

SSA CHAPTER 1

SETTING THE SCENE: THE SUB-SAHARAN AFRICA CONTEXT

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

Coordinating Lead Authors: Amadou Diop (Senegal) and Evelyne A. Lazaro (Tanzania)

Lead Authors: Wellington Otieno (Kenya), Joseph Taabazuing (Ghana)

Contributing author: Nienke Beintema (the Netherlands)

Review Editor: Davo Simplicie Vodouhe (Benin)

Key messages

1.1 IAASTD Conceptual Framework.....2

1.2 Sub-Saharan Africa Context.....4

1.2.1 Environmental and natural resources

1.2.2 Social, economic, cultural and political characteristics

1.2.3 Hunger, nutrition and human health

1.2.4 Poverty, livelihoods and the economy

1.2.5 Agriculture and R&D investments

References

Key messages

1
2
3 **1. Sub-Saharan Africa has one of the world's fastest growing populations** but the growth
4 rate of food production has not kept pace. This has led to a food deficit.

5
6 **2. Agriculture is the dominant land use in the region with permanent pasture accounting**
7 **for 35%, while arable and permanent cropland comprises only about 8% of the area.**

8
9 **3. Over 60% of the population of sub-Saharan Africa depends on agriculture for their**
10 **livelihood and agriculture accounted for 29% of GDP on average between 1998- 2000.** The
11 livelihood of the majority of the population that is mostly poor is being threatened by the rapid
12 depletion of natural resources, such as forests, and declining soil fertility. Because of its cross
13 cutting nature, land use management that minimizes degradation is a priority issue for the region.

14
15 **4. The nature of farming is changing in many sub-Saharan African countries.** As the farm
16 population is ages, rural male workers are migrating to urban areas, and many rural areas are
17 becoming urbanized. Another key factor in the changing demographics is the prevalence of
18 diseases, particularly HIV/AIDS and malaria.

19
20 **5. Women play a central role in agricultural production** and household well-being, growing
21 80% of staple foods. Males, however, are the primary decision makers.

22
23 **6. Improving the productivity and the economic returns of agriculture has immediate**
24 **effects on poverty and hunger.** Research shows that for each 10% increase in small-scale
25 agricultural productivity (which is the dominant base) in sub-Saharan Africa, almost 7 million
26 people are moved above the dollar-a-day poverty line. The number of people living on less than
27 US \$1 per day actually increased from 227 million in 1990 to 303 million in 2002 because of
28 population growth, even though the percentage of people living on less than US \$1 per day in
29 SSA declined slightly from 44.6% to 44%.

30
31 **7. The social and economic consequences of malnutrition are widely felt, not only in the**
32 **health sector but also in education, industry, agriculture, transport, human resources and**
33 **the economy in general.** Chronic hunger has decreased slightly (from 33% in 1990-1992 to 31%
34 in 2001-2003) but the absolute number of people suffering from hunger has increased. Increased
35 population growth has resulted in a decrease in the proportion of the population with chronic
36 hunger. Malnutrition in children under five years was 30% between 1995- 2002. There has not

1 been much change in the extent of malnourishment in SSA: 31% of the population was
2 undernourished between 1990- 1992 and increased slightly to 32% between 2001- 2003.

3

4 **8. Rapid depletion of natural resources such as forests and declining soil fertility**
5 **threatens the livelihoods of poor people.** Land use and degradation are priority issues for the
6 region because of their cross-cutting impacts on other resources and human activities,
7 particularly agriculture. Soil moisture stress inherently constrains land productivity on 85% of soils
8 in Africa and soil fertility degradation now places an additional human-induced limitation on
9 productivity.

10

11 **9. Sub-Saharan Africa is the most vulnerable region in the world to climate change.** Climate
12 variability is an important atmospheric phenomenon in sub-Saharan Africa, where climatic
13 conditions are uncertain and display a high degree of variability. Analysis of long-term trends
14 (1900- 2005) indicates rising temperatures in Africa as a whole, as well as drying, or decreased
15 precipitation. This change causes significant climatic disturbances in many parts of the continent,
16 either inducing drought or flooding, or increasing sea temperatures, which lead to cyclones,
17 particularly over the Indian Ocean.

18

19 **10. With growing demand for water resources from all sectors, it is projected that by 2025,**
20 **thirteen countries in sub-Saharan Africa will experience water stress and another ten**
21 **countries will suffer from water scarcity.** With global warming, changes in rainfall and
22 temperature patterns are likely to be inevitable and will negatively affect water availability.

23

24 **11. The principal threats to biodiversity in Africa include land use and land cover change,**
25 **mainly through conversion of natural ecosystems, particularly forests and grasslands, to**
26 **agricultural land and urban areas.** It is likely that land clearing and deforestation will continue
27 and hence threaten genetic diversity as species loss occurs.

1 **1.1 IAASTD Conceptual Framework**

2 The primary goal of the IAASTD is “to assess how we can reduce hunger and poverty, improve
3 rural livelihoods and facilitate equitable, socially, environmentally and economically sustainable
4 development through the generation, access to and use of agricultural knowledge, science, and
5 technology.” IAASTD uses a conceptual framework (Figure 1.1) that enables a systematic
6 analysis and appraisal of the above challenges based on common concepts and terminology.

7

8 An assessment is a critical, objective evaluation and analysis of available information designed to
9 meet user needs and to support decision-making. It is an application of experts’ judgment of
10 existing knowledge, including traditional and local knowledge, with a view to providing
11 scientifically credible answers to policy-relevant questions, quantifying the level of confidence
12 wherever possible.

13

14 **[Insert Figure 1.1]**

15

16 Agriculture in this report is defined broadly to include agricultural systems consisting of crops,
17 livestock and pastoralism, fisheries, biomass, agricultural goods and services, and land
18 management activities such as forestry and agroforestry.

19

20 The conceptual framework describes the linkages between the elements of the framework and
21 how they will be addressed. Direct drivers are: availability and management of natural resources,
22 climate change, labour, energy and AKST use. Indirect drivers can be characterized as
23 economic, demographic, educational, socio-political, infrastructural, and agricultural knowledge,
24 science and technology. These drivers are described in detail in chapter 3. The assessment
25 focuses on the interactions among the drivers in order to understand how to facilitate the
26 achievement of the IAASTD goals.

27

28 In the following chapters, we look at AKST in relation to the development and sustainability goals
29 of the IAASTD through the lens of a historical and current perspective (Chapters 2-3). We then
30 look at the next 50 years (Chapter 4) in order to provide decision makers with an assessment of
31 options for achieving development and sustainability goals (Chapter 5).

32

33 **1.2 The Sub-Saharan Africa Context**

34 **1.2.1 Environmental and natural resources**

35 The diverse physical features of sub-Saharan Africa (SSA) present opportunities and constraints
36 for agricultural development. Sub-Saharan Africa is endowed with a wealth of physical and
37 biological natural resources which have sustained the region’s growing population and helped

1 fuel development (Lelo and Makenzi, 2000). The region has large deserts (e.g., the Kalahari
2 covers $260 \times 10^3 \text{ km}^2$), high mountains (e.g., Mount Kilimanjaro at 5895 m), large rain forests (the
3 Congo basin forest ecosystem covers 200 million ha and is second only to the Amazon) and rich
4 mineral deposits (bauxite, cobalt diamond, phosphate rock, platinum-group metals, vermiculite
5 and zirconium) (Yager et al., 2004; UNEP, 2006ab). Nevertheless, this natural wealth is unevenly
6 distributed, largely unexploited and has sometimes been a source of conflict. For example,
7 mineral resources such as diamonds and oil deposits have been at the center of conflict as well
8 as economic development (Lelo and Makenzi, 2000; UNEP, 2006a).

10 1.2.1.1. Land

11 Sub-Saharan Africa covers an area of 2.4×10^9 ha. Only about 8% of this land is arable and
12 permanent cropland (Table 1.1). Over 60% of the population depends on agriculture for their
13 livelihood (WRI, 2005; ILO, 2005). One of the largest expansions of cropland in sub-Saharan
14 Africa in the last 20 years or so has been around the Great Lakes sub-region of eastern Africa
15 (Lepers et al., 2005).

17 **[Insert Table 1.1]**

19 Some of the main issues relating to land in SSA are land degradation and desertification, as well
20 as inappropriate and inequitable land-tenure systems that contribute to land degradation through
21 unsustainable practices, declining soil fertility, poor land management and conservation, and the
22 conversion of fragile natural habitats to agricultural and urban uses (UNEP, 2002a). Land use and
23 degradation are priority issues for the region because of their cross-cutting impacts on other
24 resources and human activities, particularly agriculture (UNEP, 2007a).

26 Land degradation is a loss of ecosystem function and services caused by disturbances from
27 which the system cannot recover unaided. Land degradation, which includes soil erosion by wind
28 or water, nutrient depletion, desertification, salinity caused by land-use and management, and
29 chemical contamination and pollution, is broader than soil degradation, since land includes
30 vegetation, water and microclimate (Bojo, 1996). Climate variability and unsustainable human
31 activity are associated with land degradation (UNEP, 2007b). Approximately 65% of agricultural
32 land, 35% of permanent pastures and 19% of forest and woodland in the region were estimated
33 to be affected by some form of degradation in 1990 (Oldeman, 1994; WRI, 2005).

35 There is considerable variance among countries in SSA as to estimates of the costs of losses
36 resulting from land degradation. In a 12-country study, the gross discounted cumulative loss (a

1 metric which takes into account the cumulative nature of land degradation) varied from less than
2 1 to 44% of GDP with, for the most part, modest annual productivity losses (1-3%) (Bojo, 1996).

3

4 Desertification occurs when land degradation processes affect dry lands and is the most
5 widespread form of land degradation in the region, affecting about 46% of Africa (Reich et al.,
6 2001). A recent examination of existing available data however does not support the claim that
7 the African Sahel is a desertification hotspot (Lepers et al., 2005), and in fact net greening has
8 been observed following the droughts of the early 1980s. Possible reasons for this include
9 changes in rainfall patterns, land use changes and improved land management (Olsson et al.,
10 2005).

11

12 Insufficient nutrient replacement in agricultural systems on land with poor to moderate potential
13 results in soil degradation. Whereas soil moisture stress inherently constrains land productivity on
14 85% of soils in Africa (Eswaran et al., 1997), soil fertility degradation now places an additional
15 serious human-induced limitation on productivity (Fig. 1.2).

16

17 **[Insert Figure 1.2]**

18

19 Approximately 25% of soils in Africa are acidic, and therefore deficient in phosphorus, calcium
20 and magnesium with often toxic levels of aluminum (McCann, 2005). Use of fertilizer in the region
21 is the lowest in the world with average applications of less than 9 kg of nitrogen and 6 kg of
22 phosphorus per ha, compared with typical crop requirements of 60 kg of nitrogen and 30 kg of
23 phosphorus per ha. Recent research estimates that every country in SSA had a negative soil
24 nutrient balance; the amount of nitrogen, phosphorus and potassium added as inputs was
25 significantly less than the amount removed as harvest or lost by erosion and leaching (Swift and
26 Shepherd, 2007). Although many farmers have developed soil management strategies to cope
27 with the poor quality of their soil, low inputs of nutrients, including organic matter, contribute to
28 poor crop growth and the depletion of soil nutrients.

29

30 1.2.1.2. Water

31 Freshwater resources are a critical input for agriculture, fisheries and livestock production as well
32 as many other economic activities. SSA has significant surface and groundwater resources but
33 they are unevenly distributed (FAO, 2002). The region is home to six of the world's major river
34 basins, namely the Congo, the Nile, the Niger, Lake Chad, Zambezi and Orange Rivers, and
35 includes large water bodies such as Lakes Victoria, Tanganyika and Nyasa (UNEP, 2002b).

36 Actual renewable freshwater resources average 6,322 m³ per capita, but this varies widely from

1 only 509 m³ per capita in Burundi to about 218,000 m³ per capita in the Congo (DR Congo data
2 not available) (WRI, 2005).

3

4 The agricultural sector is by far the biggest user of water resources; 88% of the total annual water
5 withdrawals in SSA in 2000 were from agriculture, 4% by industry and 9% for domestic use (WRI,
6 2005). With growing demand for water resources from all sectors, it is projected that by 2025, 13
7 countries in SSA will experience water stress (less than 1,700 m³ per capita per year) and
8 another ten countries will suffer from water scarcity (less than 1,000 m³ per capita per year)
9 (UNEP, 2002b).

10

11 Furthermore, degradation of water resources including watersheds, wetlands and groundwater is
12 occurring. For example, soil erosion leading to siltation of rivers and lakes adversely affects
13 people's health and access to clean water, and biodiversity, including fisheries, by changing the
14 ecological conditions under which species live (MA, 2005a).

15

16 1.2.1.3. Biodiversity

17 Sub-Saharan Africa is rich in both a variety and abundance of biological diversity. The region
18 closely corresponds to the Afrotropical biogeographical realm, which is the second most
19 abundant realm in terms of numbers of species and endemic species (amphibians, birds,
20 mammals and reptiles) after the Neotropical realm (Latin America and the Caribbean) (MA,
21 2005ab). Sub-Saharan Africa has a range of major habitat types or biomes, dominated by tropical
22 and sub-tropical grasslands, savannas and shrub-lands. Other major habitat types include
23 tropical and sub-tropical moist broadleaf forests, and deserts and xeric shrub-lands (MA, 2005c).
24 These biomes have the highest levels of overall species richness (MA, 2005b). The region
25 contains five internationally recognized "biodiversity hot spots" or areas of species richness and
26 endemism which are under particular threat, namely the Western Indian Ocean islands,
27 particularly Madagascar, the Cape Floristic Kingdom and the Succulent Karoo, both in southern
28 Africa, the Guinea Forest in western Africa, and the Eastern Arc Mountain Forests of eastern
29 Africa (UNEP, 2002a).

30

31 Plant and animal biodiversity are central to human well-being, most notably in food production but
32 also as a source of fiber for clothing, wood for implements, shelter, and fuel, and for natural
33 medicines and products, as well as having strong cultural and spiritual significance. Agricultural
34 biodiversity encompasses domesticated crop plants and animals used for livestock or
35 aquaculture, as well as wild food sources, their wild crop relatives, and "associated" biodiversity
36 that supports agricultural production through nutrient recycling, pest control and pollination (Wood
37 and Lenne, 1999). A number of important agricultural crops originated in Africa including several

1 species of millet and sorghum, the oil palm and coffee (UNEP, 2006a). The Afrotropic terrestrial
2 realm is among the most productive in terms of net primary productivity and biomass values (MA,
3 2005b), suggesting that agricultural output in this region could also be highly productive under
4 suitable conditions.

5
6 Principal threats to biodiversity in Africa include land use and land cover change, mainly through
7 conversion of natural ecosystems, particularly forests and grasslands, to agricultural land and
8 urban areas. It is likely that land clearing and deforestation will continue and hence threaten
9 genetic diversity as species loss occurs.

10
11 Only about 6% of sub-Saharan Africa, or 142 million ha, falls under protected areas (WRI, 2005),
12 with the best protected being the savannah habitats of eastern and southern Africa, while the
13 least protected are found in Madagascar, the drier parts of South Africa, and the most heavily
14 deforested parts of West and East Africa (Fig. 1.3). Plants are also less well covered by the
15 network of protected areas than charismatic animals, such as large mammals (UNEP, 2006a).

16
17 **[Insert Figure 1.3]**

18
19 1.2.1.4. Forests

20 About 19% of the land area of SSA is classified as forest (defined as more than 10% tree cover)
21 although estimates range between 18-52% depending on the percentage tree covers (WRI,
22 2005). The percentage of an individual country covered by forests ranges from a high of 85% in
23 Gabon to a low of 0.5% in Lesotho (FAO, 2007a). The greatest extent of forest cover is found in
24 Central Africa -- the Congo basin covers 200 million ha and is the world's second largest
25 continuous tropical rain forest after the Amazon (Bruinsma, 2003). Other significant areas include
26 the Guinea Forest of West Africa, the Eastern Arc Mountain Forests of East Africa, the Mopane
27 and Miombo woodlands of southern Africa and in eastern Madagascar.

28
29 Forests and woodlands are facing increasing pressures from a growing human population
30 including encroachment and conversion for agricultural expansion, illegal logging and poaching of
31 wild animals, overgrazing leading to loss of woody vegetation, and the impacts of conflicts. One
32 of the prominent forest-cover changes in sub-Saharan Africa has been in the sub-tropical dry
33 Miombo forests in southern Africa (Lepers et al., 2005).

34
35 Forests provide a number of important ecosystem services: provisioning services such as
36 supplying timber and non-timber forest products including wild foods, medicines, pharmaceuticals
37 and genetic resources; regulating services such as flood and climate regulation; cultural services

1 including spiritual, aesthetic, as well as recreational values; and supporting services including
2 primary production, nutrient cycling and soil formation. The large majority of households in sub-
3 Saharan Africa, rural and urban, still depend on biomass in the form of wood or charcoal for their
4 energy needs and many also depend on wood and fiber for their shelter and household items,
5 and for income generation (see SSA Chapter 2).

6 7 1.2.1.5. Climate

8 Climate variability is the single most important atmospheric phenomena in sub-Saharan Africa.
9 The region experiences a high degree of variability and uncertainty in climatic conditions, with
10 associated droughts and floods, which occur regularly (UNEP, 2002a). A recent analysis of long-
11 term trends (1900 to 2005) indicates rising temperatures in Africa as a whole, as well as drying,
12 or decreased precipitation, in the Sahel and southern Africa (IPCC, 2007a). In addition, the El
13 Nino Southern Oscillation (ENSO) causes significant climatic disturbances in many parts of the
14 continent, either inducing drought or flooding, or increasing sea temperatures, which lead to
15 cyclones, particularly over the Indian Ocean. Overall, longer and more intense droughts have
16 been observed since the 1970s, particularly in the tropics and sub-tropics (IPCC, 2007a).

17
18 Generally the continent suffers from relatively little atmospheric pollution, except in major cities
19 where emissions from industry, motor vehicles and household use of biomass for energy are
20 rising (UNEP, 2006a). Nevertheless, sub-Saharan Africa is the most vulnerable region to the
21 impacts of climate change (IPCC, 2007b) and yet it contributes the least in terms of greenhouse
22 gas (GHG) emissions such as carbon dioxide, the principal GHG responsible for global warming.
23 The region only contributes about 2-3% of global CO₂ emissions from energy and industrial
24 sources. On average 0.8 tonnes per capita were released in 2000 compared with a global per
25 capita average of 3.9 tonnes (12.4 tonnes per capita in high income countries and 19.8 tonnes
26 per capita in the United States, the world's highest emitter) (UN, 2006; World Bank, 2006). In
27 other words, an inhabitant of the USA emits about 24 times as much CO₂ as an inhabitant of sub-
28 Saharan Africa.

29
30 There is now unequivocal evidence that the climate system is warming, and that this is very likely
31 a result of observed increases in anthropogenic greenhouse gas (GHG) levels. These increases
32 result primarily from agriculture- both from inputs such as fossil fuels, and land-use changes
33 associated with agricultural practices (IPCC, 2007a). Climate data for Africa for the last 30 to 40
34 years shows that if the current trends continue, by 2050, SSA will be warmer by 0.5 to 2 C°, and
35 drier, with 10% less rainfall and water loss exacerbated by higher evaporation (Nyong, 2005).
36 Sub-Saharan Africa is vulnerable to climate change and global warming because of widespread
37 poverty and limited adaptive capacity (IPCC, 2007b). The impact of these climatic changes are

1 already manifesting in SSA as evidenced by the loss of 82% of ice mass on Kilimanjaro
2 mountain, 40-60% decrease in available water in Niger, Senegal, and Lake Chad during the last
3 two centuries (CBD, 2007). The impacts of climate change are likely to be manifest at various
4 spatial and temporal scales. These include sea level rise and flooding of low-lying coastal and
5 estuarine areas (among the most densely populated). Climate change will particularly affect small
6 islands such as those of the western Indian Ocean (e.g., Seychelles, Comoros and Mauritius) as
7 well as mangrove forests, with consequences for coastal fisheries.

8
9 Changes in rainfall and temperature patterns are likely to negatively affect water availability and
10 growing conditions, reducing food production and security, as well as hydroelectricity production.
11 Biodiversity and ecosystems, including agroecosystems, are likely to be severely affected as
12 many species may not be able to adapt or migrate to more suitable areas. The intensity of tropical
13 cyclones is also likely to increase, and the cyclone zone may expand, making the western Indian
14 Ocean islands even more vulnerable than they already are. Patterns of disease distribution are
15 also likely to change (IPCC, 2007b; UNEP, 2002b). Although global efforts to address the causes
16 of climate change are underway, global warming and sea level rise are likely to continue for
17 centuries to come because of the timescales associated with climate processes and feedbacks

18
19 Countries in SSA have a wide diversity of farming systems. Farming systems in SSA can be
20 identified by the following four types (IAC, 2004):

- 21 • The maize- mixed system, which is based primarily on maize, cotton, cattle and goats
- 22 • Cereal/root crop-mixed system, which is based on maize, sorghum, millet, cassava, yams
23 and cattle
- 24 • Irrigated system, based on maize, sorghum, millet, cassava yams and cattle.
- 25 • The tree crop-based system, anchored in cocoa, coffee, oil palm and rubber, mixed with
26 yams and maize.

27 Subsistence farming dominates the farming system in SSA. There is little application of
28 technology, particularly with food crops, leading to low agricultural productivity. Cash crops tend
29 to be better developed than food crops (IAC, 2004). Farm sizes tend to be small and decline over
30 time (Ellis, 2005; Nagayets, 2005). Average farm size in four SSA countries (Kenya, Uganda,
31 Tanzania and Malawi) was about 1.55 ha (Ellis, 2005). Generally, the average size of land
32 holdings declined from 1.5 hectares in 1970 to 0.5 hectares in 1990 (Nagayats, 2005). The
33 decline of farm size partially reflects the exhaustion of land frontiers in most SSA countries. It is
34 important therefore to take into account the peculiar needs and concerns of farmers engaged in
35 these various farming systems when developing agricultural technologies or during extension
36 delivery.

37

1 **1.2.2 Social, economic, cultural and political characteristics**

2 Sub-Saharan Africa is a region that is often divided for different types of analysis based on social,
3 economic, cultural, political and historical sub-regional characteristics. For a more productive
4 division for discussion of AKST, SSA is considered as comprised of six distinct regions: East
5 Africa, Sudano-Sahel, West Africa, the Central Africa, Southern Africa and the Islands of the
6 Indian Ocean (Lelo and Makenzi, 2000; Table 1.2). About one-half of the countries comprising
7 SSA are Anglophone and one-half are Francophone. The colonial legacy influences
8 considerations of economic integration and joint development activities, including agricultural
9 development. This fragmentation presents a roadblock to regional synergy and economies of
10 scale.

11
12 **[Insert Table 1.2]**

13
14 Present day boundaries of SSA countries are a legacy of colonialism (Britannica, 2007). The
15 European insistence on drawing borders around territories to isolate them from those of other
16 colonial powers often had the effect of separating otherwise contiguous political groups, or forcing
17 traditional enemies to live side by side with no buffer between them. These changes introduced
18 cultural dichotomies detrimental to the native inhabitants. For example, although the Congo River
19 appears to be a natural geographic boundary, there are groups that otherwise share common
20 language and culture on both sides of the river. However, the division of the land between
21 Belgium and France created boundaries that isolated groups with similar cultures.

22
23 Sub-Saharan Africa has the world's fastest growing populations, estimated at 2.7% a year,
24 compared to 2% and 2.2 % a year in Asia and Latin America respectively (Haggblade et. al,
25 2004). At the same time the per capita food production index shows a decline from 1.0 in 1961 to
26 0.82 in 2002 while the index in Asia and Latin America increased from 1.0 in 1961 to 1.82 and
27 1.25 respectively (Haggblade et. al, 2004). The population is unevenly distributed with semi-arid
28 areas not as densely populated as some of more fertile areas (Lelo and Makenzi, 2000). The
29 country with the largest population is Nigeria with 136.5 million. It is followed by Ethiopia with 68.6
30 million and the Democratic Republic of Congo with 53.2 million.

31
32 In sub-Saharan Africa women play a central role in agricultural production (growing about 80% of
33 staple food crops), yet most of their contribution goes unrecognized. They are also critical to
34 household well-being, with the majority of rural and low-income urban women performing up to 50
35 hours per week of domestic tasks, including caring for children, and performing essential social
36 functions within their communities. All of these responsibilities are borne by women and yet males
37 are the primary household decision makers and in many countries boys are still the recipients of

1 most educational opportunities (Manuh, 1998; Bruinsma, 2003; Harsch, 2004). In addition,
2 women have been among those most affected in SSA by HIV/AIDS, structural adjustment
3 programs and civil strife and conflict. The majority of refugees are women and children (Manuh,
4 1998).

5
6 The economies of SSA are diverse and shaped by international trade relations. Currently, SSA
7 and the rest of African countries, Caribbean and Pacific countries are faced with critical
8 negotiations with the European Union concerning the establishment of Economic Partnership
9 Agreements (EPAs).

10
11 Further diversity is exhibited in languages: SSA is the most diverse in the world with over two
12 thousand different indigenous languages (Kim and Kim, 2003). Most farmers in the rural areas
13 use these indigenous languages while extension agents rely more on exogenous ones such as
14 English and French. This reliance limits the effectiveness of extension communication

15 16 **1.2.3 Hunger, nutrition and human health**

17 Progress has been made against hunger globally, but the slow growth of agricultural outputs and
18 expanding population has led to setbacks in regions like SSA (IAC, 2004). Hunger tends to be
19 concentrated among the landless or among farmers whose plots are too small to provide for their
20 needs.

21
22 About 33% and 31% of people in sub-Saharan Africa were undernourished during 1990-92 and
23 2001-2003 respectively (FAO, 2007b) with 32% of children under five years of age characterized
24 as underweight (FAO, 2002). The status of undernourishment is varied among SSA countries.
25 For example, more than 60% of the undernourished population is in East Africa. More than half of
26 the populations in the Democratic Republic of Congo and Mozambique are classified as
27 undernourished, while Angola, Cameroon, Ethiopia, Kenya, Tanzania, and Zambia show
28 prevalence rates between 40 and 50% (FAO, 2002). However, the absolute number of
29 undernourished people increased from 172 millions in 1990-92 to 209 million in 2001- 2003 (FAO,
30 2007b). This means that the reduction in undernourishment has not kept pace with the population
31 growth rate. The social and economic consequences of malnutrition are widely felt, not only in the
32 health sector but also in education, industry, agriculture, transport, human resources and the
33 economy in general.

34
35 In the last decade, 14 countries in SSA have managed to reduce hunger by 25%. These
36 countries had better economies and investment in interlinked socio-economic policy (UNECA,
37 2005). However, the majority of countries in SSA do not meet the WHO standard of at least 20

1 physicians per 100,000 people (World Bank, 2006).

2

3 An estimated 24.5 million people were living with HIV at the end of 2005 and approximately 2.7
4 million new infections occurred during that year. HIV/AIDS is adversely affecting the population
5 structure of some parts of sub-Saharan African countries as the vast majority of people living with
6 HIV and AIDS in Africa are between the ages of 15 and 49 and more than 12 million children are
7 now orphans because of AIDS (Deame, 2001). However, the number of adults (over age 15)
8 living with HIV and AIDS varies greatly among SSA countries (AVERT, 2007). For example, in
9 Senegal the prevalence is under 1% of the population, whereas in South Africa and Zambia
10 around 17-19% of that age group is infected. Rates exceeding 20% are recorded in Botswana
11 (24.1%), Lesotho (23.2%), Swaziland (33.4%) and Zimbabwe (20.1%). West Africa has been less
12 affected by HIV, but the prevalence rates in some countries are increasing. Prevalence is
13 estimated to exceed 5% in Cameroon (5.4%), Côte d'Ivoire (7.1%) and Gabon (7.9%).

14

15 The experience of Uganda shows that HIV prevalence can fall; by 2001 HIV prevalence was
16 around 5%, down from around 15% in the early 1990s. This change is thought to be largely due
17 to intensive HIV prevention campaigns. More recently, similar declines have been seen in Kenya,
18 Zimbabwe and urban areas of Zambia and Burkina Faso (AVERT, 2007).

19

20 HIV and AIDS prevalence in SSA is having a heavy toll on the availability of productive labor.
21 Appropriate agricultural technologies do not necessarily imply labor intensive technologies
22 (UNECA, 2005) and should correspond to the available labor force of a given area. Another
23 related problem, given the high food insecurity in SSA, is the improvement of nutrition for HIV
24 infected people to reduce their chances of developing AIDS.

25

26 Malaria also contributes to the health challenges in SSA. It is estimated that 90% of the people
27 who die from malaria are in SSA (World Bank, 2006). HIV and AIDS, malaria and other health
28 factors result in premature deaths that disrupt the transmission of agricultural knowledge from
29 one generation to the next, and reduce the labor force.

30

31 **1.2.4 Poverty, livelihoods and the economy**

32 The rate of economic growth in SSA has improved in the last 10-15 years (McKinley, 2005), but
33 has remained low and in last few decades has had the worst growth performance of any region in
34 the world (Garner, 2006; World Bank, 2006). Poor performance has been attributed to low
35 investment, inappropriate policies and institutions and geographical constraints.

36

37 Between 1996- 2005 (World Bank, 2006), fifteen SSA countries (Mozambique, Rwanda, Cape

1 Verde, Uganda, Mali, Botswana, Ethiopia, Tanzania, Mauritania, Benin, Ghana, Senegal, Burkina
2 Faso, Gambia and Cameroon) recorded annual growth rates of more than 4.5%. During the same
3 period, thirteen SSA countries recorded growth rates of only 1.3% (Swaziland, Kenya, Lesotho,
4 Eritrea, Comoros, Seychelles, Cote d'Ivoire, Burundi, Sierra Leone, central African republic,
5 Guinea-Bissau, DRC Congo, and Zimbabwe) (World Bank, 2006).

6

7 Between 1998- 2000, agricultural GDP averaged 29% of the total GDP and agricultural labor
8 comprised 66.6% of the total labor force in SSA (Beintema and Stads, 2004). Rural livelihoods in
9 SSA are diversified between farm and non-farm activities but are largely dependent on
10 agriculture, either directly or indirectly as agriculture is both a source of income and means to
11 food security (Pinstrup-Andersen and Cohen, 2001).

12

13 Agricultural research directly contributes to growth and development (IAC, 2004); stimulating
14 agricultural growth in SSA can contribute significantly to economic growth and poverty reduction.
15 By increasing food availability and incomes and contributing to asset diversity and economic
16 growth, higher agricultural productivity and supportive pro-poor policies allow people to break out
17 of the poverty-hunger-malnutrition trap (Garner, 2006). Improving the productivity and the
18 economic returns of agriculture can have immediate effects on poverty and hunger (Kydd, 2002).

19

20 A nation's ability to solve problems and initiate and sustain economic growth depends partly on its
21 capabilities in science, technology, and innovations (UN Millennium project, 2005). Scientific,
22 technological, and innovation capacity are often associated with economic growth (IAC, 2004).
23 SSA and South Asia have the lowest access to information and communication technologies
24 (Pigato, 2001).

25

26 Poverty reduction requires a combination of economic growth and a reduction in inequality
27 (Okojie and Shimeles, 2006). Recent studies have shown that both income and non-income
28 inequalities are high in sub-Saharan Africa (Okojie and Shimeles, 2006; World Bank, 2006;
29 Blackden et al., 2006) with the level of inequality lower in rural areas (Okojie and Shimeles, 2006;
30 Table 1.3) Countries with high initial income inequality find economic growth to be less effective in
31 reducing poverty (Okojie and Shimeles, 2006). For example, in Tanzania the pace of poverty
32 reduction would have been substantial had it not been for the dampening effects of a rise in
33 inequality in the wake of economic growth (Demombynes and Hoogeveen, 2004).

34

35 **[Insert Table 1.3]**

36

1 Gender inequalities also play a significant role in accounting for SSA's poor growth and poverty
2 reduction performance (Townsend, 1999; Blackden, 2006). Analysis from Kenya suggests that
3 giving women farmers the same education and inputs as men increases yields by as much as 22
4 percent. For Burkina Faso, analysis of household panel data suggests that farm output could be
5 increased 6–20% through a more equitable allocation of productive resources between male and
6 female farmers (World Bank, 2001).

7
8 The nature of farming is changing in many African countries because of demographic changes:
9 the farm population is aging, rural male workers are migrating to urban areas, and many rural
10 areas are becoming urbanized (IAC, 2004). These changes imply an increasingly diverse
11 clientele for agricultural research and the need to give much more attention to women farmers
12 and older farmers. Moreover, although most poor, rural Africans still depend heavily on
13 agriculture for their livelihoods, many also have diversified into non-farm income sources,
14 including small-scale, rural non-farm enterprises, non-farm employment and seasonal migration.
15 As a result, many small farms may give lower priority to farming than non-farm activities and may
16 not take up promising new technology options that compete for labor. On the other hand, more
17 diversified households may have more capital of their own to invest in new agricultural
18 technologies and resource improvements and be better able to withstand shocks and risks.

19
20 Smallholders dominate the agricultural sector and have shown a capability of adopting new
21 technology options where the right incentives and market opportunities exist (IAC, 2004). Each
22 10% increase in smallholder agricultural productivity in SSA can move almost 7 million people
23 above the dollar-a-day poverty line (IFPRI, 2006). Due to the growth multipliers between
24 agriculture and the rural non-farm sector, the urban poor benefit along with the rural poor from
25 broad-based agricultural productivity growth (IAC, 2004).

26 27 **1.2.5 Agricultural R&D investments**

28 Despite the evidence of high returns from agricultural research and its importance for agricultural
29 development, growth in agricultural research and development (R&D) investments has stagnated
30 in sub-Saharan Africa. In addition, due to political, social, and economic unrest as well as
31 institutional changes (mergers, subdivisions, relocation, reshuffling and so on), research systems
32 have experienced greater instability than those in other regions in the world. As a result public
33 agricultural research spending has fluctuated in many countries (Beintema and Stads, 2006).

34 Most of the growth in sub-Saharan African agricultural R&D spending took place in the 1960s
35 when real (inflation-adjusted) investments in agricultural R&D increased by an average of 6.3%
36 per year. Annual growth declined from 1.3% during the 1980s to only 0.8% in during the 1990s
37 (Table 1.4). As a result sub-Saharan Africa's share in total spending on agricultural R&D

1 worldwide declined from 8% in 1981 to 6% two decades later. This is a contrasting trend with that
2 of other regions in the developing world that experienced an increase in their global shares. In
3 2000, sub-Saharan Africa's public agricultural R&D spending totaled \$1.5 billion (in 2000
4 international dollars). The three largest systems, in terms of expenditures, accounted for more
5 than 40% of the regional total.

6

7 The role of the private sector in R&D in SSA is still small and many of the private-sector activities
8 focus solely on the provision of input technologies or technological services for agricultural
9 production, with most of these technologies being produced in industrialized countries. In 2000,
10 private firms in sub-Saharan Africa invested \$26 million in agricultural R&D, representing only 2%
11 of total public and private research investments; almost two thirds of the private-sector investment
12 was done in South Africa.

13

14 **[Insert Table 1.4.]**

15

16 The regional averages on agricultural R&D spending mask considerable differences among the
17 27 sub-Saharan countries for which time series data were available (Table 1.5). More than half of
18 these sample countries spent less on public agricultural R&D in 2000 than 10 years earlier.
19 Growth rates in Burundi, the Republic of Congo, and Sudan were below negative 10%, for
20 example. Declines were the result of the completion of large donor-funded projects (Burkina
21 Faso, Guinea, Madagascar, Niger, Togo, and Zambia) or political unrest (Burundi and Sudan).

22

23 **[Insert Table 1.5.]**

24

25 Agricultural research in sub-Saharan Africa became increasingly dependent on donor funding
26 toward 2000; but it appears that the share of donor contributions in total funding declined in the
27 later half of the 1990s—at least for the 23 countries for which detailed data were available. These
28 declines resulted in part from the completion of a large number of World Bank projects in support
29 of agricultural R&D or the agricultural sector at large. Donor contributions (including World Bank
30 loans) accounted for an average of 35% of funding to principal agricultural research agencies in
31 2000. These regional averages mask great variation among countries. In 2000, donor funding
32 accounted for more than half of the agricultural R&D funding in 7 of the 23 countries. Eritrea, in
33 particular, was highly dependent on donor contributions. Its principal agricultural research agency
34 received more than three-quarters of its funding from donors. In contrast, donor funding was
35 virtually insignificant in Botswana, Malawi, Mauritius, and Sudan (under 5%). Funding through

- 1 sources other than government or donors, such as internally generated revenues, was relatively
- 2 small, representing 11% of total funding in 2000 (Beintema and Stads, 2006).