

An Indicative Medium-Term Plan
for the
International Livestock
Research Institute

August 1994

THE ROCKEFELLER FOUNDATION

August 29, 1994

To: *Members of the Consultative Group on
International Agricultural Research*

From: *R.D. Havener, Consultant
The Rockefeller Foundation*

Subject: *THE 1995 PLAN OF WORK AND BUDGET FOR
THE INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI)*

Recently you should have received a letter dated August 5, 1994 from Dr. Robert Herdt, Director of Agricultural Sciences of the Rockefeller Foundation, reporting on progress toward the establishment of the new global International Livestock Research Institute (ILRI). In that letter, Dr. Herdt provided considerable detail which I will not repeat here. Perhaps it is sufficient to report that all diplomatic and administrative arrangements appear to be in place for ILRI to be officially created as an international organization on September 21, 1994 in Berne, Switzerland. Following that event, the founding Board of Trustees of ILRI will assume the crucial next steps of recruiting a director general and negotiating a headquarters agreement. Fortunately, the Implementing Advisory Group (IAG) has assisted with a great deal of the required preliminary work in these important areas.

Enclosed you will find the 1995 Program of Work and Budget for ILRI, plus a supplement which contains a proposal for a CGIAR System-Wide Livestock Initiative to begin in the coming year.

As you know, ILRI is being asked by the System to develop a truly global livestock research program while at the same time continuing the relevant and important portions of the current work of ILCA and ILRAD. We believe the proposed 1995 Program of Work and Budget meets this challenge.

The ILRI Strategic Planning Task Force has worked closely with the management and staff of ILCA and ILRAD in preparing these documents. The resulting plans have twice been discussed with TAC. The Implementing Advisory Group has reviewed all documents carefully and has formally approved of their contents.

I would like to use this opportunity to specifically thank the management and staff of ILCA and ILRAD for their hard work and cooperation. Without these it would have been impossible for the implementing agency to present a strong global research program and budget to the Group. Because of their participation we believe we have done so. As implementing agency, we commend these documents and the proposed level of funding for your consideration and support.

We look forward to an opportunity to discuss these plans with you during the upcoming International Centers Week in Washington, D.C. In the meantime I am sure Dr. Herdt would welcome your comments or questions.

cc: *CGIAR Secretariat*

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SUMMARY

This MTP is referred to as an indicative plan pending the more detailed plan that incorporates a more substantial interaction with other IARCs and National Programmes which will occur in 1995 and which will involve the Board of Trustees and Management of the new institute. There are also budgetary uncertainties that involve the overall CGIAR, livestock programmes across the System and ILRI in particular. The combined budgets of ILCA and ILRAD, comprising the major resources of the new institute, have been reduced by 40% since 1990, which will certainly impact the ability to undertake the global mandate called for by the CGIAR. Despite these uncertainties, the new vision laid before the CGIAR by its Chairman at the Delhi meeting gives the centres a renewed challenge and sense of purpose. The present document is cast in that spirit, and portrays a clear sense of direction of the new institute including a proposed redirection of over 20% of the existing resources of ILCA and ILRAD over the period of the MTP.

With the establishment of a single institute, some economies in management and administration are anticipated (percent of senior staff positions declining from 16% to 11%) The two major sites at Nairobi and Addis Ababa will be retained, while resources will be redeployed to take up the new mandate in areas outside Africa, and particularly in Asia.

The baseline MTP (i.e. after restructuring, but before any extension or contraction) shows a reallocation of close to a quarter of SSY resources. This entails a reduction in animal health (mainly tryps), an increase in genetics, a substantial increase in systems (including feed resources and natural resource management), and a small increase in socio-economic and policy studies. Institutional strengthening is maintained, and administration and operations are reduced.

From existing resources, a shift of 9 positions to other regions (mainly Asia) is planned. Practically all additional resources are also targeted outside Africa. Within the span of the MTP, this would give 20% of senior scientific staff positions deployed outside Africa.

A new form of CG-wide management structure is proposed to integrate the global programme. It has ILRI in a "strong convenor" role. All projects falling within the system-wide programme will require approval from an inter-centre Livestock Programme Management Group. Funds deployed in this programme will come from a special common pool, augmented by funds brought to collaborative efforts by participating centres. A new science linkage programme is proposed to link advanced research institutions to the more difficult scientific problems being faced. This programme will also be on a competitive basis.

This indicative MTP relates specifically to the programme and resources of ILRI, which in turn is at the centre of the CGIAR strategic plan. That plan provides for a greater integration of effort with the centres addressing crop commodities and ecoregional, policy and natural resource management aspects of agricultural research within the system. It also gives increased emphasis to the integration of technologies in improving farming systems.

Assuming confirmation of the TAC-approved budget for institutional livestock research at US\$ 23.8 million in current dollars in 1994, rising to an ILRI budget of US\$ 25.1 m in 1995 and US\$ 31.8 m in 1998, ILRI will enter the plan period with 105 SSY, rising to approximately 120 SSY in 1998 as programmes in other regions are initiated.

INTRODUCTION

The Consultative Group on International Agricultural Research (CGIAR) decided, in October 1993, to revise the strategic approach to livestock research within the CGIAR system. The group called for an overall global strategy for the CGIAR and the establishment of a single broadly based livestock research entity with a global mandate. The overall strategy will link related livestock and forage research across the System; the new livestock institute will be the center piece for this area of research and will assume a major coordinative role for the System.

This new livestock research entity has been tentatively named The International Livestock Research Institute (ILRI). The intention is that ILRI will be established by January 1995 and will subsume the mandates and resources of ILCA and ILRAD. It will include about two-thirds of all livestock and livestock-related research in the CG system.

To prepare the ground for these changes, the Rockefeller Foundation, on behalf of the CGIAR, has established an Implementing Advisory Group (IAG). It has also established a Task Force (SPTF) to draft the strategic plans for the CGIAR global livestock programme and for the new institute.

These fundamental changes in structure and programme present both challenges and opportunities. Given the limitations on the resources likely to be available (and ILRAD and ILCA have already adapted to a budget reduction of 40% since 1990), the primary challenge is to re-focus the programme on the highest priority research themes, taking account of the new responsibilities for continents other than Africa. The opportunities include the chance to put in place new ways of integrating a programme that touches many centres within the CG system, and to build new partnerships, and perhaps new forms of partnership, with national institutions in both developed and developing countries.

The present document, an indicative medium term plan for ILRI, has evolved from the interim medium term plan prepared by ILRAD and ILCA in March 1994. It takes account of the third draft of the strategic plan (June 1994), and of extensive consultations with the SPTF, IAG, TAC and the boards and staff of ILRAD and ILCA.

This indicative MTP has been developed in conformity with the CGIAR Medium Term Resources Allocation 1994-1998 (TAC : IAR/93/11/Rev 1, Oct 1993).

BACKGROUND

This indicative medium term plan is presented in quite unusual circumstances. It comes at a time when ILCA and ILRAD have been through a period of rapid adjustment to the unprecedented reduction in resources from 1990. This is also the year in which both institutions face dissolution and replacement by ILRI, a new institute with a global mandate.

This indicative MTP has been developed in parallel with the strategic plan for ILRI. That strategic plan elaborates in more detail the rationale determining the broad programme of the new institute. The programme should respond to the development needs of the livestock sector, corresponding to a growing population and changing dietary preferences. The output of the livestock sector in developing countries is expected to grow at some 3.4% per annum for the next twenty years, considerably faster than for the crop sector. World-wide growth is expected in milk production and in output of meat from small and large ruminants. The consequent intensification of resource use in livestock and mixed farming systems presents a large agenda of problems to be resolved by research in the areas of disease control, use and conservation of animal genetic resources, development of feed resources and of balanced and sustainable farming systems. Significant parts of this agenda require research at the level of an international institute. Meat production from monogastrics (mainly pigs and poultry) will expand even faster, particularly in Asia. This sector also presents many technical challenges, but has a more restricted agenda for international research.

The specific research opportunities for the new centre in the improvement of animal agriculture in developing regions are principally fourfold:

1. To improve **animal performance** by overcoming identified constraints to animal productivity, through technological research and the conservation of the existing genetic diversity amongst livestock in developing regions;
2. To improve the productivity of the major livestock and crop-livestock **production systems** typical of developing regions and to maintain their long-term productivity;
3. To improve the technical and economic performance of the **livestock sector** in these regions to ensure the appropriate translation of production system improvement into increased food security and economic welfare; and,
4. To improve the development, **transfer and utilisation of technology** by national programmes and client farmers in the agricultural systems of these regions.

These goals, which serve to frame ILRI's new programme are given in Table 1.

Table 1: Classification of research programme areas

GOAL	WORK AREA	DESCRIPTOR
Increase productivity by reducing impact of animal diseases	Animal Health	Use advanced biotechnology to develop control methods for important parasitic diseases
Conserve animal genetic diversity and improve animal performance	Animal Genetics	Develop molecular, physiological and other techniques for improvement and conservation of animal genetic resources
Improve productivity of livestock and crop-livestock production systems and maintain long-term productivity	Production Systems (including Feed Resources and Natural Resource Management)	Integrate different nutrition, health, genetic, feed, agronomic and economic technologies in farming systems which are sustainable, profitable and preserve the natural resource base
Improve technical and economic performance of the livestock sector to increase food security and economic welfare	Socio-economic and Policy Analysis	Carry out policy analyses, impact assessment, economic and social research to guide and facilitate uptake of technology by livestock holders and to help governments and others to develop good natural resource policies and practices
Improve development, transfer and utilisation of technology	Institution Building and Technology Transfer	Interact with national systems through training and cooperation to help improve technology transfer

THE RESEARCH PROGRAMME

1. ANIMAL HEALTH

Losses and risks due to animal disease constitute a major, and in some cases dominant, constraint on the improvement of livestock productivity in developing countries. There are three main groups of animal diseases; Epidemic diseases (mainly viral) such as foot and mouth disease; Infectious diseases of intensification (mainly bacterial) such as brucellosis; Parasitic diseases, usually vector transmitted. The first two classes of disease occur world-wide and have been the subject of much research. The third contains many important tropical diseases which are biologically complex and for which satisfactory control methods have still not been developed.

Two of these diseases have been at the centre of ILRAD's programme. After considerable re-examination of the full animal health research agenda for developing countries, it has been concluded that this class of diseases requires reinforced attention at a level of international research.

This medium term plan outlines the research challenges aimed at controlling these diseases either through the integration of existing approaches, the development of new biotechnological solutions, or the exploitation of the natural resistance occurring in some breeds of indigenous livestock. In developing its programmes ILRI will have the advantage of established expertise in the two most important of these diseases and the opportunity to apply and develop the programme for related diseases occurring throughout the developing world.

1.1 Tick-borne diseases

Tick-borne diseases are globally important affecting the productive use of large and small ruminants in developing countries. Some provide a risk of spread to developed countries. Of the four tick-borne diseases previously studied at ILRAD (anaplasmosis, babesiosis, cowdriosis and theileriosis), anaplasmosis and forms of babesiosis are most widely distributed being found together or separately in most of the tropics and sub-tropics between 40° N and 32° S. *Theileria annulata*, the cause of tropical theileriosis, extends from the Mediterranean to China while *T. parva*, the cause of East Coast fever (ECF) is found in 12 countries in eastern, central and southern Africa. Cowdriosis (or heartwater) occurs throughout SSA and was introduced to the Caribbean in the last century and now affects several islands.

The economic cost of ECF in livestock losses and funding for control and research programmes was estimated at US\$ 168 million in 1989. In eight Latin American countries, anaplasmosis and babesiosis cause annual economic losses estimated at US\$ 1.5 billion, and the two diseases are also important in Asia.

The effects of tick-borne diseases are greatest in genetically improved *Bos taurus* breeds of cattle which might otherwise enhance production levels of meat and, particularly, of milk with a subsequent improvement in human nutritional status.

Current control methods vary from strict tick control, achieved in parts of Africa by spraying or dipping cattle regularly with acaricides, to vaccination with live parasites and chemotherapy. Each of these present cost, logistical or environmental concerns for developing countries.

1.1.2 Goals

Previous work at ILRAD has shown that vaccination of cattle with a recombinant sporozoite surface protein of the East Coast fever parasite, *Theileria parva*, can protect these animals against a normally lethal, experimental challenge. ILRI will continue this

critically important research to validate vaccine molecules and delivery procedures against *T. parva*. The group will continue collaborations with the Universities of Florida and Washington State in the USA, the USAID supported Heartwater project in Zimbabwe, scientists from EMVT in France and Guadeloupe, The Queensland Department of Primary Industries and ACIAR in Australia, and other regional and national research and control programmes concerned with the other important tick-borne diseases of livestock. The aims are to identify potential vaccine and diagnostic antigens for improved epidemiological monitoring and for improved control of these organisms by traditional means or through the development of novel vaccines. The initial objectives are to produce an effective vaccine against East Coast fever and to assist others in developing new control methods for other forms of theileriosis, babesiosis, anaplasmosis and cowdriosis. The expertise accumulated by the vaccine research group will provide unique opportunities for the testing of vaccines against other diseases of tropical livestock in the future.

1.1.3 Outputs and relevance

The outputs will be improved epidemiological monitoring and computerised systems to support national choices for the control of tick-borne diseases. The feasibility of the p67 antigen of *Theileria parva* to induce protective immunity in cattle will be determined, and antigens provoking cellular immune responses to this parasite will be isolated and characterised. Diagnostic and vaccine antigens of the important tick-borne diseases of livestock will be identified and tested in collaboration with others. Improved strategies for the delivery of vaccines to livestock populations at risk and their impacts in terms of economic return, increased productivity and environmental consequences will result, with relevance to tick-borne disease in all ecoregions.

1.1.4 Resources

The tick-borne disease research group will be established in ILRI with a total of 14 SSY. Five will be committed to epidemiological studies including the development of diagnostic technologies, 3 for vaccine and diagnostic antigen identification and production, and 6 for vaccine development including the identification of protective immunological responses in cattle. Within the plan period (1995-1998) the total manpower commitment will remain the same with a gradual reduction in those committed to epidemiology as completed diagnostic tests are validated and transferred to national partners. The antigen and vaccine development groups will be correspondingly strengthened, as antigens of other tick-borne diseases (and, potentially, other organisms) are tested in collaboration with research partners in the public and private sector. This level of collaborative research may be augmented through the new availability of contract research funds.

1.2 Trypanosomiasis

The trypanosomiasis of livestock are caused by several species of protozoan parasites transmitted principally by tsetse flies in SSA and by other biting flies in other affected tropical regions. *Trypanosoma congolense* and *Trypanosoma vivax* are the most important species affecting livestock in tsetse-infested areas. Even in resistant livestock species, infection is often accompanied by major losses in productivity in areas of high tsetse challenge.

On the African continent, the distribution of tsetse flies exceeds 7 million square kilometers of Savannah land. The disease is particularly prevalent in the wetter, semi-arid and sub-humid agro-ecological zones which recent reviews (TAC, Winrock International) have suggested should become target areas for research efforts directed towards improvement in agricultural productivity. Continental estimates for losses due to trypanosomiasis (deaths, morbidity, production losses and reduced potential yields of crops) currently exceed US\$ 2.5 billion. The costs are substantial in countries obliged to mount major vector control campaigns, e.g. up to US\$ 1.8 million per year in Zimbabwe. African nations are

anticipated to spend US\$ 15 billion in foreign exchange a year by the year 2000 in import substitutions for livestock products.

Non-tsetse transmitted trypanosomiasis occur in various forms in Latin America, Africa and Asia, including China. *Trypanosoma evansi* causes significant losses in productivity in buffalo and cattle and is important in regions where livestock are the major source of tractive power in agriculture. In Indonesia, for example, trypanosomiasis is ranked as the third most important livestock disease, with losses in 1984 exceeding US\$ 20 million. In India, as tick-borne diseases are brought under control, trypanosomiasis will increase in importance through its effects on the dairy industry. In Latin America and the Caribbean, both *T. evansi* and *T. vivax* occur, the latter being considered a major constraint to the dairy industry in countries such as Venezuela and Colombia, and the disease is severe in all regions when productivity increases are attempted through the importation of potentially productive but susceptible exotic stock.

Present control methods depend on vector control, chemotherapeutic treatment for infections and, to a limited extent, use of trypanotolerant livestock. Of the current control methods, only the widespread exploitation of trypanotolerant cattle represents a sustainable solution but this requires continued research and enhanced breeding programmes to realise. Vaccines would also represent an effective and sustainable measure but, unlike the situation with tick-borne diseases, target antigens are still in the initial stages of identification. There is thus a need to maintain the efficacy of existing control measures in the short term, to identify through research the immunological responses to trypanosomes and their antigens that limit parasite growth or the adverse effects of infection, and to examine a functional and genetic basis of trypanotolerance for its effective selection and dissemination in cattle populations. Aspects of the animal health and genetics programmes of ILRI are therefore integrated to address these research requirements.

1.2.1 Goals

The goals are to provide national systems with improved capacities for diagnosis, monitoring and selection of control methods for trypanosomiasis. Research will continue to identify the basis of trypanocide resistance in trypanosomes as this is critical to sustainable disease control. Work will also seek to establish the feasibility of producing vaccines against harmful enzymes produced by trypanosomes. This research will be conducted in the context of examining the differences in immunological and homeostatic mechanisms employed by trypanotolerant (N'Dama) and trypanosusceptible (Boran) cattle in overcoming infection and disease. The goal will be to utilise molecular physiological approaches to determine how ruminant livestock control parasites and pathological processes and to provide evidence of candidate genes governing genetic disease resistance as expressed by trypanotolerant N'Dama cattle.

1.2.2 Outputs and relevance

The programme will develop molecular markers of drug resistance in trypanosomes and will integrate them with diagnostic assays and other epidemiological (including environmental) data into computerised decision support systems for disease control. Strategies for the more sustainable use of trypanocidal drugs will be determined. Vaccine antigens, particularly focusing on anti-disease vaccines, will be identified. Detailed immunological studies may identify candidate genes governing trypanotolerance which can then be used to assist the dissemination of this trait in livestock.

1.2.3 Resources

The manpower resources within this focused programme on trypanosomiasis will comprise 5 SSY committed to epidemiological research and 8 SSY committed to immunological and molecular physiological studies of the homeostatic mechanisms in trypanotolerant

cattle. Within the epidemiology group, emphasis will switch from the development of detection assays for trypanosomes and trypanocides in livestock, as these are transferred to national programmes, to improved monitoring of systems linking disease prevalence to control and livestock productivity parameters. The capacity of the group addressing molecular mechanisms of parasite resistance will be enhanced by the development of further linkages to research groups in developed countries supported by new funding mechanisms.

1.3 Helminthiasis

Small ruminants are a major source of meat, fibre and milk production in both mixed-farming and pastoral systems in the sub-humid, highland and semi-arid zones of all regions of the developing world. They are particularly important in both economic and social terms in the evolution and intensification of mixed farming systems. Helminthiasis is the single most important constraint to improved productivity of small ruminants in Africa (in the absence of trypanosomiasis) and other regions of the developing world. It has been estimated that direct and indirect losses due to ruminant helminthiasis in SSA alone are in the order of US\$ 1 billion per year. It also has been predicted that small ruminant meat production will have to satisfy 50% of SSA's meat production requirements by the year 2025. The control of helminthiasis in the developed world currently depends on grazing management and the strategic use of anthelmintics. Resistance to anthelmintics is widespread in the developed world and has already occurred in the developing world. Sustainable control of helminthiasis will therefore require improved delivery of existing anthelmintics, use of helminth-resistant genotypes of livestock and the development of cost-effective vaccines against these diseases. A considerable amount of research is currently being carried out in Australia, Europe, New Zealand and elsewhere, on determining both the basis of the genetic resistance of individuals within different commercial breeds of sheep to helminthiasis, and its relationship to the immune response. Work on development of novel vaccines against helminthiasis is also being carried out in the same countries. However, little work is being carried out to confirm and exploit earlier observations that different breeds of sheep or goats indigenous to some developing country regions, also differ in their innate susceptibility to helminthiasis and which mechanisms underlie this resistance. Such indigenous breeds are better adapted to the physiological stresses of tropical environments than exotic breeds and can be expected to remain productive if disease constraints are overcome.

1.3.1 Goals

Determination of the immunological mechanisms concerned with the expression of resistance to helminth infections in indigenous breeds of small ruminants.

1.3.2 Resources

ILRI will examine by quantitative genetic and other means the ability of selected breeds of small ruminants to resist infection with these parasites and remain productive. This research will be monitored to estimate the contribution of immunological mechanisms to resistance. The wider animal health group will make available immunological and genetic reagents to groups evaluating similar instances of resistance to helminthiasis to enhance collaborative research between regions.

Socio-economic, environmental and other impact analyses of alternative and novel methods of controlling animal diseases will be conducted through site-specific examples in conjunction with the animal health programme and will contribute to integrated production systems analysis and management.

2. ANIMAL GENETICS

As with crops, the genetic capacity of animals can also be a limiting factor on the improvement of productivity in evolving agricultural systems. Provided animal health can be protected and feed resources are adequate, dramatic gains in productivity can often be achieved through the introduction of or cross-breeding with improved breeds. However, in much of the developing world, livestock systems will need to develop using local genetic resources which have in-built adaptations to the multiple challenges of the tropical environment.

All genetic improvement in the past has been achieved by strategies of selection or cross breeding which usually require a high degree of organisation and extensive infrastructure. Much research has been done in this area. While the technology is largely available, therefore, it is often difficult to apply in emerging agricultural economies. This is why the promise of new molecular techniques has so much potential relevance in developing countries. Techniques for identifying superior genotypes at the molecular level are now in prospect. If current research can advance these prospects, it should provide the developing countries with a fast track to genetic improvement, whether for explicit production traits or for aspects of disease resistance.

The rich store of genetic diversity in livestock indigenous to tropical regions remains largely uncharacterised and underutilised. Some of this diversity is at risk, so the FAO is developing a global conservation programme in which ILRI will support national partners through coordination and provision of genetic technology. There is great potential for improving livestock productivity by utilising genetic adaptations which have evolved in indigenous populations exposed to tropical diseases, parasites, climatic and nutritional stresses. Inter-regional transfer of these animals adapted to tropical conditions, or genes or markers of their key traits, is an important and exciting possibility. In an increasingly environmentally conscious world, the better utilisation of such genetic adaptations can support global livestock production with reduced need for chemical interventions.

2.2 Molecular Genetics

Molecular biology provides new possibilities for the identification, selection and productive utilisation of the genetic variability represented amongst breeds of livestock indigenous to developing country regions. ILRAD is an active member of a global network of laboratories formed to share resources and produce gene markers to map the bovine genome. A map at a resolution of 15 Centimorgans is already available and through advances in production of microsatellite markers, a 5 Centimorgans map is expected to be developed by the research community by 1995. These markers are currently being applied to a resource herd of cattle specifically developed for the analysis of trypanotolerance.

2.2.1 Goals

To elucidate the genetics of disease tolerance initially as exemplified by trypanotolerance. It will be important to extend these studies as quickly as possible to the examination of other important productive traits in tropical livestock and to encourage the use of markers and genetic technologies for the identification and conservation of novel genotypes of livestock important in all developing regions.

2.2.2 Outputs and relevance

An effective map of the bovine genome has been developed but will be refined at greater resolution by application of genetic markers throughout the quinquennium. It is anticipated that markers of trypanotolerance will be obtained before the end of the quinquennium and that genes will be isolated before the end of the decade. Molecular genetic definition of trypanotolerant populations will be achieved during the first quinquennium. Technology

for genetic characterisation will be transferred to other projects or conservation organisations for application to other livestock populations during this period.

2.2.3 Resources

The present plan realises the fundamental importance of this area to the improved productivity of livestock in all production systems and will devote 4 SSY to the area at the beginning of the plan period. This will be to refine at greater resolution a map of the bovine genome by application of genetic markers, initially for trypanotolerance. Attention will be given to additional important adaptive traits as these are adequately defined by phenotypic or genetic characteristics. A further 1 SSY will be added by 1998 to enhance the application of markers to other important livestock breeds, e.g. milking buffalo, in other regions.

2.3 Genetics of Animal Disease

In the case of both trypanosomiasis and helminthiasis disease complexes, documented genetic disease resistance occurs which could provide sustainable means of overcoming these constraints. In the case of trypanotolerance, the issue concerns the design of selection programmes for N'Dama cattle and the correlation of performance parameters with the genetic markers as they become available. Secondly, quantitative genetic approaches undertaken in collaboration with national programmes are required for the confirmation and characterisation of trypanotolerance in other breeds of ruminant livestock. In helminthiasis, the utilisation of genetically resistant small ruminants similarly offers a sustainable solution applicable to the present smallholder or intensified production systems. Whilst this opportunity has been recognised for high-producing stock in Australasia, North America and Europe, little work is addressing the capacity for disease resistance of indigenous breeds of small ruminants already adapted to the tropics.

2.3.1 Goals

The specific goals are to determine the extent and form of inheritance of resistance traits in selected breeds of large and small ruminants indigenous to tropical countries. Trypanotolerance criteria and health and production traits of N'Dama cattle will be used to design selection programmes for these cattle under trypanosomiasis risk in collaboration with national and regional partners in West Africa. Genetic studies will be integrated with evaluations of the effect of other diseases on productivity and socio-economic utility of these breeds to help determine their appropriate integration into farming systems. The aim, particularly in helminthiasis, will be to compare the nature of disease resistance expressed by resistant populations in different parts of the world.

2.3.2 Outputs and relevance

Quantification of the amount of genetic variation in, and the genetic relation among, traits characterising trypanotolerance and animal performance. This will assist the development of selection programmes to increase livestock production in tsetse-infested areas. Identification of African small ruminant breeds resistant to or tolerant of endoparasites and the relationship between resistance and/or tolerance and production traits. This will assist the identification of genetic markers or genes for helminthiasis and provide the necessary background for the appropriate socio-economic integration of helminth-resistant small ruminants into farming systems.

2.3.3 Resources

ILRI will enter the plan period committing 4 SSY to the genetics of disease resistance in livestock, initially supporting trypanotolerance research in West Africa and helminthiasis research in Ethiopia, Kenya and Senegal.

2.4 Conservation of Animal Genetic Resources

The tropical world is rich in both animal and plant biodiversity. Through natural selection, genotypes indigenous to the tropics have become adapted to pests, parasites, diseases and environmental constraints. In contrast, imported, exotic animals are often poorly adapted to the tropical conditions and usually require intensive management and expensive nutritional and health inputs for survival and maintenance. Reduction in this tropical animal biodiversity would restrict the options available to meet unpredictable future requirements. Genetic erosion is already occurring through introductions of specially bred exotic animals, interbreeding among previously isolated indigenous animal populations and benign neglect.

The need to curb such loss has been well argued for plants and wildlife. There is an equally clear scientific and economic case for the conservation of indigenous livestock breeds, which has been supported by the UNCED Agenda 21 declaration, reports of TAC and Winrock International, and the initiation by the FAO of a programme for the conservation of domestic animal diversity.

ILRI anticipates developing a programme which will be conducted as part of the FAO's global initiative to help national programmes evaluate and conserve all potentially endangered livestock species indigenous to their countries. This will require identification of indigenous animal genetic resources; their genetic and phenotypic characterisation, including economically important attributes, and development of strategies for incorporating these into breeding programmes; identification of endangered breeds and implementation of appropriate *in situ* and *ex situ* conservation measures.

ILRI will make specific contributions to breed characterisation through aspects of genetic evaluation, including estimation of within-species diversity by molecular genetic methods. The latter will include use of DNA technology to describe the genetic profile of different livestock populations and their micro-evolutionary relationships. This activity will be linked to aspects of genome mapping. The research will determine causes of declines in breeds believed to be at risk. Methodologies will be developed for estimating population sizes, determining population trends and for estimating rates of genetic erosion.

2.4.1 Goals

To support the characterisation and conservation of indigenous tropical livestock and their utilisation to increase sustainable livestock production without reducing genetic diversity, and thus to ensure that the diversity of domesticated animal germplasm of importance for food production is safely maintained and made available for productive use in research and animal improvement programmes.

2.4.2 Outputs and relevance

The development of molecular physiological and other techniques for the improvement and conservation of animal genetic resources. Initially, markers and genes of disease resistance in ruminants will be identified.

2.4.3 Resources

Three SSY will be required for the overall characterisation and conservation programme and to evaluate, document and, in a limited number of cases, provide policies for conserving these genotypes. ILRI will play an important supporting role to FAO's programme in SSA and will contribute input and expertise to the global programme.

3. INTEGRATED PRODUCTION SYSTEM RESEARCH

The major driving force behind the development of a new research strategy for livestock in the CGIAR is to develop a more effective vehicle for the productive implementation of new and existing techniques at the farm level in developing countries. Some

technological innovations have shown relatively poor uptake and hence low returns to research in the livestock sector. Much commodity-driven research has previously been envisaged unidimensionally, rather than as contributing but one of the parameters to the set of interactive climatic, geophysical, biological and socio-economic elements which comprise the farming system. ILRI will take major new initiatives in integrated production systems research to improve the contribution of livestock to the productivity and sustainability of tropical farming systems.

Explicit incorporation of system complexity into the research process provides greater opportunities for correct identification of constraints and the ultimate delivery of new technology. Advances in new biotechnologies and information management systems, and greater appreciation of the policy and socio-economic parameters which govern efficiency in livestock production systems together promise more effective output from research addressed to tropical production systems. The CGIAR as a whole has recognised the need for more interactive research involving crops, livestock, the natural resource base and the socio-economic policy context of agricultural systems. However, whilst there are overriding themes which demand strategic research for solution of global applicability, many of the parameters of agricultural systems, particularly climate, soils, and the range and availability of indigenous plant and animal species, vary by ecoregion.

For ILRI to have global impact it must specifically address research both at the global and ecoregional levels. The formation of ecoregional consortia established through lead centres in the CGIAR, or ILRI in specific instances where livestock are the major contributing element, will make use of the large number of players including NARS, NGOs and international and regional development organisations to make such an approach feasible. However, ILRI will have to focus and prioritise its involvement in certain research systems. The livestock Strategy document reinforces the view that rain-fed, mixed farming systems in sub-humid and humid ecoregions are important in all developing continents and justify a primary research focus of the new institute. ILRI will therefore concentrate on the main issues in mixed systems, linking nutritional and feeds research to systems expertise and ecoregional testing and will integrate policies, systems and natural resource use in widespread interactions with other centres of expertise. The establishment of ecoregional research foci will also provide the avenue for the application of technologies resulting from specific research in animal health or genetics.

The programme described below therefore indicates how ILRI will integrate existing programmes in livestock feed and forages into system-wide activities. Implicit in this is the contribution of expertise from many disciplines.

3.1 Feed and Nutrition

Seasonal shortages and low nutritional value of feed resources are the most widespread technical constraints for livestock producers in developing countries. Better utilisation of crop by-products and the establishment of improved fodder crops, including trees, which have superior energy and protein availability for ruminants, are required. Although incremental rather than major improvements in livestock productivity are expected from more efficient use of crop by-products, ILRI has a major opportunity to have impact in this area by catalysing investigations to be carried out in collaboration with the crop research centres of the CGIAR on the availability and enhanced suitability for ruminant feed from crops grown primarily for human consumption. The TAC has recommended that the CGIAR put aside funds to catalyse system-wide involvement of crop commodity centres in the development of plans and research for improved livestock feeds. The mechanism for this and ILRI's role as convenor are described elsewhere.

3.1.1 Goals

To improve the efficiency of use of tropical feeds by ruminant livestock through the introduction, testing and adaptation of forage species. As part of farming systems research, it will be necessary to investigate other protein sources and supplementary strategies for animal feeds. Technology for improving the storage and digestibility of crop residues and forage crops will be required to be undertaken by ecoregional partners.

Research priorities for feed production will vary among livestock production systems (e.g. intensive vs extensive systems) and according to agro-ecological constraints. Thus, the research will generally be ecoregional in nature. The research will involve delineation of high-potential areas and development of crop-forage combinations to match land capability and food/feed demands; assessment and modification of feeding value of various legume, cereal and other feed resources; and development of multi-regional trials of crop-forage compatible associations and technology adaptations. ILRI's research will be integrated with the studies of forages, pasture and the use of multipurpose trees conducted by CIAT, IITA, ICRAF and ICRISAT. Activities in SSA will be coordinated with activities in Asia, Latin America and the Caribbean and West Asia and North Africa, led by NARS and IARCs with regional mandates including CIAT, ICARDA and ICRISAT. It is anticipated that primary responsibility for feed production research will be handled increasingly by plant and agronomic scientists in partner institutions.

ILCA has been addressing the evaluation of the suitability of forage species for inclusion in, and improved productivity from, principally smallholder farming systems in ecoregionally representative sites in Africa. The majority of projects of this nature will terminate by the end of 1995, although national partners, largely through AFRNET, will carry on evaluations relevant to national and regional needs in Africa. Nutritional energy studies of browse and dried/stored feeds will be required and ILRI will have a key role in encouraging work at crop-related CGIAR crop centres for crop feedstuffs with improved biomass and digestibility for ruminants.

As intensified mixed production systems will depend upon high-energy nutritional inputs, integration of knowledge of all potential crop foodstuffs (grains, straws, stovers, surplus root crops, browse and multipurpose trees) is required on a system-wide basis. For this reason, ILRI will generate GIS data layers for forage and tree species for Africa, in collaboration with ICARDA, ICRAF, IITA and appropriate regional and national organisations. In the latter half of the quinquennium, it is expected that other relevant data layers (grains and cereal by-products, with CIMMYT and IRRI), ecoregional production capacities (e.g. llanos of Latin America, CIAT; inland valleys of the sub-humid zone of Africa, IITA) and natural resource and production variables will be brought together at a system level in association with UNEP. ILRI will expect to develop both *ex post* and *ex ante* analyses of livestock feeds and the parameters governing their productive use in different agricultural systems on a global scale.

ILRI may have a role in developing biotechnological approaches to the more efficient management of rumen function to improve nutrient efficiency and animal productivity. The relative advantage of this being undertaken by ILRI or advanced laboratories in developed countries will be the subject of a review in 1995.

3.1.2 Resources

A total of 12 SSY are committed to feed and forage resources and their utilisation by ruminants. Of this number, 3 SSY are dedicated to the maintenance and testing of forage genetic resources at the Addis Ababa site and 2 are provisionally allotted to the new initiative in rumen ecology.

3.2 Production System Models and Analysis

ILRI's research programme will encompass research carried out on the animals themselves (i.e. to ascertain the influences of health, physiology and some aspects of nutrition and genetics of livestock productivity) or on the other elements of the environment and societal infrastructure supporting the farming/production endeavour. These two domains overlap and interact at the level of the production system. Tangible research outputs from both the "animal research" and "society/environment research" domains will be applicable to the improved management of the production systems in which the animals are employed. ILRI will place greater emphasis on strategic research in integrated production system management in the widest sense. This will require the linkage of constraints analyses, information on existing technologies to improve animal health and productivity and newly arising technologies and interventions, to appropriate nutrient input and recycling, assessment of economic efficiency, policy implications and environmental impacts. Such improved management systems will require inputs from scientists and databases covering the variety of disciplines mentioned and will utilise and develop standardised procedures for data gathering, analysis and synthesis, for information assembly, management and retrieval, and for the use of information in making more viable and sustainable decisions. To be widely applicable the development of such information and decision support systems will require a strong element of strategic research to accommodate the common requirements of varied client groups involved with improved productivity of livestock-related production systems world wide. In addition, it will draw on the adaptive and applied research elements from ecoregional consortia to ensure their efficacy and appropriateness under different production systems and in different regions of the world. To carry out this research effectively ILRI will work collaboratively with NARS partners (amongst which national universities are an important component) and public and private sector organisations and agencies.

Production system analysis is therefore envisaged as being conducted not as a single discipline but as a multi-disciplinary endeavour utilising existing and improved computer-based analyses. The team will encompass expertise or data collection from a range of animal sciences, forage and crop science, soil science, epidemiology, economics, computer modelling and statistics, information management scientists, ecologists and social anthropologists. This group will therefore clearly be linked to those conducting socio-economic and policy analysis at the specific level of technology impact and the groups together will furnish ILRI with the required expertise for scientific impact assessment and research priority setting for the future. ILRI will consider the rearrangement of its research teams by 1998 to develop analytical and predictive skills for determining potential global and regional developments which will affect the nature of production systems.

3.2.1 Goals

The goals will be to integrate data covering all aspects of livestock production systems into widely usable predictive model systems. Together with institute expertise in socio-economics and policy analysis to provide predictive evaluations of changes in production systems, research impacts and priority setting.

3.2.2 Resources

Four SSY will initially undertake research in this area, with explicit linkage to groups working on socio-economic, policy and impact analysis.

3.3 Ecoregional Research in Mixed Livestock Production Systems

The plan period will begin with the bulk of manpower committed to three ecoregional initiatives in SSA following from the previous research focus of ILCA. Where general,

initial commitment to integrated production system research in other areas can be gauged, the specific linkages to the existing programmes and priorities of other centres of the CGIAR and regional networks in LAC and WANA will be developed during 1995. Similarly, production system priorities within the potentially large research agenda in Asia cannot be set at this stage but will be derived through consultation with representative groups from the region also in 1995.

3.3.1 Goals

The goals will be to sustain mixed farming systems in priority ecoregions through proper management of the livestock elements and the natural resources they influence. This will involve the study of complex farming systems and the technical, social and the economic interactions they involve.

3.3.2 SSA

ILCA has been pursuing production oriented and natural resource management research with other CGIAR centres and regional and national partners in three ecoregions of Africa. These are the sub-humid zones in Nigeria and the coastal region of Kenya, the semi-arid zone (with the ICRISAT Sahelian Centre in Niger), and long-term research on the sustainability of livestock production on the Vertisols of the cool highland tropics represented in Ethiopia. Decisions to be made during the planned period will be the relative balance of resources given to production-oriented research in the humid/sub-humid zones and whether natural resource management in the semi-arid zones has global implications or will require parallel initiatives in this ecoregion represented in other continents.

3.3.2.1 Resources

ILRI will slightly reduce the number of SSY supporting production systems research and natural resource management in SSA from 15 to 13 SSY during the plan period.

3.3.3 Asia

The CGIAR strategy for livestock recommends concentration on two major ecoregions and describes ten major tropical livestock production systems. The characteristics of these two ecoregions (semi-arid and the humid/sub-humid zones) in Asia vary widely, and small-scale mixed crop-livestock systems in Asia introduce important non-ruminant livestock species into the research focus. In accordance with earlier reviews of livestock in the CGIAR, the present judgement is that ILRI should make its biotechnologies available to groups working on these species, but that it should not take on specific biological research on these livestock. However, as part of the planned consultation on the Asian agenda, the involvement of these species in systems work is likely to be an important subject.

3.3.3.1 Resources

Three SSY (2 in production research and 1 in natural resource management) are initially committed to work in Asia with deployment depending upon the choice of production system chosen. Increased emphasis will also be immediately given to establishing links with livestock and production networks in Asia. With the establishment of research priorities and working relationships with CG centres and other regional organisations, a further 6 SSY may be committed to the Asian region by 1998.

3.3.4 Latin America and the Caribbean

CIAT is already pursuing an effective forage and pasture improvement programme in South America. ILRI wishes to support and encourage this work and to make better links for general production systems analysis and research priority setting for livestock in the

region. ILRI will therefore initially establish 2 SSY (one in production systems and 1 in natural resource management) to provide effective links between the two CG centres and ILRI and regional and national partners in LAC. Provision is made for a further two positions later in the plan period.

3.3.5 *West Asia and North Africa*

The needs of this region are considered to be improved forages and feeds and natural resource management in the more arid areas. ILRI wishes to support ICARDA's existing programmes in forage/barley/fallow rotations in production systems for small ruminants by the appointment of 2 SSY specialising in natural resource management and production systems.

4. SOCIO-ECONOMICS AND LIVESTOCK POLICY

The livestock sector accounts for between 22 and 40% of agricultural GDP in the developing world but has very low productivity. Although the developing regions account for two-thirds of the world's cattle, they only produce 20 and 30% of the global milk and beef supplies, respectively. Domestic demand for livestock products is increasing rapidly in the developing regions because of the relatively high income elasticity of demand for livestock products, and the rapid growth in population and urbanisation. Building on two decades of work, ILRI will continue to generate new technology through strategic research on livestock nutrition, genetics, health, production systems and resource management.

However, new technologies without appropriate policies are not sufficient. Policies that encourage imports of cheap dairy products, for example, have discouraged the development of domestic dairy industries in many parts of the developing world, especially SSA. Government policies that depress production and encourage poor management of the natural resource base include: food pricing policies that subsidise consumers and tax producers; overvalued exchange rates that favour imports rather than domestic production; and inefficient input and credit market policies that inhibit uptake of new technologies. Widespread concerns about degradation of natural resources in the developing regions also point to inadequate property arrangements. Lack of clearly defined and securely held property rights often discourage investment and tend to encourage practices that "mine" land fertility.

Many countries in developing regions (especially in SSA) are adopting macro-economic stabilisation and structural adjustment programmes. It is useful to examine the effects of the policy reforms on livestock sector development. ILRI's comparative advantage in policy research lies in its expertise in the biological, technical and socio-economic aspects of livestock production and resource management, and its ability to marshal the resources and information needed for comparisons across countries.

ILRI has first-hand knowledge of constraints to crop and livestock systems, and to sustainable management of natural resources in developing countries. ILRI also has multidisciplinary research experience in the major agro-ecological zones of the tropics, effective working relationships with NARS through collaborative research networks, and a strong commitment to inter-disciplinary and inter-institutional collaboration in research.

The goal of ILRI's policy research programme is to identify livestock policy options and their implications and to quantify the social, economic and environmental effects of policy changes. However, many major international agencies such as the World Bank, the regional development banks, FAO, the United Nations Economic Commission for Africa (UNECA), as well as research workers from national universities and policy institutes in developing countries could also provide macro-economic policy expertise. Within the CGIAR, IFPRI has the major responsibility for policy research and ILRI has already joined with IFPRI in the development of joint research protocols to address livestock policy issues.

4.1.1 Goals

In accordance with the livestock Strategy document that ILRI should be in a position to speak with authority on the broad economic background of the livestock industry, including aspects of economic strategy which affect this sector in developing countries, ILRI will maintain sufficient institutional expertise to link with other international organisations carrying out macro-economic policy analyses.

ILRI will seek a better understanding of the dynamics of marketing chains which link supply and demand through economic studies and will seek development of means to guide these changes.

ILRI's specific role in policy will be to identify the constraints on technical change in livestock agriculture through social and economic research. This will include an understanding of, and ways of improving, the factors involved in the influence of livestock agriculture on natural resource management. This will be obtained through economic and social studies with a technical dimension, e.g. to determine the socio-economic effects of alternative methods of disease control and the changes in land use they induce.

4.1.2 Resources

Previous joint programmes have been developed largely with an emphasis on requirements and patterns of change in SSA. They included macro-economic analyses of international trade and the livestock sector; policies, markets and technological change; policy requirements for livestock in sustainable systems; and livestock health and disease control policy. Three SSY are identified for the joint development and implementation of these projects with IFPRI and other partners. To address policy requirements in other regions a further 2 SSY will be added to the policy group within the plan period for collaborative research with international organisations in these regions.

Specific projects to derive economic analyses of the impacts of livestock disease and generalised models which can contribute to impact analysis, environmental health, and priority setting will be pursued by 3 SSY.

Similarly, a programme examining impacts of different disease control measures on social and land-use changes will be continued by 3 SSY integrating regional case studies in Ethiopia, Zimbabwe, and West Africa. This programme will integrate GIS and other computerised data bases into a continental-level evaluation of the effects of disease control.

It is clear that the complementary techniques and expertise in this area will be linked to the wider considerations governing modelling and impact analysis at the production systems level. The combined manpower in these areas represents a powerful new initiative in the ILRI programme.

5. INSTITUTION BUILDING AND TECHNOLOGY TRANSFER

Both ILCA and ILRAD have maintained training, information and consultation services for national programmes concerned with the development of the livestock sector. ILCA, particularly, has developed network activities to promote NARS capacity for certain aspects of livestock research in SSA. Much of this work can be extended to Asia and Latin America at reasonable cost. Rationalisation, more effective programme links with networks of NARS and other partners in all developing regions, and cross-system initiatives in training and computerised information services will allow some redistribution of manpower within ILRI whilst broadening the range of interactions with NARS and providing opportunities to enhance institutional capacity for livestock research and production. Furthermore, participation in ecoregional research in different continents, whether convened by ILRI or other ecoregional lead institutes, will provide new, structured opportunities to develop channels of instruction, information flow and technology transfer

which will enhance the traditional training and outreach activities of the CG livestock centres as previously organised.

ILRI will continue to engage in the traditional outreach activities such as training and conferences and will need expertise in documentation, publication and dissemination of information.

By carrying out aspects of its manpower development activities in conjunction with research in ecoregional fora, training on livestock research will be better integrated with work on crops, natural resource management or socio-economics. In doing so, ILRI will help break down the usual separation of disciplines to provide for more rounded and integrated systems research.

The Centre will serve as a major resource and convenor for the CGIAR system in the areas of integrated training on livestock and in associated information services. As with its research function, the Centre will seek to maximise its comparative advantage whilst being aware of the alternative sources of expertise and support provided by the international community for improved agricultural productivity and development generally.

5.1 Resources

Rationalisation of ILRI's training and information services will reduce the institute's requirements to 1 SSY to manage training and 4 SSY to manage the linked library services in Nairobi and Addis Ababa and to develop new information material and methods for livestock topics integrated into the wider CGIAR information network. These areas will rely to a greater extent on national level or complementary support positions as appropriate. In line with the intention to develop explicit NARS strengthening programmes through programme and network activity, a total of 4 SSY will be committed to network coordination in SSA, and 2 SSY in Asia to accompany new Asian initiatives. It is considered that CIAT and ICARDA have developed effective links with national programmes in their areas and any additional ILRI input, e.g. through joint programmes in forages, will be made through programme staff posted in these regions.

MANAGEMENT, ADMINISTRATION AND OPERATIONS

Formation of ILRI comes at a time when profound change is occurring in the CGIAR and in agricultural research and development in general. New management methods involving relationships between IARCs' linkages between traditional core funding and expanding external funding, and greater expectations for functioning in national programmes all come at a time when ILRI will form its first operational plan. It will be important for ILRI to position itself to operate in and take maximum advantage of this new environment. In many respects, ILRI will be the "litmus-test" for the new operating paradigm for the CGIAR.

ILRI will develop a management structure appropriate to its expanded mandate and responsibilities. The institute's activities will encompass strategic research with global relevance and strategic and applied research with ecoregional or inter-regional relevance. Many research activities will be multidisciplinary, and increasingly carried out in collaboration with a range of partners, including NARS, regional centres, advanced institutes and other IARCs. Ecoregional research is expected to be conducted by consortia and networks. The two major existing sites in Kenya and Ethiopia will be maintained. The evolution of programme interactions and staff placements in different ecoregions will develop during the plan period. While economies in administration will be achieved by the creation of a single institute, permitting some redeployment of resources to the research programme, there will also be an increase in management costs associated with the extension of the programme to continents other than Africa.

ILRI is likely to be structured as a conventional CGIAR institute with a Board of Trustees responsible for the overall direction and accountability to the CGIAR. The Board of Trustees and the new Director General are expected to be appointed before the end of 1994.

Manpower Resources for Management, Administration and Operations

The amalgamation of two separate administrations offers opportunity for rationalisation, reductions and cost savings. Although decisions will have to be taken by the new ILRI Board and Management, it is expected that the administrative structure of ILRI will require 5 SSY per year from the beginning of the planning period. Assuming that both Nairobi and Addis Ababa sites are maintained and that one will be established as the headquarters site for ILRI, the conduct of operations will require a minimum of 3 SSY. A minimum of 5 research support personnel will also be required. This will represent, in a relatively short period of time, a reduction from 17 to 13 in the number of senior positions.

Programme Management

In general, the objectives of management, administration and operations will be to render an efficient and cost-effective support service for the scientific and ancillary programmes of the institute. Project-based planning, budgeting and management will be the basis for efficient resource allocation and accountability. Extensive delegation of authority to project leaders will be carried out and delegation of administrative authority to managers of programme units will be appropriate for research locations removed from ILRI's main centres.

The development, organisation and continued coordination of collaborative research places extra responsibility on senior scientists. Fulfillment of ILRI's catalytic role for global livestock research and a prospectively much enlarged spectrum of collaborators and clients will place major managerial demands on all categories of senior staff. An increasing proportion of ILRI's agreed activities, especially ecoregional initiatives and NARS capacity building, will be supported by project funding which carries with it additional requirements for development of project proposals, and for financial and technical reporting. Capacity

building activities (training, information services) will similarly be conducted in collaboration with the institutes of the CGIAR and other organisations, particularly in sub-Saharan Africa. However, ILRI will also have a major role in ensuring technology transfer and manpower development for increased capacity for livestock research, technology application and impact in other developing regions.

ILRI is envisaged as pursuing its centralised research and collaborative programmes in conjunction with systems of scientific evaluation used previously. Both ILCA and ILRAD have utilised project-based planning, budgeting and reporting. Annual programme evaluation and planning meetings involve institute scientists, the major collaborators, management and Board Programme Committees. Scientists are encouraged to publish research results in international peer-review journals as well as to contribute to international meetings. Annual scientific reports which indicate progress against objectives are prepared for each project, and final reports are delivered on completion of projects. Additionally, scientific information and development-oriented reports and newsletters are published by the institutes to enhance the transfer of appropriate scientific technology and information. Periodic external evaluation of programmes by peer scientists from other institutions is undertaken in addition to the 4-5 year external programme and management reviews commissioned by the CGIAR.

New Mechanisms

The new challenges faced by ILRI call for new mechanisms for fulfilling its mandate. In particular, it is given responsibility for integrating the livestock research programme throughout the CG system, though one third of current livestock-related activities are already the responsibilities of other centres. Furthermore, it is clear that in the rapidly advancing front of modern molecular biology, there is much of potential value to the future of livestock production in developing countries. Though ILRI will inherit a tradition of work in the forefront of that field, it will not have the resources itself to conduct all the required research, and must therefore find new ways of gearing the work of other research institutions. Finally, it is recognised that much of the potential value of research rests unrealised because it is not adequately linked into its potential end users. This calls for a strengthening of interactions with research and development institutions in developing countries in ever more effective partnership. This has particular relevance as ILRI takes up its global mandate. Effective networks should enable the institute to be a very efficient agent for the transfer of technology, not just from its own research programme, but from the collective programmes of the institutions it works with in five continents.

The CG-Wide Livestock Initiative

The first requirement in developing a global programme is to ensure that those activities which are directly funded by the CG system are properly balanced and targeted within an overall programme. However, substantial blocks of activity already form part of the programme of other centres. Foremost among these is the forage and pasture programme in CIAT and the small ruminant/cereal systems work of ICARDA. In addition, rice-centred production systems researched by IRRI often involve livestock, while animals are an integral part of dryland systems researched by ICRISAT, and also of intensive farming systems in the humid tropics studied by IITA.

It is proposed that all of these activities, together with related programme elements within ILRI, should be brought together in a CG-wide livestock programme. This programme will need to include additional activities to respond to the research needs identified in the livestock sector in Asia and also in Latin America and West Asia and North Africa. To support these new activities, TAC has proposed the use of a system-wide livestock research fund of 4 million dollars. The intention is that the existence of this fund and the creation of the system-wide livestock programme should be used to introduce an element of comparative evaluation and competition for support across the system.

In establishing a structure to manage this system-wide programme, a balance will need to be achieved between the right of each centre within the system to pursue its own programme, and the necessity to target the resources to higher priority activities. The mechanism proposed is an inter-centre livestock research management group, whose primary function would be to evaluate proposals and to approve the allocation of resources. Individual centres would then be responsible for the execution for their parts of the programme. While the supplementary fund proposed by TAC would be central to the system-wide programme, the intention would be that individual centres would, by agreement, progressively place the resources currently devoted to livestock activities within the competitive evaluation process.

ILRI should provide the logistical support for the inter-centre group and function as a "strong convenor" of the system-wide livestock programme.

Scientific Linkage Programme

It has become apparent from ILRAD's work on biologically complex diseases that a single research institute is unlikely to be able to explore simultaneously all the scientific avenues required to produce solutions. Collaboration with advanced research institutes has therefore on a limited scale been part of the approach. The intention is that ILRI should substantially expand this kind of collaboration. In order to do so, it will need to be able to dispose of some funds, specifically aimed at capturing the attention of competent scientific partners in both developed and developing countries. The intention is therefore to establish a competitive grants programme aimed at linking scientific partners to the more challenging aspects of ILRI's programme. For this purpose, a foundation fund of 1 million dollars will be set aside from the budget of the MTP period. The hope is that individual donors can be persuaded to augment this fund because of the prospect it offers of engaging their own institutions in the solution of some of the more difficult problems facing the livestock industry of developing countries.

Cooperative Research Programme

Given that the CG commitment to livestock research in developing countries represents only about 5% of the global investment in this area, it is clear that active partnership with national institutions is a necessity. In all the CG centres, this has been acknowledged in the "institution building" activities which have been undertaken. As ILRI extends its activities outside of Africa, and particularly to Asia, it is presented with the opportunity for very fruitful two-way interaction with many national institutions. The intention is that during the period of the MTP, up to 20% of ILRI resources will be deployed in these new areas. Most of this new deployment is intended to be in the form of collaborative research, both through bilateral programmes, and through network activities, with national institutions. The total proportion of ILRI's resources devoted to collaboration of this kind, including the existing institution building activities in Africa, would therefore rise to approximately 30% of total expenditure over the period of the MTP.

Resource Allocation

Because 1994 is a transitional year, it provides an unusual opportunity, as well as imperative reasons to refocus the resources of the new institute on the highest research priorities, taking account of its expanded global remit.

The 1994 budget for ILCA and ILRAD corresponds to approximately 105 senior staff positions. Some 84% of these are scientific positions, corresponding to an average expenditure of slightly more than US\$ 200,000. Each senior management or administrative position corresponds to a higher expenditure because the overheads of the institutions are classified with these activities.

The proposed shift in programme is most readily displayed in terms of the disposition of the senior staff resources. This is shown in some detail in Table 2. The programme

TABLE 2: PROPOSED CHANGES IN PROGRAMME BY SENIOR STAFF POSITIONS (SSY)

Program element	ILRAD/ILCA					Close	ILRI Base MTP	Additional by 1998
	1994	New	Expand	Maintain	Reduce			
Health								
Trypanosomiasis								
Epidemiology	2.0		3.0				5.0	
Diagnostics	2.0					2.0	0.0	
Chemotherapy	3.0					3.0	0.0	
Immunology	6.0				2.0		4.0	
Mol physiology	6.0				2.0		4.0	
ECF & Other TBD								
Epidemiology	5.0				3.0		2.0	
Antigen	3.0		1.0				4.0	
Vaccine Dev	6.0		2.0				8.0	
Animal Genetics								
Molecular genetics	3.0		1.0				4.0	1.0
Gen. of disease & paras	3.0		1.0				4.0	
Conservation - Animal	2.0		1.0				3.0	
Nutrition/Physiology								
Feed utilization	3.0				1.0		2.0	
Rumen ecology	0.0	2.0					2.0	
Physiology of ruminants	2.0		1.0				3.0	
Feed Resources								
Forage genetic resource	3.0			X			3.0	
Feed resources mixed	2.0			x			2.0	
Production Systems								
Models & Impact Analys	2.0		2.0				4.0	
Farm level integration								
SSA	10.0				2.0		8.0	
Asia	0.0	2.0					2.0	3.0
LAC	0.0	1.0					1.0	1.0
WANA	0.0	0.1					0.1	
Natural Resource management								
In production systems								
SSA	4.0	1.0					5.0	
Asia	0.0	1.0					1.0	3.0
LAC	0.0	1.0					1.0	1.0
WANA	0.0	1.0					1.0	
Livestock policy								
Socio Economic policy	3.0	2.0					5.0	
Econ impact animal heal	3.0			X			3.0	
Ecological & Economic a	3.0			X			3.0	
NARS Capacity building								
Training	2.0					1.0	1.0	
Information	5.0					1.0	4.0	
Counselling & networks								
SSA	5.0					1.0	4.0	
Asia	0.0	2.0					2.0	1.0
LAC	0.0			X			0.0	1.0
WANA	0.0			X			0.0	
Administration								
Program support	7.0					2.0	5.0	
Administration	7.0					1.0	6.0	
Operations	3.0					1.0	2.0	
Total	105.0	13.1	12.0	0.0	17.0	5.0	108.1	11.0

classification used is that which has been used by TAC. Column 1 shows the distribution of staff resources over the programme areas in 1994. The proposed changes, taking account of new activities, and of new geographical responsibilities as well as corresponding reductions and closures are shown in the following five columns, while the sixth column shows the distribution of senior scientist positions after these adjustments. This is called ILRI's Base MTP. This represents a baseline MTP for the new institute and not a definitive plan for 1995. Considerable rescheduling will take place within the four year plan period, and the plans for 1995 are addressed in more detail in the 1995 Programme and Budget for ILRI.

Overall, these changes will require the closure of 22 positions, with these staff resources being used for expansion or initiation of other activities.

The rise from 105 positions initially to a figure of 109 for the baseline MTP corresponds to the reservation of US\$ 1.0 m in ILRI's 1995 budget for the initiation of the livestock programme activities in Asia, LAC and WANA.

The modest expansion provided for in the TAC medium term allocations will permit the addition of 11 new scientific positions along with the initiation of the new scientific linkage programme at the level of US\$ 1 million per annum. The proposed disposition of the new positions is shown in the final column in Table 2.

Table 3 shows, in summary form, the percentage distribution of the senior staff positions over the main programme areas in 1994, under the baseline MTP proposals and as projected for 1998. It can be seen that the largest reduction is in the animal health area, corresponding to the winding down and closure of some activities in the trypanosomiasis programme and the transfer of some positions to support the expanding programme in animal genetics. The genetics programme has a modest expansion to exploit the opportunities being opened by current developments in molecular biology, and also to respond to the need for additional work in animal genetic resources conservation.

Table 3: Redistribution of senior staff positions (SSY) by programme area

	1994	Base MTP	1998
	Percent		
Animal Health	31.4	24.8	22.5
Animal Genetics	7.6	10.1	10.0
Productions Systems (1)	24.8	33.0	36.6
Socio-economic and Livestock Policy	8.6	10.1	9.2
Institutional Strengthening	11.4	10.1	10.8
Administration and Operations (2)	16.2	11.9	10.8

(1) SSY contributing to production systems research encompass disciplinary expertise in animal nutrition and physiology, feed resources, production systems modelling as well as in natural resource management.

(2) Expressed as percent of total SSY and does not reflect the actual cost of administration.

The largest increase is in the area of production systems. This includes animal nutrition and physiology, feed resources, as well as production system modelling and aspects of natural resource management. It also corresponds to the need to extend work particularly to Asia, Latin America and West Asia and North Africa. A slight increase, accompanied by a considerable reallocation is proposed in areas of social, economic and policy studies.

Resources devoted to institutional strengthening are maintained. However, activities which bear on this theme will be increased substantially under the systems activities. The percent of senior staff positions in administration and operations is reduced substantially, partly because of the replacement of two administrations with one, and partly by the reallocation of biometrics and statistics activities to the research programme. Overall some 21% of staff positions are proposed for reallocation.

At present, all staff resources, and almost all activities of ILCA and ILRAD are confined to the African continent. With the new global mandate, some reallocation to other regions is necessary. Table 4 shows the proposed reallocation to other regions, first in the ILRI base MTP situation. This shows that some 9% of senior scientist positions should be redeployed to other areas, primarily to Asia. With the deployment of almost all additional staff resources to other regions, practically 20% of scientific manpower would be devoted to Asia, Latin America and West Asia and North Africa by 1998. Two thirds of this deployment would be to Asia.

Table 4: Redistribution of senior research staff positions (SSY) by region

	1994		Base MTP		1998	
	SSY	%	SSY	%	SSY	%
SSA	88	100	87	90.6	87	81.3
Asia	-	-	5	5.2	12	11.2
LAC	-	-	2	2.1	5	4.7
WANA	-	-	2	2.1	3	2.8
Total Research	88		96		107	
Total SSY	105		109		120	

Recommended Core Funding for 1995 and 1998

The proposed allocation of resources for ILRI for the period 1994-98 is presented in Tables 5 and 6, following the TAC classification of livestock programmes, and the CG-wide programme classification. The allocations were made within the guidelines given by TAC (IAR/93/11/Rev1, October 1993). These provide for an overall allocation, in current dollars of 23.8 million in 1994, rising by 4% per annum. In addition, a special fund at a level of US\$ 4 million is proposed to support the new CG-wide livestock initiative.

TABLE 5: CORE PROGRAM & ACTIVITY REQUIREMENTS
(Senior Staff Years and US\$'000)

		1994		1995		1998	
		SSY	\$'000	SSY	\$'000	SSY	\$'000
OPERATIONS PROGRAM							
TAC PROGRAMME ACTIVITIES							
Animal Health	ILCA	1.8	877				
	ILRAD	32.7	4,287				
	<i>ILRI</i>	34.5	5,164	27.0	4,203	27.0	4,728
Animal Nutrition/Physiology	ILCA	9.0	804				
	ILRAD						
	<i>ILRI</i>	9.0	804	9.0	836	9.0	940
Animal Genetics	ILCA	7.7	1,004				
	ILRAD	3.6	370				
	<i>ILRI</i>	11.3	1,374	15.0	1,897	16.0	2,143
Feed Resources	ILCA	6.1	1,472				
	ILRAD						
	<i>ILRI</i>	6.1	1,472	5.0	1,255	5.0	1,412
Livestock Production System	ILCA	12.3	1,931				
	ILRAD	2.2	147				
	<i>ILRI</i>	14.5	2,078	18.0	3,483	22.0	4,679
Natural Resources Mgmt.	ILCA	4.5	550				
	ILRAD	1.5	150				
	<i>ILRI</i>	6.0	700	11.0	1,335	15.0	2,048
Policy Analysis	ILCA	7.8	772				
	ILRAD	0.3	34				
	<i>ILRI</i>	8.1	806	13.0	1,796	13.0	2,021
Strengthening NARs Capacity	ILCA	8.2	2,152				
	ILRAD	3.0	1,145				
	<i>ILRI</i>	11.2	3,297	10.0	3,062	12.0	4,133
Contract research	ILRI	0	0	0	0	0	1,000
TOTAL DIRECT PROGRAMME	<i>ILRI</i>	100.7	15,695	108.0	17,867	119.0	23,104
PROGRAMME SUPPORT	ILCA	5.4	792				
	ILRAD	4.0	1,643				
	<i>ILRI</i>	9.4	2,435	5.0	1,228	5.0	1,381
TOTAL PROGRAMME	<i>ILRI</i>	110.1	18,130	113.0	19,095	124.0	24,485
ADMINISTRATION/OPERATIONS:							
Administration	ILCA	4.0	1,285				
	ILRAD	3.0	1,619				
	<i>ILRI</i>	7.0	2,904	5.0	2,780	5.0	3,125
Operation	ILCA	2.0	553				
	ILRAD	1.0	1,049				
	<i>ILRI</i>	3.0	1,602	3.0	1,665	3.0	1,875
Total Admin/Operations		10.0	4,506	8.0	4,445	8.0	5,000
DEPRECIATION	ILCA		1,058				
	ILRAD		1,056				
	<i>ILRI</i>		2,114		2,200		2,475
TOTAL PROGRAMME OPERATIONS	ILCA	68.6	13,250				
	ILRAD	51.3	11,500				
	<i>ILRI</i>	120.1	24,750	121.0	25,740	132.0	31,960
LESS CENTER INCOME:	ILCA		760				
	ILRAD		400				
	<i>ILRI</i>		1,160		140		160
TOTAL FUNDING REQUIREMENT	ILCA		12,490		0		0
IN CURRENT US\$	ILRAD		11,100		0		0
	<i>ILRI</i>		23,590		25,600		31,800

* A special fund of \$1.0 million to \$4.0 million (1995-1998) has been reserved for cooperative expansion in new regions and is not included in the funding requirement set out above.

TABLE 6: CORE PROGRAM & ACTIVITY REQUIREMENTS
(Senior Staff Years and US\$'000)

		1994		1995		1998	
		Estimate		Estimate		Projected	
		SSY	\$'000	SSY	\$'000	SSY	\$'000
I. OPERATIONS PROGRAM							
A.CG PROGRAMME ACTIVITIES							
1 Conservation							
1.1 Ecosys Conserv	-ILCA	4.8	658				
	-ILRAD	1.5	150				
	ILRI	6.3	808	6.3	862	6.3	970
1.2 Germplasm Coll	-ILCA	8.4	1,667	9.3	1,919	9.3	2,158
	ILRI	14.7	2,475	15.6	2,781	15.6	3,128
2 Germplasm Enhancement							
2.2 Livestock	-ILCA	2.7	432				
	-ILRAD	3.6	370				
	ILRI	6.3	802	8.4	1,065	9.4	1,340
3 Production Systems							
3.2 Livestock	-ILCA	30.7	4,077				
	-ILRAD	32.7	4,287				
	ILRI	63.4	8,364	57.5	8,403	65.5	10,629
4 Policy Research							
4.1 Econ & Social	-ILCA	1.6	315				
	-ILRAD	2.5	181				
	ILRI	4.1	496	11.5	1,865	11.5	2,097
4.2 Policy Analysis	-ILCA	1.0	261	5.0	691	5.0	777
	ILRI	5.1	757	16.5	2,556	16.5	2,874
5 Institution Building							
5.1 Training & Info	-ILCA	0.2	526				
	-ILRAD	1.0	462				
5.2 Docum & Public	-ILCA	4.0	816				
	-ILRAD	1.0	503				
5.3 Org. & Mgt. Couns	-ILCA	1.0	243				
	-ILRAD	1.0	180				
5.4 Networks	-ILCA	3.0	567				
	ILRI	11.2	3,297	10.0	3,062	12.0	4,133
6 Contract research	-ILRI		0	0	0	0.0	1,000
TOTAL DIRECT PROGRAMME		100.7	15,695	108.0	17,867	119.0	23,104

TABLE 6: CORE PROGRAM & ACTIVITY REQUIREMENTS
(Senior Staff Years and US\$'000)

	1994 Estimate		1995 Estimate		1998 Projected	
	SSY	\$'000	SSY	\$'000	SSY	\$'000
B.PROGRAMME SUPPORT						
-ILCA	5.4	792				
-ILRAD	4.0	1,643				
ILRI	9.4	2,435	5.0	1,228	5.0	1,381
TOTAL PROGRAMME ACTIVITIES	110.1	18,130	113.0	19,095	124.0	24,485
C.ADMIN./ OPERATIONS						
C.1 Administration						
-ILCA	4.0	1,285				
-ILRAD	3.0	1,619				
ILRI	7.0	2,904	5.0	2,780	5.0	3,125
C.2 General Operat.						
-ILCA	2.0	553				
-ILRAD	1.0	1,049				
ILRI	3.0	1,602	3.0	1,665	3.0	1,875
TOTAL ADMIN/OPERATIONS	10.0	4,506	8.0	4,445	8.0	5,000
C.3 Depreciation						
-ILCA		1,058				
-ILRAD		1,056				
ILRI		2,114		2,200		2,475
TOTAL OPERAT. PROGRAMME	120.1	24,750	121.0	25,740	132.0	31,960