

Climate changes and animal health and food safety

Report of an international workshop under the DTU Climate Change Technologies program



DTU Vet
National Veterinary Institute

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- Report of an international workshop under the DTU Climate Change Technologies program

3th September 2009, Copenhagen, Denmark - National Veterinary Institute and National Food Institute, Technical University of Denmark

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Part 1: Summary and key recommendation

Overview of the workshop

DTU Climate Change Technologies is a research program run by the Technical University of Denmark (<http://www.dtu.dk/subsites/klima/English.aspx>). Its primary objective is to provide a firm platform from which to develop and apply new technological solutions to climate change issues. Focusing on climate change and energy generation, the program seeks to create and test technologies which reduce CO₂ emissions and can support industrial production and welfare in adapting to climate changes.

As part of the DTU Climate Change Technologies program, DTU has arranged a series of workshops and conferences (<http://www.dtu.dk/subsites/klima/English/TechnologicalSolutions/WorkshopsAndConferences.aspx>).

The National Veterinary Institute and the National Food Institute at the Technical University of Denmark hosted the workshop “Climate Change and Animal Health and Food Safety” in Copenhagen, 3 September 2009.

International and Danish experts from academia, governmental and non-governmental organizations and the private sector gathered together to discuss the complexity and highlight the concerns from international and national organizations, and to discuss priorities for risk assessment and risk management at national and international levels, and the roles of scientists, authorities and industry.

During the day, invited expert from 10 countries shared their knowledge of the complexity of climate change and answered questions from the participants. The invited experts provided presentations on key areas, and the participants had the opportunity to work in small groups to discuss the topic and to identify recommendations for moving forward on the objective.

In his closing remarks, Henrik C. Wegener, director of the National Food Institute, concluded that the effect of climate change on animal health and food safety will be a large challenge for all actors in the future, especially because of the globalization forcing us to accept that food production is of global interest. In relation to animal health and food safety in Denmark, he concluded that one large challenge in the future is to develop the animal and food producing industry into more robust systems that can produce safe food in more extreme weather situations. Research will constitute an important element in developing robust forecasting models and sustainable technological solutions.

Key recommendations

- The following key recommendations emerged during the workshop. They represent potential areas of focussed future research and development of food production in the context of climate change and animal health and food safety.
- **Research in robust production technologies** – focusing on improved technologies making it possible to produce safe and healthy food in a more extreme and varying climate must be integrated in the research of animal and food production technologies. Especially focus should be on the robustness of the technologies in conditions of “unexpected” extreme climate situations (e.g. heat waves and flooding).
- **Research in risk assessment tools** – mathematical tools used in animal health and food safety risk assessment, should be adapted to taking into account uncertainty and variability in the effect of climate change. Further, models including large parts of the ecosystem are needed for obtaining realistic predictions of climate change.
- **Use of historical data in the context of climate change** – to improve our knowledge about how climate may influence animal health and food safety, historical data should be analyzed with the aim to obtain quantitative estimates how different climate parameters has influenced the occurrence of animal - and zoonotic pathogens.
- **Development of vaccines and vaccination strategies** – is an important tool in controlling outbreaks of (re-)emerging animal diseases. Research focusing on developing vaccines against different animal - and zoonotic diseases should continue.
- **The research in production methods, vaccines and mathematical models should be multi-, inter- and trans-disciplinary** – Disciplines such as meteorology, ecology, computer science, biotechnology and engineering should be integrated in the research in animal health and food safety.
- **Implementation of targeted and integrated surveillance systems** - for early detection of emerging and re-emerging infections, but also for early detection of changes in recognized risk factors for disease emergence should be implemented. Methods for risk based targeted surveillance (surveillance activities only in risk areas during the high risk season) should be developed.
- **Encourage stakeholders and scientists to have an open and transparent discussion about the research needs** - with the aim to prioritize the importance of potential climate related diseases, and research needed in relation to preventing the effect of climate on these diseases.
- **Future crisis preparedness plans for animal-, zoonotic- and food related diseases must be based on inter-sector collaboration** - Fast and coordinated action is needed to minimise the public health harm in the face of a crisis. The public and private stakeholders should agree on who bears the expenses to prevent diseases in a changing climate.
- **Encourage data sharing and integration** – working in a more integrated ways between both national and international organizations and sharing data and knowledge will increase the progress in future research and prevention of diseases influenced by climate change

Part 2: Setting the context

Opening remarks

Kristian Møller, Director, National Veterinary Institute

In his opening remarks, Kristian Møller welcomed participants to the workshop. Especially, he welcomed the invited speakers and asked them to consider challenges, solutions and implementation issues. To highlight the importance of climate change in relation to animal health and human, he highlighted the fact that Bluetongue virus are moving north in Europe, probably due to climate change promoting the survival of the vector at a more northern latitudes and the newly finding that TBE are present in ticks in Denmark. He also mentioned that Malaria has been present in the Nordic countries for hundred years ago.

Background and purpose of the workshop

It can be anticipated, that climate change will alter the pattern of endemic infectious diseases of humans and animals, and that new infectious diseases may emerge or re-emerge in Denmark. This is in part illustrated by the seasonal variation in the incidence of food borne bacterial infections in humans, with considerably higher numbers of cases in the summer compared to the winter season. Furthermore, in recent years there have been several examples of new infectious diseases, which have emerged in animals. However, the knowledge about the causes and effects, points to a complex association with climatic, environmental and a number of other global change caused by humans. The complexity of the system makes it inherently difficult to develop robust models for risk assessment and/or forecasting of change in infectious disease incidence as a consequence of climate change. The workshop will address this complexity and highlight the concerns from international and national organisations, and will discuss priorities for risk assessment and risk management at national and international levels, and the roles of scientists, authorities and industry.



Part 3: Working sessions and feedback

Nine presentations were held during the workshop. The presentations were from various experts and focused on lessons learned, case studies and suggested solutions. After each presentation, the participants then had the opportunity to work in pre-arranged small groups to identify recommendations for moving forward on the objective. The organizer reviewed each group's notes and developed a summary of key items, which is presented in this report.

The following sections reflect the key messages of the session, including table group work and plenary feedback; they are not meant to imply consensus agreement or confirmation of recommendations.

The World Health Organization's perspectives on climate change and animal health. Dr Hilde Kruse (WHO EURO, Rome) provided a presentation of WHO perspectives and activities on Climate change, nutrition and food safety. She outlined an overview of how climate change will have an impact on food security and nutrition and water safety on a global perspective.

Key messages of the presentation and discussions included:

- The occurrence of current significant diseases at a global perspective is caused by the interaction between climate, environment and socioeconomic relation
- Climate change can increase the risks of food borne disease due to e.g. high temperatures, storms, flooding, droughts and populations displacement.
- Nutrition-related and food borne diseases are a major public health problem throughout the European region
- The major factors causing malnutrition in Europe (obesity) are not related to climate change
- It is not evident what lack of knowledge we have to improve, in the context of climate change and food safety
- The possible increase in food borne microbial diseases is very complex – i.e. how important are climate change compared with different control measures?
- Many solutions for increasing the outcome of agriculture includes an increased outlet of CO₂

Recommendations

- Increased inter-sector collaboration and actions, nationally and internationally in relation to climate change is needed
- Need for proper surveillance and monitoring systems in regard to nutrition-related and food/waterborne diseases
- Need for increased knowledge to how to produce safe and healthy food in a more extreme and varying climate
- Agree internationally on a transparent and objective method for prioritizing needed research
- Agree internationally on a transparent and objective method for prioritizing among important diseases

The World Organization for Animal Health' perspectives on climate change and animal health. Dr. Peter Black (OIE rapporteur / Australian Department of Agriculture, Fisheries and Forestry) provided a presentation Focusing on the perspectives on the impact of climate changes on animal health. He presented the result from a questionnaire where 126 OIE member states have answer questions about the concern of how climate changes will affect animal disease incidence and distribution. The questionnaire also includes questions about how the individual member state are going to prepare for that and their expectations on OIE.

Key messages of the presentation and discussion included:

- The occurrence and importance of emerging animal diseases will increase in the future due to globalization and climate change
- Animal production contributes to climate change (the problem or the solution)
- The end-results of the effects of climate change on end-results of animal health are hard to predict
- We have to accept a large influence of uncertainty and biological variability in the effect of climate change
- Not evident were to focus the prevention of animal disease at a global level: vaccination, GMO, production methods
- Not always possible to distinguish between the effect of climate change versus production methods and environmental change
- Challenges and solutions have very long perspectives whereas the need of food are short termed – counteracting interest

Recommendations

- Establishment of international ad hoc groups focusing on the effect of climate changes and solutions
- Gap analysis has to be performed to identify critical areas where knowledge about how climate changes affect animal health are missing
- More research has to be done in areas were knowledge is lacking
- Research should focus at many different levels from farm – country – geographical regions - globally
- Development of decision making frameworks in the context of climate changes by the veterinarian agencies in different countries

The European Center for Disease Prevention and Control' perspectives on climate change and public health in Europe. Dr Jan Semenza (ECDC, Stockholm) provided a presentation reviewing infections acquired through various routes (vector, rodent, water, food and air) in view of changing climate in Europe. In the end of the presentation Dr Jan Semenza outline the proactive public health response made by ECDC. ECDC will start to develop an infrastructure named the European Environment and Epidemiology Network (E³), as a resource for the public health research community.

Key messages of the presentation and discussion included:

- Substantial gaps of knowledge to the impact of climate change on the geographical distribution of vectors, vector-host relationships, new and re-emerging pathogens, transmission of food-borne pathogens, and the vulnerability of drinking water supplies
- The contribution of socioeconomic development, urbanization, land-use, migration and globalization to infectious disease transmission is in some cases more important than climate change
- Quantification of the effect of climate change are intricate but necessary

Recommendations

- Early detecting systems needed as early indication of emerging disease
- We have to overcome political barriers and protective behaviour of data if we are going to solve this
- Environmental modelling to predict food safety risk is needed
- The interaction between different international organizations, e.g. EFSA, OIE, WHO and ECDC must be improved
- Future surveillance also have to focus on change of risk factors for disease, not only on the occurrence of diseases
- We need to quantify the effect of climate change on animal health and food safety

Australian initiatives to deal with emerging infectious diseases. Dr Peter Black (Australian Department of Agriculture, Fisheries and Forestry) provided a presentation where he, using Australian examples of preparing for emerging diseases, outlined how the Australian government has meet the challenges, solutions and implementation issues.

Key messages of the presentation and discussion included:

- Climate change create new challenges and emerging threats, which needs to be approached in a new way
- Not possible to predict how climate change will influence emerging diseases in animal and humans
- The balance between preventing current problems versus detecting and prepare for new emergency is fragile
- Robust strategies for disease control must not necessary be the most optimal strategy for each specific disease
- Research in complex systems are needed, whereas the found givers requires specific well defined output in research projects

Recommendations

- To act efficiently against new threats, we need to take a holistic approach, including many disciplines in a multi-, inter- and trans-disciplinary approach
- Focus should be on development of robust disease preventing methods, not most optimal
- Funding of research in the effects of extremes climate situations must be easier to attract

Complex interactions among drivers of global change, including climate change: potential consequences for infectious disease? Dr. Serge Morand (Institut des Sciences de l'Évolution, CNRS, IRD, Université Montpellier, France) provided a presentation outlining the complexity of climate change influences on the global ecosystem. In the presentation the interaction between climate change, species invasion, land use and globalization were exemplified by examples.

Key messages of the presentation and discussion included:

- Climate change is only one of the drivers influencing the distribution and consequences of infectious diseases
- Ecological models can be useful to describe the complex interaction between the drivers
- The climate change influence on the biodiversity in the ecosystem is important
- The extreme events have an important emergency influence
- Taking into account the whole ecosystem makes the prediction very complex and will introduce a lot of uncertainty into the prediction

Recommendations

- Models including large parts of the ecosystem is needed for obtaining realistic predictions of climate change
- Models of ecosystem should be used and inference by caution

Future animal health in Denmark – developing a pragmatic adaptive strategy to climate change.

Dr Rene Bødker (the Technical University of Denmark, the National Veterinary Institute) provided a presentation where he outlined a plan for how the animal production in Denmark should prepare for the effect of climate change. The plan includes two steps: 1) Predict potential threats to human and animal health in the future Danish climate and 2) forecast where and when these animal disease and zoonoses may re-emerge. Two plans are needed: a preventive strategy to keep animal diseases and zoonoses out and a plan for action if the preventive strategy fails.

Key messages of the presentation and discussion included:

- To optimize the resources available, surveillance systems must be adaptive using risk based surveillance
- Disease risk – especially vector borne diseases - may vary in time and space, and targeted surveillance are likely to be cost efficient compared to mass surveillance.
- Mathematical simulation models mimicking biological processes are more demanding than purely statistical models in terms of understanding of the disease epidemiology, but are likely to perform better and give more accurate predictions of future climatic and environmental scenarios.

Recommendations

- Surveillance systems for emerging diseases should be adaptive concerning the risk of the disease. Surveillance should only be performed in high risk periods, areas, etc.
- Priority should be given to development of targeted surveillance
- Whenever possible targeted surveillance should be based on mathematical process models rather than purely statistical models

Potential effects of climate change on food safety in Denmark. Dr Håkan Vigre provided a presentation, focusing on the expected effect of climate change on food safety in Denmark. By using *Salmonella* and *Campylobacter* as model infections, he summarized the current knowledge of how the occurrence of these infections are influenced by ambient temperature today, and how this knowledge can be use to predict the effect of climate change on the occurrence of food borne diseases.

Key messages of the presentation and discussion included:

- The climate change expected in Denmark within the next 50 years will affect contamination at any point along the food chain, including the farm, the processing plant and the preparation for consumption
- Both the occurrence of zoonotic pathogens in food and human susceptibility for zoonotic pathogens are influenced by the environment
- Methods and knowledge for predicting the quantity of the effect does not exist
- *Salmonella* and *Campylobacter* can be used as model infections for the effect of climate change. However, due to the complexity of the causality they are not perfect model infections

Recommendations

- The effect of extreme events must also be considered in Denmark. The effect of extreme events (e.g. heat waves, flooding) are more significant than the effect of change of the average, e.g. the increase of 1°C in the average temperature.
- Forecasting the effect of climate change must be approached using different methods both based on analysis of historical data and modeling the future scenarios using mathematical models

The perspectives of the Danish Agriculture and Food Council on climate change and animal health and food safety in Denmark. Dr. Erik Bisgaard Madsen (Food Safety and Veterinary Businesses, Denmark Agriculture and Food Council) provided a presentation stated that climate change is one of the threats to animal health and food safety. Other threats includes increased livestock trade, transport and travel, change in the agricultural practice and structure of the livestock sectors, free ranging animal farming, zoonotic challenges and antimicrobial resistance.

Key messages of the presentation and discussion included:

- Climate change will change the risk of disease spreading and eventually food safety
- The international competition due to globalization and the free trade in EU are larger threats for the Danish animal industry than the effect of climate change
- The animal production systems in Denmark are relatively robust, and an increase of 1°C will not influence the animal production

Recommendations

- There is a need for development of new vaccines against potential emerging diseases
- Coordination, exchange of knowledge and strategic research is needed
- Fast and coordinated action is needed to secure high veterinary and food safety standards – and export

The perspectives of the Danish Veterinary and Food Administration on climate change and animal health and food safety in Europe. Dr. Birgit Hendriksen (Danish Veterinary and Food Administration) provided a presentation starting with outlining the traditional eradication of infectious diseases in Europe, that was based on vaccination and culling of infected/risk animals. She presented a list of new threats in Europe, and summarized the challenges related to the new threats: international trade; spread of infection in wild animals; vectors and climate. Using Avian Influenza and Bluetongue as example she illustrated how disciplines such as meteorology, GIS and computer science today are integrated in the preparedness for exotic animal infections. Using West Nile Fever as a example of future diseases, the importance of vaccines as well as early warning systems in surveillance was emphasis.

Key messages of the presentation and discussion included:

- Europe is challenged by new/re-emerged infections continuously
- Many diseases are spread in the wild population, and movement of wild animals might change due to climate change
- Outbreak of new/re-emerging infections always reveal lack of important knowledge in the context of the epidemiology of the infection
- Climate must be considered in the spread of many different infections: survival of vectors in different climate, infectious ability to replicate under different climate conditions; movement of infectious agent over a long distance by wind

Recommendations

- Coordination with the expertise in human exotic/re-emerging diseases is needed
- The ownership of the disease has to be discussed before the disease emerge, because this discussion is a major barrier for rapid implementation of preventive measures in case of an outbreak



Appendixes

Appendix 1: Programme

Appendix 2: List of participants

**Draft programme****Workshop on climate changes and animal health and food safety**

3. September 2009 - Technical University of Denmark, Bülowsvej 27, DK-1790 Copenhagen V
Organised jointly by The National Food Institute and the National Veterinary Institute

- 09:00 – 09:30** Registration, coffee
- 09:30 – 09:40** Welcome and opening remarks
- 09:40 – 10:10** The World Health Organization' perspectives on climate change and health
- Dr. Hilde Kruse (WHO EURO, Rome)
- 10:10 – 10:40** The World Organisation for Animal Health' perspectives on climate change and animal health
- Dr. Peter Black (OIE Rapporteur / Australian Department of Agriculture, Fisheries and Forestry)
- 10:40 – 11:00** Break
- 11:00 – 11:30** The European Center for Disease Prevention and Control' perspectives on climate change and public health in Europe
- Dr. Jan Semenza (ECDC, Stockholm)
- 11:30 – 12:00** Australian initiatives to deal with emerging infectious diseases
- Dr. Peter Black (Australian Department of Agriculture, Fisheries and Forestry)
- 12:00 – 13:00** Lunch break
- 13:00 – 13:30** Complex interactions among drivers of global change, including climate change: potential consequences for infectious disease?



- Dr. Serge Morand (Institut des Sciences de l'Evolution, CNRS, IRD, Université Montpellier, France)

13:30 – 13:50 Future animal health in Denmark – developing a pragmatic adaptive strategy to climate change.

- Dr. Rene Bødker (National Veterinary Institute, Denmark)

13:50 – 14:10 Potential effects of climate change on food safety in Denmark

- Dr. Håkan Vigre (National Food Institute, Denmark)

14:10 – 14:30 Break

14:30 – 14:50 The perspectives of the Danish Agriculture and Food Council on climate change and animal health and food safety in Denmark

- Director, Dr. Erik Bisgaard Madsen, (Food Safety and Veterinary Businesses, Danish Agriculture and Food Council)

14:50 – 15:10 The perspectives of the Danish Veterinary and Food Administration on climate change and animal health and food safety in Europe

- Dr. Birgit Hendriksen (Danish Veterinary and Food Administration)

15:10 – 15:50 Discussion and sum up

List of participants

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