Responding to the Global Food Security Challenge through Coordinated Land and Water Governance

TITLE : DEVELOPMENT OF AGRICULTURAL IRRIGATED LANDS IN BURKINA FASO

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1. THE CONTEXT

Burkina Faso is located in the heart of West Africa. The population is estimated to almost 15 million inhabitants with an annual growth of 2.3%. This population will reach 18.5 million in 2015 to 51.7% consists of women. 79.7%, or more than 11 million people are located in rural areas and most of them are farmers and have difficulty to get food[1].

The country has an unimodal rainfall (the alternation of one wet season and one dry season). The wet season starts from May and June and stops on September/mid-October. The wettest months are July, August and September. Nearly 65% of the country is in the isohyets 500 mm and 800 mm.

The country enjoys an abundant sunshine, factor to increase crop's yield, particularly in dry season.

But the high evaporation is a major constraint to the management of water resources. Indeed, the evaporation increases progressively from the south to the north and the average values obtained are in the North 3020 mm (Dori), in the centre (Ouagadougou) 2720 mm and 2356 mm in the south (Bobo-Dioulasso).

The soils generally have a low depth and water holding capacity is limited and poor in organic matter. The soil erosion is important and soils are exposed to an accelerated degradation due to both water and wind, all aggravated by anthropogenic factors. Therefore, farmers in Burkina Faso give great importance to water and soil conservation techniques. There is a promotion of a variety of techniques of water and soil conservation. The most common techniques promoted are the "zai", the "lines of stones"", the "half-moons", the production of organic manure, etc.

The river system that drains the country is quite dense but most rivers are temporary and their flows tend to decline. The country has 4 major national basins subdivided into 17 sub-national basins.

[1] http://www.insd.bf/n/

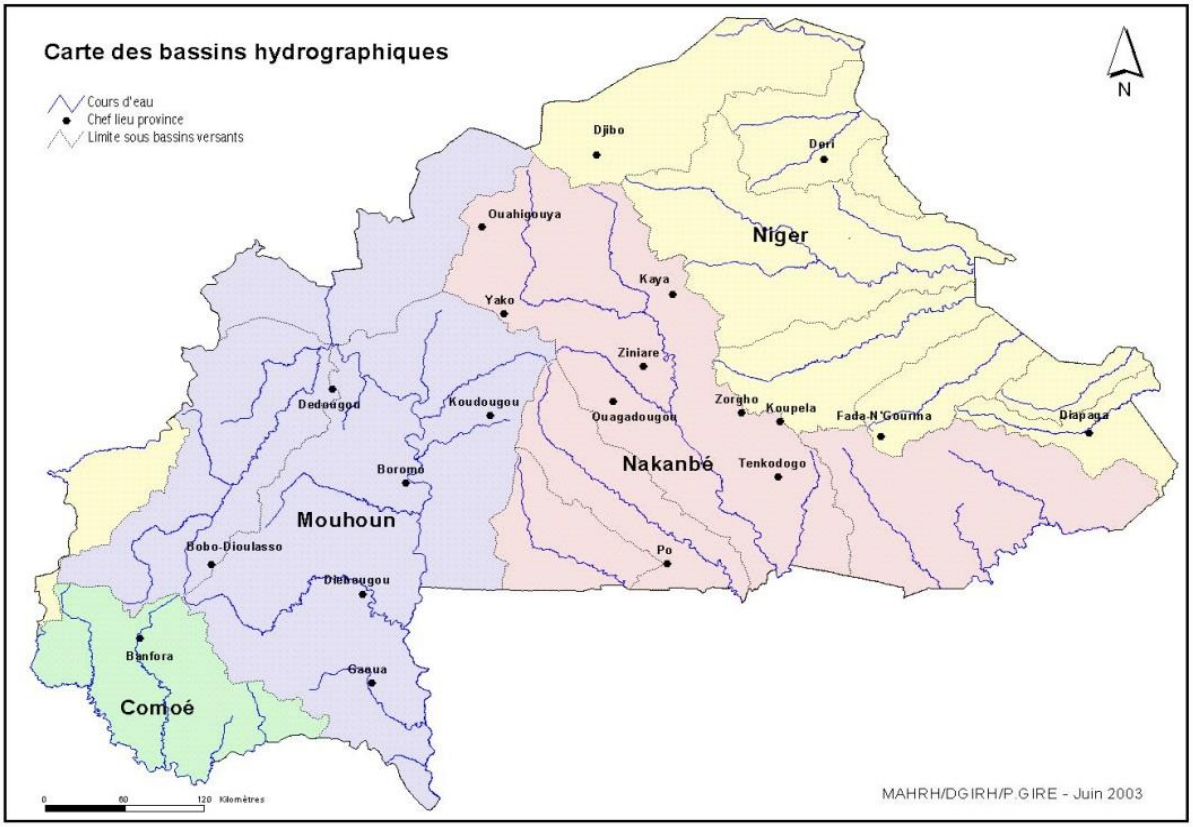

Figure 1: National basins of Burkina Faso

Surface waters are, in Burkina are the main source of water easily mobilized. All the surface water resources in Burkina are produced in the country and drained to the outside of its borders.

The country receives almost no flow from upstream neighbors.
In addition, because of the very high rate of annual evaporation. There is also the degradation of river banks by the populations and the silting of dams and rivers.

The 4 major national basins are the Comoé, the Nakanbé, the Mouhoun and the Niger and represent together a volume of about 8 billion m3.

Table 1: Annual volume of water of the national basins

National Basin	Area (km2)	Percentage of the territory (%)	Annual volume (billion m3)
Comoé	17 590	6,41	1,4
Nakanbé	81 932	29,90	2,1
Mouhoun	91 036	33,23	3,0
Niger	83 442	30,46	1,4
TOTAL	274 000	100,00	7,9

Groundwater is mainly found in two major geological units:

- In the area of crystalline basement: 82% of the area;
- In sedimentary areas: 18% of the territory.

Most of groundwaters are used for the Drinking Water Supply. But the layers of sedimentary rocks are permeable and vulnerable to pollution. There are currently few data on grandwater on the favorable areas and quantities annually recharged.

Globally we can say that there is relatively water in the country and the quality is generally good. An analysis of the water quality of major dams in the basin of Nakanbé and in boreholes in the north (Dori) gives the average results which show that waters are low level of salinity.

According to report on the performances of the country in water and sanitation published with the support of AMCOW (African Ministries Council of Water)[2] in 2013 about 1015 dams have been estimated (MARHASA[3], 2013) with a total volume of water mobilized of 5.415 billion m3. The amount of water used in all sectors is estimated at 2.97 billion m3.

The total water intake is about 690 million m3 for irrigation and livestock (86 per cent of the total).

Some policies, documents and strategies were developed and adopted:

• the adoption in July 1998 of the policy and strategy of water. This policy aims to contribute to sustainable development by providing appropriate solutions to water issues;
• the adoption in February 2001 of the law of orientation for water management;
• the adoption in March 2003 of the Action Plan for Integrated Water Resources (IWRM). This plan covers the period 2003-2015 in two phases: 2003-2009 and 2010-2015;
• the adoption in December 2009 of the law instituting a special tax called "financial contribution in water (CFE)" . This tax is collected favor of the water resources agencies responsible of the management of water of the national water basins.

In the country there is an important potential of land facilitating the development of activities (agriculture, livestock, forestry, etc.).Traditionally lands were managed by private landowners. It is since 1983 that the land became property of the government with the adoption in 1984 of the RAF (Land and Agrarian Reform).
The RAF was reviewed more than one time in 1991, 1996, 2009 and 2012 but was not permitted to solve all the problems of land tenure insecurity, especially for women and youth.

Access to rural land for irrigation purposes is governed by the act No. 034-2009 / AN of 16 June 2009 on Rural Land.
The act 034-2012 / AN of 2 July 2012 for Agrarian and Land Reform in Burkina Faso stipulates that the national land is organized into urban land and rural land. Only the rural lands are dedicated to be allocated for irrigation.

[2] AMCOW, MARHASA/DGRE, 2014. Report of evaluation of Burkina Faso Performances in Water and Sanitation Sector

[3] Ministry of Agriculture, Water Resources, Sanitation and Food Security. Former Ministry of Agriculture, Hydraulic and fishery Resources (MAHRH)

Access to rural land for irrigation obeys to two different systems depending on whether they are managed by the government or not:

- on the areas equipped by the government, an application is submitted to the examination of a Committee of attribution of plot;
- on unequipped rural land, mainly by small individual irrigators and also by collective irrigators and by new actors (agribusiness men, civil servants, traders,…).

The occupation of these lands is subject to different legal regimes depending on whether it is for subsistence or lucrative objectives or goals:

• for people who used to work the land for subsistence purposes before the implementation RAF continue to operate without any obligations imposed by the RAF. In villages the allocation of these lands is decided by the Village Development Councils (CVD);
• in the case of occupation of land for lucrative purposes the possession of a license is required.

The decree No. 97-598 / PRES / PM / MEE / AGRI of 31/12/97 indicates the possibility of introducing agribusiness-men in the large scale irrigated areas (Sourou Valley, Bagre). The government is encouraging this type of farmers and some specifications were adopted in 2012.
The country has also elaborated the document of National Policy on Land Security in Rural Areas (PNSFMR)[4] adopted in 2007.

Women are about 52% of the population and more than 60% of national agricultural production is provided by women according to estimations of the Ministry of Economy and Finance (1998). However they represent 51.7% of extremely poor groups.
64.2% of people in the country have access to an improved source of drinking water. This proportion falls to 43% in rural areas. Women are traditionally the main responsible for the water supply of the family. But, they are excluded from decision-making on the location, management and technical maintenance of water points. Women are also the main victims of water shortages.

Land tenure insecurity is a major constraint for the majority of rural women.
In most of the societies women are not landowners. Women simply have precarious rights on land they use. To conduct large agricultural activities, they are forced to borrow a piece of land from the traditional landowners. Women rights for land use may be contested by the heads of households in which they belong to. This means that they have no guarantee on the lands and these can be removed especially after the land is equipped. In matrilineal societies women can inherit land. For Fulani women who do not cultivate the land security problem does not arise.
Women are not often identified as the owners of an agricultural land during the phase of identification and evaluations when starting a project of development of an irrigation area. They are Most of time registered with the name of the heads of households in which they belong to. In such cases, most of time they lose their rights to access to this piece of land after the land is equipped.
In some developed areas only a small percentage of land is attributed to women (for example: around 10%). However the reality is that most of time women have productive capacities.
Like women, unmarried young people have limited access to agricultural equipped lands (DADI, 2011).

[4] http://www.dgfomr.org/index.php/le-foncier-rural/la-politique-nationale-de-securisation-fonciere-en-milieu-rural-pnsfmr

2. IRRIGATED LANDS COORDINATION

Water and land management

The water and agricultural land sector has been attached to the Ministry Agriculture, Water Resources, Sanitation and Food Security.. But the management falls under three ministries:

- the Ministry of Agriculture, Water Resources, Sanitation and Food Security;
- the Ministry of Animal Resources;
- the Ministry of Environment and Fishery Resources.

However the Ministry of Agriculture, Water Resources, Sanitation and Food Security is the guarantor of the integrated management of water and agricultural resources across the country. The country is organized in 13 regions and 45 provinces. One region is constituted by several provinces.

Figure 2: Region and provinces of Burkina Faso

To achieve its missions the Ministry of Agriculture Water Resources, Sanitation and Food Security has decentralized its activities through directions in each region and in each province of the country.

Each direction has many services for water and land management. And all the activities are coordinated at the central level by the Ministry.

However globally the organizations or agencies below are contributing together for the planning and implementation of water and land development programs and projects:

- Ministry of Agriculture, Water Resources, Sanitation and Food Security (MARHASA);
- General Directorate of Equipment and Irrigation Development (DGADI) ;
- General Directorate of Water Resources (DGRE);
- General Directorate of Land, Training and Organization of the Rural World (DGFOMER);
- General Directorate of Crops Production (DGPV);
- Permanent Secretary of Implementation of IWRM Action Plan (SP/PAGIRE);
- Agency for Rural Facilities Construction (AGETEER);
- National Bureau of Soil (BUNASOL);
- National Institute of Environmental and Agricultural Research (INERA);
- National Agency of Water and Sanitation (ONEA);
- National Company for Land and Rural Equipment (SONATER);
- Authority for the development of the Sourou Valley(AMVS);
- Authority for the development Bagré (Bagré Pole);
- National Program for Land Management (PNGT2).

The General Directorate of Equipment and Irrigation Development (DGADI) of the Ministry of Agriculture, Water Resources, Sanitation and Food Security is responsible of development, implementation and monitoring of national policy on development of irrigation and related activities.

3. LESSONS LEARNED

Overview of the irrigated agriculture

The economy is based on the rural sector, which employs about 86 % of the population and contributes to 40% of GDP in which 30.7% comes from agriculture. Agriculture contributes to about 60% of exportation revenues. The Agricultural production is dominated by traditional cereals (sorghum, millet, maize, ...).

Main cash crop are cotton, maize, groundnuts, sesame , sugar, cashew nuts, beans, onion, mango ,, .

During the rainy season we have on average between 4 million and 4.5 million ha under cultivation. Between 3 million and 3.5 million ha are reserved for cereals , source INSD .Contrary to some countries in Europe, d'Asia, Northern and Eastern Africa, Burkina Faso has not a tradition of irrigation. Irrigated agriculture in Burkina Faso has remained poorly developed a long time, despite a potential of 233,500 hectares of irrigable land and 500,000 hectares of inland wetlands easy to equip. It was in the 1960s that appeared formal irrigation in Burkina Faso.

According to Brown and Notter (1992) in AMCOW and al. 2014 we have three (3) phases ():

- first phase in the 70 to 80, with the establishment of large scale schemes for rice production Kou Valley (1.260ha) of Bazon (460 ha), Karfiguela (350 ha), and Banfora sugar perimeter (4,000 ha), Sourou and Bagré with a potential of 30,000 ha for each (Aouba, 1993);
- second phase (80 to 90) for small and medium areas of 20 to 200 ha realized downstream (or upstream) of small dams ;

- third phase, since year 2000 the focus is on small-scale irrigation, the promotion of individual or private initiative and for vegetables and rice.

The National Strategy for Sustainable Development of irrigated agriculture (SNDDAI) has also been developed in 2003 to boost the facilities perimeters and shallows to offset the deficits of the wet seasons of productions and provide cash income to producers. Its action plan includes by 2015, the development of 5000 ha of lowlands and 55 000 ha of irrigated areas. Currently, more than 240 million $ US[5] were mobilized for the implementation of projects and programs of the irrigation sub-sector. Most of these projects (PAFASP, PIGEPE, PICOFA, PPB / BAD & IDB PIAME, etc.) should be closed at the end of 2013.

The challenge of the irrigation sub-sector program is to maintain the dynamic of the realization of agricultural water infrastructure in order to increase part of irrigated crops and dry-season crops to 50% of national production by 2015 in accordance with the objectives of SCADD (Strategy of Accelerated Growth and suitable development).
In the current context of climate change, innovations are being implemented since 2012 for better utilization of rainwater. These innovations include the development of supplementary irrigation by mobilizing more water through micro-basins (AMCOW, 2014).

Techniques and technologies

The irrigation schemes are grouped into four categories: large schemes, medium schemes, small-scale irrigation and inland wetlands.

Major irrigation schemes
Major schemes of irrigation have been realized mainly near big dams. They cover big areas with 100 to 1000 (hundred to thousand) hectares in one piece.
In 2004 (MAHRH) with a total area of 12,058 ha, they were representing 37% of equipped areas in Burkina Faso. The production is mainly rice and based on the peasantry, often consisting of peasant settlements.
The Government is encouraging now the development of agribusiness in some selected major irrigation schemes (for example: Bagré).
The size of irrigated plot is generally around0.5 to 2 ha, but on the areas dedicated to agribusiness can reach 10 ha for one plot. In these schemes we have total control of the water. In some major schemes the use of systems with the pivots (For example: Pivot irrigation for cane Sugar SN-SOSUCO).

The medium schemes
The size of medium schemes is between twenty (20) and one hundred (100) hectares. In 2004 it was evaluated a total of about 3,000 ha of this type of schemes in the country). In these schemes, the irrigated plot per farmer is generally around 0.1 to 0.25 ha.
These schemes are dedicated in priority for rice production in rainy season and for the production of vegetables in dry-season. But some schemes are essentially reserved for vegetables production.

[5] 1 $ US = 500 F. CFA

Small-scale irrigation

In 2014, the small-scale irrigation was covering around ten thousands (10000) of hectares in Burkina Faso.

These schemes are less than one hectare to twenty (-1 to 20) hectares.

Small-scale irrigation works with both surface water resources and groundwater.

The mobilization of water is carried out by using small dams, wells and boreholes, as well as rivers. The withdrawal of water is made by both mechanical diesel pumps and with the use of treadle pumps.

Nowadays we see some irrigators of small-scale implementing systems like drip-irrigation systems, popularized by many projects and programs operating in the field of irrigation.

The inland wetlands

In 2004 it was estimated 7000 ha inland wetlands equipped and under production. The potential (temporarily) estimated is about 500,000 ha. The development of inland wetlands usually uses simple techniques, relatively inexpensive and easy to implement. In these areas water is in partial control.

Irrigated surfaces and crops production

Since the start of the implementation of the action plan of the national Strategy of Suitable Development of Irrigated Agriculture (SNDDAI) we note an increase of the surface equipped for irrigation. With only 9% of irrigable surfaces developed in the years 2000, this rate reached 20% in 2013 including major schemes, medium schemes, and small-scale irrigation and in inland wetlands. The irrigated surfaces evaluated at 13043 ha in the year 2000 are at around 42973 ha in 2013. On this 42973 ha, 33179 ha are with full control of water.

Year (i)	2000	2010	2011	2012	2013
Irrigated surfaces (IA) (ha)	13 043	34 480	39 240	40385	42973
Rate of increase *RiIA* (%) *= (IAi-IA2000) /IA2000*		164,4	200,9	209,63	229,47

Irrigation is improving in the country and the surfaces under cultivation are also increasing year after year as presented in the table below.

Agricultural campaign (Period)	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Surfaces under cultivation (Dry season) (ha)	1000	14800	17300	19151	27787	33551	48161	54138	52753	60325

As this table shows, we observe that in addition to the cultivation realized in the areas equipped, there are also productions realized in some areas unequipped conventionally.

The increase of irrigated areas has contributed to additionnal and diversified food production particularly in dry season. However despite the increase in irrigated areas, the contribution of irrigated agriculture to the national cereal production remains low.

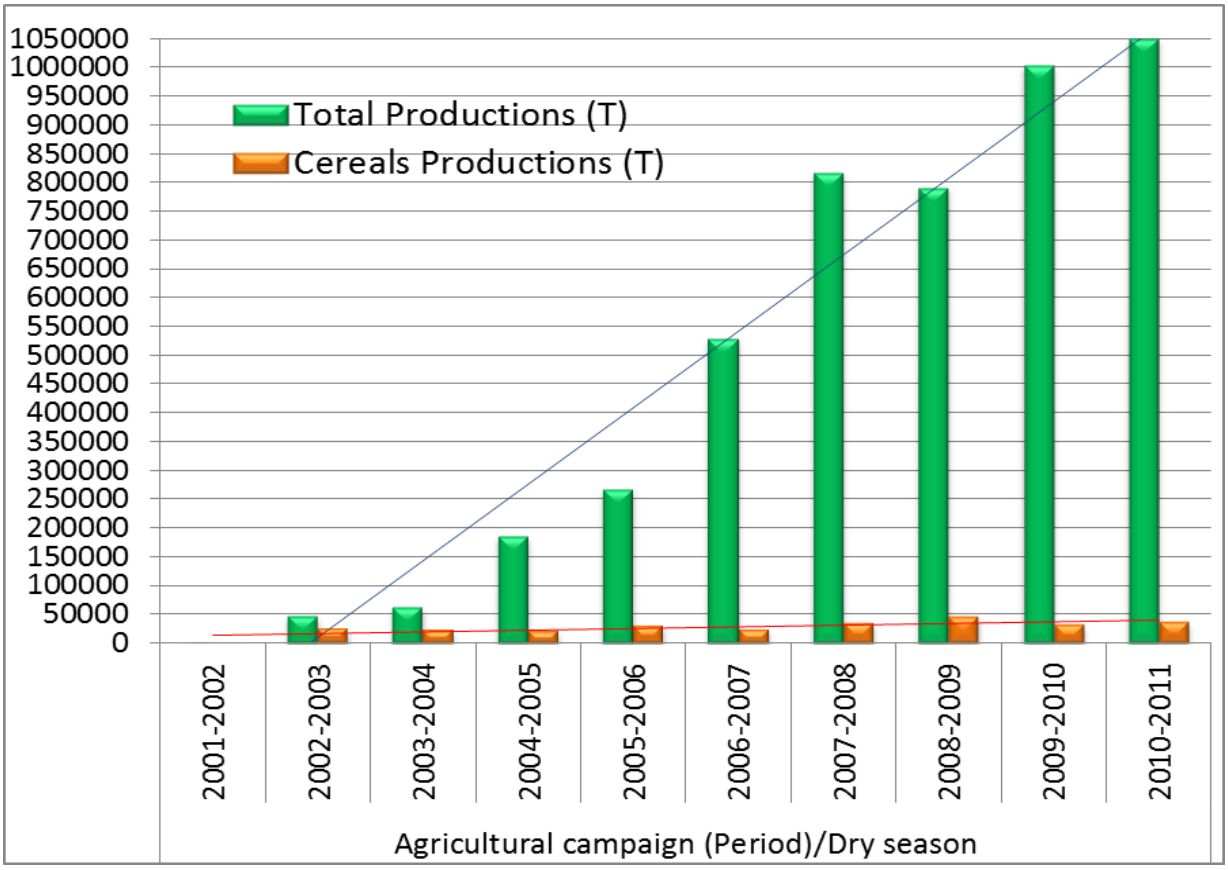

Figure: Evolution of irrigated crops production in dry season in Burkina Faso

Dry season irrigation is practiced from September to May each year and mainly on equipped areas. The cultivation can be realized three (3) times in the same site during three (3) potential crop cycles in the dry season each year.
The country is divided in three (3) parts of agricultural production as below:

- Zones 1 and 2 : September to May
  - ✓ 1st cycle / September-December : maize, vegetables
  - ✓ 2nd cycle / December-Mars : maize, vegetables, cassava
  - ✓ 3rd cycle / March-May : vegetables, maize, cassava
- Zone 3 : September to April
  - ✓ 1st cycle / September-December : maize, vegetables, beans, patato
  - ✓ 2nd cycle / December-April : beans, vegetable

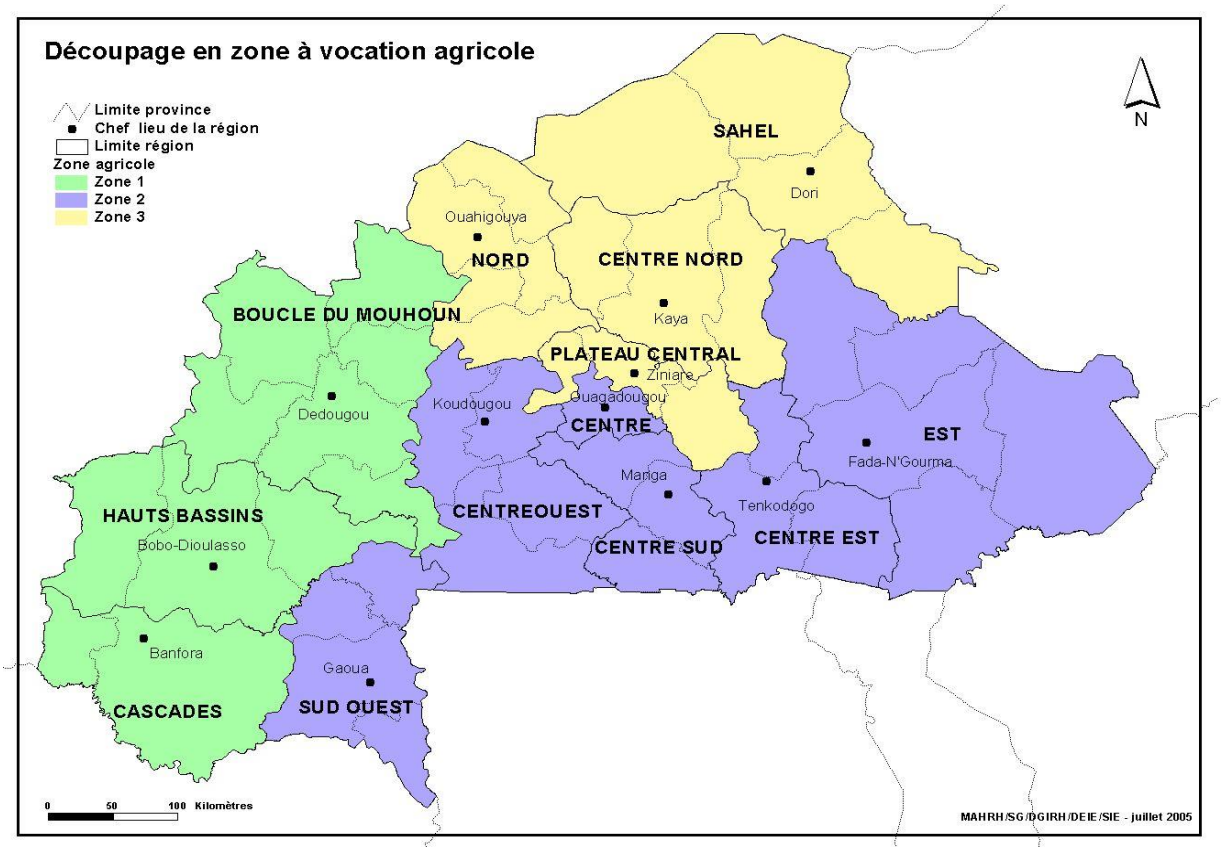

Figure : Agricultural zoning

Socio-economical impacts

The development of irrigation activities has positive socio-economical and significant impacts on rural populations with:

- the creation Of new jobs in all the regions of the country and is done individually or in groups ;
- the development of related activities (creation of local enterprises in manufacturing of irrigation equipments, small agricultural equipment, etc.) that lead to the creation of new sources of income ;
- the maintain fo rural youth in the local areas and the limitation of migration of young people out of their local communities ;the availability and accessibility of diversified foods in the markets ;the improvement of the quality of life of populations (increase of revenues, school for children, health, etc.);
- the diversification and availability of agricultural products allow producers to vary their meals;
- the additional production of food can lead to an increase of GDP and therefore of national income.

Constraints and challenges

Most of the irrigation schemes are not properly managed and some work and some not because of low level of practical knowledge of the users. In addition, some producers have some difficulties to sell the irrigated products. Weak conservation techniques and weak storage and processing capacity are noticed. Most of the producers have difficulties in rational management of equipments and there

is a low level of organization of producers. There is also insufficient resources dedicated for technical support of the producers due to the low rate of financing of irrigation sub-sector. Degradation of river banks by the population and the silting of reservoirs and water ways are also observed. There is a need for management of soil fertility on irrigated areas.
The small plots in the irrigation schemes reduces their economical interest in the view of the farmers On many irrigated areas, the need for an extension of the schemes is expressed. However, when the parcel is too large, its total cultivation is not always obvious.
The RAF (Land and Agrarian Reform) Voted in 1984 and revised in 1991, 1996 and 2009, 2012 is not effective yet and the land tenure insecurity is still a reality, especially for women and youth.

4. CONCLUSION/RECOMMANDATIONS

To strengthen the development of irrigated lands in Burkina Faso the actions must:

- Encourage and support private investment;
- Aim the return on investment and production costs through the promotion of profitable crops;
- Increase efforts in the development of production, through simple and appropriate techniques to store and process agricultural products near the place of production;
- Strengthening the capacity of actors through training and research / development;
- Aim for a better use of water resources to promote the management of soil fertility on irrigated areas.

5. REFERENCES

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