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IRRIGATION IN AFRICA IN FIGURES

EXTRACT FROM
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Presentation of the survey

A massive effort has been made in the last decade to understand better the situation of water resources management and irrigation in Africa. In almost every country where water is seen as a major constraint to agricultural development, detailed studies on water resources and irrigation have been carried out. Yet it is still very difficult to obtain reliable, systematic information by country over large regions of the continent.

To address this problem, it was decided to launch a programme, later called AQUASTAT, which would use the information existing in the countries and make it available, in a standard format, to users interested in global or regional perspectives. In 1994, priority was given to the 53 countries of the African continent, and this publication is the result of that survey.

The purpose of the survey was twofold:

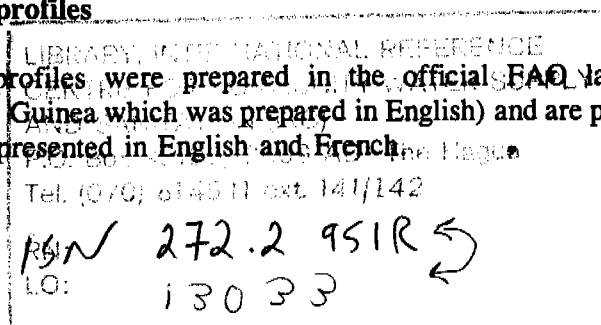
- to provide a clear picture of the situation of rural water resources management on a country basis, with emphasis on irrigation, and featuring major characteristics, trends, constraints and perspectives;
- to help support continental and regional analyses by providing systematic and reliable information on water for agriculture and rural development, and to serve as a tool for large-scale planning and projection making.

In order to obtain information that was as reliable as possible, the survey was developed and carried out as follows:

1. Country-based reviews of literature and existing information.
2. Data collection through a detailed questionnaire.
3. Data processing and critical analysis of the information, with the assistance of data processing software developed specifically for the survey and selection of the most reliable information.
4. Preparation of a country profile and submission to national authorities responsible for water resources and irrigation for further correction and approval.
5. Preparation of continental tables and maps, and cross-checking the information wherever possible.

Country profiles

Country profiles were prepared in the official FAO language of the country (except Equatorial Guinea which was prepared in English) and are presented here as such. Tables and maps are presented in English and French.



The country profile describes the situation regarding water resources and use in the country, and especially of the irrigation and drainage subsector. Its aim is to emphasize the particularities of each country, as well as the problems encountered in rural water management and irrigation. It also summarizes the trends of irrigation in the countries, as described in the literature available. It was a deliberate choice to attempt standardizing the country profiles as much as possible. All profiles follow a single pattern, organized in sections:

- geography and population, and climate and water resources;
- irrigation development;
- institutional environment;
- trends and evolution in water management;
- sources of information.

Standardized tables are used for all country profiles. When information is not available, it is represented by a dash (-). As most of the data are available for only a limited number of years, the most recent reliable data are used in the tables, with an indication of the year to which they refer.

Data collection, processing and reliability

The main sources of information were:

- national water resources and irrigation master plans;
- national yearbooks, statistics and reports;
- reports from FAO or other projects;
- international surveys;
- results from national or international research centre surveys.

In total 50 variables were selected and are presented in the tables attached to each country profile. They are grouped into categories corresponding to the sections of the profiles. A detailed definition of each variable is given below.

In most cases, a critical analysis of the information was necessary to ensure consistency between the different data collected for a given country. When several sources give different or contradictory figures, preference was always given to information collected at national or sub-national level and, unless proved wrong, to official rather than unofficial sources. In the case of shared water resources, comparison between countries was made to ensure consistency at river-basin level.

It remains that the accuracy and reliability of the information vary greatly between regions, countries and categories of information, as does the year in which the information was gathered. These considerations are discussed in the country profiles.

Terminology, conventions and definitions used in the survey

The following definitions have been used for the variable presented in the tables in the country profiles. They are presented in the order in which they appear in the tables.

Area of the country: (ha) The total area of the country, including area under inland water bodies. Data in this category are obtained from the United Nations Statistical Office.

Cultivable area: (ha) Area of land potentially fit for cultivation.

Cultivated area: (ha) Land under temporary (annual) crops.

Total population: (inhabitants) The figures are UN estimates for 1994.

Water supply coverage: (%) The percentage of urban and rural population with access to safe drinking water (criteria defined locally).

Average precipitation: (mm/yr and km³/yr) Double average over space and time of water falling on the country in one year. Figures computed by FAO.

Internal renewable water resources: (km³/yr) Average annual flow of rivers and groundwater generated from endogenous precipitation.

Global renewable water resources: (km³/yr) The sum of internal renewable water resources and incoming flow originating outside the country.

Dependency ratio: (%) The part of the global renewable water resources which originates outside the country.

Total dam capacity: (km³) The total cumulative capacity of all dams

Desalinated water: (10⁶ m³/yr) Installed capacity of desalination plants.

Water withdrawal: (10⁶ m³/yr) Gross amount of water which is extracted from the resources for a given use. It includes conveyance losses, consumptive use and return flow.

Agricultural water withdrawal: (10⁶ m³/yr) Annual quantity of water withdrawn for agricultural purposes. It includes irrigation and livestock watering.

Domestic water withdrawal: (10⁶ m³/yr) Annual quantity of water withdrawn for domestic purpose. It is usually computed as the total water withdrawn by public distribution networks, and usually includes the withdrawal of those industries connected to public networks.

Industrial water withdrawal: (10⁶ m³/yr) Usually, this sector refers to self-supplied industries not connected to any distribution network.

Total water withdrawal: (10⁶ m³/yr) Annual quantity of water withdrawn for agricultural, industrial and domestic purposes. It does not include other withdrawal (see below).

Other water withdrawal: (10⁶ m³/yr) This includes all other sectors: energy, mining, recreation, navigation, fisheries and environmental. Those sectors are usually characterized by a very low consumption rate.

Wastewater produced: (10⁶ m³/yr) Annual quantity of wastewater produced in the country. This does not include agricultural drainage water.

Treated wastewater: (10⁶ m³/yr) Annual quantity of produced wastewater which is treated.

Reused treated wastewater: (10^6 m³/yr) Annual quantity of treated wastewater which is reused.

Irrigation potential: (ha) Area of land suitable for irrigation development, taking into account land and water resources. It includes land already under irrigation.

Full or partial control irrigation: equipped area: (ha) Irrigation schemes executed and managed either by government, private estates or farmers, and where a full or partial control of water is achieved. Gardening is including in this category.

Surface irrigation: (ha) Part of the full or partial control area under surface irrigation: i.e., furrow, border, basin, and flooded irrigation of rice.

Sprinkler irrigation: (ha) Part of the full or partial control area irrigated by aspersion (sprinkler).

Micro-irrigation: (ha) Part of the full or partial control area irrigated by micro-irrigation.

Percentage of area irrigated from groundwater: (%) The part of the full or partial control area irrigated from wells (shallow wells and deep tubewells).

Percentage of area irrigated from surface water: (%) The part of the full or partial control area irrigated from rivers or lakes (reservoirs, pumping or diversion).

Percentage of equipped area actually irrigated: (%) The part of the full or partial control area which is actually irrigated. Often, the whole area equipped is not irrigated for various reasons, such as lack of water, absence of farmers, damage, organizational problems, and so forth. It concerns the physical areas. Irrigated land that is cultivated twice a year is counted once.

Spate irrigation area: (ha) Area of land equipped for spate irrigation.

Equipped wetlands and inland valley bottoms: (ha) The part of cultivated wetlands and inland valley bottoms which have been equipped for irrigation with water control structures (intake, canals, etc.). Developed mangroves are included in this category.

Other cultivated wetlands and inland valley bottoms: (ha) Part of wetland and inland valley bottom which have not been equipped with water control structures but are used for cropping.

Flood recession cropping area: (ha) Area along rivers, where cultivation occurs in the areas exposed as floods recede.

Total water managed area: (ha) The sum of full or partial control irrigation equipped areas, spate irrigation areas, equipped wetlands and inland valley bottoms, other cultivated wetlands and inland valley bottoms and flood recession cropping areas. It does not include water harvesting area.

Power irrigated area as percentage of water managed area: (%) That part of the water managed area where pumps are used for water supply. It does not include areas where water is pumped with human- or animal-driven water lifting devices.

Full or partial control schemes: (ha) The areas of large, medium and small schemes, following the criteria used by the country, with the criteria given.

Total number of households in irrigation: Total number of households living directly from earnings coming out of full or partial controlled irrigation schemes.

Total irrigated grain production: (t) The total harvested quantity of cereals produced annually in the water managed area.

Harvested crops under irrigation: (ha) Total harvested irrigated area for the crop for the given year. Areas under double cropping should be counted twice. It concerns the crops cultivated in all water managed areas. If figures are only available for the full or partial control irrigation areas, it has been indicated between brackets.

Drained area: (ha) The area equipped with subsurface or open drains. Cultivated wetlands and inland valley bottoms where some kind of drainage is provided are not included in this category.

Flood-protected area: (ha) Area of land equipped with flood control structures.

Area salinized by irrigation: (ha) Total irrigated area affected by salinization as a result of irrigation. This does not include naturally saline areas.

Notes

Notwithstanding the detailed description of each variable, some problems persist due to the fact that it is not always clearly indicated in the available literature what definition has been used in computing the figures. The most frequent problems encountered in computing the figures are listed below:

Arable land: the official definition of arable land is "land under temporary crops, temporary meadows for mowing or pasture, land under market and kitchen gardens, and land temporarily fallow". This definition tends to equate arable land with cultivated land. In this study, "cultivated land" has been preferred to "arable land" and the term "cultivable land" has been used to describe the area of land potentially fit for cultivation.

Cultivable land: this term may or may not include part or all of the forests and rangeland.

Cultivated land: some countries include perennial crops into the computation of cultivated land. The official FAO definition has been used systematically in this report. The way multiple cropping and intercropping are accounted for in the literature is not always clearly explained.

Agricultural water withdrawal: methods for computing agricultural water withdrawal vary from country to country. A review of the figure was performed for each country, based on crop water requirements and irrigated areas, and comments were added in the country profiles to explain the figure when necessary.

Livestock water withdrawal: some countries include it in domestic water withdrawal, others in agricultural withdrawal.

Surface and groundwater resources: it happens frequently that no attention is given to the possible double counting of water in these two categories. A critical review of the data was performed to systematically avoid double counting.

Irrigation potential: assumptions made in assessing irrigation potential vary from country to country. In most cases it is computed on the basis of available land and water resources, but economic and environmental considerations can also be taken into account. Except in a few cases, no consideration is given to the possible double counting of shared water resources. Mangrove, wetland and flood plains are usually, but not systematically included in irrigation potential.

Typology of water managed areas: it is particularly difficult to choose a typology which suits all country specificities.

In this survey, the distinction was made between five broad categories of land using water for crop production (see Table 8). In some cases, distinction between flood recession cropping and cultivated wetland was not clear and an arbitrary decision had to be taken. When no distinction was possible between equipped and other cultivated wetland, all the area was accounted for in "other cultivated wetland and inland valley bottoms".

Irrigated area: in the text, irrigated areas consist of areas equipped with hydraulic structures to provide water to the crops. It includes areas equipped for full and partial control irrigation, spate irrigation areas, and equipped wetland or inland valley bottoms. It does not include non equipped cultivated wetland and inland valley bottoms and recession cropping areas.

Drainage: equipped wetland and inland valley bottoms often have structures for drainage as well as irrigation, in which case they have been accounted for as equipped wetland and inland valley bottoms.

GENERAL SUMMARY

The 53 African countries have been grouped into seven regions on a basis of geographic and climatic homogeneity, which has a direct influence on irrigation. These regions, presented in Figure 1, are referred to as the **Northern**, the **Sudano-Sahelian**, the **Gulf of Guinea**, **Central**, **Eastern**, **Indian Ocean islands**, and **Southern**¹. This section briefly presents the particularities which can be observed at national and regional level, as well as trends which emerge from the information which was collected.

Water resources

The survey concentrated mostly on renewable resources. Distinction is made between the water resources generated from precipitation falling on the territory of the country or *internal renewable resources*, and *global renewable resources* which includes transfers from neighbouring countries (mostly through rivers). In both cases, the figure represents the maximum potential water resource irrespective of development potential, such as regulation of stream flow, or extractable groundwater.

Table 1 presents, for each region, data relative to internal resources and compares these results with precipitation figures. The ratio between these two figures can be assimilated to some kind of "runoff coefficient" which would take into account recharge of that portion of the aquifers which are not connected to the river network. At regional level, this coefficient varies from 6% in arid areas to 32% in the humid zones of the Gulf of Guinea and 34% in Madagascar. Data collected in the countries show that the coefficient varies from 2% in arid countries like Libya, Niger or Botswana, up to extreme values higher than 80% in the most

¹ The regions are:

Northern: Algeria, Egypt, Libya, Morocco, Tunisia

Sudano-Sahelian: Burkina Faso, Cape Verde, Chad, Djibouti, Eritrea, Gambia, Mali, Mauritania, Niger, Senegal, Somalia, Sudan

Gulf of Guinea: Benin, Côte d'Ivoire, Ghana, Guinea, Guinea Bissau, Liberia, Nigeria, Sierra Leone, Togo

Central: Angola, Cameroon, Central African Republic, Congo, Equatorial Guinea, Gabon, São Tome and Príncipe, Zaire

Eastern: Burundi, Ethiopia, Kenya, Rwanda, Tanzania, Uganda

Indian Ocean Islands: Comoros, Madagascar, Mauritius, Seychelles

Southern: Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe

TABLE 1
Regional distribution of water resources

Region	Area	Precip.	Internal renewable resources			
	(1000 km ²)	(km ³ /yr)	(km ³ /yr)	(mm/yr)	% of total	% of precip.
Northern	5 753	411	50	8.7	1.2	12.2
Sudano-Sahelian	8 591	2 878	170	19.8	4.3	5.9
Gulf of Guinea	2 106	2 965	952	452.0	23.8	32.1
Central	5 329	7 621	1 946	365.2	48.8	25.5
Eastern	2 916	2 364	259	88.8	6.5	11.0
Islands (I.O.)	591	1 005	340	575.3	8.5	33.8
Southern	4 739	2 967	274	57.8	6.9	9.2
Total	30 025	20 211	3 991	132.9	100.0	19.7

humid areas of Sierra Leone and Liberia. Although they cover the largest part of the continent, the Northern and Sudano-Sahelian regions contribute only respectively 1.2% and 4.3% of the total water resources of Africa. The Southern region also shows a very low runoff coefficient (9%).

Withdrawals

Table 2 shows the distribution of water withdrawals by region between the three major sectors of water use: agriculture, communities and industries. Water requirements for navigation, fisheries, mining, environment and recreation, although they can represent a significant part of the water resources, have a very low net consumption rate and are computed in very different manners by the countries, which complicates the regional analyses. For these reasons, they are not included in the computation of regional withdrawals but they appear, when available, in the country profiles.

For the continent as a whole, about 85% of water withdrawals are directed towards agriculture but this figure varies considerably from one region to another. Arid regions, where irrigation plays an important role in agriculture, have the highest level of water withdrawal for agriculture. The Northern region alone represents more than half of the agricultural withdrawal of the continent. In contrast, the humid regions show the lowest agricultural withdrawals: 62% for the Gulf of Guinea and 43% for the Central region, where it is the same as domestic use.

The percentage of water withdrawal over internal renewable water resources is an indicator of the importance of transfers for some countries. Libya, Tunisia, Morocco and Algeria have almost no transfer from other countries. The rate of utilization of water resources is high. This situation requires a very strict management of the resources and leads to a competition between the sectors of water use. In Libya, annual water withdrawal is higher than the volume of renewable resources, the difference coming from non-renewable resources (fossil water). Egypt and Mauritania also withdraw more water than is produced

TABLE 2
Regional distribution of water withdrawals

Region	Withdrawals by sector					
	Agriculture	Communities	Industries	Total	As % of total	As % of internal resources
	$\times 10^6 \text{m}^3/\text{yr}$	$\times 10^6 \text{m}^3/\text{yr}$	$\times 10^6 \text{m}^3/\text{yr}$	$\times 10^6 \text{m}^3/\text{yr}$	%	%
Northern	65 000 (85%)	5 500 (7%)	5 800 (8%)	76 300 (100%)	50.9	152.6
Sudano-Sahelian	22 600 (94%)	1 200 (5%)	300 (1%)	24 100 (100%)	16.1	14.2
Gulf of Guinea	3 800 (62%)	1 600 (26%)	700 (12%)	6 100 (100%)	4.1	0.6
Central	600 (43%)	600 (43%)	200 (14%)	1 400 (100%)	0.9	0.1
Eastern	5 400 (83%)	900 (14%)	200 (3%)	6 500 (100%)	4.3	2.5
Islands (I.O.)	16 400 (99%)	200 (1%)	20 (-)	16 620 (100%)	11.1	4.9
Southern	14 100 (75%)	3 000 (16%)	1 800 (9%)	18 900 (100%)	12.6	6.9
Total	127 900 (85%)	13 000 (9%)	9 020 (6%)	149 920 (100%)	100.0	3.8

on their territory, but benefit from transfer from other countries through the Nile and Senegal rivers respectively. Niger, Somalia, Eritrea and Chad, in the Northern hemisphere, and Namibia and Botswana in the South, have few internal renewable resources but benefit from important transfers. In these countries, withdrawal is still less than their internal resources, but some of it is already taken from incoming water.

Sudan, South Africa and Swaziland have high rates of use of their internal resources, but benefit from important resources and significant amounts of incoming water.

Wastewater treatment and reuse (Tunisia, Egypt and Morocco) and desalinated water (Cape Verde, Egypt, Libya, Mauritania and South Africa) are also indicators of scarce water resources.

Irrigation potential

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 benefitting 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 the transfers of water they imply hampers the computation of irrigation potential on a regional basis. In the same way, the computation of irrigation potential as it is presented in Table 5 may lead to a double counting of part of the shared resources, which could be avoided only through a river-basin approach. It should be noted also that the methods used in estimating irrigation potential vary from country to country, and that the choice of method can significantly affect the result, especially in humid countries. Estimates for Zaïre, 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 in mind these uncertainties, one can notice that seven countries concentrate about 60% of the irrigation potential of Africa (Angola, Sudan, Egypt, Zaïre, Ethiopia, Mozambique and Nigeria), while at the other end of the list, 18 countries share only 5% of this potential.

Water managed areas

The diversity of water management situations encountered in Africa requests the choice of a classification which 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 called in the text *water managed areas*. The term *irrigated areas* has been limited to that part of the water managed areas equipped with hydraulic structures: full or partial control irrigation, equipped wetland or valley bottoms and areas equipped for spate irrigation (see Table 3). The difference between the two categories comprises cultivated wetland and valley bottoms without irrigation equipment and recession cropping areas.

Water managed areas comprise 14.3 million ha in Africa. There is a very heterogenous geographical distribution of water managed areas: the North represents more than 40% of the total. The part of water managed areas in national agriculture varies from less than 1% of cultivated land (Zaire, Uganda, Ghana, Togo and Comoros) to 100% in the most arid countries (Egypt and Djibouti, where agriculture is impossible without irrigation). This distribution of water managed areas shows clearly the relation between climate and the role of irrigation in agriculture. In Equatorial Africa, where precipitation is greatest, rainfed agriculture is dominant. Irrigation is used for winter cropping, rice cultivation, to secure high value crops, or in wetlands and inland valleys. In Madagascar, rice cultivation on the plateaus is very developed, which explains the high percentage of irrigation in that country even though rainfall is relatively favourable.

At national level, the distribution of water managed areas is very uneven. Five countries (Egypt, Sudan, South Africa, Morocco and Madagascar), 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.

Among the five classes of water management presented in Table 3, one can notice that full or partial control irrigation is the most widespread (81% of the area). Among the other classes of water management, cultivated wetlands and valley bottoms and recession cropping are a majority (15% of the total). Apart from full and partial control irrigation, present in

TABLE 3
Regional distribution of water management methods

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					
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

almost all countries, the other categories are usually concentrated in a few countries. Recession cropping is used essentially on the rims of the rivers Niger and Senegal and of their tributaries, or along the Logone, Chari, Zaïre, 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 analysing irrigation techniques used in the full and partial control schemes, Table 9 shows that surface irrigation is by far 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), in Zimbabwe, in 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.

Irrigated crops

So far, the figures given in the text refer to physical areas, which is not the case for 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 very 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 4, in which the different crops have been grouped in six major categories.

TABLE 4
Regional distribution of main irrigated crops (partial information)

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%)	2 221 (45%)	423 (9%)	1 207 (24%)	80 (2%)	459 (9%)	4 928 (100%)
Sudano-Sahelian	384 (22%)	839 (48%)	61 (3%)	4 (-)	471 (27%)	1 (-)	1 760 (100%)
Gulf of Guinea	993 (80%)	52 (4%)	168 (14%)	- (-)	21 (2%)	6 (-)	1 240 (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%)	1 130 (100%)
Total	3 136 (30%)	3 550 (34%)	856 (8%)	1 564 (15%)	876 (8%)	510 (5%)	10 492 (100%)

The most widespread crop is rice, which alone 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-Saharan region, mostly as recession cropping.

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 in fact 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 in South Africa, with this last country having most of the irrigated pasture land (220 000 hectares).

Rate of use of equipped areas

One of the most frequently used indicators to assess the rate of intensification of the use 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 almost never 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, in particular where irrigation schemes have problems of water availability. In Table 9, the average rate of use of irrigated schemes for full and partial control is presented for each of the 30 countries where this information could be found. A regional analysis does not allow consideration of geographical trends in the variation of this value. This is probably due to the fact that it is a factor which is more related to socio-economic conditions specific to individual countries rather than to criteria related to climate and geography.

For eight out of the thirty countries, the rate of use of equipped areas is recorded to be 100% and 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, very diverse, are described in detail in the country profiles. 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.

Environment and health

Environmental and health problems in Africa are as serious as in other developing regions. However, in Africa, very little quantitative information is available on this aspect. Salinization of irrigated lands is a serious problem in a number of irrigation projects, such as in Egypt, Namibia, Morocco, Ethiopia and Senegal. Although water pollution by agriculture is not very serious at the continental level, due to relatively low levels of fertilizer application, fertilizer and agrochemical pollution of water resources is reported in the Northern region. Health problems related to water development, particularly vector-borne diseases such as schistosomiasis and malaria, are serious throughout the continent. Approximately 90 to 95 percent of malaria-related deaths in the world are estimated to be in Africa. Again, country-specific data, linking irrigation development and human health, are lacking in many countries. Some of these environmental and health issues, depending on availability and reliability of data, are described in the country profiles.

SUMMARY TABLES

Explanatory notes

TABLE 5

Population: For Rwanda, figure is for 1993.

Cultivated area: For Central African Republic, South Africa and Zimbabwe, as the figure for total cultivated area was not available, the figure of arable land has been used (see FAO Agrostat for definition).

Irrigation potential: Figures on irrigation potential cannot be totalled due to possible double counting of shared water resources.

TABLE 7

Egypt: The total water withdrawal for agricultural, domestic and industrial purposes is estimated at 53.1 km³ per year, which is equal to 2 950% of the internal renewable water resources (1.8 km³). Most of the water is withdrawn from the Nile, being part of the global renewable water resource.

Eritrea and Ethiopia: Figures reflect the situation as in 1987.

Libya: The total water withdrawal for agricultural, domestic and industrial purposes is estimated at 4.6 km³ per year, which is equal to 766% of the total renewable water resources, explained by the fact that part of water is withdrawn from non-renewable fossil groundwater resources.

Mauritania: Total water withdrawal for agricultural, domestic and industrial purposes is estimated at 1.63 km³ per year, which is equal to 408% of the internal renewable water resources (0.4 km³). Most of the water is withdrawn from the Senegal river, being part of the global renewable water resource.

TABLE 8

Djibouti: The total water managed area is 166% of the total cultivated area. No cultivation is possible without irrigation, but not all equipped area is actually irrigated.

Egypt: All agriculture is irrigated.

Rwanda: The irrigation potential area is equal to the total water managed area. This is due to the fact that the irrigation potential concerns the wetlands and inland valley bottoms, which are part of the total water managed area, and all cultivated.

São Tome and Principe: The total water managed area is 284% of the cultivated area, due to the fact that the cacao is irrigated, which is a perennial crop, while cultivated area refers only to annual crops.

TABLE 5
Population, land use and irrigation potential

COUNTRY	POPULATION 1994	AREA			IRRIGATION POTENTIAL	
		Total	Cultivable	Cultivated		in % of cultivable area
		inhab.	ha	ha	ha	ha
(1)	(2)	(3)	(4)	(5)	(6)=100x(5)/(3)	
ALGERIA	27 325 000	238 174 000	-	7 500 000	730 000	-
ANGOLA	10 674 000	124 670 000	-	2 900 000	6 700 000	-
BENIN	5 246 000	11 262 000	7 050 000	907 800	300 000	4.26
BOTSWANA	1 443 000	58 173 000	6 200 000	324 200	20 216	0.33
BURKINA FASO	10 046 000	27 400 000	9 000 000	3 688 000	164 460	1.83
BURUNDI	6 209 000	2 783 400	1 400 000	800 000	185 000	13.21
CAMEROON	12 871 000	47 544 000	-	1 200 000	240 000	-
CAPE VERDE	381 000	403 000	-	37 000	2 987	-
CENTRAL AFRICAN REP.	3 235 000	62 298 000	-	1 930 000	1 900 000	-
CHAD	6 183 000	128 400 000	-	1 987 515	935 000	-
COMOROS	446 817	186 100	-	78 100	303	-
CONGO	2 516 000	34 200 000	-	130 075	40 000	-
COTE D'IVOIRE	13 780 000	32 246 200	17 000 000	6 000 000	475 000	2.79
DJIBOUTI	566 000	2 320 000	6 000	407	-	-
EGYPT	61 636 000	100 145 000	-	3 246 000	4 434 000	-
EQUAT. GUINEA	389 000	2 805 000	-	230 000	-	-
ERITREA	3 437 000	12 189 000	1 650 000	439 000	-	-
ETHIOPIA	53 435 000	110 001 000	13 200 000	6 000 000	3 637 000	27.55
GABON	1 283 000	26 767 000	20 000 000	100 000	440 000	2.20
GAMBIA	1 081 000	1 130 000	430 000	195 543	80 000	18.60
GHANA	16 944 000	23 854 000	10 000 000	1 140 000	1 900 000	19.00
GUINEA	6 501 000	24 585 700	6 000 000	1 600 000	520 000	8.67
GUINEA-BISSAU	1 050 000	3 612 000	622 000	153 004	281 290	45.22
KENYA	27 343 000	58 037 000	9 936 000	3 738 105	352 400	3.55
LESOTHO	1 996 000	3 035 000	-	209 293	12 500	-
LIBERIA	2 941 000	9 775 000	-	538 000	600 000	-
LIBYA	5 225 000	175 954 000	2 170 000	1 933 648	750 000	34.56
MADAGASCAR	14 303 000	58 704 000	8 000 000	2 580 000	1 500 000	18.75
MALAWI	10 843 000	11 848 000	3 600 000	2 105 500	161 900	4.50
MALI	10 462 000	124 019 000	43 700 000	2 600 000	560 000	1.28
MAURITANIA	2 217 000	102 552 000	20 129 689	199 000	221 000	1.10
MAURITIUS	1 104 000	204 000	-	85 400	-	-
MOROCCO	26 488 000	44 650 000	8 000 000	7 212 000	1 653 000	20.66
MOZAMBIQUE	15 527 000	80 159 000	36 000 000	3 600 000	3 300 000	9.17
NAMIBIA	1 500 000	82 490 000	25 000 000	205 150	45 000	0.18
NIGER	8 846 000	126 700 000	15 000 000	3 800 000	270 000	1.80
NIGERIA	108 467 000	92 377 000	61 000 000	22 600 000	3 137 000	5.14
RWANDA	7 554 000	2 634 000	1 385 000	825 000	160 000	11.55
SAO TOME & P.	130 000	96 000	43 000	3 420	-	-
SENEGAL	8 102 000	19 672 000	3 782 000	2 300 000	400 000	10.58
SEYCHELLES	73 000	45 500	1 400	400	-	-
SIERRA LEONE	4 402 000	7 174 000	5 360 000	600 000	807 000	15.06
SOMALIA	9 077 000	63 766 000	8 150 000	980 000	240 000	2.94
SOUTH AFRICA	40 555 000	122 104 000	18 320 000	12 356 000	1 500 000	8.19
SUDAN	27 361 000	250 581 000	105 000 000	7 600 000	4 842 600	4.61
SWAZILAND	832 000	1 736 400	-	191 500	90 000	-
TANZANIA	28 846 000	94 509 000	40 000 000	6 300 000	828 000	2.07
TOGO	4 010 000	5 678 500	3 407 000	1 431 000	180 000	5.28
TUNISIA	8 733 000	16 361 000	8 700 000	3 961 000	563 000	6.47
UGANDA	20 621 000	23 588 000	16 759 600	5 027 880	202 000	1.21
ZAIRE	42 552 000	234 486 000	80 000 000	6 000 000	4 000 000	5.00
ZAMBIA	9 196 000	75 261 000	16 350 000	1 029 570	520 000	3.18
ZIMBABWE	11 002 000	39 076 000	-	2 750 000	331 000	-
AFRICA	706 985 817	3 002 420 800	632 351 689	143 348 510		

TABLE 6
Water resources

COUNTRY	ANNUAL AVERAGE PRECIPITATION		ANNUAL RENEWABLE WATER RESOURCES			DEPENDENCY RATIO
			INTERNAL	per caput	GLOBAL	
	(1) mm	(2) km ³	(3) km ³	(4) m ³ /pers	(5) km ³	(6) = 100x((5)-(3))/(5) %
ALGERIA	68	162.9	13.9	509	14.3	2.8
ANGOLA	1 052	1 311.2	184.0	17 200	184.0	0.0
BENIN	1 111	125.1	10.3	1 963	25.8	60.1
BOTSWANA	401	233.2	2.9	2 010	14.7	80.3
BURKINA FASO	844	231.4	17.5	1 742	17.5	0.0
BURUNDI	1 139	31.7	3.6	579	3.6	0.0
CAMEROON	1 595	758.0	268.0	20 822	268.0	0.0
CAPE VERDE	228	0.9	0.3	787	0.3	0.0
CENTRAL AFRICAN RE	1 380	859.7	141.0	43 586	141.0	0.0
CHAD	348	446.5	15.0	2 426	43.0	65.1
COMOROS	900	1.7	1.0	2 283	1.0	0.0
CONGO	1 612	551.4	222.0	88 196	832.0	73.3
COTE D'IVOIRE	1 377	444.1	76.7	5 566	77.7	1.3
DJIBOUTI	147	3.4	0.3	530	2.3	87.0
EGYPT	18	18.1	1.8	29	68.5	97.5
EQUAT. GUINEA	2 077	58.3	30.0	77 121	30.0	0.0
ERITREA	329	40.1	2.8	815	8.8	68.2
ETHIOPIA	744	818.8	110.0	2 059	110.0	0.0
GABON	1 803	482.7	164.0	127 825	164.0	0.0
GAMBIA	961	10.9	3.0	2 775	8.0	62.5
GHANA	1 264	301.7	30.3	1 788	53.2	43.0
GUINEA	1 835	451.2	226.0	34 764	226.0	0.0
GUINEA-BISSAU	1 705	61.6	16.0	15 238	27.0	40.7
KENYA	572	331.8	20.2	739	30.2	33.1
LESOTHO	760	23.1	5.2	2 605	5.2	0.0
LIBERIA	2 372	231.9	200.0	68 004	232.0	13.8
LIBYA	26	46.1	0.6	115	0.6	0.0
MADAGASCAR	1 700	998.0	337.0	23 561	337.0	0.0
MALAWI	1 014	120.1	17.5	1 614	18.7	6.1
MALI	334	414.8	60.0	5 735	100.0	40.0
MAURITANIA	99	101.9	0.4	180	11.4	96.5
MAURITIUS	2 180	4.4	2.2	1 993	2.2	0.0
MOROCCO	336	150.0	30.0	1 133	30.0	0.0
MOZAMBIQUE	969	776.7	100.0	6 440	216.0	53.7
NAMIBIA	284	233.9	6.2	4 133	45.5	86.4
NIGER	180	227.7	3.5	396	32.5	89.2
NIGERIA	1 177	1 087.3	221.0	2 037	280.0	21.1
RWANDA	1 111	29.3	6.3	833	6.3	0.0
SAO TOME & P.	3 200	3.1	2.2	16 770	2.2	0.0
SENEGAL	742	146.0	26.4	3 258	39.4	33.0
SEYCHELLES	1 742	0.8	-	-	-	0.0
SIERRA LEONE	2 691	193.0	160.0	36 347	160.0	0.0
SOMALIA	253	161.3	6.0	661	13.5	55.6
SOUTH AFRICA	451	350.5	44.8	1 104	50.0	10.4
SUDAN	436	1 092.6	35.0	1 279	154.0	77.3
SWAZILAND	778	13.5	2.6	3 123	4.5	42.2
TANZANIA	937	883.5	80.0	2 773	89.0	10.1
TOGO	1 214	68.9	11.5	2 868	12.0	4.2
TUNISIA	207	34.0	3.5	401	3.9	10.3
UGANDA	1 133	267.3	39.0	1 891	66.0	40.9
ZAIRE	1 534	3 596.6	935.0	21 973	1019.0	8.2
ZAMBIA	1 011	760.7	80.2	8 721	116.0	30.9
ZIMBABWE	652	254.9	14.1	1 282	20.0	29.5
AFRICA / AFRIQUE	673.1	20 210.3	3 990.8	5 645		

TABLE 7
Annual water withdrawal

COUNTRY	YEAR	ANNUAL WATER WITHDRAWAL					
		Agricultural	Domestic	Industrial	Total	in % of internal renewable water resources	per inhabitant
Unit		(1)	(2)	(3)	(4)=(1)+(2)+(3)	(5)	(6)
		million m ³	million m ³	million m ³	million m ³	%	m ³ /pers.
ALGERIA	1990	2 700.0	1 120.0	680.0	4 500.0	32.37	180
ANGOLA	1987	365.0	67.0	48.0	480.0	0.26	57
BENIN	1994	97.0	33.0	15.0	145.0	1.41	28
BOTSWANA	1992	54.0	36.0	23.0	113.0	3.90	85
BURKINA FASO	1992	303.0	73.0	0.0	376.0	2.15	40
BURUNDI	1987	64.0	36.0	0.0	100.0	2.78	20
CAMEROON	1987	140.0	184.0	76.0	400.0	0.15	31
CAPE VERDE	1990	22.6	2.7	0.5	25.8	8.60	70
CENTRAL AFRICAN R	1987	51.8	14.7	3.5	70.0	0.05	26
CHAD	1987	147.6	28.8	3.6	180.0	1.20	34
COMOROS	-	-	-	-	-	-	-
CONGO	1987	4.4	24.8	10.8	40.0	0.02	20
COTE D'IVOIRE	1987	475.0	156.0	78.0	709.0	0.92	64
DJIBOUTI	1973	5.1	2.8	2.1	10.0	3.33	47
EGYPT	1993	45 400.0	3 100.0	4 600.0	53 100.0	2 950.00	880
EQUAT. GUINEA	1987	0.6	8.1	1.3	10.0	0.03	31
ERITREA + ETHIOPIA	1987	1 892.0	239.8	68.2	2 200.0	1.95	51
GABON	1987	3.6	43.2	13.2	60.0	0.04	57
GAMBIA	1982	18.2	1.4	0.4	20.0	0.67	29
GHANA	1970	156.0	103.0	39.0	300.0	0.99	35
GUINEA	1987	644.0	74.0	22.0	740.0	0.33	139
GUINEA-BISSAU	1991	6.0	10.0	0.6	16.6	0.10	17
KENYA	1990	1 566.2	403.3	80.0	2 049.5	10.14	87
LESOTHO	1987	28.0	11.0	11.0	50.0	0.96	31
LIBERIA	1987	78.0	35.1	16.9	130.0	0.06	55
LIBYA	1994	4 000.0	500.0	100.0	4 600.0	766.00	880
MADAGASCAR	1984	16 137.0	163.0	-	16 300.0	4.84	1 638
MALAWI	1994	809.0	95.0	32.0	936.0	5.35	86
MALI	1987	1 319.0	27.0	14.0	1 360.0	2.27	161
MAURITANIA	1985	1 499.6	101.1	29.3	1 630.0	407.50	923
MAURITIUS	1974	276.8	58.4	24.8	360.0	16.36	409
MOROCCO	1991	10 180.0	543.0	322.0	11 045.0	36.82	436
MOZAMBIQUE	1992	540.0	53.0	12.0	605.0	0.60	39
NAMIBIA	1991	170.0	71.0	8.0	249.0	4.02	171
NIGER	1988	410.0	80.0	10.0	500.0	14.29	69
NIGERIA	1987	1 960.0	1 125.0	545.0	3 630.0	1.64	37
RWANDA	1993	720.0	36.0	12.0	768.0	10.24	102
SAO TOME & P.	-	-	-	-	-	-	-
SENEGAL	1987	1 251.0	68.0	41.0	1 360.0	5.15	201
SEYCHELLES	-	-	-	-	-	-	-
SIERRA LEONE	1987	329.3	25.9	14.8	370.0	0.23	96
SOMALIA	1987	785.7	24.3	0.0	810.0	13.50	99
SOUTH AFRICA	1990	9 580.0	2 281.0	1 448.0	13 309.0	29.71	561
SUDAN	1995	16 800.0	800.0	200.0	17 800.0	50.86	651
SWAZILAND	1980	629.8	10.5	15.7	656.0	25.23	1 161
TANZANIA	1994	1 040.0	101.0	24.0	1 165.0	1.46	40
TOGO	1987	23.0	56.0	12.0	91.0	0.79	28
TUNISIA	1990	2 727.5	261.4	86.1	3 075.0	87.86	382
UGANDA	1970	120.0	64.0	16.0	200.0	0.51	20
ZAIRE	1990	82.8	216.4	57.8	357.0	0.04	9
ZAMBIA	1994	1 318.0	270.0	118.0	1 706.0	2.13	186
ZIMBABWE	1987	963.8	170.8	85.4	1 220.0	8.65	135
AFRICA		127 894.4	13 011.5	9 021.0	149 926.9	3.76	212

TABLE 8
Types of water control

COUNTRY (Unit : ha)	YEAR	FULL/PART. CONTROL IRRIGATION	SPATE IRRIGATION	EQUIPPED WETLAND & I.V.B.	OTHER CULT. WETLAND & I.V.B.	FLOOD RECESSION CROPPING	TOTAL WATER- MANAGED	% OF CULTIVATED AREA
		(1)	(2)	(3)	(4)	(5)	(6)=(1+2+3+4+5)	(7)
ALGERIA	1992	445 500	110 000	-	-	-	555 500	7.4
ANGOLA	1974	75 000	-	-	350 000	-	425 000	14.7
BENIN	1994	9 786	-	450	6 988	-	17 224	1.9
BOTSWANA	1992	1 381	-	-	-	6 500	7 881	2.4
BURKINA FASO	1992	15 430	-	8 900	21 400	-	45 730	1.2
BURUNDI	1985	14 400	-	-	60 000	-	74 400	9.3
CAMEROON	1987	20 970	-	-	-	-	20 970	1.7
CAPE VERDE	1988	2 779	-	-	-	-	2 779	7.5
CENTRAL AFRICAN CHAD	1987	135	-	-	500	-	635	0.0
CHAD	1988	14 020	-	-	21 400	78 000	113 420	5.7
COMOROS	1987	130	-	-	-	-	130	0.2
CONGO	1993	217	-	-	-	1 783	2 000	1.5
COTE D'IVOIRE	1994	47 750	-	25 000	16 250	-	89 000	1.5
DJIBOUTI	1989	674	-	-	-	-	674	165.6
EGYPT	1993	3 246 000	-	-	-	-	3 246 000	100.0
EQUAT. GUINEA	-	-	-	-	-	-	-	-
ERITREA	1993	12 494	15 630	-	-	-	28 124	6.4
ETHIOPIA	1994	189 556	-	-	-	-	189 556	3.2
GABON	1987	3 150	-	1 300	-	-	4 450	4.5
GAMBIA	1991	1 670	-	-	13 170	-	14 840	7.6
GHANA	1994	6 374	-	-	-	-	6 374	0.6
GUINEA	1994	15 541	-	77 339	-	6 268	99 148	6.1
GUINEA-BISSAU	1994	5 110	-	12 005	25 322	-	42 437	27.6
KENYA	1992	66 610	-	-	6 415	-	73 025	2.0
LESOTHO	1994	2 722	-	-	-	-	2 722	1.3
LIBERIA	1987	100	-	2 000	18 000	-	20 100	4.1
LIBYA	1990	470 000	-	-	-	-	470 000	24.3
MADAGASCAR	1992	1 087 000	-	-	-	-	1 087 000	42.1
MALAWI	1992	28 000	-	-	61 900	-	89 900	4.3
MALI	1994	78 620	-	-	3 826	109 023	191 469	7.4
MAURITANIA	1994	49 200	-	-	-	64 000	113 200	56.9
MAURITIUS	1995	17 500	-	-	-	-	17 500	20.5
MOROCCO	1989	1 093 200	165 000	-	-	-	1 258 200	17.4
MOZAMBIQUE	1993	106 710	-	-	-	-	106 710	3.0
NAMIBIA	1992	6 142	-	-	-	2 000	8 142	4.0
NIGER	1989	66 480	-	-	-	12 000	78 480	2.1
NIGERIA	1991	219 621	-	13 200	-	723 714	956 535	4.2
RWANDA	1993	2 000	-	2 000	156 000	-	160 000	19.4
SAO TOME & P.	1991	9 700	-	-	-	-	9 700	283.6
SENEGAL	1994	71 400	-	-	37 000	33 000	141 400	6.0
SEYCHELLES	-	-	-	-	-	-	-	-
SIERRA LEONE	1992	1 000	-	28 360	126 000	-	155 360	25.9
SOMALIA	1984	50 000	150 000	-	-	-	200 000	20.4
SOUTH AFRICA	1994	1 270 000	-	-	-	-	1 270 000	10.3
SUDAN	1995	1 900 000	46 200	-	-	-	1 946 200	25.6
SWAZILAND	1990	67 400	-	-	-	-	67 400	35.2
TANZANIA	1993	150 000	-	-	-	-	150 000	2.4
TOGO	1990	2 008	-	5 000	-	-	7 008	0.5
TUNISIA	1991	355 000	30 000	-	-	-	385 000	9.7
UGANDA	1987	5 550	-	3 570	-	-	9 120	0.2
ZAIRE	1995	10 000	-	500	2 000	1 000	13 500	0.2
ZAMBIA	1992	46 400	-	-	100 000	-	146 400	14.2
ZIMBABWE	1993	116 577	-	-	20 000	-	136 577	5.0
AFRICA		11 477 007	516 830	179 624	1 046 171	1 037 288	14 256 920	9.9

TABLE 9
Full or partial control irrigation techniques

COUNTRY	YEAR	FULL/PARTIAL CONTROL IRRIGATION						
		Equipped area						Part actually irrigated
		Surface	Sprinkler	Micro	Total	Part of surface water	Part of groundwater	
Unit	(1) ha	(2) ha	(3) ha	(4)=(1)+(2)+(3) ha	(5) %	(6) = 100 - (5) %	(7) %	
ALGERIA	1992	-	-	-	445 500	-	-	82.0
ANGOLA	1974	-	-	-	75 000	100.0	0.0	29.0
BENIN	1994	3 956	4 470	1 360	9 786	99.6	0.4	10.0
BOTSWANA	1992	218	892	271	1 381	55.7	44.3	100.0
BURKINA FASO	1992	11 530	3 900	0	15 430	-	-	100.0
BURUNDI	1985	-	-	-	14 400	-	-	-
CAMEROON	1987	-	-	-	20 970	-	-	-
CAPE VERDE	1988	-	-	-	2 779	-	-	65.0
CENTRAL AFRICAN	1987	-	-	-	135	100.0	0.0	51.0
CHAD	1988	10 820	3 200	0	14 020	-	-	92.0
COMOROS	1987	-	-	-	130	-	-	-
CONGO	1993	105	111	1	217	-	-	100.0
COTE D'IVOIRE	1994	-	-	-	47 750	100.0	0.0	92.0
DJIBOUTI	1989	-	-	-	674	0.0	100.0	60.0
EGYPT	1993	2 830 000	312 000	104 000	3 246 000	95.5	4.5	100.0
EQUAT. GUINEA	-	-	-	-	-	-	-	-
ERITREA	1993	-	-	-	12 494	-	-	48.0
ETHIOPIA	1994	-	-	-	189 556	-	-	-
GABON	1987	-	-	-	3 150	-	-	-
GAMBIA	1991	1 670	0	0	1 670	-	-	65.0
GHANA	1994	5 794	580	0	6 374	100.0	0.0	61.0
GUINEA	1994	13 947	1 594	0	15 541	100.0	0.0	-
GUINEA-BISSAU	1994	-	-	-	5 110	88.3	11.7	100.0
KENYA	1992	44 610	21 000	1 000	66 610	99.0	1.0	100.0
LESOTHO	1994	-	-	-	2 722	-	-	7.4
LIBERIA	1987	-	-	-	100	-	-	-
LIBYA	1990	-	470 000	-	470 000	-	-	51.0
MADAGASCAR	1992	-	-	-	1 087 000	-	-	83.0
MALAWI	1992	15 700	11 300	1 000	28 000	100.0	0.1	96.0
MALI	1989	78 520	100	0	78 620	97.4	2.6	-
MAURITANIA	1994	-	-	-	49 200	90.4	9.6	54.0
MAURITIUS	1995	1 500	14 600	1 400	17 500	88.0	12.0	-
MOROCCO	1989	986 000	103 200	4 000	1 093 200	69.0	31.0	-
MOZAMBIQUE	1993	-	-	-	106 710	-	-	42.0
NAMIBIA	1992	2 950	1 845	1 347	6 142	85.6	14.4	100.0
NIGER	1989	-	-	-	66 480	-	-	-
NIGERIA	1991	-	-	-	219 621	-	-	74.0
RWANDA	1987	-	-	-	2 000	-	-	-
SAO TOME & P.	1991	-	-	-	9 700	100.0	0.0	-
SENEGAL	1994	-	-	-	71 400	-	-	-
SEYCHELLES	-	-	-	-	-	-	-	-
SIERRA LEONE	1992	1 000	0	0	1 000	-	-	-
SOMALIA	1984	-	-	-	50 000	-	-	-
SOUTH AFRICA	1994	-	-	-	1 278 000	82.0	18.0	-
SUDAN	1995	-	-	-	1 900 000	96.0	4.0	63.0
SWAZILAND	1990	-	-	25	67 400	-	-	100.0
TANZANIA	1993	-	-	-	150 000	-	-	-
TOGO	1990	1 448	550	10	2 008	98.1	1.9	100.0
TUNISIA	1991	294 000	55 000	6 000	355 000	39.0	61.0	91.0
UGANDA	1987	-	80	-	5 550	-	-	-
ZAIRE	1995	10 000	0	0	10 000	100.0	0.0	80.0
ZAMBIA	1992	28 400	17 200	800	46 400	94.6	5.4	99.0
ZIMBABWE	1993	21 144	87 433	8 000	116 577	-	-	-
TOTAL		4 363 312	1 109 055	129 214	11 477 007			

TABLE 10
Irrigated crops

COUNTRY	YEAR	IRRIGATED CROPS	MAIN IRRIGATED CROP			Part of grain production which is irrigated
			Name	Area	in % of total irrigated crops	
Unit		(1) ha	(2)	(3) ha	(4) = 100*(3)/(1) %	(5) %
ALGERIA	1986	-	Vegetables	95 000*	-	-
ANGOLA	1972	-	Sugarcane	12 500*	-	-
BENIN	1993	8 444	Rice	7 870	93.20	-
BOTSWANA	1991	1 381*	Vegetables	431*	31.21	2.6
BURKINA FASO	1992	45 730	Rice	30 900	67.57	3.2
BURUNDI	-	-	Rice	-	-	-
CAMEROON	-	-	Rice	-	-	-
CAPE VERDE	1985	2 307	Sugarcane	1 022	44.30	2.5
CENTRAL AFRICAN	-	-	Rice	-	-	-
CHAD	-	-	-	-	-	-
COMOROS	-	-	Rice	-	-	-
CONGO	-	-	-	-	-	-
COTE D'IVOIRE	1994	43 540*	Sugarcane	20 220*	46.44	-
DJIBOUTI	1989	407	Veg. / Fruits	405	99.51	100.0
EGYPT	1993	4 820 000	Berseem	1 082 000	22.45	100.0
EQUAT. GUINEA	-	-	-	-	-	-
ERITREA	1993	-	Veg. / Fruits	4 109	-	-
ETHIOPIA	-	-	-	-	-	-
GABON	1987	4 450	Rice	4 450	100.00	-
GAMBIA	1991	11 277	Rice	11 277	100.00	19.6
GHANA	-	-	Rice	-	-	-
GUINEA	-	-	Rice	-	-	-
GUINEA-BISSAU	1994	42 437	Rice	42 437	100.00	48.8
KENYA	1990	73 025	Vegetables	26 407	36.16	-
LESOTHO	1994	203	Vegetables	203	100.00	0.0
LIBERIA	-	-	Rice	-	-	-
LIBYA	-	-	-	-	-	-
MADAGASCAR	1992	895 000	Rice	880 000	98.32	67.0
MALAWI	1992	31 500*	Sugarcane	15 000*	47.62	2.0
MALI	1987	273 556	Rice	193 000	70.55	22.4
MAURITANIA	1993	134 899	Sorghum	62 488	46.32	65.5
MAURITIUS	-	-	Sugarcane	-	-	-
MOROCCO	1990	1 073 000*	Grain	410 000*	38.21	15.4
MOZAMBIQUE	1994	-	Rice	18 000	-	2.0
NAMIBIA	1991	6 142*	Maize	2 200*	35.82	43.9
NIGER	1990	-	Rice	29 000	-	-
NIGERIA	1989	950 000	Rice	714 000	75.15	14.2
RWANDA	-	-	Sweet Potato	-	-	-
SAO TOME & P.	1991	9 700	Cocoa	9 500	97.94	-
SENEGAL	1993	52 306*	Rice	32 000*	61.18	-
SEYCHELLES	-	-	-	-	-	-
SIERRA LEONE	1991	-	Rice	155 000	-	38.0
SOMALIA	1984	-	Maize	150 000	-	30.0
SOUTH AFRICA	1988	-	Pasture	220 000	-	9.0
SUDAN	1988	940 422	Cotton	324 240	34.48	22.0
SWAZILAND	1994	67 400	Sugarcane	52 000	77.15	-
TANZANIA	-	-	Rice	-	-	-
TOGO	1990	2 008*	Sugarcane	900*	44.82	-
TUNISIA	1991	308 000	Fruit/Grape	112 000	36.36	3.5
UGANDA	-	-	-	-	-	-
ZAIRE	1995	13 500	Sugarcane	11 200	82.96	-
ZAMBIA	1991	46 400*	Wheat	14 500*	31.25	5.4
ZIMBABWE	1989	178 547	Wheat	47 500	26.60	-

* refers only to full or partial control irrigated areas

FIGURE 1
Regional division of Africa

Country codes

ALG	Algeria
ANG	Angola
BDI	Burundi
BEN	Benin
BKF	Burkina Faso
BOT	Botswana
CAF	Central African Republic
CHD	Chad
CMR	Cameroon
COI	Comoros
CVI	Cape Verde
DJI	Djibouti
EGY	Egypt
EQG	Equatorial Guinea
ERI	Eritrea
ETH	Ethiopia
GAB	Gabon
GAM	Gambia
GBS	Guinea Bissau
GHA	Ghana
GUI	Guinea
IVC	Côte d'Ivoire
KEN	Kenya
LES	Lesotho
LIB	Libya
LIR	Liberia
MAG	Madagascar
MAR	Mauritius
MAU	Mauritania
MLI	Mali
MLW	Malawi
MOR	Morocco
MOZ	Mozambique
NAM	Namibia
NER	Niger
NIR	Nigeria
PRC	Congo
RSA	South Africa
RWA	Rwanda
SEN	Senegal
SEY	Seychelles
SIL	Sierra Leone
SOM	Somalia
STP	São Tome and Principe
SUD	Sudan
SWA	Swaziland
TOG	Togo
TUN	Tunisia
UGA	Uganda
URT	Tanzania
ZAI	Zaire
ZAM	Zambia
ZIM	Zimbabwe

FIGURE 1
Regional division of Africa

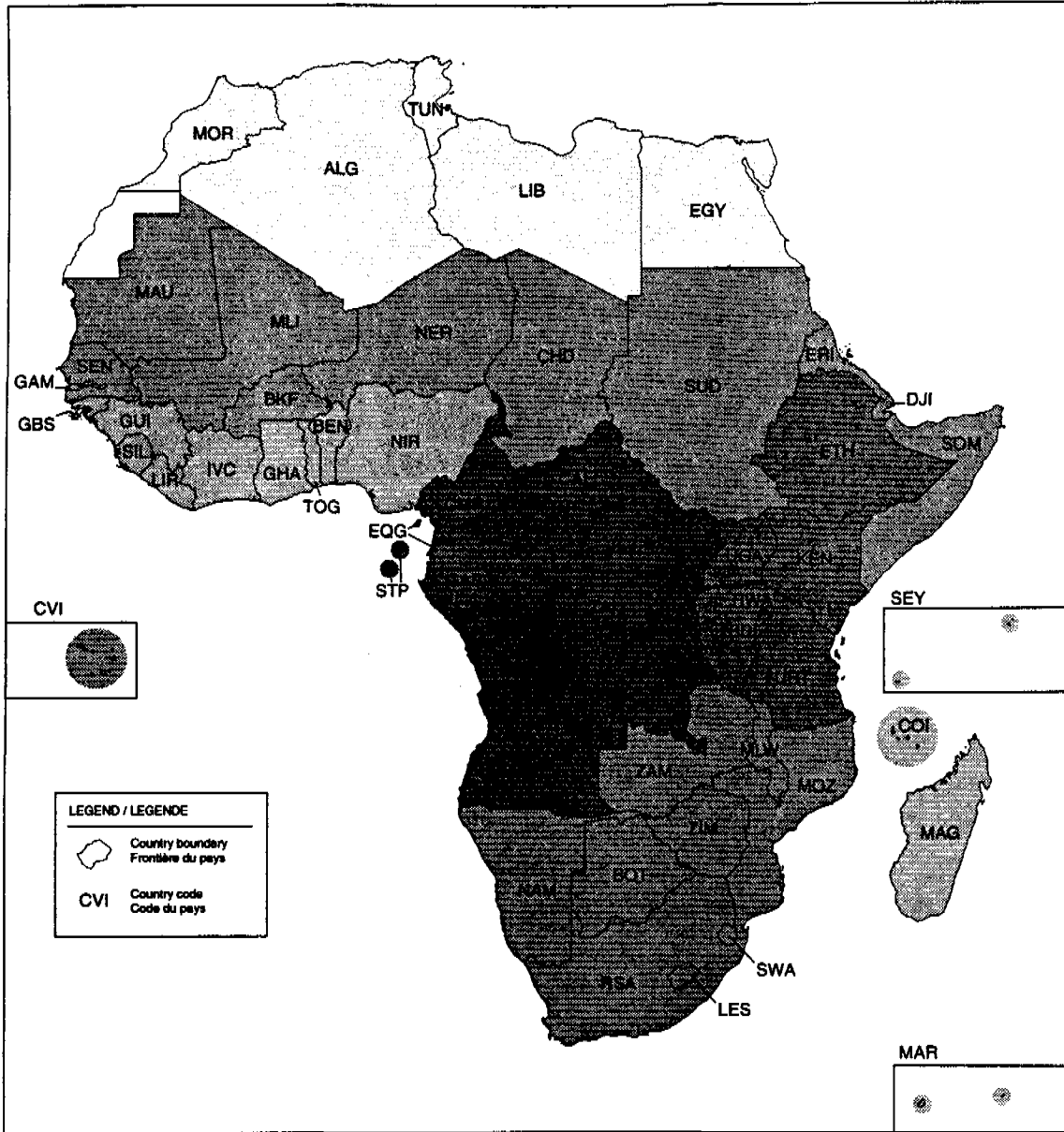


FIGURE 2
Water resources

Note

Figures represent internal renewable water resources. They are a compilation of information issued from numerous sources and do not refer to a single period of reference.

Internal renewable water resources: (km³/yr) Average annual flow of rivers and groundwater generated from endogenous precipitation.

For the following countries, no recent information was available and the figures have been computed on the basis of the publication by L'vovitch (1974):

Burundi
Cameroon
Central African Republic
Equatorial Guinea
Gabon
Guinea
Liberia
Rwanda
Sierra Leone
Uganda
Zaire

FIGURE 2
Water resources

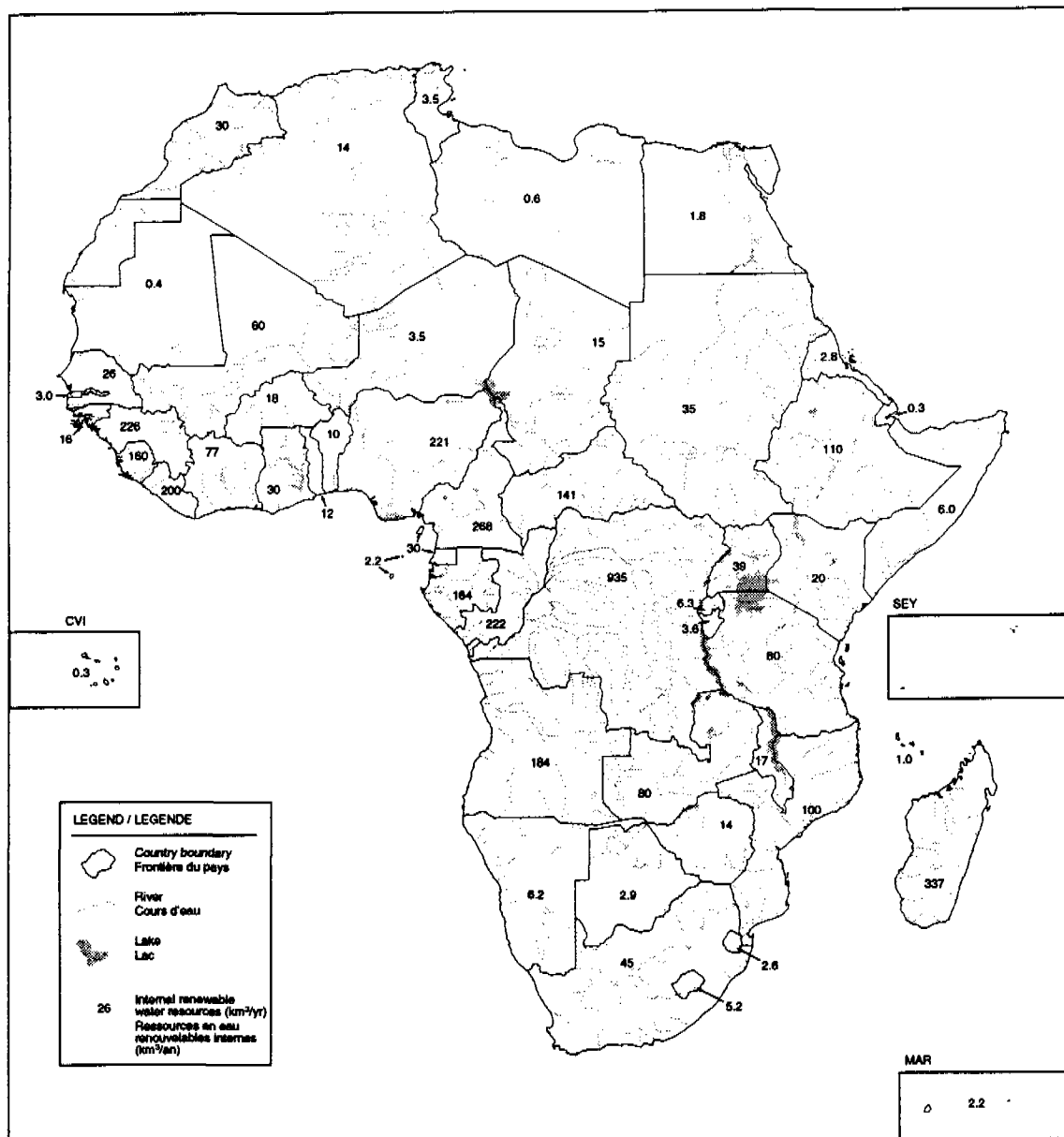


FIGURE 3
Water withdrawal (as a percentage of internal renewable water resources)

Water withdrawal: Annual volume of water withdrawn for agricultural, industrial and domestic purposes, expressed as a percentage of internal renewable water resources. It does not include withdrawal for energy, mining, recreation, navigation, fisheries, and the environment, the net consumption rate of which is very limited or nil.

Country notes

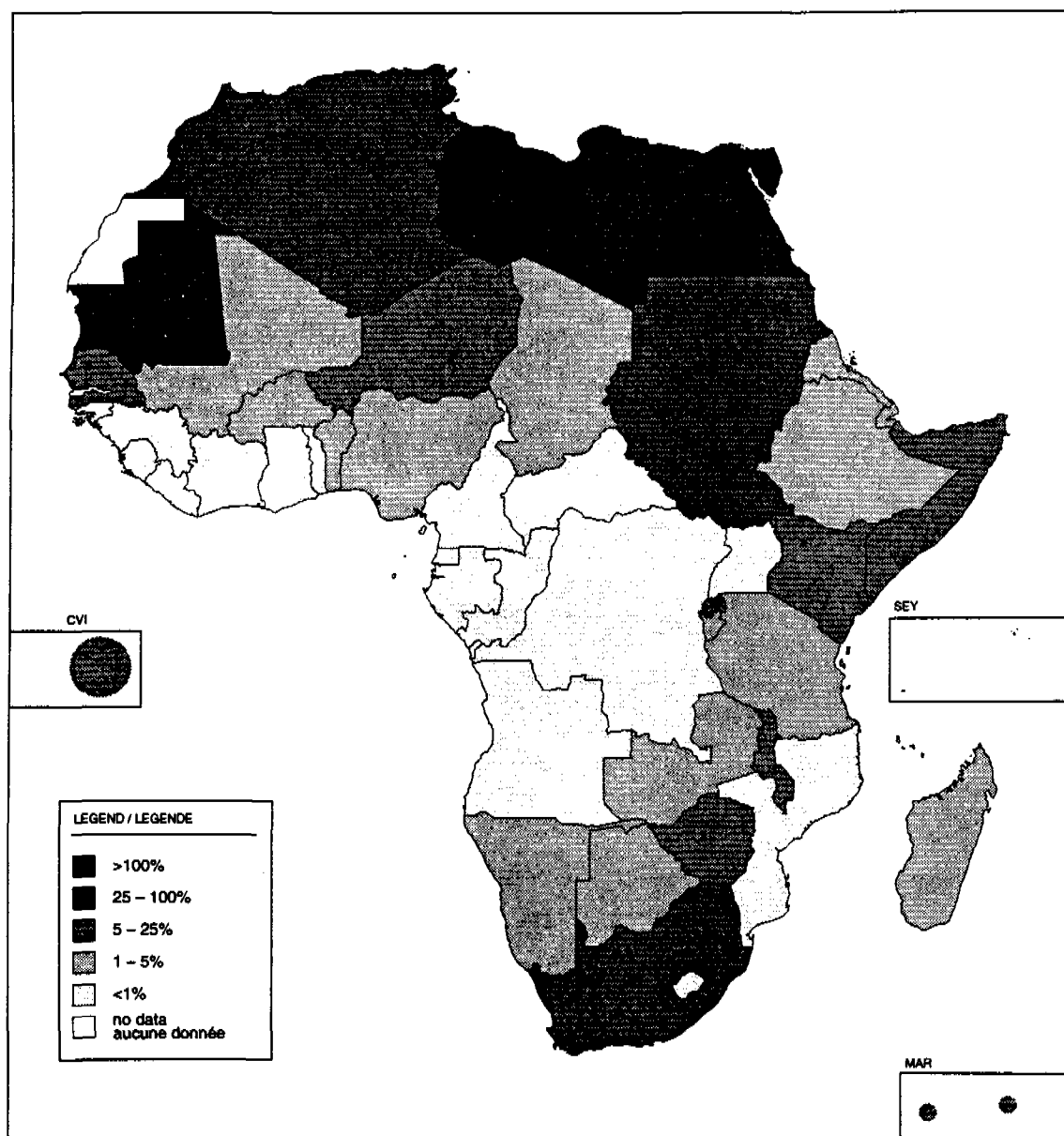
Egypt: The total water withdrawal for agricultural, domestic and industrial purposes is estimated at 53.1 km³/year, which is equal to 2 950% of the internal renewable water resources (1.8 km³). Most of the water is withdrawn from the Nile river.

Eritrea and Ethiopia: Figures reflect the situation as in 1987.

Libya: The total water withdrawal for agricultural, domestic and industrial purposes is estimated at 4.6 km³/year, which is equal to 766% of the total renewable water resources. A significant part of withdrawal comes from non-renewable (fossil) groundwater resources.

Mauritania: The total water withdrawal for agricultural, domestic and industrial purposes is estimated at 1.63 km³/year, which is equal to 408% of the internal renewable water resources (0.4 km³). Most of the water is withdrawn from the Senegal river.

FIGURE 3
Water withdrawal (as a percentage of internal renewable water resources)



FIGURES 4-7

Irrigation and water managed areas

Data on *irrigation* refer to areas equipped with hydraulic structures to provide water to the crops. It includes areas equipped for full and partial control irrigation, spate irrigation areas, and equipped wetland or inland valley bottoms. It does not include non-equipped cultivated wetland and inland valley bottoms and recession cropping areas.

Data on *Water managed area* refer to the sum of full or partial control irrigation equipped area, spate irrigation area, equipped wetlands and inland valley bottoms, other cultivated wetlands and inland valley bottoms and flood recession cropping area. It does not include water harvesting area.

Country notes

Djibouti: The total water managed area is 166% of the total cultivated area. No cultivation is possible without irrigation, but not all equipped area is actually irrigated.

Egypt: All agriculture is irrigated.

Rwanda: The irrigation potential area is equal to the total water managed area. This is due to the fact that the irrigation potential refers to the wetlands and inland valley bottoms, which are part of the total water managed area, and all cultivated.

São Tome and Príncipe: The total water managed area is 284% of the cultivated area, due to the fact that the cocoa is irrigated, which is a perennial crop, while cultivated area refers only to annual crops.

Central African Republic, South Africa and Zimbabwe: As the figure for total cultivated area was not available, the ratio has been estimated in percent of arable land according to FAO definition (Agrostat).

FIGURE 4
Irrigation (in '000 ha)

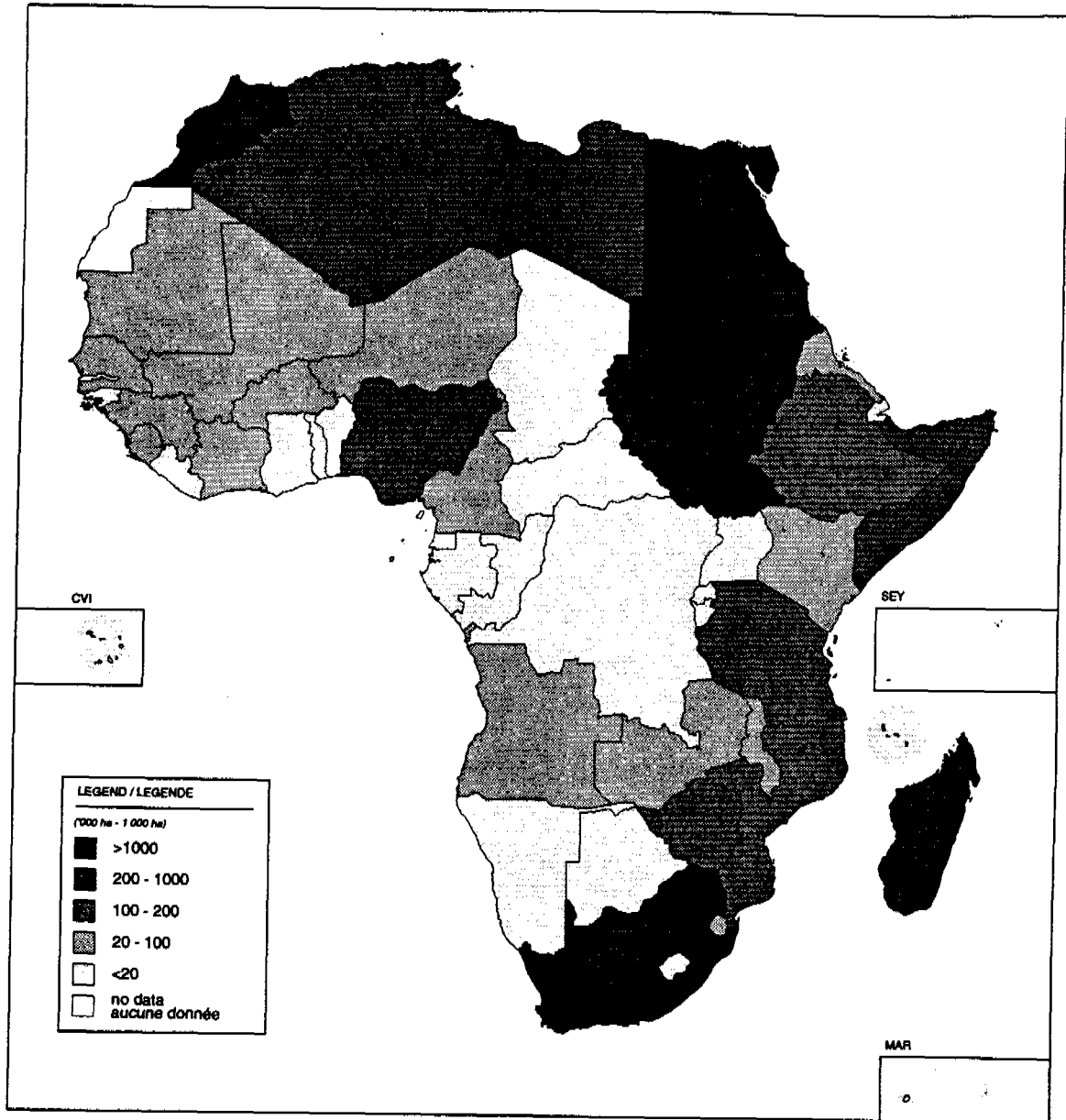


FIGURE 5
Water managed areas (in '000 ha)

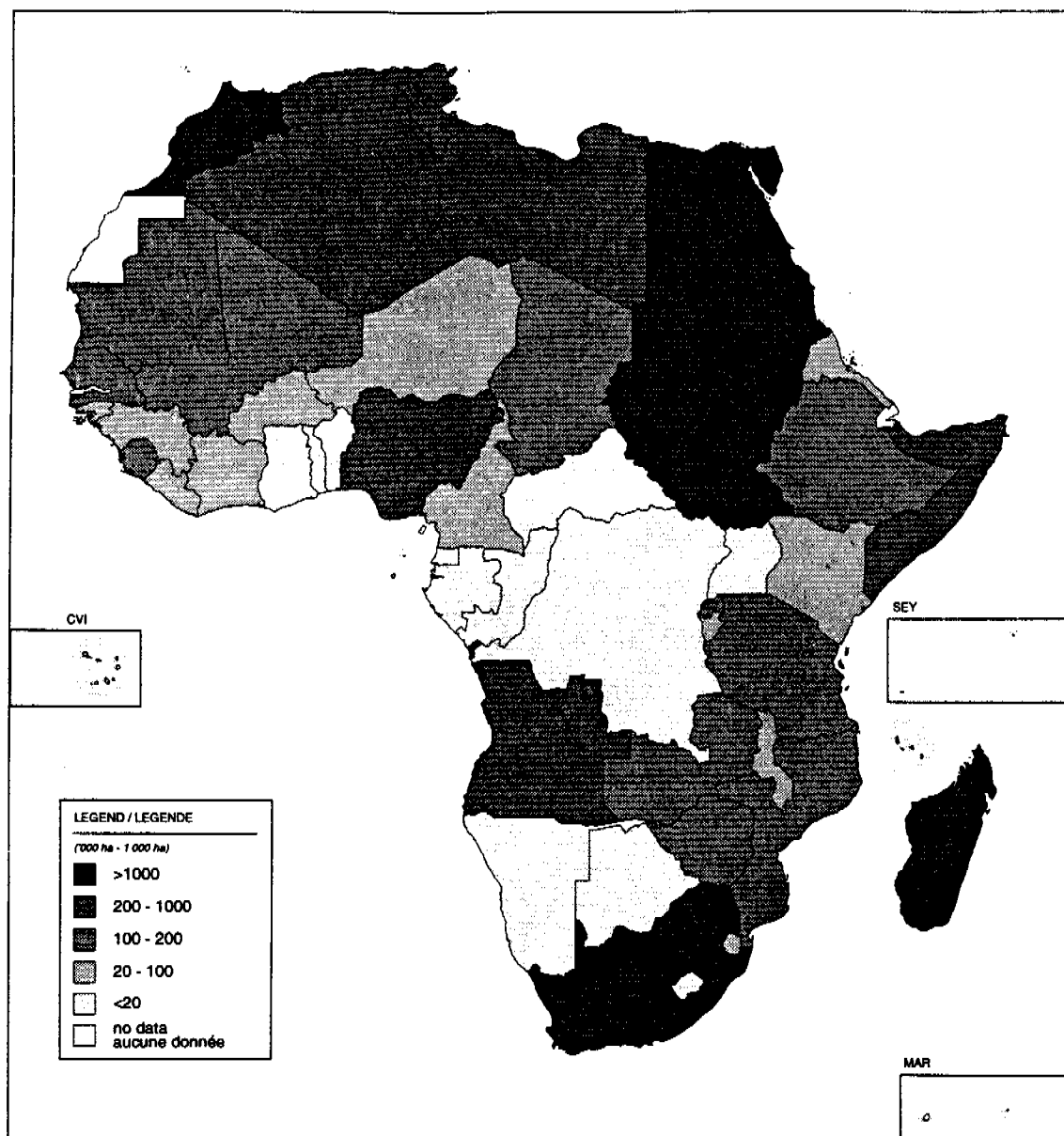


FIGURE 6
Water managed areas (as a percentage of cultivated areas)

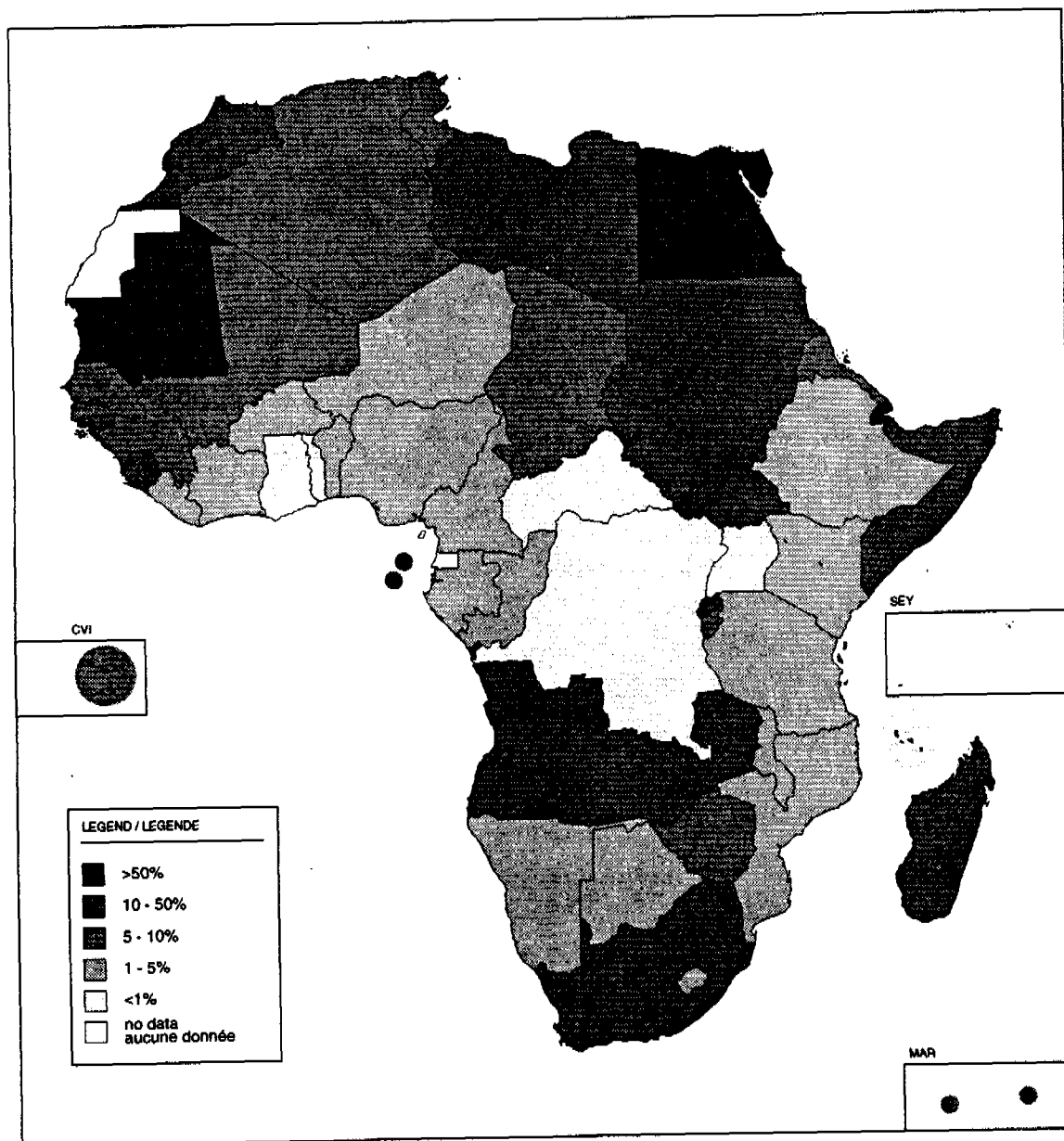


FIGURE 7
Water managed areas (as a percentage of irrigation potential)

