Chapter 4

Opportunities and Challenges for Sustainable Agricultural Land Management in Kenya

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4.1 Background

Despite technological advances in land management (i.e. use, care and improvement) across the world, land degradation not only persists, but also continues to escalate, thus threatening the livelihood of many agriculturally dependent communities. Projections of world food situation into 2020 for instance singles out potential scarcity of maize - an important cereal in Kenya, whose demand will have to be met by a 40% increase in grain production, however on a steadily deteriorating land resource (Pinstrup-Andersen et al., 1999). Estimates from the Global Assessment of Soil Degradation (GLASOD) indicate that degradation of crop land and pasture land is most extensive in Africa, affecting 65% and 31% of the two systems respectively (Scherr and Yadav, 1996). In Kenya, 73% of land degradation is attributed to overgrazing and arable agriculture, while conversion of arid and semi-arid lands to other uses accounts for some 14% of land degradation (Mutiso, 1991). With increasing population pressure, only little evidence exists to indicate that this condition may after all not be disadvantageous as conventionally understood (Tiffen et al., 1994).

In the past, soil erosion and subsequent fertility decline, diminution of agricultural productivity and decline in environmental quality were normally attributed to the effect of natural phenomena like climate. Emphasis on the attainment of optimum resource management and productivity was thus put on biophysical factors, which however was met with little success as earlier mentioned. This indicated that other factors hitherto ignored were equally critical. Therefore, since the 1980s, there has been growing recognition that persistent land degradation results from the failures on the part of conventional research, policy and development approaches to recognise the importance of the participation of the land users and the total human dimension at all levels of decision making in resource management. Further, programmes with spontaneous support of the target group stood a better chance of success, especially when such interventions were accompanied with tangible short-term benefits (FAO, 1995; Mcclelland, 1998; Steiner, 1998). However, a considerable gap still exists between conceptual acceptance and real implementation on the ground. Widespread failure on the part of the target groups to adopt what would be appropriate technologies

(Fujisaka, 1994, Ashby et al., 1996; Thomas, 1996) and tendencies of "experts" to address symptoms rather than root causes and hence persistence of land degradation in many tropical agro-ecosystems attests to this.

4.2 Conceptualising Sustainable Land Management

In this chapter sustainable land management (SLM) refers to the use, care and improvement of the land resource in a way that guarantees intra and inter-generation equity with respect to access to land and its products and services. As such this would entail a system of technologies and planning that aims at integrating ecological with socio-economic and political principles in the management of land for agriculture and other purposes. As an example, SLM is distinguished from conventional soil and water conservation as shown in table 4.1. However, in dealing with tropical rural agro-ecosystems, where food insecurity, poverty and land degradation are closely inter-related, the starting point towards sustainable land management would be deliberate efforts towards self-sufficiency in household food requirements. This requires concerted efforts to keep the land resource as productive as possible within tolerable levels of degradation.

Table 4.1 From soil conservation to sustainable land management

Soil and Water Conservation (SWC)	Sustainable Land Management (SLM)
Emphasis is on soil loss and curative measures and off-site impacts of erosion	Emphasis is on soil loss, fertility and moisture conservation, and on preventive measures, on-site & off site impacts
Emphasis is on structural remedies	Integrated approaches with emphasis on agronomic, vegetative and land user management.
Land users as 'ignorant' and agents of degradation.	Indigenous knowledge and farmer innovations as important requirements
'Experts' to plan and impose on a top-down approach	Interdisciplinary teams in partnership with land users as equal participants at all levels of decision making
Legislation and coercion dominant, when incentives & rewards fail.	Voluntary contributions on the basis of accountability is essential. Enforcement used as a last resort.
Emphasis on private property rights as a prerequisite for conservation.	Beyond titling and security of tenure for conservation
Monitoring and assessment of physical achievements.	Assessment of adoption rates of appropriate technologies
External support dependent.	Mobilisation of community resources for own development
Women marginalisation	Gender sensitivity

Modified from Critchley (1998)

The focus is deliberate reduction in land quality improvement costs by preventing all potential forms of degradation. Thus, reclamation and or rehabilitation of degraded land are undertaken as an inevitable last resorts. Accordingly, SLM is locality and land use specific, and would rely largely on specific management options introduced by land users for its success. The next section of this chapter address common threats to sustainable land management within the Kenyan context.

4.3 Forms of Land Degradation

Three forms of land degradation are generally distinguished: physical, biological and chemical, and none occurs alone. They are all complementary processes, which necessitates integrated approaches in their management. The most critical form in agro-ecosystems of resource-poor African farmers is erosion damage, which is a form of physical land degradation that results in the reduction in the capability of the land to produce benefits from a particular land use under a specific form of land management (Douglas, 1994). Further, the process is insidious and characterised by loss of biological diversity and productivity (SIDA, 1993).

Although natural factors such as the physical environment and climate determine the forms and severity of land degradation, catalysis and persistence of the problem is clearly driven by the unending human perturbations in the land system in pursuit of survival. As such, the core of land degradation problem is economic (Christiansson et al., 1993 and Barbier, 1997). With increasing population pressure in the already fragile semi-arid environments, where inadequate and unreliable rainfall and soil fertility problems limit agricultural productivity, the risk of chronic land degradation is bound to increase and contribute to the entrenchment of rural poverty in Kenya. Therefore attuning human needs, particularly economic needs to environmental management would be a critical step towards sustainable land management.

Table 4.2. Percentage relative importance of land quality indicators in Ndome and Ghazi, Taita Taveta, Kenya

Indicator	Ndome	Mngalenyi	Majengo	Mbulia
Decline in crop yield	85	67	63	70
Presence of big gullies	61	77	73	68
Land compaction	-	-	-	60
Massive sand deposits	32	-	40	54
Bareness and denuded ground	21	60	19	45
Diminishing tree density	22	40	32	43
Emergence of new weeds	22	-	20	26
N	129	30	30	30

Source: Waswa (2000)

Another problem area in degradation management is the land quality factor. Waswa (2000) observed that farmers appreciated only land quality indicators that were visible to the naked eye and had direct effects on their subsistence (Table 4.2). For instance, appreciation of erosion damage based on existence of big gullies (difficult to jump over) was often realised rather too late and subsequent interventions could not compensate for the damage that would already have been caused by rill and inter-rill erosion, which tend to proceed unnoticed.

A rather unexpected observation in Ndome and Ghazi was farmers' perception of gully control as not being a part of soil conservation. To them soil conservation was relevant only where the degraded land could be brought back to economic use, and within their financial capabilities. This may explain why gully control and use of structural soil conservation measures are generally low in these areas and also countrywide. Gullies thus signify a state of permanent land loss that is automatically followed by land abandonment for new areas and thus spread of erosion damage. The missing knowledge gap is thus failure of farmers to link gully erosion to rill and inter-rill erosion and destruction of ground cover, which remain the main precursors.

Emphasising the insidious nature of the degradation process derives its importance on its ability to delay timely interventions, which normally result in excessive fertility losses and environmental damage. Common symptoms of physical land degradation are captured in Plates 4.1-4.4 and include:

- Rills and gullies, which indicate irreversible loss of top productive soil,
- Exposed tree roots, rock pedestals, stone pavements, and exposed sub-soil horizons,
- Mass movement such as land slides, which though rare could cause severe ecological and economic consequences particularly in high potential zones.
- Laterisation (desiccation and hardening of the plinthitic material on exposure), surface soil sealing, crusting, and sub-soil compaction which reduce infiltration and increases the erosion risk through increased surface runoff,
- River bank erosion and sedimentation of farms adjacent to the flood plains,
- Profile tunnelling, which may lead to gully development on collapse of the soil ceiling,
- Sedimentation of water reservoirs and bottom lands, and
- Vegetative degradation[14]

Rill and inter-rill erosion for instance is a major threat to land productivity in cultivable areas of Kenya (Kilewe and Thomas, 1992). For instance Kilewe (1987)

[14] As a form of vegetative degradation, deforestation has reduced Kenya's forest cover to around 1.2% of the land total area. This is much below the acceptable international standard of 10%. Much needs to be done to correct this trend.

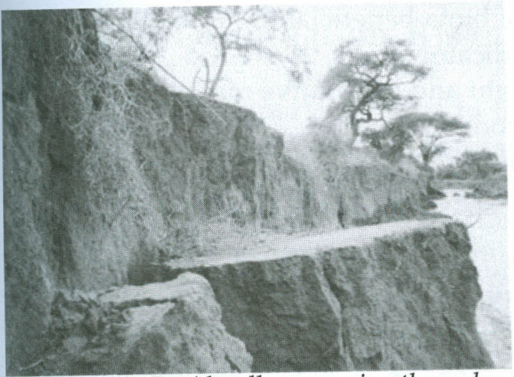

Plate 4.1. *Rapid gully expansion through slumping in Ghazi, Taita Taveta, 1998.*

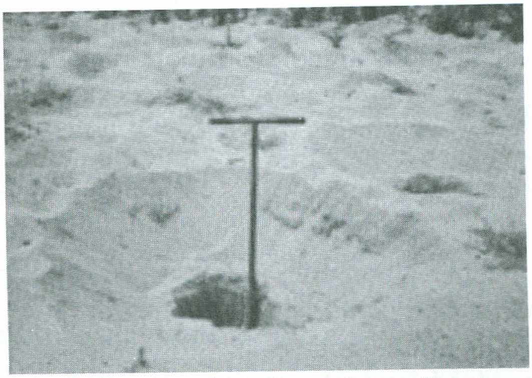

Plate 4.2. *Land loss by sand deposition in Mbulia, Taita Taveta, 1998.*

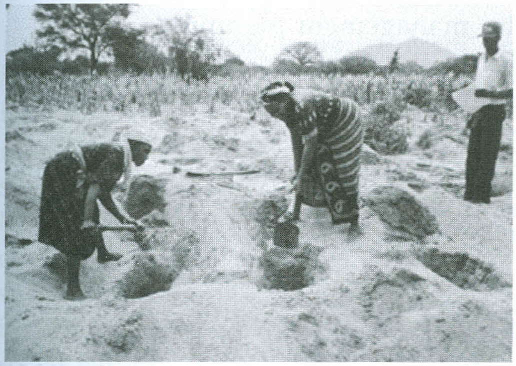

Plate 4.3. *"Sand planting" in Mbulia, Taita Taveta, 1998: (farmers must dig approx. 60 cm deep to original top soil)*

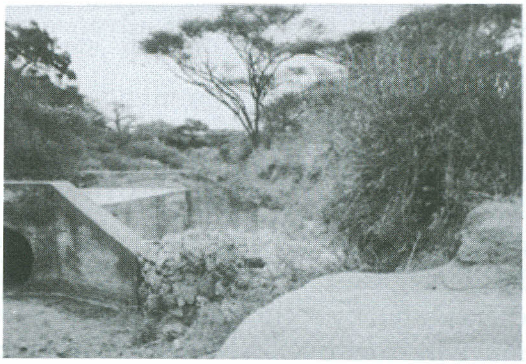

Plate 4.4. *Bridge destroyed by peak floods in Mngalenyi in Taita Taveta, 1998*

showed that a loss of 12 cm or more of topsoil resulted in a partial or total loss of the soil as a resource, and any attempts to restore productivity was uneconomic. A popular saying in Kenya equates annual soil loss per acre to one lorry load, which corresponds to about 20 tons. As such preventive measures are better than curative options especially where land users are poor and still struggling to meet basic livelihood needs. Of equal concern in soil management in the tropics is loss of soil organic matter and the implications on soil productivity (Martius et al., 2001).

Another concept that is closely related to land degradation is desertification. Current conceptualisation no longer views desertification as extending deserts. In defining desertification, Katyal and Vlek (2000) suggested that reference should be made to:

- Human action as the causative element
- Land degradation as the driving process

- Decline in economic productivity of biota beneficial to human beings and their animals support system as indicator
- Climatic variability especially drought and restorative management as the modifiers of the loss in potential productivity
- Arid, semi-arid and sub-humid environments as areas of prime concern for global initiatives.

As such desertification is a condition of human-induced land degradation that occurs in arid, semi-arid and dry sub-humid regions (P/ET of 0.05-0.65) and leads to a persistent decline in economic productivity (>15% of the potential) of useful biota related to a land use or a production system. Climatic variations intensify the decline, while restorative management moderates it. With more than 70% of Kenya's land area being arid and semi-arid, desertification remains a serious threat that begs for advance counter management planning.

That desertification commences when vegetative cover in affected areas is destroyed, is indicative of the critical role human management can play in desertification control programmes, an approach also recognized by the United Nations Convention to Combat Desertification (UNEP, 1997). Arid and semi-arid land areas are particularly susceptible to desertification due to their inherently low biological-productivity, and hence low carrying capacities. This threat is further exacerbated by recurrent droughts and increasing human pressure as populations move in from over crowded medium and high potential zones.

Because of the tendency to first make use of the best land, ASAL development in Kenya was neglected for a great part of the colonial period, a trend that continued well into post independence Kenya. Preference for agricultural development (production of high value cash crops) was given to the high potential areas, which were perceived as zones of the greatest opportunity. ASAL areas were hitherto ignored or neglected under the notion of climatic and economic constraints and political insignificance. Under such conditions, the first tendency of extreme ecologists would be to protect the ASAL from any human activity. The impracticality of such measures however, point to the need to develop environmentally sound methods of ASAL utilization. Of necessity would be deliberate efforts to tap the vast knowledge not found in books but which is part of the living traditions of the communities who have survived in these delicate environments for a long time. The challenge however remains whether the "first will be willing to put the last first" (Chambers, 1983), and partner with them towards realization of sustainable livelihoods, in line with the outcomes of Agenda 21, the 2002 world summit on sustainable development and now the millennium development goal agenda.

4.4 Land Degradation Risks and Hazards

The single most important threat to the stability, resilience and productivity of the land resource is population pressure. The importance of people is perhaps best depicted in the pressure-state-response framework (PSRF) of Dumanski and Pieri (1997). More pressure will continue to build on the increasingly scarce land, commensurate with the activities and demands of growing human population. Agriculturally oriented pressures will dominate the rural areas while industrial and urbanisation pressures will dominate the urban and peri-urban areas. The state of the ecosystem in response to such pressure normally triggers various human responses, which could have either positive or negative consequences to the entire ecosystem (Figure 4.1).

In agro-ecosystems, expansionism (into forests, wetlands, arid and semi-arid lands, and other protected areas) tends to be the immediate response to increased land pressure, where land is still thought to be plenty. Where this is not possible intensification becomes the next possible land use, with, various intensification systems evolving to annul the pressure. Where this is not possible, other measures like off-farm engagements or alternative land uses may be adopted, with different effects. Severe degradation for instance could occur depending on several factors such as limitations on land suitability, inappropriateness of technologies in place, inappropriate land use policies and laws, as well as the quality of human and social capital.

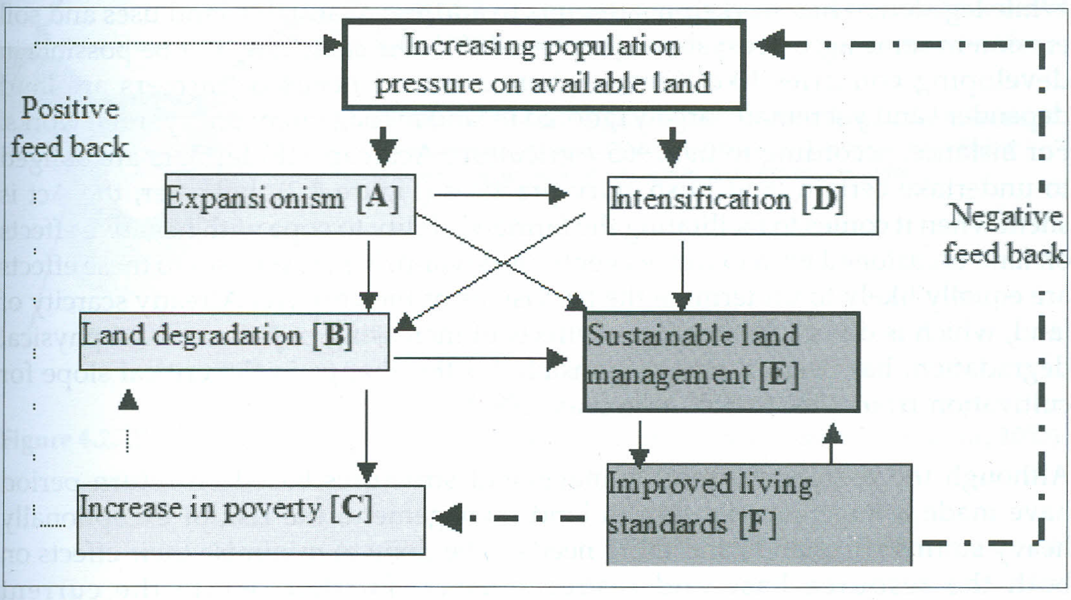

Figure 4.1. Relationship between population pressure and sustainable land management

The most typical scenario in many tropical land use systems are pathway DBC ABC and ADBC. All these human responses are largely determined by existin socio-economic and institutional factors such as demographic policies, land rights culture and religion, economic policies, and politics and governance whose comprehension is necessary for relevant policy interventions. Only then can land use systems shift towards sustainability (i.e. such as pathways ABE; AE, ADE DE). Attainment of sustainable land management (SLM) has potential to bring about improved living standards, which could reverse effects of population pressure and poverty through negative feed back mechanisms.

Other hitherto ignored threats to the stability and productivity of the land resource are sudden extreme rainfall events that have been observed to cause extensive and often permanent damages with far reaching socio-economic and ecological implications. Extreme events such as abnormally heavy rainfall, earthquakes or volcanic eruptions are critical because their effects are normally outside the capacity of ordinary resource-poor land users to absorb. Where such events have occurred like was the case of the *El Nino* rains in Kenya in late 1990s, land users have permanently lost their land resources at rates that normal erosion damage would take a long time to effect. Lack of comprehensive government policies on environmental monitoring, recovery, and compensation of affected land users often result into deep poverty levels and spread of degradation when such people are forced to "colonise" new sites in pursuit of survival often in total disregard of existing environmental policies and legislation. Steep lands, wetlands and protected areas are particularly at risk in Kenya.

While legislation has worked in attempts to address unsuitable land uses and soil erosion in some agro-ecosystems (Looney, 1991), the same may not be possible in developing countries like Kenya, where survival needs of farmers are land dependent and yet remain largely ignored in land management policy frameworks. For instance, according to the 1965 Agriculture Act (cap 318) farmers are obliged to undertake certain land husbandry practices (Figure 4.2), however, the Act is silent when it comes to facilitating the farmers' ability to cope with negative effects on land occasioned with extreme events. Survival-driven responses to these effects are equally likely to undermine the provisions of the very Act Already scarcity of land, which is due to the combined effects of increasing population and physical degradation, has been in part responsible for the change in the critical slope for cultivation from 35% to 55% (Thomas, 1996).

Although the design of runoff management structures based on return period have made a huge contribution in land management, the risk of exceptionally heavy storms still stands and more needs to be done to minimise their effects on both the resource base and resource users. Further, while the current Environmental Management and Coordination Act, 1999 (Republic of Kenya, 2000), addresses issues like environmental restoration and easement orders, the law is silent when it comes to addressing land damages and human responses resulting from extreme natural events.

Although extreme rainfall events are rare, their damages have extensive and lasting implications on livelihoods. Coping with such damages is normally beyond the capacity of individual resource-poor farmers. As such government's direct involvement is critical and inevitable. This can be actualised through the establishment and implementation of a national environmental recovery, stabilisation and rehabilitation fund, to cushion the farmers at least in the short and medium term.

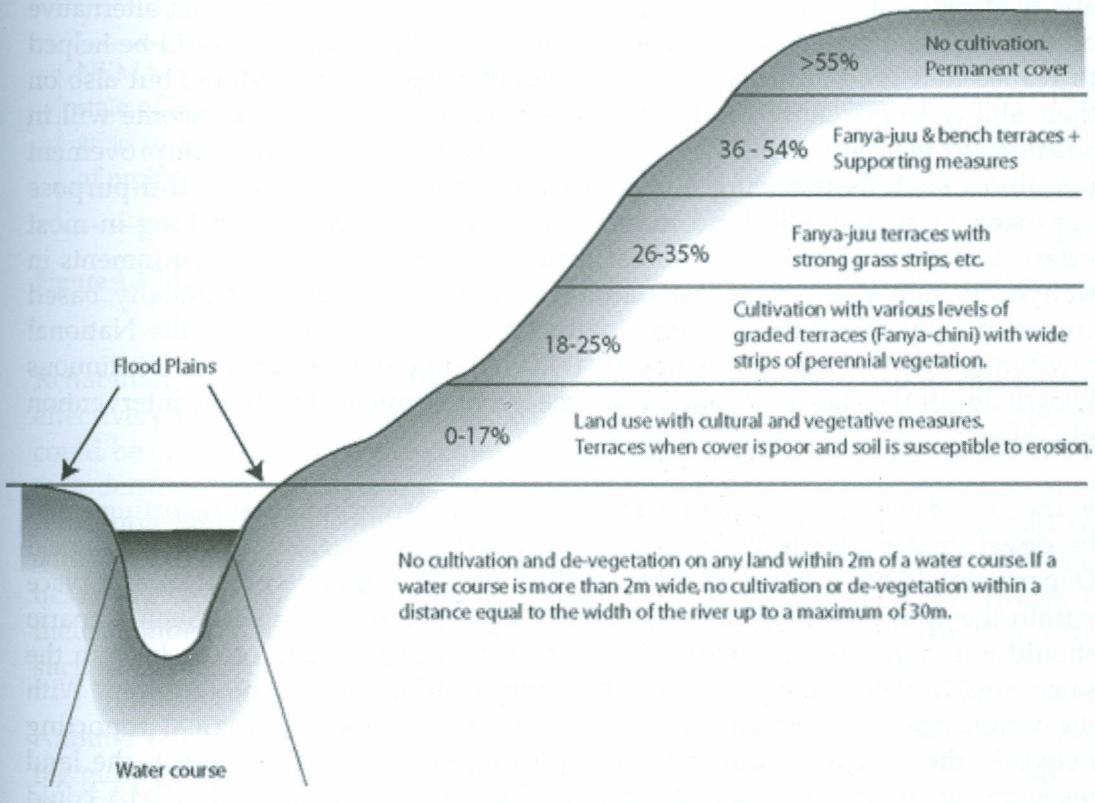

Figure 4.2. Illustrated soil and water conservation Act of Kenya (Waswa and Oduor, 2003)

4.5 Critical Lessons for the Way Forward

It is important to close existing knowledge gaps within land users through strategic awareness and education campaigns. Farmers' participation at all levels of decision-making about land resource utilization is inevitable as it accords them the recognition they need as equal partners in problem identification and the design of workable solutions. Spontaneous farmers' co-operation and participation is enhanced when interventions are accompanied with tangible short-term benefits and upon taking their multiple needs, with food security as priority, into account. Such a scenario would no doubt be the greatest mark of sustainability, when land users take responsibility of their own resources and livelihoods.

To lessen pressure on available land, while at the same time enhancing farmers' ability to cope with adverse conditions in the semi-arid agro-ecosystems, alternative off-farm income generation sources should be sought. Farmers should be helped to realise that food security is not dependent on production alone, but also on their ability to purchase food. Access to increasing amounts of income will in addition to meeting pressing needs find its way back into land improvement initiatives such as terracing and irrigation technology. Such a multi-purpose approach to sustainable land management is what has been lacking in most external driven initiatives to combat land degradation in rural environments in Kenya. So that environmental damages do not go unnoticed, locally based environmental monitoring centres, with appropriate networks to the National Environmental Management Authority (NEMA) should be established. Continuous knowledge of the state of the land resource is a prerequisite for timely intervention planning.

In the case of extreme events, rapid mechanisms of environmental reporting could be developed patterned on rainfall reporting by the Kenya Meteorological Department (KMD). Extreme (abnormally heavy) rainfall received in any place within the country is indicative of potentially high erosion risks. Such scenario should automatically be followed by assessment of the state of the land in the same area to determine whether urgent interventions would be required. With the whole country almost already covered by the meteorological reporting network, the cost of a countrywide reporting system on the state of the land resource can be minimised if the meteorological department and NEMA could find a way of networking as suggested in figure 4.3.

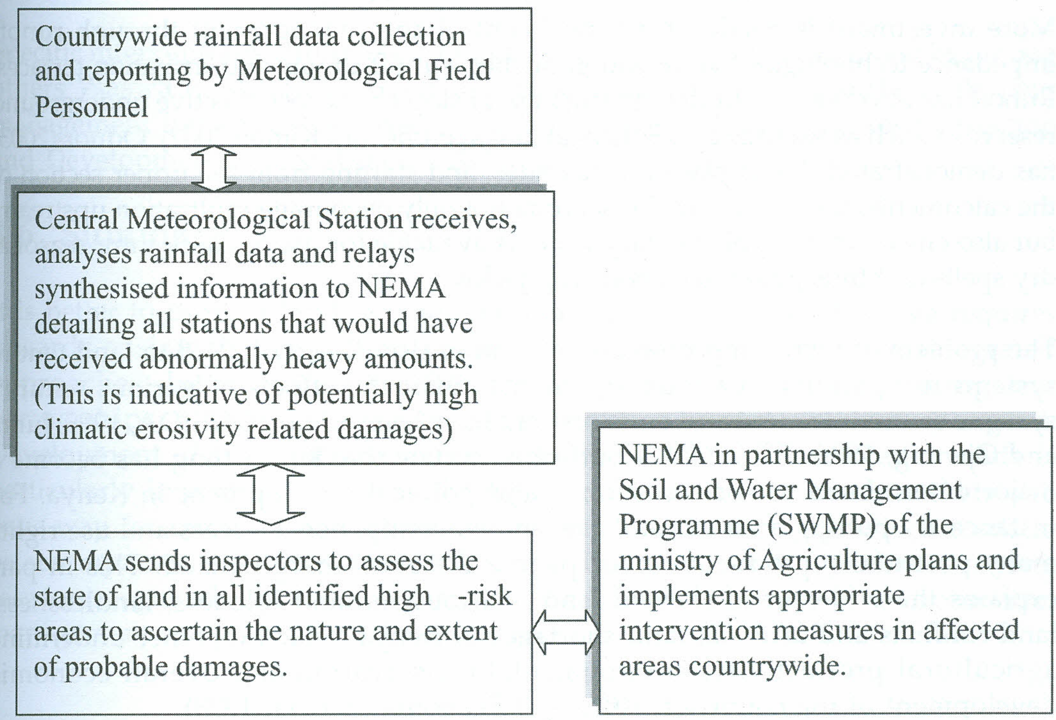

Figure 4.3. Meteorological Department-NEMA Network Model (Waswa and Oduor, 2003)

Rehabilitation policy could be invoked where the land in question can be cost effectively reclaimed with active participation of farmers. The easement policy could be enforced where the population pressure on the damaged land is likely to undermine land reclamation and rehabilitation efforts. In some cases population relocation may be the only ecologically sound policy. Availability of land for compensation can be guaranteed if government land tenure is enhanced. For deserving cases, such land tenure would allow relocation of affected farmers as their denuded land reverts to government land for reclamation or alternative use such as nature conservation sites.

Another key management implication is how to reclaim, restore and or stabilise big gully systems or extensive agricultural land lost to massive sand deposition. Unrecoverable gullies can be transformed into dams for water storage, or stabilised as nature conservation sites or reclaimed for farming through a technology called "dam lands". This is attained through construction of embankments using soil from the banks of the gully. The embankment is constructed in one foot compacted layers employing the principles of check dams to design and space them depending on the gradient of the gully floor (Wenner, 1981). The embankments trap silt and organic matter collected from eroded farmlands upslope. The throwback of this silt is what forms the fertile "dam lands".

More investment is needed for runoff control and management through run(impedance technologies like retention ditches, cut off drains and irrigation terrac(Runoff has also been controlled through use of stop-check cost effective undergrou reservoirs such as sausage and Spherical tanks (Hune and Kimeu 2002). Oduor (200 has demonstrated that if placed in cascades, and starting from the upper section (the catchments, the terraces and reservoirs not only encourage infiltration upstrea but also ensure that supplementary water is available for use to check intra-season dry spells and thus guarantee good crop yields.

The problem of increasing pressure on land is also directly linked to land tenur systems in operation. Various arguments about the effects of various tenure[1] systems on environment and development have been advanced (SIDA, 1993; Jum and Ojwang, 1996; GTZ, 1998;). Suffice is to state that land titling has become a major determinant of socio-economic and political development in Kenya. For instance, by putting a lot of emphasis on ownership, hence access and use rights many potentially productive poor people are often marginalized. This in part explains the widespread skewed land distribution, land idleness, landlessness, land conflicts and artificial land shortages in Kenya, which together undermine agricultural productivity, environmental conservation and overall economic development of the country (Institute of Economic Affairs, 1998).

The Zimbabwe case, where 1% of farmers own nearly 50% of available agricultural land and the bulk of the fertile land (Adams et al., 1999), is a typical current example of the long-term socio-economic and political implications of inequity in land distribution. A similar situation is true for South Africa largely due to procrastinated land reforms, while in Kenya, land ownership remains perhaps one of the oldest problems in agricultural and political development, with potential for serious socio-economic and political repercussions. The sensitivity of the Ndungu[16] report on land attests to this fact. Further, since poverty, farming and land tenure are closely related in Kenya, attainment of sustainable land management will necessitate land tenure policies that would help alleviate poverty countrywide. To this end, land tenure systems and management policies will have to be tailored towards the enhancement of four main objectives, thus:

- Deliberate efforts to preserve/save available agricultural land
- Putting as much land as possible to agricultural use
- Deliberate efforts towards equitable re-distribution of available land, and
- Effective approaches and strategies to control degradation of agricultural land in-situ.

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[15] Three main designations of land tenure are distinguished in Kenya: Government (public), Customary (communal, traditional) and Private (titling) tenure (Pander, 1995).

[16] Commission set up to look into land problems in Kenya by the NARC government and recommend the way forward

Specific interventions within these broad objectives have been discussed by among others Waswa et al, (2002), while aspects of partnerships for sustainable land management have been discussed by the International Bank for Reconstruction and Development / World Bank (2005).

4.6 Summary

It is better to prevent land degradation than to "treat" it. What Kenya requires towards sustainable land management is continuous adoption of integrated approaches, lubricated with effective participatory decision-making and partnerships. Figure 4.4 is a possible conceptual framework in this regard. Development of rural infrastructure particularly a network of feeder roads is particularly important as it would trigger a proliferation of rural markets and pave way for increased initiatives towards commercial farming, which tends to be accompanied with conservation farming. This framework represents a strong case for integrated approaches in line with the ecosystems theory in environmental management for sustainable development.

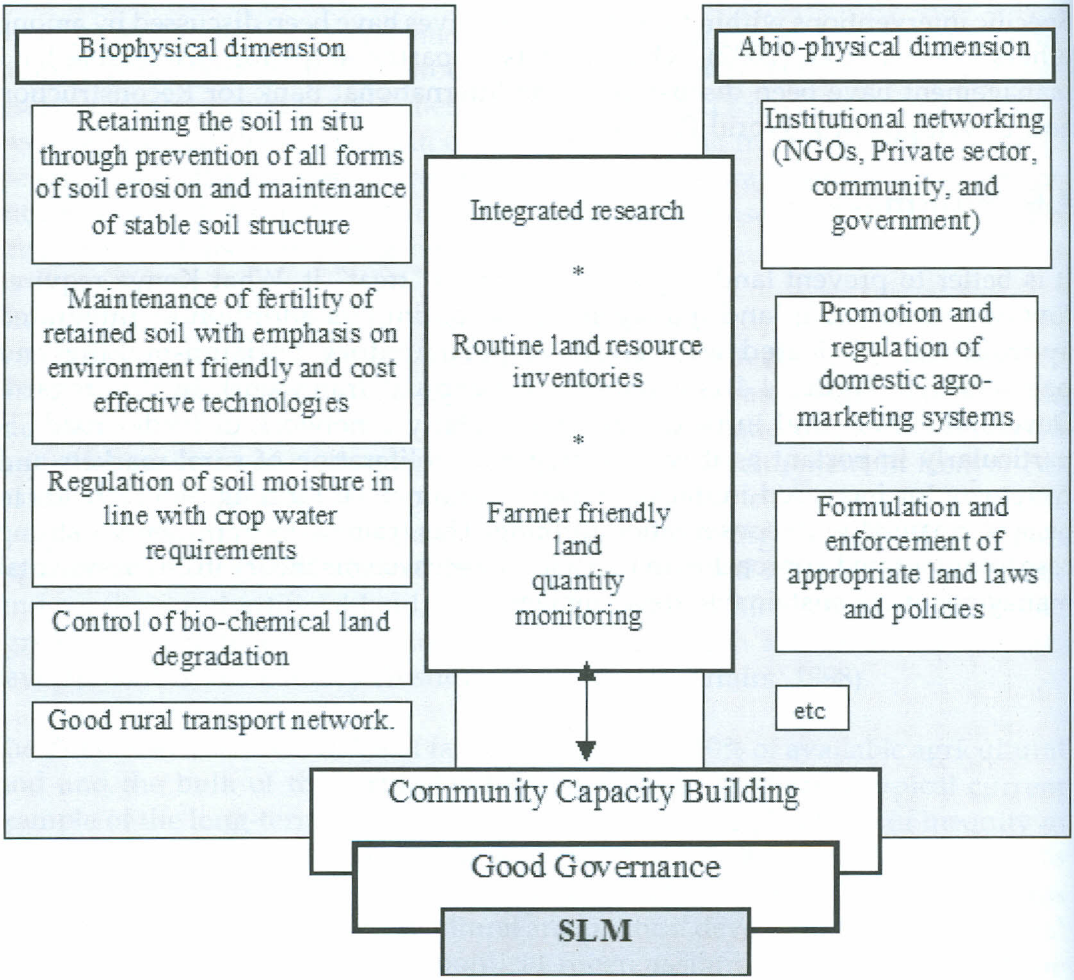

Figure 4.18 Sustainable land management (SLM) conceptual framework (Source: Waswa, 2000)

4.7 Sample Questions

i Using practical examples show that population pressure and land use changes are critical drivers of ecosystem changes, their services and hence human well-being.

ii Distinguish between land degradation and desertification and explain their potential impact on human well-being

iii Critically examine the main challenges and opportunities for sustainable management of agricultural land in Kenya.

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