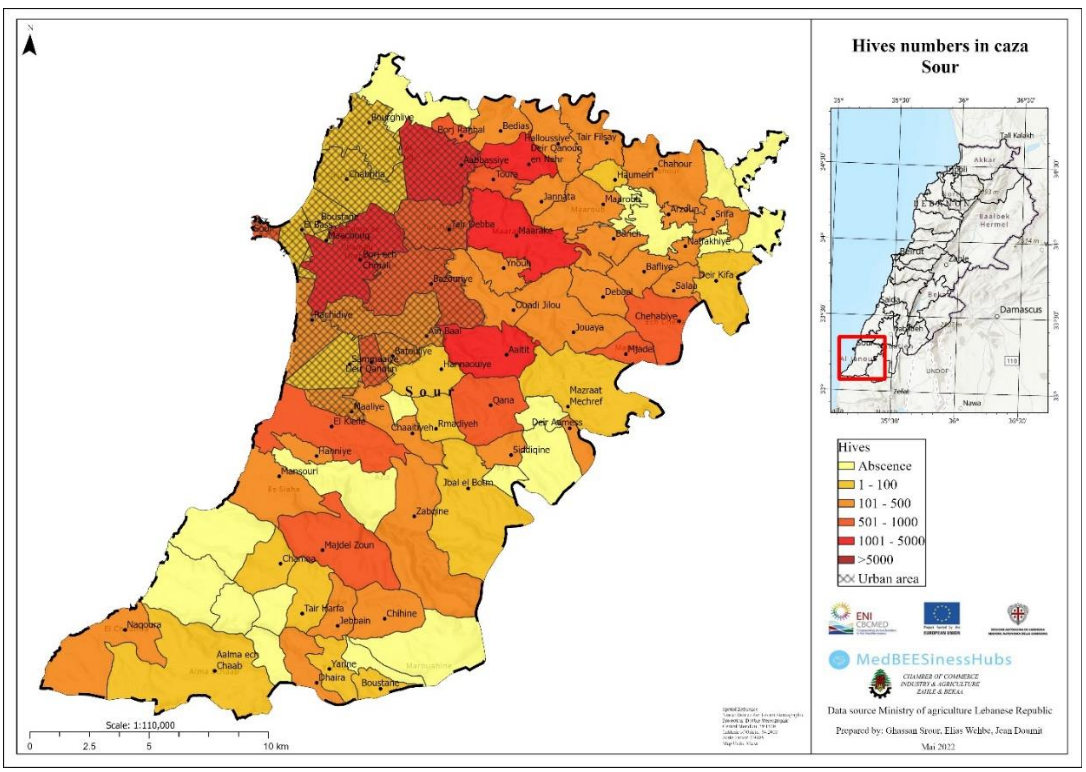

Hives numbers in caza
Minieh-Danieh
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:100,000
0 2.25 4.5 9 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

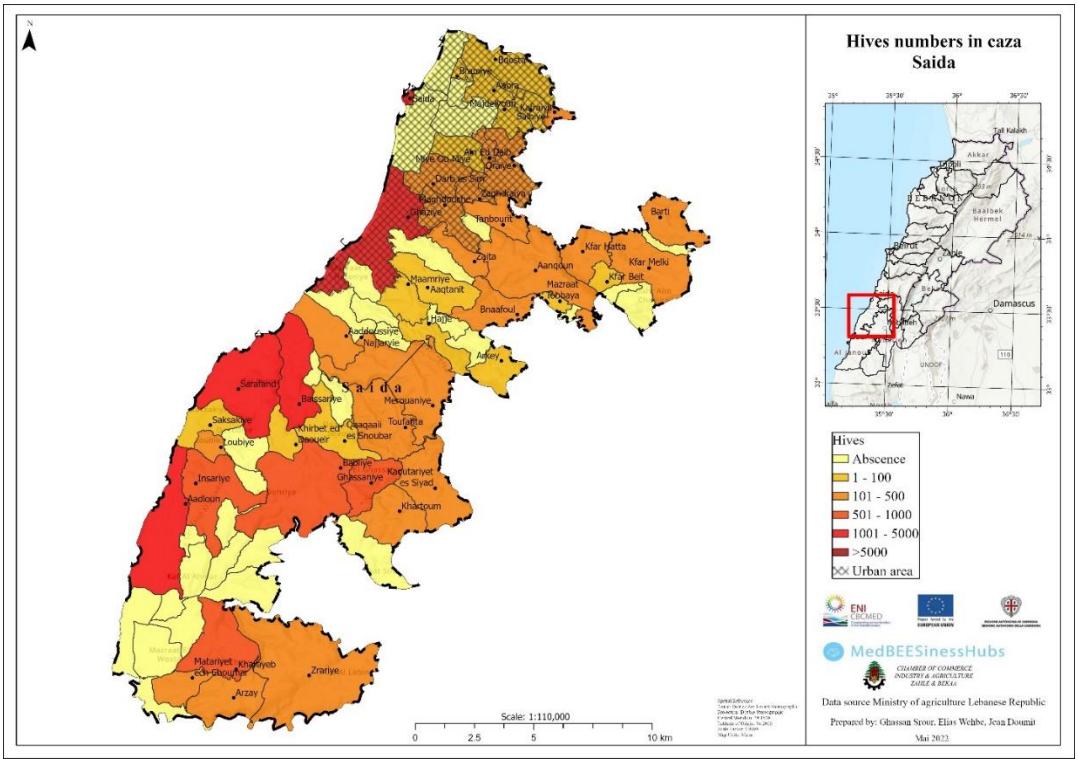

Hives numbers in caza
El Metn
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:120,000
0 2.75 5.5 11 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

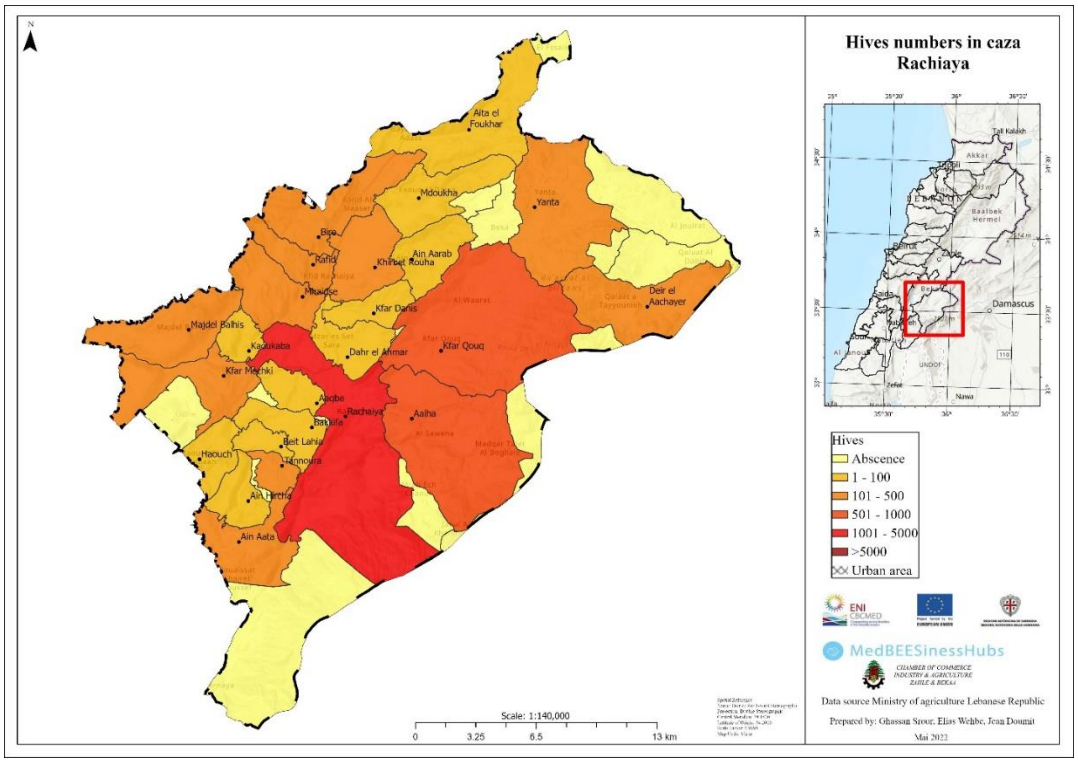

Hives numbers in caza Zahle
Zahle
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:110,000
0 2.5 5 10 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

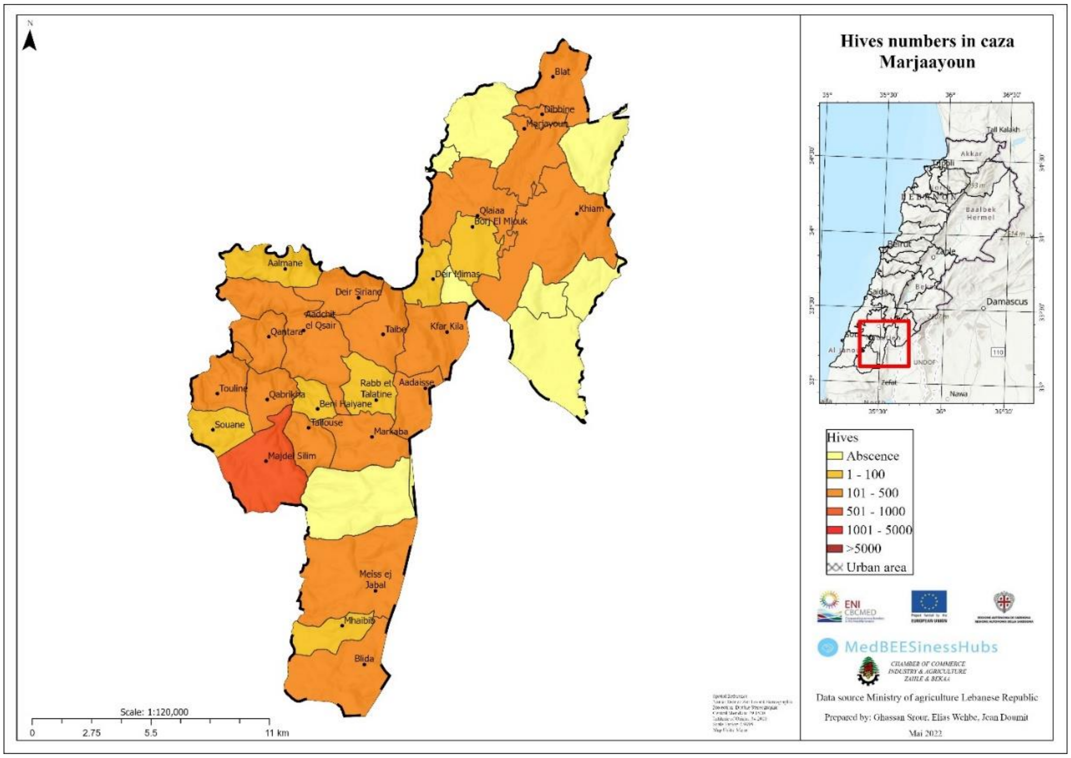

Hives numbers in caza West Bekaa
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:140,000
0 3.25 6.5 13 km
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

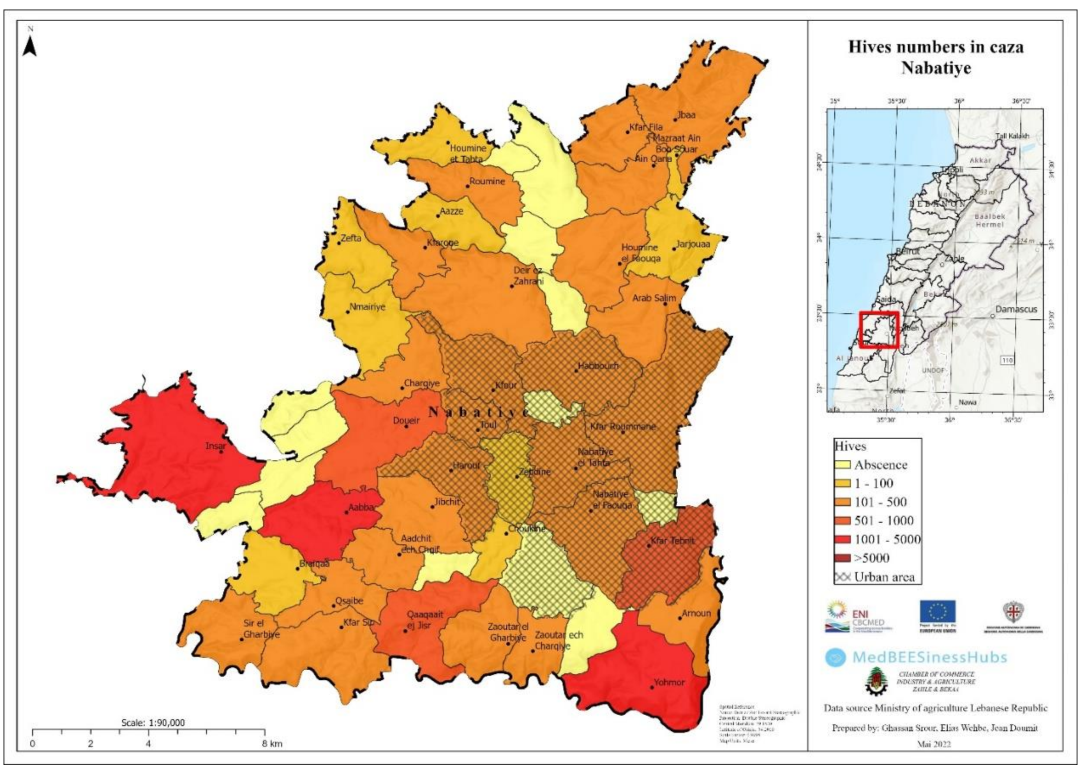

Hives numbers in caza
Tripoli
El Mina
Tripoli
Dahr El Ain
Scale: 1:30,000
0 0.5 1 2 km
Hives
Absecence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022

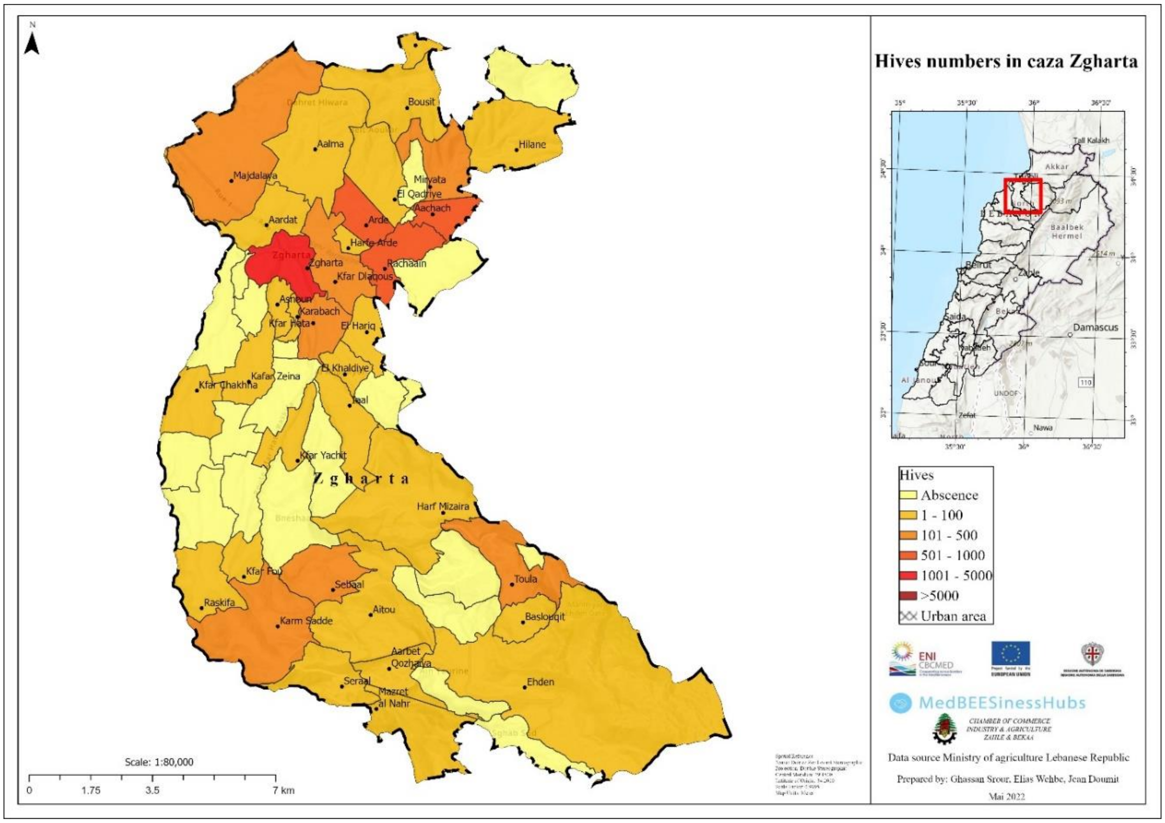

Hives numbers in caza
Sour
Sour
Naqoura
Majdel Zoun
Zabqine
Qana
Aaitit
Jouaya
Mazraat Mechref
Deir Kifa
Scale: 1:110,000
0 2.5 5 10 km
Hives
Absecence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
MedBEESinessHubs
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022


Hives numbers in caza Saida
Saida
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:110,000
0 2.5 5 10 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022


Hives numbers in caza Rachiaya
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Scale: 1:140,000
0 3.25 6.5 13 km
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022


Hives numbers in caza Marjaayoun
Blat
Marjayoun
Qlaiaa
Borj El Mlouk
Khiam
Aalmane
Deir Mimas
Deir Siriane
Qantara
Taibe
Kfar Kila
Touline
Qabrikha
Rabb et Talatine
Aadaisse
Beni Haiyane
Souane
Tallouse
Markaba
Majdel Silim
Meiss ej Jabal
Mhaibib
Blida
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:120,000
0 2.75 5.5 11 km


Hives numbers in caza Nabatiye
Jbaa
Kfar Fila
Mazraat Ain Bou Souar
Ain Qana
Houmine et Tahta
Roumine
Aazze
Zefta
Kfarrome
Houmine el Faouqa
Jarjouaa
Deir ez Zahrani
Arab Salim
Nmairiye
Habbouch
Charqiye
Kfour
Nabatiye
Insar
Doueir
Toul
Kfar Roummane
Harouf
Zebdine
Nabatiye et Tahta
Nabatiye el Faouqa
Aabba
Jibchit
Kfar Tebnit
Aadchit ech Chqif
Qsaibe
Sir el Gharbiye
Kfar Sir
Qaaqaait ej Jisr
Zaoutar el Gharbiye
Zaoutar ech Charqiye
Arnoun
Yohmor
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Srour, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:90,000
0 2 4 8 km


Hives numbers in caza Zgharta
Hives
Abscence
1 - 100
101 - 500
501 - 1000
1001 - 5000
>5000
Urban area
Zgharta
Data source Ministry of agriculture Lebanese Republic
Prepared by: Ghassan Sroor, Elias Wehbe, Jean Doumit
Mai 2022
Scale: 1:80,000
0 1.75 3.5 7 km