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# ANIMAL PRODUCTION AND THE ENVIRONMENT IN LATIN AMERICA AND THE CARIBBEAN REGION

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## ABSTRACT

In Latin America and the Caribbean, culture, resource endowment, market opportunities, government policies and external pressures provide a milieu of agricultural production patterns. In addition, animal agriculture is affected by the often unpredictable climate, water availability, land degradation, pests, diseases, and genetic resources. Despite these problems, grazing animals utilize 76% of the agricultural land, livestock production accounts for 30% of the agricultural gross product and generates 35% of the total food produced in the region. On the other hand, shifting agriculture practices, greed and poor farming practices have led to natural resource degradation. Many environmentalists point to poor animal agriculture systems as the main culprit in the loss of the natural resource base. Nevertheless, the region has the potential for dealing with challenges to its food production and its natural resource protection. Since the late 1970s the application of a holistic approach to solving production constraints at the farm level has been a feature in the region's research and development programmes, an effort led by the Latin American Network for Animal Production Systems Research (RISPAL). RISPAL is a network comprising 16 projects in Guatemala, Costa Rica, Mexico, Panama, Colombia, Chile, Guyana, Peru and Venezuela. Its methodological achievements have helped establish appropriate research undertakings in the region. The focus of a 1992 livestock specialist meeting was to examine the commonly held belief that livestock have only negative impacts on the environment and are solely responsible for major environmental damage. The findings of this analysis contributed to the development of strategies for the International Livestock Research Institute (ILRI). ILRI, created in September 1994, is responsible for two-thirds of all CGIAR livestock-related research in developing regions. In January 1995, 28 experts in livestock research from 25 countries were consulted in Nairobi to help ILRI define its global programme of research, training and information activities. With over 300 million people around the globe depending for their livelihoods on their health and productivity, the time has come for a reassessment of the roles of livestock in society and their interplay with the environment must be confronted.

## INTRODUCTION

In Latin America and the Caribbean, culture, resource endowments market opportunities, and other factors, provide a large matrix of agricultural production patterns, modified by changing government policies and external pressures; for example, shifting cultivation in the Amazonian countries, the diversified agriculture practised by small farmers and peasants, the dual-purpose cattle systems practised in the wet/dry tropics, the highly specialized agriculture practised in Chile, and the subsistence-level goat herding in northern Mexico and Peru. The economic, technical, social and political factors affecting animal agriculture are, in turn, affected by the often unpredictable climate, water availability, land degradation, pests and diseases and genetic resources. Despite these problems, grazing animals make use of 76% of the agricultural land, livestock production accounts for 30% of the agricultural gross product and generates 35% of the total food produced in the region. Overall, there is self-sufficiency in beef production but a deficiency in milk production (12%). There is a high elasticity of demand for livestock products though inequity in consumption between social groups is still evident.

The rural poor and natural resource degradation are closely linked since survival practices of resource-poor farmers can result in deforestation, reduction in fallow lands and erosion. As production on these lands becomes unsustainable, many resource-poor farmers are forced to move to marginal lands, such as steep hillsides and humid tropical areas, and to begin the poverty-degradation cycle anew or to migrate to urban areas, compounding unemployment and food security problems there. Environmental degradation, in turn, compromises current agricultural productivity, undermines future productivity and perpetuates poverty. Deforestation has been the result of shifting agriculture and opportunism. The ensuing degradation of the natural resources has been the result of inadequate practices in cropping, irrigation and grazing. In fact, many environmentalists and other specialists point to poor animal agriculture systems as the main culprit in the loss of the natural resource base. Nevertheless, the region has the potential for dealing with challenges to its food production and its natural resource protection. It holds only 8.1% of the world population but 23% of the potentially usable lands, 12% of those under cultivation, 17% of grasslands, 23% of forests, 46% of tropical forests and 31% of freshwater runoff that might be used in a sustained manner. A single hectare of tropical forests holds greater biodiversity than the whole of Europe.

The effective application of this natural resource base to the alleviation of hunger and poverty problems in a sustained manner will occur only if systematic attention is paid to conditions favouring the growth of production and productivity, key among which will be the provision and use of suitable technologies.

## THE NEW ECONOMIC AND INSTITUTIONAL TRENDS

Structural adjustments, the economic crisis and the liberalization of trade have diminished public investment in agricultural research and extension. Market forces are encourag-

ing a change in the region from its traditional commodity structure toward a more diversified one. As the GATT Uruguay Round accords take effect toward lower subsidies and trade barriers, and as subregional pacts such as NAFTA are implemented, the region will undergo profound and quick changes in search of its competitiveness in agricultural production and trade. The establishment of novel information systems and access to pertinent data will be a key development in this process.

Although not all rural problems are caused by the poor, any strategy that fails to deal squarely with the issue of rural (and urban) poverty will prove ineffective in reducing natural resource destruction and degradation while increasing food production and productivity in the region. The new strategy will require investment and a range of policies, among which agricultural technology is of foremost importance (Ruiz, 1994). The new technology, for example, will have to have an ecoregional systems approach, particularly in those fragile and low-potential areas where many of the rural poor live.

Decisions are being made toward a smaller role and financing for the public sector while encouraging the private sector to take up agricultural research and development duties. However, the public sector will most likely retain: (i) the responsibility to define agricultural policies and implement selected programmes; (ii) a capacity to develop technologies for smallholders and other farm groups not favoured by the private sector efforts; and (iii) a service function for those segments of the agricultural society which cannot respond through market mechanisms (peasants, smallholders, remote or small regional situations). These changes in the function of the public sector will demand a broader participatory model that brings together a wide array of institutional actors (Ruiz, 1995a). The region is already developing strategic alliances and consortia seeking to increase multinational efficiency in research and development, particularly when an ecozone involves more than one country. This new spirit of cooperation can be observed in organizations such as FAO, CIAT, CIP and IICA, as well as national institutions, which are joining expertise, strategies and resources in tackling problems of common interest. Among the intended efforts of these organizations figures the linkage between networks having similar objectives.

## RISPAL

The Inter-American Institute for Cooperation on Agriculture (IICA) is the agricultural agency of the Inter-American System. IICA has positioned itself in support of the search for sustainability in the agricultural sector of Latin America and the Caribbean emphasizing a participatory form of regional technical cooperation. This collaboration has taken the forms of lateral, multi-organizational and multinational undertakings, with well-defined rules and procedures for accountability and administrative transparency. To mention some of these schemes, IICA, in alliance with national agricultural institutes, has established subregional and ecoregional cooperative programmes in a number of key areas. Also, topic-specific networks have been established through the support of the international cooperation institutions; such is the case of the Latin American Network for Animal Production Systems Research (RISPAL), which was created in 1986 with the support of the International Develop-

ment Research Centre (IDRC) and has contributed to the development of research methodologies for the improvement of animal agricultural systems with the participation of the smallholders (Ruiz, 1995h).

RISPAL is a mechanism for regional cooperation in research and transfer of technology as they pertain to animal production systems, as such or in conjunction with other agricultural systems. Specifically, RISPAL has the following objectives: (i) to implement cooperative farming systems research activities; (ii) to stimulate the development of a research methodology that uses a systems approach; (iii) to validate and recommend technology; and (iv) to strengthen local programmes, projects, and institutions through technical support and training.

In the early 1970s, cropping specialists began a new approach in research whereby, in close cooperation with the small farmer, real problems and constraints were identified (and thus subject to experimentation), as well as interactions among the farming system's components and between these and the environment. This approach was embraced by animal scientists toward the end of that decade but it was soon realized that the methodology could not be followed in its entirety (Borel et al., 1985). The major difficulties arose because: (i) for on-farm experimentation, animal experimental units are very few; (ii) animals within a production system are highly variable due to differences in physiological function, breed and/or undefined crossbreeding, sex, production function, and management; and (iii) animal response to treatment is multiparametric (weight changes, milk production and reproduction, for example).

In view of the methodological limitations and the scarcity of technical people involved in the pioneering systems-oriented projects, these agreed to pool knowledge and efforts by working as a group. From 1981 to 1985, six meetings were held to discuss methodological advances and to interact on topics of common interest. In 1986, the group was consolidated as a formal network. From 1987 to 1995, RISPAL continued not only holding general meetings but also conducting workshops, consultancies to the member projects, providing training to young researchers, publishing bulletins, books, manuals and CD-ROMs, establishing a supporting information system and promoting information exchange.

#### Methodology development.

This area has constituted the main technical thrust. Practically all of RISPAL's publications contain methodological procedures and analytical tools for animal systems researchers. Figure 1 illustrates some of the methodologies developed or tailored to practical situations and incorporated into the project's technical arsenal. The open-ended bars in Fig. 1 indicate that once a methodological tool is taken up by the network's projects, it is tested, improved and used with increasing intensity.

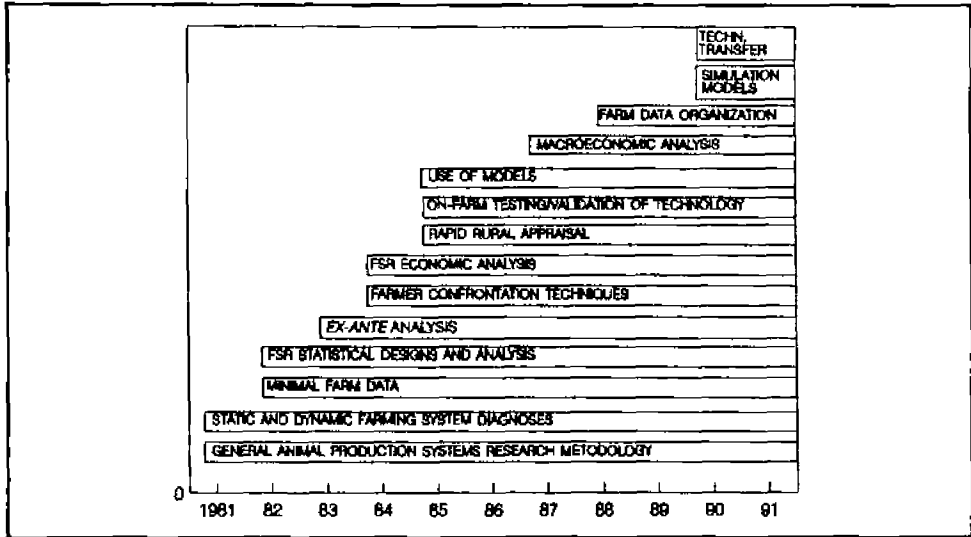


Figure 1 Methodological progress in RISPAL

#### Training and consultancies.

As animal production systems research is not part of the training programmes given by the region's universities, RISPAL's role in this area has been very much appreciated. This has been accomplished through short training courses, workshops, consultancies, and exchange of scientists. Training (over 300 person-days) has been accomplished in various areas such as farm diagnosis, design and evaluation of technological alternatives, animal nutrition, pastures, economics, animal reproduction, project planning and evaluation, and systems research methodology, while consultancy activities have been varied and numerous (over 600 person-days) in the same areas.

#### Information dissemination.

The network's coordination has encouraged its members to release their information on appropriate technologies for small landholders in a systematic fashion, and has been very active in the preparation, editing and publication of methodological guides. Some of the products obtained include:

- Publication of nine proceedings of general meetings
- Publication of five books on research methodology in Spanish
- Translation into English of 17 technical documents on technology and methodology developed in the network and their publication in the form of four books:
  - *Ruminant Nutrition Research: A Methodological Guideline*
  - *Social Sciences and Agricultural Research: A Systems Approach*

- *Animal Production Systems Research: Methodological and Analytical Guidelines*
- *Social Analysis in Farming Systems Research*
- Publication of 13 bibliographies on animal production systems, 34 newsletters (the quarterly bulletin *Carta de RISPAL*) and a glossary of terms on animal production systems
- Participation in the production of two CD-ROMs containing RISPAL's database of 16,730 registries, 80% of which include summaries.

## FUTURE CHANGES

Animal production in Latin America and the Caribbean must face new challenges concerning the fragility of natural resources and the deterioration of environmental quality. The agricultural sector is directly affected by these challenges and, therefore, agricultural research, development, and education will have to undergo profound changes, making these activities more ecologically oriented.

With respect to the systems approach, if it has already been confusing to some, in the future it will become even more complex, as ecological variables will be added to the present social, economic, physical and biological variables. Several events must occur if livestock research with a systems approach is to contribute effectively to the development of a new technological order.

### Institutional policy aspects.

There is no doubt that Latin America and the Caribbean countries will continue to promote food production with urgency (Ruiz, 1995a). To this policy must be added mechanisms that will put a stop to the destruction of the natural resources, but which, at the same time, will not limit the people's right to achieve a minimum level of well-being. The implementation of this double-edged policy (productivity plus environmental protection) will require a long-term commitment to maintain and strengthen national agricultural research systems and to develop working linkages with the private sector in the areas of research and development.

International cooperation agencies and donors could change their strategies so as to facilitate and strengthen the consolidation process that the national institutions may undergo. For example, instead of providing direct support to specific projects, they should do so by way of the institution the project is attached to, while ensuring the institution's commitment to support the project.

### Research and development.

The systems approach is uniquely suited to help in the conceptualization and solution-seeking required now that ecological concerns need to be added to everyone's agenda. As new technological policies which satisfy environmental and production demands are drafted,



the systems approach may become the instrument through which the new policies can be put into effect. However, certain changes may need to be inserted in the present systems-oriented research and development. These are as follows:

- The need to create a database on land-use capacity (or production potential), determined not just on the basis of ecologically justified arguments but also on evidence or opportunities for rational use of the land for production purposes as well as the corresponding technological requirement.
- Information on land-use capacity (both from the social and biological aspects) should be of primary importance if good development programmes are to be designed. This information should be based on macroeconomic studies, market trends, competitiveness and sustainability.
- Instead of taking the farming system as the focal point of research (as it is at the present time), the researcher would do well to focus directly on an agro-ecological zone or ecosystem. This change in focus would not ignore the farm, since it is the next level in the hierarchical order of systems (Hart, 1979).
- Much has been written and said about agricultural sustainability, but little has been done to translate this concept into concrete research and development actions. For this reason, one of the first commitments in the future should be to define which indicators would aid in determining what is sustainable and what is not.
- In view of the international economic contraction, funding of research and development projects has become more and more difficult. This is in conflict with the manifest interest of donor agencies in environmental and sustainability issues. In any case, horizontal cooperation and electronic communication through networking is justified more than ever. Networking has been proven effective in complementing technical needs and in promoting exchange of information, but most of all, in facilitating the effective participation of rural men and women in the overall process of generating and transferring technology suitable to their social, economic and ecological environments.

## ILRI

Following expert reviews of the status and opportunities for livestock research in developing countries, the Consultative Group for International Agricultural Research (CGIAR) created in 1994 a new international livestock research entity to address global problems of livestock research and agricultural development. The new organization is the International Livestock Research Institute (ILRI), based in Addis Ababa (Ethiopia) and Nairobi (Kenya). ILRI incorporates certain priority programmes that were carried out by the former ILRAD (International Laboratory for Research on Animal Diseases) and ILCA (International Livestock Centre for Africa); however, ILRI's mandate expands its role to all developing regions, that is, in addition to Africa activities will also be carried out in Asia and the Latin American and Caribbean region.

## Strategic principles.

The ILRI strategy document identifies two levels of concern: a global strategy and the particular role ILRI will play in livestock research. The global strategy evaluates the research requirements for improved sustainable livestock production across-regions and the particular emphasis for research required at the ecoregional level. To determine these requirements, the CGIAR assessed the total population, the value of agricultural output (for both livestock and crops) and the total agricultural land in use classified into grazing and cultivated. Given that the CGIAR has identified six priority ecoregions, and has designated convening centres for these, Table 1 reviews the relationship between these ecoregions, centres and livestock populations; some 80% of developing country cattle sheep and goats are present in the six ecoregions.

Table 1 CGIAR priority ecoregions and estimated livestock populations

Ecoregion	Centre*	Cattle		Sheep and goats	
		Millions	LDC (%)	Millions	LDC(%)
Warm arid and semi-arid subtropics with summer rain	SSA-ICRISAT	47	5.4	88	8.0
	ASIA-ICRISAT	179	20.4	221	20.2
Warm subhumid/humid tropics and subtropics with summer rain	SSA-IITA	39	4.4	68	6.2
	ASIA-IRRI	186	21.2	265	24.1
	LAC-CIAT	203	23.1	43	3.9
Cool subtropics with winter rain	WANA-ICARDA	21	3.6	178	16.2

Source: Gardiner and Devendra (1995)

\*SSA: Sub-Saharan Africa; LAC: Latin American and Caribbean; WANA: West Asia/Near East and North Africa; ICRISAT: International Crops Research Institute for the Semi-Arid Tropics; IITA: International Institute of Tropical Agriculture; IRRI: International Rice Research Institute; CIAT: Centro Internacional de Agricultura Tropical; ICARDA: International Centre for Agricultural Research in the Dry Areas.

The relative requirements for production research, or the need for improved natural resource management in specific ecoregions, have been identified (Table 2). From this table, it is also clear in what subject matters and regions ILRI will concentrate its efforts.

In addition, the CGIAR also considered the importance of each animal species (with the exception of pigs and poultry) in the context of 10 different livestock systems (except-

ing landless systems). For the Latin American and Caribbean region, the relative importance of ruminants is given in Table 3 for each of the 10 land-use livestock systems.

Comparisons of figures among all regions, indicates that ILRI will underline its work in mixed crop-livestock systems, particularly in the semi-arid and the humid/subhumid ecoregions.

Table 2 The relative importance of research programme areas by region\*

Programme area	SSA	Asia	WANA	LAC
Animal health	XXX	XX	X	X
Animal genetics		XX	XX	X
Animal nutrition	X	X	X	X
Feed resources	XXX	XXX	XX	XX
Production systems	XXX	XXX	XX	XX
Natural resources management	XXX	XXX	XXX	XXX
Policy analysis		XX	XX	XX

Source: Reprinted from the Strategic Plan for ILRI (Gardiner and Devendra, 1995).

\*SSA: Sub-Saharan Africa; LAC: Latin American and Caribbean; WANA: West Asia/Near East and North Africa

Table 3 Distribution of ruminants (% of LDC total) in the Latin American and Caribbean region (LAC) and in the less developed countries (LDCs) by production systems

System	Cattle		Sheep & goats	
	LAC	LDC total	LAC	LDC total
Livestock grassland tropical highland	2.6	3.6	1.8	2.4
Livestock grassland humid/subhumid tropics	3.1	4.9	2.8	5.3
Livestock grassland arid/semi-arid tropics/subtropics	0.1	3.2	0.1	6.9
Mixed farming rainfed temperate/tropical highlands	1.9	5.7	0.5	5.2
Mixed farming rainfed humid/subhumid tropics	21.5	35.2	3.2	20.3
Mixed farming rainfed arid/semi-arid tropics/subtropics	2.6	20.3	0.9	30.1
Mixed farming irrigated humid/subhumid tropics	1.6	13.5	0.7	14.0
Mixed farming irrigated arid/semi-arid tropics/subtropics	1.9	13.6	0.7	15.8
Total	35.3	100.0	10.7	100.0

Source: Partial data obtained from Gardiner and Devendra (1995)

LDC total for cattle is 879 million, and for sheep and goats is 1,097 million

<sup>1</sup> The term ecoregional refers to regions of the world linked by common agro-ecological conditions so as to approach their agriculture research problems in a coherent manner.

## Research opportunities

The principal research opportunities for the new centre in addressing animal agriculture in developing regions are fourfold and associated with the improvement of:

animal performance by overcoming identified constraints to animal productivity through technological research and the conservation of the existing animal genetic diversity in developing regions

productivity of the major livestock and crop-livestock production systems typical of developing regions and to maintain their long-term productivity

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

the development, transfer and utilization of technology by national programmes and client farmers in the agricultural systems of these regions.

The above goals will serve as the framework of the development of ILRI's new programme. They are applicable to the improvement of animal and agricultural productivity globally. However, the combination of biotechnological, adaptive, integrative and managerial solutions appropriate to the different problems, production systems and regions will differ. The commitment to globalizing and integrating key aspects of research on livestock, largely through ecoregional initiatives and linkages to existing programmes, is central to the strategy. Selection of problems and regions therefore becomes paramount in the efficient and effective use of CGIAR resources (Gardiner and Devendra, 1995).

## The global research agenda

To plan and implement ecoregional activities ILRI will establish working relationships with national programmes and promote technology transfer between international and national partners. In addition to this ecoregional approach, ILRI will seek extensive collaborative partnerships that will help in the identification and development of system-wide initiatives for livestock research. This strategy is certainly ambitious and a novelty within the CGIAR system but will maximize the effectiveness of CGIAR financial resources by interacting with the much greater financial resources being invested in agricultural research worldwide.

As ILRI became operational in 1995, a Global Consultation was held in Nairobi (Kenya) in January 1995, with the objective of: (i) identifying priority requirements for improved and sustainable livestock production systems in developing regions; and (ii) identifying cross-regional priorities, major constraints, and the researchable areas and issues in livestock production as they pertain to small-scale farmers. For the case of the Latin American and Caribbean region, it was pointed out that the following issues were of capital importance: increasing poverty (mostly in the rural area); increased demand for food due to an

expanding urban population; improvement of productivity without causing harm to the environment; incorporation of policy concerns in research and development schemes; social equity; and whole-commodity production-to-consumption food chain analysis. Constraints and opportunities were identified for each of the following ecological zones:

- Subhumid and humid tropics: hillsides, lowlands (Llanos, Cerrados, Central American and Caribbean), forest margins
- Andean zones above 2,000 m above sea level and reaching 23° latitude.

The following researchable areas were suggested:

- Systems and impact analysis of livestock production systems
- Agricultural policy studies
- Livestock and natural resource management
- Improved feed utilization
- Livestock commodity systems research
- Forage development
- Characterization of indigenous breeds
- Strategies for in situ conservation of breeds
- Social framework analysis
- Institutional capacity building strategies
- Research on technology transfer systems for livestock production
- Genetic selection of small ruminant breeds resistant to endoparasites

#### Regional consultation

An agreement has been reached between ILRI, IDRC and IICA, where RISPAL is coordinated, to hold a Regional Consultation Meeting at IICA's headquarters during the week of 16–20 October 1995, under the auspices of ILRI and IDRC with IICA acting as the host organization. The meeting will have as an overall objective to develop an agenda for priority livestock research in the Latin America and the Caribbean region; also, the roles of national, international and regional institutions in this agenda will be identified.

Prior to the meeting, RISPAL and IDRC will conduct a wide-scope, open-ended survey of stakeholders from both the private and public sectors in order to gain an insight of how problems and opportunities are perceived by national institutions and individuals. The results of this survey will be analyzed and presented during the Consultation Meeting.

## FINAL COMMENTS

As described in this paper, the world may be witnessing a new awakening of interest in the role livestock plays in the economies and the lives of the people in the developing regions. This renewed interest, however, lies within a more complex framework where social, economic, environmental and policy factors intertwine together and produce a myriad of situations and problems. The solution of these problems and constraints demands an effort calling for more dynamic international cooperation, active participation of national and international agencies and donors, participation of private and public entities, interdisciplinary work and a more holistic, systematic approach in training, research and development initiatives. The livestock sector, long-blamed for many maladies affecting the environment, human health and the economy, is now being revisited; it is an opportunity to help develop a more efficient, environmentally friendly and equitable agriculture.

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