Scarcely noticed by the general public, the global livestock industry is going through a rapid process of concentration. Company takeovers and co-operation agreements proliferate and technology is changing fast. Patents are flying out for genetic material, and other proprietary strategies are being vigorously pursued. In a process that bears an uncanny resemblance to what has happened to the global seed market, the breeding sector – now renamed "livestock genetics" – is becoming the nerve centre of the industry and extending its control over livestock farming. Quick to seize the opportunity, agro-giants such as Monsanto are moving in.

Livestock breeding in the hands of corporations

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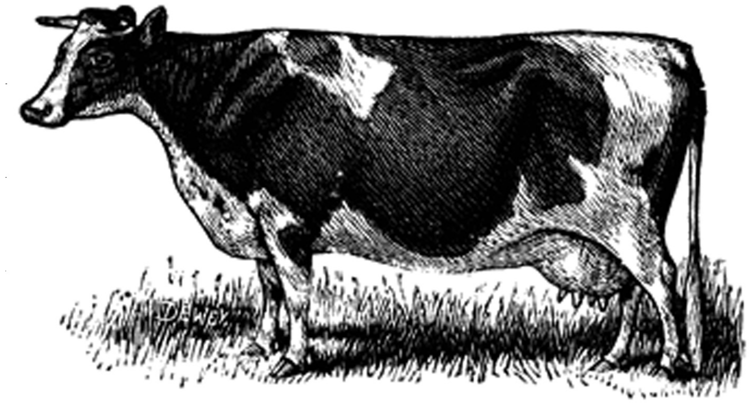
Like many other sectors of farming, the livestock industry has been through a process of radical change over the last decade. The proliferation of free trade agreements, both multilateral and bilateral, has led to an unprecedented growth in international trade in livestock products. Cheap imported meat has flooded the markets of countries in the South. Even though in many of these countries smallholders contribute up to a third of national economic output, they have received very little public support to withstand the influx. Unable to compete, many have been driven out of business. Many African farmers, for example, lost their livelihoods when first milk powder and then low quality chicken parts, originating from the European Union, were dumped in their countries. Thousands of chicken farmers in the Philippines went bankrupt during the "Broiler Crisis" in 1999–2000, when huge quantities of cheap poultry were imported from the USA. Today smallholders in many parts of the world, particularly in Asia and Latin America, have to accept extremely unfavourable contract deals to provide cheap raw material to large meat and milk processors. The smallholders mostly receive breeding stock, feed, and veterinary services from the same company that buys the product. Government policies are generally supportive of this industrial livestock system, providing it with significant subsidies and tax exemptions, as well as drawing up health regulations that favour industrial livestock production and discourage smallholders.

These far-reaching economic changes have been facilitated by a technological revolution that is allowing industrial companies to take control of livestock farming. In **poultry breeding** a key innovation was the introduction of the hybrid chicken, first developed in the 1940s by former

US President Henry A. Wallace. Applying the same principles that he had used to develop hybrid corn (maize), he discovered that productivity usually increased when two different lines (one carrying female traits such as prolificacy [number of offspring], the other carrying male features such as muscle growth) were crossed. This effect is called "hybrid vigour". The emerging poultry industry took full advantage of this new technology to develop lines of chickens that, when crossed, would maximise the qualities sought. This meant breeding chickens that, in the case of layer hens, would produce a large number of eggs and, in the case of broilers, would grow rapidly and produce tender white meat. A range of other products, including special concentrated feed and veterinary pharmaceutical drugs, were also developed to make factory farming viable and to maximise output. Today industrial farming is responsible for about two-thirds of the world's broilers and about half of egg production.

In response to the huge market opportunities that came with hybrid technology and lower prices, breeding, multiplication and fattening were developed as three separate industries: multipliers buy the chicks from the lines bred by the breeders and sell the next generation to the farmers for fattening. To make sure that the farmers remained dependent on them, the breeding companies introduced into this process something that can best be described as a "biological lock". Hybrid vigour lasts for only a single generation, which means that hybrids have to be permanently bred from pure lines. To make sure that the multipliers do not start rearing their pure lines and thus competing with them, the companies provide the multipliers with only male chickens from the male line and female chickens from the female line. This means that the multipliers must return to the breeding companies each generation for further supplies of breeding stock, and farmers must return to the multipliers to buy the chickens for fattening.

The concentration of the **cattle breeding** industry has also gained momentum in recent years. There are no hybrid breeding lines yet, but artificial insemination was introduced during the 1940s and is widely used. This permits one high-performance bull to have up to a million offspring. Most commercial dairy farmers buy semen from these high-performance bulls. Even when by chance a farmer develops a world-class bull, the marketing of its semen is usually handled by a large company. About two-thirds of the world's milk is produced by high-output cows. These are cows that have been carefully bred around a few clear objectives:



http://etc.usf.edu/clipart

Nineteenth-century drawing of a Holstein cow

to maximise the amount of milk they produce and its fat content; and to ensure that they use their feed efficiently. The lifespan of these animals is now reduced to three or four years, so dairy farmers need to buy replacements more often than ever before.

The concentration of the **pig breeding** industry was slowed down by one technical problem: artificial insemination is not as successful in pigs as in cattle. If inseminated with deep-frozen pig semen, sows have on average 10 per cent fewer litters and each litter contains one fewer piglet than would be the case if fresh semen were used. However, fresh semen remains viable for only a short period. For this reason live boars were widely employed until very recently, which facilitated the survival of pig farmers' associations and co-operatives. But their days now seem numbered: the companies are trying to place restrictions on insemination from live boars, pointing out that it entails a greater risk of infection. Hybrid lines are also very common in pig-rearing, with the separation of breeders, multipliers and fatteners. The biological lock, using male and female lines, is increasingly applied. Lines are also being developed of sows with large uteri, which means that they are able to give birth to more piglets, transferred to the sows in embryo stage.

The revolution in gene technologies

The early innovations, such as hybrids and artificial insemination, are now being overtaken by another technological transformation, which may have even more far-reaching consequences – the gene technology revolution. New technologies, such as cloning and gene transfer, are becoming increasingly important. The genetic engineering of poultry has been feasible since the 1980s, and transgenic birds have frequently been produced in laboratories. But this technology has not yet been used for the commercial production of poultry, largely because of widespread public resistance. Meat from cloned animals is also on its way to consumers, after the US Food and Drug Administration gave its approval in January 2007, and the EU announced that no specific approval procedure would be necessary for such food.

Hybrid breeding and the associated separation of breeding, multiplying and fattening have strengthened the breeding companies and fostered concentration in the livestock breeding industry. The process of concentration has been fast: today there are just four breeders in the broiler sector (*see* Table 1), whereas in 1989 there were eleven. Among companies providing genetic stock for laying hens the number of companies operating at a global scale has fallen even more sharply: from ten to two in the same period. Today farmers all over the world wanting to produce eggs, broilers, ducks or turkeys on a commercial scale must buy genetic material from this handful of breeders.

A dominant player in the chicken market is the German Erich Wesjohann (EW) Gruppe, the world leader in genetics for layer hens and broilers as well as for turkeys. With 4,000 employees, the EW Gruppe operates in 15 countries (including Germany, Poland, USA, Canada, Brazil, Japan and South Africa). It has more than 35 subsidiaries, one of which is Aviagen, the world's leading broiler chicken and turkey breeder. The EW Group provides the genetics for 68 per cent of white eggs and 17 per cent of brown eggs. Almost all the rest (65 per cent) of the genetics for brown eggs comes from the Dutch company Hendrix Genetics, which is also a leading player in genetics for broilers and for pigs.

Vertical integration

At first, integration occurred vertically, with breeders and meat processors becoming part of a single powerful company. Tyson Foods Inc., the world's largest processor of chicken and red meat, was one of the first to take this route. With 120,000 employees and a turnover of US$25 bn, this giant company is producing some 25 per cent of chicken, beef and pork eaten by US Americans. Tyson became aware of the strategic importance of breeding, and in 1994 took over Cobb-Vantress, the USA's oldest breeding company, which supplies breeding stock for broilers. Cobb-Vantress is today the world's third largest company in this sector.

Table 1: Key players in the global breeding market

Genetics for:	Global Market Leader	Mother company	Subsidiaries
White-egg layer hens	1 (68% of market)	Erich Wesjohann Gruppe (Germany)	Lohmann Tierzucht, Hyline, H&N
	2 (32% of market)	Hendrix Genetics (Netherlands)	ISA, Hendrix
Brown-egg layer hens	1 (60–65% of market)	Hendrix Genetics (Netherlands)	ISA, Hendrix
	2 (17% of market)	Erich Wesjohann Gruppe (Germany)	Lohmann Tierzucht
Broilers	1	Erich Wesjohann Gruppe (Germany)	Aviagen
	2	Grimaud Group (France)	Hubbard
	3	Tyson (USA)	Cobb Vantress
	4	Hendrix Genetics (Netherlands)	Hybro
Turkeys	1	Erich Wesjohann Gruppe (Germany)	Aviagen, British United Turkeys
	2 (34% of market)	Hendrix Genetics (Netherlands)	Hybrid
	3	Willmar (USA)	
Ducks	1	Grimaud Group (France)	Grimaud
	2	Cherry Valley (USA)	
Pigs	1	Genus plc (UK)	PIC
	2	Hendrix Genetics (Netherlands)	Hypor, Pigs Online
	3	Pigture Group (Netherlands)	Topigs
	4	Danish Meat Cooperative	Danbred
Cattle	1	Genus plc (UK)	ABS
	2	Koepon (Netherlands)	Alta
Aquaculture	1	Genus plc (UK)	Syaqua

Box 1: Monsanto moves to patent pigs

In 2005 a Greenpeace researcher found out that Monsanto was seeking patents not only on methods of pig breeding but also on actual herds of pigs and their offspring, even though none of the procedures involved genetic modification. To uncover the scale of Monsanto's ambitions, Greenpeace investigated 30 pigs of nine different breeds and found that they nearly all possessed a genetic combination which, according to the patent specification, would be regarded as a Monsanto invention. The implications were huge. "If these patents are granted, Monsanto can legally prevent breeders and farmers from breeding pigs whose characteristics are described in the patent claims or force them to pay royalties", said Christoph Then, the Greenpeace researcher. "It's a first step towards the same kind of corporate control of an animal line that Monsanto is aggressively pursuing with various grain and vegetable lines."[1]

The public criticism that followed Greenpeace's disclosure led to Monsanto watering down its patent application, but the giant biotechnology company was not thrown off course. Monsanto made a dozen other pig-breeding patent applications. PIC, now belonging to Genus plc, has also made a series of patent applications. Such developments have led Greenpeace jointly with many other civil society organisations to call for a complete overhaul of European patent law in order to prohibit patents on non-GMO animals and plants, and their genes.

Monsanto has faced other temporary setbacks. For instance, it reached an agreement with the UK-based company, JSR Genetics, to become exclusive distributor of its "Genepacker" boar. Probably because it had had little experience in livestock breeding, this deal did not flourish. In September 2007 Monsanto sold Monsanto Choice Genetics to another US company, Newsham Genetics. Monsanto will, however, be carrying on with swine genetics research, which is the most important and potentially the most profitable part of its swine operations. As part of its new relationship with Newsham, it has signed a three-year research agreement. Monsanto has already developed the pig industry's most extensive genomic map, with over 6,000 genomic marker associations for swine performance.

1 Greenpeace International, "Monsanto files patent for new invention: the pig" http://www.greenpeace.org/international/news/monsanto-pig-patent-111

Vertical integration is also occurring among breeders for the pig industry. Smithfield, which is responsible for about a quarter of US production of both pigs and pork products, in 2006 bought a share in ACMC, a UK-based pig breeder.

Not all breeding organisations are corporations. Topigs, for instance, is an important pig-breeding organisation, based in the Netherlands, which is co-operatively owned by 3,000 pig farmers. The co-operative used to be a widespread organisational form in livestock breeding in the North, until privatisation was promoted in many countries, paving the way for the corporate take-over.

Horizontal integration

More recently a process of horizontal integration has been occurring alongside the vertical integration. In 2005 Genus plc, a UK-based breeding corporation (which developed from ABS Global, the world's largest bovine genetics company, which markets annually about 10 million doses of semen in more than 70 countries), purchased Sygen, a leading pig- and shrimp-breeding company, along with its subsidiary company, PIC, the world's largest pig-breeding company. PIC (the Pig Improvement Company) sells each year about 2 million breeding animals and controls about a third of the North American market and a tenth of the European. A gene giant was created, bringing together the largest cattle-, pig- and aquaculture-breeding companies. Horizontal integration is gaining momentum. In 2007 Hendrix Genetics, a leading company in the genetics of layers, broilers and pigs, took over all the breeding business belonging to Nutreco, Europe's largest animal compound feed and fish feed producer. Nutreco had earlier integrated vertically, taking over leading breeding companies in the turkey, broiler and pig sectors. This means that Hendrix Genetics now owns breeding companies in a wide range of livestock.

This process of horizontal integration is driven by recent technological advances. Transnationals have realised that the same principles of gene technology can be applied across a broad spectrum of farming, and that this technology, supported by a rigid regime of patenting, will help them to achieve global dominance.

The process is bringing new players into the livestock genetics market. In 1998 Monsanto acquired DeKalb Genetics Corporation, including its pig-breeding sector. Setting up Monsanto Choice Genetics, a special subsidiary for swine genetics, Monsanto then signed a deal with MetaMorphix, a genetic research company, which gave it access to all the available pig genome data (see Box 1). It is likely that, just as has happened to layer hens (two companies), broilers (four companies), and turkeys (three companies), within a relatively short period

Box 2: Livestock production threatens coastal habitats in Asia*

Nowhere have the rapid growth of livestock production and its impact on the environment been more evident than in East and South-east Asia. In the 1990s alone, production of pigs and poultry almost doubled in China, Thailand and Vietnam. By 2001, these three countries accounted for more than half the pigs and one-third of the chickens in the entire world. Not surprisingly, these same countries have also experienced rapid increases in pollution associated with concentrations of intensive livestock production. Pig and poultry operations concentrated in coastal areas of China, Vietnam and Thailand are emerging as a major source of nutrient pollution of the South China Sea. Along much of the densely populated coast, the pig density exceeds 100 animals per sq. km. and agricultural lands are overloaded with huge nutrient surpluses.

Land-based nutrient pollution has caused algae blooms in the South China Sea, including one in 1998 that killed more than 80 per cent of the fish in a 100-sq. km. area along the coast of Hong Kong and southern China. These changes affect the habitats of many forms of life, since the South China Sea supports substantial populations of fish, invertebrates, marine mammals and sea birds. The consequences for regional diversity may be far-reaching. As an example, since 2002 increasing masses of giant jellyfish reach the Japanese coast all year round and severely hamper fishing campaigns. These species originate in the East China Sea, where they are proliferating because of an increasing availability of zooplankton resulting from land-based pollution-induced eutrophication and decreasing fish stocks.

The impact of the decline in the quality of coastal seawater and sediment in one of the world's most biologically diverse shallow-water marine areas, the East Asian Seas, goes well beyond algal blooms and the related effects upon the food chain. Fragile coastal marine habitats are threatened, including coral reefs and sea grasses, which are irreplaceable reservoirs of biodiversity; the last refuge of many endangered species. Threatened coastal areas of the South China Sea, for example, have provided the habitat for 45 of the world's 51 mangrove species, almost all of the known coral species and 20 of the 50 known sea grasses. In addition, the area is the world's centre for diversity of hermatypic corals, with more than 80 recorded genera, of which four appear to be endemic to the region; there are record high numbers of molluscs and shrimp species. It also contains a high diversity of lobsters, with the second highest endemism count.

*This text is taken from FAO, Livestock's Long Shadow – Environmental Issues and Options, Rome 2006, pp. 211–12.

just a very few companies will control the supply of hybrid pigs to the world.

These huge gene companies are developing careful strategies to protect their profits. In 2007, Genus plc announced further progress in what it described as the "de-risking"[1] of its business, pointing out that 70 per cent of its US and European business is now based on a royalty model, and 90 per cent of production is now sub-contracted. In other words, the corporate giants are now safeguarding their profits by limiting their role to providing genetic material under contracts that ensure that payment will be made in all circumstances, and thus transferring all the financial risk to those who actually do the farming – largely contract farmers.

Future technological developments

The pace of change is speeding up. As was mentioned earlier, the technology to genetically modify chickens already exists. Indeed, Avigenics, a US pharmaceutical company, says it has been producing genetically engineered chickens for more than four years. Probably because a large majority of the European public believes this technology to be both unsafe and unnecessary, EW and its subsidiary, Aviagen, have both stated firmly that they have no intention of adopting it. It seems likely, however, that other European companies, some of which (such as Hendrix Genetics from the Netherlands and the Grimaud Group from France) have been keeping quiet on the subject, may eventually move into this sector. The same is true for Cobb-Vantress.

Another sector where genetic modification is expected to take off in a big way is fish farming. It is likely that a transgenic salmon that takes half the normal time to grow to market size will be launched on the US market in 2009. A large number of fish species, including salmon, trout, sea bass and turbot, can now be farmed, and they are being adapted to industrial production. It is probable that this sector will soon be dominated by biotech corporations, such as Genus plc.

Several cattle-breeding companies are developing the technology to sort semen, thus increasing the proportion of calves of desired gender from 50 to 85 per cent. Many dairy farmers are very interested in having female calves, and are ready to pay considerably higher prices for sorted semen. Such technologies will also speed up the breeding activities of the big corporations, an end to which

1 http://tinyurl.com/38t5rl

embryo transfer, embryo breeding and other technologies also contribute.

Starting with artificial insemination in cattle, research has been carried out into how to conserve livestock genetic material, not only semen, but also oocytes (egg cells) and embryos. Unlike seeds from plants, genetic material from livestock cannot survive outside an animal's body, and has therefore to be kept deep-frozen (cryoconservation). These technologies are being developed for many reasons, including the conservation of genetic material from breeds at risk of extinction.

Social and environmental consequences

In the race to boost productivity, the companies have concentrated on only a handful of breeds of cattle, pig and chicken. Although the high-output breeds can deliver substantial increases in egg production, milk yields, milk fat content and growth rates, these advances are achieved only if the animals are fed large quantities of high-energy feed and are reared in special conditions with regard to temperature, veterinary supplies, and "biosecurity" – management systems and technologies designed to control completely the hygiene of all entrants into a factory farm, in order to avoid infection. Because they have neither the necessary capital nor access to the marketing networks, smallholders cannot compete with this production system. One option open to them, which at least ensures their survival, is to become contract farmers, even though this means that they will be poorly paid, bear high risks and be liable to become entrapped in a modern form of debt bondage. (*See* "Contract farming in the world's poultry industry", page 12).

At the same time, the companies' concentration on just a few breeds means that the high-yielding livestock populations have become genetically very similar. Population geneticists say that about 100 unrelated individuals are required in a breed to prevent inbreeding and to maintain genetic diversity. However, for many industrial breeds of cattle and pig, the "effective population size", as it is called, has fallen to dangerously low levels. Take pig production: about 42 per cent of global pig production is industrial, with five dominating breeds (Large White, Duroc, Landrace, Hampshire and Pietrain). According to the UN Food and Agriculture Organisation (FAO), 66 per cent of the mothers of European fattening pigs are hybrid crosses of the Large White and the Landrace breeds. In the US, the "effective population" size is only 74 in Hampshire and 61 in Duroc.

The situation is little different in cattle production. About two-thirds of the world's milk is produced by high-output breeds. Consistent selection for desirable traits (amount of milk, fat content, weight gain and feed efficiency) has led to excessive genetic narrowing: although there were more than 3.7 million Holstein cows producing milk in the USA in 2004, the size of the Holstein "effective population" there was only 60 animals. The actual diversity in poultry farming is not known, as breeding companies are not obliged to reveal genetic information, which is regarded as a trade secret. FAO assumes that most commercial strains are based on four breeds.

The intensive breeding to select desirable traits has caused cascading problems in many industrial cattle-, pig- and poultry-breeding lines. As they are selected for productivity, other traits, such as vitality or fertility, are lost. Turkeys, for instance, were developed to produce the large breasts demanded by the supermarkets. Due to these heavy breasts, they now cannot mate naturally but depend on artificial insemination. They also developed skeletal problems from their excessive body weight. To counteract this problem, breeders selected traits to improve walking and leg strength, but the breeders failed to realise that these traits were correlated with other characteristics, such as competitive behaviour. These turkeys have now become unduly aggressive for the confined environment they are reared in.

Another problem has been growing vulnerability to disease. This is scarcely surprising, given that not only was resistance to disease neglected as a trait in

Young hybrid sows (gilts)

the intensive breeding, but also that thousands of genetically very similar animals are being raised in close proximity. It is estimated that 10–15 per cent of the potential profit from poultry production is being lost as a result of disease. Local breeds and wild relatives are known to carry some of the diseases, often without being ill, and so regulations such as culling were set up that discriminate against local breeds in order to protect industrial livestock production. Large public funds are required to control the diseases, in addition to the insurance fees that farmers in some countries now have to pay.

While industrial production with the same few breeds is spreading all over the world, local breeds are being lost. It is estimated that, of the 8,000 or so breeds documented by FAO, one is becoming extinct every month, compared with the one every year that was lost during the last century. Already, 20 per cent of breeds are at risk. Very little development has been carried out in Southern breeds during the past decades, and many of them have been crossbred with Northern breeds, without maintaining the pure lines.

Serious environmental problems have also been occurring. These include water and soil contamination and the environmental cost of transporting large quantities of animal feed over long distances. It is often argued that rainforest is being saved through the rearing of industrial animals, as their high feed conversion means that less feed is required to produce a unit of meat. But this argument is easily challenged: local production systems are based on local feed and rarely use imported concentrate, often made from soya, the cultivation of which is leading to the destruction of rainforest, particularly in the Amazon basin. At the same time local breeds have multiple other uses, such as providing manure and transport, and serving as "banks on hooves" (a term coined by the Indian NGO ANTHRA). They also possess the ability to adapt to their environment and even to contribute to environmental sustainability.

Conclusions

The livestock-breeding industry has experienced an enormous degree of concentration in recent years, and cloning, gene transfer, and other emerging

Box 3: The transformation of the pampas*

The Pampas, the humid grasslands of northern Argentina, were the site of one of the earliest documented and dramatic transformations of a landscape by alien plants brought by animals. In the The Origin of Species (1872) Darwin remarked that the European cardoon and a tall thistle "are now the commonest [plants] over the whole plains of La Plata, clothing square leagues of surface almost to the exclusion of every other plant". Even in southern Uruguay he found "very many square miles covered by one mass of these prickly plants impenetrable by man or beast. Over the undulating plains, where these great beds occur, nothing else can now live." These scenes had probably arisen in less than 75 years.

Von Tschudi (1868) assumed that the cardoon had arrived in Argentina in the hide of a donkey. Many early plant immigrants probably arrived with livestock, and for 250 years these flat plains were grazed but not extensively ploughed. Cardoon and thistle were eventually controlled only with the extensive ploughing of the pampas at the end of the nineteenth century.

This was far from the end of livestock-related plant invasions, however. The transformation of the pampas from pasture to farmland was driven by immigrant farmers, who were encouraged to grow alfalfa as a means of raising even more livestock. This transformation greatly expanded the opportunity for the entry and establishment of alien plants. Towards the end of the nineteenth century over 100 vascular plants were listed as adventive near Buenos Aires and Patagonia. Marzocca (1984) lists several dozen aliens officially considered "plagues of agriculture" in Argentina.

While the massive transformation of Argentinian vegetation continues, the globalising livestock sector recently drove yet another revolution of the pampas. In just a few years, soya has become the country's major crop. In 1996 a genetically modified soya variety entered the Argentinian market with a gene that allowed it to resist herbicides. Upon arrival of the GM variety, soya covered six million hectares, while today it covers 15.2 million ha, more than half Argentina's arable land. Rates of deforestation now exceed the effect of previous waves of agricultural expansion (the so-called cotton and sugar-cane "fevers"). At the same time the intensive cropping of soya results in a severe mining of soil fertility. Altieri and Pengue estimated that in 2003 soya cropping extracted a million tonnes of nitrogen and some 227,000 tonnes of phosphorus, losses that would cost some US$910 million if replaced by mineral fertilisers.

* This is an edited extract taken from FAO, *Livestock's Long Shadow – Environmental Issues and Options*, Rome 2006, p. 201.

technologies, including proprietary arrangements, can be expected to accelerate concentration. These developments are not in the interest of the general public and will exacerbate problems associated with high-performance breeds and industrial production: large public expenditure caused by animal diseases, environmental pollution, human diet-related diseases, and animal welfare problems.

What is needed

New approach to breeding: The increasingly narrow genetic base of the small number of industrial breeds is a danger that has been known for many years, but only now is a start being made to address it. Instead of paying lip service to sustainability in public statements, countries and companies need to revise fundamentally their approach to breeding.

Internalise the hidden costs of industrial livestock production: Industrial livestock impresses with its high yields and enormously improved feed conversion rates. However, the economic efficiency of industrial livestock production looks very different if public costs are factored into the equation. Although meat, eggs and dairy products are cheap to purchase, society must also consider the following hidden costs:

- for cleaning up the environment (water, soil, and air) from livestock production effluents.
- for treating human diseases caused by over-consumption of livestock products. Even in developing countries, the recommended daily allowance of animal proteins has been reached. In the North, on average, three times the recommended amount is being consumed.
- for containing the spread of zoonotic diseases that increase in virulence when passing through dense, genetically similar livestock holdings.
- for *ex situ* and *in situ* conservation programmes necessary to maintain genetic diversity.

Redirect research funds from industrial production to sustainable breeding: Support for conventional breeding has almost vanished, and almost all research funds are now directed towards the "Life Sciences", i.e. gene technology. This means that most publicly funded biotechnology research is carried out by the very industry that benefits from it. To top it all, the livestock genetics industry prepares the research grant cornerstones, on which the programmes are based that provide the criteria for deciding which research projects will be selected for funding.

Giant thistle of the pampas

Cardoon

R. T. Pritchett, in Darwin, A Naturalist's Voyage Round the World

No patents on animals or on genes: Historically, animal breeders have benefited from the exchange of animals. The patenting of genes and traits is expected to disrupt this exchange, to impede breeding and research, to increase corporate concentration and to be detrimental to farmers and consumers.

Abolish subsidies for industrial livestock production: For the past fifty years or so, national subsidies, tax exemptions, development projects and other support measures have been used to establish industrial breeds all over the world. Local production systems have been disadvantaged.

Start investing in local breeding: In the South, very little has been done to develop breeds, since faster results were expected from imported breeds – results focusing on the performance of individual animals. It is important to start investing again, this time focusing not on individual animal performance but on objectives that emphasise family farms, communities and the environment.

Address trade liberalisation and industry concentration as main reasons for the breed loss: Imports of cheap – usually subsidised – livestock products to a developing country following a free trade agreement often mean that local products cannot compete and local breeds are thus wiped out within a very few years. This is a major reason for loss of breeds and needs to be urgently addressed.