Conflict and Natural Resource Management in Agricultural and Pastoral Systems

of Arid and Semi-Arid Regions of West Africa

A Review of the Literature, Key Informant Perspectives and Lessons Learned

DRAFT

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Keith M. Moore[1], Daniel Kabore[2], Brigitte Gnoumou[3], and Michael Bertelsen[1]

SANREM CRSP (West Africa)

I Introduction

Recurrent drought - with its concurrent threat of climatic change, advancing desertification and the deteriorating natural resource base - have heightened fears of increased conflict among populations in West Africa. In particular, the unique agricultural and pastoral systems and constituent peoples of the West African Sahel appear increasingly vulnerable to conflict given these weather-related phenomena and the intensifying population pressure and changing socioeconomic conditions affecting all in the region. This review holds a two-fold purpose. The first is to draw together the relevant literature (both formal and "gray", found in the accompanying Annotated Bibliography) and the perspectives of key informants involved in conflict, natural resource management, and agro-pastoral systems in the West African Sahel (see Appendix A). The second is to analyze this knowledge base and current experience in order to identify where and how the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP) can intervene effectively to improve conflict and natural resource management (NRM) within these systems in West Africa.

1.1 SANREM CRSP

The SANREM CRSP is sponsored by the United States Agency for International Development's (USAID) Global Bureau and participating US and host country institutions around the world. SANREM uses a landscape ecology approach "to describe and understand the complex internal, external, and interactive processes within and between individual ecosystems". For the SANREM CRSP, these ecosystems include both the "landscape", which refers to interacting physical and biological ecosystems within a given area, and the "lifescape", which refers to the interacting human communities and institutions that drive natural resource decision-making. This distinction allows the conceptual isolation and analysis of the natural

[1] Office of International Research and Development, Virginia Tech
[2] Department of Agricultural and Applied Economics, Virginia Tech
[3] Department of Animal Sciences, University of Wisconsin-Madison

resource base and its internal dynamic processes from the human communities, institutions, and flow of goods and services that induce changes in that natural resource base.

The objective of the SANREM CRSP is to support NRM decision-makers at multiple levels by providing access to appropriate data, information, tools and methods of analysis, and by enhancing capacity to make better decisions and thereby improve the sustainability of natural resources. Its holistic approach is based on four cornerstones: 1) Landscape/lifescape interactions; 2) Participatory methodologies; 3) Interdisciplinary teamwork; and 4) Institutional partnerships. SANREM has finished its first five-year phase and is now beginning its second phase with a global program, and project activities in three regions (West Africa, Andes, and Asia). USAID has mandated that SANREM CRSP-West Africa focus regional activities in Northern Mali.

SANREM's landscape/lifescape (L/L) concept has evolved from its Phase I identification with a "watershed" to include multiple scales. The relevant L/L scale may vary but must ultimately be associated with a geographical area (e.g., plot or animal unit, household, village, watershed, district, nation) sufficiently large to fully encompass both specific NRM problems and potential solutions. Distinctive characteristics of the West African L/L include the extensive pastoralist systems based on spatial and temporal strategies with which actors seek to optimize resource use across several lower scale levels. It also includes sedentary, increasingly intensive, agricultural systems. Consideration of the time dimension of NRM in West Africa allows certain types of issues and conflicts to be focused at varying scales across farming systems.

The document's organization presents a synthetic overview of the relevant issues contained in the literature and expressed by stakeholders in five West African countries (Burkina Faso, Ivory Coast, Mali, Niger, and Senegal). We set the context for SANREM's efforts with a brief description of the landscape and lifescape of the West African Sahel. An overview of the primary trends in development assistance strategies over the past few decades that highlights successes and failures follows. An analysis characterizing the dynamic forces shaping NRM conflicts and development trajectories is then presented and supplemented by conclusions outlining a proposed general strategy and initial program directions that SANREM CRSP may choose to pursue.

II The Landscape of Agro-Pastoral Systems in Arid and Semi-Arid West Africa

The arid and semi-arid region of West Africa is commonly known as the Sahel (see Table 1). In general, the Sahel is characterized by a monomial rainfall regime with an annual rainfall from 100-200 mm and rarely exceeding 1,000mm (McIntire *et al.*, 1992) to 1,200mm (Sanders *et al.*, 1996). The region experiences sporadic and locally highly variable rainfall patterns. Annual rainfall levels overall have been decreasing over the course of this century (Farmer, 1989; Sunzuni, 1992). Some authors believe this trend dates back to the 17th century (Rasmusson, 1987). Marked climatic/weather change over the last two decades in the Sahel has shortened the rainy season, substantially modifying the landscape of the region as rainfall isohytes have moved southward.

The recurrent droughts of the 70s and 80s have further disturbed the equilibrium of the natural vegetation while the irregular distribution of rainfall has contributed to increased land erodability and the reduction of land area suitable for cultivation. Drought has transformed the landscape through: (1) water shortage which limits grazing and settlement; (2) soil degradation due to depletion of mineral elements (mining of crop nutrients without replacement through continuous cropping), and the consequent exposure to fluctuating environmental condition (wind and water erosion) leading to further reduction in water holding capacity; and (3) changing the equilibrium and composition of natural vegetation, in particular leading to the disappearance of annual grasses (Gillet, 1975).

In combination with weather/climatic changes, other stresses have led to severe land degradation in the region. Low fertility (phosphorus and nitrogen), low humus content and low water retention capacity of the

soils has limited rainfed agriculture in the region and the productivity of natural vegetation (Sunzini, 1992). Only 8% of the land area in the Sahel is suitable for agriculture and irrigated agriculture currently occupies only about 5% of this land. "Despite the semi-arid zone's low theoretical support capacity, population density is often higher than in subhumid and humid agroclimates [zones of sub-saharan Africa]" (McIntire, *et al*., 1992). With a population growth rate of more than 2.5% per year, more land has had to be put in cultivation to satisfy food needs. Additional lands could only come from existing fallow or from increasingly marginal lands that have been traditionally shared with herders. The once 10-15 year fallow period is now reduced to 1 or 2 years or has entirely disappeared (Sanders, *et al*., 1992). As a result, soils are losing their production potential as indicated by productivity declines for both food crops and cash crops on traditional agricultural lands. As these yields have declined, farmers have reacted by expanding production into marginal lands where current cultivation techniques are no longer adapted to the new environmental conditions and where the potential for conflict with traditional herders has increased.

Agro-Climatic Zones of the Sahel

a. The arid and semi-arid region of West Africa is a north-south succession of grassy savanna, shrub savanna, tree savanna and wooded savanna (Penning de Vries *et al*., 1991) and can be subdivided into agroclimatic belts according to the length of the growing season and the amount of rainfall as follows: a. The arid zone, also known as the Sahelo-Saharan or Sahelian zone, has a short growing season (up to 74 days, according to McIntire *et al*., 1992; up to 90 days, according to Sanders *et al.*, 1996) and a deficit in moisture availability. It is characterized by a short single rainy season and a long dry season (8-9 months). The annual amount of rainfall varies between 100-400 mm. The natural vegetation is of steppe type composed of sparse scrub with some perennial grasses; annual grasses are dominant only in more humid parts of the zone. Sheep, cattle, goats, and camels graze in an extensive manner utilizing pastures throughout the region. The extension of cultivated lands combined with the use of woody vegetation for fuel and browse and increasing pressure from a growing animal population have contributed to accelerated land degradation (FAO, 1986; Penning de Vries *et al.*, 1991).

b. The semi-arid or Sudano-Sahelian zone is characterized by a single 3 to 4 month rainy season of 75 to 119 days. The annual rainfall tends to vary between 400-600 mm (FAO, 1996). The vegetation consists mainly of Combretacea tree and shrub grassland. Perennial grasses are present but not dominant. This region is favorable for extensive grazing and cultivation; however, the potential for rainfed agriculture is low because of nutrient deficiency (nitrogen and phosphorus) and the high variation in rainfall. Irrigation may offer the only alternative to greatly improve food production in this zone. The Niger River and the Senegal River are important watersheds of this zone. The recession of these rivers after the rainy season allows the development of valuable flood-recession pasture (Penning de Vries *et al*., 1991) and/or agricultural production (Tabor, 1993).

c. The semi-arid zone gradually becomes the Sudanian Zone located as one moves southward. Annual rainfall is more abundant and can sometimes reach 1,200mm. The length of the growing season is longer (120 to 179 days). Sanders *et al*. (1996) suggest combining this and the preceding zone into a single major sorghum/millet zone. The vegetation is made of woodland (Parkia, Butyrospermum, Khaya), tree and shrub grassland and Adropogon grasses commonly known as savanna. The Sudanian zone is suitable to crop production and has been used historically by pastoralists as dry season pasture. Zebu cattle, sheep and goats are the main animal species. Land degradation and the reduction of yields in the region arise from changes in traditional farming practices and increasing pressure on land resources. These changes have been more dramatic where populations have migrated due to the recent control of river blindness (World Bank, 1985; FAO, 1986).

Pastoralists vary herd composition depending upon the type of long-term environmental adaptation required, drought, and markets. Natural vegetation (range and fallow), crop residues, and water are the main resources used by pastoralists. Water is of particular importance because it largely determines the value of other resources. Grazing resources are comprised of annual and perennial grasses and woody vegetation. Rainfall variability significantly affects the quality and quantity of these resources. Because the

length of the rainy season and the amount of rainfall in the northern part of the region make it unsuitable for agriculture, these areas can only be used by pastoralists who produce meat, milk and animal by-products. These contributions to the national economy are important although only the surplus is usually marketed (Aronson, 1980; Konczacki, 1978).

In the past, pastoralists have been accused of causing land degradation by overgrazing and overstocking. However, recent research in rangeland ecology has demonstrated that pastoral land stewardship practices are not as culpable as previously believed for two reasons (Behnke, 1995; Pratt *et al*., 1997). African rangeland (at least many species) is very resilient, capable of rapid regeneration during the rainy season despite being trampled or grazed down to the surface. Furthermore, pastoralist use of mobility and other herd management strategies have helped to demonstrate the adaptability of pastoralism to erratic rainfall in the zone (Shanmugaratman *et al*. 1992; Behnke R. 1995). In fact, pasture productivity is variable and the theory of constant carrying capacity is not applicable (Behnke and Scoones, 1992). New approaches to rangeland ecology and study of past trends of climate and weather variation in the region suggest that land degradation is due more to climate variation than to actions of the pastoralists. Within this new perspective, "opportunistic" range management strategies may be used to manipulate vegetative composition to favor production of nutritious species and reduce thicket-forming or poisonous species (Pratt *et al*., 1997).

Non-irrigated agriculture in the Sahel is only possible in areas where the length of the growing season allows crop maturation. The lack of water, in association with high temperatures (up to 45° C at certain periods of the year), is the most limiting factor for agricultural productivity in the region. Rainfed and recessional agriculture are the dominant practice (McIntire *et al*., 1992; Tabor, 1993; and Sanders *et al*., 1996). In the arid zone, millet and sorghum are cultivated near water points. In the semi-arid zone, the important food crops are millet, sorghum, cowpeas and maize (McIntire *et al.*, 1992; FAO, 1986). Sorghum predominates in the heavier soils and millet in the sandy soils (Sanders *et al*., 1996). The main cash-crops are cotton and groundnut. Farmers are predominantly small-holders using traditional farming systems which mix food crops and cash crops on the same farming unit. Purchased agricultural inputs are rarely used on food crops, and less is used on peanuts and cotton than in the past.

Although the potential for rainfed agriculture intensification is limited, the large potential for irrigation is not fully exploited. Both modern and traditional irrigation schemes are present in the region. Modern irrigation schemes have been developed in Mali and Senegal along the Niger and Senegal Rivers. The main objective has been self-sufficiency in rice but productivity has always been low. Modern irrigation at small and medium scales based on dams is also present, and traditional irrigation is practiced in various parts of the region. In addition to the flooded systems in the inland delta of Niger in Mali, floating-rice cultivation in the valleys and flood-recession cereal cultivation are traditionally practiced by farmers. The shaduf-type irrigation also exists around the oases. Ground water is used in other traditional systems for fruit and vegetable production where ground water is close to the surface and markets are available.

III The Lifescape of Arid and Semi-Arid Agricultural and Livestock Systems

Traditionally, three general systems of production have characterized the Sahel: agro-forestry, agro-sylvo-pastoral, and sylvo-pastoral (Sunzini, 1992). These systems, however, are in transition as herders and farmers seek out new means of survival in a transforming ecology: herders are sedentarizing; agro-pastoralists are increasingly using trees for animal feed and soil fertility enhancement; and agriculturalists are raising more livestock. In addition, significant and increasing numbers of each of these groups seek urban employment, thereby reducing available labor and shifting management responsibilities, many times to already overburdened and under-trained women.

Traditional production systems have existed in various proportions depending on available resources and the ethnic groups. Sustainable NRM has been a conscious practice, if not always explicit (Watts, 1987; Pratt *et al*., 1997; Park, 1993; although Blench, 1997, disagrees). The agricultural systems used were largely extensive in terms of land. That is, the ratio of output to input was low: for cultivation, new fields were cropped nearly every year and large areas were left in fallow or for animal grazing. A key adaptive

strategy was to maximize returns to labor on a selective temporal and spatial basis (Park, 1993). Fishing and gathering were also extensive, performed on a relatively large natural resource base (water or forest). Watts (1987) suggests these systems operated on four basic principles of resource use: (1) application of a variety of techniques for soil fertility maintenance; (2) complex land-use combinations, exploiting the variety in accessible microenvironments; (3) intercropping; and (4) adaptive capability in response to climatic uncertainties and risk.

Ethnic groups were associated with specializations in distinct but interrelated systems. For example, the Maure, Tuareg and Fulanis (Peul) in Mauritania, Mali and Niger were pastoralists (nomads or transhumants), the Bozo in Mali were fisherfolk, while the Mossi in Burkina Faso, Bambaras in Mali, and Wolof in Senegal were sedentary farmers. Some sedentary farmers like the Serere in Senegal owned livestock and integrated them with their crop production activities. A multitude of additional ethnic groups also existed, each with their own particular natural resource niche.

Although different ethnic groups tended to choose particular production systems, within clans there was considerable division of labor between castes, i.e., who may be farmers, herders, warriors, fishermen, specialized craftsmen, or slaves (Ngaido, 1993). In the northern pastoral zones, sedentary society at oases and around watering holes were populated by subordinant classes of politico-military societies of nomadic peoples (Foti, 1992). In the more southerly agricultural zones, the sedentary populations were often dominant. Among these ethnic groups, farmers could arrange for local herders to tend cattle that they owned.

Scales of management reflected the needs of each system for natural resources. Sedentary farmers organized their production on a concentric basis within their terroirs (village-scale L/L), first cultivating fields around their dwellings, then in the village, and finally in the bush. Fisherfolk migrated along the river with the fish after the flood wave each year (Ambach, 1996). Pastoralists operated on a larger scale going from place to place seeking pastures for grazing and water for their animals according to seasonal availability (Pratt *et al.*, 1997). They essentially move from dry to humid regions, following the rainfall and searching for fresh pasture. During the rainy season they go north and come south as the pastures and water holes dry out.

While various specializations developed in farming and herding, complementary relationships have led to interaction between farmers and herders through livestock sharing and bartering milk for grain. Milk/grain bartering was conducted in Burkina Faso (Delgado, 1974), in Mali (Swift, Winter and Fowler, 1985), in Niger (Eddy, 1979, Bernus, 1974) as well as elsewhere in West Africa (Swift, 1980). Cultivators obtained manure and labor for taking care of animals in return for cash, crop residue, or water rights (wells) given to herders (Heasley and Delahanty, 1996). These relationships have decreased as sedentary farmers have increasingly come to manage their own cattle herds and herders become sedentary (Toulmin, 1983). In Mali, the Peul became largely sedentarized in the mid-1980s, expanding their system into agro-pastoralism (Kebe and Hilhorst, 1997).

There are also intra-household specializations, between old and young and between men and women. As a general rule, planning and decision making are left to the senior members of the household (most frequently the male household head). For the most part women are charged with household and reproductive tasks (food preparation, collecting water and firewood, childcare, and so on). Women are also often involved with tending to livestock kept around the homestead and, in particular, milking and processing dairy products. In nomadic households, women are also often responsible for taking down and rebuilding the household structures. Men, on the other hand, are charged with clearing and preparing land for cultivation, herd management (herding, castration, vaccination and slaughter), and digging wells (Pointing, 1995). As population increase puts pressure on the limited resource base - intensifying livestock production, sedentarizing into agro-pastoral production systems, and increasing migration in search of employment - women appear to be taking on more of what had been seen as masculine tasks (Pointing, 1995).

Land tenure in West Africa has traditionally served to balance the needs of various households for land within low population pressure production systems (Sanders *et al.*, 1996). Rights to the use of natural

resources tended to vary from season to season and from resource to resource. Customary law required constant interpretation and adaptation by local authorities (Ngaido, 1996).

Access to land is determined at the village level, first through the lineage, then through the household. Leaders of the original or conquering lineage or ethnic group are often the only ones deemed capable of "owning" property (Ngaido, 1993). For the most part, male household heads inherit the use right to the majority of land that they farm. Some may borrow from others in the same lineage, or outside the lineage (Matlon, 1993). Temporary use rights may be had under sharecropping or rental arrangements. Slaves may also access land through their masters (Ngaido, 1993). Women, as well as other subordinate family members, have traditionally had access to lands through the male household head. Inheritance of land by women, although occasionally practiced, is rare as it would tend to fragment household and lineage lands (Ngaido, 1993). Within pastoral systems, women are not authorized to own cattle as such; however, childbearing may establish rights in, and responsibility for, milk (Pointing, 1995).

Wealth may not only be indicated by the amount of land controlled and operated, but also by the size and composition of the herd. Wealth differentials among sedentary households determine the capacity to withstand drought and subsequent famine. Poorer farmers may be forced to sell off productive assets, while richer farmers may even gain (Frankenberger and Lynham, 1993).

Wealth status determines the vulnerability of the pastoralist to distress, (e.g. a drought or disease epidemics): poor pastoralists may lose their herds or have them reduced to only a breeding nucleus (or lower) while rich pastoralist may increase their herds. The poorer the pastoralist, the more likely he is to disappear after such a disaster, thus widening intra-system disparities. Survival strategies have led some marginalized and impoverished populations to becoming salaried herders and others to sedentarization. Traditional support mechanisms no longer function (e.g. cow sharing; Bovin, 1995). Sedentarization reduces herd size and the economic returns from raising livestock (Horowitz and Jowkar, 1995). As men migrate in search of seasonal employment, women's workload increases. Intensification of milk or meat production, on the other hand, leads to further individualization and differentiation of wealth.

Presently, another type of entrepreneur is growing in West African countries: the absentee herder or farmer, i.e. an owner of livestock or of a farm but living in town. This category of entrepreneur is caused by ongoing changes due to drought and consequent economic problems that have been impoverishing rural people relative to urban inhabitants. In the Ivory Coast, some urban inhabitants hire workers to grow cash crops (coffee, coconut, rice) on their behalf on rural or semi-urban lands. Most of the time, they get the legal right to use these lands straight from government institutions in Abidjan; this is a step leading to conflicts with local people who are the traditional landholders (key informants). In the Sahelian countries, this pattern is more frequent among pastoral populations. Poor herders, who lost their livestock during previous droughts and have been unable to re-stock their herds, hire out to take care of urban rich people's livestock in return for a salary or other beneficial arrangements (key informants in Mali and Niger).

IV Development Assistance Strategies and Agro-Pastoralism

4.1 Historical Context: Development Assistance Agents/Agencies

The main actors providing leadership and support for development assistance to agro-pastoral populations include multinational banks, bi-lateral donor agencies, and international agricultural research centers (IARCs) at the international level, national ministries, research institutes, and NGOs at the host-country level. The most significant among these have been the national ministries and research institutes whose legacy and control over long-term program implementation often dates from the colonial period. These have provided sectoral guidance and set national priorities. Multi-national and bi-lateral agencies (The World Bank, USAID, etc.) have set the trends in development project design, building on the lessons learned from successive waves of pastoral and agricultural development projects. Much of the work in West Africa since 1973 has been coordinated and to some extent inspired by the CILSS (the Permanent

Interstate Committee for Drought Control in the Sahel). The IARCs and various national research programs (including the CRSPs) have provided scientific information needed for improvement of agricultural and livestock production systems. NGOs have come to play a brokering role through their intimate contact with local populations.

Various government ministries have promoted agricultural and pastoral policies, programs, and projects in a sectoral manner. These ministries have rarely worked in a coordinated way. Often the ministry for agriculture is separate from that of livestock (or subsumed as a separate component). Recently evoked environmental issues have been the domain of a third ministry. The livestock ministry emphasizes animal husbandry, while the agriculture ministry aims to develop farming, and the ministry of environment works on environmental preservation. (key informants). Overall government development policies have favored the intensification of sedentary agricultural production at the expense of transhumance. If, as Sanders *et al.* (1996) suggests, government policies have neglected agriculture, they have even further neglected livestock. This bias extends to the almost complete omission of pastoralist concerns in the development of famine/drought early warning systems (Sommers, 1998). However, the basis for present day veterinary services was established and a good number of wells have been drilled (Pratt *et al.* 1997).

After independence in the 1960s, The World Bank, IARCs, and other donor agencies maintained this sectoral approach. Agricultural research and development focused on the development and introduction of new crop varieties. Productivity gains were expected from genetic enhancement of export crops, rather than from improved agronomic practices (Lynam and Blackie, 1994). The introduction of new cultivars has been a major thrust of the IARCs (following the Green Revolution successes) and NARS have also followed this path (Sanders *et al*., 1996). Extension activities centered on the introduction of inorganic fertilizer and new varieties. Despite some successes, the adoption of new varieties did not catch on with African farmers and consequently population growth outdistanced agricultural growth (Lynam and Blackie, 1994). While livestock research began to be influenced by American range science during this period (Pratt *et al.*, 1997), increased livestock productivity has not occurred either. Livestock development and extension activities have stressed little more than providing veterinary services and finding new sources of water.

The Sahelian drought from 1968-74 brought about many changes in the way agro-pastoral development issues were addressed. In 1973, CILSS was established with the objective of finding permanent solutions to food self-sufficiency and socioeconomic well-being in the Sahel through the coordinated efforts of 9 countries (Burkina Faso, Cape Verde, Chad, The Gambia, Guinea Bissau, Mali, Mauritania, Niger, and Senegal). CILSS has mobilized resources, conducted research (through the Institute of the Sahel (INSAH) and national research institutes), disseminated information, and promoted awareness throughout the region and internationally on issues of drought and desertification (Djalbord Diard, 1992). Their first actions involved emergency aide, coordinating the international relief efforts of the time.

Commercial ranching, group ranching, and sedentarization designed to increase meat and milk production were the primary thrusts of pastoral development projects during this period. Although some World Bank projects moved toward addressing land tenure and policy issues, the emphasis was on capital investments, centralized planning, and reducing stocking rates (Pratt *et al.* 1997). National and bi-laterally funded projects followed this general model. For the most part, these efforts have been considered either "remarkable for their universal lack of success" (Horowitz and Little, 1987) or simply a failure of farmers and herders to adopt the proposed technologies (McIntire *et al*. 1992). Preston and Leng (1994) suggest that animal science made little or no contribution to increasing livestock productivity. Pratt *et al*. (1997) note the primary causes of failure as a lack of understanding of the traditional pastoral systems; assuming that they were market-driven; rigid organizational forms and imposed tenure right systems; inappropriate incentive frameworks; and institutional weaknesses of the implementing agencies.

Sectoral approaches have come into disrepute throughout the Sahel. Current strategies are informed by integrated approaches focusing on natural resource management, "gestion de terroir" (local resource management), a prioritization of food production, flexibility and mobility in herd management, and an emphasis on local institution building (particularly among pastoralists). These strategies shift agricultural research priorities from breeding to improved soil management technologies (Lynam and Blackie, 1994) in order to support both increased agricultural and livestock productivity. Farmers and herders need to be

provided with a menu of technological options from which they may select or adapt to their production circumstances. Intensification is already beginning to occur as Sanders *et al*. (1996) note with respect to the use of zaï and bunds combined with manure. They recommend going beyond simple labor-intensive technological innovations to increased investment by farmers in a combination of intensive technologies including inorganic fertilizer.

NGO contributions to agro-pastoral development have routinely begun with emergency relief activities. While this has led to a top-down approach, with increasing regularity, NGOs have become involved in more routine development activities (Brown, 1993). In these activities they have worked on a small scale in contact with village people and their problems. They have begun to recognize the importance of natural resource tenure issues and the associated conflicts but have tended to avoid involvement in these issues. Their lack of partnerships and contacts with government services, the small scale of activities, the absence of baseline and monitoring data, and low levels of technical expertise have also diminished their impact. (Toulmin and Moorehead, 1993). Nevertheless, NGOs are moving toward support for pastoral systems that attempt to enable pastoralists to exploit spatial and temporal availability of rangeland resources.

Currently, international donor agencies and national NGOs are promoting a focus on conflict resolution as a major component of natural resource management research and extension efforts. This has resulted from their increased understanding of pastoral management systems and project focus on institution building (pastoral organizations), and decentralized and flexible decision making processes (Pratt *et al*., 1997). NARS are only indirectly addressing issues of land tenure and conflict in agro-pastoral systems. Their major contributions are in the development of resource-intensifying technologies designed to increase and diversify incomes, thereby increasing food security and reducing the likelihood of conflict over scarce resources (key informants).

4.2 Macro Economic Policies

The poor economic growth record of Sub-Saharan Africa since the 1960s led many national and international leaders to conclude that the problems of the region were structural rather than cyclical. Significant external shocks, however, have also served to greatly exacerbate the problems stemming from misdirected macro policies. The severe drought of the 1970s led to a large-scale slaughtering of livestock; animal numbers are estimated to have fallen by 40-50% as a result (Mainguet, 1995). Similarly, the drought of 1983-84 led to herd declines of 40% in some areas (Grandin and Lembuya, 1987). Similar losses in crops were experienced. In addition, the petroleum shocks of the 70s and 80s worsened the overall economic performance. As agricultural production fell due to all causes, exports based on a few products (cotton, livestock, coffee and cocoa) also declined. As a consequence, government revenues fell and debts increased. This caused a steadily worsening crisis as debt ratios kept increasing while public resources were shrinking. The GDP declined for the West African sub-region and local food production decreased; based on the FAO standard of 180 kg of cereals per capita, food supply fell short by about 20% (Okai, 1997). This deepening crisis resulted in the implementation of structural adjustment programs.

Structural Adjustment: Structural adjustment is an attempt to first stabilize and then restructure the national economy. In general, structural adjustment policies are implemented to: (1) get the 'right' macroeconomic environment (control inflation, improve balance-of-payments, realistic exchange rates); (2) improve competitiveness (deregulation, remove urban bias and privileged access to resources, increase exports); and (3) improve institutional infrastructure (reduce the size of government, tariffs instead of import restrictions, sell parastatals) (Jones and Kiguel, 1994). The net effect of structural adjustment is expected to be higher growth rates ultimately benefiting all members of society.

The World Bank and the International Monetary Fund set up structural adjustment measures for the particular situation of each country. The measures were supposed to give market mechanisms greater influence in determining prices, wages, and resource allocation in the structuring of production. From a practical perspective, policies mostly consisted of cutting the budget deficit by reducing public expenditures on subsidies and by stopping the recruitment of state employees except for crucial sectors like health, education, and public finance. The policies included loans to renew or to promote critical sectors for

development (e.g. roads, research, and agricultural extension). Reducing the government role in the management of the economy also led to the privatization of parastatals.

Structural adjustment has had a decidedly mix result. It has not achieved the expected results because countries have been half-hearted in their implementation (Jones and Kiguel, 1994). However, external shocks also continued to impede growth. Most of the countries could not increase their exports because of the decrease in the price of agricultural products on international markets. In particular, low prices resulted from global supply increases in cotton (particularly from China) and in coffee and cocoa (from Latin America). Export earnings continued to fall and even traditional markets (coastal countries) for Sahelian livestock began importing cheaper meat from Argentina and from the European Union. For those countries having just 2 or 3 export products, the need to increase export earnings brought intense pressure on the exchange rate of the currency.

Devaluation of the Franc CFA (FCFA): On January 10, 1994, the FCFA, formerly at an exchange rate of FCFA 50.00= FF 1.00, was devaluated by 50%. This decision was aimed at boosting exports and decreasing imports. Theoretically, such a move would improve the balance of payments situation by increasing exports and reducing imports. The improved competitive position of the country should lead to higher growth, employment and improved socioeconomic conditions in general. The effects of the devaluation, however, have not been immediately positive; a rather high inflation (12-15%) has been experienced and, lacking substitutes in many cases, imports could not be reduced as much as expected.

In addition, the privatization of parastatals resulted in closure and significant lay-offs from government employment. This dramatically increased unemployment and reduced household incomes, particularly among the urban populations. The immediate effects of increased inflation combined with reduced employment and lower incomes exacerbated poverty in urban and rural areas alike. Although pastoralists benefited from the improved terms of trade, the "mixed results of structural adjustment have left the poor more vulnerable to internal and external shocks, and macroeconomic decline has increased inequalities between social strata" (Buchanan-Smith and Davies, 1995). At the same time, increasing poverty has put the biophysical environments under additional pressure and as a result is becoming increasingly degraded.

4.3 Agro-Pastoral Development Intervention Strategies

To alleviate effects of periodic drought and promote development, different types of strategies have been implemented to assist agro-pastoral groups. These include drought relief actions, targeted interventions, systematic or programmatic interventions, and participatory interventions.

Drought Relief. Drought relief actions consist of providing food to people under current drought conditions. Pastoralists who lost their livestock or farmers who lost their crops during the drought benefit from such actions. Food is distributed to needy households. Such interventions are frequent in all Sahelian countries.

Targeted interventions: apart from the above punctual drought relief actions, specific interventions are usually carried out generally for pastoral development. The objectives of such interventions are (a) to increase herd size (or reestablish/re-stock herd), (b) to increase milk yield, (c) to maintain appropriate herd structure, and (d) to develop disease resistance by selective breeding (Niamir, 1991). Veterinary medicine (vaccines), the eradication of tsetse flies (for animal health improvement), dams, and boreholes contribute to increase livestock production.

Drought relief actions, livestock salvage operations and targeted interventions have unfortunately been conducted on an *ad hoc* basis, and not as a part of a coordinated, coherent long-term strategy. As a result, they are relatively costly and are not sustainable (Okai et.al. 1987).

Systematic and Programmatic Interventions. Such interventions are intended to develop the whole system of production (agriculture or livestock) instead of targeting the actions on just restricted and isolated components of the system. Irrigation projects originally determined the model for this type of development intervention. Major new irrigation systems are not currently being developed, although older systems may

be improved or expanded along with increasing the number of micro-systems. More important today is the expansion of agricultural production into *mare*s (such as wetlands) where herders traditionally bring their herds during the dry season. Both pastures and sources of drinking water are diminishing rapidly due to this trend. Governments and NGOs have supported the intensification of agriculture and livestock production. Both require fixed investments in land and therefore the sedentarization of the producing population(s).

Historically, many reasons have been given for the sedentarization of nomads: ease of control, of taxation, of infrastructure development, and disease control. Nomads are seen as an ecological and an economic liability and militarily dangerous (ungovernable and uncooperative). The sedentarization of nomads is seen to improve both tax collection and use of infrastructure (marketing channels, veterinary posts, waters points; Gefu, 1989). Nomadic pastoralists are seen as wasteful, unproductive, self-destructive, and incompatible with modern agriculture (Awogbade, 1989). Furthermore, the pastoral way of life is viewed as conflicting or as incompatible with the standard of civilized behavior, manners, and values (Asenso-Okyere, 1997). The meat supply shortage in the coastal countries of West Africa was seen as the justification for improvement of livestock policies through sedentarization (Asenso-Okyere, 1997).

Sedentarization has been implemented in countries like Burkina Faso (Nouaho and Sissili projects). Lack of success has been recorded for many reasons: the increased number of animals contributed to environmental degradation due to surpassing the carrying capacity. Conflicts between herders and farmers increased in the area.

Livestock market development has been generally coupled with sedentarization. The aim is to facilitate livestock exports and taxation of pastoralists. Livestock products represent 20-30% of the exports of some Sahelian countries (Mali, Burkina Faso), so there are good reasons to believe that developing and formalizing such markets is worthwhile. Agreements between CEBV (Communaute Economique du Betail et de la Viande) countries theoretically delineate corridors for livestock inter-state movement, mostly from Mali, Burkina Faso and Niger to coastal countries (Ivory Coast, Benin, and Togo) in order to ensure international transhumance patterns that minimize farmer/herder conflicts. Unfortunately, these agreements are less and less respected by farmers who expand their fields in production to meet the demand for food of the growing population. The efficiency of corridors is questioned even at the country level (key informants).

Participatory Interventions. Although systematic or implemented in a programmatic framework, most interventions failed to increase agricultural or livestock production and even resulted in a higher rate if depletion of the natural resources. The reason for such bad results is the weak involvement of local population in the conception, design, implementation, and evaluation of these interventions that were seen as exogenous to the local communities. Such failures called for new community-based approaches such as "*Gestion de Terroir*" and the development of pastoral organizations in the Sahelian countries.

Gestion de Terroir is a multi-sector and global strategy aiming to establish new socioeconomic and ecological equilibria in order to achieve food self-sufficiency and to preserve/regenerate the productive potential of natural resources (Rochette, 1985 in Lowenberg-DeBoer *et al.*, 1994). G*estion de terroir* involves the local people in planning for natural resources use and gives them full responsibility for NRM within the limits of their terroir. Land tenure must be secure enough in this unit in order to ensure a sustainable use of resources. All resources users in the terroir should be included in the management unit (e.g., villages, communities, age and gender groupings).

This approach was developed since the early 80s and is implemented in some Sahelian countries like Burkina Faso and Senegal. In Burkina Faso, the PNGT (Programme National de Gestion des Terroirs), financed by the World Bank, has been conducted for a decade in regions of the country where NR management is viewed as critical. In Senegal, the USAID-sponsored Community-Based Natural Resource Management (CBNRM) Project also works with a similar approach but at a higher (multivillage level, the *Communauté Rurale*). Many NGOs have also been conducting this approach all other countries. Despite this, many problems have been noted: (a) lack of basic research-based data that could help projects or NGOs in the approach implementation; (b) the terroir geographic limits are generally not clear; and (c) the

agricultural area has nearly always been the unit of analysis at the expense of livestock (Lowenberg-DeBoer et. al.,1994).

Pastoral Organizations: an emerging general consensus on the importance of livestock within the Sahelian economies has led decision-makers to include more pastoral development in their policies. In particular, pastoral organizations supported by World Bank, African Development Bank, IFAD, France, and Norway have been developed in Mali, Senegal, Mauritania, and Niger as a new form of community-based NRM (Shanmugaratnam *et. al.*, 1992). Pastoral Organizations (PO) cover all types of institutional arrangements that regulate individual and collective actions by pastoralists to safeguard and promote their economic, social, cultural and political interests. They are legally organized by the government and dependent on the state for technical assistance, supplies and financial resources (Vedeld, 1992). The functions of the POs are related to acquiring secure land tenure, resource management, provision of services, communication of information, external relations and the building and maintenance of community coherence and morale. Key factors that determine the viability of POs include food security, water security, land security, herd ownership, credit, veterinary services, marketing, economic self-sufficiency and literacy (Shanmugaratnam *et. al.*, .1992). Implementation problems have lessened PO impacts. In particular, drought has led pastoralists to disperse as migrants in search of food. In addition, the identification of the beneficiaries has not been clear in communities and there has been a noted incapacity of POs to implement project plans (see Shanmugaratnam *et. al.*, op. cit.1992 for a complete list of the problems).

4.4 Current Local Level Policy Context

Contested Terrain: Modern vs. Customary Law. As the demand for scarce resources increases, conflict can only be avoided when access is structured according to mutually agreed criteria of legitimacy. The state has seen this as a matter of defining a single system of legal ownership and usufruct. Such a universalistic system does not account for the multiple uses and sustained sharing of the resources that have customarily governed those resources at the local level. Customary law on the other hand, is based on the locally perceived legitimacy of traditional leaders. Traditional leaders are perceived to represent the highest interests of the parties involved in any conflict over natural resources and have been able to resolve many conflicts through adaptation and interpretation of customary law. In the eyes of the state, however, customary law and traditional leaders have often been perceived as an impediment to progress, as supporting the status quo and not responsible to the new authority of the state. This appears to be the case even when customary laws and authorities are recognized in the law.

While one cannot speak of African customary law as a single body of legal customs applicable to all of the different societies found in Africa, it can be used "as a generic term for more or less similar traditional systems of law, or standards of behavior" (Rugege, 1995). It is best understood in contrast with modern law. Conflict resolution has been the core of African customary law emphasizing reconciliation of disputants, rather than, as in modern western law, winner-take-all. Procedures in traditional courts were kept simple and informal, although not easily accessible to women or younger men. In modern courts, while access is universal in principle, limits are still imposed due to transportation costs and the need for a lawyer to advocate one's case.

Modern law gains its strength and efficiency from standardized written texts. Codification or imposition of French laws, however, has restricted the flexibility of agricultural and livestock producers to adjust their production systems as needed to assure subsistence (Mortimore, 1997). This is particularly difficult for the pastoralists who, according to the codified modern laws of every country in the Sahel, must demonstrate *mise en valeur* (investment in productive use) to validate use rights to natural resources on a piece of land (Vedeld, 1994).

In recent years, Sahelian governments have been trying to adapt the realities of customary law at the village level with the need for standardized modern law for the nation (Bohrer and Hobbs, 1996). These innovations were preceded by Senegal, which in 1964 enacted the National Domain Law. This law made all lands national, but left responsibility for administering them, ostensibly, at the *Communauté Rurale* level. Customary tenure and *mise en valeur* principles to determine usufruct are adjudicated by the Rural Council under the guidance of state representatives (*sous-prefet* and *prefet*). In Burkina Faso, the

Reorganisation Agraire et Foncier (RAF) of 1991 was still not put into application by 1996. The meaning of *mise en valeur* has not yet been clearly defined and tested, although all land has been turned over to individuals (not nationalized). The *Code Rural* in Niger has been revised (*Principes d'Orientation du Code Rural* (POCR), 1993) to provide for national recognition of customary rights. The government has set about establishing land tenure commissions to register those rights. Authority for conciliation is in the hands of the customary chiefs although contravention of *mise en valeur* may be used to remove rights. In Mauritania, individuals may demonstrate *mise en valeur* and register their traditional claims or request a state concession. Privatization is promoted in the context of strict state controls. Those involved in conflict resolution surrounding these laws cite either inappropriate laws or failure to apply them correctly (Toure, 1996; Ngaido, 1996; Moore and Thiongane, 1998; and Maiga and Diallo, 1996).

Decentralization/Deconcentration: Sahelian governments have recognized that central governments are poorly placed to make decisions appropriate at the local level and have been increasingly moving toward policies of decentralization (i.e., relinquishing decision-making authority over local matters, particularly land use and natural resource allocation). Ostensibly, this increases the local populations' role in deciding appropriate land uses and ownership/usufruct. Such local control is expected to optimize the use of natural resources and encourage investment.

Senegal, Niger, Mali, Burkina Faso, and The Gambia have all instituted decentralization laws (Bohrer and Hobbs, 1996). However the reality is that local decision-makers have very little discretion in the decision making. The institutions which have been set up to govern natural resources at the local level rarely have budgetary discretion, perceived local legitimacy, and a mandate for more than awareness building. Furthermore, central governments, while delegating the responsibility for decision making to locals, have required that they implement national laws and provided few resources for implementation of their decisions. In effect, the current policy of decentralization across West Africa has become largely a matter of deconcentration of state power (i.e., strengthening the national government at the local level).

Alternatively, the *gestion de terroir* approach is advocated by many NGOs and promoted by national governments for development at the local level. These local management committees are gaining experience, but are still too few and far between to have a major impact on NRM or decentralized conflict resolution. Although these forms of local management show promise for the future of NRM, they still need considerable support in the form of literacy and budgetary training. Diversity of committee membership is urged, but the tendency is for local elites to dominate and for women and pastoralists to be excluded (Bohrer and Hobbs, 1996).

V Conflict and NRM in Agro-Pastoral Systems in the Sahel

5.1 Crop and Livestock Relationships

Although herders and farmers have traditionally utilized what appeared to be two separate landscapes, livestock now also occupy a significant place in sedentary farming systems (Sidibe, 1992). To survive, farmers are diversifying to reduce the risk of crop failure by raising livestock. While diversification in sedentarized agriculture is taking place, mobility - the equivalent risk-averting behavior in pastoral systems - has been decreasing as potential grazing lands are converted to crops. Many herders have lost their animals due to recurrent drought and have not been able to replenish their herds. Many are now either herding livestock belonging to farmers and others (urban-based government employees, merchants, and so forth) for subsistence or are turning to sedentary production systems and practicing agriculture. Such crop/livestock integration and accompanying intensification of production systems is generally viewed as a positive development for both productivity and environmental conservation (Bayer, 1996; Mortimer et al, 1993; Sturm, 1996; Williams, 1995). However, Wolmer (1997) points out that such integration and resulting environmental sustainability is not simple and rejects the notion of a single diversification development trajectory for farmers and herders. Nevertheless, faced by the necessity for diversification, there is strong evidence of a concentration of more users in areas of higher quality resources. In Mali, for

example, the delta region attracts herders, farmers, and fisherman and it is apparent that competition is replacing the more complementary and cooperative utilization of resources of the past. Competition for crop residues and grazing area arise between farmers and sedentary or transhumant herders. The traditional complementary exchange of stubble grazing for improved soil fertility is disappearing. Competition for woody vegetation to be used for either pasture or fuel has increased.

McIntire *et al.* (1992) describes two types of crop/livestock relationships. Crop/livestock interactions occur when the products and services of one system are used within the other and vise versa. For example, animal traction and manure may be used to benefit cropping systems while crop residues may be used to feed the animals. Crop/livestock integration occurs when such interactions are made within the same entity (the farm). That is, the activities and outputs of both systems are jointly managed for the benefit (profit) of the same entity.

Crop/livestock interactions may occur within any agroclimatic zone by any type of production entities. However, integration is limited by the production possibilities of the agroclimatic zones and is influenced by population density (following the argument of Boserup (1981)). For example, in arid regions where agriculture possibilities are very limited, few interactions are possible and no integration occurs. In regions where both are possible, the relationship between population density and level of integration can be visualized as an inverted "U" with weak integration at the beginning, stronger when population density increases, and then decreasing again with further increases in population density (see Figure 1). Historically, crop and livestock production systems in the Sahel have only existed in the first half of the inverted "U".

At low population densities, interactions (and integration) are relatively restricted: labor is the principal costly input. Land is relatively abundant for cultivation and for grazing. Both cropping and livestock production systems are extensive; fallow is the most important soil fertility management practice and an open pasture is used for animal grazing. As population density increases, the (usually implicit) price of land begins to rise and the value of inputs that improve the productivity of land increases. Farmers and herders develop exchange relationships following the comparative advantage of each. Farmers begin to seek animal inputs (traction and manure) through contracts with herders and existing markets. Similarly, herders react to the rising scarcity of land by seeking to enter into agreements with farmers that assure grazing rights and access to crop residues and water points. As population density and land prices rise still further with accompanying price increases for animal traction and manure, farmers find it increasingly advantageous to assure a steady (and lower cost) supply of these inputs by diversifying into animal production. Less fertile land is available and innovation is induced with new water conserving technologies increasing the demand for labor (Sanders *et al.*, 1997). These water-conserving technologies are sub-optimal without increases in soil nutrient levels. To improve soil fertility, animals are stabled to collect manure for technologies like Zai (Kabore *et al.* 1997) or mulching (Lowenberg-Deboer, 1995). Bottomlands are cultivated in the most arid zones in order to avail of soil moisture. Animal traction and mechanization are increasingly adopted to replace labor. As pasture is increasingly lost in favor of cultivated land, herders may also seek to assure access to land, water, and crop residue by sedentarizing and diversifying into agriculture. Eventually, population pressure may increase to a point where the costs of increasing integration exceed the benefits. Responding to increasing demands for food by the population, farmers find they cannot intensify sufficiently without increasingly relying on new technologies and outside purchased inputs provided through markets (e.g., chemical fertilizers, improved seed, etc.). Falling transportation costs may also re-new incentives for specialization as in the case of peri-urban areas where input and product transport costs are minimal. Managing more intensive cropping systems requires more time and money that is taken from animal production. Consequently, animals become relatively less important to the operation and farmers continue to specialize. In this environment, herders may also intensify and specialize in response to new technologies or changes in the demand for animal products.

5.2 Characterization of NRM-Related Conflicts

The connection between food insecurity, NRM, and conflict is well documented in the literature. Messer *et al*, (1998) point out that food insecurity and natural resource scarcities are major causes as well as consequences of conflict. The authors cite data indicating that conflict in countries of Sub-Saharan Africa has been associated with per capita declines in food production of over 12% per year. In the Sahel, the most severe conflict has generally involved the NRM issues of farmers and herders.

The heightened competition between livestock and agricultural production through the conversion of marginal land into cropland as well as the expansion of cultivation into irrigated agriculture along water points has limited access to water and to dry-season pasture (bourgou) (key informant in Mali). Additionally, by cultivating livestock corridors (enriched by animal manure), sedentary farmers have disturbed transhumance patterns and herders have been obliged to change their strategies to adapt to the new environmental conditions.

NRM is increasingly becoming the subject of conflicts between a wide range of resource users in the Sahel. These conflicts have been particularly acute where competition for resources between managers of distinct agricultural and pastoral systems is highest. Conflicts are not only found in conditions where complementary systems once co-existed, but they are also becoming more frequent among members of the same community. Inter and intra-community conflicts are observed as the NR-base shrinks due to higher population pressure and diminishing annual rainfall. The disputed resources revolve around access to land but are particularly focused on specific rights to cultivate, graze, water, and move.

Pairs of actors involved in natural resource conflicts are often used to develop a conflict typology. This usually involves pairing farmers and/or herders with themselves or other actors (fisherfolk, non-local private sector, in-migrants, the State or its agents). It may be more useful, however, to categorize conflicts in terms whether they are within or between production systems. Conflicts within production systems usually involve attempts of the actors to maintain or increase the productive base of their production system. Here conflicts revolve around issues of inheritance, land boundaries, and proprietorship. To the extent that unambiguous rules and procedures exist, these conflicts can normally be resolved without recourse beyond the village or community.

Conflicts between production systems are more serious because they threaten not only the immediate livelihoods of the disputants, but also the way of life of their communities. When ethnic differences between disputants are involved, the conflict may be further aggravated and larger constituencies to the conflict are drawn into the fray. Maintaining control of local resources in the face of extra-local or in-migrant "strangers" can be a powerful force mobilizing the community. For herders, herd mobility is crucial to survival and, consequently, leads to the most common flash point initiating overt conflicts (the trampling and destruction of cultivated fields).

Blench (1997) categorizes conflicts in the Sahel as eco-zonal. These conflicts are endemic to the transition between the extensive livestock and cropping systems characteristic of the pre-colonial past and the expanding, more intensive systems of the modern era. As has been shown above, traditional systems have used the natural resource base of the Sahel in multiple and complementary ways. With increasing pressure on the resource base, however, livestock and farming systems are coming into conflict over the calendar of land use by the different systems (Soumaré, 1996). For example, at one time near Nioro du Sahel in Mali, the farming Soninké and the herding Toucouleur benefited from an exchange of manure for grain and established a tradition of shared natural resource tenure. The Toucouleur eventually established a village in the region and continued their transhumance. Today, with decreased rainfall, land degradation and adoption of livestock raising by the Soninké, the exchange has lost its value. Although the Soninké rely on the Toucouleur for tending to their herds, the shared use of resources has become problematic. The herders have more difficulty accessing dry season crop residues for their herds, while the sedentary farmers feel their agricultural calendar is being restricted by the incursion of the herds. Exchanges have become monetized, but there is no unified authority to regulate local land use. While farmers are governed by the village council, herders are governed by those responsible for pastoral resources along the trail.

Increasing population growth, expansion of cultivated land (with the consequent disappearance of fallow), and the introduction of cash cropping accompanied by a degradation of the vegetative cover have conspired

across the Sahel to create situations of confrontation between rural stakeholders. The incidence of these conflicts, particularly between farmers and herders, is increasing (Souley, 1996; Maiga and Diallo, 1996; Blench, 1997). Souley (1996) explains the background for the recent military coup d'etat in Niger in this context. Often, conflictual situations are abetted by development projects. In Samorogouan (Burkina Faso), the government in collaboration with the World Bank established four ranches (a pastoral management zone) on land for which full title was not established. In so doing, use rights were left undefined for project beneficiaries. The majority of colonists in these ranches were farmer-herders (80 percent) and the rest, Peul herders. The agricultural communities grew cereals, cotton, citrus, bananas, and vegetables. The bananas and vegetables were cultivated along the streams and in the wetland areas. In fact, the cultivators left little or no room in their land use plans for animal corridors, access to water points, or pasture lands during the dry season (Sanon, 1996). In a similar project in Sideradougou (Bary, 1996), conflict resulting from the grazing of a herd in a cultivated field left the Peul herder dead, and later led to the death of the Karboro father of the assailant. Both Peul and Karboro communities accused the government forces (which defused the immediate confrontation) of siding with their opponents.

On a larger scale, the government of Niger set a limit in the northern part of the country (called the Sorghum Line), north of which agricultural producers were not allowed. This region was only reserved for rainy season grazing. Today, sedentarizing herders have occupied land around water points north of the sorghum line on lands once managed for livestock grazing (Sidikou, 1995). The official deadlines of May 30th (on which livestock should be moved out of the cultivation zone) and November 30th (the date for their return) are no longer respected. The changing rainfall regime has obliged herders to move north later, at the start of the delayed rainy season. Furthermore, herders are tempted to take advantage of the new growing grasses in the agricultural zone before moving north where the rainy season starts later (key informant).

These conflicts can become extremely violent when the disputants contesting the right to use a resource are anchored in historical relations of ethnic conflict. This was the case of the conflict between the Sosobe (Peul) and the Salsalbe in the Niger Delta of Mali. Contesting claims to a grazing territory dating back to 1936, exploded into a violent confrontation in December 1993 leaving 29 dead and 42 wounded (Maiga, 1996; Vedeld, 1994). Often contesting claims in the Niger Delta are linked to traditional relations between Peul and their ancient slaves (Rimaïbés). According to tradition, the Peul allowed the Rimaïbés to farm Peul-dominated territory, while they continued their transhumant practices (Maiga and Diallo, 1996). The coming of colonialism legally ended slavery; however, the *Dina*, a socio-religious land tenure organization established during Peul dominance remained in force. This allowed their slaves continued access to the land they farmed, but also assured Peul proprietorship (Cisse, 1996).

Inter-State relations are also involved in natural resource conflicts. Nomadic or transhumant herders have little regard for national frontiers. Key informants indicate that this is often the case when herders arrive in northern Ivory Coast or Ghana from Burkina Faso or Mali, along transhumant routes between western Mali, Mauritania and Senegal, or between Niger, Nigeria, and Benin. This type of conflict may provoke an international confrontation as in the case of the Mauritanian military actions killing two Senegalese (Soninké) cultivators after a confrontation between Mauritanian Peul herders and Soninké cultivators (Park *et al*., 1993). This led to a serious international incident involving the death of hundreds. In addition, there are cases where the natural resource in question is explicitly water. Burkina Faso, through the construction of reservoirs for agricultural irrigation or dams for electric power, has effectively reduced the capacity of dams in Ivory Coast and Ghana (key informant).

Lo *et al*. (1996) note the importance of distinguishing between conflicts which are horizontal and those which are vertical in orientation. Throughout the region conflicts are arising not only between cultivators and herders and among themselves and their communities (horizontal), but also between each of these and the state or specific development projects (vertical). Often the state, or a development project, is a background partner setting the stage for and reawakening latent conflicts. The privatization of the economy leading to access of forest reserves by the private sector has aggravated this trend. In Ivory Coast, former state companies have been privatized (e.g., Palm-Industrie). The local population has been able to accept that their lands are exploited by the government for the national interest, but has not been equally willing to accept individuals seeking private profit (key informants). In Senegal, despite encouraging the decentralized management of natural resources, the government has issued permits for the harvesting of

wood for charcoal production to urban-based charcoal merchants. For example, in Maka Coulibanta, the community (Wolof and Mandinke) attempted to assert their right to regulate the wood cutting trade only to have the Forestry Service negotiate the rights of exploitation over to urban merchants (Kane and Winter, 1996). In Niger, the government denied access to the local population of Toureg and Peul to the Gadabeji Reserve. In so doing, conflicts were created not only between herders grazing their animals on Reserve lands and the government, but also between herding communities as they tended to concentrate around the only remaining watering holes and private wells (Sidikou, 1995).

While the most frequently recounted (and often more violent) conflicts are between herders and farmers, there are nearly as many less notorious affairs between farmers and farmers, or herders and herders. In the Niger Delta of Mali, Cissé (1996) reports that 42 percent of conflicts are between farmers and herders and 40 percent between farmers and farmers. Conflicts were approximately equally divided between inter- and intra-village. An example of farmer-farmer conflict can be seen in the Burkina Faso village of Nébourou where conflict erupted between the original Nuni inhabitants and the in-migrant community of Mossi (Laurent and Mathieu, 1994). Nébourou is located in the land-rich, and once lowly populated, western region of Burkina Faso. With increasing soil degradation in the Mossi Plateau and worsening impacts of drought, Mossi populations began immigrating to Nuni villages, particularly after the establishment of the Agrarian Reform of 1985, which opened all Burkina lands to those who farmed them. The Nuni chief distributed lands to the incoming Mossi through their Chief (the first Mossi settler). By 1986, the population of Nébourou was 74 percent Mossi. When an NGO presented a proposal to establish a village woodlot, the community council agreed. When it came time to plant the trees, however, the Mossi wanted to plant theirs separately. This was not acceptable to the Nuni who did not wish for the Mossi to establish a claim to their land. Tree planting is considered sufficient to validate rightful "ownership" of land. Although the confrontation was diffused through informal mechanisms, tenure security was never established for either Nuni or Mossi and the latent conflict over land rights still exists.

At the heart of the perennial nature of most of these conflicts is the lack of a single accepted authority for the resolution of natural resource rights and, consequently, tenure security in the management of natural resources (Touré, 1996; Maiga and Diallo, 1996; Lo *et al*., 1996; Ngaido, 1996). For example, when local authorities and extension agents were asked to describe natural resource tenure in Senegal (Moore, 1996), they began by describing how the National Domain Law was supposed to operate. They explained that when the law was not explicitly followed it was due to lack of understanding of the texts and poor interpretation by illiterate local officials. When pressed, however, they admitted that traditional land allocation practices dominate: a household or compound head who requires additional land will turn to a neighboring household head to borrow it. If, after some years or in the next generation, conflicting claims arise, village elders or the village head may arbitrate. Only when village authorities cannot resolve a dispute does litigation proceed to the Rural Council, and perhaps the *Sous-Prefet*. Even in these cases, resolution of the problem is dependent on the specific circumstances (read political power of the litigants: see Blundo, 1996; or Laurent and Mathieu, 1994) of the case as much as on the technical requirements of the law.

Conflicts over access to natural resources and their benefits are also recorded between generations and between men and women in the same lineage. Women's tenure security is often very weak. For example, in the village of Sikore (Mali) daughters receive only a third share of their father's inheritance while sons receive two-thirds. Even with a third share it is unlikely that land will be involved. This was even taken to the extent that the village Imam attempted to take the land inheritance of a deceased man who only had a daughter and a wife to succeed him. This led to a conflict in which the whole village became involved (Maiga, 1996). The natural resource rights of pastoral women are rarely discussed (Pointer, 1995). Young men, eager to earn money through cash crop production, desire access to land for cash crops and don't like outsiders taking what they feel is their land by right. Within the Nuni community of Nébourou (Laurent and Mathieu, 1994), the young men were the most concerned about the continued distribution of lands to incoming Mossi. They felt that they were being dispossessed on behalf of people outside of the family.

VI Summary and Conclusions

As West African civil society re-emerges after the long and painful colonial period, a far-reaching restructuring is going forward. The wide-range of customary rules and practices that had governed NRM at multiple societal levels has been challenged in recent years by state intervention. A rapidly rising population and periodic, severe drought have complicated restructuring by putting even greater pressure on the fragile natural resource base of the region. This pressure has led to increased NRM-focused conflict involving stakeholders at local, district, national, and regional levels.

Within this context, evidence presented above indicates that:

- the landscape of the Sahel is changing, profoundly affecting both farmers and herders. Isohyets are moving south, at least over short or medium term, and if current trends continue there will be a continuation of climate/weather-related pressure in the region. Weather-related changes have combined with other stresses to reduce the productivity of natural resources and food security in the region.
- the lifescape in the Sahel is changing. Cropping and livestock production systems have combined with the mosaic of different cultures and land tenure systems to contribute to accelerated natural resource degradation and conflict. In particular, the requirement for more food production has accelerated the loss of soil fertility and limited herder access to pasture, crop residue, and water.
- in transition zones (semi-arid and irrigated arid zones) where both agricultural and pastoral systems are possible, population pressure is driving the evolution toward new integrated (mixed) sedentary systems. Traditional extensive systems are giving way to more intensive systems. Nevertheless, where transhumance is still a viable and important economic and social institution, integration is not desirable because these exclusively sedentary systems would necessarily leave underutilized the vast areas available for wet season grazing.
- the expansion of cultivation into marginal lands and near water points has reduced herder access to both land and water and serve as an important flash point for conflict.
- current development assistance strategies are shaped by three major factors: (1) the significant secular trend toward decentralized administration; (2) locally empowered associations taking the lead in NRM and, consequently, conflict resolution; (3) and recognition that savanna grasslands are much more resilient than once thought.
- national and macro economic policies have in the past contributed to the food insecurity of the poorest strata of society. Current policy trends, although generally positive, may also serve to exacerbate the food insecurity of these same strata.

Our purpose in the next section is to present a general conceptual framework for addressing priority natural resource management problems in this conflict-ridden context. A general NRM cycle will be presented first followed by the conflict cycle and its relationship to the NRM cycle. Finally, a general SANREM intervention strategy will be proposed.

6.1 The NRM Cycle

Natural resource management has always occurred within the broad framework established and maintained by civil society. Civil society refers to the interacting social, cultural and economic institutions and the rules that guide them within a defined region. Civil society is therefore largely equivalent to SANREM's concept of the lifescape. It includes the mix of social organizations, ethnic groups, extended families, gender, NGOs, as well as the endogenous pressures that drive behavior such as markets, norms and values, history and tradition, and population pressures. It is exclusive of government.

Civil society exists at multiple levels or scales with different types of social units or key actors at each level. In Figure 2, civil society is presented at a generic scale, more appropriate conceptually for analysis at a national level, but also relevant, at least at a metaphoric level, for smaller scales (district, village, household).

The focus of interest is on one component of civil society — the **West African natural resource user groups**. Specifically, the agricultural, pastoral, and agro-pastoral groups existing along the agricultural/pastoral continuum in West Africa. This continuum exhibits "pure" farmers at one end and

"pure" nomads at the other extreme. For the many reasons noted above, the vast majority of user groups mix both agriculture and pastoral elements into their household/production systems and form the center of this continuum.

The natural resource user groups are subject to the *incentives* generated and maintained by civil society. These incentives may be positive (e.g., market price signals) or negative (e.g., cultural prohibitions, constraints, etc) and largely determine what is expected of these groups and how they may act with regard to natural resource obligations and rights.

The landscape in this general model is composed of the **natural resource base** and is acted upon by the resource user groups. As discussed above, the natural resource base in the Sahel is extremely constraining; the climate is hot and dry, with low erratic rainfall. Soil resources are poor and becoming poorer while forest resources are also in severe decline.

The natural resource management strategies used by the resource user groups (both pastoral and agricultural) include *short-term production strategies* and *long-term investment strategies* that impact directly upon the natural resource base. Strategies result from users' interpretations of the incentives filtered through civil society as well as the perceived risk and uncertainty associated with their assessments of potential gains and losses.

The flexibility inherent in the availability of alternative strategies is the most important element of sustainability for these Sahelian NRM systems. Historically, agricultural and pastoral systems in the region have been sustainable because they have been opportunistic, with flexible strategies to make the best of almost constantly changing circumstances. Conditions that limit the number and flexibility of these alternatives reduce the long-term sustainability of the systems. A major role for research is to provide for more and better (more efficient/bio-physically sustainable/socially legitimate) alternatives and NRM strategies.

Food and fiber production result from the interaction of production strategies and the natural limitations imposed by the resource base. Given the extreme poverty of most members of all user groups, short-term **food security** is of primary importance. The environmental consequences of the short and long-term strategies interacting with the natural resource base are manifested in the long-term, either maintaining, reducing, or increasing production and food security over time.

The results of the production cycle, both short and long-term, serve to *transform or reproduce* civil society. Socioeconomic linkages throughout each level and beyond multiply the success or failure of the production cycle. Consequently, regional economic multipliers are important indicators of potential transformation and development. The agriculture and livestock sectors are by far the largest in the Sahelian economy and must act as engines of growth and development for the rest, creating jobs and providing savings and investment for future growth.

The **government** intervenes directly in civil society at multiple levels. Restructuring efforts are being led by decentralization (and democratization) initiatives in most countries of the region. Decentralization attempts to empower local populations to make NRM decisions and establish government/civil society dialog over land tenure security. Effective decentralization is seen as a precondition for efficient NRM in West Africa. However, decentralization policies have practical limits. Central governments cannot effectively decentralize authorities and responsibilities beyond the province or district level. These units have the responsibility to find the modalities and means for involving the lower levels in meaningful and participatory dialog. Other crucial governmental policies affecting NRM include macro (fiscal, monetary), social, foreign, research/development, drought relief policies and early warning systems.

International organizations (e.g., IMF, UN, WB, USAID, NGOs, CILSS) play increasingly important roles in NRM. International organizations impact directly on government by attempting to affect domestic policy. They may also impact directly on elements of civil society through their international memberships and their direct contributions to food security through emergency relief and pastoralist re-stocking programs.

International markets increasingly determine the policy parameters in which governments can act. They provide signals that are among the most important economic driving forces in civil society, providing incentives for innovation and also causing major disruptions. Market movements can change virtually overnight the terms of trade affecting food security.

Consideration of **drought** completes the description of the NRM cycle. Drought has obvious implications for short-term strategies and also affects the timing of long-term strategies. By limiting alternatives, drought reduces the flexibility and sustainability of the systems. If it is true that climate change is occurring, drought cycles will become more severe and longer lasting. Climate change, unlike drought, induces "permanent" changes in the natural resource base.

This general NRM cycle is the same for each resource user group, although strategies are different and scientific knowledge of short and long-term impacts (production, environmental, food security) is more limited for some users than others. Until recently, scientific work on sedentary farming systems has been more common than work on pastoral systems. Understanding of the interactions between and integration within systems remains problematic.

6.2 The Conflict Cycle

The NRM cycle doesn't include conflict as an explicit component although a bridge to the conflict cycle is always present. The *bridge* between the NRM cycle and the conflict cycle comes from food security (Figure 3). As a Collaborative Research Support Program (CRSP), SANREM's comparative advantage lies doing NRM research leading to greater food security for natural resource user groups. Food insecurity and, at its most fundamental level — poverty — has been implicated throughout the literature as a proximate cause of conflict in the region. It may also be a *contributing factor*, exacerbating other social cleavages found within civil society (e.g., ethnic, religious, class, caste).

Population increases, misguided policy, drought/climate change, etc. are all primary factors leading to increasing poverty and food insecurity. The conflicts of interest to SANREM occur over natural resources (water, farming land, pasture land, etc.) and always involve some issue about *control or access* that hampers food security access and/or entitlements. **Conflicts**, per se, are not bad. Rather, they are viewed as necessary if societies are to evolve and develop. However, when conflict is poorly managed, it can lead to degradation of the environment, violent confrontations, and war.

The NRM-related conflicts between farmers and herders have occurred for centuries in the region and management strategies have evolved to meet these challenges. Traditional group leaders have played major roles in this management. This system has broken down now with the juxtaposition of the "modern" or "western" tenure regimes with traditional regimes. As a result, the *conflict management strategies* are not effective and may themselves be responsible for imposing additional constraints on the user groups and their production management strategies — further reducing alternatives, flexibility, and sustainability.

However conflict is managed, the results of this management *reproduce* or help to *transform* civil society, reducing or exacerbating other causes. This, in turn, helps to "ratchet-up or ratchet-down" the severity of further conflict cycles.

6.3 Scales, NRM and Conflict

The '*Scaling Problem'* becomes an important issue when dealing with the conflict cycle. A related scaling problem involves the natural resources themselves. Specifically, externalities stemming from NRM actions at one scale may spill over and affect NRM at other scales (e.g., use of chemical fertilizers and pesticides may pollute wells and streams and reduce biodiversity affecting larger areas). These effects may also lead to increased food insecurity and conflict.

For the conflict cycle, scaling involves the transmission of conflict from one scale (e.g., household) to another (e.g., village). All NRM-related conflicts are local in the first instance, beginning between individual producers over livestock or land. The distinct units (individuals, households, villages, etc), however, are variously attached to social units above and below it through ethnic group ties, producers organizations, brotherhoods, political parties, and so forth. These social organizations provide the "hard wired" conduits for articulating conflict and other information. Conflict at lower levels, if it resonates with or reinforces antagonistic dichotomies at higher levels, may escalate (and vise versa). Understanding the dynamics and information flows between and among these levels will help understand how conflict scaling occurs.

Such scaling dynamics are represented in Figure 4. Within civil society one may identify different levels or scales with distinct social units. At its most fundamental level, these social units include the membership of the social unit immediately below it (e.g., the district scale includes the villages; the village includes user groups composed of the households; the households include the plot/animal units, etc). Each scale has different information needs and generates data needed by the levels next to it. This data/information dependency provides one mechanism for scaling between levels.

The NRM actors at the **individual plot/animal level** need technical information and technical alternatives to support short-run production decisions — preferably as early in the production cycle as possible. This most fundamental level operates within the most restricted timeframe and consequently has the fewest alternatives and exhibits the least flexibility. Most NRM variables are pre-determined at this level — parameters rather than variables: access/control has been defined or at least, assumed; general production decisions have been made (what, how, when). Success or failure, perhaps due to conflict at this level, is of immediate concern to the family.

The **family** needs information on alternative management strategies, especially as it is affected by risk and uncertainty. This may involve conflict and access to resources. The timeframe and potential number of alternatives are larger because the resource base (landscape/lifescape) is larger. This is the first level where inter-family conflicts may be managed. Seasonality, gender, and inter-generational concerns become important as factors to take into consideration in determining intra-household resource allocations (e.g. men may be sent to the city to seek work during the dry season). Short-term market signals may become another factor affecting intra-household resource allocations. Information at this family level (i.e., success meaning production of surplus, or failure meaning a food deficit) is of immediate concern for the village.

The **village** needs information supporting effective governance, especially as it may impact on production management strategies and intra and inter-community group conflicts (e.g., the management of common property resources, user groups - associations, producer organizations, intra-generation, migratory groups, etc.). For this reason, community-based NRM approaches can be effectively used at this level as conflict resolution fora. Because of its larger landscape/lifescape, the village must deal with longer-term problems. Its relevant planning horizon is longer and growth and development alternatives, particularly as they relate to social and economic infrastructure, also become important. The information/data scaling relationship is again present: success (surplus and growth) and failure (deficit and deterioration of the natural resource base, intra/inter-community conflicts) are of immediate concern to the district.

The **district** (if government is decentralized) is the first level where government resources and policies articulate with and impact directly on civil society. As such, it is the first level where citizens can democratically elect leaders and petition government for policy changes and relief. The district needs information on the long and short-term effects of these policies, particularly as they impact on NRM and conflict among the diverse groups of people within its borders. Because it aggregates a wide range of smaller landscape/lifescapes and has more resources and alternatives, it also the first level that can effectively act on information about the future (e.g., weather forecasts, economic growth and market projections, environmental degradation projections, future conflict flash points). It can use this information to make effective short and long-term resource allocation decisions that mitigate disasters and maximize

potential positive impacts. The results of these decentralized, district-level experiments are of immediate concern to the national government.

The **national government** possesses the resources and policy-making authority that allows it to consolidate and spatially allocate resources across several districts as well as through time. This scaling effect obliges it to become the most forward-looking level. As such, it needs information on long-term trends (e.g., climate change, demographics, economic growth, emerging problems leading to national and international conflict, other international trends) as well as the more immediate impacts of its policies on the population. Results of this level are of immediate concern to the regional level.

The **regional level** and beyond needs information on success stories and lessons learned in order to facilitate the cross-border flow of data, information, and knowledge. The region generally lacks the authority to act in other than an informational or advisory role. Nevertheless, this level provides a necessary formal forum for analysis and capacity development as well as a storehouse for data and the interchange of information and knowledge.

6.4 Implications for the SANREM CRSP: General Intervention Strategy

Given the complexity inherent in working on NRM and conflict in West Africa, it is apparent that SANREM must intervene to some extent at all scales in order to achieve a measure of success and impact. The most appropriate level for SANREM intervention in the first instance seems to be at lowest level of direct government impact on civil society (the district, province or *cercle* level). Because government becomes more remote as the scale becomes smaller, working with or through government on NRM and conflict management becomes more problematic at lower levels. Clearly to work effectively in such sensitive areas, SANREM must have at least the implicit interest and support of government. For this to occur, SANREM must be seen as supporting governmental decentralization policy and reinforcing capacity at the lowest decentralized level. The government resources and authority present at this level may also improve the chances for long-term sustainability of SANREM interventions. As a result, the proposed initial intervention zone is at the *cercle* level in Northern Mali (Niger delta region) where herder/farmer conflicts have increased in recent years.

Although the initial zone of intervention will be the district (*cercle*) level, SANREM will work with collaborators/stakeholders at the other levels to provide the data and information scaled to their needs on a sustainable basis. That is, although we will intervene at the district level (meaning we will seek district-level support and participation) for coordinating NRM and conflict-related work, site(s) will be at the local (representative) village level including their interacting pastoral communities. NRM technical interventions and information will be directed at the village and lower levels. Both through the involvement of regional authorities, NGOs, and national researchers in our work and through established formal communications channels, we will scale-up to provide district and national governments and regional entities with policy-related information. Our network for regional analysis, communication, and impact is through CILSS (INSAH) and the newly-formed Sahelien NRM Research Pole composed of NRM research representatives from each of the nine CILSS countries. International fora and the SANREM Global program are our networks to audiences and stakeholders beyond.

6.5 Initial Program Directions — the PLLA

The focus will be on community-based natural resource and conflict management with the community defined at the district (*cercle*) level. With reference to Figure 5, our initial point of intervention will be the conflict itself and the initial tool will be a participatory landscape/lifescape appraisal (PLLA) targeted on conflict resolution and herder/farmer NRM strategies and interactions. The PLLA will:

1 seek to understand the resource access/control problem and its connection with food security and poverty of the conflicting groups. The primary information users are the village and district levels.

2.investigate current conflict management strategies in order to find improved strategies within the limits imposed by government and traditional constraints. (Primary information users: village, district, national, regional levels).

3. identify priority NRM strategies and their inter-relationships with drought and conflict that need to be investigated. These technical interventions will be a major thrust of the program in the future and the PLLA will identify areas where future SANREM RFPs will be issued. One such research program is already underway. (Primary information users: village, households, and individuals.)

4.assess the possibility and means of using remotely-sensed information to inform district-level authorities and above of future weather patterns. This effort will be tied to the Global efforts in this area. (Primary information users: district, national, regional.)

5.seek to understand the incentive structure for the user groups and how research may identify policies that can change this structure and lead to more satisfactory ends. (Primary information users: district, national, regional.)

6.form the foundation for the principal monitoring and modeling activities of the program. To understand the economic linkages and potential for economic and social growth among the different sectors, the PLLA will lay the groundwork for the development of the SAM/PAM models. The ultimate SAM and PAM structures will be informed from the results of the PLLA. (Primary information users: district, national, regional.)

7.Because we seek an understanding of sustainability on the biophysical side as well as the socioeconomic, the PLLA will lay the groundwork for the development of biophysical modeling tools to monitor the short and long-term consequences of our technical interventions. Linkages to socioeconomic models will also be assessed. (Primary information users: village, district, national, regional.) To facilitate scaling up and down and leveraging resources, the PLLA will seek to finalize SANREM collaboration and data/analysis sharing strategies among researchers at the various levels.

The PLLA is scheduled to begin in January 1999. Results of the PLLA will be presented to regional partners at the Regional SANREM Workshop scheduled for April 1999 where additional input from regional collaborators will be sought.