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LIVESTOCK SYSTEMS IN DRYLANDS. CONDITIONS FOR SUSTAINABILITY

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Summary

Livestock systems in drylands. Conditions for sustainability.
In many difficult situations in the world (aridity, high altitude, slopes, etc.) and especially in the vast drylands, the most appropriate use of the land seems to be the grazing of natural resources by livestock.
This form of extensive livestock farming promotes not only the survival of the pastoral societies concerned but is also a source of protein (milk, meat and blood) with high biological value as food in towns or for export as well as for feeding these pastoralists in a difficult environment. It may also be a source of energy and manure.
Livestock survival and the viability of pastoral societies in these environments with severe constraints are often due to the application of ancestral but adaptive pastoral practices based on a number of factors such as:
- combining different species of herbivores;
- spatial mobility of flocks and herds and sometimes of families of livestock breeders (transhumance, nomadism);
- seasonal destocking;
- the use of tree and shrub resources and external foodstuffs to complement grazed grassland, etc.
Nevertheless, these pastoral zones often suffer from the degradation of land and plant resources due over-exploitation by livestock. Disputes are frequent as a result of increasing human pressure and the sustainability of natural resources involves the renewal of collective management methods through negotiation and new methods of organisation.

Key words: livestock systems, drylands, desertification, pastoralism, domestic herbivores, sustainability, mobility, organisation

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Introduction

Drylands[1] cover vast extents of the planet: with an estimated area of around 5168 M ha, they represent almost 40% of the world's land area and are often mainly devoted to pastoral activities. Raising domestic herbivores in extensive pastoral systems is an essential part of the exploitation of limited natural resources and is vital for the survival of the populations concerned.

These regions are also subject to important developments linked to growing human and animal populations as well as to various economic and political issues. Indeed, human pressure and animal density tend to increase rapidly, in spite of the precarity and fragility of die natural resources available, leading to a sometimes negative impact on the environment; this is why the threat of desertification is so acute in these regions.

They are also often the target of competition between different groups of people for the use of natural resources, and political tensions sometimes lead to bloody conflict For pastoral communities, this is the origin of another source of insecurity which adds to the climatic and ecological risk.

The viability of pastoral activities in these drylands therefore raises different problems: ecological, economic, social and political.

This memo presents a discussion on the conditions needed to sustain pastoral systems in these drylands, with particular reference to the Sahel region of Subsaharan Africa.

Problem

Vast arid areas threatened with desertification

According to the definition generally accepted by the international scientific community (UNEP, 1991, UNCED, 1992, Grainger, 1992, CSFD&AFD, 2002), desertification may affect arid, semi-arid or dry sub-humid areas. 70% of these areas, some 3600 million hectares, is thought to be affected by moderate to very severe desertification (See Table 1 based on UNEP, 1991).

[1] The concept of drylands used here is as follows, according to the UNEP definition (1991): drylands liable to desertification, i.e. arid, semi-arid and dry sub-humid regions; regions in which the P/ETP
(Precipitation/Evapotranspiration potential) ratio is between 0.05 and 0.65 (polar and sub-polar regions are obviously excluded).

Table 1. - IMPORTANCE OF DESERTIFICATION* BY MAJOR AREAS OF ACTIVITY

Type of use	Total area of Drylands (M. ha)	Area affected by Desertification (M. ha)	Area affected by severe soil degradation (M. ha)
Irrigated crops	145	43	43
Rain-fed crop	457	216	216
Range	4556	3333	757
Total	5158	3592	1016

(According to UNEP, 1991, cited by Katyal and Vlek, 2000)

* The term "desertification" is die media representation of the more generic term "land degradation". It originated in the great droughts which affected the Sahel between 1970 and 1973. The return of drought throughout the Sahel in the early 1980s and the dramatic consequences this had on the regional populations slowly gave rise to the idea of a long-term international operation to be set up in accordance with the United Nations Convention to Combat Desertification passed in 1994, following the "Earth" summit in Rio, 1992.

It should also be emphasised that the biggest part of these drylands is used for pastoral activities (4556 M. ha out of a total 5158 M, i.e. 88%), with about 9% used forrainfed crops, and irrigated areas representing barely 3% of the area. It is clear that these estimates are approximate and debatable: separating pastoral and farming activities in particular is sometimes an arbitrary distinction, because the societies concerned on the land, most often practice mixed "agro-sylvo-pastoral" activities (Lhoste, 1987).

Raising livestock is an essential activity in these drylands

In many difficult situations in the world (aridity, altitude, slopes, etc.), and particularly in the vastdryland zones, the pastoral use of natural resources for raising livestock often appears to be the most pertinent way of using the land, and the pastoral societies concerned, in the African Sahel, Central Asia or the South American Andes, often have no reliable economic activity other than extensive livestock farming.

This type of extensive livestock fanning is a way of using the parsimonious, unreliable natural resurces in these drylands as well as providing a means of survival for pastoral societies. Livestock farming is indeed the core activity in pastoral family economics, because it is a source of protein (milk, meat, blood) with high biological value to feed these farmers in a difficult environment. It is also a source of fibre (wool, hair, hides, etc.) leather, manure for crops and energy for transport (Digard et al., 1993; Bourbouze et al.,

2002). For instance, the irreplacable part played by the dromedary in the life of desert pastoralists is well known, (Faye, 1997; Faye et al. 1999).

Livestock farming undeniably provides families with food and economic security but, in many cases, it also gives a certain social prestige to the owners of herds (particularly cattle in the Sahel).

This activity also plays an economic role which may be important at national or regional level, in feeding the country's towns or exporting animal products to other countries in the region. In Subsaharan Africa, for example, regional economic complementarities between countries in the Sahel, livestock fanning countries such as Mauritania, Mali, Burkina, Niger, Chad, etc., ruminant meat exporters, and the coastal countries (Ivory Coast, Ghana, Togo, Benin, Nigeria, etc.), which are meat importers. The impact of drought, which has unfortunately become periodic in the Sahel, can easily be appreciated, with pastoral production, the size of the herds and their commercial exploitation being sometimes affected for several years. This impact has severe consequences for the families, pastoral societies and countries concerned.

These pastoral activities in an area with considerable natural constraints sometimes increases the risk of degradation

Climatic and ecological risk

With reference to the Sahel, the relatively low annual rainfall (300 to 500 mm on average) is affected by high inter-annual variability in terms of resources: precipitation varies strongly from one year to the next (Le Houerou, 1993; Mainguet, 1995). Added to this is another type of variability which also has a considerable effect on plant production; the seasonal rains: duration of the rainy season, start and end dates, number and distribution of rainy days, intensity of precipitation, etc. These major pluviometric variations are the main factor which determines the availability of grass on the pastoral lands.

In practice, these phuviometric conditions determine the importance of plant production and, for natural pastures based on annual species in the Sahel, a linear relationship has been established between "efficient rain" (infiltrated fraction of pluviometry) and herbaceous phytomass (Grouzis, 1987, Grouzis and Albergel, 1989). The spontaneous growth of fodder therefore reflects rainfall variability in these environments. Consequently the potential animal load which follows logically from this, is also very variable from one year to the next. The annual phytomass produced, which will make up the fodder

stock, therefore varies widely with rainfall. Various other types of degradation (fire, wind, trampling, etc.) cause losses which may be close to 50% of this available phytomass. Even in a difficult year (i.e. with low pasture productivity and therefore very little "refusal"), there is often only 35% of standing fodder available which will be consumed by domestic herbivores in an extensive pastoral system (Toutain and Lhoste 1978).

In a frequent jal study of a given area, the Oursi lake basin in Northern Burkina, Skot (1989) found that the animal load can potentially reach 20000 UBT[2] in a very favourable year but with a load of 10700 UBT (53% of the previous maximum), problems in feeding the stock represent a considerable risk every other year, whereas with an animal load of around 8000 UBT (40% of the previous maximum), the risk of shortages for the cattle should only arise once every 10 years. This is the type of analysis which led some authors to conclude that "considering die low resources available, their variability and the extent of the pastoral system..... the viability of Sahelian agro-pastoral systems depends on under-exploiting the environmental resources" Milleville, 1989). This difficult ajustment has ted many authors to the same pessimistic conclusion as Sicot (1989), who describes "the chronic overloading which makes the herd unproductive and a danger to environmental conservation" (P 141).

Floret et al (1989) make a similar observation for Southern Tunisia: demographic growth and the increasing sedentariness of the population is reflected in the extension of cultivated areas to the detriment of pastoral ranges. The resulting animal overload tends to degrade vegetation and reduce the environment's ability to store the rainwater which falls in parsimonious, random quantities. The risk of degradation by herds increases and environmental desertification results from this (DeHaan et al., 1997; Steinfeld et al., 1997).

Economic and social risk

This ecological risk is added to the risk of unequal economic exchange which aggravates the economic situation of livestock farmers in the event of a climatic crisis. They are extremely exposed economically speaking: in a drought, crop and range production both fell simultaneously; livestock ranners have to buy cereals to feed the family and the prices of these rise steeply; the excessive number of cattle, due to the penury of fodder on the ranges, are sold at die market to relieve pressure on die pasture and prices drop; livestock farmers lose both ways! "Bankruptcy" and die obligatory conversion to another way of life are not rare.

[2] UBT: "Unite Betail Tropical" (Tropical cattle unit), equivalent to a 250 kg steer.

Economic and social marginalization of pastoral societies is often a reality based on various preconceived ideas: this is why die pastoral farming method is (or was) too often considered to be archaic and outmoded, whereas it is a remarkable type of specialization and adaptation to die environment. These societies are also too often considered to be autarchic (another preconceived idea) whereas, on die contrary, because of their specialization, they are highly dependant on exchanges with other groups. This need for economic exchange also illustrates yet another reason for mobility (see below).

Agricultural pressure is increasing

It should be added drat activities in diese drylands are diversified and that this trend is growing with die increasing population and poverty in diese regions. These native societies are sometimes also migrant, and do not live from livestock alone, leading to an increase in pressure on resources (biodiversity, water, land, ranges....) from agriculture, hunting, using wood, collecting, etc. Generally die most ecologically suitable areas (valley bottoms, good soils) are cultivated by preference, to die detriment of pasture and cattle.

These drylands are therefore threatened with desertification, which raises die problem of sustainability of livestock systems and survival of die pastoral societies concerned: it is a problem of durable development in an ecological and socio-political context which can be particularly restrictive.

Different points of view: Several approaches

We propose to organize die discussion in a somewhat arbitrary way in three interlocking and interdependant stages:

- firstly, an ecological approach which includes resources from die start;
- next, a more systemic approach which introduces livestock fanning practices and strategies, as well as domestic herbivores and livestock systems;
- finally, a discussion centred more on those involved and their methods of organization as well as development operations.

An ecological approach for better use of environmental potential

"Ecological" methods based on favourable environmental aspects can be demonstrated; diese practices are already used by pastoral societies in drylands to limit die climatic risk and fight against the degradation processes mentioned

above. They can be (arbitrarily) classified according to their application to the characteristics of the natural environment (vegetation) or the animal populations.

Adaptation of plant species

The plant species in these drylands are diverse and adapted, not only to the arid conditions, but also to the temporal variability of precipitation. In particular, plants react very quickly to changes in the environment. These adaptations are widespread and affect reproductive mechanisms, the brevity of the plant cycle and drought resistance (Floret et al., 1989).

Add to this the fact that the sometimes categorical judgments made on the irreversibility of pasture degradation are not always pertinent, because the resilience of these steppe-like ecosystems (capacity of the ecosystem to withstand shock and return to its previous condition) is stronger than expected and sometimes surprises even the most pessimistic reviewers (Benkhe & Abel 1996).

The diversity of biological types

The unfavourable consequences of climatic variability are also attenuated by the diversity of biological plant types (and animals also, see below), and the adaptive responses of plants (Floret et al 1989). We can mention:

- plant root systems sharing different soil levels;
- associations of annual and perennial plants, herbaceous and ligneous, etc.

These complementarities are often considerably disturbed by human influence, when, for example, ligneous plants are removed by excessive exploitation, for firewood, fencing and "overhead pastures" (name given to the leaves of ligneous plants which are sometimes placed within reach of animals through drastic pruning), etc.

The heterogeneity of environmental situations

The diversity of environmental situations and their complementarity also acts in the same direction, promoting biological diversity and the possibility for animals to use these various environments differently.

The diversity of biological types and environmental situations can be used synergically, to spread the production of phytomass throughout the year and provide different types of herbivores with a wide variety of fodder (whatever is abundant).

Plasticity of breeds of domestic animals

Finally, to mention the animal sector, here is a summary of the following characteristics of domestic herbivore "populations" in these drylands[3]:

- Specific diversity: to mention only the main species of domestic herbivores, the most commonly found are bovines, camels, sheep, goats, and equines (horses, donkeys and hybrids);
- Adaptation to heat, drought and long distance travel is quite remarkable in the dromedary and is important in most of the species concerned. Drinking, in particular, can be spaced out to every two or three days for ruminants in die Sahel region (cattle, sheep and goats) at the end of the dry season when pasture is sparse and long distances have to be covered;
- Rusticity: this is due to a long period of natural selection (assisted by human influence of course), in a difficult environment, which has led to the fixation of animal populations which are remarkably adapted to this environment and breeding system;
- Versatility: many animals play a mixed role, supplying protein (milk, meat), manure and energy (draught, draught-animal cultivation); again, the rote played by goats or dromedaries in sometimes very difficult situations, is quite remarkable and notably linked to their rusticity and versatility.

In any case, the agricultural and pastoral practices of those involved is responsible for making the most of these various assets (Toutain&Lhoste, 1999).

Livestock systems: Pastoral practices

Animal survival and the viability of pastoral societies in these highly restrictive environments is often the result of an ancestral, but adaptive pastoral system, based on a certain number of factors such as:

The use of trees and shrubs and external food supplements in addition to herbaceous plants and pastures, etc. Herbivores do not only depend on the fodder provided by the herbaceous strata of natural formations. Ligneous plants in particular, can be important in certain seasons: the diversity of resources and breeder's expertise is essential to the judicious use of supplements; e.g. trees: well managed, their "overhead pasture" provides a potentially beneficial complement, especially for animal species such as

[3] Not even mentioning here the wild life which, in certain zones, clearly increases animal biodiversity, promoting the use of such different environments.

dromedaries; over-worked or ill-treated, they disappear, depriving breeders of a series of important resources (wood, fruit, gum, fodder, etc.).

The association of different species of herbivores

The diversity of species of domestic herbivores used by pastoral farmers in drylands (bovines, camels, sheep, goats and equines: horses and donkeys) may again be interpreted as an anti-risk strategy, in space and time:

- The association of this animal diversity in a single area (considered as a set of resources) is also a way of improving exploitation of the environment, which is itself diverse, as we have just seen;
- Diversity can also be expressed in time as shown by post-drought experience: animal species are used successively by livestock farmers according to their situation: horses are replaced by dromedaries to cope with increasing aridity; a new herd will be started, with goats, a species with high productivity, and these will later be replaced by sheep or cattle which have other advantages (particularly economic), etc.

The spatial mobility of herds and sometimes herders families (transhumances, nomadism)

Animal mobility first appears to be an important strategy used to limit risks and try to attenuate die inadequacy, heterogeneity and dispersion of food resources, notably so as to use their complementarity (Sicot 1989). The causes of this mobility are therefore extremely diverse and include negative implications which doubtless explain its attenuation in many parts of the Sahel. There are many types of mobility and they vary in terms of method, duration, amplitude, etc.:

- Small, medium and large transhumance,
- Nomadism, etc.

We shall not concentrate of this descriptive aspect which has already been heavily documented by geographers such as E. Dennis in Niger, H. Banal in Burkina, J.-C. Clanet in Chad, J. Gallais in Mali, etc. (Blanc-Pamard&Boutrais, 1994).

The main reason for this mobility is to search for food and drink enough to satisfy the needs of the herds of herbivores concerned (in the Sahel, essentially, cattle, sheep, goats and dromedaries). This aspect has been largely discussed in African literature (Bourgeot, 1999).

It is also an "anti-risk" strategy; it is recognised that during severe drought (1972-73, 1984-85, in the Sahel), the most mobile pastoralists best withstand deprivation and the least mobile suffer the most (Eldin et Milleville, 1989).

Pastoral mobility has other motivations also, such as to facilitate exchanges with other groups: sell animals, milk, obtain manure contracts, exchange services (e.g. animal transport), salt cures, etc.

This mobility is not problem free, however, and the example of eastern Chad Barraud et al, 2001) provides a good recent illustration, analysing die various constraints and threats which affect this type of spatial exploitation:

- Difficult access to education and health services; these are major constraints for nomads because the social services provided are best adapted to sedentary farmers;
- Conflictual access to resources: this constraint is particularly linked to the development of agricultural activities in parts of the Sahel where tension over water points is aggravated and complicates pastoral mobility, transhumance routes being regularly occupied by sedentary farmers and their fields;
- A complex judicial, legislative and regulatory context, notably due to the combination of traditional law, Muslim law and modern law;
- Difficult production conditions, for example, access to veterinary care.

This traditional mobility of Sahel pastoralists has often caused problems, notably with the administration as Colonel Largeau wrote about in Chad in 1911: " this coming and going which makes any kind of administration impossible and promotes fraud of all kinds must absolutely be stopped" (in V. Barraud et al., 2001); the keywords have already been quoted and the worries of colonial administration at being unable to control these mobile livestock fanners has often been passed on to the independent States which succeeded them.

This mobility, which does not only have benefits, is essential to maintain such systems, and for good management of natural resources; a project[4] with which we were associated understood this well, because its aim was to "secure pastoral mobility" in eastern Chad (Barraud et al., 2001). To go further and attenuate some of the disadvantages suffered by transhumancepastoralists, we must continue to discuss the security of herd mobility, which does not necessarily involve the mobility of the entire pastoral family; this is already the case in certain situations where only the young or the shepherds accompany

4 This is the "Almy Bahaim" project ("water for cattle" in Chad arabic).

transhumance; it is more difficult in cases of large transhumance with a long distance to travel or many nomads.

Seasonal destocking

To relieve pastures during the off-season, as we have seen, animals can be moved to other pastures; livestock fanners can also choose another strategy which consists of selling their livestock before the period of shortage; note mat these sales are sometimes imposed by the need to purchase food for the family.

This seasonal "destocking" is also interesting from the point of view of managing natural resources, in that it takes place before there is a shortage of fodder, the money raised by selling some animals may also, theoretically, be used to purchase food supplements for the rest of the herd.

Biologically speaking, there is also a further logic in selling animals destined for use as meat, at the time of year when they are in their best condition, i.e. before the off-season; there would be a loss effect in selling for meat animals which had lost a lot of weight during the dry season..... Even if farmers are sometimes forced to do mis to ensure their own survival.

Economically, on the other hand, many livestock farmers use this strategy (seasonaldestocking, before the dry season), and prices may fall, which is not favourable to them.

Regional complementarities, livestock stratification

Good overall coherence with this destocking may be obtained at the start of the dry season in a livestock reproduction zone, by playing on regional complementarities; this consists of fattening or working (draught-animal cultivation) young "unfinished" animals in agricultural regions, which relieves the pastoral zone used for reproduction and improves the value of these animals, either by using them for draught cultivation or by fattening them. At the same time these animals move closer to the consumer market.

This "regional stratification" of livestock activities, even if it is a kind of recurrent myth in Subsaharan Africa, is, nevertheless a reality in a country like Senegal, where the Ferlo and eastern Senegal pastoral zones supply in draught oxen and fattening animals for livestock breeders in the peanut fanning area (Lhoste, 1987); these oxen spend several years in draught cultivation, a period known as "long fattening", and are then put on the meat market when they are heavier. For this purpose, they are moved from peripheral pastoral areas to coastal city markets.

Organizing users and sustainable resource management

Organizing the different types of resource users seems absolutely essential both to develop sustainable management of renewable resources and to facilitate the settlement of disputes.

After observing the difficulties encountered by various breeding development projects which are too exclusively based on technical choices, a new generation of operations is justly giving much more emphasis to human aspects: training, mediation, organizing those involved, relations between private and public operators, etc. It involves encouraging the creation of institutions which can manage resources overall; it also includes organizations and mechanisms for settling disputes which may arise over water points, cattle routes, the use of space, damage to crops caused by animals, etc.

The "Almy Bahaim" project (already mentioned), attempts to ensure safe pastoral mobility in a vast region of eastern Chad; with this in mind, it gives priority to defining relations between the various human groups present and obtaining agreement between them on access to natural resources, on two main routes (Marty and Lhoste, 2002):

- the "user organization" approach, reflected in the creation of a certain number of bodies appropriate to a local situation, such as: die "mixed farmers-breeder commission" chaired by the administration, the "water point commission" (to develop rules for structural management of water points newly built by the project in particular), the "equal representation body" (in French "organe paritaire"), in charge of managing the water point (well or pool) from day to day, according to previously defined rules;

- the land tenure approach gives priority to the heritage aspect (in French : "demarche patrimoniale") rather man ownership (in French : "demarche proprietariste"). This tends to make relationships more rigid and to exclude those who have no rights on the land, in particular transhumancepastoralists. The heritage concept has the advantage of being open to multiple-use and multiple-user aspects, with users' rights being negotiated. In this way, pastoral infrastructures (water points, trails, parking areas) constitute a "common heritage for pastoral use" for all breeders, whether sedentary or practicing transhumance.

The project then worked at promoting a professional organization for livestock fanners, on a regional scale. This is the level which seems to be pertinent for dealing with other partners (farmers' groups, the administration, and technical services in particular), transhumance and pastoral mobility in general.

Traditional forms of solidarity (Habbanae chez les Peul...)

The practice of entrusting animals to others, which is common in livestock fanning societies, may be interpreted in terms of anti-risk strategies, but it also reflects a high degree of social integration. Within family and social networks, it may provide a veritable mutual aid mechanism, such as the Peul "Habbanae" in Africa, where a poor breeder or one who has lost his herd is given a few females which will enable him to survive or start building up his own herd again; indeed, although the females given into his care remain the property of the initial breeder, the products are shared, according to ancestral rules, between the owner and the person to whom the animals were given for care.

We could also mention a form of solidarity, based on complementarity between complementary production systems: "manure contracts" (in French: "controls defumure"). These (verbal) contracts are used during transhumance in agricultural areas and they provide an interesting illustration of the exchanges between cattle fanners looking for agricultural residues to feed their herd, and fanners anxious to fertilize their fields during die dry season. The transhumance farmer finds a "house provider" fn French: "le logeur") in the village, a sedentary farmer who will give him a roof and in return will take all the animal manure deposited on his land by the animals.

Although this type of practice is dying out, mainly because of the reduction in herd mobility, it is interesting because its entail reciprocity between the agricultural farmer and the livestock farmer, and is not necessarily a source of competitive conflict.

What support measures should be envisaged?

A great many complementary measures can be envisaged and we shall only mention a few which seem to us to be particularly pertinent for the Sahel region, with respect to various targets (research, political decision makers....) in particular:

- For research and development: we insist on a goal (discussed in recent work See Cornet et al., 2002 and CSFD&AFD, 2002): die need for reliable and pertinent monitoring indicators. We are convinced of die need for impact monitoring, in die case of projects for example; it is important to set up durable monitoring systems right from the start (of die project, to use die same example). Attention must also be paid to defining pertinent indicators[5];
- For decision makers: it is important, on die one hand, to ensure die security of pastoral mobility, and developments such as pastoral hydraulics can help this (Marry & Lhoste, 2002), and on die other hand to promote certain

infrastructures such as markets to stimulate die disposal of animals under economic conditions satisfactory for livestock farmers. The authorities in diese countries and die international public aid system must also take care to maintain an emergency plan in die event of severe drought to prevent catastrophes such as those which we were helpless to prevent during recent droughts in die Sahel (1972-73; 1984-85).

For different types of stakeholders (central and local authorities, technical services, resource users...), it is important to promote and strengdien breeders' organizations as well as equal representation organisations (in French: "organisations paritaires") grouping, for example - sedentary and nomadic pastoralists, - farmers and livestock farmers, - local administration, traditional authorities and representatives of producers' groups, etc. These local institutions have an important part to play in managing natural resources (water, range, fauna, etc.), animal movements (routes of transhumance, resting areas for animals, cattie trails), land development (sharing land between farmers and breeders, organization of space around water points, etc.) and for settling disputes.

Conclusion

This paper is presented within a context of the fight against desertification within the terms of the "Convention to Combat Desertification"[6], desertification being considered as the result of a combination of climatic evolution and human activity; desertification certainly appears to be a problem of durable development and the fight against desertification means taking an interest in protecting the natural environment as much as fighting against poverty and inequality (Barbault et al., 2002, Cornet, 2002).

After recalling some of the causes of desertification in drylands, the analysis also encourages people not to be too pessimistic about durable pastoral development in these difficult regions.

[5] It is sometimes difficult to find die right balance for diese indicators, between two common problems:

- If die monitoring system is too heavy it risks being rejected by die project and cannot be used for guidance!

- If the tighter system lacks reliability, it may lead to errors in assessment and hazardous decisions....which would not fail to disqualify this type of monitoring and guidance system

[6] United Nations Convention to Combat Desertification (already mentioned) signed in 1994, following the United Nations Conference of the Environment and Development, in Rio, 1992.

Certainly, these pastoral zones are subject to degradation of land and plant resources due to overexploitation by animals and disputes are common, due to growinganthropic pressure.

We conclude with the following positive elements:

- the environment's ability to withstand climatic accidents;
- the adaptation of plant and animal biodiversity to these environments;
- the ability of pastoral societies to adapt their strategy to "opportunistic" environmental management (Behnke et al., 1993; Scoones et al, 1995).

Finally, we can suggest the following priorities for implementation:

- maintain, secure and encourage pastoral mobility, by attempting to attenuate constraints (disputes, health, education, adequacy of representation...);
- promote breeders' organizations and strengthen pastoral and equal representation institutions, particularly for settling disputes;
- promote development activities and incitement policies for durable management of natural resources.

Indeed, it is essential to the global ecological plan to combat the desertification and degradation of a vast zone which represents more man one third of the land on our planet, and from a political and human view point to avoid marginalization and dramatic impoverishment of the pastoral societies who have lived there for centuries. The durability of natural resources is linked to renewing joint management methods involving negotiations and new ways of organizing users.

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STOČARSKI SUSTAVI U SUŠNIM KRAJEVIMA. UVJETI ZA ODRŽIVOST

Sažetak

U mnogim teškim situacijama u svijetu (sušnost, velika visina, nagibi, itd.) a naročito u velikim sušnim područjima, najprikladnije iskorištavanje zemlje čini se da je napasanje stoke na prirodnim izvorima.

Ovaj oblik ekstenzivnog uzgoja stoke potiče ne samo opstanak pastirskih zajednica već je i izvor bjelančevina (mlijeko, meso, krv) visoke biološke vrijednosti kao hrana u gradovima ili za izvoz te kao hrana tih pastira u teškom okolišu. Isto tako može biti izvor energije i gnojivo.

Opstanak stoke i održivost pastirskih zajednica u ovakvom okolišu velikih ograničenja često treba zahvaliti primjeni prilagodljivih pastirskih običaja predaka, što se temelje na brojnim čimbenicima kao što su:

- kombiniranje raznih vrsta biljojeda;
- prostorna pokretljivost jata i stada te katkada i obitelji stočara (periodično selenje, nomadstvo);
- sezonsko smanjenje broja životinja;
- upotreba resursa stabala i grmova za dopunjavanje hrane s pašnjaka;

Ipak, ovi pastirski krajevi često trpe zbog degradacije zemlje i biljnih izvora kao posljedica velikog iskorištavanja. Nesporazumi su česti zbog povećanog pritiska na ljude a održivost prirodnih resursa uključuje obnavljanje kolektivnih metoda menadžmenta pregovaranjima i novim metodama organizacije.

Ključne riječi: stočni sustavi, sušna područja, pretvaranje u pustinju, pastoralnost, domaći biljojedi, održivost, pokretljivost, organizacija

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