CSFD
Les dossiers thématiques
Issue 5

Why we should invest in arid areas?

AGROPOLIS INTERNATIONAL
Comité Scientifique Français de la Désertification
French Scientific Committee on Desertification

Les dossiers thématiques du CSFD
Issue 5

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Translated by *Coup de Puce Expansion*
Printed by *Les Petites Affiches* (Montpellier, France)
Copyright registration on publication • ISSN : 1772-6964
1 500 copies (also available in French)

For reference: Requier-Desjardins M., 2007. Why we should invest in arid areas. *Les dossiers thématiques du CSFD*. N°5. June 2007. CSFD/Agropolis, Montpellier, France. 40 p.

French Scientific Committee on Desertification

The creation in 1997 of the French Scientific Committee on Desertification (CSFD) has met two concerns of the Ministries in charge of the United Nations Convention to Combat Desertification. First, CSFD materialises the will to involve the French scientific community versed in desertification, land degradation, and development of arid, semi-arid and sub-humid areas, in generating knowledge as well as guiding and advising the policy makers and actors associated in this combat. Its other aim is to strengthen the position of this French community within the international context. In order to meet such expectations, CSFD is meant to be a driving force regarding analysis and assessment, prediction and monitoring, information and promotion. Within French delegations, CSFD also takes part in the various statutory meetings of the organs of the United Nations Convention to Combat Desertification: Conference of the Parties (CoP), Committee on Science and Technology (CST), Committee for the Review of the Implementation of the Convention. It also participates in meetings of European and international scope.

CSFD includes a score of members and a President, who are appointed *intuitu personae* by the Minister for Research, and come from various specialities of the main relevant institutions and universities. CSFD is managed and hosted by the Agropolis Association that gathers, in the French town of Montpellier and Languedoc-Roussillon region, a large scientific community specialised in agriculture, food and environment of tropical and Mediterranean countries. The Committee acts as an independent advisory organ; it has neither decision-making powers nor legal status.

Its operating budget is financed by subsidies from the French Ministries of Foreign and European Affairs and for Ecology and Sustainable Planning and Development. CSFD members participate voluntarily to its activities, as a contribution from the Ministry for Research.

More about CSFD:
www.csf-desertification.org

Editing, production and distribution of* Les dossiers thématiques du CSFD *are fully supported by this Committee through the backing of relevant French Ministries.* Les dossiers thématiques du CSFD *may be freely downloaded from the Committee website.

Foreword

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Mankind is now confronted with an issue of worldwide concern, i.e. desertification, which is both a natural phenomenon and a process induced by human activities. Our planet and natural ecosystems have never been so degraded by our presence. Long considered as a local problem, desertification is now a global issue that affects us all, including scientists, decision-makers, citizens from both the South and North. Within this setting, it is urgent to boost the awareness of civil society to convince it to get involved. People must first be given the elements necessary to better understand the desertification phenomenon and the concerns. Everyone should have access to relevant scientific knowledge in a readily understandable language and format.

Within this scope, the French Scientific Committee on Desertification has decided to launch a new series entitled *'Les dossiers thématiques du CSFD'*, which is designed to provide sound scientific information on desertification, its implications and stakes. This series is intended for policy makers and advisers from the North and South, in addition to the general public and scientific journalists involved in development and the environment. It also aims at providing teachers, trainers and trainees with additional information on various associated fields. Lastly, it endeavours to help disseminate knowledge on the combat against desertification, land degradation, and poverty to stakeholders such as representatives of professional, non-governmental, and international solidarity organisations.

A dozen reports are devoted to different themes such as global public good, remote sensing, wind erosion, agro-ecology, pastoralism, etc, in order to take stock of current knowledge on these various subjects. The goal is also to set out ideological and new concept debates, including controversial issues; to expound widely used methodologies and results derived from a number of projects; and lastly to supply operational and intellectual references, addresses and useful websites.

These reports are to be broadly circulated, especially within the countries most affected by desertification, by e-mail (upon request), through our website, and in print. Your feedback and suggestions will be much appreciated! Editing, production and distribution of *'Les dossiers thématiques du CSFD'* are fully supported by this Committee thanks to the backing of relevant French Ministries. The opinions expressed in these reports are endorsed by the Committee.

Preamble

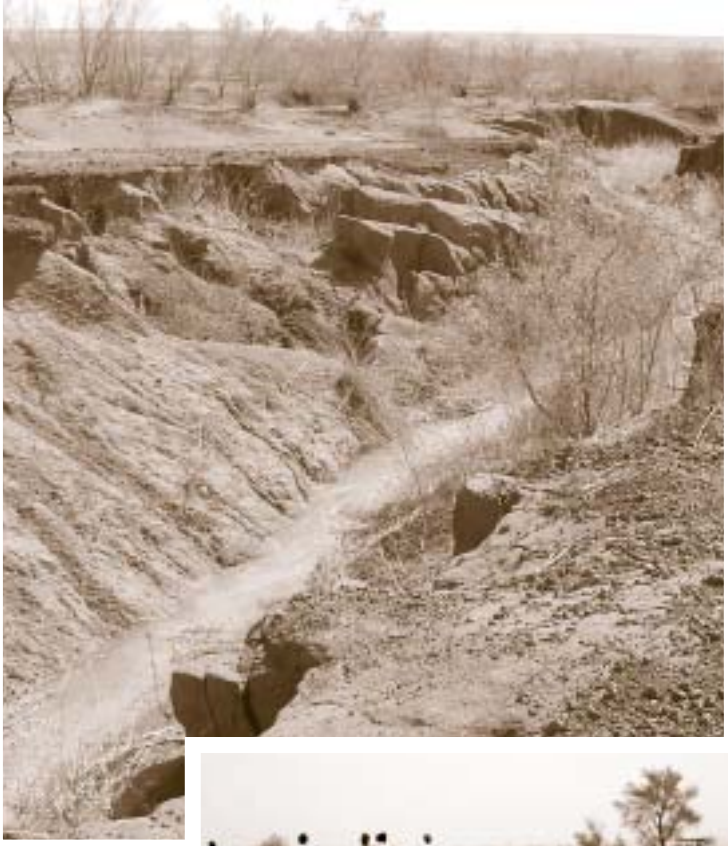
Denis Loyer
Head of the Environment and
Natural Resources Division
at the French Development Agency

This special feature was one of the basic elements introduced for discussion at the international workshop on the '*costs of inaction and investment opportunities in arid, semi-arid and dry sub-humid areas*' organised by the French Scientific Committee on desertification (CSFD) in Rome in December 2006, with backing from the Global Mechanism of the United Nations Convention to Combat Desertification (UNCCD), the French Ministry of Foreign and European Affairs and the French Development Agency (AFD). Backing was also provided by several other partners such as the International Fund for Agricultural Development (IFAD), the technical arm of the German Development Agency (GTZ, *Deutsche Gesellschaft für Technische Zusammenarbeit*), the Food and Agriculture Organization of the United Nations (FAO), the World Bank (*Terrafrica*) and the Sahara and Sahel Observatory (OSS). This international workshop was one of the events organised for the international year on deserts and desertification. It brought together about eighty people from both the North and South, representing development agencies and ministries, stakeholders such as non-governmental organisations and professional bodies, scientists and economists.

This document was prepared by the French Scientific Committee on desertification with support from the Global Mechanism and the French Ministries for Scientific Research and Foreign and European Affairs. It is based on an analysis of the socio-economic costs of desertification and a few benefits of combating desertification actions, particularly in Africa. The work was done in 2005-2006 with backing from the French Development Agency (Constance Corbier) through the Centre of Economics and Ethics for Environment and Development at the University of Versailles Saint-Quentin-en-Yvelines (France, Mélanie Requier-Desjardins, Marc Bied-Charreton). The final report attempted to synthesize the studies available to date, in particular the study undertaken for the United Nations Environment Programme (UNEP) by Dregne and Chou (1992) and the more recent ones undertaken for the World Bank, the Global Environment Fund (GEF) and the Global Mechanism by teams working under L. Berry (2003 and 2006), G. Bjorklund (2004), C. Reij and Steeds (2003). Finally, it also took into account environment evaluations undertaken for many years for the World Bank in particular by J. Bojo (1996), S. Pagiola *et al.* (2004) and M. Saraf (2004). It also suggested several development scenarios (Requier-Desjardins and Bied-Charreton, 2006).

This document also considers the achievements of international events held in 2006 during the 'International Year of Deserts and Desertification' in particular those of the scientific symposium in Tunis on '*the future of arid areas*', jointly organised by the United Nations Agencies, coordinated by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the OSS and the Tunisian Ministry of the environment and sustainable development, and those of the international forum on '*Desertification and civil society*' held in Montpellier (France) which brought together stakeholders from civil society and scientists from about fifty countries.

This special issue attempts to summarize current knowledge of the economic costs of desertification and to consider the question of investment opportunities in arid areas. It includes data and results which have not been widely published. It also raises the fundamental issue of the need to restore natural capital before it is too late, in other words before natural resources have deteriorated too much and before the resulting poverty is too widespread.



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Natural capital in dry areas

For more than thirty years, the natural resources of arid regions have been degraded due to the increased pressure of people on their natural environment as well as climatic crises such as prolonged droughts which have occurred in various parts of the world.

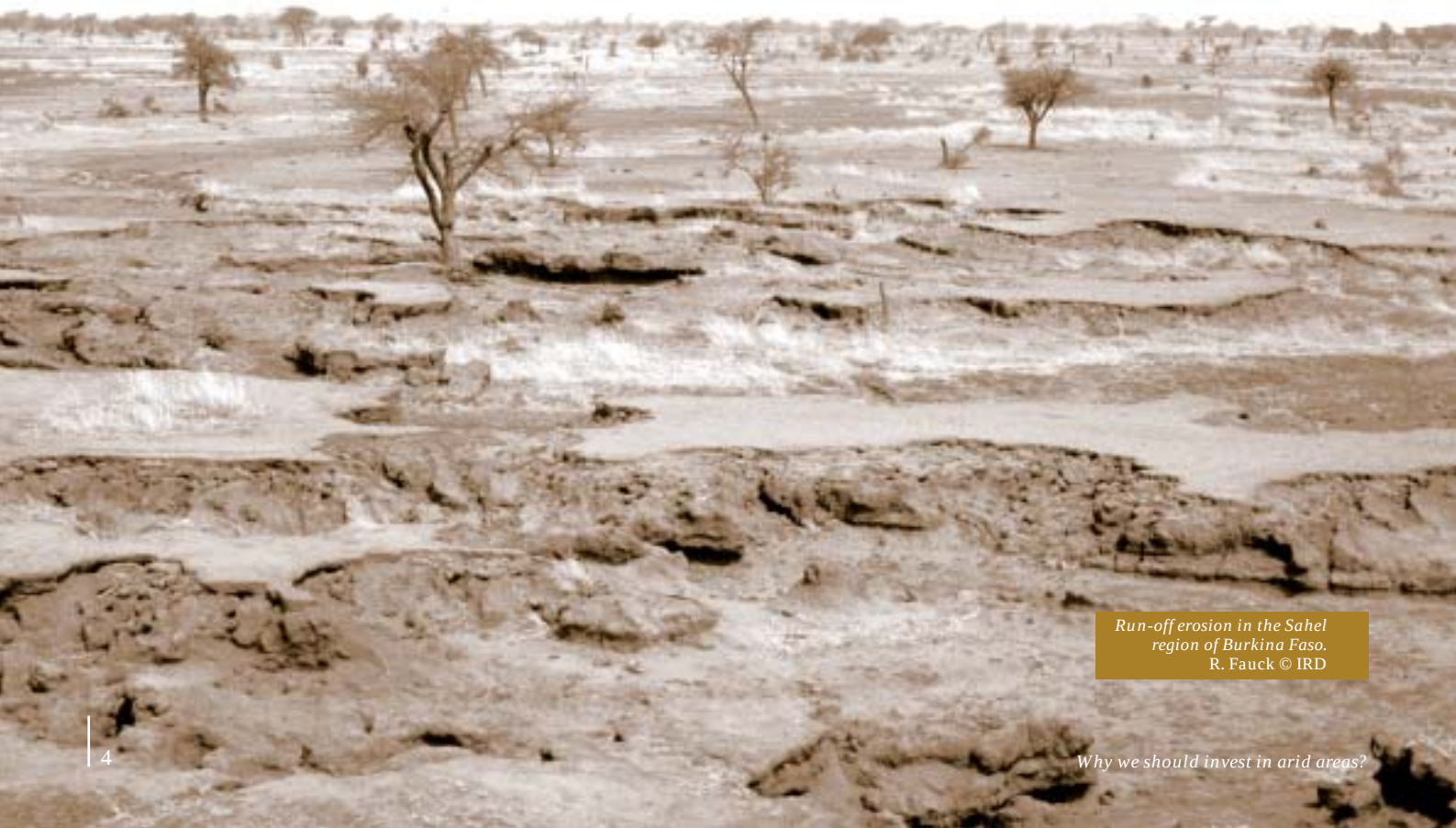
Natural capital: a set of exploitable resources

This degradation of **natural capital** has led to the gradual desertification of several hundred million hectares on all continents and to increasingly serious poverty for hundreds of millions of people.

This is particularly true in that these people get most of their income from exploiting natural resources: water, soil and vegetation. The countries located in arid areas depend mainly on agriculture and livestock farming, consequently a very significant proportion of their natural wealth depends on exploiting their **natural capital.** Furthermore, the ecosystems of arid regions provide services which go beyond simply providing soil, vegetation, water and nutrients for agriculture and livestock production.

The degradation of these ecosystems thus has a serious impact in economic, social and environmental terms. To comply with the Millennium Development Goals adopted in 2000, conservation and restoration of the degraded natural capital should be made national and international priorities. In fact, the issue of preventing the degradation of resources and desertification refers clearly to goals 'Reducing poverty and hunger' and 'Ensuring a sustainable environment'.

The Desertification section of the Millennium Ecosystem Assessment (MEA) shows that the degradation of dry arid, semi-arid and sub-humid areas will make it impossible to achieve these objectives. Finally the report entitled '*Where is the wealth of Nations*' published by the World Bank emphasises the importance of natural capital to poor countries, in particular in Africa. Moreover, most of the poor countries are located in arid areas.



Run-off erosion in the Sahel region of Burkina Faso.
R. Fauck © IRD

Valuation of the economic costs of degradation and desertification

Not much analysis has been done so far of desertification costs and little valuation. Valuation methods for environment economics have rarely been applied to arid and semi-arid areas. Generally speaking, these methods have proven too difficult to apply for such huge territories. Economic losses caused by degradation of land were first estimated for cultivated land using measurements of annual losses of crop soils per hectare and per year. The yields lost were evaluated by relating them to nitrogen losses due to erosion of soils and they were then converted into monetary values. This enabled researchers to correctly model erosion processes. How can this modelling now be developed to include not only agricultural production but also all other services provided by these ecosystems?

More spatially-based approaches also considered the costs of desertification in terms of lost rural production, focussing on agriculture, livestock production and forestry. All of these methods have limitations such as, for example, the fact that the multi-functionality of the space is not taken into account. Finally, they generally do not taken into account indirect effects such as silting up of dams, the impacts of dust clouds or losses in biodiversity. How can these indirect effects be better taken into account?

Why investing in arid land?

More knowledge of the economic and social costs may lead to a rationale in favour of investment in arid land. However this knowledge should be accompanied by an analysis of the profitability of anti-desertification investments. Unfortunately there is not much documentation available on this theme. The main references are the study by Reij and Steeds for the Sahel (2003) and that done by Hien for Burkina Faso (2004); some information may also be found in project reports which have sometimes not been published.

This document tries to show that the economic rates of return (ERR) of land rehabilitation operations are positive and encouraging. They are sometimes under-estimated, for instance, the social and institutional benefits are not taken into account in these evaluations. Should one improve ERR calculations for combating desertification projects and if so, how? On a higher level, how can information obtained on economic costs and the rates of return of some projects undertaken in arid areas be turned into a rationale to increase investment in dry regions?

This document shows the valuation of macroeconomic costs of desertification in Africa by making an inventory and describing the main results. In that scope, analysis of desertification was widened to include the degradation of land. The second section introduces data on profitability and the realities of investment in the fight against desertification.

Focus

On the Millenium Development Goals (MDGs)

On 8 September 2000, at the dawning of the 21st century, the United Nations General Assembly adopted a declared called the 'Millenium Declaration'. It reaffirmed the fundamental values which should underlie international relations: liberty, equality, solidarity, tolerance, respect for nature, shared responsibility. It set the six following goals:

- Peace, security and disarmament
- Development and poverty eradication
- Protecting our common environment
- Human rights, democracy and good governance
- Protecting the vulnerable
- Meeting the special needs of Africa.

And also to strengthen the United Nations.

The fight against desertification is clearly a part of goals 2 and 3.

For further information:
www.un.org/millenniumgoals/

Soil highly eroded by storms. Southern Niger.
M.-L. Sabrié © IRD

Focus

Millenium Ecosystem Assessment, MEA

This assessment was requested by the UN Secretary General, Kofi Annan in 2000. The secretariat for this assessment was coordinated by the United Nations Environment Programme (UNEP). Four work groups wrote a final document which was published in 2005. The originality of this document was that it attempted to find answers to new questions, for instance: How have the ecosystems and the services they provide, evolved? What has caused these changes? How do these changes affect human well-being? How might these ecosystems evolve in the future? What are the possible options for reinforcing the conservation of ecosystems and their contribution to human well-being?

About two thousand people contributed to this publication, which postulated that people are an integral part of ecosystems which provide indispensable services to human well-being: supply of non-renewable resources such as minerals and fossil energy, renewable resources such as water, wood and food; supply of climate regulation services, rivers, water quality; supply of cultural, aesthetic, spiritual, educational and leisure services. This document describes the trends and scenarios and five complementary reports are devoted to biodiversity, desertification, wetlands, health and the business world. The specific report on desertification offers what is probably the most complete and up-to-date coverage of this issue.

For further information:
www.maweb.org/en/
www.ecologie.gouv.fr/evaluation-des-ecosystemes-pour-le.html

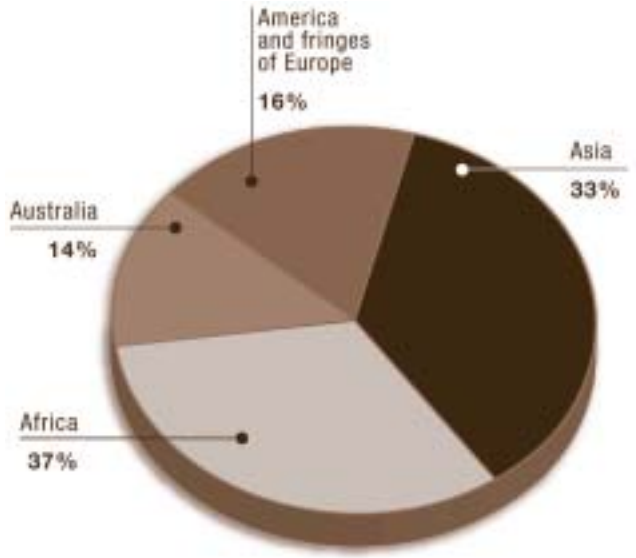
Valuation of macroeconomic costs of desertification in Africa

Desertification has been defined by the United Nations Convention to Combat Desertification (UNCCD, 1994) as *"land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities"*.

Desertification in Africa: a seriously underestimated problem

This convention, which was drawn up and ratified in 1994 following the Rio Summit, was designed to draw world attention to the tragic situation of arid areas, home to more than a billion of the poorest people in the world (Dobie, 2001). In article 7, it emphasises the situation of the African region which is particularly affected, both form an environmental point of view and a socio-economic point of view: in fact 37% of the threatened dry areas are in Africa.

Desertification is both a development and an environmental problem (Cornet, 2002). However, the proportion of official development assistance (ODA) devoted to the rural sector of dry areas has been decreasing continually for the last 15 years. In 2005, 5% of worldwide ODA was allotted to the development of degraded land (Berry *et al.*, 2006).



◀ *Distribution of drylands by continent*

The arid, semi-arid and dry sub-humid areas referred to as dry areas are characterised by an evapotranspiration rate between 0.05 and 0.65; the polar and sub-polar areas have been excluded. Dry regions represent 40% of the emerged land of the globe.

The economic costs of desertification and land degradation would increase our awareness of the extent of the phenomenon and its impact on rural development and agriculture. Finally, it could be used for decision-making on sectorial orientations for development assistance.

Two categories of methods and their principal methodological limitations are distinguished, before presenting and discussing the results as well as their potential usefulness for the rural development of dry regions.

Valuation of rainfall erosion by agro-ecological models

A great deal of work on modelling erosion phenomena has been done since the beginning of the 1960s. The initial reference for most of this research was the universal soil loss equation (USLE, Hilborn & Stone, 2000). It is used to estimate the loss of land or the annual mean erosion rate over the long term on the slope of a field. This rate (expressed in tonnes per acre) is a result of the configuration of rainfall, type of soil, of topography, of crop rotation and crop management practices.

The USLE is thus used for forecasting and analysing erosion, particularly with respect to cultivated land. It has been developed in many different ways from the formulation of alternative equations for soil loss to the modelling of relationships between soil loss, nutrient loss in soils and productivity. Identifying these relationships makes it possible to calculate the economic cost of erosion.

Women carrying water to their homes. Oudalan. Markoy, Burkina Faso.
F. Sodter © IRD

A method used in Mali and Zimbabwe: the universal soil loss equation (USLE)

In Mali, the USLE was used in 1989 to quantify the mean loss of cultivatable land per hectare (a hectare equals 2.47 acres) (Bishop & Allen, 1989, quoted by Bojö, 1996). By using statistical decline coefficients for Niger, the data on soil loss is extrapolated to that of nutrient loss*.

By extending the results on the plot level to all of the agricultural regions of the country, we obtain the mean annual loss of nutrients on a national scale. This is then valuated in monetary terms according to the price of commercial fertilizer. The annual range for this loss, which varies from 2.6 to 11 million USD (American dollars, 1989), is then used as an approximation of the macroeconomic loss related to desertification.

The economic method used in this Malian example is that of replacement costs, in other words the monetary estimation of a loss in natural capital by means of the value of the artificial capital corresponding to identical functions. There is of course a debate as to the relevance of this type of economic valuation based directly on the loss of nutrients. Many specialists acknowledge that these losses are high in dry regions due to the rare but intense rainfall which strongly contributes to the loss of soil productivity and consequently to desertification or degradation of soils (Craswell *et al.*, 2004).

At the same time, this method would lead to overestimating the costs of soil degradation (Pagiola *et al.*, 2004).

It should be noted that it was also applied to Zimbabwe in 1986. The results of statistical experiments at the time then related soil loss to that of nutrients for the two main types of soil in the country (Stocking, 1986, quoted by Bojö, 1996). The four main agricultural production systems in Zimbabwe were then assigned a differentiated erosion rate, which made it possible to quantify the loss of nutrients on a national scale while taking ecological and agro-economic factors into account. Thus, the degradation of land each year costs Zimbabwe approximately 117 million USD at the 1986 value.

However, to return to the case of Mali, one might also argue that most of the land areas affected by desertification are in fact naturally arid grazing lands which by definition are not taken into account by the USLE and that consequently the estimate of losses related to desertification for this country on the basis of loss of cultivatable soils is much less than in reality.

* The main nutrients in soils are nitrogen and phosphorus. In many field studies and experiments, only nitrogen is taken into account. The organic matter of soils is mostly made up of carbon, nitrogen and potassium.

Assessment of the impact of loss in nutrients on soil productivity in Ethiopia

Since the 1980s, a lot of experiments conducted in Africa have tried to understand and better characterise the relationships between soil loss in nutrients and in productivity. In Ethiopia for instance, the valuation of the impact of nutrient loss on soil productivity is based on the results of practical experiments on farms: the yield of the two main cereals is studied in relationship to the amount of nitrogen in the soils (Sertsu, 1999, quoted by Berry and Olson, 2003). The loss of yield observed varies between 46 and 544 USD per hectare for wheat and between 31 and 379 USD per hectare for maize, assuming the low estimate of the impact of nitrogen loss on the harvest amount per hectare.

Finally, other types of models are used to understand the relationships between water, soils and agricultural production as well as for estimating degradation costs. In Ethiopia for instance, the Food and Agriculture Organization of the United Nations (FAO) developed a model to determine crop water needs which relates the monthly rainfall values, the soil water storage capacity and the evapotranspiration to determine variation in crop yields (FAO, 1986, quoted by Bojö, 1996). In Zimbabwe, models of plant growth were applied to on the scale of districts to measure the effect of erosion on the yield of six distinct crops (Grohs, 1994, quoted by Bojö, 1996).

Increasingly complex soil erosion models

On the whole, soil erosion models are becoming more and more sophisticated as they simultaneously take into account the effects of rainfall and wind on soil erosion. They also relate the depth of soils, the losses of organic matter and the loss of water in soils as well as the organisms in soils or biota to obtain the rate of decline of crop or fodder crop yields (see for instance Pimentel *et al.*, 1995).

Several partial models are often coupled together to encourage more refined and complete modelling of erosion and its impact. There are also combinations of generic and applied models (for instance for Malawi: World Bank, 1992 quoted by Bojö, 1996). Mapping of erosion and land-use on a national scale is enriched with results obtained at plot level or district level.

Finally, from a methodological point of view, modelling is used to estimate production losses for a predefined series of years and to thus determine a mean annual value for land degradation. However, most of the work referred to is restricted to the impact of desertification on crop yields thus neglecting livestock breeding and forestry activities which are also affected by the loss of soil productivity.

Loss of yield of two cereals due to loss of nitrogen (N) caused by erosion of soils in Ethiopia (a kilogram is equal to 2.2 pounds)
From Sertsu, 1999, quoted by Berry and Olson, 2003.

Crop	Loss of yield (kg) by kg of N lost	Loss of nutrient N (kg/ha)		Harvest lost (kg/ha)	
	Crop response rate	*Low*	*High*	*Low*	*High*
Maize	9.6	36	429	345	4 120
Wheat	6.9	36	429	248	2 960

Monetary values of loss of cereal yields due to degradation of soils in Ethiopia
From Sertsu, 1999, quoted by Berry and Olson, 2003.

Crop	Harvest lost (kg/ha) Low range	Price of grain (Birr* /kg)		Total loss (Birr)	
		Low	*High*	*Low*	*High*
Maize	345	0.80	9.5	276.0	3 294
Wheat	248	1.60	19	396.8	4 736

* The Birr is the unit of currency in Ethiopia. 1 euro = 11.38800 Birr (March 2007)

Focus

Methods for economic valuation of the environment

There are several categories of techniques for evaluating environmental resources. In practice, very few of them are used to evaluate the cost of desertification and degradation of land.

The direct valuation of revealed preferences in an actual market is a very simple matter. The change of productivity provides information on variations in the state of the environment; this information may be measured directly via variations in production of goods and market services. The value of the environmental resource is here estimated in terms of its contribution to productive activities by economic agents.

The valuation by change in productivity is a two stage process, which involves:

1. Determining the physical effects of a variation in the environment on the economic activity.
2. Measuring the monetary value of the damaged ecological function.

This valuation is the one mainly used for quantifying costs of desertification: measurement of the losses for agriculture, livestock and wood.

None of the direct valuation methods in a substitute market and a fictitious market are used for evaluating the costs of desertification. The transport costs method is however useful for tourist sites in dry regions as it can be used to calculate the loss of income, for instance related to desertification, from changes in the frequency of visits to these sites. It would also thus reflect a variation in the use value of the environmental goods in question.

The contingent valuation method reveals the preferences of individuals which are then used as a basis for evaluating environmental goods. In practice, a survey is made by asking individuals to determine the amount that they are prepared to pay or to receive to maintain the same level of well-being. Thus the cost of desertification is evaluated by evaluating the agreement to pay on the basis of efforts willingly made by economic agents, for instance in terms of working time rather than monetary payment. All of these methods are used in standard economic analysis: they are based on the study of the behaviour of consumers and attempt to reconstitute a demand function for the natural goods (resources) in question.

The indirect methods assign a monetary value to the physical damage due to the degradation of the environment. Unlike the previous methods, they are not based on the behaviour of economic agents. The replacement costs method postulates, for instance, that it is possible to replace losses of productive functions of a natural environment by artificial capital which could restore the lost functions. The market price for this artificial capital is then used to assign a value to the environmental loss. This evaluation must be realistic in other words the replacement solution must be the least costly of the alternative solutions. This method is useful when it is difficult to estimate the economic and physical data or to obtain them, as the replacement scenario is independent of the preferences of individuals in these markets. For instance in the case of desertification, when the quantities and variations of nutrients in the soil are known, it is possible to assign a value to the degradation of land by using the price of commercial fertilizers.

From Bailly *et al.*, 2000; Brismar *et al.*, 2004; Lescuyer, 2005; Willinger, 1996.

Methods for monetary valuation of the environment
From Lescuyer, 2005.

Direct valuation			Indirect valuation
Preferences revealed		Preferences expressed	No preference
In the actual market	*In a substitute market*	*For a fictitious market*	
• Change in productivity • Expenses for protection • Goods which may be substituted	• Hedonistic prices • Transport costs	• Contingent valuation	• Dose-effect method • Replacement costs

The Millennium Ecosystem Assessment (MEA, 2003) is now recommending an approach in terms of services provided by ecosystems: for arid areas, this concerns the supply of food and wood, the regulation of biodiversity, the nutrient cycle, the quality of air and the climate, human health, detoxification, cultural and tourism services. Many institutions, among which the World Bank and the UNEP (United Nations Environment Programme) are currently trying to implement this approach for operational purposes by using classic or innovative methods of economic valuation (Pagiola et *al*., 2004; Shepherd, 2006).

How will the knowledge acquired through models of erosion processes which focus mainly on services provided, such as food and more marginally regulation of the nutrient cycle, be used or improved to increase our new understanding of the role of the environment and to provide more complete valuations of the costs of its degradation?

Spatial approaches based on land-use data

The second type of approach to evaluating the costs of desertification is based on dividing the rural space according to its main economic uses. Generally these are crop fields (irrigated and rainfed crops), grazing areas for livestock and forests used mainly for producing wood and non ligneous products. By applying a rate of decline in the natural productivity of these spaces, one obtains the overall losses of rural production. The evaluations of these rates of decline in productivity depend on the state of desertification observed; the data come from local observatories of desertification or experts' judgements.

World estimate of the cost of land degradation

For instance, the only world estimate of the cost of desertification divides up dry areas according to three main rural activities: irrigated agriculture, rain-fed agriculture and grazing lands (Dregne and Chou, 1992). In this study dating from the 1990s, forests appear to have been treated as grazing land. The surface areas affected are counted by country using data from the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The second part of this work consists in evaluating the cost of desertification by hectare for each type of land or activity. This valuation was based on several micro-surveys conducted in Australia and the United States: the loss of productivity related to the desertification process globally estimated at 40%; each year the degradation costs 7 USD per hectare of grazing land, 38 USD per hectare of rain-fed crops and 250 dollars per hectare of irrigated crop. These figures are then applied to all of the world surface areas which have been degraded.

Thus, each year, 11 billion USD are lost following the desertification of irrigated land, 8 billion following the desertification of rain-fed crops and 23 billion following the degradation of grazing lands. The annual economic cost due to desertification is thus 42 billion USD (1990). This study still has to be brought up to date.

Surface areas degraded by type of land in the world and in Africa (1 000 ha)
From Dregne and Chou, 1992.

Type of land	Total surface area	Affected surface area	% of surface area affected
World			
Irrigated land	145 495	43 147	30
Rainfed crops	457 737	215 567	47
Grazing land	4 556 420	3 333 465	73
All kinds of land	5 159 652	3 592 179	70
Africa			
Irrigated land	10 424	1 902	18
Rainfed crops	79 822	48 863	61
Grazing land	1 342 345	995 080	74
All kinds of land	1 432 591	1 045 845	73

Estimate of Moroccan land degradation by the World bank

Among the reports of the World Bank written in 2003 on valuation of the costs of environmental degradation in MENA countries (Middle East and North Africa), the survey conducted in Morocco used a similar approach to the previous one: the area was broken down into crops, grazing land and forests and the corresponding areas subjected to desertification were then evaluated. Two states of desertification were thus distinguished for crops and grazing lands respectively and each was given a specific rate of decline of productivity based on the opinion of experts.

Estimate of the degradation of rain-fed crop lands in Morocco

Qx is quintal (100 kg)
From World Bank, 2003.

	Lower limit	Upper limit
Moderate erosion	25%	50%
Degraded cultivated land (1 000 ha)	2 175	4 350
Decline in productivity	20%	20%
Decline in yield (qx/ha)	2	2
Lost production (1 000 qx)	4 350	8 700
Lost value (million Dirham [Dh])	130	260
Lost value (million USD)	13.7	27.3
Slight erosion	50%	100%
Degraded cultivated areas (1 000 ha)	4 350	8 700
Decline in productivity	5%	5%
Decline in yield (qx/ha)	0.5	0.5
Lost production (1 000 qx)	2 175	4 350
Lost value (million Dh)	65	130
Lost value (million USD)	??	??
Mean (millions Dh)	97.5	195
Mean (millions USD)	10.2	21.5

The loss due to burnt forest land was obtained by summing the average loss of wood with that of non ligneous forestry products derived from a mean estimate per hectare for the entire world (World Bank, 2003). The producer price for wood, wheat and barley was used to determine in monetary terms the annual quantities of production lost.

Estimates based solely on food or wood supplied by land

In many countries, the lack of data, whether it be scattered in various institutions (and thus difficult to obtain) or simply not available often means that it is impossible to evaluate such costs for desertification and land degradation. Various combinations of environmental and agro-economic data may then be used: in Tunisia, the national valuations of land areas lost each year make a distinction between irrigated surfaces and rain-fed crops. It is thus possible to calculate the economic loss for cereals on the basis of mean yields from this land and of the international wheat price (World Bank, 2003). In Rwanda, land degradation is evaluated by using the calculated loss of productivity per person between 1982 and 1994 for cereals and root crops, obtained by combining micro-research and national data on the types and volumes of agricultural production between 1966 and 1986. On the hypothesis that this loss in productivity is related to land degradation, it is possible to obtain the mean cereal production lost annually and consequently its monetary value (Berry and Olson, 2003).

Rice growing on terraces in Madagascar. A peasant farmer gathers young plants for planting out.
M.-N. Favier © IRD

These valuations are done by means of a spatial approach, taking mainly into account the costs of desertification in terms of lost rural production (agriculture, livestock breeding and forests). When used for the approach developed by the Millennium Ecosystem Assessment in terms of services provided by ecosystems, they are limited only to evaluating services for provision of food and wood.

Limitations and non-inclusion of indirect effects

Internal limitations: temporal and spatial scales

Most of the valuations are based on a reference period and use data series for long periods of time. This makes it possible to limit the particular effect of a given event, which is a fundamental criterion for dry regions in which rainfall varies greatly. However the final annual value always depends on the period of time chosen as a reference.

For the Sahel region for instance, the estimates based on the period 1970-1985 will give annual costs for desertification which are probably higher than those calculated for 1990-2003 due to the periodicity of the variation in rainfall.

All of the methods we have seen hypothesize that the data obtained at a micro scale and from local experiments can be extrapolated. They are used as a basis for representative modelling of the main types of land and farming methods, whose results are then aggregated at a national level. At this level, they can be used to define mean annual rates of decline in productivity depending on the economic activities in question. The costs resulting from these two types of method are generally gross costs since the way in which rural populations effectively adapt to the degradation of land for, instance using techniques for conserving water and soil, is not taken into account.

External limitations: the multifunctional dimensions of space not taken into account

Numerous different activities in the same dry areas are found according to the seasons. The main limitation of spatial approaches is that they are not able to take into account this multi-functionality of space when evaluating desertification costs: with these approaches, the rural surface areas are in fact broken down according to the predominant activity. As for erosion models, these mainly evaluate the degradation of crop soils and sometimes that of integrated agropastoral systems. However, they do not apply to natural grazing lands which make up the most of arid regions.

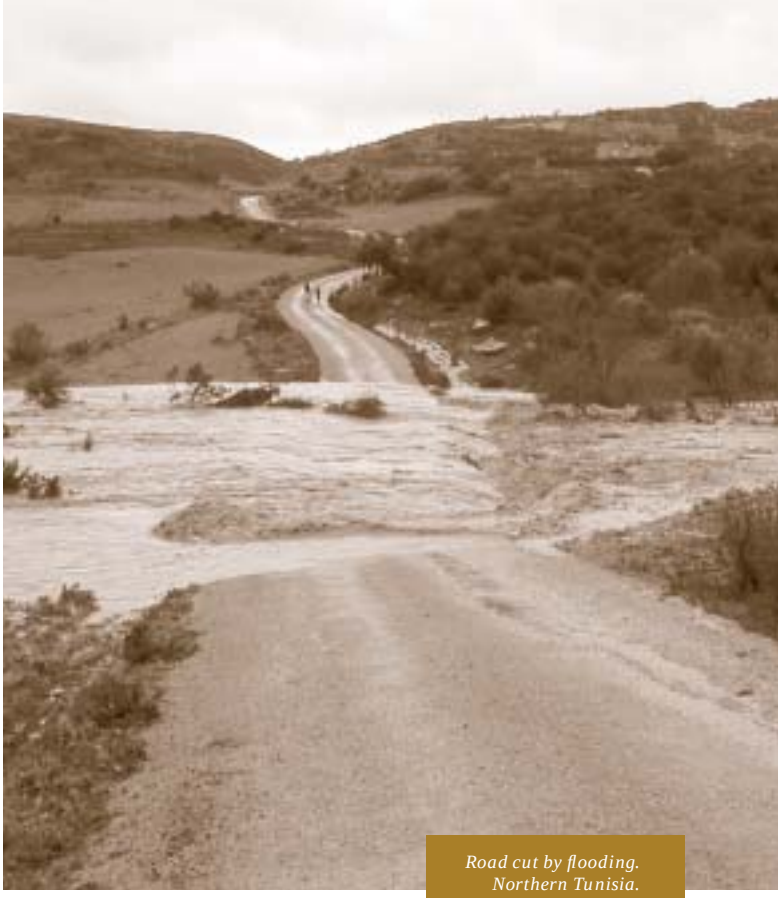
The costs of desertification expressed in monetary value also depend greatly on the price of reference cereals. These prices may vary by a factor of two from one year to the next and very strong variations have been observed for any given year. Moreover, they differ between the city and the countryside and according to whether they are considered at the producer scale or that of international exchange rates. This is why some valuations use cost intervals taking into account both the lowest price and the highest price observed for the same cereals.

These valuations use remote sensing services or national databases monitoring the evolution of the degradation, land use and rural production. The heterogeneity of the data available, depending on each country, leads in many cases and in a pragmatic way to the use of distinctly different evaluation methods. It would appear *a priori* that it is hard to compare these results.

The issue of indirect effects

Most evaluations only deal with the direct effects of desertification and the degradation of land. More rarely evaluated are: the silting-up of dams and subsequent losses of water and electricity, variation in fishing production and disturbances to shipping on water courses, the impacts of dust clouds on air transport and human health or on a more global level, the losses of carbon and biodiversity due to diversification and land degradation.

Morocco and Tunisia however estimate the costs of silting-up of dams: the amount of water lost each year is translated into the amount of electricity lost (KWh) or the loss of industrial and domestic water, which is evaluated on the basis of current prices. These indirect costs of desertification thus account for 0.06% of the GDP (gross domestic product) for Tunisia and 0.03% for Morocco.

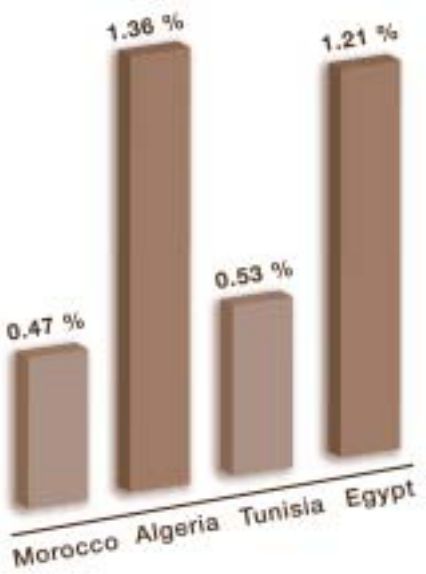


Road cut by flooding. Northern Tunisia. © J.-F. Richard

Underestimated results

Given most of the limitations referred to, the results are largely under-estimated.

The national results are given as a percentage of GDP for North African countries. For Sub-Saharan Africa, the costs of land degradation are given as a percentage of the agricultural GDP (AGDP) given the importance of the primary sector for these countries (the agricultural GDP may account for up to 40% of GDP as for Niger for instance).



The cost of desertification for four North African countries in 2003 (as a percentage of GDP)

From Sarraf, 2004.

Concerning the North-African countries, the costs of desertification speak volumes: given the proportion of oil and natural gas resources in Algeria's GDP, the relatively high amount of desertification costs emphasises the seriousness of the phenomenon. The Egyptian percentage must be related to the considerable surface areas irrigated in Egypt, for instance in the Nile valley and also to land salinisation problems.

In Sub-Saharan countries, economic losses due to degradation of land account for between 1 and 10% of agricultural GDP. It appears difficult to conclude anything *a priori* from these results to the extent that they do not appear to depend on the type of methods used. Nevertheless, the lowest percentages correspond to studies which only evaluate the agricultural loss, which means they are somewhat coherent. Then, one may also emphasise that in spite of the diversity of methods, the results obtained often fall within a significant range of from 3% to 5% of the agricultural GDP. Finally these results may be related to the annual agricultural growth of the countries in question: in short, one might argue that the annual cost of land degradation in Sub-Saharan African countries is more or less equivalent to their mean agricultural growth. Which brings into question the reality of rural development in these countries both in the present and in a more sustainable perspective*.

* In essence, this comment also applies to the agricultural growth of the Northern countries. Should we therefore work towards a general renewal of public accounting systems including the ecological downsides of economic achievements or growth in production?

Annual costs of land degradation on a world scale and for nine countries in Sub-Saharan Africa (percentage of agricultural GDP and in absolute value)
M: millions • Ag GDP: agricultural GDP • USD 90: 'the 1990 USD value'.
From Bojö J., 1996; Berry and Olson, 2003a and b.

Country, source year	Type of loss	Cost (AGDP)	Annual cost (absolute value)	Main methodological elements
World Dregne (1992)	Agriculture Livestock	_	42 billion USD (USD 90)	Spatial extent of desertification, cost of decline in productivity by ha
Rwanda Berry & Olson (2003)	Agriculture	3.5%	23 M USD (USD 2003)	Series on agricultural production, loss of productivity per person
Ethiopia Berry & Olson (2003)	Agriculture Livestock Forestry	4%	139 M USD (USD 2003)	Updating of previous evaluation
Bojö & Cassels (1994)	Ditto	4%	130 M USD (USD 94)	Improvement of Sutcliffe's study: soil transfer matrix
Sutcliffe (1993)	Ditto	5%	155 M USD (USD 94)	Depth of soils and loss in productivity
FAO (1986)	Agriculture	<1%	14.8 M USD (USD 94)	Modelling of crop water requirements satisfaction
Zimbabwe Grohs (1994)	Agriculture	<1%	0.6 M USD (USD 94)	Modelling of plant growth, erosion mapping
Norse & Saigal (1992)	Agriculture Livestock	8%	99.5 M USD (USD 94)	Improvement of Stocking's study: soil budget in nutrients
Stocking (1986)	Ditto	9%	117 M USD (USD 94)	Cost of replacement; main types of soil and farms
Lesotho Bojö (1991)	Agriculture	<1%	0.3 M USD (USD 94)	Statistics relating losses of soil, nutrients and productivity
Malawi World Bank (1992)	Agriculture	3%	6.6-19 M USD (USD 94)	Modelling of soil losses and drop in productivity
Mali Bishop & Allen (1989)	Agriculture	<1%	2.9-11.6 M USD (USD 94)	1. Cost of replacement 2. Modelling of losses of soil, nutrients and productivity
Ghana Convery & Tutu (1990)	Agriculture	5%	166.4 M USD (USD 94)	Cost of replacement

Farmers and livestock breeding in Mali. The manure contract between pastoral herdsmen and farmers on the land belonging to the village of Wuro Neema is advantageous to both: fields are replenished and livestock can graze on leftovers of harvests.
O. Barrière © IRD

Towards investment in the fight against desertification?

An analytical inventory of the different studies conducted since the 1980s on the economic costs of desertification and land degradation has made it possible to distinguish two main categories of methods: (i) those which may be called more geographical, which are based on a spatial division of economic activities in dry regions, on an estimate of degraded areas and on the corresponding rates of decline in productivity and (ii) those which are based on the agro-ecological modelling of erosion processes, which have been proven and improved for a long time but which are limited more to crop, farming of fodder systems while not taking into account the exploitation of natural grazing lands, which is the predominant type of farming in arid regions. A first category of methods uses the global scale and a second one using a local scale. The first is based on micro-studies to determine the global rates of decline of productivity or economic loss per hectare and the second extends these micro-results by aggregation as a function of spatial and human data. These methods may thus be complementary and enrich each other.

The results obtained show that the rural development of African countries is trammelled by desertification and land degradation. This is not apparent of course in the national accounting systems of the countries in question. It is thus necessary to consider more intermediary scales of analysis: there are profitable agricultural and livestock breeding systems whose positive results in terms of annual production are accounted for; some are sustainable, others less. Production based on subsistence systems (generally neglected by sectorial investment of States but which concerns again the major part of rural African populations) in also increasing in absolute value; but at what ecological price? Beyond the less than perfect statistics and difficult comparisons, the global potential of human and economic development is compromised by desertification.

These results may be considered to be the economic costs of lack of action in dry regions and be used as arguments in favour of investment in the fight against the degradation of land and desertification. To the extent that most of the studies do not take into account the direct costs of desertification and often only agricultural losses, the final values obtained are greatly under-estimated.

Finally, it should be remembered that current valuation methods are turning more and more towards the issue of services provided by ecosystems. There are many such services in arid areas: are they limited to those listed by the MEA? How can the valuations so described then be included in this new paradigm? Finally, is it necessary to achieve complete valuations in order to use the argument of the costs of desertification in an attempt to encourage more investment in these regions? May we not define the conditions for a valuation of the minimum investments that the countries concerned could implement in an easier way and more immediately?

Sheaved sorghum being brought by men and women to family granaries. Bassari country, Senegal.
O. Barrière © IRD

Profitability and realities of investments in combating desertification

Digging half-moons.
P. Burger © CARI

The investment in these projects concerned land rehabilitation operations, in other words for restoring the operation of ecosystems and services which depend on them (resilience and productivity). They are different from ecological restoration which aims to re-establish an ecological integrity or authenticity as well as from reassignment. Reassignment refers to the transformation of a landscape by choosing a new land use. These two latter types of investment may be more costly than rehabilitation which has different impacts and benefits (Aronson *et al.*, 1995). Most of the development projects focus on the *ex ante* return of action plans that they put forward. The calculation of this return serves both for planning the project and for justifying its implementation by announcing significant returns and benefits for local populations. However the results effectively obtained by these projects generally differ from those announced. This is because their implementation in fact depends on local, national or international contexts which are difficult to predict accurately.

The **economic rate of return** ex post (ERR) of anti-desertification projects is interesting because it indicates the effective success of the project or profitability of the investment made. A second statistical indicator complements the ERR by better describing producer constraints: this is the delay in economic return on investment, calculated for several techniques for water and soil conservation (WSC) based on data from projects in Burkina Faso.

The conditions for a positive economic rate of return

Method for calculating the ERR of anti-desertification projects and difficulties encountered

The reference for this work is that of Reij and Steeds who in 2003 evaluated 12 anti-desertification projects in dry African regions (rainfall between 200 and 800 mm per year). These projects were financed and implemented by joint international programmes, African governments and the populations who benefited from them. They are mainly water and soil conservation (WSC) projects (using traditional planting pits known as *zaï*, dikes, stone bunds), irrigation and reforestation operations. Their rate of return exceeded 10%.

The evaluation of economic rate of return consists in comparing an initial situation (or a situation with no project) with the situation with the project. A study of the profitability is generally limited to local benefits generated and more precisely the measurable aspects of the benefits, in other words mainly to variations in crop yields or to that of wood production in the case of reforestation operations. These volumes are then multiplied by the corresponding prices. Finally the economic valorisation of gains obtained is related to the cost of the projects.

Economic rate of return= (benefits /costs) x 100

It is important to emphasise that the duration of projects is an essential criterion for the validity of valuation operations. Moreover, it is difficult to calculate the benefits of a short term project since the productivity variations of land in dry regions depend first of all on variations in rainfall; a short-term survey is thus not sufficient for simply distinguishing the effects of a project in the fight against desertification from the climatic context in which it is carried out.

Furthermore, the response of the natural environment to rehabilitation techniques is only optimal after several years, perhaps even as much as a decade. Even if rural producers observe positive effects immediately from the first years, all of the benefits resulting from ecological improvements on the scale of an ecosystem can only be measured in the medium and long term. Evaluations of projects over three to five years will thus only take into account the smallest proportion of potential return.

Four examples promoting adaptative and consensus-building projects

By analysing the four projects in the table below, the evaluation of the benefits of the fight against desertification by means of a calculation of the ERR is based on the increase in yields, on gains due to diversifying agriculture towards crops with higher added value and of gains from planned production of wood. However, success depends above all on the context: it is because the empowered local populations of Niger and Nigeria took responsibility for the projects that they were a success. Or again success may depend upon the capacity of such projects to enable the emergence of a social demand compatible with their objectives then adapting to it.

In one case, the change in orientation of the project and its success was based on an exchange of experience between African producers from different countries; in both cases, the success of the project depended on local stakeholders and enabled them to take advantage of the opportunities offered by the local markets: the local markets were integrated into the regional market garden economy (Niger) and the combating desertification techniques led to the creation of a local market for the rehabilitated land (Nigeria).

Ex post rate of return of four combating desertification projects
From Reij and Steeds, 2003.

Project	Country	Duration	Rate of return
WSC (water, *zai*)	Niger	1988-1995	20%
Small-scale irrigation (individual pumps)	Nigeria, Kano	1975 - ?	38%
Community forest management	Tanzania	1992-1999	12%
Niger Office, large-scale rice growing	Mali	>25 years	30%

Half-moons being watered.
P. Burger © CARI

Example

Two projects which succeeded due to them being adopted by local populations

1. Conservation of soil and water in Niger in the Illela district

This project's objective was to promote water 'trapping' techniques by building bench terraces along contours and in half-moon shapes. At first, the people were fairly hostile to this as no use was made of heavy machinery nor were food rations paid in return for work, which had been the case previously in the region.

In 1989, the project organised exchanges with the region of Yatenga in Burkina Faso, a region in which land is rehabilitated using the *zaï* technique. The project then supported the Niger farmers who copied and adopted this promising technique after their visit to Burkina Faso.

In 1998, 9 000 ha of degraded land were treated, i.e. 15% of the cultivated areas of the zone covered by the project.

A cost-benefit analysis compared the yields on treated land and untreated land:

- The total cost of rehabilitation was 250 USD/ha: this required 40 to 60 days of work per ha, plus production and transport of manure and compost.
- The profits were 65 USD/ha and per year.
- The economic rate of return for the project was 20%.

2. Small scale irrigation in Nigeria, through pumping of superficial water tables

From the middle of the 1970s, agricultural development projects were initiated in the North of Nigeria to increase production by means of irrigation, by using fertilizers and by building infrastructures (in particular roads). The distribution of individual fuel pumps enabled farmers to trap well water for irrigation.
On the whole, these projects were failures, except for those located at the bottom of valleys, where dry season crops and market gardening were developed (onions, tomatoes, garlic) thanks to irrigation. The rate of return for the project of the State of Kano for instance was estimated at 38%*.

From Reij and Steeds, 2003.

* Only the cost of extracting water was taken into account. No evaluations have been made of the price of underground water in rural African environments.

The successful decentralisation of the management of natural resources and the subsequent empowerment of the producers explains the positive ERR of the two following projects (from Tanzania and Mali). Indeed:

- The achievement was due to the participation of local populations in the Tanzanian project (which limited irresponsible free-riding behaviour).
- The success of the *Office du Niger's* project was due to the decentralisation of the management of irrigated perimeters and hence of irrigation rotation.

It is not known for the Tanzanian example how the profits from the plantations were redistributed. The rehabilitation of common areas generally fails due to a lack of definition of and respect of the rights to use their resources. But in a context of desertification and rarefaction of wood, assuring a regular source of supply or supplementary income can foster coordination and encourage respect for maintaining and valorising the resource (deferred grazing, surveillance, cleaning, sharing of dead wood, etc.).

These positive economic rates of return appear in fact to depend on the social and institutional conditions governing the implementation of these projects.

Limitations on the evaluation of ERR

The ERR is an interesting indicator in that it can be used to convince people about the profitability of investments in the fight against desertification on the grounds of statistics. Can it, however, be used in the case of short duration projects which are the most common beneficiaries of current investment in cooperation in combating desertification?

The potential ecological benefits of several anti-desertification techniques have long been known. The ERR can be used to evaluate these techniques in different socio-economic contexts: when combined with a contextual analysis, it can be used to understand the profitability factors of projects. Three of the key criteria appear to be the suitability of projects to meet social demand, the access of the beneficiaries to market opportunities and participative decentralisation of the management of national resources on the local level (not much operational work has been done to date on the social demand in development actions). Reij and Steeds (2003) recommend that projects should not be made to depend on public services alone and that it is a good idea to get to know the private and public local institutions in order to identify the providers of suitable services.

Example

Deux Two successful projects thanks to participatory decentralisation of natural resources' management

1. Community management of forests in Tanzania

Between 1992 and 1999, a joint management project for 13 000 ha of forest was set up by the government authorities and the local communities of a region in Tanzania. It led to a significant reduction in illegal exploitation of wood, to the planting of trees and the construction of more efficient ovens. The benefits were calculated on the following basis:

- 9 million plants on 3 500 ha of land with a yield of 400 m^3 of firewood per ha in three crop rotations of 7 years.
- A 50% reduction in the use of wood, i.e. savings of 9 600 tonnes of wood per year for a use of 5 kg per day.

The economic return rate for this project was estimated at 12%.

2. The *Office du Niger* irrigation scheme in Mali

Reconstituted fields being irrigated. Mali. J. Laure © IRD

The *Office du Niger* scheme is one of the most significant irrigation projects in Sub-Saharan Africa. In 1980, 50 000 ha of irrigated land yielded 1.5 tonnes of rice per ha. It was a centralised State organisation with little maintenance and inefficient management of water.

From 1986 on, the management of irrigated land was decentralised through a reform: management committees consisting of farmers were created to manage irrigation rotation, the farmers were bound to these committees by performance contracts:

- Yields grew from 1.5 tonnes to 5.5 tonnes per ha. Production then reached 300 000 tonnes.
- Revenues were diversified by introducing dry season crops such as the onion (70 000 tonnes were produced in 1999).
- Water taxes collected increased from 60% to 97%.
- 30 000 ha of irrigated land were rehabilitated and 30 000 other hectares were irrigated.
- The net income from rice increased from 450 USD per ha to 1 000 USD per ha in the rehabilitated areas.

The rate of return due to this reform was 30%.

From Reij and Steeds, 2003.

In the examples given, the projects evaluated concern WSC activities or irrigation in crop and reforestation fields. They implemented traditional anti-desertification techniques*.

On one hand, pastoral projects are lacking from these statistical estimates**. It is indeed difficult to calculate their ERR: ecological surveys on grazing lands in different transhumance zones and those of veterinary surgeons on the productivity of migrants herds are cumbersome and costly to implement (Bonnet *et al.*, 2004). Furthermore, the benefits of the most innovative anti-desertification techniques, such as direct-seeding mulch-based cropping systems in agro ecological projects, have not yet been estimated: the actual data are still too recent to enable calculating a representative ERR. The positive externalities of agro-ecology such as the capacity to store carbon and to improve biodiversity are nevertheless significant and acknowledged (Raunet and Naudin, 2006). There are some figures for them. A realistic calculation of the ERR should take them into account. Finally the ERR gives no information on what occurs after the project. In several cases, the end of a project signals the stopping of the proposed developments. However, on the scale of one generation, projects have significant effects on local society.

* These WSC techniques are:
- Mechanical: *zaï*, half-moons, stone bunds, earth dikes, filtering dikes.
- Biological: straw mulching and deferred grazing.
- Agroforestry techniques: reforestation, ligneous vegetation, grass strips, herbaceous cover, windbreaks and live hedges.

** Most of the livestock breeding projects forced the herds and breeders into a sedentary life style which was not suited to the climatic variability of dry regions. They thus failed. But the arguments have changed over fifteen years and new projects are now trying to organise pastoral mobility.

Example

Benefits of WSC techniques for rural development, Central Plateau of Burkina Faso

Between 1975 and 1985, 25% of the population of the central region of Burkina Faso, which was the most degraded and the most densely populated (100 inhabitants / km²) migrated towards more humid areas, agricultural yields dropped to 400-500 kg per ha and the level of water tables dropped. From 1986 on, three projects for environmental rehabilitation and agricultural intensification over a period of 10 to 15 years enabled the improvement of 101 000 ha, i.e. 35 to 40% of the cultivated areas of 7 provinces. The projects were based on village groups which represented 30% of the target population (i.e. 120 000 people).

Strong points in villages which have a lot of experience of these techniques

1. There was a noteworthy reduction in poverty and improvement of food security.
2. The reduction in the rural exodus was due to an increase in yields of 50% and a reduction of areas cultivated per person.
3. Production surpluses gave supplementary income which was sometimes invested in livestock.
4. Better integration of agricultural and livestock activities and diversification of production systems occurred: reappearance of some commercial crops and cash crops (cowpea and sesame).
5. The development of collateral sources of income: labour market for digging planting pits *(zaï)*, the organic manure market and rental of transport equipment. These new activities helped increase agricultural income by 25 to 30%.
6. The increase in the women income who benefit from the conservation of soil and water; a reduction in the time they spend on daily chores (fetching water and gathering wood) following the replenishment of water tables and reforestation.
7. The constitution of an elite peasantry class.

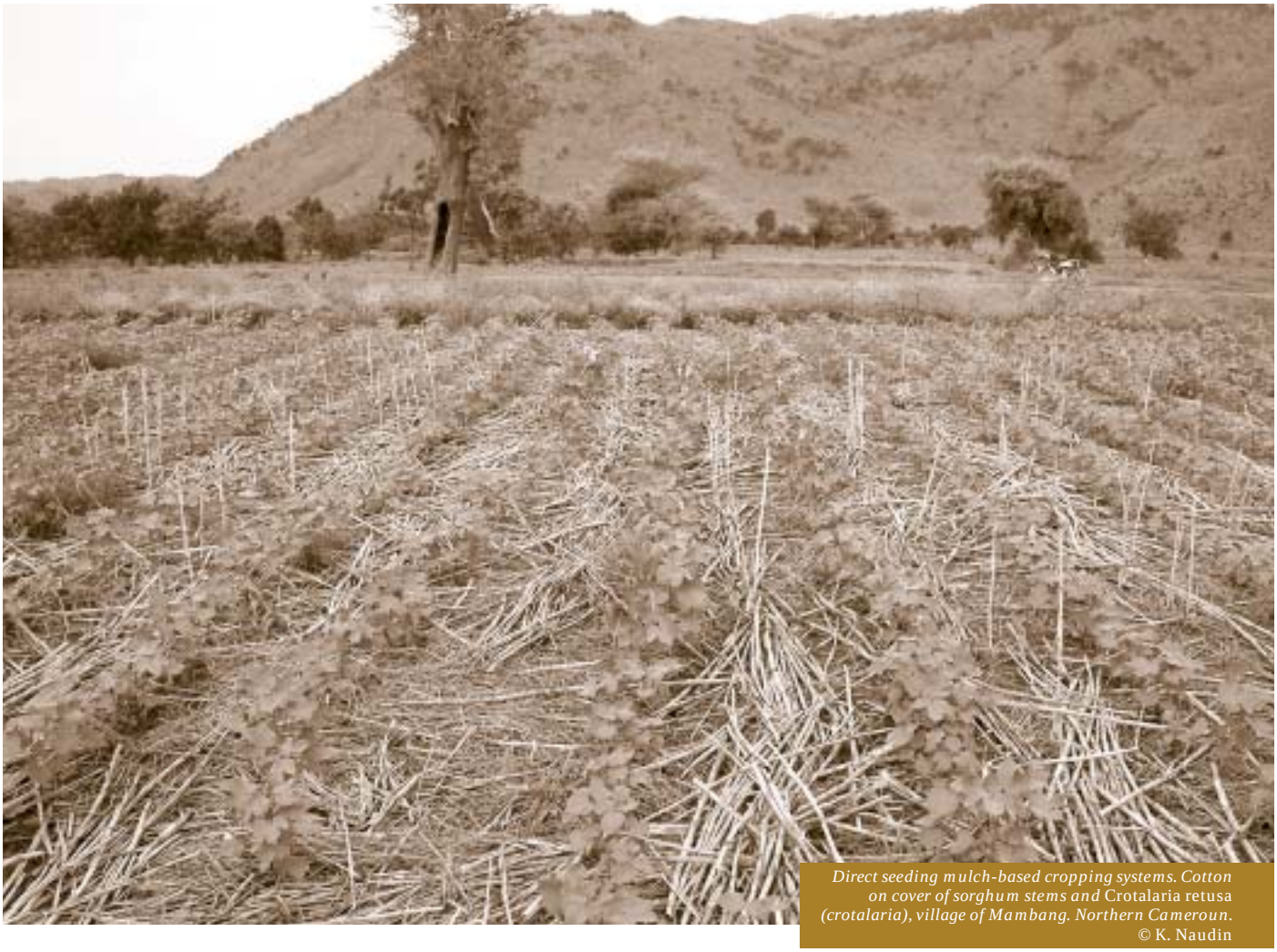
Stone bunds. © CARI

Among the criteria for success, we should also note the remaking of the main roads which enabled an extension of trading activities; in villages in which methods for conserving WSC methods were not applied, the trends to improvement did either not occur at all or only occurred slightly.

Weak points

1. The WSC developments required collective choices and organisation, in particular because they had to be implemented on the scale of the catch basin.
2. Degradation of collective areas continued, the techniques were not adopted widely, and sometimes the installations were not maintained.
3. The projects were based on a participatory approach by means of groups of producers, which had often existed for more than a generation.
4. The representativeness of these groups is an issue as this participatory approach does not prevent the marginalisation of some groups.
5. Socio-economic disparities increased leading to the exclusion and increasing poverty of those who were not able to maintain the developments (costs of inputs and lack of adequate labour) on the one hand and enriching of the beneficiaries on the other hand.

From Hien *et al.*, 2004.



Direct seeding mulch-based cropping systems. Cotton on cover of sorghum stems and Crotalaria retusa *(crotalaria), village of Mambang. Northern Cameroun.*
© K. Naudin

The role of institutional and social factors into account

The favoured indicators in Reij and Steeds' study (2003) mainly concerned the increase in agricultural yields and improvement of food security. These are the classic priority objectives of the fight against desertification adapted to dry regions: the aim is indeed to relieve poverty and increase living conditions in a sustainable way. Nevertheless, given two recent combating desertification projects, more social criteria could be included when calculating the ERR such as estimating the benefits of the reduction in local conflicts over resources in order to defend the profitability of these projects.

Other more regional or global criteria (such as migrations, water, biodiversity, climate change) could also be put forward and integrated into these calculations. They would set the issue of desertification into a global perspective.

Two combating desertification projects offering social and institutional benefits

Analysis of the evolving environmental situation in most African countries reveals three characteristics:

- The extension of cultivated areas (to the detriment of grazing land)
- The general degradation of soil fertility and modification of ecosystems
- The reappearance of conflicts over the management of natural resources

Two long duration projects, one of which is on the management of natural resources in the North of Burkina Faso (PSB Sahel project: *Programme Sahel Burkinabé*) and the other on pastoral mobility in Chad (Almy Bahaïm pastoral project) are banking on the decentralised management of natural resources and local development to promote combating desertification. The methods used have the following points in common:

- They identify the basic resources for different rural activities.
- They list the methods and time needed for different social groups to appropriate and use these resources.
- On the basis of this information they design consensus-building frameworks to define sustainable use of rehabilitated resources by placing an emphasis on traditional modes of decision-making about resources.

In the case of PSB-Sahel, the implementation of collectively-negotiated local environment conventions has made it possible to reduce conflicts over resources by 75%; the administration manages less than 20% of the residual conflicts which has led to a decrease in up to 90% of expenses related to settlements of conflicts.

The Almy Bahaïm project was based primarily on traditional managers of water resources: no conflicts occurred during the setting up of the committees for managing the installations (joint management committees for water points and prefectoral commissions for determining transhumance routes) and the migration circuits have actually been made safe.

The successful implementation of anti-desertification techniques thus requires a more integrated vision of local development. The calculation of the rate of return of such projects could take into account the benefits related to the reduction or absence of conflicts over resources. These investments in the implementation of consensus-building approaches for the management of resources have helped contribute to the successful implementation of anti-desertification techniques *.

* The reservations expressed take into account that the legal context of the country does not recognise the local institutions managing natural resources and the local development implemented by the projects.

Example

Two combating desertification projects with a key institutional component

The PSB-Sahel (1989-2004), Burkina Faso

The PSB *(Programme Sahel Burkinabé)* is a project for combating desertification in the North of the country, which is based on empowering populations to manage natural resources. It organised:

- Institutional support: defining and implementing local environment conventions
- WSC improvements: 20 787 ha (*zaï*, half-moons, grass strips, composting, straw mulching, reforestation, bunds and dikes)
- Training / literacy training
- Support for the socio-economic initiatives taken by populations (socio-economic and hydraulic community infrastructures, loans for lucrative activities)
- Sanitation and educational infrastructures.

Results:

- Doubling of crop and fodder yields in zones treated
- Variation of the subsequent pastoral load
- Increasing rate of recovery
- Return of biodiversity
- Increasing adoption of these techniques by the local populations
- A 75% reduction of conflicts over the management of natural resources

However, no quantitative data on the improvement of living conditions, on economic valorisation of increased yields gains is yet available.

The Almy Bahaïm pastoral project in Chad (1995-200x)

This is a project for gridding a pastoral zone with hydraulic infrastructures in order to increase the fluidity of the summer transhumance and avoid over-grazing. Surface area: 300 000 km²; Hydraulic installations: 400 wells and ponds (being created and repaired); livestock concerned: 3.7 million tropical livestock units (TLU), population concerned: 150 000 breeders.

Principal strategic objective: ensure a better distribution of migrating livestock in the territory by means of a hydraulic grid in which each installation has a low capacity (less than 7 000 m³) in order to limit grazing pressure and avoid agricultural installations in each area.

These hydraulic installations have different functions and are ranked differently: they allow for opening new pastures, securing transport routes and caravan routes, delaying and diverting herds of livestock moving downwards towards dry season areas (during harvesting) and moving upwards (during sowing), protecting cultivated river banks.

The project's scope includes two parts:

- A pastoral part (livestock) which goes along with local negotiations for the installation of watering points and user management of structures and resources; it includes the reconnaissance work for marking routes;
- A hydraulic part for technical studies, signing contracts and supervising work performed by companies (hydraulic structures and beacons). The traditional organisation of irrigation rotation is handled by the 'water points manager', who is often the head of the village or of that part of the population which has been using the area the longest.

From Dabiré, 2004; Bonnet *et al.*, 2004; Jouve *et al.*, 2002.

An under-estimation of benefits

By taking into account all of the aspects referred to previously, the benefits which are used as a basis for calculating the ERR of anti-desertification projects can be significantly increased.

Generally speaking, the social and environmental benefits are never or hardly ever taken into account when calculating the figures for projects. However it appears it is fairly easy to determine three types of benefit. These are:

- The benefits of reducing the number of conflicts over natural resources.
- The benefits of storing carbon once the average rates of storage are known.
- The benefits of stabilising populations even though the opportunity costs method may be criticised*.

Ultimately, the result is that the ERR of successful combating desertification projects is under-evaluated. Better integration of their benefits is hampered by the lack of available methods and the cost of implementing them.

* If the civil society of Northern countries were to classify the importance of impacts of the fight against desertification, in first place they would put themes related to climate change and migration (according to the content of the French media on the world 'deserts and desertification' year).

A more exhaustive basis for calculating the ERR of combating desertification projects
# indicates benefits which have rarely been quantified to date by combating desertification projects.
?: which (other) methods of evaluation?

Types of benefits	Indicators	Possible measurements
LOCAL		
Increase of available agricultural products	Variation in agricultural production	Variations in yields x local (global) prices
Increase of available fodder and livestock capacity	Variation in livestock production	• Variations in livestock carrying capacity x local (global) prices • Variations in fodder yields x local (global) prices of reference fodder
Reforestation	Variation in forest cover	Variations in volumes of wood and non-ligneous products x local (global) prices
Increase in available water	Replenishment of water tables	• Variation in water carrying time x average cost of labour • Volume x value of water recovered • ?
# Management of natural resources	Decrease of conflicts	Reduction in number of conflicts observed x mean cost for settlement of conflicts
# Stabilising of the population	Drop in rural exodus	Opportunity cost: cost of connecting drinking water in the city (in relation to the number of beneficiaries) ?
# Recovery of biodiversity	Species recovered in private gardens	Surface areas or amounts concerned x local (global) prices of species recovered ?
GLOBAL		
# Adaptation to climate change	Storage of carbon	Quantities of carbon stored x market price of carbon
# Recovery of biodiversity	Modification of ecosystems and landscapes	?
# Recovery of soil fertility	• Variation of vegetable cover: better water infiltration, increase in fertility (organic matter, nutrients, etc.) • Drop in albedo	?

Four years zaï plot. Gourga, Ouahigouya, Burkina Faso.
M. Lepage © IRD

Example

Delay in return according to PATECORE (1988-2000)

PATECORE = 800 groups of villagers, 8 decentralised project offices, 60 000 ha of restored land (WSC)

Costs per hectare

- Total = 155 233 FCFA ~ 237 €*
- External (paid by project) = 80 244 FCFA ~ 122 €*
- Local farmers (contributing through work) = 75 000 FCFA ~ 115 €*

Benefit taken into account

- Yield per area increased by 250 kg/year/ha (25 000 FCFA/year).

Délai de retour

- The 80 000 FCFA/ha investment in the project was amortised after 4 years.
- The 75 000 FCFA/ha local farmer investment was amortised after 3 years.
- Total period: 7 years

From Wauters, 2005.

* 1 euro = 655.957 FCFA (June 2007)

The delay in return on investment or producer constraints

While investments in combating desertification produce effects which are objectively advantageous for societies and for the environment, it remains hard to understand why rural populations of the regions affected do not invest more spontaneously and systematically. Analyses of determining factors for investment in land at the household level would be welcome.

We shall now develop an approach based on the delay in return on investment. Using a few examples with figures, we hypothesize that the delay in return on anti-desertification investments is too long given the low financial margins of most of the local producers.

Delays in return on dikes, small dikes and stone bunds

The delay in return on dikes, small dikes and stone bunds was calculated in Burkina Faso by the PATECORE project *(Projet d'aménagement des terroirs et de conservation des ressources dans le plateau central)*, then using data from the PSB-Sahel.

Delay in return on investment calculated by the PATECORE project was 3 years for producers with project backing and would have been 7 years otherwise.

Example

Economic benefits of WSC techniques in the framework of the PSB Sahel project

Production gains observed

- + 47% in the case of pearl millet with stone bunds
- + 11% for sorghum with stone bunds
- From 75% to 133% for crops grown with stone bunds, filtering small dikes and dikes.

Economic benefits for 1999

- Under stone bunds, the annual profit for millet plantations was 11 600 FCFA*, and that for sorghum was 24 682 FCFA*.
- With filtering dikes, the annual profit for the growing of sorghum was 45 570 FCFA*.

From Hien *et al.*, 2004.
* 1 euro = 655.957 FCFA (June 2007)

The costs are listed for each type of mechanical installation for WSC.

The costs of stone bunds differ according to the two projects. This may be explained by two principal factors:
• The distance over which the necessary rubble stones have to be brought and the corresponding transport. If rubble stones have to be brought, then trucking costs have been evaluated between 87 500 and 105 000 FCFA.
• Labour cost: the labour cost of individual stone bunds is 97 hours per ha (if built by the family) and 673 hours per ha for collective bunds (Non-Governmental Organisations [NGOs], development projects).

The cost/benefit ratio obtained on the basis of results for the PSB-Sahel indicates that a return on total investments (bunds, dikes and small dikes) takes from 3 to 8 years (Hien *et al.*, 2004).

Costs per ha of stone bunds, dikes and filtering dikes in Burkina Faso
From Hien *et al.*, 2004.

Structure	Costs per ha (FCFA)
PATECORE Project	
Stone bunds	32 000
Small filtering dikes	49 000
Filtering dikes	100 000
Sahel Burkina Programme	
Stone bunds	94 540
Filtering dikes	114 206

The *zaï*: a generic calculation in Burkina Faso

The *zaï* is one of the most widely documented WSC techniques in the literature. The optimum conditions for successful implementation of the *zaï* are 300 to 800 mm of annual rainfall and very poor soils. The *zaï* is not very suitable for sandy soils. The main constraint is that of labour for which periods of 900 to 4 000 hours of work per hectare have been observed (i.e. 150 to 571 work days of 6 hours each). The adoption of the *zaï* leads to a reduction in the areas cultivated. The benefits of the *zaï* for the soil and vegetation may be felt for thirty years (Le Houérou, 1998).

Thus, in Burkina Faso, a hectare of *zaï* costs a minimum of 120 000 FCFA in labour (i.e. 183 euros and 235 USD, November 2006). For the variation in yields, again in Burkina Faso, the *zaï* with organic matter has made it possible to increase cereal yields from 0.7 tonnes per hectare to a yield varying from 1 to 1.7 tonnes per hectare depending on the quality of the soils and the amount of rainfall (Somé *et al.*, 2000).

On the basis of FAO data on cereal prices between 2000 and 2003, the number of years necessary to return a profit on investment in one hectare has been estimated (see next page).

The same trends were observed for the prices from one cereal to another and significant variation from one year to another. For information, these variations appear not to be related to the level of production of these cereals for the four years.

Afforestation, Mbour, Senegal.
A.M. Sarr © IRD

Price of three cereals: millet, maize and sorghum from 2000 to 2003 (Burkina Faso, FCFA per tonne, 1 euro = 655.957 FCFA [June 2007])
Source: statistics from the FAO.

Years	Millet	Maize	Sorghum
2000	75 407	66 331	69 291
2001	120 161	99 455	107 624
2002	133 952	112 337	122 411
2003	96 737	71 653	84 382

Three scenarios (optimistic, intermediary or pessimistic) based on variations in *zaï* yields have been proposed. The crop yields obtained in the first year following the investment in is estimated at 1 tonne per hectare. The net gains were calculated successively for the three main cereals in the country: millet, maize and sorghum. The measurements for millet crops are shown in the following table for each scenario.

The delay in return on investment for a hectare of millet varies between 2 and 4 years. This delay depends greatly on the inter-annual variations in the price of millet. For maize and sorghum crops, the calculations show that the delay in return for the initial cost and a minimum of 120 000 FCFA may be as long as 5 years in the case of a pessimistic scenario (based on 2003 prices for years 4 and 5). The delay in return on investment with *zaï* planting on a hectare in Burkina Faso thus varies between two and five years taking into account the minimum cost for this investment.

These scenarios enable us to evaluate the joint impact of climatic hazards and economic variables on the possibilities for producer investment. The significance of these calculations is of course relative: as the lowest value for the cost of a *zaï* has been used, the delay in return on investment might have to be multiplied by two*. This then gives comparable delays in return on investment for the *zaï* to those for dikes, small dikes and stone bunds, of between three to eight years.

* The cost of 100 000 FCFA per ha may vary by a factor of at least one to four due to variations in necessary labour time while including the cost of organic matter, its transport and the necessary water. Maintenance costs would also have to be taken into account. In these regions of Burkina Faso, the price of manure varies from 1 000 to 2 500 FCFA per cartload (Hien *et al*., 2004), but no one knows how many cartloads are necessary to treat a hectare of land planted with the *zaï* technique.

The delay in return on investment, millet using *zaï*, Burkina Faso
The titles **in bold** refer to the year in which the initial investment is recovered by the producer.
1 euro = 655.957 FCFA (June 2007)

	Scenario 1: optimistic	Scenario 2: intermediary	Scenario 3:pessimistic
Year 0 (2000)	Yield = 0.7	Yield = 0.7	Yield = 0.7
Year 1 (2001)	Yield = 1 Net gain = 0.3 x 120 161 = 36 048 FCFA	Yield = 1 Net gain = 0.3 x 120 161 = 36 048 FCFA	Yield = 0.7 Net gain = 0.3 x 120 161 = 36 048 FCFA
Year 2 (2002)	**Yield** = 1.7 Net gain = 1 x 133 952 = 133 952 FCFA	Yield = 1 Net gain = 0.3 x133 952 = 40 185 FCFA	Yield = 1 Net gain= 0.3 x133 952 = 40 185 FCFA
Year 3 (2003)		**Yield** = 1.7 Net gain = 1 x 96 737 = 96 737 FCFA	Yield = 1 Net gain = 0.3 x 96 737 = 29 021 FCFA
Year 4			**Yield** = 1

Support investment for the recovery of land

It takes several years for producers to get a return on investments in WSC for the recovery or maintenance of their land: from four to five years on average and this may range from two to eight years. These delays are a brake on the use of these techniques. This variability of the return time is greatly dependent on that of rainfall and cereal prices. It remains difficult to evaluate the economic aspects of different WSC techniques, their cost and their benefits due to the diversity of the costs observed. The evaluations do not take into account the costs for maintaining those improvements.

Our indicator of the likelihood of people investing in maintenance of land is thus the delay in return on investment: given the low budget margins and the lack of land tenure security of rural producers in the regions, the longer this delay, the more unlikely they will be to invest*.

The land issue must of course have to be considered and integrated in the case of the district of Machakos in Kenya, analyses made of the reasons for a high investment of households in the recovery of land underlined the pivotal role of fluid systems through which people try to claim more secure rights to work land and of the fact that there were infrastructures (in particular roads) (Reij and Steeds, 2003).

* Poverty is generally considered to be the reason for the lack of investment. But we should note that no research dealing with the relationships between types of poverty (or the lack of capacity in the meaning given to it by Sen) or with rural investment was found during this work.

On the basis of these observations, several proposals may be developed:

■ The fairly traditional one would be to extend micro-loans to the rural sector to reinforce investment in fight against desertification. However micro-loans do not work very well or do not work at all in rural environments. Moreover, such an approach is one of repairing problems created by desertification; finally, as long as producers are not able to increase their income substantially, they will remain dependent on these loan possibilities. Micro-loans, while they should be developed for combating desertification issues, are not enough to stimulate local development.

■ Indeed, the Keita project in Niger shows that land rehabilitation alone is not sufficient for African rural development. This project's leaders acknowledged that it had reached a limit to agricultural development in its area after achieving several anti-desertification improvements over a period of more than 20 years. Naturally one might wonder what the local blocking factors were or the inadequacies in the organisation for implementing the project. One might also defend the idea that investment in more lucrative activities, putting a value on natural products and the specific know-how of dry areas (i), locally producing added value (ii) and involving the national and international private sectors (iii) would enable producers themselves to implement the anti-desertification techniques using the profits due to these new activities. This proposal raises several issues as to the actual feasibility (legal, institutional, etc.) of such projects undertaken (i), the local distribution of profits made (ii), the sustainability of production based on economic profit (iii).

Hydrology in Tunisia.
The hill lake of Es Senega, its dam and spillway seen from the downstream side. Around the lake we can see an agricultural landscape with fruit orchards irrigated by water from the lake. In the foreground, we can see how the slope has been shored up with anti-erosion stone walls.
J.-P. Montoroi © IRD

Example

Achievement and levelling out of anti-desertification operations: the example of the Keita project (Niger)

In 1962, the Keita region in Niger was covered with dry forests. This vegetation had completely disappeared in 1984. That year, there were no agricultural yields due to a new drought. The Keita project covering 3 500 km² (out of the 4 860 km² in the district) was implemented between 1984 and 1999. The main achievements of the project were soil and water conservation (bench terraces, trenches, windbreak vegetation strips, dike dams). The objective was to reduce erosion, to facilitate infiltration of water and provision of water to livestock. Twenty thousand ha of land were treated including 9 300 of agricultural land, the rest being grazing land and forests; 17 million trees were planted between 1984 and 1991. Dunes were fixed. Several infrastructures were built including roads, wells and schools.

Cereal yields went from 1.5 tonnes in 1972 to 0 in 1984, then to 0.364 between 1984 and 1994; production of fodder was 50% more for the zones treated by the project.

The population in the region grew from 65 000 people in 1962 to 170 000 in 1995 and to 231 680 people in 2002. The cultivated areas increased from 33 750 to 44 850 ha in 1979, to between 107 000 and 167 828 ha in 1994.

The zones which were actually cultivated exceeded those normally allotted for agriculture, indeed in 1994, it was thought that the maximum area which could be cultivated had been reached, evaluated at about 120 000 ha. This area barely covered the food needs of the population at the time: it was considered that 237 kg of cereals per person and per year were needed, which corresponded in the region to 0.7 ha of crop land per person giving a yield of 350 kg/ha.

Development perspectives thus suggested that activities should be diversified.

From Reij and Steeds, 2003; Di Vecchia *et al.*, 2002; PEICRE,1998.

Should we invest in arid areas?

Since the United Nations Convention to Combat Desertification was adopted, there has not been much commitment on the part of the countries concerned or of developed countries. The fight against desertification is the daily lot of populations in the affected regions, often the poorest and most marginal areas in the world; apart from that, the fight against desertification remains limited to the narrow circle of those people who are convinced that it is necessary to act: activists in NGOs, scientists, national organisations for development and research in the countries affected and in developed countries and finally international organisations.

Need for knowledge and open questions

Knowledge of costs still has to be improved and is not widely disseminated. There is not enough knowledge of economic achievements in the fight against desertification nor of the corresponding rates of return. Furthermore none of this knowledge has been sufficiently publicised to convince those who might be in a position to invest. Furthermore, for more than ten years we have observed a regular decrease in investment in agricultural in general, with lower priority being given to agriculture when spending public development aid, in particular in countries which are most affected by desertification, even though these countries count the most on exploitation of their natural resources through farming and livestock breeding.

There are still many obstacles to be overcome to persuade public, national, international and private investors, such as for instance, the lack of secure land title for many producers, the lack of guarantees of investment, weaknesses in the organisation of civil society, the lack of government regulations and the excessive fluctuation of markets.

Furthermore, not much has been said about the type of investments to be made:

■ Should interventions aim at the recapitalisation of the degraded natural capital of arid areas and/or the protection of areas which have not yet been greatly affected? Is this really the role of overseas development assistance and national budgets?

Women selling fruits and vegetables at the market in the village of Bol in Chad.
C. Lévêque © IRD

■ Should investments be made in food production and/or in more commercially oriented production? With which loans and which stakeholders? What role could micro-loans and money sent back by migrants play?

■ Should investments aim to set up high added-value production schemes, with all of the inherent problems of distributing this added value between the basic producers, businessmen, processors and distributors of final products to guaranteed markets? What role might private investors play? Under what conditions?

■ Should investments be made in activities other than agriculture, forestry and grazing to relieve pressure on resources (such as green tourism, craftsmanship, services, etc.)? Who can invest in these sectors? With which stakeholders?

■ Should investments be made in training, development of human and social capital and scientific research? Once again, is this the role of overseas development assistance and national budgets?

Along with these questions on guidelines for investment are those questions as to who is ready to invest, how much and how and with which stakeholders. Are local farmer or village organisations legally acceptable partners with whom one may contract, and to whom one may give or lend? If not, how can they become acceptable partners? From these partnerships, is it possible to distinguish between overseas development assistance, government loans, private loans and money sent back by migrants?

Focus

A few investment options

■ *Recapitalizing of natural capital*
Operations for protecting catch basins, anti-erosion measures, restoring of vegetation, water catchment schemes, adopting of new integrated agricultural and livestock breeding systems.

■ *Production of products with high added-value*
Argan oil, gum Arabic, shea butter, cotton, etc.

■ *Local transformation of raw materials*
Cosmetics, dried fruit, concentrates, dairy production, industries derived from cotton, wood, etc

■ *Diversification policy*
Ecotourism, services, industries, etc.

■ *Setting up complete sectors*
Market surveys, upstream/downstream organisation, sharing of added-value, public/private partnerships

■ *Local reinvesting of profits*
Maintaining of the natural environment, combating desertification, fertility. Training of people, reinforcing of civil society, taxation

Elements of an answer

The international workshop on the *'costs of inaction and investment opportunities in arid, semi-arid and sub-humid areas*' (Rome, December 2006) spent a lot of time on these questions. The following points were emphasised:

■ Producers should make strategic alliances between themselves, on a big enough scale to take advantage of market conditions and prepare adequately for production, including reinforcing their capabilities and organisations.

■ Commercial sectors should be identified and set up for specific products for arid areas. This should be supported by the adoption of intellectual property systems, quality labels of origin and certification.

■ It is important to understand the services provided by ecosystems, which would lead to better valorisation of products from a commercial and ecological point of view. Various social, economic and cultural mechanisms should be introduced to protect resources.

■ Care should be taken to avoid producers over-investing in a given sector, which might indeed have negative effects such as the over-exploiting of resources, unbridled competition between stakeholders and regions, runaway prices, dependence on downstream distributors for a given sector.

■ Investment in natural capital is economically profitable in arid areas but also in social terms and it offers the advantage of avoiding 'poverty traps', in other words areas in which production capacity has become unviable and in which population cohesion breaks down completely, so that people stop believing in their own capacities and finally emigrate.

■ So-called 'agronomic' insecurity is greater in arid areas as yields are highly dependent on rainfall and may vary by as much as one hundred percent from year to year. However, income insecurity is even greater since prices vary by a factor of 1 to 3. It is thus imperative to introduce sustainable public policies, tax structures and stable agricultural prices as well as clear land ownership rights and rules. Furthermore, local markets are too small and should be organised on a regional scale.

■ It is necessary to undertake well-designed research into resistance to drought, adaptation to change, the socio-economic assessments of the costs of desertification and the advantages of investing in arid areas and the causes and mechanisms of national and international migrations.

During the workshop, the participants made the following recommendations:

■ Methods for analysing the costs of inaction should be made available to States. Cost-benefit studies should rapidly be undertaken with attention being paid to methodology issues.

■ Efficient strategies should be implemented for communicating on resource management and investment opportunities in arid areas and a convincing arguments should be developed in favour of investment in arid areas, for the benefit of decision-makers in the countries affected as well as for developed countries.

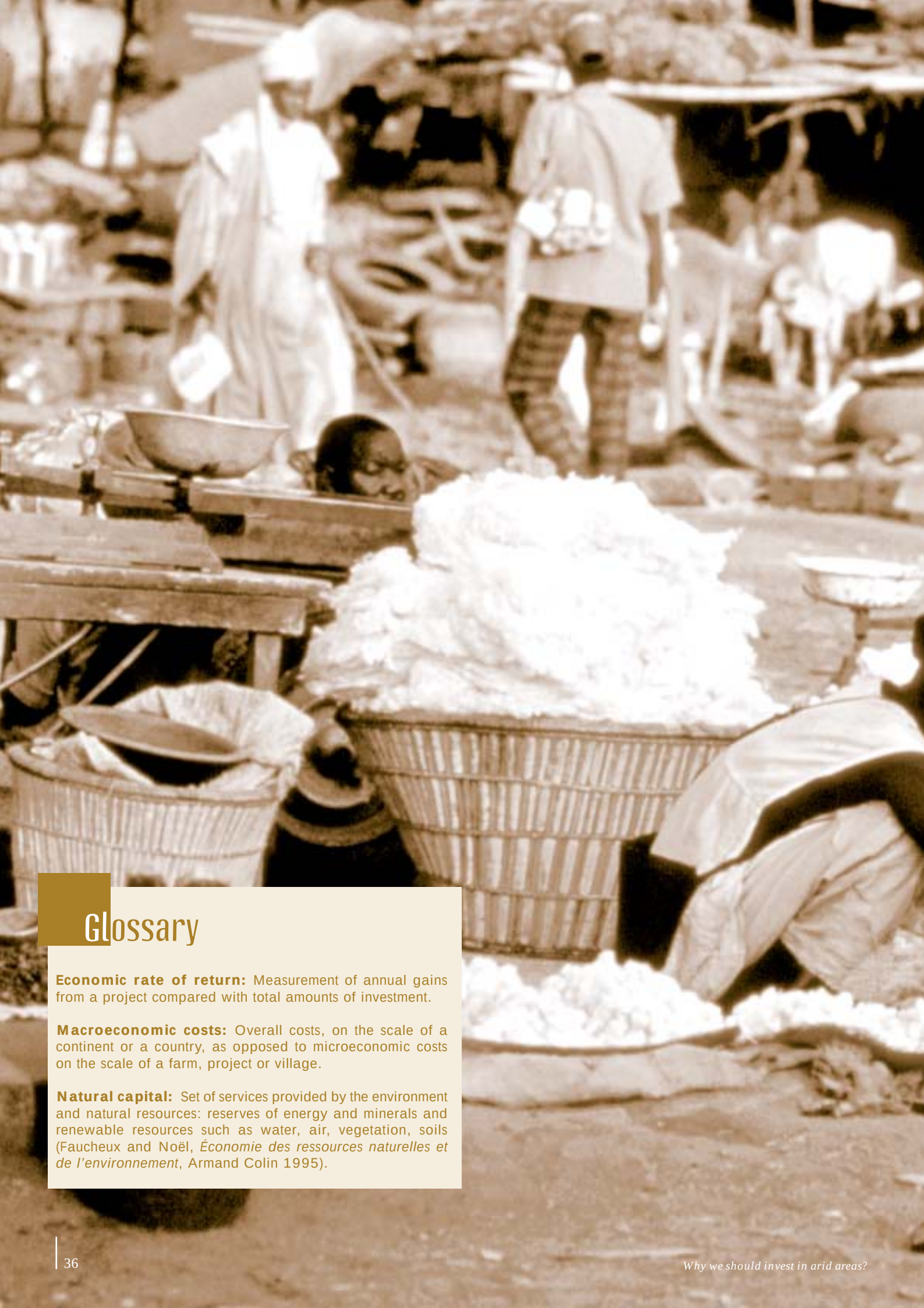
■ The capacities of producers and producer organisations should be reinforced, from a technical point of view, but also in terms of management, marketing and dialogue with public stakeholders.

■ An international network on the costs of inaction should gradually be built on the initiative of the organisers of the workshop.

The CSFD and its partners have taken these recommendations into account and 2007 is being devoted to setting up this network and undertaking a few cost-benefit analyses.

Sisal factory (Agave sisalana).
Combing sisal. Mogotio. Kenya.
J.-Y. Meunier © IRD

Sisal factory (Agave sisalana).
Drying fibres. Mogotio. Kenya.
J.-Y. Meunier © IRD



Glossary

Economic rate of return: Measurement of annual gains from a project compared with total amounts of investment.

Macroeconomic costs: Overall costs, on the scale of a continent or a country, as opposed to microeconomic costs on the scale of a farm, project or village.

Natural capital: Set of services provided by the environment and natural resources: reserves of energy and minerals and renewable resources such as water, air, vegetation, soils (Faucheux and Noël, *Économie des ressources naturelles et de l'environnement*, Armand Colin 1995).

Market at the entrance to Mopti. Cotton. Mali.
S. Martin © IRD

For further information…

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Watering market garden crops with pierced calabashes. Diarma region in Burkina Faso. M. Bournof © IRD

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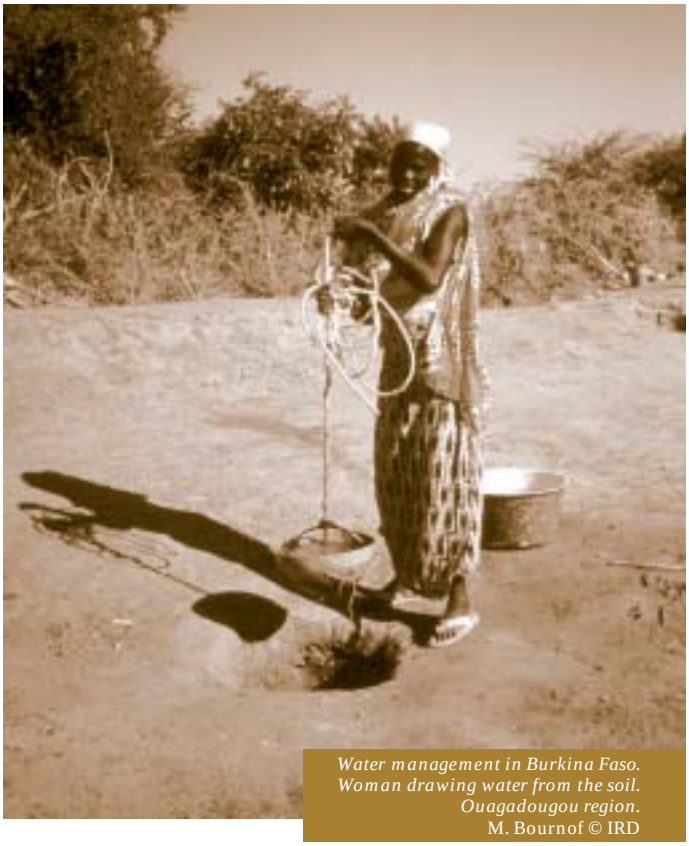

Water management in Burkina Faso. Woman drawing water from the soil. Ouagadougou region.
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• *The future of drylands* Conference, Tunis, 19-21 June 2006
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www.csf-desertification.org/actu/atelier_rome06.php

List of acronyms and abbreviations

- AFD: French Development Agency
  Agence Française de Développement
- AGDP: Agricultural gross domestic product
- C3ED: Centre of Economics and Ethics for Environment and Development, France / *Centre d'économie et d'éthique pour l'environnement et le développement*
- CARI: *Centre d'Actions et de Réalisations Internationales*, France
- CIRAD: Agricultural Research Centre for International Development, France *Centre de coopération internationale en recherche agronomique pour le développement*
- CSFD: French Scientific Committee on Desertification
  Comité Scientifique Français de la Désertification
- Dh: Moroccan dirham
- ERR: Economic rate of return
- FAO: Food and Agriculture Organization of the United Nations, Italy
- FCFA: CFA Franc 1 euro = 655.957 FCFA (June 2007)
- GDP: Gross domestic product
- GEF: Global Environment Facility
- GTZ: *Deutsche Gesellschaft für Technische Zusammenarbeit*
  German agency for technical cooperation
- IFAD: International Fund for Agricultural Development, Italy
- IRD: *Institut de recherche pour le développement,* France
- JRU: Joint research unit
- MDG: Millennium Development Goal
- MEA: Millenium Ecosystem Assessment
- MENA: Middle East and North Africa
- NGO: Non-governmental organisation
- ODA: Official Development Assistance
- OSS: Sahara and Sahel observatory, Tunisia
- PATECORE: *Projet d'aménagement des terroirs et de conservation des ressources dans le plateau central,* Burkina Faso
- PSB Sahel: *Programme Sahel Burkinabé*, Burkina Faso
- TLU: Tropical livestock unit
- UNCCD: United Nations Convention to Combat Desertification
- UNEP: United Nations Environment Programme, Kenya
- UNESCO: United Nations Educational, Scientific and Cultural Organization, France
- USD: American dollar
- USLE: Universal soil loss equation
- UVSQ: University of Versailles Saint-Quentin-en-Yvelines, France
  Université de Versailles Saint-Quentin-en-Yvelines
- WSC: Water and soil conservation

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Abstract

The issue of economic costs and in particular macroeconomic costs of the degradation of land is slowly becoming a priority one in international meetings on the development of dry regions. It is also being combined with the cost of inaction revealed by the Organisation for Economic Co-operation and Development in 2005. However, there are not many practical studies of the cost of degradation of land on a national level and furthermore the few there are not referenced very well in scientific publications. This article will describe different studies undertaken mainly by the World Bank, their methods and limitations as well as their results. Two types of approach can be distinguished on the whole: (i) modelling principally based on understanding processes of rainfall erosion, based on plot surveys and (ii) furthermore more spatial approaches dividing the areas affected according to the main economic activities which take place there. The results show that the cost of desertification is often equal to or greater than the agricultural growth of the countries concerned which brings into question the reality or sustainability of their rural development.

Analyses of the rate of return on investments in the fight against desertification are still inadequate. Referring to several key studies on this issue and a review of several anti-desertification projects, the document shows that the rates of return of successful projects are often under-evaluated because they are generally limited to agricultural production gains. However the delays in return on investment observed for the rehabilitation of degraded land can also explain why anti-desertification projects are so poorly deployed among local populations who are not able to bear the cost. Finally we consider investment in the recovery and maintenance of land as a motor of rural development. Should one not as well in order to fight against desertification, promote small industries producing products from dry regions as well as ecotourism or service activities?

Key words: Combating land degradation, costs, modelling, land use, erosion, investment, economic return rate

Résumé

La question des coûts économiques et notamment macro-économiques de la dégradation des terres devient peu à peu prioritaire dans les réunions internationales sur le développement des régions sèches. Elle rejoint celle du coût de l'inaction mise en évidence par l'Organisation de coopération et de développement économiques en 2005. Les études menées sur le coût de la dégradation des terres au niveau national restent rares et peu référencées dans les publications scientifiques. Différents travaux issus principalement de la Banque mondiale, leurs méthodes, leurs limites ainsi que leurs résultats sont présentés. Deux types d'approche sont différenciées :
(i) des modélisations majoritairement centrées sur la compréhension des processus d'érosion pluviale, faites à partir de relevés de parcelles et (ii) des approches plus spatiales divisant les surfaces affectées en fonction des principales activités économiques qui s'y déroulent. Les résultats montrent que le coût de la désertification est bien souvent égal ou supérieur à la croissance agricole des pays concernés, ce qui met en question la réalité ou la durabilité de leur développement rural.

Les analyses des taux de retour sur les investissements engagés dans la lutte contre la désertification (LCD) restent insuffisantes. À partir des quelques travaux clés et d'une revue de plusieurs projets de LCD, le document montre que les taux de retour des projets réussis sont souvent sous-évalués parce qu'ils se limitent aux gains de production agricole. Cependant, les délais de retour constatés pour les investissements dans la réhabilitation des terres dégradées permettent aussi d'expliquer la faible diffusion des pratiques de LCD auprès de populations locales qui ne peuvent en supporter le coût. En conclusion, la question du seul investissement dans la récupération et dans l'entretien des terres comme moteur du développement rural est posée. Ne faut-il pas aussi, pour lutter contre la désertification, promouvoir des petites industries de valorisation des produits des régions sèches, l'écotourisme ou des activités de service ?

Mots clés : Lutte contre la dégradation des terres, coûts, modélisation, usage des terres, érosion, investissement, taux de retour économique

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