

RE-EXAMINING THE 'MORE PEOPLE LESS EROSION' HYPOTHESIS: SPECIAL CASE OR WIDER TREND?

Charlotte Boyd and Tom Slaymaker

Recent research into natural resource rehabilitation based on in-depth case studies has highlighted situations where population growth and agricultural intensification have been accompanied by improved rather than deteriorating soil and water resources (e.g. Tiffen et al., 1994). Drawing on new case studies in six countries (Burkina Faso, Ghana, Nigeria, Senegal, Tanzania and Uganda), this paper examines how widespread are the prospects for positive outcomes of the 'more people, less erosion' type.

Policy conclusions

- There are few examples of reversal of natural resource degradation and no evidence of a wider trend towards environmental recovery. In most cases, 'success' involves the adoption of soil and water conservation (SWC) practices designed to raise yields of high value crops on selected parcels of land.
- SWC practices are likely to be adopted where agriculture is important in rural livelihoods, and agricultural land is in short supply, and/or where SWC has the potential to increase yields of high value crops.
- Policies for SWC should therefore be designed to provide tangible benefits to the individual household or community. The emphasis should be on SWC in the context of raising agricultural productivity, food security and income, against the background of wider livelihood strategies, rather than on controlling land degradation *per se*.
- A policy framework which provides for market access and attractive producer prices is essential to SWC.
- Social and economic support for rural populations to prevent the collapse of social structures and encourage labour to stay in rural areas is important, especially where labour-intensive techniques are necessary for natural resource regeneration.
- Where local authorities are expected to play a role in promoting good SWC practices, strengthening local institutional capacity to design, implement and monitor new policies is imperative.

Introduction

Recent research into natural resource rehabilitation based on in-depth case studies has highlighted situations where population growth and agricultural intensification have been accompanied by improved rather than deteriorating soil and water resources (e.g. Tiffen et al., 1994). This paper investigates the scope for replicating these successes, by examining the policy measures and underlying environmental and socio-economic conditions that support households' incentives and capacities to invest in soil and water conservation (SWC).

The research reported here was initiated through regional and country literature reviews. Drawing on these literature reviews, a case study methodology was developed and tested, (Box 1), and case studies were carried out in semi-arid regions of six countries in sub-Saharan Africa, (Table 1).

The research demonstrated that the key sets of conditions

which underlie decisions to invest substantially in SWC are:

- the importance of agriculture in rural livelihoods, combined with a shortage of agricultural land; and/or
- the potential of SWC to increase yields of high value crops.

The case studies include one example of successful reversal of natural resource degradation. Farmers in Bantieniema in Burkina Faso have successfully reclaimed abandoned land in a region where agriculture is the mainstay of rural livelihoods and there are few alternative opportunities. In Pankshin in Nigeria, farmers are continuing to use traditional, labour-intensive techniques to farm land which would otherwise be considered unsuitable for cultivation in a region of high agricultural potential. In both cases, the importance of agriculture in rural livelihoods and the shortage of agricultural land are driving investment in SWC. The availability of rural labour in the context of high population density and relatively limited off-farm diversification and migration has also played a role. In Senegal and Tanzania, and in the other Nigerian study site, the potential of SWC to improve yields of selected high-value crops has led to significant investment concentrated on small plots. In Ghana and the other Burkina Faso study site, both areas of low agricultural productivity, interest in investing in agriculture and SWC is lower, although some SWC practices are applied. A similar outcome has occurred in Uganda, this time in the context of continued livelihood insecurity and market collapse. In all three cases, off-farm diversification and/or rural out-migration have become important alternative livelihood strategies.

The importance of agriculture in rural livelihoods and strategies such as intensification and commercialisation play a primary role in influencing decisions to invest in SWC. These factors, together with alternative strategies such as off-farm diversification or migration, are discussed in the first section of this paper. Once households have decided to invest in SWC, household characteristics, in particular access to land,

Table 1 Case Studies

Country	Case Study Area	Partner
Burkina Faso	Ghagna region in the north-east	Voisins Mondiaux
Ghana	East Mamprusi District in the Northern Region	University for Development Studies and TRAX
Nigeria	Zaria-Pambeguwa Kaduna triangle and the Pankshin areas of Plateau State	Eco-Systems Development Organisation
Senegal	Niayes coastal region	ENDA-PRONAT
Tanzania	Western Pare lowlands in the north-east	Soil and Water Management Research Group, Sokoine University of Agriculture
Uganda	Katakwi	ActionAid-Uganda (Katakwi Project)

Box 1 Note on methodology

A key principle underlying the research approach was that partners in sub-Saharan Africa (NGOs and applied research organisations) should conduct the literature reviews and case studies with guidance from ODI on the selection of case study sites and research hypotheses to ensure that a broadly comparable methodology was applied in each case. The focus of each country study reflects the particular interests and objectives of partner organisations. For example, in Nigeria, the emphasis was on indigenous knowledge systems and exploring the socio-economic factors underlying the adoption and continued use of two different types of practice, with the objective of understanding the potential for replication in other areas within the same rainfall zone. In Burkina Faso, the study compared the agro-ecological and socio-economic characteristics of two villages, and investigated reasons for different levels of adoption between them. In Tanzania, the study examined the relationship between household socio-economic characteristics and adoption of SWC practices at the household-level, and the effects of NGO support on levels of adoption.

For these reasons cross-country comparative analysis is inevitably problematic. Nevertheless, an end-of-project 'analysis workshop' involving researchers and policy makers concluded that there was sufficient evidence to assess the conditions under which SWC practices are likely to be adopted, and to indicate the relationship between household investment strategies and the policy and institutional environment.

labour, equipment, financial resources, knowledge and awareness influence the specific SWC practices adopted, (Box 2). For example, in Burkina Faso, the main reason for adoption of several SWC techniques was given as impact on yields and the environment observed by farmers. While investment in SWC often occurs in the absence of direct intervention from government or NGOs, macro-economic policy and agricultural policy and support services play an important role in influencing household decisions to invest.

Livelihood strategies

Investment in SWC is most substantial where crop production plays an important role in livelihood strategies, (see Box 3 for an illustration from Burkina Faso).

In all the study areas, agriculture has historically played a central role in livelihoods, but this role is changing under the influence of changing environmental and socio-economic conditions and evolving livelihood strategies.

Land availability and productivity

Environmental context, in particular land availability and productivity, is an important component of conditions under which households will invest in SWC. There is generally greater interest where there is a shortage of land – as in Bantieniema in Burkina Faso, and in Nigeria – unless soils are very unproductive – as in Tolepsi, Burkina Faso and in northern Ghana. In Senegal, where there is no shortage of land but soils are unproductive, SWC is concentrated on small parcels producing high-value horticultural crops. There is also generally less interest where soils are productive – as in Tanzania and Uganda, – unless there is a shortage of land – as in Nigeria.

Most case study areas are characterised by growing demographic pressure. The relationship between population growth and SWC is complex. In some cases increased population growth has led to rapid degradation of soil and water resources, as in Senegal where migrants from neighbouring regions have little understanding of the unique local environment. In Burkina Faso, by contrast, reduced availability of land associated with population growth has provided an important motivation for investment in SWC. Population density data was not available to the study teams

Box 2 Examples of SWC practices in the region

Basic SWC practices, common to most case study farmers:

- mulching
- manuring
- crop rotation
- intercropping
- fallowing

Additional SWC Investment often associated with improving yields of high value crops:

- ridging and weeding
- deep tillage
- bunded basin
- stone bunds
- other organic fertilisers

Investment in preventing or reversing land degradation and/or bringing otherwise uncultivable land into production:

- stone barriers
- contour bunds
- terracing
- live barriers, quickset hedges, windbreaks
- drainage ditches for flash flood control.

at a sufficiently local scale, but estimated population densities were particularly high in the Nigerian and Burkina Faso study sites and this may contribute to higher rates of investment in SWC in these cases.

Soil characteristics and the potential of soils to be improved through SWC is potentially important, but it has not been possible to collect cross-country comparative data on these variables during the course of this study.

Households are more likely to invest in SWC under certain climatic conditions. Water conservation is often of primary importance in semi-arid areas where annual precipitation (and available moisture) is low, and especially where it is unevenly distributed across seasons and subject to high annual variation.

Total annual rainfall varies between case study areas. In Burkina Faso (average 400-650mm/yr), Ghana (800-1000mm) and Tanzania (400-600mm), it is a significant constraint on agricultural production, and water conservation techniques are given priority. For example, in Ghana and Tanzania stone bunds are used to trap and channel surface water. In the Uganda case, where rainfall totals are higher, water conservation is not practised but flash flood control is more important to prevent soil erosion. Seasonal distribution of rainfall is key. In Nigeria farmers have developed highly sophisticated techniques using residual soil moisture to grow crops during the dry season.

Topography also plays an important role. Households are

Box 3 Gnagna region, Burkina Faso

The Burkina Faso case study presents an example of successful reversal of natural resource degradation – farmers have been able to reclaim some land that had been abandoned for years, through the application of erosion control techniques, afforestation and use of organic fertilisers. Nearly 50% of households studied use more than three SWC techniques. This level of investment in SWC reflects the importance of agriculture in rural livelihoods, environmental constraints, shortage of land, and the lack of alternative economic opportunities, but there are marked differences between the two study sites. In the study villages, the main source of income is livestock products (for 43.5% of households) followed by sale of cereals and groundnuts (for 16% each). However, a higher proportion derive their first and second sources of income from cereals in Bantieniema than in Tolepsi, reflecting a better land endowment with more productive soils. Trade is more important in Tolepsi than in Bantieniema, with a quarter of all households owning a small business. Investment in SWC is considerably higher in Bantieniema than in Tolepsi. High dependence on agriculture at the national level means that SWC is afforded high priority by policy and decision-makers at all levels.

Source: Bandre & Batta (1999).

Box 4 Western Pare lowlands, Tanzania

In Tanzania, there is a strong correlation between the importance of agriculture in livelihoods and the level of investment in SWC. The case study presents an example of increased investment in SWC for a few selected crops, such as onions and other horticultural crops, demonstrably linked to new market opportunities created by the liberalisation of producer prices. SWC investment for other crops is less significant, partly reflecting the relatively good natural endowment in terms of land availability and productive soils. The Tanzanian case study also demonstrates the importance of traditional and local authorities in restricting negative practices, such as cultivation on steep slopes and on river banks.

Source: Hatibu et al., (2000).

more likely to invest in areas where erosion is a recognised problem, in particular where the terrain is generally characterised by steep slopes. For example, SWC investment in Tanzania declined following the study communities' move from the uplands to the plains. The most significant investment in SWC in the Nigerian case study occurs on the steep slopes of inselbergs. Where farmers have access to a range of field types and only low-priority crops are grown on steeper slopes, investment in soil conservation may be low despite the topography. Where land-use plans which define land uses appropriate to different elements of landscape – such as no cultivation on steep slopes or close to rivers – are adhered to or successfully enforced, as in the past in Tanzania and Uganda, the need for SWC may be seen to be lower.

Intensification and commercialisation

As rural households have become integrated into market systems, the increased value of certain crops has created strong incentives for investment in agriculture in some areas. The most substantial investment in SWC analysed in the study occurred in Burkina Faso and in Nigeria. In Nigeria, large urban centres provide buoyant markets for agricultural products. While the study site in Burkina Faso is far from major urban centres, it is only 10km away from the largest market in the province, and there is intense commercial activity in the area. However, differences in agricultural productivity rather than market access appear to explain difference in adoption rates between the two sites in Burkina Faso.

More strikingly, some of the most intensive and distinctive SWC practices are associated with specific high-value crops often produced in the dry season and targeted at urban or export markets. New market opportunities have stimulated increased investment in SWC targeted at raising the productivity of green beans, potatoes, onions, cabbages, aubergines and peppers in Senegal, onions, tomatoes and cabbages in Tanzania and tomatoes, peppers and chillies in Nigeria.

In Tanzania, market liberalisation has led to increasingly attractive producer prices and greater commercialisation. In Nigeria, expansion of horticultural production through the adoption of a residual moisture system was a rapid and innovative response to the dwindling supply of these crops from land with pump systems as energy prices rose.

In contrast, the collapse of markets for cash crops and general reduction in commercial activity in Uganda has proved a major constraint to investment in agriculture and consequently SWC.

Off-Farm Diversification and Migration

The two study sites in Burkina Faso differ in terms of both their agricultural potential and off-farm diversification. Lower adoption rates in one site are explained primarily by lower agricultural potential but this is correlated with higher off-farm diversification. In Senegal, diversification into off-farm activities has enabled many households to avoid investing in SWC, except for selected high-value crops. Agricultural

intensification has occurred at the same time as off-farm diversification and out-migration, indicating increasing differentiation in livelihood strategies.

In Ghana, around half of sample households are engaged in seasonal or permanent migration, (Box 6). Migrants, – mainly men – are an important labour source for SWC. However, local people do not view migration as a key constraint for SWC, largely because it occurs in the dry season, although much land improvement and preparation traditionally occurs at this time. Practices most affected are labour-intensive practices such as stone bunding. In Burkina Faso, recent reductions in migration opportunities to Côte d'Ivoire have stimulated new investment in SWC.

Social cohesion

Social cohesion, at the family and community level, is an important mechanism for mobilising labour. In Pankshin in Nigeria, social cohesion remains strong as families tend to migrate as whole units and influential community-based organisations maintain community networks. Whole family migration is a response to macro-economic policies which promote urban job creation. In many other areas social cohesion is breaking down, under the threat of increased differentiation, migration and other factors. Household disintegration has limited the capacity of decision makers to access and claim key resources such as land and labour. At the community-level, this breakdown has contributed to the erosion of shared labour systems and social conventions which have traditionally supported investment in SWC – including restricting cultivation and protecting vulnerable areas.

Livelihood security

Overall livelihood security – including security of access to land, resources and markets – is a pre-condition for investment in longer-term SWC practices. For example, investment in SWC is currently not a priority in the Teso region of Uganda for a number of reasons, dominated by the continued atmosphere of livelihood insecurity and the need to concentrate on meeting short-term livelihood objectives, (Box 8).

Household characteristics

Most farmers in the study consider their *land* tenure to be secure, whether it is owned according to customary law or they have long-term use rights. However, in northern Ghana, it is often argued that clan-based communal land ownership contributes to excessive degradation in the study region. Formal land policy has had limited influence on SWC investment. Nearly half the respondents practise SWC on only one plot, mainly on compound farms. Investment and maintenance of previous investment only occurs on land actually in use.

Access to *water* influences decisions on SWC in both Senegal and Tanzania. In Senegal, salt water intrusion into the water table influences differential access to freshwater between households and is a constraint on agricultural production and

Box 5 East Mamprusi District, Ghana

The Ghana case study presents an NGO intervention successfully promoting the adoption of improved techniques, but with limited impact on soil characteristics as farmers reduce investment in traditional techniques. While semi-subsistence agriculture is the main activity, farmers are less interested in investing in agriculture than elsewhere and actively pursue off-farm opportunities through diversification into petty trade and out-migration. Reductions in fertiliser subsidies have led to an increase in the use of organic substitutes, but the legacy of past policies has created a culture in which farmers view subsidised agricultural inputs as the solution to their natural resource degradation problems.

Source: Kranjac-Berisavljevic et al., (1999).

Box 6 Les Niayes, Senegal

As in Tanzania, the Senegal case study demonstrates an increased investment in SWC closely associated with agricultural intensification and commercialisation. Increased adoption rates are concentrated on small plots used to produce green beans, aubergines, potatoes, cabbages and other horticultural crops for export to Europe. This intensification has occurred in the context of an influx of migrants seeking economic opportunities in the study region, and increasing salinisation which has forced farmers to abandon some land. On other types of land, investment in SWC has been undermined by the diversification of rural economies and new off-farm opportunities. The case study demonstrates the importance of the macro-economic environment, in this case an export-oriented economy with a competitive exchange rate, in creating economic opportunities in agriculture and incentives for SWC.

Source: ENDA Pronat (2000).

consequently investment in SWC. In Tanzania, investment in certain forms of SWC is designed to complement investment in irrigation, access to which again varies between households.

Access to *labour* depends on family size and cohesion, shared labour systems – linked to social cohesion – and scope for hiring labour. It also depends on opportunity costs in terms of other agricultural activities and off-farm opportunities. For example, in Pambeguwa in Nigeria, labour is a major constraint, but is more accessible in the dry season when residual moisture cultivation takes place. Access to labour may be less important where SWC measures are concentrated on relatively small plots, as in Senegal and Tanzania. It can be an important constraint to adoption of more labour-intensive techniques, such as stone bunding in Ghana. In both examples of substantial investment in SWC (Bantieniema in Burkina Faso and the Pankshin hills in Nigeria), labour is relatively abundant in the context of limited out-migration. In the Burkina site with lower adoption rates, off-farm diversification is more common and social cohesion is weaker.

Limited access to *equipment* and *other inputs* may exclude lower income households from adopting certain techniques, although, where social cohesion remains strong, households which do not own these inputs may be able to access them indirectly, for example by exchanging labour for draught power. Essential equipment mentioned in several case studies includes:

- transport equipment – especially for stone structures;
- draught power and plough;
- light agricultural tools;
- manure and other organic fertilisers;
- other raw material – such as stones.

Financial resources are necessary to hire labour where necessary, to purchase equipment and other inputs, and for complementary investments – such as irrigation. For example, in Burkina Faso, low income households apply SWC

Box 7 Pambeguwa and Pankshin, Nigeria

The Nigeria case study presents two very different examples of investment in SWC in the absence of support from NGOs or government. In Pankshin, where population pressure is particularly high, farmers have traditionally used boulder cultivation and terracing to expand the area of land for cereal cultivation. Households are able to mobilise labour to support these labour-intensive techniques because of low migration rates and strong social cohesion at both household and community levels. In Pambeguwa, innovative farmers have recently adopted residual moisture techniques which enable them to exploit high dry season prices for tomatoes, peppers and other horticultural crops. These techniques can generate significant cash surpluses in some years.

Source: Ahmed et al., (2000).

techniques on a smaller-scale, and use techniques which require little or no labour or equipment (e.g. deadwood or millet stalk barriers). The better-off use techniques such as manure from their own livestock, as well as *zai* – which require light equipment – and low stone walls – which are labour intensive and require transport equipment. Households may be more willing to invest financial resources in SWC designed to improve yields of cash crops, although this raises questions of cash flow and credit. Lack of credit is a frequently mentioned constraint to investment in SWC.

Farmers' *perceptions* of degradation are generally realistic. In Burkina Faso, farmers' awareness of land degradation as a problem and SWC techniques as the solution is a key factor in influencing household decisions to invest in SWC. Adopting farmers believe that SWC techniques improve harvests and soil fertility and reduce land degradation. Awareness of SWC as a potential solution is reinforced by demonstration and experience of improvements. In Ghana, farmers still perceive fertiliser subsidies as the quick solution to their soil management problems, as a result of former policies promoting subsidised inputs. In Pambeguwa in Nigeria, residential moisture cultivation is viewed as an innovative technical solution to environmental constraints which enables exploitation of profitable dry season markets.

The situation in Pambeguwa in Nigeria, where farmers apply highly-developed context-specific traditional techniques with marked success, contrasts with the situation in Senegal where recently arrived migrants have no *traditional knowledge* of the unique local environment. In Burkina Faso, the most widely adopted techniques tend to be based on traditional practices. More than 80% of households stated that lack of knowledge and technical support explained their non-adoption of certain SWC practices prior to the intervention of Voisins Mondiaux.

Contrary to partner expectations, *education* had a negative impact on investment in SWC in Ghana, Tanzania and Uganda. This finding may reflect improved off-farm opportunities associated with higher education levels, rather than a direct causal link.

Policy and institutional issues

Local institutional capacity

Especially in East Africa, traditional and local institutions have a significant role to play in land-use planning, developing and enforcing locally appropriate rules or bye-laws – such as restrictions on cultivating on steep slopes and river banks, and on uncontrolled burning; and promoting locally appropriate solutions through coordinated policies and field-level extension staff. However, in Tanzania there are questions over how far the 'modern' state can substitute for traditional authority in this, and in Uganda, local councils are charged

Box 8 Katakwi District, Uganda

In the Uganda case study region, investment in SWC practices has declined in the context of severe livelihood insecurity and a reduction in market opportunities. Prior to conflict and escalated cattle-raiding in the region, livelihoods were based on a combination of cattle husbandry and cash cropping with a high degree of crop-livestock integration. Livestock ownership has since been devastated, and marketing systems for key cash crops have collapsed. Agriculture is now largely subsistence with low investment and declining fertility associated with lack of draught power to open new land. While the national policy framework is supportive of SWC, many policies are new and have not yet had significant impact on the ground. Local institutions still lack the capacity and motivation to implement these policies.

Source: Makumbi & Okubal, (2000).

Box 9 Contribution of SWC to livelihood objectives

Household livelihood objectives and the contribution of SWC may differ from those assumed by external observers:

- Household objectives are to improve livelihoods rather than increase food production as an end in itself, so SWC activities need to 'fit' with other livelihood activities;
- In Burkina Faso, SWC is a vital element of agriculture-based livelihood strategies, whereas in Tanzania and Senegal and in Pambeguwa in Nigeria, it is an optional investment to increase productivity and exploit specific market opportunities;
- SWC is often viewed as an additional agricultural input to raise yields, or as investment to reclaim degraded land or expand the area of cultivable land, rather than as a means of controlling soil erosion;
- SWC can be part of a strategy of avoiding migration - enabling farmers to stay on the land of their birth by bringing degraded land back into production.

with implementing national policy on SWC, but lack the capacity, resources and motivation.

Support to the agricultural sector

SWC interventions need to be integrated into programmes to improve crop production and marketing where these form key components of households' own livelihood strategies, (see Box 9). Where agriculture is important to rural livelihoods and agricultural land in short supply, farmers will invest in SWC to increase crop yields even in the absence of public sector or NGO support. Government and NGOs can stimulate and support farmers' own efforts by 'brokering' knowledge on SWC between areas and demonstrating the potential of different techniques to improve yields, and by supporting farmers to analyse and articulate their specific needs and call down agricultural support services. Technical support should encourage a range of techniques to suit the needs of different households. Investment in SWC has 'public' as well as 'private good' aspects. Governments should concentrate on addressing market, government and information failures – such as inadequate transport infrastructure, controlled prices and poor information systems) which prevent farmers from achieving 'privately optimal' levels of investment. When the conditions outlined in this paper and summarised in Box 10 are not met,

external support will not generate sustainable investment in reversing natural resource degradation. Past government interventions to promote 'socially optimal' levels of SWC investment, for example through prescribed cultivation practices or subsidised inputs, have failed where farmers have not seen this investment as in their private interests.

Coordinated sectoral policy

Policies in a number of other sectors can be strengthened to support investment in SWC. In particular, there is a need for coordinated – or at least coherent – land, livestock, forestry and environmental policies. It is essential that *land* policies support rather than undermine farmers' land tenure and traditional land use management systems, where these are still effective. *Livestock* policies need to support crop-livestock integration while addressing conflicts between livestock owners and crop farmers. In *forestry* policy, the main issues for SWC are providing secure tenure and usufruct rights to encourage planting and protection of trees by farmers. Multipurpose species have been more readily adopted than species which are only useful for improving soil fertility and controlling erosion. Other sectoral policies, including health and education policy, influence SWC investment decisions, primarily through their impact on *population growth* and the *rural labour* supply.

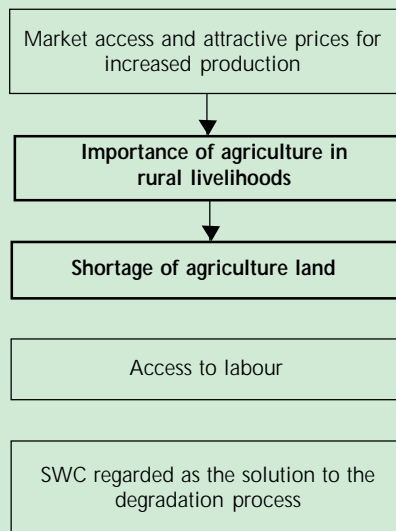
Macro-economic and marketing policies

At the macro-economic level, a policy framework which enables farmers to access markets and obtain attractive prices has proved important. In Senegal, Tanzania and Pambeguwa in Nigeria, increased investment in SWC has been driven by new market opportunities for specific crops. Tanzania and Nigeria both illustrate the significance of attractive producer prices in unregulated domestic markets, while the advantages of competitive exchange rates and an export-oriented economy for producers of export crops in Senegal has stimulated investment in SWC. Economic policy stability – often underpinned by government stability, – is necessary to generate incentives for long-term investment.

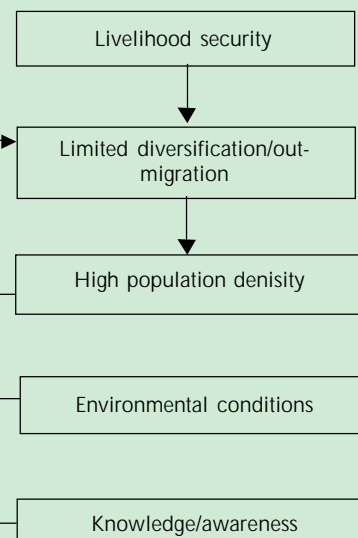
Policies which provide support to rural livelihoods, revitalising rural economies and balancing investment between rural and urban areas and reducing pressures for out-migration, can play a role in maintaining a viable rural labour force and

Box 10 Conditions for reversal of natural resource degradation

Key conditions



Underlying conditions



social cohesion, both important factors in reversing natural resource degradation. In particular, support to the development of off-farm opportunities in rural areas may relieve pressure on natural resources without placing excessive constraints on the availability of labour for key agricultural activities.

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