Chapter 3
Data sources and methodology

ANALYSIS OF SUPPLY AND DEMAND
Crop sectors
The demand analysis in this paper employs the database assembled by FAO for its study *World agriculture: towards 2015/2030. An FAO perspective* (FAO, 2003). Since the publication of the study in 2003, FAO has continued to refine the data. The analysis in this paper uses the data that were available in February 2004.

The FAO 2015/2030 study has the three-year average 1997 to 1999 as its base year, and shows projections for the years 2015 and 2030 (hereafter called the AT 2015/2030 analysis). This data underlies the AT 2015/2030 main report (FAO, 2003). The study is positive rather than normative. It aims to predict the most likely situations for these two projection years rather than the most desirable. In the case of irrigation, the projected increases in the areas irrigated and in cropping intensity are based on a combination of existing irrigation plans, potentials for expansion, and the need to increase crop production.

The projections to 2015 and 2030 are based on a combination of modelling and the views of FAO experts. The process of making the projections stated for each country and each of 32 commodities/commodity groups (Annex 3) with: (i) projections of demand using Engel demand functions and assumptions of population and growth in gross domestic product (GDP); and (ii) projections of production derived from assumptions about future yields and trade levels. (These commodities cover the vast majority of all agricultural output. To make the analysis manageable, some commodities were grouped. Commodity groups comprise cereals, sweet potatoes and yams, other roots, pulses, vegetables, citrus, other fruit, vegetable oils, tea and coffee, hard fibres, beef and buffalo meat, mutton and goat meat, poultry meat, milk from various animals and eggs from hens and other birds. For convenience, both individual commodities and commodity groups are referred to as "commodities" in the remainder of this paper. The term "commodity group" is reserved for larger groupings of commodities, such as "non-cereal food crops" and "livestock and dairy produce".) There were then several rounds of iteration in consultation with specialists until projections for 2015 and 2030 were arrived at that both were consistent with the expectations of the specialist and met conditions of accounting consistency.

The heart of the FAO projections is a set of national supply and utilization accounts (SUAs) for 1997/99, 2015 and 2030. These show the estimated/projected weight of annual production, demand, imports and exports for a total of 32 agricultural commodities/commodity groups. Demand is analysed into food for human consumption, industrial usage, feed usage, seed, and waste. For the world as a whole, the sum of estimated 1997/99 national exports of each commodity is approximately equal to the sum of estimated imports although not exactly so owing to data anomalies.

The SUAs also contain aggregations of the commodity data a number of categories:
- cereals (including coarse grains);
- other food crops;
- basic staple foods (including grains, staple root crops, plantains and pulses);
- non-food industrial crops;
- tropical beverages;
- livestock products;
- all food commodities.

For the purposes of this paper, the value data were reworked into the following set of non-overlapping commodity categories:

- ➢ cereals;
- ➢ non-cereal staple food crops (staple root crops, plantains and pulses);
- ➢ other food crops;
- ➢ dairy and livestock products;
- ➢ tropical beverages and industrial crops.

Annex 1 lists the commodities in each of these groups. As with the original AT 2015/2030 categories, these aggregations are in terms of values, which are calculated using estimated average world 1989–1991 producer prices expressed in "international dollars" derived using the Geary-Khamis formula as explained in FAO (1993). These values are notional and, of themselves, have little meaning other than allowing accounting weights to be assigned when comparing different agricultural production. To the extent that the relative producer prices of commodities changed between the period from 1989–1991 and the 1997/99 base-year period, base-year comparisons of the values of groups of commodities will be inaccurate. The same reservation also applies to the value data for the two projection years. By 2030, the prices used to weight commodities will be some 40 years out of date. For this reason, projections to 2015 and 2030 have been based on production figures or kcal/capita/year and to findings that are based on calories rather than value. Nonetheless, this nominal value data still allows comparison of aggregate agricultural output and have been used when appropriate.

Therefore, for each commodity, the national SUA spreadsheets also contain estimates of the mean calories per person per day represented by the data on human demand. Finally, each national account spreadsheet contains separate estimates/projections of: GDP, total population, agricultural population, total labour force, and agricultural labour force.

Sub-Saharan Africa component regions

In this paper, the AT 2015/2030 data for sub-Saharan Africa are grouped into seven regions:

- ➢ Central,
- ➢ Eastern,
- ➢ Gulf of Guinea,
- ➢ Islands and Others,
- ➢ Republic of South Africa,
- ➢ Southern (excluding Republic of South Africa),
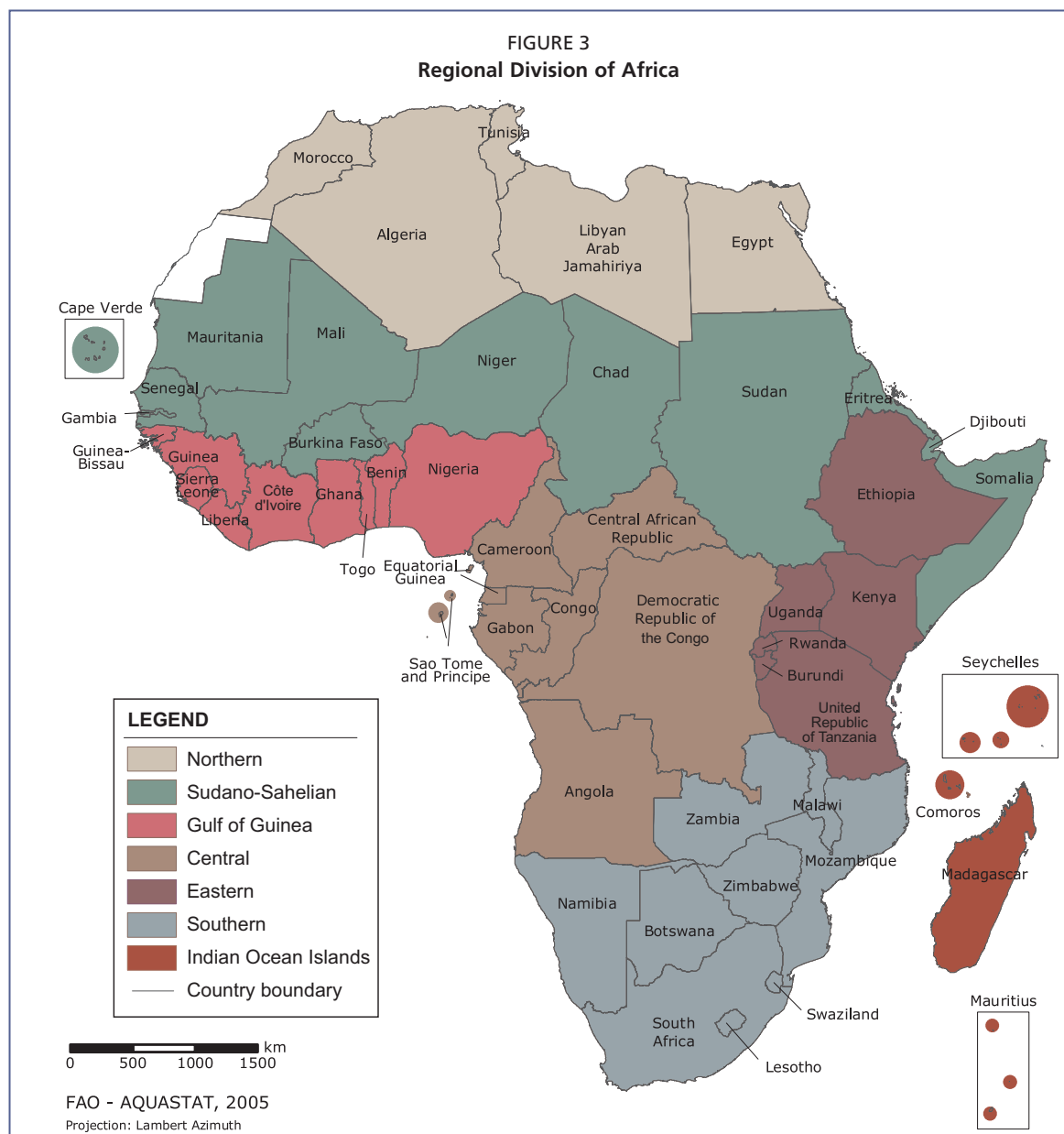- ➢ Sudano-Sahelian.

Annex 2 lists the countries that comprise each region and they are shown in the regional grouping in Figure 3.

NATURAL RESOURCES

The assessment of natural resources in the form of water and undeveloped irrigation potential for this study is almost entirely based on "Irrigation potential in Africa: a basin approach" (FAO, 1997a). This 1997 *FAO Land and Water Bulletin No. 4* comprises a detailed description of the methodology used in its preparation, which can be summarized as follows.

Planning for water resource development and utilization is best carried out on a basin basis while land-use planning is usually computed according to national boundaries, these two divisions of the continent were combined.
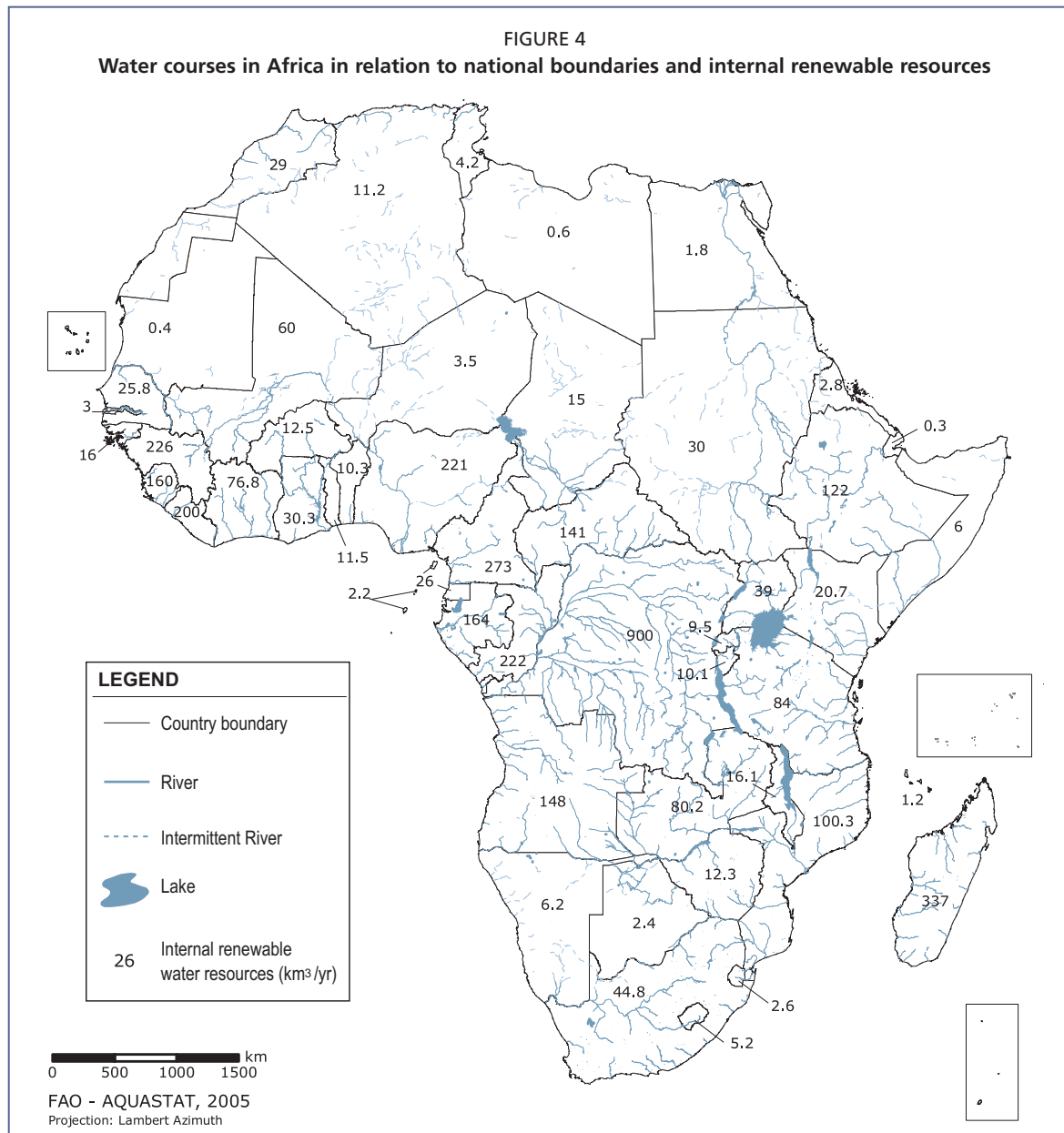
There are 24 river basins and river basin groups (including several endorheic basins) covering 53 countries. Figure 4 shows the main water courses in relation to national borders and internal renewable water resources. By combining basins and national boundaries, some 136 basic units were identified and these became the basis of all

FIGURE 3
Regional Division of Africa

LEGEND

- Northern
- Sudano-Sahelian
- Gulf of Guinea
- Central
- Eastern
- Southern
- Indian Ocean Islands
- Country boundary

km
0   500   1000   1500

FAO - AQUASTAT, 2005
Projection: Lambert Azimuth

subsequent computations (although not all of these units fall within the scope of this study).

Criteria for land potential (based only on suitability for surface irrigation) were developed using the FAO–UNESCO soils map of the world while renewable water resources were based on an earlier study (FAO, 1995). The information gleaned from the 1995 study was compared with surface runoff estimated for each of the 136 basic land units using GIS methods based on a surface runoff map of Africa (UNESCO, 1997). As non-renewable resources were not taken into account, this may have resulted in relatively low or even negative irrigation potential in the more arid units. This may explain some of the negative figures in the baseline tables presented in Chapter 4 (data anomalies account for the others).

Irrigation water requirements were estimated using FAO CROPWAT software and climate data from the FAOCLIM database (1995). This provided estimates of net reference crop irrigation water requirements (IWRs) for each of the 136 units; and wherever possible these estimates were compared with historic site-specific studies. To be of any use, reference crop IWRs have to be applied to actual farming systems.

FIGURE 4
Water courses in Africa in relation to national boundaries and internal renewable resources

LEGEND

—— Country boundary

—— River

- - - - Intermittent River

▬ Lake

26   Internal renewable
      water resources (km³/yr)

km
0   500   1000   1500

FAO - AQUASTAT, 2005
Projection: Lambert Azimuth

For the purpose of the water resources assessment, these were delineated as notionally homogeneous zones in terms of types of crops grown, cropping calendar, cropping intensity and irrigation efficiencies, before being combined with such climate data as were available. The coverage of the climate was defined using Thyssen polygons.

After collating all the farming system and IWR information, it was analysed and compared with the figures resulting from the basin studies in order to prepare: (i) regional commentaries describing conditions within each basin; (ii) tables collating statistical data such as irrigation potential by country and basin, irrigation potential by basin, and areas currently under irrigation by country and basin, etc.; and (iii) maps of where and to what extent water is a limiting factor, irrigation potential, existing and potential irrigation as a percentage of basin areas, and populations densities and possibilities for irrigation expansion. These commentaries and tables form the basis of much of what follows in this document. However, in order to be of use in this context, considerable re-organization of the data was required. The results of this were provided in the first report of the irrigation specialist and are used synoptically in this report.