2
Livestock Development Approaches

Learning Objectives: Understanding
• The differences in livestock development focus
• The animal productivity paradigm
• The farm efficiency and integrated farming paradigm
• Where did it go wrong? Reasons for project failures in livestock development
• How climate change and food security call for a new approach
• Three levels of relatively untapped potential in livestock development

On Whom to Focus in (livestock) Development?
In this book, we especially focus on smallholder mixed-farming system. Within this system, we will distinguish between the low-input and diversified smallholder livestock keeping (Chapters 7 and 9) as well as on more specialized smallholder livestock-keeping activities (Chapters 8 and 10).

In (livestock) development, there is a wide array of views on the best way to achieve a positive outcome, in terms of food security, income generation, employment and (environmental) sustainability. Some argue that funds and efforts are best spent on specialized (middle-level) commercial farmers that have the capacity to hire other people as labourers; others argue that poor smallholder farmers and pastoralists need to be supported directly. As an example, in Table 2.1, the various arguments on this topic are presented, which are from a discussion between four development professionals during the 2006 German Tropentag in Hohenheim, Germany.

The Animal Productivity Paradigm
Most livestock policies, education and research in developed and developing countries are based on the animal productivity paradigm, common in the high-input commercial livestock production systems. The main aim within the productivity paradigm is to produce the highest amount of produce (milk, meat, eggs, honey, etc.) per animal per day, at the lowest monetary costs.

In itself, specialized livestock production based on the animal productivity paradigm is good news, especially in view of the need to provide inexpensive food for urban populations. However, politicians, donors and investors often prefer big, prestigious
### Table 2.1. Arguments for focusing on different farmer groups.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Arguments to focus on middle-level farmers (more specialized)</th>
<th>Arguments to focus on smallholder farmers (low-input and diversified)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which farmers to support?</td>
<td>We have to work with middle-level farmers, e.g. use a threshold over 10 ha, or farmers that can hire labour. Hunger has to do with purchasing power. People need money and employment. Therefore, development for marginal farmers is only possible through enhanced off-farm income generation.</td>
<td>We need to focus on the potentials of small producers, e.g. by using micro-credit.</td>
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<tr>
<td>Rural development or poverty reduction?</td>
<td>The objective is poverty reduction in rural areas, not rural development. The exclusive focus on agriculture can lead to a poverty trap. Poverty reduction requires e.g. schooling for girls, rural roads, etc. It is rare to hear about rural development in the international discussions.</td>
<td>Policy and research needs to be adapted to the marginal rural areas, where rural development is necessary – research needs to focus on low-potential areas. Governments have diminished support for marginal rural areas; there has been discrimination of the poorest farmers.</td>
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<tr>
<td>Local markets</td>
<td>Local markets cannot be depended upon; they fluctuate too much to stand as the basis of income generation.</td>
<td>We need to guarantee and defend local and regional markets, improve their products, enhance food storage and processing.</td>
</tr>
<tr>
<td>Global food chains and smallholder farmers</td>
<td>Global food chains are a major threat to smallholder farmers. Marginalization is increased by globalization. Poor farmers are not likely to participate in the globalized food chain. Small commercial farmers might be more successful.</td>
<td>We need to consider whether we want to invest in global food chains or regional ones. Modernization does not work for the poorest. Smallholder farmers have problems with economy of scale. International requirements are a disadvantage to smallholder farmers.</td>
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<tr>
<td>Work with marginal farmers</td>
<td>For marginal farmers, we have to stabilize their subsistence production. The only opportunities for smallholder farmers are their relative advantage in labour-intensive production activities. There is a need for technology transfer, e.g. related to land tenure, property rights and increased production of smallholder farm enterprises.</td>
<td>We have to decrease vulnerability, e.g. through direct marketing, payment for environmental services, tourism etc. Identify innovations at the local level. People often do not pick up an innovation in the way it was intended, but these are often used in other ways (e.g. toys made from cola tins). We also need to guarantee access to land and the tenure of property rights.</td>
</tr>
<tr>
<td>Policy level</td>
<td>At policy level, we have to create a 'level playing field' that makes it possible for smallholder commercial farmers to participate. This requires supply chains and support to farmers' organizations, etc. There is a need for a public–private interface, but there are difficulties in the interaction.</td>
<td>Smallholder farmers need a functioning system to participate in decision making.</td>
</tr>
</tbody>
</table>
projects rather than building on local initiatives. Decisions about livestock development are often made in capital cities, not in villages or pastoral encampments. Not everyone benefits from these intensive, specialized livestock production systems.

The social and environmental costs are most often not included in the calculations and are often difficult to agree upon. Development based on the productivity paradigm includes the premise that high-input and specialized animal production systems – especially intensive poultry, pig and dairy farms – will provide inexpensive, high-quality and abundant food for the population, as well as a livelihood for the farmers involved. These policies are primarily aiming at supporting specialized, commercial and high-input farming operations.

The high-input livestock production systems are growing at an unprecedented rate in developing countries as well as in other parts of the world. These are sometimes supported by large international companies with major economic and political power, such as the fertilizer and chemical industries, genetic industries such as Monsanto, as well as the soy-lobby and the lobby of animal industries, to name but a few. This process, also called the Livestock Revolution, has numerous positive as well as negative impacts on smallholder agriculture (Mathias and Mundy, 2008).

As most of the rangelands/grasslands/pastures are too dry, too wet, too cold or too high to be cropped, these areas can be used agriculturally only through agro-pastoral livestock production, which supports several hundred million people.

In developing countries, the majority of rural households are smallholder crop-livestock farmers. Livestock are an integrated part of their agricultural systems that stand as the basis of the farm and family life in many parts of the world. In most rural communities in Asia, Latin America and Africa, livestock are essential for draft power, organic fertilizer and transportation. They are a source of nutritional protein, wool, leather and fibres. Raising animals is also a form of security against climatic and economic risks, and a means of accumulating and maintaining financial reserves.

In this way, animals optimize the efficiency of the farm as a whole, in terms of soil fertility, energy efficiency and minerals such as nitrogen and phosphorus. This is increasingly perceived as an option for food security and poverty alleviation, as well as climate change adaptation and mitigation.

This integrated farming paradigm is also being recognized within high-input dairy in developed countries, such as in The Netherlands. It is based on optimizing the efficiency of the dairy farm as a whole, and on increased soil fertility and natural resistance of soils, animals and plants. In this way, fewer inputs in terms of commercial fertilizer and pesticides/herbicides are needed, as well as reduced input of concentrate feeds. This increases farm efficiency, both in terms of energy efficiency and of soil minerals such as nitrogen and phosphorus, and stimulates farmer income. This is increasingly perceived as an option for food security, poverty alleviation, and climate change adaptation and mitigation (see Box 2.10 at the end of this chapter).

The Optimizing Farm Efficiency and Integrated Farming Paradigm

The livelihoods of millions of small-scale families in marginal areas of the developing world depend on livestock, in mixed farming systems, (agro-) pastoralism systems or agro-forestry systems that include several livestock species.

FAO statistics (FAO, 2009) indicate that 69% of global agricultural land and 26% of total land is covered by agricultural pastures, rangelands and grasslands. Mixed farming and agro-pastoralist systems occupy a potential of some 2.5 billion ha of land, of which 1.1 billion ha are arable rain-fed cropland, 0.2 billion are irrigated cropland and 1.2 billion ha are grassland.

Where Did it Go Wrong?

Male and female farmers on marginalized lands with limited capital, formal education and opportunity continue to depend
on low-input agricultural practices. In supporting livestock development in these areas, however, these diverse and low-input farming strategies are often perceived as a problem rather than a potential. This lack of understanding of the socio-economic and cultural reality of the families, the role of the animals within their integrated farming system, combined with top-down methodologies, has resulted in a disappointing impact of livestock development efforts in terms of poverty alleviation (Box 2.1).

Some of the causes of lack of impact found with greater frequency are:

1. Changing production systems. Projects tend to change the production system for another, generally from a low-input and diversified system to a more specialized system, without taking into account the social implications and risks of this process for the families involved. In addition, they want to implement activities and technologies based on the productivity paradigm without considering aspects of farmer knowledge and (ethno-veterinary) practices of the people involved.

2. Lack of social and cultural sensitivity. In many projects, a thorough analysis of the reality of the families involved is missing, especially in relation to their ways of perceiving the world (worldviews), the logic of their local (integrated) production systems, the function of animals within this reality and how the families perceive the project. This lack of social and cultural sensibility may have to do with the changing and abstract development approaches shown in Fig. 2.1.

3. Over-ambitious project objectives. Often the objectives of the projects are too ambitious, including too much territory or too many communities. In these cases, there is an imbalance between activities established by the project and what can concretely be achieved. Thus, in practice, the achievements in each one of the communities can be limited, often by logistical reasons such as transport, but also by factors such as unfavourable climate, lack of institutional support and personal problems of the extension workers involved.

4. Not including women. Many projects are mainly directed by men, whereas those principally responsible in animal husbandry, especially in low-input diversified husbandry, are women (Kristjanson et al., 2010). The difficulties in establishing relationships between the extension workers and the women are great. When the extension workers speak the native language of the population, their relationship with the women is generally considerably easier.

5. Top-down methodologies. Personal ideas and the education of the extension workers sometimes clash with the reality of the farm families, affecting the exchange of ideas and dialogue necessary to establish a true participatory process. In the planning phase, even with ‘participatory activities’, the basic ideas generally come from the extension workers of the implementing organization rather than from the farming community members themselves.

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**Box 2.1. Review of livestock development efforts.**

A somewhat dated but comprehensive review of 800 livestock projects (Livestock in Development, 1999) concluded that many projects have had disappointing results in terms of poverty alleviation. The diffusion and adoption of the livestock technologies promoted by governments and non-governmental organizations (NGOs) so far has been very limited and very often they have not helped the poor. The report attributed this to the lack of focus on poverty. In most cases, the technologies offered were not appropriate and were imposed on people using a top-down approach, without mobilizing their own strengths and resources, and without regard for existing traditional knowledge and institutions. The approach fails to recognize the multi-faceted role of livestock for human society, and ignores other dimensions.
6. Lack of practical experience. Several organizations, especially NGOs, have a gender department. In the case of income-generation projects for women, livestock activities with pigs, chickens or guinea pigs are frequently initiated. In addition, they are often communal projects. These projects have confronted many problems, such as the lack of technical and economic experience, unexpected changes in the male–female relationships because of the project, and the difficulties related to a communal farm.

7. Power differences in managing funds. The projects have to render accounts of their effect to donors, state organizations and NGOs rather than to the population’s own organizations. The relationship between the project, the extension workers and the families involved implies differences in power, especially relative to the management of funds. As a result, there is a lack of real coordination between the extension workers and the families that finally resign themselves to ‘whatever comes of it’ instead of taking charge of the project.

8. Communal livestock projects. There are many ideas and ideologies related to the support of the communal organization via community livestock projects. The success or failure often depends on previous experiences and organization structures. Community organization is more frequent within pastoralist societies, for example the joint shepherding of sheep or llamas among groups of families in the Andean region. Amongst smallholder farmers, however, the husbandry of cows and other species such as poultry, pigs or guinea pigs is generally done near the house. For this reason, many communal projects with these species in smallholder farmer communities have failed (Box 2.2).

9. Introduction of exotic breeds. The introduction of exotic breeds is widespread in
Box 2.2. Failure of communal chicken project in Nicaragua (van't Hooft, 2004).

In an indigenous town on the Atlantic coast of Nicaragua, some 10 h by boat from a town with a commercial market, an extension worker from a local NGO designed a communal poultry project with exotic laying hens, balanced feed and the other elements of specialized chicken production. The women of the community constructed a communal chicken farm and initiated the husbandry project. In a short time, the animals began to die from cannibalism because - when the expensive shipments of balanced feed did not arrive on time - the women began to substitute with local feedstuffs. This caused under-nutrition and stress in the high-productivity hens. The women gradually moved away from the project. When the women who had continued arrived at the conclusion that the best solution was to divide the hens and to include them into their home husbandry activities, the extension worker of the NGO ‘prohibited’ such action. He promised to ship in another load of balanced feedstuffs. The communal chicken farm failed several months later.

livestock development projects in developing countries. There are numerous reasons for the frequent failures - the introduction of animals of exotic breeds, such as Holstein dairy cows and Corriedale sheep, for example. Sometimes these new breeds are introduced without the existence of adequate husbandry conditions (Box 2.3) or motivation on the part of the families to change the system of husbandry to a more intensive system. Numerous examples have shown that animals of exotic and specialized breeds, upon being introduced to their new environment, are confronted with a series of limitations that they cannot cope with because of their sensitivity to lack of food, diseases and parasites.

10. Not including animal species relevant to the poor. The livestock-keeping systems of poorer households tend to include a wide number of livestock species with the aim of minimizing and spreading risks. For example, most rural families keep poultry, but that is not limited to chickens only, as chickens are highly susceptible to the common and fatal Newcastle disease. It is common to find poultry flocks that include ducks, turkey and guinea fowl. Other fowl species used are doves and quails. These animal species often provide culture-specific products, dishes and services. Most poultry projects, however, are limited to the most commonly used animal species in intensive animal production: chickens.

11. Micro-credit linked to improved animal health practices. Efforts to increase income of poor rural farmers through micro-credit loans are often directly or indirectly linked to improved animal health practices that require higher inputs. Many of these programmes introduce Green Revolution technologies, such as crossbreeding with highly productive breeds, use of commercial fertilizer, improved seeds and other commercial inputs. Painful experiences have shown that long-term effects can be quite the opposite, especially in environmentally risky areas. These measures have frequently led to serious environmental degradation, the genetic loss of resistant local breeds, and high vulnerability and financial drawbacks to the families involved.

12. Disease control depopulation schemes (Geerlings, 2007). Killing of flocks and other individual animals in the face of disease control programmes is another element that has resulted in negative experiences, especially of the most vulnerable livestock-keeping families. Examples are the eradication of poultry in the avian influenza outbreaks between 2006 and 2007, and hog cholera/African swine fever outbreaks. Broad-spectrum disease control practices need to include components that are designed for the smallholder as well as commercial producers.
Box 2.3. Example of exotic breed that failed to adapt to its new environment (van’t Hooft, 2004).

In the humid tropics of Bolivia, the introduction of white pigs, such as the Yorkshire and Landrace breeds, has not worked. One of the adverse factors has been the existence of vampire bats which attack and suck blood. Because of this, the female pigs may lose their nipples before the first birth and consequently they lose their ability to raise their young. This problem affects the local breeds with red or black skin less than the exotic white-skinned breeds.

Climate Change and Food Security Call for a Renewed Approach

Rarely does one see images of farmers ploughing fields, planting seeds or feeding animals in relation to climate change. Indeed, until recently, agriculture – particularly in developing countries – has been largely absent from climate change and food security discussions. However, farming is intimately involved in climate change. Agricultural activities, including forest clearing, fertilizing soil and transporting produce, and indeed livestock farming, contribute significantly to global greenhouse gas emissions (FAO, 2006).

Meanwhile, farmers, particularly in developing countries, are also the major victims of climate change. They are threatened most by climatic changes such as shifting rainfall patterns and more extreme and unpredictable weather.

As Carlos Seré, Director General of the International Livestock Research Institute (ILRI) in Kenya, reported in his paper, 'No Simple Solutions to Livestock and Climate Change' (2009):

Livestock emissions depend, however, on how animals are raised and fed. Grain-fed, factory-farmed cattle in industrialized countries emit much higher levels of greenhouse gases than the grass-fed, family-farmed cattle in developing countries. Most people who keep cattle in developing countries are either small farmers who feed their animals available vegetation with seasonal supplements of stalks and other harvested crop wastes, or herders who periodically move their stock in search of new sources of grass and water. Both these groups have very few alternatives for making a living beyond crop and livestock farming and both leave a relatively small environmental footprint. For example, all of Africa’s cattle and other ruminants contribute just three per cent of global livestock methane emissions.

Achim Steiner, the Executive Director of the United Nations Environment Programme, presented the role of sustainable agriculture for climate change mitigation during the EU Agriculture and Climate Change conference in Brussels:

We should not only invest in high-technological solutions, but rather invest in smallholders farmers. We have to do this. Without attention to agriculture and food security there can never be an agreement with developing countries in Copenhagen.

(article Volkskrant, 27 June 2009)

Olivier de Schutter, the UN Special Rapporteur on the Right to Food, also presented this view during a debate in the series ‘The Future of Agriculture and our Food’ (Rode Hoed, Amsterdam, 10 November 2009):

The UN now recognizes that it has been a mistake to exclusively support large agricultural enterprises. The Green Revolution model has produced more food and more hunger at the same time. Alternatives are silenced, not taken serious or widely under-estimated. In reality, agro-ecological farming is extremely productive per hectare. It is necessary to re-invest in smallholder agriculture.

The required changes are those proposed in agro-ecological farming and sustainable
Livestock are increasingly being cited as one of the major producers of greenhouse gases; some reports even indicate a contribution of 31% of the total of greenhouse gases produced. Replacing livestock products with meat and dairy analogues based on soy, rice or wheat is suggested as the most desirable way out. Unfortunately, reality is more complex than this. Livestock is not produced in one way, which can simply be replaced. Livestock emissions largely depend on how animals are raised and fed. Grain-fed, factory-farmed cattle emit much higher levels of greenhouse gases and other environmental effects than the grass-fed, family-farmed cattle, although their emissions per kg of milk produced is lower.

Fortunately, other international reports (IPCC, 2007; FAO, 2009) indicate another way out: increased sequestration of soil carbon through sustainable use of soils and other resources in agriculture. These reports estimate that 90% of the total mitigation could come from sink enhancement (soil carbon sequestration) and about 10% from emission reduction. Although not explicitly mentioned in the reports, this puts livestock in a different perspective.

Different livestock species are farmed as an integrated part of mixed farming systems, agro-forestry systems, pastoralist and agro-pastoralist systems throughout the world. There is an enormous scope for building on the experiences gained by supporting soil fertility within both smallholder systems as well as industrialized livestock-keeping systems. This can have a surprising win-win effect in terms of both food security and climate change.

More recent reports on the link between food security and climate change (FAO, 2010b) — indicate that (sustainable) intensification of livestock production is the only way to reduce the emission of greenhouse gases from the livestock sector. It remains to be seen what effective measures will be taken in practice to promote this sustainable intensification: based on an integrated ‘smart-climate’ approach or rather on the conventional ‘increased animal-productivity approach’.

Three Relatively Untapped Resources

Most agricultural policies and curricula still tend to focus on the productivity paradigm within high-input (semi-)industrial livestock production systems, and fail to differentiate their strategies according to the animal production system. They tend to promote replication of standard knowledge rather than stimulating the creative thinking needed to confront the major social and environmental challenges ahead. The agro-pastoralist and mixed farming systems tend to receive little attention and support within education and government programmes. It leaves problems unanswered and it underutilizes their unique potential.

One can state that there are three relatively untapped resources that can stand at
the basis of new initiatives in sustainable (livestock) development: (i) lessons from innovative farmers; (ii) lessons from successful field-level organizations; and (iii) lessons from intensive livestock keeping in developed countries.

Lessons from innovative farmers

Mostly poor farmers in agro-pastoralist and mixed farming systems are less capable of profiting from increased demand of animal products in global markets and they have less access to ‘general solutions’, such as privatized animal health systems. They do have specific local challenges, however, and they represent an opportunity to develop local solutions to local problems while making a living by producing food and adapting to climate change (Boxes 2.5 and 2.6). Their obstacles are many, such as degraded natural resources, lack of financial resources, access to new skills and knowledge, weak institutions, inadequate infrastructure and poor governance. With proper approaches, however, this is a relatively untapped potential in the process of adapting to the various ecosystems.

The large variation in these systems together with their unique combination of livestock, crops, soils and society can provide clues for sectors other than only livestock production. Moreover, the integrated nature of their soil–plant–animal–people systems can have low CO₂ footprints and positive effects on many Millennium Development Goals (MDGs), while also providing options to adapt to climate change.

Lessons from successful field-level organizations

There is a second untapped potential for livestock development available. This lies in successful service providers to these farmers, such as NGOs, farmer organizations, private enterprise and educational institutions – organizations that managed to combine formal education with successful field-based work to ‘produce’ professionals that are better equipped to work in sustainable development. Such service providers have developed methodologies to cope with the specific challenges in these systems. They are based on time-tested relations with their farmers, use of local skills and resources, and balanced input of external resources within local realities and culture (Boxes 2.7, 2.8 and 2.9). Much of this work is relatively unknown outside their direct development circle.

Box 2.5. Innovation from a South African farmer: offering leafy branches (Letty and Waters-Bayer, 2009):

In Msinga, KwaZulu-Natal (KZN), many households have indigenous goats, and women in the household are often involved in managing them. The goats go out to graze during the day and must be brought home in the evening to ensure that they are not stolen or taken by predators. Because the goats must cover long distances to be able to find enough feed, a great deal of time is often needed to find them and bring them home in the late afternoon.

One of the farmers encountered through the process of documenting local innovation was Mrs Marabela Mhla (Fig. 2.2). She had developed an effective means of ensuring that her goats returned home every evening without household members having to go and fetch them. She offers them various palatable leafy branches (e.g. Schotia brachypetala) and water when they return to the kraal. She discovered this mechanism by chance. She had kept several female goats at home while their kids were small and fed them with leafy branches lopped from indigenous trees and bushes growing naturally in the vicinity of the homestead. When the kids became older and she released the female goats for grazing, she found that they continued to return home in the evening and brought the rest of the flock with them.

This innovation has proved very useful for Mrs Mhla, as it has reduced the effort and time needed to ensure that the goats are kraaled at her home every night.

Continued
Box 2.5. Continued.

Fig. 2.2. Mrs Maduba Mbila in Msinga, KwaZulu-Natal Province uses palatable leaf branches to attract her goats home each evening. This reduces the time spent fetching them and losses from predators. Credit: Prolinnova South Africa.

Box 2.6. Another innovation: raised grass baskets (Letty and Waters-Bayer, 2009).

Mrs Mbuyisa keeps backyard chickens and has developed a system of raised grass baskets in which her hens lay eggs. This has proved effective as a way of making it easier to find and collect the eggs. The extension staff from the Mpumalanga Department of Agriculture are planning to assist her with growing supplementary feed for the chickens in an effort to prevent them from wandering out of her yard in search of food.

Mrs Dlamini is a member of a community that makes chicken nesting boxes out of the bases of sisal stems. The stem is stripped of leaves and hollowed out to create a nest. In addition, the women have found through informal experimentation that, if some burning grass is used to burn off the inside of the hollowed nest, a smoother surface is obtained, which creates a less favourable environment for external parasites. They also found that the nests insulate the chickens well and protect them from predators.
but this potential can be used more effectively, by strengthening mechanisms for exchange and joint advocacy.

**Lessons from intensive livestock keeping in developed countries**

Solutions found in intensive livestock production systems in the so-called developed countries, which have faced environmental challenges, can provide relevant options for farmers and organizations elsewhere. Examples are the dustbowl of the central US plains in the 1930s, Southern Australia in the 1980s, and the acid rain problems related with pollution caused by excessive use of inputs in industrial livestock systems in Western Europe. Experiences from these cases show that farmers with or without the official infrastructures can both

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**Box 2.7. Successful fleece improvement programme of local sheep (Perezgrovas, 2006).**

In Highland Chiapas, the Tzotzil ethnic group of Mayan origin derives up to 36% of its income from sheep husbandry and from the weaving of typical woolen clothes; government efforts have attempted to absorb the local wool sheep with high-producing breeds such as the Merino, without success. A different approach was attempted to improve the quality of wool in the local Chiapas sheep by means of animal selection, and a research project was designed utilizing an open nucleus scheme.

Commercial or industrial traits of high-quality wool (white, short, fine) were exactly the opposite of those developed by the local weavers (coloured, coarse, double-coated, long). To account for the difference, groups of Tzotzil shepherdesses and weavers were invited in 1996 to collaborate as part of the sheep-improvement plan, directing research goals by means of their continuous assessment of fleece quality in the animals of the nucleus flock. This collaboration is put into practice by grading the quality of the fleece in all sheep under 24 months of age, prior to each 6-monthly shearing. The list of achievements in the first 10 years of this unique inter-ethnic collaboration includes a set of selection objectives for fleece quality, and a comprehensive understanding of the characteristics of wool in the local sheep and its relationship with the transformation of wool into clothes through an ancient textile process utilized over centuries by the Tzotzil women (Fig. 2.3).

As a result, current fleece variables within the improvement programme include: fleece quality, staple length, textile aptitude (proportion of coarse/fine fibres), greasy fleece weight and wool growth. Improved rams from the nucleus flock have been introduced within community flocks, and their offspring have inherited superior fleece-quality traits.

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**Fig. 2.3.** Improvement of local breeds of sheep by the Institute of Indigenous Studies of the University of Chiapas, Southern Mexico, is done in close collaboration with the Tzotzil women that keep them. Selection is done on the basis of the criteria of the shepherdess. Credit: Raul Perezgrovas.
cause and solve these kinds of challenges, often by finding local solutions to local problems.

One such example is the case of Dutch dairy farmers, who 're-invented' the importance of optimizing farm efficiency through the soil–plant–animal cycle (Fig. 2.4; Box 2.10). Other examples include the work of farmers around the world in the field of organic farming, fair trade and local food chains, often initially against mainstream policies.
Concentrate
lower footprint
lower protein content

Animal
healthy animals with high production
and lower methane emission

Milk and Meat
high quality with
low urea content

Roughage
more structure and
sugar, less protein

Manure
straw bedding, lower
ammonia emission,
higher C/N ratio

Lower emissions
Climate adaptation

Soil management
higher N uptake, better soil structure, higher organic
matter content, better water retention

Artificial fertilizer
decreasing doses

Fig. 2.4. Soil–plant–animal figure used to explain the ways to optimize nutrient cycles by Dutch farmers.

Box 2.10. Dairy farmers in The Netherlands are re-establishing the soil–plant–animal–manure cycle (Proost and van Weperen, 2006; van’t Hooft, 2010). See also Case Study 6, Chapter 12.

Agriculture in The Netherlands only 50 years ago was quite similar to agriculture in developing countries: family farms with a diversity of activities, combining low-input crop production with various species of livestock and numerous other activities. After the hunger of the Second World War, agricultural policies since the 1960s were aimed at "no more hunger" and aiming at highest yields through specialization, mechanization and market protection (fixed prices): the productivity focus. In this concept, production is measured in litres per day or year, rather than life production. Crop and livestock production became disintegrated, with farms specializing in one or the other.

In the 1960s, the average Dutch dairy cow produced 4000 kg milk per year. In 2001, this was about 8000 kg (Fig. 2.5). After several years, however, the negative side-effects also became clear. The high productivity resulted in low milk prices. Gradually milk producers became dependent on subsidies for a decent income. At farm level, the mineral efficiency (nitrogen and phosphorus) also showed a downward trend, as did farm income and animal life span. The environmental problems led to new policies to handle manure and minerals, which further reduced soil fertility. With declining income and degraded resources, many dairy farmers decided to leave farming. The number of dairy farms has been reduced by nearly 90% since the 1960s (LEI Wageningen UR, 2010).

Today new dairy initiatives are in three main directions: (i) further scale enlargement and intensification; (ii) diversification of farm income, by offering new services (tourism, local markets, care farms); and (iii) increase farm efficiency and total life production on the basis of soil fertility and biodiversity through the cycle approach.
Duurzaam Boer Blijven, which roughly translated means ‘continue farming the sustainable way’ is an initiative that supports dairy farmers to improve the efficiency of their operations. It builds on initiatives from farmers in the northern province of Friesland who were concerned over problems arising from increasing loss of soil fertility, and the need to comply with new environmental regulations on ammonia and nitrate (Figs 2.6 and 2.7).

The approach encourages dairy farmers to look at their operations in terms of the ‘soil–plant–animal–manure’ cycle and examine means to reduce environmental impacts through controlling nutrient inputs more carefully. Much of the work is carried out in ‘study groups’ of farmers that get together to share information and encourage each other to try different activities on their farms.

The two key elements of the approach are effective communications between farmers and with research institutes, and the continuous monitoring of inputs and outputs. Because of this monitoring, the results are consistently being fed back to farmers so that they can see what effect the changes in their operations are having on farm outputs (e.g. milk), the financial situation and the nutrient balance in the soil and water.

Farmers using the approach have significantly reduced their input costs through reductions in fertilizer and concentrates, and through decreased veterinary bills, as fewer animals get sick and they live longer. The approach has also led to improved soil fertility and improved pasture, which results in higher roughage production per hectare of land, but most importantly, more farmers have decided to remain in farming, because of the economic, environmental and social advantages of this system.
Box 2.10. Continued.

**Fig. 2.6.** Dutch farmers learn together in study groups, looking at the results of improved soil–plant–animal management on each other’s farm.

**Fig. 2.7.** Soil quality is improved through reduction and adequate use of artificial fertilizer and concentrates, in combination with other soil-improvement practices.
Reference and Further Reading


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Hooft, K. van’t (2009) Livestock friend or foe, the need to look at different production systems in the debate about livestock & climate change. Available at Endogenous Livestock Development Network. http://www.eldev.net/


