Arabic Biology & Medicine

Biological resources exploitation policies during the 20th Century, a typical case of landlocked areas of NW Morocco

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Abstract

The Moroccan mountain areas are usually dominated by a subsistence economy based on cereal crops, arboriculture, extensive livestock breeding and, secondarily, the exploitation of by-products of the forest domain. In dealing with the conservation of these resources, the various policies pursued by central authorities must be considered, in addition to local socio-economic factors. This paper reviewed and discussed use patterns of biological resources in the landlocked area of Tizgane-Alma (Ouezzane Province, NW Morocco) during the 20th century. This area is transformed from a traditional mountain agrosystem late 19th and early 20th centuries, to a mutant subsistence system in the nineties. Morocco's involvement alongside France during the world wars has made this area, among others, a target for food supplies. The French protectorate policy was inherited by the post-independent Moroccan State, with guidance orchestrated by international organizations, particularly the World Bank. The various development projects affecting this mountain area remain without local significant impacts in terms of natural resource conservation and promotion of the local population living standards.

Keywords: Biological resources, exploitation policy, mountain, development, landlocked area, French protectorate, Tizgane-Alma, Ouezzane, Morocco.

1. Introduction

In Morocco, the mountainous areas cover an area of 11 million hectares. Population densities are highly variable, exceeding 80 inhabitants/km^2 in some locations of the Rif[1].

The agriculture gross domestic product (GDP) is so intimately associated to overall GDP that changes in the first determine those of the second[2]. The agricultural economy of the mountains is based on cereal crops and orchards benefiting annual rainfall, as well as extensive livestock production, and exploitation of natural wooded land[3].

The Moroccan agricultural zones in rural areas include 70% poor[4] ; crop yield and income per capita are among the lowest in Morocco[5]. "*The depleted resource base, degraded and misused for generations*" is the main cause of poverty in Morocco according to the World Bank; one of the leading responsible for the environmental damage is the Moroccan herdsman because of his "superabundant livestock" that caused overgrazing, erosion and soil degradation[6]. But in this context, historical facts that have experienced these mountainous areas should not lend omission.

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[1] Hagen R., Grosenick G. 1989: *Evaluation de l'aménagement de bassins versants au Maroc*. Association in Rural Development, Burlington, Vermont, USA, p.95.
[2] Akesbi N. 2003: *Les grands problèmes non résolus de l'agriculture marocaine.* NEW MEDIT, 2 pp. 2-4.
[3] Hagen & Grosenick 1989: Ibid.
[4] Davis D.K. 2006: *Neoliberalism, Environmentalism, and Agricultural Restructuring in Morocco.* The Geographical Journal, 172(2) pp. 88-105.
[5] Hagen & Grosenick 1989: Ibid.
[6] Davis 2006: Ibid.

For a long time, the mountainous regions of N Morocco are experiencing a decrease in annual precipitation marking an arid or semi-arid dominating climate. Rugged terrain, poor soil, high specific erosion and regression of vegetation cover limit, among others any development of these areas although they have benefited from major rural development programs in the W Rif.

To reveal possible constraints to local development in these mountainous areas, this work aims to highlight the main policies of biological resources exploitation during the 20th century in a mountainous landlocked area of NW Morocco (Tizgane-Alma). This zone is constituted by two proximal douars (rural communities) and their operating areas, with overlaps on crest lines of three sub-watersheds of the High catchment area of the Loukkos wadi (Figure 1, caption 1).

This area currently depends on the Rural Municipality of Ain Beida, Circle of Mokrisset of the Province of Ouezzane since 2009, and the Region of Tangier-Tetouan-Al Hoceima since 2015 (far NW Morocco). Dependent on the sub-tribe of banī ṣaltān, of the tribe of ġzāwa and Jbala region (ǧbāla before and during the French protectorate, it was administratively attached by the Moroccan State successively to the Provinces of Rabat, Kenitra, Sidi Kacem and Chefchaouen since the independence until the first decade of the 21st century.

This study is made possible through surveys and socio-economic studies we previously conducted, among others, in

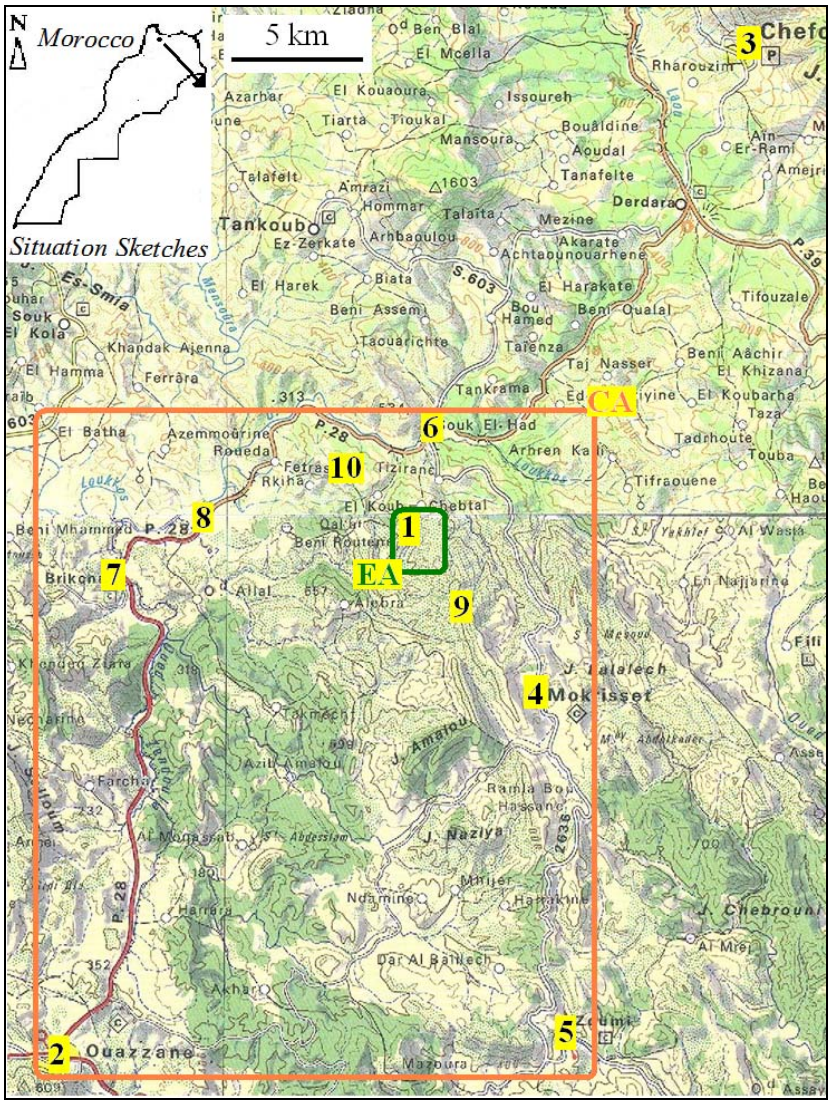


Figure 1. Situation of the studied area and surroundings. **Caption:** 1, Tizgane-Alma; 2, Ouezzane; 3, Chefchaouen; 4, Mokrisset; 5, Zoumi; 6, Souk El-Had (Laghdir); 7, Brikcha-Sebt Rhouna; 8, Ain Beida; 9, Dar El Ouad; 10, Fetrasse; EA, exploitation area; CA, commercialization and control area. **Modified Sources:** Topographical map of Morocco, Tangier and Fez, 1/250 000.

this landlocked area[7]. We made so various archives relating to the exploitation of natural resources (contracts, convening's, verdicts, records, notes and personal communications), particularly obtained from aḥmad ben 'aly 'āṭ-ṭōby 'ān-nabyly and Mrs. raḥma bent 'abdo 'ās-salam 'āl 'amrāny. These data were carefully sorted and synthesized.

2. Traditional mountain agrosystem

Agricultural activity in this area was of the traditional type involving farmers and artisans, and trying to ensure local food security. This socio-agrosystem was almost closed and any long external displacement related mainly for commercial purposes (exchange of agricultural and handicraft products against other assets), scientific activities (studies on the Quran - 'āl qor'ān- and Islamic jurisprudence) and armed resistance (involvement in the anti-colonial wars, N Morocco).

[7] Ennabili A., El Hamdouni E.M., Gharnit N. 1997: *Intérêts socio-économiques du caroubier et des plantes médicinales, aromatiques et mellifères à Mokrisset et Bab Taza (Nord-ouest du Maroc)*. Coopération Maroco-Espagnole/Agence de Développement Local de Chefchaouen - Université Abdelmalek Essaâdi de Tétouan, Maroc, p. 35. Ennabili A., Gharnit N., El Hamdouni E.M. 2000: *Inventory and social interest of medicinal, aromatic and honey-plants from Mokrisset (NW of Morocco)*. Stud. Bot., 19 pp. 57-74. Gharnit N., El Mtili N., Ennabili A.T., Ennabili A. 2001: *Social characterisation and exploitation of carob tree (Ceratonia siliqua L.) from Mokrisset and Bab Taza (NW of Morocco)*. Science Letters, 3(2) p. 10. Gharnit N., El Mtili N., Toubi Ennabili A., Ennabili A. 2003: *Exploitation du caroubier (Ceratonia siliqua L.) dans la Commune d'Aïn Beïda, Province de Chefchaouen*. In A. Boukroute (Ed.), Arbres et espaces verts urbains: du chercheur au gestionnaire, Actes Editions, Rabat, pp. 93-100. Gharnit N., El Mtili N., Ennabili A., Sayah F. 2006: *Importance socio-économique du caroubier (Ceratonia siliqua L.) dans la Province de Chefchaouen (Nord-ouest du Maroc)*. J. Bot. Soc. Bot. France, 33 pp. 43-48.

Local conflicts related to exploitation of plant and animal resources in general were settled with scholars and experts in Islamic law as ’āl faqyh ’āl hašmy ben laḥsen ’āl ‘amrāny ’an-nasab ’aṣ-ṣaltani ’āl ġzāwy. During the period from the late 19th century at about twenty-five years of the 20th century, the exploitation of biological resources in this area was then organized by using an arsenal of contracts, verdicts and records unanimously recognized (Figure 2). By way of examples, should be mentioned: (i) land and fruit trees gift (waqf), in favor of the mosques; (ii) property sharing , inheritance, loan, gift, mortgage, advances, preemptive; (iii) irrigation regulation of fruit trees and vegetables according to one hour for each orange tree[8]; (iv) service, maintenance, exploitation, proxy; (v) selling, contestation, reconciliation, tenure, testimony ; (vi) cutting and maintenance of fruit trees, and ’āl qōṭiya (fig tree category); and (vii) olive oil press.

The local population subsisted on the practice of burning maquis and matorrals to acquire additional land, while still having the right to collect wood and graze in the forest[9]. Peasant activity locally was based on the exploitation of forest resources (food, lopping, firewood, grazing, hunting resources...), arboriculture (vines, olive, orange, fig...) and livestock (sheep, cattle, poultry...). At the time, called the

[8] Ennabili A. 2005: *Problématique de la gestion des ressources en eau au Maroc méditerranéen.* Revue AFN Maroc, 1 pp. 57-76.
[9] Laouina A. (accessed April, 4, 2016) a: *Dégradation des terres dans la région méditerranéenne du Maghreb*. http://www.beep.ird.fr/collect/bre/index/assoc/HASHecf2.dir/18-033-053.pdf, pp. 33-53.

"famine period", to be "sufficiently fed" was an immense privilege. Thus, and after his release in 1926, a warplane pilot held prisoner in Dar El Ouad (Figure 1, cap. 9), declared he was "treated well and fed enough," although the Spanish and French armies attacked civilians by destroying their crops and starving the Rif tribes[10].

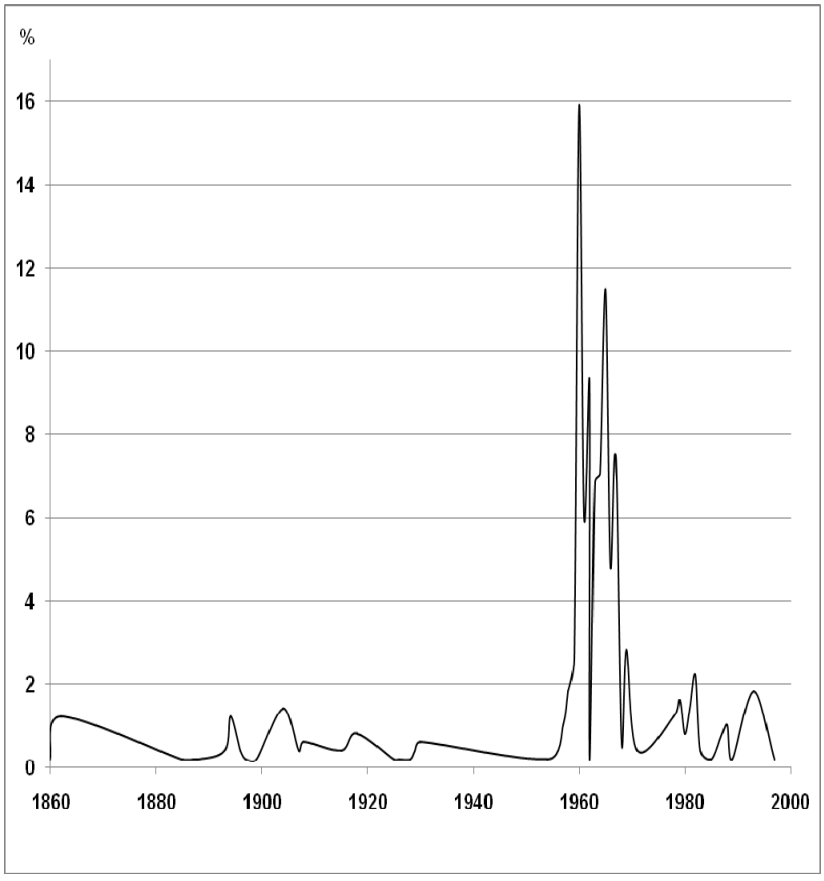


Figure 2. Yearly rate of lawsuits related to the biological resources, Tizgane-Alma area (N=497).

[10] Overblog (accessed April, 8, 2016): De quoi Dar El Oued est le nom ?, http://darelouad.over-blog.com/2014/01/dar-el-oued-mokrisset-maroc.html

Considering the direct impact of advanced droughts on public order in agrarian societies, and their political repercussions, Moroccan sultans, however, opted mainly by maintaining large stocks of grain to control food prices during shortages and, in case of urgent need, stored grain was distributed directly to the public to fight against famine[11].

3. French protectorate

3.1. Drainage of local natural resources

As Lyautey (Resident General in Morocco) pointed out in one of his official speeches "*For us, Morocco will remain a warehouse and a mine to extract the men and money...*"[12], the French colonial policy locally led from 1926 was an exhaustive drainage of any biological valuable resource, with the help of loyal local officials (’āš-šyḫ, ’āl mqad-dem, ’āl ǧārī).

Part of a classical liberal economics, the French “colonial” Administration in N Africa has also ensured the transformation of subsistence production of the local population in the production of commodities mainly by settlers and European companies. Forests as source of pasture, feed, agricultural land... were delimited, rationalized and improved to provide wood, cork and other forest products for the market[13].

[11] Swearingen W.D. 1992: *Drought Hazard in Morocco.* Geographical Review, 82(4) pp. 401-412.
[12] ‘aly ben aḥmed ben ’āl amīn ’ar-raysūnī 2016: *’āl waṯīqa ’āl ūlā lilmotā-laba bistiqlāl ’āl maġrib.* Ipnor Printing Press, Tangier, Morocco, p. 119.
[13] Davis 2006: Ibid.

Contrary to improving access to other areas of Jbala under French and Spanish protectorates by the construction of many roads through the mountains, Tizgane-Alma area has not benefited, except a further track reaching Fetrasse (Figure 1, cap. 10) for war purposes.

In full 2nd World War, the French "protectorate" forced local people to collect and transport the olives by human portage, on donkeys and mules... to the custom of Ain Beida (Figure 1, cap. 8). In this regard, inspection and audit campaigns were realized continuously and "luxurious" food products were removed. Cattle “abduction” (particularly cows and oxen) on behalf of the Caïd of Mokrisset was a common practice for various reasons (celebration of baptism and circumcision, various celebrations...). Induced local emigration of people (rural exodus) began mainly to the city of Ouezzane (Figure 1, Cap. 2).

According to the season, local people then had recourse to "famine foods" from gathering and hunting, such (i) tubers of *Arisarum vulgare* (el ‘rūq ayerna), carob pod of *Ceratonia siliqua* (es-slaġwa), acorns of *Quercus ilex* (el bel-lūṭ), berries of *Arbutus unedo* (bōḫan-nū), pickly pear of *Opuntia ficus-indica* (el hindiya); (ii) cooked salad (el bqūl) of *Mentha pulegium* (flayū), *Anchusa officinalis* (ḥor-rayša), *Allium triquetrum* (baybroṣ), *Malva sylvestris* (ḫob-bayza), *Nasturtium officinale* (gerwin-niš), *Oxalis cernua* (ḥom-mayḍa), *Rumex*

crispus (el bqūl el ḥor-rin)…[14]; (iii) broyat of capsule of *Cistus albidus* (qal-liš awkīr) and vine pruning scraps of *Vitis vinifera* (zbīr ed-dalya) ; and (iv) other products from the forest area such as honey of bees (en-nḥāl) and carpenter bees (aḏrūz), truffles (et-tōrfays), *Cytinus hypocistis* (eš-šōr-ri‘), hunting resources…

Olives and olive oil (’az-zaytūn, *Olea europaea*), dried figs (’āl karmūṣ and eš-šriḥa el bakor, *Ficus carica),* raisin (ez-zbīb, *Vitis vinifera*) and bread made from wheat landraces (*Triticum* spp.) represent luxury foods, but were carefully hidden to escape the regular inspections and audits. A pancake made of wheat landrace (baġrīr eš-šqalia) with the current year olive oil is another preparation. We secretly crushing olives at night, with fast cleaning of the space used, and olive oil was stored sometimes below ground in cowshed.

In exchange for sugar, the natives were forced to bring firewood to the Caïdat of Mokrisset (“el bīrū” in French; Figure 1, cap. 4.). Especially following the catastrophic drought of 1945, called “death year”[15], the "protectorate" proceeded through the distribution of "coupons" for limited commodities procurement (wheat, oil, sugar...) according to the members of each household.

Accordingly, the prevailing price for a hectare of land, during this time of crisis, was hardly fifty kilograms of

[14] Ennabili *et al.* 2000: Ibid.
[15] Swearingen 1992: Ibid.

cereals[16]. Given this conjuncture, induced among others by colonial policy, the number of conflicts on biological resources (exploitation unjustly, theft…) significantly decreased (Figure 2).

3.2. Agriculture taxation and control

The French protectorate gradually introduced an agricultural taxation regime based on religious principle (the tenth of fruit trees and annual crops occurring in irrigated or non-irrigated farmland, and alms or ’āz-zakat). Notebooks of receipts to date and confirm by the collector have been drawn in Arabic, French and/or Spanish, regarding the Home (Farmer or peasant name, and number of persons and Adult males), and the national of the territorial subdivision (dour or rural settlement, tribe, mašyaẖat or chiefdom) or concerned with the administrative one (Office, Commune, Fraction).

A census and taxation system has in fact been imposed on rainfed (būr or un-irrigated) and irrigated lands, fruit trees, livestock, and annual and special crops. Forms generalized on the entire Moroccan territory under the French protectorate were used for the census of (i) fruit trees such as olive trees, creepy and trellised vines, fig and non specified trees, orange and lemon trees, grenadiers, almond trees, cherry trees and walnuts, and palm trees inside and outside qṣour (or rural “castles”) ; (ii) annual and special crops such as barley, durum

[16] Swearingen 1992: Ibid.

wheat, common wheat, broad beans, “orobe” or kersan-na, lentils, oat, small pea, chickpea, sorghum, canary grass, coriander, garden crops, cumin, fenugreek, kidney beans, henna, flax, maize, millet and rye; and (iii) livestock such as adult camels, young camels, oxen, bulls, cows, calves, heifers, pigs, goats, sheeps, horses, mares, mules and donkeys. The hunting resources have also been a target for the protectorate, and it is not by chance that a national of Tizgane was a member of the Saint Hubert Club of Ouezzane in 1951-52 (Figure 3).

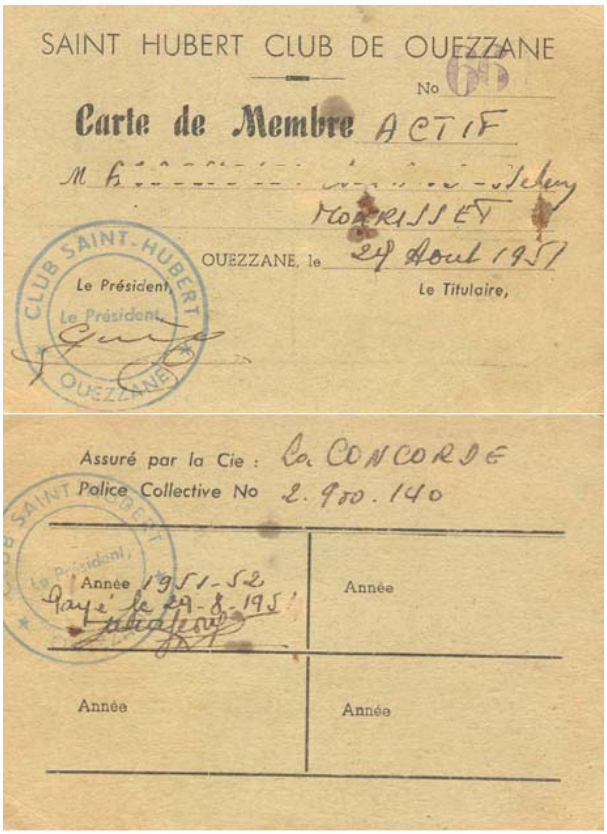


Figure 3. Membership card hunting club of a national of Tizgane (1952).

Stringent controls were conducted by the Post of Mokrisset (Figure 1, cap. 4) which depended on the Zoumi District, the Ouezzane Territory and the Region of Rabat, for displacement and freight transport outside the area of Tizgane-Alma. To exchange plums against the cereals (wheat, maize, chickpea...), a residence certificate was issued, for example, to a man accompanied by two other persons for moving around to the tribe of rhūna (Figure 4). Where displacement concerning the Chief town of Ouezzane Territory (Figure 1, cap. 3), which depended on the Region of Rabat, a circulation permit was established, for example, by the Department of Customs and Indirect Taxes for a woman to transit two cows (Figure 5).

Furthermore, crops in the area of Tizgane-Alma include mainly creepy vine, fig and non specified tree, and olive tree (Figure 6), and annual and special crops of broad bean, durum wheat, barley, common wheat and "orobe" or kersan-na (Figure 7). Livestock includes goats, bulls, cows and donkeys (Figure 8). The exploitation of creepy vines was destined primarily for production of raisins (ez-zbīb) and "raisin honey" (eṢ-Ṣamet).

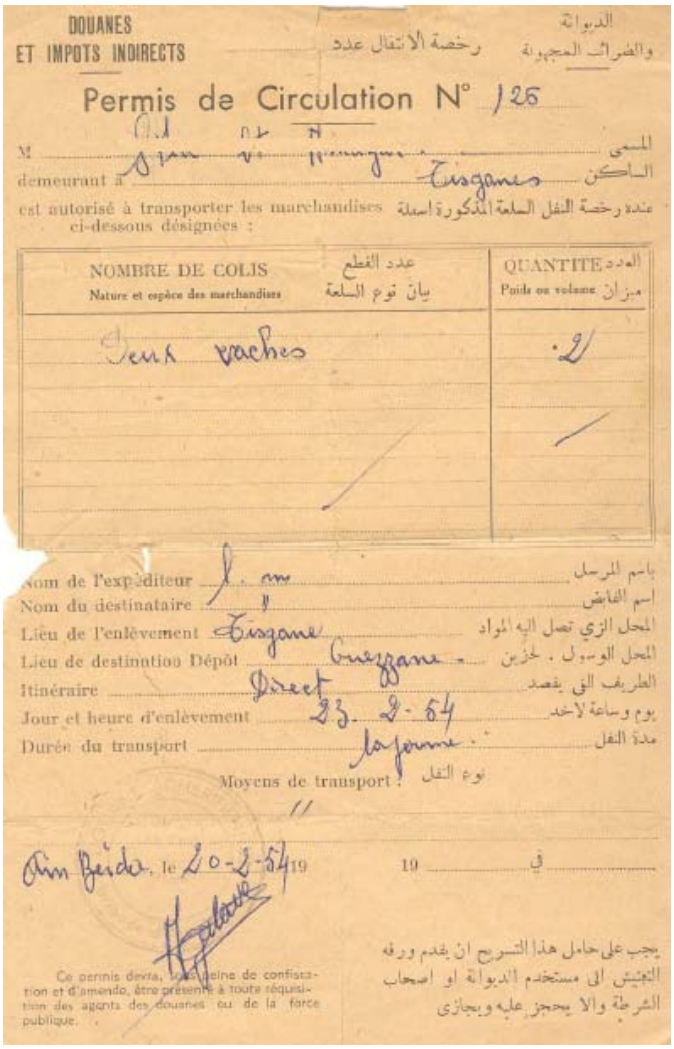
The comparison between the declared quantities and the controlled ones (Figures 6, 7 and 8) reveals a non-transparent taxation system, due to local officials who apparently penalized the rebellion of the ġzāwa tribe one hand, and “abduction” policy of all food by the "protectorate" on the other. Furthermore, the peasants generally representing their

respective households declared having 0.632±0.597 (N=19) dependent adults in addition!

Figure 4. Residence certificate established on the request of a national of Tizgane for displacement and exchange of plums against cereals (1954).

These censuses show that the local peasant activity generally consists of subsistence agriculture, given the low

numbers of fruit trees and livestock, and small crops size. The crop areas relatively large correspond generally to wealthy people who also rented land of wizārat ‘omūm ’āl ’awqāf (currently Ministry of Habous).


DOUANES
ET IMPOTS INDIRECTS

رخصة الانتقال عدد

الديوانة
والضرائب المجهولة

Permis de Circulation N° 126

M ..... المسمى

demeurant à Tizgane الساكن

est autorisé à transporter les marchandises ci-dessous désignées : عنده رخصة النقل السلعة المذكورة اسفله

NOMBRE DE COLIS Nature et espèce des marchandises عدد القطع بيان نوع السلعة	QUANTITE Poids ou volume العدد ميزان
deux vaches	2

Nom de l'expéditeur ..... باسم المرسل

Nom du destinataire ..... اسم القابض

Lieu de l'enlèvement Tizgane المحل الذي تصل اليه المواد

Lieu de destination Dépôt Guezzane المحل الوصول . لخزين

Itinéraire Direct الطريق الى يقصد

Jour et heure d'enlèvement 23-2-54 يوم وساعة لاخذ

Durée du transport la journée مدة النقل

Moyens de transport : نوع النقل

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Ain Beida, le 20-2-54 19 ..... 19 ..... في .....

Ce permis devra, sous peine de confiscation et d'amende, être présenté à toute réquisition des agents des douanes ou de la force publique.

يجب على حامل هذا التصريح ان يقدم ورقه التفتيش الى مستخدم الديوانة او اصحاب الشرطة والا يحجز عليه ويجازى

Figure 5. Circulation permit established on the request of a national of Tizgane for cow’s transit (1954).

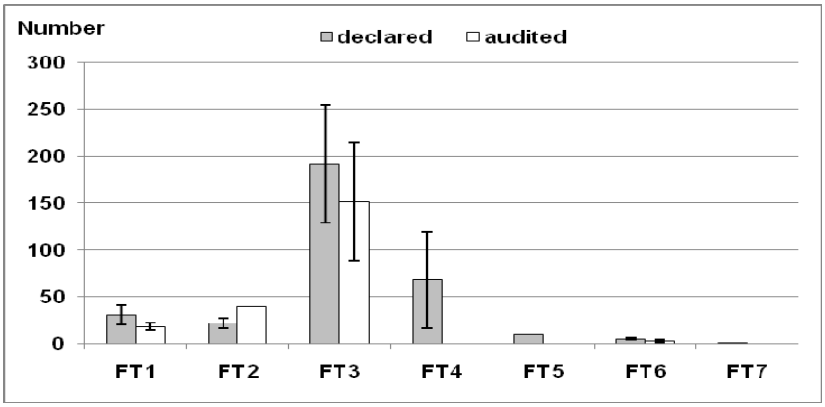

Figure 6. Census of fruit trees per farmer, Tizgane-Alma area (1945-1961). **Caption:** FT1, Olive trees; FT2, Fig and non specified trees; FT3, Creepy vines; FT4, Trellised vines; FT5, Almond trees; FT6, Orange and lemon trees; FT7, Grenadiers.

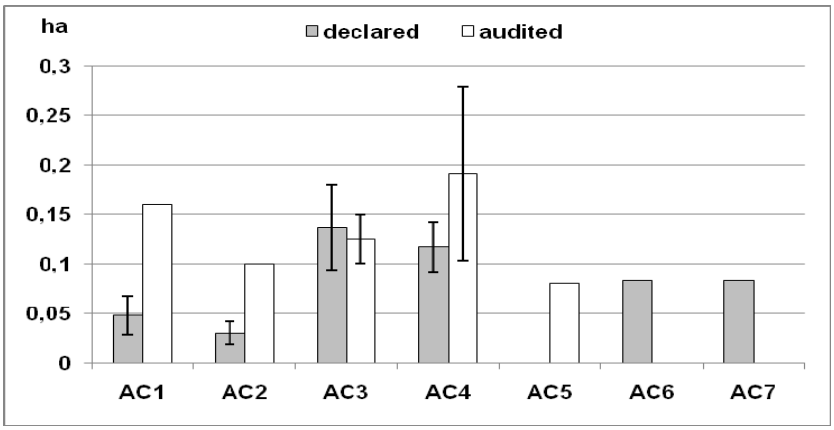

Figure 7. Census of annual and special crops per farmer, Tizgane-Alma area (1945-1961). **Caption:** AC1, Durum wheat; AC2, Common wheat; AC3, Barley; AC4, Broad beans; AC5, "Orobe" or Kersan-na; AC6, Canary grass; AC7, Coriander.

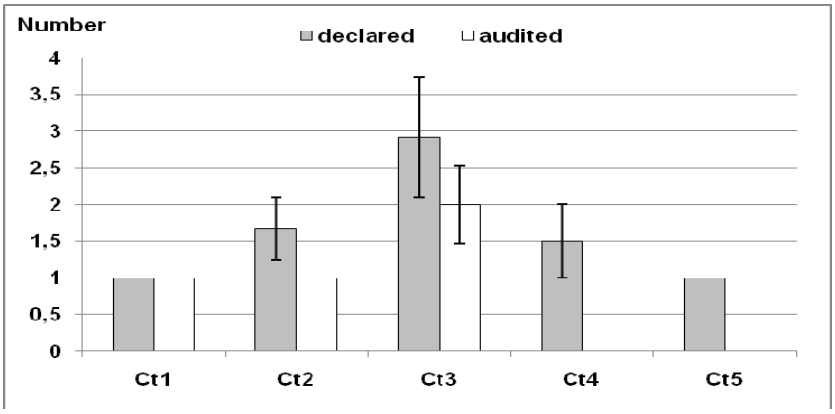

Figure 8. Census of livestock per farmer, Tizgane-Alma area (1945-1961). **Caption:** Ct1, Donkeys; Ct2, bulls and cows; Ct3, Goats; Ct4, Calves and heifers; Ct5, Mules.

The French protectorate has applied for peasants annual agricultural taxes exceeding 500, 350 and 125 MAF for respective categories of fruit trees, livestock, and annual and special crops (Figure 9). Accordance with a strict calculation method, the peasant was required to pay an annual agricultural tax of about 600 to 825 MAF, with a postponement of 59.74±82.16 MAF (N=10) (Figure 10). Sometimes additional amounts are paid by peasants as various penalties. For example, a national of Tizgane delivered in February 1952 to the Municipal Authority ("Régies, Droits de portes", Ouezzane; Figure 1, cap. 2) 9.91 tones of olives for a total of 210 MAF, i.e. 21.82±4.111 MAF/t (N=3). Late fifties, all land, and fig and carob trees of Habous (Mosque of Tizgane), one of the largest local properties, were rented at 750 MAF, i.e. about the annual agricultural tax required by peasant (Figure 10).

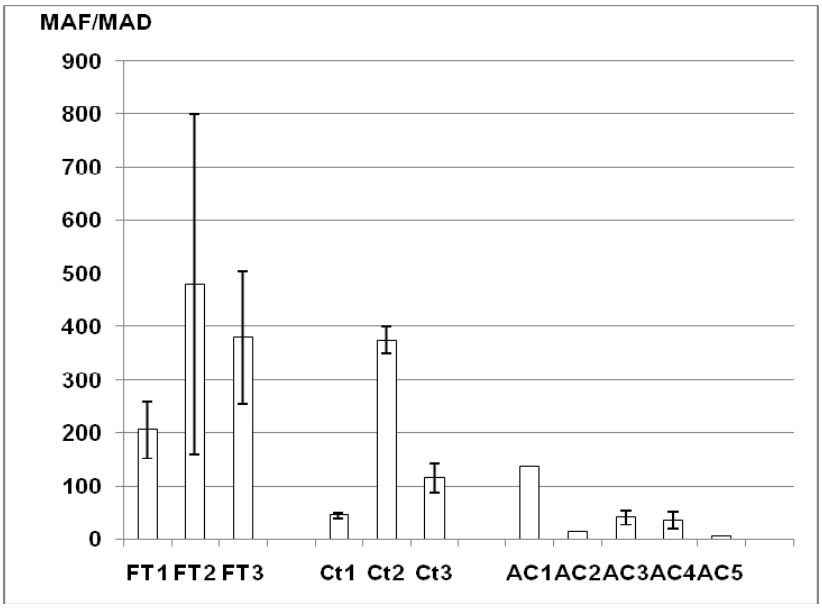

Figure 9. Tax amount paid by farmer according to the resource type, Tizgane-Alma area (1953-1961). **Caption:** AC1, Durum wheat; AC2, Common wheat; AC3, Barley; AC4, Broad beans; AC5, "Orobe" or Kersan-na. Ct1, Donkeys; Ct2, bulls and cows; Ct3, Goats. FT1, Olive trees; FT2, Fig and non specified trees; FT3, Creepy vines. MAF, Moroccan Franc (before 1958); MAD, Moroccan Dirham.

4. Post-independence

4.1. Orientations and development projects

The independence of Morocco was not without inheritance fashioned under the French protectorate (1912-1956): promotion of industrial crops, orientation towards agriculture export (citrus and vegetables in particular in irrigated areas), influence of rural and urban notables, and stagnation of non-irrigated traditional sector. Cereal imports

have always been necessary to provide enough bread for an increasing population[17].

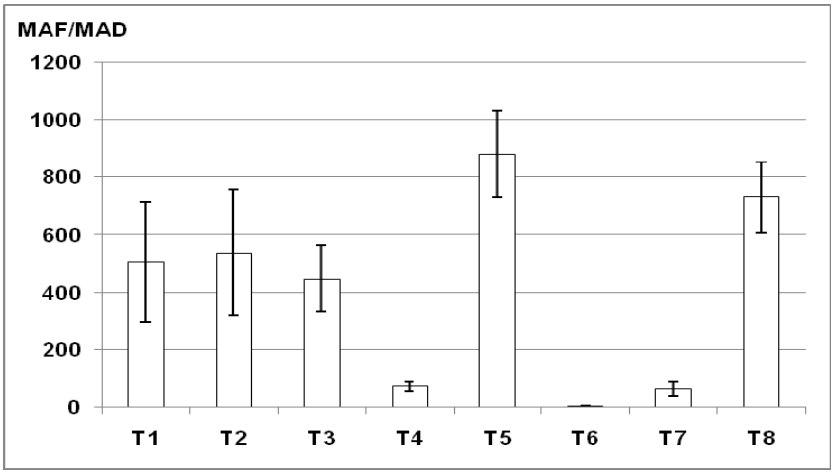

Figure 10. Agriculture tax amount components, Tizgane-Alma area (1953-1961). **Caption:** T1, Main tax and penalties; T2, Rebate or exemption; T3, Remainder ; T4, Additional cents ; T5, Services (personal tax) ; T6, Additional recipe; T7, Postponement; T8, Total to pay. MAF, Moroccan Franc (before 1958); MAD, Moroccan Dirham.

In addition, the World Bank has orchestrated a large part of the restructuring of the Moroccan agriculture since the sixties. The structural adjustment policy adopted in the agricultural sector during the 80s had questioned the interventionist orientation of the agricultural policy of the 60s and 70s (largely so identified with "dam's policy"), advocating

[17] Khrouz D. 1992: *Effets de l'aide internationale sur l'agriculture africaine: Le cas du Maroc.* Africa Development, XVII (3) pp 99-138. Davis 2006: Ibid.

the disengagement of State, liberalization of markets and prices (with some exceptions), the abolition of subsidies...[18].

Forest legislation considered woody formations as belonging to the State lands and submitted them to a regime of managing and monitoring by the State. The tribes maintained a regulated right of use, while forest clearing and woodcutting were decreed outlaw[19].

The French protectorate policy of biological resources management was adopted after independence in 1956 and until the early sixties (Figures 6, 7, 8, 9 and 10). Nevertheless, the new Administration (the Moroccan State) was faced to handle a numerous conflicts in this regard (Figure 2); the regulations arsenal, adopted the first quarter of this century, was no longer recognized. Apart from indefinite conflicts, land and water resources use was the source of most of these different; it is followed by fruit trees and annual crops, livestock and beekeeping (Figure 11), due among others to theft of crops and livestock confided for fattening, and setting aside of previous commitments.

Although agricultural censuses have continued after the sixties, farmers from Tizgane-Alma area were not taxed apparently because of their low income. In the wake of measures expected to counter the effects of the drought that prevailed in Morocco in the early 80s, farmers benefited

[18] Davis 2006: Ibid. Akesbi 2003: Ibid.
[19] Laouina A. 2016a: Ibid.

nationwide from the exemption of agricultural direct taxes from 1984 until the end of 2000 thanks to a royal decision[20].

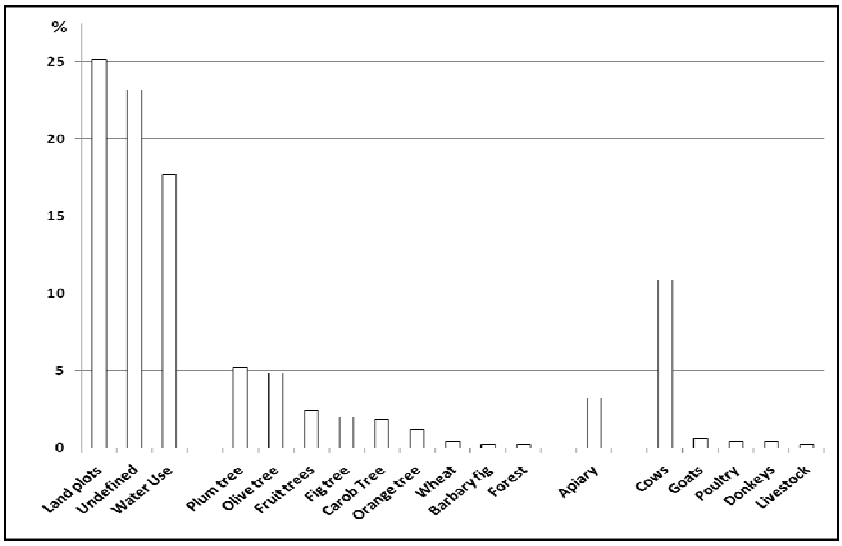

Figure 11. Lawsuits rate by resource types, Tizgane-Alma area (1860-1997; N=497).

In addition, many development projects were launched, targeting fragile areas management and new practices development: development of sustainable production systems through proper management of resources, and soil stabilization. Based on recommendations from the seventy years, the DRS Loukkos project (Soil Protection and Restoration in the Watershed of Loukkos wadi) had two main objectives: (i) reducing surface runoff on slopes and, consequently, soil loss, and (ii) losses compensation of culture surface by the

[20] Akesbi 2003: Ibid.

prohibition of pastures, including through crop diversification and introduction of new exploitation habits[21].

The introduction of *Acacia cyanophylla*, having a rapid growth and resilience to grazing, constituted the main action of the conversion of non-agricultural land in protected forests and mountain pastures, with herd exclusion for at least four years. This period would ensure an adequate vegetation cover, offer its branches for goats, and provide firewood. After the vegetation establishment, livestock would be reintroduced in an organized way by grouping shepherds in cooperatives for sustainable exploitation[22].

In the logical introduction of anti-erosion crops in farms, the State supports the acquisition of fruit seedlings, pastoral seeds and fertilizers, and provides the technical assistance, conditioning among others that the beneficiaries are in charge of equipment and maintenance costs within the farms. The rights and obligations, and the intervention framework of both the State and beneficiaries are specified by legislative and regulatory measures. A subsidy was granted to farmers (individuals or organized groups) for development work carried out within the framework of the defense and restoration of soils according to the techniques used. To encourage farmers from

[21] Laouina 2016a: Ibid. Laouina A. (accessed April, 7, 2016) b: *Evaluation des périmètres de DRS fruitière, le cas du projet Loukkos*, http://www.beep.ird.fr/collect/bre/index/assoc/HASH01c3.dir/14-271-278.pdf, pp. 271-278. Ghazi E.A. (accessed April, 4, 2016): *Projet de développement agricole intégré de Loukkos*. http://www.anafide.org/doc/HTE%2059/59-8.pdf, pp. 51-57.

[22] Laouina 2016a: Ibid. Ghazi 2016: Ibid. Hagen & Grosenick 1989: Ibid.

the project area, and in accordance with Loan Agreement, the Moroccan Government has entered into an agreement with the World Food Program, under which the latter provide to the project commodities (mainly wheat) to distribute for fellahs (farmers) as compensation for loss of enjoyment or as part payment of salaries[23].

Nevertheless, management techniques of the mountainous watersheds adopted in this respect should be reconsidered in close cooperation with farmers. These planning's types must be decided by the population and exercised by them with material assistance and technical support of the services responsible[24]. The major rural development projects in the upper watershed of Loukkos wadi, comprising the Tizgane-Alma area, were locally with no real impact. Although the pastures were improved by acacia introduction, and strengthening of olive and quince plantations, the free market and the lack of in situ valorization channels did not allow an improvement of local living standards. Introduced plantations of almond, vine, and plum (destined for drying) have spectacularly failed.

The lack of means made available for forest services (land delimitation, supervising, wildfire...) prevented the application of a balanced and sustained protection policy of forest resources. Very soon the fines have proved ineffective face appropriation and gathering forms dictated by the free

[23] Ghazi 2016: Ibid.
[24] Laouina A. 2016b: Ibid.

access to forest resources (forest clearing, wood...)[25]. Sometimes the wood is sold on forest trees (marabouts, cemeteries, old isolated trees...) by jmā'a (body representing the inhabitants of each douar) to private companies without resorting to special authorizations!

In this regard, the peasants did not feel obliged of opting for forest and semi-forest plantations to get firewood and construction materials, except for riparian forest plantations made from *Populus nigra, P. alba, Salix alba* and *Arundo donax*[26], and fencing based particularly on *Myoporum laetum*. The collection of medicinal plants in forest and semi-forest areas, and private farms seasonally occupy indigenous[27]. The conversion of non agricultural land to pastures by planting acacia was perceived as a land expropriation!

To facilitate payments, credit societies were active in this area (1956-1966), namely the Moroccan Society of Reserve, and the Society of Agricultural Credit and Reserve (Ouezzane, Mokrisset District; Figure 1, cap. 4). A cooperative oil mill was also settled in Zoumi (Figure 1, cap. 5) and receiving olives inputs from Tizgane in 1961. This cooperative was created in 1948 by the French authorities between tribes of ġzāwa and bni mes-sāra, and consists of an olive oil mill doing worked day and night more than 100 laborers, and an

[25] Laouina 2016a: Ibid.
[26] Ennabili A., Nabil L., Ater M. 1996: *Importance socio-économique des hygrophytes au Nord-ouest du Maroc.* Al Biruniya, Rev. Mar. Pharm., 12(2) pp. 95-120.
[27] Ennabili *et al.* 2000: Ibid.

administrators group, chaired by the highest military commander of the area (knīnār). This cooperative was strengthened by a grain mill, and a Factory of fruits conservation (fig in particular), but sadly went bankrupt in 1965 due to mismanagement[28].

4.2. Subsistence mountain system

Peasants sold their products based on years in weekly markets (sūq) of Sebt (sebt rhūna), Mokrisset (tlata moqriṣāt), Souk El Had (sūq el had) and Zoumi (letnin zūmi), or Ouezzane (Figure 1, cap. 4, 5, 6 and 7; Figure 12) to provide for their needs. Beside fruits and cereals, some farmers produced for regional sūq seedlings (nūqla) mainly of *Citraceae, Rosaceae* and vegetable. The mountain agriculture is a subsistence activity, and very unpredictable: production instability, lack of packaging means, and uncontrolled prices. Thus the recipes from locust beans experiencing a net increase, although its production is declining; foreign demand for this commodity is the main key in this respect (Table 1).

In contrast, the effects of drought, married to the rural exodus and market fluctuations, have affected the cultivation of olive, plum and quince trees (Table 1). The production of plums averages 11.27±7.270t/ha (N=7) and has regressed 0.429 times between 1974 and 1992. While small livestock

[28] ‘abdo ’ās-salām ’āl bek-kārī 1997: *’āl waǧīz fī tārīẖ wa a‘lām mes-sāra wa ‘alāqat waz-zān wa ma wālāhā min qabāil ǧbāla.* Boukili Impression, Kenitra, p. 370.

generated in terms of income an increase of 8.108 times (1930-2000) for goats and 1.429 times for sheeps (1994-1999). Nevertheless, commodities for the local population to provide from market grew in terms of price about 13 times. The agricultural tax exemption privilege locally was not recorded since in reality, it favors a minority of large producers[29]; the income of local farmers would not reach the tax threshold.

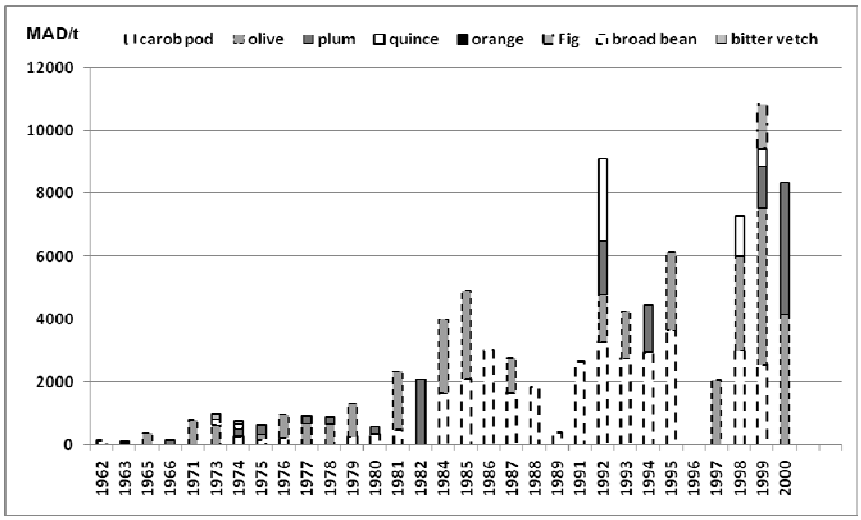

Figure 12. Evolution of the sale price (MAD/t) of the main plant products marketed, Tizgane-Alma area (1962-2000).

Conscious of the interest of improving access to mountain regions in terms, among others, of more efficient commercialization of local products, the inhabitants of Tizgane and Alma voluntarily developed a track of about 7 km flight distance, in 1974 from the National Road No. 13, passing

[29] Akesbi 2003: Ibid.

through the dours of Kalâa Beni Routen and Fej El Hanout, while also helping each other with their respective inhabitants. In Tizgane-Alma, more than ten tons of plums were sold daily at 202.5±44.75 MAD/t (1974-1975, N=12) and evacuated throughout the production season. Low income and the severe drought of 1975, and those after (1982, 1995 and 1999), have unfortunately regressed irrigated crops on the one hand and pushed the nationals of Tizgane and Alma to abandon the track servicing, on the other hand.

Table 1. Evolution indexes (*times) of fruits and sub-products production, Tizgane-Alma area.

	Total production (t)	Total income (MAD)	Unit price (MAD/t)	Period
Carob pod	0.895	16.46	18.23	1962-1999
Olive oil	2.004	3.316	1.552	1962-2000
Olive	0.257	0.879	4.070	1962-2000
Plum	0.035	0.924	28.00	1966-2000
Quince	3.589	0.768	0.214	1992-1999

With 73.47% of non-irrigated and 26.53% of irrigated (N=49) lands, the agricultural land plots size is very small: 0.316±0.463 ha (N=36) for land plot size and 0.212±0.392 ha (N=42) for agricultural plot one (1963-1998). The characteristics of a farmer's orchards model expressed the fragmentation of the land and fruit trees burst on several plots (Table 2). Agricultural property of local farmer (land, fruit plants and livestock) remains very modest (Table 3). The lot of

land requires an average of 3.336±4.515 days (N=30) of plowing, for a common wheat yield of 7.196±1.790 qq./ha (N=2), vs. 14.3 to 19.2 qq./ha in national bour areas[30]. The selling price of agricultural land is of 6,4905±17,724 MAD/ha (N=42) based on irrigated and/or planted land; a good agricultural year could easily generate an income greater than the value of the exploitation itself!

Table 2. Features of orchards and forestry land plots, Tizgane-Alma area (1997).

	Mean	**SD**	**N**
Agricultural land plot (ha)	4.176	3.762	17
Forestry land plot (ha)	3,2	1,64316767	5
Olive trees (ha^{-1})	16.21	25.75	28
Carob trees (ha^{-1})	1.857	1.351	14
Fig trees (ha^{-1})	11.92	21.92	12
Plum trees (ha^{-1})	9.444	3.127	9
Pomegranate trees (ha^{-1})	4.857	2.968	7
Almond trees (ha^{-1})	30	-	1
Vines (ha^{-1})	25	-	1
Apiaries (ha^{-1})	4	-	1

Although Tizgane-Alma area has been affected by major development projects, there was no monitoring of local achievements, to profitably integrate regional actions

[30] LA VIEéco 20016 (March, 26): *La céréaliculture affiche des résultats probants depuis 2008.* http://lavieeco.com/news/economie/la-cerealiculture-affiche-des-resultats-probants-depuis-2008.html

Table 3. Exploitation and livestock sizes per farmer, Tizgane-Alma area (1963-1998).

	Mean	SD	N
Total land surface (ha)	12.5	5.260	4
Creepy vines	300	100	3
Fruiting olive trees	257.1	322.7	9
Young olive trees	138.5	195.9	2
Fig trees	105.9	117.2	9
Plum trees	25	32.02	9
Orange trees	6	5.477	5
Carob trees	34.25	6.752	4
Pomegranate trees	26	5.292	3
Almond trees	72	-	1
Quince trees	51	-	1
Apple trees	30	-	1
Lemon trees	18	-	1
Apricot trees	3	-	1
Goats	25	13.23	3
Cows	2.25	1.5	4
Mules	1	0	4

(production chains, solidarity economy...). As examples, we note a strengthening of goats breeding by introducing acacia, and partial support of olive cultivation by distributing olive seedlings, but on the contrary a cultivation failure of almond tree, vine... and a regression of the irrigated area along the wadis due among others to dams-gabions construction! The

monitoring of these projects, for example by introducing goat breeds, and grouping and accompanying shepherds has not occurred.

4.3. Environmental hazards

Table 4 provides a non-exhaustive list of various cultures that have been practiced in Tizgane-Alma area along the past century. We count more than 70 categories or "cultivars" belonging to 22 fruit trees cultivated and/or domesticated. The infra-specific and/or generic diversity is more marked in the fig and plum trees, and vine (Table 4). The un-irrigated domain interested about 55% of fruit trees. Also practiced in non-irrigated areas, annual crops concerned 9 kinds with a significant diversity for wheat. Special crops were practiced to 90% in irrigated areas during the spring-summer, and count 24 types. Vegetable crops are in number of 19 types (Table 4) and are practiced to 70% in non-irrigated areas during autumn or throughout the year for some biennial or perennial species.

Animal breeding particularly interested bulls, calves, heifers and cows (el beldi and el mberhaš), sheep, goats (local breed in particular), rabbits, hens and roosters, guinea fowl (el ḥjel er-rūmi), turkey (bībī), pigeons and bees (el ʻadi, el waḥšī and el maʻzī). Donkeys and mules serve as means of transport and plowing (animal traction) next to bulls and cows.

Table 4. Global crops diversity during the last Century, Tizgane-Alma area.

Crops	Vernacular names*	Categories
Fruit trees		
Apple	et-tef-fāḥ	el hāmeḍ
		el ḥlū lebiaḍ
		el ḥlū leṣfar
		er-rōmī
Almond	en-nwa	er-rōmī, del filaḥa
		el beldī
Apricot	el mešmaš	
Barbary fig	el hindiya	Bešūk
		el malsa
Carob	el ḫar-rūb	Lanta
		productive dkar
		Sterile
		unproductive dkar
Cherry	ḥab elmlūka	
Fig	eš-šijar	‘onq ḥmām
		’āl qōṭy
		el ‘as-sāl
		el ber-raniya
		el bḥīrī
		el ġūd-dān
		el gwīzī
		el ḥomrāni
		el ḥrīši
		el kūrtī

		el meqrōṣ
		el mes-sarī
		en-nabūt
		et-tabli, seb‘a werqōd
		ḥjīwej
		ḥlima
		kerš leḥmar
		lemḍar lekḥal
		Selfāf
Lemon	el-laymūn	Harvesting once a year
		Harvesting throughout the year
Medlar	el mzāh	
Moroccan citron	et-trōnj	
Olive	ez-zaytūn	el būtūr
		elġlēẓ, semlāl
		er-rqīwaq
Orange	el-leš-šīn	el beldī
		el hāmeḍ
		en-nabil
Palm	en-naḫ̲la	
Peach	el ḫ̲ō ḫ̲	el beldī
		er-rōmī
Pear	el-lingāṣ	bū‘wiyed**
		ej-jiyāf
		er-rūmī
Plum	el barqūq	būbez-zūla
		del filaha
		el blenzī

		el hmīmar
		el kḥīhel
		el meknasī
		er-rūmī
		es-smāwī
		lekḥal
		tiṭ-ṭawni
Pomegranate	er-rōm-mān	es-sefrī
		del ‘ẓām
		snān ‘jūl
Quince	eš-šfarjel	el beldī
		er-rūmī
Vine	ed-dālya	Amtel
		bez-zūl el ‘awda
		ed-dalia delfilaha
		el faq-qāṣ
		el ẖoḍrī
		el mūska
		en-nabūt
		ez-zebrīj
		ez-zerwālī
		taferiyālt lekḥal
		taferiyālt lešhab
Walnuts	el gawza	
White mulberry	et-tūt lebiaḍ	
Wild-olive	el ber-rī	
Annual cultures		
Broad beans	el fūl	el ‘orbayṭ

		er-rqīqīn
Chickpea	el hom-mēṣ	el qoršī
		mʻīzō
Lentils	el ʻdes	
Orobe	kersan-na	
Oat	el ẖorṭal	
Pea	šaršarū	el ʻādī
		el kaḥ-ḥāz
Vetch	jlībna	
Wheat	ez-zrāʻ	el gemḥ
		el-lesma
		eš-šʻīr el beldi
		eš-šʻīr mirikān
		eš-šentil
		eš-šqalia
		Farina
Sorghum	ed-dra er-rqīqa	el bayḍa
		el hamra, ḥūm-mayra
Special cultures		
Eggplant	el brāniya	
Calabash	qrāʻ elma	
Canary grass	el koṣbat	
Cannabis	el kif	
Carrot	ẖez-zū	
Coriander	el qoṣbār	
Courgette	el qrāʻ	
Cucumber	el ẖiyār	
Cumin	el kamūn	

Fenugreek	el ḥōlba	
Kidney beans	el-lbīya	el bayḍa
		el ḥamra
Maize	ed-dra et-tūrkiya	
Melon	el beṭ-ṭīḫ	
Onion	el bṣal	el ‘ādī
Peanut	kawkaw	
Pepper	el felfel	el ḥlūa
		es-sūdānia
		gern el m‘īz
Radish	el fjel	
Squash	el qra‘ es-slāwī	
Strawberry	et-tūt er-rūmī	
Sunflower	nōār eš-šems	
Sweet potato	el bṭāṭa es-selkiya	
Tomato	maṭiša	el beldiya
		er-rūmiya
Turnip	el-left	
Watermelon	el kūār	
Garden crops		
Absinthe	eš-šība	
Artichoke	el ḫaršof	
Autumn courgette	el qrā‘	
Cabbage	el krūmb	
Celery	elkrāfeṣ	
Garlic	et-tūma	
Lettuce	el ḫaṣ-ṣ	
Marjoram	merdad-dūš	

Mint	en-naʻnāʻ	
Nigelle	es-sanūj	
Onion	el bṣal	et-tehrif
		el mdar-rej
Parsley	el maʻdnūs	
Pippermint	en-naʻnāʻ el ʻābdī	
Potato	el bṭāṭa	
Rose geranium	el ʻṭerša	
Safflower	ez-zaʻfrān	

* They are given usually in the plural form (e.g. et-tef-fāḥ, singular et-tef-fāḥa) for the most common cultures, and in the singular form (e.g. ḥab elmlūka, plural ḥab elmlūk; ed-dalya, plural ed-dwali) in the case of rare isolated plants, with invariable exceptions (e.g. el hindiya).

** Grafted on rootstock of *Crataegus mongyna*[31].

Continued on multiple local factors, the rural exodus, school mosques dropout, climate and economic hazards, and lack of political will and initiatives, cannabis cultivation has invaded this mountainous area in the ninety years. Although this type of culture apparently would generate a high financial product[32], its local negative repercussions are numerous.

Given this situation, the clearing and overgrazing of the semi-forest and forest areas, originally based on cork oak and holm one, and then degraded into maquis and matorrals, would imperil local biodiversity by exploiting new arable land, and causing a subsequent reduction of rain water percolation area.

[31] Ennabili *et al.* 2000: Ibid.
[32] Ennabili *et al.* 2000: Ibid.

The apparent gain of hemp cultivation pushes farmers to abandon more the local mountain legacy (cultivars and local breeds, local know-how...) while incurring its extinction. Moreover, growers of cannabis collect intensively waters from springs and wadis by transporting over long distances to increase the irrigated plots size.

5. Conclusion

The fact of breaking with the tribal mode of biological resources management (late 19th and early 20th centuries) sowed logically failure experienced by the local subsequent policies. Beyond, the various development programs having affected the Tizgane-Alma area would be measurable as well under the French protectorate (drainage of goods for world wars purposes) than under the Moroccan State (particularly large irrigation projects in lowland). Moreover, the absence of land delimitation of forest, Habous, melk (private) and chmāl (collective) areas on one hand and the improvidence of the local population on the other, deeply threaten any conservation of this mountain agro-ecosystem.

Considering the context of the water deficit in the last decade of the 20th century (7 years out of 10 which may be considered as rainfall deficits ones), the national agricultural policy was materialized in the Program against the effects of drought: creation of working days, drinking water supply,

distribution of cereals in rural sūq at subsidized prices...[33]. Address the effects of drought, whose origins are multiplying, is a "political" measure in the short term and, consequently, allow not in any case a restoration of the local mountain agro-ecosystem. The advanced regional policy should initiate, in close cooperation with farmers, a veritable mountain strategy targeting the conservation and in situ valorization of local resources.

[33] Akesbi 2003: Ibid.