FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS

Review of the new features of the Ethiopian poultry sector Biosecurity implications

Consultative Mission

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Executive summary

Traditional practices continue to dominate domestic poultry production in Ethiopia. In the past 20-25 years, however, there has been a shift to industrial production with an increase in small- and medium-scale producers that have been established to exploit mainly urban markets. Trends suggest that numbers and size of producer flocks are rising, and particularly in urban and peri-urban areas. Recognizing these changes a qualitative risk assessment was undertaken on the premise that the avian virus H5N1 HPAI has already became endemic in Ethiopia. This assessment will help local producers and those who service and monitor them to remain vigilant for the better care of flocks and of people who come into contact with them. And, if the virus is not yet endemic – then to provide guidelines for when the virus is introduced into the country.

To this end, risk and recognition of the extent of risk has been considered and explored. The main results suggest the probability that the disease will became endemic and that this will vary on the basis of a number of factors. These will include the means whereby the virus is introduced, the target bird populations *(domestic and/or wild)* and the location of poultry farms – whether in urban or rural areas.

Subsequent to the assessment of the extent of risk of the epidemiological situation, the implications for biosecurity have been considered and a number of appropriate recommendations made. Of these, one of the most important messages provided is to strengthen the capacity of the Urban Agricultural Departments to enable them to better monitor and/or supervise the health of the birds making up the local poultry industry. It follows that this will better help protect the public at large. Therein is support for government policies that aim to promote urban agricultural production as one means of providing food security, raising incomes and reducing poverty in local communities.

Contents

Figures and Tables

Abbreviations and acronyms

AI	Avian Influenza
CSA	Central Statistical Authority of Ethiopia
DOC	Day old chicks
ETB	Ethiopian Birr *(1 EUR = 13,9078 ETB www.Oanda.com 18/02/08)*
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross domestic product
GIS	Geographical information system
HPAI	Highly pathogenic avian influenza
NCD	Newcastle disease.
RAB	Rural agricultural bureau
PMDC	Poultry multiplication & distribution centre
RIR	Rhode Island Red (breed of chicken)
SNNP	Southern Nations and Nationalities Peoples *(Regional State)*
ToR	Terms of reference
URAD	Urban & rural agricultural departments
UAD	Urban agricultural department
Wereda	Administrative district in Ethiopia

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1. Introduction

1.1. Purpose of the consultancy

The terms of reference (ToR) for the work required are described in Annex 1. They envisaged two different tasks:

- Co-writing a manuscript for presentation at the XXIII World Poultry Congress to be held at Brisbane, Queensland, Australia, 30th June – 4th July 2008; *"Progress towards practical options for improving biosecurity of small-scale poultry producers*";

- Review of the Ethiopian poultry sector and in particular the newly emerging production industries in urban and peri-urban areas; and issues of improved biosecurity that need to be considered.

This report focuses exclusively on the second assignment. Recognizing the extent of reporting already available to describe poultry production in the country, the mission/report has focused almost exclusively upon the emerging urban/peri-urban sector and associated biosecurity implications. Annex 2 comprises a bibliography and contains a selection of texts that have been reviewed for the preparation of the report; and/or contains text that is recommended for further use.

1.2. Calendar of the mission

The mission in Ethiopia was undertaken from 23rd of January to the 4th of February 2008 by a team comprising one international consultant and one national consultant. Two field trips were made to Oromiya Region and to SNNP Region, respectively, 24th - 26th January and 31st January - 2nd February. The remaining period of the mission was spent in Addis Ababa. The list of people met during the mission is contained in Annex 3[1].

1.3. Methodology

A measure of preliminary work was undertaken prior to fielding the mission to seek information, to update on national activities and to better prepare for fieldwork. This included collection of secondary data, analysis and review of related studies and selected scientific bibliographies in order to better define the status of poultry production in Ethiopia and, where practical, across the region.

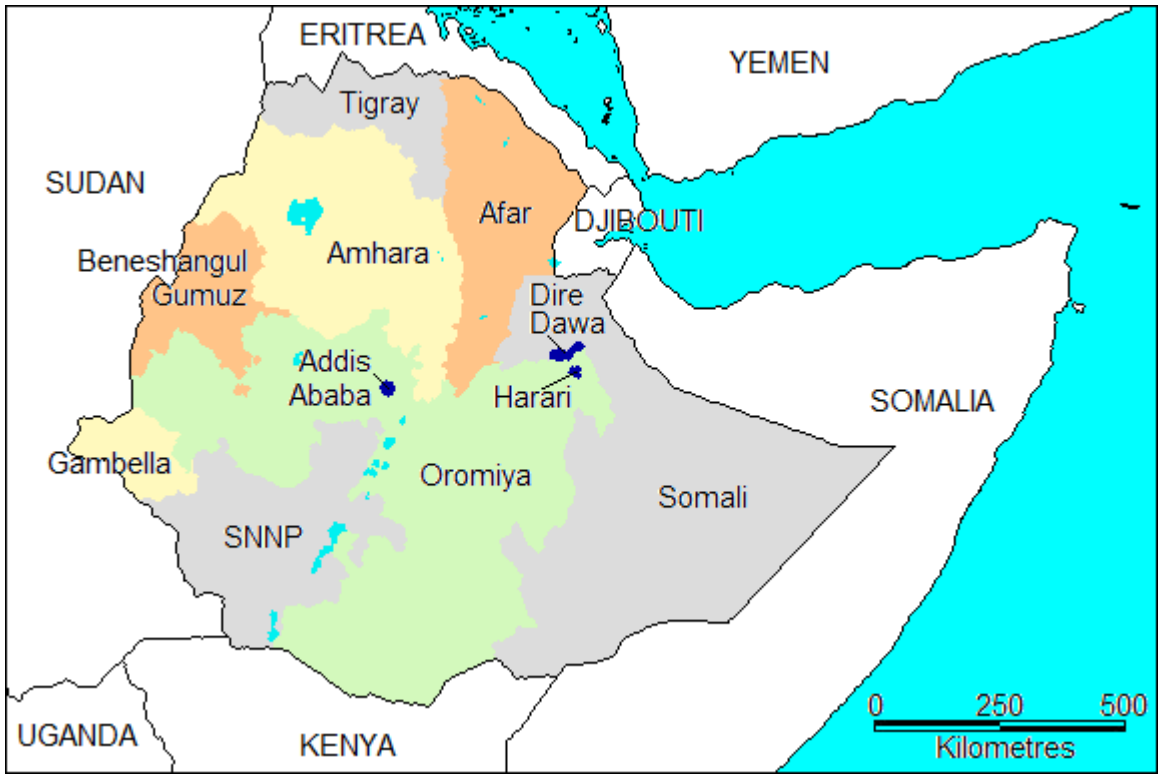
Considering the duration of the mission and the multiple tasks required of the ToR, a rapid appraisal of the Ethiopian poultry sector was considered a logical first step. A list of selected people, poultry farms and organizations were identified for visiting and a topic-specific questionnaire prepared.

[1] All dates in the report are based on the Gregorian calendar, which is nearly eight years in advance of the Julian calender followed by Ethiopia. For example, new years day 2001 for most Ethiopeans will be 11th September 2008 of the Gregorian calendar.

Different sources of quantitative and qualitative data were found. Of the selected bibliography described in Annex 2, two web sources were particularly valuable. http://www.csa.gov.et/ and http://www.ifpri.org/pubs/books/oc54.asp#dl. Both refer to the Central Statistical Authority (CSA) of Ethiopia, where it is possible to find information on domestic livestock at wereda (i.e. district) level and correlated maps that give spatial patterns and, importantly, the opportunity to link with tools that provide for analysis within a geographical information system (GIS).

In the following text, unless cited differently, the source of quantitative data has been provided by the CSA. Equally, the source of geographical data has come from http://www.maproom.psu.edu/cgi-bin/dcw/dcwarea.cgi?Africa. This has been modified and developed by the mission with the use of the GIS software MapInfo Professional ©, Version 4.5.2.

Figure 1. Map of Ethiopia with administrative divisions: Regions[2].



Annex 4 shows administrative areas of the country to the smaller administrative '*zonal'* unit

[2] Ethiopia is a federal state. Names, administrative regions and frontiers within the country and between Ethiopia and neighbouring states are for indicative purposes only.

2. Ethiopian poultry sector

2.1. Agricultural sector overview

Agricultural production dominates the Ethiopian economy and contributes of the order 45% of gross domestic product (GDP) and provides more than 80% of employment. The major source of foreign exchange is coffee, which provides 65% of export earnings. Other agricultural export products are oilseeds, pulses, cotton, sugar cane, flowers, hides and skins and livestock - mainly sheep and cattle. Ethiopia has the highest livestock populations in Africa and accounts for 17% of cattle, 20% of sheep, 13% of goats and 55% of equines in sub-Saharan Africa. Livestock contributes 16% of GDP. Seventy per cent of cattle, 75% of sheep, 27% of goats and 80% of equines are found in the highlands (Tangka et al. 2002).

Of domestic animals in the country the most numerous are bovines and poultry each estimated 45 million head. This is followed by goats and sheep each at 17 million head, by donkeys (4 million) and by horses and camels (each one million). There are an estimated one million bee-keepers in the country. Poultry are represented exclusively by chickens.

The agricultural system is divided into smallholder mixed farming (or agro-pastoral) systems in the highlands and pastoralism in the lowlands. The highlands cover less than half of the total land area but contain the majority of the human population. The highlands are characterized by having regularly cultivated cropland and support different types of livestock. This is because the highlands are favoured by suitable climatic conditions and low disease incidence, and thus provide proper conditions for the introduction of all manner of domestic livestock including exotic breeds. Despite this potential, the agricultural sector has remained underdeveloped and provides a poor economic base - low productivity, weak infrastructure, low levels of technical application and poorly informed population.

Figure 2. Map of altitude.

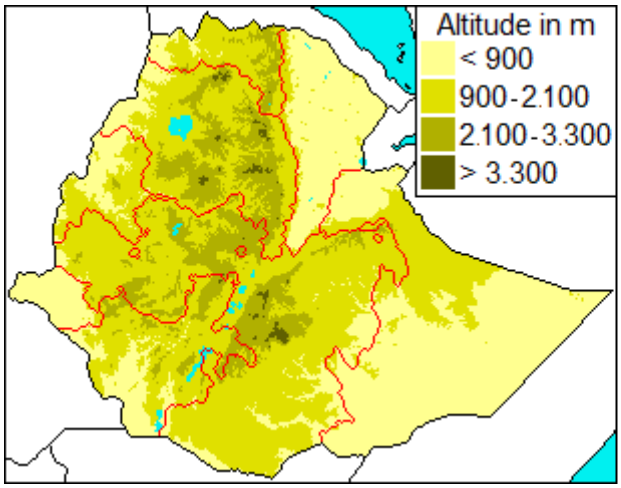
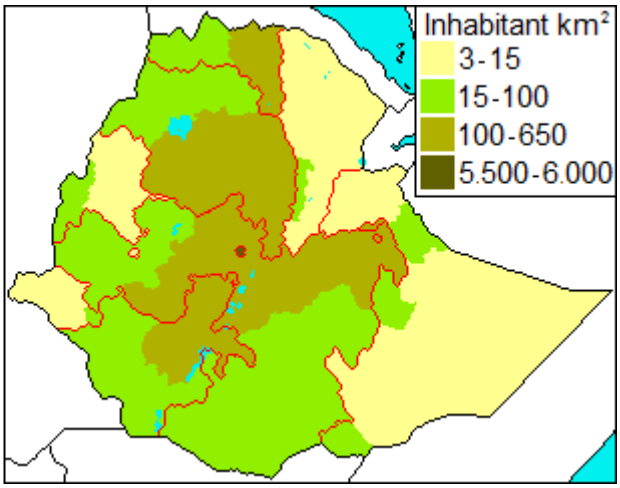


Figure 3. Map of population density.

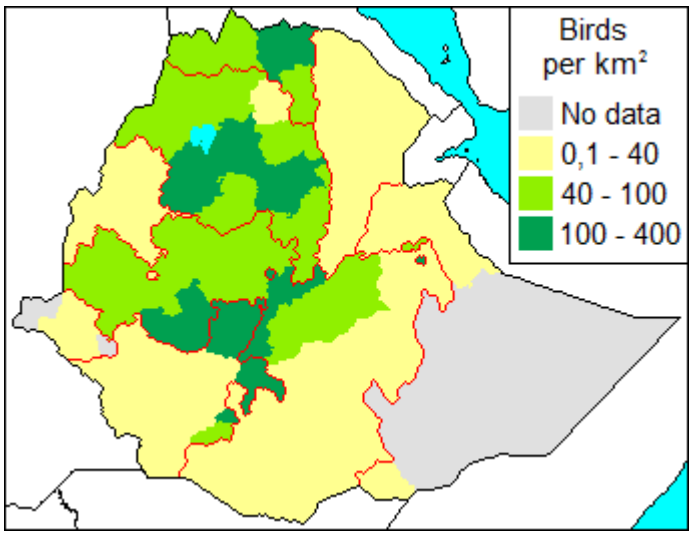


2.2. Poultry production systems

Up to the present, the domestic poultry sector has been dominated by traditional production practices, and local breeds represent almost 98% of the national poultry flock. This despite

government effort during recent times to modernise poultry production by introducing exotic breeds and encouraging more productive technologies.

Figure 4. Map of poultry density.



2.2.1. Traditional poultry sector

For the majority of sedentary populations in sub-Saharan Africa, poultry is an important part of an integrated food production/security system. Diversification of crops and livestock production has evolved to reduce the risks of food crisis as the result of unfavourable weather and diseases. Agricultural production dominates community development, and the importance of livestock varies according to local environmental conditions.

Figure 5. Map of flock size.

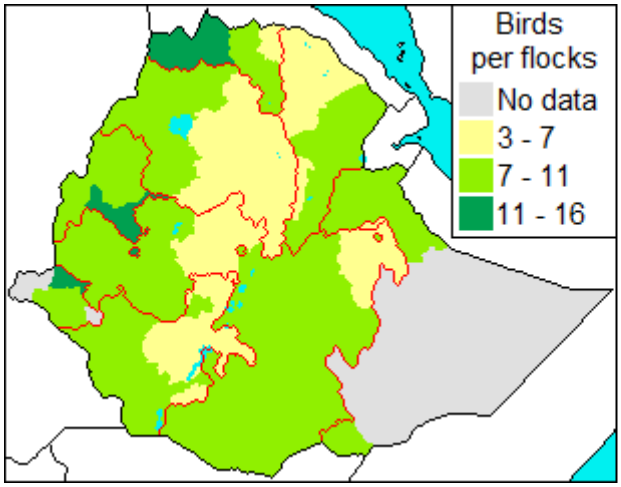
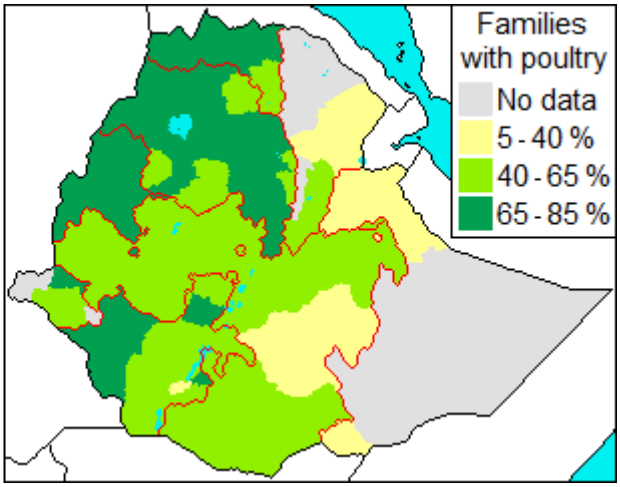


Figure 6. Map of rural households with poultry.



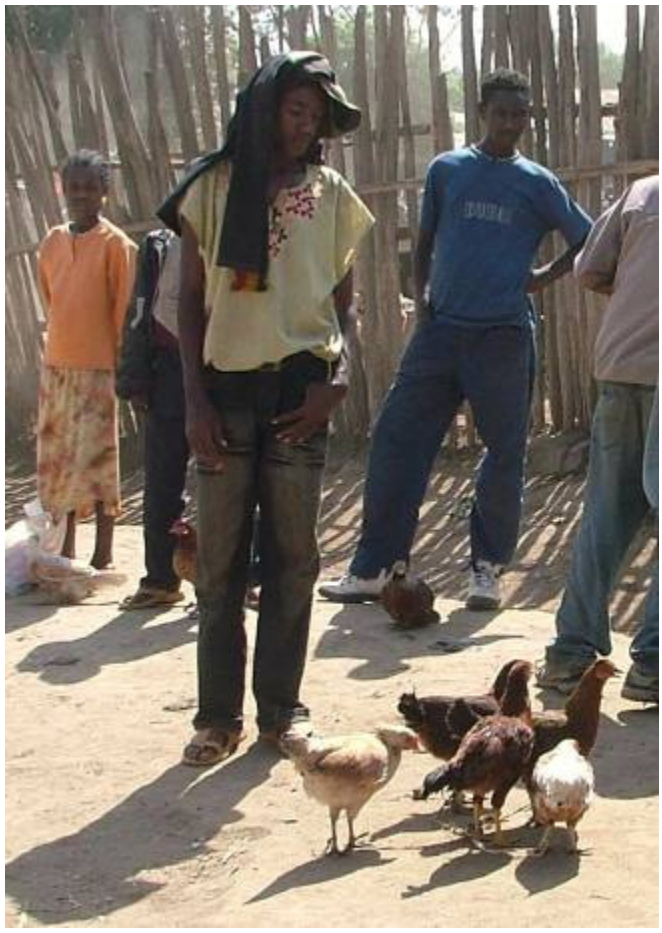
Ethiopian indigenous chickens have a variety of morphological appearances. They vary in colour, comb type, body conformation and weight, and may or may not possess shank feather. Eggs have thick shells and deep yellow coloured yolk. Indigenous chickens, however, have low productivity - average annual egg production is estimated at 60 eggs (average 38 g); while the carcass at 6 months of age is about 0.5 kg from a live bird of about 1.5kg. Low productivity is also due to low hatchability at about 70% and high mortality. Estimated 40-60% of chicks die during their first eight weeks mainly due to disease and predators (Demeke 2007).

The low productivity of indigenous poultry can also be part attributed to the fact that traditionally chickens receive little care. At night they are sheltered in small hen houses or in a room of the family house, to protect them from predators and bad weather. During the day, the chickens seek their food around the house (Kock et al. 2007). They receive bran, cereals and residues from the kitchen when available, with supplementary food given during the rainy season. Water is generally provided. Under these conditions, biosecurity issues arise for both the health of birds and associated risks to people.

Figure 7. Poultry roost in the kitchen.

Figure 8. Stone trough for chicken feed.

Figure 9. Chickens in a rural market



Poultry population density in the country is relatively low and may not necessary follow the one for people (see Figures 3 & 4). The predominant bird species are chickens. Other species such as ducks, geese, turkeys, pigeons, quails, etc. are rare in the villages, and were not seen by the mission There is no data available regarding these species except that of Wossene (2006), who reported the opening of a duck farm at Chancho in Oromiya Region in the early 2000s.

Domestic chicken flocks are small with average 7-10 mature birds per household *(but this can vary from region to region as shown in Figure 5).* Typically, the household flock consists of 2-4 adult hens, one male bird and growers of various ages.

Chicken production in the home is mainly the business of the women, who manage them freely and without any traditional feedback required of the husband. This provides for a measure of economic security to the women in

the house. The main objectives of egg production are hatching (51.8%), sales (22.6%), home consumption (20.2%) and gift (5.4%). Objectives of bird production are sales (26.6%), sacrifice/healing ceremonies (25.0%), replacements (20.3%), home consumption (19.5%) and gift (8.6%) according to Gottard and Soares Magalhaes (2006).

Live birds and eggs are usually sold by the owner in local markets. Single bird sales or sales of small numbers typify most rural markets, with many sellers competing. During times of festivity, the numbers and the prices of birds in the market rise considerably, because of demand (Dessie and Ogle 2001). Occasionally birds are sold to middlemen for transport and sales in the larger towns and cities.

The largest proportion of eggs and poultry meat consumed in the country comes from indigenous birds produced by rural growers. Large numbers of these birds are also exported to neighbouring countries within trade that is mainly informal. Therefore, the main movement of poultry and poultry products is one of rural producer to urban consumer *(i.e. from the periphery to the centre*) and from Ethiopia to neighbour country, which, from an Ethiopian biosecurity point of view is profitable, because is not favourable to the diffusion of poultry diseases all over the country.

The knowledge of poultry diseases by producers is poor; the only disease which people were able to name during interviews was Newcastle Disease (NCD). The use of traditional medicines in poultry is low; these have generally been replaced with antibiotics such as tetracycline with is cheap and easy to find on local markets. A few local medicines/treatments used for sick birds comprise mixtures of lemon and undefined grasses and roots, but they are not recognized as being effective. According to producers, once dead the chicken in not .

2.2.2. Emerging small- to medium-scale poultry sector

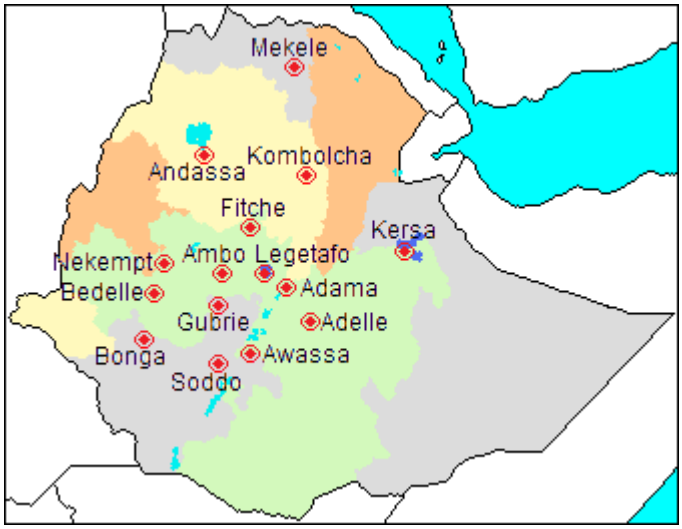
Traditional production methods dominate the market for birds, eggs and meat. However, during the past 15-20 years, there has been gradual increase to commercial small- and medium-scale flock production. This reflects the efforts of the Government of Ethiopia during the period since the early 1990s to boost the productive basis of domestic birds within a genetic improvement programme. Herein has been concerted effort to introduce and distribute exotic breeds, provide improved extension advice and services and to generally exploit the capacity of the sector to boost rural productivity (with the implications therein for raising incomes, providing employment and alleviating poverty). These programmes have been introduced courtesy of poultry multiplication and distribution centres (PMDC) and the Urban and Rural Agricultural Departments (URAD).

In recent years, an emerging middle-class urban sector with higher income and more buying power has boosted the demand for poultry products, and this has led directly to expansion of poultry production particularly within urban and peri-urban areas. One reflection on this has been the establishment of privately-owned veterinary services – with pharmacies, practices and medicines widely available. More poultry-service products are now sold. The mission found service industries expanding on the basis of demand from mainly urban and peri-urban producers. The other key finding of the mission confirmed the nature of recent investments; of the nearly a dozen commercial producers met, only one had been in business for 2 years. Everyone else had begun their poultry business during the past 12 months.

The first exploratory PMDC was established in 1985 (in Kombolcha) and was quickly followed by others during the 1990s. The PMDCs have been an unqualified success such that some PMDCs are being privatised as others are still being established. *See Figure 10.*

Some PMDCs have their own parent stock and hatchery from which they multiply and distribute breeding and production birds to urban and rural areas. At the beginning, the PMDCs were mainly involved with distributing improved poultry breeds to farmers in rural areas, but with better links to urban agricultural departments (UAD) they now distribute to urban and peri-urban areas. At present there are 14 PMDCs with four additional centres planned for Amhara Region (Demeke 2007).

Figure 10. Map of regional poultry multiplication & distribution centres.



The PMDC methods of working are standardised and simple. They raise and multiply parent stock, which is imported as fertile eggs and/or DOCs. The F1 stock is then sold either as fertilized eggs, DOC or three-month old growers. In the latter case, birds are vaccinated for NCD and Gumboro and, in some cases, against Marek's Disease. No other vaccination or treatments are scheduled during the subsequent production cycle. Only antibiotics and vitamins may be given when problems arise. All products are sold to small-scale farmers with subsidized prices, which are usually around 50% below real market prices.

Table 1. Regional poultry multiplication & distribution centres.

Region	Name	Production / distribution 2005		
		Fertile eggs	DOC	Pullets
Tigray	Mekele	900.000	1.890.000	100.000
Amhara	Andassa	1.080.000	18.000	46.800
	Kombolcha	3.500.000	360.000	14.000
Addis Ababa	Legetafo			
Oromiya	Adama	388.331	113.373	54.000
	Adelle	397.485	113.373	54.000
	Ambo	9.000		
	Fitche	7.200		
	Kersa	3.000		
	Nekempt	9.000		
	Bedelle	627.544	108.838	27.000
SNNP	Awassa	1.000.000	180.000	100.000
	Soddo	9.000		
	Gubrie			
	Bonga			
Total		**7.930.560**	**2.783.584**	**395.800**

In a typical PMDC, basic biosecurity rules are generally understood and, to varying degrees of qualification, implemented satisfactorily. Notwithstanding this general observation, much can and should be done to boost application and thus control. Almost without exception, improvements to structures, condition of premises, accessibility, understanding and application of procedures is required to further improve control of biosecurity Figure 11 shows facilities, layout, site of a typical PMDC.

Most of the DOC imported by PMDCs have been, and remain, Rhode Island Red (RIR) breed. RIR are known for dual purpose productivity – meat and eggs. In early times, batches of Fayoum breedstock were imported for research purposes from Egypt. Before recent outbreaks of avian flu virus H5N1 in Africa, importation was also made from a number of other sources including the Netherlands, Saudi Arabia, Egypt, UK, Kenya, Germany and France. For practical improved sanitary control, however, current importations have been restricted to single-source suppliers in the Netherlands.

Control of importation is vested in the authority of the Federal Ministry of Agriculture, but existing quarantine and inspection facilities remain inadequate for screening of eggs and birds as carriers of contagious diseases including avian flu viruses.

Table 1 provides an indication of the potential production capacity of existing PMDCs. There is, however, considerable flux between theoretical and actual production. Production at Awassa PMDC exemplifies these differences, with 30.000 three-month old growers produced in 2007 against a potential of 100.000 shown. Managers cite limitations of production budgets available.

Figure 11. Adama poultry multiplication & distribution centres.

In addition to the PMDCs, there are a handful of other medium-scale and large-scale commercial importers of poultry and service materials in both the private and public sectors. Public sector importers include the agricultural research institutes such as Debre Zeit Agricultural Research Centre. Private sector poultry farms generally comprise a few dozen producers, the largest of which are Elfora Agro-Industries, Alema and Genesis. In total they supply Addis Ababa with about one million chickens and 34 million eggs annually (Demeke 2007). Producers are mainly based in Debra Zeit *(60 km from Addis Ababa)* and maintain an important role for the expansion of small-scale poultry production along the main Addis Ababa and Debre Zeit road axis and in-and-around the two cities.

The demand for improved breed DOC by newly establishing small-scale poultry farmers is much greater than supply. This is not simply because prices are subsidized, but as a result of the higher productivity of the exotic breeds and the encouragement of the local office of the UAD. This has given rise to the emergence of many small-scale importers; for own-use and for trading. For example, a farmer met by the mission was typical. Three times he had imported a stock of 2.500 DOCs directly from the Netherlands. Chicks were raised as 12-week old growers for home use and surplus stock sold to other producers. The importer/trader/producer had followed the same principles and methods as that recommended by the PMDC, but had operated in the marketplace with prices that had not been subsidized. There was little or no concern for the competitive element of the business, and the trader had reconfirmed that issues of productivity would continue to improve as more stock were imported. The business was a sound one.

The mission was unable to gain entrance to the larger commercial farms; and was thus unable to verify the extent of the biosecurity status that was followed. From talking with producers there was presumption that they were, at least, exercising bioexclusion aspects of recommended biosecurity procedures. This was not the case with other reporters, for Wossene (2006) had found low-level biosecurity standards practiced by some large commercial producers.

False reporting of HPAI prevalence on site following a poultry disease outbreak at Gubre PMDC in 2006 – which resulted in all the chickens being culled - caused considerable public panic and debate, and severely depressed demand for poultry and products in the country. This situation served as an impetus for the larger commercial farms such as Elfora to invest in biosecurity. The outbreak of Gumboro disease devastated production activities on many commercial farms at about the same time and provided further encouragement for producers to raise on site standards of biosecurity. Changing attitudes amongst producers provides a good start for the protection/veterinary care of birds *(and the health of people who come into contact with them)* into the next period. This will assist with preventing the introduction and/or spread of HPAI.

Large-scale investment is following the boom of the small-scale urban and peri-urban poultry producer, and a number of companies have industrial facilities under construction. This includes the Abudiab Poultry Production and Processing Company which was visited by the mission. The Company expect to begin commercial activities mid-2008 and will eventually produce 400.000 broilers annually with its own parent stock, slaugtherhouse and feed production. The Company is targeting the Ethiopian domestic market with surpluses directed to export.

The distribution of exotic poultry breeds and improved production technologies in Ethiopia comes with the guidance of the PMDC, and is strictly linked to the technical advice of the UADs and RABs. The establishment of UADs as a separate entity is a recent phenomenon *(given that 'agriculture' has traditionally been a 'rural activity').* For example, the Addis Ababa UAD was established five years earlier in 2002 and was quickly followed by UADs in the regional towns. The principles behind support for 'urban agriculture' comply with the policies of the Government of Ethiopia for the creation of employment, raising incomes and providing livelihoods for the economically weaker sectors of the population such as women and young people.

The organizational set-up and the activities undertaken by UADs differ from region to region, but generally they comprise similar models and provide similar services including extension/advice, health services and production resources (e.g. PMDC). The separate advisory units promote activities within 'packages' that aim to train, provide technical

assistance and/or deliver production inputs at subsidized prices *(e.g. seed, chickens, fertilizers, etc).* The principal packages are directed at 'small-scale', 'smallholder' and similar production scales that help local people to make a living from horticulture, crops, poultry, beekeeping and, in some cases, sericulture. Many of these are novel sectors, and the support provided to more traditional sectors such as dairy, beef and small ruminant production is limited to technical advice. Poultry production is particularly well-supported with attention to healthcare and production. Many of the small producers seen by the mission had recommended housing/shelter, bell drinkers and feeders. In some cases, footbaths were provided for visitors.

The price of birds sold to producers remains subsidized, but no credit sales are offered. This is probably the main reason why the majority of producer flocks seen by the mission in urban and peri-urban areas was small (30-250 birds). Only two of the producers met had between 1.000-2.000 birds.

UADs maintain close working relationships with Federal and Regional Micro-Enterprise Departments and, where applicable, the small- and medium-scale producer is directed into micro-credit programmes that may assist with the establishment of poultry farms. This was the case with a group of people met by the mission at Debre Zeit.

At the time of the mission the UADs continue to provide the training, organizational management and support required of the new producers, but a considerable state of flux exists within the way that the industry is developing. For example, the mission saw 18-month old exotic RIR birds for sale in Awassa Market, as usual, available for direct consumption but, according to sellers, also for a second year of production. Current large-scale practice has been to encourage turnover of stock at the end of the first production cycle. Increased establishment of small-scale producers is one indication of the success of this approach, with new producers buying healthy birds that are capable of continuity into a second (and a third) year; and without the effort of start-up required of growers. As-and-when egg production begins to fall, birds can be consumed. Herein is the creation of networks of enterprises and the basis of food/economic security for people with little or no access to rural land.

Most small-scale poultry producers sell table eggs and live birds in the local public markets either directly or through traders. Others have a regular 'contract' and supply kiosks, shops and supermarkets. Most of the main supermarkets in Addis Ababa, for example, receive their poultry products (eggs and meat) from smallholder producers. Other supermarkets contract with large-scale producers such as Alema and Genesis Farms.

Specialist slaughter facilities are not available apart from those owned by Alema and Elfora Agro-Industries. It follows that most of the dressed carcasses from the small-scale sector are prepared and packaged without the veterinary/healthcare inspection recommended, which further raises issues for delivery of safe foods into the food chain. Poultry slaughter/dressing facilities were not visited by the mission, and there was no indication of the quality of slaughter practices followed.

2.3. Biosecurity implications

The findings from the risk assessment undertaken by Gottard and Soares Magalhaes (2006) for the introduction of HPAI H5N1 virus in Ethiopia found[3]:

- The quantitative risk of introduction of the virus via DOC legal trade was assessed as ***'low, but likely to occur'.***

- The qualitative risk of introduction of the virus via wild migratory water birds was assessed as '***low***'.

Subsequent recommendations were made for the improvement of an early warning surveillance system to track incoming infestation and, importantly, the need to follow similar developments in those countries of origin from which birds, eggs and similar were imported into the country.

2.3.1. Risk assessment

Based on the results found, the mission made effort to extend analysis taking into account the rapidly emerging poultry sector as represented by domestic urban and peri-urban producers. It may be that emerging small- and medium-scale poultry producers will considerably change the epidemiological situation and, importantly, the will include the biosecurity implications required of the poultry sector concerning HPAI H5N1 virus introduction. To assist, the mission made use of the methodology of qualitative risk assessment using procedures shown in Annex 5.

The two specific risk questions requiring answers are:

A. What is the probability of transmission of the H5N1 HPAI virus to domestic poultry in case of introduction of the virus in Ethiopia; and the subsequent probability that the disease will became endemic in domestic poultry?

B. What is the probability of transmission of the H5N1 HPAI virus to residential wild birds in case of introduction of the virus in Ethiopia; and the subsequent probability that the disease becomes endemic in wild bird populations?

The pathway used to answer both risk questions is as follows:

a Release parameters *(contact with infected material)*
Introduction of infected material → first case of infection.

b Exposure parameters *(local pattern of diffusion)*
First case of infection → presence of multiple outbreaks.

c Consequence *(appearance of healthy carriers)*
Presence of multiple outbreaks → disease becomes endemic.

Information required for the qualitative risk assessment is listed in Table 2. Availability is also reported. Source material for Ethiopia and for the behaviour of the virus is described in the bibliography (in Annex 2).

[3] The pathway followed by Gottard & Soares Magalhaes (2006) to reach this result is illustrated in Annex 6.

Table 2. Information required for qualitative risk assessment.

Required information		**Availability**
Potentiality for indirect exposure of domestic and wild resident birds to the virus	Virus stability in environment	Available on different strains from H5N1
	Climate data	Available
	National and international trade	Partially available
Potentiality of direct exposure of domestic and wild resident birds to wild migrant birds	Habitat and behaviour data of migratory wild birds	Partially available
	Infection status of migratory and resident wild birds *(surveillance results)*	Only empirical data
	Population numbers of migratory and resident wild birds	Partially available
	Data on congregation sites and spatial distribution of wild bird	Partially available
Consequences for direct or indirect exposure to the virus in domestic and wild resident birds	Susceptibility to H5N1 HPAI	Only empirical data on recent outbreak
	Data on survival post- H5N1 infection	Only empirical data on recent outbreak
	Population dynamics *(persistence)* of H5N1 virus	Unknown
Transmission	Domestic poultry census, devised by species	Partially available
	Number and location of farms	Partially available
	Husbandry systems and biosecurity measures	Available
	Susceptibility of domestic poultry	Available on different strains
	Poultry market chain	Partially available
Agricultural departments and veterinary services	Occurrence on the territory	Available
	Operational capacity	Available
	Technical knowledge	Available

Exposure and consequence assessment to risk - Question A

What is the probability of transmission of the H5N1 HPAI virus to domestic poultry in case of introduction of the virus in Ethiopia; and the subsequent probability that the disease will became endemic in domestic poultry?

a.1 Infected material introduced in Ethiopia

Probability for infected material to be directly or indirectly in contact with domestic poultry. Different options according to the manner and place of introduction:

- Introduction via imports in urban areas. **High**
- Introduction via imports in rural areas. **Moderate**
- Introduction via wild birds near congregation sites. **Moderate**
- Introduction via wild birds far from congregation sites. **Slight**

a.2 Population of domestic poultry in contact with infected materials

Probability for domestic poultry to be infected by HPAI H5N1 virus after contact:

- **High**

a.3 First cases of infection in domestic poultry

The conditional probability that domestic poultry will became infected in the case of introduction of infected materials in Ethiopia can be considered:

- Introduction via import in urban areas. **High**
- Introduction via import in rural areas. **Moderate**
- Introduction via wild birds near congregation sites. **Moderate**
- Introduction via wild birds far from congregation sites. **Slight**

Probability for infection to spread to different domestic flocks *(or epidemiological unit):*

- In densely populated areas. **High**
- In lightly populated areas. **Slight**

b.1 Transmission of infection to other domestic poultry *(viable local pattern of diffusion)*

Probability that veterinary services cannot detect outbreaks and patterns of diffusion:

- **High**

b.2 Presence of multiple outbreaks

The conditional probability that the infection spread to multiple domestic flocks in Ethiopia can be considered:

- In densely populated areas. **High**
- In lightly populated areas. **Slight**

Probability for some specimens of domestic poultry to became healthy carriers:

- **Moderate**

c.1 Disease becomes endemic

Conclusion. The conditional probability that HPAI becomes endemic in domestic poultry after the introduction of infected material in Ethiopia can be considered:

- Introduction via imports in urban areas. **High**
- Introduction via imports in densely populated rural areas. **Moderate**
- Introduction via imports in rural areas. **Slight**
- Introduction via wild birds near congregation sites in densely populated areas. **Moderate**
- Introduction via wild birds near congregation sites in lightly populated areas. **Slight**
- Introduction via wild birds far from congregation sites in densely populated areas. **Slight**
- Introduction via wild birds far from congregation sites in lightly populated areas. **Low**

Exposure and consequence assessment to risk - Question B.

What is the probability of transmission of the H5N1 HPAI virus to residential wild birds in case of introduction of the virus in Ethiopia; and the subsequent probability that the disease becomes endemic in wild bird populations?

a.1 Infected material introduced in Ethiopia

Probability of infected materials to be directly or indirectly in contact with residential wild birds. Different options according to the means and place of introduction:

- Introduction via imports. **Low**
- Introduction via wild birds near congregation sites. **High**
- Introduction via wild birds far from congregation sites. **Slight**

a.2 Population of residential wild birds in contact with infected materials

Probability for wild birds to be infected by HPAI H5N1 virus after contact:

- **High**

a.3 First cases of infection in residential wild birds

The conditional probability that residential wild birds become infected in case of introduction of infected materials in Ethiopia can be considered:

- Introduction via imports. **Low**
- Introduction via wild birds near congregation sites. **High**
- Introduction via wild birds far from congregation sites. **Slight**

Probability for the infection to spread to different wild flocks *(or epidemiological unit):*

- Near congregation sites. **High**
- Far from congregation sites. **Moderate**

b.1 Transmission of the infection to other wild flocks *(viable local pattern of diffusion)*

Probability that veterinary services cannot detect outbreaks and patterns of diffusion:

- **High**

b.2 Presence of multiple outbreaks

The conditional probability that the infection spreads to multiple wild flocks in Ethiopia can be considered:

- Near congregation sites. **High**
- Far from congregation sites. **Moderate**

Probability for some specimens of wild resident birds to became healthy carrier:

- **High**

c.1 Disease becomes endemic.

Conclusion. The conditional probability that HPAI becomes endemic in wild bird populations after the introduction of infected materials in Ethiopia can be considered:

- Introduction via imports. **Low**
- Introduction via wild birds near congregation sites. **High**
- Introduction via wild birds far from congregation sites. **Slight**

These conclusions overlap to some extent with the results and the recommendations of the work of Gottard and Soares Magalhaes (2006) and Wossene (2006).

2.3.2. Discussion and recommendations

It follows from the risk assessment undertaken that the one key factor increasing the probability that the HPAI virus will become endemic is directly linked to concentration/density of birds and people. Other aspects are also evident and may play an important part with the introduction of the virus including the means of introduction, target bird populations *(domestic or wild)* and/or location *(urban or rural areas).* Only population density continually comes up as 'moderate to high' risk factor in the assessment. This follows from the assumption that more people correspond to more poultry flocks, but this may not always be the case in Ethiopia.

The evolution of the poultry sector in the country in recent times has highlighted the growing importance of small- and medium-scale producers in urban and peri-urban areas. The commitment of the government with promoting poultry farming and supporting the industry with the establishment of the network of PMDCs is encouraging. This will contribute towards food self-sufficiency and poverty reduction. To this end, the role taken thus far by the UAD has been essential. Notwithstanding these constructive beginnings, issues of biosecurity have arisen and recommended practices with which to protect both bird populations and people have not been implemented satisfactorily. The industry remains dynamic. Findings of the mission indicate that the UAD seems to be rapidly losing overall control and supervision of the sector *(as it shifts to private enterprise).* There is scope for policy reviews and planning, that the essential frameworks are in place within which the industry can be encouraged to grow.

Concerning the potential risks of HPAI virus outbreak and the probability that the disease will become endemic in Ethiopia. Until recently this was thought unlikely and the epidemiological situation considered favourable. Indeed, the limited industrialization of the poultry sector, the relatively low density of poultry population and low numbers of ducks and geese in the country are factors that may limit opportunities for the virus to become endemic. Notwithstanding the practicalities of these earlier assumptions, the recent evolution of the small- and medium-scale sector has created concern for when the virus will eventually be found:

- The greater concentration of commercial producer birds in areas of high population density *(i.e. towns and cities)* and issues for the risk of infection are growing.

- Public institutions previously responsible for public planning, control and management of industrial development in urban areas are giving way to the private sector; this raises issues for control and/or interventions and/or supervision required of HPAI outbreaks.

Contingencies currently in hand include efforts to strength the capacity of the UADs to monitor urban and peri-urban poultry producers – to enable them to continue to react to changing situations.

The security precautions of previous times with importation of biological materials vested in the hands of few public institutions and large-scale producers is unlikely to continue into the next period with the loss of effective control that will result. Herein may be opportunities for the importation of infected or contaminated materials. That said, sanitary facilities and measures available to these larger importers have not always been (and remain) largely inadequate, and biosecurity measures have sometimes been less than satisfactorily. With more importers entering the trade, government will be advised to act to provide the most

cost-effective and viable measures for health control into the near future. Contingency planning will be required.

One possible solution is for the Federal Ministry of Agriculture and the UADs to provide incentives for public and commercial importers to develop quarantine centres, and to reinforce their biosecurity standards and particularly with biocontainment procedures. The incentive could be the facilitation of the import procedure for institution with adequate infrastructures, but at the same time to strengthen the controls to meet international standards.

Finally, the case for supporting the CSA of Ethiopia should be made. The CSA provide a reliable source of data/information for a host of development issues that is freely available in hard and electronic copy. Information is updated annually. All public administrative levels are covered from the nation/state to wereda-level (i.e. district-level). There is value in having access to services and information that provide the basis for the modelling and tools of agricultural, demographic, socio-economic, etc. development. In a continent that is notorious for lack of information, these Ethiopia public services are an example to be treasured.

That said, improvements can always be made. A scrutiny of information reveals gaps and inaccuracies in the material/information available, for example, in the areas of land cited where different values are given for the same land area in different parts of the database. Differences may be small, but they suggest lack of clarity and the loss of confidence that may follow. Other examples can be cited, where there is a clearly mixed information. This is particularly evident for the weredas in the SNNP region.

Lack of potential reliability is one reason why the mission has adopted/used maps that have been limited to zones when attempting to make assessments of risk – and these have been made on the basis of zones. There is a broader generalization with use of the larger land areas, but no less value in recommendations that will lead to maps that show where the UAD should focus more resources and effort. Small investments may lead to great improvement; and the value of more accurate information as tools for decision-makers and their development advisors. The mission strongly recommends more collaboration and/or investment in the CSA to assist with improved collation, analysis and publication of information; and with providing services to the public at large.

Finally, if good risk management of HPAI infection is the final goal, the specific recommendations of the mission to FAO and to the donor community can be summarized:

- To strengthen the capacity of the UAD to enable them to monitor the urban and peri-urban poultry sector and to better supervise the current situation.
- To provide incentives to public and private poultry/product importers to assist them with establishing quarantine facilities; and to reinforce biosecurity standards with emphasis on biocontainment procedures required.
- To collaborate with the CSA and devise possible ways of improving services.

Annex 1. Terms of Reference

International Consultancy

Duration: 21 working days (20th January 2007 – 14th February 2008).

Duty station: (2 weeks mission in Addis Ababa/Ethiopia and 1 week home station in Holland, total 21 working days)

Background

Practical options for improving biosecurity on small-scale poultry farms can improve the livelihoods of producers.
Responding to widespread outbreaks of highly pathogenic avian influenza (HPAI) in Asia, Europe and Africa necessitates action at national, regional and international levels. The social and economic impact, especially on the livelihoods of affected communities, and the loss of assets associated with HPAI, disrupts markets and influences government policies. The promotion of safe production and processing practices throughout the poultry value chain is therefore essential for the control and mitigation of HPAI and its consequences. This requires a better understanding of how the poultry market chains work in the different poultry sectors. Improving biosecurity through the upgrade of management practices will be an essential part of this process.

FAO has recognized the importance of biosecurity measures for small-scale poultry producers in controlling and preventing HPAI virus and other pathogens from being introduced to farms. FAO has been involved in developing practical options for safe husbandry and management practices that improve biosecurity within the poultry value chain. Reports from the field and technical recommendations are available from Egypt, Cameroon, Togo Kenya, Ethiopia and Tanzania. An electronic conference has been conducted by FAO to collect data and views from international experts; a workshop was conducted in Ghana organized by the Regional Animal Health Centre in Bamako to collect views from the regional experts of 10 Western African Countries. A training workshop was organized in the Gambia for improving biosecurity on poultry farms and live bird markets in Western Africa. Biosecurity principles apply to all poultry production systems and at processing and marketing levels. For the small-scale producer, biosecurity measures can be simple and low-cost. FAO needs to compile all conducted practical experience in this field. Major outputs have been received from Eastern Africa under the OPEC/HPAI funded project.

Reviews undertaken by FAO in different countries in Western and Eastern Africa and the Middle East provide firm examples of the action needed to assist smallholder poultry producers with improved biosecurity. The major outcome of these works will be incorporated into the paper required.

Objective of the consultancy

1. To develop a paper that highlights practical options for improving biosecurity of small-scale poultry producers that can improve livelihood incomes.
2. To look at the emerging peri-urban/urban poultry sector (sector 3) and analyse husbandry practices and biosecurity implication in relation to the risk of spreading HPAI.

The paper will review the FAO practical field experience in this field, and highlight the major outputs that are delivered from Eastern Africa under the OPEC/HPAI funded project.
This paper will contribute to promote family poultry as a means of increasing household food security in developing countries and this can be done under the treat of HPAI.

Output of the consultancy

A peer-reviewed paper entitled *"**Practical options for improving biosecurity of small-scale poultry producers**"*
This paper will be presented at the World Poultry Congress in 2008 in Brisbane, Australia in the session for village poultry on Wednesday 2nd July 2008.

A technical paper reviewing the new features of the Ethiopian poultry sector and briefly discussing the biosecurity implications.

The papers will be submitted to AGA/SFE for technical clearance and peer reviewed. The papers should be concise and contain a summary, references and annexes as required. The papers will be provided in electronic format (MS Word). Annotated outlines and format of the peer-reviewed paper are given in Annex 1 of the ToR.

Approach

The consultation will start in January 2008 and will be done in Ethiopia and Holland and will be completed within 21 days (not later than end of February 2008). The 21 working days will be divided into:

- Field mission in Ethiopia to look at the various aspects related to biosecurity with smallholder and start the write up of the paper. The outlines will be agreed with the responsible officer in SFE (annex 1 of provisional outlines) 2 weeks

- Write up the respective draft final papers incorporating analyse of the role of FAO in disseminating information on biosecurity measures and risks control. In collaboration with AGA/SFE submit drafts for peer review and then incorporate relevant comments and prepare/submit final reports. 1 week plus revision if needed

FAO Responsible Officer:
Ms Emmanuelle Guerne-Bleich (Emmanuelle.Guerne-Bleich@fao.org)

Annex 2. Selected bibliography

Aklilu HA. Almekinders CJM. Udo HMJ and van der Zijpp AJ. (2007). Village poultry consumption and marketing in relation to gender, religious festivals and market access. Tropical animal health and production, 39, (3): 165-177. http://www.aseanfood.info/Articles/11019586.pdf

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Avery A. (2004). Red Meat and Poultry Production and Consumption in Ethiopia and Distribution in Addis Ababa. ILRI http://www.worldfoodprize.org/assets/YouthInstitute/BRinternship/2004/papers/AveryAbbey.pdf

Bush J. (2006). The threat of Avian Flu: predicted impacts on rural livelihoods in SNNPR (Ethiopia). http://www.ilri.org/Link/Files/Theme3/Avian%20Flu/Avian%20Flu%20%20Livelihoods%20-%20Final%20Report%202.pdf

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Wossene A. (2006). Poultry bio-security study in Ethiopia.FAO

Zepeda C. (1998). Méthodes d'évaluation des risques zoosanitaires lors des échanges internationaux. Séminaire sur la sécurité zoosanitaire des échanges dans les Caraïbes. Port of Spain (Trinidad et Tobago), 9-11 décembre 1998, 2-17.

Annex 3. List of people met.

Mr. Mafa Chipeta. Subregional Coordinator for Eastern Africa and FAO Representative in Ethiopia, to AU and ECA.

Mr. Eshetu G/Mariam. Team leader Agricultural Service Department. Addis Ababa, Gulele Sub-city.

Mr. Abebe Jiru. Team leader Agricultural Service Department. Addis Ababa, Bole Sub-city.

Mr. Tamirat Teshome. Extension agent Urban Agricultoral Office. Debre Zeit.

Mr. Zekarias G/Mariam. Extension agent. Erer, Addis Ababa.

Mr. Fikre Kayamo. Development Assistant (Gemeto Peasant Association). Awassa, SNNPR.

Mr. Kebreab Abdissa. Manager Poultry Multiplication & Distribution Centre. Nazareth.

Mr. Solomon Ayalew. Deputy manager Poultry Multiplication & Distribution Centre. Awassa.

Mr. Mohammed Hassen. Technical Manager Abudiab Poultry production and processing complex. Modjo.

Mr. Abel Mersea. FAO national consultant and representative at the Bureau at SNNP.

Mr.Yeshitila Haile and Mr. Ewnetu Alemu. Members of Microfinance supported collective farms. Addis Ababa.

Mr. Moges. Animal Health Technician (Gemeto Peasant Association), Wereda Veterinary Clinic. Awassa.

Mr Dameto Boru. Veterinary Technician, Wereda Veterinary Clinic. Awassa.

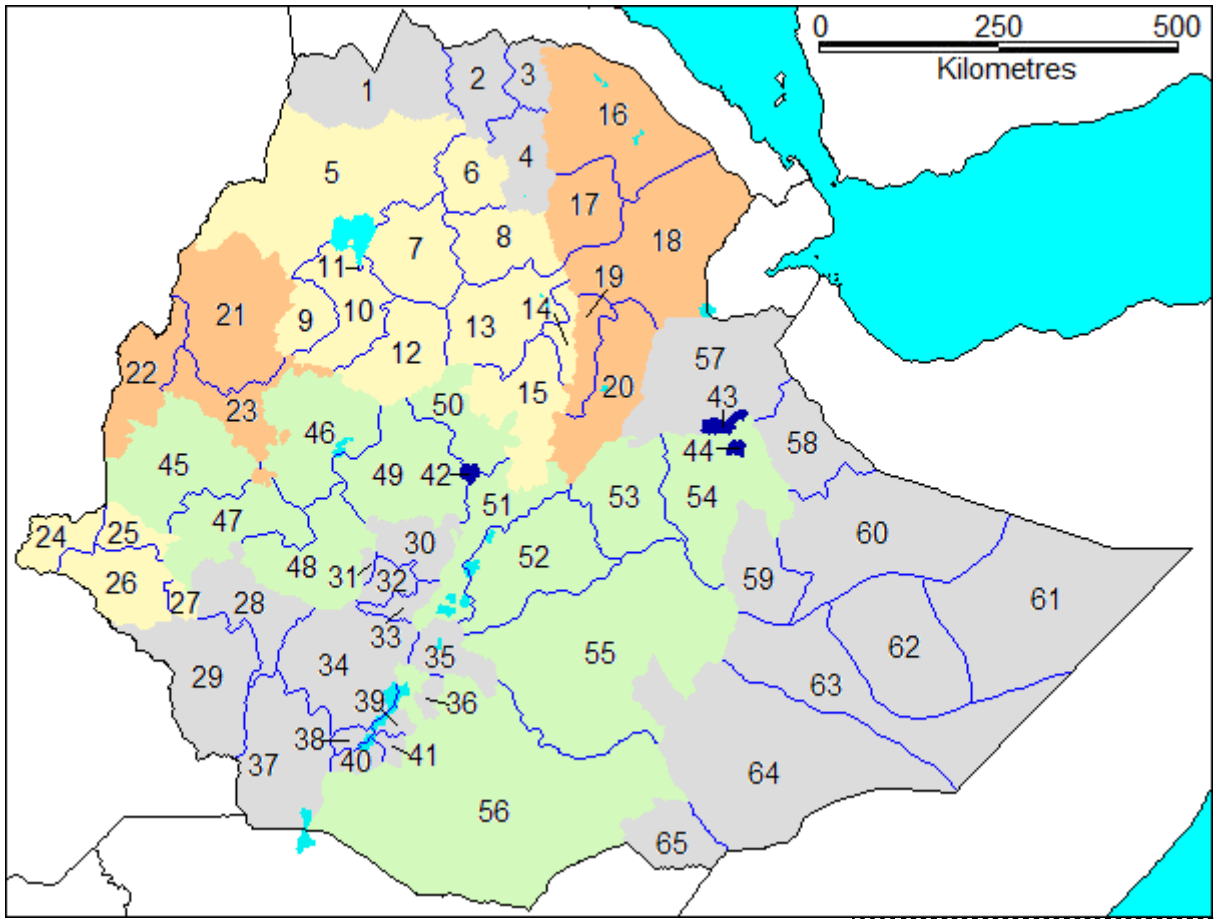
Mrs. Etagne. Private veterinarian and owner Fanab veterinary drug shop. Nazareth.

Mr. Siraj Yusuf. Private veterinarian and owner. Shalla veterinary drug and equipment store. Awassa.

In addition, a number of people directly or indirectly involved with poultry production were met. This included:

- Backyard, small- and medium-scale poultry breeders.
- Poultry retailers.
- Poultry collectors, traders and middleman.
- Consumers

Annex 4. Map of Ethiopia with administrative division: Zones.



1 Mirabawi (West)	21 Metekel	44 Harari
2 Mehakelegnaw (Central)	22 Asosa + Tongo	45 Mirab (West) Wellega
3 Misrakawi (East)	23 Kamashi	46 Misrak (East) Wellega
4 Debubawi (South)	24 Zone 3	47 Illubabor
5 Semen (North) Gondar	25 Zone 1	48 Jimma
6 Wag Hemra	26 Zone	49 Mirab (West) Shewa
7 Debub (South) Gondar	27 Zone 4	50 Semen (North) Shewa (R.4)
8 Semen (North) Wello	28 Keficho Shekicho	51 Misrak (East) Shewa
9 Agew Awi	29 Bench Maji	52 Arssi
10 Mirab (West) Gojam	30 Gurage	53 Mirab (West) Harerge
11 Bahir Dar Special zone	31 Yem Special Wereda	54 Misrak (East) Harerge
12 Misrak (East) Gojam	32 Hadiya	55 Bale
13 Debub (South) Wello	33 Kembata Alaba and Tembaro	56 Borena
14 Oromiya (R. 3)	34 Semen (North) Omo	57 Shinile
15 Semen (North) Shewa (R.3)	35 Sidama	58 Jigjiga
16 Zone 2	36 Gedio	59 Fiq
17 Zone 4	37 Debub (South) Omo	60 Degehabur
18 Zone 1	38 Dirasche Special Wereda	61 Warder
19 Zone 5	39 Amaro Special Wereda	62 Korahe
20 Zone 3	40 Konso Special Wereda	63 Gode
42 Addis Ababa Zone 1-6	41 Burji Special Wereda	64 Afder
	43 Dire Dawa	65 Liben

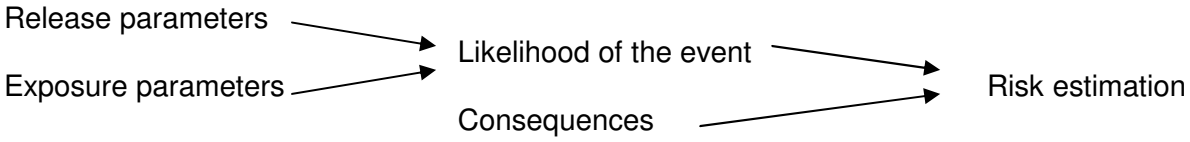
Annex 5. Qualitative risk assessment

The qualitative risk assessment, used by the mission, adopts simple methods, and uses limited information. It has value as an initial evaluation to help further identify situations requiring more complete examination or when there is insufficient information available for qualifying key parameters required. It has the advantage of being simpler than a quantitative approach and is thus applicable in a greater number of circumstances. It is also quicker to apply.

A model is constructed based upon a structured study of all the parameters that may have an impact/bearing on the end decision required. Herein is the value of organization in review, collation, study and analysis of information that all parameters required are marshalled, and that decision-makers are presented with end-results but also, and importantly, with the means whereby the decisions/recommendations were obtained. Methods can, in some cases, be more important than end results. The model adopted makes it all but impossible to leave out valuable parameters that may impact upon risk. There is a measure of emphasis on the value of data as it may apply to the end result. Qualifier descriptors used in the model are shown in Table A5.1.

Notwithstanding these advantages, quantitative risk assessment models are normally more precise; and depend less on the subjective nature of decision-choices on the part of modellers. Quantitative risk assessment is a deal more complex, however, and requires in depth knowledge of all parameters required for evaluation. This information is not always easy to source, and inevitably opportunities for analysing many real-life situations will be reduced. Findings are more rigorous for the arbitrary nature of the assessment is largely eliminated. Time is a key factor in the choices required, for quantitative risk assessment models can take time to assemble and apply. The approach is of particular value for case study analysis.[4]

The original method used by the mission was proposed by Zepeda (1998) and is based on a *"Probability assessment of each event"*. Each parameter has to be assessed using information available; for each the likelihood of occurrence is estimated to lead to a given level of probability, as follows:



[4] Dufour B. & Pouillot R. (2002). Approche qualitative du risque. Epidémiologie et santé animale, 41, 35-43.

Table A5.1. Qualifiers use for modelling. [5]

	Insignificant	Extremely low	Very low	Low	Slight	Moderate	High
High	I	EL	VL	L	S	M	H
Moderate	I	EL	VL	L	S	M	M
Slight	I	I	EL	VL	L	S	S
Low	I	I	I	EL	VL	L	L
Very low	I	I	I	I	EL	VL	VL
Extremely low	I	I	I	I	I	EL	EL
Insignificant	I	I	I	I	I	I	I

[5] Xiangdong S. (2007). Introduction to Veterinary Epidemiology and Animal Disease Risk Analysis. China Animal Health and Epidemiology Centre. http://www.adb.org/Documents/Events/2007/HPAI-Control-Technology-CAREC/Veterinary-Epidemiology-Animal-Analysis.pdf

Annex 6. Risk assessment of introduction of the HPAI H5N1 virus in Ethiopia.

Question risk:
Probability of domestic poultry to be infected with H5N1 introduced by wild birds.
(From Gottard and Soares Magalhaes, 2006.)

Source population of migratory birds

Probability to be infected by H5N1:
- **High to Very High**

Population of migratory birds infected by H5N1

Probability to survive infection and to reach congregation sites:
- **Low to Moderate**

Population of migratory birds, infected by H5N1, reaching congregation sites

The conditional probability that wild migratory birds infected with H5N1 HPAI enter an Ethiopian congregation site to release the virus can be considered:
- **Low to Moderate.**

Probability of migratory birds, infected by H5N1, to be in contact with resident birds:
- **High to Very High** *(depending on density of birds)*

Resident bird population in contact with infected migratory birds

Probability to be infected by the virus:
- **Moderate to High**

Population of resident water birds infected by H5N1

Probability to survive infection:
- **Low to Moderate** *(depending on species susceptibility)*

Population of resident water birds infected by H5N1 surviving the infection

The conditional probability that wild resident water birds become infected with H5N1 HPAI and that the disease become endemic in Ethiopian congregation site can be considered:
- **Low.**

Probability to be in contact with domestic poultry:
- **High to Very High** (depending on distance from the congregation sites)

Population of domestic poultry in contact with infected birds

Probability to be infected by the virus:
- **Very High**

Population of domestic poultry infected by H5N1

The conditional probability that backyard poultry become infected with H5N1 HPAI in Ethiopian after the wild birds infection can be considered:
- **High**

Conclusion. The global risk estimation of backyard poultry production system being infected by H5N1 in Ethiopia as a consequence of migratory wild water birds infected by H5N1 can be considered:

Null to Low