CHAPTER 8

POPULATION–ENVIRONMENT RELATIONSHIPS IN THE TUNISIAN HIGH TELL

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INTRODUCTION

At the end of the nineteenth century the Tunisian population, which was more than 90 percent rural, numbered less than 2 million; in 1870 it was estimated to be 1.5 million (Rouissi, 1983). Most of the country, especially the arid zones, was characterized by the predominance of pastoralism and by very extensive exploitation of natural resources. In 1860, the nomadic population exceeded the sedentary population (Ganiage, 1966). During the twentieth century, Tunisia, like other countries of the Maghreb, experienced population growth, multiplying three times over the last 60 years.

At the same time, particularly since independence in 1956, the natural environment has undergone important changes: intensification of the processes of erosion, deforestation (Quezel *et al.*, 1992) and desertification (Floret *et al.*, 1986). The global relationship between demographic growth and degradation of natural resources corresponds initially to the disequilibrium of the whole population–resources system linked to demographic growth. It leads to the multiplication of extensive systems and to the over-exploitation of natural resources. The global character of this relationship must not, however, overshadow regional differences in the diversity of individual or collective strategies observed in rural environments.

Faced with rapid demographic growth, a rural society has different ways of responding to disequilibrium between population and natural resources (Codur, 1993). In the short term it is migration; in the middle or longer term, reduction in fertility and technical, social or institutional changes. During recent decades these various responses have been brought into play to a greater or lesser extent in the rural areas of the Maghreb. Migration of rural populations has been unprecedented during the 1960s and 1970s before subsequently easing off (Ben Zid and Elloumi, 1993). Rural fertility decline is also evident in numerous regions of the Tell (or mountains). The transformation of technical and social conditions of agricultural and livestock production, encouraged by government policy (Gachet, 1987), is effective in spite of strong regional disparities. The course of the twentieth century has witnessed the settlement of nomads; the intensification of systems of produc-

tion (including a tenfold increase in irrigated areas and in tree cropping, and growing recourse to mechanization and agricultural modernization) (Kassab, 1981); and the increasing integration of the agricultural sector into the market economy, linked with the urban explosion and the development of international trade (Sethom, 1992). Two main technical revolutions affect the Maghreb countryside: the tractor and the motor pump. Large-scale institutional, social and land ownership changes accompanied this evolution: nationalization of forests, widespread privatization of land at the expense of communal pastures, and disintegration of tribal and communal solidarity (Attia, 1984). The relationship of rural society to space and to natural resources is in the process of great change, at the origin of a 'spatial–cultural identity crisis' (Pitte, 1986). The consequences are important to the management of natural resources (marginalization of extensive farming, important state intervention, etc.). Economically and socially, regional inequalities increase and some small peasant farmers become more marginalized (Sethom, 1992; Ben Zid and Elloumi, 1993).

In studying the rural population–natural resources system in the Tunisian High Tell, we have favoured a multidisciplinary approach, and in order to reveal the diverse strategies and behaviours of the rural population faced with disequilibrium caused by demographic growth, we have also favoured a typological approach. Rural society in the High Tell is not homogeneous; it is especially characterized by an unequal agrarian structure.

After briefly describing the natural environment, we present a synthetic typology of rural households, which has been established by crossing two other typologies: production systems and natural resource use. The various types will be described from economic and demographic viewpoints. Subsequently, we shall try to reconstruct the main trends of agricultural history, and the different responses to the population–natural resource disequilibrium (migration, fertility, transformation in production systems). These dynamics will be linked with vegetation cover and land use, evaluated by aerial photographic interpretation.

A CHARACTERISTIC ENVIRONMENT OF THE TUNISIAN HIGH TELL: MOUNTAIN, PIEDMONT AND ALLUVIAL PLAIN

The study zone (Ouled Frej *imadat* in the delegation of Bargou within the governorate of Siliana) covers about 9000 ha, on the edge of the Tunisian Dorsale (Backbone) and part of the High Tell. The semi-arid climate is characterized by continental influences and an annual rainfall of 450–600 mm. Ranging from 600 to 1200 m in altitude, the geomorphology is divisible into three ecological units (Figure 8.1) which constitute 32 percent, 14 percent and 54 percent of the study area respectively:

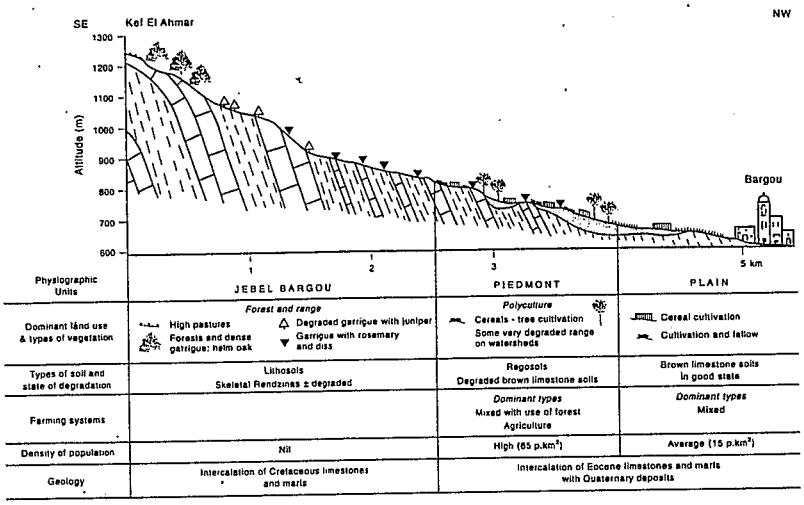

Figure 8.1 Cross-section of the study zone of Ouled Frej

(1) The massif of the Jbel Bargou rises to 1260 m, and is a vast anticline whose limestone structure forms karst relief and skeleton soils (lithosols and regosols). The vegetation cover is strongly affected by human action. Near the piedmont, scattered and shaven patches of *Tymelea* sp. and *Marruba* sp. dominate, indicating intense livestock pressure. Higher up the slopes, these formations give way to open *garrigue* (scrubland) of rosemary, juniper and *diss* (*Ampelodesmos mauritanica*). On the highest slopes one finds dense coppices of holm oak, relics of the former forest cover of the Jbel Bargou.

(2) The plain of Robaa to the west corresponds to a Pliocene–Quaternary fault basin characterized by silt and clay deposits and black, cracking clay soils (vertisols). The contraction fissures enable the autumn rains to infiltrate and water supplies to accumulate. These lands have good agricultural potential and are occupied by large cereal farms.

(3) A narrow piedmont glacis, deeply gashed by ravines, forms the transition zone between mountain and plain. Thin rendzinas and degraded brown limestone soils with crustal surfaces have limited water storage capacity and are susceptible to erosion on the steeper slopes. Land use is dominated by small cereal plots.

A SYNTHETIC TYPOLOGY: THE USE OF WOODLAND PASTURES IN THE JBEL BARGOU

The results presented come from a survey undertaken in 1992 in the context of the DYPEN research programme[1]. The sample included 185 households of the Ouled Frej imadat, constituting about half of the rural population.

First, a typology of utilization of Jbel Bargou has been defined based on a multidimensional analysis of seven variables in the questionnaire: numbers and composition of livestock, duration of use of jbel rangeland, collection of fuelwood and various vegetal resources. Secondly, we have established a typology of production systems from 20 qualitative and quantitative variables concerning land ownership, production machinery, systems of cultivation and livestock rearing (Hassainya, 1984). These two approaches were then merged to produce the synthetic and simplified typology presented here (Figures 8.2 and 8.3).

Type 1 – mixed farmers

These are localized on the piedmont, and represent 18 percent of households sampled. This type is defined by the importance of livestock rearing and by the use of the Jbel Bargou rangeland mainly from autumn until the beginning of spring. Fuelwood necessary for domestic needs is taken from the mountain, as are other vegetal resources (seeds of the Aleppo pine, food plants, etc.). Some households produce charcoal in winter and sell it and wood locally and illegally. Livestock rearing mostly includes sheep, goats and cattle, the average flock being about 40 sheep or goats with three or four head of local cattle. Farmers have less than 20 ha (80 percent have less than 10 ha), and also produce cereals (hard wheat and barley), fodder and tree crops. The use of chemical fertilisers and tractors is widespread. However, some 40 percent of mixed farmers continue to plough the steepest and least accessible plots of land. Most of their incomes come from livestock, though some have regular external incomes (the local administration employs 9 percent of the working men) and employ herders. These are the largest sheep farmers and the most dynamic and diversified; most have little external income and only employ young family members.

1 Research programme of DYPEN (Dynamique des populations et environnement en Tunisie) grouping ORSTOM (France), the Institut Sylvo-Pastoral de Tabarka, the Ecole Supérieure d'Agriculture de Mograne and the Institut des Régions Arides de Médenine.

Type 2 – small farmers

Small farmers are the largest group (37 percent of the total number of households) found on the piedmont. Livestock are of low importance and, when present, only amount to less than 10 sheep and one or two cows; about a third of small farmers use the Jbel Bargou rangeland, but the great majority take fuelwood from the Jbel. Most have less than 10 ha of agricultural land, and production is largely confined to hard wheat and barley. The use of chemical fertilisers is limited and irregular, but that of machinery (hire of tractors and harvesters) is widespread. Most young men have off-farm jobs; 63 percent of household heads have a secondary non-farm job. When there is a surplus, it is devoted to housing construction or improvement rather than to productive activities. Some families have relatively important outside incomes, but farming obtains little investment. Lands are often let or worked in partnership, and family labour on the farm is limited to less than one person per farm; generally 70 percent of the workforce are over 50. Yet there are few permanently abandoned farms in this category.

Type 3 – market gardeners practising irrigation

These are found on the margins of piedmont and plain where the watertable is accessible, and account for 8 percent of the total number of households. The production system is well identified: irrigated market gardening associated with a small number of cattle. There is no use of the rangeland on the Jbel Bargou, but 60 percent of the families collect domestic fuelwood. These are small farms in full production with an average of 13 ha cultivated with cereals, fodder crops and irrigated market garden crops (peppers, tomatoes, etc.) which provide the main income. Surface wells have motor pumps, and farmyard manure and phytosanitary products are widely used. Manual labour is widespread, provided especially by women of the family.

Type 4 – cereal and stock farmers

These are principally found on the plain, and account for 19 percent of total households. We have included in this type the farms mainly involved in livestock but not using the woodland pastures of the Jbel Bargou, either for rangeland or for fuelwood. This category contains the largest farms in our study area; 20 percent cultivate less than 10 ha but most are middle-sized farms with 20–100 ha, and renting extra lands is widespread, especially by the largest farms. Several production systems involve cereal cultivation associated with sheep farming on fallow and stubble, the differences depending on the level of intensity of agricultural production. There is general use of mechanization and chemical fertilisers, but above the threshold of 35 ha the farmer generally possesses his own equipment which he hires out to other

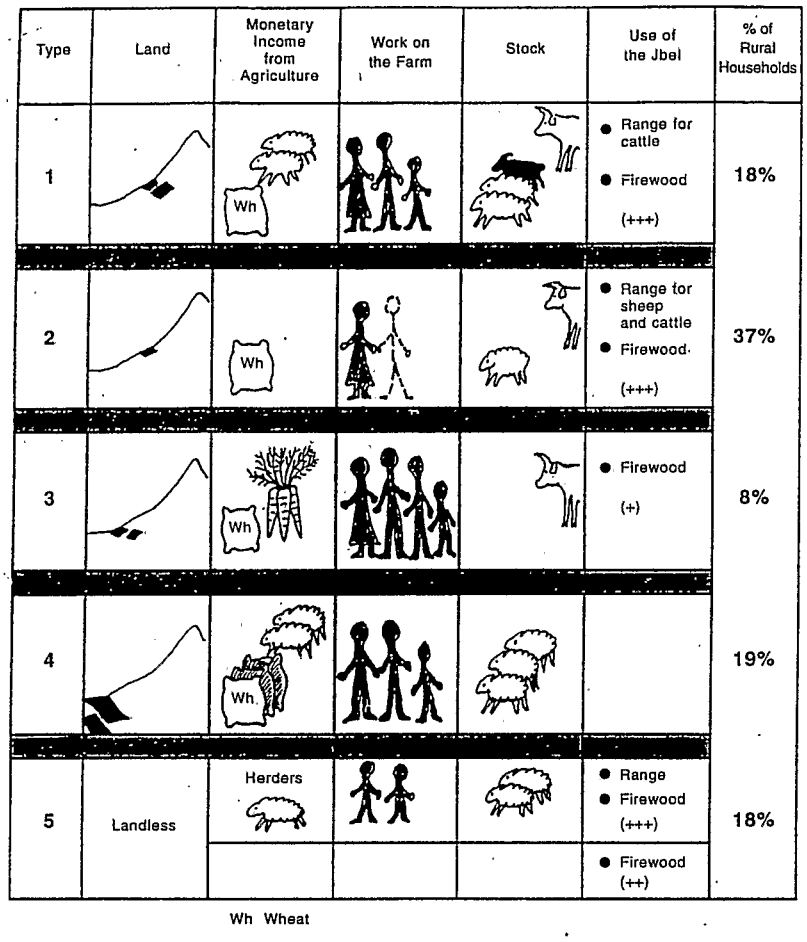

Figure 8.2 Synthetic typology: production systems and utilization systems in Ouled Frej

farmers (Aubry *et al.*, 1991). The larger farms have their own permanent workforce.

Type 5 – non-farmers

These include rural households who have no right to land. Mainly located on the piedmont, they represent 18 percent of rural households.

(1) Shepherds mostly live in tents although they are permanent residents in the area. Generally, they have their own flock of about 30 sheep, and work for the farms on the plain and for the mixed farms of the piedmont. About ten families of shepherds, who came from south-west

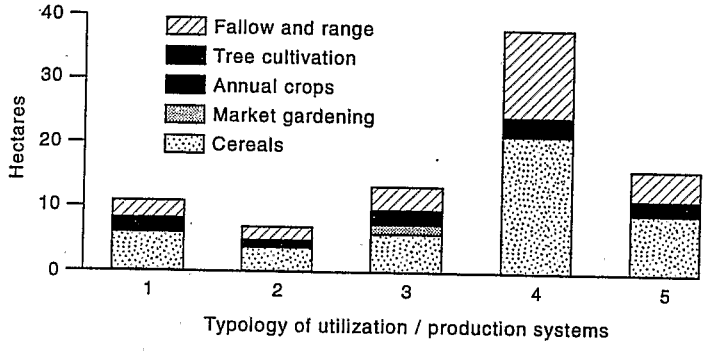

Figure 8.3a Occupation of the useful agricultural area

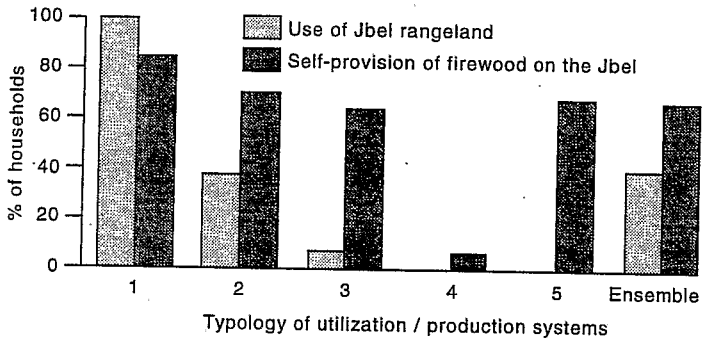

Figure 8.3b Uses of the Jbel Bargou

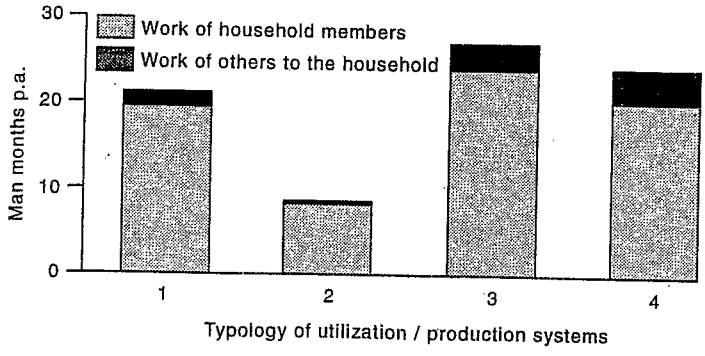

Figure 8.3c Work on the farm

Tunisia, settled on the piedmont during the last decade. Fuelwood is collected from the mountains. Shepherds try to acquire land when they have accumulated a little capital, and then become small mixed farmers of Type 1.

(2) The families of day labourers and small wage earners who settled in the region during the 1950s are the most deprived. They subsist on the wages of public works (40 percent of the active males) and agriculture (26 percent), but many of the households collect fuelwood on the Jbel and produce charcoal.

This typology reveals the diverse use of the Jbel Bargou and the contrast between agrarian systems. One, localized on the piedmonts, involves agriculture, forestry and pastoralism and is characterized by complementary use of the resources of the mountain and the agriculture of the piedmont. The other, involving agriculture and pastoralism, is confined to the plain and has no connection with the massif of the Jbel Bargou. To these large ecological units correspond specific agrarian structures:

(1) The plain of Robaa has fertile soils and middle-sized private properties, two-thirds of more than 10 ha, and rural densities are fairly low at about 15 per km^2.

(2) The piedmonts of the Jbel Bargou with mediocre soils and small fragmented farms, two-thirds of less than 10 ha, and have densities in excess of 85 per km^2.

Diverse land uses and family strategies are associated with the different types of agriculture on the piedmont. Type 1 has the most impact upon mountain resources, rangeland and fuelwood. The collection of fuelwood and production of charcoal concern Types 1, 2 and 5, particularly the most deprived households in these categories. Market-gardeners and cereal and stock farmers use few of the mountain resources.

DEMOGRAPHIC CHARACTERISTICS

The mixed farmers (Type 1) of the piedmont contain a relatively young population (Figure 8.4), with 35 percent aged 0–14 and 12 percent over 50. The average household size is as high as 8, corresponding to several families (1.8 on average). Fertility is high, 2.7 children per woman aged 20–40. The non-farmers (Type 5) have a comparable age structure, but the average household size of 6 persons is clearly smaller, the age of the household head younger and the fertility index lower.

In contrast, the small farmers (Type 2) of the piedmont contain an ageing population: the average age of the household head is 58.3, the 0–14-year-olds account for 24 percent of the population, and the over 50s, 26 percent. The

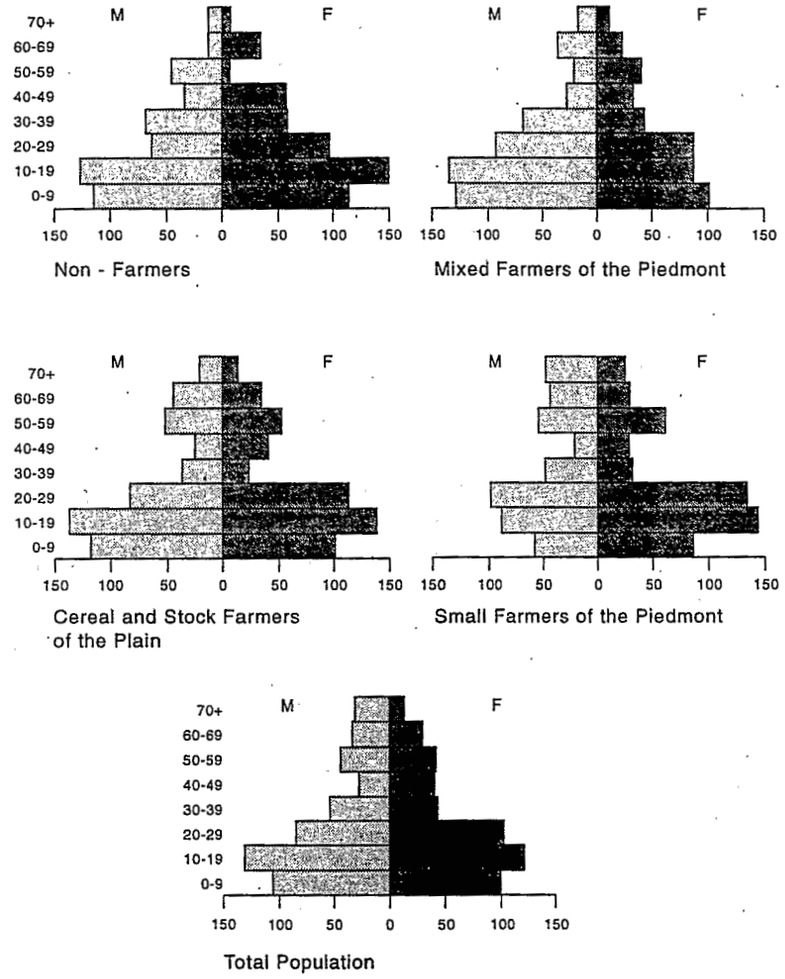

Figure 8.4 Age pyramids according to the typology. Market gardeners are not included because the sample included only 14 households of this type

age pyramid is clearly indented in the middle-aged groups (30–50 years), indicating the departure of an important element of the population, and the imbalanced sex ratio of those aged 15–29 shows significant mobility of young men, 40 percent of whom have left for jobs in Tunis and the towns of the Sahel. The fertility index has very appreciably declined to 1.3 children per women aged 20–40, and the celibacy rate is particularly high among young women. The cereal and stock farmers (Type 4) have a similar age structure, but much larger average households and higher fertility, while the market

gardeners (Type 3) group have an intermediate age structure with a tendency to ageing and lowering fertility.

The mixed farmers may be characterized by the permanence of demographic and traditional social behaviour: high fertility, large households, few permanent departures among those older than 30, and relatively low levels of education. The other groups, with the exception of non-farmers, are characterized by ageing of population, the important role of migration for more than a generation, the appreciable decline in fertility, and high levels of celibacy (especially among small farmers) and education.

ATTEMPTS AT RECONSTRUCTION OF POPULATION–ENVIRONMENT INTERRELATIONSHIPS ON THE PIEDMONTS OF THE JBEL BARGOU

The pre-colonial period: extensive use of resources and mobility when faced with climatic fluctuations

During the pre-colonial period population densities were 4–5 times lower than at present. Recurrent times of famine followed bad harvests and caused considerable mortality (Monchicourt, 1913). The fertile lands of the plain of Robaa were partly under the control of the Bey (Henchir El Abiod; lands of the Oueslatia) and land-owning families (private *habous*). The lands were submitted to regular cultivation cycles by one-fifth share-croppers (*khammès*) and by families. Apart from the best lands, the Robaa Ouled Yahia (the former name of the area) was the undivided property of tribal factions, especially the Ouled Yahia who lived from cereal cultivation and above all from transhumant pastoralism. The large number of tents at the end of the nineteenth century (more than 80 percent of dwellings in 1895) bore witness to Bedouin origins and mobility.

Vast areas were given over to pasture and fallow. The massif of Jbel Bargou, then covered with forest, served as a refuge and range for livestock, especially during winter. The watershed corresponded to the frontier between the territory of the Ouled Yahia to the west and that of the Braga, settled villagers to the east. The livestock profited from the different ecologies of mountain, piedmont and plain at different seasons. In addition, the movement of animals to winter pastures on the steppes and to summer pastures in the northern Tell depended closely on the rhythm and intensity of the rains. The beginning of summer was accompanied by the mass arrival of seasonal harvesters from the steppes. However, during the eighteenth and nineteenth centuries, a period of relative stability, there was a tendency towards private ownership of land and reduction in pastoral movements (Monchicourt, 1913).

The colonial period (1881–1956): profound change and agrarian crisis

French colonization belatedly extended its hold over the plain of Robaa after 1920, by acquiring Beylical lands but also by the appropriation of lands used by communities. The colonial period witnessed profound changes throughout the High Tell and the steppes of central Tunisia (Attia, 1984). The demographic explosion, the restriction of communal territories and the breakdown of inter-regional complementarities (seasonal and pastoral movements) meant that a more and more numerous population had to live on a more and more constrained territory on the piedmont. Moreover, the mechanization of cereal cultivation on the large farms of the plain after 1930 greatly diminished the number of agricultural jobs.

Monchicourt (1913) noted a doubling of population between 1881 and 1911, that was corroborated by the census of housing between 1895 and 1921 (Bernard, 1924). Such a growth, of the order of 3 percent annually, suggests in-migration into a depopulated territory probably greatly affected by the famine of 1867. Between 1921 and 1956, the population increased by 75 percent in the Ouled Frej cheikhat (Makhlouf, 1969), which seems to correspond with reduced in-migration.

The clearing of the piedmonts and lower slopes of the Jbel Bargou for the needs of subsistence cereal cultivation, and the progressive destruction of mountain forest formations under human and livestock pressure took place from the beginning of the twentieth century. Monchicourt (1913) notes:

> 'In September 1900, in the high valley of Wadi Bargou ... I have seen over a hundred fires at different points. All the owners of livestock had taken part in this work.'

Flocks, mainly goats, had lost pastures and depended strongly on the mountain.

Throughout the colonial period, the demand of the local population for land, range, fuelwood and wood for building continued to grow. The number of houses and shacks increased 13-fold between 1895 and 1921, the tent diminishing to less than 20 percent of dwellings (Bernard, 1924). Charcoal production increased along with the growth of towns. Poncet (1962) wrote:

> 'Traditional labour is the ultimate resource of poor populations, who clear not only the least accessible slopes in the mountains which are normally reserved for pasture but attack badly protected woodland by fire and axe. The forest of Maktar and Kessera has been seriously damaged during the post-war years (1945–50); equally the Bargou woodlands.'

Demographic growth and the multiplication on the piedmont of small mixed farms (Type 1) led to frenzied appropriation of land, the source of the current land ownership. The division of land and degradation of soils corresponded

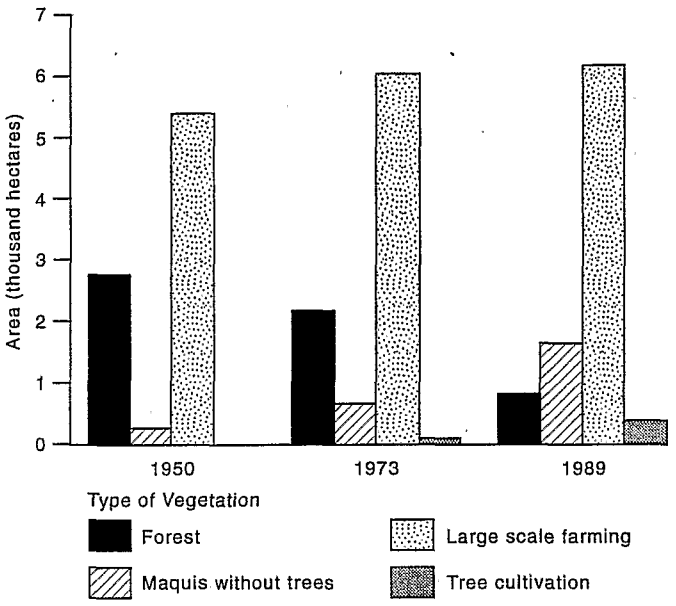

Figure 8.5 Evolution of land use in the *imadat* of Ouled Frej, 1950–89

to the over-exploitation of the resources of the mountain, leading to a two-dimensional crisis: economic and ecological, probably perceptible from the 1930s and characteristic of a Malthusian economy (Malassis, 1973). The production systems of the piedmonts based on subsistence cereals and extensive livestock rearing remained unchanged.

The years of independence (1956–66): the affirmation of the Tunisian state

Between the censuses of 1956 and 1966, the population grew by more than 40 percent (Makhlouf, 1969) due to important natural increase but also to in-migration from the steppe. Aerial photographs show the extension of agricultural clearings which took place in the 1950s and 1960s in the wooded sectors of the piedmont. During this period, the delimitation of the state forests of the Bargou has been preceded, as elsewhere in the Tell, by a veritable rush of clearings to appropriate land, as evidenced by the installation in the forests of several in-migrant families of agricultural day labourers and shepherds. Between 1950 and 1973 the wooded area of the Jbel Bargou declined by 24 percent (Figure 8.5) at the expense of maquis and garrigue (types of degraded shrub and scrubland).

Henceforth, the state intervened strongly to protect and manage the woodland pastures of the Bargou as well as to organize agricultural production. Although the episode of production co-operatives was brief

(1964–69), with several units established in the plain, the planned economy would have numerous consequences to the rural area. The eruption of the market economy in the countryside would lead many to move, partly or totally, out of agriculture (Ben Zid and Elloumi, 1993), a phenomenon which would become clearly perceptible in the following years.

The present period: diversification of family strategies and production systems

Since the end of the 1960s, new family strategies have come to modify production systems and resource use. They are linked to the considerable increase in rural out-migration of young workers to Tunis and the towns of the Sahel, and to progress in non-agricultural economic activities of farmers. Between 1966 and 1984 the delegation of Bargou experienced a perceptible decline in its rural population (–1.4 percent), and a stabilization in its total population (+0.9 percent). The urban centre of Bargou appeared during the 1960s, and was promoted as the administrative town causing its population to increase ten-fold between 1966 and 1984.

Family labour, especially of the young, is less common on the farm. Many small mixed farms (Type 1) are turning to cereal production of Type 2. Investments in capital and labour are severely reduced. The number of family livestock has declined, and generalized mechanization occurs through the hiring of agricultural equipment. On the lower slopes of the Jbel Bargou, the plots of mediocre quality and difficulty of access are no longer cultivated and are used as fallow pastures.

Meanwhile, some mixed farms of Type 1 remain; others have additional incomes from the local administration which allows them to increase their flocks and employ shepherds. These in-migrant families put pressure on the cultivated land and on the pastoral resources of the mountain. Certain farms of the piedmont move towards Type 4 (cereal and stock) and Type 3 (irrigated market gardening) when water resources permit. For these farms, non-agricultural incomes (out-migration, commerce, services) seem to be the main factor in changing production systems.

Use of the mountain has changed over the last two decades. The number and size of small family flocks pasturing the Jbel has diminished, while the large flocks of sheep led by shepherds increased. Numbers of goats dwindled at the expense of sheep and cattle, which are left untended on the mountain during winter. Livestock pressure on pastures is heavy. Nearly 5000 sheep and goats and 500 cattle depend on the mountain pastures during winter, and when there is a dry year there is a deficit of fodder.

The collection of fuelwood for domestic consumption has declined because of the growing use of butane gas for cooking. Average consumption of wood per household is of the order of 3–4 tons a year, mainly small wood for home

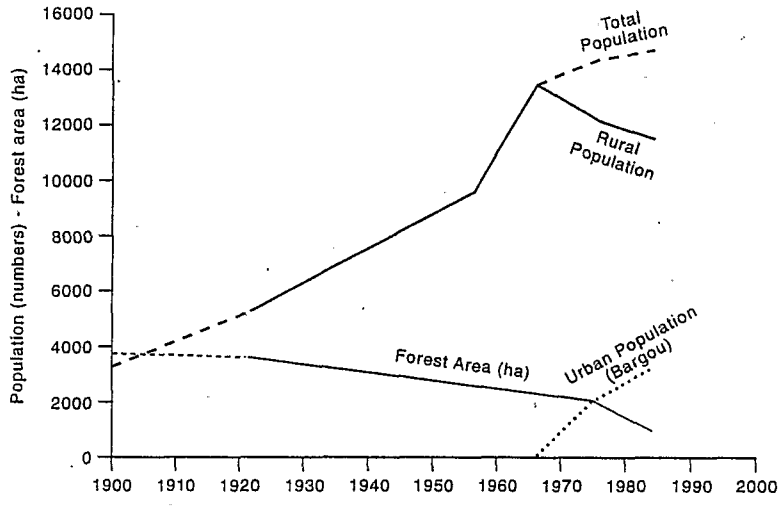

Figure 8.6 Evolution of population and forested area of the Delegation of Bargou, 1900–80s

baking of bread (Bueno and Ottaviano, 1994). Moreover, recourse to modern materials limits the use of wood in building. In contrast, charcoal production and its illegal sale in the town of Bargou involves a considerable number of households of the piedmont (about 50, of whom a dozen are 'professionals'). Illegal charcoal production is a lucrative activity that the forestry service is unable to effectively suppress. It provides most of the fuelwood of Bargou and an indispensable additional income to the small farms of the piedmont, which have a lot of young and unemployed labour (especially Types 1 and 5). Aerial photographs show the 65 percent retreat of woodlands, mainly of holm oaks, between 1973 and 1989 (Figure 8.5). Its rapid decline is not inevitably linked to fuelwood collection; the degraded forest of today is more vulnerable than that of yesteryear.

CONCLUSIONS

During this century landscapes and land use have experienced profound transformations in relation to unprecedented demographic growth. In recent decades population numbers have stabilized (Figure 8.6) with the changes in family strategies and production systems. Progress has been conditioned strongly by political events (colonization – national policy since independence), technological developments (mechanization) and macro-economics (agricultural prices, labour market).

The predominance on the piedmonts and most marginal agricultural areas of small farmers, with an ageing population, important non-agricultural employment and limited work on the farm, points to important consequences for the dynamics of agricultural employment and the use of natural resources. The first effect seems to be *a priori* reduced pressure on woodland and pastoral resources through less use of rangeland and the most marginal cultivable land. We should note, however, the changed systems of stock raising, the arrival of in-migrant shepherds and the maintenance of strong pastoral pressure on the rangeland of the mountain. Finally, charcoal production remains important for the most deprived fringe of small farmers on the piedmonts, compromising the renewal of woodlands. Although resource use has changed with the growing integration of the state woodlands into the market economy (large flocks, charcoal) and the diminution of subsistence use (small family flocks, firewood), the renewal of resources is no more certain. The woodland pastures continue in one sense to pay the price of social peace.

The demographic revolution mainly expresses itself on the piedmonts, not in terms of intensification and increased productivity of land, but more in terms of productivity of labour, leading most small farms towards mechanized systems of extensive cereal production and freeing an abundant labour force for paid employment in the region and cities. That poses the following question: can such systems, so strongly dependent upon the non-agricultural labour market, duplicate themselves or are they the prelude for a massive rural exodus?

Footnote

Research programme of DYPEN (Dynamique des populations et environnement en Tunisie) grouping ORSTOM (France), the Institut Sylvo-Pastoral de Tabarka, the Ecole Supérieure d'Agriculture de Mograne and the Institut des Régions Arides de Médenine.

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