Assessing the economic contribution of the pastoral common of the Yagur. A pastoral territory managed communally by the traditional berber system of the Agdal (Moroccan High Atlas)

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ASSESSING THE ECONOMIC CONTRIBUTION OF THE *YAGUR*

A PASTORAL TERRITORY MANAGED COMMUNALLY BY THE TRADITIONAL BERBER SYSTEM OF THE *AGDAL* (MOROCCAN HIGH ATLAS)

This study provides an ethnographic analysis of the pastoral mountain territory of *Yagur* in the High Atlas of Marrakech, Morocco and estimates quantitatively its agroeconomic contribution. The *Yagur* is governed by the institution of the *agdal*, a system for the communal management of natural resources of the Amazigh (the Berber ethnic community). The local version of the *agdal* consists in a three-month ban on herding, mainly in the spring, to allow regrowth of the vegetation, and in ensuring that all households have equal access to pasture. At the same time, the integration of the traditional *agdal* within local religiosity and its associated ethics entail a local conservationist and egalitarian set of values. Specifically, we focus on the economic pastoral contribution of the *Yagur* to the population of the *Ait Ikiss* belonging to the *Mesioua* tribe. Field work was conducted in all agropastoral seasons from 2003 to 2008, totalling a full year (12 months) of living with the *Ait Ikiss*. The main finding of the study is that the *Yagur* generates up to 18% of its users' annual agropastoral gross monetary income through its supply of fodder. Nevertheless, since it is impossible to produce precise and detailed accounting in a society that is nowhere near to monetizing its entire production, we present complementary qualitative data throughout the text to provide a better picture of the full range of agroeconomic and eco-anthropological dimensions of the *agdal*. We conclude that, although highly underestimated by national administrations, the *agdal*, which extends across almost the entire Atlas Mountain region and thus covers thousands of square kilometres of key and fragile ecosystems, should be considered as an important practice for the peasants' livelihoods, for the continuity of local agropastoral economies, and for the socio-ecological sustainability of present Magrebian mountain environments.

Keywords: Morocco, *Agdal*, Agropastoralism, Economy, Anthropology, Environment.

1. *Introduction*

A review of the literature reveals that the link between pastoralism and environmental degradation has been the source of fierce debate among researchers. Pastoralists are typically accused of degrading vegetation cover and causing desertification worldwide[1]. Nevertheless, while this may be the case in many situations of unregulated pastures, numerous studies have argued the reverse if institutions of community-based natural resource management are well in place[2]. Hardin's «Tragedy of the Commons»[3] justified heavy top-down state management or privatisation of natural resources held in common. But as has since been shown by others, this was based on the mistaken conflation of what is common property with what is open access and lacking in property rights[4]. Much empirical and theoretical work has been done in recent decades to rectify this erroneous and damaging assumption[5].

There has been wide international recognition of the potential contribution of local knowledge[6] and institutions of communal natural resource management to sustainable practices[7]. Nevertheless, surprisingly little research has analysed the existing traditional institutional options of communal natural resources in the Maghreb[8]. In fact, while *agdals* can be counted by the hundreds of thousands throughout all of northwest Africa, they have only very recently started to receive direct international scientific attention[9] and practically still none at policy level. The *agdal* is Morocco's best example of such existing institutions[10] and can be defined as the seasonal closure of an agro/sylvo/pastoral resource, such as the three-month spring ban on grazing in the high mountain pastures. This allows the vegetation to rest during its most critical period of growth, contributes to the sustainability, optimal productivity and resilience of the resource, and ensures that the community of users has relatively equal access to it. In comparison to open-access pastoral spaces in the same areas, the *agdal* has been shown to lead to: 1) maintenance of denser plant cover than open access ones due to the three-month long prohibition on biomass removal[11] and 2) higher rates of biodiversity conservation in *agdal* managed spaces than in the equivalent non or less *agdal* managed areas[12]. At the same time, all stakeholders have a voice in its rules of management, as the opening and closing dates and the resources and spaces affected by the ban are set and enforced by the local assemblies (*jmaa*) according to their own history, territorial heritage, political structure, and economic strategies.

Economically speaking, various small-scale studies have revealed that the collective management of natural resources by the *agdal* makes

a positive contribution to local communities. For example, harvesting of foliage from the forest *agdals* of *Querqus ilex* in the vicinity of the Ait Bouguemez tribe (150 kilometres north-east of Marrakech) is seasonally regulated and serves as a complementary economic opportunity during the snow period, when other pastoral resources, such as grass and bushes, are snow covered or dormant[13].

In other High Atlas villages, the rights of access to the pastoral *agdals* are exchanged for rights of water use between neighbouring tribal groups[14]. In the forest *agdal* of the village of Ait Ourhayn belonging to the Mesioua tribe, herders from nearby hamlets without forest *agdal* buy loads of leaves and wood during snow periods, providing the Ait Ourhayn people with a complementary source of collective income. Pastoral *agdals* also contribute to agricultural enrichment through the recycling of nitrates and derivatives which are returned to the soil by using animal manure fertilisers collected at night from the animal folds. In fact, nitrogen deficiency is one of the most significant limiting factors of crop production in the local agropastoral system.

Previous socio-economic studies have improved our understanding of *agdals* mainly by describing and analysing their strategic role within the agropastoral system[15]. While these studies have been invaluable, they lack concrete economic quantitative analyses to help further explain the existence and maintenance of such communal systems. The present paper aims to fill this gap by estimating the gross monetary agroeconomic contribution of a communal highland territory managed by the *agdal* system, – the Yagur of the Ait Ikis, an Amazigh/Berber agropastoralist group of the High Atlas located 50 Km south-east of Marrakech – in order to quantify the contribution of this territory collectively governed, to the welfare of the community.

Also, as Baur *et al.* has pointed out[16], new information about the factors driving the behaviour of real common-pool resource use needs to be integrated into experimental design. This will help provide common ground for building a more general behavioural theory of human actions in the use of common-pool resources that goes beyond models of individual maximization of payoff. With this in mind, the present work deals with the study of the Ait Ikis belonging to the Mesioua tribe and which use the Yagur mountain pasturelands. Very little prior research has been conducted on this population and none of it has implied economic quantitative analysis. This paper thus represents a step forward in providing access to a new type of information about the herding communal societies of the High Atlas Mountains.

Framework

The commons are complex socio-ecological systems involving a multitude of nonlinear variables that are mutually influential on different scales[17]. Their study is essential to understanding the processes affecting their sustainability, without losing sight of their complexity. As Ostrom notes, commons are all complex systems comprising second-level variables, including the productivity of the system, the economic value of the resources and their importance[18]. It has also been pointed out that these systems need to be studied from a transdisciplinary perspective[19], and with mutual-use methodologies, in order to bridge disciplines and allow comparative analysis between cases[20] and sustainability assessment of such systems[21].

It is from this theoretical perspective that we will be approaching the evaluation of the economic contribution of the Yagur to the production system and economic value of some of its resources, specifically the livestock. Apart from mere economic evaluation, this methodology allows assessment of the pastoral common from a new perspective in the literature on pastoral commons, for it is not intent on determining the market value of commons output, but the gross magnitude of its monetary product contribution to the market value of the resources generated. These quantitative economic assessments have generated criticism and sparked debates, as its main goal has been considered the allocation of market value to the environment and to natural resources[22], forgetting that the complexity of socio-ecological systems not only generates monetary values, but organisational, ethical, cultural, etc. values as well[23].

We are aware of these criticisms and limitations of such economic quantitative analysis of socio-ecological systems, because all the factors and the people-nature dynamics involved are often random and of immeasurable complexity[24]. As noted by various authors, they are processes influenced by many external factors and in contexts where the system boundaries themselves are relative and difficult to demarcate[25]. Even so, it has to be taken into consideration that in the current dominantly capitalist context spearheaded by economic growth logics, market prices also end up spurring practices and policies[26], since the economic factor is one of the key factors in the structure of incentives available to the users of any socio-ecological system of commons[27].

Therefore, our purpose is not to commodify the commons systems nor to provide an accurate market value of the output produced by the Yagur territory communally managed/governed, an issue that would be extremely complex in and of itself, but to illustrate and demonstrate the quantitative economic importance of the territories managed by

agdal systems. In this way, we hope to add some extra light on the understanding of pastoral commons and their significant contribution to human welfare. At the same time, to round out the socio-economic assessment of this deeply cultural system of territorial management, we furnish qualitative ethnographic data to help elucidate the numerous facets of the agdal. This will also improve our understanding of the necessary intertwining pragmatics of anthropology and agronomy, illustrating the benefits of a rarely combined quantitative and qualitative ethno-agro-economical approach to the agdals.

Hence, this paper implements a new methodology useful for the social and economic study of commonly managed territories. This methodology is applicable to other scenarios and has comparative value, serving as a common tool bridging the different disciplines involved in scientific research on Indigenous Peoples' and Community Conserved Territories and Areas (ICCAs) and their enhancement. In the word of Gómez-Baggethun & Ruiz-Pérez, «economic valuation can be a potent information tool when not used as a single decision-making criteria (e.g. Cost Benefit Analysis), and if used alongside other valuation methods that capture the non-economic-value dimension of nature»[28].

2. *Methodology*

Data collection. Most of the qualitative data in this paper was gathered through intermittent participative observation across all agropastoral seasons from 2004 to 2008, totalling a full year of living with the Ait Ikis people of the Mesious tribe (south-east of Marrakech, Morocco). After an initial period of participative observation fieldwork in 2004, a more systematic semi-directive interview phase concerning the livestock production system and practices of the Yagur of Ikis and other territories of the Ait Ikis was carried out from June to September in 2005 and 2006 (corresponding to the local summer and the busiest period of use of the Yagur). A blend of both methodological approaches was used to prepare the systematic survey which took place from June to September of 2007 concerning the 2006-2007 agropastoral cycle, with a focus on the socio-economic attributes of the households. Questions were asked, among others, regarding the breeding rate of each household's sheep, goats and cows, their selling price at the local market, and the number of adult females (since adult males are a very small minority and kept only for breeding). Data was also collected on the agricultural economy of the Ait Ikis, including information about the main vegetable and fruit products obtained during the 2006-2007 cycle

and their mean price at the local market (barley, wheat, corn, pulses, nuts, etc.). Finally, net family income derived from employed seasonal migration during the 2006-2007 cycle was also estimated.

In each case, the data from 2004 to 2007 was collected with the help of native Amazigh/Berber speakers who handled the translation and/or enquiry process. Most interviews were held with the male household heads of the Ait Ikis. If the male household head was absent, the interview was held with the oldest man of the household present when the interviewer arrived. Male heads of household were targeted because the nature of the data examined here, which is mainly the province of the men (i.e. choosing the opening date of the *agdal*, the number of animals a family owns, and the agricultural production or the extension of its cereal fields on the Yagur). The survey was conducted in 83 of the 107 households that make up the Ait Ikis, which represents about 77% of its population and nearly 100% of the owners of pastoral animals using the Yagur. The remaining 27 households were not interviewed because there was no male adult present in the period of the survey, primarily due to seasonal migration.

Quantitative data processing. As will be explained in detail in the results section, the quantitative data obtained through the survey allowed us to calculate different parameters related to the agroeconomic contribution of the Yagur to the Ait Ikis community. In Table 1, we calculate the nutritional contribution of the Yagur to the different types of livestock. Also, we present the basic data concerning the number of herding animals (ZUs: 1 Zootechnical Unit is equal to 1 reproductive female and her progeny and constitutes more than 95% of the livestock) that graze on the Yagur of Ikis, according to the survey conducted in 2007. Starting from these ZU and following Jarrigu[29], we calculate the percentage of the annual alimentary contribution of the Yagur per ZU. This is done by calculating the Fodder Unit (FUs: the quantity of fodder corresponding to the energetic value of one kg of barley harvested at the grain's maturity, equivalent to 1,650 calories) taken from the Yagur per ZU per year.

To facilitate estimation of the monetary value of the primary animal production, the results of the survey concerning livestock production were separated into two data sets. The first set is summarized in three diagrams showing the different production that an adult female of each species provides per year, as reported by the herders (Figg. 2, 3 and 4). The second set shows the weight and local price of the different types of animal production (Tabb. 2.1, 2.2 and 2.3). Starting from these data, we calculate the monetary value in Moroccan dirhams (DH) corresponding to the productivity of each type of livestock ZU during the 2006-2007

cycle. Finally, with the aforegoing data, we calculate the total monetary value of the main production of all livestock reared in the Ait Ikis, to estimate the gross monetary income (in DH and %) that the Ait Ikis community obtains from the pastoral resources of the Yagur.

3. *Results*

Socio-cultural organisation and utilisation of the agropastoral space. The study area is the territory of the Ait Ikis people and their share of the Yagur pastoral highland territory, both of which are located less than 50 kilometres south-east from Marrakech, in the heart of the Mesioua tribe-lands (Fig. 1). Like other high mountain areas, it is terraced in a vegetation altitudinal gradient. Between 1,200 and 2,500 masl, several types of ligneous vegetal structures (scrubs, bushes, and Mediterranean forests) cover the faces of the mountain and are especially dense on the north slopes. From 2,500 to 3,000 masl, (the *Meltsene* peak at 3,600 masl is the highest point in the region), high mountain plants and rich pastures appear, followed by steppe vegetal structures with a strong presence of cushion-shaped xerophytes, although some thick pastures remain, combined with some very resistant *Juniper* trees. The humid prairie habitat most conducive to the existence of the *agdal* systems is some of the rarest types of habitats. Local herders mainly occupy small and very specific biotopes of the high mountain Yagur territory such as the bottom of small valleys and faults, on shallow slopes, or water resurgences[30].

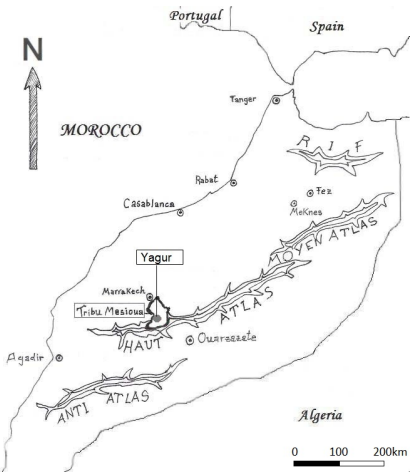

FIG. 1. Location of the Mesioua tribe, the Ait Ikis population and the Yagur territory.

There are about 7,500 people in almost 50 villages that use and depend on the agropastoral resources of the Yagur[31]. Although application of the model of segmentation to Moroccan tribes has often been legitimately criticised[32], one can say that the traits of tribal organisation of these populations roughly resemble those described by British anthropologists as «segmentary»[33], in that one social group (or segment) fits more or less into the next, from smallest to largest, like a set of Russian dolls[34]. For example, the High Atlas people continue to organise themselves into tribal groups, sub-groups, villages, clans, and nuclear families. These human groups or «segments», generally organise their communal activities (such as collective work, irrigation rules, herding rights, different *agdals* concerning different group levels, and the organisation of festivities and religious celebrations) through collective discussion and agreement searching. This is done most notably through the *jmaa* (traditional assemblies), which constitute one of the most basic institutions of their autonomous social and political rule.

The Ait Ikis population is patrilineal, and like other Berber societies, all decisions on household use of the agropastoral resources are made by the male household head, and in his absence, by the oldest adult male of the family (a brother, the eldest son, etc.). The Ait Ikis speak Tachelhit, a south Moroccan Berber dialect, as its mother tongue. Nevertheless, practically all the men speak Arabic, which they learn through television, social relations, work, administrative procedures, or school. Schools were set up in the area starting in about the 1980s. Up to about 75% of the local income is derived from the agropastoral sector, which is usually combined with employed seasonal migration or work in specialised local trades such as masonry or blacksmithing[35]. The main animals reared are cows, sheep and goats.

The Yagur is a large pastoral territory of about 70 km² located in the centre of the Mesioua highlands, but it is just one of several territories making up a larger and more complex agropastoral system of other *agdal* managed spaces, with which it is often combined for use. Its importance lies in its larger size, which means that the opening and closing dates of the other *agdals* depend on those of the Yagur. According to the rules of the *agdal*, herding in the Yagur is forbidden from approximately March to the beginning of July each year. This ban is enforced by the *Ait Rbain*, guardians appointed from among the members of the community of users, who are responsible for reporting infractions and helping to apply sanctions appropriate for the different types of violation.

The *agdal*'s seasonal ban on use of the Yagur has been traditionally legitimised and maintained through the centuries by long-held religious beliefs of the descendants of the main local saint, Sidi Boujmaa[36]. These descendants were – and still are in some cases – considered by the locals to be saints themselves. They reside in a village neighbouring the Yagur and the Ait Ikis. This small community created around the saint's tomb forms a local *Morabitic* institution that serves as a centre for Islamic teaching and thought. This centre and its tomb are frequently seen by local populations as mediators to God, despite pressure exerted by a more urban/orthodox Islam hoping to encourage the demise of such centres all over the High Atlas and beyond.

Until the 1970s, the annual *agdal* ban on use of the Yagur was lifted by an announcement made by descendants of the Sidi Boujmaa at the Wednesday market just before the first Friday of Berber summer, which starts on the July 28th. As Friday is the Muslim day of prayer, it served as a day of blessing for the opening. Several weeks later, the Ait Ikis people and other neighbouring villagers with access to the Yagur would honour Sidi Boujmaa through ritual offerings of vegetables, grain, cooked food, butter, sacrifices of cattle, and so on. These were presented to the descendants of the saint next to the patron's grave. In return, tradition has it that the buried saint assured prosperity and fecundity to those who honoured him, as well as their animals, the site, and the natural resources they profited from. Today, the weight of this cultural heritage can still be felt among the users of the Yagur *agdal*. Hence, beyond its agroeconomic function, the *agdal* is also a cultural element with deep historical – and likely prehistorical – roots and constitutes the lynchpin of a whole system of sacramental and symbolic references that make the *agdal* a faithful reflection of mountain Berber/ Amazigh culture and raise it to a total social fact[37].

Nevertheless, from the 1970's onwards, foreign players in the region, imams, civil servants, NGO representatives and islamists among others[38], but also mass media and external socio-cultural changes linked to an increasing globalization, have tended to stigmatise the figure of the saints as archaic, useless and even anti-islamic. In this sense, it is true that times are changing for all. Hence, it is relatively understandable that the descendants of the saints are «deviating» from their path in search for other social and economic niches. But I believe that an also essential reason behind the present belief loss on the great tribal saints and that is affecting the communal use of the pastures to which they were linked[39] does not lay so much in the decrease of their devotion to their ancestors and tradition, but in the broader deconstruction of the

tribal structures and edifice, first by colonial powers and then by the postcolonial central state that saw always in the tribes and especially in the large tribes and tribal confederations of the High Atlas a competitor in terms of power and territorial and social control.

In an increasingly interconnected and globalized world, the social status of the mountain people's religiosity, their rituals and beliefs that do not belong to the more broadly dominant religious ideology of urban Morocco and oriental Islam, are growingly less respected. These overall external pressures against the reference to the saints has certainly played a role in the fact that nowadays the five tribal factions using the Yagur do practically without the intermediary of the descendants of the saints, which also means that they manage their resources in a growingly less concerted manner.

At the same time, emigration as a result of an increasing scarcity of resources per capita and Morocco's economic progresses in the more industrialized areas, as well as the improvement of communication channels among others, have also led to the upheaval in local life and culture[40]. New social relations settle in, illustrated by young men who work externally to the valley during certain seasons or most of the year, often in urban centers and that no longer want to be shepherds, and influence the rest strongly through their periodic returns to the highlands. In fact, shepherding is an activity increasingly considered as tiresome and a socially devalued job. At the same time the quest for greater productivity and the monetarization of products through market integration, have taken an extra toll on the aforementioned *agdal* system. In fact, its landscapes have changed particularly strongly in the last half century, passing from a mostly pastoral area, to the area with the highest cereal production concerning the Ait Ikis.

The use of the territory of the Yagur managed by the *agdal*, is no more such a «wild» space as it was before, and follows today a more classical agro-sylvo-pastoral profile. Agricultural land is located mainly in the surroundings of the summer human settlements. The small irrigated plots are adapted to the relief of the valley bottoms or to the gentler slopes and provide the local population with barley, corn, alfalfa, peas, broad beans, garlic, onions, turnips, other horticultural species and fruits. Rainfed agriculture, of cereals such as barley and wheat only, is also located in the surroundings of the villages and hamlets but generally further away, or even in areas with steeper slopes.

The forest (sylva) and its wood or fodder resources are regulated according to the needs of the community and are concentrated in the steepest slopes, the lower lands or those higher but far from populated

areas. Despite the force with which nature expresses itself in the Yagur, there are very few spaces not used by its inhabitants. Its wooded masses of holm oaks or junipers show, to varying degrees, the effects of browsing by livestock or the collection of wood.

In fact, pastoralism has traditionally been the basis of the local economy and its main commercial asset. And even if diminishing today, the management of fodder resources has in fact shaped the way of life of the inhabitants of the Yagur, the position of their permanent or temporary settlements and the strict calendar that governs the opening or closing of the different grazing areas. The distribution of the three different main types of rearing animals in the area (cows, sheep and goats), follow also a typically concentric distribution, where cows mow in the lower parts, with thicker soils, more fertile, more humid and with higher grass growing, followed by sheep in pastures of intermediate fertility, humidity, pedology and biomass production, and goats in the very margins, in more important inclinations of the slope, even touching already forested areas or very stony surfaces with many xerophytic plants. Even if the sheep and goats tend to be driven together in mixed flocks and therefore sheep can move very far from cows, when left alone guiding their own pace, sheep always tend to come lower down or to aread where thicker grass is found. However, at the end of each agricultural season, when the barley and wheat is collected, around the end of July, all three types of rearing animals find themselves mixed on the lower parts of the Yagur (e.g. 2,000 masl) grazing on the leftovers after the harvest.

Agroeconomic contribution of the Yagur to the Ait Ikis community

Stage 1: Contribution of the Yagur to livestock nutrition. The livestock population grazing on the Yagur of Ikis is high and corresponds to approximately 4,000 animals between sheep, goats, and cows grazing on the (with the exception of the Yagur flatlands) mostly very steep 20 Km^2 of territory belonging to the Ait Ikis. All Ait Ikis have at least one animal and no more than 300. As a mean, each household has 48 animals, although the most common number is between 10 and 20 adult animals per household. As shown in Table 1, our data indicate that sheep are the most reliant upon the forage resources of the Yagur, which fulfils 42% of their annual alimentary requirements, followed by goats (27%) and cows (17%).

TAB. 1. *Number of ZUs and analysis of the nutritional contribution from the Yagur of Ikis*

	Sheep	Goats	Cows
Number of ZU per animal species in 2007	1,261[41]	1,794[42]	138[43]
FU taken from the Yagur per ZU	Mean average: 33.3 FU/month/ ZU[44] 33.3 FU/month x 5 months on the Yagur[45] = 167 FU/ZU from Yagur throughout the year[46]	Mean average: 27 FU/month/ ZU[47] 27 FU/month x 3.3 months on the Yagur[48] = 89 FU/ZU from Yagur throughout the year[49]	Mean average: 167 FU/month/ZU[50] 167 FU/month x 2 months on the Yagur[51] = 333 FU/ ZU from Yagur throughout the year[52]
Percentage of the annual alimentary contribution of the Yagur per ZU	167 FU of the Yagur / 400 FU annually[53] = 42%	89 FU of the Yagur / 325 FU annually[54] = 27%	333 FU of the Yagur / 2,000 FU annually[55] = 17%

Stage 2: Monetary value of the main animal production per ZU. Below we estimate the monetary value of the main animal production of each species per ZU obtained from Yagur's resources. As indicated above, the results of the survey concerning livestock production were summarised as two types of data sets: 1) diagrams showing the different production that an adult female of each species provides per year according to the herders (Figg. 2, 3 and 4); 2) tables showing the weight and local price of the different animal productions (Tabb. 2.1, 2.2 and 2.3)[56].

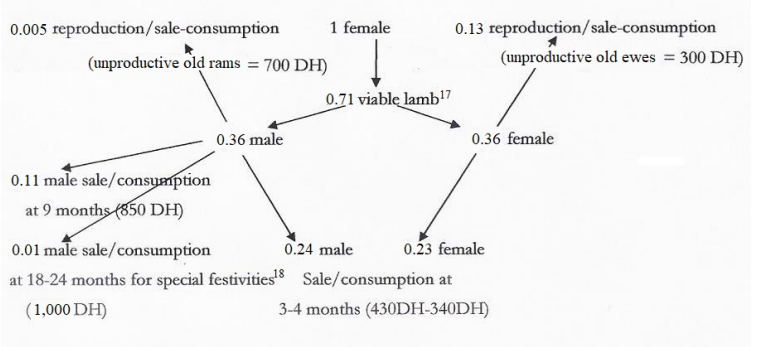

FIG. 2. Mean annual production of a ewe.
Note: Based on data obtained in the 2007 survey (896 lambs born and reared up to selling age in the period 2006-2007 / 1,261 sheep ZUs over 1 year old in 2007 = 0.71). Obtained from field interviews in 2004 and reconfirmed in 2007.

TAB. 2.1. *Mean weights and prices of sheep production according to differences in age and sex*[57]

Mean weight of a 3–4-month-old male lamb with a 0.24 annual sales coefficient	14.5 Kg	Sale price of a 3–4-month-old male lamb	430 DH
Mean weight of a 3–4-month-old female lamb with a 0.23 annual sales coefficient	12 Kg	Sale price of a 3–4-month-old female lamb	340 DH
Mean weight of a 9-month-old male lamb with a 0.11 annual sales coefficient	28 Kg	Sale price of a 9-month-old male lamb	850 DH
Mean weight of an 18–24-month-old ram with a 0.01 annual sales coefficient	32 Kg	Sale price of an 18–24-month-old male ram	1,000 DH
Mean weight of an old ewe with a 0.13 annual sales coefficient	20 Kg	Sale price of an unproductive old ewe	300 DH
Mean weight of an old ram with a 0.005 annual sales coefficient	30 Kg	Price of sale of an unproductive old ram	700 DH

According to the above data and using the calculation specified below, we calculate a monetary value of 336 DH corresponding to the productivity of one sheep ZU in the 2006-2007 cycle (430 x 0.24 + 340 x 0.23 + 850 x 0.11 + 1,000 x 0.01 + 300 x 0.13 + 700 x 0.005 103 + 78 + 102 + 10 + 39 + 4 336 DH); multiplying this value by the percentage of the sheep alimentary contribution of the Yagur of Ikis, we get 336 x 42 %[58] = 141 DH/sheep ZU_obtained from Yagur's resources in the 2006-2007 cycle, which, as we said in «Stage 1», corresponded to a standard year in terms of climate.

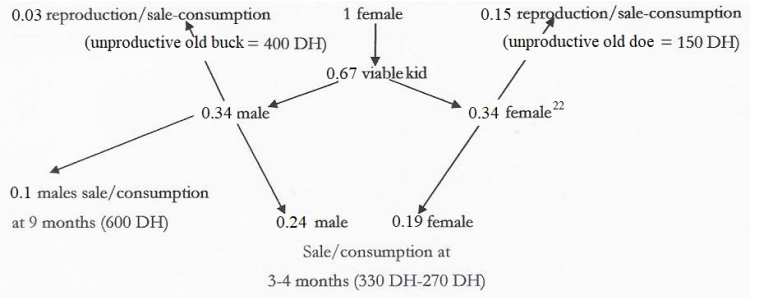

FIG. 3. Mean annual production of a doe (a female goat).
Note: Based on data obtained in the 2007 survey (1,206 kids born and reared up to selling age in the period 2006-2007 / 1,794 goat ZUs over 1year old in 2007 = 0.67). Obtained from field interviews in 2004 and reconfirmed in 2007.

TAB. 2.2. *Mean weights and prices of goat production according to differences of age and sex*[59]

Mean weight of a 3–4-month-old male kid with a 0.24 annual sales coefficient	12 Kg	Sale price of a 3–4-month-old male kid	350 DH
Mean weight of a 3–4-month-old female kid with a 0.19 annual sales coefficient	10 Kg	Sale price of a 3–4-month-old female kid	280 DH
Mean weight of a 9-month-old buckling with a 0.1 annual sales coefficient	22 Kg	Sale price of a 9-month-old buckling	600 DH
Mean weight of an old doe with a 0.15 annual sales coefficient	22 Kg	Sale price of an unproductive old doe	150 DH
Mean weight of an old buck with a 0.03 annual sales coefficient	24 Kg	Sale price of an unproductive old buck	400 DH

According to the above data and using the calculation specified below, we calculate a monetary value of 232 DH corresponding to the productivity of one goat ZU in the 2006-2007 cycle (350 x 0.24 + 280 x 0.19 + 600 x 0.1 + 150 x 0.15 + 400 x 0.03 84 + 53 + 60 + 23 + 12 232); multiplying this value by the percentage of the goat alimentary contribution of the Yagur of Ikis, we get 232 x 27 %[60] 62 DH/goat ZU_obtained from Yagur's resources in the 2006-2007 cycle, which, as we said in «Stage 1», corresponded to a standard year in terms of climate.

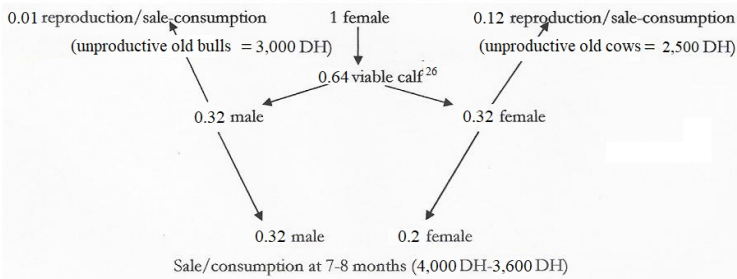

FIG. 4. Mean annual production of a cow.
Note: Based on data obtained in the 2007 survey (89 calves born and reared up to selling age in the period 2006-2007 / 138 bovine ZUs of more than 1year old in 2007 = 0.64). Obtained from field interviews in 2004 and reconfirmed in 2007.

TAB. 2.3. *Mean weights and prices of bovine production according to differences of age and sex*[61]

Mean weight of a 7–8-month-old male calf with a 0.32 annual sales coefficient	120 kg	Sale price of a 7–8-month-old male calf	4,000 DH
Mean weight of a 7–8-month-old heifer with a 0.2 annual sales coefficient	110 kg	Sale price of a 7–8-month-old heifer	3,600 DH
Mean weight of an old female cow with a 0.12 annual sales coefficient	200 kg	Sale price of an unproductive old cow	2,500 DH
Mean weight of an old bull with a 0.01 annual sales coefficient	240 kg	Sale price of an unproductive old cow	3,000 DH

According to the above data and using the calculation specified below, we calculate a monetary value of 2,330 DH corresponding to the productivity of one bovine ZU in the 2006-2007 cycle (4,000 x 0.32 + 3,600 x 0.2 + 2,500 x 0.12 + 3,000 x 0.01 = 1,280 + 720 + 300 + 30 = 2,330); multiplying this value by the percentage of the bovine alimentary contribution of the Yagur of Ikis, we get 2,330 x 17 %[62] = 396 DH/bovine ZU obtained from Yagur's resources in the 2006-2007 cycle which as we said in the notes of «Stage 1», corresponded to a standard year in terms of climate.

Stage 3: Monetary value of the main production of all livestock reared in the Ait Ikis, obtained from the resources of the Yagur. Here we estimate the monetary value of the main production for all the livestock of the Ait Ikis, obtained from Yagur's resources (Table 3)

TAB. 3. *Monetary value of main livestock production obtained from Yagur in 2006-2007*[63]

Number of ZU per species	Monetary value of the main livestock production per ZU obtained from Yagur	Monetary value of the main livestock production in total obtained from Yagur
1,261 ZU sheep	141 DH/ZU	177,801 DH (1,261 x 141)
1,794 ZU goats	62 DH/ZU	111,228 DH (1,794 x 62)
138 ZU cows	396 DH / ZU	54,648 DH (138 x 389)
		Total: 343,677 DH

Stage 4: Estimation of the DH and % of gross monetary income that the Ait Ikis obtain from the Yagur. Here we estimate the overall gross income of the Ait Ikis in Moroccan national monetary terms (DH or Dirhams, the national Moroccan currency equal to approximately □ 0.09 in the year of inquiry) and weight of the Yagur in percentage of the total gross income.

By assigning to each type of gross production the monetary price found at the local market of the Arbaa Tighdouine, where all local agropastoral products are sold (i.e. in 2006-2007, family «X» obtained 80 *abraas* – a local weight unit equal to approximately 16 kg – of barley at a local price of 30 DH/kg = 2,400 DH; 20,000 nuts at 0.12 DH/nut = 2,400 DH; 80 sheep at 335 DH/sheep = 31,520; 11,000 DH from seasonal migration or permanent emigration = 47,320 DH), we were able to estimate the gross agropastoral income for the Ait Ikis community as a whole by adding together the production of each family. The pastoral gross income that we calculated was 1,190,667 DH and the agropastoral gross income that we found was 1,886,379 DH. In making these calculations, we did not differentiate between own consumption and sold production in order to use the same monetary value for the valuation of all products produced locally and be able to express all the different productions in just one unit, the *Dirham* (DH). As described in the «Data collection» section, the quantitative survey of the 83 households in 2007 also collected data on the family gross annual income of the household derived from seasonal or permanent emigration. From the previous agropastoral data plus the emigration income of families, we were able to calculate the total gross income (2,775,159 DH). We have inquired about income from hired work and tourism in the region, but since we found that this value was extremely low[64], we omitted it.

4. *Discussion*

On a general note, we think that the ethnographic data collected allows us to demonstrate the advantage of a traditional cosmological and agropastoral production system that has proved over time to be able to sustain large productive yields for local economies. In the quest for a sustainable development of the *agdal* systems, it would therefore be interesting to investigate how reinforcement of the saints' and/or other *agdal* symbolic traditions might effectively contribute to the future maintenance of this pastoral management system that has proved to be sustainable over the centuries.

According to the calculations of the present study, we report that during the 2006-2007 cycle, the weight of the agropastoral gross income of the Ait Ikis was at least 68% (1,886,379 DH/2,775,159 DH x 100) of the total gross income, which is rather close to the figure proposed by Bellaoui in 1989, who estimated that the weight of the whole agropastoral sector of the Zat valley is about 75% of the total economy[65]. Noting the importance of the agropastoral sector still today, it therefore seems important to make a first estimation of the weight of the Yagur *agdal* managed territory in the local economy. Dividing the gross monetary income of the main animal production obtained from the Yagur of Ikis (343,677 DH, see Table 3) by the total gross income of the Ait Ikis (2,775,159 DH, see Stage 4) and multiplying it by 100, we find that the Yagur of Ikis would contribute «at least» 12% of the total gross monetary income of the Ait Ikis. Following the same procedure and basing the calculations on the different types of gross incomes obtained in Stage 4, the Yagur of Ikis would represent at least 18% of the gross agropastoral income (343,677/1,886,379 x 100), and up to 29% of the gross pastoral income (343,677/1,190,667 x 100).

Although we have not taken into account the total contribution of the Yagur, the results suggest that this territory makes a significant contribution to the total gross income of the Ait Ikis community (12%). In fact, the present results are only «estimations of minimums» since the real contribution of the Yagur to the gross monetary income should be higher. Amongst other things, the present paper does not include: 1. the production of milk, manure, sheep wool or goat hair, either own consumed or sold at the weekly market, 2. the cereals produced in the Yagur, 3. the mules that partially feed from the Yagur and that contribute to agriculture and sale of products, 4. the herding of animals that do not fulfil their complete production cycles because of accidents, illnesses, etc., and which are in any case very often destined for local

own consumption or even sold at lower prices between herders and 5. the fact that summer is the period of highest food consumption and when animals obtain most FU per month. Although we have divided the annual animal feeding by 12 months to obtain the FUs consumed in the Yagur (Table 1), the overall reliance on the Yagur is undoubtedly higher. In our calculations we have also omitted other aspects, such as the natural resources obtained in the Yagur that contribute to the local economy, such as wood for building or heating, honey sold at 300 DH/kg in the local market, the water that irrigates the fields of Yagur of Ikis, and other resources that are likely to contribute to the local economy.

In this context, it is important to highlight that the economic weight of the agropastoral gross income comprises at least 18% of this sector, which is the sector that almost solely determines space and natural resource management in the region today, for, as pointed out in the introduction, the *agdal* can be a guarantee for its conservation. Furthermore, in qualitative terms, Yagur's fodder contribution arrives in the summer, when other pastures are dry in the lowlands and no other fodder is available. In fact, the natural grasses of the Yagur during this season can reach an opportunity cost as high as tilled barley. Without the highland pastures, especially abundant in summer because of the existing *agdal* herding ban, the current system of ecological equilibrium would simply collapse, favouring the loss of a large part of its economic productivity as observed in other open-access spaces within the Mesioua tribe. All in all, this means that the qualitative and quantitative role of the Yagur must necessarily be taken into account as intertwining phenomena, in order to fully understand how they together both influence the population's decision-making process regarding the natural resource management system of the *agdal*.

5. *Conclusions*

As observed by McCorkle[66], the place and potential of anthropological inquiry in agricultural studies is too often poorly understood, as colleagues from other disciplines (particularly those closer to naturalistic and engineering paradigms) often have trouble identifying how and where the humanities and particularly here the social anthropology, can make its contribution to international agronomic studies helping complete the picture. In this regard, the present text performs detailed ethno-agroeconomic analysis on the commonly owned highland territory of the Yagur to show that these pastoral ecosystems are also of

great symbolic and material value for the overall Ait Ikis population. In so doing, it provides an original and detailed estimate of Yagur's contribution to the Ait Ikis' global household economy.

As already discussed, the real figures are undoubtedly higher than those appearing here, since the fieldwork was conducted in a context where some data are difficult to measure and have been omitted (i.e. higher feeding rates in summer than in winter, production of milk, wool and manure not recorded, etc.). However, the fact that the productive contribution of the Yagur is actually higher than the present figures show, merely reinforces the initial hypothesis that this communally managed territory is not only qualitatively central for the continuity and sustainability of the local agroeconomic annual cycle[67], but also quantitatively very significant in terms of gross monetary income for the communities that use it. Without the *agdal* not only the system as a whole (including upper and lower lands) would collapse and would have to change, but it would be also less productive. This leads us to conclude that the concrete agronomic contribution of these *agdal* managed territories must be considered another of the key drivers maintaining such systems, at least big tribal or intertribal pastoral *agdals* such as that of the Yagur, and which can be counted by the thousands throughout the entire Maghreb. As Baur state, the economic value of the commonly managed resource units is relevant as a contextual variable explaining users' behaviour. In this sense, the data presented in this article may provide useful insights concerning a gap in *agdals* studies, and more broadly, on common pastoral land governance studies[68].

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44 1 sheep and her progeny need approximately 400 FU/year (Jarrigu (ed.), 1995); dividing by 12 months, this corresponds to 33.3 FU/month.

45 Dominguez (2010).

46 The sheep received no complementary alimentation during the 5-month grazing period on the Yagur (mainly summer, the beginning of autumn and the end of winter) because, with the exception of years of severe drought (and the 2006-2007 agricultural year was an average year for the Zat valley), they are not given complementary feed. We can therefore conclude that the 167 FU/ZU obtained in 2006-2007 came almost exclusively from the resources of the Yagur.

47 1 goat and her progeny need approximately 325 FU/year (Jarrigu (ed.), 1995); dividing by 12 months, this corresponds to 27 FU/month.

48 Dominguez (2010).

49 The goats received no complementary alimentation during the 3.3-month grazing period on the Yagur (mainly summer and the beginning of autumn) because, with the exception of years of severe drought (and the 2006-2007 agricultural year was an average year for the Zat valley), they are not given complementary feed. We can therefore conclude that the 89 FU/ZU was obtained in 2006-2007 came almost exclusively from the resources of the Yagur.

50 1 cow and her progeny need approximately 2000 FU/year (~~Jarrigu (ed.), 1995~~); dividing by 12 months, this corresponds to 167 FU/month.

51 P. DOMÍNGUEZ, *Approche multidisciplinaire* cit.

52 The cows received no complementary alimentation during the 2-month grazing period on the Yagur (mainly summer) because, with the exception of years of high drought (and the 2006-2007 agricultural year was an average year for the Zat valley), they are not given complementary feed other than some weeds and grasses obtained from the «cleaning» of cereal fields in lower Yagur. This small complementary alimentation from the cereal fields is approximately equal to the grass fodder cut from the Yagur during the first three days after the opening of the *agdal*, which is mainly dried and fed to the cows during the autumn and winter. We can therefore conclude that the 333 FU/ZU obtained in 2006-2007 came almost exclusively from the resources of the *Yagur*.

53 JARRIGU (ed.), *Alimentation des bovins*~~...~~ cit.

54 *Ibid*.

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56 Generally local festivities that concern the *Aid el Kebir* or other celebrations indicated by the Koran, but also animal sacrifices for the saints, for the opening of the Yagur, or for marriages and other events.

57 We have considered the mean prices and weights obtained during interviews at the Ait Ikis and the local market of the Arbaa Tighdouine in 2004 and 2007, where the price of the animals is expressed in live weight. This means that we apply the price of the meat, organs, skin and bones together (as a live animal), even though each component has a different market price.

58 Percentage concerning the alimentary contribution of the Yagur for the whole 2006-2007 cycle (stage 1).

59 We have considered the mean prices and weight obtained during interviews at the Ait Ikis and the local market of the Arbaa Tighdouine in 2004 and 2007, where the price of the animals is expressed in live weight. This means that we apply the price of the meat, organs, skin and bones all together (as a live animal) even if these elements have different market prices.

60 Percentage concerning the alimentary contribution of the Yagur for the entire 2006-2007 cycle (stage 1).

61 We have considered the mean prices and weight obtained during interviews at the Ait Ikis and the local market of the Arbaa Tighdouine in 2004 and 2007, where the price of the animals is expressed in live weight. This means that we apply the price of the meat, organs, skin and bones all together (as a live animal) even if these elements have different market prices.

62 Percentage concerning the alimentary contribution of the Yagur for the entire 2006-2007 cycle (stage 1).

63 The origin of the data measured in ZUs is described in «stage 1» and the data measured in DH/ZU was obtained using the calculations shown in «stage 2».

64 For example, there have only been 22 nights in which tourists have stayed at one of the houses in the village out of the 97 households that make up the Ait Ikis and out of the 365 nights that made up the 2006-2007 cycle.

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