Food and Agriculture Organization
of the United Nations

POTENTIALS OF NON-WOOD
FOREST PRODUCTS FOR

VALUE CHAIN DEVELOPMENT, VALUE ADDITION AND DEVELOPMENT OF NWFP-BASED RURAL MICROENTERPRISES: TUNISIA

POTENTIALS OF NON-WOOD FOREST PRODUCTS FOR VALUE CHAIN DEVELOPMENT, VALUE ADDITION AND DEVELOPMENT OF NWFP-BASED RURAL MICROENTERPRISES: TUNISIA

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FOREWORD

There is global recognition that forests are not only about trees but they are about the people who live around them. Empirical evidence on the role of forests in food security, poverty reduction through income and employment generation and in addressing the challenges of climate change are increasingly generated and documented. Over 1.6 billion people worldwide depend heavily on forest resources for their livelihoods, of which 1.2 billion people in developing countries use trees on farms to generate food and income.

For the Near East and North Africa (NENA) region where forest resources are scarce and the potentials for timber production are limited, Non-wood Forest Products (NWFPs) such as fruits, bark, roots, tubers, corms, leaves, flowers, nuts, gums, sap, resins, dyes, honey, mushroom, medicinal and aromatic plants and wildlife animal products are gaining growing importance. The local people use these products for their domestic daily needs as a source of food, fodder, medicine and for income generation. However, the actual production of the majority of NWFPs remain a small fraction of their potential production in most countries of the region and their full potentials for poverty reduction, livelihoods improvement and environmental sustainability has yet to be harnessed to help local people in the region out of poverty and food insecurity. Though the commercialization of NWFPs in the NENA region goes deep in the region's history and for millennia, still the local producers remain at the sidelines and get the smallest commercial margin as compared with other actors.

It is under this background that the FAO through its Regional Initiative for Small Scale Family Farming (SSFF) supported country studies in selected NENA countries on the potential of NWFPs for value chain development and value addition to generate evidence-based data on the valorization of the NWFPs in the NENA region to support policy recommendations, strategies and actions that can increase benefit retention and poverty reduction from NWFPs commercialization at the local level and enhance their contribution to the well-being of the rural communities, to the national economies and to sustainable development of NENA countries at large.

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EXECUTIVE SUMMARY

The rationale of the study of NWFPs is to improve the livelihoods of local rural communities living within forests. The aim of the study concerns the promotion of small and medium enterprises exploiting the state's forest products in order to contribute towards creating employment in disadvantaged forest governorates.

NWFPs contribute significantly to the national economy (0.33 percent to agricultural GDP and 0.025 percent to National GDP), to the forest/local populations' income (32.3 percent of total revenue) and to the protection of the environment (reduced sedimentation and carbon sequestration). The selection of NWFPs examined in this study was based on micro level (population perceptions and preferences) and macro level (contribution to income and exports) considerations; based on these indicators, the four products assessed are: myrtle, mastic, stone pine and Aleppo pine. These products have been examined in previous studies to explore their potential to develop value chains and improve the livelihoods of the concerned populations.

In the various value chains, the local population and associations play a crucial role in the collection and (first) transformation or processing of the products, but they are only marginally integrated in the chain due to the status of the resources and to legal access issues, as well as to other constraints.

The various value chains showed some common characteristics;

- an important natural resource base, existence of local expertise in harvest, post-harvest and distillation processes, and a market potential both nationally and internationally;
- major weaknesses result from the problem of access to the resource by small enterprises, market and marketing research and lack of appropriate equipment and technologies;
- there are however promising opportunities, such as the reform of the Forestry Code, which would allow better legal access to the resource by the local populations and as a result favor the development of rural microenterprises.

Among the four value chains, myrtle has strong potential. There is a pilot microenterprise run by a women's association in Tbainya which has received substantial support from NGOs, including financial support. The members of the association have had training in distillation and management of the oil extraction business. They also participated in national and international fairs to market their produce. Myrtle is known as a traditional oil product that has proven interesting virtues, including antioxidant properties, and as a result it is known as a medicinal product. Because of these characteristics, the product and its value chain has strong potential for employment and income generation.

The policy, legal and institutional setup, as it is embedded in the new strategy and the existing initiatives, is in favor of rural microenterprises, as they:

- Create an environment conducive to sustainable development of forests and rangelands (Axis I)
- Secure sustainable added value of forest and rangeland resources (Axis II)

A number of institutions are supporting such activities; these include NGOs providing micro-financing to support the creation of jobs in rural forest areas, and government bodies in charge of coaching and training in relevant areas, as required by such initiatives.

TERMS OF REFERENCES

The main objective of the study is to gather information that will contribute to the development of a full-fledged regional project on small-scale rural microenterprises based on selected non-wood forestry products. Specifically, this report addresses the following aspects:

1. Identify and gather information on 2-3 NWFPs that are widely produced, used and traded at local and national level and possibly for export;
2. Define the product and indicate if the product is traded and used in its raw form, processed or holds potential for processing and value addition;
3. Indicate the history of the country's involvement in the identified product, main production areas, seasonality of production and trade, the resource ownership, methods of production, nature of enterprise (involvement of individuals, families, small businesses, cooperatives, etc), role of small producers and traders, community groups/ organizations and large scale producers;
4. Describe market structure, conduct and performance of the commonly used NWFPs;
5. Collect information and data on costs and margins along the value chain of at least one of the potential NWFPs.

METHODOLOGY

The rationale of the study of NWFPs is to improve the livelihoods of local rural communities living within and around forests. The aim of the study is to promote the creation of small and medium-sized enterprises that exploit the state's forest products, namely NWFPs, in order to create jobs in disadvantaged forest governorates.

The guiding **conceptual approach is a value chain analysis that integrates the** concerns of the local population regarding the **ecosystem, poverty, gender** and job creation (Figure 1).

Traditionally, the approach based on ecosystem services associated ecosystem services to human well-being (MEA, 2003). This framework bridges the ecological and social sciences by linking intermediate services (ecosystem characteristics) to final services (human well-being). The assumption is to consider rural people as end-users; the purpose is to understand the impacts that changes to the ecosystem have on human welfare (MEA, 2003, 2005).

The involvement of (and support to) rural populations in co-managing natural resources rests on evidence about their position in the system, and their role in generating (producing and conserving) the ecosystem services and associated products.

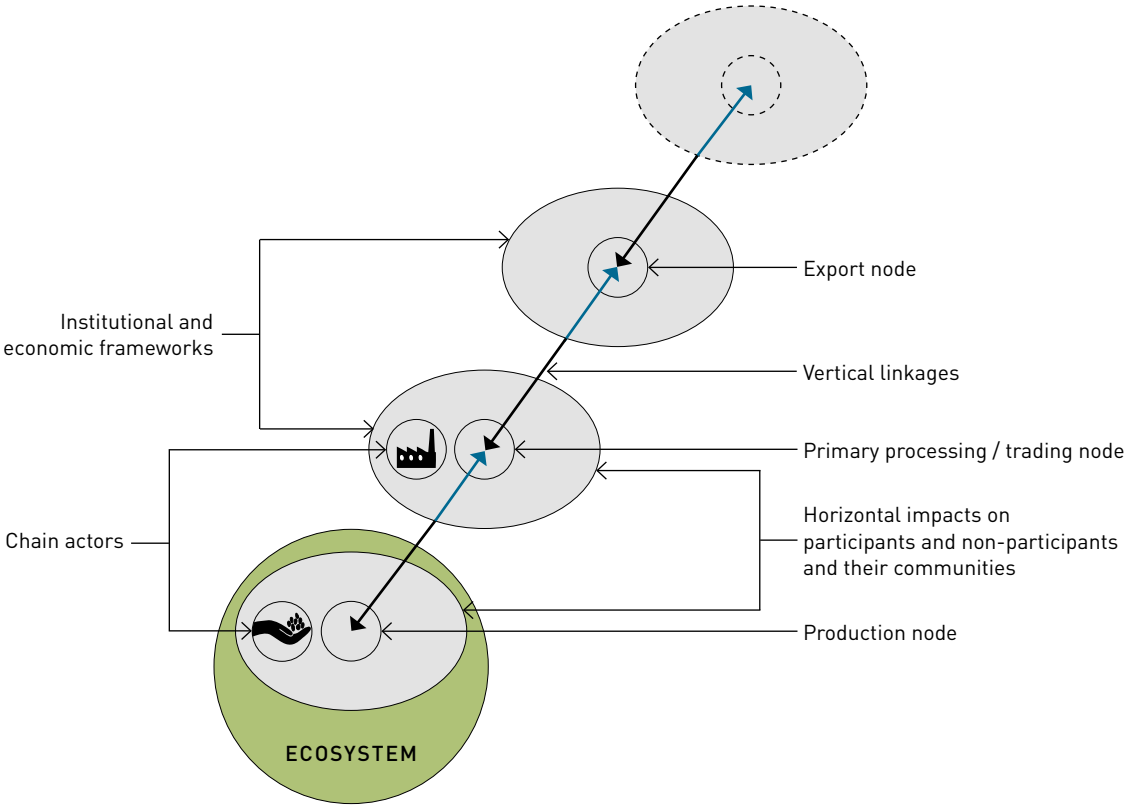
In the various value chains, the local populations play a crucial role in the collection and (first) transformation or processing of the products, but they are only marginally integrated in the chain due to the status of the resources and to legal access issues, as well as to other constraints.

Integrating local forest users in the value chain requires:

- Acknowledging their functions and value (i.e. valuation of forest users)
- Allocating (the right to) access to the resource
- Facilitating market access through fair insertion into value chains
- Creating value (chain functions) at local level

In this study we use this conceptual framework to: (i) identify key NWFPs (based on macro level considerations, but also on micro level and population needs); and (ii) analyze the selected value chains.

Figure 1. **Value chain mapping including horizontal and vertical linkages, poverty, gender and resources**



(adapted from Du Toit and Halberg, 2010)

SOURCES OF INFORMATION:

The DGF has initiated and led a series of studies to promote value added activities and co-management of forest resources.

Existing studies (DGF, 2013-2014) have assessed:

- Forest population and income structure;
- The value of forest services;
- The value of forest population and the capacity of local users' associations to manage forest resources;
- The potential of value chain development for selected products, namely Aleppo pine (*Pinus halepensis), stone pine (Pinus pinea) and essential oils of myrtle (Myrtus communis) and mastic (Pistacia lentiscus);*

We used and compiled key results from these mentioned studies to identify, select and analyze the 4 products that are investigated in this study.

CHAPTER 1

Identification of common NWFPs

The identification of the NWFPs examined in this study was done consulting the General Directorate of Forests (DGF).

The selection of NWFPs for this study was multi-criteria, based on macro data and other considerations (such as export and income values), and micro data and other considerations (according to communities' assessment and needs, including gender considerations).

Macro level assessment

DG/Forests (Saadani and Abdelwahed, 2013; Mokhtar, 2014) presented NWFPs commonly used and of economic importance. The listed products (Table 1) show potential for development at the national level (macro). These studies contain information on harvested areas, production, income and export values. The study by Saadani and Abdelwahed listed 12 NWFPs according to their use: Aromatic and medicinal plants (essential oils from rosemary, myrtle and mastic), food (capers, mushrooms, etc) and artisanal products (from cork).

Table 1. **Main forest products and their relevant economic importance**

Forest product	Total area ha	Harvested area	Average production in tons	Average production kg/ha	Export value TND (2012)	Export value US$ 1000 (2012)
Cork	90 000	6.5-12	8 000		4 069 639	2 605.736
Aleppo pine	296 000	152 000	300	5		
Stone pine	20 000	12 000	140	12	168 203	107.698
Mushrooms	180 000	150 000	300	3	713 131	456.608
Rosemary	160 000	60 000		1,2	519 960	332.923
Myrtle	45 000	20 000		0,65	253 228	162.138
Mastic	69 000		TND 129 000*	5 000**		
Capers	27 000	13 500	660		8331	5.334
Snails	ND	ND	700		582 832	373.179
Honey		3 500	200		104 946	67.195
Hunting	Domain		400			

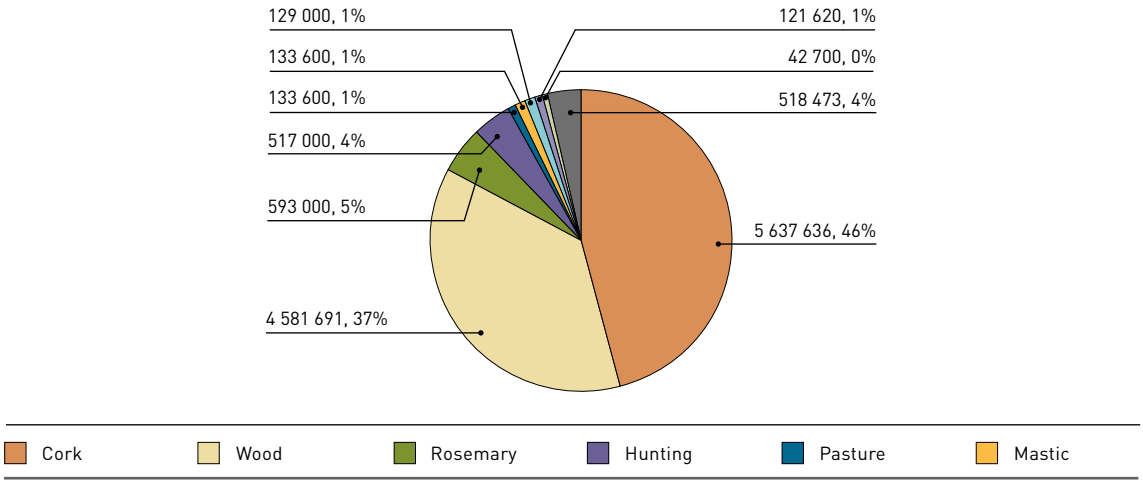
Source: DG/F (Saadani and Abdelwahed, 2013)

* Average production is available in value (Tunisian Dinars TND)

** Unit = bouquet of 10 stems/month sold at EUR 0.7 per bouquet

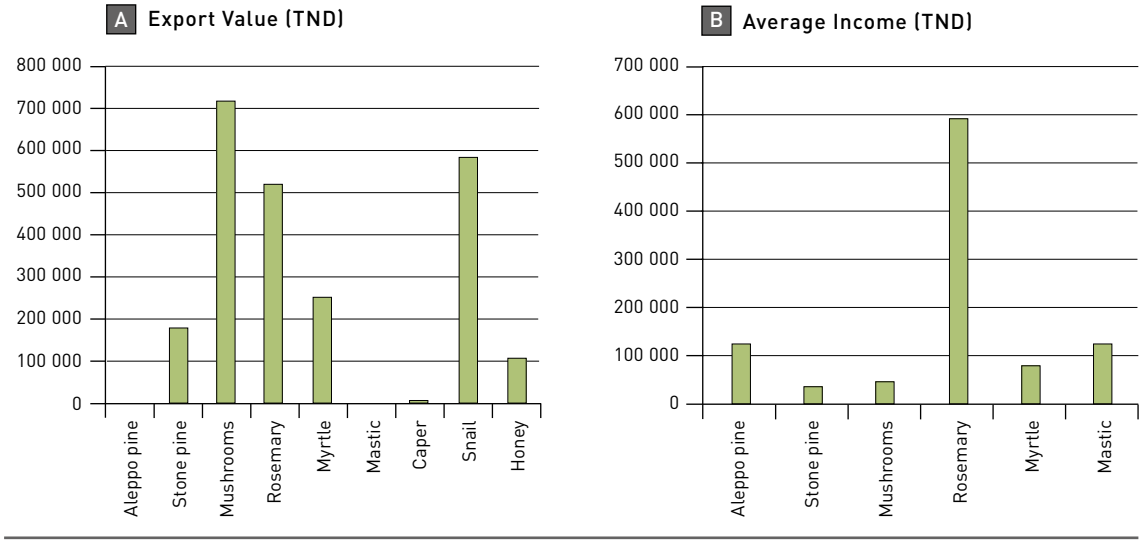
Strategically important forest products are evaluated according to production and generated income for the government (Mokhtar, 2014). The value of exports of all products indicated in Table 1 ranges between as high as US$ 2 605 736 for cork and US$ 5 334 for capers. The percentage contribution to income is equal to: wood (37 percent), cork (46 percent), rosemary (5 percent), mastic, hunting (4 percent), pasture (1 percent), pine (1 percent), myrtle (0.7 percent), and mushrooms (0.3 percent). The respective contributions to the total income are displayed in Figure 2 below.

Figure 2. **Income generated from forest products**



The respective contributions of NWFPs to export and government income are displayed in Figure 3. Based on these two criteria, the ranking according to export value is: mushrooms, snails, rosemary, myrtle, stone pine and honey, and the ranking according to average income is: rosemary, Aleppo pine, mastic, myrtle, mushrooms and stone pine.

Figure 3. **Export value and average income of NWFPs**



Micro level assessment

The selected products are those most widely produced, used and traded or which have strong potential for export. These products also have the potential to create jobs and generate income for forest populations. On top of the studies mentioned above, substantial analysis, using participatory rural appraisal approaches, has been performed to assess the level of knowledge and use of forest resources by local populations, as well as the ranking of these products according to their contribution to income (Zaibet, 2014) and to other criteria selected by the communities (Meliane, 2013).

Meliane (FAO-TCP/TUN/3304. 2013) identified six criteria for the selection of key NWFPs based on participatory rural appraisal (Table 2).

Table 2. **Criteria used to assess forest products (Meliane, 2013)**

C1	Resources are sufficiently available to serve commercial activities
C2	Resources used by users' associations already in place, formal or informal
C3	Resources that (potentially) contribute significantly to the local economy
C4	Resources that (potentially) contribute significantly to employment
C5	Resources that have the potential to create added value (by transformation and technology)
C6	Existing interest in the resource

Zaibet (2014) used a PRA approach to identify sources of income and assess the importance of forest resources for local communities (last column in Table 3). Participants, including a women's association (in the locality of Tbainya), were asked to rank these resources according to their current contribution to income. Results show that essential oils of myrtle and mastic ranked 3rd in 4 cases out of 5. Based on these result six products were selected as a priority for value chain development: myrtle, stone pine, mastic, Aleppo pine, mushrooms and honey.

Table 3. **Importance and ranking of NWFPs according to the local population**

User association (by location)	Resource/product of interest to the population	Availability	Exploitation and transformation	Ranking of sources of income (Zaibet, 2014)
Gouairia	Mastic	Abundant over 800 ha	Quasi-totality of the women	
	Mushrooms	Variable (seasonality)	+ 100 families	
	Myrtle	Less abundant than mastic	Not exploited Absence of Distiller	
	Pine	130 ha	Considered a problem (surveillance)	

User association (by location)	Resource/product of interest to the population	Availability	Exploitation and transformation	Ranking of sources of income (Zaibet, 2014)
Tbainia	Mushrooms		150 families	1. Cork/ labor 2. Mushrooms 3. Essential oil 4. Pine 5. Agriculture 6. Honey
	EO from myrtle and (second place) eucalyptus, Cyprus, mint mastic...)	Myrtle relatively abundant, the others are limited	10 women are active in the women association with the coaching of the NGO «Atlas»	
Tabouba	Diss	Abundant	7 women are trained	1. Livestock 2. Pine 3. Essential oils 4. Honey 5. Labor
	Pine (Zgougou)	70 ha and more in a 5 Km radius	Very few people	
	EO from myrtle and (second place) eucalyptus, Cyprus, mint mastic...)	available	One woman practices distillation	
	Honey		Very few people	
	Pine	300 ha		
Oued Maaden	Diss	Abundant	15 families	1. Agriculture 2. Diss catering 3. Essential oils 4. Honey
	EO from myrtle and (second place) eucalyptus, Cyprus, mint mastic...)	Abundant, including private lands	15 women	
	Caper and carob		Family use, rarely sold	
	Honey	Very interesting resource	Very few people	
Dmaien	Pine	4 000 ha	700 families	
	Mushrooms	Abundant	Very few people	
	EO from myrtle and (second place) eucalyptus, Cyprus, mint mastic...)	Abundant	Not used	
	EO Mastic	Less abundant	Not used	
Jebal Zaghouan				1. Livestock 2. Agriculture 3. Essential oils 4. Honey 5. Cork/as labor
Kbouch				1. Labor 2. Livestock 3. Agriculture 4. Remittance 5. Hunting

CHAPTER 2

Tunisian forest sector and vegetation distribution

Tunisia is the northernmost country on the African continent and the smallest of the nations situated along the Atlas mountain range. Around 40 percent of the country is covered by the Sahara desert, with much of the remainder consisting of particularly fertile soil and a 1 300 km coastline. Approximately 17 percent of the total area is arable land, where the country's 35 percent share of rural population lives.

Forests and pasture lands cover 5.65 million ha: that is a third of the country's surface area. Forests and other woodlands alone occupy 8 percent of the territory, which is about 4.5 million ha. The majority of forests (70 percent) are located in the north and centre-west of the country.

Most of the Tunisian forest area (94 percent) is located within and along the three mountain chains of the Khroumiries, the Mogods and the Dorsal. Among the forest species present, Aleppo pine (*Pinus halepensis Mill.*) is the most widely distributed tree in the country, due to its well-known adaptation to the prevailing arid and semi-arid conditions (DGF, 1995a).

Wood production in Tunisia includes a high proportion of fuelwood (61 percent) and a lower share of industrial roundwood (30 percent). The remaining 9 percent consists of other types of roundwood used for various agricultural and domestic uses, such as poles. Despite their low productivity, Tunisian forests play a prominent socio-economic role, as they insure employment and provide basic needs for some forest inhabitants.

Importance of forests

The population living in forests is estimated at 800 000 people, representing about 8 percent of the country's total population (DGF, 2013). The importance of forests can be seen from its contribution to the revenue of the local forest population and also at national level. At local population level, the role of forests is shown in Table 4. This table shows that forests contribute on average 32 percent to forest populations' income.

Table 4. **Importance of forest revenue to local population**

Governorate		Agricultural production in %	Forest production in %	Work in agriculture in %	Principal occupation & small trades %
Beja	Total	40	33	3	24
	Living in the forest	82	12	0	7
	Living 5 Km around forest	34	36	4	26
Jendouba	Total	46	36	1	18
	Living in the forest	47	36	1	16
	Living 5 Km around forest	28	30	3	39
Kef	Total	50	31	0	17
	Living in the forest	45	48	0	7
	Living 5 Km around forest	51	29	0	20
Average (%)		47	32.33	1.33	19.33
Average (rev)	National: TND 905 per capita	425.35	292.5865	12.0365	174.9365

Source: Etude sur la caractérisation de la population forestière, DGF (2012)

At national level, the forestry sector contributes 0.33 percent to the agricultural GDP and 0.025 percent to the national GDP. These figures do not include derived forest incomes for the forest population. Had this income been accounted for, the real contribution of forests would reach 5 percent of the agricultural GDP and 0.36 percent of the national GDP.

Environmental benefits

The value of environmental benefits of forests has been evaluated according to non-market valuation methods in a study by Daly et al. (DGF, 2013):

Valuation method/Output	Quantity	Value (US$ 000)
Cost avoided method:		
Watershed protection:		25 623
Reduced dam sedimentation (m3/ha)	1.9 -16.2	16 223
Agricultural soil conservation (mil. ha)	1	9 400
Shadow pricing:		
Carbon sequestration (Tons Carbon)	220 890	4 418

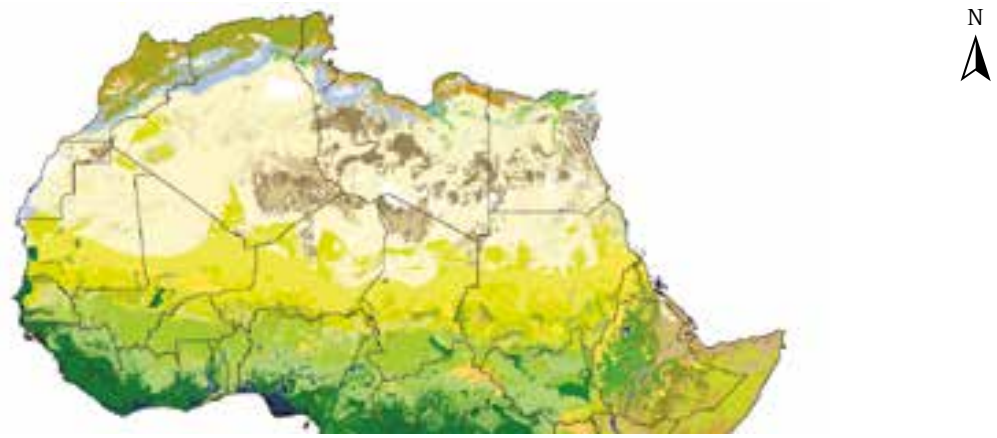
The main environmental issues affecting Tunisia are desertification and drought, coastal erosion, threats to biodiversity and deforestation. A major cause of deforestation is the fact that forest communities are disorganized and subsequent strategies and policies have not succeeded in reintegrating these populations into the co-management processes of these resources.

Classification of forests

In the African context, the ecosystems of Tunisia fall into two categories: temperate forests and temperate grasslands and scrublands (Association of American Geographers, 2013)[1]. These ecosystems are identified as follows:

- Mediterranean lowland Mixed Forest
- Northern African *Pinus / Quercus Forest and Woodland*
- *Mediterranean Mountain Coniferous Forest*
- *Mediterranean Mountain Shrub and Mediterranean lowland Shrub*

Figure 4. **Africa ecosystems map**



Source: Association of American Geographers, 2013

Tunisian forests are characterized by a high presence of coniferous species (53.7 percent), compared to pure broad-leaved ones (20.3 percent). Table 5 reveals that Aleppo pine is the most common dominant species, mainly concentrated in arid and semi-arid areas. In these regions also other forest species are found, such as stone pine (*Pinus pinea L.*), sandarac tree (*Tetraclinis articulata Vahl*), eucalyptus (*Eucalyptus spp.*) and acacia (*Acacia spp.*). Cork oak (*Quercus suber L.*) is the most important broad-leaved species and grows only in the humid and sub-humid areas of northern Tunisia. In better soils, cork oak is replaced by other native oak species, such as pubescent oak (*Quercus faginea Lam.*), but they extend to less

[1] As part of an initiative to map the African continent's vegetation and ecosystems (A new map of standardized terrestrial ecosystems of Africa, 2013), Tunisia has been examined and inputs from experts used to complete the classification and map the ecosystems of the entire African continent. The initiative provides the most current and finest spatial and thematic resolution characterization of African vegetation in its biophysical context.

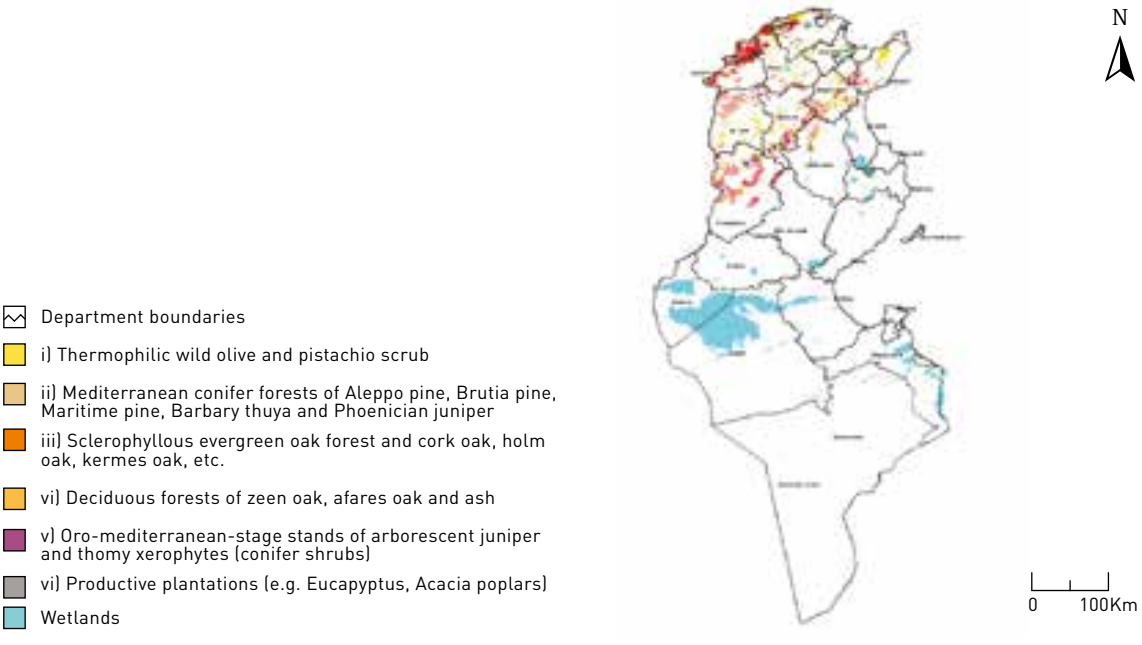
than 1 percent of all forests. Similarly, maritime pine (*Pinus pinaster Sol.*) is concentrated in higher fertility areas in north-western parts of Tunisia. Stands with a mixed presence of both conifers and broad-leaved species are relatively rare in higher attitudeforests, but more frequent in degraded woodlands.

Table 5. **Distribution of forest species**

Dominant species	Area (000 ha)	Proportion (%)
Aleppo pine	296.6	35.1
Maritime pine	3.8	0.5
Barbary thuya	21.8	2.5
Other coniferous species	35.7	4.2
Cork oak	45.4	5.3
Other oak species (such as pubescent oak)	7.9	0.9
Eucalyptus	28.5	3.3
Acacia	12.6	1.4
Other broad-leaved species	29.6	3.5
Mixed woodlands	20.9	2.4
Shrubs within trees	132.9	15.7
Scrubs without trees	194.8	23.1
Other (forest roads, clearing areas)	12.3	2.1
Total forest area	842.8	100.0

Source: DGF, 1995 (Dali, 2013)

Figure 5. **Map of Tunisian forest typologies (Daly, 2014)**



CHAPTER 3

Non-wood forest products' distribution

The identification of NWFPs and their distribution is based on the map above (typology of forests) and more details are provided in the maps of specific selected areas indicated by the name of forest user associations, as shown in Figure 6. The English legends are shown in Table 6.

Figure 6. **Geographic location of forest user associations (GDA)**

1 Elgouairya
2 El Baraka (Tebainya)
3 Tabouba
4 Oued El Maaden
5 El Kebouch
6 Chenanfa
7 Bou Ebdellah
8 Edkhila

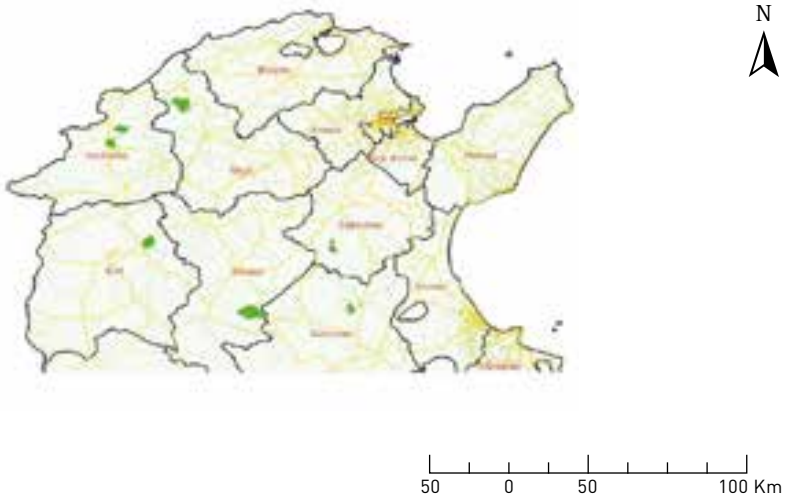


Figure 7 shows the mapping of 7 regions indicated by the name of user association or GDA; these are respectively: Al Baraka, Bouebdellah, Echenanfa, El Gouairya, El Kebouch, El Maaden and Tabouba. These locations cover the governorates of Beja, Kef, Siliana, Zaghouan and Jendouba in the north-west of Tunisia. These maps confirm, as indicated by local populations (shown in Table 3), the abundance in these regions of myrtle and mastic (as sources of essential oils) and pine (stone and Aleppo).

Figure 7. **NWFPs geographic distribution by GDA (GiZ, 2014)**

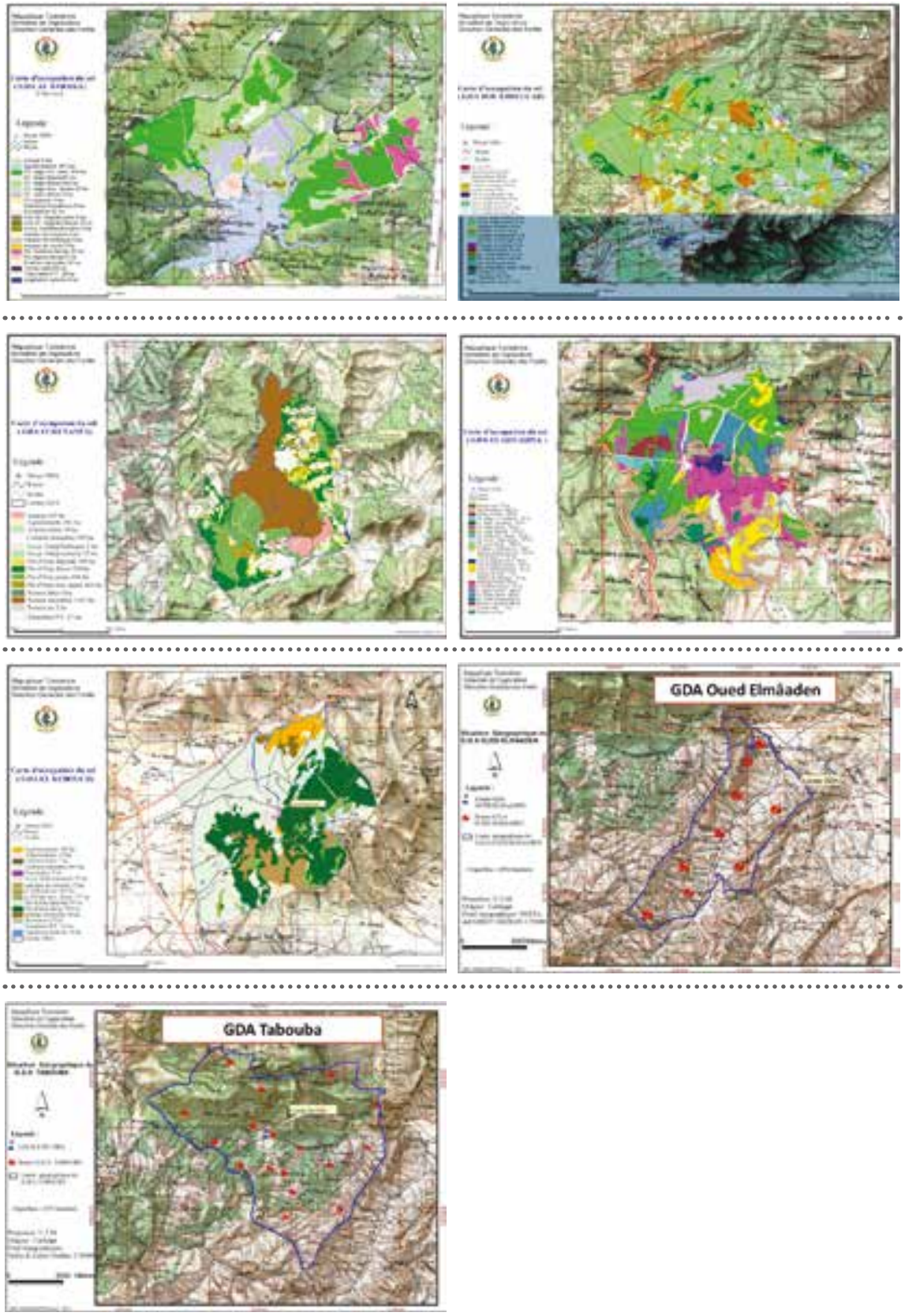


Table 6. **Translation to English of legend of Figure 7**

French legend	English legend
Acacia	Acacia
Agroforesterie	Agro-forestry
Chêne liège/Chzeen	Cork oak
Chêne liège dégradée	Cork oak degraded
Chêne liège dense	Cork oak dense
Chêne liège moy dense	Dense cork oak average
Chzéen dense/pin	Pine
Clairière forestière	Clearing area
Eucalyptus	Eucalyptus
Chêne liège/	Cork oak/Thuya
Chêne liège Lentisque	Cork oak/Mastic
Chêne maritime	Cork oak/maritime Thuya
Maquis de bruyere	Thuya maquis
Maquis Lentisque	Mastic maquis
Maquis myrte	Myrtle maquis
Pin maritime	Maritime pine
Pin pignon	Stone pine
	Natural plain

CHAPTER 4

Value chain analysis of Aleppo Pine

Description of the tree and the fruit

The Aleppo pine (*Pinus halepensis, Pin d'Alep,* (قوقوزحلبالصنوبر)

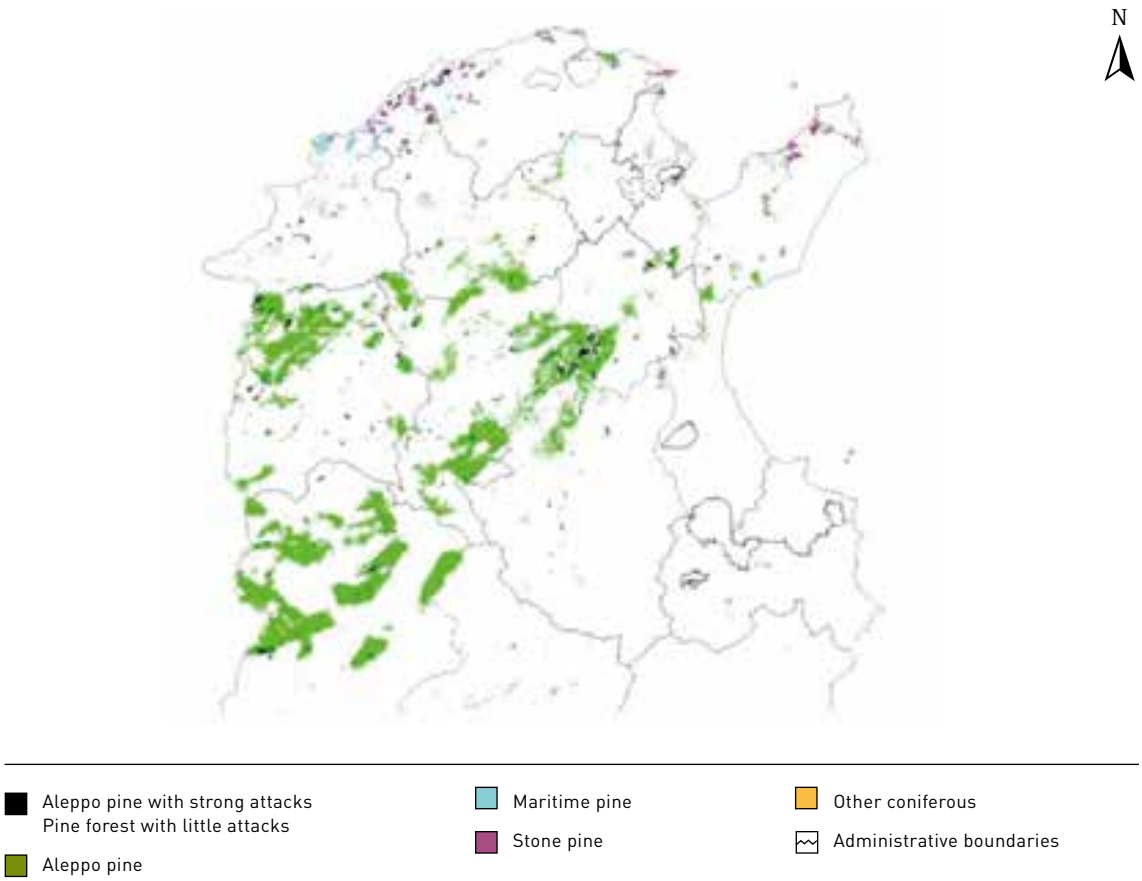
The tree is 15 to 30 m high, with irregular and pale crown, and branches that are quite spread out. Twigs are green to gray and quite thin. The buds are not resinous, ovoid, acute, brown and free of scales. Fruits: male cones are yellow, with touches of red; females are purplish-pink and thick stalked.

Figure 8. **Aleppo pine tree and fruit**

Production, Ecology and Habitat distribution

The Aleppo pine tree is found on mountain limestone soils of the central part and the Dorsal of Tunisia. Figure 9 shows the main regions covered by the species: Kasserine, Kef and Siliana. The map shows strong concentrations of pine forest (in black) in these regions. It also shows the habitat of other pine species, namely stone and maritime pine trees located in the northern sub-humid region.

Figure 9. **Distribution of coniferous species in Tunisia, 2006**



Source: DGF, 2010

The total cover area is estimated at 361 221 ha (DGF, 2010) (Table 7). The three governorates of Kasserine, Kef and Siliana have the highest proportion: they account for 74 percent of the total area covered by Aleppo pine, which shows the importance of these trees and their products for the local populations.

Table 7. **Distribution of Aleppo pine and percentage of land covered in each region**

	Area (ha) DGF, 2010	
	Total	%
Kasserine	123 937	34
Kef	68 765	19
Siliana	75 800	21
Zaghouan	35 190	10
Beja	13 086	4
Kairouan	16 270	4
Other	29 173	8
Total	361 221	100

Valorization of the product

Pine trees were initially used for wood and for reforestation projects. It wasn't until 1997 that Sghair and Khaldi (1997) highlighted the economic importance of the seeds compared to wood. "Aleppo pine seeds" then began to appear in the list of 41 NWFPs that the DGF identified for their economic importance. Subsequently this product was included in action plans resulting from the study on the identification and valuation of NWFPs (DGF, 1999). The FAO - TCP / TUN / 3304 cited Aleppo pine seeds as a forest product of great importance, but no specific support action has been initiated to promote microenterprise projects for the product.

The valorization of products stems from the multiple uses and derived products available in the market. The list of derived products from Aleppo pine seeds (called "zgougou") include:

- Cream dessert 'yoghurt'
- Ice cream with zgougou aroma
- Pots of Assida
- Zgougou vegetable oil
- Candies with zgougou aroma
- Aleppo pine cones for decoration
- Makroudh, Baklava and other Tunisian pastries with zgougou as an ingredient

Currently, domestic consumption is estimated at 1.5 kg seeds or 500 g of ground zgougou per family per year with an upward trend. Predictions estimate an increase to 2 kg of seeds per family per year. Zgougou is also available on websites specialized in supplying Tunisian communities living abroad and a targeted export of zgougou for the Occasion of Mouled is made through oriental pastry shops with branches in Europe (among others "The Rose of Tunisia").

Figure 10. **Aleppo pine seed production (tons)**

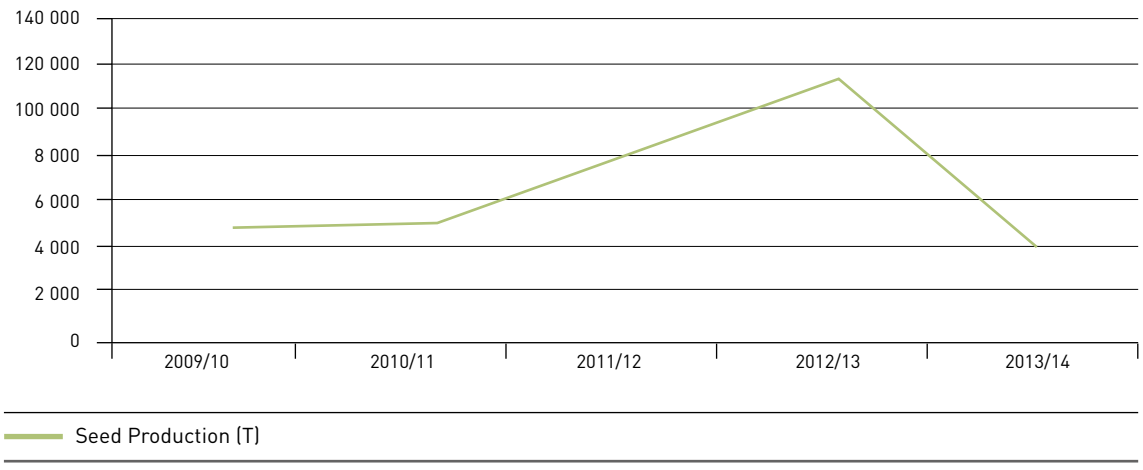
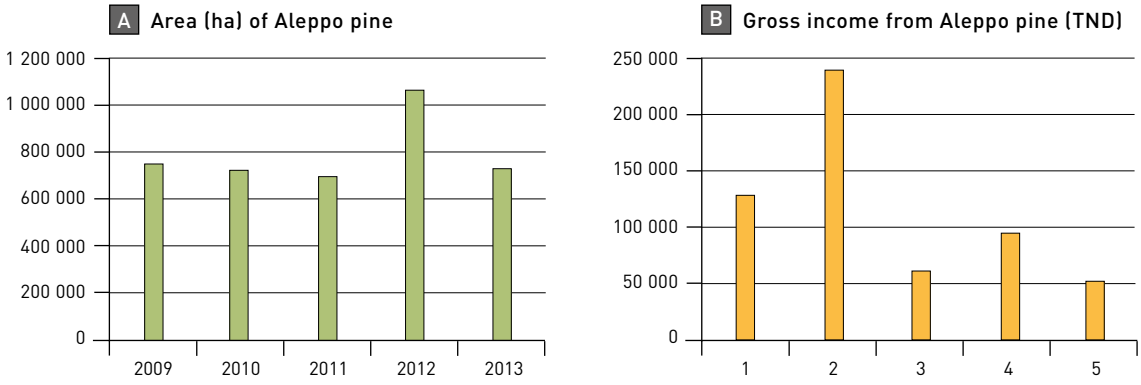


Figure 11. **Aleppo pine production (area in ha) and gross income**

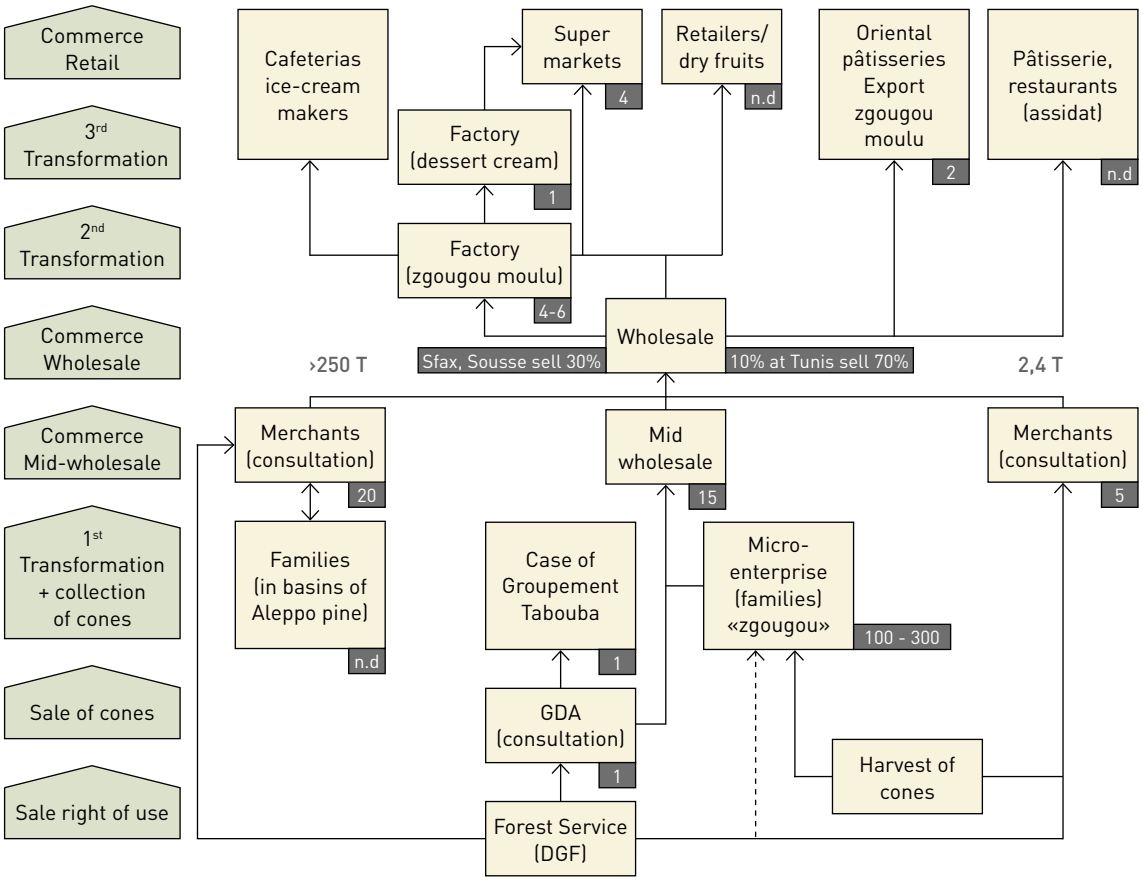


Markets: Structure, Conduct and Performance

The value chain of Aleppo pine includes the following stages/operators: the harvest, which starts with the sale of use rights by the Forest Department (Ministry of Agriculture); then the sale of cones by the local population (there is one case of GDA) and 100-300 microenterprises (harvesting with first processing); and finally wholesale and further processing (2nd and 3rd transformation) by a limited number of operators in Tunisia's major cities, Sousse and Sfax. The majority of the product is sold and consumed in the local market (250 tons) and only a small proportion (2.4 tons) is exported and/or used for pastries. This structure creates a market power that favors merchants (in a limited number) and microenterprises, as opposed to the local population due to the process of sales based on public consultation and bidding.

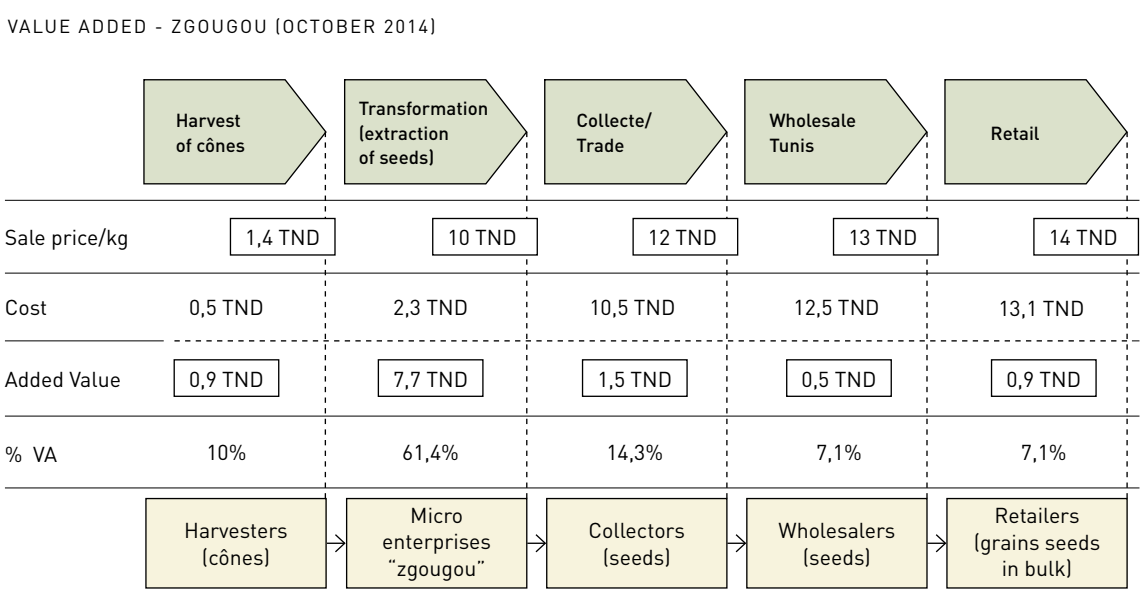
The value added measures the value created by each actor in the value chain (the difference between the sale price and the total expenditure for the actor to procure the goods and services it transforms).In the case of bulk pine seeds (zgougou), the values and prices at each level of the chain, as of October 2014, are shown in Figure 13.

Figure 12. **Value chain of Aleppo pine**



(Source: DGF-GiZ, 2014)

Figure 13. **Value added along the pine chain**



Source: DGF-GiZ, 2014

CHAPTER 5

Value chain analysis of Stone pine

Description of the tree and the fruit

The stone pine (*Pinus pinea Linnaeus, Pin pignon,* البندق)

The stone pine tree is a conifer with a stem shape that changes according to the nature of the soil and to the location as it searches for sunshine. The tree can reach a height of 15 to 30 meters. The fruit is a solid globular cone that when mature produces edible seeds: pine nuts. There are two types of nuts determined by the shape of the shell: one type (variety) with a hard shell and another with a soft shell.

Image 1. **Stone pine tree and fruit**

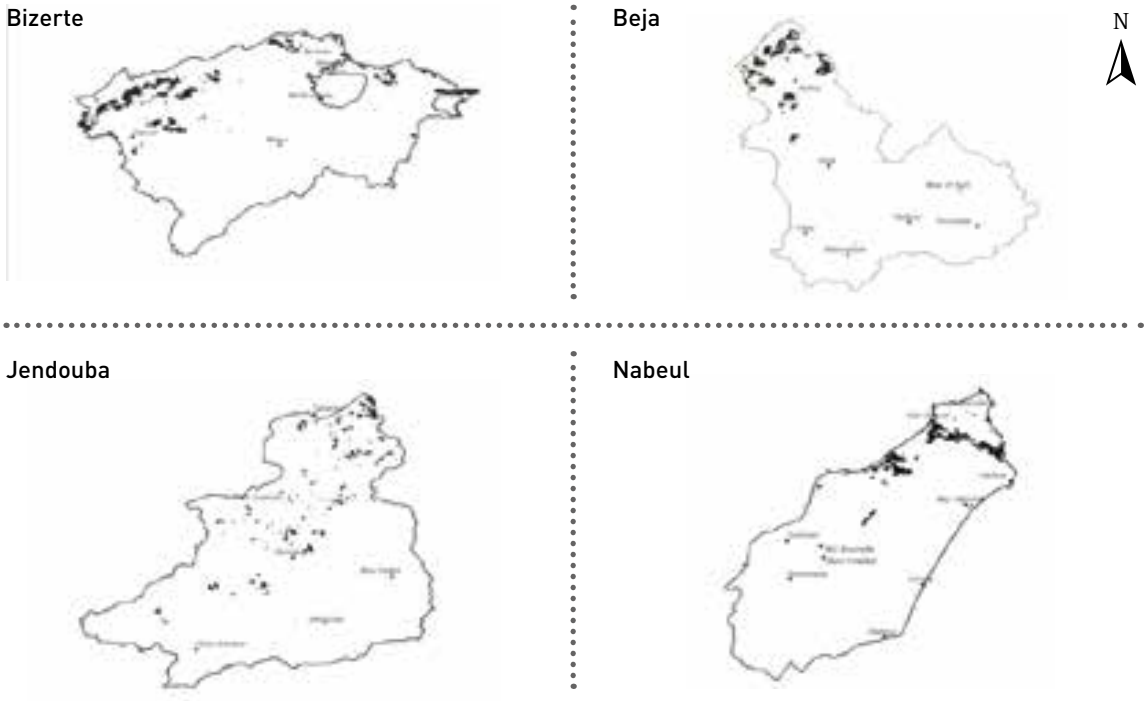
History and production distribution

The species was brought to Tunisia at the beginning of the 20th century, initially for dune fixation (Ouchtata 1904, Remel 1914, Dar Chichou 1925). Since then, because of its adaptability, hardiness and an increasing use in reforestation, the area covered by the tree has reached over 20 000 ha in pure stands and more than 4 000 ha in mixed stands. Because of their success, stone pine trees are now among the main species plantations in wet environments and sub-humid zones.

The distribution of this resource is illustrated in the maps (Beja, Jendouba, Nabeul and Bizerte) and is displayed by delegation and governorate for the two main regions in Table 8 (Khaldi, 2010).

Table 8. **Distribution of stone pine in two governorates: Beja and Jendouba**

	Region	Pure stands (ha)	Mixed stands (ha)	Total (ha)
BEJA	Nefza	4 787	208	4 995
	Amdoun	234	15	249
	Total	5 021	223	4 244
JENDOUBA	Tabarka	1 216	169	1 384
	Fernana	476	160	636
	Ain Draham	409	126	535
	Ghardimaou	212	79	291
	Jendouba	65	52	117
	Bousalem		99	99
	Total	2 377	665	3 042



Valorization of the product

In spite of the importance of wood production from stone pine trees, the provision of pine nuts has become the primary objective and target of forest populations. Demand for pine nuts has increased and as a result it has grown in value over the years. This increased demand and value has therefore led pine nuts to become more valued than wood production.

According to Khaldi (2009), average fruit production is as low as 647.6 kg/ha in Nefza and Tabarka and as high as 2 530 kg/ha in Ain Draham. The fruit to nut (without the shell) ratio is approximately 1 percent, so the yields vary between 6.56 kg/ha and 30 kg/ha. If we consider an average price of 20 TND/kg, the value of such a production is estimated at between 129.5 TND/ha and 506 TND/ha. Compared to wood production (25.9 TND/ha to 33.5 TND/ha), this is clearly more profitable.

Table 9. **Pine cone yields (Khaldi, 2010)**

Regions	Average cones/ha	Average cone weight (grams)	Average cone yield Kg/ha
Bizerte	6 968	212.4	1 479.8
Sejnane	8 136	248.2	1 940.3
Nefza-Tabarka	2 703	275.8	647.6
Ain Draham	8 066	313.7	2 530
Cap Bon	6 674	209.51	1 398

Besides the two major productions (wood and pine nuts), pine trees also offer two other productions, resin and bark. The latter is produced by recovering bark during the debarking of logs to use in the preparation of compost for raising seedlings. Like bark, seed hulls are also reused and the same also applies for unopened cones that are greatly used as a source of energy, including during the extraction chain of pine nuts.

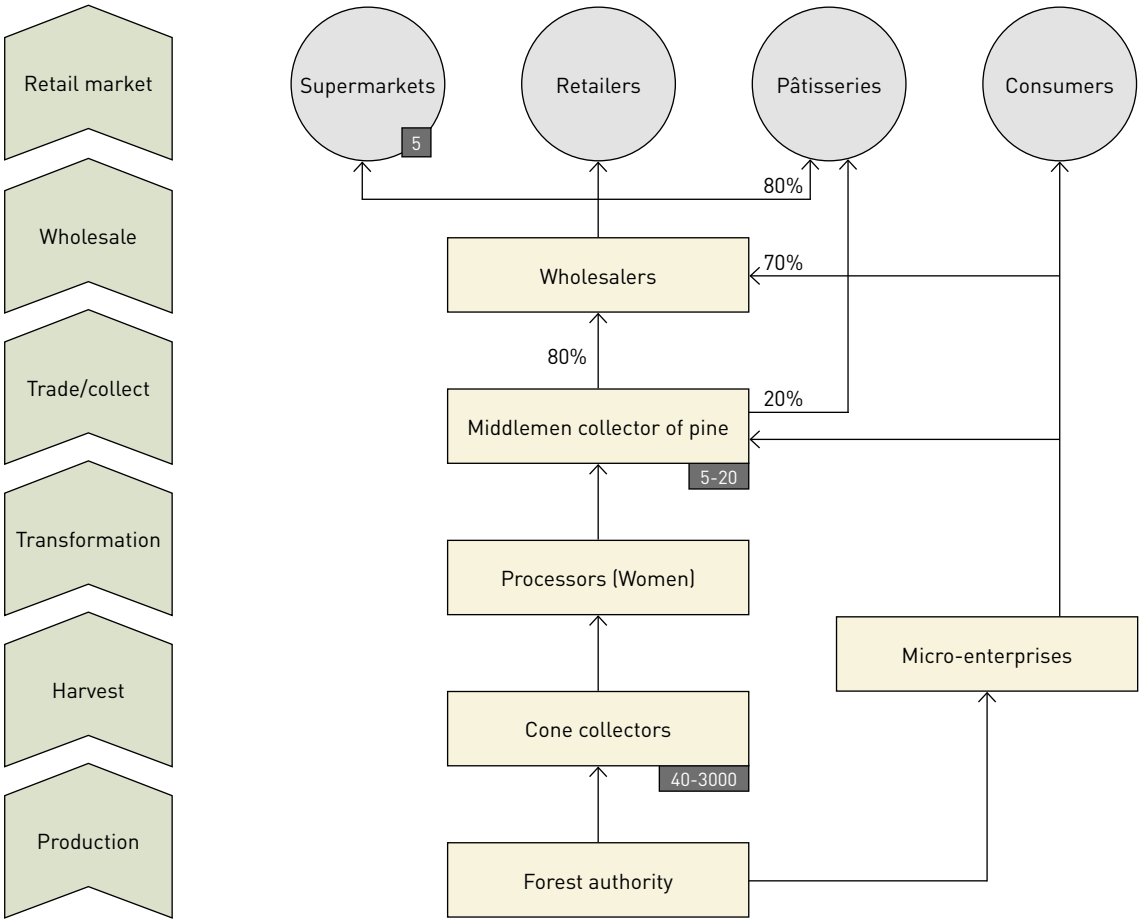
Markets: Structure, Conduct and Performance

The different production stages of pine nuts and the relative actors involved are described in Figure 14. This is a typical structure for a forest product in the absence of local/population-based enterprises. The value chain starts with the local population harvesting the pine cones (up to 3 000 collectors) and finishes with 5-20 middlemen selling the pine nuts to supermarkets and other retailers.

Harvesting:

Pine cones are “sold” by the Forest authority to collectors following a tender. In reality, part of the produce is collected illegally. The harvest of ripe cones is performed by local communities on behalf of the contractors (in the case of legal operation). The ripe cones can be harvested from October to April-May of the following year. However, most farmers begin to harvest the cones before maturity. Harvesting, which is a risky activity, is often done by children and young men.

Figure 14. **Value chain of stone pine**



Collection of cones:

Collecting cones is done by intermediaries from the region, which then process the cones further or sell them to other processors.

Drying:

Drying is done in the open air in heaps, or in warehouses where the cones remain until the following year. This is the case of ripe cones harvested in October. For immature cones harvested in August, they are immediately exposed to the sun for 1 to 2 weeks and then peeled.

Shelling and seed extraction:

Women usually take care of the shelling of cones and seeds. They generally work for the benefit of local wholesalers and are paid from March to April TND 3-4 for the first shelling of a bag of 25-30 kg of cones, and TND 12 for crushing a 30 kg container of seeds for the extraction of pine nuts. This takes maximum one week.

Collection of pine nuts:

This activity is practiced by intermediaries in the region that take pine nuts to sell them to domestic wholesalers or exporters. The collectors are well known in the region.

Distribution:

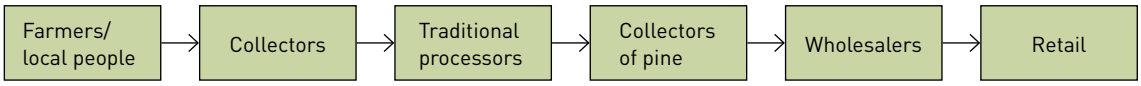
The distribution is carried out by national wholesalers based in big cities, who sell their products to retailers. As shown in Figure 14, the number of cone collectors varies from 40 to 3 000, whereas the number of middlemen is only 5 to20. This may result in marketing power created along the chain.

Market channels and marketing margins

As shown in Figure 14, the sale of the pine nuts follows three channels:

- Short circuit: Direct sales at home or on the roadside, from the local operator to the consumer;
- Average System: Operators - cone collectors - retailers/exporters;
- Long circuit: The cone operators sell to collectors who shell them and then sell to wholesalers. Operators work for themselves or are pre-financed by the collectors themselves, who are either pre-financed by wholesalers or working on their own account.

The marketing margin is at its highest at the processing stage (value added / processing costs) and then goes up by TND 10 in each step from pine collectors to wholesalers to retailers. The local population benefits in the steps that go from the first processing of the cones to the extraction of the seeds, but their benefits are restricted by a limited access to the resource.



Source : Dali, 2013

Trade and markets

China is the main world producer with 20 000 tonnes in 2011/2012. Russia produces 5 000 tonnes and Pakistan 4 000 tonnes. During the 2012/2013 season production in China declined by 90 percent due to fires and drought.

The largest importing countries are the USA (3 000 tonnes per year), China (2 481 tonnes per year), Germany (2 361 tonnes per year), Italy (965 tonnes per year). Global imports reached 13 297 tonnes in 2011. China has increased its imports by 87 percent since 2007 and has become a platform for the international trade of this product.

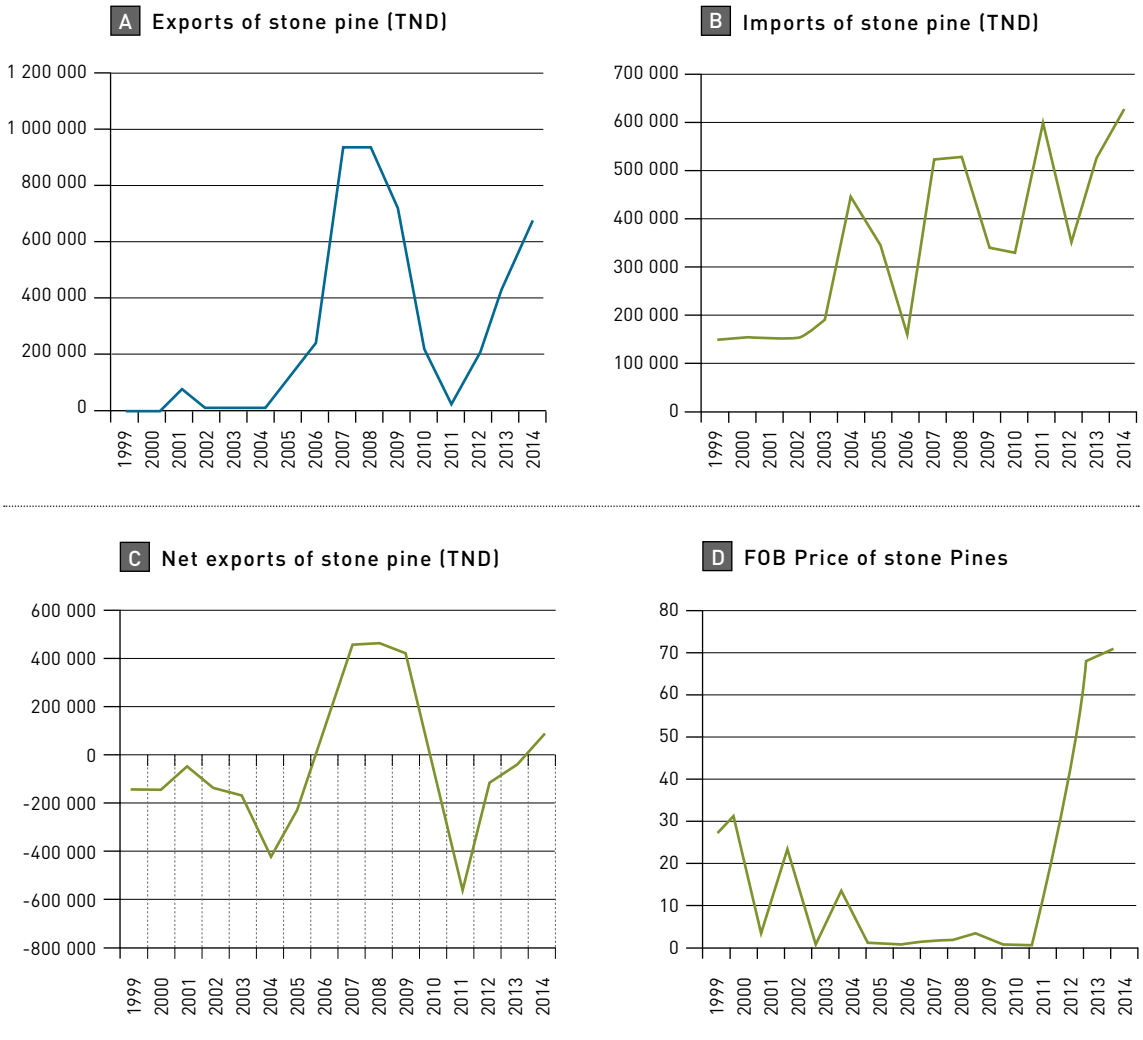
In Tunisia pine nuts are exported and imported. Figure 15 shows the evolution over the period 1999-2014 of exports, imports and FOB price. Exports peaked at a high of TND 1 million in 2008 and a low of TND 0.6 million in 2014, but imports are normally stable between these two peaks at TND 0.6 million (equivalent to US$ 0.35 million).

The Mediterranean market is largely lacking in pines, allowing Central Asian countries to sell their products from other pine varieties at very competitive prices. A better use of existing plantations could increase production volumes. This is a product that is sold at a high price and can thereby help to consistently improve incomes of the local populations.

Constraints to an increase of production and therefore to exports include:

- The absence of a development plan or a management plan to increase and improve management of pine nut production;
- The pine trees are harvested before the maturity of cones. This results in significant losses in quantity and quality;
- The production chain, exploitation and marketing of pine nuts is not organized;
- The local users do not have legal access to the resource and are not organized in user associations.

Figure 15. **Trade of Tunisian stone pine**



CHAPTER 6

Value chain analysis of Essential oil of Myrtle

Description of the tree and the fruit

The Myrtle (*Myrtus communis, Myrte,* الريحان).

The myrtle is considered by the DGF as a «strategic product». The plant is subject to tendering procedures (Article 18 of the Forestry Code) and requires strict conservation measures. Myrtle is the second most important distilled spontaneous plant in Tunisia. Currently only a small part of the tendered area (by the DGF) is contracted and harvested. In 2011, the area proposed for sale was 23 611 hectares, and only 13 800 ha (58 percent) were tendered. The total value is equivalent to TND 157 300 with an average price of 11.4 TND/ ha. In 2012, the tendered area fell to 25 percent; only 5 500 ha were tendered of the 23 000 ha on offer. Therefore, resources are available to be used if there are possibilities for sale.

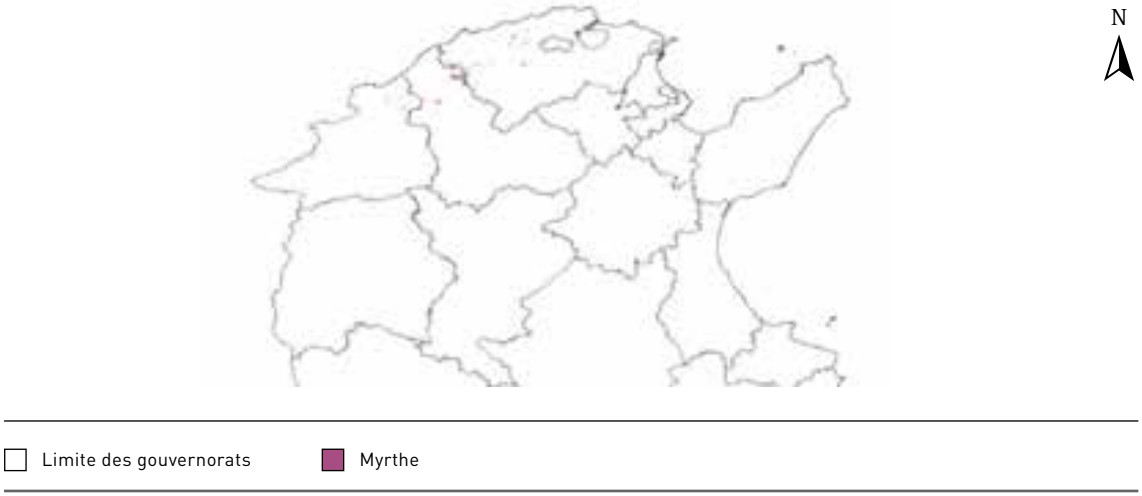
Myrtle (*Myrtus communis L.),* the only representative of myrtle in the Mediterranean basin, is a multi-stemmed shrub that grows upright and arches with age: it can reach 2 to 3 m, but usually remains in its bushy form not exceeding 1 m in height (see Picture 1 & 2 of Figure 16). It can live for 300 years, a considerable age for a shrub. Its fruits are oblong ellipsoid berries, 0.5 to 1 cm in diameter, that go from green to blackish blue in maturity, which is reached starting in September (Picture 3 & 4 of Figure 16). These fruits are edible, with a bitter and resinous flavor, and can remain on the plant well into winter.

Figure 16. **Myrtle plant and fruit**

Vegetation distribution

Myrtle plants are located in the Kroumirie-Mogods region. They are spread over an estimated area of 35 000 ha, located in four regions: Tabarka, Ain Draham and Fernana, Nefza, Sejenane and Ghezala. Note that the myrtle also exists in Cap Bon, but it is not used for distillation. Figure 17 shows the resource's distribution across the country.

Figure 17. **Geographic distribution of myrtle plants**



The total area covered by myrtle is estimated at 26 000 ha located primarily in Jendouba (55 percent), Beja (43 percent) and Bizerte (2 percent), as shown in the following table:

Table 10. **Importance and distribution of myrtle by region (2010)**

Region	Surface (ha)	%
Jendouba	14 300	55,00%
Beja	11 300	43,46%
Bizerte	400	1,54%
TOTAL	**26 000**	**100,00%**

Valorization of the product

All parts of the myrtle plant are used: the fresh or dried leaves, flower buds, open flowers, flowering branches, fresh fruits (for the preparation of a liqueur and jam) or dried roots and the bark. The leaves are harvested from May to September, leaving 1/3 to 2/3 of the foliage to avoid weakening the plant. The berries are harvested as soon as they acquire a dark color and become slightly soft to the touch.

Current regulations in Tunisia restrict the use of the myrtle plant to cutting branches that are to be used for distillation. Besides distillation, the myrtle is used for pasture and as a

honey resource. In recent years, the use of its branches in bouquets of flowers by florists of the capital, in particular, has continued to grow, while the use of its fruit was tested in preparations for export during the 1990s.

Its use as a resource for the production of essential oils makes it (with rosemary) an important forest species, which is cultivated for this sector in a regulated manner only for the extraction of essential oils, exclusively for export, mainly to countries of the EC.

Table 11. **Productivity of Mastic and Myrtle trees**

Station	Mastic Kg/ha	Myrtle Kg/ha
Bellif (Dmaien et Tbaba)	102,69	1 091
Tbaba (Oued Maaden)	138,74	1 883
Sidi Badr	61,34	401
Ouled Yahia	105,99	435

Source : Meliane, 2013

Markets: Structure, Conduct and Performance

The different production stages of myrtle and the associated actors are presented as follows:

Resource ownership and management: the resource is under the state's control and managed by the DG of forests, which identifies on a yearly basis the myrtle proposed for sale and exploitation.

Resource use rights and harvesting: the resource use rights are subject to a public tender organized by the Forestry Authority (Forest logging authority); harvesting is done by processing operators and businesses. The local population is used as workforce to collect the product. The population may also operate and harvest for local use on small territories as part of pilot projects.

Distillation/processing: this operation is also done by local associations and rural women in particular, either for their own benefit in the case of pilot projects or by the tendered operators and processing enterprises.

Marketing: this is done by distributors. There are seven companies (2012) involved in myrtle's local distribution and export (Abdelaziz Ben Belgacem, Mrobirtech Aromacha, Stolia, Essential oils, Ouhada, Herbs Tunisia, Carthago species).

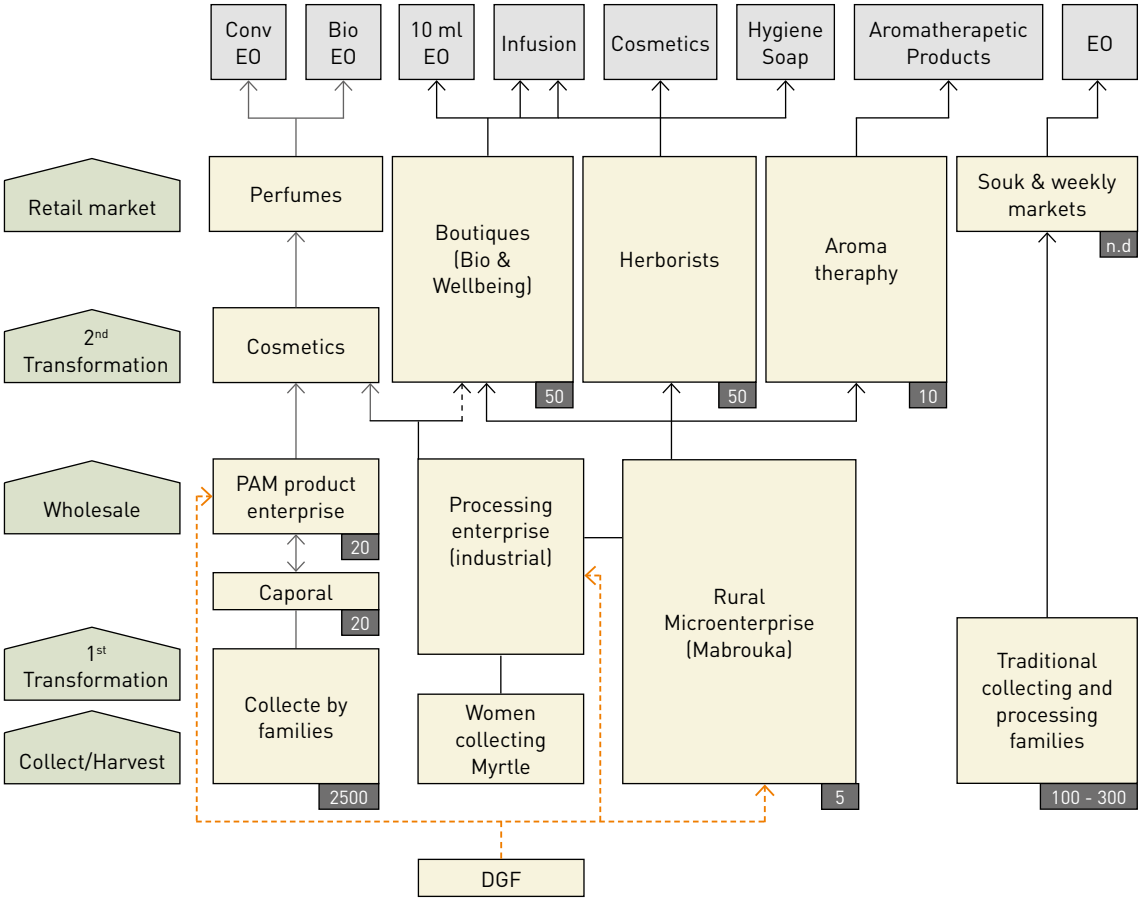
International market: the essential oil of myrtle remains a niche product both nationally and internationally. Myrtle consumption at local level is limited to rural areas with a market size estimated at 400-500 kg. Therefore practically all the production is exported.

The value of essential oils exports reached TND 632 654 in 2012 (INS). International market demand for the perfume industry, for cosmetics and aromatherapy, as well as herbal medicines, is increasing with an annual growth rate of 11 percent from EUR 19.5 billion in 2008 to EUR 32.9 billion in 2013 (BCC Research). The segment for the cosmetics and perfume industry market is not seeking organic products. This is more common in the food industry, but also

for aromatherapy. As a result, the market size for certified "organic" essential oil of myrtle is estimated at 100 kg.

The value chain is composed of different stages and operators: 2 500 families collecting the myrtle and selling it for processing (distillation) to aromatic and medicinal enterprises (20). There are families involved in distillation (100-300) that sell directly to consumers at the souk; and there are 5 microenterprises engaged in processing and selling to (50) organic product outlets, (50) boutiques selling aromatic plants, and 10 enterprises in aromatherapy.

Figure 18. **Value chain of myrtle essential oil (GTZ, 2014)**

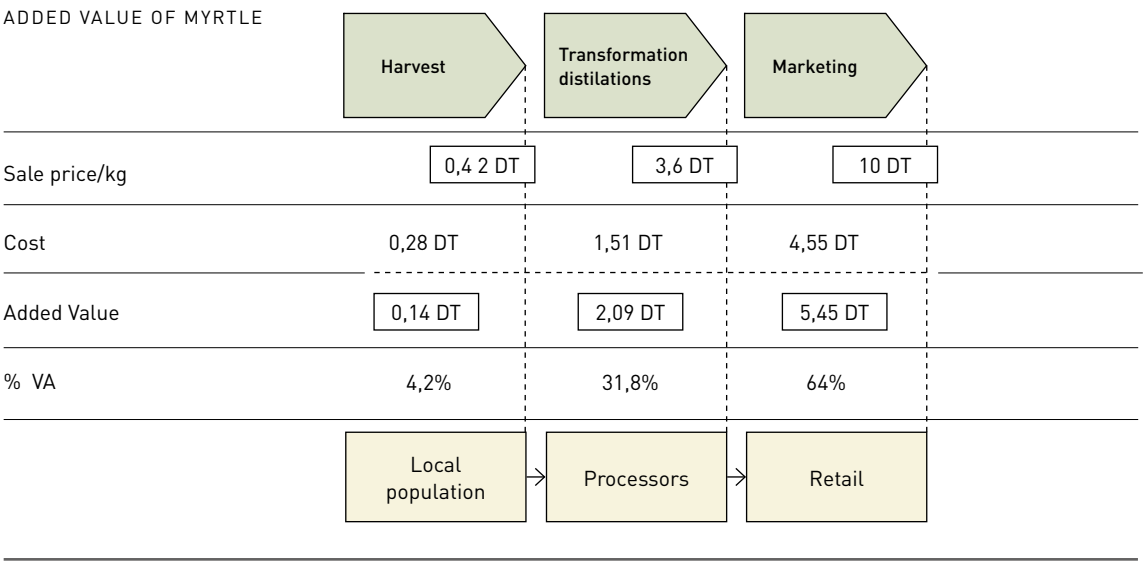


Value added

Figure 19 shows the value added per 10 ml bottle of essential oil of myrtle at the different stages of production and the value chain. At the collection stage, the value added is estimated at 4.2 percent. The gross margin per bottle is very low and is in the order of TND 0.14. The processors who are also selling as wholesalers have a gross margin 15 times higher, i.e. TND

2.09 per 10 ml bottle of essential oil of myrtle and an added value of about 31.8 percent. The added value and the most important gross margins are registered at retail level. This is mainly due to the bottling and the business/marketing environment. The added value is 64 percent and the gross margin is estimated at TND 5.45 per 10 ml bottle of essential oil of myrtle.

Figure 19. **Value chain and added value of myrtle essential oil**



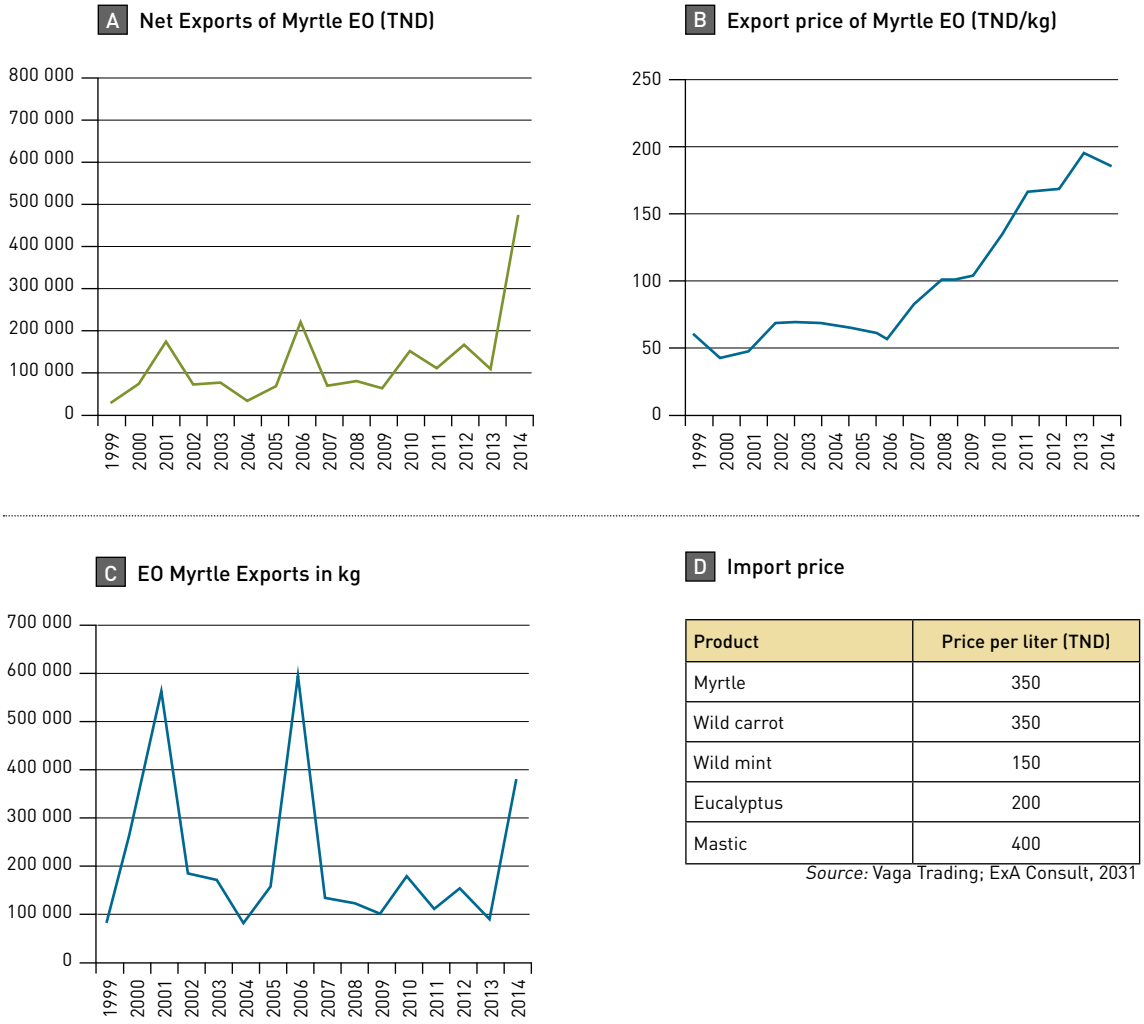
Trade and markets

The main countries importing myrtle essential oil are France (80 percent in 2007), Spain (9 percent), Switzerland (9 percent) and the USA (2 percent). Exporters often have long-standing business relations with clients from these countries, which require a steady supply and guaranteed quality. Exporters receive certificates of good practice from the Ministry of Agriculture and INORPI (the quality assurance standards institution in Tunisia). Export prices have increased from TND 55 in 2006 to TND 184 in 2014 (Table 11). A study by ExA Consult in 2013 indicated that the company Vaga Trading in France is offering TND 350 per liter of myrtle essential oil from Tunisia.

Potential for microenterprise development and gendered value chain

At present a women's association has started a microenterprise for myrtle essential oil processing and marketing in the Tebainya (Tbainia) region. This experience has been supported by a number of NGOs operating in the region. This is seen as gendered value chain development. The association aims to organize the use of forest resources by creating an association (GDA) of 51 members (6 of these will form the steering committee). The group has benefited from training and capacity building in the areas of distillation, administration, management and accounting. It has also engaged in marketing by creating the label "Kroumirie".

Figure 20. **Export volume and prices of myrtle EO**



D Import price

Product	Price per liter (TND)
Myrtle	350
Wild carrot	350
Wild mint	150
Eucalyptus	200
Mastic	400

Source: Vaga Trading; ExA Consult, 2031

Available information on production and costs regarding this local association of women forest users shows the potential and difficulties of such an activity (Daly, 2012).

- The export of myrtle essential oil by microenterprises seems difficult, given the prices on the international market, often below the cost of production, and due to requirements in terms of quality.
- Taking into account the results of previous experiences of local participation in the promotion of the product, the sale of quality products in small bottles is much more profitable.
- Microenterprises would benefit from strategic alliances by establishing direct contact with key distributors.
- Pharmaceutical companies and specialty stores show strong potential as outlets. Signing long-term supply contracts and strategic alliances by direct contact between actors and participation in trade forums seems effective.

Constraints for microenterprise development include (ExA Consult):

- Conditions of access to unsecured business resources (reducing their motivation to invest), and not conducive to the involvement of users and companies in the sustainable management of resources.
- The inadequacy of distillation techniques (equipment, distillation process, decanting, filtration and storage of oil), hence the amount of losses and the low quality of produced oil;
- The regularity of production of oils in terms of quantity and quality demanded by the world market (lack of local references developed by the research);
- Unprofessional companies engaged in the sector (lack of training, lack of supervision and technical support, lack of knowledge of the market, lack of involvement of businesses and users in the management of groundwater, inadequate legislation to resource access, lack of organization to face the competition of the world market).

Data collected at Tebainia GDA on production costs and returns (Daly, 2012)

- Activity coordinated by ATLAS (NGO) which receives in turn 10 percent as management fees
- Cost of harvest: 10 TND for 100 kg
- Capacity of alembic: 60 kg
- Distillation done by 2 workers paid after sale of product
- One bottle of gaz is needed for 2 alembics
- 100 kg of Myrtle is needed to produce 0.2 liter during July/August and 0.04 liter in September. Same quantity produces 0.5 Liter of eucalyptus essential oil or Cyprus.
- Production of last season: 3 liters of eucalyptus EO
- Production cost was estimated to 35 TND / 250 ml of myrtle EO in 2008 and 17.5 TND / 250 ml of Eucalyptus and 20 TND / 250 ml of Cyprus EO.
- Distillation produces 5 liters of floral water which is used to make soap. This sells for 4 TND the piece,
- The price of EO from Eucalyptus is 100 to 160 TND/kg, Myrtle EO: 170 TND/kg minimum.
- Distillation produces 5 liters of floral water which serves the production of soap. This sells at 4 TND the piece.
- Price of floral water is 8 TND for the one liter bottle.

CHAPTER 7

Value chain analysis of Essential oil of Mastic

Description of the plant and the fruit

The mastic tree (*Pistacia lentiscus L., arbre au mastic, or Pistachier lentisque,* الذرو).

The mastic tree is an evergreen shrub that can reach 3 m of height with smooth gray bark. The fruits are small red rounded drupes, which then turn black, containing an identical-shaped seed to the pistachio. Fruits grow in clusters: they are found on the female plants and they measure 4 to 5 mm in diameter, maturing in September-October, when they turn dark and shiny, lasting into winter.

Figure 21. **Mastic plant and fruits**

In Tunisia the cover area of mastic plants is estimated at about 69 000 ha. The habitat of the plant is northern and central Tunisia, the Kroumirie Mogods, but also the great majority of the Dorsal, Cap Bon and even the coast of the Sahel (Enfidha Chebba). Similar to the myrtle plant, its distribution is limited to humid, sub-humid and upper semi-arid agro-climatic zones (Figure 22).

Figure 22. **Geographic distribution of mastic plants**

Valorization of the product

Mastic has multiple uses:

- The leaves or leafy twigs are used for two purposes: distillation of the essential oil that mastic produces, which is not very common in the country, despite the fact that this has been experienced, and floral bouquets selling, that has started in recent years to give rise to operating rights on mastic twigs in areas sold by auction.
- Fruits contain fixed oil that is traditionally extracted by crushing and decanting the ground material mixed with warm water; it is already practiced, especially since this oil was used for lighting, as food and to make soap, and it is still traditionally used against liver diseases, for dermatological disorders, burns and injuries, for the treatment of cough and asthma, and diarrhea; research on its therapeutic properties is underway, as part of an ongoing doctorate.
- Seeds that contain fruits, similar to pistachios, have a nutritional value and are edible. They are sent to eastern Algeria, for the preparation of a popular dish.

- The resin obtained by cutting into the bark has been used in the past simply chewed to scent the mouth; chewing it has proved effective in fighting stomach ulcers. Indeed, its effectiveness against the *Helicobacter pylori* bacteria has recently been verified and confirmed by several scientific studies. This use is not known in the country, and this function remains very limited.

Areas covered by the mastic plants with a density of 600-900 plants /ha and a sex ratio of 10-20 percent of males, have a biovolume and a biomass, compared to the myrtle plant, that is indicated in the table below.

Table 12. **Cover, average biovolume and dry biomass of myrtle and mastic**

	Cover (m^2/ha)	Biovolume (m^3/ha)	Biomass (Kg/ha)
Myrtus communis	1 000	1 340	931
Pistacia lentiscus	653	1 087	1 032

The yield resulting from the distillation of essential oil of mastic is given in Table 12 (liter per tonne of mastic material).

Table 13. **Oil yield from female and male mastic material**

	Female material		Male material	
	humidity	Essence (l/t)	humidity	Essence (l/t)
Un-milled fresh material	60	1,22	54	1
Milled fresh material	60	1,25	54	0,75
4 days milled material	29	1,2	45	0,4
6 days milled material	22	1,1	27	0,9

Markets: Structure, Conduct and Performance

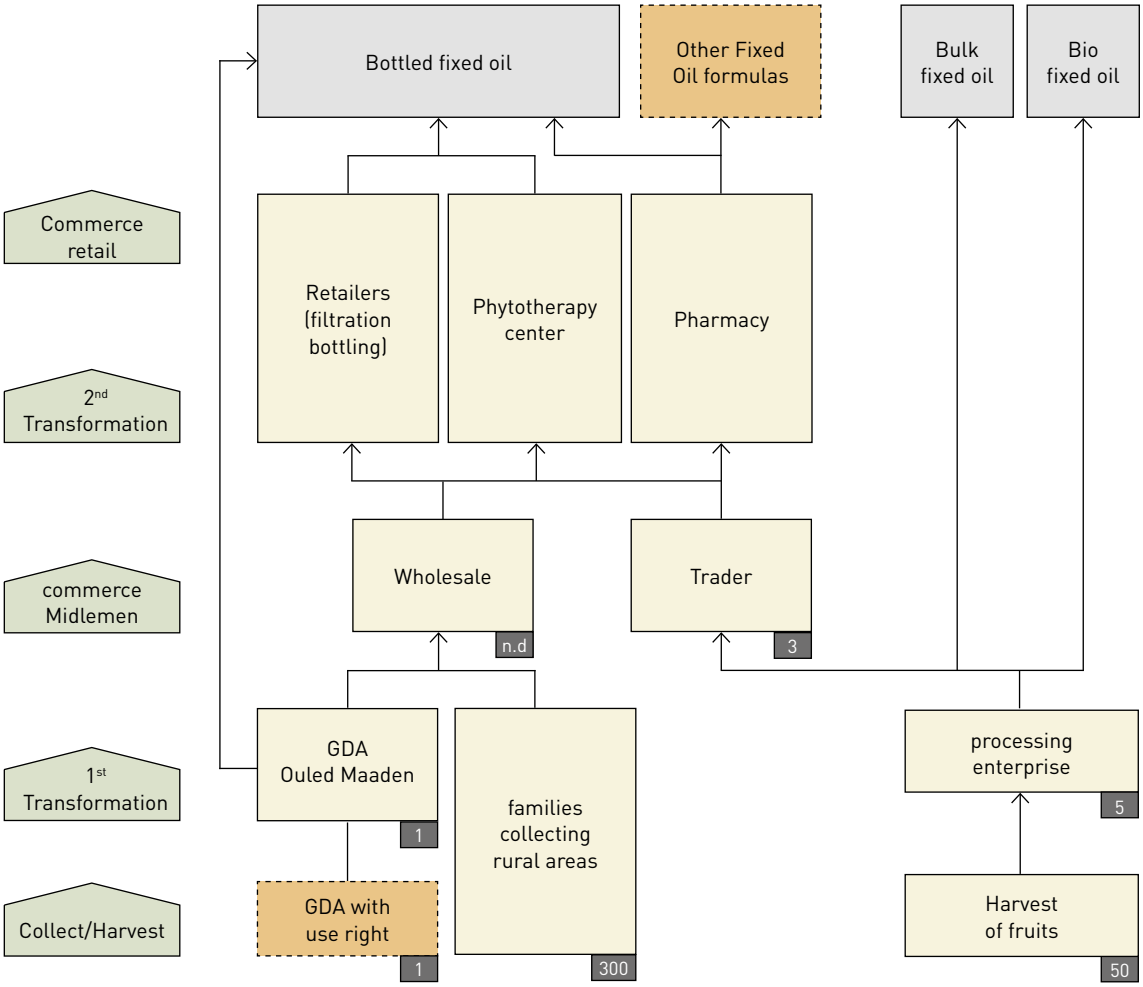
The structure of the chain is similar to that of the myrtle one. It is composed of harvesting, first transformation, middlemen, 2nd transformation and retail market. The collection/harvest is done by local families (300 families), one GDA and 50 fruit harvesters. The only user association with legal authorization is GDA Oued Maaden in the region of Nefza. The mastic collected at this stage is processed at the local level and sold wholesale to merchants (3 of them). At this stage the mastic product is further processed for filtration and bottling, by phytotherapy centers and pharmacies. These latter operators sell the product retail.

The organization of the different stages of production and related actors are presented as follows:

Management of the resource and harvest

In the case of mastic fixed oil, there is no legal framework which regulates the fruit harvest. Families that harvest mastic plants are considered users who perform this practice for their personal needs exclusively, according to Article 35 of the Forestry Code. Harvesting the mastic plant fruit is usually performed by rural women.

Figure 23. **Value chain of mastic essential oil (DGF-GIZ, 2014)**



As mentioned before, a women's associations (Tbainya int Oued Maaden) have had "formal access" to the resource as a pilot enterprise and is therefore operating distillation units, which are supported by an NGO all along the chain.

Processing/Distillation

The processing involves transforming the oil of fruits. Operators are the rural women producers of mastic fixed oil. This extraction is done over three months of the year (November to January). There are two processing techniques.

The traditional extraction technique is the most common model in Tunisian forest areas. Women use an extraction method that they have inherited from their mothers. In this way a woman is capable of producing an average of 64 lt of oil per year. This relatively low production is a direct result of the arduous and slow traditional extraction processes.

Women sell their product to consumers who come to their home for their supplies, to small shops that exist in the area or to jobbers who play the role of intermediaries.

The sale price varies between TND 15, if the woman is selling her oil to middlemen, and TND 35 if it is sold directly to the consumer. This low selling prices is due to the low quality of the extracted oil (caused by repeated exposure to fire during extraction) and the packaging that is used is not usually suitable for the sale of edible oil. These women generate turnovers of TND 1 000-2 200 per year.

The "improved process" was developed at a research institution, the INRGREF (IDRC project). Experiments were conducted to test different extraction methods and their effect on the yield and on the quality of the oil extracted. The improved method has raised the quality and efficiency by 40 percent compared to the traditional method, and more than 12 training sessions have been held to train rural women.

Wholesale

Wholesale involves the operations of purchasing the oil product in bulk, storage and wholesale marketing. Suppliers are the women producing the oil that sell their product throughout the season in small quantities ranging between 1 and 5 liters.

Customers are generally small traders of the souks in Tunis. The marketing of oil is performed only during the extraction season that lasts three months of the year. The amount of oil sold to retailers is 15 liters per shop per year.

The purchase price among women is between TND 12 and 15/lt and the sale price in Tunisia is around TND 25/lt. The price difference is between TND 10 and 13/lt. On average, the margin does not exceed 6 percent.

Retail market

At this level of the value chain, small traders can be distinguished between the souks and some pharmacies. Operations performed at this level are usually the filtering and bottling of the oil.

Small traders in the souks buy the mastic fixed oil from wholesalers. The average amount purchased per year is 15 liters per trader. The purchase price is TND 25/lt. The oil is divided into small bottles of 30 ml. Sold at TND 5 per bottle, the price of a liter of oil can reach TND 160. Throughout the year the gross profit margin of the trader is estimated TND 1 775.

In pharmacies, the sale of mastic fixed oil takes place in 100 ml bottles at a price that varies between TND 30 and TND 40 per bottle.

Margins, Costs and benefits

Besides the packaging, the high retail price is also due to the good quality of the extracted oil. This high quality is primarily due to a lack of direct contact with fire during extraction.

The income for these women is around TND 9 750 per year. The leftovers from extraction are sold at a rate of TND 1 200 and used as farm compost. The total return from extraction of the fixed oil mastic is in this case equal to TND 10 950.

Production costs are higher compared to the traditional method. Women use sophisticated equipment to extract the mastic fixed oil. The investment for the mill and the press is about TND 4 000. The depreciation cost calculated over 10 years is TND 400.

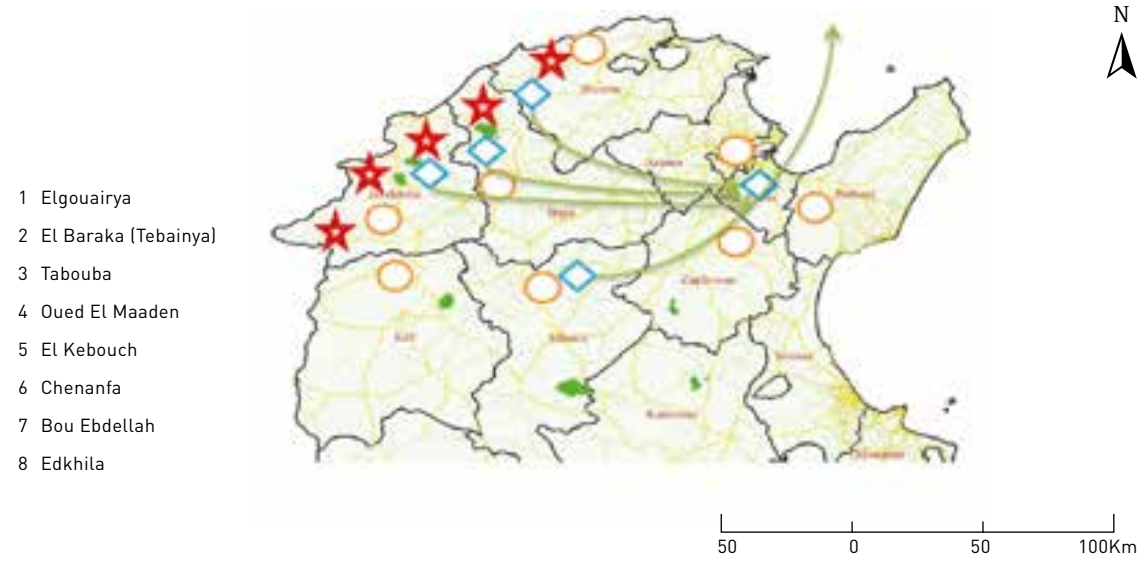
In general, production costs have been estimated at about TND 770. In this case, the annual gross margin is estimated at TND 10 180. This high profit margin contributes significantly to improving the living conditions of rural women. The revenues generated from this activity could help in the development of other activities such as the micro-rearing of hens.

Market channels and marketing margins

Figure 24 shows the points of harvest/processing and the different market channels. The product is mainly sold and consumed in the region of production, where the local people are acquainted with the product. Only one point of sale is located in the capital area.

At the transformation stage, also called production, added value is estimated at 9.38 percent. In this case the gross margin per liter is in the range of 10 TND /lt of oil. These are processors that use the traditional method following this circuit to market their product. The jobber has a gross margin of TND 21/ lt, which corresponds to a margin of around 6.25 percent. The added value and the largest gross margin are recorded at retail trade level. This is mainly due to the appropriate bottling of oil. The added value can reach 84.38 percent and the gross margin is estimated at TND 74.67/ lt.

Figure 24. **Marketing channels of mastic essential oil**



Trade: the case of the mastic twig product

The branches of mastic plant (twigs) are recognized internationally. Mastic twigs are used for the decoration of flowers and for the making of decorative crowns.

Figure 25. **Mastic flower bouquet for export**

International demand for mastic plant branches is increasing. This demand extends throughout the year for the branches used in bouquets of flowers, and especially in the Christmas period. The export is mainly directed to the Netherlands, which is the hub for transportation to countries of the European Union.

Table 14. **Production of mastic branches**

Year	Area tendered (ha)	Area (Qty) sold (ha)	Price (TND)	%	Aver price (TND/ha)
2010	39 169	36 511	182 820	93%	5 007
2011	35 970	13 736	68 830	38%	5 011
2012	24 500	15 200	127 100	62%	8 362
2013	18 227	10 865	137 350	60%	12 642
2014	21 059	10 664	102 310	51%	9 594

CHAPTER 8

Potential for improvement and microenterprise creation

The recommendations to enhance NWFPs enterprises are directly derived from the analysis of the various value chains. These recommendations are also based on (reference made to) the **FAO expert meeting on "creating an enabling environment for the sustainable development of community-based forest enterprises in Africa" held in Douala-Cameroon in November 2015. These include:**

1. Creating enabling institutional settings and mobilizing funds for the development of Small and Medium-sized Foresty Enterprises (SMFEs);
2. Create a favorable legal/regulatory setting by moving from informality to formal businesses;
3. The development of SMFEs faces problem of leadership in the advocacy and promotion of enterprise development policies and activities both at the national and local levels, including at the level of development partners;
4. From the technical stand point, constraints to the development of SMFEs include the varying sizes of community forests, a narrowly focused products base, lack of norms and standards;
5. One of the most important impediment to the development of SMFEs is the availability and access to financial resources, either from own sources, credit institutions or development agencies;
6. Marketing knowledge is supposed to be at the disposal of producers to enable them identify market opportunities in the form of market needs and wants, analyze competition and know market potentials, and develop appropriate approaches to reach the markets and to make profit;
7. On the institutional setting, many local forest products producers are dispersed and unorganized to tap into the advantage of pooling resources together for easier access to markets, information, common processing equipment and increased bargaining power;
8. Weak technological innovations and consequent possible poor quality products. Rural people generally do not have enough finances to invest in product development technologies such as better processing tools;
9. At the policy making level, there is general lack of incentive measures on the part of most governments in Africa that favor the development of SMFEs. This is compounded by the absence of synergies among sector ministries.

Based on this report, we summarize the main issues related to NWFP value chain development with regard to **the enabling environment** in Tunisia as follows:

Legislation and policy:

A new strategy has been recently issued (2014) for the development and management of forests and range lands up until 2024. The new vision puts forward the interests of the social and economic wellbeing of the local populations. It is useful to provide and highlight some pillars of such a strategy as related to NWFP development:

- Create an environment conducive to sustainable development of forests and rangelands (Axis I)
- Securing sustainable added value of forest and rangeland resources (Axis II)

These two axis ensure all measures (legal, institutional and policies) are put in place to promote the development of value added activities and enhance population involvement and wellbeing.

At present, land tenure status of public forests is rather complex (Daly, 2013). Only 58 percent of all State owned lands - forests and rangelands included - are actually titled properties with clear boundaries.

Regardless of land tenure status, regional administrations at district levels are in charge of protecting forests from user damage. In addition to surveillance and policing, decentralized forest administrations are also responsible for the implementation of long-term forest management plans.

Tunisian forest policy is based on the 1959 Forest Code. The protection of forests was enforced, banning clearing and cultivation, and reforestation programs were developed for job creation. Further amendments to the Forest Code were made in 1988 aiming at the participation of local populations in the management of forest resources. According to the Tunisian Forest Code, the management and use of private forests must abide by all forest laws and regulations. The shift towards a greater involvement of forest users to forest management was promoted in 1996 with the legal creation of 'Common Interest Forest Associations', in which members are consulted and directly involved as full partners in all forest development plans and operations.

Institutions:

Besides the General Directorate of forests, the institutional setting is composed of a number of institutions to support and promote value added activities and microenterprises. Among these institution we want to cite: CEPEX for the promotion of exports; NGOs (ex. ENDA) providing micro-finance; INNORPI in terms of quality and product standards needed to overcome export barriers; and other government bodies, such as ODESYPANO and APIA providing capacity building, fiscal and financial benefits, etc. (see below):

Institution	Responsibility/Support
CEPEX	**Centre de Promotion des Exportation:** • Enterprise coaching • Information and prospection • Provide access to export promotion funds • Support participation in international fairs and B2B
ENDA	**NGO** • Provides loans to micro-projects • Provides support to business plan development, training and finance education • Facilitation between microenterprises and banks
INNORPI	**Institut National de Normalisation et de la propriété intellectuelle** • Diffusion of Tunisian (and international) standards • Information system on standards • Training on quality • Identification of risks, audit
ODESYPANO	**Office de développement sylvopastoral du Nord-Ouest** • Support the creation of rural enterprises • Coaching to entrepreneurs • Contribution to management plans of forest value chains
APIA	**Agence de promotion des investissement agricoles** • Provides fiscal and financial benefits, including import of equipments • Supports the establishment of microenterprises

Based on our analysis, integrating poverty and job creation concerns of local forest users in the value chain could be enhanced though:

- access to the resource by the population and their associations
- access to the market through fair insertion into value chains
- improved techniques including:
  - certification for organic (bio) standard products
  - New chain functions (grading, packaging etc.) at local level

Other means for improvement were identified by stakeholders during workshops organized during the study of NWFPs (FAO-MA-TCP/TUN/3304):

- improved extraction process
- supervision and training on quality of product
- training on marketing and access to the market

In this section we present some recommendations based on all the above with regards to:

- improving production and quality **at the harvest and processing stages**
- improving **marketing and market performance** with the aim of improving economic benefits
- enhancing **value addition** and product quality in the sector; engaging with research and valorization of bio-resources initiatives
- strengthening the **role of forest users** and rural communities
- key **policy and legislative reforms** to improve income of small producers and forest users

1. Harvest and processing

According to local populations, the recommendations are summarized as follows.

For myrtle:

- To improve the quality of EO, the establishment of a laboratory associated with government departments or other concerned associations that can handle the required analysis for rural microenterprises.
- Allocate an area of up to 20 percent of the total area available to rural families at a fair price and with no competition from other larger enterprises.
- Promote NWFPs as natural products among the general public in order to stimulate the local consumption.
- Develop a product label to indicate that the product originates from Tunisian forests, similar to organic certification.

For mastic fixed essential oil:

- To provide training on the extraction, packaging and quality of mastic fixed oil.
- Provide financial support to acquire needed equipment.
- Support producers to analyze/certify their oil.
- Creating a local label.
- Create platforms for public-private dialogue.
- Organize the use of mastic plant branches in areas where fruit harvest takes place.

For branches of mastic:

- Identify good harvesting techniques for twigs and develop specifications.
- Use special tools to avoid damaging shrubs.

2. Enhancing value added

Valorization of these bio-resources requires an engagement with research at national level and cooperation at regional and international levels. Existing initiatives include SATREPS, a joint project between Tunisian and Japanese research centers. Results show the potential to develop products based on olives and other plants that have anti-oxidant, anti-cancer and anti-allergy properties (see box below).

Amazing functional components of arid land plants

We have identified plants and functional plant components from olive and medicinal plants found in Tunisia that have anti-oxidant, anti-cancer and anti-allergy properties. We are trying to find their practical industrial application through water and soil related production base improvements, economic feasibility studies and production technology development. Through our research, we aim to be able to contribute to the development of a sustainable food resources distribution system and prevention of desertification worldwide.

Figure 26. **Conducting plant survey to estimate the density of useful plant resources**

Figure 27. **SATREPS project**

We analyze not only the properties of extracted components in detail, but we also engage in the development of useful methods for extraction and identification of the functional plant components and their evaluation at the genetic level.

Source: ISODA Hiroko, Valorization of Bio-resources in Semi-Arid and Arid Lands, University of Tsukuba
http://www.jst.go.jp/global/english/kadai/h2105_tunisia.html

3. Product quality

Every product creates its own image thanks to its quality, packaging, labeling, trade mark, design, etc. Product quality is the ability to satisfy the expectation of the users. It generates customer loyalty, attracts new customers or new segments, constructs an image of quality and seriousness, and positions the brand compared to competing products.

The label is the product's ID. It is a legal obligation for all products. It satisfies the consumer's information needs and facilitates their choice. According to Tunisian standards, a label should be affixed to the packaging and it must specify the name of the product, the geographical origin, the capacity or the net weight, the name and address of the operator, the date of harvest, storage instructions, lot identification and the composition.

Regularity of supply is another critical issue. The problem of access to the market has resulted in a production that ignores the demand. Regular production helps retain customers, but it should explore markets well in advance to prepare for the production.

The small quantities produced cannot compete with large-scale productions of export enterprises for a long time. It is therefore important to adopt a differentiation strategy for organic products. Continuity of supply is very important for international importers and intermediaries.

4. Legislative reforms to strengthen forest users

Analysis of the legal texts governing the exploitation of forest resources and the various stakeholders in the forestry sector (local user organizations, businesses) shows no crucial institutional problems, except for the status of forest user associations which does not allow for income-generating activities, in particular with the dividend ban. Indeed, incentives set for institutions operating in the forest are of great importance: however, forest law seems to favor large investors over users of forests and small investors acting individually or as small business due to the rule of selling forest produce by public tender.

Given these constraints, it seems reasonable to proceed with a change to forest legislation regarding the sale of these products in order to establish positive discrimination rules to the benefit of SMFEs and user associations in forest areas by allowing them flexible access to forest resources for a reasonable percentage, without compromising the operators of forest products, which would remain dependent on participation in public auctions (see FAO-Ministere de l'Agriculture-TCP/TUN/3304).

5. Markets and marketing

Microenterprises need assistance in marketing their products on the national market and particularly for potential sales to tourists in the country. They need assistance to access existing distribution channels (regional and national fairs, specialized shops, bazaars,

businesses, pharmacies) and to create new distribution channels (shops in hotels and parks). The assistance is required to enable them to differentiate their products and capture a segment of the tourism trade.

It should be noted that Tunisia has developed a support program for export, with the aid of the Access Fund of Export Markets (FAMEX). This fund provides technical assistance for export, financial support for prospecting markets (participation in fairs, advertising) (70 percent subsidy for user associations), and training on the international market.

There is a lack of consumer and consumption studies, at the national level and of international markets. These studies would boost the marketing of these products mainly in the export markets. Products from forests are mostly known and consumed in the local and surrounding market. Therefore it would be recommendable to conduct consumer studies, which take into account awareness, use and willingness to pay for value added products. These studies are also needed in potential international markets to investigate the potential demand and the requirement of these markets.

Conclusions

The rationale of the study of NWFPs is to improve the livelihoods of local rural communities living within the forests. The aim of the study concerns the promotion of small and medium enterprises exploiting the state's forest products in order to contribute towards creating jobs in disadvantaged forest governorates.

NWFP contribute significantly to the national economy (0.33 percent to agricultural GDP and 0.025 percent to National GDP), to the forest/local populations (32.3 percent of their total revenue) and to the protection of the environment (reduced sedimentation and carbon sequestration). The selection of NWFPs examined in this study was based on micro level (population perceptions and preferences) and macro level (contribution to income and exports) considerations; based on these indicators, the four products assessed are: myrtle, mastic, stone pine and Aleppo pine. These products have been examined in previous studies to explore their potential to develop value chains and improve the livelihoods of the concerned populations.

In the various value chains, the local populations and associations play a crucial role in the collection and (first) transformation or processing of the products, but they are only marginally integrated in the chain given the status of the resources and legal access issues, as well as other constraints.

The various value chains showed some common characteristics:

- an important natural resource base, existence of local expertise in harvest, post-harvest and distillation processes, and a market potential both nationally and internationally.
- major weaknesses derive from the problem of access to the resource by small enterprises, market and marketing research and lack of appropriate equipment and technologies.
- there are however promising opportunities, such as the reform of the Forestry Code, which would allow better and legal access by local populations to the resource and as a result the development of rural microenterprises.

Among the four value chains, myrtle has strong potential. There is a pilot microenterprise run by a women's association in Tbainya which has received substantial support from NGOs including financial support. The members of the association have had training in distillation and management of the oil extraction business. They also participated in national and international fairs to market their produce. Myrtle is known as a traditional oil product that has proven interesting virtues including antioxidant properties and as a result is known as a medicinal product. For these characteristics this product and its value chain have strong potential for job and income generation.

The policy, legal and institutional setup as embedded in the new strategy and the existing initiatives is in favor of rural microenterprises:

- Create an environment conducive to sustainable development of forests and rangelands (Axis I)
- Secure sustainable added value of forest and rangeland resources (Axis II)

A number of institutions are supporting such activities; these include NGOs providing micro-finance to support the creation of jobs in rural forest areas, and government bodies in charge of coaching and training in relevant areas as needed by such initiatives.

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APPENDIX 1

SWOT Analysis

Table 15. **Myrtle value chain**

Strengths	Weaknesses
• Local expertise of harvest, post-harvest and distillation processes • Knowledge of the resource and its distribution • Local population masters of collection techniques • Interesting export market and price • Interesting national market price • Important natural resource in terms of economic value	• Low performance and lack of equipment • Lack of hygiene in working environment • Low awareness of scientific-based benefits of the plant • Labeling and Packaging • Unstable production (by rural microenterprises) • Problem of access to the myrtle resource • Lack of knowledge of the market
Opportunities	**Threats**
• Labeling of the product Kroumirie • Optimization of the distillation process • Marketing nationally • Reform of the Forestry Code in favor of rural microenterprises • Management Plan to improve use	• Overuse • Deforestation, fires • Overgrazing

Table16. Aleppo **pine (Zgougou) value chain**

Strengths	Weaknesses
• Important income source • Job creation • Importance to the local economy in Aleppo pine basins • Good image of "zgougou" products on the national market • Diversified products • Unsaturated market	• Improper forestry production • Interest in wood for DGF until recently • Lack of control (forest service and Regional Department of Commerce) • Lack of a monitoring & evaluation system and valid statistics on quantities harvested, processed, stored and marketed • The consultation system ignores small enterprises and local families • Limited research in the valuation of the resource • Low rate of managed forest (Aleppo pine)
Opportunities	**Threats**
• Creating new products based on "zgougou" for the domestic market: juice, etc. and for the international market, such as vegetable oil from "zgougou" • Upgrading extraction processes • Profitability of plantations for production of seeds (areas of the state and private) • Reform of the Forest Code in sight	• Overexploitation of cones • Deforestation, fires • Parasitic attack

Table 17. **Mastic value chain**

Strengths	Weaknesses
• Income source • Important therapeutic properties • Unsaturated market	• Lack of control/over use • Quality of uncontrolled product • Lack of market knowledge • Level of consumer knowledge (what to buy, product quality, how to buy...) • Lack of enforcement of regulations
Opportunities	**Threats**
• Improved extraction methods and equipment • Designation of a new local (Geographic indication) product label • Better knowledge of the product on the market	• Exploitation of the mastic plant (of branches)

Table 18. **Stone pine value chain**

Strengths	Weaknesses
• Source of income • Job creation • Importance for the local economy • Good image of the product on the market • Unsaturated market	• Current regulations prohibitive to the enhancement of the product • Absence of monitoring devices • Lack of visibility (national and international) • Poor access to financial resources • Lack of public-private dialogue
Opportunities	**Threats**
• Professionalization of actors • Upgrading of traditional processing methods • Creating a local product label • Creating platforms for public-private dialogue • Interest for more plantations in the forestry sector and among private entrepreneurs	• Over-exploitation of pine • Deforestation, fires, diseases • Illegal business operations throughout the chain

APPENDIX 2

National statistics

Figure 28. **Stats of rosemary**

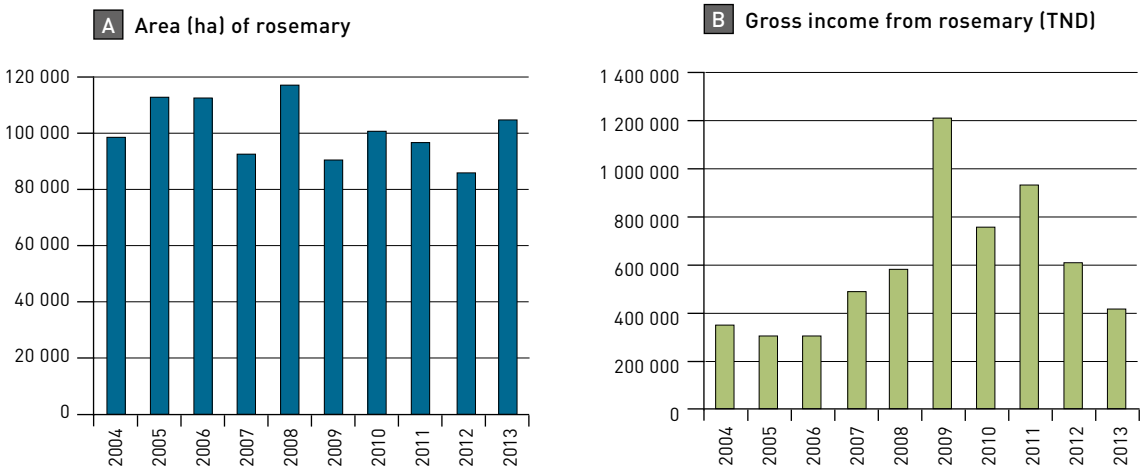

Figure 29. **Stats of myrtle**

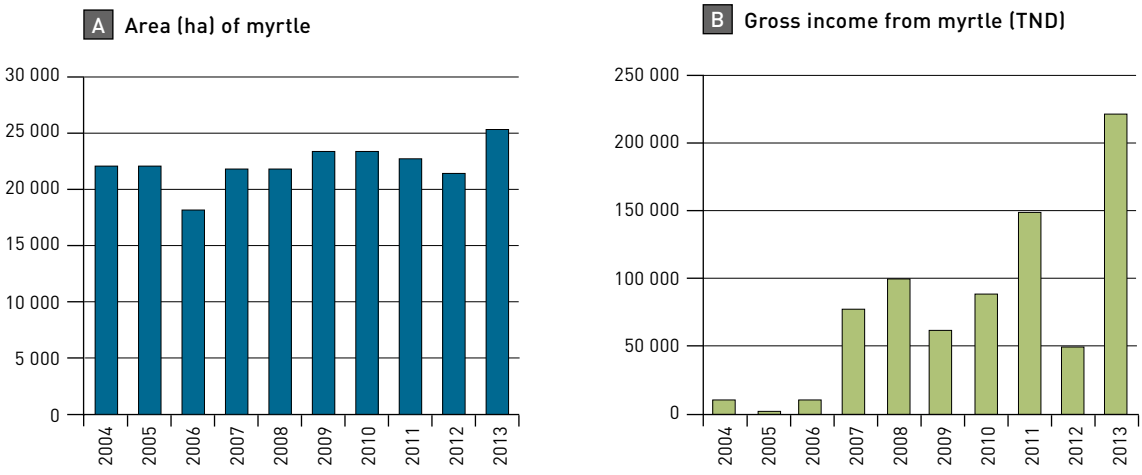

Figure 30. **Stats of Mastic**

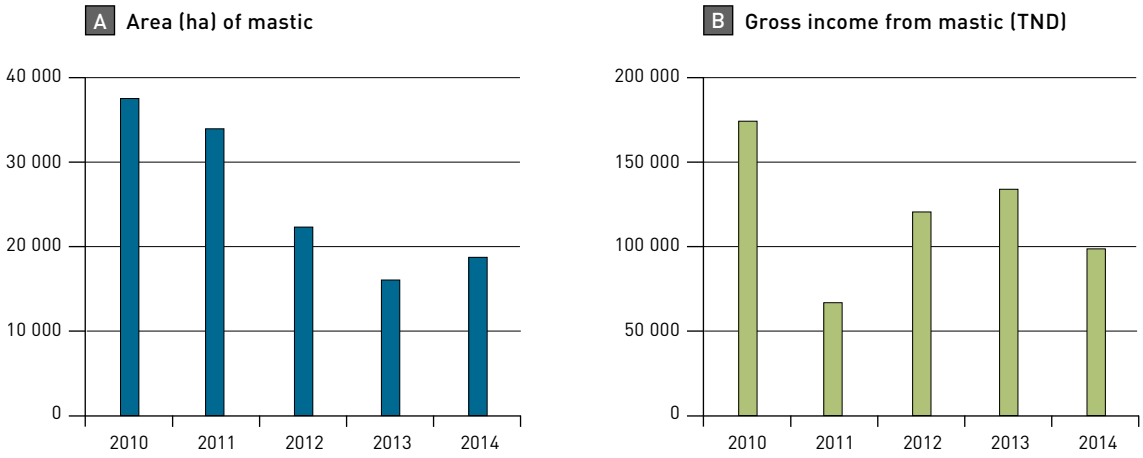

Figure 31. **Stats of mushrooms**

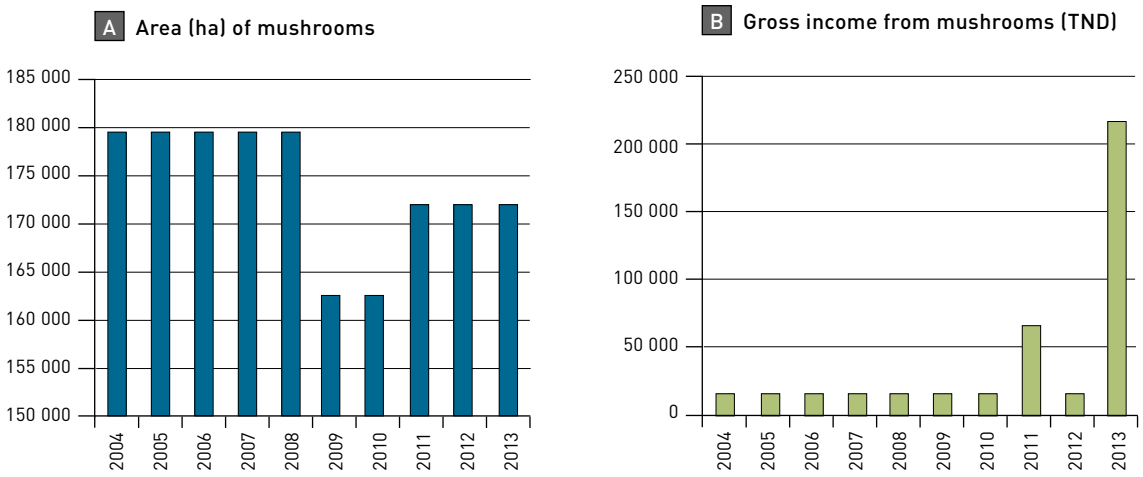

Figure 32. **Stats of Aleppo pine**

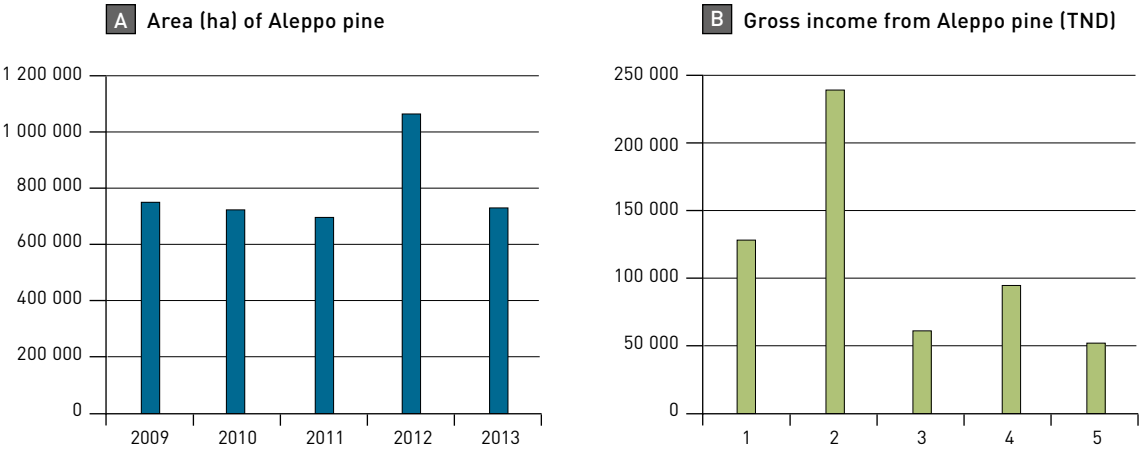

Figure 33. **Stats of Stone pine**

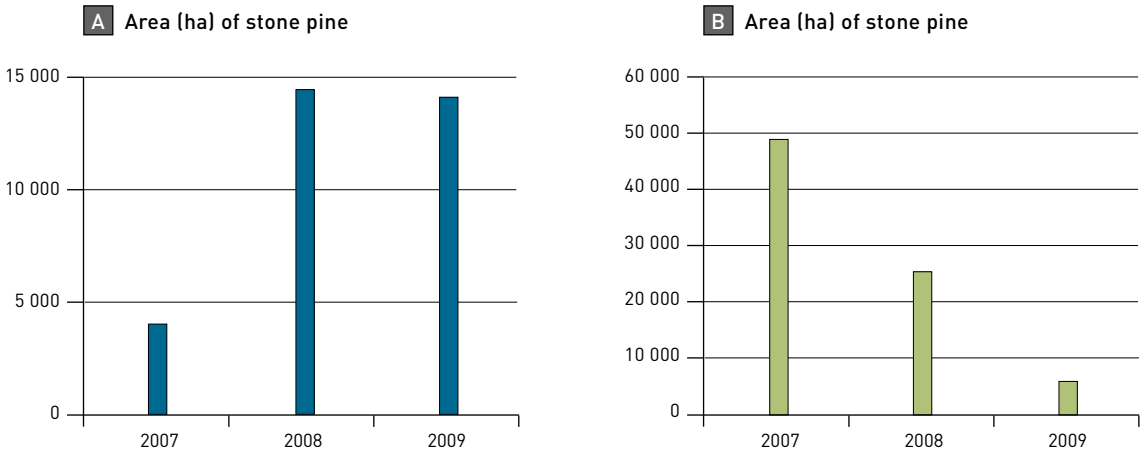

Figure 34. **Stats of pasture lands and hunting**

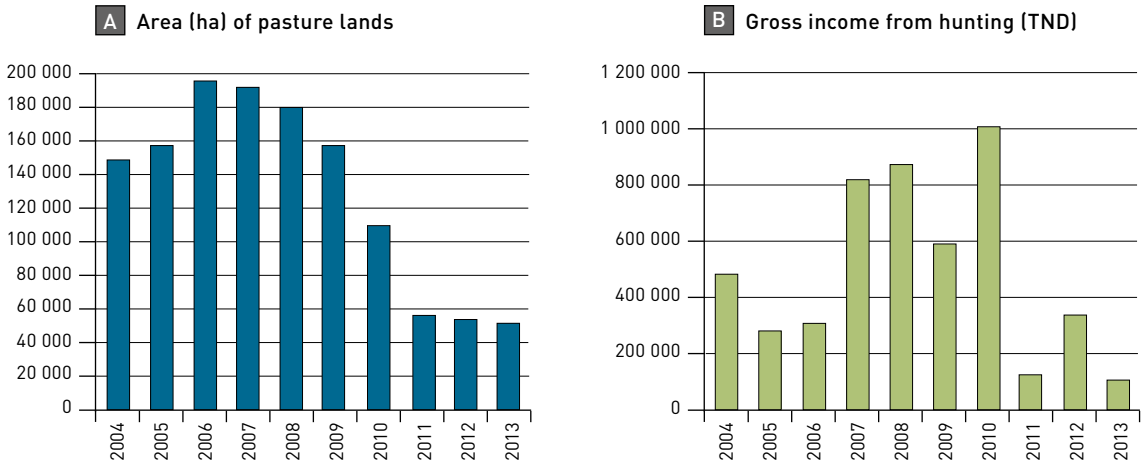

Figure 35. **Stats of cork**

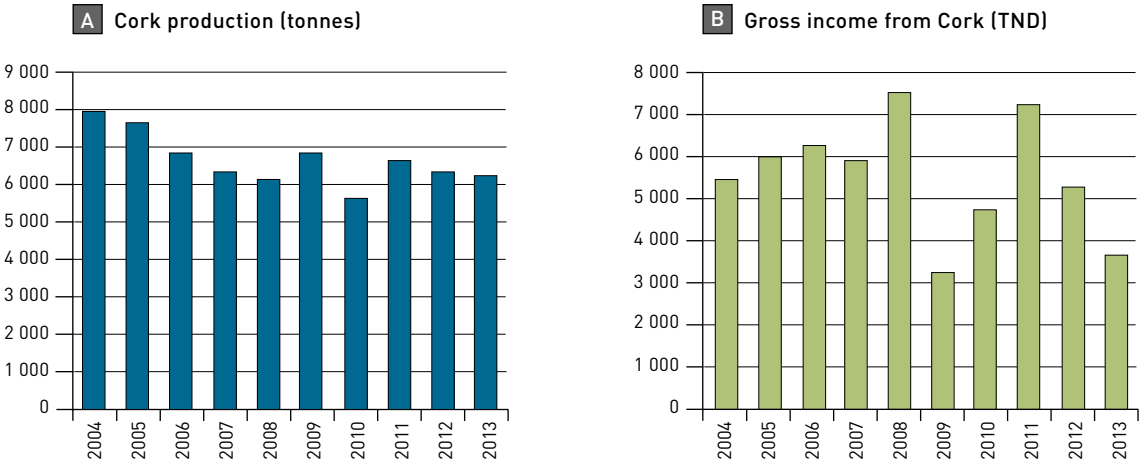

Figure 36. **Stats of myrtle essential oil**

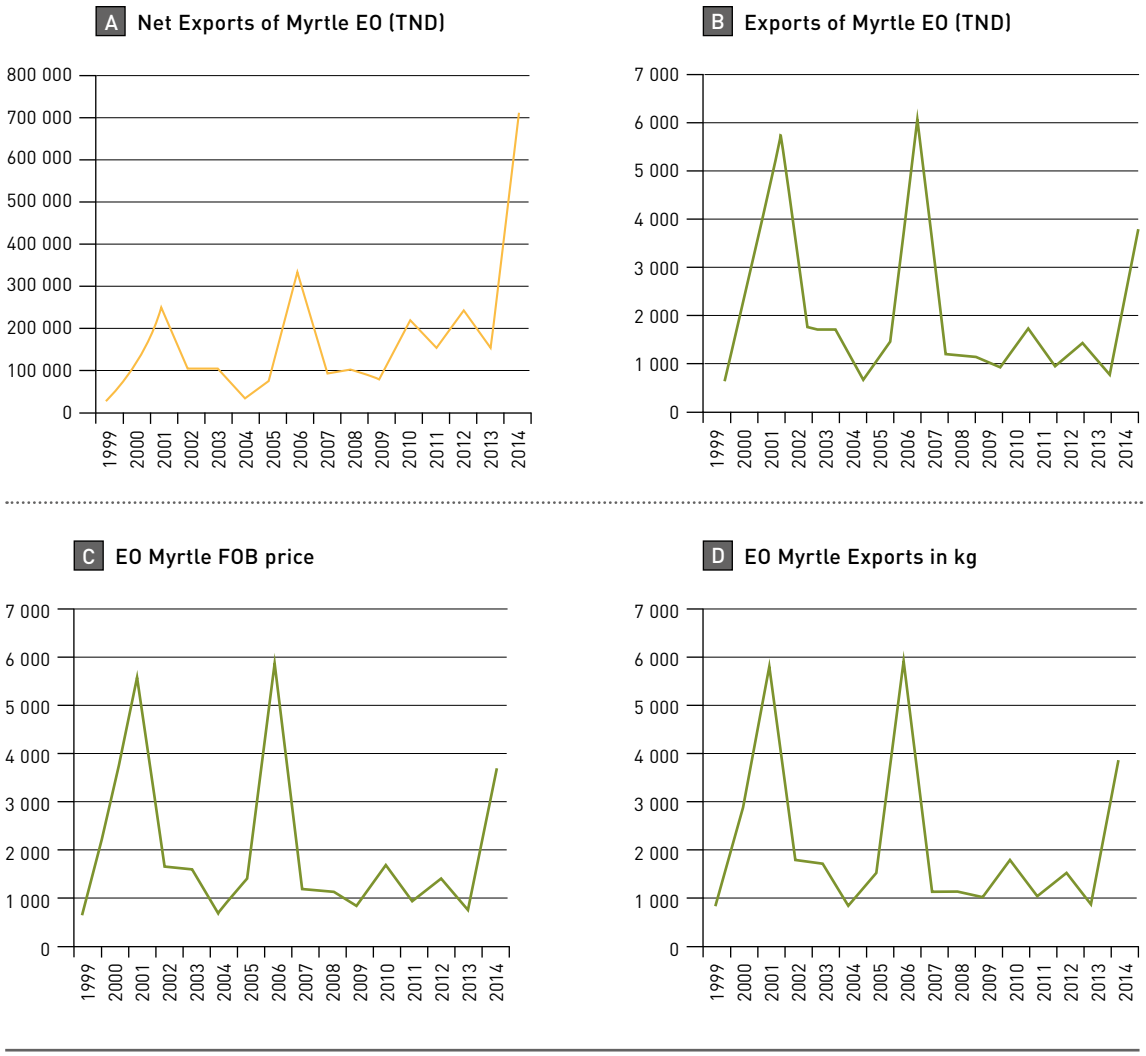

Figure 37. **Trade of stone pine**

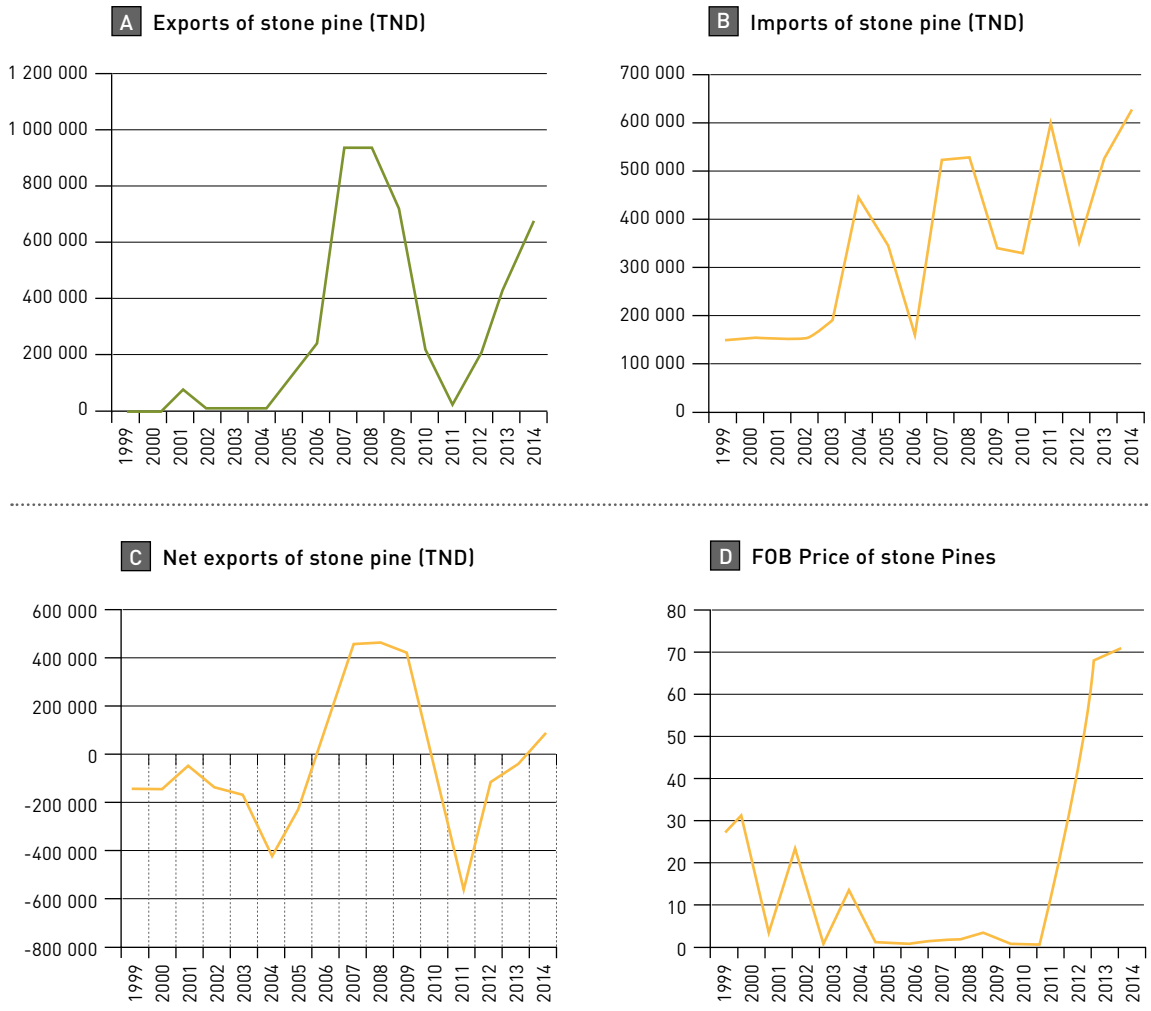

Figure 38. **Production of Aleppo pine**

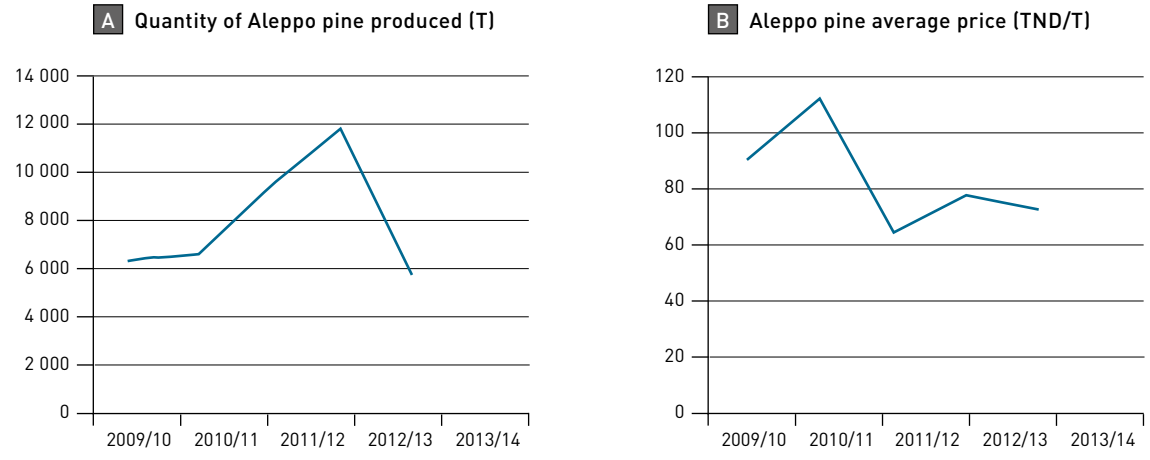

Figure 39. **Production and trade of mushrooms**

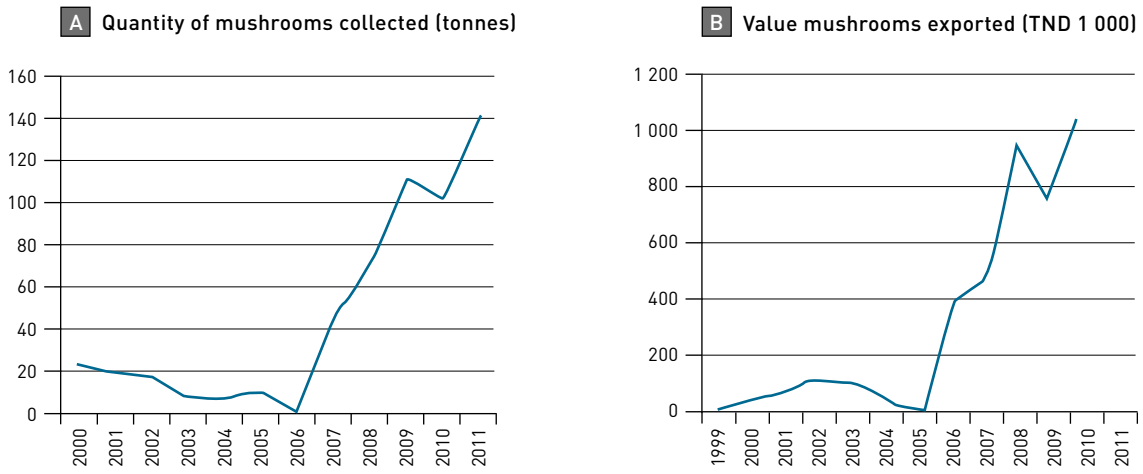

Table 19. **Exchange rate Tunisian Dinar to US$ 2005-2015**

Year	Rate in USA $
31/12/2005	1.29812
31/12/2006	1.32945
31/12/2007	1.27993
31/12/2008	1.2309
31/12/2009	1.3494
31/12/2010	1.4326
31/12/2011	1.4079
31/12/2012	1.5618
31/12/2013	1.6253
31/12/2014	1.7001
31/12/2015	1,9623

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POTENTIALS OF NON-WOOD FOREST PRODUCTS FOR

VALUE CHAIN DEVELOPMENT, VALUE ADDITION AND DEVELOPMENT OF NWFP-BASED RURAL MICROENTERPRISES: TUNISIA

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