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CONTROLLING THE IMPACT OF LIVESTOCK PRODUCTION SYSTEMS ON THE ENVIRONMENT: A CHALLENGE FOR THE FUTURE

Photo 1. The zebu herd, increasing as it does over a period of time, enhances and maintains land usurped from the forest. It represents the cumulative capital–the fruit of the pioneer's labour. Pará State, Brazil.
Le troupeau de zébus, constitué progressivement, valorise et entretient les terres conquises sur la forêt. Il représente le capital accumulé, fruit du travail du pionnier. État du Pará, Brésil.

An international study directed by The World Bank, FAO and USAID involving several European and American donors concerned interactions between livestock and environment throughout the world. The current approach is to divise tools for assessing and monitoring environmental impact applicable to new livestock development projects and new policies.

The future of mankind is indisputably linked to that of the world's natural resources and the environment. The new worldwide awareness that these resources are in fact limited was clearly expressed in the conclusions of the 1992 Rio de Janeiro conference. The role of domestic animals in natural resource usage and their impact on the environment are two of the major issues. For instance, the number of cattle worldwide is estimated at almost 1.3 billion, each animal needing between 0.5 and 5 hectares to feed on. Lobby groups, mainly led by ecologists, have even been set up, particularly against ruminants, to denounce the environmental consequences of such animal populations.

OBJECTIVES AND CHALLENGES

The development of livestock rearing has been accused of causing particularly newsworthy and worrying environmental damage (STEINFELD *et al.*, 1997), for instance the rapid deforestation of large expanses of tropical rainforest, such as in Amazonia, followed by the extension of large-scale ranches. The desertification of sub-arid tropical regions, particularly in the Sahel, both north and south of the Sahara, combined with both a series of dry years and an increase in the number of nomadic or transhumant farmers, is another example, as is aquifer pollution in densely populated temperate countries (particularly France and the Netherlands) due to the excessive intensification of industrial livestock production. There is also some controversy about competition for cereals from domestic animals when people are starving in certain parts of the world; to produce concentrated feeds, it is often necessary to farm previously natural areas, thus reducing the habitats of local flora and fauna. The following question sums up the issues: does livestock production have its rightful place in the world garden, and under what conditions?

An international study directed by the World Bank, FAO and USAID involving several European and American donors set out to determine the environmental impact of livestock production systems on a worldwide scale and establish objective criteria for assessing the positive and negative interactions between livestock production and natural resources. It aimed to open the way for an analysis of the indirect causes of damage so as to provide the information required to draw up environment-friendly livestock production development policies. Close attention was paid in the study to the issues facing developing countries, since it is in hot countries that livestock production is developing and changing fastest and that future demand will be strongest. An e-mail discussion forum organized in 1997 opened up the talks to many more participants. The conclusions of the study and the elements provided by the e-mail discussion forum were presented at Wageningen (Netherlands) in June 1997, to a mixed audience of representatives from every continent (NELL, 1998).

From that time on, the livestock and environment initiative (now "livestock, environment and development", LEAD), has been supporting and facilitating exchanges of information on livestock and environment issues. It is establishing a facility for professionnal capacity building, providing expert advice in this field, developing training curricula and courses for policy makers and holding workshops at the regional level.

CURRENT LIVESTOCK PRODUCTION SYSTEMS AND TRENDS

For the purposes of the study, a distinction was made between three main livestock production systems (SERÉ, STEINFELD, 1996):

• **Extensive systems** in which the animals primarily (over 90%) feed on pasture. Such systems are particularly common in arid and semi-arid regions, generally on rangelands managed on a community basis (open grasslands and common ranges). They are also increasingly important in the sub-humid and humid tropics, either on common land or on privately owned, fenced ranges.

• **Mixed systems** in which livestock production is combined with agriculture. The animals not only feed on pasture, but also on crop residues and a certain proportion of the agricultural output. Agriculture and livestock production are not independent of each other, as there are numerous mutually advantageous interactions, both technical and economic. Certain agricultural systems are irrigated.

• **Landless systems** in which the animals are entirely fed on agricultural feed.

Both mixed and landless systems play a major role in world meat production. The development of livestock production is naturally governed by two different, sometimes contradictory, forces:

– feed supplies;

– market demand.

Depending on the livestock production system and production site (figure 1), one or other force may determine animal production dynamics. This interplay of constraints and opportunities is the starting point for changes in livestock production systems: this could mean their intensification, insofar that the appropriate technologies are both available and cost-effective, or even their extensification.

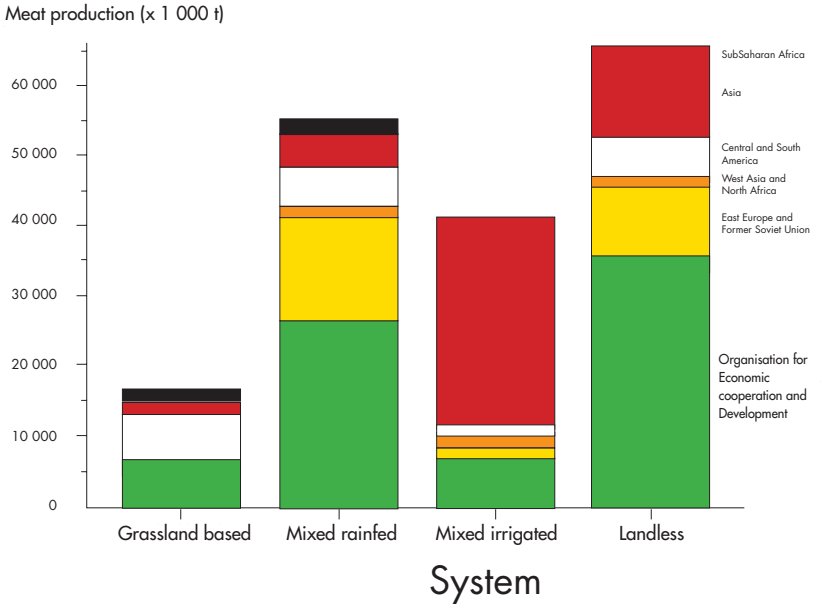

Figure 1. Relative importance of world meat production by type of production system and major world region (reproduced from WILSON, 1998, adapted from SERÉ, STEINFELD, 1996).
Production mondiale de viande en fonction des systèmes de production et des principales régions productrices. WILSON (1998), adapté de SERÉ, STEINFELD (1996).

It is often the case, particularly for extensive systems, that an increase in livestock production results from an increase in the number of animals reared, with no improvement in the performance of the system, in which case the pressure on the available resources increases proportionally. If, on the contrary, the increase in production partly results from intensification of the system, as is partly the case in mixed and above all in intensive systems, the environmental constraints change and new specific problems arise, for instance those linked to the use of concentrated feeds and waste products.

THE DIRECT IMPACT

EXTENSIVE GRASSLAND-BASED SYSTEMS

Grazing by ruminants has a significant impact on vegetation, its structure and its botanical composition, and consequently on local fauna. The whole landscape is modified and shaped by animals. The percentage of dry land under pasture worldwide is estimated at 26 percent.

In arid and sub-arid zones, heavy grazing often results in a reduction of herbaceous plant cover, which increases the risks of erosion and reduces woody scrub and tree cover (CARRIÈRE, TOUTAIN, 1995). The pastoral value of the remaining plants is satisfactory, but the available biomass decreases as grazing pressure increases. The development of water points contributes to land degradation. Around them, bare

Photo 2. After some years, pasturelands degrade and are invaded by ligneous vegetation. Mechanical equipment is required to restore them to their former state. Farmers then sell this land to large landowners. Paragominas, Pará State, Brazil.
Après quelques années, le pâturage se dégrade et il est envahi par des ligneux. Il faut des moyens mécaniques pour le réhabiliter. Les paysans vendent alors ces terres à de grands propriétaires. Paragominas, État du Pará, Brésil.

surfaces are caused by animal trampling, estimated at five to ten percent of the total area.

In the sub-humid tropics, the damage is much more marked: the plant cover decreases overall, erosion is exacerbated due to the heavier rains, and the changes in the flora generally favour species of little use to livestock production, making it less worthwhile.

In the humid tropics, particularly savannah zones, grazing reduces the competitiveness of grasses in relation to woody species, reduces the intensity of bush fires and favours bush encroachment and a return to forest (AUDRU, 1995). In tropical rainforests, grasslands set up after clearing are unstable, and without cumbersome upkeep techniques, they tend to give way to woody regrowth that grows into secondary forest (PIERRE *et al.*, 1995). Inadequate use of rangelands and pastures can eventually lead to a reduction in soil fertility.

Offsetting these apparently adverse effects on the vegetation, there is generally a high capacity for spontaneous regrowth once grazing pressure is lifted. The fact that livestock no longer ensures upkeep of the plant cover even has its own environmental drawbacks, such as a return to woody cover and the closure of landscapes, an increased risk of accidental fires and a reduction in the variety of ecosystems and in biodiversity (AUDRU, 1995).

In short, depending on the ecoclimatic environment, the long-term consequences of ruminant production on rangelands are quite varied, and it is impossible to draw overall conclusions as to the advantages or risks of developing extensive livestock production on rangelands. As long as changes in vegetation tend towards an improvement in the ecosystem or do not reduce the overall pastoral value, livestock production can be continued. If this is not the case, farmers eventually have to abandon the areas they have degraded. Once the signs of degradation, such as surface soil trampling, the appearance or spread of patches of bare soil, erosion and a reduction in soil fertility or invasion by weeds begin to spread, it is essential to reduce grazing pressure or introduce less damaging practices. This is the main aim of pastoral ecology.

MIXED FARMING SYSTEMS

Mixed crop-livestock production systems in the sub-humid tropics combine the adverse effects of land clearance for agriculture and overgrazing on rangelands. The drop in soil fertility, erosion and the disappearance of dry forests are all signs of degradation. In this context, livestock production should not merely be seen as an additional source of pressure on resources, but also as a means of improvement: animals can help improve soil fertility, use agricultural by-products and work the soil more effectively than can be achieved manually (D'AQUINO *et al.*, 1995).

In the humid and sub-humid tropics and sub-tropics, there has been little technological change in the way livestock are kept. Traditional technologies are clearly efficient in the use of local resources. Livestock is often of secondary importance in this system. Nevertheless, animal rearing provides farmers with an opportunity to diversify products and strengthen the economic stability of households. Even with low levels of technology, livestock enable:

- spatial allocation of nutrients to cropping areas;
- acceleration of the turnover of nutrients in the production cycle;
- a reduction in nutrient losses compared to agricultural production without livestock. In many places, the need for intensification increas-

Photo 3. Large estates–*fazendas*–are involved in livestock farming which pays off as long as the pasture is in good condition. Should the pasturelands degrade, they are abandoned, and the forest takes over. Paragominas, Pará State, Brazil.
Les grandes propriétés, fazendas, *maintiennent une activité d'élevage, lucrative tant que le pâturage est en bon état. Dans le cas où ce pâturage viendrait à se dégrader, il serait abandonné et la forêt s'installerait. Paragominas, État du Pará, Brésil.*

ingly brings livestock into cropping areas (STEINFELD *et al.*, 1998).

Technologies must be used appropriately to develop positive effects and avoid negative impacts on soils, vegetation and water. For example, heavy grazing of young fallow considerably delays soil fertility restoration, but can usefully be allowed on old fallow covered by perennial grasses.

INDUSTRIAL SYSTEMS

In situations where animal production is driven by market demand, particularly in the case of landless systems, high concentrations of animals, mainly close to human agglomerations, create enormous pollution problems and associated human health risks. Globally, industrial livestock production has in recent years grown twice as fast (4.3 percent) as mixed farming systems (2.2 percent) and more than six times as fast as grazing system production (0.7 percent). This type of production is growing rapidly in humid and sub-humid tropical zones (STEINFELD *et al.*, 1998).

Cereals are the major component of concentrated livestock feeds. Thirty-two percent of world cereal output is consumed by livestock. Areas of high animal concentrations are out of balance with the waste absorption capacity of the surrounding land: soils become saturated by nutrient surpluses. Excess nitrogen and phosphorus leach into groundwater, causing high nitrate levels in drinking water and damaging aquatic ecosystems. Heavy metals which are contained in feeds as growth stimulants (copper and zinc) may reach excessive levels and affect the fauna and flora of the soil.

INDIRECT CAUSES

DEMAND FOR ANIMAL PRODUCTS

Livestock rearing is an essential subsistence activity for certain groups of farmers for whom milk, wool, butter or fat, meat and leather are indispensable resources. However, it is more often a cash activity with the

Photo 4. Livestock farming is the most evident activity in the Sahel. Grass and shrubs provide fodder. Oursi, Burkina Faso.
L'élevage est l'activité la plus apparente dans le Sahel. Herbes et arbustes fournissent le fourrage. Oursi, Burkina Faso.

products being sent to market. For their owners, large ruminants represent an investment and an easily accessible capital. Owning livestock is also a sign of wealth, a way of expressing one's success and social standing.

The major driving force behind the surge in demand for livestock products is a combination of population growth, urbanization and income growth, especially in developing countries. The human population is currently growing by an annual 1.6% worldwide and 3.0% in sub-Saharan Africa (STEINFELD *et al.*, 1998; WILSON, 1998). The number of potential consumers of animal products is growing faster than the world population. The main reason for this is that the real incomes of consumers in developing countries have doubled since the early 1960s (STEINFELD *et al.*, 1997). Demand is soaring not only because there are more people with higher disposable incomes but also because of increased urbanization where much of the demand is concentrated.

PROPOSED MEASURES

The rapid rise in demand must be met without putting excessive additional pressure on natural resources. With the increasing scarcity of resources, livestock producers have to continue to look for technologies that increase resource use efficiency. In schematic terms, population pressure, animal population levels and economic growth have to drive livestock system development via the progressive intensification, specialization and organization of production. The challenge is to achieve greater efficiency without over-concentrating animal production.

Technologies result in different environmental benefits (STEINFELD *et al.*, 1997). We can distinguish between:

- those that simply reduce environmental damage by alleviating the direct pressure on natural resources or by reducing the pollution load;
- those that enhance natural resources and make them more productive, for instance mixed crop-livestock systems;
- those that save natural resources and make it possible to generate higher revenues from the same resource, particularly in feeding systems and by increasing diet efficiency;
- technologies that turn waste into products such as feed, energy and fertilizer.

It is also worth mentioning technologies for the rehabilitation of degraded areas.

Once it is clear that the environment has been degraded, it is essential to intervene so as to reduce or prevent further damage. Mechanisms that address the underlying causes of environmental degradation are likely to be more effective than those that address the symptoms. The instruments used to enhance positive and mitigate negative environmental effects include the development of incentive policies, regulations, infrastructures and producer awareness of the environmental issues.

The challenge is to design policies that correspond to the intended social and economic objectives but at the same time comply with environmental sustainability (DE HAAN *et al.*, 1997; STEINFELD *et al.*, 1997). The choice of policy instruments should take careful account of local institutions, infrastructures and income levels.

Institutions are required to develop environmental policies, enforce environmental regulations and monitor compliance. For traditional grazing systems, local empowerment is required: the need to transfer authority and responsibility for resource management to the lowest level at which it can be exercised effectively

Photo 5. Watering holes, ponds and bore holes are daily gathering places. The surrounding area is heavily trampled and degraded, sometimes over several kilometres. Biltine, Chad.
Les points d'eau, mares ou forages, sont des lieux de rassemblement quotidiens. Les alentours sont très piétinés et dégradés, parfois sur plusieurs kilomètres. Biltine, Tchad.

Photo 6. Savannah fires, lit by hunters, livestock rearers and farmers help to maintain an open countryside.
Allumés par des chasseurs, des éleveurs ou des agriculteurs, les feux de savane contribuent à maintenir un paysage végétal ouvert.

is increasingly recognized. Community-based wildlife management is becoming generally accepted as an essential component of sustainable wildlife management and in managing livestock-wildlife interactions. Property rights instruments have the potential to grant resource users a tangible interest in the environmental consequences of their actions.

Incentive policies rely on market prices. Grazing pressure may be reduced by increasing the cost of rangeland grazing: for example, full-cost recovery of water and animal health services, or taxation or fees for pasture in certain areas. An appropriate benefit-sharing system could encourage farmers by special incomes or subsidies for landscape or resource maintenance and could charge those damaging the environment with taxes. Incentives include subsidies for investments in improving technologies reducing environmental hazards.

The priority issues expressed during the Wageningen workshop (NELL, 1998) were:

- the need for informed decision-making by a participatory approach, the establishment of a database on the livestock-environment interaction, the generation of information, for example on the impact of policies on those interactions, the consequences of poverty on the environment, training and education, development of research;
- the need for consistent and appropriate policies, balanced with other policies and sectorial strategies;
- institutional development to strengthen the participatory process, reinforce regulations and encourage private sector investment.

CONCLUSION: CURRENT DEVELOPMENTS

To ensure the widest possible dissemination of the information available on the interactions between livestock production and the environment, the instigators of the study have decided to set up a virtual centre intended to facilitate the exchange of knowledge between environmentalists and farmers. It will permit the circulation of information on research results, and make it possible to publicize and build on practical examples and coordinate studies of new problems in a wide range of situations.

At the same time, an environmental toolbox is also being developed. It is intended to provide policy makers and planners with a practical aid to decision-making within the field of livestock environment interactions. This should facilitate the systematic introduction of environmental objectives into the design of livestock projects, development programmes and policies.

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RÉSUMÉ

CONTRÔLER L'IMPACT DES SYSTÈMES D'ÉLEVAGE SUR L'ENVIRONNEMENT : UN DÉFI POUR LE FUTUR

Une étude internationale – pilotée par la Banque mondiale, la FAO et l'USAID, impliquant la Commission de l'Union européenne et des bailleurs de fonds européens et américains – a porté sur les interactions entre l'élevage et l'environnement sur le plan mondial. Les impacts directs de la dégradation ainsi que les risques liés à l'élevage ont été mis en évidence. De plus, les causes indirectes – principalement économiques et sociales – ont retenu l'attention, afin de préciser les liens entre les politiques de développement de l'élevage et l'utilisation des ressources naturelles et finalement d'améliorer les mécanismes de prise de décision. L'étape actuelle consiste à mettre au point des outils pour évaluer et suivre les impacts environnementaux dans les futurs projets de développement et à choisir de nouvelles politiques.

Mots-clés : système d'élevage, environnement, protection.

ABSTRACT

CONTROLLING THE IMPACT OF LIVESTOCK PRODUCTION SYSTEMS ON THE ENVIRONMENT: A CHALLENGE FOR THE FUTURE

An international study directed by The World Bank, FAO and USAID involving several European and American donors concerned interactions between livestock and environment throughout the world. Three main production systems have been identified: extensive grazing system, mix-farming system and landless intensive system. Positive and negative impacts on the environment have been analyzed in the main eco-climatic regions. The main direct impacts of degradation caused by livestock have been highlighted. Nevertheless more attention has been paid to the indirect causes–mainly economic and social–in order to establish a clearer linkage between livestock development policies and resource use, and to improve decision making. The current approach is to devise tools for assessing and monitoring environmental impact applicable to new livestock development projects and new policies.

Key words: livestock farming system, environment, protection.

RESUMEN

UN RETO PARA EL FUTURO : CONTROLAR EL IMPACTO DE LOS SISTEMAS DE GANADERÍA SOBRE EL MEDIO AMBIENTE

Se ha llevado a cabo un estudio internacional sobre las interacciones entre ganadería y medio ambiente en el plano mundial dirigido por el Banco Mundial, la FAO y la USAID, con la participación de la Comisión de la UE y de proveedores de fondos de varios países europeos y americanos. Los impactos directos de la degradación y los riesgos vinculados a la ganadería han sido puestos en evidencia. Además, las causas indirectas, principalmente económicas y sociales, han sido objeto de atención para precisar los vínculos entre las políticas de desarrollo de la ganadería y la utilización de los recursos naturales y, finalmente, mejorar los mecanismos de toma de decisiones. La etapa actual consiste en poner a punto instrumentos para evaluar y seguir los impactos medioambientales en los futuros proyectos de desarrollo y en elegir nuevas políticas.

Palabras clave: sistema de ganadería, medio ambiente, protección.

SYNOPSIS

CONTRÔLER L'IMPACT DES SYSTÈMES D'ÉLEVAGE SUR L'ENVIRONNEMENT : UN DÉFI POUR LE FUTUR

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Les ressources naturelles mondiales ne sont plus illimitées. La conférence internationale de Rio de Janeiro, en 1992, a marqué la prise de conscience. Depuis cette époque, l'impact sur l'environnement des animaux domestiques, en constante extension, a été mis sérieusement en question. Des situations préoccupantes, associées de façon évidente à l'extension de l'élevage ont été invoquées pour justifier un courant défavorable aux activités de production animale : en particulier l'impressionnante déforestation de la forêt vierge amazonienne au profit d'énormes *fazendas*. La désertification à l'œuvre dans les régions subarides, notamment au Sahel, a fait la une des journaux à l'occasion de plusieurs séries d'années sèches. Dans les pays tempérés densément peuplés, on évoque la pollution des sols et des nappes phréatiques dues à l'intensification agricole excessive et aux quantités considérables de déjections animales. Face à la faim dans le monde, le débat a été lancé sur la compétition de l'alimentation animale pour les céréales. La sauvegarde de la flore et de la faune se heurte à la réduction inquiétante des habitats naturels. Ainsi, les questions suivantes sont-elles posées : l'élevage a-t-il sa place dans le « jardin planétaire » ? Quelle place lui assigner dans la perspective d'un développement durable ?

Des organisations internationales (Banque mondiale et FAO) et des bailleurs de fonds européens et nord-américains se sont unis au sein d'une initiative commune pour faire un bilan objectif des interactions entre l'élevage et l'environnement dans le monde, plus particulièrement dans les pays en développement. Une série d'études a été commandée depuis 1993, complétée par un forum électronique et une conférence internationale (Wageningen, Pays-Bas, 1997).

DRESSER UN BILAN

Pour les besoins de la cause, on a distingué trois grands systèmes de production en élevage : les systèmes extensifs pour les ruminants essentiellement nourris au pâturage, les systèmes mixtes dans lesquels certains produits de la ferme servent à nourrir les animaux et les systèmes industriels ou hors-sol, dans lesquels les animaux, majoritairement monogastriques (porcs et volailles), sont entièrement nourris avec des aliments spécialement produits et préparés. Les dynamiques de ces systèmes de production répondent de façon différente selon les contextes à deux sollicitations distinctes : la disponibilité en aliment et la demande du marché. Les évolutions vers l'intensification ou, au contraire, vers l'extensification résultent principalement de facteurs techniques et économiques.

Les impacts directs de l'élevage sur l'environnement – qu'il s'agisse du sol, de l'eau douce, de la composition de l'atmosphère ou de la biodiversité – diffèrent beaucoup selon les zones écoclimatiques. En régions arides et subarides, ils altèrent le couvert végétal et érodent les sols. Mais, en même temps, une pression pastorale modérée contribue à l'ameublissement superficiel bénéfique du sol et à la diversité des espèces végétales. Sous un climat tropical subhumide, la dégradation du pâturage se traduit, en fait, par l'embuissonnement qui favorise des espèces de peu de valeur et l'évolution vers une végétation boisée. Dans les zones tropicales humides, les pâturages installés après la déforestation tendent à se dégrader sans un entretien relativement lourd, en évoluant vers une forêt secondaire ; le processus se solde par une réduction considérable de la biodiversité.

Dans les zones agricoles tropicales, le défrichement et le surpâturage entraînent la baisse de la fertilité du sol, l'érosion et la disparition des forêts sèches. Dans ce contexte, l'élevage peut être pourvoyeur de fertilisant par le fumier, d'énergie par la traction animale et il valorise économiquement des sous-produits. Selon les modes de production utilisés, le bétail peut avoir un rôle important pour la viabilité économique des exploitations et il contribue au recyclage des éléments fertilisants. Il peut être nécessaire dans une optique d'intensification agricole. Le bilan entre des effets négatifs et des réponses positives de l'élevage sur l'environnement dépend largement des choix techniques et des modes de production.

Les systèmes industriels sont pilotés par la demande du marché. Ils s'accroissent le plus vite actuellement, notamment dans les zones tropicales humides et subhumides. Les principales matières premières sont les céréales (32 % des céréales mondiales sont consommées par les animaux). Les déchets produits posent un problème de recyclage sur les terres agricoles en raison de leur abondance. Ils saturent les sols en nutriments, notamment en azote et en phosphore, et ils contribuent à la pollution par les nitrates et à l'eutrophisation des eaux douces.

AGIR SUR LES CAUSES

Plutôt que d'agir sur les symptômes directs de la dégradation, il faut remonter aux causes indirectes pour pouvoir intervenir et trouver des voies d'amélioration des systèmes d'élevage respectueuses de l'environnement. Les moteurs de la croissance de la demande en produits animaux, plus rapide que celle de la population mondiale dans les pays en développement, combinent l'accroissement de la population, l'urbanisation et l'augmentation des revenus. Il n'est pas d'autre solution que de conduire l'évolution des systèmes vers une plus grande efficience et de trouver, autant que possible, des solutions techniques et économiques adaptées à chaque contexte particulier et présentant, à la fois, un avantage de production et un avantage écologique. Ce sont les solutions « *win win* » des Anglo-Saxons.

Les voies d'intervention reposent sur des choix techniques selon le résultat attendu : réduire les dommages environnementaux, soutenir les ressources naturelles ou les économiser, transformer un impact négatif en un avantage écologique.

Cependant, les moyens d'action reposent principalement sur des instruments politiques d'incitation et de réglementation, sur le renforcement des institutions, sur l'amélioration des infrastructures, sur des investissements appropriés, y compris dans la recherche, et sur un gros effort d'information et de formation. Les développements actuels de l'initiative internationale LEAD hébergée par la FAO portent principalement sur ce dernier point, avec la mise en place d'un centre virtuel, base d'une animation destinée aux responsables du développement.