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Abstract: This article looks at the challenges posed by the introduction of locally developed, low cost techniques for soil and water conservation on the Central Plateau of Burkina Faso in dryland West Africa. It asks how local community organisations and farmer groups are involved in managing these important activities, and what role they play in overseeing and directing the future trajectory of environmental change in the region. While farmers continue to adapt these techniques and experiment with new ones, it is their community institutions - which act across many households - which provide an important point of contact with the rural development projects and local government services involved in agricultural and environmental work in these remote rural areas. Also, these local institutions often provide a forum for co-ordinating, and improving, the land rehabilitation efforts of the village or of the community itself. This is important, as many development projects and western donors are now looking to operate their environmental programmes at the village scale - and thus target their activities less at individual farmers or their households. These development projects, and their donors, need to realise the opportunities, and the constraints, afforded by their increasing reliance on community organisations as the 'point of contact' with rural people.

**Conservation and community:
local organisations and environmental management in Burkina Faso**

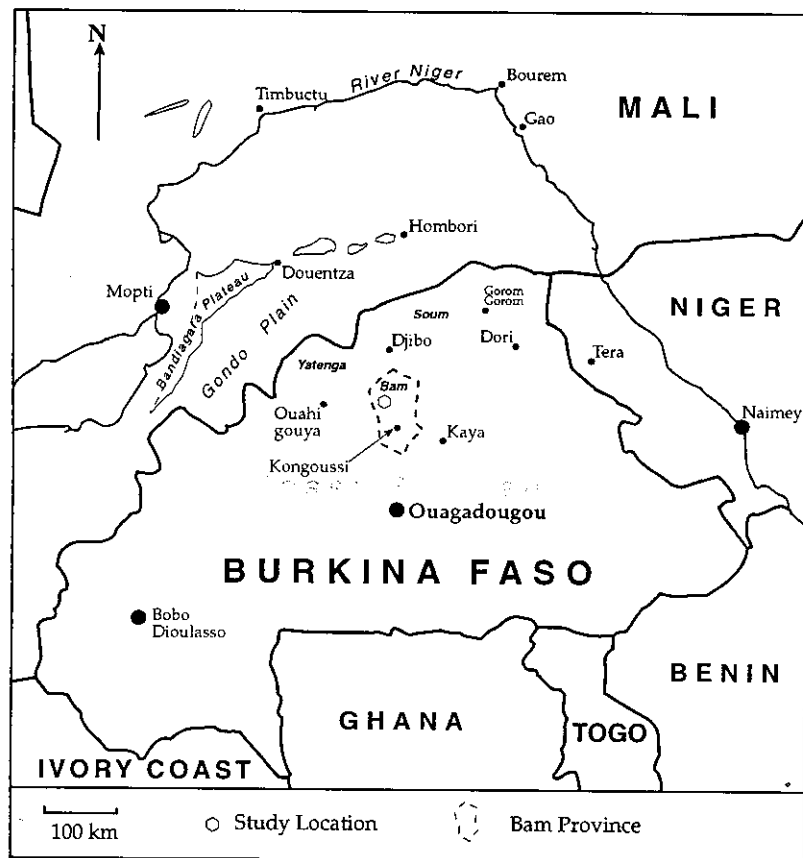
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Soil and water conservation: the key technologies

The Central Plateau of Burkina Faso (Figure 1), the heartland of the Mossi people, has been identified as a 'laboratory' for some of the most innovative techniques in soil and water conservation and water harvesting systems in Sub-Saharan Africa (Critchley & Graham, 1991; Critchley *et al*, 1992; Pacey & Cullis, 1986). As recently as fifteen years ago, the record of soil and water conservation programmes in the area was poor. The area had hosted efforts by several internationally supported projects to rehabilitate highly degraded agricultural land. However, these projects placed too much faith in ambitious technical solutions such as the construction of large earthen bunds across contours, using imported bulldozers and heavy machinery and the promotion of unrealistically expensive agricultural technologies; the latter including inorganic fertiliser inputs and ox-drawn tillage systems (Marchal, 1986; Martinelli & Serpantie, 1987; Mietton, 1987; Reij, 1983). While these interventions were based on sound principles and could, under certain conditions, increase crop yields, they were unpopular with the majority of the near subsistence farmers in the region. The techniques in use, and the institutions promoting them, have changed since this time.

Figure 1: The study area - Bam province, Burkina Faso



Today the work of the more popular environmental programmes is modest, less costly, and rooted in local skills and technology. Many farmers have designed and built cheap and effective conservation systems using techniques adapted from a repertoire of old and newly-learned skills. These systems have proved more sensitive to soil type and existing land use, and almost always avoid the use of expensive inputs or machinery. They include:

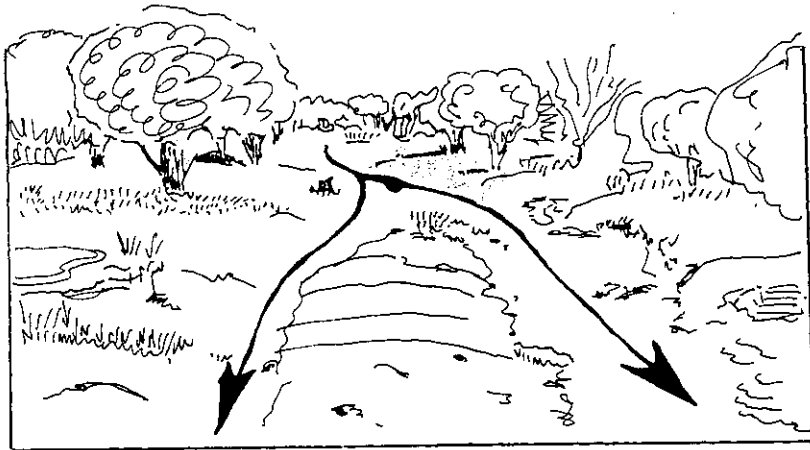
- permeable and semi-permeable contour stone lines and stone bunds of varying sizes, spacing and height, built from rock or stones placed across the land contour. These preserve farmland or communal areas where soils are noticeably degraded by continued use, or lack sufficient moisture to ensure reliable crop growth (see Figure 2);

- larger rock dams, built on the same principle but used to slow and eventually halt the flow of water brought downslope in gullies, aiding the accumulation of nutrient-rich sediments upslope;
- other methods to bring degraded land back into productive use (i.e. to expand the cultivated area): these include *paillage* (the covering of the soil surface with nutrient-rich crop stover) and the digging of planting pits (*zay*) to which organic manures (some produced from local *fosses fumières* or compost pits) are added prior to planting (Reij, 1994);
- biological methods of erosion control, including 'trash lines' of millet stalks and branches, grass strips (commonly of *andropogon* grasses, known locally as *pitta*), and the selective planting and pruning of certain trees and shrubs on fields, along contour stone bunds, and in bush areas;
- conservation-oriented cropping practices which increase soil cover or surface roughness, including planting patterns oriented across the slope, the incorporation of manures from compost pits, contour tilling and ploughing (using cheaper donkey-drawn ploughs), and particular attention to the spacing of crops and the micro-topography of the field;
- the protection of *brousse libre* (communal bush areas) through access restrictions and 'set-aside' (*mise en defens*) zones where animal grazing and cutting for fuelwood is minimised and the growth of useful species is encouraged.

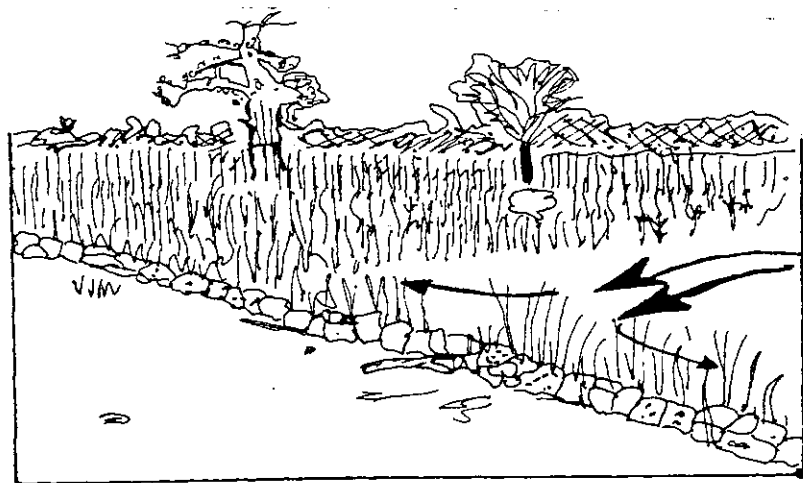
These systems have been adapted by individual cultivators to meet their own needs; depending on the type of land rights they enjoy, the availability labour from family and neighbours, and local differences in soil types and topography. Rain-fed agriculture on the poor soils of the Central Plateau requires great skill, and the constant adaptation of traditional and modern practices to variations in rainfall and in land quality. While most farmers do experiment with conservation techniques as part of their farming activities when they have sufficient time or resources, it has not always been possible for them to keep pace with the naturally high rates of soil erosion encountered on friable sandy soils, or to capture sufficient precipitation and runoff on their fields given the unpredictability of the short annual rains. In addition, Plateau soils are naturally low in key nutrients which, combined with problems of soil structure and moisture retention, impose severe constraints on their use for agriculture (Matlon, 1990; Dugué, 1989).

Contour stone lines and bunds are the 'miracle' technology for which the farmers of the Central Plateau have become well known in recent years (Harrison, 1986). These methods of water harvesting have often been viewed as the saviour of highly

Figure 2: Land degradation on the Central Plateau, and control by contour stone lines



2a Gullies beginning to form as overland water flow (represented by arrows) becomes channelled, topsoil is slowly removed to expose iron-rich horizons to hardening.



2b A form of land rehabilitation by farmers. A stone line has been constructed by a farmer, his brother and wife using stones brought to the field by donkey-drawn cart and supplemented by branches and sticks. Water flow (represented by arrows) is slowed and diverted, aiding infiltration and modest accumulation of soil nutrients. Millet and cowpeas are growing behind the stone line, whereas land in the foreground is uncultivable *zipellé*.

degraded agricultural systems in sub-Saharan Africa since they are replicable, built by farmers themselves, and appear to be an appropriate remedy to the decline of soil fertility and falling crop yields on most soil types. Although they are hard work to build, contour stone lines are cheap to construct, require a minimum of complex planning other than some time spent by farmers estimating contours and slope angles with simple levelling devices, and have strongly positive effects on yields of the staple dryland crops of millet, sorghum and maize (Soura, 1992; Reij, 1994; Atampugre, 1993). Stone lines act as braking mechanisms, slowing the passage of floodwaters (which accompany the strong rains of the cropping season from May to October) downslope and thus encouraging the infiltration of water on the field and the deposition of nutrient-rich sediment where it can be of most benefit to crops and vegetation. Soil fertility is improved, particularly on *zipellé*, the hardened crusts left behind after runoff has stripped away fertile topsoil. Larger rock dams require greater quantities of stones to be moved to the site; these are used to reclaim gullies, which form where floodwaters carve out deep channels through sandy soil. Again, crops thrive on the moister soils behind the dams.

Semi-permeable stone lines and rock dams may be locally developed technologies, but they are not a wholly indigenous response to land degradation since their design has been much adapted and improved by a succession of foreign volunteers, non-governmental organisation (NGO) staff and extension workers operating in the area since the late 1970s (Atampugre, 1993). Innovation has come from these different actors, or been learned from neighbours, family, or through travel to other communities or regions. It is the most 'participatory' soil and water conservation (SWC) projects, - those with a relaxed approach to farmer experimentation and decision making and few strictures about technology 'adoption' or 'results' - which have supported the most impressive examples of farmers own conservation efforts. The approach taken by outsiders involved in these programmes has not been 'technocratic' - instead the idea of self-built conservation structures, such as contour stone lines, has been developed in concert with individual cultivators and farmer organisations. After all, projects have limited lifetimes and it is therefore the latter that will be fully responsible for the maintenance of such conservation works once projects and their staff have moved away.

Once the advantages of semi-permeable stone structures became clear through the early experiences of pioneering villages (notably those around Ouahigouya in Yatenga Province (Atampugre, 1993)), this knowledge spread, aided by the publicity associated with the many NGOs and bilateral environmental programmes set up on the Plateau over the last three decades, and through local language advice issued on national radio. Also, some development projects, such as PATECORE (*Projet*

d'Amenagement des Terroirs et Conservatin des Ressources dans le plateau central) in Bam Province, have set up enclosed demonstration plots in village *terroirs* (territories) where the effects of various stone lines and other techniques are clearly visible to visiting farmers. The PATECORE project also conducts training for farmers which allows one or two individuals in certain villages (usually those who expressed a prior interest in conservation work) to learn the necessary skills to train others in stone bund construction and other conservation methods.

The role of community organisations

The construction of stone lines and rock bunds, and many of the other management practices mentioned above, occurs in the dry season from December-May; after the harvest in, and before land preparation activities resume for the new season. Building these structures is a highly labour intensive activity, requiring major investments of time and energy on the part of farmers. Most, but not all, Plateau villages have some form of *association villageois* - a farmer organisation or community group. In some cases these date from the mid-1980s, having evolved from committees set up under the regime of Burkina Faso's revolutionary leader, Thomas Sankara; in others they replicate a traditional unit of social organisation which traverses individual households, the *saka*. The *saka* is a unit of political organisation where strong communal ties exist; many so-called 'village' groups are actually based on amalgamations of these units (Broekhuysse, 1991). The *associations* have representatives from the various lineages which reside in the village; they are distinct from other traditional authority structures which are built on the chiefs, elders and earth priests. Some of the newer *associations* are highly formalised, with sub-committees responsible for different aspects of village affairs: others are built around the enthusiasm of key individuals who retain prominent roles in decision-making, or have grown up as membership 'clubs' to purchase inputs and materials at favourable prices. These *associations* rarely include those not resident in the village, and nor do they hold a large enough constituency to link neighbouring communities. Nonetheless they are absolutely vital to the slow process of building and maintaining water harvesting systems and other sorts of conservation activities requiring large amounts of labour or time from farmers. This is because traditional social institutions, at least among the Mossi (which form the predominant ethnic group here) are concerned more with customary law and internal decision-making, and have only rarely made decisions about resource management for the *entire* village (Farenhorst, 1992).

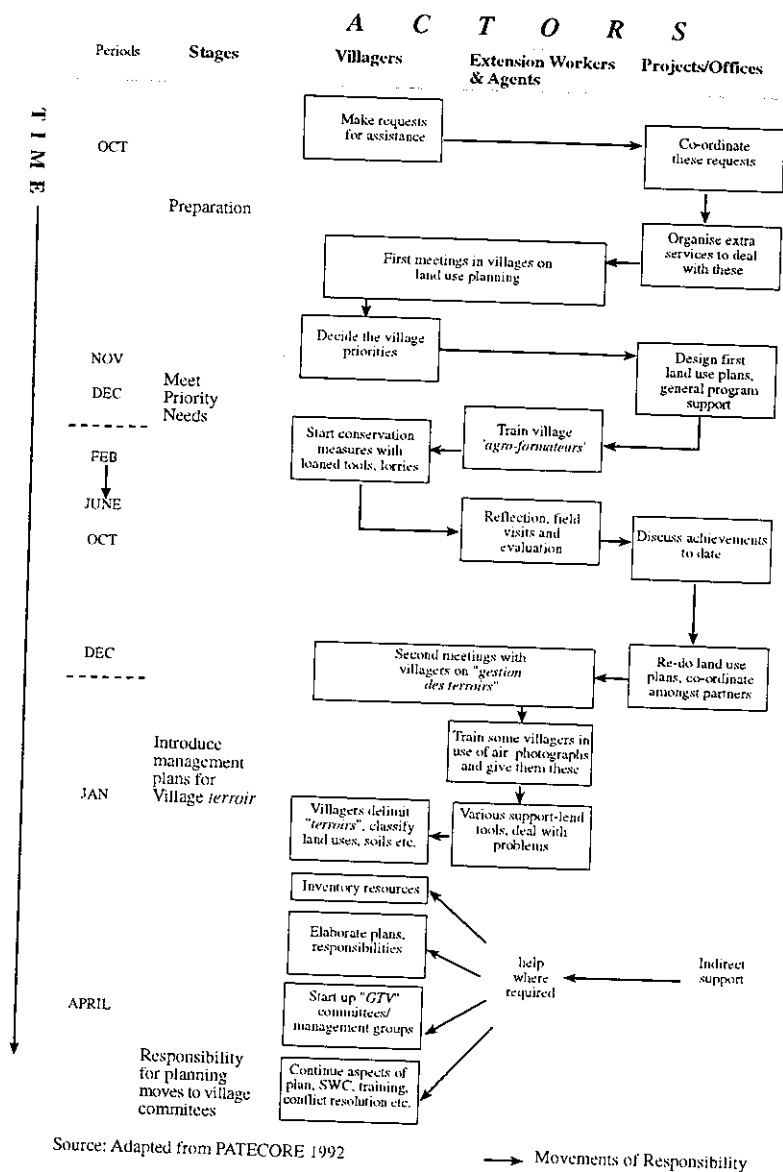
In order to manage the village *terroir* effectively, institutions are needed with sufficient organisational capacity to inspire their members to work together and to see through a plan of action over several years; soil and water conservation is a slow business. *Gestion des terroirs* (village land use management) is a policy instrument

used by some development projects, and by the Burkinabè government, which tries to do just this. The aim is to enable villages to manage the whole *terroir* over which they enjoy traditional land rights (see Critchley & Graham, 1991). The rudiments of the *gestion des terroirs* approach are set out in Figure 3; over a period of months and years, a development project works with the *association* to encourage first understanding, and then action, on land degradation in the 'action space' or *terroir* of the community. The approach is innovative, although not without its problems; where individual *terroirs* overlap, or where social conflicts do not allow communities to make unilateral decisions on land management or on the allocation of the benefits of conservation activities. It is the modern-day *associations* and other farmer organisations which are assuming the task of resource management at the *terroir* scale, and it is they that form the bridge between individual farmers and development projects and local government extension activities. Their roles are varied, for example, they act as:

- contact points or 'bridges' where they convene their members to listen to development organisations, and sometimes extension agents and other visitors, who use meetings held in the village to discuss environmental concerns and the programming and content of conservation activities;
- a form of 'management committee' or regulatory body with diverse responsibilities ranging from lobbying actions, unravelling disputes and conflicts, to taking control of the entire process of conservation activities involved in *gestion des terroirs*. The group in Figure 4, the *association* of a small village of Yarsé farmers, has taken on all conservation efforts in the village *terroir*. It meets regularly to discuss the division of responsibility for care of seedlings, tree planting, stone bund construction, and so forth;
- instigators of group projects including the cultivation of communal plots, and as managers of items such as donkey carts, handtools for anti-erosion works and ploughs bought from member's funds or donated by projects; these are rented out to farmers on a short term basis.

Despite the wide-ranging activities of village *associations* in this and other regions of Africa, observers of rural development often wonder what the much-praised 'community organisations' of this type actually do, and what they can achieve. Figure 4 provides an answer for one community studied in depth in 1992 and 1993. It shows the types of activity undertaken by subsistence cultivators in a village of around 300 individuals in Rollo Department, Bam Province, over a two year period. Information was collected from the villagers' own records or observed directly. A very wide range of resource management activities have been performed

Figure 3: The *gestion de terroirs* approach to environmental management; the PATECORE project system in 1993.



Source: Adapted from PATECORE 1992

→ Movements of Responsibility

Figure 4: What village groups do: male and female participation in *groupe Tengsongho*, near Rollo, Bam Province.

Date	Activities	People Participating	
		Men	Women
Jan 1990	Tree planting - digging planting holes	72	63
"	Meet with forestry extension agents	48	0
"	Tree planting - digging planting holes	72	0
"	Tree planting - finish planting holes (900)	69	0
"	Tree planting - plant seedlings	52	0
"	Tree planting - plant seedlings		
-----NO RECORDS-----			
Sept. 1990	Village meeting on soil conservation	41	90
"	Village meeting with agricultural extn. agents		
Nov. 1990	Begin collection of stones for contour bunds	40	109
Feb. 1991	Collection of stones from hills with PATECORE truck	53	149
"	"	43	107
"	"	59	139
Mar. 1991	"	40	100
"	"	66	159
"	"	72	128
April 1991	Training on contour bund work (extn. agents)	63	142
"	Building contour bunds in village centre	59	153
"	"	61	102
"	"	62	139
"	"	57	146
"	"	32	150
"	"	72	142
June 1991	Village meeting decides to start a communal field (1ha)	70	127
"	Communal field prepared and seeded for millet	36	43
July 1991	Communal field is weeded		
"	Tree Planting - tidy saplings in plantations	42	59
"	Meeting with head of primary health service (Advice on guinea-worm)		
"	Tree planting: replace dead saplings	48	0
"	Meeting with agricultural extn. agents on land husbandry techniques	47	63
"	Tree planting: prepare new plantation	25	0
"	Plant grasses next to contour bunds	15	0
"	"	25	0
"	"	15	0
Aug. 1991	Communal field: second weeding	35	15
"	Women's communal field (peanuts): first weeding	35	75
"	Tree Planting: re-digging planting holes	36	0
"	Communal field: third weeding	17	42
"	Tree Planting: along tracks	39	43
"	Meeting with local officials	79	43
Sept. 1991	Communal field: harvest	43	62
Oct. 1991	Repair communal meeting place	39	0
"	Tree Planting - repair fencing	49	0
Nov. 1991	Meeting with forestry & agric. extn agents	40	0
Dec. 1991	Meeting with extension agents and PATECORE	22	36
"	Building contour stone bunds in village centre	63	42
"	Collection of stones from hills with PATECORE truck	25	16
Feb. 1992	"	37	25
"	Make bricks for communal granary	47	0
"	Buy and transport chicken wire	3	0
Mar. 1992	Meeting with forestry and agricultural extn. agents	25	0
"	Prepare 'demonstration plot'	32	0
"	"	42	0
April 1992	Visit from farmers from other region		
May 1992	Collection of stones from hills with PATECORE truck	23	67
"	Building contour bunds in village centre	52	0
June 1992	Work on the 'demonstration plot'	55	0
"	Collection of stones from hills with PATECORE truck	37	60
"	Communal field prepared and seeded for millet	48	67
-----NO RECORDS-----			
Oct 1992	Meeting with PATECORE agents		
"	Rebuild old compound to host visitors		
"	5 days of participatory rural appraisal with team of 8 visitors	all	all
Dec. 1992	Meeting with PATECORE agents	40	60
"	Collection of stones by truck	42	66
"	"	51	60

Source: Records of village group (confidentiality preserved)

by the group; note the relationship between male and female participation in these activities, and the large numbers involved in the construction of contour stone lines which villagers have built in the heavily degraded central portion of their village lands. In this initial stage of conservation work (the stone line technique was first applied here in 1991) planning is almost always conducted in well-attended group meetings, since the management of communal areas concerns the whole community and farmers were extremely curious to hear what extension agents and project workers were proposing. Today, with several kilometres of stone lines built in the centre of the village and large areas returned to agriculture, the group is turning its attention to restoring the fertility of the outlying bush fields of its members, and is beginning to lobby for the provision of government services like primary schooling and health services. As the village begins to tackle conflicts with neighbouring communities over land access, working together - not just as individuals - becomes vital in order to present a 'united front' in these struggles.

Village organisations among Mossi cultivators involve most individuals of the village, but women often run their own group with a separate membership fee. They may pool their scarce resources to farm a collective field for a cash crop such as groundnuts. Some women's groups are beginning to assume other responsibilities, including the management of credit schemes for the purchase of sheep and goats, although these are often modest in scope and lack a 'financial return' of the sort that donor organisations wish to see. Women are often hesitant to use the money they build up in communal funds, since it is difficult for any individual to take responsibility for its investment or other use (Rohatynskyj, 1993). Overall, the role of women's groups in environmental management itself has been limited, in part because women have no formal land rights (at least among the Mossi and Yarsé), being reliant on their husbands for plots on which they cultivate small amounts of crops for sale or to supplement the household food stores. Rohatynskyj (1993) points out that conflicts can arise between members of the women's group, and that these can impede the effectiveness of such organisations.

The continuing challenge

The primary emphasis of environmental programmes on the Central Plateau now rests on ensuring the fruits of effective local soil and water conservation begin to reach *all* sectors of the community, including those disadvantaged by gender, by lack of access to land, or by social status. Assuming that conservation efforts are a 'good thing', because they restore productive potential or at least insure more reliable crop yields (Reij, 1993; Atampugre, 1993), how may all those who wish to do so benefit from these new technologies and continue to experiment with them and adapt them?

Research efforts in the region are starting to explore these issues. On the positive side, it appears that 'rich' farmers do not take all the benefits invested in soil and water conservation; an obvious concern given the differential access to resources and power relations pervading everyday village life. Mossi farmers plan for the future (Batterbury, 1993), and sometimes a chief or members of a strong family lineage ask that structures built in their fields before those of others. Yet many *associations*, including the ones studied as part of my own fieldwork, select the areas to receive these structures based upon other criteria: the quality of degraded lands, or their proximity to the village centre. Richer farmers and traditional leaders cannot dominate these discussions; where decisions are made within the context of *association* meetings, these transcend or cut across traditional authority. The effect can be that conservation structures are built without regard to social hierarchy, in some cases. Rohatynskyj (1993), also working in Bam Province, is less positive about the equality of participation in village groups; indeed the degree to which the *associations* conceal gender conflicts and conflicts between households, is of continued concern for some development projects. Yet, in a village close to Rollo, the group of the village built stone lines across the modest fields of a widow who farms alone; in a neighbouring community, structures have been used to reclaim a large area to which three separate lineages - one with little capital and no animal herds - have rights over the land. Here, the chief's fields are far from the village and of low fertility; they received no structures and continue to require intensive cultivation to assure meagre yields. Because of the strong cultural pressures placed on individuals not to 'opt out' of communal activities organised by the *association*, several unmarried young men have returned to this village from Côte d'Ivoire (where the Mossi migrate in large numbers to seek paid work) to assist in these endeavours and to farm with their families. In interviews, some returnees said the opportunity to participate in the activities of the group and to learn new skills helped draw them back, at least for a season or two.

However there are still problems with promoting and managing this particular form of technological change at the village level, even if many regard it as successful. Even the most 'participatory' forms of soil and water conservation in sub-Saharan Africa cannot hope to overcome the complex and interlocking social and ecological process driving land degradation. These latter create unequal power relations, lead to differential access to productive resources, and may exacerbate particularly insidious forms of rural poverty. There are three issues of particular importance for future conservation efforts on the Central Plateau. First, individuals without secure access to land obviously benefit less, if at all, from soil and water conservation; yet they are expected to contribute their labour to the village group nonetheless. They may participate in building stone bunds or planting trees in the village centre, while

their own land lies elsewhere and - in the case of 'loaned' plots - cannot be treated in the same way if their landowner would see such work as an unwelcome assertion of 'squatter's rights'. Secondly, women's personal fields (their *beologo*) are important sources of supplementary food and income, but lack of land rights and heavy workload makes it extremely difficult for women to make, or receive, the same level of investment in structures or other forms of inputs. This is regretful, since women contribute their share to construction works elsewhere in the *terrior* (Vlaar & Brasser, 1990; Atampugre, 1993; David, forthcoming). Women's groups are still inexperienced in defining responsibilities, negotiating conflict, lobbying for services and running co-operative ventures: problems that can only be solved by allowing their members time to learn new skills and apply them in sometimes highly traditional (and suspicious) patriarchal communities. Thirdly, it has been argued that there is a need to work at multiple scales in the complex social environments of Mossi communities and those of other agriculturalists in the region. While retaining the *village association* as the primary point of contact with development organisations, it is still vital to target extension advice and occasional assistance at individual farmers, particularly women, and to listen and learn from them. This recognises that not everybody has a voice in the village group, and that individuals make important technical innovations on their own land and in their own households.

In summary, village level institutions can be appropriate vehicles for initiating technological changes on the Central Plateau: a region of Africa where high rates of land degradation have been met with concerted action by farmers. Institutions such as the *associations* act as a conduit between traditional authority, farmers, and development projects offering access to training and limited development assistance. These community endeavours are needed, given the limitations of traditional power structures (chiefs, earth priests, and powerful clans) to mobilise across all households - and are important contact points at a time when the majority of conservation programmes are still backed by 'outsider' development projects and extension services. The challenge for the future is a difficult one: to develop an institutional environment where farmers, extension workers, local government and project staff work harmoniously towards the refinement and development of the new agro-ecologies slowly emerging. This will require that the technical innovations, such as stone lines and bunds, promoted by outsiders are self-replicating - where their adoption (and experimentation with them in different micro-environments) is by individual farmers and their families, who pool the tools, means of transportation and capital at their disposal and work together. To date, it has been development projects which have motivated farmers - rarely the reverse. The delinking and 'scaling down' of development projects, as farmers 'scale up' their own activities and strengthen their own institutions, is the only realistic option to assure the durability

of local-level soil and water conservation in the region. One hopes that the role of 'outsider' institutions is to support and nurture this process of indigenous adaptation and change - in which farmers, and their own organisations (both traditional and modern), play a vital role. Villages in Bam Province involved in *gestion des terriors* initiatives appear to be making encouraging progress in reversing the flow of knowledge from the community to outsiders, and are beginning to plan their own futures; this is the purpose of the *gestion des terriors* approach. However the road is a long one.

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Footnotes

1. *Gestion des terriors* approaches to natural resource management do not tackle this problem adequately, since in practice it has not been possible for *village associations* to control the majority of land tenure decisions which are usually made by traditional leaders. While conflicts over land access and use rights have remained minor in the villages studied in Rollo, elsewhere they have escalated into political struggles which have set back SWC programmes (Atampugre, 1993)

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Abstract: This paper is based on continuing research into the differences between women and men in their attitudes towards a range of environmental issues. A central premise of the paper is that decisions concerning the environment are made, primarily, by men within a masculine decision-making context, and that, consequently, environmental policy and practice is more likely to reflect priorities identified by men whilst those concerns which might be given greater prominence by women are marginalised. A discussion of the theoretical literature upon which the paper's premise is based is followed by the presentation of evidence from initial research in the London Borough of Hounslow into the environmental attitudes of women and men.

Addressing Environmental Issues in the 1990s: a gendered perspective

- Susan Buckingham-Hatfield -

Introduction

The Women's Environmental Network's (WEN) submission to the United Nations Commission on Environmental and Development stressed that women are first to be affected by environmental pollution through their various roles as childbearers, child carers, housekeepers and carers for others (Thompson, 1991). This view is supported by Jonasdottir (1988) who cites research through the 1980s which indicates that women, to a greater degree than men, and in different ways, initiate, pursue and support issues concerning these roles. Whilst it is dangerous to assume that all women will be more sympathetic to environmental issues than all men (Grier, 1990) it remains true that women bear the greatest share of domestic responsibilities and have a greater interest in health related issues (LeBourdais, 1991; Miller, 1991; Vallély, 1991). The WEN argues, however, that women's capacity to make environmentally well-informed decisions is hampered by a lack of information and power.

Women and Environmental Policy

In 1992, the United Nations Conference on Environment and Development went some way towards recognising the specific relevance of women to environmental issues by endorsing Agenda 21. The terms of this agenda require signatories to recognise the contribution women can make to sustainable environmental management as well as the effects that environmental degradation have on them. The mech-