Bread or Trough

Animal Feed, Competition for Land and Food Security

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Contents

1. Introduction

While the phenomenon of land grabbing has led to a wider public debate, essential drivers of this trend still remain comparatively underexposed. This is particularly true for land-use changes caused by the growing demand for animal-based products and the associated cultivation of animal feed.

The high consumption of animal feed is a result of diets with a high proportion of meat, milk, eggs and other animal products. This type of nutrition uses a large number of resources such as arable land, water and energy and is also very wasteful due to the inefficient conversion of plant energy and proteins into animal-based foods. The risks of this consumption pattern increase with the growing number of people switching to diets with high proportions of animal products. Nevertheless, it still remains a highly unequal consumption model excluding the majority of the human race. It presumes that not all humans have equal access to the Earth's natural resources.

It is therefore urgent to deal with the continuous boom in animal feed, its drivers and consequences. With this publication, the Centre for Research and Documentation Chile-Latin America (FDCL) aims to contribute to the public debate on this pressing issue.

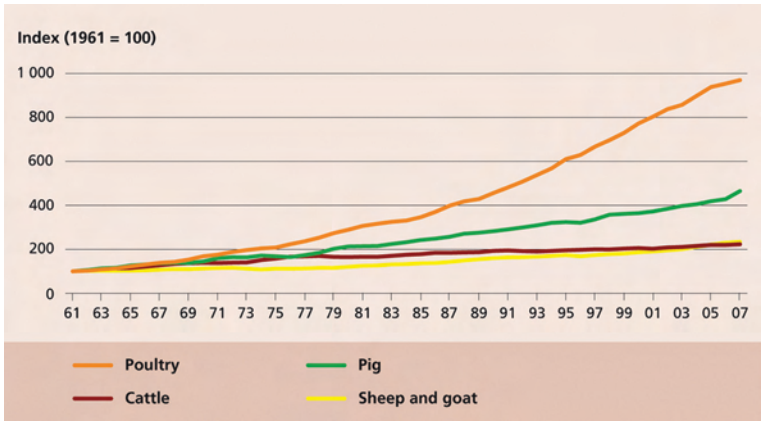
The publication describes how the increasing consumption of meat is encouraging the cultivation of feed crops. It analyses the European Union's high deficit in animal feeds, particularly with regard to protein-rich crops, as well as its heavy dependence on the imports of soy. It then outlines the social and ecological impacts of the cultivation of this protein crop in the main supplying countries of South America. The publication also asks to what extent a dietary change reducing the consumption of animal products could contribute to limiting the risks of the excessive demand for animal feed. Finally, it offers a range of recommendations on how animal feed consumption can be reduced in order to mitigate the growing number of land disputes and ensure global food security.

2. Boom in animal feed

The continuous growth in the production and consumption of animal-based foods is the main driver behind the increasing demand for animal feed. Between 1990 and 2010, global meat production rose by 61 percent, from 180 to 290 million tons, milk production by 29 percent, from 550 to 710 million tons, and egg production by 65 percent, from 37 to 61 million tons (LfL 2011, FAO 2005, 2011). Meat production has a particularly strong impact on the demand for animal feed. Among the main meat categories, chicken meat production increased most significantly over the last few decades, followed by pork-meat production. In contrast, meat production from ruminants such as cows, sheep and goats remained comparatively stable and increased only to a minor degree (see graph 1). Today, nearly three quarters of global meat production is made up of pork and chicken meat.

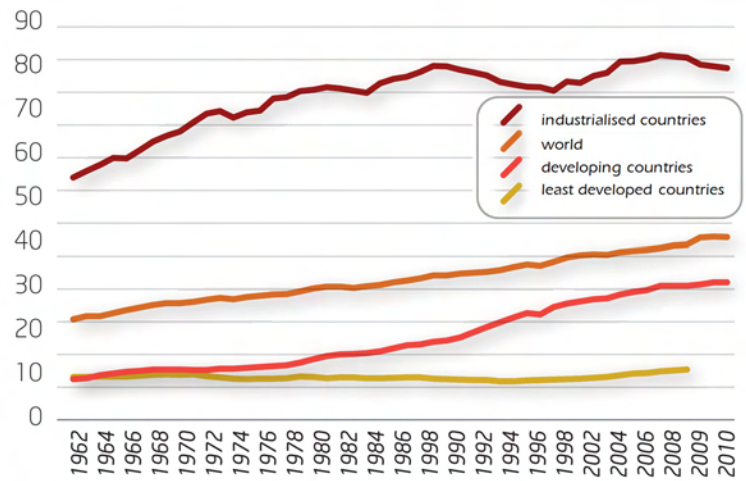
While meat consumption in industrialised nations has stabilised at a high level since the 1980s, it has risen more significantly in emerging and developing nations. Nevertheless, consumption in the northern hemisphere remains disproportionately high. Industrial nations still consume more than 40 percent of the global meat output even though they only represent 18 percent of the world's population. Per capita consumption of meat is considerably lower in developing countries (see graph 2). While people in industrialised countries consumed annually on average 82 kilograms of meat per capita over the last five years, this amount was only 31 kilograms in developing countries (FranceAgriMer 2011).

Graph 1:
World production of main categories of meat (1961-2007)



Source: FAO 2009

Graph 2:
Global meat consumption (in kilogram per capita)



Source: FranceAgriMer 2011

The global gap in milk consumption is even more pronounced. People in industrialised nations consumed 233 kilograms of dairy products in 2010, those in developing countries only 68 kilograms (FAO 2011). Europeans are by far the biggest consumers of dairy products. Although they only make up 10 percent of the world's population, they consume 30 percent of global milk production (IDF 2010).

Move towards industrial livestock systems

Besides the increasing consumption of animal-based foods, the far-reaching transformations of livestock production are also having an impact on the demand for animal feed. Industrialised countries and parts of the developing world are witnessing the rapid expansion of large-scale industrial livestock production systems which strongly depend on feed purchases on national and international markets. These operations often only raise one species of farm animals fed with highly concentrated compound feeds consisting mainly of grains and oilseeds (while the use of roughages such as crop residues and natural pastures decreases). Large numbers of animals are kept in confined areas, often in sheds and regionally concentrated. Special breeds of high-performance animals and feed concentrates boost meat and milk yields, while mechanisation reduces labour costs (FAO 2009).

Since poultry and pig farming is easier to mechanise than cattle farming, the intensification of poultry and pig production is particularly widespread. Nowadays, industrial animal farms account for 75 percent of global poultry production, 68 percent of egg production and more than half of global pork output (Smith et al. 2010, FAO 2009). Although industrial production is not possible to the same extent with cattle farming, even the latter is becoming increasingly intensified. The number of feedlots, for instance, where thousands of cattle are confined in outdoor installations to be fattened with concentrate feeds purchased from outside, is growing significantly (Deblitz 2011, Fink 2010).

While intensification boosts the productivity of animals and land, it is also accompanied by greater risks. Due to close confinement and the use of fast-growing and high-producing breeds, the animals are very prone to diseases, which increases the risk of epidemics. The high levels of medication and the use of antibiotics have already resulted in the emergence of drug resistant pathogens in humans and animals (Otte et al 2007). Animal farms produce considerable

amounts of manure and slurry which may lead to contamination of ground and surface water in the affected regions. Excess manure also produces high emissions of greenhouse gases such as methane and nitrous oxide (Humane Society 2011). Moreover, the rapid spread of high-performance breeds is threatening the genetic diversity of farm animals globally. The accompanying displacement of native livestock breeds adapted to local conditions (such as heat, drought and disease) is endangering food security, particularly in developing countries (CIWF 2009).

Trough or plate: feeding of cereals

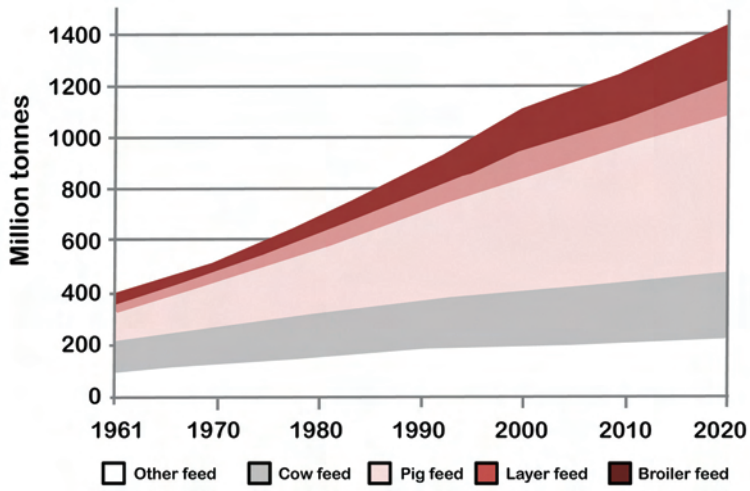
Growing meat and dairy consumption as well as the intensification of livestock production fuelled the global demand for animal feed. Over the last 50 years, the consumption of energy- and protein-rich compound feed has more than tripled. Feedstuffs for pigs, laying hens and broilers registered particularly high growth rates. The UN Food and Agriculture Organisation FAO estimates that this growth might remain virtually unchanged (see Graph 3).

Emerging economies, foremost China, have also increased their animal feed consumption over the last few years. Nevertheless, industrialised countries are still heading the list of major consumers. They were responsible for over half of the 1.2 billion tons of feed concentrate used globally in 2005, even though they only represent 18 percent of the world's population. South Asia and Africa, on the other hand, consumed less than 50 million tons, respectively (FAO 2009: 29).

On a global average, approximately 57 percent of concentrate feed consists of cereals. Other important components are oilseed meals (accounting for 15 percent) as well as roots and brans (see graph 4).

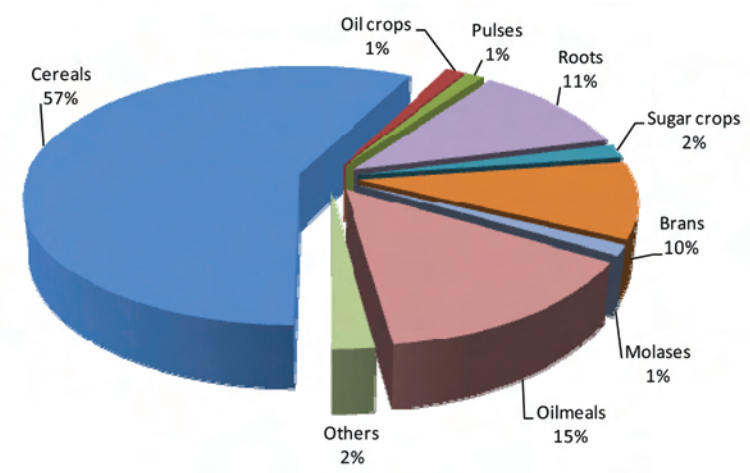
Nowadays, large proportions of cereal harvests – wheat, barley, oats, rye or maize – end up in feed troughs. In 2010, over 34 percent of the global cereal harvest was fed to animals and only 48 percent was processed into food. In industrialised countries with their disproportionately high consumption of meat and dairy products, the proportion fed to animals is significantly higher. In the European Union, around 62

Graph 3
Growth in global demand for animal feed, projection (in million tonnes)



Source: Speedy 2004

Graph 4
Contribution of different crops to global concentrate feed utilisation (period 1996-2005, in percent)



Source: Mekonnen/Hoekstra 2010

percent of the cereal harvest is used for animal feed and just 24 percent for direct human consumption (see table 1).

In developing countries the picture looks quite different. Here, more than three quarters of the cereal harvest is used for human nutrition and only a minor part ends up in the feeder trough (LfL 2011). In sub-Saharan Africa and India, where animal feed still mainly consists of grass, crop residues and by-products, less than 10 percent of the cereal supply is used for feed (IMWI 2007: 95).

Large quantities of oil seeds also end up in animal stomachs, particularly oil meals, the residues of the process of oil seed crushing. With a proportion of approximately 70 percent, soybeans are the most important oil seed used for animal feed, followed by rapeseed, cotton and sunflower seeds. Around 75 percent of the global soybean harvest is used as animal feed (Aiking 2011).

Animal feed: inefficient and land-consuming

The growing global livestock population greatly increases the demand for land used for animal feed. The agricultural land currently available worldwide amounts to around 5 billion hectares. Of this, approximately 1.5 billion hectares are arable land for crop production and 3.5 billion hectares grasslands like meadows and pastures. The world's grasslands are largely used as grazing grounds, many of which still for extensive livestock farming where animals graze across large areas. Besides grasslands, a third of the global crop land is used for cultivating feed crops. Thus, in total, roughly 80 percent of the global agricultural land is either used for grazing or for producing animal feed (FAO 2006, Smith et al. 2010).

The huge land requirements for animal feed purposes is also due to the low efficiency of converting grass and feed crops into meat and dairy products. A major part of the energy and proteins contained in feedstuff gets lost during its conversion into animal products because animals use large parts of the acquired energy for their own metabolism. The Canadian environmental scientist Vaclav Smil evaluated the conversion losses of meat production on the basis of long-term data from the US Department of Agriculture (see table 2).

In the case of chicken production, for instance, only 11 percent of the energy and 20 percent of the proteins contained in chicken feed find their way into the final product of chicken meat. These values are even worse for pork and beef production. Beef only contains three percent of the energy once absorbed by cattle via feed rations. Conversely, this means that 89 percent of the energy contained in feed for chicken production is lost; for pork and beef production these figures are 91 percent and 97 percent, respectively. The wastage of plant protein fluctuates between 80 and 96 percent (Smil 2002: 308f.).

The relative inefficiency of animal-based versus plant-based nutrition can also be measured

Table 1
Cereal consumption and proportion used as animal feed (2009/2010, in million tonnes)

	Total cereal consumption	Proportion of feed	Percentage
Worldwide	2,232.9	766.8	34.3
EU-27	275.7	171.9	62.4

Sources: FAO 2011

Table 2
Energy and protein losses of meat production (conversion efficiency in percent of gross energy/protein content)

	Chicken meat	Pork meat	Beef
Energy conversion efficiency	11%	9%	3%
Protein conversion efficiency	20%	10%	4%

Source: Smil 2002

by the extent of arable land required to produce a given amount of food. It must, however, be taken into account that land requirements of crops differ according to local conditions such as hectare yields, micro-climate, soil fertility or production methods.

Studies conducted in the Netherlands and Germany compared the specific land requirements of animal-based and plant-based food items (see table 3). The land requirement for the production of a kilogram of pork in the Netherlands or Germany, for instance, is roughly five times higher than that for the production of a kilogram of cereals. Producing a kilogram of beef in Germany even requires an area nine times larger than that needed for a kilogram of cereals (Gerbens-Leenes/Nonhebel 2002, Bringezu et al. 2008: 49f.).

Table 3
Specific land requirements for animal-based and plant-based foods (measured in square meters per kilogram of food per year)

	Netherlands, m²	Germany, m²
Animal-based food		
Beef	20.9	15.28
Pork	8.9	8.23
Chicken meat	-	4.49
Eggs	3.5	3.89
Milk[1]	1.2	1.99
Plant-based food		
Cereals	1.4	1.73
Fruit[2]	0.5	0.36
Vegetables	0.3	0.36
Potatoes	0.2	0.31

1 For the Netherlands: whole milk. For Germany: 1 litre of cow's milk.
Conversion factor for litre to kilograms: 1 litre of milk is converted to 1.02 kilograms of milk.

2 For Germany: apples

Source: Gerbens-Leenes/Nonhebel 2002, Bringezu et al. 2008

3. EU: animal feed imports and surplus production

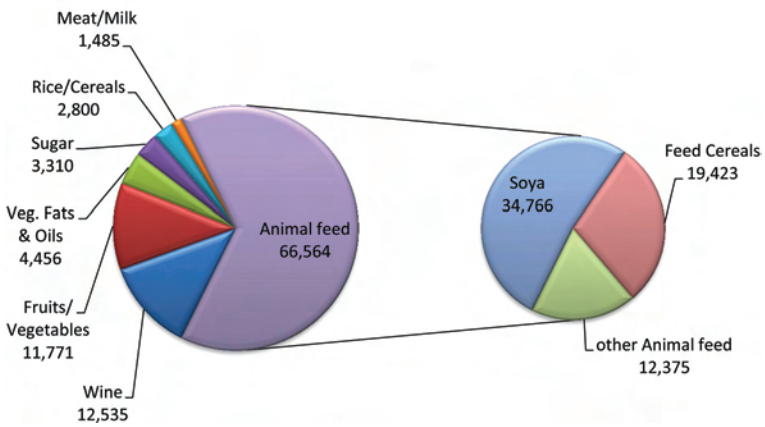
From surplus production to dumping

The production of animal products in the European Union in many cases far exceeds internal demand, so that large proportions are being exported. According to the European Commission, the degree of self-sufficiency of meat throughout the EU reached 107.4 percent in 2009. The overproduction of pigmeat is particularly high with an EU-wide self-sufficiency level of 108.8 percent. In the case of edible offals, the self-sufficiency level even totals 164 percent (European Commission 2010).

Accordingly, European exports are significant. Around 8.3 percent of pork and 9.7 percent of chicken meat have been sold outside the EU in 2010. The same goes for dairy products such as cheese or skim milk powder. EU producers sold 7.6 percent of cheese production and 42 percent of skim milk powder to the world market in 2010 (own calculation according to: European Commission 2011).

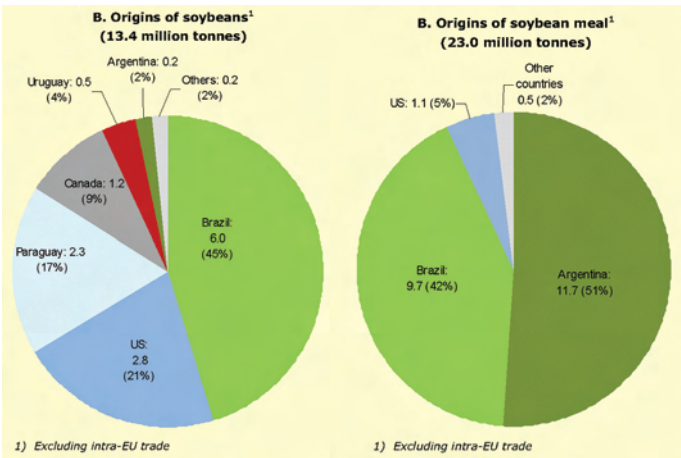
Numerous producers in developing countries have already lost their livelihoods due to European exports of animal products, which would not be

Graph 5
EU-27 Agricultural imports (2008, in 1000 tonnes)



Source: Reichert/Reichardt 2011

Graphs 6 and 7
EU: origins of soybeans (2010) / EU: origins of soybean meal (2010)



Source: Product Board MVO 2011

possible without the use of cheap animal feed (Fritz 2011). Moreover, EU exporters benefit from considerable subsidies, particularly direct payments and – to a lesser degree – export subsidies (Berthelot 2011). For instance, two thirds of EU dairy exports are sold to developing countries, a quarter of them to Africa (Oxfam 2009, Boulanger 2009). In West African countries such as Cameroon, Burkina Faso or Ghana, thousands of small dairy farms cannot sell their raw milk to dairies because these use the far cheaper milk powder imported from the EU to produce milk or yoghurts (Brot für die Welt/EED 2009). Pig farmers in Cameroon or Angola are experiencing similar difficulties since the price of meat imported from the EU is significantly lower than that of local fresh meat (APRODEV/EED/ICCO 2008). Small chicken farmers are pushed out of their African markets due to the flood of imports of frozen poultry parts that also primarily originate in the EU (EED/ACDIC 2010, EED 2011).

The European protein deficit

The European Union relies heavily on imports of animal feed which accounts for two thirds of all EU agricultural imports (see graph 5). The majority of EU animal feed imports – around 52 percent – is made up of soy (Reichert/Reichardt 2011). The soy imports reflect the particularly high European deficit in protein-rich feed, whether it be of plant or animal origin. With 68 percent, soybean meal represents the most important source of protein used in the EU, followed by rapeseed meal with around 15 percent. Locally available protein crops such as pulses only contribute two percent to EU protein supply. The EU self-sufficiency level of soy is just two percent, i.e., 98 percent must be imported to feed European livestock (FEFAC 2011).

As a result of the large European protein deficit, the EU has developed into the world's biggest importer of soybean meal and the second largest importer of soybeans after China. In 2010, the EU imported 23 million tons of soybean meal and 13.4 million tons of soybeans. Brazil is the EU's largest supplier of soybeans, followed by the USA and Paraguay. Soybean meal, however, predominantly originates from Argentina and Brazil (see graphs 6 and 7).

Land as a commodity: virtual imports

Due to the EU's agricultural imports, European consumers are using a lot more arable land than is actually available within the European Union.

Table 4
The EU's virtual land imports 2007/2008 (in million hectares)

	Land exports	Land imports	Net land trade
Sugar crops	0.15	0.44	-0.29
Rice	0.04	0.53	-0.49
Other	0.31	0.54	-0.23
Vegetables	0.22	0.56	-0.35
Coarse grains	2.92	1.40	1.52
Corn	0.56	2.48	-1.92
Wheat	3.28	2.57	0.71
Palm fruits	0.05	2.61	-2.56
Fruits	0.95	3.31	-2.36
Coffee, cocoa, tea	0.44	6.72	-6.28
Other oilseeds	3.47	8.59	-5.12
Soybeans	1.71	19.24	-17.53
Total	**14.10**	**48.99**	**-34.90**

Source: von Witzke/Noleppa 2010

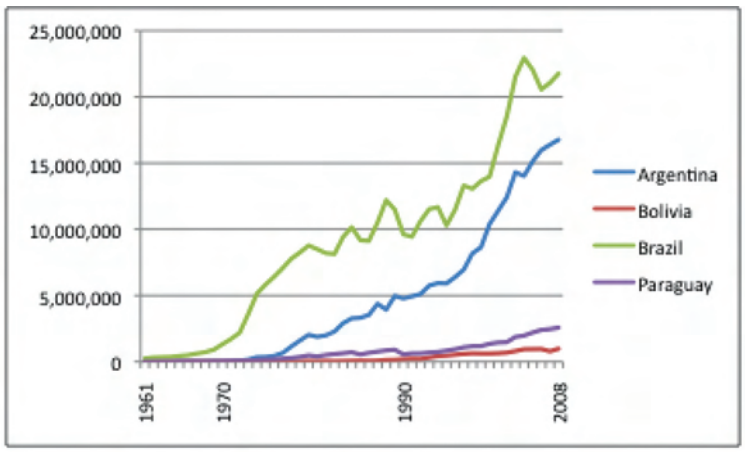
The imports of animal feed and other agricultural goods thus represent, in a certain sense, virtual imports of land. Agricultural economists Harald von Witzke and Steffen Noleppa calculated the EU's virtual trade of arable land on the basis of its net balance of agricultural imports and exports. According to their analysis, soybeans account for by far the largest share of the total virtual land imports of the European Union. EU soybean imports require an area of more than 19 million hectares abroad (see table 4). This area is roughly equivalent to the area of England and Scotland combined. Because the EU also re-exports a small proportion of soy, its net deficit in virtual land trade of soy amounts to 17 million hectares. The virtual land trade associated with all feed imports is even larger because, besides soy, several other feedstuffs are being imported into the EU, for instance, oil crops like rapeseed and cereals such as wheat, barley and maize (von Witzke/Noleppa 2010).

4. Impacts of soy cultivation in South America

European feedstuff demand caused by the disproportionately high consumption of animal products is having a significant impact on South American countries supplying high-protein soy for Europe's livestock. Land disputes are on the rise, biodiverse ecosystems are being harmed, greenhouse gas emissions are increasing and communities living near soy plantations are exposed to considerable health risks.

Besides Argentina and Brazil, which are the EU's most important suppliers of soy, Paraguay and Bolivia are also playing increasingly important roles. Between 1988 and 2008, the combined soybean area of these four countries expanded two-and-a-half-fold from 17 million to 42 million hectares (see graph 8). It is estimated that Brazil's soy fields will grow to 25 million hectares in 2011/12 and those of Argentina to 19 million hectares (Panorama Agropecuario 2011). More than 30 percent of the soy fields of Brazil, Argentina and Paraguay are intended for exports to the European Union.

Graph 8
Planted area of soy in Argentina, Bolivia, Brazil and Paraguay (1961-2008)



Source: WWF 2011

Local soy cultivation is still dominated by South American growers. The areas controlled by the biggest and most rapidly expanding soybean producers often exceed more than 10,000 hectares, sometimes even 100,000 hectares (including owned and leased land), like those of Argentinian companies Los Grobo and El Tejar or Brazilian groups André Maggi and SLC Agrícola. In contrast, ownership of processing and trading facilities is largely dominated by transnational companies. In Argentina, a small group of international grain traders – Cargill, Bunge, ADM, Louis Dreyfus und Noble – controls over 80 percent of soybean exports (Teubal/Palmisano 2010). In Brazil, the biggest three agricultural traders Cargill, Bunge und ADM account for around 60 percent of the soybean exports (Bradesco 2012). In both countries, transnational grain traders also possess the largest oil mills where the soybeans are processed into oil and meal (Andreani 2008).

Environmental destruction: shrinking forests and pastures

Soy plantations are among the driving forces of deforestation in South America. A large proportion of the land planted with soy in Brazil, Argentina and Paraguay comes from the clearance of 64 million hectares of natural forests over the past two decades. According to the somewhat conservative estimates of FAO, Brazil lost approximately 55.3 million hectares of forests, Argentina 5.2 million hectares and Paraguay 3.6 million between 1990 and 2010 (FAO 2010).

Soy plantations not only directly occupy land previously covered by forests, but also cause so-called indirect land-use changes that lead to further deforestation. One of the well-known indirect land-use changes triggered by soy expansion is the displacement of grasslands previously used for cattle or dairy farming. Livestock farmers are subsequently pushed to other regions where they start clearing forests and savannahs to make way for cattle ranching. These indirect land-use changes are responsible for an important part of the deforestation in the Amazon region, the highly biodiverse Brazilian Cerrado or the dry forests of the Gran Chaco, which stretches across northern Argentina, Paraguay and southern Bolivia (Governo do Estado de Mato Grosso 2009, Base IS/Repórter Brasil 2010).

Soybean production also contributes significantly to global warming, mainly as a result of deforestation. Unlike in industrialised Europe, the lion's share of greenhouse gas emissions in soy-producing Brazil is not caused by burning of fossil fuels, but by clearance of forests. According to a Brazilian government report, deforestation accounts for 61 percent of Brazil's total emissions of carbon dioxide equivalents (CO_{2eq}) (Ministry of Science and Technology 2010).

Land grabbing and rural conflicts

Many family farms, small peasants and indigenous peoples are coming under threat of being displaced by expanding soy plantations. The pressures to leave their land take different forms, ranging from price competition to physical violence. They affect both families owning their land as well as those with insecure customary tenure rights.

More than a million family farms in Brazil do not own the land they farm. 412,000 of these families are so-called posseiros, who enjoy the constitutional right to use public land they once occupied. However, they do not have a legal

land title which could effectively protect them from displacement. The majority of posseiros are working on small holdings of less than two hectares (Cazella/Búrigo 2011). Professional land grabbers, so-called grileiros, take advantage of this legal uncertainty by falsifying land titles and registering them at regional cadastres. Subsequently, they initiate the eviction of posseiros with the help of private or public security forces (Umbelino de Oliveira 2009).

Besides the classical form of title falsification, grileiros also resort to methods intended to create an impression of legality. They, for instance, buy up posseiros' use rights to plots on the edges of larger areas and then start exerting pressure on the remaining settlers in that area to also abandon their land. In this way, entire swaths of land in the Amazon and the Cerrado are being depopulated like, for instance, the region around Santarém.

Following the Brazilian government's decision to pave the 1,800 kilometers of the federal highway "BR 163" between Cuiabá in Mato Grosso and Santarém in the state of Pará, the grain trader Cargill built a grain terminal on the Amazon river at Santarém in 2001. Since then, soy cultivation has been booming in and around Santarém. Between 2000 and 2008, the soybean area expanded from 50 to 30,000 hectares (Greenpeace Brasil 2010). Those small farmers who continue to grow maize, beans, manioc and fruits in that area are being pressurised to give up their land. Owners of neighbouring soy plantations, for instance, deny them access to paths and roads. Furthermore, pesticides used on the soy fields contaminate rivers and groundwater as well as crops and animals of small farmers (Schlesinger/Noronha 2006: 82). However, those small farmers and indigenous peoples who resist these pressures suffer from grileiros' acts of violence, for instance, death threats or arson attacks (CPT 2008).

The growing competition for land has been exacerbated by the lack of employment on soy plantations. Analyses in Brazil show that soy plantations occupy 44 percent of arable land. However, due to mechanization, these plantations only account for 5.5 percent of employment in agricultural primary production (Schlesinger 2006).

Large monocultures are threatening local food production and frequently impede people's access to a balanced and healthy diet. Staple food production has fallen dramatically in the Brazilian centres of soy cultivation. Between 2000 and 2004 alone, the production of black beans declined by 47 percent in the region of Santarém, maize by 22 percent and oranges by 61 percent (De Carvalho/Tura 2006).

Lethal cocktail: GMOs and herbicides

In addition, the industrial production model of mostly genetically modified soy with its intensive use of pesticides poses further environmental and health threats. Genetically modified varieties are grown in approximately 60 percent of Brazil's soybean fields (Cert ID 2010) and in nearly the entire Argentinean soy area (GRAIN 2009). The US seed multinational Monsanto is the market leader for transgenic soy. Its "Roundup Ready" soy varieties are resistant to its own herbicide "Roundup" based on the highly toxic chemical glyphosate (Costa/Cordeiro de Santana 2011).

Transgenic soy varieties are cultivated accord-

Resistance to glyphosate spraying

Many people in affected areas are fighting against the sprayings of glyphosate and other herbicides. Following the death of 11-year-old Silvino Talavera who was directly sprayed with glyphosate in the Paraguayan District of Itapúa in January 2003, his mother launched a campaign together with the National Coordination of Rural and Indigenous Women (CONAMURI) against the impunity of the two soy farmers responsible for the child's death. It was a huge success for the activists when both soy farmers were finally convicted to a two-year prison sentence in 2004 (Sonderegger 2008).

In Argentina, the campaign "Stop spraying" (Paren de fumigar) was also initiated to put an end to the spraying of agro-chemicals. The campaign achieved a success in February 2011 when a court of the Province of Santa Fe banned spraying activities close to the municipality of San Jorge following a lawsuit of a local citizens group (Aranda 2011).

ing to the production model of "direct seeding" or "no-till". This farming method leaves crop residues on the ground instead of ploughing them under. As a result, farmers save time, energy and labour costs. However, many weeds thrive in the mulch layer formed by the crop residues, so that no-till farmers have to apply large quantities of herbicides with ingredients like glyphosate. In Argentina, the use of glyphosate increased from 1.3 million liters to 180 million liters between 1991 and 2008 (Teubal 2009). In the same time, numerous weeds have also emerged that are resistant to this toxic agent (Mertens 2011).

The herbicides sprayed by airplanes or tractors frequently drift onto human settlements and severely affect the health of people living near soy plantations. Various studies have proven that glyphosate harms human and animal cells, impairs metabolism and interferes with human reproduction and embryonic development. Since even very low doses of glyphosate caused malformations of frog and chicken embryos, a research team led by Argentinian embryologist Andrés Carrasco presumes that similar effects can also occur in human beings (Paganelli et al. 2010).

There are indeed a growing number of reports on the increased incidence of infertility, premature births and deformations in the South American GM soy areas. According to a study conducted in Paraguay, women who were exposed to herbicides during pregnancy gave birth to children with various birth defects, for instance, microcephaly (small heads, accompanied by a mental disability of the child) or anencephaly (absence of parts of the skull and brain resulting in the child's death several days after birth) (Antoniou et al. 2010).

5. Benefits of a diet change

Assessing the effects of reduced consumption of animal-based products is very complex. Nevertheless, most of the studies concerned with such a dietary change agree that this would contribute to reduced land requirements, less environmental pollution and a lowering of food prices.

Saving land

A team led by Dutch scientist Elke Stehfest has examined the potential impact of different scenarios of a global dietary transition to less animal-based food until the year 2050. The reference scenario assumes a "business as usual" development path: a global population growth from six to nine billion people between 2000 and 2050, an income-driven increase of meat consumption and a doubling of livestock production. The scientists contrast the reference scenario with four scenarios of a dietary change, the first three of which are rather drastic. The first one substitutes proteins of ruminant meat by plant proteins, the second one assumes a complete substitution of all meat and the third one a substitution of all animal-based products (i.e. including meat, milk and eggs). The fourth scenario, somewhat more realistic, concerns a so-called "healthy diet" with a lower global consumption of animal products compared to the reference scenario (52 percent less beef, 35 percent less pork and 44 percent less chicken meat and eggs) (Stehfest 2009).

Due to the lower demand for animal feed, the dietary transition would result in a considerable decrease of global land requirements in 2050, especially in the case of the more drastic scenarios. This would apply mainly to grassland and to a lesser degree to cropland (see graph 9). However, even the more realistic scenario of the "healthy diet" would still lead to a significant reduction of land use requirements. The researchers estimate that the requirement of cropland will be reduced by 135 million hectares and of grassland by 1.3 billion hectares.

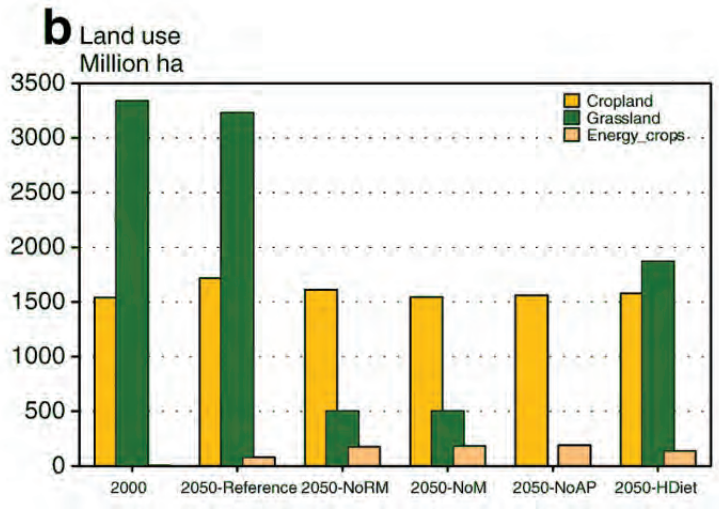
Finally, the Dutch scientists also expect a considerable reduction in greenhouse gas emissions in case of a global diet change. In the reference scenario, the land-use related greenhouse gas emissions would amount to 3.3 billion tons of CO_{2eq} (carbon dioxide equivalents). In the "healthy diet" scenario, emissions of carbon dioxide equivalents would decrease to 2.1 billion tons, and in the case of a complete substitution of meat, CO_{2eq} emissions could be reduced to 1.5 billion tons (ebd.).

Food security

Scientists at the International Food Policy Research Institute (IFPRI) presented a study assessing the impact of a low-meat diet, which would also reduce animal feed consumption, on global food prices. IFPRI's low-meat scenario simulates a 50 percent reduction of per capita meat consumption in high-income countries by the year 2030. A second scenario assumes that, along with high-income countries, also Brazil and China reduce their per capita meat consumption by half. Both scenarios have been compared with a baseline scenario that simulates a continuation of current consumption trends, i.e. rising levels of meat and milk consumption until 2030 (Msangi/Rosegrant 2011).

According to the IFPRI calculations, meat prices, in particular, could drop significantly compared to the baseline scenario (see table 5). Cereal and meal prices would also decline, mainly as a result of lower demand for animal feed. The decrease would be particularly strong if also Brazil and China were to cut down on their meat consumption. In this case, wheat prices would drop by 7 percent, maize prices by 19 percent and meal prices by 22 percent.

Graph 9
Land use requirements under alternative scenarios of global dietary change (in million hectares)



NoRM (no ruminant meat), NoM (no meat), NoAP (no animal products), Hdiet (healthy diet)

Source: Stehfest 2009

Table 5
World prices of food items under baseline and low-meat scenarios for high-income countries (HIC), Brazil and China (in US$ per metric ton)

	2000	2030 baseline scenario	2030 low-meat in HIC	% change from baseline in 2030	2030 low-meat in HIC, Brazil and China	% change from baseline in 2030
beef	1971	2031	1646	-19%	1245	-39%
pork	899	848	649	-24%	345	-59%
poultry	1245	1174	910	-22%	536	-54%
wheat	115	135	132	-2%	125	-7%
maize	89	119	111	-7%	96	-19%
other coarse grains	68	91	84	-8%	73	-20%
soybeans	203	310	310	0%	309	0%
meal	189	360	331	-8%	282	-22%

Source: Msangi/Rosegrant 2011

6. Recommendations

To minimise the risks that accompany the growing consumption of animal feed, a wide range of measures is required. These must apply both to the demand of the biggest consumers as well as to the supply of the most important producers of animal feed. The following measures could be taken:

Reducing consumption of animal products

In order to reduce the high land requirements of animal feed, it is indispensable that European consumers limit their consumption of animal-based foods. Given the social, environmental and health-related benefits of such a diet change, services offerering consumer education and nutritional counseling should be extended (von Koerber et al. 2009).

Considering a taxation of animal-based products

It could be examined whether taxes on the consumption and/or the production of meat and other animal-based products would support a desired dietary transition. For doing so, strengths and weaknesses of various forms of taxation must be taken into consideration (See: Grethe et al. 2011: 48f.).

Reconnecting land, livestock and feed

The reform of the Common Agricultural Policy (CAP) currently being discussed for the period after 2013 should stimulate a reconnection of livestock production to the land and the local availability of animal feed. Payments to farmers must be coupled to binding requirements, for instance, a reduction of the number of farm animals per land unit as well as the adherence to minimum crop rotation intervals. In addition, certain amounts of arable land should be set aside for growing domestic protein crops (German Platform 2010).

European protein strategy

Reducing the EU's protein deficit and its huge dependence on soy imports requires the promotion of domestically-grown oilseed crops and legumes (e.g., clover, peas, field beans, lentils or lupines) which have been neglected over the past decades in agricultural research, breeding and production (EED/Brot für die Welt 2011). Due to the shortage of high-yielding domestic varieties, it is frequently not profitable for farmers to cultivate legumes (Häusling 2011).

Social and environmental standards for animal feed imports

As long as the EU continues to import animal feed, it is necessary to make these imports conditional to the respect of binding social and environmental norms. Such sustainability criteria should be developed jointly with civil society groups and must include internationally recognised social, environmental and human rights standards such as, inter alia, the human right to adequate food and the land rights of indigenous peoples. These criteria would have to go far beyond the sustainability criteria set out in the EU's renewable energy directive, since they include neither social nor human rights standards (EU 2009).

Partnership agreements with supplying countries

Since the expansion of soy fields in South America is not caused by European imports alone, the EU could additionally conclude bilateral partnership agreements that support supplying countries to protect forests and grasslands and to defend land rights of small farmers and labour rights of farm workers (see Reichert/Reichardt 2011). The FLEGT initiative (Forest Law Enforcement Governance and Trade) could serve as an example. In the framework of this initiative the EU has concluded partnership agreements with, to date, six African and Asian countries in order to jointly combat illegal logging and timber trade.

No funding for feed monocultures

A considerable part of the funds that international investors have been channeling into the acquisition of arable land over the last few years are being used to create large monocultures for the production of animal feed like soy or maize. It is therefore important to raise awareness about the social and environmental impacts of these "green deserts" and prevent private investors and financial institutions from investing in such projects.

Securing land rights

In order to defend their rights to land and forest, small farmers and indigenous peoples in the South American areas of soybean expansion depend on international solidarity and support. In the case of violations of land rights, solidarity groups in Europe should pressurise their own governments and those of supplying countries to respect the human rights of those affected by land grabbing and illegal displacement.

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