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Effects of international legal regimes and policy measures aimed at the protection of human, animal or plant life or health on animal genetic diversity

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1 Introduction

This study deals with the question whether there is an impact of the international zoosanitary and food safety regimes on the diversity of animal genetic resources for food and agriculture (AnGRFA) or diversity of livestock.

It is mandated by the Animal Production Service (AGAP) of the FAO. Its background comprises the developments and events of the recent past that are characterized by different strands:

- the increase of the volume of international trade, caused by greater ease of transportation, the gradual liberalization of market access and reduced tariff barriers;
- the relative novelty of international standards aimed at minimizing the risk to animal, plant and human life and health in the trade with animals, plants and products thereof, and their growing importance, as trade is being liberalized and tariff barriers reduced (Desta 2007, Perry and Sones 2007);
- the recent outbreaks of virulent epidemics, causing significant losses among the affected livestock populations; and
- the increasing awareness of the value of diversity of AnGRFA and, simultaneously, of its erosion.

Against this background the question emerged whether the measures to manage the implied risks in international trade have an impact on livestock diversity, and accordingly whether measures to mitigate these impacts ought to be devised.

Movements of animals and animal products, in particular in international trade, entail a high risk of transfer of diseases. Growing incidence of virulent diseases such as avian influenza (highly pathogenic avian influenza (HPAI)) and foot and mouth disease (FMD) is therefore a cause for concern. Precautionary measures applied by the importing states may in turn hinder trade, or be applied with protectionist intentions. This is why, in the international trade order, standards for preventive measures by states have been adopted.

The goal of this study is to explore the interface between the conservation and maintenance of the diversity of AnGRFA and the international legal regimes for the protection of human, animal or plant life or health in the trade of live animals and animal products (zoosanitary and phytosanitary measures). The basic question is if the international legal regimes and policy measures have an impact on animal genetic diversity, and if so, what this

impact is and how it takes effect. The study is solely focused on biodiversity related aspects in the context of international trade, and makes no attempt to provide a broader overall picture.

The study deals with the international standards as adopted by the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS), which acknowledged the standards of the World Organisation for Animal Health (OIE) and the Codex Alimentarius as the international reference for sanitary standards for the trade in animals and animal products. The study in part also takes up the (higher) standards of the European Union.

The study is based on three case studies:

- the outbreak of HPAI in Asia from 2003 to 2005;
- the outbreak of FMD in the United Kingdom in 2002; and
- a study on the possible impacts of zoosanitary and food safety measures on the creation of export markets for products of breeds at risk.

First, an abstract of each of the case studies is given. Secondly, details of the pertinent zoosanitary regulations are presented. The third step is an assessment of the interface between the standards, the measures they prompt and AnGRFA diversity.

As the matter of international standards is complex, we abstain from an inclusive description. The mechanisms will be considered in a concrete way in relation to the case studies.

2 Relevant developments in the livestock sector

2.1 Value of AnGRFA diversity for the prevention of livestock diseases

Studies on many livestock diseases have found evidence that the extent to which the animals concerned are resistant or tolerant to diseases is related to genetic variation (FAO 2007). There is much anecdotal evidence indicating greater disease resistance of livestock breeds indigenous to environments where they face a heavy disease challenge. However, research into the genetics of resistance and tolerance to livestock disease is limited in terms of diseases, breeds and species investigated (FAO 2007).

There is evidence from mathematical models that genetic diversity within a population affects both the probability of a disease outbreak and its outcome. The lower the genetic diversity in a population, the greater the probability of extreme outcomes (not affected or catastrophic epidemics). With an increasing number of genotypes in the population, disease

dependent mortality during major epidemics decreases (Hoffmann 2007; FAO 2007).

Against the background of these findings the “State of the World’s Animal Genetic Resources for Food and Agriculture” (FAO 2007) concludes that there is a strong case for inclusion of genetic elements within disease control strategies. If genetic resources are eroded, potentially important means of combating disease may be lost.

2.2 Erosion of AnGRFA diversity

There is consensus that global diversity in farm animals is under threat (Hiemstra et al. 2006), even if for lack of population data, the exact risk status cannot be established (FAO 2007).

The State of the World (FAO 2007.) reports 20 percent of the breeds registered in the Global Databank as being classified “at risk” and points to the alarming fact that 45 percent of the newly reported *local* breeds, for which population data are available, are either at risk or already extinct.

Livestock diversity is potentially threatened by a variety of factors: FAO (2007 *p. 113 ff.*) identifies the following:

- the general trends in the livestock sector, i.e. economic, social and policy factors;
- disasters and emergencies such as droughts, floods, earthquakes, war; and
- epidemics and disease control measures.

2.3 The “livestock-” and the “supermarket-revolution”

The livestock sector is undergoing intense changes. Demand for and supply of animal proteins is increasing rapidly. Developments have been most dynamic in the developing countries experiencing rapid economic growth. This development is triggered by increased purchasing power of the population, which leads to a higher consumption of meat, milk and eggs by a new middle class. The trend, termed the “livestock revolution”, is amplified by population growth, increasing urbanization and changing lifestyles (Steinfeld and Chilonda 2006; FAO 2007).

This leads to structural changes of trade and retailing (FAO 2007). The globalization of markets and the weakening of trade barriers entail growth of the livestock sector and changes in production mode. Technological development combined with efficient international transport is increasing the role of international trade in animal products. Characteristic elements are the prominence of large retailers, vertical coordination and integration along the food chain and the industrialization of the production process (Costales et al. 2006); an evolution dubbed “supermarket revolution” by Seré et al. (2007). Concurrently, the increasing markets are seen as an opportunity

for developing countries to satisfy world demand for livestock products and to access lucrative, high-value markets (Perry et al. 2005; Scoones and Wolmer 2007).

There is a risk that these developments have an adverse impact on livestock diversity: local breeds that represent a relatively greater diversity (in comparison to international transboundary breeds) are increasingly being replaced by a narrow range of high-yielding breeds, or diluted by indiscriminate cross-breeding with exotic animals (FAO 2007).

2.4 Increasing health risks in animal production

Warnings are being voiced of an increased risk for transmission of zoonoses caused by the intensification of livestock production systems, which leads to a changing disease distribution, including the expansion of vector borne diseases as a result of global warming. The concern is that this will lead to the international spread of the diseases (Perry and Scoones 2007, p. 334; Zinsstag 2007; GRAIN 2008). Otte et al. (2007 p.2) speak of a “global commons of disease risk”, due to human and livestock population growth, changes in livestock production, the emergence of worldwide agro-food networks, trade in wild animals and significant changes in personal mobility.

2.5 Conclusion

The situation at the interface of diversity of AnGRFA, animal health and international trade is characterized by intertwined developments, with a mutually reinforcing effect.

With regard to the interface between international zoosanitary and food safety regimes, international trade in live livestock and livestock products and AnGRFA diversity, two factors need to be considered: first the *direct* effects of the measures to contain and prevent an outbreak, corresponding to the international norms (in order to regain access to the international markets); and second the *indirect* effects that these international regimes may have on access to international markets for keepers of local diverse livestock, thus potentially creating a negative incentive for their conservation and sustainable use.

The international regimes, be it the standards set in the framework of the World Trade Organization's SPS; the superior standards of importing countries that are permitted by the SPS, if “based on science”; or the increasing amount of private standards applied by integrated market chains, are perceived by developing countries as tools to exclude their products from the international markets (Desta 2007; Abeiderrahmane 2003).

3 Abstracts of background studies

Three situations have been studied to serve as a basis for the analysis of possible effects of international zoosanitary and food safety regimes on livestock diversity. They give examples of the impact of animal diseases on the access to international markets for animals and animal products for the countries affected. They describe the disease situation, measures taken, consequences for the animal stock, impact on the trade and market structure, economic costs and the legal and institutional follow-up.

Two examples describe diseases that have a serious impact on the market access of a country: HPAI¹ and FMD. The third study takes up the argument that the marketing of products of local, endangered breeds can create incentives for their conservation and sustainable use and extrapolates it in relation to international markets.

In the following the essential elements of these studies are summarized (see annexes 1–3 for full details of the studies).

3.1 Avian influenza

Avian influenza, in particular influenza of the H5N1 type, which is highly pathogenic, is one of the most telling examples for the need for effective international cooperation in the control and management of animal diseases. Its spread from Southeast Asia to other regions has had enormous impacts on markets, prices, trade and income, affecting national economies and domestic industries. Avian influenza is specific inasmuch as it poses severe risks for human health and threatens to evolve into a zoonosis, instigating a pandemic of human influenza.

In the case of an outbreak of HPAI, direct losses are caused by death and culling of birds. During the 2003–2005 outbreaks in Asia, direct losses were highest in Vietnam (44 million birds, amounting to 18 percent of the poultry population) and in Thailand (29 million birds, representing 14.5 percent of the poultry population).

HPAI virus is easily transmitted and can for instance be contracted through contact with the aerosol or faeces of infected birds, or contaminated feed or water. The following have been identified as factors influencing the spread of HPAI:

- breeding and market practices that foster proximity and contact among birds and poultry and contact with humans;
- specific farm management practices;
- movement of poultry;

¹ The OIE terminology is NAI for notifiable avian influenza, which is differentiated into highly pathogenic avian influenza (HPAI) and low pathogenic avian influenza (LPAI). The study deals with HPAI only.

- lack of genetic diversity for disease resistance among commercial poultry; and
- weaknesses in the institutional climate relating to veterinary services.

The measures to curb the outbreak were two-tiered: compulsory slaughter and decontamination of infected sites and their surroundings with vaccination programs in some countries (Hong Kong, Viet Nam, Indonesia, China); the introduction of biosecurity measures, such as hygienic protocol for production, strict control, or even prohibition of live poultry markets (Viet Nam), monitoring of the circulation of poultry and poultry products, and the introduction of licensed slaughterhouses. These measures led to a restructuring of production, the markets and the industry, and significantly decreased the role of the small backyard poultry producers. The measures were strongly directed toward the centralization and integration of poultry production systems where biosecurity is deemed to be better assured.

Economic losses were the result of diminished export earnings, the restructuring of markets and a decline in consumer demand. The epidemic led to shocks on the world market that in turn had repercussions on the local markets.

Owing to the lack of information on the state of diversity, the loss of diversity is difficult to assess (see also FAO 2007). There is only anecdotal evidence of the loss of individual animals of rare breeds by culling and of the loss of some breeds as a result of the preventive measures in Europe. It is assumed, however, that diversity may have been affected on several levels: first, directly, by death and culling of birds and second, indirectly, by changing market structures that forced smallholders out of the markets.

It is assumed that in Asia, the village backyard systems are to a certain degree composed of indigenous breeds. They were to a (relatively) larger extent affected by the measures taken to contain and prevent the disease.

It seems that the epidemics, i.e. the change of the avian flu virus into highly pathogenic strains and its effects, in particular the human deaths involved, took affected countries by surprise. The responses were immediate and fierce, based on the traditional veterinary practices in the case of epidemics. As diversity had not been an issue before the outbreaks, information and knowledge were lacking, not only in Asia, but also in Europe. No strategies to prevent the loss of diversity had been developed, in particular regarding vaccination and ex-situ storage.

However, in the OIE and the EU an adaptation of the normative basis was initiated in the follow-up.

3.2 Foot and mouth disease

FMD is considered to be (one of) the most contagious animal diseases. It can be transmitted:

- from animal to animal in the breath, through bodily fluids which contaminate the environment and may be transported by the wheels of vehicles, or even by the wind; and
- via animal products such as meat and milk.

Depending on the temperature and pH conditions, the virus can persist in contaminated fodder and the environment for up to one month. It can even survive in some processed meats (frozen lymph nodes, bone marrow, residual blood clots, uncooked salted and cured meat) and in unpasteurized milk and dairy products. It can be inactivated by the normal post-slaughter acidification process and by thorough cooking, or salting combined with drying.

The virus can kill young animals, but is not deadly in adults. They can recover within weeks, but there are reductions in productivity (of milk and meat) afterwards. FMD is not contagious to humans, nor is the meat considered unsafe for human consumption.

The epidemic of 2001 in the UK spread within two weeks throughout the entire country. The major control strategy during the outbreak was to cull infected animals, and to trace and slaughter dangerous contacts. This led to the slaughter of 5.5 million sheep, 759 000 cattle, 432 000 pigs, and 7 000 other animals (goats and deer).

Exports were strictly banned: the economic loss in agriculture as a result of loss of exports was estimated at £310–£400 m in 2001 and continued at £36 m each month during the imposition of export ban. It took about 40 days for EU markets to reopen after the UK was declared disease-free and up to six months for some non-EU destinations.

Vaccination was a hotly debated issue but in the end vaccination was not used because of the fear of trade restrictions. (Europe as an important export market has the status of FMD-free without vaccination.) Also, the waiting period until the “disease-free without vaccination” status could be re-acquired, was at this time not clearly formulated.

As AnGRFA diversity was not an issue before the outbreak there are few statistical data on the effects. Some data, however, are available from non-governmental organizations (NGOs) (see FAO 2007). The slaughter programmes threatened breeds that were concentrated in the affected areas, even if before the outbreak the population was quite big. Several breeds were severely affected. Yet there is no evidence of any breed becoming extinct.

In the aftermath, the experiences were discussed at conferences taking place at the regional (EU) and international level. The lessons learned led to a change in the vaccination policy in the EU; to the inclusion of biodiversity aspects in the relevant regimes; and in the OIE the clarification of the regulation regarding recovery of disease-free without vaccination status after emergency vaccination.

3.3 Animal products

The question asked in this study is whether international zoosanitary and food safety regimes have an indirect effect on livestock diversity, because they have an impact on the creation of export markets for products resulting from non-intensive production based on local breeds. The underlying assumption is that creation of markets can provide incentives for the conservation and sustainable use of local breeds in general and – if specifically targeted – of local breeds at risk.

As no example of international marketing of products of local breeds at risk has been found, the study advances in three steps: first, examples of initiatives for *successfully marketing products of breeds at risk* are described. Second, examples for the *marketing of products from extensive smallholder production* are considered, and third, the attempt to *export a product* resulting from smallholder production (camel cheese) to the EU markets is analysed.

The first examples deal with initiatives to promote the sustainable use of breeds at risk by creating specialized niche markets, mainly in Europe, but also in India and the US. Examples include the feral sheep in Norway, the Iberian pig in Spain and Bresse chicken in France. The conditions for the success of the initiative were:

- organized cooperation between livestock-keepers and breeders, and possibly government agencies;
- production of a high quality product;
- intensive marketing measures accompanied by some kind of certification scheme;
- consumers willing to pay higher prices.

The experiences show that the concept can be successful. The question in our context, however, is to what extent success depends on local or regional socio-cultural contexts.

The second set of examples is based on the assumption that the variety in extensive smallholder production is greater and that therefore conservation of livestock diversity has to take account of these breeding structures. The study describes a successful initiative by a South African corporation to integrate smallholders into the successful production of quality lamb and goat meat for high-level export markets. This example is characterized by a high degree of cooperation and capacity-building activities by the

corporation, the support and cooperation of the governmental agencies, a product of outstanding quality and constant marketing activities.

The third example deals with the attempt to export camel cheese from Mauritania to the EU from a small, local pilot factory in Mauritania. As the milk production is not regular throughout the year, at some times production exceeds demand. In 1994 a first world-wide experience in the production of camel cheese for the conservation of surplus milk was positive. So the factory promoted the production of camel cheese. As the consumption of cheese does not normally feature in the diet of Mauritians (nor of the populations of the neighbouring countries) the idea was to gain access to the European market. The planned strategy was to create niche markets in luxury shops in the UK, Germany and France. However, negotiations for access to European markets have so far been unsuccessful.

The EU in principle allows the importation of milk products from countries with endemic FMD if treated according to the prescribed inactivation procedures and hygienic standards. However, the exporting country must provide equivalent sanitary services, such as competent authorities for dealing with both veterinary and food safety issues and must have at its disposal laboratory facilities for testing maximum levels of antimicrobial substances, pesticide residues and contaminants. The task of assessing, *inter alia*, hazard analysis and critical control point (HACCP) procedures, microbiological testing and documentary requirements for sanitary control systems is particularly challenging for veterinary services and food safety authorities in a least-developed country (LDC) with limited resources.

3.4 Analysis

The case studies show different characteristics that are each relevant for our context: the case of FMD in the UK describes the outbreak and measures taken in an industrialized country that had previously held the status of "FMD free without vaccination" which is the most favourable for trade.

The significant characteristic of the outbreak of avian influenza is that it affected different types of producers: industrial producers as well as smallholders. The measures for prevention also affect both types of producers; however, with regard to the latter all steps in the production line, including transport, local markets and slaughter are involved.

The examples of HPAI and of FMD illustrate the severe measures taken by the affected states. An enormous number of animals were slaughtered, and market structures changed completely. This was the case in the emergency reactions to HPAI because of the rapid spread and the threat to human health, and in the FMD outbreak because of the rapid spread and extent of the disease. This confirms the observation that diseases posing a severe threat to the livestock economy, such as FMD in the UK, and serious threats to human health from zoonotic diseases motivate strong, concerted control efforts (FAO 2007).

The study on products shows that there are options to foster production systems that have the potential to maintain higher livestock diversity, and to promote conservation and sustainable use of breeds at risk by accessing niche markets with high quality products. It also illustrates the complexity of the measures and procedures for both animal health and food safety required by importing countries which impose high standards.

The questions arising from the examples with relevance to our topic are:

- How do the international standards for animal and human health shape the measures taken by the trading partners (i.e. exporting and importing countries) to contain and/or prevent animal diseases?
- What is the impact of these measures on AnGRFA diversity?

Before we further discuss the measures and their impacts, it is necessary to understand the basic philosophy and system of the relevant international disciplines, norms and standards. In the following, first the system of international standards – those of the OIE and of the Codex Alimentarius, and their integration into the system of the WTO – will be described. The mechanisms of the system will then be explained by the description and analysis of the standards that are relevant in the context of the three case studies.

4 The system of international standards

4.1 Rationale and institutional environment

International trade in animals and animal products and risk prevention are opposed interests a priori. Risk prevention in human and animal (public) health is one of the primary responsibilities of states, and increasingly of the international community too. Likewise, governments are increasingly subjected to public scrutiny and pressure with regard to food safety, and to management of risks caused by the importation of animals and animal products (Brückner 2004). Risk prevention may lead to a restriction of trade by importing countries both in the interests of their public health mandate and to safeguard their own economic interests in animal production. Yet, greater demand for animal proteins is perceived as an opportunity for developing countries, as traditionally big meat producers, to increase trade volume and to expand trade into lucrative high-value markets (see Scoones 2006). And of course, the philosophy of trade liberalization calls for the reduction of restrictions.

To mitigate the conflicting interests between trade and public health, international zoosanitary and food security standards have been created. Two standard setting bodies are of importance in the context of the topic treated here: the OIE and the Codex Alimentarius Commission. In the following these two bodies will be briefly presented and their interface with the WTO's SPS Agreement explained.

4.1.1 World Organisation for Animal Health (OIE)

At the origin of the OIE lies the linkage between increasing movement of animals and increasing risks: it was founded in 1924, in reaction to an outbreak of rinderpest (a contagious viral disease affecting mainly cattle and water buffalo) in Europe. This outbreak was caused by a transport of zebus originating from India and destined for Brazil via the port of Antwerp. Twenty-eight states then concluded the "International Agreement for the Creation of an 'Office International des Epizooties'" in Paris, (now known as the World Organisation for Animal Health) and so established the OIE as an intergovernmental organization.²

The objective of the OIE is to ensure transparency in the global animal disease situation, by collecting, analysing and disseminating veterinary information;³ and to safeguard world trade by publishing health standards for international trade in animals and animal products. These standards are laid down in Codes.⁴ The Code relevant in our context is the Terrestrial Animal Health Code (THC). The aim of the THC is to assure the sanitary safety of international trade in terrestrial animals (mammals, birds and bees) and their products. This is achieved through the detailing of health measures to be used by the veterinary authorities of importing and exporting countries to avoid the transfer of agents pathogenic to animals or humans, while avoiding unjustified sanitary barriers.⁵

It is important to note that the OIE system is based on the official veterinary services: it is exclusively their responsibility to provide the information they approve and they develop the norms in the Code Commissions with the assistance of scientific panels. So the Codes are norms decided upon by an international body and *not* a scientific document.

4.1.2 Codex Alimentarius

In contrast to the OIE, the Codex Alimentarius Commission (CAC) is an international organization within the UN system, namely a subsidiary body of FAO and the World Health Organization (WHO). It was established jointly by the FAO Conference and the WHO Assembly in 1963.

Similar to the OIE mission, the purpose of the Food Standards Programme is twofold: first to protect the health of the consumers and second to ensure

² A short history of OIE, is available at http://www.oie.int/eng/OIE/en_histoire.htm?e1d1 (last accessed on 8 June 2009).

³ OIE has no mandate to publish other information (for example received through other international organizations, as FAO or the World Health Organization or through NGOs).

⁴ Terrestrial Animal Health Code – Terrestrial Code, and Aquatic Animal Health Code.

⁵ Foreword of the Terrestrial Animal Health Code, 17th edition, 2008. Paris.

fair practices in the food trade (Statutes of the Codex Alimentarius Commission, Article 1 (a)).⁶

Because Codex focuses on safety of food (and feed), its relevance regarding trade in AnGR is limited to animal products for consumption. Its relevance is that it deals with questions such as acceptable residues of veterinary drugs in foods, e.g. antibiotics or hormones and the use of biotechnology for the production of animal feed or to boost animal production. For our case studies it is mainly the standards of the OIE that are relevant. Only in the camel cheese case are Codex norms applicable. Therefore in the following the focus is on the norms of the THC.

4.1.3 The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS)

The WTO's SPS acknowledges the standards of the OIE and the Codex as the reference for sanitary standards for the trade in animals and animal products.⁷

The SPS Agreement was negotiated during the Uruguay Round negotiations of the WTO and became part of the 1994 Final Act. Particularly in connection with the negotiation of the Agreement on Agriculture, the SPS aims at concretizing the (older, already existing) General Agreement on Trade and Tariffs (GATT) norm on sanitary and phytosanitary measures. A driving factor was the fear of many countries that, as non-tariff barriers to agricultural imports were banned, greater and unjustified use might be made of sanitary and phytosanitary restrictions. Accordingly, the negotiators of the SPS Agreement aimed at limiting the ability of a government either to use the protection of human animal and plant health and life as a pretext for measures that favour domestic producers or to impose local values concerning food safety and animal and plant health on international trade (Echols 2001).

The underlying objective of the SPS Agreement is to find a solution for the dilemma between the WTO's goal of liberalization and promotion of international trade and the (national) interest to protect human, animal and plant life or health by establishing strict standards for the importation of goods posing a risk to public health.

As a principle, the agreement acknowledges the right of nation states "to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health" (Art. 2.1 SPS). But it sets specific conditions for the application of measures. They can be applied:

⁶ Procedural manual of the Codex Alimentarius Commission, 16th edition (available at http://ftp.fao.org/codex/Publications/ProcManuals/Manual_16e.pdf) (visited: 8 June, 2009).

⁷ Annex A, 3. (a, b) SPS.

- 1) “only to the extent necessary to protect human, animal or plant life or health”; they must
- 2) be “based on scientific principles”; and
- 3) they must not be “maintained without sufficient scientific evidence” (Art. 2.2 SPS).

In other words, the standards and measures must be based on scientific facts and correspond to the principle of proportionality and necessity, as regards the means–effect relationship and the duration of the measure.

In order to facilitate international trade through harmonization, the SPS acknowledges the OIE and Codex standards as the international reference for sanitary standards for the trade in animals and animal products (Art. 3.4 SPS).

4.2 The SPS Agreement and the Terrestrial Health Code applied

4.2.1 The SPS measures: overview

The SPS is based on several principles that are then concretized in the THC: it promotes the *harmonization* of the sanitary and phytosanitary measures by international standards and it provides a framework for members to define their appropriate level of protection.⁸ Yet, there is a legal presumption that measures which conform to international standards are deemed to be necessary and consistent with the SPS (Art. 3.3 SPS).

Accordingly, importing States may choose between two approaches regarding the conditions they impose on the exporting country: they may choose to base their sanitary or phytosanitary measures on international standards, guidelines or recommendations (Art. 3.1 SPS), i.e. require the fulfilment of the conditions as spelled out in the standards. Or they may opt for a higher level of sanitary or phytosanitary protection. In this case, they have to demonstrate, “that the relevant international standards, guidelines or recommendations are not sufficient to achieve its [the state’s] appropriate level of sanitary or phytosanitary protection” (Art. 3.3 SPS and footnote 2).

Measures must be based on an assessment of the risks on the basis of scientific evidence (Art. 5 SPS), and are to be applied in a *non-discriminatory* way (Art. 2.3 SPS). Measures differing from those of the importer, must be accepted as “*equivalent*” if they achieve the importing member’s appropriate level of protection (Art. 4 SPS). Concepts of pest or disease-free areas are to be accepted if the necessary evidence is provided (Art. 6 SPS). And the dispute settlement procedures of the GATT apply (Art. 11 SPS).

⁸ An appropriate level of protection is defined as “The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measures... in their territory (Annex A, 5. SPS).

4.2.2 The THC in general

As mentioned above, the objectives of the OIE are threefold: to ensure transparency in the global animal disease situation; to collect, analyse and disseminate veterinary scientific information; and to safeguard world trade by publishing health standards for international trade in animals and animal products.

According to Brückner (2005), the THC itself is based on three principles: First, a scientific basis for all recommendations, not only regarding the animal diseases listed, but also relating to methods of surveillance, diagnostics, risk analysis, risk mitigation procedures and methods of disease control; second a reliable, well-functioning and independent veterinary service; and third, transparency, integrity and maintenance of ethical standards in disease reporting.

The purpose of the THC is to guide decision-making for international trade. Importing countries may request compliance with its requirements by the exporting country, to protect their own industries, to safeguard the health of their animal population, and to avoid endangering their own export status. In turn it allows the exporting country to use the Code to set standards for its national sanitary measures and to enable acceptance of its products in the export market (Brückner 2005).

The standards in the disease-specific chapters of the THC indicate the measures to be taken by the importing country to avoid the risks implied in the trade of animals and animal products (OIE w.y.); or, in other words, the standards define the minimal conditions an importing country might impose on the exporting country.

The applicable level of conditions that may be imposed depends on the disease situation in the exporting country. In the THC this is taken up in the so-called status of the country wishing to export.⁹ In the case of FMD, different levels are defined: “disease-free without vaccination”, “disease-free with vaccination”, and “disease infected” country or zone (Art. 4.3 THC). In the case of avian flu, the standards differentiate between NAI infected or free and HPNAI infected or free (Art. 10.4.2–10.4.4). The higher the risks implied in a particular status, the tighter the requirements for exportation to a country which itself has a higher status regarding the disease in question. The status “disease-free without vaccination”¹⁰ is therefore the most

⁹ Animal health status means the status of a country or a zone with respect to an animal disease, according to the criteria listed in the relevant Chapter of the Terrestrial Code dealing with the disease (THC, Glossary; available at https://www.oie.int/eng/normes/mcode/en_glossaire.htm (visited June 9 2009).

¹⁰ If animals are vaccinated against a specific disease, in the serological surveillance it is not possible to distinguish between the antibodies induced by vaccination or induced by (vector borne) infection. This of course signifies an increased risk. Therefore for the exportation of animals from vaccinated populations, specific requirements, e.g. quarantine periods and special surveillance obligations, are in place.

favourable. It eases the conditions for exportation of both animals and animal products. The following examples illustrate the system:

For the importation from an FMD-free country, where vaccination is not practised, into equal zones, only must be certified that animals showed no clinical signs of FMD on the day of shipment, were kept in a FMD-free country or zone where vaccination is not practised for at least the past three months and have not been vaccinated.

If animals are to be imported from an FMD-free country or zone with vaccination to an FMD-free country or zone without vaccination, in addition it is to be certified that the animals have not been vaccinated, and that animals have to be tested for FMD antibodies with negative results. If animals are to be imported from FMD infected countries there are tight quarantine and test restrictions (Art. 8.5.10 to 8.5.12 THC).¹¹

From this it follows that the quality of the certifying veterinary services of the exporting country plays a key role in the international trade in animals and animal products.¹²

Regarding the assessment of risks by the country wishing to import animals or animal products, three different situations can be distinguished:

- Case one: the Terrestrial Code provides standards regarding a disease, for instance HPAI or FMD.
- Case two: there are standards, but the importing country considers them not to be appropriate and wishes to apply higher standards.
- Case three: the Terrestrial Code does not provide standards, or the commodity to be imported is not mentioned in the standards.

In all cases, the importing country will start the process of defining the health measures it intends to require by a risk analysis. In case one, the conditions and measures indicated in the THC might be applied without carrying out a complete scientific risk assessment.

In cases two and three, the conditions for the importation of the goods are to be based on a full risk assessment by the importing country. Section 2 of the THC gives detailed recommendations on the import risk analysis. The principal aim of import risk analysis is to provide importing countries with an objective and defensible method of assessing the disease risks associated with the importation of animals, animal products, animal genetic material, feedstuffs, biological products and pathological material. The analysis should be transparent. This is necessary so that the exporting country is provided with clear reasons for the imposition of import conditions or refusal to import (Art. 2.1.1 THC).

¹¹ There are also norms regarding importation of fresh and frozen semen; and in vivo or in vitro produced embryos. For the norms on HPNAI see Chapter 10.4 THC.

¹² The THC contains quality standards for veterinary services and recommendations for the evaluation of the veterinary services (Section 3).

4.2.3 Instruments to facilitate trade

From the above it is clear that the means for conformity with the standards and thus the conditions for access to international markets might exceed the capacities of a state, in particular of the developing countries. The Terrestrial Code, to facilitate participation in international trade, in particular for developing and transition countries, has put in place several measures aimed to take into account their specific situation. These measures are: zoning and compartmentalization, the principle of equivalence and measures to facilitate trade in products.

Zoning and compartmentalization

Disease-free status with or without vaccination is a precondition for export of animals. Yet disease-free status may be difficult to achieve for an entire country. The instruments of zoning and compartmentalization allow this status to be achieved for a defined part of a country (zones¹³) or a closed production system (compartments¹⁴) only (Article 4.3.1 THC).

The underlying rationale is that, in this way, resources can be focused on those activities that have the greatest chance of success in controlling or eradicating a disease, or in gaining or maintaining market access for certain commodities (OIE w.y.; Brückner 2005; Brückner 2004).

The conditions for zoning or compartmentalization with regard to specific diseases are defined in the disease standards. Biosecurity, close veterinary surveillance, and documentation are requirements in both cases. In the case of *zoning* a clear physical separation of the infected and non infected areas, accompanied by buffer zones and strict control of animal movements between the zones are required. *Compartmentalization* is for instance applicable in closed, biosecure systems in industrial production.¹⁵

Equivalence of sanitary measures

As mentioned above, the SPS Agreement introduces the principle of equivalence. Sanitary and phytosanitary measures that are equivalent to those required by the importing state, are to be accepted by other Members, even if these measures differ from their own or from those used by other Members trading in the same product (Article 4 SPS). The exporting Member

¹³ “Zone means a clearly defined part of a country containing an animal subpopulation with a distinct health status with respect to a specific disease for which the requisite surveillance, control and biosecurity measures have been applied for the purpose of international trade (THC, Glossary).

¹⁴ “Compartment means one or more establishments (i.e. closed premises) under a common biosecurity management system containing an animal subpopulation with a distinct health status with respect to a specific disease or specific diseases for which the requisite surveillance, control and biosecurity measures have been applied for the purpose of international trade” (THC, Glossary).

¹⁵ For details of compartmentalization, see Chapter 4.4 THC.

needs to objectively demonstrate that its measures achieve the importing Member's appropriate level of sanitary or phytosanitary protection (see also Wilson and Beers 2001). One example of the effects of this equivalence is the agreement of the OIE to revise its Terrestrial Code to reflect the importance of veterinary para-professionals and the privatization of part of the service¹⁶ (for details see: Scoones and Wolmer 2006).

Elements to facilitate trade in products

For some major diseases, the THC indicates measures for the inactivation of pathogens and vectors in products. This means that if the inactivation procedures have been followed, animal products from an infected country can be deemed safe from the point of view of animal health. They are then free from the risk of vector or pathogen transmission. Such measures are for instance listed for export of milk and meat from a country with FMD and for eggs and meat from a country with avian influenza.

In meat for exportation from a country that is not free from FMD, the virus can be inactivated by canning, thorough cooking, or drying of the deboned meat after salting (Art. 8.5.32 THC). Milk and milk products for human consumption need to be sterilized, according to their pH either using the ultra high temperature (UHT) or high temperature method (Art 8.5.36 THC).

In the case of HPAI, meat and eggs that are not certified to be free from the virus need to be processed according to the procedures given in Art. 10.4.25 and 10.4.26 THC.

For instance in the case of camel cheese, for the exportation of milk products from Mauritania, which has no FMD free status, sterilization (HTST¹⁷) was requested (see Annex 3). In a study on the export of poultry from Thailand, Perry et al. (2005, p. 19 f.) report that the rapid shift of the industry from the exportation of frozen meat to cooked chicken products prevented the breakdown of the industry after the outbreak of HPAI.

4.3 Summary

To sum up, there are two levels of preconditions that need to be met for the exportation of animals or animal products, i.e. at country level and at business level.

At country level it is essential to have a functioning sanitary service that is *equivalent* to the importing countries services. This means that a country must have at its disposal competent authorities for dealing with both veterinary and food safety issues. Unless this condition is fulfilled, disease-free status will be denied. Yet, to have a disease-free status, at least for a

¹⁶ Art. 3.2.5 THC. Evaluation Criteria for Human Resources.

¹⁷ High-temperature short time treatment.

zone or compartment, is a precondition for most exports of animals and animal products.

Exemptions from these preconditions apply to animal products which have been processed in such a way that animal-disease viruses have been inactivated, although on practical grounds, the potential volume of exports of animal products from third countries which do not achieve equivalent veterinary and sanitary standards to high value markets might remain limited.

At business levels, the producing establishment in the exporting country must achieve food hygiene standards “equivalent” to those that apply in the importing country. In principle, these regulations should be based on international standards.¹⁸ Regarding food hygiene requirements, there are many standards, including the different Standards of the Codex Alimentarius (e.g. the General Standard for Cheese) and protocols production modes e.g. the Code of Hygienic Practice for Meat (CHPM) and the implementation of the HACCP principles.

If the establishment is not located in a disease-free country or zone, but wishes to export products of animal origin, as is the case in the example of camel cheese, first, it must provide a certificate that the product originates from FMD-free flocks (THC 8.5.26) and second, it has to follow strict inactivation procedures for animal disease viruses as set out by the OIE, for instance UHT or HTST treatment for the milk. In order to comply with food hygiene standards, the establishment in the exporting country is required to have access to laboratory facilities for testing, inter alia, maximum levels for anti-microbial substances, pesticide residues and contaminants.

As to the (other) measures for facilitating the access to competitive markets, in particular zoning, compartmentalization, and the principle of equivalence, Brückner (2005) estimates that they create opportunities for developing countries for a gradual phasing in of their measures. He sees the quality of the veterinary services as being a particularly important requirement, and proposes that as a first step, countries ought to begin to work towards compliance with the relevant standards in addressing the most important issues for veterinary services delivery.¹⁹

¹⁸ It should be noted that retail chains often apply private standards, e.g. EurepGAP, which impose higher levels of sanitary control than international standards and national sanitary regulations. Public awareness about avian influenza and other animal diseases increases the risks to the good reputation of retailers. The retailers transfer these additional costs of precaution further down to importers and producers by requiring the highest possible biosecurity levels. Thus, economic considerations may actually hinder the importation of processed foods from countries where animal diseases are prevalent.

¹⁹ In the context of the creation of zoosanitary services for animal health and certification, see also Pratt et al (2005) for an analyses of the benefits and costs of compliance in livestock markets for the Somali Region of Ethiopia; and Cabrera et al (2008) who draw lessons from the Namibian and Botswanese beef industry.

5 The standards applied

In the following, the standards applicable to our case studies are described. The goal is to demonstrate the link between standards and measures, and to be able to comprehend the decisions taken. To facilitate the overview, the standards will be described only in general terms. For more comprehensive and detailed information it is necessary to refer directly to the standards, recommendations and guidelines of the Code itself.²⁰

As explained above, the analysis is based on the assumption that it is not only the direct influence of the emergency measures in the case of outbreaks of epidemics, such as the stamping out of infected or in-contact animals, which have an impact on animal genetic diversity. It is submitted that there may also be indirect influences exerted by measures that have an impact on the marketing of animals or animal products, and the creation of export markets for products resulting from non-intensive production based on local breeds that are assumed to host a relatively greater livestock diversity. In the case of outbreaks of epidemics, the importance of direct measures is predominant.

Accordingly, the following analysis has two parts: the first discusses examples of the outbreak of epidemics, and the second, the case of trade in animal products where (only) indirect impacts may occur.

5.1 Outbreak of epidemics

In the case of an outbreak of an epidemic the primary aim is to contain and then eradicate the disease. The main goal is to prevent the spread of the disease and limit the losses of animals. Another goal, in particular in countries exporting animals and animal products, is the reopening of the markets.

5.1.1 Foot and mouth disease

In the case of FMD in the UK, the epidemic broke out in a country that formerly had the status of disease-free without vaccination. As explained above, this is the most trade-friendly standard.

During the 2001 outbreak, the spread of the epidemic was so fast and wide that the creation of a containment zone was not possible. Although the THC contains recommendations for exporting animals (and animal products) from FMD-infected countries or zones, they may not have been realistically applicable in this case.²¹

²⁰ http://www.oie.int/eng/normes/mcode/en_sommaire.htm (last visited: 3 March 2008).

²¹ Art. 8.5.12 THC demands quarantine, control and certification measures.

The consequence was that in practice all exports of animals susceptible to FMD were blocked. Therefore, with regard to international trade, it was crucial to recover one of the disease-free status' after the outbreak.

The measures to be implemented to regain a former status are defined in the standards. As a rule they include stamping out measures,²² disinfection of infected premises, and waiting periods during which there must be no occurrence of new disease outbreak,²³ accompanied by tight surveillance. The waiting periods are graduated according to the status of the country, and the eradication strategy chosen.²⁴

A basic requirement is the existence of an effective veterinary system corresponding to OIE prescriptions. The elements necessary for an effective surveillance system and strategy are listed in Art. 8.5.42 THC. The structure has to encompass an early warning system and mechanisms for rapid testing of samples. Different types of surveys (random, clinical, virological and serological) must be executed.

In the case of the UK, a stamping out policy without emergency vaccination was chosen. Accordingly the following conditions had to be fulfilled in order to regain the former status: slaughtering of all affected and in-contact animals; disinfection of infected premises, and a waiting period of three months after the last case, accompanied by tight surveillance, and with no occurrence of a new disease outbreak.

5.1.2 Highly pathogenic avian influenza

Since the time of the above-mentioned HPAI outbreaks in Central Asia, much research has been done and the capacity for preventive and

²² "Stamping-out policy means carrying out under the authority of the Veterinary Authority, on confirmation of a disease, the killing of the animals which are affected and those suspected of being affected in the herd and, where appropriate, those in other herds which have been exposed to infection by direct animal-to-animal contact, or by indirect contact of a kind likely to cause the transmission of the causal pathogen. All susceptible animals, vaccinated or unvaccinated, on an infected premises should be killed and their carcasses destroyed by burning or burial, or by any other method which will eliminate the spread of infection through the carcasses or products of the animals killed (THC, Glossary).

²³ In the case of FMD, the waiting periods are differentiated according to the kind of stamping out strategy chosen; stamping out of all clinically infected and in-contact susceptible animals is the most efficient method in view of the waiting period imposed.

²⁴ In the case of the status "disease-free without vaccination" the options are: stamping out policy, stamping out policy with emergency vaccination; with or without slaughtering of the vaccinated animals. Waiting periods amount to between 3 and 6 months after the last case. In the case of "disease-free with vaccination": with or without stamping out policy. Waiting periods amount to between 6 and 18 months after the last case.

emergency measures has increased, also thanks to the experiences gained. The relevant standards in the THC have been further developed and differentiated. Yet the principles remain the same:

As for FMD, two elements are necessary to be able to claim the status of “disease free”: no outbreak during a specified time frame and the existence of an effective surveillance system. Accordingly, a country (or compartment or zone) is considered disease-free, if no outbreak of HPAI has occurred within the past 12 months. This finding must be based on a survey system and strategy for sampling, clinical surveillance at flock level and virological and serological surveillance which comply with the recommendations of the THC (Art. 10.4.27 to 29). This means that the country has at its disposal an effective, documented surveillance system under the veterinary authority providing for a formal and continuous system for detecting and investigating disease outbreaks; a procedure for rapid collection and transport of samples to a laboratory that fulfils the recommendations of the Terrestrial Manual²⁵ and encompassing a system for recording, managing and analysing diagnostic and surveillance data (Art. 10.4.28 THC).

If an outbreak of HPAI occurs in a country, all exports of animals and animal products are blocked (Art. 10.4.21 THC). The only exceptions are certified free zones or compartments, and eggs treated and meat processed in order to inactivate the virus, both under tight surveillance and certification schemes (Art. 10.4.16 and 22 in connection with Art. 10.4.25 and 26 THC).

The condition for the reopening of international trade is that the disease-free status is regained. In a country, zone or compartment, HPAI-free status can be regained three months after a stamping-out policy has been applied and all affected establishments have been disinfected. Another condition is that active surveillance has been carried out during that three-month period. (Art. 10.4.4 THC). The results of the surveillance must be reported.

5.1.3 Trade in animal products

For animal products, a double set of standards applies: first, the standards of the OIE, as the importation of commodities produced in infected countries, or originating from infected animals, might imply an animal health risk for the importing countries and, second, the standards of the Codex Alimentarius regarding the safety of the product for the consumers.

The aspect of animal health: the standards of the OIE

²⁵ The purpose of the Terrestrial Manual is to contribute to the international harmonization of methods for the surveillance and control of the most important animal diseases. Standards are described for laboratory diagnostic tests and the production and control of biological products (principally vaccines) for veterinary use across the globe.

The risk implied in the camel cheese case is the transfer of the FMD virus. As mentioned, the THC makes recommendations for some commodities – beef, pig and poultry meat, eggs, and milk – in the case of some diseases of major international importance – HPNAI and FMD among others.²⁶

The chapters treating measures regarding the diseases also make recommendations for the inactivation of vectors and pathogens in animal products. The treatment needs to be duly certified by a veterinary service that meets the requirements laid down in the THC. Importation of the appropriately treated products from infected countries is then deemed safe.

As Mauritania is a country infected with FMD, the following conditions must be fulfilled for the exportation of cheese: first, it must be certified that the milk for producing the cheese originates from herds that were disease-free at the moment of collection; second, that it has been processed to inactivate the virus; and, third, that the necessary precautions were taken after processing to avoid contact of the products with any potential source of FMD virus. To inactivate the virus, sterilization processes (UHT or HTST) have to be applied, according to the pH of the milk (Art. 8.5.26 and 8.5.36/7 THC).

The aspect of food safety: the standards of the Codex Alimentarius

Regarding the Codex Alimentarius food safety norms, in the case of camel cheese, the General Standard for Cheese and additional standards apply.²⁷ Besides the definition of quality factors and the listing of permitted food additives, the standards also set maximum limits regarding contaminants (heavy metals, pesticide residues – No 5); the obligation to conform with the General Principles of Food Hygiene (Recommended International Code of Practice – No 6) and to compliance with “any microbiological criteria established in accordance with the relevant Principles”.²⁸ Furthermore, the product needs to be labelled (milk fat content, date marking – No 7). Sampling and analysis have to be carried out according to defined methods (CODEX Stan 234-1999).

Additional requirements

As described above, for the exportation of animals or animal products it is vital for the exporting country to be equipped with an effective veterinary service, including the necessary laboratory facilities to certify compliance with the standards.

²⁶ See the table in OIE: Commodity based approach, p. 6 ff (http://www.oie.int/eng/normes/guides/EN_commodity_based%20approach.pdf) (last accessed 5 March 2008). If no standards exist, the country wishing to import has to carry out a complete risk analysis.

²⁷ Codex STAN A-6-1978, Rev. 1-1999, Amended 2006.

²⁸ Principles for the establishment and application of microbiological criteria for foods (CAC/GL 21-1997).

The THC and the Codex provide corresponding standards and guidelines. Yet, in the case of the EU, an “equivalent” veterinary and food safety service is required.²⁹ The principle prescribes that food safety standards in an establishment proposed for approval shall be comparable to the requirements of the relevant EU legislation. As examples, the implementation of HACCP principles,³⁰ microbiological controls and an effective control system with documented records are mentioned (European Commission, 2006b).

Regarding the case at hand, the veterinary services and food safety authority of Mauritania would be obliged to guarantee that the food safety standards in the Tiviski dairy factory are equivalent to the ones which apply to establishments in EU Member States. The task of assessing, *inter alia*, HACCP procedures, microbiological testing, and documentary requirements for sanitary control systems might be particularly challenging for veterinary services and food safety authorities in an LDC with limited resources.

6 Analysis

The analysis will take up the above distinction between possible direct and indirect impacts and is structured accordingly. “Impact” of the zoosanitary and food safety measures on livestock diversity as we understand it means that the measures lead to a (negative) change in the (risk) status of a breed. This can only be detected with any certitude in cases where a functioning registration system existed before the outbreak.

In the following, a distinction is made between direct and indirect impacts. *Direct* impacts are due to the death of animals, caused by the disease itself or by stamping out measures. *Indirect* impacts can occur in two different scenarios both based on the assumption that in livestock systems with a high proportion of subsistence farming and/or smallholder production, diversity is relatively greater. First, these systems might be affected to a higher degree by measures and situations that lead to a competitive disadvantage on the market, such as obligations to prevent further outbreaks or the volatility of market prices. Secondly, trade standards might have a relatively stronger impact on the competitiveness on international markets of small production systems as compared to industrialized production.

Due to a lack of relevant data, in the case of indirect impacts, the *potential* of zoo-sanitary and food-safety measures to affect livestock diversity *in general* (irrespective of the risk status in concrete cases) is investigated.

²⁹ See European Commission, Health & Consumer Protection Directorate-General (2006a).

³⁰ HACCP= hazard analysis and critical control point. This is an audit system for food hygiene management, laid down in the Codex Alimentarius (CAC/RCP 1-1969 Rev. 3 (1997) – Basic texts on food hygiene).

6.1 Direct impacts

There is consensus that the outbreak of disease might have a direct impact on AnGRFA diversity, either through the death of animals or – even to a larger extent – by the stamping out measures. Yet, it must also be taken into account that the measures to contain the outbreaks may make a positive contribution to the preservation of breeds at risk.

There are two situations in which the impact of emergency measures on AnGRFA diversity might be greatest: firstly, in situations in which rare breeds are confined to areas that are severely affected by a disease, as was reported for instance for the FMD outbreak in the UK. There, as reported by Bowles *et al.* (2003) at the height of the first stage of the epidemic in Cumbria, the Herdwick breed of sheep was severely threatened, despite comprising large numbers of individuals (approximately 80 000) and being commercially farmed. The reasons for the huge loss were the concentration of the breed in one geographical area and the farming method (flocks of 2 000 to 3 000 animals were kept on the unfenced mountains and moorlands of the Lake District (the “fells”) (FAO 2007; case study FMD p. 10). In these cases, the number of animals has been greatly reduced. But there is little evidence that a breed has become extinct due to the impacts of zoosanitary measures (see HPAI case study p. 8).

Secondly, an intensified impact may occur when measures affect entire production systems where rare genetic resources are or might be found. This is supposed to have been the case with smallholders of chicken flocks during the outbreaks of avian flu in Asia, but owing to the lack of statistical data no clear statement is possible.

A third factor is that – in the cases of the FMD outbreak in the UK and the HPAI outbreak in South-East Asia – governments and veterinary services had to deal with extreme emergencies. The well documented and analysed FMD outbreak in the UK demonstrates the problems with which a government is confronted in the case of an outbreak. The extent of the outbreak and the rapidity of reaction needed caused problems of time and capacity. Difficulties arose in the communication processes and with the integration of expertise into the decision-making (cf. for all, Anderson 2001). The anecdotal report on the heritage breeds shows that a threat existed in fact. It is important to note, however, that there was neither time nor the capacity to take appropriate decisions and to implement them during the outbreak and no official preparedness measures regarding AnGRFA diversity had been taken beforehand. The answer to the question whether the outbreak could have led to the extinction of a breed remains in the realm of speculation.

Yet the states, the regional (EU) and international community reacted to these experiences. The aspect of conserving livestock diversity is taken into account in the revised EU legislation on FMD and HPAI, and in the cooperation of international organizations in the case of HPAI.

6.2 Indirect impacts

Whereas the direct impacts of measures to stamp out a disease on AnGRFA diversity are relatively clear cut (even if not clearly assessed), the matter of indirect impacts is more varied and complex. A variety of indirect impacts are described in the case studies and in the literature. One group of indirect impacts may first be caused by the measures directed at the prevention of the spread of the disease and of new outbreaks, and second by additional measures for reopening or opening markets, such as compartmentalization and zoning.

Another group of indirect impacts may be caused by the standards and conditions for the exportation of animal *products*, as described in the camel cheese case study.

6.2.1 Indirect impacts of measures to eliminate and prevent diseases

The measures to eliminate and prevent diseases may not only lead to the direct elimination of livestock, but may also set in motion a restructuring of production and markets in favour of industrialized integrated market chains. This impact is described for the poultry sector in the case of HPAI. On the one hand, the restructuring might be driven by losses caused by emergency measures, and/or related price swings that drive smallholders out of the market (case study HPAI pp. 9/10). However, impacts might also be the result of the preventive measures that follow an outbreak. In the case of HPAI, such measures include restrictions of movements; restrictions concerning live poultry markets, their closure or relocation; closing of collection points and small slaughter points and the obligation to slaughter animals in approved slaughter units only.

The HPAI case, in particular, gives illustrative examples of the possible effects of such preventive measures. For instance, Viet Nam banned poultry farming in 15 towns, and the movement, collection and sale of poultry between provinces. The sale of live poultry was prohibited. All incoming birds were to be monitored and quarantined only at approved slaughterhouses. Furthermore, Viet Nam enacted a series of legislative measures, including monitoring of the circulation of poultry and poultry products among provinces and cities through the establishment of permanent quarantine operating stations at the entrance to each province, urban area, district and village, and the creation of mobile quarantine teams. Additional rules referred to inputs for raising animals, and the areas where the animals were bred, assembled, transported and sold. Owners of birds or poultry products and/or establishments had to observe strict obligations regarding hygiene, inspection, notification to authorities, certification and transport. Animal slaughter was to be carried out only in licensed slaughterhouses. Regulations specify classification and control of animals before and after slaughter. The proper construction and maintenance of slaughterhouses is also strictly governed by legislation.

These measures risk driving smallholders out of the market chain. The same effects may be caused by increasing production costs as a result of emerging constraints in the form of tightened hygienic and health obligations, and control measures.

On a second level, the goal of preventing outbreaks may increase the bias between commercial breeds and local breeds on the political level and negatively affect the conservation of local breeds (Hiemstra 2006). The World State (FAO 2007) points out that the potential contributions of local breeds to wider development objectives are overlooked at the policy level. This may lead to the promotion of a limited range of AnGR, and to the failure to put measures in place to protect threatened breeds.

6.2.2 Indirect impacts of zoning and compartmentalization

Zoning and compartmentalization of areas of a higher health status are described above as measures to secure export options in the most efficient way, or to allow a graduated phasing in to the international trade obligations. Zones and compartments need to fulfil the conditions for the respective health status as to surveillance and quality of veterinary services. These conditions are to be defined in a *biosecurity plan*. Applicable biosecurity measures include further movement controls, use of natural and artificial boundaries, the spatial separation of animals, and commercial management and husbandry practices and surveillance. The documentation of the measures is part of the negotiations with the importing country. The zones or compartments have to be formally recognized by the importing country (THC 4.3). The creation of zones of higher health status is recommended not only to allow export of animals and animal products, but also to assure the production of commodities for the increasing urbanized areas. Therefore the policy is to create them around urbanized areas (Zinsstag, personal communication, 2007).

This may lead on the one hand to a concentration and frequently to industrialization of production processes and thus to a restructuring of the entire industry. On the other hand, there is a risk that small producers are cut off from the markets, as the transition into the disease free zone, and with it to interesting marketing opportunities, implies strict veterinary measures,³¹ let alone the fact, that in concentrating the – frequently scarce - veterinary capacities within the zone, the breeders outside the zone might be less well served. A two-tier system might come into existence, creating incentives solely for the intensive, industrialized sector. Accordingly, the measures are not unanimously judged as being favourable to the smaller livestock keepers (Scoones and Wolmer 2006).

³¹ See for instance for the transfer directly to slaughter of FMD-susceptible animals from an infected zone to a free zone within a country, Art. 8.5.9. THC.

6.2.3 Indirect impact of animal health and food security measures with regard to marketing and exportation of animal products

It was assumed above that international trade regulations that have a negative impact on smallholders may also have an (indirect) impact on AnGRFA diversity, although, to our knowledge, this impact has yet to be clearly and statistically established and demonstrated. Hence, it is submitted that, if AnGRFA have a direct use value, that is that they are directly contributing to the food security, livelihoods and profits of their keepers, breeders, communities and/or companies are likely to find it in their own interests to undertake the management and conservation of these genetic resources (Hiemstra 2006; see also 2007b).

It is conceivable that local breeds, such as animals reared by pastoralists, and/or the products of these breeds could find special niches in high value markets.³² Anecdotal evidence also shows that there is a market for labelled products (e.g. fair trade, organic production). From this it follows that if the products of local breeds find a market, incentives may be created for their conservation and sustainable use. This approach becomes more important, the scarcer public funding for conservation measures. The idea is to make use of the liberalized market, in order to (also) further the public good of AnGRFA diversity, possibly in public–private partnerships.

The camel cheese case study and its analysis show that the exportation of products to high ranking markets – in this case the European Union – is confronted with complex standards and procedures.³³ Even if the THC provides facilitation through a commodity-based approach, as is the case for the exportation of milk products, the infrastructural conditions for the guarantees of food safety are burdensome for exporting countries. For the exporters themselves, it is absolutely necessary to have a trading partner as door-opener in the importing country, to be supported by the governmental agencies of their country, based on cooperation between the exporting and the importing country.

The example of the camel cheese illustrates two typical aspects of market access for animal products: it discusses market access to an – arguably – high standard country; combined with the need to comply to the standards pertaining to a highly infectious disease.³⁴ Yet, as has been shown in this study, the ultimate hurdle was the lack of capacity to certify the conformity

³² See e.g. the cases described in Perry, 2005.

³³ According to Nancy Abeiderrahmane, who set up the Tiviski milk processing plant and tried to export camel cheese to Europe “These trade and hygiene rules are an even greater obstacle to trade than customs duties!” (2003)..

³⁴ The options and practice for export to other, less demanding destinations would have to be further studied and analysed.

of the product and of the production processes with the applicable standards.

A trustworthy certification is – besides an efficient veterinary service – a primary requirement for access to international markets. In taking account of the specific problems of developing countries, Thomson et al. (2006) propose the creation of an independent network of national third party accreditation or standards authorities, operating under the provisions of the International Organization for Standardization (ISO) or – alternately- the formation of regional quality assurance programmes.

In turn, one can also enquire into the EU's request for veterinary services in exporting countries that are equivalent to its own. The EU standards are higher than the relevant international standards. Therefore, according to the SPS (Art. 3.3), they need to be scientifically justified. The question here is whether such a justification could in fact be adduced.

In sum, even if the SPS Agreement can, in principle, be qualified as an instrument to contain protectionist intentions disguised as sanitary or phytosanitary measures, the capacity to use the tools successfully depends on a variety of factors:

- the know-how on international standards and standard-setting, and for exploring the flexibilities in the system;
- the capacity to identify potential markets and to negotiate with foreign commercial interests and governments on SPS requirements;
- the cooperation with a partner in the importing country; and
- where necessary, the ability to use the dispute settlement mechanism of either the OIE or the WTO, in particular for testing the scientific background of required standards. These capacities may be difficult to achieve, in particular, by LDCs.

This result closely coincides with the outcome of an analysis by authors advocating fair market access for poor smallholders (see Perry et al. 2005, and Byron 2005). If it is assumed that, at present, non-industrial breeders are key players in maintaining the diversity of AnGRFA, then poverty alleviation and maintenance of AnGRFA diversity are reciprocal intentions and the respective arguments can be used for mutual reinforcement.

In this context the question of private standards has to be taken into account and discussed too. Integrated market chains for animal products increasingly require the compliance with specific standards that might be even more demanding than the public ones. The question here is, if and how these enterprises can be induced to find solutions for the integration of products promoting biodiversity, in the interests of the global public good biodiversity and in the framework of a good governance policy. This could for instance take the form of capacity building for smallholders to enable

them to attain the standards,³⁵ and the making available specific labels (such as “slow food”) for the products concerned.

6.3 Outlook: Emergency strategies and measures

The outbreaks of FMD in the UK and HPAI in Asia took the responsible agencies by surprise and led, as a result of their rapid spread and their wide extent, to a shortage of capacities, to organizational bottlenecks, and problems of integrating scientific expertise into decisions and measures.

These experiences made the necessity to develop emergency measures and strategies obvious. Consequently, such strategies were or are being developed on the national and international levels. In our context, the integration of conservation of AnGR diversity into the strategies is of prime interest.

6.3.1 Examples of emergency measures and strategies

The case study on HPAI reports that Hong Kong built up an intensive laboratory-based surveillance system, Viet Nam enacted a series of legislative measures aimed at controlling the spread of infection and diminishing the threat of future outbreaks. Papua New Guinea reports having established a legal framework for enforcing zoosanitary regulations, particularly against HPAI and Newcastle disease.

Some countries have stated that exceptions to the obligatory culling of animals are possible for the preservation of threatened animal genetic resources. In Poland, there is a proposal whereby the National Research Institute of Animal Production, in its capacity as coordinator of the AnGR conservation programme, will be obliged to provide the Chief Veterinary Officer with information on the location and number of birds included in the programme. This would enable exceptions to be made when making decisions about culling of flocks. The same is true for Spain (State Law 8/2003 of the Health of Animals); Sweden allows for exceptions to culling and the possibility for vaccination and quarantine if the breed association has a register of animals which is known to the responsible authority. Papua New Guinea has an established (legal) framework for enforcing zoo-sanitary regulations, the National Agricultural Quarantine and Inspection Authority (NAQIA) At present, in view of lacking national policy guidelines to take care of issues related to conservation of FAnGR when disease eradication measures are enforced, negotiations are ongoing between NAQIA and the National Agricultural Research Institute (NARI). They try to introduce some flexibility in the implementation regime. Vaccination is possible for industrial enterprises, but cannot easily be applied to rare breeds as Papua New Guinea lacks national conservation programmes.³⁶

³⁵ See the example of the Desert Kid in Perry et al. 2005.

³⁶ E-Mail communications to DAD-Net.

6.3.2 The measures of the EU

The EU has integrated exemptions for rare breeds from culling measures in its most recent legislation on HPAI and FMD. These measures are backed by a series of norms relating to the identification of animals,³⁷ and initiatives to foster conservation of threatened breeds.³⁸

As a consequence of the experiences with the outbreaks of FMD and HPAI the EU has changed its vaccination policy. According to Directive 2003/85 on community measures for the control of FMD, “the action taken to control the foot-and-mouth disease epidemics which struck certain Member States in 2001 has shown that international and Community rules and the ensuing practices have not taken sufficient account of the possibility offered by the use of emergency vaccination and subsequent tests to detect infected animals in a vaccinated population. Too much importance was attached to the trade-policy aspects, with the result that protective vaccination was not carried out even when it had been authorised” (Recital para 24). As a result, emergency vaccination and protective vaccination are now possible, if carried out in line with precise criteria and if accompanied by measures limiting the risk of transmission (Art. 53-58).

With regard to HPAI, Council Directive 2005/94/EC of 20 December 2005 on Community measures for the control of avian influenza “integrates lessons learnt during the recent outbreaks of HPAI” (Recital para 6). It recognizes vaccination as a potentially effective tool to supplement disease control measures for both emergency and preventive vaccination (Recital para 20). It must be accompanied by appropriate surveillance and restriction measures; the strategy allowing the differentiation between vaccinated and infected animals (Recital 21).

With regard to conservation of AnGRFA diversity, Article 15 of the European Union Council Directive 2003/85/EC on community measures for the control of FMD places a responsibility on Member States to establish a list of holdings where animals are kept for purposes related to the conservation of animals that are indispensable for the survival of that breed or in other words rare breeds, so that they can benefit from any special measures that may apply at the time of an FMD outbreak. Inclusion on the Breeds at Risk Register means that any special measures prevailing in the event of an FMD outbreak to conserve rare breeds could apply to the

³⁷ See e.g. Regulation (EC) No 1760/2000 of the European Parliament and of the Council of 17 July 2000 establishing a system for the identification and registration of bovine animals and regarding the labelling of beef and beef products and repealing Council Regulation (EC) No 820/97.

³⁸ Council Regulation (EC) No 870/2004 of 24 April 2004 establishing a Community programme on the conservation, characterisation, collection and utilisation of genetic resources in agriculture and repealing Regulation (EC) No 1467/94 (Text with EEA relevance).

premises concerned, but this does not guarantee that rare breeds on the premises would necessarily be spared.³⁹

As regards HPAI, in specified instances, the competent authority of a Member State may grant derogations from culling in cases of an outbreak in a non-commercial holding, a circus, a zoo, a pet bird shop, a wildlife park, a fenced area where poultry or other captive birds are kept for scientific purposes or purposes related to the conservation of endangered species or officially registered rare breeds of poultry or other captive birds, provided that such derogations do not endanger disease control (Art. 13.1).

According to the definition in article 2.7 “officially registered rare breeds of poultry or other captive birds” are poultry and other captive birds officially recognized as a rare breed within the contingency plan. The contingency plan (approved by Commission) specifies the national measures to be implemented in the event of an outbreak according to given criteria (Art. 62).

Vaccination, which in principle is prohibited (Art. 52), may be used for defined exemptions, according to an emergency vaccination plan, approved by the Commission. This must be accompanied by registration and record keeping, including records on the movements of the vaccinated animals.

6.3.3 The OIE/FAO Global Strategy on the Control of H5N1 Highly Pathogenic Avian Influenza

On the international level, the outbreak and the global spread of HPAI and the threat that it could develop into a pandemic led to a host of initiatives for collaboration in controlling the disease and to curb its spread. On the global level this initiative was jointly led by the OIE and the FAO. In collaboration with WHO they developed the FAO–OIE Global Strategy for the Progressive Control of Highly Pathogenic Avian Influenza, first published in November 2005, and subsequently revised in March 2007 and October 2008. The strategy was continuously refined. In the last edition, it shifts its emphasis away from emergency to longer term measures. In this development – and in taking account of the concurrent development of insight into the AnGRFA diversity situation – it increasingly takes biodiversity into consideration. Conservation of poultry diversity is strongly linked to the livelihoods of poor farming communities. Its strategic goals include: information gathering on the impacts of diseases and of prevention and control programmes on the livelihoods of smallholders, on rural development and on biodiversity (p. 6); the promotion of research into the impacts of HPAI incursion and control on socio-economic factors and biodiversity; “and work to ensure that the medium to longer-term control measures ... do not do more harm than the disease itself, especially to vulnerable poultry owners and to biodiversity” (p. 11).

³⁹ Department for Environment Food and Rural Affairs (DEFRA) 2008, <http://www.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/fmd/about/riskreg.htm> (last accessed July 2010).

6.4 Conclusions

The question at the outset was, whether international legal regimes and policy measures aimed at the protection of human, animal or plant life or health have an impact on animal genetic diversity.

The study has identified different types of impacts. First, and most obviously, AnGRFA diversity might be *directly* influenced by the measures taken in the case of an epidemic outbreak of a disease. What springs to mind here is the negative impact of slaughtering infected or in-contact animals. Yet, there might also be a positive side – that diversity is maintained thanks to the measures to contain the outbreak. Second, there might be *indirect* impacts caused by measures that influence the marketing and profitable exploitation. Such impacts might be the result of measures to control production and marketing or of the creation of biosecure, disease-free zones. Third, the diversity of AnGRFA might be even more indirectly affected by measures to assure the safety and quality of exported animal products.

Two basic insights result from the research: *First*, no clear answer to the question can be given. This is due to the lack of evidence and robust data on the existence and distribution of breeds at risk. Therefore there is hardly any substantial data as to which breeds have been negatively affected by the emergency and preventive measures or – to the contrary – have been spared thanks to the measures taken. Neither is there data on the genetic background of breeds directly affected by death or culling. The same is true for potential indirect effects of the economic impacts of the panzootic. This is particularly true for the outbreaks of avian flu in South-East Asia, whereas in the case of FMD in the UK – thanks to the work and initiative of private breeders – some evidence is available. Yet, this does not mean that there has been no impact. The theoretical line of argument – which is obviously in need of verification – points to this conclusion. In some cases, as mentioned in the case studies and in the discussion above, there is anecdotal evidence of breeds having been negatively affected by the emergency measures, in particular those that were concentrated in one geographical area.⁴⁰ This finding leads to the urgent demand for research, particularly for characterization and inventories of breeds, including information on spatial distribution.

Second, in order to assess the impact of the international *trade* standards on AnGRFA diversity, one must ask to what extent the measures for containment and prevention were motivated by the wish to reopen the country as soon as possible for international trade. This correlation is difficult to assess as well. In the first place the measures are taken to prevent the spread of a highly contagious disease and, in the case of HPAI, to avert the contamination of humans. Yet there might be a difference between the outbreak of HPAI and that of FMD. In the case of FMD, disease-free status

⁴⁰ See FMD case study p. 10.

without, or with vaccination is, at least for a zone or compartment, the benchmark for most exports of animals. In this context, the discussions and argumentation about vaccination during the outbreak in the UK might be an indicator of the trade-relatedness of the decisions taken.

With a view to answering our question, it is interesting to note, that the case studies give no indication of any proactive initiatives regarding AnGRFA diversity. In the camel cheese case, the motivation of the Mauritanian Government to further the export of animal products seems to be solely economic (to support, promote and foster the exportation of fish, for which there seems to be a big demand in Europe). Likewise in the cases of avian influenza and FMD, no consideration of AnGRFA diversity is reported. So one question resulting from this study is how the objective of conservation of biodiversity could be integrated in the relevant processes.

The joint FAO–OIE Global Strategy for Prevention and Control of H5N1 Highly Pathogenic Influenza (2008) postulates undertaking studies on the impacts of measures regarding HPAI. The scope of the studies should include cost–benefit analyses, scenario development and testing of the impacts of H5N1 HPAI incursion and control measures, including restructuring of the poultry industry, on socio-economic factors and biodiversity.

In the area of setting international standards, no reference to AnGRFA diversity issues has so far appeared. In this context the new regulations of the EU on measures with regard to HPAI and FMD are of great interest because they do take AnGR diversity into account. This example may also give a lead as to how such measures could be implemented. The examples show that in principle, if strategies for disease elimination are prepared in good time, it is possible to include measures for conservation of livestock diversity in the emergency procedures recommended by OIE. The proposed measures are to vaccinate valuable genetic stock against HPAI (and FMD) as protection from disease and mortality and to spare these animals from culling (Hoffman 2007). This approach would ideally be combined with cryoconservation programs and the establishment of in-situ conservation sites in more than one location (FAO 2007, p. 130).

As shown in the strategy developed by the EU, the basis of such measures would be breed characterization and recording of data, building of inventories, including spatial information on breeds and valuable breeding stock within a country (Hoffmann, 2007). Second, the genetic resources need to be considered in all risk assessment, disease preparedness and contingency activities. Measures adapted to the country-specific situation would have to be elaborated and integrated into the emergency plans. The infrastructure and personnel necessary for their implementation must be available. If vaccination is chosen as a solution, a system must be in place to register the vaccinated animals and track their further movements, if necessary including quarantine measures.

All these measures require capacity and institution-building. However, implementing these measures would by far exceed the capacities of the developing countries and LDCs which are most affected by the outbreaks.

The conclusion here is that, given the global nature of the risk, the burden of risk prevention measures also ought to be shared. This calls for a stronger commitment of the developed countries. This leads to the question of which are the appropriate fora and means for the initiation of such processes.

7 Discussion and recommendations

In the background to the debates on the application of international standards on animal health and food safety that take place between exporting and importing countries lies the tension between the two – legitimate – goals the SPS seeks to reconcile. These are, on the one hand, the liberalization and, in principle, the fostering of international trade and, on the other, the need to assure the safety of trade in animals and animal products for both the livestock and the human populations of the importing countries.

As the above research has shown, the issue of conservation of diversity comes as a new and cross-cutting issue. Even if there are no robust data to prove any impact of the zoosanitary and food safety standards – or more generally of the measures to prevent the diseases, to contain outbreaks and to curb their spread – the indications that such impacts exist are strong. Accordingly, the question is whether and how the risk of the loss of breeds can be taken into account in the relevant strategies.

The study has shown that the impact of zoosanitary and food-safety standards on AnGRFA diversity is not always direct and linear, but might depend on more complex mechanisms. It is therefore submitted that a multilayered approach is needed, encompassing different procedural, institutional and educational measures on different levels of governance; i.e. at the international, regional, national and local levels.

In the following, three different approaches are presented: first, the options for preventing losses in cases of emergency; second, means to mitigate indirect impacts; and third, information and capacity-building as a backbone of the entire exercise. The conclusions are drawn from the above-mentioned EU concept for HPAI and FMD, from the OIE/FAO strategy on HPAI, and the strategies for fair market access for the poor. In our view it is necessary to test the extent to which these strategies need to be and can be generalized to cover other transboundary diseases.

7.1 Elaboration of emergency, containment and prevention strategies and plans

Given that during a disease outbreak there is no time to decide on a strategy to conserve AnGRFA diversity, plans for preventive measures and the elaboration of strategies are important. We propose to include the aspect of conservation of AnGRFA diversity into the emergency, containment and

prevention strategies for the most virulent diseases. Based on the model introduced in the EU, the following measures ought to be envisaged:

First, an inventory of AnGRFA breeds considered to be valuable for the maintenance of genetic diversity, and of their spatial distribution, is needed as a basis for all other measures. The experience with the Herdwick sheep in the UK (above 5.1 and case study FMD p. 10) shows that such an inventory must not be limited to breeds at risk.

Secondly, the necessary infrastructure for the conservation of AnGRFA needs to be created, in particular, the definition of a vaccination strategy and the creation of cryoconservation facilities.

Another background requirement is the initiation and promotion of capacity-building at the level of the responsible national administration, in particular, of the veterinary services responsible for the implementation of emergency, containment and prevention strategies and plans. It is necessary to educate them not only on health and food security matters, but also about matters regarding AnGRFA diversity.

Besides these more general measures, two aspects specific to the situation in LDCs need to be taken into account: first, the option to create new, or to make use of existing instruments for funding and technology transfer that are sustained by the international community, for measures in the context of conservation of AnGRFA diversity. The case study on avian influenza in particular demonstrates that LDCs lack the technical and financial means for executing the background studies, for the creation of the necessary infrastructure, and for the implementation of the measures that have been identified as being necessary for the conservation of threatened breeds. As the maintenance of AnGRFA diversity has been identified as being of global interest, it is argued that this implies global responsibilities and global solidarity.

Further – in devising the combined strategies to contain, combat and prevent outbreaks of epidemics and to take into account AnGRFA diversity – it is necessary to take their application to the flocks or herds of small livestock keepers into consideration. It was submitted above that livestock in traditional farming systems and kept by small breeders may be more diverse than in the more rationalized systems. Accordingly, these flocks or herds might be crucial for the conservation of AnGRFA diversity. In turn it has also been shown that measures for containment and prevention may have different and more intense impacts on smallholders.

7.2 Mitigating the indirect impacts of standards on trade in animal products

It has been shown that standards applicable to trade in products offer some room for manoeuvre. It is submitted that more means to mitigate the impact of the diverging interests on safety and access to markets might be devised. In our view, the following fields should be further explored:

First, it would be useful to explore options and means to expand the remaining room for manoeuvre. The analysis of the Terrestrial Code showed that there are different tools available for complying with standards, e.g. processes to inactivate pathogens and vectors, and vaccination programmes. In line with these findings, it is recommended that further research be done on the specific tools and instruments provided by the Codex and the OIE Codes and Guidelines and, in particular, on the options for gaining access to regional markets.

In order to use these tools successfully, specific knowledge and capacities are necessary. Consequently, capacity-building initiatives are crucial:

- on the international standards and standard-setting;
- for increased negotiation capacities; and
- for the ability to use, if necessary, the dispute settlement mechanisms of either the OIE or the WTO.

Further, as stated above, options for the exportation of specific products to high-value niche markets might create incentives for conservation and sustainable use of AnGRFA diversity. Here, a convergence has been noted between the objectives of maintaining AnGRFA diversity and initiatives for fair market access for the poor (PPLPI). It is proposed to further investigate how synergies could be brought about, in particular to what degree the postulate of a commodity-based approach and of certification can be successfully applied to conserve AnGRFA diversity. Pilot projects and case studies on targeted approaches might be helpful.

This observation coincides with the call to further investigate the creation of standards to minimize the zoo-sanitary risks implied in international trade of animal products, which set out from an approach based on the safety of the traded *commodities*. This approach focuses on the process by which products are produced, rather than on their regional origin (Rich et al. 2009). This approach is proposed to be backed up by the delegation of the certification of the quality of the commodity to specialized (registered and audited, public or private) bodies (rather than to public veterinary institutions that may not be trusted by potential trade partners) as advocated by Thomson et al. (2004 and 2006) and Perry et al. (2005).

Large retailers and food chains are setting their own standards which are frequently higher than the public ones. This makes market access for smallholders even more difficult. Yet it has been shown that (at least some of the) big enterprises are also interested in having a good reputation for their engagement in objectives in the public interest, such as environmental performance. It is argued that the positive effects of standardization should be more carefully assessed. This approach could create win-win situations in the sense that providers and provider countries could profit from a higher standard in their food production and food safety for their own population, and retailer companies could profit from a positive public image. Means to further motivate retailers to partake in the process of capacity-building and fostering market access of smallholders should be investigated.

7.3 Information and capacity-building on measures for the conservation of AnGRFA

As mentioned above, the topic of AnGRFA diversity does not appear in the recommendations and guidelines of the THC or in other documents of the OIE. Yet, in the case of HPAI, successful cooperation between FAO and OIE allowed for the integration of AnGRFA diversity aspects into the Global Strategy for Prevention and Control of HPAI (FAO, OIE (2008)). It would be useful to assess whether this model is also valid for application to other epidemics.

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Annex 1

Highly Pathogenic Avian Influenza (HPAI)

Donah Sharon Baracol Pinhao, Xuan Li and Susette Biber-Klemm

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1 Introduction

The global spread of highly pathogenic avian influenza (HPAI) (of the H5N1 subtype) has not only had enormous impacts on markets, prices, trade and income and affected national economies and domestic industries, but has also caused human deaths. As of 10 June 2010, the World Health Organization (WHO) had reported a total of 499 human cases worldwide of whom 295 had died⁴¹. Between 2003 and 2010, the World Organisation for Animal Health (OIE) recorded 63 countries which have reported H5N1 avian influenza in domestic poultry and wildlife in their territories,⁴² resulting in the culling of more than 300 million birds (FAO 2006). HPAI has developed a panzootic character, spreading from Asia to Europe and both North and West Africa.

Because HPAI is highly contagious in birds, movements of animals in international trade entail a high risk of transmission of the disease. States therefore have an interest in controlling importations from countries where outbreaks have occurred. In turn, such precautionary measures may be abused as trade barriers. This is why the international trade community has adopted standards for preventive measures. Indirectly these standards define the measures to curb an outbreak.

The question asked in the present study is, if and how such measures taken in the case of an outbreak of avian flu affect the genetic diversity of the affected animals in the exporting country. Its results feed into the study on "Effects of international legal regimes and policy measures aimed at the protection of human, animal or plant life or health on animal genetic diversity". There the findings of the case study will be examined in relation to the relevant international legal regimes.

To understand the policy and the measures taken, it is necessary to have some background information on phenomenology, evolution and spread of the disease, and on the international standards and the resulting measures employed by governments to curb it. The study is limited to the Asian experience in 2003–2005, as this is the best documented and continues to provide insights into the continuing evolution of the disease, its management, and its impacts.

⁴¹

http://www.who.int/csr/disease/avian_influenza/country/cases_table_2010_06_08/en/index.html (accessed June 2010).

⁴² OIE. Facts and Figures: Avian Influenza (available at http://www.oie.int/eng/info_ev/en_AI_factoids_2.htm); in domestic poultry 51 countries were affected (http://www.oie.int/eng/info_ev/en_AI_factoids_3.htm; last accessed on June 2010).

2 Relevant background information

2.1 Phenomenology and spread

Avian influenza is a highly contagious disease of poultry and other captive birds with a high morbidity and mortality rate. The infection might trigger outbreaks of epizootic dimensions. In some circumstances it affects humans. The much feared risk is that the virus (in humans) could mutate into a pathogen that can be transmitted between humans.

Birds contract HPAI through contact with the aerosol or faeces of infected birds, or contaminated feed or water. Human infection is usually traceable to close contact with dead or sick birds (WHO 2006).

The primary so-called reservoir hosts for influenza A viruses are the various species of waterfowl from the family Anatidae – ducks, geese, swans and related web-footed birds. Numerous bird species within this group are migratory within Asia. In wild birds, the avian influenza viruses circulating are normally low pathogenic avian influenza (LPAI) in a subclinical state. But when an LPAI virus is transmitted from the wild birds into chickens or other domestic poultry, it becomes progressively more virulent through successive infection cycles in those spillover hosts.⁴³

The roles of the different types of hosts – reservoir and spillover – explain the spread of HPAI and give indications as to measures that could prevent the spread and curb outbreaks. In spillover hosts such as domesticated chickens, the virus mutates to a highly contagious strain. Given this characteristic, there can be cascades of spillover hosts. Yet, the infection will not be maintained in the species in the long term, unless the virus is replenishment from a reservoir host species (such as a wild duck). If the reservoir host source is removed, the spillover cascade will eventually dry up (Morris and Jackson 2005; Suarez 2000). From this, it follows that where poultry density is low the disease spreads slowly and may be self-limiting (OIE/FAO/WHO 2005).

The characteristics described above explain the measures taken in the case of an outbreak: the immediate culling of infected birds; the isolation of flocks in biosecure premises to prevent transmission between different spillover hosts; and the prevention of the contact with wild (or domesticated) ducks to prevent re-infection.

⁴³ A spillover host is one which is susceptible to infection if exposed. It may transmit the infection to other hosts, but could not maintain it within the species in the long term unless there is replenishment of infection from a reservoir host species.

2.2 Factors influencing the spread of HPAI

There are still few robust epidemiological data on the spread of the disease (in particular on the international spread).⁴⁴ Yet a preliminary identification of risk factors seems to be possible: it is evident that countries with weak economies and consequently weak veterinary services have difficulty in detecting and containing outbreaks and are at a higher risk of an epidemic (OIE/FAO/WHO 2008). An additional factor is that in these less wealthy countries poultry is kept by smallholders and/or backyard producers in situations where a high density of birds and poor biosecurity measures prevail. Serious risks for dissemination of the virus are presented by market activities, in particular live bird markets that ensue transports of animals and fomites.⁴⁵

The poultry market system is characterized by two chains, firstly the commercial or industrial production chain, which supplies urban and possibly export markets; and secondly the smallholder or backyard chain, which supplies rural households and local wet or live-bird markets. The commercial chain is longer and more complex, integrating processing and marketing activities such as abattoirs, food processors, wholesalers and retailers; as well as upstream industries such as suppliers of (imported) chicks and feed. The smallholder chain is much simpler. Inputs of birds and feed are supplied within the household production system.

FAO has grouped these different poultry production chains into four sectors:

1. industrial production with integrated biosecurity;
2. commercial production with high biosecurity,
3. commercial production with low biosecurity; and
4. the village or backyard sector, characterized by scavenging chickens.

In low-income developing countries, rural households with backyard poultry systems outnumber industrial producers. This is especially true for most of the countries in Southeast Asia where the outbreaks occurred (Upton 2006).

⁴⁴ http://news.bbc.co.uk/2/shared/spl/hi/world/05/bird_flu_map/html/1.stm (last accessed June 2010).

⁴⁵ A fomite is an inanimate object or substance that is capable of transmitting infectious organisms from one individual to another (The American Heritage® Dictionary of the English Language, Fourth Edition. Retrieved 11 July, 2007, from Dictionary.com website (available at <http://dictionary.reference.com/browse/fomites>).

2.3. Measures and strategies to prevent and curb the outbreak in general

2.3.1. On the national and regional levels

The interventions by affected countries during the outbreaks of 2003–2005 were two-tiered: one was a set of aggressive and rapid measures to fight the outbreak as quickly as possible, such as slaughtering of flocks. The other was a set of sustained and longer-term controls and surveillance-type measures aimed at prevention of future outbreaks. These long-term strategies include increased biosecurity measures for all types of production and a trend towards the centralization and integration of poultry production systems (sectors 1 and 2). This implies a significantly diminishing role for the small backyard system.

2.3.2 International trade

The avian flu outbreaks in Asia and other countries set off bans on importation of live poultry and birds from disease-affected countries.

These measures taken are in line with the standards set in the Terrestrial Health Code of the World Organisation for Animal Health (OIE): importing countries are advised to ask for a veterinary certificate attesting that the poultry is free of the infection. Accordingly, if an outbreak of HPAI occurs, exportation from the country is blocked (Art. 10.4.21 THC). The only exceptions are: poultry produced in biosecure production sites (so-called compartments) that are certified to be free of the disease, and eggs treated and meat processed in order to inactivate the virus (Art. 10.4.16 and 22 in connection with Art. 10.4.25 and 26 THC).⁴⁶

3 The case: avian influenza in Asia

3.1 The Asian HPAI epidemic 2003–05

The H5N1 virus only came to international attention in 1997 following an outbreak of the disease in poultry in Hong Kong, which affected 18 people and caused 6 human deaths. It is believed, though, that the virus had

⁴⁶ This has saved the Thai industry which succeeded in changing its production from raw to processed meat (see Perry 2005).

emerged at least a year before when there was an outbreak of influenza in geese in Guangdong, China and may even have been circulating in the region for some years. The first recorded isolations of H5N1 from wild birds were in Hong Kong.

The epidemic affected all species of domestic poultry. Village chickens and ducks were the principal focus of clinical disease. Moreover, outbreaks appeared also to occur predominantly in smaller flocks.

In December 2003, the Republic of Korea reported its first outbreak of H5N1 infection. Similar outbreaks followed in seven other countries. A total of 35 cases in humans with 23 deaths were reported. In July of the following year, a second wave of the outbreak began in poultry in Thailand and Viet Nam, and then in Cambodia. Malaysia also reported the disease for the first time.

Since the H5N1 virus was first identified in Viet Nam in 2003, HPAI has become endemic to the country⁴⁷ affecting the livelihoods of more than 9 million households. In 2005 and 2006, the H5N1 influenza spread from Eastern Asia to Eurasia, the Near East, Africa, and to Central and South Asia.⁴⁸

3.2 Causes of spread

In the affected Asian countries, the typical practices of smallholders in breeding and farm management, of local markets and poultry transport led to a high risk of virus transmission between spillover hosts.

On the large majority of poultry farms, flocks scavenge freely and therefore can contract and spread the disease more readily than poultry confined within dedicated shelters. This is a particular risk for ducks that scavenge, as they typically wander to open ponds where the risk of contracting the virus from water fowl is high.

Transport and marketing of poultry provide perhaps the single most effective virus exchange mechanism. The persistence of live bird markets in Asia is due to a regional preference for “warm” meat. The mixing of birds from different sources, and of different ages and/or species, often in confined spaces, fosters the transmission of infections. Poultry transport has been identified as an important agent of HPAI spread given the significance of

⁴⁷ See on the OIE website the Animal Health Information (WAHID) http://www.oie.int/wahis/public.php?page=disease_timelines&disease_type=Terrestrial&disease_id=15 (last accessed in May 2010).

⁴⁸ In Thailand and Vietnam the level of outbreaks in domestic poultry has remained high (1141 and 2575 cases respectively; statistics from 2003 to 2010). In other countries (some) control seems to have been achieved (for example in China and Cambodia (only a few outbreaks), Malaysia and Republic of Korea) (available at www.oie.int/eng/info_ev/en_AI_factoids_2.htm) (last accessed June 2010).

fomites in transmitting the disease. Moreover, the movement of contaminated people and/or equipment between farms presents a significant risk.

The institutional climate relating to veterinary services, inspection and government implementation of policies to control HPAI was characterized by inadequate operating budgets, lack of veterinary capacity – both in terms of adequate staffing and of veterinary knowledge – and weak communications links between the central government and its provinces (World Bank 2004).

3.3 Measures to curb the outbreak at the national and regional levels

As mentioned above, the specifics of the spread and increasing virulence of the HPAI virus dictate the measures taken in the situation of high density of poultry: the emergency measures of compulsory slaughter, if possible combined with compensation schemes, and the quarantine and decontamination of infected areas; and the measures targeted at prevention of further outbreaks such as biosecurity measures and surveillance strategies.

3.1.1 Compulsory slaughter

During the 1997 outbreak in Hong Kong, the entire poultry population, equivalent to 1.5 million birds, was slaughtered within a period of 3 days (WHO 2006). Stamping out was also completely successful in Japan and the republic of Korea. These countries were able to maintain their infection-free status despite the presence of infection in their wild birds (Morris and Jackson 2005). In Viet Nam, the general policy was to cull any birds found on an infected site and those within a radius of 1 km.

3.1.2 Zoning and decontamination

Areas classified in Viet Nam as being infected with HPAI were immediately subject to quarantine notification and the application of control and eradication procedures. Protocols were imposed for disinfection and decontamination of infected areas and other parts of the environment that came into contact with AI pathogens. In areas with declared outbreaks, local animal inspectors were ordered to contain the infected sites by creating temporary veterinary checking stations to monitor movement, supervise the disinfection of all contaminated areas and to oversee the burial or incineration of waste and faeces and the disinfection of any transport vehicles that had been in contact with contaminated areas. Dead birds were either incinerated or buried with quicklime (calcium oxide) (Agrifood 2006).

3.1.3 Vaccination

Hong Kong introduced vaccination and strict biosecurity, and succeeded in getting through the Asian epidemic of 2003–2005 without a case in commercial poultry or a human infection despite the widespread infection in neighbouring countries. Vietnam also initiated a compulsory vaccination programme, which was at first limited to two provinces and was then expanded to cover 46 provinces. The programme is believed to have had a crucial role in ending the outbreaks (Agrifood 2006). Vaccination was also used in Indonesia and China.

3.1.4 Control of movement of birds and other biosecurity measures

Intensified control measures such as those applied in Hong Kong included the separation of species in the markets, the use of rest days (when markets were completely emptied of poultry and then re-opened with new birds), and the banning of some birds (such as quail, ducks and geese) from live markets. Viet Nam banned poultry farming in 15 towns and cities in late 2005, and banned the movement, collection and sale of poultry between provinces. The sale of live poultry was prohibited, while all incoming birds had to be monitored and quarantined in approved slaughterhouses prior to slaughter and sale. Introduction to and removal from epidemic areas of any livestock, livestock products, animal feed, tools used for management of livestock and animal waste were also banned. Infected farms had to be disinfected regularly (Agrifood 2006).

3.1.5 Surveillance strategies

Reporting of disease by owners and active case-finding efforts contributed to the control of the spread of infection. Japan and the Republic of Korea undertook extensive surveillance procedures and both countries were able to detect infected farms and stamp out the disease, and to detect infection in wild birds, which (as far as could be determined) progressively disappeared once the infected flocks had been stamped out. An intensive laboratory-based surveillance system was set up by Hong Kong for local farms and imported live birds, and to monitor activities of the virus in wild birds (Morris and Jackson 2005). Advocacy and communication strategies for public information continue to be undertaken, with FAO taking a lead role in the global campaign (FAO 2007).

3.1.6 Compensation

Compensation for the destruction of privately owned poultry is an important element, as it serves as an incentive to owners to report the disease and cooperate with its eradication. Governments in affected countries organized their compensation schemes differently. In Thailand, the compensation rate was about 75 percent of the bird's market price, in Indonesia it was 10 to 20 percent (Dolberg et al. 2005), and in Vietnam, from 20 to 30 percent of the market value. On the other hand, farmers in Cambodia who suffered losses did not receive any compensation at all (McLeod, Morgan, Prakash and Hinrichs 2006).

4 Impacts

The HPNAI panzootic has had notable social and economic impacts, due partly to the disease control processes and market shocks set off by import bans, and partly to changes in poultry production chains and market chains, as a result of biosecurity regulations applying to all producers and/or government policy fostering industrial, biosecure production (FAO, OIE, WHO 2008).

Yet, as to the direct impacts – positive or negative – of the emergency and preventive measures on the diversity of chicken breeds, little is known. The reason is that in the countries most affected, no population data incorporating information on genetic diversity of poultry and spatial distribution are available. Therefore no indications exist as to which breeds have been negatively affected by the emergency and preventive measures or which have been spared thanks to the measures taken. Nor are there any data on the genetic background of breeds directly affected by death or culling. The same is true for potential indirect effects of the economic impacts of the panzootic.

Yet, it may be possible to draw some indirect conclusions. The background for the line of argumentative are the findings of the “State of the world’s animal genetic resources for food and agriculture” (FAO 2007). This report states that the share of local breeds in a country’s population differs by region. It is influenced by the amount of specialized livestock industries, industrial production being highly concentrated and dominated by a small number of lines (Hoffman 2007). Therefore diversity depends on

- the number of breeds developed before the increase of commercial and industrialized production;
- in Europe, on the number of fancy breeders; and
- on the current degree of commercialization.

According to Hoffmann, it can further be stated that in the industrial and commercial highly biosecure sectors⁴⁹ no local breeds exist. This does not imply that in the other sectors there are only local breeds. The number of local breeds in these populations⁵⁰ depends on the amount of cross-breeding that may either be furthered by governmental policy or be the result of indiscriminate cross-breeding around the centres of intensive production.

Yet in countries without a significant commercial sector, mainly local breeds can be expected in smallholdings. In the sense of a hypothesis it may therefore be stated that impacts affecting smallholders more than industrial breeders may also have an impact on genetic diversity.

This impact on smallholders may be due to various influences: firstly there is the direct influence of the illness itself, and of the compulsory slaughter of the animals. Second, there might be an indirect impact of the preventive biosecurity measures and the restructuring of production and markets; and third, the market shocks triggered by the epidemic may affect smallholders who lack economic resilience more than they affect industrial breeders.

4.1 Direct impacts

There is anecdotal evidence of the HPAI outbreak having a *direct* impact on localized genetic resources in several ways. Firstly, some cases of compulsory slaughter of breeds at risk are documented: for instance, when it became infected with the HPAI virus, the entire poultry population of the Faculty of Agriculture of Cairo University, Egypt, was culled (Hoffmann, 2007); and in the (first?) outbreak in Hong Kong, a zoological collection of Anatidae was slaughtered (Sims and Narrod, undated). In Europe, the losses were mainly due to the lock-in obligations. It is known that a great number of fancy breeders, and breeders practicing free-range production, gave up poultry-keeping or suffered heavy losses due to the lock-in obligation. It seems that one goose, one duck and two chicken breeds have disappeared (Hoffmann citing Eglin, 2008).

Thirdly, the restocking after the disease may have led to replacement with industrial breeds, due to their wider availability.

4.2 Indirect impacts of emergency and preventive measures

During the outbreak, Viet Nam, for instance, enacted a series of legislative measures aimed to control the spread of infection and diminish the threat of future outbreaks. The directives were comprehensive in coverage, aiming at

⁴⁹ Sectors 1 and 2 according to the FAO grouping (see section 2.2).

⁵⁰ Sector 4 and in part also sector 3 (see section 2.2).

removing possible sources of infection across the entire poultry industry chain, and contained detailed instructions for specific activities that stakeholders and all involved in the poultry sector must adhere to. They included:

- monitoring of the circulation of poultry and poultry products through the establishment of permanent quarantine operating stations at the entrance of each province, urban area, district and village;
- rules regarding the areas where the animals were bred, assembled, transported and sold;
- strict obligations on hygiene, inspection, notification to authorities, certification and transport; and
- the obligation to use only licensed slaughterhouses (Agrifood 2006).

The strict imposition of these measures is believed to have been critical in the containment of the disease in Viet Nam in subsequent outbreaks.

Nevertheless such measures caused disruption of production structures and restricted market operations, in particular for smallholders. Additionally, heightened biosecurity measures change the structure of market chains and lead to the decline in the importance of semi-commercial producers and backyard farmers. Neither of these groups produces, nor can they afford to produce, chickens using acceptable biosecure certification methods.⁵¹ The (government-led) restructuring of the poultry production system and increased requirements on biosecurity implied a significantly diminished role for the small backyard system. Also, smallholders recover more slowly. This leads to further loss of market shares to large-scale commercial operations (FAO 2007).

4.3 Indirect impacts caused by the breakdown of the international trade

The international ban on exportation of poultry had different impacts on importing and exporting countries.

Limitations on movement of fresh or chilled produce from Asian exporters, in particular Thailand and China, caused a decline in Asian exports from over 1.8 million tonnes in 2003 to less than 1 million tonnes in 2004–2005. On international markets, these restrictions on exports led to shortages and to a

⁵¹ For instance in Viet Nam, gains after the recovery of the market were largely attributed to industrial sector production, where highly biosecure systems were employed to produce “safe” chickens (Agrifood 2006).

20 percent increase in the international price over the same period. Simultaneously, demand declined as consumers responded to food safety and human health concerns. These factors together led to an unprecedented 8 percent decline in global poultry trade (FAO 2006).

The upward world price movements contrast dramatically to the situation in disease-affected countries, where prices declined as exportable supplies moved back into domestic markets. Consumption gains in Asia slowed too, as consumers in 2004 switched to other protein sources. Together with the culling of flocks, this prompted a decline in the Asian production. These market shocks may have forced small producers out of the market.

5 Results

The question asked in this study is, if and how the international standards for the protection of human and animal life and health in international trade affect AnGR diversity.

The main finding of this research is that, owing to a lack of evidence and of hard data, no clear answer is possible. This leads to the urgent call for research, particularly for characterization and inventories of breeds, including information on spatial distribution and of genetic control of the breeds affected by losses as a result of death from the disease or slaughtering.

Secondly, it is difficult to judge the extent to which the measures for containment and prevention are motivated by the need to reopen the country as soon as possible for international trade. In the first place measures are taken to prevent the spread of the highly contagious disease and to avert the contamination of humans. In preventing the spread, the measures may also have a positive effect on diversity.

Keeping this in mind, it can be stated that there is some anecdotal evidence that direct measures to contain the epidemic have an impact on those populations at risk that were concentrated in a specific location. There are also some indications that prevention measures have a negative impact on smallholders and therefore could also have an impact on indigenous breeds.

Yet, strictly speaking, the only consequences that can be clearly attributed to an impact of international zoosanitary trade standards are the economic repercussions of the flooding of the local markets with meat originally produced for export and the resulting breakdown of market prices.

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Annex 2

Foot and Mouth Disease

Xuan Li, Isaac Fokuo Donkor and Susette Biber-Klemm

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1 Introduction

The economic and social impact of outbreaks of disease among livestock cannot be overemphasized. The growing incidence of virulent diseases such as avian influenza and the foot and mouth disease (FMD) is therefore a cause for concern. Movements of animals and animal products, in particular in international trade, entail a high risk of transfer of diseases. Precautionary measures applied by the importing States may hinder trade or may be applied with protectionist intentions. This is why standards for preventive measures by States have been adopted in the international trade order.⁵² Indirectly these standards define the spectrum of measures to curb an outbreak of a disease.

The present case study asks if and how such measures have an impact on the genetic diversity of the affected animal species. Its results feed into the study on "Effects of international legal regimes and policy measures aimed at the protection of human, animal or plant life or health on animal genetic diversity". There the findings of this case study will be assessed in relation to the relevant international legal regimes.

Based on the example of the huge outbreak of FMD in the United Kingdom in 2001 this paper analyses the following:

- the impact of the measures taken on the genetic diversity of the affected animals;
- whether and how this issue was tackled during and in the aftermath of the epidemic; and
- the lessons learned.

To understand the general policy, the emergency measures taken, and the ensuing debate on these measures, it is important to have some background information. This includes the relevant characteristics of FMD and the risks it implies, particularly for countries participating in the increasing international meat market (or at least aiming to do so) in general. Then the concrete situation in the United Kingdom and the ensuing strategy to curb the outbreak is described. The focus will be on measures that are likely to

⁵² The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS), adopted in the Uruguay Round Agreements, in 1994, acknowledged the standards of the World Organisation for Animal Health (OIE) and the Codex Alimentarius as the international reference for sanitary standards for the trade in animals and animal products.

most affect the animal genetic diversity, first of all the so-called “stamping-out” strategy.

2 Relevant background information

2.1 Phenomenology

FMD is a severe, highly infectious viral disease of cloven-hoofed animals such as pigs, cattle, buffaloes, sheep, goats, wild boars and deer. It is not contagious to humans, nor is the meat of infected animals considered unsafe for human consumption.

Listed by the World Organisation for Animal Health (OIE), as a disease that spreads significantly in naïve populations and has the potential for international spread, FMD is perhaps the most contagious of animal diseases. Pigs are regarded as important amplifying hosts for the disease because of their ability to be infected orally and their capacity to excrete large quantities of virus in their exhaled breath. The ability of sheep and goats to retain certain viral strains with little sign of infection makes them good maintenance hosts. Although the disease can kill young animals it is not deadly in adults. Animals can recover within weeks, but some species are never the same again. Cattle, for example, can lose up to half of their milk production in the first year after infection, and do not easily put on weight after they have had the disease.

The virus is so tenacious that it can survive even in some processed meat and in dairy products. The normal post-slaughter acidification process can inactivate the FMD virus in the meat of carcasses. However, the virus can maintain its infectivity for prolonged periods in frozen lymph nodes of meat, bone marrow and residual blood clots. Uncooked salted and cured meat, green-salted hides, unpasteurized milk and dairy products are environments conducive to the virus retaining its infectivity.

Infected animals take 2–14 days, depending on the species, to develop clinical symptoms. In the early days of the infection, they become viral factories, turning out millions of foot-and-mouth particles which find their way into products destined for the food chain, such as milk and meat, and into other bodily fluids, such as saliva or urine, which contaminate the environment. These can be carried by humans, non-susceptible animals such as rodents, cats and dogs, the wheels of vehicles or even the wind.

Depending on the temperature and pH, the virus can persist in contaminated fodder and the environment for up to 1 month.

Between 2000 and 2004 high incidences of FMD were recorded in important meat markets in South America, especially in Argentina and Brazil as well as

in Asia (China, Japan) and the European Union (EU) (mainly in the United Kingdom and Greece). Foot and mouth disease is endemic in 60 countries across Africa, the Near East, Latin America and some parts of Asia.

Table 1: Foot and mouth disease 2000–2004

	Occurrence		Total number of deaths resulting from disease		Number of animals destroyed	
	Outbreaks	Cases	All susceptible animals	Cattle	All susceptible animals	Cattle
Argentina	2 396	88 544	319	295	181	33
Brazil	91	2077	27	27	12 310	9 353
China	33	10 799	776	776 ⁵³	-	732
EU ⁵⁴	44	478	-	7	302 641	88 293
Japan	3	22	-	-	740	740
UK	2	2034	7	-	4 147 242	4 105 331

Source: FAO-GLIPHA (2004)

2.1.1 Spread

An important cause for the spread of the disease is the movement of livestock. Livestock movements take two forms: transboundary movement between countries through imports or exports (legal or illegal) and domestic movement. Because of the high risk implied in movement of live animals and animal products into FMD-free countries, importation is strongly regulated and controlled. The incentive to import meat products through *illegal means* is high if border control measures are lax and especially if the cost of procedural adherence is high. The risk of introduction of FMD into the importing country through this means is highest for products from FMD-endemic areas.

⁵³ Incidence attributed to infection in pigs.

⁵⁴ EU-15 excluding UK.

Livestock are moved within a country for several reasons including for selling, slaughtering, relocation for “finishing”, to the port for onward export and for medical (veterinary) checks. In industrialized countries, the usual mode of animal transport is to use a vehicle.⁵⁵ Movement of animals within the country has increasing health implications the greater the distance between the farm and the destination. For instance, an FMD-infected sheep — a good maintenance host — transported over a long distance to the “finishing” place or to an abattoir presents a high risk of the spread of disease within the area through which the animal is transported (The Economist 2001).

2.1.2 Prevention and curbing of outbreaks: OIE⁵⁶ and EU Policy

Since the 1970s, OIE has been in charge of deciding which areas of the world can carry its privileged “disease-free” status. There are several classifications of disease-free status, of which the most important are: disease-free countries where vaccination is not practised; disease-free countries where vaccination is practised; and disease-free zones (with and without vaccination) within larger countries.

To maintain their status, disease-free countries or zones without vaccination have to prove, among other things, that there has been no outbreak of FMD for at least 12 months (Art.8.5.2 THC⁵⁷). They must also have in place “an effective system of surveillance” and ensure that all “regulatory measures for the prevention and control of foot-and-mouth have been implemented”.

The OIE is not prescriptive about vaccination; the issue is only important because countries free of disease without vaccination are reluctant to import vaccinated animals, as they would automatically lose their status as “disease free without vaccination” country. Additionally, regarding imports of produce (e.g. meat or milk) many guarantees have to be provided by the exporting country. In places where the disease is not endemic, governments can use a mix of reactive measures (including limited vaccination and emergency vaccination) tailored to the circumstances.

Broadly speaking, there are three methods for the vaccination of livestock against FMD (Scoones *et al.* 2006):

- *Routine (prophylactic) vaccination*: This involves mass vaccination for long-term prevention when FMD is endemic or recurrent.
- *Protective vaccination*: Emergency vaccination of a limited number of animals in a restricted area (“vaccination to live”) after which the

⁵⁵ Whereas in arid and steppe regions of the South, animals of pastoralists move “on hoof”.

⁵⁶ OIE: World Organisation for Animal Health.

⁵⁷ THC: Terrestrial Animal Health Code: OIE Standards for trade in animals.

animals are allowed to live until the end their economically productive lives.

- *Suppressive vaccination*: Another form of emergency vaccination, of a limited number of animals in a restricted area; however, these animals are subsequently slaughtered (“vaccination to die”).

The EU which had the status of “FMD-free without vaccination” adopted a harmonized approach to vaccination and effectively phased it out between 1991 and 1993.⁵⁸ By 2001, any Member State wishing to use emergency vaccination was subject to EU law and, even when permission was granted, had to adhere to the EU guidelines contained in the “Strategy for the emergency vaccination against FMD” adopted in 1999.⁵⁹

3 Foot and mouth disease outbreak in Great Britain

3.1 Factual background

Foot and Mouth Disease has had a long and thorny history in Great Britain since it was first officially documented in 1839. The severity of the disease notwithstanding, local stockowners’ opposition to compulsory measures of control meant that the resulting Contagious Diseases Act (1869) only conferred permissive powers to local authorities. It was not until more than two decades later that the Contagious Diseases Act of 1892 adopted the slaughter policy to prevent the disease from becoming endemic in the country.

The primary objective of the slaughter policy is to destroy the source of virus as rapidly as possible by slaughtering affected and in-contact animals (also known as stamping-out) to prevent further multiplication of the virus, and by preliminary disinfection of the infected premises immediately the diagnosis has been established. These conventional measures, which were adopted in 1892 and modified in the 1920s have helped to reduce the impact of the outbreaks of the disease in Great Britain compared to its effects in continental Europe. For example, the number of FMD outbreaks in the UK fell from 4-digit figures in the 1920s to 2 to 3-digit figures in the late 1950s compared to over 1000 outbreaks in France and Germany over the same period. The only severe FMD outbreak that had occurred since the 1950s then was in 1967. The huge outbreak of FMD in 2001 in the United Kingdom

⁵⁸ This followed provisions contained in Council Directive 90/423/EEC; amending Directive 85/511/EEC.

⁵⁹ The provision was adopted in 1999 following report submitted by the EC Scientific Committee on Animal Health and Animal Welfare.

was therefore surprising not only because of its magnitude but also because the conventional method of control was deemed to have failed.

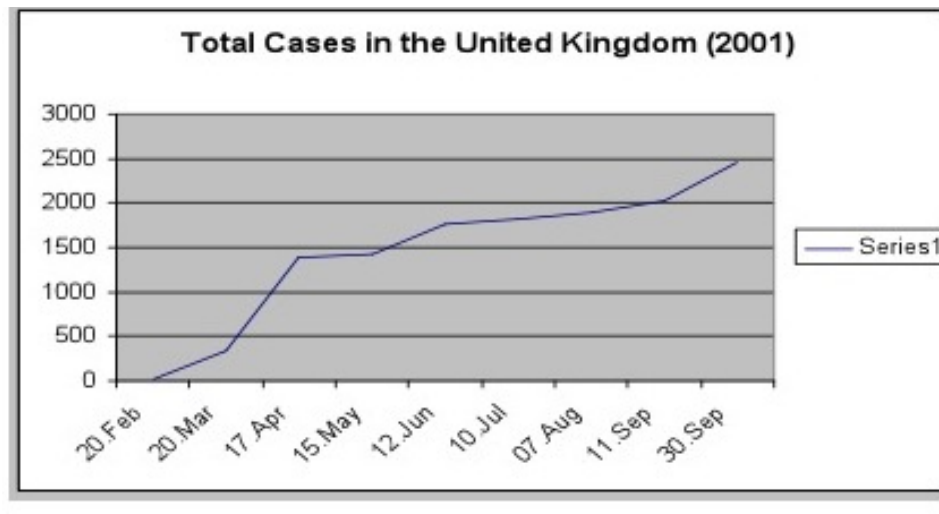


Figure 1: Foot and Mouth Disease in UK, the path of spread (2001)

Source

http://news.bbc.co.uk/olmedia/1615000/images/1617423_foot_and_mouth_trail.gif (accessed 14 May 2010)

Figure 1 is a graphical representation of the outbreak and spread of FMD in the United Kingdom, beginning in February 2001. The outbreak was first reported on 19 February, in Little Warley, Essex in a batch of sows. Clinical diagnosis pointed to either FMD or swine vesicular disease since the two are indistinguishable. The second case of FMD (as was later confirmed) was reported far north of Essex in Heddon-on-the-Wall in Tyne and Wear on 23 February, followed by another outbreak in the south, in Highampton, Devon, which was reported the following day. The disease made its cross-border debut in Wales on 27 February and within a week it had reached Cumbria. By 3 March, the whole of Great Britain was hit by what was to become its worst FMD epidemic.



Source: Department for Environment, Food and Rural Affairs (DEFRA) (2001)

According to the Department of Environment, Food and Rural Affairs (DEFRA) the final confirmed number of farms affected reached over 2000.

3.1.1 Causes of the spread

Mode of Infection: Official enquiry report "*Foot and Mouth Disease 2001: Lessons Learned Inquiry Report*" suggests that the 2001 outbreak of FMD in the UK was spread by pigs on Burnside Farm, Heddon-on-the-Wall when they became infected with the virus. Catering waste, containing *illegally* imported meat infected with the virus, is believed to have been fed to pigs as swill. By law, the swill should have been heat-treated before use.

The disease could have been present at Burnside Farm for weeks, but it went unreported, despite the requirement for farmers to report suspected cases of notifiable diseases. Sheep and cattle on the nearby Prestwick Hall Farm, Ponteland, were the next victims of the disease. This farm is five kilometres north east of Burnside Farm and *lies under the potential virus plume generated* by the infected pigs. *Weather conditions* had been suitable for airborne spread throughout the likely period of infection.

Import Regimes in the UK: The outbreak of FMD in 2001 exposed some shortcomings in the import regime in place in the UK prior to that time. In particular, in the regulation and surveillance of intra-EU imports. The volume of air traffic into the UK coupled with the fact that it is a net importer of meat products imply that the likelihood of illegal import of meat and livestock products is very high. The probability of infection through legal imports remains very low in the UK. For instance, between 1 November 2000 and 9 April 2001, 1 321 customs declarations were selected as a control sample to test overall compliance with customs requirements.

All consignments selected were physically examined. None was found to have failed to declare meat imports.

Movement of animals: Sheep are good maintenance hosts of the FMD virus and signs of infection in such diseased hosts are easily missed by farmers and vets. Sixteen of the infected sheep from Prestwick Hall Farm were inadvertently sold at Hexham market. Further sales of six sheep to a farm in Lancashire, three to a butcher and ten at the Longtown Market (Cumbria) are thought to have possibly exposed 24 500 sheep in 9 days. In all there were 181 formal purchases before the disease was confirmed, infecting 57 farms in the process.

The rapid spread of the disease across the UK was blamed in part on the increased transportation of livestock, a trend that has been accelerated in Britain by the closure of many smaller abattoirs in an effort to raise standards following an earlier crisis over bovine spongiform encephalopathy (BSE).

3.1.2 Measures taken to curb the outbreak

The major control strategy during the outbreak – and the strategy most directly affecting rare or threatened breeds – was the compulsory slaughter of infected animals coupled with the tracing and slaughtering of dangerous contacts. When these measures did not succeed in containing the epidemic, a strategy of pre-emptive culling of sheep within a radius of 3 km from the infected premises was decided upon.⁶⁰

The case for and against vaccination was hotly debated during the outbreak. Contingency planning for vaccination was minimal and outdated.⁶¹ The stamping out programme was clearly given priority over vaccination as the latter was deemed impractical and would contribute little by way of containing the disease owing to the widespread nature of the infection. However, various allusions attributed to the Chief Veterinary Officer suggested that the negative impact on trade of vaccination contributed significantly to the choice of culling over vaccination.⁶²

⁶⁰ After considering a pre-emptive cull of all sheep on Dartmoor, or the slaughtering of all fat-stock sheep (Anderson 2001, section 10).

⁶¹ Ibid., section 13.

⁶² See also Council Directive EC 2003/85/EC, Recital (25). The issue is relevant to trade because distinguishing between infected and vaccinated animals is still not possible; vaccination can hide a non-clinical infection. According to Anderson (2001), the International Animal Health Code at this time had not yet taken into account the use of emergency protective vaccination. "The period that countries using emergency protective vaccination had to wait until they regained 'FMD-free without vaccination' status could have been 12 months, two years or longer, depending on how the Code was interpreted".

An immediate ban on animal movements was imposed following confirmation of FMD to confine infected animals for the enhanced culling process. This meant a complete breakdown of, for example, the sheep market; thousands of animals were stranded on farms, suffering from lack of fodder or from bad weather conditions (or both) and were consequently slaughtered under the welfare programme. Thus, “unprecedented numbers of animals were slaughtered during the outbreak, not only as a direct result of the disease control culling strategies but also because of the welfare problems caused by movement restrictions”.

3.1.3 Impacts

3.1.3.1 Livestock slaughtered

Numbers of livestock slaughtered as a result of the FMD epidemic in 2001		
Animals slaughtered	Total	Additional information
Sheep: 3.4 million culled for control purposes, 1.6 million culled under the LWDS, 525 000 lambs culled under the LLS	5.5 million	Additional culling of 3.4 million lambs estimated (this derives from the estimates of the MLC of 1.2 lambs per breeding ewe and cross-checks with the lambs marketed in 2001 down from 15 million to 11.1 million)
Cattle: 590 000 culled for disease control purposes, 169 000 culled under the LWDS	759 000	Additional culling of up to 100 000 estimated
Pigs: 145 000 culled for disease control purposes, 287 000 culled under the LWDS	432 000	Additional slaughtering of piglets not estimated as most pigs culled were assumed to be fattening pigs rather than breeding stock
Others (includes goats and deer): 4 000 culled for disease control purposes, 3 000 culled under LWDS	7,000	

Source: DEFRA, Meat and Livestock Commission (MLC); LWDS, livestock welfare disposal system; LLS, light lambs system.

3.1.3.2 *The impact on diversity of animal genetic resources*

As the diversity of AnGR was not an issue prior to the epidemic, there is no statistical evidence on its loss during the outbreak. Yet, Bowles *et al.* (2003) report that at the height of the first stage of the epidemic in Cumbria, the breeders of heritage breeds sounded the alarm: the Herdwick breed of sheep was severely threatened, despite comprising large numbers of individuals (approximately 80 000) and being commercially farmed. The reasons for the huge loss were the concentration of the breed in one geographical area and the farming method (flocks of 2000 to 3000 animals were kept on the unfenced mountains and moorlands of the Lake District (the “fells”). In response to pleas for help from sheep breeders, a group of academic scientists established a gene bank⁶³ to store the genetic information of the Herdwicks and later of other heritage breeds. Recent research by Carson *et al.* (2008) into the overall geographical isolation of native sheep breeds in the UK shows that endangerment through geographical distribution is a real risk: the breed maps indicate that thirteen of the sixteen breeds analysed had up to 95% of their numbers concentrated within a radius of 65 km from the main centre of each breed.⁶⁴

The FAO’s State of the World (2007, p. 129) gives an overview of the breeds affected by the FMD outbreak. For instance, the numbers of breeding females of the endangered Whitebred Shorthorn Cattle were reduced by 21% to only 120 in 2002; the British Milksheep was reduced by over 40% (1232 breeding females remained in 2002); and the Whitefaced Woodland by 23% (656 breeding females were left in 2002).

3.1.3.3 *Economic impact*

A report by DEFRA (2002) estimates that the impact of the 2001 outbreak of FMD on the UK economy was up to 0.5 per cent (£4 billion) of its gross domestic product (GDP). However, upon closer inspection, the cost is deemed immeasurable because GDP only captures the resulting loss of output. Human costs were not captured. Broadly, the economic effects can be summarized as follows:

The losses occurred in agriculture are estimated at £800–2.4 billion. The ban on meat and livestock products from the UK during the disease outbreak contributed significantly to the loss of revenue in the agriculture sector (Anderson, 2001). The report estimated that the loss of exports cost the country between £310 and £400 million in 2001 and continued at £36 million

⁶³ This is now the Heritage Gene Bank, the first national gene bank in the UK.

⁶⁴ The lesson learned is that with regard to the protection of farm animal genetic resources, not only must the numerically rare breeds of domesticated species be taken account of, but also breeds existing as large numbers of individuals in geographically concentrated areas.

during each subsequent months of the imposition of the export ban. It took about 40 days for EU markets to open after the UK was declared disease-free – and up to 6 months for some non-EU destinations reopen. The total cost of FMD compensation to farmers for slaughtered livestock was approximately £1.3 billion. Knock-on effects for the UK agricultural supply sector included a decline in sales, livestock market closures and loss of business to livestock transporters.

Other sectors affected were tourism (losses of £2–3 billion) due to a decline of overseas tourists, and general economic losses (estimated losses £2.4–4.1 billion). Job losses resulting from the epidemic accounted for the economic downturn in the agricultural supply industry, the food industry and tourist-related businesses (Anderson, 2001).

4 Political and legislative follow-up

4.1 In the UK

There was no new legislation during the outbreak except to reinforce the existing laws and contingency plans which mainly had to do with import bans, border closures and movement restrictions. As part of the measures to forestall recurrence of an outbreak of FMD of the magnitude of the 2001 epidemic, the government commissioned an enquiry to outline options for future preventive and control measures.

Even if diversity of AnGRFA was not an issue in this report, its recommendations on emergency vaccination are of interest in our context: it recommended that the Government establishes a consensus on vaccination options for disease control in advance of an outbreak and ensures that this option forms part of any future strategy for the control of FMD. Further, the unclear wording of the OIE regarding protective vaccination was pointed out.

The Animal Health Act 1981 was amended in 2002 in the light of the lessons learned during the 2001 outbreak. Various sublegal instruments were later adapted to the revision of the EU Directive⁶⁵ including provisions for the conservation of animal genetic resources.

4.2 Follow-up at the regional (EU) and international level

⁶⁵ Council Directive 2003/85/EC of 29 September 2003 on Community measures for the control of foot-and-mouth disease repealing Directive 85/511/EEC and Decision 89/531 EEC and 91/665/EEC and amending Directive 92/46/EEC.

An OIE/FAO International Scientific Conference on FMD was convened in Paris in April 2001. Its recommendations contain explicit measures for protection against FMD, including the use of vaccination, in special cases, such as “rare breeds, rare genetic material, endangered species (Rec. No. 2 c)” (OIE, FAO, 2001). In December of the same year, an International (EU) Conference on Control and Prevention of Foot and Mouth Disease took place in Brussels.⁶⁶ In May 2002, the OIE General Assembly revised the International Animal Health Code regarding the status after emergency protective vaccination (Art. 8.5.8.2 THC).

In September 2003, the Council of the EU adopted the new Directive on FMD.⁶⁷ Article 15 of this Directive places a responsibility on Member States to establish a register of breeds at risk, so that they may benefit from any special measures that may apply at the time of an FMD outbreak.⁶⁸

5 Assessment and conclusion

The massive outbreak of FMD in the UK illustrates the risks implied in international trade in animals and animal products. It also demonstrates the problems with which a government is confronted in the case of an outbreak. The extent of the outbreak and the rapidity of reaction needed caused problems of time and capacity. Difficulties arose in the communication processes, and with the integration of expertise into the decision-making (cf. for all, Anderson, 2001). The anecdotal report on the heritage breeds shows that a threat did in fact exist. There was neither the time nor the capacity to take appropriate decisions and to implement them during the outbreak and no official preparedness measures regarding FAnGRFA diversity had been developed beforehand. Nevertheless, the question whether the outbreak could have led to the extinction of a breed remains open.

⁶⁶ Organized by the Belgian EU Presidency, the European Commission, the Netherlands and the United Kingdom.

⁶⁷ Council Directive 2003/85/EC of 29 September 2003 on Community measures for the control of foot-and mouth disease repealing Directive 85/511/EEC and Decision 89/531 EEC and 91/665/EEC and amending Directive 92/46/EEC.

⁶⁸ See a critical assessment of the implementation in the UK in Marshall, Roger and Bashiruddin (2006).

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Annex 3

Trade in products of breeds at risk

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1 Introduction and question

The present case study looks at the question whether, and if so how, measures to mitigate risks for animal health and food safety in international trade with animals and animal products have an impact on the genetic diversity of the affected animals.

The underlying thesis is that successful marketing of products of endangered breeds can create incentives for their conservation and sustainable use. There is anecdotal evidence to support this thesis. A second underlying assumption is that products of breeds at risk may attract a greater demand in niches of high-value export markets.

Accordingly, and worded more precisely, the study takes up the question whether the international zoosanitary and food safety standards have an *indirect* effect on the diversity of animal genetic resources for food and agriculture (AnGRFA) by emburdening the creation of international markets for products from endangered breeds.

The results of this case study feed into the paper on “Effects of international legal regimes and policy measures aimed at the protection of human, animal or plant life or health on animal genetic diversity”. There the findings will be examined in relation to the relevant international legal regimes.

The question being asked is subject to some uncertainties: to start with, it is not clear to what extent a demand for products of endangered breeds exists or could be created in markets abroad. Second, there is a broad range of possible products: live animals, raw and processed meat, milk products, fibres, hides, pelts and skins. Not all of them present the same level of risk for human and animal health; accordingly less stringent measures for risk prevention may apply to some products than to others. And third, no (documented) case on internationally traded products of breeds at risk could be found. There may be several reasons for this: particularly in African countries few data are available on the (risk status of) indigenous breeds and their transboundary flows in the informal markets.⁶⁹ Also it can be argued that it is *because of* the international standards that the exportation of such products is not possible!

Yet there are examples of both the successful creation of niche markets for products of traditional breeds and the integration of smallholders into niche markets for animal products.⁷⁰ Therefore, the case study will proceed as

⁶⁹ See e.g. Perry *et al.* 2005.

⁷⁰ The inclusion of the examples of smallholders is based on the argument that smallholder production and AnGRFA diversity have a strong correlation and the assumption that local/small livestock keepers and breeders in extensive systems maintain a large part of in-situ conserved diversity (see FAO 2007).

follows: some examples of successful marketing from both the developed and the developing world will be presented and analysed. They cover both the marketing of rare breeds and the development of niche markets for smallholder production. The niche markets for smallholder production are in line with the goal of alleviating poverty and improving the livelihoods of smallholders. However, neither of the examples looks at breeds at risk.

The international aspect will be covered by a case study of the endeavour to export camel cheese from Mauritania to the EU. The camel is not at risk in the sub-Saharan region (but for instance in India); yet the well-documented study may serve as an example of the conditions to be fulfilled to enable export of animal products into (some) high value markets.

First, the cases will be described; they will then be analysed and possible (positive and negative) impacts assessed. Details of the legal background regarding the different level of standards are presented in the main study.

On the basis of these examples, tentative conclusions will be drawn. But it is already clear that further research and debates are needed.

2 Examples

2.1 Niche markets for traditional breeds

There are records from several industrialized countries such as the United States, the United Kingdom, France and Switzerland, as well as from India, of successful initiatives in marketing products of indigenous traditional (and at risk) breeds.⁷¹ Examples include free range production of heritage turkey in the United States;⁷² handbags made of the hides of Valais black-necked goats in Switzerland;⁷³ and from India the marketing of meat, eggs and chicken from traditional breeds in renowned cooperative retail shops in towns,⁷⁴ and of camel milk and camel milk products in Rajasthan.⁷⁵

In the United Kingdom, the Traditional Breeds Meat Marketing Company Ltd⁷⁶ organizes and certifies slaughtering, processing and marketing of rare and traditional breeds. The starting point for this company was the difficulty in finding adequate slaughtering, processing and marketing possibilities for rare breeds through the conventional channels.

71 The information results from an inquiry in FAO's DAD-Net information and communication platform.

72 <http://albc-usa.org/downloads.html> (accessed 02.03.09).

73 <http://www.alpeninitiative.ch/d/AlleProdukte.asp> (accessed 02.03.09).

74 E-mail message to FAO's DAD-Net by Sandip Banerjee, 10.03.2008.

75 Personal communication by Ilse Köhler-Roleffsson.

76 <http://tbmm.co.uk/> (accessed 02.03.09).

In France, the successful Bresse chicken production started from the conservation of Bresse chickens by fancy breeders. The breed was protected by a Protected Designation of Origin Label (AOC) that applies only to chickens produced in a defined geographical area (the “Bresse”) and from a Bresse breed.⁷⁷ It also defines a fixed set of growing and feed conditions, and regulations for slaughtering and processing. The selection procedure is strictly regulated; selection goals are discussed by an inter-professional committee, including breeders, producers, distributors and a scientific institution. The number of white Bresse chickens has increased and stabilized at a level at which the breed is no longer endangered (Verrier *et al.* 2005).

In the Alps of Northern France, a successful revival of the use of mountain areas was attained by using traditional cattle breeds (Abondance and Tarentaise). These breeds show some adaptation and functional traits of interest for the mountain farming system: their milk has favourable properties for cheese production and the animals are well adapted to the mountain pastures. The revival of the mountain pastures also involved a collective organization of farmers and was supported by local and regional public policies. The farmers developed the production of cheeses under an AOC (Appellation d’Origine contrôlée). The use of local breeds is included in the rules (Verrier *et al.* 2005).

A comparable development has been documented by the FAO (2007) regarding the sustainable utilization of the Iberian pig in Spain (p. 144) and of feral sheep in Norway (p. 456). In both cases, production standards, a certification scheme and a successful marketing infrastructure contributed to an impressive increase in the number of animals.⁷⁸ A part of the pig population is still raised under the traditional extensive system that produces meat of excellent quality. The Norwegian feral sheep are only certified if produced under an extensive system

In some of these examples, e.g. the Bresse chicken, the Iberian pig and the Norwegian feral sheep, successful marketing moved the species from the brink of extinction to healthy and economically important populations.

2.2 Developing markets for smallholder production

There are several examples of successful integration of smallholders into production for exportation into high-value niche markets. For instance Perry *et al.* (2005) describe the integration of emergent black farmers into the system for the production of high-quality goat and lamb meat for both the domestic and export markets (such as Middle Eastern countries) by the

⁷⁷ A distinct breed, with white plumage, blue shanks, single comb, red wattles, white earlobes and white skin (Verrier *et al.* 2005).

⁷⁸ From 2 000 to 20 000 animals in the case of the feral sheep, and from 66 000 to 193 000 for the Iberian pig (FAO 2007p. 144 and p. 456).

South African Kalahari Kid Corporation.⁷⁹ The Corporation is a joint initiative between commercial promoters and the South African Government through the Provincial Province of the Northern Cape and emergent farmers. Increasing productivity of the sector of emergent black farmers is seen as essential to provide the volumes of meat needed. The production is based on improved varieties of indigenous breeds (for instance the Boer Goat, which is indigenous, but not declining). Production and processing are tightly supervised and meet criteria corresponding to international standards. The corporation has an expansive marketing strategy.⁸⁰

2.3 Analysis

These cases illustrate the growing interest in products from traditional breeds in industrialized countries and in urban markets in emerging economies, and perhaps also in (urban centres of) developing countries.⁸¹

From the consumer side this may be a reaction to the (uniform) foodstuffs produced in industrialized systems. Reasons given for the preference are the quality of the product, such as taste and cooking qualities (meat); specific nutritional and health values as for instance in camel milk⁸² or free range produced meat,⁸³ and the declared production mode including information on feed quality (Verrier *et al.*). Furthermore ecological arguments play a role.⁸⁴

From the producers' side the specific characteristics of a breed are relevant, regarding for instance its adaptability to a production mode (high mountain pastures; free range chickens and turkeys); limited disease susceptibility; the specific (better) quality of the end-product, or intermediary product (e.g. milk to make cheese) (Verrier *et al.* 2005).

⁷⁹ www.kalaharikid.co.za. (last accessed June 2010)

⁸⁰ Targeting local and international markets such as the Middle East, Mauritius, the United States, the United Arab Emirates, Oman, France, Jordan, Greece, Italy, Turkey, Cyprus, Iran, Iraq, Yemen, Algeria and Switzerland (see http://www.kalaharikid.co.za/intern_export.htm; accessed 02.03.09).

⁸¹ Harris *et al.*, 2003 p. 34 cite the following personal comment made by Meebelo Bhadurkhan from Zamiba "I am aware that in my country, we have a large stock of native, 'organic' stock which has not been tampered with genetically, found in remote parts of western and southern provinces of Zamiba'. 'The market is very much open for this kind of meats. Zambians are becoming quite sensitive about the kind of beef, chicken, pork and other products, seeking more naturally produced meats'.

⁸² See below, case study on camel milk, p. 6.

⁸³ For instance the meat of the extensively kept Iberian pigs is high in unsaturated fatty acids (FAO 2007 p. 144).

⁸⁴ "Due to their [the Abundance and Tarentaise cows] ability to use high altitude pastures and due to their typical traits, the local breeds strongly contribute to the favourable image of the AOC cheeses" (Verrier *et al.* 2005).

Yet, several specific features of these markets need to be taken into account in the context of our discussion: first, all the examples described above cover niche-markets, tied to a specific class of consumers, frequently in urban surroundings, and who can afford and are willing to pay the higher prices for specialized niche products. Second, in most cases there is a strong link to local or regional cultures in production as well as in consumption. A third important point is whether the production would be able to regularly meet the higher demand of an international market.⁸⁵

2.4 Case study on the exportation of camel cheese to the European Union⁸⁶

2.4.1 Background

In the Sahel, camels play a central role as milk suppliers. It is widely recognized that in absolute terms, the camel produces more milk and for a longer period of time than any other milk animal kept under the same conditions. The comparative advantage of camels is huge as they produce 20 percent more milk than a cow with 20 percent less food intake in similar climatic conditions (Schwartz and Walsh 1992, cited by Chaibou and Faye 2006).

Camels are little affected by the main infectious diseases such as rinderpest and are less susceptible to foot and mouth disease and contagious bovine peri-pneumonia.

Indigenous breeds have good and diversified genetic potential and the capacity to resist many diseases as one disease will not wipe out the entire population. Thus the genetic diversity of the camel is a great asset in pastoral production systems. Preserving these genes and breeds is of prime importance.

Camel milk not only has an economic potential in the context of the increasing demand for dairy products and meat products, but also a niche public health potential. The composition of camel milk provides advantages compared to other milk products. It is rich in vitamin C, insulin (40 UI/litre), fatty acids (linoleic and linolenic acid) and antibacterial factors such as lysozyme, lactoferrine and many immunoglobulins (Viateau 1998). The high contents of minerals, vitamins and antibodies can help those who drink it to fight some diseases.

⁸⁵ See the experiences of Namibia and Botswana, which are successful exporters of beef; yet commercial production for export is industrially organized (Cabrera *et al.* 2008).

⁸⁶ This case study is based on a draft by Bassirou Bonfoh.

2.4.2 Tiviski dairy factory

Tiviski⁸⁷ is a small dairy located in Nouakchott in the desert of Mauritania. It was set up to process the milk produced by nomadic herders in 1989. It was the first dairy to process camel milk in Africa and the second in the world.

Today, the Tiviski® dairy factory processes up to 15 000 litres of milk per day of which 20 percent is camel milk. The Tiviski Dairy factory collects 3 000 litres of camel milk per day from which two products are derived: Tiviski® (3000 litres per day) and Caravane® (camel cheese) (400 litres per week). The price paid per litre to the farmer is 160 MRO (0.47 euros) at the factory gate. The number of households supplying camel milk at the factory is 115. They are located in Rosso (203 km), Boghé (400 km) and Nouakchott. Tiviski is a whole camel milk pasteurized and packaged in Tetra Paks of 0.5 litres and sold for 170 MRO.⁸⁸

The camel milk is pasteurized at 80 °C for 20 seconds and is conserved at +6 °C for 8 days. The physico-chemical characteristics of the whole milk without fat content modification have a pH ranging from 6.6 to 6.8 and Dornic acidity of 16 °D. The products comply with French and European regulations and norms.

This initiative has created a market niche for milk producers. The Tiviski dairy factory, through cow, goat and camel milk, distributes more than 700 millions UM (2.1 million euro) worth of milk per year to more than thousand households. The price per litre of camel milk is 160 UM (0.46 euro).

2.4.3 Diversification and marketing

The diversification of camel milk products was a response to the challenge to the private dairy sector in Mauritania to increase production, and to raise the income of producers through the generation of high added value products.

The seasonal nature of the milk production means that at certain times the production exceeds the demand. One solution envisaged to manage and store the surplus was the production of cheese. Tiviski developed the world's first camel cheese. At least 10 kg of milk are necessary to produce 1 kg of camel cheese. This cheese has a soft consistency with the same characteristics as Camembert, but a taste of goat cheese. The cheese is available in 250 g packages which are priced at 700 UM each.

The Tiviski factory has promoted camel cheese Caravane® since 1994. This is the first product of its type in the world and, with the support of the FAO and French scientists, it was successfully exhibited at a German cheese fair.

⁸⁷ <http://www.tiviski.com> (last visited: 16 August 2009).

⁸⁸ MRO, UM: Mauretanian Ouguyia; 10 MRO = 0.03 EUR.

2.4.4 Exportation

Mauritanians (3.1 million inhabitants) are great consumers of camel milk, but camel cheese is not consumed as part of their normal diet, nor that of the populations of neighbouring countries. The nearest possible export market was Europe.⁸⁹ Accordingly the idea to gain access to luxury shops in European markets was developed.

Thanks to the intensive negotiation initiated by Tiviski, Mauritania is now on the list of countries authorized to export milk products to Europe. But in order to export its products, it has to fulfil certain conditions.

2.4.5 The conditions for the exportation to the European Union⁹⁰

There are two preconditions for the exportation of animals or animal products from a third country to the European market. First, at the business level, the establishment in the third country must achieve food hygiene standards “equivalent” to those applying in EU Member States; and second, at the country level, the third country must provide “equivalent” sanitary services.

EU regulations on the food hygiene standards at business levels should, in principle, be based on international standards. The relevant standards regarding food hygiene include, among many others, the Codex Alimentarius Code of Hygienic Practice for Meat (CHPM) and the implementation of the Hazard Analysis and Critical Control Points (HACCP) principles. In order to comply with food hygiene standards, the establishment in the third country, e.g., the Tiviski dairy company, is required to have access to laboratory facilities for testing, *inter alia*, maximum levels for anti-microbial substances, pesticide residues and contaminants.

If the establishment is not located in a disease free country or zone, but wishes to export products of animal origin, such as camel cheese, it has to follow strict inactivation procedures for animal disease viruses as set forth by the OIE, for instance ultra high temperature (UHT) or high-temperature – short time (HTST) treatment for the milk.⁹¹

At the country level, the third country must provide “equivalent” sanitary services, for instance competent authorities for dealing with both veterinary and food safety issues. The competent national authorities are required to supervise the animal health as well as the public health situation. For this purpose, laboratory facilities for testing, *inter alia*, maximum levels for anti-

⁸⁹ See also Abeiderrahmane 2003.

⁹⁰ This part is based on a draft by Michael Burkard.

⁹¹ Mauritania is listed in Annex 1 of the Commission Decision 2004/438/EC of 29 April 2004 with the status of a country where there is foot and mouth disease (FMD). For disease control the EU therefore requires the milk products to be processed in order to deactivate the virus.⁹¹

microbial substances, pesticide residues and contaminants, are indispensable. In the case at hand, the veterinary services and food safety authority of Mauritania are obliged to guarantee that the food safety standards in the Tviski dairy factory are equivalent to the ones which apply to establishments in the EU Member States. The task of assessing, *inter alia*, HACCP procedures, microbiological testing and documentary requirements for sanitary control systems is particularly challenging for veterinary services and food safety authorities in a least-developed country (LDC) with limited resources.

2.4.6 Lessons learned

The case study on sanitary barriers to exports of camel cheese shows the intertwined obstacles to the quest for an export-oriented livestock sector particularly in LDCs. As shown by the case study, it is not sufficient for the Tiviski dairy company to invest in in-house laboratory capacity unless the competent authorities of Mauritania are able to deliver veterinary and public health services, including official laboratory facilities, equivalent to those of their EU counterparts. Likewise, increasing the capacity of veterinary and public health services in Mauritania will not enhance prospects for the export of animals and animal products unless these changes are accompanied by investments in the private livestock sector, in particular to improve biosecurity and in-house laboratory facilities. Given these findings and at least for the time being, the development of livestock sectors oriented towards exports to high-value markets such as the EU, especially in LDCs seems rather unrealistic. More promising seems the strategy adopted by the Tiviski dairy company after the breakdown of its attempts to export camel cheese to the EU.⁹² In order to resolve some of the problems of overproduction in times of low consumption, the company – in cooperation with a leading European firm – has adopted UHT technology. It can now treat cows milk (from Zebu cattle), which allows the milk to be stored for six months and sold on local markets. Camel milk at present is not suitable for treatment using this technology, but research is ongoing.⁹³

3 Discussion and conclusions

Regarding the above defined question on the impact of international standards on AnGRFA diversity, the following can be concluded:

- There are strong indications that initiatives to develop markets for endangered and/or local, indigenous, traditional, heritage breeds

⁹² The factual information is from Abeiderrahmane, N. 2003. *Quality for all? Innovation in food quality*. In: SPORE, Information for agricultural development in ACP countries, No. 106, August 2003, p. 16 (available at http://spore.cta.int/spore106/spore106_view.html) (last visited 18 July 2007).

⁹³ <http://www.tiviski.com/index2.html>.

successfully contribute to their conservation and sustainable use, in particular if specific brands are developed. Yet, there are also indications that success depends on local and regional customs and cultures. There might be exceptions, the camel cheese case being one of them. This of course does not exclude the possibility that products showing similar promise for gaining entry to high-value markets can be developed.

- In the literature it is stated quite unanimously that, because of the sanitary regulations, it is difficult if not impossible, for smallholders from developing countries to gain access to high value markets, in particular the EU. Only a few developing countries are able to export livestock products to the EU.⁹⁴
- No detailed comparison between the SPS standards (OIE and Codex) and the standards of the EU was found. According to the above analysis, the scientific basis for the higher standards of the EU might be challenged in some cases.
- As an alternative, access to local or regional markets, or markets of emerging economies with lower standards than those of the EU, is proposed (Desta 2007; FAO 2007). One argument in favour of this solution is that it offers a better cost–benefit relationship.
- In any case, a cooperative approach at the level of the producers, and cooperation with and the interest of the state agencies in entering into international negotiations for market access is a condition *sine qua non*.

In conclusion, we note that first, little indication could be found that international zoosanitary and food safety standards that regulate the importation of animal products have an impact on AnGR diversity by impeding the marketing of products of endangered breeds. The globalization of the markets furthers the production of tradeable (safe) products and the promotion of biosecure production sites that exclude smallholders and channels public investments. An indirect impact on the diversity of AnGRFA is possible.

Second, these findings do not exclude the positive argument that product-oriented standards, together with production and marketing initiatives that combine the zoosanitary and food safety needs with both the interests of smallholder producers and conservation of biodiversity at the international and national levels might have a positive impact on conservation and sustainable use of AnGR diversity and food safety in producing countries.

In both instances, further research and debates are needed.

⁹⁴ Compare e.g. Harris et al. 2003, and the tables in the Appendixes; Desta, 2007, Cabrera et al. 2008. But see Rich et al. 2009.

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