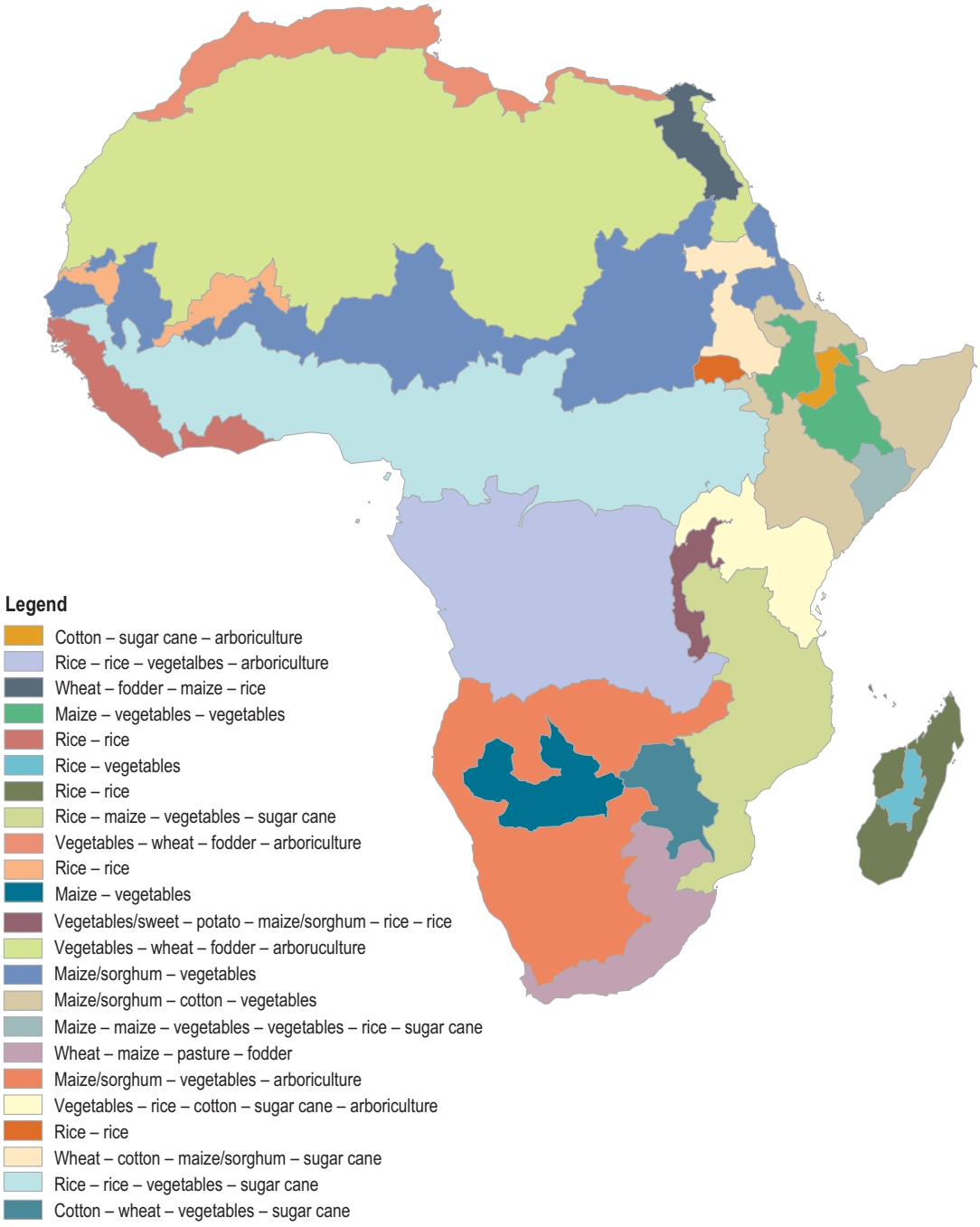
However, the analysis used for the preparation of FAO Water Bulletin No. 4 (1997a) was mainly concerned with an assessment of physical potential and its scope did not take into account complex institutional issues such as those described in Chapter 2.

AGRICULTURE

Cropping patterns / farming systems

Two systems of farming were used during the preparation of this study, one as described in FAO (1997) as indicated in Figure 5, the other from a joint FAO/World Bank (2001)

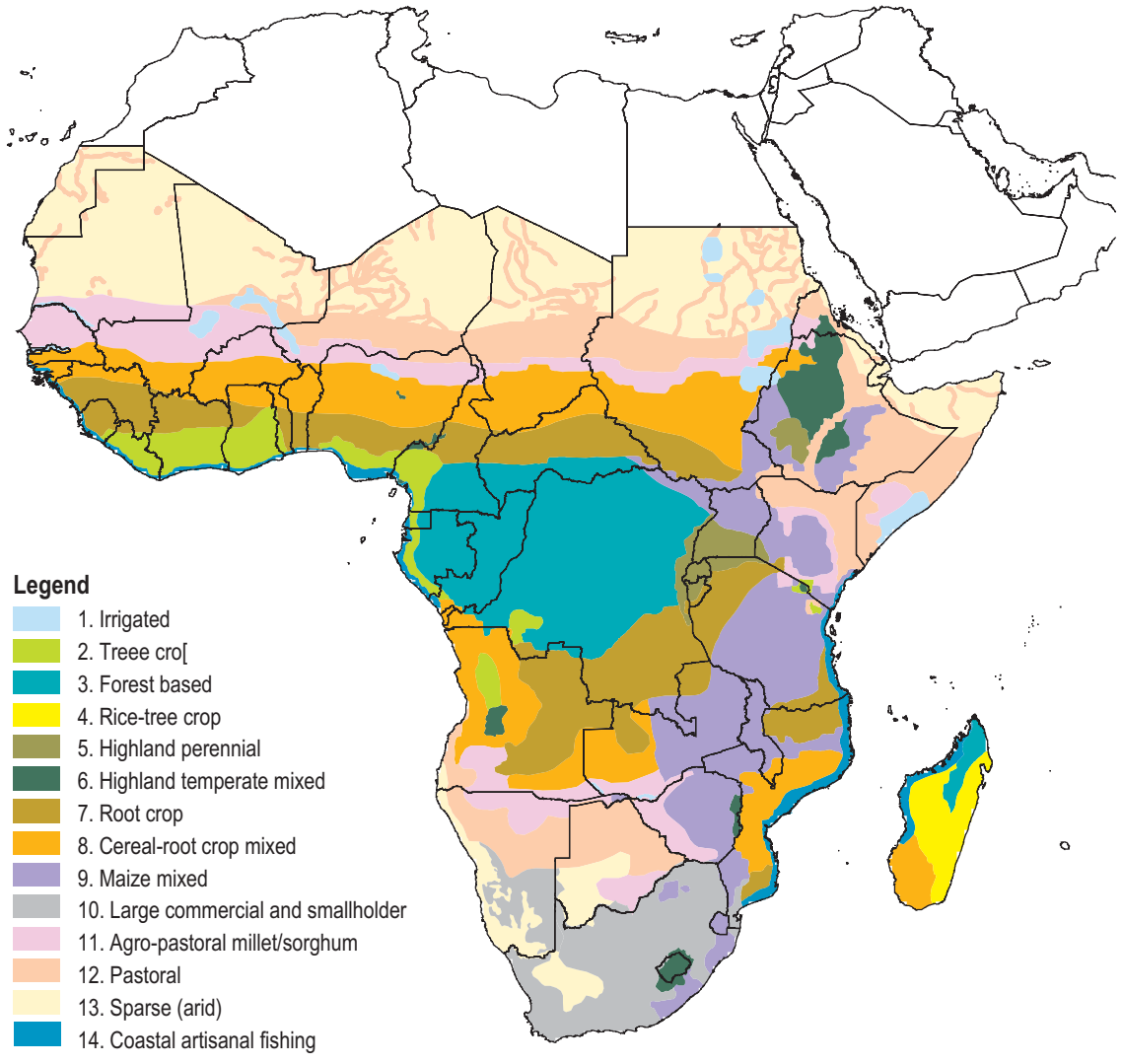
FIGURE 5
Cropping patterns map



Note: Multiple codes reflect different cropping calendars.
Source: FAO (1997).

publication, Figure 6. Despite FAO involvement in the preparation of both, they are essentially incompatible, not least because the former is based on specific cropping calendars with specific crops, whereas the latter considers clusters of crop types. In fact, both systems are highly generic and in some cases do not represent a complete picture of irrigated agriculture for any particular country, basin or region. Equally, the "Irrigated Farming System" for sub-Saharan Africa as described in FAO/World Bank (2001) concerns only permanently equipped areas (whether managed by commercial operators, government service providers, parastatals or farmer groups). It specifically does not include small-scale schemes or water harvesting, which are subsumed into other farming systems which are not classified as irrigated. As a consequence, a degree of judgement, caution and adaptation was necessary in order to prepare this analysis.

FIGURE 6
Farming systems map from "Farming Systems and Poverty"



Source: FAO/World Bank (2001).

Areas under agricultural water management

Baseline data for the area under agricultural water management have been taken from the AQUASTAT database and are summarized in Annex 4.

Irrigated yields

The data underlying the AT 2015/2030 analysis also provide information regarding yields and areas under both rainfed and irrigated production for a wide variety of crops and countries. Actual baseline information is provided (1997/99), while yields and irrigated areas have been estimated for 2015 and 2030 on the basis of expert judgement.

When using yields in a diagnostic exercise such as this, it is very important to compare actual yields with yields attainable on well-managed and well-resourced farms, thereby establishing realistic indications of any yield gaps.

With the important caveat that low yields are also a function of price expectation and social connectivity in terms of market access, yield gaps are a very important parameter in the context of this study. This is because a yield gap analysis provides an appropriate framework within which to consider the baseline situation, and also for financial and environmental reasons, it makes better sense to improve the yields upon existing assets before investing in new infrastructure, especially if expensive storage works are required. To calculate expected yield gaps, it has been necessary to make reasonable estimates of obtainable yield targets. This was done on the basis of literature review and expert judgement. The results are presented in Table 5.

Hence, an analysis of yield gaps provides an indication of the extent to which the 2015 and 2030 estimates can be achieved. Closing the gaps obviates the need to develop new irrigated areas. Type I yield gaps (generally reflecting agro-ecological constraints such as poor soils, topography, or climate) that cannot be narrowed are not applicable in this case. Type II yield gaps (generally taken to mean the difference between actual yields and those that could be obtained at the same location with better crop management) are much more relevant to irrigated production and they are generally of much larger magnitude. Intuition and the literature suggest that Type II gaps can be closed without recourse to major leaps forward in agronomic technology but rather by means of rehabilitated or upgraded infrastructure and strengthened institutions (including extension services).

Accordingly, it is necessary to examine:

- areas currently irrigated;
- typical yields of key crops;
- potential yields of these key crops.

Hence, for the purposes of this study, target yield estimates have been taken from several sources (ILACO, 1981; FAO, 1979). In some cases, these have been adjusted according to the judgement and experience of the consultants (Table 5).

It is also important to note that SSRs in excess of unity, but nonetheless low, do not necessarily represent a satisfactory state of affairs. Population growth means that

TABLE 5
Target yields assumed for the yield gap analysis

Crop	Potential yield (tonnes/ha)	Crop	Potential yield (tonnes/ha)	Crop	Potential yield (tonnes/ha)
Bananas	50.00	Millet	3.75	Sugar	150.00
Barley	4.25	Other cereals	2.50	Sunflower	3.00
Beets	75.00	Potatoes	20.00	Sweet potatoes	20.00
Citrus	32.50	Rice	4.00	Wheat	5.00
Groundnuts	2.50	Sorghum	1.20		
Maize	7.50	Soybean	3.00		

Note: Potential yields for groundnuts are for unshelled nut.

demand for agricultural production will continue to rise. This may mean improving productivity, but equally it may require that production be increased through new investments. This in turn requires an understanding of the regional irrigation sectors as they now stand and how they might look in the two horizons of 2015 and 2030.