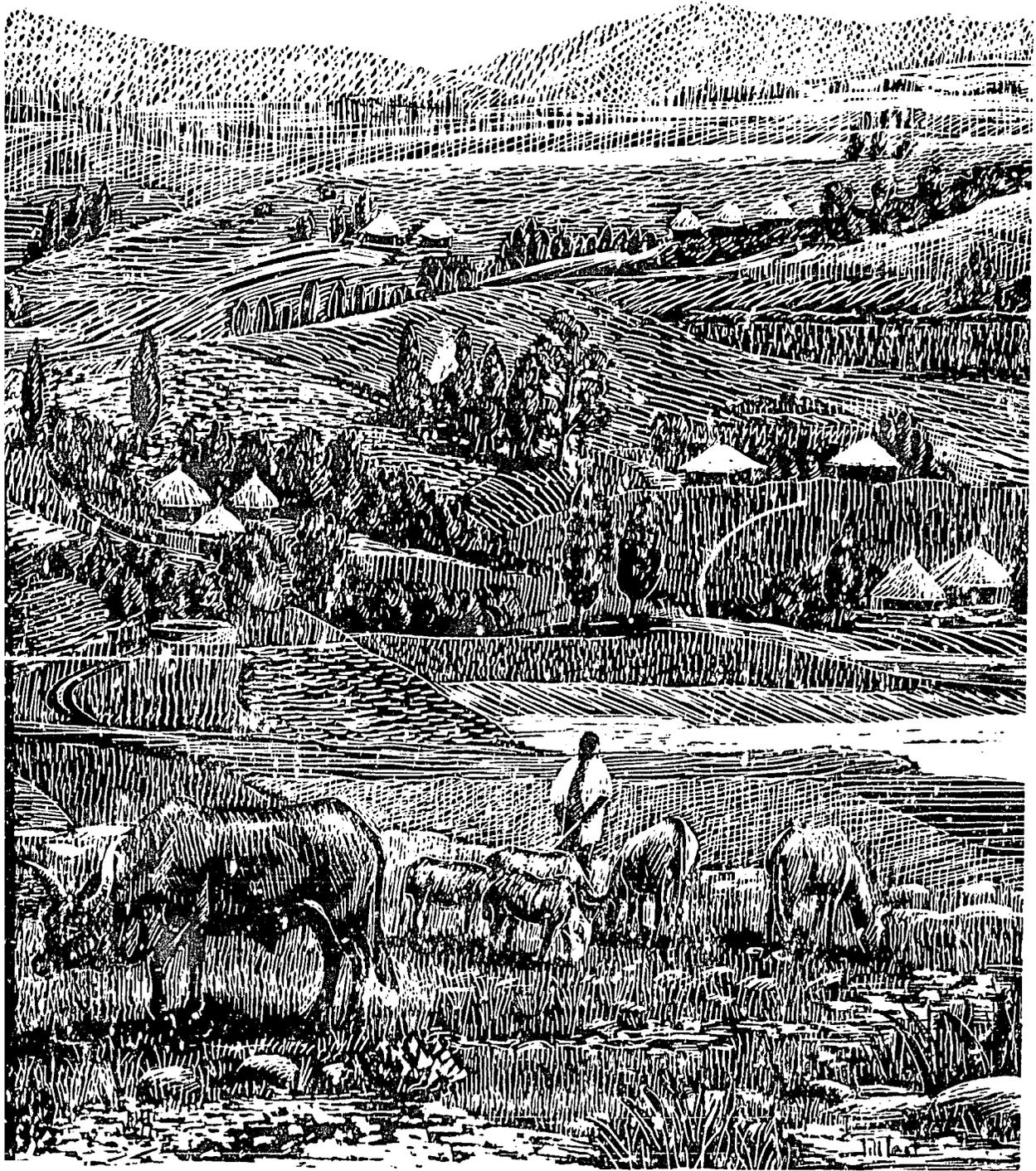
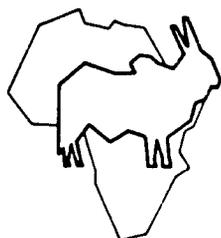


ILCA's Strategy and Long-term Plan



International Livestock Centre for Africa

ILCA's Strategy and Long-term Plan



**International Livestock Centre for Africa
Addis Ababa, Ethiopia**

- 2 -

The 1st edition of this document was submitted to the 42nd Meeting of the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR), Rome, 16–24 March 1987.

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What is ILCA?

The International Livestock Centre for Africa (ILCA) was established by the Consultative Group on International Agricultural Research (CGIAR) in 1974. Out of the 13 international agricultural research centres in the Group it is one of two devoted to livestock research; the other is the International Laboratory for Research on Animal Diseases (ILRAD).

A need to focus?

The [EPR] panel considered ILCA's mandate to be valid... The panel strongly recommended that ILCA should endeavour to focus its research activities, ensure continuity of effort and avoid spreading its resources too thinly over a broad spectrum of activities. – Prof. C C Thomsen, Fortieth Meeting of the Technical Advisory Committee (TAC) of the CGIAR, Cali (Colombia), June/July 1986.

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Preface

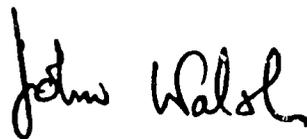
This strategy document was prepared in response to the perceived needs for the Centre to make choices on how its limited resources should be allocated to maximise impact, and for the Centre's broad 1986 work programme to give way to a more focused one. It was deemed necessary also to identify where and how the core skills of ILCA might best complement those of other institutions.

ILCA's strategy and plan up to the year 2000 is outlined, with special emphasis on the work plan for the next 5- to 10-year period. The strategy is unlikely to alter over the coming years, but the work plan will be subject to periodic review according to both ILCA's progress and impact, and the changes in priorities that are likely to evolve over time. We thus distinguish between the need for a focused strategy and for a flexible organisational structure necessary to achieve innovation. ILCA's internal structure will retain the basic characteristics of any successful research centre, namely scientific skills, flexibility to respond to change, innovation, and the ability to learn from and work within the external environment.

ILCA's Strategy and Long-term Plan was prepared jointly by the Centre's management and Board of Trustees, in consultation with the staff of ILCA and their counterparts in the national agricultural research systems (NARSs) of sub-Saharan Africa. It is our response to recommendations made by our recent External Programme and Management Reviews (EPR/EMR) that we should carry out a strategic planning exercise in which strong participation by the future implementers of the strategy should be sought.

ILCA's future role had already been discussed in meetings between the team leaders of our field programmes and their national counterparts, held in late 1986. In January 1987 the staff and Board of ILCA met in Addis Ababa for a 3-day session on ILCA's future strategy. This meeting allowed us to take into account the advice of NARS representatives on our Board of Trustees, as well as the experience of representatives of TAC, the CGIAR Secretariat, and of other observers. ILCA also maintains continuous contact with its clients through research networks and training activities. This strategy document was also discussed in detail by the participants of the Fourth Biennial Meeting of ILCA and Leaders of African Livestock Research, Development and Training in Tropical Africa at ILCA headquarters in July 1987.

Other important influences on our strategy were the 1986 World Bank reviews of livestock research in West, East and southern Africa, attended by ILCA staff and Board members, and visits to national universities and other bodies during the same year. Last but not least, we have also taken into account TAC's own assessment of research priorities for the CGIAR system.



John Walsh
Director General
May 1987

ILCA's Mandate

ILCA's Memorandum of Agreement, signed in 1974 with the Government of Ethiopia, states that the Centre's purpose is

... to assist national efforts which aim to effect a change in the production and marketing systems in tropical Africa so as to increase the sustained yield and output of livestock products and improve the quality of life of the people in this region.

More specifically, ILCA's terms of reference, also set out at that time, are to:

- retrieve, assemble and make available in both English and French relevant information on animal production in tropical Africa;
- establish multidisciplinary research teams to study existing animal production systems, develop new or modified methods of production and define priorities for other research;
- support, supplement and cooperate with national and regional research stations or programmes in developing a fully coordinated research programme related to the urgent needs of livestock development;
- develop the capacity to undertake research programmes in specific aspects of livestock production appropriate to an international centre;
- organise or assist in organising seminars, technical conferences and training courses for national staff engaged in livestock research, extension, planning and production, in order particularly to increase regional competence in the interdisciplinary systems approach to livestock research and development;
- make available statistical support, information or advice to national, regional or international authorities in the various fields relating to animal production in which the Centre is actively engaged;
- engage in such other activities as may be found necessary to further the Centre's objectives.

Chapter 1

Introduction

Background

- 1.001. The need for ILCA to sharpen the focus of its programme was stressed by the Centre's EPR/EMR in April 1986 and reiterated by TAC at its 40th meeting in June/July the same year. In November 1986 the Centre's strategy was a major subject of debate at the International Centres' Week in Washington. Here are some quotations reflecting the background against which ILCA's strategy and long-term plan have been prepared:

There can be few problems more relevant to the future development of sub-Saharan Africa than those ILCA is seeking to solve. Significant progress has been made, valuable programmes are in place and prospects for impact are promising...

Report of the 40th TAC Meeting, June/July 1986.

The [EPR] panel considered ILCA's mandate to be valid...

The panel strongly recommended that ILCA should endeavour to focus its research activities, ensure continuity of effort and avoid spreading its resources too thinly over a broad spectrum of activities.

Prof C C Thomsen, Chairman of ILCA's EPR, 40th TAC Meeting, June/July 1986.

In the absence of an agreed long-term plan, ILCA's diffuse programme strategy was a 'soft-spot'. A broad mandate and a broad programme strategy were not compatible...

Prof L S Hardin, Chairman of ILCA's EMR, 40th TAC Meeting, June/July 1986.

The strategy that ILCA should follow... [should]... ensure continuing thought and debate on what is a continually changing situation; the key criteria of innovation and flexible thinking [must] continue to characterise our approach to this subject...

Dr P J Brumby, Director General, ILCA, October 1986.

The preparation of a strategy paper for ILCA is not an easy task, because of the broad mandate which, theoretically, authorises ILCA to do anything relating to livestock in sub-Saharan Africa. It is further complicated by the farming systems approach, the current existence of 15 to 20 ILCA programmes in several different countries, and the very wide range of different views on priorities held by our client countries, and also by you, our donors.

B Nestel, Chairman of ILCA's Board of Trustees, Centres' Week, November 1986.

Africa's food needs

- 1.002. Over the past two decades, land and labour productivity in sub-Saharan Africa has remained static and per caput food production has declined sharply. The shortfall in food production, coupled with rapid population growth, has led to increasing dependence on food imports.

- 1.003. Sub-Saharan Africa's imports of basic food staples are growing at 8% a year, and annual food imports, currently about 14 million tonnes, are projected to rise to 40 million tonnes by the year 2010. Over the period 1975–83, imports of cereals rose from 3.6 to 10.4 million tonnes, while imports of meat and milk increased from 83 000 and 1.02 million tonnes to 240 000 and 2.5 million tonnes respectively. In recent years (1983–85), sub-Saharan Africa has imported annually about 139 000 tonnes of meat and about 2.5 million tonnes of liquid milk equivalent (see 2.050–2.052).
- 1.004. Africa's escalating demand for food will mean added pressure on natural resources that are already threatened. There is thus an urgent need for technological innovations that will raise the productivity of both livestock and crops without causing further environmental degradation. While trying to exploit Africa's resources better, we must ensure their continual renewal through sound land management and integrated crop–livestock production.

Livestock production in Africa

- 1.005. There are aspects of livestock production in Africa which have no parallel in cropping systems. They relate to the importance of livestock in the arid and semi-arid zones and the difficulty of improving feed supplies there; the special role of livestock in African cultures; the longer generation time in livestock compared to crops; and the less predictable response of livestock production to technical innovation.
- 1.006. Furthermore, since research and development in sub-Saharan Africa have tended to focus on crops rather than on animals, few technological interventions have been developed and the number of technologists working in the region is low. All these constraints have been exacerbated by highly variable rainfall, fragile ecology, underdeveloped infrastructure and major animal diseases, the latter especially in the humid and subhumid zones where the potential for feed production is greatest.
- 1.007. When ILCA started work in the mid-1970s it was believed that, despite these constraints, the efficiency of livestock production in sub-Saharan Africa could be improved. Moreover, it was becoming increasingly accepted that improvements in livestock output, and in the associated supply of technical services to agriculture, could play an important role in development and in increasing total food production in the region. This belief was reiterated in a recent review of agricultural research in West Africa, in which it was stated that “increasing livestock productivity and production can bring large economic benefits to many West Africans” (1).
- 1.008. ILCA was established partly in response to the lack of impact on production made by disciplinary research. It was given a specific mandate to adopt a farming systems approach to research, in order to understand production systems before undertaking component research to find solutions to producers' problems.

ILCA's development and achievements

- 1.009. ILCA has now been in existence for 12 years. The first years were spent in institution building and establishing infrastructure, while the research programme studied the factors influencing the output of different farming systems. After 1981 ILCA concentrated on developing technical expertise at headquarters, and, increasingly, on designing and testing technological interventions. By 1986, we had well established research, training and

information programmes at headquarters to support our field research programmes.

- 1.010. Some of our more successful research has included the testing of alley farming in the humid zone and fodder banks in the subhumid zone. In the highlands, water-harvesting and soil-conservation techniques have been developed using simple animal-drawn implements. Simple milk processing technology has been successfully tested in Ethiopia, and progress has been made in improving the cultivation and productivity of Vertisols. We have shown that trypanotolerant animals can be productive under challenging conditions, and confirmed that using chemotherapy to control trypanosomiasis can open up new areas for intensive livestock production. ILCA has assumed a leading role in the collection and distribution of forage germplasm. We have also provided a wide range of information services to national livestock researchers through our Documentation Centre at headquarters. All these achievements are described in more detail in 3.067 to 3.078.

Strategy formulation

- 1.011. ILCA's formal mandate is less specific than that of other centres in the CGIAR system. Although it defines the region in which the Centre shall work, it specifies neither the commodities nor the species on which to focus. Nor does it name ecological zones or production systems.
- 1.012. Neither of ILCA's two External Programme Reviews (1981 and 1986) recommended any change in the Centre's formal mandate. The impact study of the CGIAR (2) found no clear relation between the impact of centres and the degree of focus in their mandates, but this was partly because of confounding factors such as age of centre and amount of research predating its establishment.
- 1.013. According to the study, a more important factor in impact was the adequacy of resources provided to match designated research goals. In ILCA's experience, a diffuse mandate can give rise to a disproportionate amount of time spent debating resource allocation rather than solving practical problems.
- 1.014. By the end of 1986 it was obvious that we had to make hard choices on how limited resources should be allocated so as to maximise ILCA's impact. The Centre's broadly based programme had to give way to a more focused one. We also had to identify where and how the core skills of ILCA might best complement those of other institutions.

African regional priorities

- 1.015. Reflecting concern about future food production in Africa, a number of studies (e.g. ref. 3) published in 1986 stressed the need to strengthen national research and extension, to conduct research with a farming systems approach and to increase the sustainability and stability of agriculture.
- 1.016. The World Bank review of agricultural research in West Africa (1)*, carried out in consultation with NARSs, suggested that research resources should be concentrated "on a few high-priority activities that hold substantial promise for major and sustained benefits", while recognising that "coming up with the correct choices may not be easy".

* A similar review was conducted in East and southern Africa, and is currently under consideration.

- 1.017. The research priorities recommended for the ruminant livestock sector included animal disease (particularly trypanosomiasis and gastrointestinal parasites); gathering and evaluating field data on local stock; application of animal traction in the semi-arid and subhumid zones; animal nutrition, with emphasis on increasing feed resources and improving the mineral content of diets; work on legumes in all zones and on grasses for mixed farms in the subhumid zone; crop–livestock interactions; economic evaluation of livestock production systems; increasing milk yields and developing low-cost methods for processing and preserving milk; and reducing neonatal mortality in small ruminants. Incremental increases in livestock productivity and production were foreseen, rather than a revolutionary breakthrough.
- 1.018. The report also suggested that a West African centre for research be established, possibly managed by ILCA. The centre's work would focus on legume agronomy, trypanotolerance, animal nutrition and the coordination of networks; its priority target would be the subhumid zone.

Lagos Plan of Action

- 1.019. The priorities identified by the World Bank review echo many of the concerns of African countries expressed in the Lagos Plan of Action (4). Recognising that the livestock subsector has an important role to play in national economies, the plan recommended that increased efforts should be made to improve animal health (including the control of trypanosomiasis and tick-borne diseases, and the eradication of foot-and-mouth disease), animal breeding, feed resource development, training, and infrastructural development.

TAC and CGIAR priorities

- 1.020. The 1985 TAC review of CGIAR priorities and future strategies (5) outlined the system's long-term goal as "increasing sustainable food production in developing countries in such a way that the nutritional level and general economic well-being of low-income people are improved". Research was to focus on developing technology for sustainable food production, including production of milk and meat. The operational strategy emphasised a multidisciplinary commodity approach, cooperation among the IARCs and with global research systems, and evolution towards a service function to NARSs.
- 1.021. While recognising that priority setting is a complex process, the TAC review suggested some priorities at the CGIAR level. The two primary areas of concentration identified in livestock research were animal nutrition and health.
- 1.022. TAC recommended that research on small ruminants should be strengthened in the medium to longer term, that increased attention should be given to integrating livestock into farming systems, and that research to increase livestock productivity should be given greater support in the CGIAR system.

Priorities Identified by ILCA's EPR

- 1.023. The EPR of ILCA in 1986 supported the TAC recommendations of 1985 that we should give more emphasis to developing technologies for the African smallholder, to promoting sustainable production systems, and to research on small ruminants and crop–livestock interactions (6). The review panel recommended us to address in greater detail the complex interactions among the nutrition, health, management and genetics of ruminant livestock, and to strengthen interdisciplinary links among our headquarters units and field programmes. The panel also recommended that ILCA do more to strengthen the NARSs, as our impact in the long term will depend on their ability to solve national food problems. ILCA was considered to have a special advantage in

initiating and hosting research networks for African livestock production, but we were cautioned against trying too many of them.

- 1.024. With regard to types of research, the review panel recommended that ILCA continue applied and adaptive research and move into strategic research as and when this becomes possible.

ILCA study of resource allocation

- 1.025. A study on the allocation of ILCA's research resources was completed in 1985. The conclusions of the study (7) were that ILCA's resource allocations by zone were congruent with TRLU* numbers, but that, when criteria such as per caput income, human population, protein consumption and the transferability of research results were included:

- more resources should be allocated to the humid and subhumid zones;
- allocations to the arid and semi-arid zones were too high; and
- current research allocations to the highlands were justified.

The study also suggested that:

- resource allocations to the social sciences needed to be re-examined; and
- more resources should be allocated to small ruminants.

Strategy and internal management

- 1.026. Efficient allocation of research resources is not the only factor behind the need for a more narrowly focused strategy at ILCA. We are aware that in order to achieve greater impact we must reorganise internally.
- 1.027. In the commercial world, competitive pressures, environmental uncertainties and rapid technical change have led companies to assume more focused strategies. They find greatest competitive advantage, growth and internal harmony when they concentrate on a limited range of closely related tasks. Experience has shown that the focused plant can outproduce the complex factory; it has also shown that managing, in parallel, multiple tasks that are unrelated to each other leads to organisational inadequacies resulting in severe internal problems.
- 1.028. A focused strategy is as imperative in research as it is in commerce. The work of research institutions also faces environmental uncertainty and change, so that their internal structures must be organised for innovation. Such structures allow for the continual adjustment and redefinition of individual tasks, the emphasis being on the contributive rather than the restrictive nature of specialised knowledge.
- 1.029. We may thus distinguish between the need for a focused strategy and the flexibility of the internal organisational structure necessary to achieve innovation. Whereas the focal points for measuring ILCA's success must be clearly identifiable, the internal structure to achieve it must retain the basic characteristics of any successful research centre, namely scientific skills, flexibility to respond to change, innovation, and the ability to learn from and work with others.

* TRLU = tropical ruminant livestock unit = 250 kg.

Strategy paper

- 1.030. In this paper we outline ILCA's strategy and plan up to the year 2000, with special emphasis on our work plan over the next 5 to 10 years. Barring major changes in our external environment, our strategy is likely to alter little over the coming years. However, we do not perceive our work plan as fixed; it will be subject to periodic review in terms of both our impact and the changes in priorities likely to emerge over time.
- 1.031. The document is in six chapters. This introductory chapter is followed by a description of the environment in which we operate (Chapter 2). The internal environment of ILCA, including its resources and programmes, is described in Chapter 3. The strategy of the Centre is presented in Chapter 4, and our proposed future programme in Chapter 5. Chapter 6 outlines the modes of operation and resource allocations needed if we are to achieve our goals.

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ILCA's External Environment

The physical environment

2.001. Sub-Saharan Africa is a region of enormous environmental diversity. This diversity derives mainly from variations in rainfall, altitude and slope, and soils. Some elements in the natural environment may be changing over time in parts of sub-Saharan Africa, but the nature, location and speed of these changes are not well understood.

Rainfall

2.002. The most important variations in rainfall relate to its total amount and its temporal distribution. A major influence on the potential for crop and livestock production is the number of rainy seasons during the year when growth of a crop or significant regrowth of natural pasture is possible. In this respect, areas can be classified as having a unimodal or bimodal rainfall pattern.

2.003. Mean annual rainfall ranges from less than 100 mm in parts of the Sahara and Kalahari deserts and in the Horn of Africa, to over 9000 mm in the mountains of Cameroon. The coefficient of variation of annual rainfall varies from 15% to over 50%, variations being greatest in the drier areas. Most of West, central and southern Africa has a single growing season (unimodal rainfall); in the more humid areas this is long enough for different crops to be grown in relay on the same piece of land during a single year. In parts of East Africa there are two distinct growing seasons (bimodal rainfall) in each of which a crop can be grown, sometimes on the same piece of land. In unimodal areas north of the equator the rains occur between May and September, and south of the equator between October and April.

2.004. Information on the amount and temporal distribution of rainfall can be summarised in terms of the mean number of days during the year in which the relation between rainfall and evapotranspiration makes plant growth possible. But this summary in terms of 'plant-growth-days' does not incorporate any assessment of the number of growing seasons, of inter-year variability in total rainfall, or in its seasonal distribution.

Altitude and slope

2.005. Sub-Saharan Africa ranges in altitude from 120 metres below sea level, in the Danakil depression of Ethiopia, to 5895 metres above sea level (a.s.l.) at the summit of Kilimanjaro in Tanzania. About 4% of the subcontinent lies above 1500 metres a.s.l. and is classified as highlands. Altitude affects net incoming radiation, temperature and potential evapotranspiration, each of which directly affect both the livestock themselves and their feed supplies.

2.006. About 40% of sub-Saharan Africa has a slope of more than 8° and is therefore vulnerable to water-induced erosion. Of this vulnerable area 37% lies in West Africa and 27% in East Africa. However, half of the most erodible land (slope > 30°), which accounts for 8% of sub-Saharan Africa's surface area, lies in East Africa. Both cropping and livestock production cause greater damage on sloping land than they do on flat land, but grazing on the former is probably less destructive than cropping.

Soils

2.007. The soils of Africa have been classified into six major types. Aridisols cover about 37% of sub-Saharan Africa, Alfisols about 21%, Ultisols and Oxisols

together about 23%, Entisols about 14%, and Inceptisols and Vertisols about 2 to 3% each. Most of these soils are deficient in nitrogen, phosphorus, sulphur and some micronutrients, especially zinc, molybdenum and copper, all of which affect the growth of plants and animals.

Ecology

- 2.008. Not only is sub-Saharan Africa geographically diverse, but the continent's environments are also changing over time. For example, in many parts of Africa rainfall during the period 1965–85 was considerably less favourable for crops and livestock, both in its amount and intra-year timing, than in the previous 20 years.
- 2.009. Both geological and historical records indicate 'very long' (millennia), 'long' (centuries) and 'medium-term' (decades) episodes of alternating periods during which the climate of sub-Saharan Africa has been both much wetter and much drier than during the last two decades. The change-overs between the 'very long' and 'long' episodes seem usually to have been quite abrupt, and fears are being expressed that sub-Saharan Africa is now in the process of such a change-over to a drier epoch.
- 2.010. However, there is still a wide divergence of expert opinions, both about this and about whether human influence either within Africa (through deforestation or overgrazing) or elsewhere (e.g. through the 'greenhouse' effect) is responsible. Although we are uncertain about these issues at present, we should bear the possibility of climatic deterioration in mind when planning future research.
- 2.011. Change is also occurring in Africa's vegetation and soils. Due to increasing human pressure the vegetation is rapidly evolving away from its climax state, and soils are being compacted and eroded, making them less fertile. The effects are currently most obvious in the highlands of Ethiopia and in semi-arid areas throughout sub-Saharan Africa.

Zones

- 2.012. In order to focus our efforts from the myriad of micro-environments that constitute sub-Saharan Africa to a limited number which share important characteristics and are therefore likely to react similarly to new technology, we have classified sub-Saharan Africa into five ecological zones. The bases of this classification are plant-growth-days and/or altitude, and ILCA therefore takes into account only some of the causes of diversity mentioned in 2.002–2.011. Table 2.1 gives the definitions of these zones and the proportions they form of the different 'regions' of sub-Saharan Africa and of the subcontinent as a whole.
- 2.013. In summary, the dry areas (arid and semi-arid zones) account for more than 50% of sub-Saharan Africa's surface and are important in every region except central Africa. Seventy per cent of the highlands are found in East Africa and nearly 75% of the humid zone is in central Africa. The subhumid zone is spread over, and is important in, all regions.
- 2.014. These ecological zones differ not only in the proportion of land they occupy within sub-Saharan Africa; they also vary in their grazing and livestock resources and in the contribution of their livestock to subsistence and to national economies. These differences, coupled with further environmental diversity within each zone, have meant that no universally right solutions can be found to the many problems facing livestock development in sub-Saharan Africa. As a result much of the livestock research needs to be carried out in different locations.

Table 2.1. *The ecological zones of sub-Saharan Africa.*

Zone	Definition	% of surface area of				% of SSA	Total area of SSA ^a (million km ²)
		WA	CA	EA	SA		
Arid	< 90 pgd ^b	54	1	52	20	36	7.7
Semi-arid	90– 180 pgd	20	7	18	34	18	4.0
Subhumid	180– 270 pgd	16	29	16	38	22	4.8
Humid	>270 pgd	10	59	2	7	19	4.1
Highland ^c	<20°C	0	4	12	1	5	1.0
Total %		100	100	100	100	100	
Total area of SSA (million km ²)		7.3	5.3	5.8	3.2		21.6

^a WA = West Africa; CA = central Africa; EA = East Africa; SA = southern Africa; SSA = sub-Saharan Africa.

^b pgd = plant-growth-days.

^c Highlands are defined as all those areas in the semi-arid, subhumid and humid zones of sub-Saharan Africa where the mean daily temperature during the growing period is <20°C.

Source: (1).

2.015. Table 2.1 mentions both zones and regions. Regions are clusters of countries defined in terms of their location. Such regions have significance for livestock development in several ways: firstly, countries within a region often share a common rainfall pattern; secondly, they are often linked by trade and other economic ties (e.g. labour migration) even if these are unofficial or even illegal; thirdly, they often share a common historical experience, official languages, a pattern of education and, in some cases, regional institutions. The grouping of countries into the regions referred to in this paper is indicated in Appendix 2.1.

The human population

2.016. The human population of sub-Saharan Africa in 1986 was about 440 million, of whom about 25% live in urban areas, a much lower proportion than in other parts of the developing world. This population is growing fast (>3% p.a.) and, because of its present age structure and the continuing desire for large families, it will continue to grow fast for the next 20 years or more, unless some appalling disaster intervenes.

2.017. The population of sub-Saharan Africa in the year 2000 is projected at 675 million, more than 50% above its present level. By that time, the urban population will probably be around 250 million, i.e. 35 to 40% of the total, while the rural population will be nearly 30% above its present level. This rapid growth will substantially increase the demand for food, including milk and meat. Large gains in the productivity of both land and livestock are needed if this increased demand is to be met. As regards livestock, such gains are not expected in the immediate future (1.017).

2.018. Of the total present population, about 42% live in West Africa, 30% in East Africa, 16% in central Africa and 12% in southern Africa. Population growth

rates in the different regions are broadly similar. Accurate estimates of the distribution of the human population by different ecological zones are not available. The best 'guesstimate' is that a little over 25% live in each of the semi-arid and subhumid zones, 20% in the humid, 15% in the highlands and 10% in the arid. Limited evidence suggests that the growth rate in the subhumid zone may be higher than in the drier areas.

- 2.019. We estimate about 5% of sub-Saharan Africa's population to be pastoralists, i.e. people drawing the bulk of their income (cash and subsistence combined) from keeping livestock on natural vegetation. Most pastoralists live in East Africa, but there are some large groups in West Africa too.
- 2.020. Education levels in sub-Saharan Africa are low. Twenty years ago less than 40% of children were being enrolled in primary schools and less than 5% in secondary schools (2). Those who were children then are today's mature farmers. Nearly 80% of today's children (who are tomorrow's farmers) are enrolled in primary school, but only about 16% in secondary, and these 16% will mostly find employment in the urban economy. Almost all of sub-Saharan Africa's farmers and herders in the year 2000 will not have had any secondary education, and many will not be functionally literate.
- 2.021. Enrollment of females in school is substantially less than that of males. Herding has traditionally been done by men, but nowadays women are often left behind in the rural areas to manage traditional agricultural operations, including herding, when their better educated husbands go to find better paid jobs in the urban or modern agricultural sectors. Children too have often provided an important proportion of herding labour, especially for young and small stock. Increasing school attendance is thus depleting the traditional sources of herding labour.
- 2.022. A wealth of African languages is spoken and written on the continent. By reason of their very diversity, few of these currently act as a unifying cultural force at either national or continental level. Languages that are widely spoken (shared between several countries) include Swahili and Hausa. The official language of publication and of international communication in most NARSs on the continent is usually the heritage of the colonial era.
- 2.023. Thus, of 39 countries in sub-Saharan Africa for which adequate data are available, 18 can be classified as anglophone, 18 as francophone, and in 3 the main foreign language is Portuguese. Anglophone countries account for 64% of the human population and for 72% of the livestock population (in terms of TRLUs). Francophone countries account for 30% of the human population and 26% of the livestock. Portuguese-speaking countries account for 6% and 2% of the human and livestock populations respectively.

The economic background

- 2.024. The economic and agricultural background in sub-Saharan Africa has not been favourable for livestock development in recent years. Per caput GDP, which grew at 1.3% p.a. in the 1960s, virtually stagnated in the 1970s (growth rate 0.7% p.a.) and fell in the first half of the 1980s. Per caput food production in the period 1982–84 was 8% lower than a decade earlier, with 31 out of 39 countries showing a decline. Inflation has averaged 15% p.a. over the last decade, and the gross domestic saving rate has declined by a third. The ratio of foreign debt service payments to export earnings has also deteriorated (rising by about 50%) during the 1980s so far.

- 2.025. The ability of governments to raise revenue (expressed in terms of current revenue as a percentage of GNP) declined slightly (from 15% to 14%) in sub-Saharan Africa as a whole, and markedly (from 17% to 12%) in the low-income countries. This is reflected in the increasing difficulties governments have in maintaining the services they provide. The trend in real expenditures on livestock services may have been better than for some other services, but, within the total for livestock services, expenditure on staff costs has risen at the expense of other costs, to the detriment of quality.

The livestock population

- 2.026. The domestic livestock populations of sub-Saharan Africa consist of ruminants (i.e. cattle, sheep, goats and camels) and non-ruminants (i.e. equines, pigs and poultry). Over the past 10 years we have worked mainly with cattle, sheep and goats and to some extent with camels. ILCA's concentration on these ruminant species reflects their importance in the subcontinent in terms of numbers and the role they play in subsistence production.
- 2.027. It has often been suggested that we should consider starting work on some non-ruminants, particularly poultry and pigs, and even fish. According to our mandate, we could also work on equines and on some of the so-called non-conventional* livestock found in sub-Saharan Africa. The reasons for our decision to exclude these species from our work are discussed in 4.010–4.015. Since we have decided to exclude them, the discussion of livestock in the rest of this chapter will be restricted to ruminant species.

Distribution of ruminant livestock species

- 2.028. Table 2.2 shows the distribution of ruminant species by zone and region. The final column of the table lumps the species together, on the basis of their respective mean liveweights, into a composite tropical ruminant livestock unit (TRLU). Table 2.3 integrates the information on TRLUs by zone and region. The data are drawn mainly from reference 1 and refer to 1979. The absolute numbers have changed since then but the proportions have probably not changed much.
- 2.029. The arid zone, covering 37% of sub-Saharan Africa's surface area, has 30% of its ruminant biomass (TRLUs), almost all its camels**, but proportionately few cattle. The semi-arid zone, with 18% of the surface area, has 27% of the TRLUs, with all species except camels being well represented. The subhumid zone, with 22% of the surface area, has 20% of TRLUs, with cattle slightly over-represented and goats and sheep under-represented. The humid zone, with 19% of the surface area, has only 6% of the TRLUs, with all species (except camels) more or less equally represented. The highlands, with only 4% of the surface area, have 17% of the TRLUs, with goats under-represented but sheep and cattle well represented.

* This term is used to cover a wide range of species which are unfamiliar to the majority of producers and consumers, and whose potential is not yet fully exploited. Water buffalo, deer, rabbits, guinea fowl, duck, grass cutters and other small rodents are among those thought to offer favourable prospects.

** Seventy to eighty percent of camels are thought to live permanently in the arid zone, with 20 to 30% moving seasonally between the semi-arid and arid zones. The number of camels living permanently in the semi-arid zone is low but may be slowly increasing.

Table 2.2. *Distribution of different species of domestic ruminant livestock by region and zone of sub-Saharan Africa.*

Location	% of total population in SSA				TRLUs
	Cattle	Sheep	Goats	Camels	
Zone					
Arid	20.7	33.7	38.2	100.0	29.8
Semi-arid	30.6	22.9	26.3	0.0	27.1
Subhumid	22.7	14.4	16.5	0.0	19.6
Humid	6.1	8.3	9.4	0.0	6.1
Highland	19.9	20.8	9.6	0.0	17.4
Total %	100.0	100.0	100.0	100.0	100.0
Total No. ¹	(144.5)	(98.4)	(122.6)	(11.1)	(134.3)
Region					
West	24.8	34.2	42.3	15.2	26.3
Central	6.6	4.1	6.4	0.0	5.8
East	54.1	59.5	46.2	84.8	56.3
Southern	14.5	7.2	5.2	0.0	11.6
Total %	100.0	100.0	100.0	100.0	100.0
Total No. ¹	(144.5)	(98.4)	(122.6)	(11.1)	(134.3)

¹ In millions.

Source: (1).

2.030. East Africa, with 25% of the surface area, has about 56% of the TRLUs, with a high camel population (85% of sub-Saharan Africa's total) and goats (46%) slightly under-represented. West Africa, with 33% of the surface area, has 26% of the TRLUs, with sheep (34% of sub-Saharan Africa's total) and goats (42%) being over-represented and camels (15%) under-represented. Central Africa, with 25% of the surface area, has only 6% of TRLUs, with all species other than camels evenly represented. Southern Africa, with 15% of the surface area, has only 12% of the TRLUs, with cattle (15% of sub-Saharan Africa's total) relatively well represented, sheep (7%) and goats (5%) under-represented and no camels.

2.031. Information on the distribution of ruminant livestock in sub-Saharan Africa is one of the factors likely to influence the allocation of ILCA's research resources. The summarised data indicate that, at present, the semi-arid and subhumid zones have a relatively high proportion of cattle, while sheep and goats are found mostly in the arid and semi-arid zones. The highlands, especially in East Africa, have considerable numbers of both cattle and sheep, but not of goats.

Table 2.3. Relative distribution of sub-Saharan Africa's TRLUs by zone and region.

Zone	% of SSA's total				Total %	No. of TRLUs (millions)
	WA	CA	EA	SA		
Arid	8.08	0.39	18.03	3.41	29.8	(40.1)
Semi-arid	11.71	1.21	10.23	3.94	27.1	(36.4)
Subhumid	3.50	1.77	11.31	3.05	19.6	(26.4)
Humid	2.77	0.93	1.44	0.92	6.1	(8.1)
Highland	0.29	1.53	15.30	0.26	17.4	(23.3)
Total %	26.30	5.80	56.30	11.60	100.00	
Total No. of TRLUs ¹	(35.3)	(7.8)	(75.6)	(15.6)		(134.3)

¹ In millions.

Source: (1).

- 2.032. The figures quoted so far are for absolute livestock levels. There are substantial differences in trends between different zones and regions. There is a problem, however, in that even over the medium term (e.g. a decade) such trends may be very unstable. For example, from 1963 to 1970 the total number of livestock (TRLUs) in sub-Saharan Africa apparently rose by 2.5% p.a.; from 1970 to 1975 by 0.6% p.a.; and from 1975 to 1984 by 1.7% p.a.
- 2.033. This instability over time is matched by even greater instability between regions and species within and between time periods. Part of this instability is real, as different species in different regions first suffer losses from drought or disease to different degrees and then recover at different rates. Part of the instability, however, arises from the practices of statisticians.
- 2.034. The figures suggest that over the last two decades total domestic livestock biomass grew more rapidly in central (3.5% p.a.) and East (2.3%) than in southern (1.4%) or West (1%) Africa, and that sheep (3.4% p.a.) grew more rapidly in number than did camels, goats or cattle (1.9%). There is some evidence that over the longer term (i.e. since the post-rinderpest pandemic trough of 90 years ago) the cattle population may have grown at an average annual rate of as high as 3.4%, but not even inspired guesses are available for other species or for inter-zonal or inter-regional differences.

Production systems

- 2.035. Livestock in sub-Saharan Africa are managed in a variety of different production systems, and these can be defined or classified in a variety of ways, principally in terms of the following characteristics: specialisation in livestock production to the exclusion of other activities; the degree of mobility (nomadism); and the extent to which, when livestock and crops are produced on the same land, they are owned by the same enterprise. Table 2.4 lists the more important production systems and their usual characteristics.

Table 2.4. Livestock production systems and their usual characteristics.

Production system	Characteristic		
	Specialised in livestock	Mobile	Combined crop–livestock production
Ranching	yes	no	no
Pastoralism	yes	usually	no
Agropastoralism	somewhat	somewhat	somewhat
Mixed farming	no	no	yes

2.036. Almost all livestock in the highland and humid zones are owned by mixed farmers, and in the arid zone by pastoralists. Ranches occur in almost all zones (although they are disappearing from the highlands) but only account for about 5% of sub-Saharan Africa's TRLUs. In the semi-arid and subhumid zones the situation is very complex: shifts occur over time between more range-based and more farming-based livestock systems; livestock owned or managed by one social group may graze the crop residues of another group; and there is also absentee ownership (by bureaucrats, traders and cultivators) of livestock managed and herded on a semi-permanent basis by pastoralists or agropastoralists.

Livestock holdings

- 2.037. In sub-Saharan Africa sizes of livestock holdings vary considerably among households within a given environment. In Botswana, for example, 50% of the national cattle herd is held by only 5% of the livestock holders, whereas the poorest 50% of livestock holders hold only 13% of the total herd. In addition, 45% of rural families hold no livestock at all. Appendix 2.2 provides data for other countries. Because richer households tend to have more members than poorer ones, the distribution pattern of livestock per person tends to be more equitable than the distribution per household.
- 2.038. The size distribution of livestock holdings between households is important for three main reasons. Firstly, if new technology to be introduced is not 'scale-neutral', it may, when the size distribution is unequal, fit only a small proportion of the total herd. In practice, some technologies introduced, such as rinderpest vaccination, have been scale-neutral; others, such as fencing, have been very 'scale-sensitive'.
- 2.039. Secondly, if a critical problem in the dissemination of new technology is the difficulty of speedily communicating research results to many independent herdowners or of providing them with inputs and services, then a very concentrated pattern of livestock ownership allows more rapid communication and distribution to owners who control a large proportion of the national herd. In practice there is no significant evidence that the spread of profitable new technology has been substantially inhibited by the difficulty or cost of communication. Provision of services and inputs has been a more difficult problem, but this has been the result of the overall shortage of inputs, or of the lack of incentives, as much as of the difficulty of delivery to small-scale producers.
- 2.040. Thirdly, if a major concern is to bring the benefits of new technology to the mass of poorer livestock holders, the question arises as to whether this implies not

only focusing on only a small proportion of the livestock but also on the least productive herds. The evidence on the comparative productivity of small and large herds is mixed. Productivity in terms of physical output per animal of large herds on ranches tends to be higher than that of small herds on communal areas, but output per hectare on communal areas is probably higher than on ranches. Different surveys comparing the productivity per animal of large and small herds on communal areas have given conflicting results, with probably a slight majority showing greater productivity among smaller herds.

- 2.041. In other parts of the world, smallstock (sheep and goats) are considered to be “poor man’s” livestock, while cattle or camels are “rich man’s”. This is partly true in Africa. For example, in Kenya’s Maasailand the smallstock-to-cattle ratio is about three times higher among the poorest third of households than among the richest third. Nevertheless, because of specialisation this ratio is far from being an infallible indicator of relative wealth. Some tribes, especially in drier areas, specialise in smallstock and others in cattle/camels. Also, within an ethnic group or environment a particular household may specialise in one species at one time and in another at another time, without this necessarily indicating a change in its wealth ranking in that society but rather some other factor, for instance the availability of family labour of the right age.

Livestock outputs and markets

- 2.042. Livestock play diverse economic and social roles in sub-Saharan Africa. They provide direct subsistence foods, in the form of milk and meat and, in some societies, blood. They provide farm inputs to crop production, in the form of animal traction and manure, and other inputs, for example fibre, skins and transport, to the rural subsistence economy. Sales of livestock and their products provide cash to their owners with which to purchase what they cannot produce themselves. Livestock are often a form of investment in which current savings can be kept and increased. And because they are valuable in these and in other ways livestock are often the currency in which other social transactions, such as bridewealth, generosity and compensation, are expressed.
- 2.043. In terms of its commodity outputs the livestock subsector contributes about 18% to the agricultural GDP of sub-Saharan Africa, or about 5% to the total GDP. This contribution includes both marketed output and output consumed by herders or owners’ households for their own subsistence. Continent-wide data do not exist for the proportion of commodity outputs which are sold rather than consumed at home. Table 2.5 gives some illustrative data, expressed in value terms so as to integrate several commodities.
- 2.044. However, commodity outputs are not the only contribution made by livestock to the agricultural economy. Also important are traction (in field operations), manure and on- and off-farm transport. Since transport is primarily an output of non-ruminant animals and does not directly affect food production, it will not be dealt with further here.
- 2.045. Table 2.6 gives the most consistent figures available on the total gross value of food and non-food* outputs of ruminant livestock in sub-Saharan Africa. The figures refer to 1975 and exclude non-food outputs such as fibres and skins, which do not contribute directly to food production.

* The data in Table 2.6 for traction and manure are more in the nature of inspired guesses than hard fact. More recent data than 1975 for these outputs do not exist.

Table 2.5. *Examples of sales as proportions of household output of livestock commodities^a.*

Region/ country	Zone	Year	Production system	% of total output sold (by value)	Source
East					
Ethiopia	highland	1980/81	mixed	55	(3)
Kenya	semi-arid	1980/81	pastoral	59 ^b	(4)
Southern					
Zimbabwe	semi-arid	1974	mixed	35	(5)
Botswana	arid	1981	pastoral	55	(6)
West					
Nigeria	humid	1981	mixed	65 ^c	(7)
Niger	semi-arid	1976/77	mixed	26 ^d	(8)
Niger	arid	1963	pastoral	52 ^e	(9)

^a Commodities covered are live animals, meat, milk and butter.

^b On 'underdeveloped' group ranches.

^c Unweighted average of forest and derived savannah subsystems.

^d 'Bush Tuareg' system.

^e Unweighted average of Fulani and Tuareg systems.

2.046. Table 2.6 shows that the single most important form of livestock production in sub-Saharan Africa, accounting for 47% of the total value, is meat from all species including pigs and poultry. Beef accounts for 55% of meat output. The next most important kind of output is animal traction, accounting for 31%. However, nearly 75% of all animal traction output occurs in East Africa. Milk accounts for 15% of the total value. East Africa accounts for 58% of the total livestock output in sub-Saharan Africa and West Africa for 23%.

2.047. As with livestock numbers, trends in the production of meat and milk are unstable over time and space. Over the last two decades in sub-Saharan Africa as a whole, beef production apparently grew at 2% p.a. in the first decade and 2.4% p.a. in the second. Goat meat performance closely paralleled beef, while mutton production grew at 1.3% p.a. in the first decade and 3% p.a. in the second. Cow milk output grew at 1.2% p.a. in the first decade and 3.5% in the second. With human population growing at about 3% p.a., production per caput has for the most part been declining. Further details are shown in Appendix 2.3. The performance of different regions varies between periods and commodities without a clear overall pattern.

2.048. The pattern of consumption often differs from that of production because for certain kinds of output, for example milk and meat, deficits or surpluses between domestic consumption and production are taken care of by international trade or aid. Appendix 2.4a shows that in sub-Saharan Africa as a whole per caput *consumption* of meat fell slightly over the decade 1972–82, but the decline was considerably less than in the case of per caput meat *production*.

Table 2.6. Value of total and regional livestock production by kind of output^a, sub-Saharan Africa, 1975.

Kind of output	Value in US\$ millions ^b				
	WA	CA	EA	SA	SSA
Animal traction ^c	312 (21) ^d	11 (3)	1474 (39)	239 (26)	2036 (31)
Manure ^e	62 (4)	5 (1)	111 (3)	16 (2)	196 (3)
Meat ^f	811 (56)	277 (79)	1410 (38)	545 (58)	3043 (47)
Milk	160 (11)	40 (12)	644 (17)	85 (9)	929 (15)
Eggs	115 (8)	16 (5)	108 (3)	45 (5)	284 (4)
Total	1460 (100)	349 (100)	3747 (100)	930 (100)	6486 (100)

^a Includes only food and food-related outputs, both marketed and non-marketed.

^b Output is valued at uniform, continent-wide prices (1975). The prices used are: meat \$1000, milk \$150 and eggs \$750, all expressed in US\$/tonne. Animal traction is valued at US\$ 5.2/ ox-day worked.

^c Includes field operations by bovines only.

^d Figures in parentheses indicate percentages of column totals.

^e Valued at the equivalent commercial fertilizer prices of the plant nutrients contained.

^f Includes beef, goat meat, mutton, pork and poultry meat.

- 2.049. Appendix 2.4b shows that, in sub-Saharan Africa as a whole, there was a shift in the composition of consumption away from ruminant meat (cattle, sheep, goats) towards non-ruminant (pork, poultry), but this is almost entirely accounted for by a major shift in West Africa (particularly in Nigeria and Ivory Coast), whose dependency on ruminants fell from 76% in 1972 to 65% in 1982.
- 2.050. Annual per caput meat consumption ranges from 14 kg in East Africa (88% ruminant meat) to 7 kg in central Africa (only 65% ruminant meat). These figures exclude the consumption of game, which is high in central Africa. In recent years (1983–85), sub-Saharan Africa has imported annually about 139 000 tonnes of meat, worth US\$ 184 million, of which 30% (by volume) is accounted for by West Africa and 63% by central Africa. There is thus a ready market in these two regions for increased domestic supplies of ruminant meat. Appendices 2.5 to 2.9 show changes in per caput consumption and production of meat for different regions in recent years.
- 2.051. Per caput milk consumption in sub-Saharan Africa also fell during the period 1972–82, but the overall figure for the subcontinent masks a rise in West Africa and sharp declines in East and southern Africa. East African per caput consumption, however, is still much higher (at 48 kg per year) than that of other regions.
- 2.052. Sub-Saharan Africa's self-sufficiency in milk is declining fast, from 90% in 1972 to 79% in 1982. In West and central Africa more than 40% of the milk consumed during this decade was imported, while for Nigeria the figure was nearly 70%. In recent years (1983–85), sub-Saharan Africa has imported annually on commercial terms about 2.5 million tonnes of liquid milk equivalent, worth US\$ 492 million, of which 54% by volume is accounted for by West and 21% by East Africa. Additional imports occur in the form of food aid, adding about 30% to the volume of milk (liquid equivalent) imported. Appendices 2.10 to 2.14 show changes in per caput production and consumption of milk for different regions in recent years.
- 2.053. While imports have been rising, exports have been falling. Africa has never been a significant exporter of dairy products. Over the last decade, the number

of live animals exported from sub-Saharan African countries (often to other sub-Saharan African countries) has risen slightly, but far more slowly than in the previous decade. Meat exports have fallen, however, and the aggregate exports of meat and the equivalent of meat in live animals have fallen at an average annual rate of 4% over the last decade in volume terms.

- 2.054. The causes of the deterioration in the trade position in livestock and their food products are several. Firstly, *real* international meat prices have fallen substantially since the early 1970s, making exporting much less attractive for unsubsidised exporters. Secondly, many African countries have seriously overvalued exchange rates, which 'suck in' imports and discourage exports. Thirdly, several markets in Africa and outside it (e.g. the Middle East) have been used by the world's major non-African dairy and meat exporters for 'dumping' their surpluses. Fourthly, the widespread droughts of the mid-1970s and mid-1980s severely damaged the breeding herd and production base needed for a stable export industry. Finally, the domestic supply of livestock and their products in sub-Saharan Africa has not kept up with domestic demand, and this 'gap' has attracted imports and left little over for export.
- 2.055. Rising imports or declining exports of livestock and livestock products may indicate an unexploited market opportunity as well as a potential foreign exchange problem. They may result from wrong policies and planning. Thus while many of the identified constraints to livestock production are within the scope of animal science and related disciplines, there is also a need for more work at the macro-economic level.
- 2.056. In spite of the declines in per caput consumption of milk and meat, and of the deterioration in the trade position, livestock production in sub-Saharan Africa over the last 20 years has risen, for example in the case of beef by 56%, of mutton and goat meat by 60%, and of cow's milk by 58%. Increases in livestock output can be achieved by increasing the number of animals, by increasing the yield per animal or by a combination of these (Table 2.7)*.
- 2.057. Table 2.7 suggests that, for the commodities considered, yields changed little during the 1970s, and that their contribution to output increases was always less than 40% and in most cases much less and even negative.

Constraints to livestock development

- 2.058. In this section we shall discuss the main constraints to livestock development in sub-Saharan Africa. Not all these constraints are susceptible to solution, and where they are, a solution may not necessarily require research. Where research is required it may be more appropriate for this to be undertaken by some organisation other than ILCA. Nevertheless, a precondition for the sensible selection of our future programme, to be made in Chapter 5, is an appreciation of the main constraints in the systems in which we are trying to intervene**.

Socio-economic and institutional constraints

- 2.059. Investment is usually an essential accompaniment to successful economic development. During the last two decades much of the monetarised investment in the livestock subsector of sub-Saharan Africa (other than in indigenous

* However, estimates of the relative contribution of each pathway are susceptible to changes arising simply from small changes in the time period considered.

** A number of systems studies describing these constraints in detail have been published or are nearing publication. Each species in each production system in each ecological zone to some extent faces different constraints. However, our description in this chapter will be limited to a broad overview.

Table 2.7. *Yield changes and contribution of yield and numbers to changes in livestock output in sub-Saharan Africa, 1963–85.*

	Beef			Sheep and goat meat			Cow's milk		
	1970	1980	1985	1970	1980	1985	1970	1980	1985
Relative yield ¹ per productive animal ² for all animals in herd	102	102	101	103	106	104	99	102	110
	109	112	113	104	110	112	97	98	113
	1963–70	1970–80	1970–85	1963–70	1970–80	1970–85	1963–70	1970–80	1970–85
Relative contribution (%) to change in: numbers	60.6	80.2	80.3	87.1	69.3	68.1	129.6	94.6	47.7
yield ³	39.4	19.8	19.7	12.9	30.7	31.9	-29.6	5.4	52.3

¹ 1960 = 100.

² Productive animals are the ones slaughtered for meat, and cows in milk.

³ Includes the interaction effect of yield and numbers.

Sources: (10, 11).

animals) has been financed by foreign aid. This external capital aid to the livestock subsector averaged above US\$ 80 million per year in the decade up to 1983 (12), or just over 1% of the annual total value of output at the beginning of the period (see Table 2.6). This is an insufficient amount to have had a significant impact.

- 2.060. However, shortage of investment funds for livestock development has probably not been a critical constraint. If it had been, one would have expected to see a high rate of return to those investments in livestock projects which did take place. This has not occurred, at least in donor-financed projects. For example, in the World Bank's 'pure' livestock projects the average rates of return were negative, and most projects (including both 'pure' livestock projects and those with a livestock component) yielded unacceptable (< 10%) rates of return.
- 2.061. In this respect the record of livestock projects in sub-Saharan Africa has been worse than that of livestock projects elsewhere in the developing world, and of other agricultural projects in the continent. It seems that the mere shortage of investment funds has not been the most critical constraint, even though the funds provided would have been inadequate for significant development if other constraints had not been limiting.
- 2.062. Insufficient recurrent expenditure on government livestock services has probably been a more critical constraint. Lack of satisfactory data on output make it difficult to demonstrate any causal relation, but a deterioration in animal health services over the last 15 years is evident. Although average expenditure per animal has risen, in most countries recurrent expenditure still gets a much lower proportion of the total agricultural budget than would be justified by livestock's share in total output. And much of the increase in real expenditure per animal has been rendered ineffective by the rising share of staff costs in total costs at the expense of essential non-staff costs such as veterinary drugs and transport. More numerous and more expensive staff have tended to become less effective (13).

- 2.063. A major cause of the poor return to investment in livestock projects has been the lack of appropriate technical packages into which to channel this investment. Partly this is because most of the investments were made in dry zones of low productive potential; partly because investment planners overestimated the extent to which the available technology was appropriate to African conditions. Consequently they underinvested in adaptive research, spending proportionately much less on this in livestock development projects than they did in comparable other agricultural projects (14).
- 2.064. Another problem in some countries has been the relatively low density of the human population, the underdevelopment of infrastructure such as roads, and the distance of final markets from producing areas. High temperature, and in some areas high humidity, lead to rapid spoilage of products such as meat and milk. The consequences of these factors are high transport, storage wastage, and processing costs.
- 2.065. The economic environment over the last decade has not been conducive to successful livestock development in sub-Saharan Africa. Many African governments have tried to keep retail prices of meat and dairy products down, and although such attempts were often unsuccessful, they could not but shake the confidence of potential investors. At the same time, ill-judged attempts by donors and governments to interfere in marketing systems often widened the gap between producers' and retail prices. World markets have deteriorated, with declining real prices and aggressive protection and other trade policies by developed countries upsetting Africa's export markets for meat and providing intense competition in its domestic markets for dairy products. In addition, the real prices of production inputs have risen substantially.
- 2.066. Land tenure has been another problem. In the drier areas, in spite of several imaginative experiments, it is still unclear what forms of land tenure will be efficient and equitable. In higher potential areas, where the solutions are clearer, many governments have not yet grasped the nettle of land reform. Lack of cheap and reliable fencing is a major impediment to the adoption of some improved management practices.
- 2.067. Lack of adequately qualified and experienced manpower, to conduct research, analyse policies and implement development, is another major constraint. The problem of lack of qualified research scientists is dealt with in some detail in 2.092 to 2.100.
- 2.068. Over the last decade there have been several other economic, institutional and political problems. Several important livestock-producing areas have been ravaged by war and insecurity. Because of worsening economic conditions, governments have been unable to make their planned financial contributions to livestock development. The designs of livestock projects were often grandiose and unrealistic (especially in the light of the lack of qualified and experienced staff); and donor agencies failed to provide firm but flexible supervision of implementation. Institutions to provide credit and other production inputs have often been neither financially viable nor sensitive to producers' needs.
- 2.069. In many respects the experience of the livestock subsector in sub-Saharan Africa has paralleled that of the agricultural sector as a whole in the economic and institutional constraints encountered. In some respects, for instance security and land tenure, it has faced particularly acute problems. The development of appropriate technology started later and is in any case inherently more time consuming and expensive in the livestock than in the crop subsector, because of the longer reproduction and growth cycle involved (see 1.005).

Technical constraints

- 2.070. We can divide the technical constraints to livestock development into four broad categories: feed and nutrition; genetic; health and disease; and other constraints.
- 2.071. Adequate livestock nutrition depends on the availability of adequate feed supplies and on good management. Feed supplies in Africa are constrained mainly by soil fertility (see 2.007) and by scant, unreliable and markedly seasonal rainfall. In almost all areas they are, as a result, highly seasonal in both quantity and quality (digestibility and protein content). Conservation and storage of feed from the time of its growth to the time of its use is therefore a critical issue. In some areas deficiencies in specific minerals also occur.
- 2.072. In drier areas feed is widely dispersed in space, involving a high expenditure of energy in harvesting it either by grazing or by other means. In moister areas, due to poor soil fertility, there is inadequate concentration of nutrients in the dry matter produced, so that livestock cannot eat enough to achieve optimum production.
- 2.073. The genetic structure of African livestock has evolved largely as a result of natural selection, influenced by environmental factors and the level of technology. Selection has been for survival in the face of fluctuating feed and water supplies and disease challenges, rather than for high levels of production.
- 2.074. In some higher potential areas of East Africa, where new technology such as disease control and artificial insemination has evolved and been maintained, a changed genetic structure has emerged, sometimes incorporating exotic genes and resulting from selection for high production. In lower potential and more highly fluctuating environments the ability to survive is still the dominant selection criterion, and this is reinforced by social institutions, in particular land tenure, which encourage competition for scarce feed and water resources rather than adjustment of herd size to them.
- 2.075. Although modern technology has reduced some disease risks (see 2.080–2.082), animal health problems still form a major category of constraint. For example, trypanosomiasis, transmitted by tsetse flies, is considered to be a major problem over 46% of sub-Saharan Africa's surface area. Other internal and external parasites can also be important causes of low productivity and high mortality, and there are often important interactions between nutrition, disease and reproductive performance.
- 2.076. In some instances technical solutions to health problems are available but only at uneconomic cost, such that the opportunity for alleviating the problem lies in improved herd management rather than in high technology. In any case, ILCA's special advantage lies in the discovery of such management methods rather than in developing treatments or preventive vaccines. In other instances new technology may be the only way forward to substantially improved productivity and profitability (see 6.017).
- 2.077. In some cases the disease issue relates not to physical productivity but to price. Unless the disease is eliminated in a particular way (e.g. by slaughter and quarantine rather than by vaccination, as in the case of foot-and-mouth disease), relatively high-priced export markets cannot be entered, and much lower prices will be received in domestic or more saturated export markets.
- 2.078. Among other constraints which have been identified are water shortage, toxicity and poor management. In most areas of sub-Saharan Africa water development programmes have ensured that lack of watering points is not the serious problem

it was half a century ago, although unreliability and poor maintenance continue to cause crises from time to time. The continuing problem is as much an institutional as a technical issue.

- 2.079. Poor management is also sometimes a major problem, although this is often caused more by shortage of herding labour (a social or economic problem) than by ignorance or inefficiency. Nevertheless, differences in productivity are sometimes extremely large between herds and flocks with apparently equal access to the same feed and water resources and exposure to the same health risks. These differences may be due to differences in management practices not yet properly identified, and our ignorance of these constitutes a constraint.

Technology

- 2.080. Some of the constraints mentioned in the previous section have been at least partly overcome by a number of 'non-traditional' technologies which have been tried over the last half-century. Among those which were wholly or largely 'developed' in sub-Saharan Africa were rinderpest vaccination, tick control, especially for theileriosis, and control of tsetse and trypanosomiasis by bush-clearing, by direct chemical control of tsetse, and by chemotherapy of trypanosomiasis. The first of these can by and large be considered a success, the second a partial success but with continuing problems of implementation, while the third is still in the course of development.
- 2.081. Rinderpest control was particularly associated with work in Kenya, Nigeria, Chad and Senegal; tick control with work in Kenya and Zimbabwe; and work on tsetse/trypanosomiasis (prior to the founding of ILRAD) with Nigeria, Zaire, Zimbabwe, Uganda and francophone West Africa. For the most part, work on developing these 'African' technologies occurred during the colonial period or its immediate aftermath rather than during the post-colonial period. Implementation, however, has been largely in the post-colonial period.
- 2.082. Rinderpest vaccination is applicable throughout all zones and regions of sub-Saharan Africa, although its actual impact has been less in southern Africa, where the disease has already been brought under control by other methods. Tick control has been most important in combatting East Coast fever (ECF – a form of theileriosis) in subhumid and semi-arid East Africa; and tsetse/trypanosomiasis control, if successful, could have a substantial impact throughout the subhumid and humid zones.
- 2.083. A number of other technologies largely developed outside sub-Saharan Africa have been adapted and applied within it. Modern techniques of water extraction (boreholes) and storage (stockponds) have, together with rinderpest vaccination, been largely responsible for the increase in livestock numbers and output in sub-Saharan Africa over the last half-century. Naturally, water technology was of greatest use in the drier areas, with outstanding impact in Botswana, Sudan and the Sahel. Vaccinations against anthrax, foot-and-mouth disease, blackquarter and contagious bovine pleuro-pneumonia (CBPP) were developed outside sub-Saharan Africa, but were also applied with some success within it.
- 2.084. Natural genetic change in the livestock herds of the continent has occurred as a result of human migration, of inter-tribal theft and market exchange of stock, and of livestock diseases such as trypanosomiasis and rinderpest. Deliberate genetic change has occurred only on a small scale, principally on ranches in Botswana, Zaire and Zimbabwe, and on smallholder dairy farms in highland Kenya. The proportion of sub-Saharan Africa's total cattle herd on which such deliberate change has had a significant effect is probably less than 3% (i.e. less than 5 million head).

- 2.085. However, scientific evaluation of the performance and potential of different exotic and indigenous cattle breeds and their crosses has been widespread. Very much less has been done on species other than cattle. While exotic genes have demonstrated their superiority for dairy production in some areas (mainly high-potential areas, but also in parts of semi-arid Zimbabwe)—subject always to a substantial improvement in animal health and feeding—, on the whole such improvement has not been demonstrated in increased meat production or draught power in any of the ecological zones.
- 2.086. Particularly in East and southern Africa, research or extension departments have made considerable efforts to improve livestock feed supplies from forage crops and natural range and pasture. Where a commercial dairy sector has emerged, it has usually done so in conjunction with the development of forage crops. Otherwise, the efforts have not led to much on-farm/on-range adoption except for fodder production in the irrigated areas of Sudan and for commercial ranches. Range management research has not led to the development of economically viable techniques for substantially increasing either primary or secondary productivity per hectare.
- 2.087. The discussion of technology so far has dealt mainly with single components rather than with complete production systems. Three ‘modern systems’, each involving a whole package of new technologies, have been tried on a fairly large scale in sub-Saharan Africa in the last half-century. Commercial feedlots appeared promising initially, but were badly hit when international beef prices collapsed in the mid-1970s. Commercial ranching (and its cousin, parastatal ranching) has been adopted over wide areas in Angola, Botswana, Kenya, Nigeria, Tanzania, Zaire, Zambia and Zimbabwe.
- 2.088. When well managed, ranches have higher productivity per animal than traditional African livestock systems in similar environments but not, it now appears, higher productivity per hectare. Ranches have been successful only when their proprietors have privileged access to land and do not have to pay the opportunity cost of diverting that land from other uses.
- 2.089. The third modern system introduced has been commercial dairying, involving a complete package of breed, health, feed and other production innovations, as well as modern transport, marketing and processing facilities. While it has been successful on large farms in Zimbabwe and initially on large, and later on small, farms in Kenya, it has not been successful generally, for a variety of political, economic and technical reasons. These include low producer prices, shortage of breeding stock, and disease problems, particularly dermatophilosis (see 5.008).

National organisations

- 2.090. ILCA’s mandate is to assist national efforts to develop sub-Saharan Africa’s livestock sector rather than to implement development on its own. In the following section we examine the nature and needs of the national organisations directly responsible for livestock research, training and development on the continent.
- 2.091. There are about 39 countries in sub-Saharan Africa with sizeable human populations (defined as more than half a million in 1982). These countries, listed in Appendix 2.1, constitute ILCA’s primary client countries. Within them we can distinguish various kinds of client organisation:
- national agricultural (livestock) research institutes: these are primarily involved in research, but also do some training of extension staff and are involved to some extent in policy-making;

- **agricultural universities:** these are primarily involved in academic training but also provide research and some job-specific vocational or in-service training; they also have some involvement in policy analysis and policy-making;
- **agricultural training colleges:** these are primarily involved in job-specific vocational or in-service training;
- **livestock development services (animal health, extension, etc):** these are primarily involved in implementing development programmes using improved technology;
- **policy-making organisations:** these government organisations (usually ministries) direct and allocate resources to livestock research organisations and development services, and make the decisions which determine the background against which livestock development takes place;
- **professional associations:** these national and regional bodies can, in some cases, play a role in research and in technology transfer, in policy formulation and in the training of scientists;
- **farmers' organisations*:** these operate in various forms at local level, and can act as the mechanism for testing or introducing new technology, buying and distributing inputs, organising labour, allocating land, and marketing surplus produce.

Each of these kinds of organisation has different functions, and hence requirements which ILCA can meet (see 6.043).

- 2.092. NARSs differ substantially among countries in terms of their effectiveness. There is a modest positive correlation between the degree of effectiveness of the different kinds of organisation set out in 2.091: countries with more effective national agricultural research institutions tend also to have more effective 'other' livestock services. Four factors mainly determine the effectiveness of NARSs:
- the number of well qualified scientists in different disciplines;
 - the adequacy of the budget for non-staff expenditure;
 - the effectiveness with which research efforts are managed; and
 - continuity in research activities and effective incentives for isolated researchers.
- 2.093. There is some information on the endowment of different countries in sub-Saharan Africa with qualified agricultural scientists. The best figures available suggest that there were, in the first half of the 1980s, about 6000 scientists (defined as having at least a BSc) working in research in national organisations (including universities) in sub-Saharan Africa on all agricultural topics and commodities. This figure can be compared with the estimated 31 750 'professionals' working in the whole agricultural sector in 1984.
- 2.094. About 49% of agricultural research scientists are found in West Africa (which has 42% of the human population), 27% in East Africa (30%), 17% in southern Africa (12%) and 7% in central Africa (16%). About 15% of all these scientists have PhDs, and a further 35 to 40% have MScs. Total annual expenditure on agricultural research (at 1980 prices) is about US\$ 400 million, of which 58% is spent in West Africa.

* A few African countries have farmers' organisations that are important enough for ILCA to try to involve in its work. While we can not directly serve any significant number of individual farmers or their organisations, some peasants' associations in Ethiopia and group ranches in Kenya have collaborated with us on a modest scale in on-farm research and technology testing.

- 2.095. Incomplete figures suggest that 18% of the 6000 agricultural researchers, i.e. 1100 of them, work in livestock-related fields, i.e. veterinary medicine, animal husbandry and forage crops and pasture. Of these about 30%, say 350 people, are working on veterinary issues. For most countries figures indicating expenditure on livestock-related research are not available, but we assume that expenditure will be proportional to staff costs, i.e. of the order of US\$ 70 million p.a. (at 1980 prices).
- 2.096. There are 24 countries for which reasonably complete data exist on the number of scientists concerned with livestock-related research. These countries account for 64% of sub-Saharan Africa's TRLUs. In seven of them (accounting for 33% of TRLUs) there are more than 35 livestock scientists, in another seven (accounting for 23% of TRLUs) there are between 15 and 35; and in the remaining 10 (accounting for only 7% of TRLUs) there are less than 15. For five countries, accounting for 37% of TRLUs, data are not available. Of these 'unknowns' Sudan almost certainly has over 35 livestock scientists.
- 2.097. Rather arbitrarily, we define countries with more than 35 livestock scientists (i.e. Mali, Nigeria, Cameroon, Kenya, Tanzania, Zimbabwe and Senegal) as being potentially capable of conducting a reasonably comprehensive set of adaptive experiments (comprehensive in the sense of including several components, e.g. nutrition, fodder production, etc). We believe countries with less than 15 livestock scientists to have very little capacity, and those with 15 to 35 to have a capacity provided they concentrate their efforts. We can categorise these countries as 'well endowed' (> 35 livestock scientists), 'modestly endowed' (15–35), and 'ill-endowed' (< 15) respectively. These terms are used relative to conditions in sub-Saharan Africa, not in an absolute sense.
- 2.098. Implicit in this categorisation is that a certain critical mass is needed to make progress, whatever the size or complexity of a country's livestock sector. With current PhD/MSc/BSc ratios, a total of 15 'scientists' implies only about three PhDs, i.e. people formally trained to carry out research.
- 2.099. This information is important for two reasons: it identifies those countries in which the need to train scientists to conduct livestock-related research is greatest, and it helps us to identify those countries in which we can expect to engage in effective collaborative research in the near future.
- 2.100. The World Bank has undertaken a study of the focus of current national livestock research in sub-Saharan Africa. Results of this study for the West African region (15) reveal that the main emphasis is on veterinary work and, secondly, on animal breeding experiments. Analysis of the research papers relating to sub-Saharan Africa's livestock published between 1975 and 1983 in refereed journals confirms the emphasis on animal health (52% of papers) but not on breeding (only 5%). In relation to species, 50% of the papers dealt with cattle, and, in relation to zone, 45% dealt with arid/semi-arid areas and 30% with the subhumid zone.
- 2.101. Individual national organisations differ in their requirements from ILCA according to their kind and to their own effectiveness as well as that of other organisations in the same country. In our experience so far, research organisations need particular help with research techniques, services and germplasm. Training/teaching establishments need teaching materials, and livestock development services need complete technology packages. Many national organisations need an improved understanding of relationships in their livestock subsectors.

- 2.102. The less effective a country's research organisation, the more will that country need ILCA to provide complete technology packages. On the other hand, the more developed its research organisation, the greater will be its demand for research and analytic techniques and the less its demand for laboratory services; and the more developed its teaching and training organisations the greater will be their demand for training materials.

Regional and international organisations

- 2.103. A number of regional and international organisations as well as bilateral donors are involved in livestock-related research in sub-Saharan Africa. Some of these organisations, and their major activities, are listed in Appendix 2.15.
- 2.104. A number of other regional and international organisations and donors are active in African livestock development. Some of these are listed in Appendix 2.16.
- 2.105. Within the limits of its resources, ILCA seeks to assist, collaborate with and benefit from the work of these international and regional organisations. This is done by inviting them to meetings at ILCA, by attending workshops organised by them, by less formal visits, and by occasional specific missions with or to them.

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ILCA's Internal Environment

- 3.001. ILCA's external environment has to a large extent dictated the development of the Centre. This chapter describes the internal environment of ILCA in terms of our resources, organisation, activities and our achievements. In so doing it outlines the institutional circumstances that will condition the implementation of our future strategy.

Resources

Locations

- 3.002. ILCA's research locations represent the major agro-ecological zones of sub-Saharan Africa, and are in areas with high concentrations of ruminant livestock. Ethiopia, with the highest ruminant livestock population of all African countries, was chosen as our host country. Further reasons for choosing Ethiopia were its neutrality from an anglophone/francophone viewpoint, and the fact that the country already hosted several other international organisations.
- 3.003. Nigeria, with the third highest livestock population in the subcontinent and with large areas representative of the humid and subhumid zones, is the site of two of our field programmes. Mali, with large livestock populations and with arid, semi-arid and subhumid areas, hosts a third field programme giving the Centre a base in francophone West Africa. ILCA's Highlands Programme is located in Ethiopia, which includes most of the highland area of Africa. Our East African rangelands work is in the southern rangelands of Ethiopia and on group ranches in the Kajiado District of Kenya. (Rangelands work in Botswana was discontinued in 1985.)
- 3.004. ILCA has two major research stations at Debre Zeit and Debre Berhan in the highlands of Ethiopia and conducts research at a range of sites in collaboration with various Ethiopian institutions. These include sites in the Rift Valley, the southern rangelands and the highlands. The Highlands Programme and part of the East African Rangelands Programme operate from our headquarters, which are in Addis Ababa, the country's capital.
- 3.005. The Livestock Productivity and Trypanotolerance Group and the Kenyan team of the East African Rangelands Programme are based at ILRAD's headquarters in Nairobi, Kenya. The rangelands team works principally in the Kajiado District of southeast Kenya, while the group operates, jointly with ILRAD, a network of sites in West, central and East Africa. The Humid Zone Programme is based at IITA's headquarters in Ibadan, Nigeria. The programme conducts research at village sites in southwest and southeast Nigeria. The Subhumid Zone Programme is located in Kaduna and conducts research at four major sites in central Nigeria. Our Arid and Semi-arid Zones Programme operates from Bamako and Niono in central Mali and does research at a wide range of sites in the central and southern parts of the country. One of the staff members of this programme works at ICRISAT's Sahelian Centre in Niamey, Niger. Studies have been carried out at sites in the area surrounding Niamey.
- 3.006. Through its networks ILCA collaborates with NARSs in several other countries in sub-Saharan Africa. The Trypanotolerance Network includes collaborative research in Ethiopia, Gabon, Gambia (as well as having a staff member working at ITC in Banjul), Ivory Coast, Kenya, Senegal, Tanzania, Togo and Zaire. We are also involved in field activities in Botswana and Zimbabwe, and maintain

collaborative links through the ARNAB Network in Senegal and through the Small Ruminant and Camel Network in Rwanda, Mozambique, Somalia, Congo and Sudan.

- 3.007. ILCA conducts research at a number of sites owned and administered by NARSs. Such arrangements exist in Benin, Botswana, Ethiopia, Gambia, Kenya, Mali, Niger, Nigeria, Rwanda, Senegal and Zimbabwe.

Facilities

- 3.008. Major facilities at ILCA's headquarters include offices, a library, an animal barn, laboratories for animal nutrition, reproduction and health work and soil/plant sciences, a forage germplasm genebank, central and micro-computers, telephones, telex and radio communication links, an auto-tutorial room for trainees, and specialised documentation, publication and photographic equipment. We also have 23 houses for staff and hostel accommodation for 60 visitors/trainees.
- 3.009. Facilities at other sites in Africa are primarily in the form of office and laboratory equipment. Besides basic office facilities there are 15 micro-computers used by ILCA outside Ethiopia. We own and operate two aircraft (one based in Ethiopia and one in Mali), which we use primarily for aerial surveys. ILCA also owns transport vehicles, distributed over all major sites.

Expenditure

- 3.010. Calculated as percentages of total core expenditure, ILCA's mean expenditures on research, training and information over the 1982-86 period were 64%, 7% and 10% respectively. The corresponding 5-year means for all 13 CGIAR-supported centres were 61%, 8% and 6% respectively. ILCA's 5-year mean expenditure on research lies between that of CIMMYT (66%) and ICRISAT (61%), being fourth highest after WARDA (81%), IFPRI (67%) and CIMMYT. The proportion of funding allocated to training at ILCA is the seventh highest of all centres, while that to information is the highest.
- 3.011. Following the recommendations of our 1981 QQR we have strengthened headquarters research, but because of insufficient growth in funding this has been achieved at some cost to our field operations. In 1982, central research accounted for 19% of total core funds and field programme research for 46%; in 1986 the respective figures were 36% for central research (which includes research networks) and 27% for field research.
- 3.012. The ratio between staff and non-staff costs at ILCA has remained fairly constant at 1.17:1.00, core expenditures for these two categories being US\$ 5.31 million and 4.65 million respectively in 1982 and US\$ 7.60 million and 6.31 million respectively in 1986.
- 3.013. Net funding for ILCA in 1986 was US\$ 14.89 million, plus an additional US\$ 2.00 million received for special projects. The 1986 ratio of expenditure between our research, training and information activities was approximately 60:10:10, with the remaining 20% used for Board, administration and finance operations and outreach activities (Table 3.1). The ratio of expenditure for headquarters compared to field operations is currently 70:30.
- 3.014. The projected net core funding requirement for 1987 is US\$ 16.4 million (in 1987 US\$), an amount that does not include provision for real growth in senior staff or operating costs over the 1986 estimate, only a 10% inflation element. Additional, special project, funding is projected to be US\$ 1.842 million in 1987.

Personnel

- 3.015. The changing ratio of expenditures on central research and field programmes in part reflects the ratio of staffing. In 1982, 54% of professional staff were stationed at headquarters and 46% in field programmes; in 1986, 68% were at headquarters and 32% in field programmes.
- 3.016. In 1986 the staff of ILCA comprised 55 internationally recruited professionals, 26 national professionals, 9 postdoctoral and research associates and 514 support staff, 384 of whom were at headquarters. Thirty of the international staff hold PhD degrees, 15 hold MSc degrees and 10 hold BSc degrees. Among the local professionals there are 2 PhDs, 11 MScs, 6 BScs and 5 Diplomas.

Table 3.1. *Core expenditures at ILCA, 1986.*

Item	Expenditure (US\$ '000)
Research	
Direction	194
Central research units	2 791
Central support units	1 345
Networks	730
Field programmes	3 711
(Total)	(8 771)
Training and information	1 989
Outreach	342
Board, EMR/EPR and management	836
Operations	
Finance	424
Administration	448
General operations	1 103
(Total)	(1 975)
Capital	1 087
Earned income	- 110
Net requirement	14 890

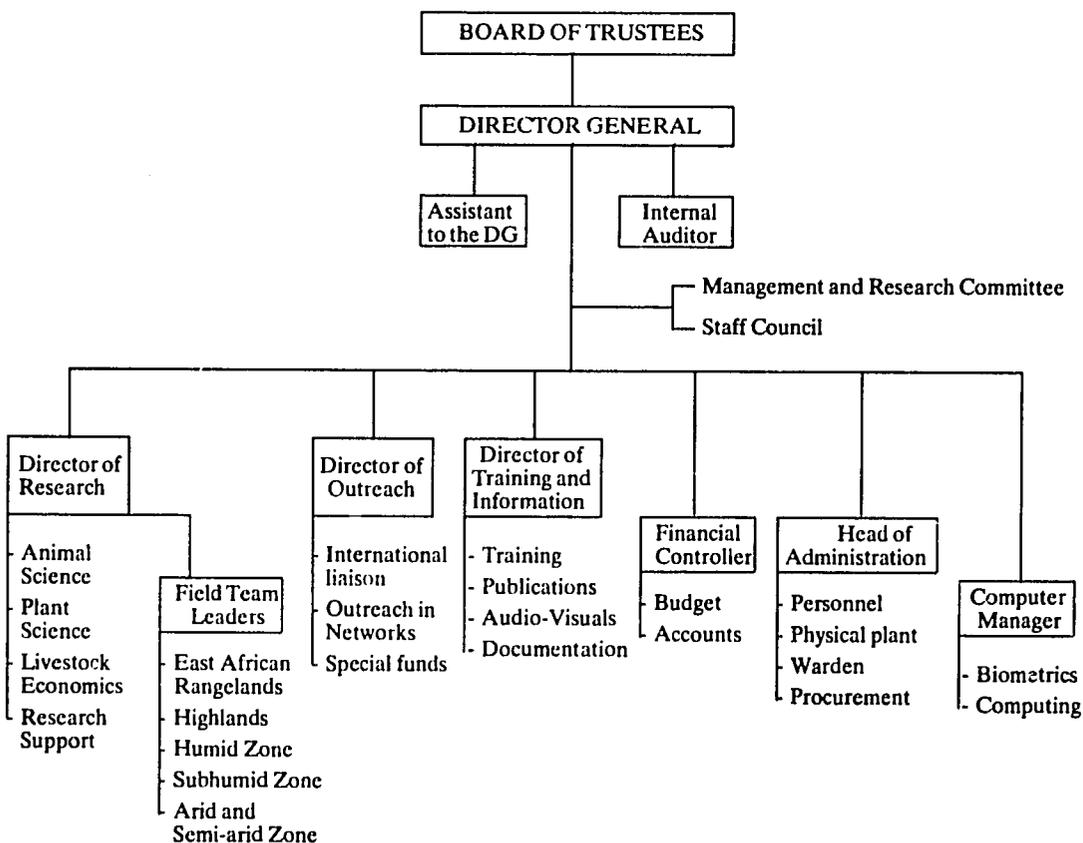
- 3.017. When ILCA started, social scientists were a particularly important disciplinary group in studying and understanding the livestock systems of sub-Saharan Africa. Since we have developed our component research, we have employed more biological scientists in both field programmes and central research units. Out of a total professional staff of 81, ILCA's scientific professional staff in 1986 included 12 animal scientists, 20 other biological scientists, 13 social scientists, 3 programmers and 1 biometrician.
- 3.018. To an outsider these figures may convey the impression that we are well endowed with scientific staff. Considering our broad mandate, however, as well as the complex nature of livestock production in sub-Saharan Africa, which we will still have to deal with even if we focus our efforts, we do not have critical mass in personnel. Ways of complementing the Centre's human resources are described in 4.061-4.064.

Organisation

Departmental structure

- 3.019. At present, we have three major departments: Research, Outreach, and Training and Information. These are supported by two departments concerned with 'operations' – Administration and Finance. This organisational structure (Figure 3.1) follows a restructuring exercise in January 1986, in which research was reorganised into five divisions, the former Training Department and the former Information Department were merged to form the Training and Information Department, and the Liaison Department assumed additional responsibilities for network operations and special projects, becoming the Outreach Department.
- 3.020. The divisions within the Research Department include Animal Science, Plant Science, Livestock Economics, Research Support and Zonal Research. The Director of Research is supported by three deputy directors, each of whom also heads a central research division.
- 3.021. We introduced a new system of research protocols in 1986. Each research project now has to have an approved protocol that covers problem specification, research objectives and hypotheses, programme of work, data analysis and a statement of anticipated impact. These protocols are intended to improve the quality of research, and are used to assist the monitoring of research projects and to provide justification for the use of donor funds.

Figure 3.1. *Organisational structure of ILCA, January 1986.*



- 3.022. A Research Committee has also recently been formed. The committee is responsible for helping review research protocols, deciding on areas to be supported through the appointment of postdoctoral associates and identifying priorities for research conferences and workshops.
- 3.023. The Outreach Department has a director supported by a deputy director and a small team of liaison staff.
- 3.024. The Director of the Training and Information Department is supported by a deputy director, and by the heads of the department's three divisions: Training, Documentation and Publications. He chairs three committees which enable staff from other departments to help formulate policies for training, documentation and publications activities.
- 3.025. The Training Division is responsible for organising and administering our official training activities. The Documentation Division provides library and specialised information services to national livestock researchers and ILCA staff, while the Publications Division is responsible for producing our official publications and providing communication services.
- 3.026. The Finance and Administration departments provide support to the three other departments, both at headquarters and in field programmes. The heads of these two departments report directly to the Director General.
- 3.027. Internal communication channels at ILCA include a weekly meeting of senior staff, a weekly Management Committee meeting, intra-departmental meetings held according to need, and regular meetings of additional committees on Works and Maintenance, Transport and Housing (as well as those mentioned in 3.024).

Board and management

- 3.028. ILCA's 14-member Board of Trustees consists of two members designated by the Ethiopian Government, four designated by the CGIAR, seven elected by the Board and the Director General (*ex-officio*). Board committees consist of the Executive, Programme, Audit/Finance and Nominating Committees. Board practices were reviewed during 1986 and changes effected to ensure a more positive relationship between the Board and ILCA's management.

Activities

General

- 3.029. ILCA's research activities during the first 5 years were aimed primarily at understanding traditional livestock production systems and at identifying constraints to increased production. At the same time we developed a documentation centre, provided limited training opportunities and organised meetings.
- 3.030. Since 1981 we have emphasised component research aimed at developing technology to improve livestock production. The information and documentation services have been expanded and, over the past 3 years, the training opportunities we provide have increased dramatically. We have also placed greater emphasis on international cooperation in research, particularly through our coordination of networks. The following section outlines the major activities of ILCA's organisational units up to December 1986.

Research

- 3.031. We have used a farming systems approach to identify researchable problems, commodity- or component-oriented research to develop or adapt technology suitable for intervention, and policy and institutional research to increase understanding of the economic and social issues of livestock development.
- 3.032. The Animal Science Division has included three sections: the Animal Nutrition Section, the Animal Reproduction and Health Section and the Animal Husbandry and Breeding Section.
- 3.033. The Animal Nutrition Section has used experimental facilities at ILCA's headquarters and at Debre Zeit. It has been linked to NARs in Africa through the African Research Network for Agricultural Byproducts (ARNAB, begun in 1982, currently with 569 African members). The aim of the section has been to improve livestock production through the more efficient use of available feedstuffs and through the introduction of strategic supplements. The section has been involved in diagnostic research on nutritional problems, in applied research to address specific constraints, and in basic research focused on unique problems of livestock nutrition in Africa.
- 3.034. The Animal Reproduction and Health Section has aimed to develop the resources and methods needed to understand better the problems limiting the rates of ruminant reproduction in sub-Saharan Africa and the health constraints limiting productivity. The section's research programme has been divided into three major areas: reproductive physiology, reproductive diseases of cattle, and animal health.
- 3.035. The Animal Husbandry and Breeding Section has included three groups: the Livestock Productivity and Trypanotolerance Group, the Small Ruminant and Camel Group and the Dairy Technology Group.
- 3.036. The Livestock Productivity and Trypanotolerance Group, based in Nairobi, has aimed to evaluate the productivity of different breeds of domestic ruminants under different management systems in different ecological zones. Its task has also been to predict the productive capacity of different breeds under different levels of disease risk, and to evaluate the cost-effectiveness and impact of different methods of disease control. The group has coordinated the African Trypanotolerance Network (with ILRAD) and the collection and analysis of data on livestock productivity outside the tsetse-infested areas.
- 3.037. The African Trypanotolerance Network (begun in 1977) has involved collaborative research at sites in 10 African countries. Its work has included collection of data on environmental factors, performance traits, mortalities, nutritional status, vector prevalence and trypanosomiasis infection levels in more than 10 000 animals.
- 3.038. The objective of ILCA's Small Ruminant and Camel Group has been to evaluate and improve the productivity of small ruminants and camels under different management and ecological situations. Since its establishment in 1983 the group has been involved in analysing production data and proposing solutions to production constraints, in documenting the importance of genotype-environment effects on productivity, in identifying social and management factors affecting productivity, and in helping NARs implement research.
- 3.039. ILCA's Dairy Technology Group has aimed to improve the marketability of dairy produce by designing processing technology suitable for smallholders and

by implementing training programmes. The group's research has included work on fermented milk technology, butter and cheese processing, and the use of milk byproducts.

- 3.040. The Plant Science Division has included the following sections: the Forage Agronomy Section, the Soil Science and Plant Nutrition Section, and the Pastoral Ecology Section.
- 3.041. The Forage Agronomy Section has comprised five subprogrammes. One of them has been devoted to developing a genebank of potentially useful forage germplasm by collecting or acquiring accessions and by maintaining curatorship through inventory, quality control, seed multiplication and selective dissemination.
- 3.042. The forage evaluation work has included initial screening, regional evaluation and seed increase of germplasm, as well as developing a database of performance information. Much of this work has been done through interactions with other ILCA programmes and with NARSs.
- 3.043. The plant adaptation/agroclimatology subprogramme has focused on developing modelling and predictive procedures for germplasm adaptation based on environmental (agroclimatic) analysis and growth response modelling. Rhizobiology work has been aimed at developing a basic understanding of the role of *Rhizobium* in forage legume adaptation and its use in African environments.
- 3.044. In conjunction with ILCA's zonal programmes and with NARSs, the section has also aimed at developing collaborative, multidisciplinary research on improved feed resources and soil fertility inputs appropriate to African farming systems. This has been attempted either directly or through networks and training programmes.
- 3.045. The section has coordinated a network on forage genetic resources (begun in 1983, currently with 1301 African members) in sub-Saharan Africa. It has also provided support for the Pasture Network for East and Southern Africa (PANESA, begun in 1986, currently with 712 African members).
- 3.046. The objectives of the Soil Science and Plant Nutrition Section have been to characterise the chemical/physical constraints to the growth of legume forages for the major soil orders of Africa, to evaluate the efficiency of use of nutrients and water and their management in legume-based crop-livestock systems, and to identify the role of legumes in maintaining or improving soil fertility and forage quality.
- 3.047. Three major projects within the subprogramme have been designed to support ILCA's zonal and national research programmes. These involve soil nutrient typification, diagnosis of constraints to plant and soil productivity, and nutrient and water use management.
- 3.048. The Pastoral Ecology Section was established to evaluate existing, and develop new, techniques for assessing range resources. Its tasks have been to evaluate mathematical models for the analysis of primary and secondary rangeland production, and to explore the use of new techniques such as satellite imagery and computer mapping to establish trends in range productivity.
- 3.049. The Livestock Economics Division has aimed to heighten the awareness of African governments of the importance of livestock policy issues, to carry out research on priority issues, and to encourage others to carry out similar research. The division has also been involved in evaluating new technology and

in assessing the economic impact of ILCA's work. Results and methods have been communicated to policy makers through the African Livestock Policy Analysis Network (ALPAN), begun in 1984, currently with 654 African members.

- 3.050. ILCA's research support facilities have included experimental stations and the nutrition and soil/plant laboratories. Research has also been supported by resource surveys and the Computer Unit, which provides biometric and computer facilities and expertise.
- 3.051. Zonal research has comprised five field programmes: the Highlands Programme, the Humid Zone Programme, the Subhumid Zone Programme, the Arid and Semi-arid Zones Programme and the East African Rangelands Programme.
- 3.052. The objective of the Highlands Programme has been to improve agricultural production in the mixed smallholder farming systems of the highlands. The programme has aimed to determine the obstacles to improved crop and livestock productivity, to design and test interventions that will alleviate them, to develop and implement techniques to overcome infrastructural limitations and to transmit research methods to NARSs.
- 3.053. The programme has included the following major components: soil/plant nutrition and agronomy, animal power for improved management of Vertisols, sheep production, and smallholder dairy production.
- 3.054. The Humid Zone Programme in Ibadan, Nigeria, has aimed to increase the productivity of small ruminants under village conditions, to evaluate browse legumes for the dual role of feed and mulch in alley farming systems, and to investigate the role of cattle in the zone's farming systems.
- 3.055. The programme's research has included projects on animal nutrition, productivity, diseases and their interactions. Browse and forage agronomy studies have concentrated on the identification of improved *Gliricidia* germplasm, on alley farming and on the development of intensive feed gardens. Other studies have included small ruminant marketing, land-use rights, the role of women in agriculture and the economics of livestock production.
- 3.056. The tasks of the Subhumid Zone Programme in Kaduna, Nigeria, have been to develop and test interventions that will improve feed supplies, to study socio-economic circumstances affecting the design of interventions, to do agronomic research to solve technical problems limiting both crop and livestock production, and to pass on research methods to NARSs.
- 3.057. The programme has introduced the fodder bank concept through on-farm research, with agropastoralists and crop farmers being an integral part of the research process. The major disciplinary groups involved have been animal science, agronomy and social science.
- 3.058. The objectives of the Arid and Semi-arid Zones Programme in Bamako, Mali, have been to determine constraints and develop interventions in both pastoral and agropastoral livestock systems. The research has been geared to evaluating feed resources, determining the profitability of possible improvements, investigating the use of draught animals, establishing suitable forage legumes for strategic feeding, and investigating grazing patterns and the effects of drought.
- 3.059. The East African Rangelands Programme has twin bases at ILCA headquarters and in Nairobi, Kenya. Work in the southern rangelands of Ethiopia has been

aimed at designing and testing interventions to increase rangeland and animal productivity. Research has been organised in four major areas: animal productivity interventions, including calf feeding; the introduction of forages and their evaluation; the exploitation of forage and water resources; and studies of plant ecology and remote sensing.

- 3.060. The aims of the research in Kenya have been to identify constraints to livestock production, determine how development interventions modify traditional production methods, clarify the causal relations between the factors influencing production and develop methods enabling more effective appraisal of pastoral production systems.
- 3.061. The team has begun joint projects with Kenyan institutions on interventions in the pastoral system, on crop–livestock interactions and on technology generation.

Outreach

- 3.062. The Outreach Department has been responsible for liaison with governments in countries where ILCA has operations, and with donor-country, international and national organisations. Its other tasks have been to assist field operations to expand their zonal impact and to oversee the administrative aspects associated with ILCA's research networks. Recently, the department has taken a lead in coordinating ILCA's submissions for special project funding and the Centre's reports to donors to special projects.
- 3.063. The Outreach Department has arranged Memoranda of Agreement with a number of African governments, and has been instrumental in promoting good relations with government departments in Ethiopia. It has also provided assistance to network coordinators in liaising with African governments. The department has occasionally been involved in organising meetings, particularly with the leaders of African NARSs (see 6.002).

Training and information

- 3.064. The Training Division has organised group and individual training activities, primarily at ILCA's headquarters. Training activities have expanded considerably since early 1985. The division has also organised joint training and conference activities with other institutions.
- 3.065. The Documentation Division has managed the library at headquarters and provided specialised information services for ILCA staff and for other livestock researchers in sub-Saharan Africa. Its activities have included the recording on microfiche of non-conventional literature from NARSs, the preparation of indexes and specialised bibliographies, the provision of a monthly SDI service, and the operation of facilities for database searches and indexing and abstracting of ILCA documents and publications. The division has also been responsible for distributing ILCA's publications.
- 3.066. The Publications Division has established in-house publishing facilities and now produces all of ILCA's official publications, meets internal printing requirements, produces tape/slide presentations and training modules, provides photographic services, assists in the preparation of visual aids, prepares maps and figures and provides editing, translation, proofreading and typing services.

Achievements

Research

- 3.067. In the highlands, studies of mixed farming systems have clarified the constraints limiting livestock and crop production. Interventions have been defined and

tested, including the combined use of crossbred cows and forage legumes, which together are capable of increasing farm income threefold, water and soil conservation techniques to prepare terraces for cropping and ponds for use during the dry season, and techniques for the improved management of Vertisols, including a modified plough to prepare broadbeds and furrows. Ethiopia's Ministry of Agriculture has been using much of this technology in a nationwide trials programme planned to include 2000 sites by the year 1990. Testing of these interventions, some of which have already demonstrated a substantial impact on crop yields, includes assessment of their economic impact.

- 3.068. In the humid zone of Nigeria, alley farming (based on alley cropping developed by IITA) using *Leucaena leucocephala* and *Gliricidia sepium* has been successfully introduced under a pilot development project of the NLPD. More than 100 producers have now established tree legumes on their farms. Over the next 5 years a further 15 000 farmers are expected to plant alley farms as part of Nigeria's Fourth National Livestock Development Plan. We are currently assessing the economic impact of alley farming.
- 3.069. In the subhumid zone, ILCA has developed fodder banks, based on the legume *Stylosanthes*, as a means of providing high-quality livestock feed during the dry season. The testing of 66 fodder banks by NLPD with the assistance of ILCA has attracted financial support from the World Bank for the establishment of an additional 2000 banks over the next 5 years. Fodder banks are also being used to improve food crop yields.
- 3.070. Studies in the arid and semi-arid zones of Mali have shown that it is more difficult to develop interventions for improving production in these zones than it is in wetter ones, but new techniques for improving the management of livestock and for introducing legumes (in particular cowpea) to improve both livestock and crop production have been tested.
- 3.071. Results in the East African rangelands suggest that pastoral systems can be at least as productive as ranching systems on a per hectare basis. Three-day watering in the southern rangelands of Ethiopia appears to have had little effect on the productivity of cattle, while increasing grazing orbits around watering points. In both Ethiopia and Kenya possible intervention points have been identified, including the introduction of forage legumes for increasing calf growth, this being the most limiting factor in the system. However, the chances of successfully introducing technical innovations that will substantially increase production in communal rangeland areas with low rainfall appear poor.
- 3.072. Research by the African Trypanotolerance Network has shown that, contrary to earlier views, trypanotolerance is quite strongly inherited and tolerant animals in areas of low to medium tsetse challenge can be as productive as other breeds in tsetse-free areas. Latest results suggest that the incorporation of trypano-tolerant animals in a package of other control measures permits animal production in areas previously devoid of livestock.
- 3.073. Research on animal nutrition has evaluated a wide range of feed supplements, including those most useful during drought. Our researchers have examined the effect of work on intake and utilisation of feed, and have determined the nutritive value of several leguminous browse species.
- 3.074. Dairy technology research has led to the development of techniques for conserving increased milk supplies in various forms of cheese and butter. These techniques are appropriate to smallholder farmers, and, in Ethiopia, have been included in the extension work of several dairy cooperatives.

- 3.075. We have built a unique collection of forage germplasm backed by catalogues containing information on each accession. Accessions have been tested in a range of environments and a distribution system has been established. We have developed several methods for introducing forage legumes into different ecological situations, including alley farming, fodder banks, intercropping and rotational cropping. Agro-ecological studies have assisted in identifying the forage legumes most appropriate to a given system.
- 3.076. Major studies have been undertaken to analyse the policy constraints to agricultural and livestock production, to assess levels of infrastructural development and the financing of livestock services, to determine the impact of new technologies on small farms and to outline the policy and economic implications of the high levels of dairy imports into sub-Saharan Africa.

Training and information

- 3.077. ILCA's training activities, both at headquarters and in the field programmes, have been intensified over the past 3 years. Five major categories of individual training have been established, and we are now able to accommodate each year 160 course participants and 50 individual trainees at headquarters alone. Altogether, about 550 trainees have attended our training courses and 140 individuals have spent from 2 weeks to 2 years working and studying at ILCA. A further 2500 people have attended the meetings we have organised. Training activities have also strengthened our links with African universities.
- 3.078. Our Documentation Centre now provides a monthly SDI service to scientists in sub-Saharan Africa and a current titles service to 100 African libraries. The Publications Division has established a number of serial publications in which our research results are published. Our publications are sent (selectively) to a mailing list of nearly 6000.

A Strategy of Choice

ILCA's goals

- 4.001. ILCA's ultimate goal is to fulfil the Centre's formal mandate, as given at the outset of this document. As the wording of the mandate indicates, ILCA is not to pursue this goal by its own efforts alone, having, like all the centres in the CGIAR system, been established specifically to assist national efforts. However, we can define a number of intermediate goals, in terms of areas which ILCA can be expected to influence directly. These intermediate, or operational, goals are:
- to strengthen the ability of NARSs to conduct technical and policy research in livestock-related fields and thus to develop their own technical solutions to production problems and to promote livestock and rural development;
 - to develop, through ILCA's own research and that of other organisations, technical packages for increasing livestock production and the contribution of livestock to sustainable agricultural production and income;
 - to contribute to scientific knowledge in a way conducive to solutions to livestock production problems; such knowledge may relate to the understanding of production constraints and opportunities, or to research methods and techniques.

Success measurement

- 4.002. It is against these operational goals that ILCA's success will be measured. We define success as an improvement in the sustainable economic output of livestock products.

Strategy statement

Recognising the Centre's limited financial resources and the number and complexity of factors affecting livestock production in Africa, ILCA's strategy is to choose a limited number of activities that will achieve measurable and sustainable increases in livestock output in sub-Saharan Africa.

The operational mandate

- 4.003. As noted in 1.011, ILCA's formal mandate is less specific than that of other centres in the CGIAR system. However, a centre of ILCA's size cannot simultaneously address all the livestock problems of a continent the size of Africa. To be effective, we have to be selective.
- 4.004. Thus, while TAC have stated that ILCA's formal mandate need not be altered (1), we have developed an operational mandate that delineates our priorities. We see our operational mandate as differing from our formal one in being more sharply defined, and subject to periodic revision as goals are achieved or new priorities arise.
- 4.005. In the operational mandate we make the basic choices of species, target groups, zones and commodities/functions that are not made for us in our formal

Figure 4.1. *ILCA's research priorities.*

Species	Cattle, Sheep, Goats Camels, Equines, Pigs, Poultry, Unconventional Species, Fish
Target Groups	Smallholders, Agropastoralists <i>Pastoralists,</i> Ranchers
Zones	Semi-arid, Subhumid, Humid, Highland, Arid
Products	Meat, Milk, Traction, Manure Transport, Hides, Skins, Fibres, Eggs

Bold = High priority; *Italic* = Medium priority; Light = Low/no priority.

mandate. These choices are outlined in Figure 4.1 and discussed in detail in the following section.

Choice of species

- 4.006. **Cattle, sheep and goats.** Throughout its first 10 years ILCA has worked almost exclusively on the three major ruminant species: cattle, sheep and goats (see 2.026). In accordance with TAC's belief that the CGIAR should not start work on additional animal species in Africa (2), we propose no change in this selection. Like much of the work elsewhere in the CGIAR system, research on livestock at ILCA is of a long-term nature, requiring continuity and focus if it is to be successful.
- 4.007. The choice of these three species is also justified on technical grounds. Unlike monogastric species, which need better quality feed, ruminants are extremely efficient converters of low-quality plant biomass into high-quality human food. Among the domestic ruminants found in Africa, cattle, sheep and goats are the most numerous. They also play an important part in transferring plant nutrients and, in the case of cattle, provide draught power to cultivate the land.
- 4.008. **Camels.** We see no special advantage in starting major work on camel production at present. Camels live almost entirely in the low-potential arid zone of sub-Saharan Africa (see 2.029). Their owners, the pastoralists of this zone, are highly efficient managers of their livestock, such that this species is probably already performing as efficiently as it can under existing levels of technology. The chances of significantly changing those levels within the foreseeable future are low. Apart from Kenya, Somalia and Sudan, few countries in our mandate region have camel research units in their NARSs; the lack of organisational structures and trained staff would therefore make it difficult to develop effective collaborative research on this species.

- 4.009. **Nevertheless**, we recognise the importance of the camel as the key to survival for some of the world's neediest people, the nomads of East Africa. We also acknowledge that few regional or other international organisations in Africa have programmes on this species. For these reasons, although we have decided against camel production as a major research thrust for ILCA, we do not rule out occasional work on this species – for instance in technology adaptation or in data analysis – whenever the capability for doing such work at low cost exists within ILCA.
- 4.010. **Pigs**. We do not intend to start work on pig production for at least the next 5 years. Pig production for urban consumers is growing rapidly in some regions (4.5% p.a. in central and West Africa), but this growth is occurring mostly in specialised commercial enterprises, which are not a primary target group of ILCA's research (see Figure 4.1). In rural areas, for religious and cultural reasons pork is not traditionally eaten. There is therefore little demand for pork amongst ILCA's major target groups.
- 4.011. **Poultry**. We do not intend to start work on poultry production for at least the next 5 years. Poultry are widely kept by smallholders and agropastoralists throughout sub-Saharan Africa, but growth in the poultry sector (3.5% p.a.), as in the pork, is occurring mostly in peri-urban areas, while production in rural areas appears static. The advanced technology available for production in the large-scale intensive units primarily responsible for this growth is, for financial and managerial reasons, not applicable to the smallholder sector.
- 4.012. We nevertheless perceive an unexploited potential for growth in smallholder poultry production, which could be achieved through relatively simple managerial and disease control inputs. This potential is one that could be tapped fairly easily by NARSS, through local adaptive research using existing technology; given the need to concentrate our research efforts, we do not therefore see it as a priority area for ILCA involvement at present.
- 4.013. **Unconventional species**. There may be some potential for improving livestock production in Africa through the use of so-called unconventional species. The smaller of these especially, being easy to feed and handle, offer opportunities for production within the household by landless peasants and resource-poor smallholders. As population growth increases the pressure on land, such species may well assume increasing importance in the future. While we see possible involvement with unconventional species over the long term, the current small numbers in each species do not warrant a major research effort at present. Also, the diversity and multiplicity of these species – there are over 50 of them inhabiting a wide range of ecological niches – would make the choice of a focused research programme difficult and prone to location-specificity. (See also 2.027).
- 4.014. **Equines**. Work by ILCA on equines has so far been restricted to a few studies on the nutrition of donkeys and their use for transport. We do not intend to expand this work at present. Equines are used for traction as well as for transport, and thus benefit farm efficiency, but they do not contribute directly to food production, and the prospects for generating new technology for these species look at best uncertain. However, as in the case of camels, there may be some low-cost adaptive research on equines that can be done as a byproduct of our work on traction, which will focus mainly on cattle.
- 4.015. **Aquaculture**. Fish are already locally important as a source of protein in Africa. We acknowledge the considerable potential of small-scale fish farming to increase both human food supplies and farm income. While we do not intend to

include fish in our research programme at present, we may have some minor involvement with fish production through the development of better water harvesting techniques.

Choice of target groups

- 4.016 Among the various groups of livestock producers in Africa we have chosen smallholders and, to a lesser extent, agropastoralists to be the main focus of our work (see Figure 4.1). Some of our work will also be relevant to pastoralists, and a small part of it to ranchers.
- 4.017. **Smallholders.** We have selected mixed crop–livestock smallholder farmers to be the main focus of our work in the medium term. Although they may own few livestock individually, they are the most numerous group of livestock holders in Africa. By virtue of their numbers alone, smallholders offer the opportunity for making a major impact on the continent’s livestock output.
- 4.018. There are, however, other compelling reasons for focusing primarily on smallholders. These reasons centre round the concept of concentration of resources in order to maximise impact. Mixed smallholder farming systems offer the possibility of a wider range of technical and market-oriented innovations than do pastoral systems, in which the intermediate functions of manure and traction are not developed. Through these intermediate functions the primary focus on smallholders allows concentration on the key area of crop–livestock interactions, of vital importance in increasing African food production. This focus also offers considerable potential for increasing the marketable output of the two major food commodities of livestock production, meat and milk. This potential is more likely to be fulfilled in the subhumid, humid and highland zones, where producers tend to be closer to markets and can take advantage of the opportunity to produce fodder.
- 4.019. While we will place major emphasis on increasing the output of marketable commodities, we intend to continue to pay some attention to potentially underprivileged subgroups within the smallholder group, such as women farmers and farmers with few livestock. Some of these subgroups – for instance, agropastoralists without land tenure – have already been the subject of research by ILCA’s existing zonal programmes.
- 4.020. Small-scale intra-urban milk producers and peri-urban forage/meat producers are also considered as subgroups of the smallholder target group, and are considered to be targets of ILCA’s current and future research.
- 4.021. **Pastoralists.** As livestock producers, pastoralists are undoubtedly included by formal mandate among ILCA’s target groups. However, in the short term we intend to reduce our work on site-specific technology generation in areas where pure pastoralism is practised, in order to devote more resources to areas of higher potential (see 4.031 – 4.033). We reach this decision for the following two reasons:
- lack of pay-off: after 10 years of research on pastoralism in both East and West Africa we have been unable to identify technical innovations that bring more than a marginal benefit over traditional practices;
 - social trends: pastoralists are thought to account for only 5% of sub-Saharan Africa’s total population (see 2.019) and, in comparison with other groups, they are declining still further in importance; while their absolute numbers may still be slowly rising, many pastoralists are forsaking their traditional transhumance or nomadism to become agropastoralists or town dwellers; the potential for impact on this target group relative to others is thus declining.

- 4.022. Neither of these two reasons applies in semi-arid areas where pastoralists are settling. In these areas, where both agropastoralism and mixed farming are practised, we see considerable potential for increasing both livestock and crop production by developing the intermediate functions of traction and manure or by introducing forage crops. We have developed several innovations that appear to have as much promise in this zone as they do in others. Moreover, the human and animal populations of these areas are high and are expanding fast (see 2.018 and 2.029), so that a small percentage gain in output will have greater overall impact than a larger percentage gain might have in other, less populated areas.
- 4.023. Our decision to continue work on sedentary or settling pastoralists accords with TAC's own belief that more attention should be paid to rainfed agriculture in the semi-arid tropics (2). TAC has emphasised the need for a variety of tools, including greater use of trees and shrubs and the improved management of water, to produce better conditions for animal survival during the dry season.
- 4.024. As cropping expands in the semi-arid zone, more crop residues will become available for feeding animals; this trend may benefit some pure pastoralists as well as agropastoralists and mixed farmers. Pastoralists will also stand to benefit as livestock markets and services develop in other zones, acting as a magnet for themselves and their herds.
- 4.025. While we will reduce the amount of site-specific field work done in pastoral areas, some of ILCA's non-site-specific research will continue to be relevant to pastoralists provided national bodies can supply any necessary inputs. We will continue and expand our work in areas such as dairy processing and animal reproduction, with the intention of developing at least some technology that will apply across ecological zones and target groups.
- 4.026. In a few countries, notably Ethiopia and Cameroon, there are areas of rangeland that receive relatively high annual rainfall. In the short term we will continue to do research on technical innovations to improve calf growth – the critical intervention point in many pastoral systems – in such areas. If this research is successful we will consider a switch of resources back towards the more difficult rangeland areas in the longer term.
- 4.027. Our results in the pastoral areas so far have revealed some scope for improving government policies towards livestock production there. In particular, there are opportunities for increasing the income from herd offtake from pastoral systems by revising meat pricing policies. We will therefore continue to do policy research relevant to pastoral areas.
- 4.028. We will also continue studies on the resources used for livestock production in sub-Saharan Africa, and the pastoral areas will figure largely in this work because they are areas of concern in this respect. Resource use will form part of one of our major research thrusts (see 5.070 – 5.081).
- 4.029. **Ranchers.** Keeping only 5% of sub-Saharan Africa's TRLUs (see 2.036), we do not see ranchers as a major target group in operational terms. In some environments, for example areas of low human population and high tsetse infestation, ranching may be the only economically feasible form of livestock production for the foreseeable future. At the request of NARSs we have in the past carried out work on ranching systems, usually involving the collection and/or analysis of specialised data. For as long as such work continues to be in demand by our client groups and can be carried out collaboratively at relatively low cost to ILCA, we will continue to perform it. But we do not intend to

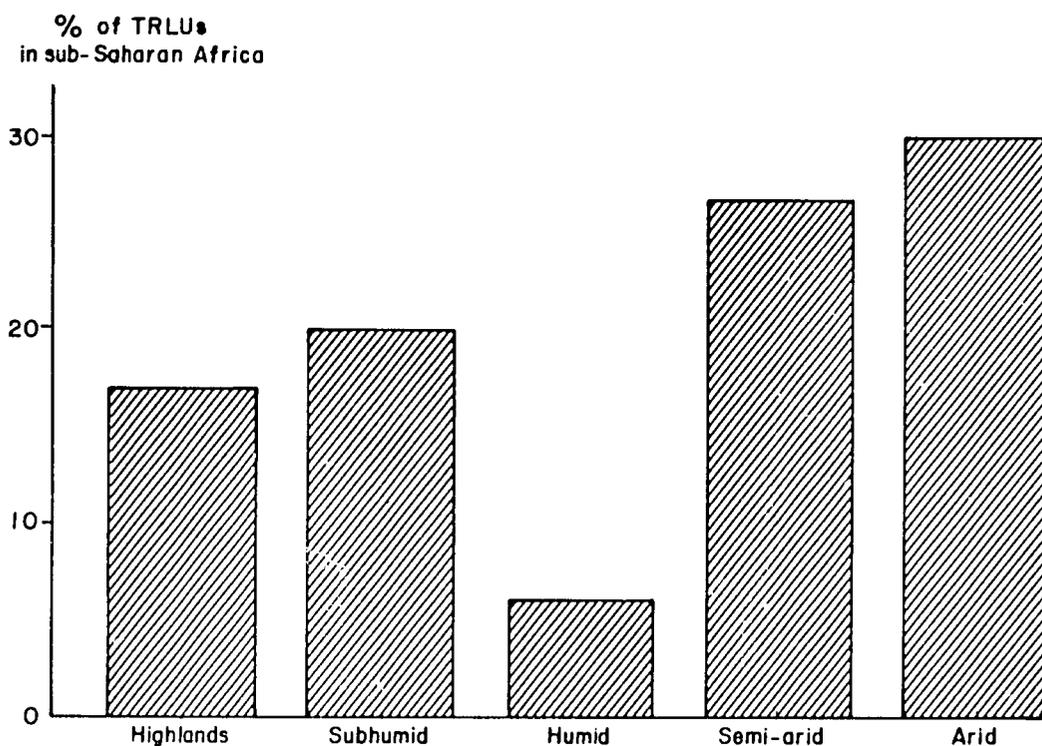
increase our overall expenditure on ranching *per se*, and we will reduce our research presence on ranches where the prospects for improving production appear low.

- 4.030. Because they have large herds and better conditions for managing experiments, ranches will continue to provide a suitable research location for the generation and testing of non-site-specific technology. We may therefore expand our use of ranches for this purpose in the future, but we should emphasise that small-holders, agropastoralists and pastoralists, not ranchers, will be the intended target groups for this work.

Choice of zones

- 4.031. We propose in the short term to concentrate our efforts in the high-potential semi-arid, subhumid, humid and highland zones, where the chances of achieving substantial increases in food production are greatest. The distribution of TRLUs in these and in the arid zones is summarised in Figure 4.2.

Figure 4.2. Percentage of TRLUs by ecological zone in sub-Saharan Africa.



- 4.032. The highland and subhumid zones, with 17% and 20% respectively of sub-Saharan Africa's TRLUs (see 2.029), are retained on the grounds of their important livestock populations and their high feed production potential. Research needs in the humid zone, with only 6% of TRLUs (see 2.029), might at first appear small, but we retain this zone because of its vast potential for livestock production once the major constraint, the presence of tsetse fly, can be overcome or circumvented. If animals can be successfully maintained and multiplied in this zone, they may in the longer term make a significant

contribution to crop production through traction and manure – inputs which are almost wholly unused in the zone at present. The zone also contains Africa's largest urban markets for both meat and milk.

- 4.033. The semi-arid zone, with 27% of the TRLUs (see 2.029), is included partly on the grounds of need and partly on the grounds of pay-off. It is a vast area in which per caput incomes are probably falling while the environmental conditions for agriculture deteriorate. Yet we have retained it among the zones we consider to have high potential because of recent evidence that moisture is less of a constraint here than was previously thought (3), and because it is free of some constraints, notably tsetse fly, that severely curtail production in other zones.
- 4.034. The arid zone, with 30% of TRLUs (see 2.029), is omitted because of its low potential and declining share of sub-Saharan Africa's overall human population (see 2.018). Most of the livestock biomass in this zone consists of camels, a species we have decided not to concentrate on at present (see 4.008–4.009)*.

Choice of commodities/functions

- 4.035. We have elected to focus our research on the four major livestock commodities/functions: meat, milk, traction and manure (see Figure 4.1). These products are central to the mixed crop–livestock systems whose smallholder farmers have already been identified as the primary target group of ILCA's research (see 4.017–4.020). All four of them contribute either directly or indirectly to food production and income generation, while the second two also play a vital role in maintaining the ecosystems on which future production depends. In addition, all four are products whose output can be quantified and valued for the purposes of success measurement (see 4.002). In emphasising the food or food-related outputs of livestock, ILCA is adhering to TAC guidelines on priorities (2).
- 4.036. Producing meat and milk contributes directly to food production, augments rural incomes and generates employment opportunities. The macro-economic importance of meat and milk in Africa has been discussed in Chapter 2, where it was shown that for both commodities the self-sufficiency rate is declining (see 2.047 and Appendix 2.3). Sub-Saharan Africa's self-sufficiency in milk (see 2.052) is declining faster than that for meat (see 2.048 and Appendix 2.4a), such that dairy imports are rising very rapidly (see 2.052). ILCA should therefore give priority to activities which will help improve food commodity output, especially that of milk. Because of Africa's large and growing urban markets for both commodities, meat and milk production offer significant income-generating opportunities for small farmers.
- 4.037. **Milk.** It is not difficult to defend the choice of milk as a major research area for ILCA. Accounting at present for only 15% of the value of sub-Saharan Africa's food-related livestock outputs (see 2.046), milk is in great demand in many urban areas of the continent, especially in West Africa (see 2.051–2.052). In contrast, milk yields per animal appear to have declined rather than risen throughout Africa during the 1970s (2.057). As the continent's self-sufficiency rate falls, imports are rising rapidly (2.052). Besides providing food, milk is a near-cash commodity suitable for production by the smallholder and

* The arid zone contains a riverine subzone which, though small in area, is relatively important in terms of its potential. This subzone is more likely than other parts of the arid zone to benefit from innovations developed for other, higher potential zones.

offering opportunities for stimulating the rural economy as a whole. Elsewhere in the developing world it has been shown that a combination of effective extension and sensible marketing policies with sound national research can bring about a rapid expansion of the smallholder dairy sector. ILCA's task will be to help African countries replicate this success.

- 4.038. **Meat.** Sub-Saharan Africa imported nearly 140 000 tonnes of meat in 1985 (see 2.050). Ninety-three per cent of these imports went to tsetse-infested West and central Africa, where there is clearly a large market demand unmet by domestic production. Per caput meat consumption throughout the continent remains low, at 7 to 14 kg per year. These figures provide ample justification for a major research effort by ILCA, directed at increasing animal growth rates and herd offtake.
- 4.039. **Traction.** Animal traction is the second most valuable output of sub-Saharan Africa's livestock, accounting for 31% of total value (see 2.046). It is the livestock product of primary concern to many smallholders, for whom the timely planting of the grain crops on which they and their families depend for survival is of paramount importance. We see considerable potential for improving the efficiency and increasing the applications of traction in areas where it is already used, and for seeking to spread its use to areas where the hoe is still the main agricultural implement. Both these objectives warrant a major research effort by ILCA.
- 4.040. **Manure.** In a continent where few farmers have easy access to commercial fertilizers, manure from domestic animals represents an important alternative means of increasing the productivity of cropland. However, in many areas, because of a shortage of firewood, it is increasingly used as domestic fuel instead, such that its potential contribution to the sustainability of agriculture is lost. In the short term, ways must be found of reversing this trend, and of increasing the efficiency of manure collection, storage and spreading. In the long term, the role of manure is less certain, depending on trends in the use of commercial fertilizers and the availability of firewood or other fuels. While we do not feel that manure *per se* merits a major research effort by ILCA, we nevertheless include it among the commodities we intend to research because of its key role in crop-livestock interactions at present.
- 4.041. **Other products.** We do not intend to start major research on any of the other products of livestock: eggs, hides, skins and fibres, and transport. Eggs are ruled out by virtue of our having chosen to work only on the three major species of ruminants (see 4.006-4.007). Hides, skins and fibres are excluded not because we consider them unimportant—indeed, they represent significant income-generating opportunities—but because they make no contribution to food production, such that their inclusion would detract from our ability to achieve maximum focus on Africa's most pressing need. Their output will in any case rise automatically if we are successful in our primary objectives of increasing the production of milk, meat and traction. Transport is rejected as a major research thrust, but some low-cost adaptive work on this subject may be done as part of our Animal Traction Thrust (see 5.030-5.045).
- 4.042. Although we will do no technical research on these other livestock products, we acknowledge the need to take into account the side-effects on them of any technology we develop in relation to our chosen commodities/functions.

The criteria for project selection

- 4.043. Having defined our operational mandate (see 4.003-4.042), we can now turn to the criteria by which we select individual research projects. Such criteria are

needed because, even within our operational mandate, the problems on which NARSs request our help are too many for us to be able to respond positively to all of them. The criteria are thus useful for screening new research proposals as well as ILCA's current activities.

4.044. The criteria* we have developed are as follows:

- nature of problem
- special advantage
- availability of partners
- critical mass
- probable impact
- stability and sustainability.

Nature of problem

4.045. **Is the problem a researchable one? If so, where does it lie in the research spectrum, and how widely applicable will the research results be?**

4.046. ILCA is a research not a development institute, and must avoid involvement in matters pertaining purely to national livestock development. On the other hand, we have a responsibility for ensuring that our research results are taken up by national development organisations. The guiding principle in borderline cases is that research aims and opportunities should be the basis for any involvement in activities that verge on development.

4.047. Livestock systems research is a complex and relatively expensive venture for NARSs to undertake, with the result that their capacity in this field has, in many cases, yet to be developed. Much of the research that ILCA has done so far has accordingly been developmental in character, lying at the adaptive end of the research spectrum. This work has fulfilled its purpose in demonstrating the potential for impact through livestock-related technology, but it has tended to be somewhat site-specific.

4.048. In the short term, while NARSs develop, we will continue to be involved in adaptive research at the same time as seeking to strengthen national capacities in this field. This course was recommended to us by our 1986 External Programme Review (1). We will also seek to broaden our involvement in non-site-specific applied and strategic research, with a gradual shift towards the latter over the longer term, as NARSs become stronger. TAC has cautioned the CGIAR centres against overinvolvement in basic and strategic research while there is still an overriding need in many developing countries for problem-oriented applied and adaptive research (2). This need is nowhere more apparent than in Africa.

4.049. A given research project may have several activities associated with it, lying in different parts of the research spectrum; and the results of each activity may be more or less site-specific. In assessing a proposed project we need to decide which activities within it should be performed by ILCA and which by our national or other institutional partners in the work.

4.050. The interrelated nature of research and development problems is a further factor governing the selection of our research programme. Before undertaking work on a given problem we should consider whether its success might not depend on the successful outcome of work on another related aspect of the same problem. If so, is that aspect being adequately addressed by another institute, and what, if any, form of collaboration should we seek with that institute?

* In line with recent guidelines from the CGIAR, activities fulfilling the criteria can, for budgeting purposes, be subdivided into those we regard as essential and those we see as desirable.

Special advantage

- 4.051. **In the light of its past experience and current resources, does ILCA have an advantage over other institutes that might work on a given topic?**
- 4.052. The criterion of special advantage is met when activities:
- transcend the institutional, financial or political limitations faced by NARSs;
 - require long-term continuity to ensure success;
 - are international rather than national in character, requiring the movement of resources, skills and information across national frontiers;
 - are ones which ILCA can perform more efficiently than any other institute;
 - lend themselves well to collaboration with other IARCs or with other organisations in the developed or developing world.

Availability of partners

- 4.053. **Can we find organisations, within or outside ILCA's mandate region, that are both able and willing to work with us so as to increase the scope of our research on a given topic and to broaden its impact?**
- 4.054. Much of the successful agricultural research in Africa today is done collaboratively: by organisations pooling their skills and resources in order to tackle problems that are too big and too complex for them to undertake alone. Some of ILCA's more successful programmes already follow this pattern, and the greater their degree of integration with national efforts, the greater their chances of substantial impact over a wide area in the long term.
- 4.055. We must therefore seek to strengthen our collaboration with both NARSs and other IARCs, as well as institutes in the developed world. By so doing we can fulfill an important bridging function—bringing the results of work in the developed world to bear on the problems of Africa.
- 4.056. Our institutional partners must be both able and willing. As we have already seen (2.096–2.097), few NARSs in Africa can be considered strong in terms of their numbers of trained livestock scientists at present. We therefore argue for an immediate and substantial increase in ILCA's funds for training in research techniques, in order to increase the ability of NARSs to participate effectively in collaborative research (see 5.088).
- 4.057. If we are to find willing partners among the African NARSs, we must convince them of the advantages of working with us. Their involvement will essentially depend on:
- our ability to provide the kind of expertise that will command their respect and trust;
 - our ability to define projects that they will recognise as having a high chance of success.
- 4.058. These conditions can be met only if we ourselves have built up a core of experienced and imaginative scientific staff in the key areas in which we intend to work.

Critical mass

- 4.059. **Can ILCA command the scientific staff and facilities needed to tackle a given research problem?**

- 4.060. Critical mass is too often perceived as the mere number of scientific staff working on a problem. In reality it includes all the expertise that an institution can enlist in a given field of research, as well as the capital, facilities, services and information needed to backstop the research. It is a concept requiring the careful matching of the quality and quantity of resources available against the magnitude and complexity of the problem to be solved. Hence, while the criterion itself is an enduring one, the results of applying it will vary in each case.
- 4.061. To gain maximum productivity we must tap the resources of other organisations. One way of doing this is by outpostting our staff to other IARCs. TAC has indicated its intention to explore ways of strengthening the inter-centre cooperation already evolving in sub-Saharan Africa, with the emphasis on integrating the work of different IARCs on selected production systems of high priority (2). ILCA welcomes such an approach, not least because it will enable our scientists to work against a wider background of knowledge.
- 4.062. Secondly, we propose a gradual shift away from our present zonal programmes, which are proving a relatively expensive way of achieving critical mass, towards a system whereby we place ILCA staff within those NARSs through which we can expect to achieve substantial impact (see 2.097). Such staff will act as managers of resources earmarked to solve problems on a regional rather than a national level.
- 4.063. As TAC has noted, dispersion of staff in a continent as large and diverse as Africa can lead to loss of critical mass (2). ILCA must ensure that its 'outriders' in the regions are strongly supported from headquarters, that the necessary local logistical support is forthcoming, and that any agreements negotiated protect them from pressures that might divert them from their regional or zonal responsibilities.
- 4.064. A third way of complementing ILCA's internal resources is through contract research. Topics requiring sophisticated experimentation can be contracted to specialised institutions in Africa and other parts of the world, including developed countries.

Probable impact

- 4.065. **Is the research likely to have a sizeable impact commensurate with one or more of ILCA's operational goals?**
- 4.066. Our impact will be measured primarily by the extent to which the technology we generate (whether alone or jointly with other institutes) demonstrates a potential for improved livestock production (see 4.002). The following are some indicators of research that is likely to have a substantial impact:
- the experimental work is likely to lead to new technology or to adapted forms of existing technology;
 - such technology will be within the financial and managerial capacities of producers;
 - any additional inputs needed will be available;
 - there is an unmet market demand for the product(s) whose output is to be increased;
 - meeting that demand will generate additional income and employment opportunities for poor producers;
 - the food security of producers and consumers will be increased; and
 - there will be an adequate resource base to ensure large and widespread production gains.

Stability/sustainability

- 4.067. **Will the research contribute to an improved production system that is at once sustainable ecologically and stable in terms of economic return?**
- 4.068. Livestock provide special opportunities for improving the sustainability and stability* of smallholder farming systems, but their effects may be either negative or positive. For example, cattle contribute to the sustainability of crop production by providing traction and manure, but they also contribute to erosion by trampling the soil. Again, animals may contribute to the stability of farm income because they can be bought following a good cropping year and sold following a bad one, but the beneficial effects of this mechanism may be outweighed by reciprocally fluctuating terms of trade.
- 4.069. The negative, as well as the positive, implications of new livestock-related technology for sustainability and stability therefore need to be taken into account when new research projects are being designed. Sustainability will also be the yardstick of success when the impact of research is assessed (see 4.002).
- 4.070. As the Bellagio group** have emphasised, research on soils, water and plant nutrients is fundamental for sustainable agriculture. Much of such research is site-specific, however. As far as possible ILCA will concentrate on work that will either help establish the underlying principles or lead to the design of new production systems.
- 4.071. If they are to appeal to producers, ecologically sustainable production systems must also be economically stable—consistently bringing in worthwhile returns over a prolonged period. One way of meeting both criteria is to introduce forage legumes into mixed farming systems. By fixing atmospheric nitrogen legumes enhance soil fertility and stability, boosting subsequent grain crop yields at the same time as providing a high quality feed for livestock. Linking crop and livestock production in this way should lead to higher whole-farm output as well as preserve the basic resources on which production depends. We see legume technology as one of the lynch-pins of our future research thrusts (see 5.048–5.050).

References

1. CGIAR/TAC. 1986. Report of the Second External Program Review of the International Livestock Centre for Africa (ILCA). TAC Secretariat, FAO, Rome.
2. TAC/CGIAR. 1987. *CGIAR priorities and future strategies*. TAC Secretariat, FAO, Rome.
3. Penning de Vries F W T and Djiteye M A. 1982. *La productivité des pâturages sahéliens*. Pudoc, Wageningen, The Netherlands.

* Sustainability is a concept relating to the direction of a long-term trend: unsustainable production systems are ones in which the long-term trend of output is downward, ending in collapse. Stability relates to variability around a trend: unstable production systems are those in which output or income fluctuate considerably, and often unpredictably, around the mean.

** The Bellagio group was a group of experts drawn from the international agricultural research community. They met at Bellagio, Italy, in January 1986 to discuss questions relating to the research priorities identified by TAC for the CGIAR.

The Proposed Programme

Research

- 5.001. On the basis of the considerations given in Chapters 1 to 4, we have selected the following six research thrusts to be the major areas of ILCA's work over the coming years:
1. Cattle milk and meat
 2. Small ruminant meat and milk
 3. Animal traction
 4. Animal feed resources
 5. Trypanotolerance
 6. Livestock policy and resource use.
- 5.002. The first three thrusts we call 'commodity' thrusts, their aim being to increase output of the three products, milk, meat and traction. Because of the multi-purpose nature of African livestock, we have chosen the animal species, not the commodity *sensu strictu**, as the focal point for research in the first two thrusts, although commodity output will remain a primary criterion for success measurement (see 4.002). In the third thrust the focal point is the commodity itself, because we feel the complex technical and economic problems of introducing animal traction warrant specialised study. For all three commodity thrusts we envisage a span of at least 10 years, with major review after 5 years.
- 5.003. The second three thrusts we call 'strategic' thrusts, their aim being to support the commodity thrusts by providing inputs of information and/or technology. In the medium to long term we foresee these thrusts diminishing in importance as their results are gradually transferred to the commodity thrusts. For all three strategic thrusts we therefore envisage an initial span of 5 years only, their continuation after this period being subject to need.
- 5.004. This chapter outlines each thrust in terms of its objective, rationale, research topics, modes of operation and training and outreach. The topics selected represent the broad framework within which NARSS will be asked to participate in the selection of a detailed work programme at the planning meetings scheduled for each thrust. The process used for planning each thrust is outlined in 6.002–6.005.

Thrust 1: Cattle milk and meat

- 5.005. **Objective.** The objective of the Cattle Milk and Meat Thrust is to improve the sustained output and yield of cattle milk and meat produced in mixed crop–livestock smallholder farming systems.
- 5.006. **Rationale.** Cattle are both the most numerous and one of the largest domestic ruminant species in sub-Saharan Africa. The continent's 145 million zebu and

* Our first two commodity thrusts are analogous with the so-called commodity thrusts of the crop centres in the CGIAR system, which also take the species or group of species, not the commodity in the strict sense, as the focal point of their research. Just as a single livestock species may produce multiple commodities, including milk, meat, traction and manure, so also a typical crop research programme deals with several commodities, including grain for human consumption and residues for various purposes, among them animal feed.

taurine animals are distributed fairly evenly across ecological zones (20 to 30% in each), except for the tsetse-infested humid zone (only 6%) (see 2.029). Regionally, distribution is more skewed, with the highest concentrations occurring in East (56%) and West (26%) Africa and the lowest (6%) in central Africa (see 2.030).

- 5.007. As incomes rise, the consumption of milk and meat is expected to go up in Africa. Both commodities are produced by smallholder raising cattle, but for those using draught animals meat is often merely the end-product of an enterprise primarily devoted to traction, with milk as a useful byproduct. In areas where cattle are not used for draught, they serve other important functions in crop-livestock interactions, meet human subsistence needs and act as a form of investment or insurance. Milk is consumed at home or sold locally, surpluses being generally very small at present, dwindling to nil in poor years. Animals are sold in exchange for grain, but in times of drought the terms of trade tend to be adverse, so that returns are often low.
- 5.008. If better technologies were to be matched with the right pricing, input supply and marketing policies, this situation might change rapidly. There are three major technical obstacles to change: in the wetter lowland areas, where feed supplies are plentiful (albeit low in quality), trypanosomiasis and dermatophilosis inhibit the raising of cattle other than trypanotolerant breeds, which show a degree of resistance or tolerance to both diseases but are not highly productive milk animals; in the drier lowland areas, where disease is less of a problem, seasonal shortfalls in both the quantity and the quality of feed severely constrain the potential for increasing output; in the highlands, where the potential for feed production is higher, pressure on land makes it difficult to fit fodder crops into existing subsistence crop production systems.
- 5.009. Besides these technical constraints, there are policy and institutional problems to be overcome, especially in the case of milk production. Outside southern Africa few African countries yet have pricing policies for either meat or milk that act as an incentive to producers; the infrastructure for collecting and processing milk is often lacking; and input services such as veterinary supplies and AI are scarce or unreliable. Finally, there may also be other barriers to increased milk consumption, such as lactose intolerance, or even to its production, such as lack of management skills.
- 5.010. To sum up, despite a daunting array of problems there are major opportunities for increasing cattle milk and meat production in many parts of Africa. These opportunities take different forms according to zone and region. In humid West and central Africa the potential is vast in the long term if disease problems can be circumvented and cattle numbers of appropriate breeds increased. The subhumid zone offers perhaps the best opportunity in the short to medium term, because of its reasonable potential for forage production (e.g. fodder banks, see 3.069), combined with relative freedom from tsetse fly, lower pressure on land and relatively large existing cattle herd. The highlands of East Africa are well supplied with meat but offer a major market for milk if forages can be accommodated in cropping systems. In southern Africa markets are smaller (because the human population is lower), but policies, infrastructure and services are relatively favourable.
- 5.011. **Research topics.** We propose the following major research topics as the basis on which a detailed work plan can be selected with the participation of NARs:
- evaluation of the genetic potential of cattle breeds and their crosses for milk and meat production;

- use of forage legumes to support both crop production and a dairy enterprise;
- development of feeding systems for dairy cows and fattening cattle;
- reduction of reproductive wastage and young stock losses;
- development of simple milk processing techniques to promote the marketability of dairy produce;
- use of trypanotolerant stock to launch pilot smallholder milk production projects in the humid zone
- policy and institutional factors determining successful smallholder milk and meat production and marketing;
- investigation of the social and economic obstacles to increased milk production and consumption.

5.012. **Modes of operation.** This thrust will rely on a network approach to carry out its research. We hope to promote this approach first in West Africa, then in eastern and southern Africa. We will use our existing research bases in Kaduna and Ibadan (Nigeria) and in Bamako (Mali) as the basis for developing collaborative research in the humid and subhumid zones of West Africa, while our research station at Debre Zeit (Ethiopia) becomes the focal point for operations in the highland and mid-altitude zones of East Africa. If funding becomes available we will seek to increase our presence in southern Africa.

5.013. The major disciplines involved in the research will be animal breeding, animal nutrition, animal health, animal husbandry, forage agronomy, reproductive physiology, dairy technology, production economics and socio-economics.

5.014. We cannot specify the exact division of future research responsibilities between ourselves and our partners. It is likely that much of the applied and adaptive research at our major research locations will have to be done by us in the short term, until greater numbers of NARS staff have been trained. The emphasis in the short term must therefore fall on using the strength of our existing research bases as a training resource for the zone/region. Once this training is accomplished, much of the work on agronomy, nutrition and management can probably be handled by NARSs. Responsibility for strategic research, including the more complex work on nutrition and reproductive physiology will continue to be shared between ILCA and other more specialised institutes. Work at the Debre Zeit station will be handled by ILCA alone, at least in the short term.

5.015. **Training and outreach.** Besides the training carried out through our network and collaborative research activities, using our zonal research bases, we hope to launch a series of regional seminars on dairy production in Africa. At headquarters we envisage annual group training courses for 20 to 25 participants in milk production, dairy processing, and calf rearing and beef production. Individual training at headquarters will accommodate up to four postdoctoral and eight postgraduate associates at a time, in a variety of topics. We hope that a number of visiting scientists will also work with us on this thrust.

5.016. The main outreach mechanisms will be the various network arrangements, coordinated from headquarters, and the seminars and other meetings organised regionally or at headquarters according to need. Our zonal research locations will serve as subsidiary centres of outreach, sharing with headquarters the responsibility for spreading the testing of technology in their respective zones and regions.

Thrust 2: Small ruminant meat and milk

5.017. **Objective.** The objective of the Small Ruminant Meat and Milk Thrust is to improve the sustained output and yields of small ruminant meat and milk in mixed crop–livestock farming systems.

- 5.018. **Rationale.** Meat from sheep and goats accounts for almost 30% of the meat consumed in Africa and is an especially important marketable commodity in the continent's high population density areas—for example, the humid zone of West Africa and the highlands of East Africa (1). Demand is particularly high at religious festivals and cultural celebrations.
- 5.019. Small ruminant milk accounts for about 16% of total African production (1). It is important for subsistence, especially in areas where cropping is risky, and the surpluses available for marketing are at present small or non-existent.
- 5.020. Both commodities are important potential sources of additional income for resource-poor smallholders. Both sheep and goats are particularly numerous in the semi-arid zone (23 and 26% respectively of sub-Saharan Africa's total population), while sheep are also plentiful in the highlands (21% of total population) (see Table 2.2). In the semi-arid zone especially, small ruminants are associated with the poorest producers, who value them for both subsistence and income-earning purposes.
- 5.021. Because of their small body size, high reproductive capacity and rapid growth rates, small ruminants are ideally suited to production by resource-poor smallholders. They can be variously integrated into the overall production system, absorbing surplus labour and consuming small amounts of otherwise unused feed. The low capital requirement for starting or expanding small ruminant production means that production risks are low and that the enterprise is well suited to low-input systems.
- 5.022. Increased meat and milk production from small ruminants will benefit farm income and liquidity, generating cash with which to purchase inputs for other production activities. Animals can also be sold to raise cash following low crop yields, or whenever circumstances require, thereby adding to income stability.
- 5.023. To sum up, there are three major zones in which research on small ruminants should be located: perhaps the most important, in terms of both need and potential pay-off, is the semi-arid zone, where there is room for considerable growth in 'exports' of live animals to the markets of the more humid zones to the south (or to other consumer areas); secondly, the highlands of East Africa provide a major opportunity for increasing the production and marketing of sheep; and lastly, there is a case for seeking to raise the productivity of both sheep and goats in the humid zone of West Africa, where both the markets and the potential for forage production exist.
- 5.024. **Research topics.** We propose the following major research topics as the basis on which a detailed research programme can be selected with the participation of NARSs:
- evaluation of small ruminant genetic resources in order to identify appropriate breeding strategies;
 - identification and testing of suitable browse and other forage legumes for smallholder production systems;
 - use of improved management and feeding practices to reduce disease risk and increase productivity;
 - investigation of the extent and causes of reproductive wastage and the testing of possible solutions;
 - impact of improved production systems on farm income and producer welfare;
 - analysis of social and economic factors affecting technology uptake.

- 5.025. **Modes of operation.** This thrust will use our existing network on small ruminants to strengthen our collaborative research. We will use our existing research bases in Ibadan (Nigeria) and at Debre Berhan (Ethiopia) to develop technology for the humid and highland zones, while research for the semi-arid zone will be based at ICRISAT's Sahelian Centre near Niamey (Niger). Some work may also be done in the subhumid zone of West Africa. Given funding, we hope soon to start more collaborative research with NARSs in a number of West African countries, and eventually in East and southern Africa also.
- 5.026. The major disciplines involved in the research will be animal breeding, animal nutrition, animal husbandry, forage agronomy, reproductive physiology, animal health, production economics and socio-economics.
- 5.027. We cannot specify the exact division of future research responsibilities between ourselves and our partners. It is likely that, in the short term at least, ILCA will handle much of the economic and production data analysis, some of the strategic work in reproductive physiology, all the work at Debre Berhan, and most of the nutrition research. We hope that all other work will be done collaboratively with NARSs, with the exception of some work on reproductive physiology and disease, which may be subject to contract research with more specialised institutes.
- 5.028. **Training and outreach.** Besides the training carried out through our network and collaborative research activities, we envisage an annual group training course at headquarters for 20 to 25 participants on improving sheep and goat production, and individual training on a variety of topics for up to two postdoctoral associates and six postgraduate associates at a time. We hope that a number of visiting scientists will also work with us on this thrust. The thrust will continue to issue a newsletter to its network participants.
- 5.029. The main outreach mechanisms will be the network and its newsletter, coordinated from headquarters, and workshops or other meetings held at headquarters or regionally according to need. Our zonal research locations will serve as subsidiary centres of outreach, sharing with headquarters the responsibility for spreading the testing of technology in their respective zones and regions.

Thrust 3: Animal traction

- 5.030. **Objective.** The objective of the Animal Traction Thrust is to raise the sustained production and income of smallholders by improving and increasing their use of draught animal power.
- 5.031. **Rationale.** Although estimated to be the second most valuable output of livestock in sub-Saharan Africa (see 2.046), only 10 to 15% of farmers use animal traction at present*. Most of them are in Ethiopia, where paired oxen have been used for centuries for ploughing. Animal traction is also well established in Madagascar and Botswana, where the practice was introduced in the late nineteenth century.
- 5.032. In other countries where animal traction is now used it was introduced comparatively recently, primarily for the production of cash crops. Major

* This apparent paradox is largely explained by the fact that, even in countries where cattle—the major draught species—are important, up to 45% of farmers own no cattle whatsoever (see 2.037), while still others own too few to make use of them for draught. In countries where cattle are not important, the proportion of farmers not owning them will probably be even higher.

countries in this category include Senegal, Burkina Faso and Mali, where groundnuts and cotton are cultivated for export. Many other countries in West, East, central and southern Africa have tried introducing animal traction and have met with varying degrees of success.

- 5.033. In zonal terms, most draught animals are found in the highland and semi-arid zones. There are two major reasons for this distribution: on the heavy soils found widely in the highlands, using animals for ploughing substantially reduces human labour; in areas where the growing season is short, as in the semi-arid zone, draught animals help the farmer reduce the risk of cropping by either expanding the area cultivated or planting earlier in the season. Even in these zones, however, animal traction is highly localised, and its spread is often very slow.
- 5.034. As regards species, most draught animals are cattle, but equines and camels are also used for cultivating lighter soils in drier areas, and to varying degrees for packing and carting. At present, the major functions of draught animals are ploughing and threshing, with little secondary cultivation (such as weeding and planting) and few other tasks on the farm. Some diversification has nevertheless taken place in the countries of major use.
- 5.035. The outcome of past investments in animal traction has sometimes been disappointing. This has been so for several reasons. First, a combination of factors, including high initial investment costs, poor techniques or technologies, and lack of uses besides ploughing, mean that effects on crop yield and farm income can be disappointingly low. Where land is scarce, effect on area cultivated is also limited. Second, the support services provided, such as training, veterinary care and the supply of spare parts, have often been inadequate. Third, in the drier areas there have been insufficient feed and water supplies. Fourth, in the more humid areas trypanosomiasis severely limits the productive use of livestock.
- 5.036. These constraints help explain the limited spread of animal traction in those areas where it is traditional, and its occasional failure altogether when introduced into new areas where the hoe is still the main agricultural tool.
- 5.037. Nevertheless, draught animals have remained in use in all but a few of the countries where they have been introduced. The potential benefits of animal traction can be summarised as follows:
- improved crop production through effects on area cultivated, seedbed quality, soil drainage and fertility, planting date, seeding rate, weed control and threshing efficiency;
 - increased labour productivity, leading to release of farm labour for other activities and to greater opportunities for raising farm income;
 - use of draught animals to combat erosion at the same time as increasing crop production, for example in building ponds, dams and terraces;
 - diversified use of draught animals, for example in transport, milling, logging and water-lifting;
 - integration of crop and livestock production through production of milk, meat and manure by draught animals;
 - stimulus to national economies through development of upstream rural industry and reduced dependence on imports.
- 5.038. If the use of draught animals is to persist once introduced, a number of conditions must be met. First, investment costs for both animals and implements must be kept low (in many instances, credit or loans will have to be provided).

Second, there must be opportunities for intensifying and diversifying the applications of animal traction. Third, farmers will have to learn animal management skills in addition to cultivation techniques, and, if extension staff are to provide useful advice, they too will have to be trained. Fourth, the problem of animal nutrition will have to be addressed through low-cost inputs to increase the efficiency of draught animals, and appropriate animal health packages will be needed to protect them against disease.

- 5.039. To sum up, we may identify research priorities for two major types of area. In the highland and semi-arid zones, where animal traction is already established, we need to intensify and diversify the uses of draught animals while increasing the quantity and quality of their feed. In the subhumid zone, where animal traction is as yet seldom used, we need to examine more closely the constraints preventing adoption and to seek to overcome them by introducing packages that combine all the necessary inputs, not just implements and animals alone. The main aim in both cases will be to develop low-cost technologies that enhance both the profitability and the sustainability of agriculture*.
- 5.040. **Research topics.** We propose the following major research topics as the basis on which a detailed work programme can be selected with the participation of NARSs:
- adaptation and testing of low-cost implements to improve farm operations and benefit soil/water management;
 - assessment of working efficiency at low feeding levels and testing of strategic supplementary feeding;
 - impact of improved animal traction technology on food production and farm income;
 - development of efficient dual- and triple-purpose (draught, milk and meat) animal production enterprises;
 - integration of crop and livestock production through improved use of manure;
 - diagnosis of technical, social and economic constraints to the use of draught animals in the subhumid zone;
 - creation of complete packages (including credit, veterinary services, etc) for introducing animal traction to new areas.
- 5.041. **Modes of operation.** This thrust will start a new network to launch collaborative research on these topics. We will continue to use our research base at Debre Zeit (Ethiopia) for applied and adaptive research, while seeking to spread the testing of technology successfully developed in Ethiopia to other countries. We will also build on our existing relationship with the ICRISAT Sahelian Centre near Niamey (Niger) to increase activities in the semi-arid zone, while our sites near Kaduna (Nigeria) will be used for technology testing following constraint diagnosis for the subhumid zone. Funds permitting, we will seek to build up collaborative research with NARSs through the new network.
- 5.042. The major disciplines involved in the research will be animal nutrition, animal physiology, forage and crop agronomy, agricultural engineering, and economics.
- 5.043. We cannot specify the exact division of future research responsibilities between ourselves and our partners. Future field work on the testing of technology will

* This thrust will not address the overall issue of agricultural mechanisation, but will restrict itself to the contribution of animal traction to energy supplies on the farm. Some work on the relative costs and benefits of introducing animal traction or other forms of mechanisation at different stages of agricultural development may be undertaken or commissioned by our Livestock Policy and Resource Use Thrust.

doubtless be carried out collaboratively, as it has been in the past. So also will studies to diagnose constraints or assess impact. We will seek close cooperation with ICRISAT for all aspects of work relating to crop production. On-station work at Debre Zeit will continue to be carried out by ILCA alone; will try to ensure that this work is applicable to the widest possible range of soil types and cropping systems.

- 5.044. **Training and outreach.** Besides the training carried out through our network and collaborative research activities, we hope to provide group training at headquarters and technology transfer for about 50 participants in two courses each year, and two regional seminars for a further 50 participants yearly, one in West and one in southern Africa. We envisage individual training at headquarters in a variety of topics for up to two postdoctoral fellows and four postgraduate associates at a time. We hope that a number of visiting scientists will also work with us on this thrust. The new network will issue a network newsletter.
- 5.045. The main outreach mechanisms will be the network and its newsletter, coordinated from headquarters, the two regional seminars mentioned in 5.044, and any additional meetings which may be organised at headquarters or regionally according to need. Our zonal research locations will serve as subsidiary centres of outreach, sharing with headquarters the responsibility for spreading the testing of technology in their respective zones and regions.

Thrust 4: Animal feed resources

- 5.046. **Objective.** The objective of the Animal Feed Resources Thrust is to develop suitable forages and other feeds to improve livestock and crop production in mixed crop-livestock farming systems, and to improve the efficiency with which existing and new feed resources are utilised*.
- 5.047. **Rationale.** Except in the humid zone, feed shortages during the dry and sometimes even the wet season constrain animal output in almost every production system of sub-Saharan Africa. Even where feed is plentiful it may be low in nutritive value, may form an imbalanced diet lacking critical elements, or may be inefficiently converted into protein and energy within the animal.
- 5.048. The feed resources available on smallholder crop-livestock farms in Africa consist mainly of residues from subsistence crops and vegetation on uncropped or fallow land. Both are highly seasonal, with quantity and quality declining as the dry season progresses. Besides the need to improve the nutritive value and efficient utilisation of these traditional resources, there is a major need to introduce new high-quality feeds, such as forage legumes and multi-purpose fodder trees, that can be used to supplement existing resources at critical times of the year. Where new food crop varieties are being introduced, it is also important to ensure that these retain good animal feed characteristics.
- 5.049. Introducing forage legumes into traditional cropping systems is difficult in Africa, where labour and/or land are often scarce, fallow land may be communally used, nutrients and water may be limiting, and the farmer's primary concern is for the food crop on which survival depends. To succeed, legumes must meet several criteria:
- they must be well matched to environmental conditions;
 - they must be efficient in their use of nutrients, particularly phosphorus;

* Improved grasses are not excluded from the work of this thrust, but the main emphasis will fall on multipurpose forages. Similarly, no strategic work on plant diseases will be done, but we will encourage the testing of disease-resistant varieties where appropriate.

- they use in conjunction with food crops must lead to minimum reductions in grain yields during the same year, and/or to substantial gains in following years;
- they must generally be good seed producers;
- they must require low labour inputs for their establishment and maintenance, and must not compete for labour with food crops;
- they must provide feed at appropriate times of the year, for example at the end of the dry season, to satisfy farmers' strategic feeding requirements;
- they must be conducive to efficient feed conversion within the animal;
- they must result in increased income for the farmer.

5.050. This set of conditions means that forage legumes must be introduced very carefully. The ways in which soils determine the relationships between available nutrients and water must be understood, as well as agronomic aspects and the many other factors governing ultimate feed value. Such understanding must come largely through the links between this thrust and ILCA's zonal locations and collaborative research with NARSSs. The feedback that comes through these links, and especially from on-farm research, is vital in helping to formulate feed resources packages by selecting from available forage genetic and other resources. Each commodity thrust and NARS project must have agronomic and/or animal nutrition expertise to make these links operational.

5.051. Another potential source of additional high-protein or high-energy feed is provided by the many agro-industrial byproducts available in Africa. Many of these are exported at present; others are used for purposes other than animal feed; a few are simply wasted, the problems here often being ones of collection, processing and transport. Worthwhile work on assessing and improving the feed value of these resources can be done provided the economic costs and benefits of their alternative uses are properly taken into account.

5.052. To sum up, the main purpose of our Animal Feed Resources Thrust will be to provide suitable feed resource packages to NARSSs and to ILCA/NARS commodity research programmes. These packages will combine forage legumes, fodder trees and agro-industrial byproducts with existing feed resources. The thrust will cater for the needs of all zones except the arid (see 4.034). Special emphasis will be given to the identification of legumes suitable for different production systems and able to supplement existing feed resources during the dry season. The right combinations of feeds for given species and classes of ruminants will be identified, and their benefits in terms of increased output from the whole system will be measured. Feedback from users is considered essential to the success of the thrust.

5.053. **Research topics.** We propose the following major research topics as the basis on which a detailed work programme can be selected with the participation of NARSSs:

- acquisition, storage, screening and evaluation of forage germplasm of potential value to smallholder production systems;
- identification of entry points for forage legumes and multi-purpose fodder trees in traditional farming systems;
- investigation of soil-plant-water-nutrient relationships in order to increase forage and food crop yields;
- response of legumes to rock phosphate or other low-cost fertilizers;
- development of grain crop varieties with increased feed value of the residue as well as higher grain yield;
- determination and improvement of the nutritive value of new and existing feed resources in order to develop improved feed packages;

- ability of selected feed combinations to increase animal production through improved rumen function and feed conversion;
 - investigation of economic and institutional factors inhibiting the optimum use of feed resources.
- 5.054. **Modes of operation.** This thrust will use our existing international networks on forage production and animal nutrition (PANESA and ARNAB) to strengthen our collaborative research on feed resource topics. It will also need to maintain close links with ILCA's commodity research at the zonal sites. We will continue to use existing sites in Ethiopia and elsewhere for the initial screening and evaluation of germplasm held at headquarters. For the collection and evaluation of forage germplasm we will collaborate mainly with IBPGR and CIAT. Nutrition research will be carried out at headquarters and, on crop residues, at ICRISAT's Sahelian Centre near Niamey (Niger).
- 5.055. The major disciplines involved in the research will be forage agronomy, soil/plant nutrition, animal nutrition, rumen microbiology and physiology, and micro-economics.
- 5.056. We cannot specify the exact division of future research responsibilities between ourselves and our partners. It is likely that germplasm collecting missions will continue to be a joint exercise with NARSs and IARCs, and that site-specific evaluation and agronomy work will increasingly be done by NARSs as our collaborative arrangements strengthen in the future. Strategic and, in the short term, applied research on soil-nutrient-water-plant relationships, as well as on animal nutrition, will continue to be central to our work. Specialised institutes will provide expertise on specific problems in strategic research.
- 5.057. **Training and outreach.** Besides the training carried out through our collaborative research and localised network activities, we envisage annual group training courses at ILCA headquarters for approximately 25 participants in germplasm evaluation (through PANESA), in feed resources evaluation and development (through ARNAB), and in forage seed production. Individual training, also at headquarters, will accommodate up to two postdoctoral fellows and four postgraduate associates at a time. We hope that a number of visiting scientists will also work with us on this thrust. Workshops and conferences will be organised through the existing networks according to need. Both networks will continue to issue their newsletters, which, however, might be combined as the networks develop closer links (see box, p. 71).
- 5.058. The main outreach centre will be ILCA headquarters, responsible for coordination of the thrust, for running the networks, for disseminating seed, promoting the testing of feed technology packages, and spreading knowledge of strategic feeding systems. ILCA's zonal research locations will serve as subsidiary centres of outreach, sharing with headquarters the responsibility for spreading the testing of technology in their respective zones and regions.

Thrust 5: Trypanotolerance

- 5.059. **Objective.** The objective of the Trypanotolerance Thrust is to contribute to improved livestock production in tsetse-infested Africa through a better understanding of the factors affecting the performance of trypanotolerant animals and the effectiveness of trypanosomiasis control measures.
- 5.060. **Rationale.** Vast humid and subhumid areas of Africa are held captive by tsetse flies and the trypanosomes they transmit. Trypanosomiasis occurs throughout

much of the best watered and most fertile land of the continent. Much of this region could be used immediately for livestock or mixed agricultural development, without stress to the environment, if trypanosomiasis could be controlled or circumvented.

- 5.061. Small populations of *Bos taurus* cattle and dwarf sheep and goats possessing some degree of resistance to trypanosomiasis are found in West and central Africa. *Bos indicus* cattle, which are more prevalent, are generally regarded as susceptible, although evidence is emerging that they too may show some resistance if exposed to the disease over several generations.
- 5.062. A joint ILCA/FAO/UNEP study (2) emphasised the importance of trypanotolerance by indicating that trypanotolerant breeds were at least as productive as other indigenous African breeds in areas of low tsetse challenge, and that in areas where tsetse challenge is substantial only trypanotolerant breeds could survive. However, it also emerged that the productivity of trypanotolerant livestock diminishes as tsetse challenge increases. It was therefore apparent that more precise information was needed on genetic and acquired resistance, environmental factors affecting susceptibility, and the efficacy of control measures, as well as further studies on the productivity of trypanotolerant breeds. The African Trypanotolerance Network was set up by ILCA and ILRAD to obtain this information, and by 1986 was operating at various sites in 9 African countries (see 3.006).
- 5.063. To sum up, covering an area larger than the USA, the tsetse-infested humid and subhumid zones of Africa offer a substantial opportunity for producing milk and meat to fulfill the rapidly growing demand for these products in central and West Africa. If trypanotolerant livestock are to play their part in meeting this demand as well as improving the efficiency of crop production, more needs to be known about the circumstances in which they can be successfully used. The role of trypanotolerant livestock needs to be compared with that of tsetse control using prophylactic drugs and other measures to reduce disease risk and increase tolerance. These are the main aims of our Trypanotolerance Thrust.
- 5.064. **Research topics.** We propose the following major research topics as the basis on which a detailed work programme can be selected with the participation of NARSs:
- collection and analysis of data on the productivity of trypanotolerant breeds under varying levels of trypanosomiasis risk;
 - identification of more reliable indicators of trypanosomiasis risk;
 - definition of a selection criterion for trypanotolerance, in order to devise optimum breeding programmes;
 - evaluation of the costs and benefits of selected tsetse control measures, and their interaction with prophylactic drugs;
 - testing of nutritional interventions to improve livestock productivity in tsetse-infested areas;
 - study of the effects of trypanocidal drugs in order to determine appropriate interventions in areas of medium to high trypanosomiasis risk.
- 5.065. **Modes of operation.** This thrust will continue to use the existing African Trypanotolerance Network to carry out its research. Activities will be mainly concentrated in the humid and subhumid zones. The network will be coordinated, as in the past, from the shared offices of ILCA and ILRAD in Nairobi.
- 5.066. The major disciplines involved in the research will be animal breeding, animal nutrition, reproductive physiology and micro-economics. ILRAD will provide

further disciplinary inputs relating to epidemiology and molecular biology.

- 5.067. We cannot specify the exact division of future research responsibilities between ourselves and our partners. Data collection in the field is already handled by NARSs or funded by special projects in several instances; this will increasingly be the case in the future, as collaborative arrangements for any new work are made. Data analysis is done at Nairobi and in Addis Ababa, usually by national staff assisted by ILCA/ILRAD scientists. As NARS staff are trained they will increasingly be able to analyse their data independently in the future. Other IARCs and specialised institutes will continue to handle certain strategic aspects of the research.
- 5.068. **Training and outreach.** Since 1982, more than 42 field staff have come to Nairobi for training. Training in data sampling and analysis, including the standardisation of results, will continue to be activities central to the thrust. Besides this individual training, group training courses have been conducted at ILC headquarters and in Nairobi, using a manual jointly prepared by ILCA, ILRAD and ICIP staff (3). These courses too will continue to be held periodically, according to need. We hope that a number of visiting scientists will also work with us on this thrust.
- 5.069. The main outreach mechanism in the short term will continue to be the network, coordinated by ILCA/ILRAD, Nairobi, together with any meetings or workshops organised at various locations according to need. ILCA headquarters, Addis Ababa, will play a growing role in the transfer of results to our commodity thrusts in the medium term.

Thrust 6: Livestock policy and resource use

- 5.070. **Objective.** The objective of the Livestock Policy and Resource Use Thrust is to help increase the sustained output of livestock and crops in sub-Saharan Africa by improving policies towards the livestock sector and increasing the efficiency with which natural and other resources are used.
- 5.071. **Rationale.** Better policies and management of resources are crucial to livestock development in Africa. A complex of problems involving land tenure, credit supply, pricing policies, input supplies and other factors (see 2.059 – 2.069) impedes the adoption of new technology by livestock producers. In addition, the management of natural resources under current technical conditions is reducing crop and livestock productivity in some areas. And there is still uncertainty about the effects on resources of different kinds of livestock development, inhibiting policy formulation and the planning of effective interventions in the future.
- 5.072. Policy problems are ubiquitous in Africa and broadly similar in kind throughout the continent. However, there is a need to compare the experiences of different countries in their search for solutions, since these will often vary according to the natural and socio-economic environment.
- 5.073. Problems regarding the use of natural resources, on the other hand, are without doubt at their most acute in the semi-arid and arid zones, where the long-term future of both crop and livestock production appears to be threatened. Here there is a need to improve the methods for assessing both resources and medium-term productivity trends (see 2.008–2.011), and to study and improve the role of livestock in stabilising and sustaining farm income and crop production in marginal areas.
- 5.074. ILCA has a special advantage in implementing this thrust for five reasons. First, much of the work can best be done by comparing experiences in different zones,

countries and regions. Second, in some of the work, especially in resource assessment, there are economies of scale in terms of skills and equipment. Third, other IARCs are or ought to be involved: in the policy field IFPRI, and in resource use the other centres working in Africa, particularly ICRISAT and IITA. Fourth, through its documentation centre and its close links with key technical and policy making officials, ILCA has good access to much of the information relevant to the issues involved. Fifth, through these same links, ILCA has a ready audience for the results of its work.

- 5.075. To sum up, our research activities in this thrust will concentrate on cross-country comparison of the critical policy issues affecting technology uptake, and on the sustainability of crop and livestock production in the semi-arid zone.
- 5.076. **Research topics.** We propose the following major research topics, as the basis on which a detailed work programme can be selected with the participation of NARSs:
- ways in which government policies influence the use of inputs and the uptake of technology by producers;
 - effects of government policies on the stability and sustainability of mixed farming in marginal areas;
 - role of livestock in stabilising and sustaining farming systems in the semi-arid zone;
 - development of low-cost methods for assessing long-term productivity trends in the semi-arid and arid rangelands;
 - role of credit in technology adoption by livestock producers;
 - relationships between land tenure and other factors affecting technology adoption;
 - social and economic factors affecting the demand for livestock products;
 - financing of livestock services;
 - effects of milk and meat pricing policies on production by smallholders and pastoralists.
- 5.077. **Modes of operation.** This thrust will develop the existing network devoted to policy issues, ALPAN, with a view to strengthening collaborative research where possible and widening the scope of the network to cover problems of resource use. Research on both policy and resource use will be based at headquarters, but studies on resource use will also involve field locations, probably in the semi-arid zones of East and West Africa.
- 5.078. The major disciplines involved in the research will be macro-economics, micro-economics, anthropology, ecology, and land use planning.
- 5.079. We cannot specify the exact division of future research responsibilities between ourselves and our partners. We hope that, as NARSs develop, more of the data will originate from national work, while its analysis will increasingly be done collaboratively. Studies of social factors affecting long-term productivity will mainly be carried out collaboratively, with ILCA facilitating the work but not directly funding it. Work on the role of livestock in semi-arid farming systems will involve both on-station and on-farm work and will doubtless be done collaboratively with ILCA's commodity thrusts, NARSs and other international organisations. Aerial survey, which may be used as a tool in the research, will be done only on a full cost recovery basis, using ILCA's staff and facilities wherever possible.

- 5.080. **Training and outreach.** Besides the training carried out through our collaborative research and network activities, we envisage a group training course, held annually at headquarters for 20 to 25 participants, on livestock policy analysis, and short in-country courses on aerial survey using SRF techniques. Individual training at headquarters will accommodate up to two trainees at a time, preferably at the postdoctoral level. We hope that a number of visiting scientists will also work with us on this thrust. The ALPAN network will continue to issue a newsletter, and we will develop training materials for use on policy analysis courses.
- 5.081. The main outreach mechanism will continue to be the network and its newsletter, coordinated from ILCA headquarters, and various meetings or workshops organised at headquarters or regionally according to need. ILCA's zonal research locations will act as subsidiary centres of outreach, sharing with headquarters the responsibility for spreading the testing of technology or monitoring the results of policy changes within their respective zones or regions.

Training and information

- 5.082. Training and information are the two major channels through which we communicate research results and methods to NARSs; they are also the channels through which NARSs communicate their findings and needs to us. Our main activities consist of training NARS staff in the transfer of technology, teaching them research techniques, providing them with publications, and supplying them with additional information through our pan-African documentation service. But our training courses also provide NARSs with an opportunity to familiarise us (and each other) with local production problems and technologies, while our publications are outlets for national as well as ILCA research results and our documentation services stress the exchange of information.
- 5.083. In formulating our information and training strategy we have been governed by four major concepts:
- activities should be demand-led, i.e. based on the needs expressed by NARSs;
 - in most cases they should be closely related to our chosen thrust areas;
 - we have a bridging role to fulfill, in bringing skills and information to Africa from the developed world;
 - there must be a two-way flow of information between ILCA and NARSs.
- 5.084. Our Training and Information Department at present comprises three divisions: Training itself, Publications, and Documentation. The rationale for each of these major operations is described below, with an indication of current activities and probable future trends.

Training

- 5.085. **Rationale.** There is an urgent need for increased manpower training in the NARSs of sub-Saharan Africa. According to FAO (4), the number of graduates working in the continent's livestock sector as a whole is 6700. However, relatively few of these are working in research: only about 1100 altogether.
- 5.086. Three major training needs for NARSs can be identified:
- career training of more livestock scientists;
 - further training of existing livestock scientists in up-to-date research techniques and new technology;
 - training of livestock subsector staff in technology transfer.

- 5.087. We regard the first of these as largely a national responsibility. Our input is mostly restricted to enabling a small proportion of African graduates to conduct their thesis research at ILCA.
- 5.088. The second need is a major one which ILCA must address if collaborative research with NARSs is to be effective. National staff must be trained to use modern, standardised research techniques. They must also become familiar with the farming systems approach to research, and with any new technology available for applied or adaptive research in their own programmes.
- 5.089. The third need, which becomes more important as research gives rise to new technology, is one that ILCA can address selectively, mainly through training the trainers.
- 5.090. **Current activities.** ILCA's current training activities are of three kinds: group, individual and distance training. The first two are already well defined and established at ILCA, whereas the third is a relatively new venture.
- 5.091. Group training currently comprises around 8 to 10 courses annually. The number of group trainees passing through the centre each year is now approximately 200, having increased from a 1983 level of under 50 (see 3.077).
- 5.092. Individual training covers various categories of trainee, the main ones being long-term graduate associates and short-term research fellows and technician associates. Individual trainees in 1985/86 numbered 60, 10 to 20 of whom were on long-term visits lasting over a year.
- 5.093. The distance training available from ILCA at present consists of four manuals and two draft tape/slide presentations. More of both these types of product are currently under consideration.
- 5.094. **Future trends.** The short-term focus will be on the training of young African scientists in research techniques, either on courses or as research fellows or graduate associates of the Centre. Given additional funding, we hope to expand this area of our training programme considerably, in order to strengthen our collaborative research and network operations with NARSs.
- 5.095. As our research programme generates more technology the focus will shift towards training the technicians needed to adapt and transfer it. The two-way flow of information will be an essential ingredient in this process, as the teaching materials used will need to reflect local conditions.
- 5.096. Most group training, and all individual and distance training, will be closely tied to our research thrusts. However, in collaboration with developed-world institutes we will continue to offer courses in a limited number of additional subjects in which it is felt vital to import skills and knowledge to Africa from the developed world.
- 5.097. To supplement the full training programme carried out at headquarters, more emphasis will be placed on in-country training. National courses related to ILCA's research thrusts will be run jointly by NARS staff trained at ILCA and by one or more ILCA scientists, using training materials developed at ILCA. In-country training will have a multiplier effect, with ILCA acting as a catalyst for the training of relatively large numbers of national staff.
- 5.098. Once NARSs have obtained sufficient experience in hosting ILCA training courses, we envisage their staff becoming wholly responsible for such courses. ILCA's input will then be limited to the provision and revision of training materials.

- 5.099. **Rationale.** ILCA has a publications programme primarily in order to communicate its research results and techniques rapidly to users, but also to allow those users to communicate with us. Many African libraries and scientists do not get access to the scholarly journals in which our research results are sometimes also published. In addition, ILCA addresses other audiences besides scientists—for example, trainees and donors—who require information in forms tailored to their specific needs. Lastly, national scientists themselves lack publishing outlets and hence information about each other's activities.
- 5.100. **Current activities.** ILCA currently produces the following series geared to the needs of its various audiences:
- network newsletters, linking national scientists working on similar topics;
 - the *ILCA Bulletin*, an outlet for medium-length scientific articles;
 - research reports, for publishing more detailed collaborative research results;
 - the *ILCA Newsletter*, carrying news of NARS and ILCA activities;
 - manuals and tape/slide presentations, for training in research techniques and technology transfer;
 - conference proceedings, of meetings hosted and/or sponsored by ILCA;
 - the *Annual Report*, summarising the year's activities for donors and research partners.
- 5.101. In addition, miscellaneous brochures, posters and other short publications are produced.
- 5.102. In-house services, including editing, translating and printing, are geared mainly to the production of official ILCA publications, but are also devoted to the preparation of non-conventional documents when resources allow.
- 5.103. A Publications Committee and a review procedure have been set up to guide the implementation of publishing policy and to safeguard the scientific quality of ILCA's publications.
- 5.104. Publications are currently distributed free-of-charge to African readers. A number of marketing arrangements have been made in developed countries. Our mailing list now contains some 6000 names. Limited attempts to reach beyond this audience have been made through contacts with the mass media, and exhibitions at meetings and bookfairs.
- 5.105. **Future trends.** We intend to continue with the series of publications outlined above, though we may seek to reduce the amount of resources currently devoted to conference proceedings by publishing abstracts instead. In order to strengthen the two-way flow of information we will encourage contributions from NARS scientists to the *ILCA Bulletin* and the *ILCA Newsletter* as well as to network newsletters. We expect the number of network newsletters and research reports to grow as ILCA's collaborative research and network operations increase. We may decide to start publishing an annual *Research Highlights*, and state-of-the-art reviews on topics covered by our research thrusts. And we expect to increase the number of posters, brochures, tape/slide presentations and non-conventional documents produced in support of research thrusts.
- 5.106. While marketing opportunities in Africa remain limited, we will continue to distribute publications free-of-charge to all African users. Our mailing list will grow and will be subject to revision as we improve our knowledge of NARSs. And we will seek to strengthen links with both our African clientele and with our

donors worldwide by increasing our outreach activities. We may seek to promote knowledge of ILCA and its work through greater use of African radio programmes, and by publishing magazine articles and other items through the media of donor countries. Most publications will relate closely to our research thrusts, but contributions from NARS scientists not participating in collaborative research with ILCA will also be accepted for publication.

Documentation

- 5.107. **Rationale.** National agricultural staff and institutes in Africa generally have very limited access to information. Little foreign currency is available for buying expensive international journals and textbooks published in the developed world. In addition, few national agricultural publications are financially viable, with the result that many research results appear only as non-conventional literature, receiving little circulation in the country of origin, let alone in the rest of Africa. Lastly, the technology and skills needed to provide up-to-date information services are often lacking.
- 5.108. ILCA's response to these problems has been to set up a comprehensive range of information services based at its headquarters library and documentation centre in Addis Ababa. The aim has been to collect and disseminate relevant information on livestock production throughout the continent.
- 5.109. **Current activities.** The documentation services provided at present are:
- specialised dissemination of information (SDI), based on research profiles of NARS scientists;
 - data base searches on specific topics, on request;
 - provision of lists of current titles in various fields, on a regular quarterly basis;
 - provision of microfiches or photocopies, on request;
 - microfiching of national non-conventional literature;
 - supply of national microfiche collections, with indexes and microfiche readers;
 - publication and dissemination of specialised bibliographies;
 - exchange of literature with African and other libraries;
 - provision of library loan services to ILCA and collaborating NARS staff;
 - training of African library and documentation staff.
- 5.110. These services are provided free-of-charge to African users. Through ILCA, African scientists can now get access to international data bases such as CAB and AGRIS, as well as to relevant African literature.
- 5.111. **Future trends.** We intend to continue to provide these services, and to expand them where possible. We expect the use of computerised information services to diversify and grow.
- 5.112. We will emphasise the provision of information in areas directly related to ILCA's research thrusts. However, we will continue to supply information in some areas not directly covered by our research thrusts, and to scientists in non-collaborating NARSs. We have elected this strategy because of the isolation in which many African scientists work. For some scientists, ILCA may be the only institute currently catering for their information needs. For those NARSs not collaborating with ILCA, information services to keep them in touch with research progress are all the more important.

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Changes at ILCA

In this box we state the main changes we are making or proposing to make to ILCA's programme.

The major change over the short term is our reorganisation of research under thrusts. This is an attempt to:

- focus our research programme and direct it towards ILCA's goals;
- strengthen the links between field programmes, and between headquarters and field research.

A further change, over the medium term, will be a gradual shift in emphasis away from zonal field teams towards collaborative research using a network approach. This will be an attempt to strengthen NARSs and increase the potential impact of our research.

We have reduced our activities in the following areas:

Site-specific work on pastoralism. Field programmes in Kenya and in central Mali are being cut; some aspects of the work in southern Ethiopia are being handed over to other agencies.

Satellite imagery. Research on the applications of this technology to agroclimatology, the prediction of primary productivity and drought early warning systems is being substantially reduced, but we do not preclude the occasional use of satellite imagery as a research tool in the future.

Poultry. Work on the analysis of constraints to traditional poultry production in Mali will cease.

Ox-seed project. Work to test the effects of a package of innovations, including single-ox ploughing, on the post-drought recovery of Ethiopian smallholders is being handed over to a development agency.

Network newsletters. Activities associated with the editing, production and distribution of network newsletters devoted to feed resources will be rationalised.

Pastoral ecology. The headquarters unit devoted to this subject has been abolished. Some aspects of pastoral ecology will be studied by the Livestock Policy and Resource Use Thrust.

Photo-interpretation/mapping. Work on the interpretation of aerial photography and the large-scale mapping of rangelands has been discontinued.

Should additional funding become available, we would wish to expand:

- training of NARS scientists in research techniques;
- production and distribution of training materials;
- work on technology generation, especially in the fields of animal nutrition and milk/meat/traction;
- the network approach, and collaborative research with NARSs;
- our presence in southern Africa;
- work on milk production for market;
- our emphasis on sustainability, especially in the semi-arid zone;
- our cooperation with other IARCs in Africa.

Programme Implementation

- 6.001. In this chapter we deal with the organisational implications of implementing the strategy and programme outlined in Chapters 4 and 5. We look first at our chosen modes of operation, then at the allocation of our future resources*. We end with a brief glance at the long-term future role of ILCA.

Modes of operation

Research planning

- 6.002. The major topics of ILCA's research programme (see 5.011, 5.024, 5.040, 5.053, 5.064 and 5.076) have been planned in accordance with the needs identified by NARSs. For each thrust these needs were identified through:
- regional contacts maintained by our zonal field teams;
 - contacts with NARS scientists and trainees visiting ILCA headquarters;
 - missions to current and future network participants;
 - visits to African universities;
 - advice from NARS representatives on ILCA's Board of Trustees;
 - research priorities previously identified at conferences and workshops;
 - priorities expressed at the 1984 Biennial Meeting with the Leaders of Livestock Research, Development and Training in Africa.
- 6.003. At the outset of the initial 5-year period envisaged for each thrust we intend to hold a planning meeting at ILCA headquarters to which NARS scientists and other specialists will be invited. At these meetings we hope to draw up a detailed work plan with the participation of NARSs, specifying the content of collaborative research and the sharing of tasks between the various institutes involved.
- 6.004. As we have done in the past, we will continue to host at headquarters a Biennial Meeting with the Leaders of Livestock Research, Development and Training in Africa. At these meetings we ask our clients to help us set guidelines on research priorities, assess past progress and identify new opportunities.
- 6.005. Within ILCA, the mechanisms set up in 1986 (see 3.021–3.022) will continue to ensure the coherence and relevance of the research programme. Projects within each thrust will be subject to three major forms of control:
- research protocols
 - annual reporting and reviewing, and
 - biennial success evaluation.

Research Implementation

- 6.006. **Collaborative research.** In order to integrate ILCA's work with that of NARSs, we propose a gradual increase in collaborative research, using a network approach (see 4.054–4.055). Besides the planning meetings mentioned in 6.003, NARS staff will be periodically invited to attend regional or zonal meetings with ILCA staff to discuss their role in the implementation of research projects.

* Detailed allocations will be given in our 5-year programme and budget proposal, to be presented to TAC in late 1987 or early 1988.

Eventually, NARS staff will contribute substantially to our critical mass and to our ability to spread research over a wide number of sites, thereby broadening its potential for impact.

- 6.007. Collaborative links will continue to be forged through ILCA's existing networks and zonal research programmes. Some new networks are proposed, but it may take several years for these to develop. The priority task in networking will be to transform our existing information exchange networks into fully fledged collaborative research networks. The principles behind an effective network (1) are:
- there must be a clearly identified, commonly shared problem, and a realistic research agenda;
 - participants must be motivated to contribute by a strong element of self-interest, derived from the perceived benefits flowing from the research (see 4.056–4.058);
 - participants must be willing to commit resources to the network, including both staff and facilities;
 - national groups must get the modest incremental funding needed to enable them to participate;
 - participants must have sufficient training and expertise to be able to make a contribution (see 5.094);
 - the network must have strong, efficient leadership that earns the confidence of participants.
- 6.008. **Contract research.** While collaborative research with NARSs will for the most part concern applied and adaptive research, contract research with more specialised institutes will be needed to address certain strategic issues in which ILCA lacks the necessary expertise. Core funds will be used to pay for such research when necessary, but special funding arrangements will be preferred (see 6.061). In the latter case, care must be taken at the outset to identify research priorities clearly, and to ensure that these are relevant to Africa's needs.
- 6.009. If this condition is met, contract research will fulfill an important bridging function in bringing the research capacities of institutes in other parts of the world to bear on African problems.
- 6.010. **Own research.** Despite our increased emphasis on collaborative research, some research will remain the exclusive province of ILCA. This will be the case whenever:
- NARSs do not yet have the necessary resources to participate in applied/adaptive research;
 - strategic research is needed, and such research lies within the capabilities and facilities of ILCA working alone.
- 6.011. **Farming systems approach.** In accordance with our mandate, we have adopted a farming systems approach to our research. We will continue to do so in the future. The essence of such an approach is that the farmers' viewpoint is central to the research process. As in the past, new technologies will therefore be tested on-farm as well as on-station, and producers' reactions will be fed back into the research process.
- 6.012. Our 1981 Quinquennial Review recommended a shift in emphasis away from the description of constraints in existing systems towards component research to alleviate those constraints. We followed this recommendation, and our 1986

review commended the progress we had made in designing and testing technological innovations (2). We expect the emphasis on technology generation to continue and intensify over the next 5 years. Our new research structure, based on thrusts, is an attempt to adopt an organisational form conducive to this process.

- 6.013. While we hope to train national groups in the farming systems approach and will develop manuals for this purpose, we do not intend to devote resources to publications on the theoretical aspects of farming systems research methodology.
- 6.014. **Mix of disciplines.** ILCA uses a wide range of disciplines to implement its mandate for multidisciplinary research. However, there are seven main areas of concentration, accounting for 70% of international professional staff in 1986. These are: animal nutrition, agronomy, animal health and reproduction, computing, animal production, ecology and economics (see also 3.017).
- 6.015. Of these, the animal science areas, especially animal production and nutrition, are the ones in which ILCA needs to continue to build expertise in order to support its main commodity thrusts in the coming years. The disciplines required for each thrust are listed in 5.013, 5.026, 5.042, 5.055, 5.066 and 5.098.
- 6.016. **Animal disease.** ILCA's mandate is considered to cover animal nutrition rather than animal disease, the latter being the responsibility of our sister institute, ILRAD. In order to concentrate its resources, ILRAD has so far limited its work to basic and strategic research on two major diseases, theileriosis and trypanosomiasis. In so far as diseases are a serious constraint to production, they are clearly a legitimate concern of ILCA.
- 6.017. Our work on animal disease will therefore be strictly production-related. It will cover two main areas. First, we need to understand the patterns of disease in African livestock and to identify the main causes of mortality and morbidity. Specific areas of concern here include the causes of reproductive wastage, high postnatal mortality, pneumopathies in small ruminants, and the depressive effects of disease on milk production. Secondly, we need also to study the impact of disease control on animal production and farm income, and, in certain cases, to assess the feasibility and effectiveness of different forms of control.
- 6.018. In both these two main areas, much of the work can be done collaboratively with NARSs. There will in addition be areas of strategic research, especially in the field of reproductive physiology, requiring inputs from developed world institutes. ILCA will not seek to develop new drugs or vaccines, but will encourage the testing of existing technology by NARSs and the development of new technology by companies and institutes in the developed world. For example, dermatophilosis, as a major barrier to increased milk production in West Africa, is one disease for which we might seek the active involvement of an institute such as IEMVT in the search for solutions.
- 6.019. **Macro- and micro-economics.** The current allocation of resources between these two areas is about 33% to the former and 66% to the latter. Work on micro-economics will form an integral part of each research thrust. It will cover input, marketing and production economics, and will become increasingly important in the longer term as we assess the impact of innovations on farm income and the welfare of producers.
- 6.020. Work on macro-economics, forming part of the Livestock Policy and Resource Use Trust*, will continue at about its present level. We will ensure continuing consultation with IFPRI in order to avoid any potential areas of overlap.

* That is, work on livestock policy, interpreted in a broad sense to include work on inputs, institutions and market assessment.

Internal organisation

- 6.021. **Research thrusts.** As indicated in Chapter 5, we intend to launch six research thrusts, as follows: Cattle Milk and Meat, Small Ruminant Meat and Milk, Animal Traction, Animal Feed Resources, Trypanotolerance, and Livestock Policy and Resource Use.
- 6.022. Each thrust will be both multidisciplinary, involving a mix of disciplines drawn from ILCA's existing disciplinary divisions, and multilocational, working at several field sites representing the different zones and regions of our mandate area.
- 6.023. Thrusts do not replace the current structure of ILCA. Instead, they are superimposed over both our disciplinary divisions at headquarters and our multidisciplinary zonal programmes in order to unify our work and to give it greater coherence and direction. The new organisational structure will thus resemble a matrix, with staff within a specific disciplinary division moving between thrusts and locations according to need (see Figure 6.1).
- 6.024. Each thrust will contain a number of different projects. Whereas the divisions and sections of ILCA will probably remain relatively stable over the years, the research projects within thrusts will be subject to change.
- 6.025. ILCA's existing zonal research programmes will be called 'zonal research sites'. A number of thrusts may work at each site. Network sites, on the other hand,

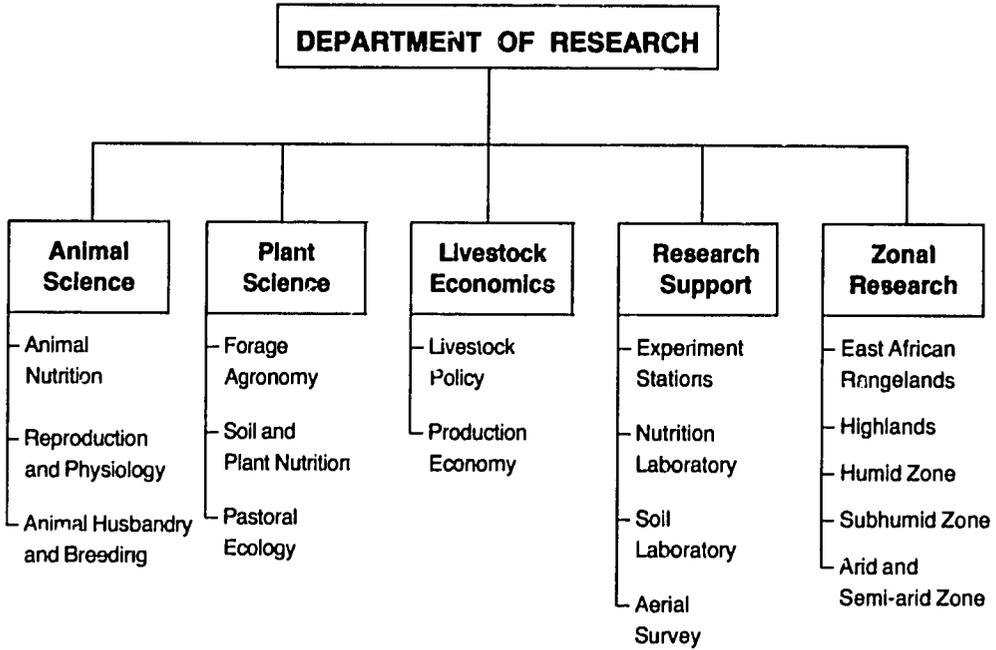
Figure 6.1. A matrix approach to multidisciplinary research.

Discipline \ Thrust	Cattle milk and meat	Small ruminant meat and milk	Animal traction	Animal feed resources	Trypanotolerance	Livestock policy and resource use
Animal Science						
Nutrition and management	x	x	x	x	x	
Reproduction and health	x	x	x			x
Breeding	x	x			x	x
Plant Science						
Forage agronomy	x	x	x	x		
Plant/soil nutrition				x		
Ecology				(x)	(x)	x
Livestock Economics						
Policy	x	x	x			x
Production and marketing	x	x	x	x	x	x
Zonal research sites						
	Humid Subhumid	Humid Semi-arid Highland	Subhumid Semi-arid Highland	All zones except arid	Humid Subhumid	All zones
On-station	x	x	x	x		x
On-farm	x	x	x		x	x

may continue to be the responsibility of a single thrust, although close cooperation with other thrusts will be sought when appropriate.

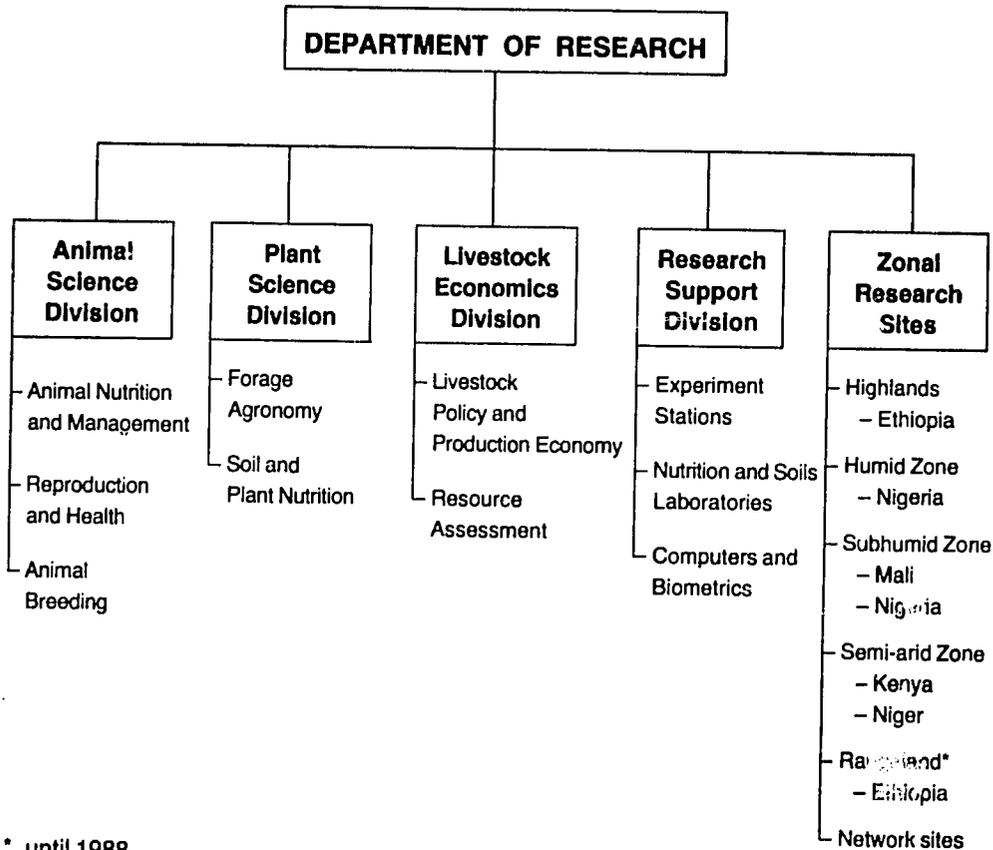
- 6.026. Each thrust will have a coordinator (who may also be a division or section head). Thrust coordinators will, with the Director of Research, be responsible for the planning, budgeting, implementation and evaluation of thrusts, and for ensuring the publication of results. Their administrative duties will be to plan and mobilise the human, financial and environmental resources needed to implement the thrust's research. Thrust coordinators will also have major responsibility for establishing the mechanisms for thrust review and the extension of results.
- 6.027. Where the division head is not a thrust coordinator, the overall direction of thrusts in which that division's disciplines work will be subject to the judgement of the latter. Similarly, while zonal site leaders will continue to be the administrative heads of their sites, and will be closely involved in the planning and evaluation of the research that takes place there, overall responsibility for research and its coordination at the various sites will lie with thrust coordinators.
- 6.028. Individual research workers may be involved in several projects within a thrust, and in more than one thrust. They will take their research direction from the Director of Research, through the thrust coordinator, but their immediate administrative supervisor will be the zonal site leader. Their disciplinary advisor will be the divisional head at headquarters. The zonal site leader will be responsible for multidisciplinary research implementation at a given site, while the divisional head will ensure the quality of disciplinary research.
- 6.029. Besides the need to give a greater sense of shared purpose to ILCA's research programme, there are two operational reasons for introducing research thrusts. First, they will enhance the degree of interaction between headquarters and field programmes as well as between one field programme and another; secondly, they will enable the Director of Research to measure the effectiveness of the research programme more easily.
- 6.030. **Research divisions.** ILCA's Research Department at the beginning of 1986 included central units based variously on disciplines (for example, Livestock Economics), animal species (Small Ruminants and Camels), objectives (Animal Reproduction and Health) or zonal studies (Range Science). The zonal research programmes, which were not formally included in the Research Department, worked on topics related but not confined to those of the central units. Biometrics and computing were not part of the Research Directorate.
- 6.031. During 1986 this organisational structure was replaced by a more formal, discipline-based one, in which both the central research units and the zonal programmes were included in the Research Department (Figure 6.2). Biometrics and computing were still excluded, however.
- 6.032. The reorganised department had three central research divisions (Animal Science, Plant Science and Livestock Economics), a Research Support Division, and zonal research programmes in the East African rangelands, the highlands, the humid zone, the subhumid zone, and the arid and semi-arid zones (see also 3.020).
- 6.033. The heads of the three research divisions, together with the team leaders of the multidisciplinary zonal programmes, provided disciplinary and administrative leadership of the research programme. Each of the research divisions consisted of a number of sections and/or units (see 3.032–3.049).

Figure 6.2. Organisation of the Research Department, 1986.



- 6.034. Our decision to introduce research thrusts requires some realignment of existing units, and this is shown in Figure 6.3.
- 6.035. The Animal Science Division reflects the new organisational emphasis on component research on animal production in general, via the nutritional and reproductive/health problems recognised to be the major constraints. Animal breeding will be concerned with the identification of animals particularly adapted to specific environments (e.g. trypanotolerant stock) and selection procedures based on appropriate characteristics.
- 6.036. The Plant Science Division includes the previous Forage Agronomy and Soil and Plant Nutrition Sections. Pastoral Ecology is merged into Forage Agronomy and Resource Assessment.
- 6.037. It is envisioned that there will be two major directions in the Livestock Economics Division. One of these will conform to the work done in the Livestock Economy Division before May 1987. Additionally, the Division is developing a resource assessment capability which will include the ILCA aerial survey team and other personnel as needed to work on resource assessment concepts.
- 6.038. Research services associated with the experiment stations at Debre Zeit and Debre Berhan in Ethiopia, the nutrition and soils laboratories, the computer and biometrics services and the aerial survey team comprise the new Research Support Division. This is an attempt to make support services more accessible to all ILCA units and to ensure appropriate collaboration between them. The success of the Research Support Division will be measured in terms of the quality rather than the quantity of the services provided, and of their degree of incorporation with the research programme.
- 6.039. Zonal research sites will include Debre Zeit and Debre Berhan in Ethiopia (highlands), Ibadan in Nigeria (humid zone), Kaduna in Nigeria (subhumid

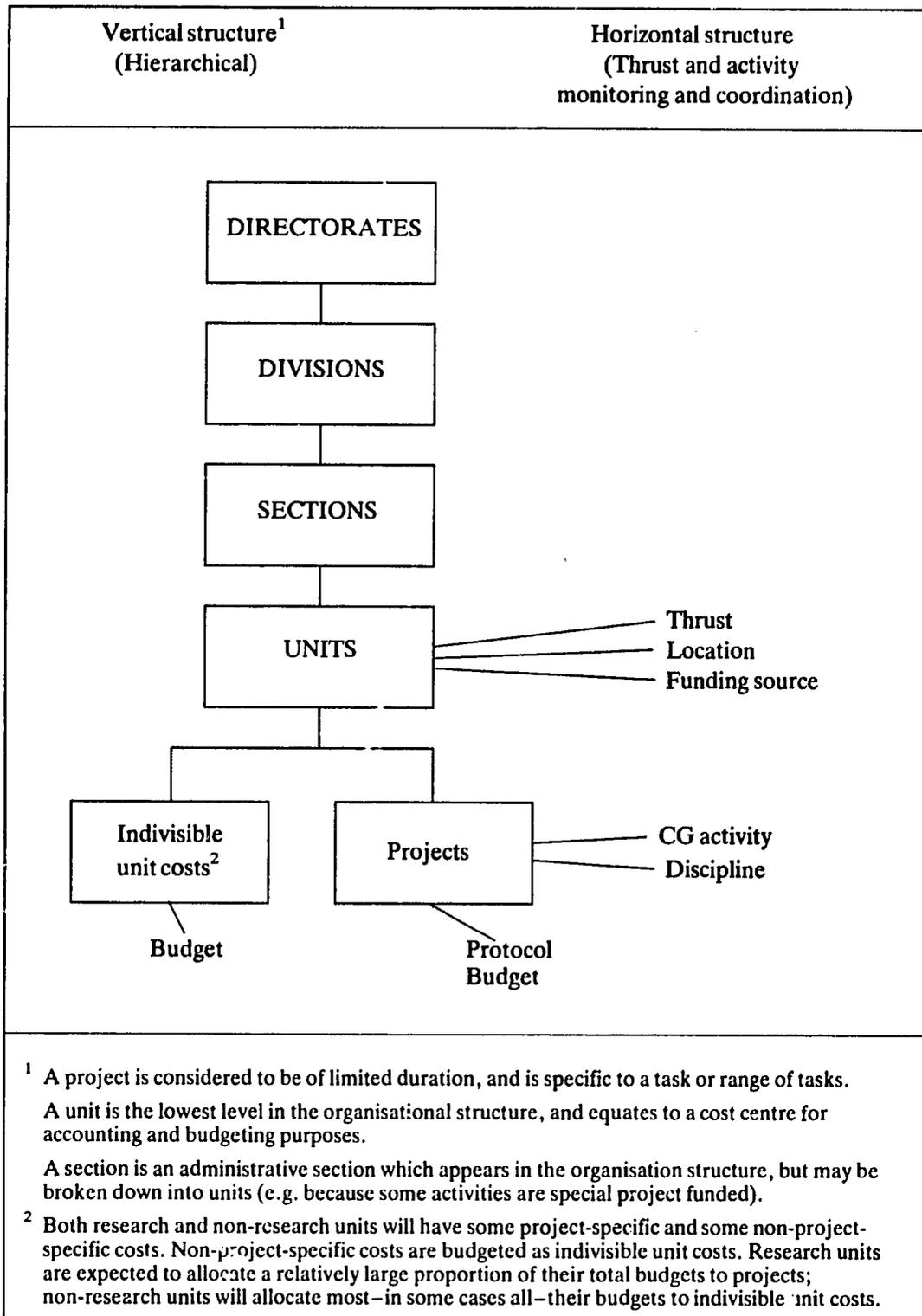
Figure 6.3. *Organisation of the Research Department, 1987.*



zone), Bamako in Mali (subhumid zone), Niamey in Niger (semi-arid zone) and Kenya (semi-arid zone). Our rangeland sites in Kenya and the drier areas of Mali are being reoriented to reflect ILCA's strategy and in order to facilitate future collaborative research with the NARSs of these countries.

- 6.040. The administrative units shown in Figure 6.3 (headquarters divisions/sections and zonal research sites) will continue to provide the focus for budgetary responsibility, since it is at this level that day-to-day management takes place. These units will be the cost centres recognised by the Finance Department, which will, as in the past, provide them with information about budgeted and actual expenditures. However, initial budget allocations will in the future be on the basis of activities rather than locations.
- 6.041. Figure 6.4 shows the budget and financial reporting mechanisms we propose to use from 1988 onwards. In the Research Department, section budgets will be broken down by projects, with each project having an approved protocol. This will provide the necessary link between research management and financial planning. On receiving budget submissions, management will use the budget-by-project analysis as a basis for reconciling research proposals with available funds. Since both research activities and thrusts will consist of projects, it will be possible to aggregate project budgets within each activity and thrust, and so derive total budgets by both activity and thrust for reporting purposes.
- 6.042. Project-accounting facilities in the computer general ledger package will be used to extract figures on actual expenditure by project.

Figure 6.4. Proposed budget and financial reporting structure, from 1988 onwards.



Services to NARSs

- 6.043. ILCA has built up a considerable reputation for the breadth and quality of its support services to NARSs. The Centre assists NARSs by:
- collecting, storing and evaluating forage germplasm, and distributing seeds;
 - analysing soils and plants and assessing the feed value of forages, for NARSs involved in collaborative research;
 - conducting aerial surveys to assess the resources available for livestock production and the distribution of human and livestock populations;
 - providing statistical analyses of national data sets, and training NARS staff in the use of computers;
 - developing appropriate software, for free distribution in Africa;
 - providing back-up for networks, including editing, printing and distributing network newsletters and the proceedings of meetings;
 - providing other publishing outlets, such as joint ILCA/NARS research reports, the *ILCA Bulletin* and the *ILCA Newsletter*;
 - providing distance training materials, in the form of manuals and tape/slide presentations;
 - microfiching and cataloguing national non-conventional livestock literature, and providing complete collections together with microfiche readers and catalogues;
 - disseminating information on livestock production in sub-Saharan Africa, in the form of an SDI service, current titles service, photocopies or microfiches on request, and specialised bibliographies;
 - distributing ILCA's publications free-of-charge to African users;
 - organising and hosting conferences, workshops, seminars and training courses, both at headquarters and on a regional basis;
 - providing individual training and other opportunities for NARS staff to visit ILCA in order to study and work with us.
- 6.044. We intend to continue providing these services. Priority will be given to NARSs collaborating with ILCA, and some services, especially laboratory ones, will be available only to collaborating NARSs (for a discussion of information services in this respect, see 5.112). Other services, notably aerial survey, will be provided only on a cost recovery basis.
- 6.045. In the longer term, we expect NARSs to become more able to meet their own needs for the kinds of service we currently provide, allowing ILCA to move 'upstream' towards more sophisticated services associated with strategic research.

Links with farmers

- 6.046. In developing ILCA's research programme the needs of African farmers, as well as scientists and extension workers, will be taken into account. We need to know what their problems are, and how useful they find our innovations. For this reason, the farming systems approach will continue to be central to our research (see 6.011).
- 6.047. On-farm research will thus constitute an important additional source of institutional learning to supplement our major sources of such learning, the NARSs.

Operational languages

- 6.048. ILCA's official languages are French and English. Our formal mandate requires

us to make relevant information available in both. In operational terms, the high cost of translation and interpretation compels us to be selective in this respect. Our policy is therefore as follows:

- pan-African meetings: high-level, continent-wide meetings of senior officials are normally held bilingually, with the presence of interpreters;
- training courses: to increase teaching effectiveness course instruction is monolingual, usually in English and French in alternate years;
- regional/national meetings: these are held in the appropriate language for the region or country;
- publications: priority is given to the translation of ILCA's main official publications – the Centre's *Annual Report*, *Bulletin* and *Newsletter*. Other publications are translated according to the resources we have available and the needs of our target audience;
- documentation services: literature is provided in its source language. No written translations are made, but on request a summarised spoken translation of short items can be provided at headquarters.

6.049. Portuguese, a third language of some importance in Africa, is not mentioned in ILCA's formal mandate. In operational terms we exclude it as a working language for ILCA on the grounds of cost and of the small proportion of Africa's human and livestock populations (6 and 2% respectively, see 2.023) for whom it is relevant.

6.050. However, translations or adaptations of ILCA's publications, and especially its training materials, may be made into African or any other languages, including Portuguese, under copublication arrangements with national publishers.

Resource allocation

Research, information and training

6.051. As we have already seen (3.013), the allocation of resources between research, training and information at ILCA is currently about 60:10:10, with the remaining 20% devoted to other operations. In the short term, we hope to increase the resources devoted to training, in order to strengthen the ability of NARSs to participate in collaborative research (see 5.094). These extra resources will take the form of both greater budget allocations and more time spent on training by ILCA's research staff.

Research thrusts

6.052. Within research, we propose initially to make the following approximate allocation of resources between thrusts: 30% to cattle milk and meat, 20% to small ruminant meat and milk, 14% to animal traction, 20% to animal feed resources, 8% to trypanotolerance and 8% to livestock policy and resource use. Resources allocated to strategic thrusts may diminish over time as their results are transferred to commodity thrusts (see 5.003).

6.053. These proportions reflect our intention to seek maximum impact through our two major commodity thrusts. Cattle milk and meat receive the major share of resources because the work needed to make this thrust successful must span a wide range of disciplines, encompassing social and economic issues concerned with the marketing of milk as well as technical ones relating to its production. The resources allocated to small ruminants indicate the increased importance we now attach to these animals as sources of both subsistence and income for resource-poor smallholders (see 1.022, 1.025 and 5.020), but also reflect the fact that the milk produced is more likely to be consumed at home or sold locally than marketed for urban consumers, at least in the short term.

- 6.054. Although a complex subject, animal traction receives a somewhat lower proportion of resources than do the other two commodity thrusts because we are less certain of the potential for impact in this area, which is one in which we will need to assess our progress relatively frequently, adjusting the resources we devote to it accordingly.
- 6.055. Among the strategic thrusts, the highest proportion of resources goes to animal feed, because technology from this thrust is vital to the success of the two major commodity thrusts, and probably to the third commodity thrust as well. The resources allocated to trypanotolerance reflect the concentration of this thrust on strategic research, as applied and adaptive research on this subject is gradually incorporated into the respective commodity thrusts. The importance we attach to livestock policy and resource use is reflected in the resources allocated to this thrust, but it is likely to do less field work than the other thrusts.

Headquarters and field research

- 6.056. Our recent EPR (1986) commended us for having strengthened operations at headquarters (2), as recommended by our first review in 1981. The EPR recommended that the trend should now switch to building up ILCA's field work, mainly in the zonal programmes. We intend to implement this recommendation by allocating roughly 65% of any future real growth in research funding to zonal research and 33% to headquarters.

Staff and non-staff costs

- 6.057. We are currently at the initial stages of organising our research in terms of thrusts. It is therefore too early to make a realistic projection of the impact of our strategy on staff and non-staff costs. Our experience over the last few years (3.012) suggests that future allocations are likely to be about 50% to the former and 40% to the latter, leaving about 10% for capital investment.
- 6.058. We realise that our staff costs may seem relatively low compared to other CGIAR centres. We attribute this to three main factors. First, the cost of national support staff is in some instances lower in Africa than in other continents. Second, the diversity and size of ILCA's mandate area means that the Centre needs a wide geographical spread of research activities, resulting in a higher proportion of operating costs. Third, the operating costs of on-station and on-farm research with livestock are high compared to those with crops. Additional emphasis on field research will tend to raise operating costs still further.

Capital requirements

- 6.059. Over the last 4 to 5 years we have used on average 10 to 12% of our core budget for capital investments. This amount was divided equally between buildings, and machinery and equipment. In the future we believe we will wish to maintain the level of expenditure on machinery and equipment at about its current level, while we may slightly reduce that on buildings.

Special project funding

- 6.060. Between 1974 and 1981, special project funding represented an average of 3.6% of ILCA's total budget. This figure increased to 8.6% for the period 1982 to 1986, with a peak of 13% in 1982. For 1987, special project funding, estimated at about US\$ 2 million, once again accounts for 13% of the total budget.
- 6.061. ILCA's real growth has thus been higher for special project funding than for core operations. We intend to consolidate this trend in the coming years, maintaining a special project funding level of approximately 10% over our total core budget. Special attention will be paid to the generation of additional special project funding, provided always that the conditions outlined in 6.008 are met.

Longer term projections

- 6.062. The complex nature of livestock production in Africa, the present low technical basis, the long generation time of livestock, and the current problems faced by NARSs suggest that progress in livestock production in the continent may initially be slow (see 1.017, 2.017). The strategies outlined in this paper are expected to be relevant until at least the year 2000 (see 1.030).
- 6.063. Thereafter, the growing ability of NARSs to conduct site-specific research, either collaboratively with ILCA or alone, should begin to speed up progress. As this occurs, ILCA will increasingly focus on those aspects of livestock production and marketing research for which the Centre retains a special advantage over NARSs by virtue of its contacts with other IARCs, its expertise in strategic research and its ability to fund the considerable costs of such research.
- 6.064. Thus our research programme in the long term will probably include topics such as the development of new forage germplasm resources, artificial insemination technology, embryo transplants, egg splitting techniques, genetic engineering, animal fertility control, and meat and milk processing technology for increasingly sophisticated consumer markets.
- 6.065. The rate at which these long-term developments unfold will depend on the pace of change in national policies in Africa that favour agricultural development, on trends in both world and African food production, and on population growth, especially that of urban populations (see 2.016–2.017).
- 6.066. In the long term we can expect ILCA's ultimate target group to change from the present traditional smallholder farmer, keeping animals for a variety of purposes, to the specialised livestock producer using fodder, cereal crops or byproducts obtained specifically for use as animal feed.
- 6.067. As population grows and urban consumers become wealthier, we can expect the peri- and intra-urban share of livestock production to grow. With increasing success in trypanosomiasis control programmes, we can also expect increased output in rural areas where livestock production has not been possible hitherto. If population continues to rise in the subhumid and semi-arid zones, there will also be larger markets locally available for livestock from pastoral systems. Together with the progress in agroforestry and crop production, these larger markets may justify renewed attempts to improve feed production in pastoral areas.
- 6.068. As NARSs increasingly meet their own training requirements, ILCA's investment in training will eventually diminish. Percentage expenditure on information, however, will probably remain at present levels, since we see information sharing as an important area of special advantage on the part of ILCA, and believe that the information needs of NARSs are likely to increase rather than decline in the long term.

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Appendices

Appendix 2.1. *Country geographical groupings.*

West Africa

Benin
Burkina Faso
Chad
Côte d'Ivoire
Gambia
Ghana
Guinea
Guinea Bissau
Liberia
Mali
Mauritania
Niger
Nigeria
Senegal
Sierra Leone
Togo

Central Africa

Angola
Burundi
Cameroon
Central African Republic
Congo
Gabon
Rwanda
Zaire

East Africa

Ethiopia
Kenya
Somalia
Sudan
Tanzania
Uganda

Southern Africa

Botswana
Lesotho
Madagascar
Malawi
Mauritius
Mozambique
Swaziland
Zambia
Zimbabwe

Appendix 2.2. *Inter-household distribution of cattle holdings, some examples.*

Country Region/ zone/ system	Year of data	% of households holding 50% of cattle	% of cattle held by the lowest 50% of cattle-holding households	% of rural households without cattle
Botswana				
Whole rural population/ agropastoral	1974/75	5	13	45
S.W. Zimbabwe				
Arid/agropastoral (S.Gwanda)	1982	13	20	32
Central Zimbabwe				
Semi-arid/subhumid (Wedza)	1982	20	25	24
Ethiopia				
Gojam/highland/ mixed farmers	1968	18	21	24
Ethiopia				
Hararge/ mixed farmers	1968	18	18	22

Sources: (1 –5).

Appendix 2 3. *Annual changes in output and human population 1961/65–1983/85.*

Output/Human population	Annual changes (%)				
	West Africa	Central Africa	East Africa	Southern Africa	Sub-Saharan Africa
1961/65–1974/76					
Beef	1.0	5.2	2.4	1.1	2.0
Mutton	2.3	1.9	0.7	4.0	1.3
Goat meat	2.3	2.7	2.0	5.6	2.3
Cow's milk	0.6	1.0	1.5	0.8	1.2
Human population	2.7	3.0	2.9	2.8	2.9
1974/76–1983/85					
Beef	2.2	1.4	3.1	1.3	2.4
Mutton	3.6	0.7	3.0	2.5	3.1
Goat meat	3.4	1.9	1.9	0.9	2.5
Cow's milk	2.2	1.8	4.3	1.7	3.5
Human population	3.6	3.2	3.3	3.3	3.4

Source: (6).

Appendix 2.4a. Annual growth rates in the per caput production and consumption of total and individual meats by region, 1972–85.

	Annual growth rate (%)				
	West Africa	Central Africa	East Africa	Southern Africa	Sub-Saharan Africa
Per caput production					
Total	0.90	0.00	-0.29	-0.59	0.24
Ruminant	-1.00	-0.45	-0.52	-1.68	-0.72
Pork	0.00	1.41	5.48	0.00	1.19
Poultry	7.63	0.00	1.11	3.62	4.71
Per caput consumption					
Total	0.98	2.00	0.06	-0.70	0.47
Ruminant	-0.84	1.38	-0.13	-1.95	-0.41
Pork	0.00	2.04	5.48	0.00	1.19
Poultry	7.63	4.88	1.11	3.62	4.40

Source: (7, 8).

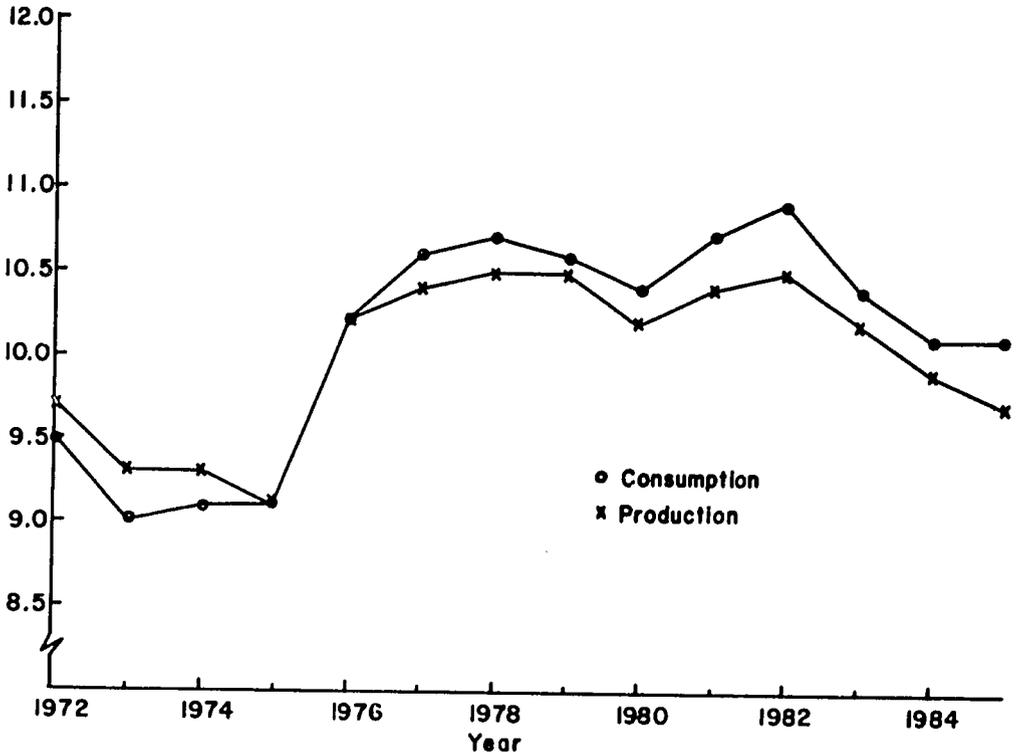
Appendix 2.4b. Composition of meat consumption by region, 1972–85.

Region	1985 per caput consumption of meat (kg/year)	% contribution of ruminant meat to meat consumption	
		1972	1985
West Africa	8.5	78.4	61.9
Central Africa	7.5	70.7	65.3
East Africa	13.0	89.2	87.0
Southern Africa	11.5	73.8	62.6
Sub-Saharan Africa	10.1	81.1	72.3

Source: (7, 8).

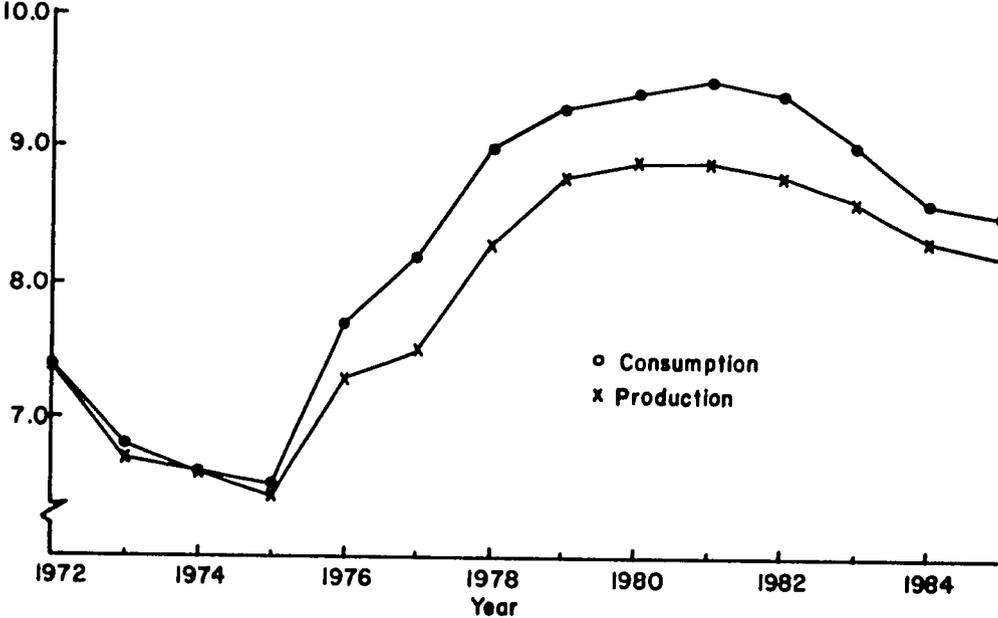
Appendix 2.5. Per caput production and consumption of all meat in sub-Saharan Africa, 1972-85.

Meat production/consumption
(kg/person)

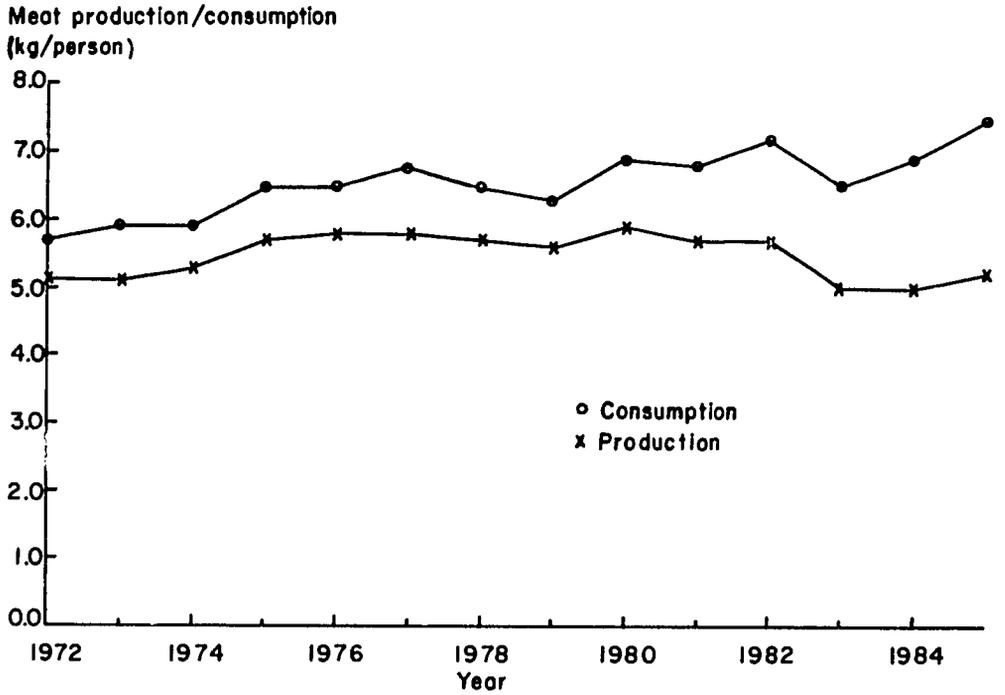


Appendix 2.6. Per caput production and consumption of all meat in West Africa, 1972-85.

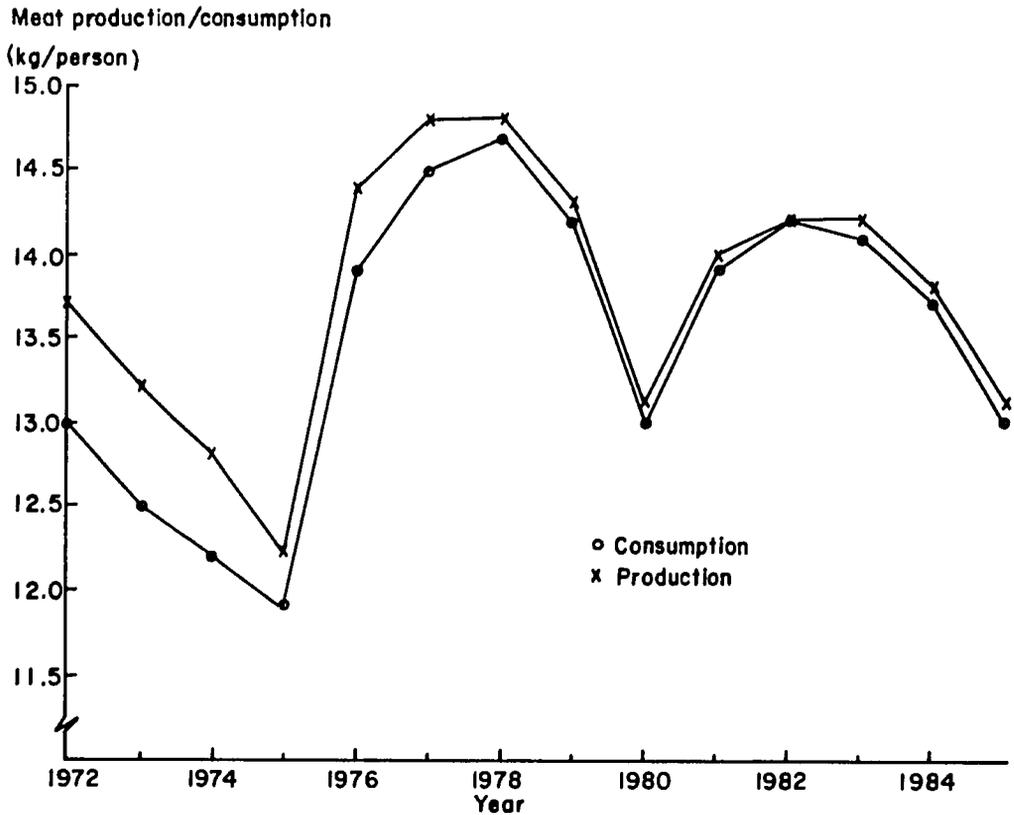
Meat production/consumption
(kg/person)



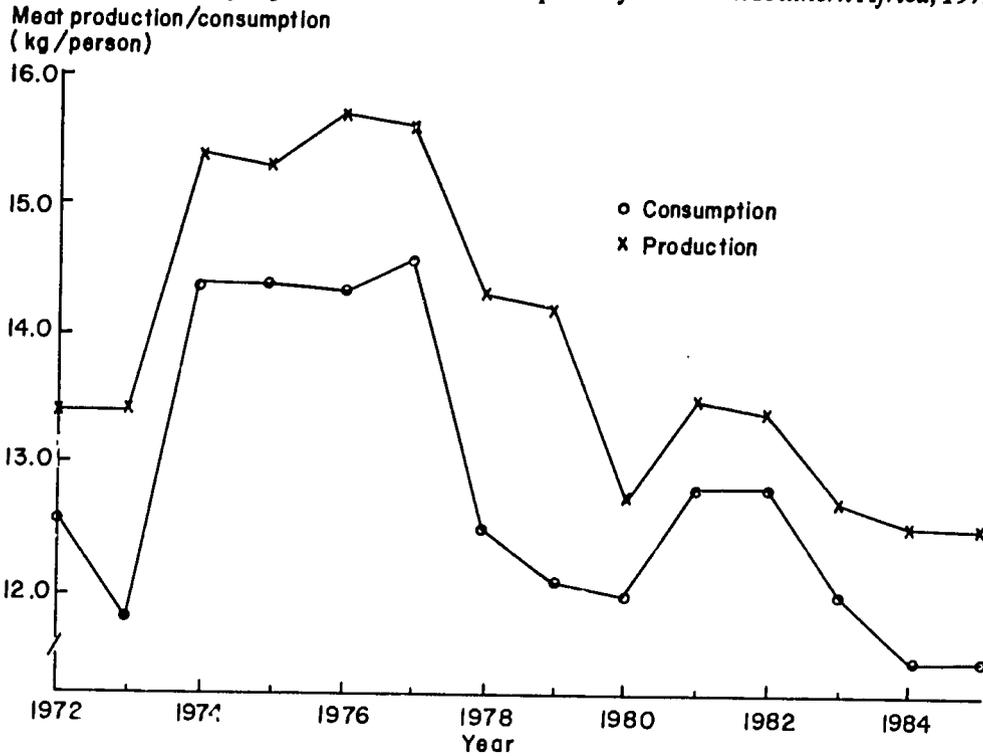
Appendix 2.7. *Per caput production and consumption of all meat in central Africa, 1972–85.*



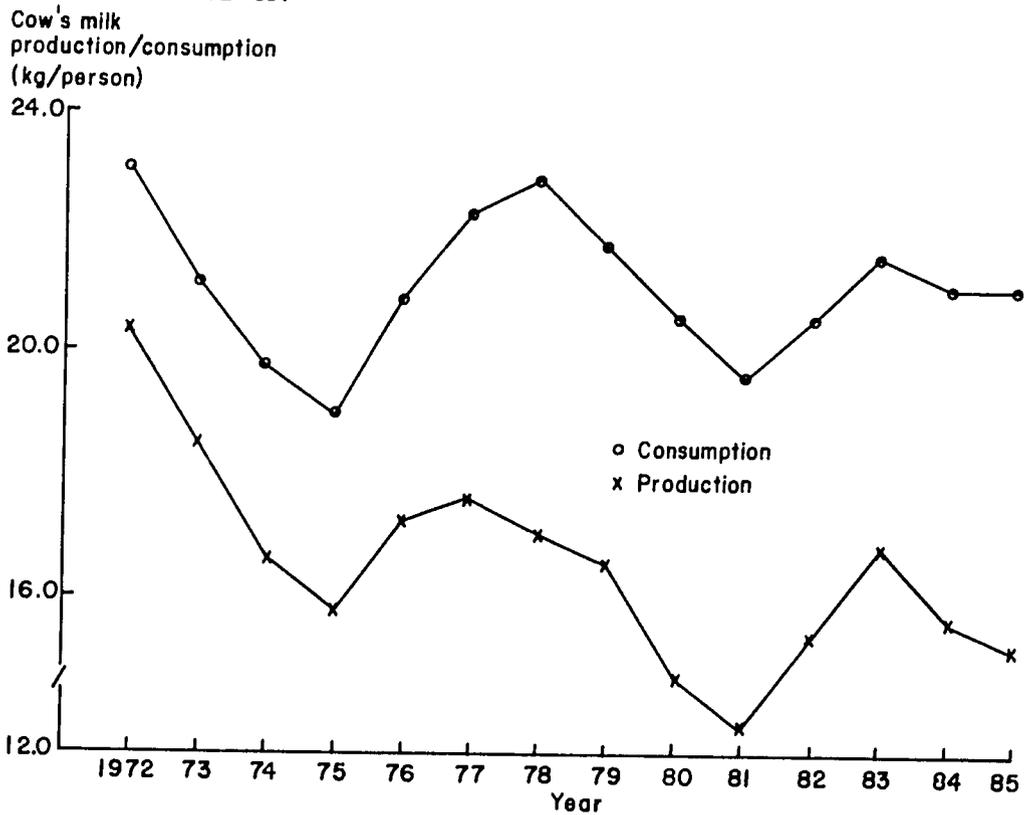
Appendix 2.8. *Per caput production and consumption of all meat in East Africa, 1972–85.*



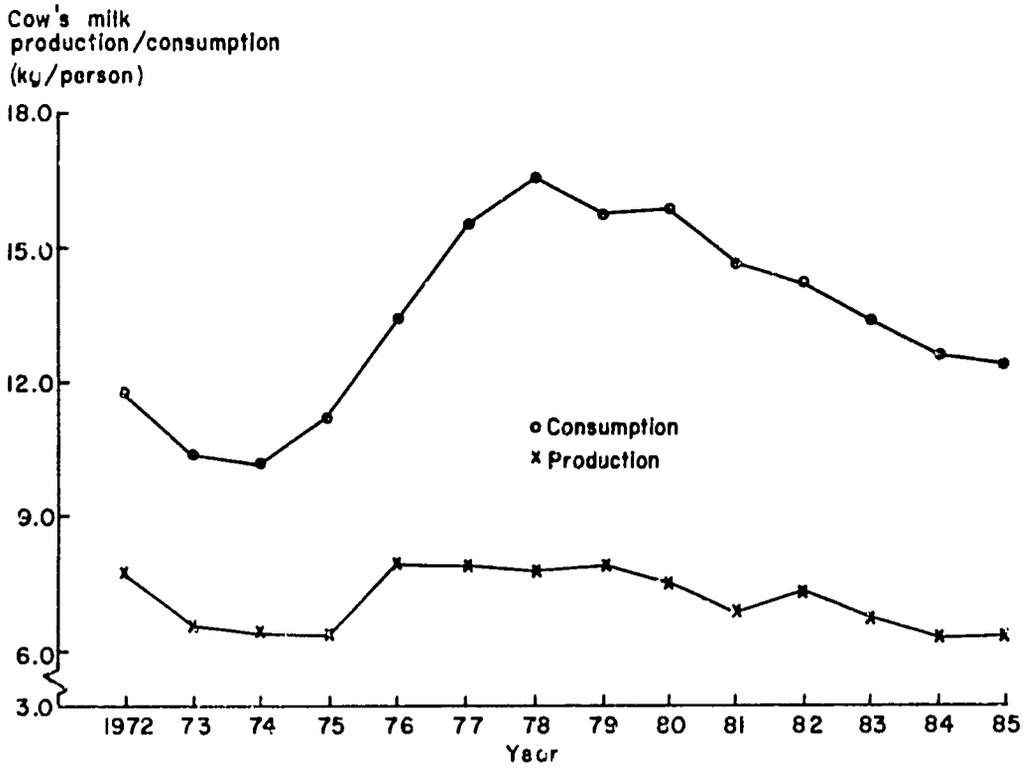
Appendix 2.9. Per caput production and consumption of all meat in southern Africa, 1972-85.



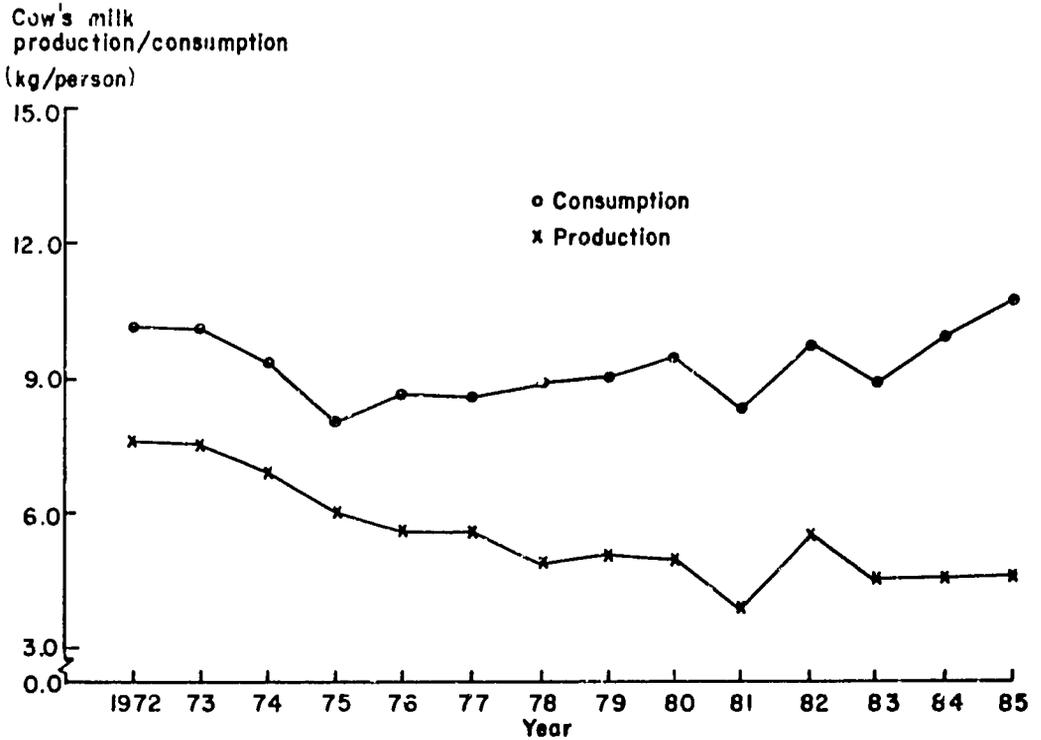
Appendix 2.10. Per caput production and consumption of cow's milk in sub-Saharan Africa, 1972-85.



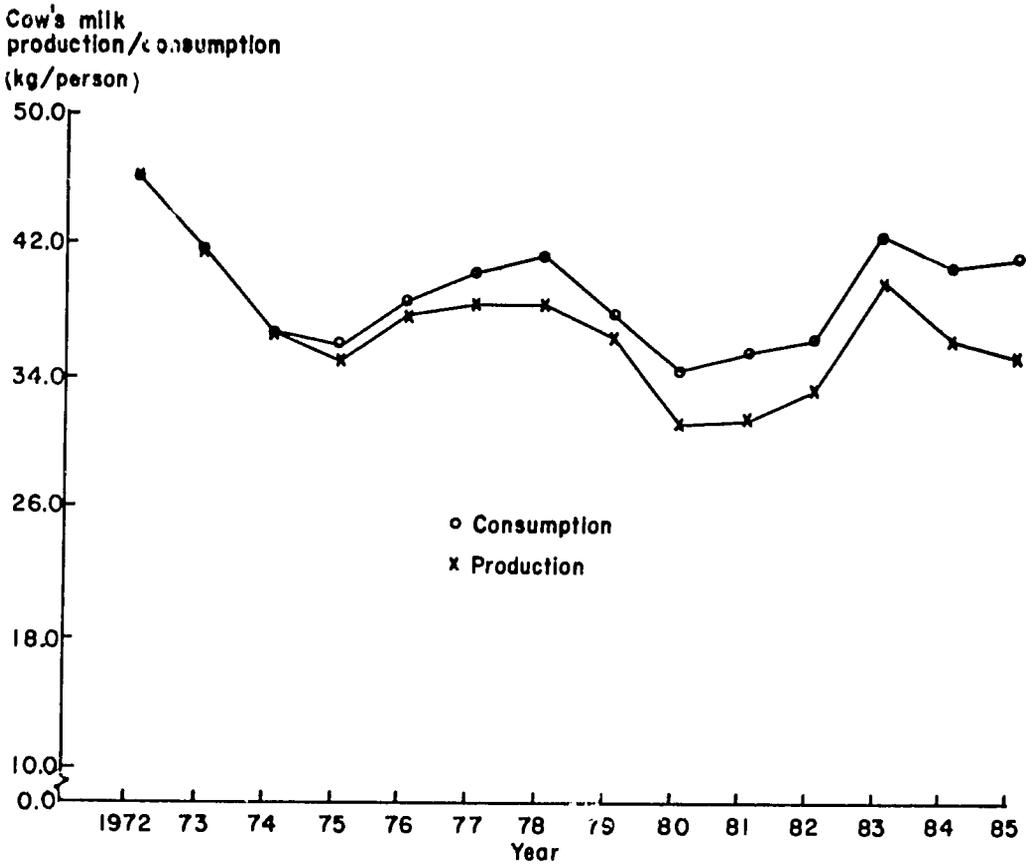
Appendix 2.11. *Per caput production and consumption of cow's milk in West Africa, 1972-85.*



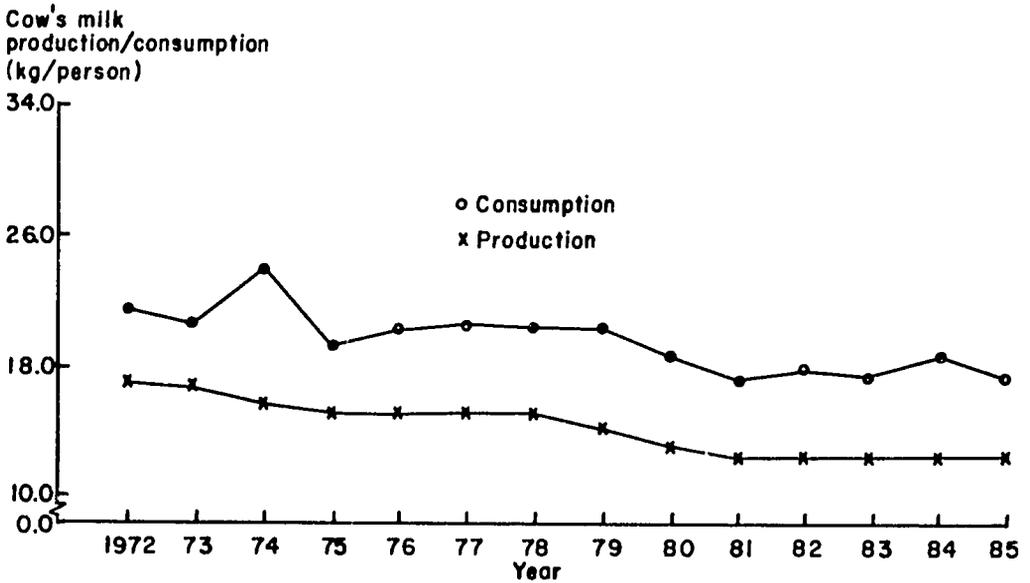
Appendix 2.12. *Per caput production and consumption of cow's milk in central Africa, 1972-85.*



Appendix 2.13. *Per caput production and consumption of cow's milk in East Africa, 1972-85.*



Appendix 2.14. *Per caput production and consumption of cow's milk in southern Africa, 1972-85.*



Appendix 2.15. *Regional and international research organisations.*

The organisations involved in livestock-related research in sub-Saharan Africa are:

- the World Bank/IDA, USAID, ODA (UK), GTZ (West Germany), IEMVT (France), SAREC (Sweden), IDRC (Canada) and FAO/UNDP, which provide financial and/or technical assistance to NARSs;
- the International Laboratory for Research on Animal Diseases (ILRAD), based in Nairobi and a member of the CGIAR system, which has a formal mandate to tackle any serious livestock disease, but is restricted by operational mandate to trypanosomiasis and theileriosis (specifically East Coast fever);
- the International Centre for Insect Physiology and Ecology (ICIPE), based in Nairobi, which spends about one third of its annual budget on livestock-related studies dealing mainly with the tick which transmits East Coast fever and with the tsetse fly;
- the International Council for Research on Agro-Forestry (ICRAF), based in Nairobi, which assists in the transfer of tree- and shrub-related technologies;
- the Centre for Research in Animal Trypanosomiasis (CRTA), based in Burkina Faso and managed jointly by IEMVT and GTZ, which studies methods for the control of tsetse fly and mechanisms of trypanotolerance;
- the Institut d'élevage et de médecine vétérinaire des pays tropicaux (IEMVT), based in France and in francophone sub-Saharan Africa, which deals with pasture agronomy, range ecology, veterinary pathology, animal nutrition, animal breeding, economics and processing;
- the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), based in India, which has a regional centre at Niamey, Niger, to serve the Sahel; ICRISAT has also been collaborating with ILCA on the Vertisol project in the Ethiopian highlands;
- the International Institute of Tropical Agriculture (IITA), based at Ibadan, which pioneered the alley farming technology currently being tested by ILCA's Humid Zone Programme on smallholders' farms in southwest and southeast Nigeria;
- Other CGIAR centres, such as CIP, CIMMYT and ICARDA, which have collaborated with ILCA's Highlands Programme in testing several crop varieties; CIAT, which has worked closely with ILCA on tropical pastures; IBPGR, which assisted in the development of forage germplasm collection and storage at ILCA; and IFPRI, ISNAR, IRRI and WARDA, whose activities are, at present, only slightly related to livestock.

Appendix 2.16. *Donors and developmental agencies.*

The main donor agencies financing livestock development in sub-Saharan Africa are:

- the World Bank (including IDA), USAID, EEC, the African Development Bank (including ADF), FAC (France), GTZ (West Germany), the Islamic Development Bank (mainly in Sahel countries) and IFAD. The two largest donors, the World Bank and USAID, have both in recent years been reducing the level of their commitments to the livestock sector, and particularly to range development projects.

Other agencies are:

- the Inter-African Bureau for Animal Resources (IBAR), which is the livestock arm of OAU and whose primary concerns are to conduct regular surveys of and report on the main epidemic diseases, coordinate transnational campaigns to control or eradicate livestock diseases, and, jointly with FAO, classify and conserve livestock breeds indigenous to Africa;
- FAO, which has been providing (often in collaboration with UNDP) technical assistance to African livestock research and development. Its international meat and dairy development schemes are important mechanisms for assessing current situations in and future prospects

of individual African countries. FAO is also the major source of published statistics on African livestock populations, production and trade;

- the United Nations Environmental Programme (UNEP), which has played a major role in drawing attention to the dangers of desertification caused by human activities, including the herding of livestock;
- several intra-African organisations, such as CILSS in West Africa, SADCC/SACCAR in southern Africa, IGADD in East Africa and SAFGRA (OAU), which are beginning to coordinate livestock-related research, development and conservation activities in semi-arid Africa.

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Acronyms and Abbreviations

ADF	African Development Fund
AFRC/IER	Agricultural and Food Research Council/Institute of Engineering Research (UK)
AGRIS	Agricultural Information Service (FAO)
ALPAN	African Livestock Policy Analysis Network
APRU	Annual Production Research Unit (Botswana)
ARNAB	African Research Network for Agricultural Byproducts
a.s.l.	above sea level
BBF	broadbed and furrow
CA	central Africa
CAB	Commonwealth Agricultural Bureaux (UK)
CBPP	contagious bovine pleuro-pneumonia
CEEMAT	Centre d'études et d'expérimentation du machinisme agricole tropical (France)
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (Colombia)
CILSS	Comité permanent inter-Etats de lutte contre la sécheresse au Sahel (Burkina Faso)
CIP	Centro Internacional de la Papa (Peru)
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo (Mexico)
CRTA	Centre for Research in Animal Trypanosomiasis (Burkina Faso)
EA	East Africa
ECA	Economic Commission for Africa (Ethiopia)
ECF	East Coast fever
EEC	European Economic Community
EMR	External Management Review
EPR	External Programme Review
FAC	Fonds d'aide et de coopération (France)
FAO	Food and Agriculture Organization of the United Nations (Italy)
FSR	farming systems research
GDP	gross domestic product
GNP	gross national product
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (FRG)
IARC	international agricultural research centre
IBAR	Inter-African Bureau for Animal Resources (Kenya)
IBPGR	International Board for Plant Genetic Resources (Italy)
ICARDA	International Centre for Agricultural Research in the Dry Areas (Syria)
ICIPE	International Centre for Insect Physiology and Ecology (Kenya)
ICRAF	International Council for Research on Agro-Forestry (Kenya)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics (India)
IDA	International Development Association (World Bank)
IDRC	International Development Research Centre (Canada)
IEMVT	Institut d'élevage et de médecine vétérinaire des pays tropicaux (France)
IFAD	International Fund for Agricultural Development (Italy)
IFPRI	International Food Policy Research Institute (USA)
IGADD	Intra-Governmental Group Against Drought (Djibouti)
IGAP	Institute for Grassland and Animal Production (UK)
IITA	International Institute of Tropical Agriculture (Nigeria)
ILCA	International Livestock Centre for Africa (Ethiopia)
ILRAD	International Laboratory for Research on Animal Diseases (Kenya)
IRRI	International Rice Research Institute (Philippines)

ISNAR	International Service for National Agricultural Research (Netherlands)
ITC	International Trypanotolerance Centre (The Gambia)
NARS	national agricultural research system
NLPD	National Livestock Projects Department (Nigeria)
OAU	Organization of African Unity (Ethiopia)
ODA	Overseas Development Authority (UK)
PANESA	Pasture Agronomy Network for East and Southern Africa
p.a.	per annum
PCV	packed cell volume
pgd	plant-growth-days
QQR	quinquennial review
SA	southern Africa
SACCAR	Southern African Centre for Cooperation in Agricultural Research (Botswana)
SADCC	Southern African Development Coordination Conference (Botswana)
SAFGRAD	Consultative Advisory Committee for Semi-Arid Food Grain Research and Development (Nigeria)
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SDI	selective dissemination of information
SRF	systematic reconnaissance flights
SSA	sub-Saharan Africa
TAC	Technical Advisory Committee (of the CGIAR)
TRLU	tropical ruminant livestock unit
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme (Kenya)
USAID	United States Agency for International Development
WA	West Africa
WARDA	West Africa Rice Development Association (Liberia)