

***MedAgriFoodResilience***

***“Socio-environmental shocks assessment and resilience empowerment in Mediterranean agri-food heritage systems: Italy, Morocco, Algeria FAO GIAHS sites”***

**List of cultivated species and varieties**

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## 1. Agro-biodiversity assessment

The concept of agricultural biodiversity, according to FAO, refers to the “variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fiber, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators), and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic) as well as the diversity of the agro-ecosystems.”

This type of biodiversity is part of the one more general concept of Biocultural Diversity, included in the preamble of the GIAHS criteria, and it’s typical of the rural territory. The Florence Declaration on the Links between Biological and Cultural Diversity, signed in 2014 (UNESCO & SCBD 2014), states that the current state of biological and cultural diversity in Europe is the result of the combination of historical and current environmental and land use processes and cultural heritage, and that the European rural landscape is predominantly a biocultural multifunctional landscape. The Mediterranean rural landscape, therefore, represents a crucial and effective space for integration of biological and cultural diversity, and landscapes rich in biocultural diversity are often those related to small-scale farming and traditional practices.

## 2. Agrobiodiversity in the Olive orchards of Assisi-Spoleto (Italy)

Despite its small surface, the Italian region of Umbria has about 27,000 ha (Torquati et al. 2007) dedicated to the cultivation of olive trees, which represent 8.5% of the region's cropped area. In 2012 olive oil production in Umbria was about 5,130 tons, 67% of which in the Province of Perugia and 70% was extra virgin olive oil (EVOO), the highest grade of olive oil quality (ISTAT, 2013). Furthermore, Umbria is characterized by a high degree of fragmentation of production on the agricultural level and a widespread use of cooperatives for the management of production, with about 257 mills throughout the region (Peluso, 2013). Olive cultivation in Umbria is traditionally carried out on slopes, so that dry stone terraces, earth terraces or dry stone *lunette* (semicircular terraces with dry stone walls built around each olive tree to hold up the terrain) are common.

Most of the olive groves of the area are fruit of the interventions supporting new groves designed at various times by the Papal States beginning in the second half of the 18<sup>th</sup> century until the Unification of Italy. The olive trees were planted with a regular layout to make counting them easier for those responsible for controlling and giving out incentives. The work passed on to the newly born Italian State, contributing to the transformation of the landscape all along the hilly regions surrounding the basin of the Tiber river and its many tributaries. In the first decades of the 20<sup>th</sup> century the olive tree was still considered of the utmost importance both economically – for its rich product – and socially – for the vast use of labor in the winter season. The cultivation was mainly associated with herbaceous or arboreal crops in the sharecropping farms at the lower limit of the specie's altitude profile, on the valley edge, where the soil is more fertile. Mixed cultivation played an important role in the economy of small producers, with the intention of making farmer families independent. Monocultures were mainly carried out at greater altitudes, where it was the prerogative of medium and large properties. The two types of cultivation are different in the density of the grove, with the olive trees much further from one another in mixed cultivation to make it possible to plant fodder and cereals between them.

Municipality	Assisi	Foligno	Spello	Campello sul Clitunno	Spoleto	Trevi
Number of olive trees per hectare in monocultures	282	250	269	280	280	220
Number of olive trees per hectare in mixed cultivations with fodder or cereals	73	110	108	119		110

*Tab. 1: Number of olive trees per hectare in monocultures and in mixed cultivations with fodder or cereals, according to the Agrarian Cadaster of 1929.*

In the second half of the 20th century, the surface devoted to olive farming and the number of olive trees progressively decreased, mainly because of the structures antiquated, compounded by the damage caused by frost in 1929 and 1956, which led to the death of many trees that were not sufficiently replaced. Furthermore, over the last decades the uprooting of plants in the areas nearest

the plains where mixed cultivation had been practiced, the abandonment of the olive groves in areas difficult to reach, and the lack of incentives for the creation of new groves have determined an ulterior contraction of the surface cultivated with olive trees. For pedoclimatic and orographic reasons, in these areas there aren't many farming or work alternatives, so the income of many farmers comes entirely or mostly from olive cultivation.

Umbria produces high quality extra virgin olive oil (EVOO) certified by the PDO (Protected Designation of Origin), in Italian DOP (Denominazione di Origine Protetta), a label developed by the European Union (Regulation (CEE) 2081/92) for the safeguard of high quality agro-food products typical of certain territories.

The production of DOP Umbria extra virgin olive oil has regulated production regulations approved by the Italian Ministry for Agricultural, Food and Forestry Policies in 1998 (Ministerial Decree 6<sup>th</sup> August 1998). There are five subzones of production. The area proposed for the inscription in the GIAHS program is part of the "Colli Assisi Spoleto" subzone. The olive oil produced in this subarea must be made with at least 60% of oil coming from the Moraiolo cultivar, while Leccino and Frantoio cultivars must not exceed 30%; no more than 30% of other local cultivars can be used. The production must not exceed 5,000 kg/ha in intensive groves, and the maximum yield of olive in oil cannot exceed 21%. As for oil production, only mechanical techniques are allowed, in order to guarantee the high quality of the oil and no alteration whatsoever.

Other agricultural activities are commonly associated the cultivation of olive trees and are part of the agricultural system. The most common ones are the cultivation of cereals, fodder, vines, fruit trees, and mixed crops. All these activities are less important than olive oil production, but they show that the agricultural system was self-sufficient regarding agricultural products. Olive oil was produced mainly for trading with the other Italian regions, while other products were produced above all for self-consumption. Other common crops are reported in the following table.

SPECIES	VARIETY/CULTIVAR	DESCRIPTION
Olive ( <i>Olea europaea</i> )	Moraiolo	Moraiolo is one of the most renowned and exquisite olive cultivars, providing one of the best Italian oils. The tree is rustic, without specific necessities regarding farming and soil. As a contraindication, however, it lacks of vigor. It is a self-sterile cultivar; therefore, it needs a pollinator nearby. The moraiolo is the most popular cultivar in the proposed area and is certainly the best cultivar to withstand the difficult pedoclimatic conditions due to its adaptability. In fact, it adapts easily to rocky terrains and to the reduced soil profile typical of these areas. It is characterized by a limited growth with the fruiting and main branches that rise upward in a distinctive way. It has small fruit and a late and scaling maturation, with strong resistance to detachment, to rapid temperature changes typical of spring, and to summer drought. Abortion is uncommon if compared to other

		<p>cultivars, with a maximum percentage of 25%. The olives are spherical and black, with purple shades. Even if the olives have a limited weight, usually between 1.5 and 2 grams, the yield is high, equal to 20% and over. But what makes this olive special is the high polyphenolic concentration in its fruits. The concentration of oleic acid and of unsaturated and saturated fats is good. Productions obtained with this cultivar have excellent organoleptic qualities and excellent chemical characteristics that make it an appreciated component of the Mediterranean diet and an irreplaceable ingredient in local cuisine. Olives are harvested in November for the best yield, more precisely in the last two weeks.</p>
	Frantoio	<p>The Frantoio cultivar is widespread in central Italy. It is a medium-sized and vigorous tree, with a broad crown, and good resistance to diseases and cold. It produces ovoid olives with good yield, usually between 16 and 20%, from which it is possible to get a good quality and fine oil. Its flowering is contemporary to Moraiolo and Leccino cultivars, and it has medium resistance to low temperatures in the spring.</p>
	Leccino	<p>The Leccino cultivar is spread throughout Italy and other parts of the world, although its origin is probably to be found in Tuscany, due to its great resistance to the main adversities and the ability to adapt to different soils. It has reduced resistance to low temperatures in the spring and is a self-sterile cultivar, therefore it needs a pollinator nearby. It is a medium-sized tree, with a broad and dense crown and upward branches. It produces medium quality oil but it can also be used to produce olives for direct consumption.</p>
Grapevine ( <i>Vitis vinifera</i> )	Trebbiano Spoletino	<p>Typical of the valley of Spoleto, in an excellent landscape modeled by human work over the centuries, is the cultivation of Trebbiano Spoletino, a variety of indigenous white grapes. In 1553 the scholar from Bologna, Leandro Alberti, described the pleasant plains between Foligno and Spoleto in his <i>Descrittione di tutta l'Italia</i>: "On each side of the via Flaminia you can observe, in this beautiful plain, fruitful fields embellished by several rows of grape vines paired with many rivulets of clear waters. And further you can observe great multitudes of almond and olive trees where in winter time the great thrushes nest, descending from the mountains in search of olives for their nourishment. This pleasant plain produces wheat and other fodder, and good wines and other fruits are extracted from it. Thanks to its beauty, as well as its fertility, it can certainly be listed as one of the beautiful and fruitful places of Italy." This was the period when mixed agriculture asserted itself as a manner of producing cereals, grapes and tree leaves useful to feed the animals without having to reserve part of the fields for hay. Thanks to the "flexibility" of this variety of grapes, <i>piantate</i>, i.e. fields with rows of maple trees that supported the vines, were</p>

		<p>established on the plains, on the hills, and even on the mountains. On hillsides, the rows were alternated with rows of olive trees. The first mention of the <i>Vinum Tribulanum</i> dates back to Pliny the Elder and his <i>Naturalis Historia</i> (1<sup>st</sup> century A. D.), in which it was described as a wine of noble origins. In modern times, this variety was considered a “luxury” cultivar because of the particular wine that could be extracted from it, simple and delicate in taste. Because of its great productivity, wine farmers called it “debt banisher.” As the years went by, the cultivation and related production of Trebbiano Spoletino gradually decreased because of the need to eliminate the cumbersome mixed cultivation, until it nearly became extinct. In recent years this precious variety was rediscovered and 22 wineries were established, triggering an increase in production. Because of its peculiarity, the Trebbiano Spoletino cultivar has been added as number 243 to the National Registry of Vine Cultivars, and has been classified as a DOC wine by the Ministry for Agricultural, Food and Forestry Policies with the publication, on November 30, 2011, of the production regulation for DOC SPOLETO wines. DOC SPOLETO territory includes portions of the municipalities of Campello sul Clitunno, Castel Ritaldi, Foligno, Montefalco, Spoleto, and Trevi, and its surface is about 23,600 ha at 200-550 meters a.s.l.</p>
Saffron ( <i>Crocus sativus</i> )		<p>Saffron was extremely widespread in ancient times. This spice with a unique and inebriating scent had different meanings. It was, for example, a symbol of unhappy love, evoking the myth of young Crocus who was in love with the nymph Smilax and other significations. Its use was varied: it was employed to color clothing, to prepare ointments and scents, to color the bandages of Egyptian mummies. The use of saffron in cooking dates back to the Middle Ages and the Renaissance, when it was used to color and flavor foods. In fact, it gives food a particularly intense aroma and taste, aside from the typical ocher color. Production of saffron in Umbria is first mentioned in the 13th century. Castel della Pieve (Città della Pieve) was considered the most important production area, while Valnerina is first mentioned in historical sources in the 15th century. In the 16th century Cascia became affirmed as one of the most active centers in the trade of this spice, mainly used as a pigment and later for its pharmaceutical and cosmetic properties. In the 17th century the cultivation of saffron was progressively abandoned, to be revived only in recent years. In particular, lately a group of farmers has reintroduced saffron in Valnerina and in some municipalities of the Apennine range between Gualdo Tadino and Spoleto, prompting the creation of new producers’ consortiums.</p>
Onion ( <i>Allium cepa</i> )	Cannara onions	<p>Cannara onions, aka <i>cannara flat (yellow and red)</i> have a white rounded bulb with convex (flattened) poles. They are</p>

		sowed in full field in the month of May, while hoeing takes place in April and is repeated several times. Considering the peculiarity of the product, phytopathic control is carried out with copper-based products. The harvest takes place in July and August, and the onions are left out in the field to dry. Later come the cleaning and selection phases, when the product is divided by type and size. The bulbs are then “braided” and ready to be sold. This is actually not a specifically local cultivar, but an onion belonging to three cultivars (Florence Red, Rovato Borrettana, Parma Gold), which becomes a particularly appreciated high-quality product when grown in this partially swampy sandy-clay soil.
Celery ( <i>Apium graveolens</i> )	Trevi black celery	Trevi black celery is, without a doubt, one of the most unique vegetables cultivated in the Province of Perugia. Its stalks remain green even when fully ripe. This vegetable is known at least since the 19th century, when it was mentioned in some historical documents. Black celery was served to the passengers of the ships that, at the times of the Papal States, sailed to America from Genoa, Livorno, Naples, etc., because it was an “excellent second course that kept for a very long time and was an aphrodisiac.” The features of black celery, the cultivation of which experienced a downfall after the Second World War with the arrival of American celery, are its length – greater than most other varieties, it can measure as much as 1 meter – its dark green stalks, the fact that it has no strings, and its strong scent. If let grow without special attention it is very dark, and takes on a lighter coloring only if buried under the ground: a white-stalk celery, without strings, with a sweet and pulpy heart. The operations carried out to obtain “Trevi black” are rigorous and have remained unvaried for centuries. Sowing takes place in April under a waning moon. Traditionally it took place on Good Friday because, according to local farmers, vegetables planted in this period grow faster and flower later, and to this day many farmers follow this rule. Trevi farmers are extremely jealous of their seeds and each reproduces his own taking them from the best plants at the end of every season. In mid-October, the celery is ready to be harvested and is sold mainly on the local market, at most reaching the city of Perugia. The particularly intense flavor of Trevi black celery is enhanced in local cuisine, in dishes that are regularly offered during the yearly festival. The sale of the celery usually takes place directly “from the field to the market.” On the third Sunday in October, the Black Celery Festival is held in Trevi.
Bean ( <i>Phaseolus vulgaris</i> )	Green and yellow Cave di Foligno bean	The Cave di Foligno bean. In this town two varieties of bean have been cultivated for over a century – green and yellow – both with thin skin, easy to cook, and excellent in taste. Cave is more a neighborhood of Foligno than a town unto itself. It rises on a hill barely 200 meters a.s.l., on the right bank of the



		<p>Topino river. For over a century a bean in two extremely rare varieties has been cultivated here: the <i>giallo</i> (yellow) and the <i>verdino</i> (green). It seems that the most ancient of the two is the <i>giallo</i> or <i>giallino</i>, from the beginning of the 20<sup>th</sup> century. Main (and sometimes only) food of farmer families until the '50s, production reached 10 tons circa, but, as has happened in the rest of Italy, with the advent of progress there was a depopulation of the countryside, generating a migration towards the city and new jobs. This is the reason why today the quantity produced is much diminished, barely reaching 1000 kg. And this is the reason why Cave beans are an absolute rarity, hard to find and unique in quality. Because of their limited production, they are known only by a small number of experts who manage to acquire them in limited amounts. However, everyone may have a chance of tasting them during the famous "Cave bean festival" that takes place in the last week of October, when the entire production is used up. In Cave, this particular bean acquires a unique organoleptic profile and flavor, thanks to the fertile low-calcium soil that endows it with intense flavor and scent. It is cultivated without chemical fertilizers, pesticides, or herbicides. Harvest takes place between August and September by reaping. Then, once the beans have been dried in the sun, they are beaten and shucked (hence the expression "shucked Cave bean"). After drying, which takes place in special areas, they can keep up to a year if preserved carefully in hermetic glass jars.</p>
<p>Truffle (<i>Tuber melanosporum</i>)</p>	<p>Black Umbria Truffle</p>	<p>Umbria, and the area proposed, is also well known for the production of truffles. Traditionally truffles were gathered in the oak woods of the area, using dogs or pigs. Over the last 20 years, many truffle plantations have been established in Umbria, using <i>Quercus ilex</i> and other trees with mycorrhizae. These plantations have a negative aesthetic impact on the local landscape and they should be object of careful evaluation. Fortunately, in the proposed area, their total surface is still less than 1%, according to 2011 data. The prevalent variety of truffle present in the proposed area is the Black Umbria Truffle (<i>Tuber melanosporum</i>): it grows in calcareous soil with a high clay content, and lives in symbiosis with other plants, especially oak and holm oak, but also beech and chestnut. Its size can vary from that of a nut to that of an apple; it is roundish and often irregular; its surface is rough to the touch, but not sharp-cornered. It has a strong aromatic smell, and blackish-reddish pulp with fine white veins.</p>

### 3. Agrobiodiversity in the El Oued site (Algeria)

The Wilaya (province) of El Oued is located approximately 600 km northeast of the capital Algiers (Fig. 1). The Wilaya is divided into two homogeneous regions: the border region with Tunisia to the east, and Oued Souf to the west. The Grand Erg Oriental occupies three quarters of the Souf's surface area; it is a succession of sand dunes. This Saharan region is characterized by a climate of very wide variations in air temperatures, which exceed 40°C in summer. Total rainfall is generally less than 100 mm.

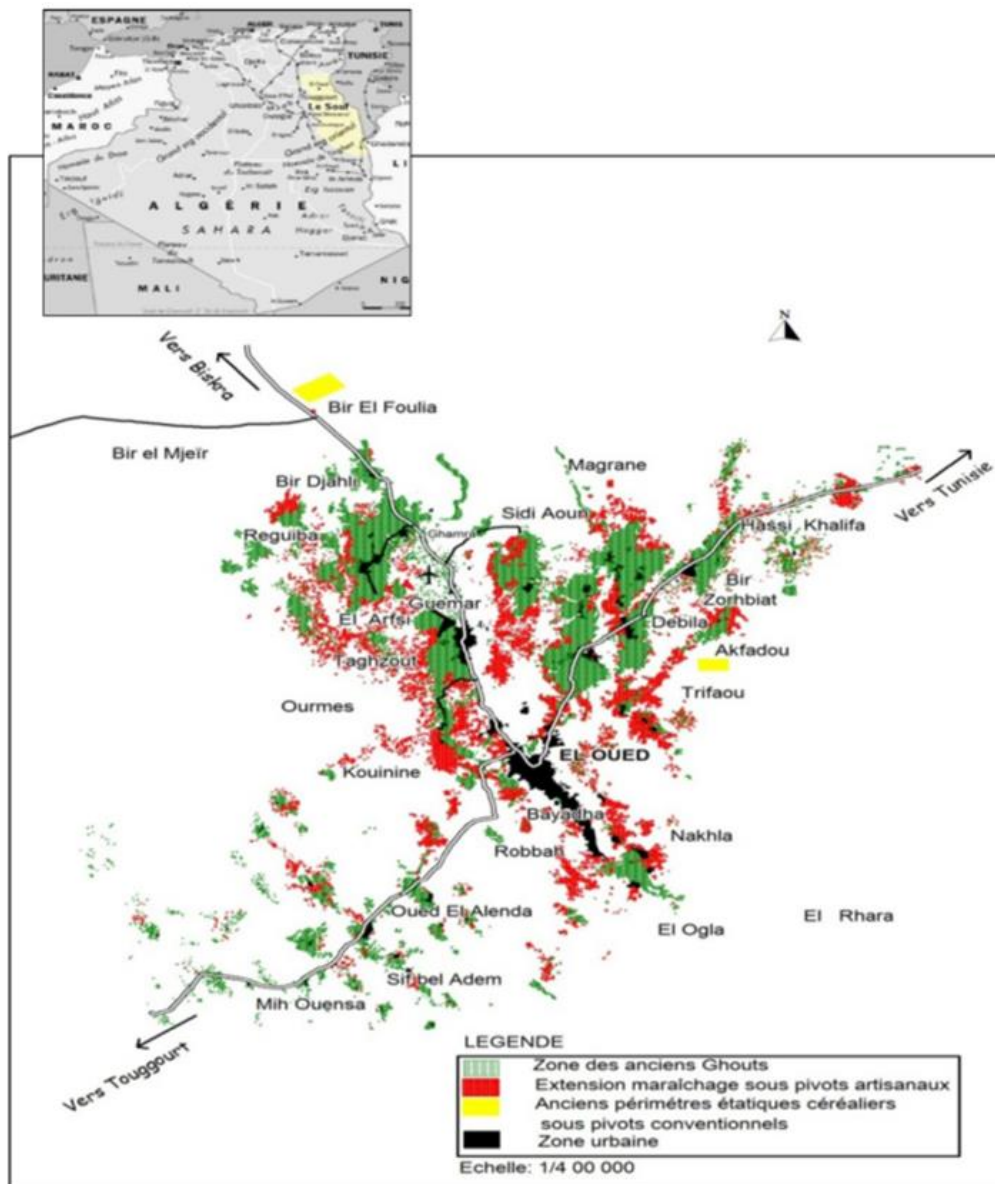


Fig. 1: Municipalities of the Oued Souf region (INSID, 2011).

El Oued is one of Algeria's most densely populated Wilayas in the Sahara, with over 900,000 inhabitants in 2020, and a growth rate of 3.5%. 39% of the population is under 14 years of age, and only less than 5% is over 60. The agriculture sector employs 42% of the Wilaya's active workforce. Available groundwater resources in this agricultural region are estimated at 4.9 billion cubic metres. The agricultural sector is currently booming in the Wilaya, where the total agricultural area is around

1591752 hectares, or 35.70% of the wilaya's total area. The useful agricultural area covers around 52911 hectares, or 3.32% of the total agricultural area, of which 51456 hectares are irrigated. The main crops are:

- *Market gardening*: mainly potatoes, green beans and peas in winter, and watermelons, cucumbers and aubergines in summer. However, potato cultivation has been a key feature of the region for the past decade, covering an area of 7,289 hectares and producing 17,5601.4 tonnes, with a yield of 24.1 tonnes per hectare.

- *Protected crops*: greenhouse cultivation is a relatively new practice in the region. The satisfactory results of the early harvest have led to an increase in the area cultivated; the main crops are tomatoes, peppers and courgettes.

- *Industrial crops*: mainly snuff, henna and spices, covering an area of 1,127 hectares.

- *Field crops*: represented by cereal and forage crops, with a cereal area of 3,305 hectares, a production of 1,061.9 tonnes and a yield of 3.4 tonnes per hectare.

- *Date palm cultivation*: previously represented by traditional palm groves, known as Ghout, which enabled the Souf population to survive; nowadays, palm groves are being planted in new developments, which are expanding.

There are more than thirty spontaneous plant species (wild plants) in the region, belonging to six botanical families.

The Ghout system is one of the world's most fascinating models, a sustainable agricultural system that conserves water and soil and adapts to a difficult environment. Due to the difficult soil and climatic conditions in the Souf region, the local population adopted an ingenious agricultural system back in the 15<sup>th</sup> century. In this agrosystem, the irrigation water is not transferred to the cultivated plants, but it is the plant that is placed at the water level.

The Ghout is a depression, dug out partially or entirely by man, to the point of approaching underground water; at this level, plants are cultivated up to a height of 1 to 2 m. The date palm is present in all Ghouts, and fruit trees are planted under this stratum, while fodder and food crops (vegetables, condiments, etc.) are grown at ground level. However, this last layer needs surface irrigation, as the roots would not reach the water table, so farmers dig wells. Generally speaking, the plant production of these small traditional farms is intended for family self-sufficiency and animal feed. In addition to plants, animals were raised, generally goats and chickens inside Ghout and camels in the surrounding area.



*Fig. 2: Irrigated Ghout with the two upper layers; date palm and fruit trees (vine and citrus) (BEDJAOUI H., 2023).*

According to an 1896 census, there were 13,364 Ghouts in the El Oued region; unfortunately, by 2022, the number had fallen to just 5,540 (Fig. 4). This agrosystem is shrinking due to problems with groundwater pumping, resulting in a drop in water levels in some areas and the Ghouts drying up in others. On the other hand, during the 1990s and early 2000s, poor drainage in some areas led to the drowning a large number of Ghouts, especially in the municipality of El Oued. Other factors have contributed to the deterioration of this agricultural heritage, such as sand advancement, urban expansion, an ageing workforce, inheritance and division of Ghouts (Fig. 3).



*Fig. 3: Degraded Ghout (FACI M, 2023).*

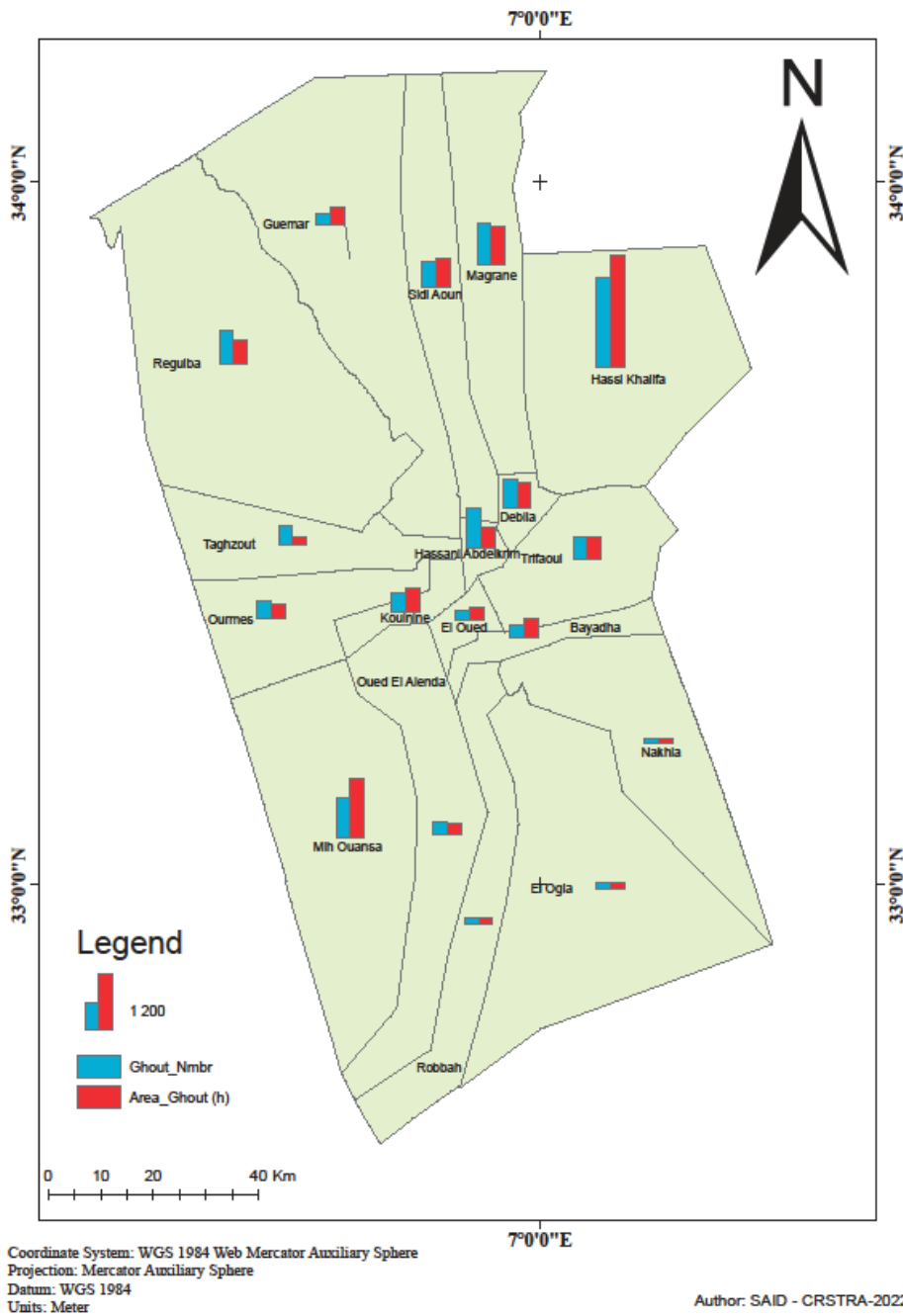


Fig. 4: Number and surface area of Ghouts per municipality in the Oued Souf region.

According to the first surveys, we carried out in January and June 2023, agrobiodiversity in the Ghouts has suffered a remarkable decline. In 47% of the gardens in this ancient agrosystem, there are only date palms, while in 53% of the other farms there are only a few fruit trees, such as pomegranates, lemons, vines and figs. While the underlying crops, present in 7% of gardens, are generally composed of onions, tomatoes and fodder crops. Even the varietal biodiversity of the date palm is limited to two cultivars, present in all the Ghouts, the Deglet Nour and the Ghars; although there are other cultivars, but in a limited number of gardens: Degla Beidha (in 23% of the Ghouts visited) and in 7% of the gardens there are Takarmoust, Tamjhourt, Tantbouchet and Tinissine.

SPECIES	VARIETY/CULTIVAR	DESCRIPTION
Date palm ( <i>Phoenix dactylifera</i> L.)		<p>The date palm (<i>Phoenix dactylifera</i> L.) is one of the oldest known fruit crops and has been cultivated in North Africa and the Middle East for at least 5000 years. It is an angiosperm, monocotyledonous and dioecious (2n=36) plant, Inflorescences of female and male trees differ in morphology, both are enclosed in a hard, fibrous cover (the spathe) that protects the flowers from heat and sunlight during the early stage of flower development. This species is engaged in the social and economic importance of the oasis ecosystem where the date palm (<i>Phoenix dactylifera</i> L.) is the mainstay limiting the damage caused by silting and protecting the underlying crops against intense solar radiation for underlying crops. The date palm develops a cylindrical, unbranched and large stem (10-20 m tall) marked with leaf scars, and generally produces basal suckers. The date palm is often propagated clonally by offshoots because cross-pollination results in new cultivars out-of-type with unknown characteristics. Furthermore, about 50% of the seedlings are male although they cannot be recognized visually until trees begin to bloom after 4–5 years. The Date palm is a strategic fruit crop in Algeria, which is one of the largest producers of dates in the world. Centered on the botanic interpretation, there are about 944 cultivars denominated by farmers on the basis of shape and color of the fruits or the presence of specific location. Along with this, the date palm is selected for cultivation on the basis of better fruit quality and post-harvest life. Each cultivar is obtained from the elite successor individual offspring or seed-based selection.</p>
	Deglet Nour	<p>The Deglet Nour (DN) cultivar or 'Deglet Noor' or 'date of the light' in Arabic, also known as 'Deglet Nour', 'Deglet Nur' or 'DegletNuur', is believed to originate in the early 17th century near Touggourt in Algerian Sahara. It was recognized as a superior date and was established in many oases in Algeria and southern Tunisia at the end of the 17th century. Deglet Nour is particularly popular with local and foreign customers. It is known for its quality, which is the result of specific local know-how. This elite cultivar is present in all the Ghouts. Deglet noor is an late-maturing variety (taking longer to ripen) The harvest period extends from the end of October to December. The date used consumed fresh mainly at stages tamer or stored and has an average weight of 12 g with a water content about 24%. Semi soft dates, characterized by its tenderness and the golden appearance of the pulp and sweet specific taste due to its high sucrose content. This balance between water content and sugar makes Deglet noor dates very special classifying them as one of the best dates in the world. This cultivar has a slender, cylindrical stipe, long palms with a well developed and distinguishable spine part since all spines have the same orientation and characteristic elongated spathe with the duration of receptivity of female inflorescences of 12 days. On the other hand, Deglet is the one of the most sensitive cultivar to</p>

		<p>abiotic constraints. The average production per palm in the Wilaya of El Oued is 74 kg. DN dates are the most widely marketed and exported dates in Algeria. These dates are produced in the northeast of the Algerian Sahara and accounting for 62% of national production. Deglet Noor dates being exclusively the most exported and appreciated dates in Algeria, which ineluctably leads to a severe genetic erosion in date palms. The number of date palms cultivated in the Ghouts of the Oued Souf region (20 municipalities) is estimated at 279565, in 2022, over an area of 2462 ha</p>
	Ghars	<p>Ghars has a secondary economic importance and is considered among the most famous cultivars after Deglet Noor. It is vigorous with long and dense palm giving it a drooping appearance. His name means pasty and sticky according to the dates it is producing which are irregular with oblong shape (larger towards the apex); soft (at full maturity) and brown regarding their high water content (more than 30%) and the invert sugars content (fructose, glucose) that weighs 9gr. It can also be consumed earlier at “bser” stage where the date is honeyed yellow. The dates are usually processed into pastes for later use: pitted and compressed in bags or goat skins or used in confectionery and preparation of traditional cakes or processed by the local population to other products such as “Rob” (date jam), whose nutritional and therapeutic value remains unquestionable. It is one of the hardiest variety, as it adapts to all types of soil and all locations in the palm groves. The average yield is 69 kg/palm in the Wilaya of El Oued, higher than the national average that around 64 kg.</p>
	Mech Degla	<p>The most abundant dry date in Algeria. Its name means that it is not a degla date (to distinguish it from Deglet Nour). Very tasty dates and very rich in sucrose and fiber. Harvested in October-November. Considered as one of the principal exported dates to Asian Muslim countries (Malesia and Indonesia) very easy to package and store. Cultivar of southeast oasis, of low vigor, small number palms which are moderately long with few spines. The date are very tasty and well appreciated locally, water content around 15%, high sucrose content (more than 50%) and fiber. Used as fresh fruit or mainly as a powder as a natural remedy for bone fractures. Scientifically, it has been proved that the date of this cultivar are among the richest in calcium content.</p>
	Degla Beidha	<p>The name means “white dates” given its very light beige color. This cultivar is as important as the previous one, considered as one of the famous dry date in Algeria and among the main exported (to the south and Sahel countries) due to its big size and easy packaging and storage. With a drooping overall appearance, this cultivar is very abundant particularly in southeast oasis. The dates, harvested in October, weight about 7gr with an average of water content of 14%. Consumed fresh or processed most often in</p>



		confectionery. The yield of 49.6 kg per palm, lower than that recorded in El Oued (68 kg/palm).
	Takarmoust	These dates are harvested in September, soft consistency with moderately spherical shape and black color at rutab stage. Water content about 22%. They are less abundant than the cultivars described above.
	Timdjouhart	The meaning of the date name is "looks like a pearl". Soft date, attractive, by its vivid color with a specific aroma. This cultivar is of low vigor, harvested in september-october. Used fresh for consumption or stored, the dates are of good quality but not widely marketed. Even if this cultivar is considered as frequent in Oued Righ and Ouargla and M'Zab regions even if found in a limited number of visited Ghouts.
	Tantboucht	It is a frequent cultivar, considered as a tasty excellent date, well appreciated by the local population. Spherical medium-sized black date at maturity. Soft consistency weighting around 10gr. Harvested in October, one of the most appreciated dates consumed fresh or processed. Large-scale commercialization in local market.
	Tinissine	Less frequent cultivar. The dates are harvested in October. Usually consumed fresh or mashed with others soft dates. An elongated, black fruit, which weighs approximately 5gr. These soft dates are most often intended for family consumption.
	Dokkar	Globally, phenotyping date palm males is not very considered in the Ghout and elsewhere in Algeria. Only some ancient farmers are able to distinguish between the phenotype of Ghars male and other phenotypes based on the shape of the spathe. Generally, the male palm is known locally as the "Dokkar" and is developed from seedling and selected by farmer on the base of its vigor and then propagated clonally. The most common preferred phenotype of Dokkar is the one closest to Ghars cultivar and its recognition is determined by the shape of the spathe that is large and contains the pollen. Male flowers are usually waxy white and female flowers usually are yellowish green. Dokkar palms focus their development solely on vegetative growth, whereas female palms focus on both vegetation and fruiting. Commercially, few male trees are grown in date gardens, and pollen is collected for the artificial pollination that is critical for the success of production. Approximatively, the number of Dokkar should be around 5% of the total number of the trees in the grove to ensure the pollination, done artificially for the economically important cultivars to guaranty a good yielding.
Pomegranate tree ( <i>Punica granatum</i> )		The culture of the pomegranate tree is very known in the Algerian Southern constituting the main fruit species in most groves and its production is complementary of that of the dates. With other fruit trees they form the second layer of the oasis. its production is

		complementary of that of the dates. In the field, two different cultivars for the pomegranate tree are identified: 'Hlou', which means sweet, and 'Hamad', which means sour taste. The pomegranate tree in the Wilaya of El Oued is generally grown in palm groves (under palm trees), with an estimated 19030 shrubs of this species and a yield of 81 kg/tree. The pomegranate tree is found in most Ghouts that contain fruit trees.
Fig tree ( <i>Ficus carica</i> L.)		Important componenet of the oasis in the traditional Five cultivars are locally known: 'Kharfi', which means maturation of fruit in autumn; 'Ngaoussi', from the village called Ngaous; 'Bou3ank' , which means that the fruit has a long petiole; 'Tinedli', from the village called Tinedla; 'Bakor', which means early maturation cultivar. There are 4,950 fig trees in the Wilaya. It is grown in palm groves, where there are only a few trees on each farm. The number of trees at Ghout level is 1-3 trees/Ghout.
Grape ( <i>Vitis vinifera</i> )	Table grapes	Only table grapes are grown in the Oued Souf region, covering an area of 223 ha. There are 9240 bushes of this species and the yield is 42 kg/tree. It is grown on a symbolic basis in a limited number of Ghouts, between 1 and 3 shrubs per Ghout.
Apple tree ( <i>Malus communis</i> )		It is planted on an area of around 268 ha. The number of trees is 16160 and the yield per tree is 61 kg. At Ghout level, it is planted under palms with a number that does not exceed the fingers of the hand.
Pear tree ( <i>Pyrus communis</i> L.)		The area planted with pear trees is small, only 107 ha, where only 4,300 trees are planted, with a yield of 41 kg/tree. Pear trees are not widely planted in the Ghouts.
Lemon tree ( <i>Citrus limon</i> L.)		Lemon growing in Oued Souf is negligible, with an annual production of 450 qx. The number of lemon trees is very low in the Ghouts (1 to 3 lemon trees per Ghout).
Watermelon ( <i>Citrullus vulgaris</i> )		In the Wilaya of El Oued, watermelons and melons are grown on a surface area of 2361 ha, producing 1126640 quintals, with an average yield of 477.3 qx/ha. Watermelon is grown on only small plots of land in the Ghouts.
Melon ( <i>Cucumis melo</i> L.)	Melon	Melons have been grown for a long time in the Ghouts. It used to be sold, but is now used for family consumption.
	Melon canari	Canary melons have only been grown in the El Oued region since the second half of the last century.
Pumpkin ( <i>Cucurbita maxima</i> )		This species, which belongs to the cucurbitaceae family, is highly prized by the local population. Its cultivation in the Ghouts has declined in recent years.
Zucchini ( <i>Cucurbita pepo</i> L.)		Zucchini is grown in El Oued in open fields and under greenhouses, on a surface area of 171 ha, producing 56430 qx, i.e. a yield of 330 qx/ha. The average yield in greenhouses is 1000 qx/ha, but only 12 ha are used. Zucchini are rarely grown in the Ghouts.

Eggplant ( <i>Solanum melongena</i> L.)		The area under Eggplant is around 282 ha, producing 162970 qx, or 578.8 qx/ha. In the Ghouts, production is generally for family consumption.
Onion ( <i>Allium cepa</i> )		Onions are grown over an area of around 2,000 hectares, producing 600,000 quintals, with an average yield of 300 quintals per hectare. The Ghouts have been growing onions for a long time, and onions are still grown today.
Tomato ( <i>Solanum lycopersicum</i> L.)	Tomato	Tomatoes grown in open fields and greenhouses occupy an area of 3,397 ha, of which palm-grown tomatoes account for 2,398,000 qx, or 16% of Algeria's production. The average yield in El Oued is 705.9 quintals per hectare.
	Cherry tomato	The cherry tomato is grown in several Ghouts, but there are no statistics on its production. It is eaten in the form of salads.
Peppers and chillies ( <i>Capsicum annuum</i> )	Peppers	Hot pepper is an unavoidable component of the Algerian population's diet. It is consumed in various forms including fresh consumption, dry powder and pasta. It is grown across the whole country in a different of settings varying from small-scale subsistence farming to large-scale commercial enterprises. Currently, the Southeast Algeria, including Ghouts, represent the last rampart of the cultivation of pepper landraces. Over many centuries, farmers have cultivated pepper crops using traditional practices to preserve local populations in various environments, saving and exchanging the seeds, they produced and transferring them from one generation to the next promoting the occurrence of both outcrossing and introgression. This obviously led to phenotypically different populations. Usually, local varieties have varying names that carry the meaning of a specific region or characteristic or use. However, despite the important cultivated area, all pepper landraces in Algeria have the same appellation: Arabian pepper or "Felfel Arbi". Peppers are grown on an area of 119 ha, producing 42700 qx, or a yield of 358.8 quintals per hectare. It is grown in Ghouts where there are wells.
	Chillies	Chillies are grown on 630 hectares, with an annual production of 173,080 qx and a yield of 274.9 qx/ha. It is grown in open fields and greenhouses. The chillies of Ghouts are generally grown from local seeds, known as "Laarbi".
Potato ( <i>Solanum tuberosum</i> )		Potato cultivation was introduced to the Oued Souf region in the 1990s, and has expanded rapidly since 2000. Today, the region produces 24% of Algeria's output, some of which is exported. Potatoes occupy an area of 37,000 ha, with an annual production of 12140000 qx, giving an average yield of 328.1 qx/ha. It is also grown in the Ghouts, but on small plots, where the produce is intended for self-consumption by the farmers.
Purslane ( <i>Portulaca oleracea</i> )		Purslane is one of the oldest crops grown in the Ghouts. Purslane is generally cooked with couscous, a delicious traditional dish.

Fodder cabbage ( <i>Brassica oleracea</i> L.)		This fodder plant is grown in some Ghouts by farmers with livestock, especially goats and sheep.
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It should be noted that the farmers have stopped growing other plants in the Ghouts, such as olive trees (*Olea europaea* L.) for trees; wheat (*Triticum turgidum* L.) and barley (*Hordeum vulgare* L.) for cereals; coriander (*Coriandrum sativum* L.), parsley (*Petroselinum crispum*) and mint (*Mentha spicata* L.) for condiments; alfalfa (*Medicago sativa* L.) for fodder; carrots (*Daucus carota* L.), cucumbers (*Cucumis sativus*), broad beans (*Vicia faba*), lettuce (*Lactuca sativa* L.) and turnips (*Brassica rapa* L.) for market garden crops, as well as henna (*Lawsonia inermis*) and roses (*Rosa*).

## 4. Agrobiodiversity in the Argan tree agro-forest-pastoral system of Ait Souab-Ait Mansour area (Morocco)

### 4.1 Overview of Argan biosphere reserve

Located in the middle and southwestern of Morocco, the argan reserve covers a vast area of more than 2,560,000 hectares, bordered by the High Atlas and Anti-Atlas Mountains and open to the Atlantic in the west. Figure 4 shows the geographical distribution of argan reserve.

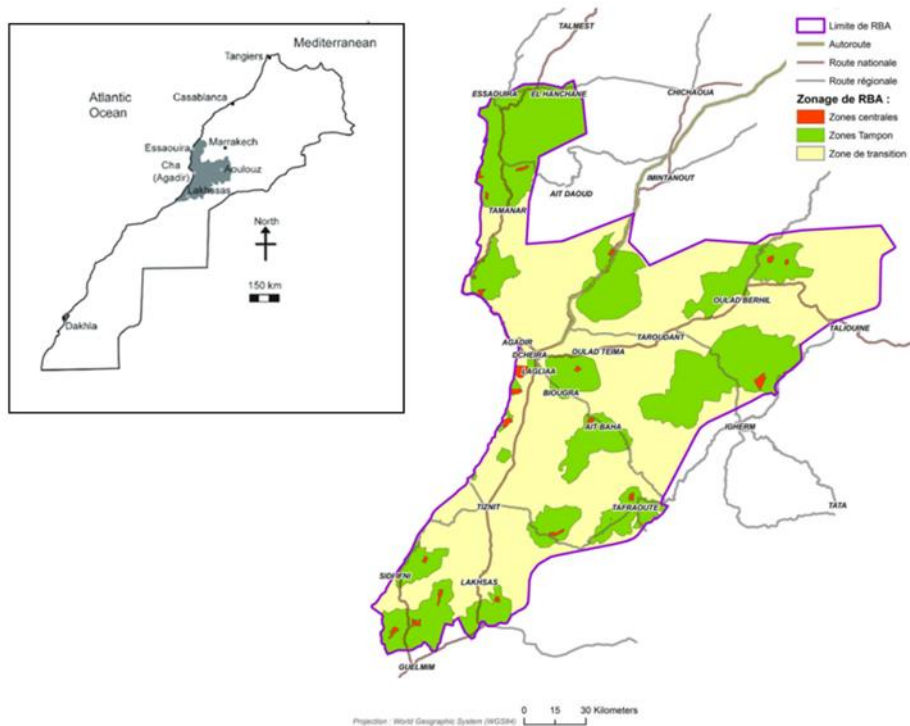


Fig. 5: Biosphere reserve of Argan tree (*Argania spinosa*) ([source](#)).

This distribution is widely variable in terms of surface covered and density of trees. The Table 2 gives the area of three zones represented in the map using the same color.

Zones	Total area (ha)
Core areas	16.620
Buffer zones	582.450
Transition zones	1.900.900

Tab. 2: division of the territory into zones and their area in hectares.

## 4.2 Agro-sylvo-pastoral system of Ait souab Ait Mansour

The agro-sylvo-pastoral system is based on four major productions: goat, barley, wood and argan oil. In the argan grove, the forest and agricultural land are integrated into a complex organization. The figure below summarizes some aspects of the organization of the system.

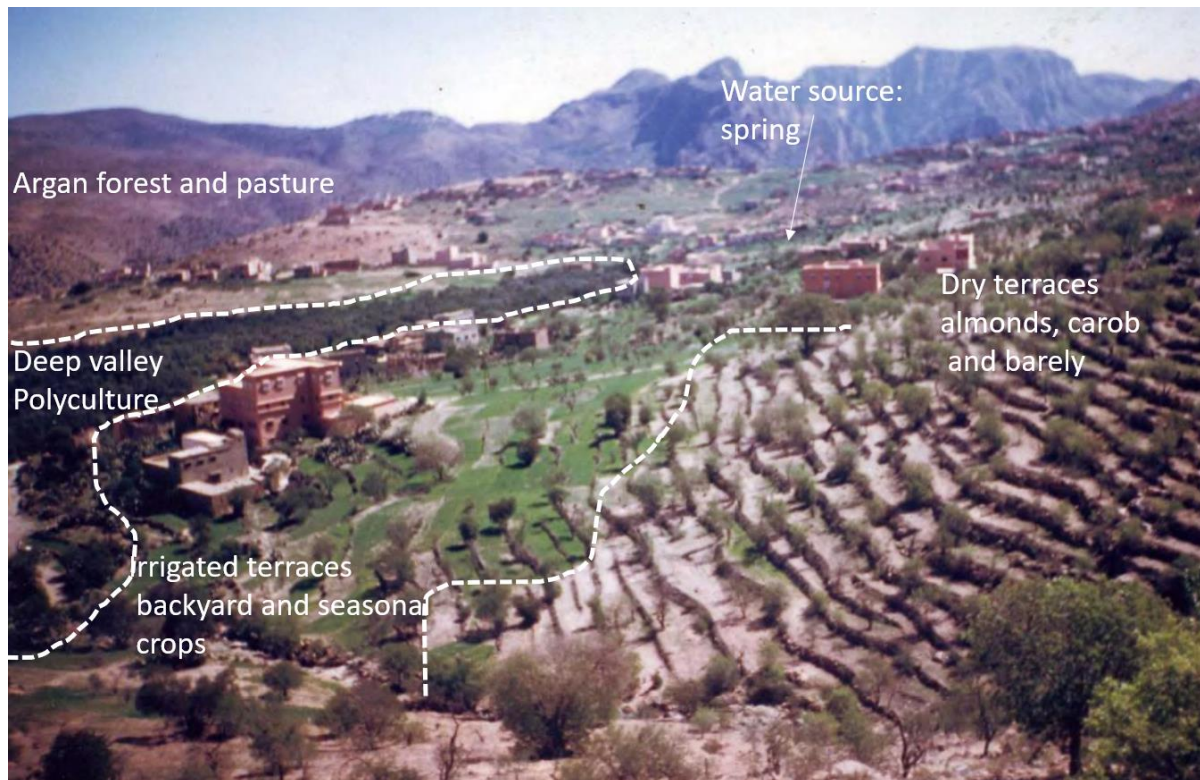


Fig. 6: Example of Agro-sylvo-pastoral landscape, from Ait Lahcen Douar (village) Commune Tanalt. Photo credit: M.Ziyadi, 2005).

## 4.3 Agrobiodiversity within the agro-sylvo-pastoral system of Ait souab Ait Mansour

Field investigation reveals that farmers cultivate a total of 53 species, including 5 cereal species, 2 forage species, 21 fruit species and 25 vegetable species. Botanical diversity is very pronounced in market gardening and arboriculture, where there are respectively 5 and 7 different botanical families. The cultural and botanical diversity as well as the regeneration of local seeds are at the origin of the maintenance of the production in these regions. In the description below we only focus on the most important crop in terms of surface and relevance to local communities.

### a. Arboriculture

Almond, Olive tree, date palm and argan are the four abundant species in the site. As for the almond tree, this species is spread over an area of 6,600 ha including 60% around Taфраout district, and its production is estimated at 180 to 300t/year. Regarding olive trees, it occupies an area of 2,450 ha, located almost everywhere, but in the lower areas, with a production ranging between 550 and 1,250 t / year. For date palm, it occupies about 1,565 ha of which 70% in Afella Ighir and its production varies between 600 and 1250 t / ha. (ANDZOA, 2018)

Despite that argan is a wild endemic tree, it is considered as a source of local argi-food production. The argan tree is a species essentially thermophilic and xerophilic, its distribution is determined by very strict conditions of temperature and humidity. The argan tree supports a wide range of temperature from 3°C to 50°C. The argan tree has no requirements regarding the physico-chemical nature of the substrate. It develops on the most varied substrates at the origin of many types of soils: regosols, lithosols, vertisols, calcisols, ferralsols. In general, the yield of fresh fruit per hectare varies according to the density of the stand, the age of the tree, the size of the fruit and the rainfall of the year. As an order of magnitude, average yields of 15kg/tree to 30kg/tree and an average density of 30 trees/ha can be used to estimate fresh fruit production at 450kg/ha/year (ANDZOA, 2018).

#### **b. Cereals**

The main type of cereal within the site is barely. It is cultivated for its nutritional and forage value as well as its resistance to dry climate conditions. Other cereals are produced as complementary to barely, especially in irrigated areas: maize, wheat.


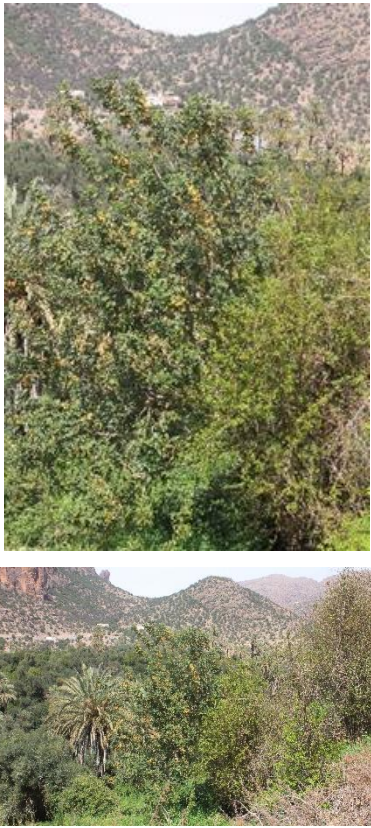
#### **c. Gardening and backyard crops**

The system of gardening near home or in small parcels under trees (almond, carob and palm) is well known on the site. It contributes to the food security of families and in case of abundance the extra is sold in local markets (souk). The list of crops depends on the season, climatic condition, and farmers practices in each part of the site. Below the inventoried crops within the whole territory: Eggplant, Potato, Pumpkin, radish, Chayote, Tomato, Pepper, Carrot, Coriander, Zucchini, Bean, Watermelon, Parsley, Peas, Hot pepper, Onion, Lettuce, Beetroot, Melon, Mint, Turnip, Pumpkin, Radish, Tomato. Water availability and farmers' traditions are key variables defining the cultures practices.


#### **d. Forage**

Alfa alfa is the main crop practice in the site. But farmers also use barely as a source of nutrition for their livestock especially for meat production and to feed donkeys and mules. These two are important for local farmers since access to some areas is only possible using them. The culture of alfa alfa is practiced between trees in a relatively big (200m<sup>2</sup>) parcel.

The table below summarizes key varieties of crop cultivated by communities in the GIAHS site of Ait souab Ait Mansour:

SPECIES	VARIETY/CULTIVAR	DESCRIPTION	PHOTO
Arganier ( <i>Argania spinosa</i> (L.) Skeels)	8 non registered varieties within the site (Ait Aabd et al, 2020)	<p>The argan is an endemic tree of southern Morocco, 8 to 10 metres tall, that has a very hard and heavy wood. The leaves are alternate, lanceolate and often green, darker on the upper side and lighter on the underside. The fruit of the argan tree is a green to light yellow false drupe, of variable shape, essentially thermophilic and xerophilic. The species is widely used in arboriculture. The argan tree is part of the traditional agricultural system in the region and plays a key role in the ecological stability of the region. The argan tree blends, especially along the coast, with the flora of the region (<i>Euphorbia echinus</i>, <i>E. beaumierana</i>, <i>E. regis-jubae</i>, <i>Senecio anteuphorbium</i>, etc.).</p>	
Carob tree ( <i>Ceratonia siliqua</i> L.)	1 variety (GIAHS)	<p>The carob tree is a typical mediterranean fruit tree which is found alongside the argan tree, olive tree, mastic tree and thuja. The carob tree is located in the plains and middle mountains of the Rif, the Middle Atlas, the High Atlas and the Anti-Atlas and in humid, sub-humid, semi-arid and coastal arid bioclimates with warm and temperate variants.</p> <p>The carob tree is often used to fight soil erosion. It is exploited for various products such as its fruit which is sweet and edible, and the flour from the pods and gum, extracted from the white translucent endosperm of the seed. It is used mainly by the food, pharmaceutical and cosmetic industries.</p>	




		Moreover, there are wild species with honey production in the area.	
Fig tree ( <i>Ficus carica</i> L.)	1 variety (GIAHS)	<p>The ficus carica is a shrub or small tree of 5 or 6 m. The fruit, called fig or breva, is up to 8 cm long, globular or pear-shaped, green, yellowish-green or purple in colour, with a fleshy, sweet pulp.</p> <p>The common fig tree is made up of male trees (caprifiguier) and female trees, by which the pollinating insect is the <i>Blastophaga psenses</i>, which is very important for fruiting. Specifically, the female trees are intended to produce the edible fruit.</p> <p>A characteristic species of the Mediterranean areas that is cultivated and used very commonly in the region constituting an ancient tradition.</p> <p>The cultivation of the fig tree is exploited for commercialisation of the fresh fruit, dried or in paste.</p>	
Grapevine ( <i>Vitis vinifera</i> )	1 variety (GIAHS)	<p>Under this name there are gathered many varieties of semi-woody climbing plants. When growing freely, the vine can reach 30 m in height. However, after years of tradition in their cultivation and harvesting, they have been reduced to a shrub of about 1 m in height. The vine adapts to a wide range of soils but prefers deep clay-loam soils and prefers semi-arid and subtropical climates with dry summers and cool winters (15-40°C).</p>	



		<p>The vine is used among cultural techniques such as tillage and fertilization. Generally, it is maintained by 3 ploughings per year: in January-February near the budburst, in April-May, a little before the flowering, and around June, at the fruit set. The purpose of this ploughing is to destroy weeds and to loosen and aerate the soil.</p> <p>Vines can be found randomly in some of the more watered localities and are essentially self-consumption products. No vineyards were identified in the area we visited.</p>	
Oleander ( <i>Nerium Oleander</i> L.)	1 variety (GIAHS)	<p>It is a species easily recognisable by its fruit in the form of a sheath or double leathery follicle, which is dried and opens by means of lateral slits, releasing numerous hairy and ugly seeds (horse hair). Alli or laurel is widely used and can be found in all ecosystems. Of ethnobotanical interest thanks to its medicinal uses. Despite its known toxicity to Moroccans, it is used in traditional care.</p> <p>The roots are used as a fumigant against headaches and head colds and against uterine diseases. The dried leaves and wood are used to make fumigations that are inhaled by children against colic. On the other hand, the leaves are used in various superficial non-bloody lesions (contusions, burns, tumours etc.) in external cases. Finally, the stems are also used to make fire points in rheumatism and joint pain.</p>	
Harmel ( <i>Peganum harmala</i> L.)	1 variety (GIAHS)	<p>The flowering of this specie is between March and April. One of the most used medicinal and aromatic species in the Argan site. Generally, it is a plant widely</p>	

		<p>used for ritual, magical, prophylactic or therapeutic purposes.</p> <p>In Morocco, it is used to treat several illnesses.</p> <p>The mixture of a few Harmel seeds and white sagebrush plant (<i>Artemisia herba alba</i> Asso), in powder or infusion, is a proven anthelmintic. Harmel seed is commonly used to treat infant toxicosis and infantile diarrhoea. Harmel seeds are usually detoxified by roasting beforehand.</p> <p>In the Saharan regions, the seed powder is used externally as a healing agent during circumcisions.</p> <p>Throughout Morocco, the seed powder is macerated in olive oil and combined with cloves (and sometimes ox bile) to produce a kind of gloss that is applied as a hair mask to make the hair thicker and stronger. The oil is also used as a healing agent for small wounds and injuries. The fresh branches and the juice are used as a revulsive for rheumatism and joint pain.</p>	
<p>Timija (<i>Mentha suaveolens</i> subsp. <i>timija</i> (Briq.) Harley)</p>	<p>1 variety (GIAHS).</p>	<p>It is a perennial herb that finds its natural habitat in semi-arid and sub-humid areas along rivers.</p> <p>Timija, Amazigh name, or aromatic mint is widely exploited and found in all ecosystems.</p> <p>Its leaves and part of its flowering are used in Moroccan ancient medicine as a powder or infusion for the treatment of cough, bronchitis, ulcerative colitis, antispasmodic and as an excellent carminative. It is also mainly used in food consumption, commonly used in herbal tea and infusions for its tonic and stimulating properties, and also as an additive to many</p>	

		<p>foods to provide aroma and flavour.</p> <p>Timija mint is frequently harvested in its natural habitat. Unfortunately, it has been reported that an over collection of it is dramatically reducing the natural populations of this endemic plant and increasing its risk of extinction.</p>	
<p>Round-leaved mint (<i>Mentha xrotundifolia</i> (L.) Huds.)</p>	<p>1 variety (GIAHS).</p>	<p>This variety is distinguished by its round leaves. It is harvested between March and July. Likewise, the leaves are sessile, opposite each other, waffle-like, hairy and downy on the lower surface, clearly toothed and oval in shape.</p> <p>The plant is used as an infusion, throughout Morocco, against cold, against palpitations of the aorta, as a tonic, etc. The powder mixed with vegetable tar is applied as a poultice to haemorrhoids, so it is used to treat haemorrhoids and lower abdominal pain. In addition, the fresh plant is used as a healing agent.</p> <p>In cosmetics and aesthetics, it is also added to the lime paste used for hair removal.</p> <p>As far as food consumption is concerned, in winter, in the countryside, a cake containing round-leaf mint is much appreciated which is eaten hot. The plant is used in some regions to filter melted butter, which gives it flavour and improves its preservation. It is also used in fusion as a hot drink.</p>	
<p>Mint (<i>Mentha viridis</i> L.)</p>	<p>1 variety (GIAHS).</p>	<p>Moroccans drink mint tea daily, which is an infusion of <i>M. spicata</i> and <i>M. viridis</i> leaves.</p>	
<p>Laurier rose (<i>Nerium oleander</i> L.)</p>	<p>1 variety</p>	<p>It is a species easily recognisable by its fruit in the form of a sheath or double leathery follicle, which is dried and opens by</p>	

		<p>means of lateral slits, releasing numerous hairy and ugly seeds (horse hair). Alli, Amazigh name, or laurel is widely used and can be found in all ecosystems. It is of ethnobotanical interest thanks to its medicinal uses. Despite its known toxicity to Moroccans, it is used in traditional care. The roots are used as a fumigant against headaches and head colds and against uterine diseases. The dried leaves and wood are used to make fumigations that are inhaled by children against colics. On the other hand, the leaves are used in various superficial non-bloody lesions (contusions, burns, tumours etc.). Finally, the stems are also used to make fire points in rheumatism and joint pain.</p>	
<p>Rosemary (<i>Salvia rosmarinus</i>)</p>	<p>1 variety</p>	<p>Rosemary is an evergreen shrub, 0.5 to 2 m tall, with a woody stem, covered with greyish bark and divided into numerous opposite branches. Its leaves are sessile, opposite, and leathery, curled at the edges, and its flowers are purplish blue, visible from January to May. It is a nectar source for several pollinators such as butterflies and bees. This species is of ethnobotanical interest for its medicinal uses and benefits. It is used against coughs, digestive disorders, and rheumatism thanks to the phenolic acid it contains. In addition, it has the function of being a natural anti-inflammatory.</p>	
<p>Citronelle (<i>Lippia citriodora</i> Kunth)</p>		<p>In Morocco there are two species of verbena used in herbal medicine from two different genre: the common "inodorante" verbena</p>	



		<p>(<i>Verbena officinalis</i>) and the scented verbena or lemon verbena, being the latter, which is grown in Morocco.</p> <p>Common vervain is an odourless plant with its leaves opposite in pairs. However, lemon verbena can be recognised by its long, woody, highly branched stems with narrow, elongated leaves. It is a small, balsamic shrub with whorled, toothless leaves like those of the peach tree. This species is cultivated for its benefits and uses, including soothing and anti-stress properties, stimulating the appetite, treating difficult digestion and stomach aches.</p> <p>Specifically, sweet vervain is an aromatic plant with a fresh, lemony fragrance, which is prized in cooking and infusions. This plant has therapeutic and sedative properties, particularly in the case of mild sleep disorders. On dry and sensitive skin, it has a calming, firming and healing effect. For this reason, its leaves are sold as a digestive infusion.</p>	
<p>Majoram (<i>Origanum majorana</i> L.)</p>		<p>It is a perennial plant of 20 to 60 cm with an erect, reddish stem covered with black hairs. The leaves are oval, opposite, fairly large and are borne on a 5-10 mm long stalk with no or marked teeth, whitish, pink or purple flowers, the fruits are achenes. The whole plant has a pleasant aromatic smell.</p> <p>The useful parts are the flowering tops and the leaves. It is harvested in the morning in summer. Dried oregano can be stored in an airy place, but it can be used fresh or as an essential oil from the aerial parts.</p> <p>Species cultivated for its benefits and uses,</p>	


		recommended for stomach disorders, insomnia and other more common illnesses such as colds or migraines, generally considered a nervous system tranquilizer and used to reduce stress.	
Date palm ( <i>Phoenix dactylifera</i> )	1 variety (GIAHS)	<p>The surface area occupied by the date palm is 1,565 ha, 70% of which is in Afella lghir, and its production varies between 600 and 1250 t/ha. The date palm is common but more abundant in the commune of Targua N'touchka and the Ait Mansour valley.</p> <p>This plant can reach 30 m, although its trunk is thin, 20-50 cm in diameter and often with shoots from its stump, which distinguishes it from the Canary palm (<i>Phoenix canariensis</i>). There are thousands of crops or cultivations, commonly referred to as varieties. In Morocco there are 453 varieties of dates with a high proportion of khal types representing about 55% of date palm cultivars in Morocco. Also, it is characterized by its genetic variety.</p> <p>It is a species of interest to the community for its capital role on the socio-economic and ecological level. It produces dates and other by-products.</p>	 
Olive ( <i>Olea europaea</i> )	subsp. maroccana	<p>The olive tree ssp maroccana is morphologically close to the Canary Islands olive tree but it has a well-differentiated taxon. This specie originates from an ancestral strain from tropical Africa.</p> <p>The olive tree is a tree of the Oleaceae family whose raw material is olein. It is highly branched and thorny, with quadrangular branches and very small leaves. This</p>	

		<p>species is well adapted to water stress conditions and is therefore used as rootstock and for reforestation in arid and semi-arid areas. Olive trees occur in two morphologically indistinguishable forms, either native or derived from enslaved olive descendants or 'ferals'. Cultivated trees can grow to 5 m, the wild olive tree is a shrub of 1-3 m. The latter is thorny because of its old branches. Both are evergreen plants, genetically identical, with glaucous foliage, flowering in May-June.</p> <p>Nine annual and/or seasonal crops are cultivated under the olive trees. These can be pumpkin, carrot, bean, pea, mint, turnip, maize, barley and alfalfa. Some protection systems are common for olive trees. These are tubes of wire mesh, palms, stones, enclosures of jujube trees...</p> <p>The olive tree in the region occupies an area of 2,450 ha, located mainly in the lower areas, with a production varying between 550 and 1,250 t/year.</p> <p>The olive tree is used in various fields, namely, the agricultural, food and therapeutic domains. As for its benefits, the olive tree is composed of vitamins (A, B, C, D and E) and minerals (Phosphorus, sulphur, potassium, manganese, calcium, chlorine, copper, iron, magnesium). The olive tree and its derivatives can be considered as a potential source of natural anti-oxidants, anti-inflammatory,</p>	
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		<p>anti-viral and anti-carcinogenic agents and can be used in the pharmaceutical industry. Olive leaves and olive oil also reduce the incidence of heart disease.</p>	
<p>Almond (<i>Prunus dulcis amygdalus</i>)</p>	<p>1 variety (GIAHS)</p>	<p>The almond tree is a vigorous tree that adapts to different climatic conditions. It can reach 6 to 12 m in height. Its flowers are white, pinkish and pentamerous, in groups of five. The fruit is a light green, velvety drupe containing, generally, a single seed which is the almond or kernel. Botanically, the almond tree is a member of the Rosaceae family and belongs to the genus <i>Prunus</i>, species <i>Prunus dulcis</i>. A great genetic diversity is remarkable in each almond producing region which is due to the variability of the environment, the climate and the agricultural practices adopted by the farmers who generally sow the almond seeds. As a result, the genetic variability of local populations of Moroccan almond trees is very high. Three annual and/or seasonal crops are grown under the almond tree in the Targant Ntouchka region (pumpkin, turnip and alfalfa). In Tafraout, the almond tree is the most important fruit crop, both in terms of income and the space it occupies. This species covers an area of 6,600 ha, 60% of which is in the Tafraout circle, and its production is estimated at 180 to 300 tons/year. Furthermore, in Tafraout there are mosoum, celebrations, for the almond. These are annual meetings and places of cultural discovery of the ancestral traditions that characterize</p>	

		the history of the region. Finally, the almond is used for sweet products like amellou.	
Grenadier ( <i>Punica granatum</i> )	1 variety (Mekness) (GIAHS)	The pomegranate is a bushy, slightly thorny, deciduous tree or shrub 2 -5 m high with a twisted trunk. It grows mainly throughout the Mediterranean region, either as a subspecies or in cultivation. The general pomegranate is strongly represented in the Middle East, its native land. Thus, it is frequently found in Afghanistan, Turkey, Transcaucasia, and India. It is also widely cultivated in the Mediterranean basin: Spain, Italy, Greece, Algeria, Tunisia and Morocco. In Morocco, pomegranate trees are commonly found in some of the more watered areas and its fruit are mainly for self-consumption. Morocco has a variety called Mekness, without seeds.	
Medlar ( <i>Eriobotrya japonica</i> )		The Japanese medlar that must not be confused with the German medlar, is a fruit tree of the Rosaceae family (tribe Maleae), cultivated for its edible fruit, medlar or bibace, and for its leaves used as a tea or as an ornamental plant. The medlar is a self-fertilising shrub that grows quite rapidly, reaching up to 5 m in height, and is popular for its ornamental appearance. The fruit is very similar to the apricot, but can only be harvested after 8 to 10 years on seeded trees and 5 years on grafted trees. It is rich in tannis, pectin, calcium and vitamin A. It has a sweet and sour taste. If eaten when it is not ripe, it can be astringent.	
Basilic ( <i>Ocimum basilicum</i> L.)		Basil is an aromatic and condiment plant of the Lamiaceae family. It is produced in particular in the	

		<p>Maghreb. Basil is often cultivated for its aromatic uses, known for its fragrant taste. As an essential oil with a very strong smell and taste. It protects against cardiovascular disease, aids digestion and disinfects. Basil is used as a mouthwash in the treatment of mouth ulcers. In addition to its gastronomic use, basil is rich in antioxidants, vitamin K, iron, antibacterial agents and has several digestive virtues that allow it to fight against the onset of certain diseases. As an essential oil it can have antioxidant properties and is known for its antispasmodic, anti-infectious, calming and relaxing properties.</p>	
<p>Wild Lavender (<i>Lavandula angustifolia</i>)</p>	<p><i>Lavandula multifida</i>, <i>L. dentata</i>, <i>L. stoechas</i></p>	<p>The wild lavender is a small shrub (or large bush), perennial, covered with abundant hairs, more foliaceous at the base, with quadrangular stems, almost whitish because of the very numerous hairs, with glabrous and rounded edges. Leaves glaucous green, often yellowish, deeply divided (pinnatipartites or pinnatisectes), narrow-lobed, up to 5 cm long. Flowers grouped two by two in opposite, alternating whorls, dense, so dense that they resemble an elongated spike, without a tuft of bracts at the tip of the inflorescence. Corolla protruding from the spike, up to 1.5 cm long, tubular, purplish, open into a 2-lobed upper lip and a 3-lobed lower lip, with the 5 lobes spotted by a central line of greater intensity of colour. Fruit is nucellus-like, about 1.5 mm long. Its native habitat is southeastern Morocco. Its uses are those of wild lavender. In powder or infusion, they are used in the treatment of gastroduodenal</p>	

		<p>disorders, renal lithiasis and heavy menstruation. It is also used as a tonic and diuretic. Lavender is prescribed as a decoction (a handful of plant in a teapot) for gastralgia, gastric acidity and liver diseases. Externally, wherever it exists, the chopped fresh plant is applied to wounds and injuries as a vulnerary and antiseptic. The flowers are used to perfume linen, as is done with true lavender. Lavender is used to calm anxiety, insomnia, digestive discomfort of nervous origin, and bloating.</p>	
<p>Spanish sage (<i>Salvia lavandulifolia</i>)</p>		<p>Sage is an evergreen herbaceous plant that can reach a height and width of about 30 cm. The leaves are narrow, evergreen, lanceolate, whitish-grey in colour and less than 50 mm long. The leaves grow opposite each other on the stem and appear to grow in clusters. When the leaves are rubbed, the oils give off a scent similar to rosemary. Lavender flowers are lilac coloured, 25 mm long and grow on short inflorescences, flowering for about a month between late spring and early summer. The flowering stems have very few flowers on widely spaced spirals. Some varieties have a dark calyx. It is native to southwestern Europe, especially Spain and southern France, and is found in northwestern Africa, Morocco and northern Algeria.</p> <p>Its habitat is rocky soil, in Mediterranean scrub shrubs, often grown with rosemary, <i>Lavandula lanata</i> and <i>Genista cinerea</i>. The plant is used to flavour tea and as an aromatic plant used with white meats. With its balsamic scent, blue flowers,</p>	

		<p>it is astringent, tightens tissues, moderates secretions, heals wounds and prevents inflammation in cases of haemorrhage, diarrhoea... Sage has many medical applications: against sore throats, mouth ulcers, colds, and clears the airways.</p>	
<p>Thym (<i>Thymus vulgaris</i> L.; <i>Thymus satureioides</i>)</p>	<p>2 varieties</p>	<p><i>Thymus satureioides</i> belongs to the botanical family Lamiaceae within the genus <i>Thymus</i>. It is an erect shrub, reaching up to 60 cm in height with numerous branches. The leaves are spatulate, the inflorescence in loose glomerules, the corolla is pink or pale pink. It is harvested by hand in the Tafraout region of Morocco between April and July by women. Thyme is the most popular and oldest known plant in all Mediterranean civilisations, both for its medicinal and aromatic properties. These properties still give it a wide range of uses such as: sanitation of premises, skin disinfection, various hygienic products (toothpaste, mouthwash). In certain regions of Morocco, thyme is used after maceration in olive oil to treat wounds. In infusion, it is used to treat several ailments: colds, coryzas, rheumatism, joint pains, etc. In gargle, it is administered against gingivitis and throat ailments. In decoction, it is recommended against jaundice and other liver diseases. Overall, it is a galactogen, emmenagogue, vermifuge, diuretic, digestive, aperitif, intestinal and general antiseptic. Thyme is also used in the preparation of food recipes. Thyme has an irresistible flavour that is used to season grilled meats, sauces and salads. It also has many benefits for the digestive</p>	

		system, a small amount of this plant can relieve stomach aches. Thyme is also antiseptic and speeds up the healing process during a cold.	
White wormwood ( <i>Artemisia herba-alba</i> )	2 varieties	Artemesia herba alta and its varieties are white wormwood plants. It is the most widespread aromatic plant in Morocco. It is a perennial steppe plant which grows in the courses, pastures, rock gardens, steppes of the plains and dry mountains. Artemesia is harvested between April and July by women for their own use. The decoction of its leaves is used to treat jaundice, abdominal pain, vomiting and digestive disorders. It is also used as a vermifuge. It is a plant that is widely used by rural women who always keep a quantity of it at home and offer it to their families.	