SUSTAINABLE PRODUCTION SYSTEMS IN DRY AREAS

WHICH OBJECTIVES FOR DEVELOPMENT COOPERATION ?

Summary of the report

Authors:
Philippe Deygout
Marion Treboux
with the support of:
Bernard Bonnet

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MINISTÈRE DES AFFAIRES ÉTRANGÈRES ET EUROPÉENNES

Warning

This document is the summary of a report drawn up by consultants from IRAM (Institute of Research and Application of Development Methods), in close collaboration with the Biodiversity and Development Group and the Working Group on Desertification (*Groupe de Travail Désertification – GTD*) coordinated by the organisation CARI, at the joint request of the French Ministry of Foreign and European Affairs and the French Development Agency.

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Outline of the report

The report on sustainable production systems in dry areas was written by a consultancy bureau based on a collective work bringing together representatives of civil society organisations, research institutes, administration and public organisations. The report has a dual objective:

- to illustrate the constraints, opportunities and potential for the sustainable rural and agricultural development of dry areas;
- to make recommendations for decision-makers and operators involved in international development cooperation with a view to consolidating policies supporting the sustainability of the production systems in these areas.

This report is based on a series of case studies which highlight specific development cooperation experiments and provide support for more theoretical considerations. The aim is to identify courses of action geared towards the sustainable management of agro-ecosystems in dry areas and to analyse their integration in the adaptation and planning strategies of rural territories. In doing so, the report facilitates progress in defining the specific challenges facing these areas, in particular in terms of development of technical innovations, governance of land and natural resources, involvement of the local communities, support for family farming activities, promotion of agricultural products from dry areas and consolidation of public policies.

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Summary for decision-makers

The question of truly sustainable development, in particular applied to the agricultural sector and rural areas, will be at the heart of major international events in 2012 and more particularly the "Rio+20" United Nations Conference on Sustainable Development. This refers to several issues of social, economic and environmental sustainability in a context of major global change (population, climate, etc.): how can we produce more while respecting the environment and the social dimension, ensuring a more economical performance, in particular in terms of water and energy, and contributing to rural/urban dynamics generating both employment and wealth?

Within this framework, it is essential and of the utmost urgency that particular attention be paid to dry areas, which account for 40% of all land and are home to 37% of the world's population, given the challenges facing them in terms of geopolitical considerations (security, migration), economic development (high prevalence of poverty in rural dry areas) and environment (scarcity of water resources, desertification, etc.). The populations living there cannot for much longer be sacrificed to unequal development. Furthermore, due to their inherent characteristics, these areas are little concerned by the agronomic techniques promoted as part of the "green revolution" and requiring natural resources (in particular water resources) which are sadly lacking in a context marked by a high level of vulnerability to climate change.

It is therefore a pivotal theme and the areas concerned are critical to the sustainable development of the planet: what can be done to better promote the potential of these dry regions while successfully combining productivity, food security, the preservation of the balance of ecosystems and environmental protection? The ecological fragility of these areas (as well as their wealth and their resilience and capacity to adapt), the dependence of their populations on the state of the ecosystems and their projected expansion due to climate change make it absolutely essential to identify sustainable management solutions for these agro-ecosystems and to integrate them into the rural territories' planning strategies.

To this end, it is necessary to **prioritise an integrated approach to sustainable management of natural resources and poverty reduction**: the development of sustainable production systems in dry areas refers to the objectives of preserving the production capacity of the ecosystems and ensuring the food security of the rural populations concerned. In these dry areas where the societies and economies are primarily rural and the populations are vulnerable, exploring the issue of the sustainability of production systems necessarily implies combining environmental and development objectives, paying specific attention to family farming.

This study focuses on these issues. It is not the result of a unified and dogmatic approach; on the contrary, it is based on a collection of different cases. **There is no "single" lesson to be learned, rather specific approaches, a range of options**; the key words here are diversity and pragmatism.

Some key conclusions can be drawn from the case studies communicated by the members of the Biodiversity and Development Group and the Working Group on Desertification (GTD), reiterated in this summary:

- **proven agricultural potential** in dry areas, albeit limited given the magnitude of the demographic challenge and the environmental constraints, but which could nevertheless be promoted more effectively with a view to "increasing the security" of the rural populations concerned;

- **the need to adopt an integrated vision of the development of rural territories** with a view to improving market access, promoting the agricultural products of dry areas, consolidating the complementarity between agricultural activities (agriculture/livestock/forestry) and developing non-agricultural activities;
- **an objective of adapting sustainable agricultural techniques to the ecological, agronomic, social and economic backdrops of dry areas**, backdrops which are subject to severe constraints (climate hazards, family farms with weak investment capacities, etc.) and a high level of diversity (it is impossible to define one "single" standard reference model for dry areas);
- **the need to combine technical and organisational innovations and to encourage interactions between local dynamics and national policies**: the development of sustainable agricultural practices necessarily requires the governance of natural resources in collaboration with the communities and the negotiated definition of rights of access to and use of natural resources (in particular land, pasture, water points, firewood) between the local actors (local authorities, traditional authorities, decentralised public services, farmers' organisations, etc.) and with the national stakeholders;
- a major objective of providing support to **family farms** which are capable of developing techniques adapted to the local conditions for conserving water, soil and trees in order to create more resilient systems, if the economic and institutional context is favourable and if the states provide the necessary support (development of public services and goods, social security nets in the event of crises, etc.).

REPORT SUMMARY

1. The priority challenges for the sustainability of production systems in dry areas

1.1 The capacity to integrate hazards and cope with shocks – a major determinant of sustainability

Sustainable development, a concept inherited from the Rio Conference

This concept appeared in the political discourse with the 1987 publication of the report requested by the United Nations from the Commission chaired by Gro Harlem Brundtland during the preparation for the Rio Conference which recognised it five years later in June 1992: "*Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs*."

Following the Brundtland report, the term has experienced success justified by the importance attached to **incorporating the duration of the benefits of development**, in particular in the medium and long terms, and the **preservation of opportunities** for future generations.

Specific implications for sustainability at the level of production units

In terms of production systems, sustainability is linked to the preservation of **agronomic production capacities** (water and soil conservation) and the **preservation of the social and economic capacities of the operators involved in the system.**

Specific sustainability challenges for production systems based on family farming and marked by a high level of variability of natural resources

In dry areas, **agriculture is primarily family-based**, meaning that the agricultural production unit corresponds to the family. Access to sufficient means of subsistence at the family level is a prerequisite for the sustainability of production systems. However, in these areas, highly variable precipitation combined with the fragility of the ecosystems affects the availability of natural resources and therefore represents a risk factor, in particular for agricultural activity which conditions the livelihoods of the majority of rural populations. Furthermore, in these contexts of high climatic uncertainty, the sustainability of production systems is consolidated by **combining numerous strategies, both agricultural and non-agricultural (including migration) at family level.** Agricultural production should therefore be perceived as an element interacting strongly with the other activities from which farming families derive their livelihood.

Hazard management as a determinant of the sustainability of agriculture: reducing vulnerability to natural fluctuations and increasing resilience

For the agro-ecosystems of dry areas, the aim of the production systems is to **reduce vulnerability to fluctuations in the natural environment**. This involves integrating **risk management strategies at different levels**: technical (diversity of farmed environments, in the composition of herds/flocks, of cultivated plants cultivated, etc.) and social (maintenance of solidarity networks, information management to minimise losses, etc.)

Vulnerability, adaptation and resilience are linked and interdependent. It is necessary to consider **the dynamics of the systems in the hazard cycles**, their ability to absorb a shock and to return to a situation which sustainably meets the needs of the populations. Adaptation,

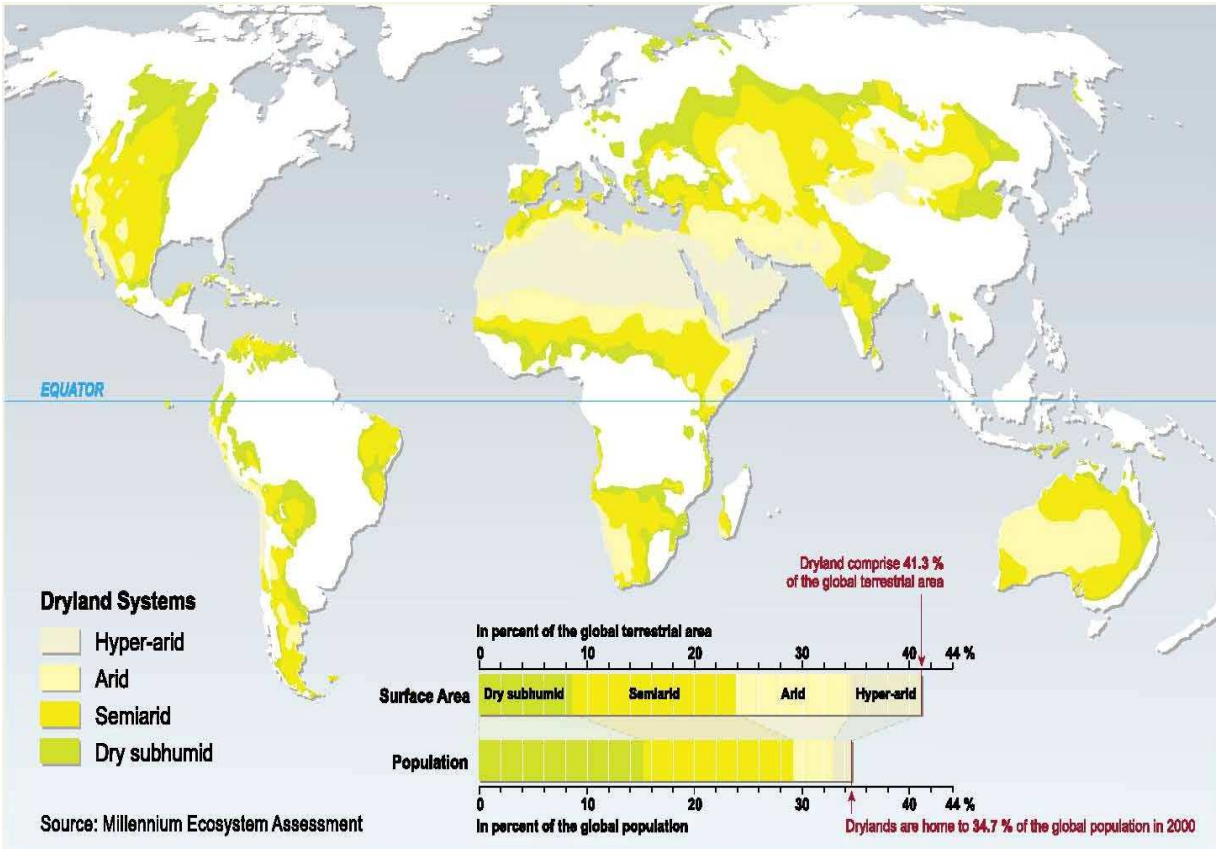
or the reduction of vulnerability, makes it possible to **minimise the negative impacts of fluctuations by avoiding crossing points of no-return in terms of altering the socio-economic conditions or the natural environment**. Resilience refers more to the ability to recover the necessary production factors (seeds, livestock, tools and labour) in order to **re-establish the level of production and the environmental services**. To guarantee the sustainability of production systems and accompany the evolution of the technical production models and, more broadly speaking, the rural development models, **a good understanding of the adaptive properties of these systems and the resilience to the natural hazards typical to dry areas** is a key element.

1.2 The climatic, socio-economic and demographic dynamics of dry areas and the challenges facing sustainable agricultural development

Characterisation of dry areas

According to the French Scientific Committee on Desertification (*Comité Scientifique Français de la Désertification – CSFD*), dry areas are characterised by the scarcity and extreme variability of precipitations, a **rainfall deficit in relation to the potential needs of the vegetation (reflected by the aridity index)**, a high level of insolation and high temperatures (causing a low level of air humidity and thus a high level of evaporation). These are areas where water is a restrictive factor on the production of agricultural goods, forage, wood and other ecosystem services.

Dry areas account for more than 40% of the visible surface of the planet and are home to approximately 37% of the world's population. They are located across all the continents: North America, South America, Africa, Asia and Oceania.



World map of drylands (Source: Millennium Ecosystem Assessment)

Prospective elements for dry areas

Increasing demographic pressure combined with **exacerbated climate hazards** is threatening the living conditions of the populations and the preservation of the ecosystems in dry areas. Many of them are experiencing population growth which is significantly higher than that observed worldwide in all climatic zones combined. In the case of Africa, this demographic dynamic is reflected by a theoretical doubling of the population every 30 years. At the same time, climate hazards are becoming more frequent and more intense, causing dry areas to expand and aridity levels to increase. This double constraint – both anthropogenic and natural – is generating **extreme pressure on natural resources** which run the risk of exceeding their capacity for renewal. For example, certain simulations show that in 2025, water resources available in dry areas could have fallen well below 1,000 m^3 per year per inhabitant, which is much less than the critical threshold of 1,700 m^3. Similarly, land degradation already affects between 10 and 20% of the total surface area of dry areas and, in certain countries of sub-Saharan Africa, it is estimated that the annual cost of desertification is equivalent to the benefits of agricultural growth. **The deterioration of natural resources is therefore a major risk for the populations living in dry areas who derive the vast majority of their livelihoods from these resources and already suffer from more precarious living conditions than in other climatic zones.** Moreover, a major degradation of the ecosystems of dry areas could have a domino effect on the balance of other ecosystems (increased erosion and sanding up of rivers and damns, dust storms, etc.); it could also give rise to migration phenomena over short lapses of time which could themselves have a highly destabilising effect on the social balances: uncontrolled growth of towns, social exclusion and increased competition for access to resources in destination zones less restricted by aridity.

Major challenges facing agriculture in dry areas

Agriculture, and more generally speaking the use of natural resources, faces three challenges: to contribute to food security in a context of highly limited water resources; to contribute to improving the living conditions of the rural populations; and to preserve the functions of the ecosystems. With this in mind, we can **differentiate strategies according to the importance of the aridity constraint**.

In areas subject to major climatic risk (i.e. some arid areas seeing no rainfall for one or more years), the challenge is to **enable the production systems to co-exist with the hazard.** The strategy involves developing very flexible and reactive methods of farming making it possible to seize the changing opportunities: diversity of farmed environments, nomadic pastoralism, the promotion of forest products, etc. This strategy requires good information management and specific means of governing natural resources.

In areas where the climate hazard is less present – i.e. areas characterised by a certain degree of stability in the availability of water through rainfall or underground resources (dry sub-humid areas as well as oases and irrigated areas) but where this availability remains a constraint (be it in farming crops, obtaining fodder for livestock or enjoying access to energy wood) –, the challenge is to **intensify the production systems in a way which takes account of the fragility of the ecosystems**. The strategy involves optimising the abstraction and use of water. This approach requires specific water and soil conservation techniques as well as an appropriate choice of crops.

A common challenge facing all dry areas is to **enhance the promotion of agricultural production on the markets**, both at local level and on urban markets and certain high value-added niche markets. This promotion requires easy access to the markets and an increased acknowledgement of the intrinsic qualities of the goods produced in dry areas (local traditional products, certified organic products, labelled products, etc.)

1.3 Which principles of action to consolidate the sustainability of production systems in dry areas?

The need for agricultural development approaches which integrate the constraints of water resources, available biomass and climate hazard

Historically speaking, the approaches to agricultural development have primarily focussed on intensification in areas with a high natural potential, while dry and mountainous areas have been left in the shadow of this development in many countries. We can therefore hypothesise that the prevalence of poverty in dry areas reflects not only a natural potential which is more difficult to exploit, but also a lack of **rural development models adapted to the characteristics of these zones and in particular to hazard management.**

The limits of the conventional intensification models

The movement of the "green revolution", aimed at increasing food production through increased productivity, has primarily focussed on areas where water resources are not a constraint. This increased productivity has required an **"artificialisation" of farmed environments, intensification through the use of inputs, specialisation and mechanisation.** This has been made possible by **minimising the costs of access to infrastructures, inputs and markets**. This green revolution has in part achieved its objectives, although it has also given rise to major negative environmental externalities affecting the production capacity of the agro-ecosystems in the long term. In dry areas, this approach of agricultural intensification is too risky in economic terms given the climatic constraints and, due to the fragility of the ecosystems, can lead to environmental deterioration such that it quickly affects the production capacity of the environment. The green revolution approach is not particularly effective in the context of the constraints specific to dry areas.

Ecological intensification and risk management

The conservation of water and soil resources is an essential priority as regards the technical production model. It is taken into account in approaches such as sustainable land management or agro-ecology which promotes **interactions between agrarian systems and the functioning of ecosystems.** In order to avoid the degradation of the environment, the ecosystem services are preserved and used to consolidate the agrarian system. Dependence on external inputs is reduced with a view to improving management of the climate risk. Finally, diversity is introduced at all levels to make different use of a wide range of resources and to promote synergies between the different activities.

These approaches open a **range of possibilities for the ecologically sustainable intensification in fragile ecosystems** on which more than a third of the world's population depends. A promising option is the **case-by-case hybridisation of the technical models of agricultural production,** using the experience of the green revolution as a catalyst of water and soil conservation mechanisms. This vision of intensification means that practices and techniques better adapted to the climatic constraints can be envisaged with a return on investment in the medium term. Without achieving the productivity levels of systems enjoying better water and soil resources, this approach nevertheless makes it possible to envisage **a long-term optimisation of the productivity of each agro-ecological zone**.

The implementation of these types of production methods requires **innovations adapted to the environmental and socio-economic context of each agro-ecosystem** and thus recognition of the farmers and their knowledge in the innovation processes. Changing practices in the production systems also require a **sufficiently reassuring institutional and economic context to encourage producers to adopt strategies which generate long-**

term benefits: fair governance of natural resources by securing long-term access (to land, water, forest resources and fodder) and access to income-generating outlets for goods produced in dry areas.

2. Lessons learned from experiments supporting more sustainable production systems

The case studies proposed by the members of the Biodiversity and Development Group and the Working Group on Desertification (GTD), presented in their entirety in the appendices of the report (CD-ROM), relate different experiments conducted by development partners with a view to accompanying the transition of agricultural production systems. The nature of the ecosystems and the climatic, social and economic dynamics give rise to a wide variety of situations and thus to numerous variations of the challenges of sustainability. It is therefore necessary to conduct the analysis on the more detailed scale of human societies linked to large agro-climatic zones in order to compare the biophysical, human, social and political determinants and to better understand their interactions. In order to emphasise the role of international cooperation, the analysis here primarily focuses on Africa while nevertheless presenting parallels with experiments undertaken in similar agro-ecosystems on other continents. An initial series of case studies presents initiatives relating to production systems in four main types of areas: oasis, Sahelian pastoral, agro-sylvo-pastoral and, finally, irrigated areas. A second series of case studies examines transversal issues of sustainability common to all production systems in dry areas: land tenure, the management of common resources, the promotion of products by the market and, finally, the role of farmers' organisations.

2.1 Oasis areas: accompanying the collective management of water resources and promoting patrimonial resources

Oases are man-made, cultivated sites within vast arid or even desert areas. Historically speaking, they were often created to serve as **relay points along the caravan routes and major international trade routes.** While most oases have existed for hundreds of years, we note that these complex agro-ecosystems are currently in decline. Several threats are calling the sustainability of the farming systems into question both in terms of agro-ecological reproducibility and of economic and social viability: reduction in water resources, overexploitation of aquifers, the sanding up and salinization of soils, the human migration, the evolution of trade, the evolution of the social control of water resources and labour force, and the development of large-scale modern palm groves - which compete with other types of farming (old palm groves with small family farms around the edges) for the use of the available water resources.

The major initiatives aimed at consolidating the sustainability of oasis systems highlights three types of support which can in particular be observed within the framework of the experiments conducted by NGOs in Morocco: i) improving control and equity in the use of water, ii) promoting the products of the oases and diversifying sources of income and iii) encouraging concerted management of the oases.

Improving control and equity in the use of water

The technical and social optimisation of water resources is the cornerstone of the efficient "functioning" of an oasis. The first theme of intervention in terms of consolidating the sustainability of oasis systems is to **improve the conditions of obtaining and using water**. The reconstruction of the social control, to be accompanied, must enable those historically

excluded from access to the rights to acquire them. **Greater equity** in the access to water resources is a condition for the mobilisation of the population of the oasis: certain actions undertaken in Morocco demonstrate that this perspective is far from being unrealistic. Improved control of water in the oases also requires a **more economical and rational use of the resource** through the rehabilitation of irrigation networks, the development of micro-irrigation and the pooling of pumping operations resulting from the creation of small private gardens around the former palm groves. Finally, it is a question of **reconciling sustainability and equity** by making the entire population of the oasis responsible for the water management process.

Once water mobilisation has been improved, it is then possible to undertake the **regeneration of degraded palm groves**. This involves replanting palm trees, giving priority to varieties which are resistant to *bayoud* (a disease affecting date palms) and improving the maintenance of the palm groves.

Promoting the products of the oases and diversifying sources of income

The economic viability of the oases is dependent on the produce that these oases are able to supply. The strategies developed to this end are aimed at promoting the comparative advantages of the oases and the opportunities they offer: the production of high-quality dates, the development of a wide range of quality fruit trees, the improvement of alfalfa stands supporting the extension of sedentary sheep farming using local breeds, the harvesting of plants for use as medicines or dyes and the introduction of floodplain crops based on low-cost constructions.

However, the survival of the oases is also dependent on **sources of income other than from agricultural production**. Currently, income from emigration has taken over from that of the caravan trade. With the return of certain emigrants when they retire or following the economic crisis experienced in the countries of the North, the money provided by emigration tends to be invested in economic activities, be they in the field of trade, transport, agriculture or tourism. This trend should be encouraged. **Tourism** can represent an opportunity by enhancing the attraction of oasis areas due to their architectural heritage (*ksour*), the beauty of the landscape and the welcome offered by the populations.

Finally, the future also depends on national solidarity, which is becoming more visible in the Maghreb through the implementation of public policies for the development of services and infrastructures in oasis areas. It would also be desirable for the international dimension of this solidarity to be consolidated, given that the oases represent an aspect of world heritage as already recognised by the United Nations Food and Agriculture Organisation (FAO).

Encouraging concerted management of the oases

It is important to **encourage the emergence of new institutions which take over from former representative structures with a view to organising the concerted management of resources** on which the future of the oases depends. The political structures and the rural communes must rely on relays at the local level of the oasis. By increasing the responsibility of the civil society through local associations and NGOs, the populations of these oases, and in particular women, can become actors in the story of their own development. Far from being unrealistic, in light of the numerous examples witnessed in the field, this involvement of the civil society is a major advantage in developing a policy conducive to ensuring the sustainability of the oases.

2.2 Pastoral areas: securing pastoral mobility and adapting the crisis management mechanisms

The challenges facing the sustainability of pastoral systems can be divided into five main strategic pillars: i) securing the mobility of herds and flocks in light of the extension of agriculture, ii) restoring the public pastoral infrastructures and services provided to livestock farmers, iii) adapting and implementing legislation recognising the right to pastoral mobility, iv) improving the mechanisms for providing support to livestock farmers during pastoral crises and v) building the capacities of shepherds' organisations to intervene in the political dialogue at national and regional level.

The failure of policies encouraging sedentary livestock farming in the Sahel

The works of the CIRAD on the retrospective analysis of the experiment of a pastoral region in Senegal (Ferlo) highlight the **limitations of a public policy aimed at improving the management of pastoral resources by encouraging livestock farmers to become sedentary and reducing the mobility of herds/flocks**. This type of planning policy has had a profound effect on the livestock farmers' mobility system. However, in this case, despite the decline of the great seasonal migrations, mobility has become more complex without for all that disappearing: there are still numerous mobility systems which are highly flexible in order to adapt to the seasonal, climatic, economic or land-related opportunities and constraints. With regard to environmental impacts, lessons which can be used in pasture management demonstrate the **relevance of traditional methods of managing natural pastoral resources** (mobility, integration of livestock and crop farming areas) which appear to be more suitable than so-called modern systems (ranching systems, long-term periods of grazing ban in some areas).

The development of approaches securing mobility and pastoral systems

The countries of the Sahel such as Chad, Niger and Mali, accompanied by different partners (French Development Agency – AFD, Danish Development Agency – DANIDA, Belgian Development Agency – CTB, etc.), have developed experiments aimed at securing mobile pastoral systems. These experiments are founded on a "pastoral hydraulics" approach and rely on the strong involvement of representatives of migrating stock farmers, territorial authorities, land security mechanisms and decentralised hydraulic and stock farming services. Initially focusing on certain regions in the Sahel, they have gradually facilitated the development of genuine **national inter-sectorial strategies of pastoral hydraulics taking into account the diversity of constraints of access to pastoral resources**. These experiences have enabled major investments to be made (more than 600 new or rehabilitated pastoral wells and more than 3,000 km of beacons securing the migration routes and pasture land). With regard to social capital, this represents so many social agreements for the installation of the public pastoral wells, well management charters and social agreements for the delimitation of pasture land. The local stakeholders underline the **advantages of these approaches – based on dialogue and negotiation – with regard to reducing agro-pastoral conflicts**.

The factors of success of these experiments highlight the need to combine three approaches: i) **capacity building enabling local land institutions** to undertake actions to secure pasture land, migration routes and the areas around water points, ii) **capacity building enabling public actors to integrate pastoral mobility in their vision of land management** at the local, departmental and regional levels and iii) support in defining **social agreements for the installation and management of public pastoral wells**, with a view to rehabilitating the pastoral infrastructures.

The main limitation of this concerted approach concerns the setting up of **sustainable financing mechanisms ensuring that these constructions are renewed** and adapted to

the existing institutional contexts. Generally speaking, the involvement of several states, such as Mali and Niger, in developing national pastoral hydraulics strategies demonstrates the need to shift from occasional interventions in the form of projects to a more sustained and profitable implementation of these actions across pastoral and agro-pastoral regions in several countries of the Sahel.

A major challenge of pastoral crisis management

Information and early-warning systems as well as agricultural policy observatories have been developed in an attempt to manage the food crises faced by the inhabitants of the Sahel as a result of recurrent drought. These systems are generally designed to enable decision-makers to identify the most vulnerable zones and groups. In light of the objectives of supporting the sustainability of pastoral systems and of the recent crises of 2005 and 2009, these mechanisms generally demonstrate a number of failings. The aim is to succeed in **bringing together the shepherds' observation systems and the public intervention mechanisms which are decisive in the decision-making process**. It is also a question of implementing sustainable and structural mechanisms ensuring an **improved supply of fodder**, preferably using local resources, in order to cope with crisis periods and facilitate the reconstitution of the herds/flocks after these periods.

2.3 Rain-fed crop areas: promoting diversity and encouraging water, soil and tree conservation

The sustainability of crop systems in dry areas is linked to the ability of the farmers and local communities to cope with hazards by adapting their plot practices, and at the level of local land areas (*"terrroirs"*), to the rainfall and market conditions and to the demographic dynamics. The experiments show the importance of promoting **water and soil conservation, the potential of trees and shrubs and that of farming varieties in all their diversity**. They also highlight the need to consolidate family farming, the only form of agriculture capable of ensuring the sustainable management of natural resources in the utmost respect of their local characteristics. To consolidate agro-ecosystems, the farmers must be made responsible for choosing and transforming the methods of managing resources, and their **access to land, diversified seeds, suitable equipment and markets for different products** must be secured**.**

Developing and managing watersheds and controlling agricultural run-off

The outcomes of the actions conducted with regard to **preventive water and soil management** demonstrate their utility in protecting against erosion and enhancing the potential for rehabilitating degraded land. They confirm the interest of building physical structures intended to limit run-off and underline the importance of suitable replanting actions to consolidate these structures and re-launch the production of biomass. They emphasise the **utility of watershed management approaches** with a view to optimising investments in light of upstream and downstream run-off mechanisms. These approaches and related investments help preserve and rehabilitate productive land, raise the water table thus increasing water availability for production, restore biodiversity and increase the availability of fodder. Besides, the value-added and jobs created through these investments can result in the reduction of seasonal migration and in the investment of the local labour force on the farms.

Prior clarification of the objectives of rehabilitation works, of the **status of the land concerned**, the responsibilities of the different stakeholders and of the **rights of use of the rehabilitated land** is crucial to preventing conflicts. In particular, **a balance must be found between land used for farming and pasture**.

Developing agro-forestry

Agrarian societies in the Sahel have developed farming methods whereby shrubs and trees play an essential role for food and income and in **stabilising the soil and maintaining fertility**: periodic fallow periods, creation of agro-forestry parks combining useful trees (comestible leaves, fruits and condiments, fodder) and low ligneous species with annual crops, wasteland fodder promotion systems improving the fertility of the fields through livestock farming, etc. The experiments studied show that it is possible to **strengthen this role of woody plants by developing the different forms of agro-forestry and improving the fallow periods, planting hedgerows, etc.**

Fallow land enables fertility, reduced by years of farming, to be regenerated. Introducing woody plants to fields facilitates their upkeep in the case of a permanent crop which is also optimised in terms of productivity and soil protection through the practice of combined crops (in particular cereals and pulses). Certain contributions underline the **success in reconstituting tree crown cover by means of assisted natural regeneration;** this involves farmers protecting saplings resulting from natural dissemination in the farmed fields (by natural direct sowing and the provision of manure), conserving the annual regrowth of low ligneous species and integrating these trees in the development of agro-forestry plots.

Diversifying crops, varieties and the combinations thereof

It is important to **adapt the cropping systems, the use of the different species and varieties, their combination and their spatial arrangement,** while promoting local agro-biodiversity and consolidating access to the resources and information necessary to extend the opportunities for diversification and ecological intensification. The case is cited of the introduction of new annual and multi-annual crops which both generate food and contribute to protecting against erosion. The sustainability of the production systems can also be strengthened by promoting existing natural resources that are still untapped: development of apiculture, promotion of non-woody forest products, promotion of wild plants for medicinal use, etc.

Transversally speaking, the different case studies demonstrate that the **construction of local competencies based on technical, social and institutional experimentation processes at territorial level** represents a key objective in facilitating the transition of practices towards agro-ecology. The innovations proposed in the research are adapted by the communities according to the objectives they perceive as being the most important to their livelihoods. In practice, for example, a cover plant introduced in a project with a view to soil conservation may be adapted as a fodder crop (and diverted from its initial theoretical function of providing plant cover) within family production systems.

2.4 Irrigated areas: supporting integrated management of water resources and accompanying family farms with regard to high value-added crops and livestock activities

In dry areas, in light of the limited volume of rainfall, **promoting water resources** represents a major opportunity (resources which can be linked to permanent water courses, water spreading, artificial bodies of water, permanent or semi-permanent pools and groundwater). Access to water facilitates the development of **specialised systems** (fruit and vegetables, flood plain sorghum, irrigated rice, etc.) in addition to or as a replacement for rain-fed crops.

The situations are diversified, sometimes involving very complex systems requiring considerable facilities and infrastructure: water from lowlands and pools is tapped by means of gravity, drawing or pumping; water from the water table is extracted manually or using motorised pumps; water resources from rivers and dammed lakes are adapted for irrigation with partial water control (flood retention and management) or total water control (control of

the height of the water by means of irrigation and drainage): see diversion work in the *Office du Niger*, land planning dams in Morocco, networks supplied by pumping from the river in Niger, etc.

The sustainability of these different systems of irrigation and the production systems to which they contribute relies on a series of factors linked to the type of water resource, the characteristics of the infrastructures, the water management methods and the crop systems in place. The experiments studied point towards a **consolidation of the watershed and water resource management approaches**, the **increased responsibility of irrigators** in managing the networks, **water-saving** mechanisms and an **ecological intensification** of the irrigated crop systems.

Managing water resources and watersheds

The first objective is to ensure **good management and preservation of water resources**, both in terms of quantity (volumes, availability over time) and quality (pollution harmful to market gardening production, etc.). On the scale of a large river, the first question will concern the inter-state management of water flows. At the level of a mountain dam or a hillside basin, it is a question of protecting the watershed upstream by maintaining plant cover and implementing agricultural and livestock practices **enabling the infiltration of water and the buffer effect of soils**; the objective is to maintain the gradual restitution of flows and to avoid the phenomena of sanding up and floods which are devastating to the zones and the irrigation equipment downstream.

It is also a question of maintaining **conditions of secure access to the resource** using mechanisms facilitating **dialogue between users** and the equitable distribution of volumes between agricultural water and water intended for other uses: off-season market gardening, access for herds/flocks around a pool, urban use and the needs of downstream crops. Water policies should therefore evolve towards planning the different uses of water and regulating demand (promotion of economical localised or drip irrigation systems, etc.); they must also manage competition for water and land where there are also needs linked to residential development and the installation of urban, industrial and tourist infrastructures and equipment.

Managing the facilities

The essential objective concerning facilities with collective infrastructures is often the **suitable appropriation by the users**, both with regard to their operation and their maintenance. The States tend to **entrust certain functions** previously under their control **to irrigators' organisations**, thereby requiring major efforts towards joint diagnostics and **capacity building**, which are all the more necessary as the upstream design of the works will have involved very little participation. The experiments show that it is necessary to build the capacities of user associations while consolidating their involvement in the design of the facilities, their responsibility with regard to water distribution, the management of the networks and the appropriate recourse to additional service providers.

Supporting the productivity of family farms by improving the promotion of water and integrating livestock farming

At the level of the irrigated crop systems themselves, the small areas per farmer and their reduction as the population increases give rise to situations in which the **economic promotion of irrigated production** becomes a key factor of sustainability. At plot level, the objective lies in **economical water management**, for example by adopting the localised or drip irrigation techniques which serve to reduce supply losses and evaporation and thus the volume of water supplied at source in relation to the volume of water effectively used on the

plot. **Optimising the choice of crops and the farming methods** then refers to the sustainability factors examined in the section on rain-fed agriculture, with limited evaporation, control of the technical choices and fertilisation, improved access to seeds and the processing and commercialisation of products.

In the major rice irrigated areas, the **role of complementary activities within the production systems, such as livestock farming,** has been underestimated. Certain experiments nevertheless underline the importance of animal traction and animal manure in rice production and the role of livestock incomes in securing the livelihood of family farms.

Generally speaking, it is important to take account of the needs of family farming, which provides greater productivity per hectare than agro-industrial farms. Taking this element into account presupposes accompaniment for the transition of intensive market gardening production systems towards more sustainable practices adapted to the different types of farming. It also requires infrastructures, equipment and facilities adapted to the pluri-activity which guarantees the viability of these family farms. Finally, it implies building their capacities and those of their organisations.

2.5 Land tenure: securing community rights

The land problem in dry areas is particularly complex due to the **accumulation of uses of natural resources imposed by an arid or semi-arid climate** and the necessary combination of rain-fed or floodplain agricultural practices, of woody plants and pastureland. This **multiple uses** mean that the process of individualisation of the land is unsuitable to achieve the objective of managing shared resources in dry areas. At the same time, the increasing pressure on resources leads to increasingly frequent conflicts between users. Against this backdrop, three main challenges can be identified:

i) **finding a way out of the jurisdictional dualism** (national and legal approach on the one hand and local approaches based on collective land management on the other) by enabling the rights of all citizens to be recognised and protected;

ii) ii) **securing farmers' practices aimed at ensuring the long-term management of the soil and the associated resources** in light of the increasing temptation to adopt an activity generating short-term profits;

iii) iii) accompanying the necessary **implementation of decentralised governance bodies** acting as a relay for political frameworks and ensuring the full involvement of the local stakeholders in controlling sustainable and equitable land management.

The incorporation of the land dimension since the 1980s, in light of these challenges and the shortcomings of the national legal frameworks, has given rise to different approaches to natural resource management. **The management of village land (*"gestion des terroirs villageois"*)** was the first innovation, showing the utility of increasing the responsibility of users in managing natural resources at village level. In Burkina Faso for example, the agrarian and land reform went as far as institutionalising village land management committees. In the 1990s, several approaches were developed at the same time: the definition of the **national legal mechanism reforms** (e.g. the Rural Code in Niger), the **development of the experimental Rural Land Plans** (Côte d'Ivoire, Benin, Burkina Faso and Madagascar) and the support for local management through **local shared resources management conventions**. More recently, with the furthering of decentralisation policies, the process of **communal land management** (*"gestion du foncier communal"*) was developed and different experiments have included the commune as a more or less central element of land management. While the relevance and impact of land registration are generally being called into question at present, those approaches focus on the consolidation of land policies, of the land management capacities of the communes and the local and concerted management of land and shared resources (such as local conventions).

The construction of policies and the evolution of the legal and institutional frameworks are seen as a sustainable response by giving form to the choices made concerning the land. Priority is given to integration, in particular through the fight against evictions, with a desire to respond to the diversity of local situations and offering a wide range of options in terms of land tenure. The emphasis is placed on the recognition of occupants' rights irrespective of their legal land status, on the participation of all those concerned in taking the decision, including informal operators and basic community organisations, and on the decentralisation of responsibilities with regard to land management and administration. It is a question of developing **a new vision prioritising land rights "from the bottom up"** (it is the use and the local land regulations which provide access to formal land rights and protect these rights) rather than their creation "from the top down" (the attribution of ownership by the state, independent of local rights). The main limitation lies in the application of these regulations by the institutional operators in the field, which requires accompaniment and monitoring by actors of the civil society.

Land tenure and decentralisation

In several countries, the land reforms were prepared at the same time as the decentralisation process and the local authorities were often given the responsibility of creating **mechanisms for managing land certificates**. The emphasis placed on the **increased responsibility of local authorities in land matters** must nevertheless not mask certain realities which largely continue to restrict the action of the communes. The local authorities must be strengthened considerably before being in a position to fulfil their role and be endowed with the corresponding legal capacities and competent technical departments. In dry areas, the local authorities could – in the long run – represent an interesting, although not exclusive, level of management, capable of combining proximity and public service and reconciling the "legal" and the "legitimate" approaches which is a key objective of the land reforms.

Local conventions

In parallel to the approaches developed to define land policies in favour of land management at the municipal level, different experiments have accompanied **an increased responsibility of local actors in managing land and shared resources**. The local conventions are thus considered an important instrument for the local management of natural resources in West Africa. Negotiated between local stakeholders (professional groups, resources' users, traditional leaders, local authorities, representatives of the State, partners, etc.), these conventions represent agreements which stipulate the rules, rights and duties of each party in using and managing local land and natural resources. Such social agreements can play an important role in clarifying land rights and regulating the rights of use of common natural resources. These conventions nevertheless demonstrate certain limitations: they are not necessarily recognised as regulatory decisions and, in general, the decentralisation of management of land and common natural resources must be accompanied by a reform of the decentralised environmental services.

2.6 Natural resources management: making the users and local operators responsible

A disappointing observation from the natural resource conservation experiments in dry areas, both in terms of conservation proper and the integration of local neighbouring populations. In this context, the main lever of intervention adopted is the **transfer of responsibility for the management of natural resources to the rural populations**. Several experiments have been conducted to this end, both in relation to protected areas (animal reserves, classified forests, etc.) and in "ordinary" rural zones.

The forms of management tested are diverse and doubtless deserve a comparative analysis highlighting the diversity of social and ecological contexts, as well as the regulatory frameworks and methods accompanying the dynamics. They range from contractual measures requiring a low level of commitment from the different parties concerned (in the local conventions) to contracts with an external operator providing counterparty funding and controlling compliance with the commitments ("conservation agreements").

More particularly, with regard to **natural forests in dry areas**, the experiments concerning the organisation of **rural wood markets** have re-placed the **populations at the heart of governance of the resources within their territories**; the approach is both an economic one, with a view to reducing poverty, and forestry one, in order to plan and organise the farming of woody plants.

As well as building the capacities of the communities to manage their natural resources, one of the main characteristics of these experiments has been to **push all the institutions involved to examine natural resources governance and their role within that framework**. In a shifting context of incomplete decentralisation, local operators have re-appropriated the resources to which they had lost their rights. Adjustment strategies are in progress between these institutions to identify who will control the access to and use of the resources: bypass strategies, dialogue through local conventions, etc.

Thus the forest and pastoral codes and the laws concerning the environment are gradually demonstrating strong principles with regard to the **decentralisation of the management of common natural resources**. However, to consolidate the ecological and economic viability of the local management structures, several limitations to these experiments must still be overcome. First and foremost, it is essential to **adopt appropriate timeframes to accompany these local management dynamics while implementing and operating genuine impact monitoring systems**. The question of developing mechanisms enabling local natural resources management bodies to **accumulate the budget necessary to their operations**, in particular through **taxation mechanisms** adapted to dry areas, also represents an important objective.

2.7 Marketing agricultural products: promoting the comparative advantages of dry areas and quality products

Climatic hazards, weak or non-existent infrastructures, distance to the markets, high transport costs and unsuitable technology greatly penalise the agro-sylvo-pastoral farms in dry areas. Promoting local products or specific high value-added products may therefore represent a means of ensuring the promotion of territories which are not, in principle, particularly competitive from the global standpoint but which are essential to social balances and certain ecosystem services.

One of the strategies is to promote the **production and commercialisation of local products or quality products linked to geographical origin by promoting their comparative advantages** (specific quality, unique natural resources and traditional know-how), while enabling the reproduction of these local resources in the long term.

Several case studies are presented in the report concerning the saffron value chain in Morocco, shea butter in Burkina Faso, arabic gum in Chad, as well as an experiment in **paying for environmental services** in South Africa. In the end, several principles of action have been highlighted, in many cases in reference to local development and territorial dynamics: **mobilisation of local stakeholders**, promotion of **local heritage in the broadest sense of the word** (ecosystems, know-how, culture and tradition), interaction between endogenous dynamics and external opportunities (offered by the market and the external demand of nearby urban markets).

2.8 The role of farmers' organisations: combining different lines of action and representing the diversity of family farming

The primary function of famers' organisations is to defend the interests of their members and enable them, collectively, to **seize market opportunities or enjoy access to means of production w**hich would be inaccessible to them individually. The services provided are aimed at **ensuring productivity at the different stages of a profitable value chain**: production support, in particular through access to inputs and financing systems for these inputs, collective storage and grouped commercialisation operations. In light of the economically precarious situation of the majority of family farms in dry areas, **access to a revenue-generating market is a *sine-qua-non* condition for mobilising the members of farmers' organisations (FOs) in analysing the sustainability of their production systems.**

Combining different lines of action for the FOs: the case studies highlight experiments in accompanying and consolidating farmers' organisations to develop "double trigger" approaches in the field: the objective is to improve productivity quickly in response to immediate needs as well as to support member producers in the long term in their transition towards production practices and models more sustainable and resilient to hazards.

Consolidating the FOs as actors of the transition of production systems

First and foremost, **dialogue between farmer's organisations in the South** is essential to have a more concrete idea of the specific changes undertaken in certain dry regions and to demonstrate the relevance of including sustainability issues (socio-economic and environmental) in the FOs strategies. Identifying and testing innovative practices, technically and socially adapted to the local contexts, also requires **increased collaboration between the farmers' organisations, agricultural research institutes and training centres**. Finally, the services made available to members by the FOs must take account of the needs and constraints specific to the systems in dry areas (exposure to climate hazards, difficulty in obtaining market access, need for funding for investments, need for training for producers in new techniques, need for equipment to prepare and transport compost, etc.); the benefits of these services on productivity can be seen in the long term.

A strong institutional role

Beyond their predominant role as local bodies, farmers' organisations also play an important institutional role. It is their responsibility to ensure that public policies take the diversity of agricultural models into account, as well as the specific needs of producers and challenges of sustainability in dry areas.

3. Proposals and priorities for international cooperation towards the sustainable development of dry areas

The priorities identified with a view to supporting the sustainable development of dry areas focus on five main strategic areas:

1. Integration of risk and hazard management in rural and agricultural development strategies in dry areas.
2. Creation of synergies between farmers' innovations and research, in particular with regard to promotion of water, soil conservation and risk management, with a view to adapting to the difficult and diversified contexts of dry areas.

3. Promotion of public policies adapted to the constraints/opportunities in dry areas.
4. Support for multifonctionality and the dynamics of rural territories in dry areas.
5. Evolution of development cooperation approaches (economic-environmental, programme-project, civil society-decentralisation approaches).

3.1 Placing risk management at the heart of rural and agricultural development strategies in dry areas

Agricultural development models in dry areas must fully incorporate risk and hazard management. This involves improving the understanding of endogenous risk management systems, supporting diversity in the production systems and promoting the existing "withdrawal-deployment" mechanisms which strengthen resilience.

1 *Improving the understanding of endogenous risk management systems among rural societies in dry areas to better support them*

The understanding of the tactics and strategies used by local societies to prevent and manage risk must be improved. **Promoting the potential of dry areas requires a deeper knowledge of both the agro-ecosystems and the societies which make use of them**. The response of the production systems to hazards cannot be analysed for the annual production cycle. It is essential to **examine the development paths of farms over long periods to understand the effects of the different crises which have confronted them**: how do natural resources evolve in a given agro-ecosystem? Which strategies are implemented by the different groups of actors to counter the risks and, following the shocks experienced by their production systems, which strategies are developed to encourage resilience? With what degree of frequency do hazards occur and what are the socio-economic and environmental impacts? This knowledge must be developed in cooperation with local stakeholders, both in research institutes as well as in local communities and among the different territorial actors.

It is also important to take account of **the social networks which act as insurance for the families and on which are founded** the strategies of resistance and re-mobilisation of the factors of production. Sources of flexibility, adaptability and reactivity to critical situations, these systems of alliances, reciprocity and solidarity woven into the heart of the families, between rural and urban inhabitants, both in the communities and between communities (shepherds/farmers), must be better analysed in order to receive appropriate support through national policies.

2 *Supporting diversity in the production systems and the combination of agricultural and non-agricultural strategies*

It is important to **move away from a fragmented and sectorial management of systems and environments seen as specialised and non-integrated** (pastoral zones, irrigated areas, protected areas, forests, crop zones, etc.). A more integrated vision is fundamentally opposed to the specialisation of agriculture and a sedentary vision of livestock farming, and emphasises **complementarity between agriculture, livestock farming, forestry, etc**. It highlights the flexibility of family farms, the know-how of farmers in dry areas and their finely-tuned knowledge of the properties of the agro-ecosystems, as well as their **capacity to take advantage of good years and to limit losses in less favourable periods in a rationale of "withdrawal-deployment"** (shifting from one activity to another and one zone to another depending on climate conditions and the state of the natural resources. An essential quality of resilience, **diversity is introduced at different levels**: seed diversity (genetic diversity) and crop diversity (different crop cycles), diversity of combinations (multi-layered agriculture,

synergies in the combination of plants, efficiency of rotations, complementarity of species bred, etc.), diversity of activities (agricultural – for example systems combining agriculture and livestock, agro-forestry – and non-agricultural, less sensitive to climatic risks: services, tourism, promotion of wild products, etc.). Any intervention must therefore take account of and consolidate the different mechanisms maintaining this diversity. When faced with hazards, recourse to diversification can be combined, depending on the socio-economic context, with the **development of storage systems** (cereal granaries, fodder for animals).

3.2 Accompanying the development of innovations adapted to the local and diversified conditions of dry areas

The efforts engaged to improve policies supporting the sustainability of production systems through research must be aligned with new rationales consolidating the **synergies between farmers' innovations and research, in particular with regard to the promotion of water, soil conservation and risk management**.

3 *Strengthening the synergies between farmers' innovations and research*

Sustainability can be defined as a system's capacity to redevelop in line with the changing constraints (climatic, demographic, etc.) and opportunities. In this dynamic approach, the production systems' capacity to innovate is essential.

Most case studies emphasise the irrelevance, in the case of dry areas, of innovation seen as the dissemination of a standard technical model and pack; the great innovations (*zai*, assisted natural regeneration, etc.) which have marked agricultural production, in particular in the Sahel, are not the result of research. However, dialogue between farmers and researchers must be broadly encouraged in order be able to **validate the technical, economic and environmental referentials of the farmers' innovations**. Generally speaking, the **hybridisation of contributions between research and farmers should be encouraged**.

This raises the question of building the capacities of farmers' and their organisations as pivotal actors of innovation as well as the need for sustainable mechanisms for quality rural development coordination (farm advisory services, professional training, etc.).

4 *Promoting and assessing innovations conducive to water and soil conservation and risk management systems*

Numerous fields of research-action need to be developed with regard to the sustainability challenges of production systems in dry areas: water-saving, soil microbiology, biomass evaluation, social insurance systems against risks, etc. Innovation must build on **tried and tested technical and economic referentials integrating multi-functionalities and "contextualised"** such that the effects can be assessed *ex ante*. The assessment of the economic sustainability of the systems should be particularly examined, while naturally taking account of the ecological and social dimensions. To ensure that these economic assessments are complete and relevant, they should also incorporate the frequency of droughts and extreme events in line with probable trends caused by climate change in dry areas.

Beyond the technical aspects, **the social and professional dimensions of the innovation processes are also key factors** in their dissemination within the networks of crop and livestock farmers. New structures encompassing not only the usual institutional operators but also the producers, the operators in the value chains concerned and their associations,

NGOs, should therefore participate in the decision-making process relating to the programming, monitoring and assessment of the research-actions to be promoted.

3.3 Promoting public policies adapted to the constraints and opportunities in dry areas

In light of the weakness of development policies dedicated to dry areas, it is important to show the institutional authorities the potential of these zones and what can be gained by **investing in them, encouraging the restoration of the appropriate production factors, and supporting the dynamics of sustainable rural development and an increased resilience of family farms**. This involves improving public policies so that they incorporate international commitments (in particular with regard to multilateral conventions on the environment: climate, desertification and biodiversity) and resolutely support: i) **the improvement of basic public goods and services**, ii) **productive investments** which strengthen the resilience of family farms, iii) **the crisis early-warning and management mechanisms** and iv) **the implementation of decentralised management** of natural resources and land.

5 *Investing in basic public goods and services for the development of rural dry areas*

The sustainability of production systems in dry areas refers to social issues and raises the question of **access to essential basic services** for populations who are forced to adapt their systems in light of global changes such as pressure on resources and climate change. The existence of infrastructures (rural tracks, agricultural hydraulics, etc.) is an important condition for overcoming certain obstacles to market access in dry areas. The investments to be made must provide the opportunity to create activity on-site by prioritising local employment. To guarantee the durability of such infrastructures, the prime contractor must be local or regional (design-adaptation-responsibility). Efficient **public services**, primarily in the field of capacity building (education and professional training, agricultural advisory services, rural coordination, etc.), are necessary to enable ownership of the local development processes by communities. Such an approach means transcending purely sectorial considerations and restoring the sovereign functions of the State in the fields of education, health and basic infrastructures.

6 *Preventing crises by supporting productive investments contributing to the resilience of family farms in dry areas*

Regarding public intervention, the idea is not to oppose emergency intervention and structural support. Public policies should **target productive investments strengthening the resilience of family farms** to prevent crises and reduce their impact: this includes securing pastoral mobility by developing transhumance routes, implementing durable complementary feeding systems for livestock, integrating activities which are less sensitive to climatic risks in farms and developing storage capacities (food, forage). The major challenge of promoting the scarce and random water resources should **orient action towards physical investments to reduce erosion by run-off water, improve the abstraction of water and its conservation in soils and regenerate soil fertility**: cover plants, agro-forestry parks, techniques such as *zai*[1], half-moons, spraying thresholds, dikes, etc.

[1] *Zai* is an ecological intensification technique that involves seeding in holes where the loosened earth has been mixed with compost (and sometimes fertiliser as well). The field looks like a collection of alveoli. This process means that rainwater is captured more easily and the nutrient inputs can be concentrated at the foot of the plant by avoiding run-off.

Strengthening intercommunity social links by improving awareness of rights and supporting reciprocities, and the development of harmonised cross-border regulations are also important issues to be supported by public policies.

Finally, family farms should benefit from **support in selling their products in more favourable conditions** and in creating local added value; this requires support for post-harvest processing and accompaniment in quality approaches targeting different markets: national urban markets, international niche markets. Capacity building and long-term accompaniment are crucial here.

7 *Supporting integrated crisis response mechanisms*

State intervention in direct response to crises is legitimate and often necessary to avoid the total disintegration of severely shaken production systems. In these situations, it is a question of preserving the factors of production (land assets, breeding animals, draught animals, equipment and seeds) which are essential to restarting the system as quickly as possible.

The crisis management and assistance mechanisms must be assessed regarding both their short-term impacts in terms of emergency response and, more broadly, the development paths of the stakeholders concerned and the dynamics of agricultural production over longer periods. Those mechanisms should be more broadly assessed and capitalised on (interaction of national information and warning systems with decentralised local systems, promotion of information provided by the local stakeholders themselves, mechanisms for targeting the beneficiaries of aid and efficiency with regard to the most vulnerable groups, modalities for distributing emergency aid, security stockpiling, support in rebuilding herds and for agricultural diversification, etc.). It is the role of the states and their institutional partners to implement such an assessment/capitalisation procedure in order to adapt their policies to better respond to the recurrent crises affecting dry areas.

8 *Improving the consistency of regulatory frameworks with the processes of decentralisation*

The capacities of the new institutional actors (local authorities) established through the process of decentralisation must be strengthened in order to enable them to assume their new responsibilities with regard to land management, natural resources management, education, health and infrastructures. Decentralisation implies **subsidiarity, increased responsibility and the recognition of local management capacities**.

Support for this process first and foremost requires the **adaptation of regulatory texts and a better consistency between different sectoral regulations** (water, forest, biodiversity, land, etc.), as well as the development of the effective delegation of mandates and of the corresponding financial resources.

Public policy adjustments should be part of a medium-term process with the full involvement of the institutional actors, the representatives of user groups, the local authorities and the decentralized public services. To ensure that the reforms to be launched are relevant and appropriate, they must build on innovative experiments studiously and continually testing these decentralised management processes at local level.

3.4 Supporting multi-functionality and the dynamics of rural territories in dry areas

9 *Promoting the numerous potentials of ecosystems in the farming systems*

Land and natural resources (water, soil, natural pastureland, trees, agro-biodiversity, etc.) are multi-functional and offer diversified potentials which can be put to more profitable use. It is therefore important to facilitate support for the different actors of the territories of dry areas and for their initiatives aimed at promoting these potentials (biodiversity, product processing, development of value chains, crafts, tourism, etc.). This necessarily requires dialogue between the different categories of actors concerned, as well as a **shared understanding of territorial and land dynamics** and of the effects of global and local changes on these dynamics.

10 *Supporting market access and the promotion of products from dry areas*

The sustainability of production systems in dry areas requires an **increase in wealth created locally and the improved promotion of products on the different markets**. This means encouraging the installation and local supply of operators with processing and distribution capacities. This in turn requires the involvement of professional organisations and inter-professions whose actions are supported by the State and accompanied with regard to capacity building.

The existence or development of markets for certain products not traditionally promoted can increase the income of the populations and, in certain conditions, the complementarities between the different uses of natural resources. It is therefore important to **better promote the distinguishing characteristics of resources and societies concerned, through** "*terroir*" products, high value-added products (spices, medicinal plants, etc.) and the organisation of value chains certified as organic and/or ethical and intended for national and international urban markets.

11 *Supporting the implementation of systems of payments for environmental services and the promotion of patrimonial resources*

Among the environmental services provided by ecosystems in dry areas, the functions of carbon fixation and storage would appear to be a priority, in particular in light of the scarcity of biomass and its multi-functional nature: water cycle, energy wood, building wood, soil fertility, forage, other non-woody forest products, biodiversity landscapes and habitat. Through these functions, carbon has induced global effects: sustainability of production systems, employment and reduction in migrations. So although dry areas demonstrate weak carbon production capacities per hectare, the importance of the induced effects of carbon storage in these zones, at both local and global level, should justify **higher payment coefficients than in wetlands**. The **recognition of these functions of carbon, specific to drylands, combined with the potential in terms of surface areas to be promoted,** could make a significant contribution to poverty reduction and socio-eco-environmental sustainability in these regions. In that context, it seems important to further **develop and adapt financial mechanisms such as "carbon mechanisms" and other emerging systems of payments for environmental services** ("conservation agreements"). The idea is not only to improve their complementarity with other more traditional sources of financing, but also to include the **initiatives put forward by farmers' organisations and small-scale producers**.

3.5 Shifting methods of cooperation towards more integrated approaches recognising local initiatives and encouraging innovation

The cooperation mechanisms should be revised to better integrate economics and environment, to combine programmes and project approaches and to accompany the mobilisation of the civil society and the decentralisation processes currently in progress.

12 ***Promoting rural and agricultural development approaches better integrating economics and environment and equipped with appropriate impact monitoring systems***

To consolidate the sustainability of the production systems in its different dimensions, it is necessary to **abandon the dualist approach of "increasing producers' incomes"** ***vs.*** **"improving the state of natural resources"**. It is nevertheless important to remain vigilant with regard to the risks of dilution and efficiency loss for interventions that would pretend to cover all of the aspects.

With regard to strategic vision, it is important to ensure that the issues of agricultural development are indeed well taken into account within environmental fora and vice-versa, to highlight the constraints and potential of dry areas within these different fora and to collectively develop rural development models adapted to these contexts and open to the diverse range of situations, experiments and "solutions".

At an operational level, the aim is to adopt approaches which take account of the different aspects of sustainability. The objective is thus for actors involved in "socio-economic development" (farmers' organisations, agricultural advisory services, etc.) and those involved in "resource management" (conservation organisations, forestry services, etc.) to integrate the referentials on environmental sustainability and socio-economic sustainability respectively.

Finally, monitoring and assessment tools should be adopted and implemented on a timeframe adapted to the impact analysis of interventions engaged at the level of production systems in shifting environments ; those tools should be based on indicators to be combined with those relating to human development (health, education, labour, household resources, etc.). This type of intervention and the associated monitoring mechanisms must be long-term projects with suitable budgets.

13 ***Combining programme and project approaches***

The means of intervention in dry areas should largely give way to a concerted search for innovative models better promoting the territories and their specificities. Programme and project approaches must be combined to encourage innovations in the field and support technical and socio-economic referentials for the definition of appropriate legal and public policy frameworks.

The development of the programme approach is an opportunity, at national level and in the medium and long term, to capitalise on the experiments, adapt the regulatory frameworks and sectorial approaches and facilitate the necessary changes of scale based on approved and assessed mechanisms. The project approach, subject to favourable conditions and in particular financing timeframes which are sufficiently long to test social and technical innovations, facilitates dialogue with the local stakeholders, in particular intermediate organisations, and allows to fully leverage the potentials for innovations.

Like decentralisation, the programme approach involves extensive restructuring and requires capacity building within the central institutions and the decentralised state services. Training government personnel (with regard to the new allocation of mandates within the framework of decentralisation and the associated procedures, or to the new technical concepts of rural development in dry areas, etc.) is essential so that once the regulatory and legislative frameworks have been adapted, they can be effectively implemented and produce the desired impacts in terms of sustainable development of dry areas.

14 *Accompanying the communities and civil society organisations in governing their natural and land resources*

It is important for the communities to be recognised both as beneficiaries of and actors in the rural development policies. The implementation of decentralisation policies must be accompanied by a strong involvement of these communities and the organisations of the civil society. The intervention mechanisms must grant a central role to the recognition and defence of rural communities' rights, to the integration of local initiatives and to the participation of the actors in the decision-making, planning and monitoring/assessment processes of local development.