

INTERRELATION BETWEEN SOCIO-ECONOMIC FACTORS OF THE NEARBY POPULATIONS AND PLANT RESOURCES OF THE AMSITTENE FOREST (ESSAOUIRA-MOROCCO)

RACHIDA MEHDILOU, ZOUBIR CHATTOU Y EL HOUSSINE ZAID

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S U M M A R Y

THE USE OF MEDICINAL PLANTS HAS CONTINUED AS A LONG STANDING TRADITION IN THE Haha COMMUNITIES OF SOUTHERN MOROCCO. OUR STUDY IS BASED ON FIELD SURVEYS AND OBSERVATIONS CARRIED OUT OVER SEVERAL TIME PERIODS AMONG THE RURAL COMMUNITY LOCATED NEAR THE AMSITTENE MASSIF (ESSAOUIRA), IN ITS NORTH-EASTERN PART. THUS, TWO ETHNOBOTANICAL SURVEYS WERE CARRIED OUT RANDOMLY IN THE FIELD. THE FIRST ONE, IN 2004, DEALT WITH 90 VILLAGE DWELLERS NORTH AND EAST OF AMSITTENE MASSIF, THE SECOND ONE, IN 2005, WAS CARRIED OUT ON 92 VILLAGE DWELLERS IN THE EASTERN PART OF THE AMSITTENE MASSIF. THIS CHOICE WAS MADE IN ORDER TO ANALYZE THE IMPACT OF THE LOCAL CONTEXT (POVERTY, ILLITERACY, ETC.) ON THE FREQUENCY OF THE UTILISATION OF PLANT RESOURCES, ESPECIALLY MEDICINAL PLANTS. THE CONCERNED RURAL COMMUNES LIVE IN AREAS WHERE POVERTY AND ILLITERACY HAVE REACHED A VERY HIGH AND ALARMING RATE. THE SURVEY WAS ALSO CARRIED OUT AMONG SALESMEN OF MEDICINAL PLANTS IN THE LOCAL WEEKLY MARKETS, "SOUKS", OF IMI N'TLIT AND SMIMOU. THESE SURVEYS AMONG THE USERS OF MEDICINAL PLANTS RESULTED IN IMPORTANT INFORMATION. 41 MEDICINAL PLANTS WERE IDENTIFIED DURING THE SURVEY. THE STUDY HAS SHOWN THAT THE PRESSURE ON THE MEDICINAL PLANTS IS BOTH ENDOGENOUS, RESULTING FROM LOCAL PRACTICES OF THE POPULATION, AND EXOGENOUS, RESULTING FROM THE PRACTICES OF THE COMMERCIAL MIDDLEMEN WHO ARE STRONGLY INVOLVED IN THE BUSINESS NETWORK OF MEDICINAL PLANTS.

THE PRESSURE LEVELS ON THE MEDICINAL GENOTYPE OF OUR STUDY AREA DIFFER ACCORDING TO MANY FACTORS: THE ACTORS, THE COLLECTING TECHNIQUE AND THE PARTS OF THE PLANTS THAT ARE UTILIZED. AMONG ALL THE EXISTING PRESSURES, THE OPENING OF A NEW MARKET IN A DISORGANIZED WAY, DUE MAINLY TO A GROWING OUTSIDE DEMAND, APPEARS TO BE THE MOST THREATENING FACTOR TO THE AMSITTENE MEDICINAL PLANT. A SUSTAINABLE USE OF MEDICINAL PLANTS IS THEREFORE NECESSARY, AND IT IS CONVENIENT TO ELABORATE A GLOBAL CONSERVATION STRATEGY IN ORDER TO IMPLEMENT A SOUND AND EFFICIENT MANAGEMENT OF THESE RESOURCES.

KEYWORDS:

MEDICINAL PLANTS, AMSITTENE FOREST, ETHNOBOTANIC SURVEY, SOCIO-ECONOMY, THREATENED PLANTS, SUSTAINABLE USE, ESSAOUIRA

The Mediterranean region, despite its location in a temperate zone far from the diversity hotspots popularized by the media, is one of the areas with

a greatest diversity on the planet, and thus it is considered that it should be maintained as a conservation sanctuary (Myers *et al.* 2000). Moroccan

biodiversity appears to be one of the richest in the Mediterranean region, occupying the second rank after the Anatolian region (Turkey). The floristic endemism rate (unique plants found nowhere else) is over 20%. The medicinal plants, the subject of our present research, make up an essential component of this floristic genotype.

The forest plays an important role in rural areas. In fact, forest resources are part of the means of subsistence for neighbouring populations: they insure their wood needs (fire, service, and timber). Moreover, the forest is the main source for livestock fodder. It is also a primordial source of medicinal plants used in traditional medicine.

Our selection of the area terrain is within the project context of conservation and management of sensitive sites aimed at developing a Mediterranean network within a partnership between WWF¹, ENDA-Maghreb², Chouala Association for Education and Culture, and the Administration of Waters and Forests. This project for the protection of sensitive sites had concerned some environmental aspects in the area and those related to the preservation of the forest patrimony.

As a site of biodiversity, Amsittene Forest is an important natural patrimony (argan-grove and thuya-grove): it was thus classified as a site of biological and ecological interest and managed by the Forestry Department. However, the Forest's density, as well as the area, are slowly decreasing. This is mainly a consequence of the overuse of forest resources (wood, hay and medicinal plants) by the native dwellers, but, recently, it has also been deeply accentuated by several successive unprecedented dry years.

This ethnobotanic study gives an inventory of the medicinal plants used by the local populations nearby Amsittene Forest. The fact that these plants were also used for other purposes makes some of them threatened by extinction. The aim of this study is to present the nature, the forms and the consequences of these pressures on local plant biodiversity. It is therefore a contribution in the evaluation

of the vulnerability of medicinal plants species of the Amsittene Forest.

STUDY FRAMEWORK

Located to approximately 40 Km from the prestigious city of Essaouira, the Amsittene Massif constitutes the main forest area where thuya and argan are dominant. It is a part of the argan biosphere and it opens to the sea. This makes the site highly attractive and gives it a particular environmental value.

In the hinterland of Essaouira, the Amsittene Forest covers an important mountainous massif which is shared by the neighbouring rural communes of Imi N'Tlit, Smimou, Imgrade and Ida Ou Azza (Fig.1). It covers nearly 9000 Hectares with its highest point at 912 m (Benabid, 1976). Its northern slope is relatively wet and shows rather dense vegetation (Fig.2) while the southern, dry and rocky, presents less dense vegetation.

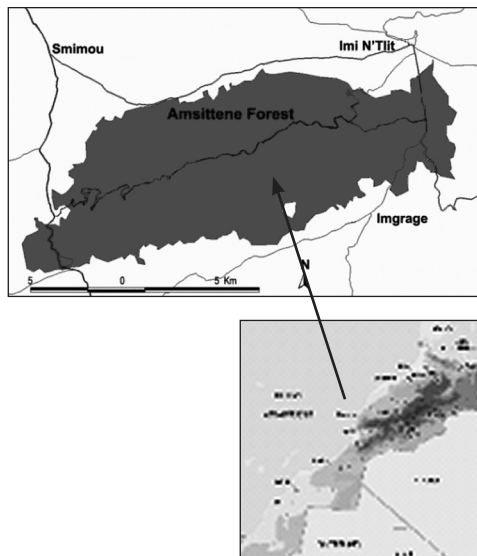
The rural land around Essaouira is part of the extensive territory of Chiadma – Haha. These tribes, whose historical influence reached the city of Mogador (Essaouira), live in the hinterland of a metropolis in constant expansion towards the rural areas. Essaouira is a commercial city opened to the Atlantic Ocean and towards Europe. The main agricultural products (dry fruits, goat skins, etc.), which formerly transited through the port of Essaouira, originated in this hinterland.

The rural communes bordering Amsittene are among the poorest communes in the southern Morocco and belong to the Administrative Circle of Tamanar, Essaouira. There, resources are limited; and the budget is affected at 70-80% to the operation of the commune. The main resources come from taxes levied in the souks and from the VAT on timber sales. It becomes impossible to achieve a real economic take off with such a low budget.

The socio-demographic characteristics of Imi N'Tlit and Imgrade rural communes are generally similar. Each family comprises 5 to 6 individuals; however, several families often live together under

¹ WWF: World Wide Fund for Nature

² ENDA: Environment Development and Action in Maghreb

Pic. 1: Location of Amsittene Forest**Pic. 2: Amsittene Forest****Table 1****Illiteracy rate with respect to age and sex groups in Imi N'Tlit and Imgrade communes**

Age in years	10-14	15-24	25-34	35-49	50 et +	average
Men and women %	29,5	62,2	78,9	86,6	91,8	69,8
Men %	15,4	36,8	57,6	71,6	83,3	52,9
Women %	43,5	80,3	96,3	99,6	99,8	83,9

Source (HCP, 2004)

the same roof. According to the National Planning Commission (H.C.P, 2004), Imi N'Tlit and Imgrade communes contain a population of 8201 and 7089 inhabitants, respectively, of which 52,6 % and 53,3 % are women. Their socio-economic conditions are unfavourable and get worse by a very high poverty and illiteracy rate.

As far as this subject is concerned, our area of interest has a very low rate of literacy. Official statistics from H.C.P (2004) show that girls benefit less from schooling than boys. However, there is a significant improvement with respect to the 1994 survey, which showed that only 13% of school age girls went to school against 61% for the boys. The illiteracy rate in these two communes reaches 69.8%, which is far above the national average (48%). It affects more the female population (83.9%) than

the male population (52.9%). This status can be partially explained by the fact that the local beliefs consider that women should be only limited to procreation. Although, women constitute an essential entity in the household, they remain under the authority of men.

These results have been confirmed by our field work. In fact, schooling level is low in our study area: 74% of the surveyed persons are illiterate, 20% have gone to the primary school, only 5% have reached high school, and less than 2% have gone to college. However, as it is the case all over Morocco, women are the most affected by illiteracy, with a rate of 89%.

It should be noted that in addition to the long distances from the communes to high schools, the few girls that have had the opportunity to study

in the primary school cannot enter high school, mainly because of the precarious living conditions of their families. This grim reality tends to support the common thought that "it is useless to go into so much effort in schooling girls, since they cannot get further education anyway" (testimony). This factor also affects to a certain degree the boys.

This socio-demographic context, which is almost common to all the rural commune of the Haha region, constitutes an actual obstacle to local development. It is a handicap for the development of local skills in the communes, which would play a first order role in the promotion of innovative socio-economic activities within the observance of conservation principles and the protection of natural and patrimonial resources. As the economic development relies essentially on women and men acting in a territory and not as a simple outcome that results only from its resources, it should take into account the entire local context and it should implicate all the actors in the territory. This will lead to the reduction of the pressures on its natural resources and to make available new alternative economic opportunities.

The present local economy is based on a traditional agriculture, which aims essentially at satisfying the family's living needs. It relies mainly on cereal crops in non irrigated areas (bour) depending on climatic hazards and on an extensive low return stock breeding.

According to the surveys carried out in the field, the most practiced cultivation is barley (*Hordeum vulgare*) which represents 52%, followed by corn (*Zea mays*) with 21%, broad bean (*Vicia faba*) with 12%, chick pea (*Cicer arietinum*) with 10%, and wheat (*Triticum aestivum*) with 5%. Cereals cultivation practiced over small pieces of land in the valley near the forest is hardly productive. The area suffers from persistent drought and the breaking up of cultivated land into very small units.

In spite of the fact that agriculture is for the sole use of the population, it is the only opportunity for making a living. This activity represents about 70% of the work opportunities in the area. All other activities account for the remaining 30%

of the family's income. Thus, families try and combine sources of revenue.

Local activities in the way of agriculture and stock breeding become more and more insufficient for the population, although they are important to them. Productivities can become the half or the double depending on the climate change.

Stock breeding is, by far, the first source for the population's revenue; its contribution is about 50%. Based on the local survey carried out in the area, 54% of the stock are goats, while sheep accounts for 31%. This activity is carried out in addition to agriculture. The selling of stocks takes place in the closest weekly markets. These transactions are concentrated at the beginning of the farming season and of the harvest, and during some holiday feasts. During the drought, the farmers sell out some of their stock in order to face feed deficit.

Fruit tree cultivation comprises olive trees, nut trees, and carob trees. This is also another additional source of income for the population (20%). However, its present status needs to be improved both from a technical point of view (plants rejuvenation, use of certified plants, plants treatment, etc.) and from a commercial aspect. They are products from local soil whose value needs to be enhanced for both their intrinsic biologic and ecologic quality so as to meet the demand of a growing naturalist market.

Other activities contribute to the income of the population: seasonal emigration (20%); exploitation of the forest, commerce, and handicraft (10%).

The strong dependence of these populations on agricultural activities with uncertain and small revenues constitutes per se an important handicap for the socio-economic development of the area. It is therefore necessary to envisage a rational and efficient exploitation of all the potential of the area: diversification of revenue sources, improvement of feed stock races and seeds, development of new activities, etc.

On the other hand, the emigration of the work force toward cities participates in improving family's revenue, but it bleeds off the work force

from the area, and enhances the ageing of the population of the place. This situation makes it difficult to launch new activities in the area.

The rural commune neighbouring Amsittene suffers from an ever increasing poverty. People's economic resources are dependent on the climatic changes. This economic situation affects all the parameters of human development and leads the population to poverty and social exclusion.

Official statistics from H.C.P (2004) concerning the poverty of the population in the area are eloquent. In fact, 38% live under threshold of poverty (minimum level of income necessary to achieve an adequate standard of living), 23.5% live in fragile and vulnerable socio-economic conditions, and 6.4% live in an extreme poverty.

The poor living conditions of the population are very visible; the persistence of drought and the lack of profitable economic activities deepen poverty. As a result, the pressure over forest resources is increased; this is but a handy solution that helps many families to survive.

The observations and results acquired in this area are the product of the methodology developed hereunder.

METHODS

Ethnobotany, the study of how people of a particular culture and region make use of indigenous plants (WHO³, IUCN⁴ and WWF 1993), is necessary for the understanding of the interactions between man and natural resources. It is gaining an increasing interest across the world (Ghorbani 2005). Ethnobotanists explore how plants are used for such things as food, shelter, medicine, clothing, hunting and religion ceremonies (Amsallem 2001).

We have conducted an ethnobotanical survey within the local populations in order to understand the relations between these people and the medicinal plants in the Amsittene Massif. From the point of view of the health, the populations neighbouring Amsittene Massif suffer from a difficult access to

conventional medicine. The recourse to traditional medicine based on plants concerns most of the population. The people bordering Amsittene Forest and, mainly, those of Imi N'Tlit and Imgrade hosted our survey. The field work was carried out during March/April 2004 and Mai/June 2005. Ethnobotanic information was collected thanks to the interviews to 90 persons in 2004 and 92 persons in 2005. The first leg was carried out among nearly 20 focus groups and semi-structured interviews in order to understand the local socio-economic context. The second leg was based only on individual interviews whose aim was to identify the different plants that are used. Certain suppliers form the local weekly souks, i.e. those of Smimou and Imi N'Tlit, as well as from Essaouira, were targeted. Discussions were focused on the plant origin and the personal therapeutic knowledge with respect to the plants that are used in our study area. The information mentioned in this article is only a part of the information collected in the field.

Plant identification was partly carried out in the field using previous works and also at Scientific Institute Herbarium, Mohamed V University, Rabat. The field data was analyzed both qualitatively and quantitatively. The responses from the open-ended questions were categorized basing them on the similarity of ideas expressed; while percentages, based on valid responses, were calculated from closed-ended questions. The statistical program SPSS was used in the analysis.

It is interesting to highlight that all the persons we talked to near Amsittene Forest were well aware of the importance of the forest as a provider of resources. However, impoverished, rural resource users are constrained to turn to the forest to draw their needs for their daily living (fire wood, hay, medicinal plants, etc.). This constitutes a generalized pressure on resources and requires the implication of all (local population, local authorities, and concerned government department such as Forestry, Agriculture, Finance, Commerce, Handicraft, etc.) to preserve this natural patrimony.

³ WHO: World Health Organization.

⁴ IUCN: International Union for Conservation of Nature and Natural Resources.

The field survey has given important information and disclosed structure problems in the communes neighbouring Amsittene Forest involved in the exploitations of its flora and fauna and, particularly, its medicinal plants.

RESULTS AND DISCUSSION

Traditional medicine has always held an important place in medicine of all the communities across the world. Pharaohs, Greeks, Romans, and Arabs made significant contributions in the specific use of medicinal plants. Modern medicine has evolved in the rich countries, and is also progressing in the developing countries. However, traditional medicine is far from disappearing. Moreover, there is a significant return to medicinal plants even in the rich countries, the motivations of which are not triggered by the same cause. In the west, people look for a medicine that is ecologically acceptable to break with modern chemical medicine. In the third world, the main aim is to compensate the inefficiency or the lack of a suitable local health care (Tabuti *et al.* 2003).

Morocco is one of the Mediterranean countries which have a long medical tradition and a confirmed know-how in the use of plants. This has been proven through studies conducted in the Mediterranean basin (Scherrer *et al.* 2005). This know-how, passed on from one generation to the other, may become discontinued because the new generations do not ensure the transmission.

The Amsittene Forest is rich in medicinal plants and has a significant importance in biodiversity. Our survey for the identification of plant species and their medical uses has come up with 42 medicinal plants, 34 of them originated in the Amsittene Forest (Table 2). These species are used by local populations in various and diversified manners.

The degradation of the forest ecosystem may be consequent to unfavourable natural conditions (climate), or in direct relation to human activity (overexploitation, overgrazing, deforestation, farming, industrial activities, etc.)

The objective here is to acquire some understanding about the impact of the population over the local medicinal plants and on their durable sur-

vival. Indeed, as reported by Arizpe *et al.* (1994), people and environment are not necessarily antagonistic.

Uncontrolled picking of medicinal plants may have several negative effects on plant biodiversity, in particular, the vanishing of certain rare or endangered species and the potential degradation of forest ecosystems. This may cause both soil degradation and deterioration of local faunistic biodiversity.

The absence of a legal framework for plant collecting does not favour the species regeneration and increases the pressure on natural resources. This situation could lead to the vanishing, in the short term, of the medicinal plants from the vegetation cover in Amsittene.

NATURAL PRESSURES:

The Amsittene Massif is located in an area of climatic transition, between the Sahara desert, the Mediterranean sea, and the Atlantic ocean influences (Weisroch 1980). The climate is generally semi-arid. It is under tropical influence coming from the South and South-East in summer, the hot and dry season, and under the influence of the winds coming from the North or the North-West in winter, the cold and rainy season. The orography, a consequence of the orientation of the slopes and of the continentality effect, is another factor that also affects Amsittene's ecosystem.

The yearly rainfalls change from one year to the other and from one place to the other and show clearly altitude and continentality influence. The rainfall averages are higher on the top of the massif and lower in the valleys.

The influence of low water resources does not favour the regeneration of the local floristic resources. Drought has become a structural element in the natural environment in the southern part of Morocco. It has become an important pressure factor in the forest. This pressure, added to other factors resulting from human and animal activities, constitute a serious challenge in the struggle for the preservation and management of the Amsittene Forest.

In addition, the erosion caused by vegetal cover degradation favours the soil leaching and the loss of possibilities of plant regeneration.

Table 2
Medicinal plants used by the neighbouring population of Amsittene Forest

Local Name	Botanical Name	Common names	Family
Titekt	<i>Pistacia lentiscus</i> L.	Mastic tree, Evergreen pistachio	Anacardiaceae
Azad/tazadt	<i>Rhus pentaphylla</i> Desf.	Sumac or Sumach	Anacardiaceae
Adrias	<i>Thapsia garganica</i> L.	Drias plant	Umbelliferae
Addad	<i>Atractylis gummifera</i> L.	Atractyle	Compositae
Tafgha	<i>Centaurea chamaerhaponticum</i> Ball.		Compositae
Afezdad	<i>Warionia sabarae</i> Benth & Coss.		Compositae
Aknari	<i>Opuntia ficus-indica</i> (L.) Mill	Prickly pea	Cactaceae
Tahidourt	<i>Paronychia</i> sp	Algerian tea	Caryophyllaceae
Tikida	<i>Ceratonia siliqua</i> L.	Carob	Leguminosae
Irguel	<i>Cistus salvifolius</i> L.	Sage-meaved Cistus	Cistaceae
Azouka	<i>Tetractinis articulata</i> (Vahl) Masters	Thuya/Thuja	Cupressaceae
Azoubar	<i>Arbutus unedo</i> L.	Strawberry tree	Ericaceae
Abouhou	<i>Quercus rotundifolia</i> Lamk.	Holm oak	Fagaceae
Tasselgha	<i>Globularia alypum</i> L.	Shrubby Globularia	Gobulariaceae
Iguiz	<i>Lavandula maroccana</i> Murbeck		Labiatae
Ijerch	<i>Lavandula dentata</i> L.	Toothed lavender	Labiatae
Ifzi	<i>Marrubium vulgare</i> L.	White horehound	Labiatae
Timenra Izelkad	<i>Teucrium polium</i> L.	Felty germander	Labiatae
Tazouknite	<i>Thymus satureioides</i> Coss & Bal.	Thym sarriette	Labiatae
Azoukni	<i>Thymus broussonetii</i> Bois.	Thym de Broussonet	Labiatae
Ighri	<i>Asphodelus microcarpus</i> Salzm & Viv.	Asphodèle	Liliaceae
Tanechfalt	<i>Smilax aspera</i> L.	Sarsaparilla/Smilax	Liliaceae
Azalimouchen	<i>Urginea maritima</i> (L.) Baker	Sea squill/ squill white	Liliaceae
Azemmour	<i>Olea europaea</i> L.	Olive	Oleaceae
Tiznirt	<i>Chamaerops humilis</i> L.	Dwarf fan Palm	Palmae
Taida	<i>Pinus halepensis</i> Mill.	Aleppo Pine	Pinaceae
Ouden lhalouf	<i>Ranunculus</i> sp		Ranunculaceae
Azouggar	<i>Ziziphus lotus</i> (L.) Lam.		Rhamnaceae
Tassenante	<i>Rubus ulmifolius</i> Schott	Elm-leaved bramble	Rosaceae
Taroubiya	<i>Rubia</i> sp		Rubiaceae
Argan	<i>Argania spinosa</i> (L.) Skeels	Argan tree	Sapotaceae
Tiremt	<i>Withania frutescens</i> (L.) Pauguy	Bufera/Capseta	Solanaceae
Tamaite	<i>Tamarix</i> sp		Tamaricaceae
Lharmel	<i>Peganum barmala</i> L.	Harmal shrub	Zygophyllaceae

HUMAN PRESSURES:

High poverty and illiteracy rates among the rural populations in the vicinity of Amsittene Massif seriously affect the status of the local vegetal cover in general and of medicinal plants in particular. These socio-economic factors are the bases for several practices that take up different forms so as to meet special needs. They can be classified as follows:

- Collecting for traditional medicinal uses
- Land clearing
- Overgrazing
- Marketing

These activities, alone or combined, constitute the main factors of the degradation of the natural resources and the entire Amsittene ecosystem (vegetal cover, soil, water, etc.). This article will essentially develop the pressures over medicinal plants and the threats thereof.

COLLECTING FOR TRADITIONAL MEDICINAL USES:

As mentioned above, the lack of a local health system and the poverty of the population increase the pressure on medicinal plants. The latter are collected and stored in each household in order to face any health hazards (cold, flue, spasm, diarrhoea, etc.) that may occur anytime. The recourse to modern medicine is still a luxury for these populations and it does not often happen until the sick person has reached an advanced, if not the latest, stage of sickness.

Old women master the different preparations of medicinal plants. They are holders of this particular traditional medical knowledge that has come down from mother to daughter, and it represents a medicine that is parallel to the modern medicine. We do notice, however, that the transmission of this knowledge has a tendency to weaken.

Local men hold a marginal function in this local medical activity based on the use of plants. Their action is limited to the collection of plants, especially when these plants are located far away from the village.

Results showed that 10 vegetal medicinal species are very used in this area. Thyme (*Thymus*

broussonetii and *Thymus satureioides*) and lavender (*Lavandula maroccana* and *Lavandula dentada*) are used by all the surveyed population. While the following species are used in accordance with the frequencies here below:

- *Marrubium vulgare*, 74%
- *Globularia alypum*, 72%
- *Ceratonia siliqua*, 69%
- *Tetraclinis articulata*, 69%
- *Cistus salvifolius*, 67%
- *Argania spinosa*, 59%

The other medicinal plants that have been found are mentioned by only a few surveyed persons among the oldest ones. In the same way, some remedies are more familiar to certain interviewed persons and not to the others, and their utilizations are more specific with respect to disease or health problems in consideration.

Among medicinal plants, *Thymus broussonetii* is the most known by local population and it is considered more efficient to overcome several health problems. In fact, in Morocco, it is widely used in folk medicine for the treatment of a variety of diseases, including gastro enteric and bronchopulmonary disorders, and to relieve dolorous process (El Habazi *et al.* 2006). This plant is a concrete example of these species that are mostly used in the region and which are becoming scarcer. As a result, the species is almost absent in the Amsittene Forest. It is encountered in the souks, particularly during spring period, in the possession of some suppliers who collect it in the Massif.

Thymus broussonetii is an endemic species in the High Atlas and in Atlantic Morocco (Fennane et Ibn Tattou 1998). It is likely to disappear from Amsittene Forest because of the intensive collecting, if no protection measures are taken by the authorities and the concerned actors (Forestry Department, Local Authorities, neighbouring population, etc.). Moreover, as opposed to other species, it is known to be well appreciated by the livestock.

Thymus satureioides, relatively abundant in Amsittene Forest, does not seem to suffer from this pressure. This, however, does not exclude the pos-

sibility that in the foreseeable future it will become threatened if its exploitation is not handled in a more reasonable manner.

Lavandula dentada and *Lavandula marocana* are not very abundant in the region. So their intensive collecting is likely to arrange them in the category of threatened species in the Massif.

The collecting mode, as well as the nature of the utilized parts of plants, is a non-negligible parameter which needs to be considered in the analysis of their sustainability (Cunningham 1996). In fact, for a better appreciation of the sustainability of a species, it is very important to know which parts of the plants are utilized. If the use concerns the entire plant or its underground part, the species will be considered as really threatened; because, as time goes by, the species will have a tendency to become scarce before it completely disappears. However, if the utilization concerns only the aerial part, the threat level may be considered less.

The figure below (Fig. 3) shows that leaves alone represent 30% of the total of plant parts used, while stems with their leaves, fruits, and underground parts respectively represent 23%, 21%, and 11%. The preference towards leaves may be because leaves are the main photosynthetic organs in plants and that the photosynthesis are translocated later to other parts like stems, fruits and roots (Jeruto *et al.* 2008). These results coincide in part with those obtained internationally. Camejo-Rodrigues *et al.* (2003) found that the aerial part and leaves account for the parts of the medicinal plant that

are most utilized in the “Serra de São Mamede” national park in Portugal. By contrast, Shrestha and Dhillon (2003), in Nepal, have reported that roots are the most utilized parts of plants, followed by the leaves.

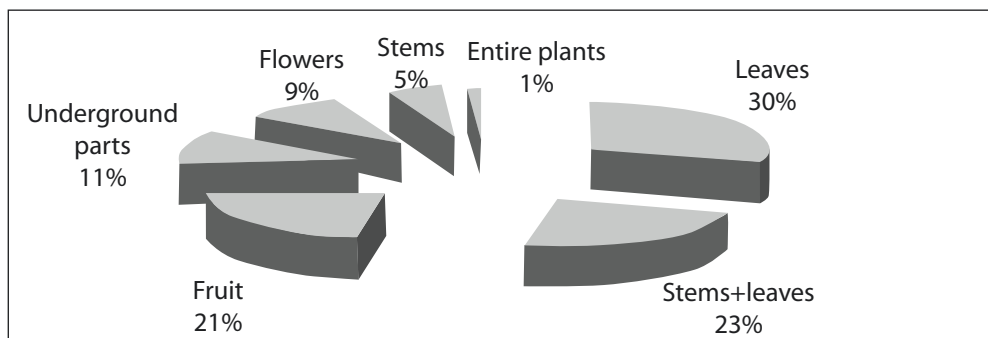
The combined parts utilized in Amsittene region, “leaves only”, and “stems with their leaves” add up to 53% of medicinal plants. At first hand, this does not appear to constitute a real pressure over medicinal plants. However, as the inhabitants have a tendency to pull out the entire plant, including its root, this picking mode is seriously damaging the sustainability of this plant type.

This threat on the medicinal plant could get worse if it is combined with other factors such as overgrazing, land clearing for cultivation, and commercialization. These factors together may play a decisive role in the decline of the surface cover by medicinal plants in the Amsittene Forest.

LAND CLEARING:

If land clearing has always been there, we notice that it is increasing from one year to the other. Deforestation is usually carried out in order to mainly satisfy the ever increasing needs of the neighbouring population in the way of wood material and also with the aim of preparing the area for future land clearing. Deforestation, combined with medicinal plants collecting, can result in a real pressure on medical species; mainly trees and shrubs as is the case with *Tetraclinis articulata* and *Argania spinosa* (Fig. 4). The picked wood is often made up of

Fig. 3
Utilization distribution of parts of the plants in Imi N'tlit Commune



thuya, argan, carob, and wild olive tree. However, and based on most of the surveys, thuya and argan are the most appreciated, and they are considered to be a good source for heating wood. Moreover, thuya is very used in handicraft in Essaouira, and constitutes, by far, a real quality label of this city; while argan, an endemic species of the South-Western Morocco, is researched for its oil as a source of medicinal, food, and cosmetic products (Charrouf and Guillaume 1999).

From field surveys, 60% of the interviewed persons have declared to visit Amsittene Forest every week for collecting dead wood. But, because of the long distances to the forest and due to the non availability of this wood in sufficient quantities, most people prefer to chop healthy branches off the trees.

OVERGRAZING:

It is well known that the livestock participates in the control of shrubs and grass proliferation. But, overgrazing causes an excessive browsing of vegetation and young shoots, hinders any regeneration, exhausts available resources, degrades pasture and exposes the soil to erosion.

The system of livestock breeding practiced within Amsittene Forest is also a factor that cannot be neglected in the degradation of vegetal biodiversity (Fig. 5). The size of the livestock and the area over which it evolves, especially if the latter is small, are sources of pressures on plant resources. Areas especially affected by the overgrazing are those closer to the population. The cartographic analysis of the pasture areas, based on the influence of livestock grazing, shows that overgrazed lands have a poor biodiversity.

The survey area is characterized by an extensive livestock breeding. Goats, which are dominant in the herd, are a rustic species, fit to arid and rough conditions. The livestock headcount per surface unit and the high frequency of passes are responsible for the degradation of pastures, especially near the population (Fig. 6) and also inside the forest. The situation gets worse when the load capacity is overtaken. Goats tend to be attracted by the key species (Argan and Thuya) thus modifying their morpho-

logy. Consequently, soil cover is destroyed, and the specific floristic ecosystem that is organized around these key species is deteriorated.

Overgrazing is thus an essential threat for medicinal plants; these are often appreciated by ruminants, and thus become unable to regenerate, and finally they get extinct.

Fig. 4

Observed land clearing in Amsittene Forest



Fig. 5

Overgrazing impact on Amsittène Forest

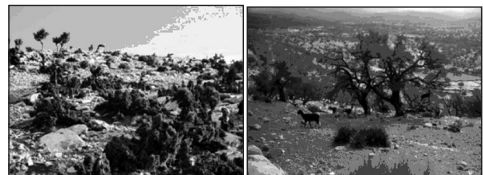
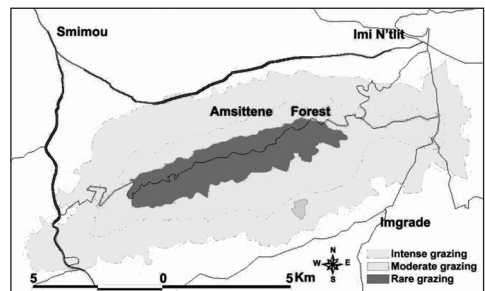


Fig. 6

Grazing frequency distribution in the Amsittène Forest



MARKETING:

Two main destinations for medicinal plants have been identified during this study: local use by families, and commercial use outside the area where plants have been collected.

Areas where plants are picked become further and further from inhabitants reaching a distance of 8 to 15km. This is subsequent to the pressure over plants through the combined action of collecting, overgrazing and drought. Plants thus abandon the populations who exploit them intensively to the point of degrading them and even causing their extinction around residential areas.

Traditionally, the utilization of medicinal plants by rural populations in their own health system was not per se a major pressure source. It is the increasing poverty that has driven rural population to seek additional revenues for daily life. Forest resources and specifically thuya wood, argan tree by-products and medicinal plants constitute an additional revenue to this population, despite the fact that it remains rather a meagre revenue compared to the time invested. It must be stressed that a flourishing informal economy both on the national (Essaouira, Agadir, Marrakech, etc.) and on the international (exportation, tourism) markets sustain the pressure so it becomes a major threat.

The concept of medicinal plants has changed throughout time. Considered for a long time as the medicine of the poor, medicinal plants are becoming more and more used by urban dwellers and foreigners. New behaviour attitudes in the use of medicinal plants are illustrated by the growing pharmaceutical laboratories demand, and that of people who are giving up modern drugs and seek more ecological alternatives (cosmetics, hygiene, etc.). This foregoing demand unfortunately contributes to the increase of the pressure on medicinal plants and benefits from the poverty and the unemployment of the population, who is strongly in need for revenue resources to survive.

“We observe that people use medicinal plants more and more. Earlier only poor people used these plants while the rich could offer modern medicine;

nowadays, we observe that the rich are coming back to traditional medicine” (Aicha, 54 years old)

This interest is reinforced by a local development necessity, with respect to NGOs, which integrate in their approaches, often with little thought, the utilization of medicinal plants among the activities for the generation of revenues. However, populations are well aware of the danger represented by this new economic opportunity that might end up creating an important influx of actors in plant collecting, thus damaging local ecosystem in an irreversible manner.

In Smimou Commune, the commercial activity of medicinal plants is more developed because of the easy access conditions as it is located by the main road from Essaouira to Agadir. Buyers from Essaouira, Marrakech and from other places come by the region during the harvesting season to purchase the available products from the villagers. Moreover, the quantities exposed for sale in the weekly ‘souks’ are more important here than at Imi N’Tlit. The local population reports that thyme is the most sought species by the retailers. It is for this very reason that the species is being extinct from the nearby local vegetal cover.

CONCLUSION AND RECOMMENDATIONS

The degradation of Amsittene Forest in general and of medicinal plants in particular is due to a combination of causes: disorganized harvesting of medicinal plants, overgrazing, subsistence agriculture, unfavourable climatic conditions and subsequent land clearing. This situation is further getting worse by the precarious socio-economic conditions of the neighbouring populations (poverty, low education levels, and absence of positive sensitization).

In addition to the fact that local population utilizes medicinal plants to meet its household and health needs, the market for these plants is developing in a very disturbing way: many middlemen from outside either carry out a disorganized picking of plants or buy them from local collectors at prices that are more and more attractive to the popula-

tion. This marketing is made more demanding by the tourism phenomenon which encourages local people to benefit from local resources.

Whereas in Europe medicinal plants are often cultivated on a large scale to meet the growing demand for herbal medicine, the most common practice in Africa is still to collect medicinal plants from wild populations (Zschocke *et al.* 2000).

The consequences of the degradation of these resources may become drastic: total and irreversible destruction of the ecosystem, impoverishment of the population and emigration toward urban centres, and return back into unemployment, exclusion, etc.

In order to remedy this situation that is highly disturbing, we feel that it is necessary to adopt a global approach that involves together the local communities, the elected bodies, local authorities, NGOs, and the concerned government departments. The approach for forest protection may not go against the needs of local people who are obliged to exploit the resource neither allow this population to destruct the ecosystem. Indeed, people and the environment are not necessarily antagonistic as stated by Arizpe *et al.* (1994). The approach should seek a balance between a local utilization that is less threatening for the regeneration of plants and a marketing that needs to be more organized and controlled. To reach this goal, it is important to build a dialogue between all these actors.

Local communities are a decisive factor for the success of any conservation strategy or action. In order to encourage the participation of people in the sustainable management of medicinal plants, it is advisable to have them organized into cooperatives or associations so as to define a strategy for the harvesting and the marketing of forest resources. In addition, these organizations shall also define a strategy for the protection and the renewal of the resources in order to prevent them from degradation and extinction.

Since the education status of the local population is rather poor as demonstrated by the survey data, it then appears imperative to proceed in the first step in a progressive schooling of the popula-

tion and the increase of its awareness toward the dangers that threaten the forest and even its existence. Cooperatives and associations must become the bearers of this action in collaboration with the concerned organizations.

This action must be accompanied by a targeted training in the areas of plant harvesting, their storage, their preliminary physical processing, their preparation and their marketing. With respect to the protection and the renewal of resources, it is necessary to review the harvesting mode both from the technical harvesting point of view and also from the harvest areas that need to be alternated from one year to the other. Moreover, the planting of species that are most affected by harvesting in degraded areas is bound to help to reconstitute the degraded parts of Amsittene Forest.

With respect to the marketing of medicinal plants, local cooperatives and associations should organize and look after the marketing chain from harvesting through the sales to detailers. If the demand shows to be important, which is more likely, it may become necessary to revert to the domestication of certain species through their integration among the cultivated crops. Thus domestication of medicinal plants is a suitable option for optimizing the resource utilization, as well as decreasing over-dependence on wild habitat (Jeruto *et al.* 2008). Encouraging such domestication will reduce pressure on several species such as *Thymus broussonetii*.

In doing so, irreversible ecosystem degradation should be avoided and more interesting revenues should be ensured to the population. In this way the populations will become leading pioneers in the protection and rational utilization of natural resources.

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