

Chapter 8:

Water for Food Security

Food security may have different meanings for different people. The International Conference on Nutrition (ICN), held in Rome in 1992, defined food security as “access by all people at all times to the food needed for a healthy life” (FAO, 1997). Essentially, in order to achieve food security, a country must achieve three basic aims (FAO, 1997):

- Ensure adequacy of food supplies in terms of quantity, quality and variety of food;
- Optimize stability in the flow of supplies; and
- Secure sustainable access to available supplies by all who need them.

Adequate food availability at the national, regional and household levels, obtained through markets and other channels, is the cornerstone of nutritional well being. At the household level, food security implies physical and economic access to foods that are adequate in terms of quantity, nutritional quality, safety and cultural acceptability to meet each person’s needs. Household food security depends on adequate income and assets, including land and other productive resources owned. Food security is ultimately associated with access to nutritionally adequate food at household level, that is the ability of households or individuals to acquire a nutritionally adequate diet at all times. It is well recognized that poverty is the principal cause of malnutrition (FAO, 1997).

Table 8.1: Indicators of Food Security in Burundi

Indicator	YEAR										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
% of Agricultural Production to GDP	41,3	47,2	35,9	34,8	27,7	32,6	41,0	36,7	33,4	34,8	29,1
Daily supply of Calories as % of Needs	103,1	102,7	-	-	-	-	-	-	-	-	-
Coefficient of Food Dependency	3,1	4,0	3,2	4,5	17,4	10,0	7,7	9,1	11,1	13,23	18,9

Source: AWDR National Report based on Database for Human Development Index: 1990-2000

Acute and chronic undernutrition and most micronutrient deficiencies primarily affect the poor and deprive people who do not have access to adequate food, live in unsanitary environments without access to sufficient and clean water and basic services and lack access to appropriate education and information. In sub-Saharan Africa, where approximately 70 per cent of the population lives in rural areas, crop and animal production, fisheries and forestry activities are direct sources of food and provide income with which to buy food. Increased and diversified

production of food for family consumption or as a source of income is a basic prerequisite for improved household food security (FAO, 1997). Better home and community food processing, preservation and storage and access to marketing facilities can also contribute to household food security by alleviating seasonal shortages in food supply and stabilizing market prices. Due to lack of conservation techniques, most of Africa's perishable agricultural products such as tomatoes, eggplant, cassava, plantains and many others, go to waste.

The main causes of food insecurity and vulnerability

There are many natural and human-made factors that affect agricultural production and enhancement in Africa, leading to endemic malnutrition, persistent hunger and even famine in various sub regions of the continent. Primary among them are (FAO, 2000):

Political constraints

The African continent, which is more familiar with the pangs of hunger than any other region in the world, is ravaged by an array of armed conflicts occurring within countries or between neighbouring countries (Angola, Burundi, Congo, DRC, Eritrea, Ethiopia, Guinea-Bissau, Rwanda, Sierra Leone, Somalia, Sudan, Uganda and so on). These troubles, which arise from political crises, not only cause terrible human suffering, including massive population displacement and the enforced recruitment of children, but also paralyze production structures and absorb virtually all of the national and international financial resources that should have been allocated to development programmes. Although the situation is improving in Congo, Liberia, Rwanda and Sierra Leone, as a result of agreements between warring parties, food supply is still a source of concern, especially for the women, children and mutilated adults. In Sudan, the percentage of needs met this year is far below that of 1998 (FAO, 2000).

Physical constraints

In many parts of Africa, irregular weather patterns (drought, floods), isolation of agricultural regions and environmental degradation all contribute significantly to reduce the rate of growth of agricultural and food production.

Social constraints

Social constraints restrict agricultural and rural development in sub-Saharan Africa: low level of literacy and schooling, insufficient access to safe water for humans and livestock, poor dietary habits,

low health care coverage, spread of malaria and HIV/AIDS, and uncontrolled population growth.

Financial and economic constraints

Serious financial and economic constraints hamper the development of the agricultural sector:

- Sizeable external debt;
- Disequilibrium of public finances and balance of payment;
- Low level of domestic savings;
- Limited proportion of national financial resources allocated to the agricultural sector;
- Low participation of basic infrastructure and the private sector in the economy;
- Export essentially confined to primary commodities;
- Stagnation or regression of the industrial sector; and
- Restricted markets, which, coupled with the serious difficulties of national institutions in formulating and implementing appropriate policies, exacerbate resource degradation and increase the level of unemployment, therefore fuelling social disruption.

Technical constraints

The technical constraints essentially translate as limited application of technology in production systems, inappropriate agricultural practices, low use of inputs and insufficient farmer training and advisory assistance. Agricultural production, especially food production, depends almost exclusively on natural factors (rain, soil, rudimentary tillage tools). The progress made in raising food production in certain countries is the result of an extension of cropped area rather than an increase in productivity.

Institutional and political frameworks

Poorly defined and poorly articulated legislative, regulatory and policy frameworks with little motivational impact contribute largely to raising the transaction costs of direct investments by nationals and foreigners (FAO, 2000).

The severity of the problem of food security varies from one African sub region to another. Although West Africa is more populated than any other African sub region, it has the lowest number of hungry (about 18%), while East Africa, with a far smaller population, has more than twice as many (42%). The proportion is also higher in central and southern Africa, which are also far less populated. Some 44 per cent of the 340 million people living in the 26 countries that make up these three sub regions are undernourished. Food production has made rapid progress

in West Africa, notably in Burkina Faso, Côte d'Ivoire, Ghana, Mali, Nigeria, and a number of other countries, but two out of every five persons still do not have adequate food intake. The food situation in the other sub regions has further deteriorated, primarily due to political instability in Angola, Somalia, Ethiopia, Eritrea, Congo Brazzaville and in the Great Lakes Countries, including DRC (FAO, 2000).

The state of agricultural production in Africa

In the past three decades, agricultural production has increased at an average of less than 2% per annum, while the population has risen by about 3%. Under current demand and supply trends, cereal imports are expected to rise from the current 10 million metric tons per annum to 30 million metric tons in 25 years. Much of this can be explained by the fact that about one third of the population in the region live in drought-prone areas. In much of West Africa, average food supply (2430 kcal/day/person) is below what is regarded as the optimum level of nutritional supply, namely 2700 kcal/day/person. In east and southern Africa, the number of food insecure people has almost doubled from 22 million in the early 1980s to 39 million in the early 1990s. It has been estimated that a 3.3 per cent increase in agricultural output per annum is needed to achieve food security objectives for the continent. Worse still, scenarios suggest that if the area under irrigation were to grow by a factor of 3, to over 16 million hectares, this would only represent a 5 per cent contribution to the required three-fold food production increase needed by 2025. Finally, it is worth noting that despite the high levels of food insecurity in the region, most countries have substantial under utilized potential for irrigation expansion (\pm 39.5 million hectares, not taking into account large-scale river diversion schemes). In fact, two thirds of African countries have developed less than 20% of their potential (in all but four countries in the region, less than 5% of the cultivated area is irrigated). The three countries with the most irrigation potential have each developed less than 10% of their potential irrigated area. The scope for expansion of irrigation is, therefore, considerable; however, it is apparent that there is an even greater scope for expansion of rainfed agriculture if agriculture is to make the necessary contribution to Africa's socio-economic development.

Table 8.2: Performance of the Agricultural Sector in Nigeria

Total in Million \$ US			Average Annual Growth Rate %			Share in Total GDP %		
1992/94	1995/97	1998/99	1992/94	1995/97	1998/99	1992/94	1995/97	1998/99
8,328	9,178	9,825	1.9	4.2	2.6	30.6	31.6	31.7

Source: AWDR National Report

The continent's land and water resources are important for agriculture, which accounts for 34 per cent of Africa's GDP, 70 per cent of its labour force and 40 per cent of its exports. In 1998, Africa recorded a sustained growth rate of its economy of 3.3% as compared to 2.9% in 1997 and 4.0%

in 1996. The agricultural sector accounted for 19.4% of total output in 1997 as compared to 22.3% of 1980, and recorded a growth of 1.7% and 3.5% respectively in 1997 and 1998.

Table 8.3: Output of Main Agricultural Products in the Democratic Republic of Congo (tons/hectares)

Products/ Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Corn	0,8	0,8	0,85	0,81	0,81	0,82	0,81	0,81	0,83	0,83	0,8
Cassava	8,05	8,05	8,06	8,06	8,07	8,07	8	8	7,81	7,73	8,14
Rice	0,8	0,8	0,8	0,8	0,81	0,81	0,8	0,73	0,72	0,73	0,74
Peanuts	0,72	0,75	0,8	0,82	0,82	0,83	0,8	0,8	0,79	0,79	0,74
Bean	0,58	0,59	0,58	0,59	0,6	0,59	0,6	0,6	0,6	0,59	0,56
Sweet Potato	5	5	5	0,76	0,77	0,77	5	5	4,95	4,95	4,46
Plantain	5	4,88	4,89	4,8	4,87	4,87	4,88	4,87	4,77	4,77	4,8
Banana	4	3,98	3,98	3,82	3,82	3,82	3,82	3,82	3,49	3,49	3,7

Source: DRC Report on Climate Changes

The Food and Agricultural Organization (FAO) statistics show that Africa's per capita agricultural and food production indices were 99 and 100 in 2000 (1989-1991=100), much lower than the total production indices of 127 and 128. This fact attests that agricultural growth did not keep pace with population growth. Given disparities among countries, the little change in per capita food production combined with increasing inequalities in income and food distribution leads to the conclusion that there has been, at best, no change or worse, an increase in the number of food-insecure and malnourished people in most countries in recent years. There are several factors explaining the persisting food insecurity problem in Africa. Largely because of continuous rapid population growth, low agricultural productivity, environmental degradation, and weak science and technology infrastructure, many people in Africa lack adequate amounts of food that are rich in the nutrients needed for health and a productive life.

Table 8.4: Agricultural Production in Cameroon from 1996-1999

Year	Annual Cereal Production, x1000 MT	Cereal Yield, kg/ha	Annual Root & Tuber Production, x 1000 MT	Root and Tuber Yield, kg/ha	Annual Pulse Production, x 1000 MT	Pulse Yield, kg/ha	Annual Meat Production, x 1000 MT
96-98	1222	1274	2588	5777	98	665	202
1999	1574	2107	4117	9950	284	1315	

Source: AWDR National Report (MINAGRI, (1999), WRI, (2001))

Chronic undernutrition affects some 215 million people in sub-Saharan Africa, or 43 per cent of the population (FAO, 1996b). Deficiencies of iron, vitamin A and iodine are also widespread; about 300 million people are affected every year, and a much greater number are at risk of these deficiencies. Malnutrition increases people's vulnerability to infections, causing numerous deaths. In the face of this bleak situation, major efforts are required by national governments and the international community to bring about reductions in malnutrition and micronutrient

deficiencies through increased and diversified agricultural production.

Table 8.5: Statistics of Food Production in Burundi

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Mean
Cereals											
Production (000) T	306,1	299,7	224,7	269	272,6	304,7	260,5	264,5	245,3	271,7	276
Vegetables											
Production (000) T	385,9	376,6	258,5	357,9	326,7	310,6	313,5	261,9	219	284	320
Roots and tubers											
Production (000) T	1486	1263	1326	1364	1449	1322	1479	1458	1458	1615	1423,5
Bananas and plantains											
Production (000) T	1020	1580	1268	1564	1544	1527	1573	1495	1526	1516	1471,7
Meat (T)											
Beef	13130	13260	11440	10010	9360	8892	9880	9150	8600	9100	10627
Horse	4150	4412	4000	3800	3400	8600	2500	3350	2850	2850	3468
Mutton	1344	1381	1512	1380	1200	1080	960	1008	1008	1020	1202
Pork	5120	5400	5200	4880	4600	4200	4400	4252	4880	4880	4899
Fowls	6480	6660	6570	6390	6300	6120	6295	6150	5485	5485	6174
Rabbits	552	600	408	372	324	288	312	296	184	198	376
TOTAL	30776	31712	29130	26832	25184	23180	24347	24206	23007	23533	26672
Milk(T)	46370	46820	41440	36950	34750	32600	35420	32110	27580	28290	37567
Eggs (T)	5494	5792	5512	5180	4600	3680	3460	4358	3858	3002	4597
Honey (T)	380	380	330	300	260	250	260	250	200	200	288
Fish (T)	24183	17055	22055	21151	3091	20346	13481	9254	17197	10609	16408

Source: AWDR National Report (FAO Statistics)

Fish supplies

The land area of Africa is the principal food supply source for crop and livestock products; the rivers, lakes and waters around Africa also have a role in the continent's food supply systems by providing fish. Fish and fishery products provide, on average, 3.8 per cent of total dietary protein supply in sub-Saharan Africa. Table 8.6 is a food balance sheet for fish and fishery products of African countries for the period 1988 to 1990. Fisheries have an important role in food production, income generation and provision of employment. According to the International Centre for Living Aquatic Resources Management (ICLARM), the number of full-time fishermen in sub-Saharan Africa totals approximately 1.5 million. In addition, there are millions of part-time fishermen (FAO, 1997).

Table 8.6: Average Supply of Fish and Fishery Products, 1988-1990

Country or area	Production (tons live weight)	Imports (tons live weight)	Exports (tons live weight)	Per capita supply (kg/year)
Western Africa	1 389 092	927 143	330 327	1 1.3
Benin	40 263	4 052	122	9.8

Burkina Faso	7 649	8 930	0	1.9
Cape Verde	7 475	69	1 918	16.9
Côte d'Ivoire	82 584	227 253	76 503	20.2
Gambia	14 311	7 047	6 493	16.8
Ghana	371 835	31 946	18 392	26.4
Guinea	33 333	8 861	0	7.6
Guinea-Bissau	5 163	533	465	5.5
Liberia	16 337	17 805	618	13.4
Mali	66 087	2 211	1 860	7.4
Mauritania	90 247	412	70 975	10.1
Niger	3 538	1 365	0	0.7
Nigeria	298 473	541 366	5 525	8.9
Saint Helena	867	4	271	99.3
Senegal	282 867	35 837	144 779	24.4
Sierra Leone	52 154	3 340	2 199	13.6
Togo	15 909	36 1 14	206	15.1
Central Africa	458 316	343 787	11 827	11.6
Angola	104 594	97 426	1 963	22.4
Cameroon	79 272	75 307	5 020	13.4
Central African Republic	13 089	1 771	0	5.2
Chad	23 000	-	-	4.2
Congo (Republic of)	45 342	3 6545	3 618	36.1
Equatorial Guinea	4 000	2 681	99	19.1
Gabon	22 487	13 661	1 127	31.4
Sao Tome and Principe	3 200	544	-	32.2
Former Zaire	163 333	115 851	0	7.7
Eastern Africa	1 146 871	50 366	56 317	6.0
Burundi	13 278	349	0	2.6
Comoros	6 750	523	0	13.9
Djibouti	415	948	0	2.8
Ethiopia	4 435	41	13	0.1
Kenya	162 110	422	19 526	6.3
Madagascar	101 135	454	7 890	77
Malawi	84 300	404	275	9.5
Mauritius	16 335	10 949	6 999	19.4
Mozambique	37 714	12 647	5 323	3.2
Reunion	2 009	12 991	642	24.2
Rwanda	1 776	327	0	0.3
Seychelles	4 705	8 054	8 693	59.2
Somalia	17 967	5	4 359	1.6
Tanzania, United Rep.	382 352	343	988	15.4
Uganda	223 906	-	-	12.9
Zambia	63 933	618	1 576	8.0
Zimbabwe	23 750	1 291	33	2.6
Southern Africa	104 872	7 239	7 456	5.0
Botswana	1 900	4 607	789	4.6
Lesotho	30	2 632	0	1.5
Namibia	23 032	-	-	12.5
Swaziland	110	-	-	0.2

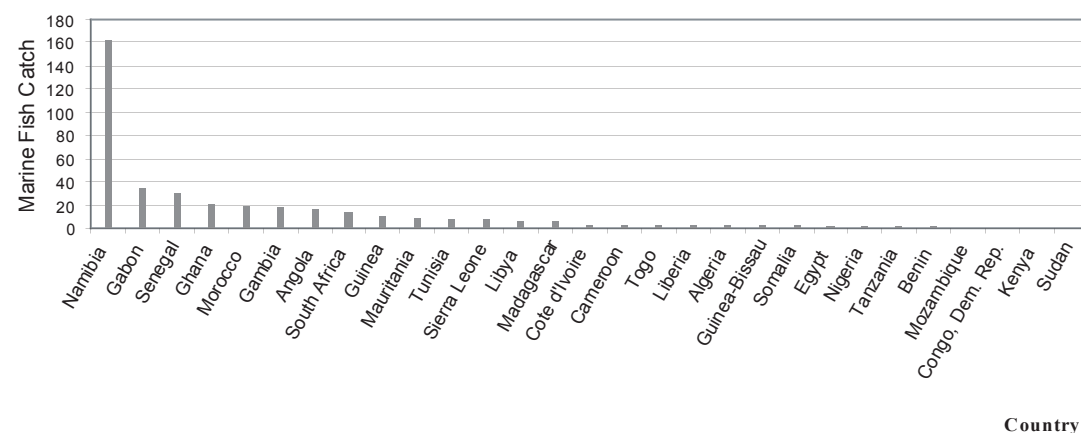
Source: FAO, 1997

Table 8.7: Evolution of Meat and Fish Consumption in the Democratic Republic of Congo

Produce	1993	1994	1995	1996	1997	1998	1999	2000	2001
Beef	13 098	14 968	11 391	3 666	3 831	3 725	-	-	3 937
Pork	3 536	2 973	2 517	2 993	1 310	3 560	-	-	115
Poultry	13 179	6 468	7 236	14 463	6 357	12 056	-	-	17 563
Mutton	9	31.5	57.9	52	6	26.5	-	-	21
Others	17.5	34	19	15.08	37.8	19.2	-	-	33
Fish	-	-	-	67 300	59 360	61 280	51 295	66 832	-

Source: AWDR National Report (Cattle Breeding Department and Fishery Department)

Figure 8.1: Total Marine Fish Catch per 1000 People



Source: FAOSTAT online database, <http://apps.fao.org/via/ciesin.org>

Animal production and supplies

Livestock and their products contribute about 19 per cent to the total value of the production of agriculture, forestry and fisheries in sub-Saharan Africa (FAO, 1997). However, this figure underestimates the substantial contribution that livestock frequently make to crop production through draught power and manure. Ten countries account for 70 per cent of the value of animal production, and five countries, Ethiopia, Kenya, Nigeria, Sudan and Tanzania, account for one half. Table 8.8 shows the population of selected livestock in sub-Saharan African countries in 1994 (FAO, 1997).

Table 8.8: Sub-Saharan African Livestock Population, 1994 (selected countries and animals)

Country	Cattle	Sheep	Goats	Pigs	Chickens
Angola	3 280 000	255 000	1 570 000	805 000	6 400
Benin	1 223 000	960 000	1 190 000	555 200	20 000
Botswana	2 800 000	238 000	1 850 000	16 000	2 100
Burkina Faso	4 261 400	5 686 000	7 242 100	550 900	18 776
Burundi	420 000	350 000	920 000	80 000	3 800
Cameroon	4 870 000	3 780 000	3 770 000	1 400 000	20 000
Central African Republic	2 735 100	163 700	1 340 000	524 100	3 282
Chad	4 620 750	2 151 540	3 178 260	16 813	4 400
Congo (Republic of)	68 000	111 000	305 000	56 000	1 800
Côte d'Ivoire	1 231 000	1 251 000	978 000	403 000	26 919
Djibouti	190 000	470 000	507 000	-	-
Ethiopia	29 450 000	21 700 000	16 700 000	20 000	54 200
Gabon	39 000	172 000	84 000	165 000	2 600
Gambia	400000	121 000	150 000	11 000	500
Ghana	1 680 000	3 288 000	3 337 000	595 000	11 500
Guinea	1 780 000	475 000	580 000	38 000	13 500
Kenya	12 500 000	5 500 000	7 300 000	102 000	25 000
Lesotho	600 000	1 200 000	750 000	60 000	1 400
Liberia	36 000	210 000	220 000	120 000	3 500
Madagascar	10 288 000	740 000	1 300 000	1 558 000	23 000
Malawi	980 00	196 000	890 000	245 000	8 750
Mali	5 541 500	5 172 500	7 380 000	62 800	23 250
Mauritania	1 100 000	5 280 000	3 520 000	-	3 900
Mozambique	1 270 000	120 000	384 000	172 000	22 500
Namibia	2 035 790	2 619 520	1 639 210	1 7 843	2 000
Niger	1 968 100	3 678 400	5 565 760	38 500	20 000
Nigeria	16 316 000	14 000 000	24 500 000	6 926 000	122 000
Rwanda	453 827	280 000	950 000	90 000	1 400
Senegal	2 800 000	4 600 000	3 200 000	320 000	38 000
Sierra Leone	360 200	301900	165 800	50 000	6 000
Somalia	5 000 000	13 000 000	12 000 000	9 000	3 000
Sudan	21 750 000	22 800 000	16 400 000	-	36 000
Swaziland	626 356	27 000	428 000	30 000	1 000
Tanzania, United Rep.	13 376 000	3 955 000	9 682 000	335 000	24 000
Togo	248 000	1 200 000	1 900 000	850 000	5 685
Uganda	5 150 000	1 850 000	3 450 000	910 000	22 000
Former Zaire	1 475 276	1 046 878	4 2 1 2 409	1 191 546	35 000
Zambia	3 300 000	69 000	620 000	295 000	22 000
Zimbabwe	4 300 000	450 000	2 580 000	246 173	13 500
Total	170 523 300	129 468 400	152 738 500	18 864 880	652 712

Source: FAO, 1997

Enhancing nutritional status

The nutritional value of diets in Africa is enhanced by traditional legumes, oilseeds, fruits and vegetables. They add taste and flavor to the diet, improve palatability and help to balance protein, vitamin and mineral intakes. Vegetables and fruits supply vitamins A and C, iron, calcium and many other micronutrients. An estimated 80 per cent of vitamin A and more than one third of

vitamin C is supplied through traditional food plants (FAO, 1997). Nuts and oilseeds are also good sources of protein and energy, valuable supplements in children's diets and useful in preparing snack foods. Seasonal food scarcity accentuates the severity and incidence of malnutrition. In order to overcome such deficiencies, many urban residents often resort to backyard gardening.

Table 8.9: Some Sources of Food Nutrition in Africa

Energy	Fats and oils	Protein	Iron	Vitamin A	Vitamin C
Avocado	Avocado	Cacao bean	Amaranth	Amaranth leaves	Annona
Cacao bean	Locust bean	Cashew nut	Banana heart	Ampalaya fruits/leaves	Baobab fruit
Breadfruit	Groundnut	Cowpea	Cassava leaves	Carrot	Cashew apple
Cassava	Soybean	Hyacinth bean	Ceylon spinach	Cassava leaves	Citrus
Maize		Groundnut	Dried beans	Ceylon spinach	Guava
Potato		Pigeon pea	Dried fruits	Drumstick leaves	Mango
Sweet potato		Soybean	Drumstick leaves	Hot chili pepper	Muskmelon
Yam		Watermelon seed	Green onion	Mango (ripe)	Papaya (uncooked)
			Mustard	Parsley	Potato (white, Irish)
			Spinach	Sorrel	Soursop
			Sweet potato leaves	Spinach	Sugar apple
				Squash leaves	Sweet pepper
				Sweet potato leaves	

Source: FAO, 1997 (Adapted from WHO/UNICEF, 1985.)

Table 8.10: Specific Nutrients found in the Major Plant Groups

Plant group	Nutrient
Cereals	Carbohydrates, protein, dietary fibre, ^a vitamin B complex, ^a iron, ^a calcium ^a
Roots	Carbohydrates, protein, some vitamin C
Legumes, oilseeds, nuts	Carbohydrates, protein, dietary fibre, ^a iron, ^a calcium, ^a vitamin B complex ^a
Fruits and vegetables	Vitamin C, vitamin A, iron, calcium, vitamin B complex, dietary fibre

Source: FAO, 1997.

International Targets

- Reduce by half the number of undernourished people on earth by 2015 (Rome); and
- Increase water productivity for food production from rainfed and irrigated farming by 30% by 2015.

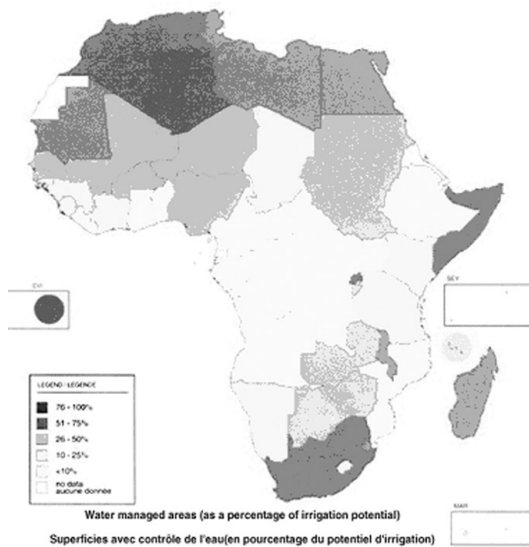
Irrigation potential and water-managed areas

The diversity of water management situations encountered in Africa requests the choice of a classification that would best represent the situation of irrigation in each country. The land on which water is used for the purpose of agricultural production has been referred to as water-managed

areas. The term ‘irrigated areas’ has been limited to the part of water-managed areas equipped with hydraulic structures: full or partial control irrigation, equipped wetland or valley bottoms and areas equipped for spate irrigation. The difference between the two categories comprises cultivated wetland and valley bottoms without irrigation equipment or recession cropping areas. Water-managed areas comprise 14.3 million hectares in Africa. There is a very heterogenous geographical distribution of water-managed areas: the North represents more than 40% of the total. Water-managed areas in national agriculture vary from less than 1% of cultivated land (DRC, Comoros, Ghana, Togo and Uganda) to 100% in the most arid countries (Egypt and Djibouti, where agriculture is impossible without irrigation). This distribution of water-managed areas clearly shows the relation between climate and the role of irrigation in agriculture (FAO, 1995).

In equatorial Africa, where precipitation is greatest, rainfed agriculture is dominant. Irrigation is used for winter cropping and rice cultivation, or in wetlands and inland valleys and to secure high value crops. In Madagascar, rice cultivation on the plateaus is highly developed, which explains the high percentage of irrigation in that country even though rainfall is relatively favourable. At the national level, the distribution of water-managed areas is very uneven. Five countries (Egypt, Madagascar, Morocco, South Africa and Sudan), which cover 19% of Africa, hold more than 60% of the water-managed areas. By adding Nigeria, Algeria, Libya, Angola and Tunisia, more than 80% of the water-managed area is controlled by 10 countries. In contrast, 28 countries, covering more than 30% of Africa, share a mere 5% of water-managed lands (Fig. 8.2).

Figure 8.2: Water-managed Areas as Percentage of Irrigation Potential



Source: FAO AQUASTAT online

Box 8.1 Food Security Targets in the Democratic Republic of Congo

As part of its National Water Vision 2025, the following targets related to food security have been adopted:

- 10% increase before 2005, 30% before 2015 and 60% before 2025 of water productivity for rainfed and irrigated crops;
- 25% increase before 2005, 50% before 2025 and 10% before 2025 of irrigated soils acreage; and
- 5% increase before 2005, 100% before 2025 and 25% before 2025 the potential of agriculture, hydroelectricity, industry, tourism and transport at national level.

Irrigation potential in Africa

Due to its close relationship with water resources, irrigation potential is also unevenly distributed between the regions. It is significant to observe that this value is much less known and studied in countries benefiting from important water resources than in more arid countries. It should also be noted that the important transfers of water resources from humid to arid regions allow these latter to benefit from an irrigation potential much larger than their internal water resources would permit. This is the case of the regions traversed by the Rivers Senegal, Chari and Niger in West Africa; Nile, Juba and Shebele in Eastern Africa; and Limpopo, Orange and Zambezi in Southern Africa, to name some of the most important. The existence of inter-regional rivers and water transfers hampers the computation of irrigation potential on a regional basis, since this may lead to double counting of parts of the shared resources, which could be avoided only through a river-basin approach (FAO, 1995).

Table 8.11 Actual and Projected Irrigation Surface Areas in Burundi (hectares)

Désignation	Imbo-Nord	Imbo-Centre	Plaine de Kabezi	Imbo-Sud	Rumonge, Nyanza-Lac	Mosso-Sud
Actual Irrigation Area (1990 -1994)	968	5.975	0	0	0	920
Actual Irrigation Area in 2000	5.995	900	0	0	0	920
Projected Irrigation Area in 2010	5.995	14.285	0	0	0	920
Irrigable Area	0	0	800	1.000	3.080	920

Source: AWDR National Report

It should also be noted that the methods used in estimating irrigation potential vary from country to country, and that the choice of methods can significantly affect the result, especially in humid countries. Estimates for DRC, for instance, vary from 1 to 40 million hectares, and irrigation potential of Congo, estimated at around 40 000 hectares in the literature, is probably only a small portion of the physical potential of the country. Bearing these uncertainties in mind, one can notice that about 60% of the irrigation potential is concentrated in seven African countries (Angola, Sudan, Egypt, DRC, Ethiopia, Mozambique and Nigeria), while at the other end of the

list, 18 countries share only 5% of this potential (FAO, 1995).

Table 8.12: Estimated Net and Gross Irrigation Water Requirement in Cameroon

Irrigation Type	Area, ha	Irrigation requirement per year, m	Net consumption, km ³	Application efficiency	Gross consumption, km ³
Large-scale sprinkler for bananas	6,790	0.45	0.03	0.50	0.06
Large-scale irrigated paddy rice	15,000	1.00	0.15	0.30	0.50
Small-scale systems of various types used for different crops	18,000	0.50	0.09	0.50	0.18
Total consumption, km³			0.27		0.74

Source: AWDR National Report

Water management methods of irrigation

Among the five classes of water management presented in Table 8.13, full or partial control irrigation is the most widespread (81% of the area). Among the other classes of water management, cultivated wetlands, valley bottoms and recession cropping are a majority (15% of the total). Apart from full and partial control irrigation, which is present in almost all countries, the other categories are usually concentrated in a few countries. Recession cropping is essentially used on the rims of the Rivers Niger and Senegal and of their tributaries, or along the Logone, Chari, DRC, Molopo and Okavango. The **fadamas** of northwestern Nigeria classified here as recession cropping due to lack of detailed information on their degree of development, represent 70% of that category. Spate irrigation is concentrated in the Maghreb and the Horn of Africa. When analyzing irrigation techniques used in the full and partial control schemes, it appears that surface irrigation is the most widely used technique (more than 80% of the total). However, more than one million hectares of irrigation by aspersion have been reported, most of it being concentrated in the North (Libya, Egypt, Morocco, Tunisia), Zimbabwe, South Africa and, to a lesser degree, in Kenya and Zambia. In relative terms, aspersion represents the most widely used technique in Botswana, Zimbabwe and South Africa, which benefit from a relatively long tradition in this field. Finally, the most important areas under micro-irrigation are concentrated in Egypt and South Africa (FAO, 1995).

Table 8.13: Sub Regional Distribution of Water Management Methods in Africa

Sub Region	Irrigation				Other cultivated wetlands/ valley bottoms	Flood recession cropping	Total		
	Full or partial control	Spate irrigation	Equipped wetlands/ valley bottoms	Total irrigation			'000 ha	as % of total	as % of cultivated land
	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha			
Northern	5 610 (95%)	305 (5%)	- (-)	5 915 (100%)	- (-)	- (-)	5 915 (100%)	41.5	24.8
Sudano-Sahelian	2 263 (79%)	212 (7%)	9 (-)	2 484 (86%)	97 (4%)	296 (10%)	2 877 (100%)	20.2	12.1
Gulf of Guinea	307 (22%)	- (-)	163 (11%)	470 (33%)	193 (14%)	730 (53%)	1 393 (100%)	9.8	4.0
Central	119 (25%)	- (-)	2 (-)	121 (25%)	352 (74%)	3 (1%)	476 (100%)	3.3	3.9
Eastern	428 (65%)	- (-)	6 (1%)	434 (66%)	222 (34%)	- (-)	656 (100%)	4.6	2.9
Islands (I.O.)	1 105 (100%)	- (-)	- (-)	1 105 (100%)	- (-)	- (-)	1 105 (100%)	7.7	40.3
Southern	1 645 (90%)	- (-)	- (-)	1 645 (90%)	182 (10%)	9 (-)	1 836 (100%)	12.9	8.1
Total	11 477 (81%)	517 (4%)	180 (1%)	12 174 (86%)	1 046 (7%)	1 038 (7%)	14 258 (100%)	100.0	9.9

Source: FAO, 1995

Irrigated crops and rate of use of equipped areas

The figures given in the text refer to physical areas, and do not apply to irrigated crops, which are measured in terms of harvested areas. The same plot can thus be counted several times if it is used for several crops in a year. The figures on crops in water-managed areas are incomplete and do not allow the establishment of statistical tables by country showing the distribution of the major crops under water management in Africa. However, by using all the information available, information can be obtained on about 10.5 million hectares of crops. This figure corresponds to 75% of the physical area with water control and it can thus be considered as representative of the situation of crops in water-managed lands on the continent and in the major regions. Results are summarized in Table 8.14, in which the different crops have been grouped in six major categories (FAO, 1995).

The most widespread crop is rice, which represents more than one third of the water-managed crop area. However, large discrepancies can be seen between the regions. Cultivated mostly in wetlands and valley bottoms, rice is the predominant crop in the humid zones of the Gulf of Guinea

and Eastern Africa. It is also very developed on the plateaus of Madagascar. In the northern and southern regions, it represents only a small portion of the total crops under water management. Among the other cereals, wheat and maize are cultivated and irrigated mostly in the countries of the North (Egypt and Morocco) and in South Africa, Sudan and Somalia. Sorghum is cultivated in the Sudano-Sahelian region, mostly as recession cropping (FAO, 1995).

Table 8.14: Sub Regional Distribution of Main Irrigated Crops in Africa (partial information)

Sub Region	Rice	Other cereals	Vegetables	Fodder	Industrial crops	Arboriculture	Total
	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha
Northern	538 (11%)	2221 (45%)	423 (9%)	1207 (24%)	80 (2%)	459 (9%)	4928 (100%)
Sudano-Sahelian	384 (22%)	839 (48%)	61 (3%)	4 (-)	471 (27%)	1 (-)	1760 (100%)
Gulf of Guinea	993 (80%)	52 (4%)	168 (14%)	- (-)	21 (2%)	6 (-)	1240 (100%)
Central	21 (29%)	- (-)	4 (6%)	- (-)	42 (59%)	4 (6%)	71 (100%)
Eastern	173 (38%)	80 (18%)	158 (35%)	- (-)	33 (7)	8 (2%)	452 (100%)
Islands (I.O.)	880 (97%)	- (-)	- (-)	- (-)	31 (3)	- (-)	911 (100%)
Southern	147 (13%)	358 (32%)	42 (4%)	353 (31%)	198 (17%)	32 (3%)	1130 (100%)
Total	3136 (30%)	3550 (34%)	856 (8%)	1564 (15%)	876 (8%)	510 (5%)	10 492 (100%)

Source: FAO, 1995

Vegetables (in the Table, root and tuber crops have been included in this category) are present in all regions and almost every single country. On the whole, they represent about 8% of the cultivated areas under water management in Africa. In Algeria, Mauritania, Kenya, Burundi and Rwanda, they are the most widespread crops under water management. Arboriculture, which represents 5% of the total, is concentrated almost uniquely in the northern region and is mostly composed of citrus. Industrial crops are located mostly in Sudan and in the countries of the Southern region (mostly cotton and oilseed crops). In this category, one also finds sugar cane, coffee, cocoa, oil and date palm, banana, tobacco and cut flowers. Apart from sugar cane, present in all regions except the Northern, the other crops are generally concentrated in a limited number of countries. Finally, the category grouping fodder crops and irrigated pastures, although it concerns only a very limited number of countries (concentrated in the northern and the southern regions) represents an important part of the cultures under water management (15%). Berseem, cultivated almost exclusively in Egypt, represents the most widespread irrigated crop in that country (1 million hectares). Other fodder crops or irrigated pasture are found principally in Morocco and South Africa, with the latter having most of the irrigated land (220 000 hectares).

Table 8.15: Dynamics of Irrigation Water Demand in Burundi

Year	Irrigation Region	Surface Area Km ²	Maximum Demand (l/s)
1990 2000 2010	Imbo-Nord	13,04 59,95 59,95	2891 7969 7969
1990 2000 2010	Imbo-Centre	59,75 108,4 129,25	4702 8745 10495
1990 2000-2010	Imbo-Sud	19,41 19,41	2280 2280
1990 2000-2010	Buragane	10 5	2000 1000
1990 2000-2010	Mosso-Sud	19,41 19,41	2280 2280

Source: AWDR National Report (PDNE)

One of the most frequently used indicators to assess the rate of intensification of irrigated land is the cropping intensity, or the ratio between irrigated crops (including double and triple cropping) and areas equipped for irrigation. The survey showed, however, that this figure was hardly available or not reliable enough at country level. Another possible indicator is the rate of use of land equipped for irrigation, which is the part of the equipped areas actually used for production at least once in the year. This figure can vary significantly from one year to another, particularly where irrigation schemes have problems of water availability. A regional analysis does not allow consideration of geographical trends in the variation of this value. This is probably because it is a factor that is more related to socio-economic conditions specific to individual countries rather than to criteria related to climate and geography. For eight out of thirty countries in Africa that report data, the rate of use of equipped areas is recorded to be 100%. More than half of the countries report rates of use above 80%. Conversely, countries like Lesotho, Benin, Angola, Mozambique and Eritrea show rates of use below 50%, the causes of which are very diverse. Overall, the equipped areas of the 30 countries represent 8.3 million hectares. About 1.5 million hectares, or 18% of the equipped area, is not irrigated (FAO, 1995).

Box: 8.2

The Food Supply System and its Nutritional Consequences for a Pastoral Family in the Malian Sahel

A Fulani "noble" family of six lives in round huts built of dried stalks, which when new, are rain-resistant. They have a herd of 24 cattle and ten goats; during the rainy season they grow a millet crop. During the wet season they camp around rain-filled ponds, which dry out by November, when the young men, in cooperative groups from several households, leave with the main herd in search of better pastures. The remainder of the household, with their goats, weaker animals and some milk cows, camp during the cold dry season (November to February) on the edge of a village, buying or bartering for cistern water; during the hot dry season they move to camp around a well.

The adult men are responsible for the main herd and for most of the millet cultivation, especially weeding. Boys tend the goats and calves. The women and girls collect fuel and water for domestic use, help with the harvest, pound millet and also prepare meals. The household's maximum dietary energy intake in October, after the harvest, is 14 700 kcal per day (65 percent from millet, 35 percent from milk); 9 105 kcal would cover the children's total requirements and allow the adults to maintain their body weights if they did no work, leaving 5 595 kcal for the adults' activities and weight gain. However, from December to June their intake is only from 7 840 to 8 820 kcal per day (9 to 20 percent from milk), so that the family is in a negative energy balance. During the rainy season they supplement their diet with gathered food. Their intake in June/July is from 9 996 to 10 740 kcal per day (43 to 50 percent millet, 8 to 12 percent milk and 42 to 45 percent gathered food).

The man and the woman (172 and 163 cm tall, respectively) are at their heaviest in November/December, when they weigh 55.3 and 49.6 kg, respectively; the post-harvest period of abundant food and little work allowed them to gain 2.3 and 0.7 kg, respectively, since July/August. During the dry season, decreasing food and increasing distances to walk for water and pasture cause weight losses of 2.2 and 1.5 kg, respectively, by May/ June. Despite increased intakes during the rainy season, the labour demands of millet cultivation prevent their regaining weight until after the harvest.

The weight changes of the four children, aged 5 to 12 years, between July/August and November/December range from +0.6 to +1.5 kg; from November/December to July/August they range from -0.7 to +0.5 kg. Despite their poor growth during the dry season, their weight rarely falls below 80 percent of the standard for their height. Households with sufficient milk or grain for barter during the dry season are able to reduce livestock sales and their dependence on the market, but if a family's food supply runs out during the hot dry season, they may be forced to sell off young livestock below their full value. Livestock sales accounted for 93 percent of the family's 1982/83 cash income; 68 percent of their total income was from barter of cereals and 5 percent from barter of milk products. Some 50 percent of the family's cash expenditures went to purchases of cereals, and of their expenditures in kind 55 percent were for milk products. Recently the situation has worsened because of deteriorating terms of trade resulting from poor rainfall. A prime steer that in 1982 was worth the equivalent of 1 300 kg of millet was worth only 520 kg a year later, grain prices having doubled while livestock prices fell.

In 1973, after five years of drought, grain prices soared to nearly 1 000 Malian francs per kilogram [426 MF = US\$1 at 1 July 1973], while the emaciated livestock fetched only one-sixth to one-twelfth of their pre-drought prices. In that year alone, an estimated 100 000 people died, as did 40 to 60 percent of the livestock. Many pastoralists, forced to sell their animals, were reduced to dependence. Currently, while the majority have rebuilt their herds sufficiently to return to pastoralism, some have never regained former herd sizes and so are in a weaker market position, while others work as paid herders, tending animals bought cheaply by profiteers during the drought.

Taken from: FAO: Agriculture Food and Nutrition for Africa - A resource book for teachers of agriculture. UNFAO, Rome, 1997

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