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COMMISSION STAFF WORKING DOCUMENT

Adaptation to climate change impacts on human, animal and plant health

Accompanying the document

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

An EU Strategy on adaptation to climate change

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In 2009 a Commission Staff Working Document (CSWD) was published in order to highlight the main effects of climate change on human, animal and plant health¹. It referred to the initiatives taken to address these challenges and indicated key future steps to be considered for the Commission and Member State action.

This document was based on the general framework set out in the White Paper "Adapting to climate change: Towards a European framework for action"² which proposed to increase the resilience of health and social systems to climate change and underlined the need to ensure adequate surveillance and control of the human, animal and plant health impacts of climate change.

The present document is an update of this first CSWD. Follow-up of the action plan introduced by the 2009 CSWD as well as projects and actions launched since then are briefly presented highlighting the work performed on human, plant and animal health.

It further introduces the potential evolution of the European Commission action to tackle impacts of climate change on human, animal and plant health. In particular by pointing out how the implementation of the European Parliament's and Council's Decision on serious cross-border threats to health will address the impacts of climate change on human health and by clarifying how existing and/or future legislation on animal, plant health and plant reproductive material will address the impacts of climate change.

1. INTRODUCTION

The processes affecting morbidity and mortality are very complex; they are influenced by various factors like behaviour, social determinants, demographics, policy decisions, etc. The stresses created by climatic fluctuations add another layer of complexity to this already very intricate matter.

However, climate change is on-going and amplifies the negative health impacts of other environmental stressors such as land degradation, soil nitrification, air pollution, depletion of freshwater stocks, ocean acidification and biodiversity loss³.

Even if the available data and models are subject to a certain degree of uncertainty, the current state-of-the art confirms that the most important health effects from future climate change which will generate changes in their incidence on death will be originating in disease and injury from extreme weather events such as storms and heat waves, the spatial distribution and spread of communicable disease, particularly water-food and vector borne diseases, and the frequency of cardio-respiratory diseases.

Heat related mortality and morbidity in humans depend on the scenarios being considered. Not all effects will be negative; health gains can be expected from milder

¹ The Commission Staff Working Document *accompanying the Communication Together for Health: A Strategic Approach for the EU 2008-2013* {COM(2007) 630 final}: p.33 "The Commission will produce a report on Climate Change covering a range of areas of concern including health. The most up-to-date scientific information on health effects from extreme weather and events relating to climate change will be gathered and analysed to support effective responses in preventing and responding to them. The implementation of surveillance systems for the main effects of climate change such as heat-waves and flooding will be examined. The capacity of EU health systems and infrastructure to cope with different levels of climate-related health threats will be estimated, with the aim of supporting contingency planning for hypothetically dangerous situations as necessary."

² COM(2009)147.

³ McMichael T, Montgomery H, Costello A. Health risks, present and future, from global climate change. *BMJ*. 2012; 344.

winters in some regions. Nevertheless Mc Michael and colleagues have argued that the risk of negative health effects does outweigh the potential health benefits.³

Impacts on animal and plant health are mainly characterised by changes in the occurrence, incidence, pattern of spread and geographical distribution of diseases and pests that are influenced by climate change, as well as emerging animal and plant pathogens. Those impacts may also have a detrimental effect on agriculture, forestry and food security.

In general, climate change is not creating many new or unknown health threats, but it will increase certain interactions between environment and human, animal and plant health with stronger and more pronounced effects than currently seen. Most public, animal and plant health measures and systems are already in place but they need to be tuned to the new situation and demands.

2. DIRECT AND INDIRECT IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH

Impact assessments conducted in a number of European countries and research funded by the EU, the World Health Organisation (WHO)'s Regional Office for Europe and the European Centre for Disease Control and Prevention (ECDC)⁴ confirm that climate change has impacts on the distribution of many diseases and health conditions. This assessment is further supported by reports⁵ from WHO⁶, the Intergovernmental Panel on Climate Change (IPCC)⁷, European Environmental Agency (EEA)/ECDC/WHO(2008) and the EEA Report No 12/2012 - Climate change, impacts and vulnerability in Europe 2012⁸ describing the impact on human health.

The nature and scale of the final impacts will depend on the adaptive capacity and actions of health systems and the baseline access of different populations to these services. Some of the measures might be efficient enough under current climates, but might need to be strengthened or revised in a situation of much stronger or accelerated climate change⁹.

Climate change might have an impact on health systems by increasing the demand for health services beyond the capacities of those systems. It may also interfere with their ability to cope with demand by undermining infrastructure, technology and the availability of workforce. This is linked to emergency preparedness and response. As a result of climate change, health systems will need to prepare for gradual changes in health outcomes, sudden extreme events (e.g. heat-waves, infectious disease outbreaks), an extra burden of disease and potential new conditions.

Climate change will affect human health, either directly - in relation to the physiological effects of extreme weather events, or indirectly through altered human behaviours (e.g. environmentally induced migration, more time spent outdoors), the increased transmission of food or vector-borne diseases, or other effects of climate change, such as flooding. An increase in some of these impacts has already been

⁴ ECDC mapped the impact of climate change on IDs on 27 MS and 3 EEA countries.

⁵ <http://www.euro.who.int/Document/E91865.pdf> page 9.

⁶ Menne et al, 2009.

⁷ <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf>.

⁸ <http://www.eea.europa.eu/publications/climate-impacts-and-vulnerability-2012>.

⁹ Menne et al, 2009; Parma commitment to Act, 2010, et c.

observed in Europe over recent decades (for example, the summer heat waves in 2003 alone are believed to have resulted in more than 70 000 excess deaths¹⁰).

Not all climate related changes are negative for human health as for example in temperate areas, milder winters will lead to less cold-related fatalities.

2.1. Extreme weather events – increased frequency and impact on human health

The primary concern in Europe is linked to heat-related morbidity and mortality, due to increases in annual temperature and extremes of heat, although these issues are also influenced by socio-economic changes due to population growth and the ageing of the population¹¹. In Member States, it is estimated that mortality increases by 1–4% for each one-degree rise in temperature, meaning that heat related mortality could rise by 30 000 deaths per year by the 2030s and by 50 000 to 110 000 deaths per year by the 2080s¹².

The Climate-Trap¹³ project has estimated that by 2035 the annual mortality will increase by 1.25% and 1.45% (depending on the scenario used). The increase in expected respiratory related hospital admissions attributed to the additional cases in 2035 range between 0.08% and 0.76% for the different countries studied.

Certain causes of death linked to the environment play a major role in the outermost regions. Mortality caused by cardiovascular and respiratory diseases is far higher in the Azores, Madeira and Reunion Island than on the continent. These findings are a cause for concern considering that the cost of the health system is high and preventive health measures are in their early stages in the OR¹⁴.

The elderly, in which the ability to control and regulate body temperature is reduced, are most at risk of death from heat stroke and cardiovascular, renal, respiratory and metabolic disorders.¹⁵ Whilst the numbers of total deaths are strongly related to population size, the change in death rates can be much greater in regions where conditions are conducive to greater warming. The greatest impact is expected in central southern Europe.

These punctual higher temperatures combined with the reduced summer precipitation, is expected to enhance the frequency and intensity of droughts across Europe. For European Union populations the biggest projected impacts are from long term environmental and economic damage, potential population displacements, potential impacts on mental health of farmers and livestock producers as well as threats from water quantity/quality and the subsequent disruption of public or private domestic water supplies. Water stress is projected to increase over central and southern Europe, affecting 16-44 million additional people by 2070.

¹⁰ Robine J-M, Cheung SL, Le Roy S, Van Oyen H, Griffith C, Michel J-P, et al. Death toll exceeded 70,000 in Europe during the summer of 2003. *C R Biologies*. 2008.

¹¹ It is increasingly agreed by scientists that the current emission pledges and commitments of countries will likely result in 3.5 - 4°C warming. The longer these pledges are unfulfilled, the likelier a 4°C world becomes, with the resulting health implications.

¹² PESETA report, <http://peseta.jrc.ec.europa.eu/docs/Agriculture.html>.
¹³ <http://www.climatetrapp.eu>.

¹⁴ Study 'Demographic and migratory trends in the outermost regions: Impacts on economic, social and territorial cohesion', by INED, http://ec.europa.eu/regional_policy/activity/outermost/publications_en.cfm.

¹⁵ Matthies F, Bickler G, Cardenosa Marin N, Hales S, editors. Heat-Health Action Plans. Guidance. Copenhagen: WHO Regional Office for Europe; 2008.

Forest fire dangers have increased over the past 50 years especially in the central, southern and a small portion of northern Europe. Longer fire seasons are expected particularly in the Mediterranean. Vegetation fires can create elevated levels of toxic gaseous (Carbon monoxide, nitrogen oxides, sulphur dioxide, organic compounds) and particulate air pollutants over a long period of time, leading to acute and chronic health effects. The effects of smoke range from eye and respiratory tract irritation to more serious disorders including reduced lung function, bronchitis, exacerbated asthma and premature death.

There has been about a 20% increase in heavy precipitation in recent decades, with more heavy precipitation in Northern and Southern Europe¹⁶. This will influence the frequency of floods. The number of winter floods is projected to rise in north-western countries, and of flash floods throughout the EU. Coastal flooding is likely to threaten up to 1.6 million more people every year in the European Union. Over the past 30 years, floods killed more than 200,000 people and affected more than 2.8 billion globally¹⁷. In Europe between 1998 and 2009, there were 1126 fatalities due to floods. Flooding leads to an increase in prevalence of mental health disorders (traumatic stress disorder, serious mental illness and suicide) which affect more younger children and females report more problems than males^{18,19}. The Floods Directive establishes a framework for the assessment and management of flood risks. The Floods Directive 2007/60/EC²⁰ establishes a framework for the assessment and management of flood risks. The CSWD 'Adapting infrastructure to climate change'²¹ and the CSWD 'Climate change adaptation, coastal and marine issues'²² provide further information.

Recent climatic change events resulted in periods with excess mortality in many European countries and will affect Europe in the future. The timely assessment of the impact of such exposures is thus needed to guide public health measures.

2.2. Food- and vector-borne diseases²³

Temperature-sensitive infectious diseases, such as food-borne infections (*Salmonella* sp., and others.) are likely to grow²⁴, with potentially an extra 20 000 cases per year by the 2030s and 25,000 to 40,000 extra cases per year by the 2080s.

¹⁶ Deliverable 8 report on capacity and impact assessment of Climate Trap project.

¹⁷ Climate, Environment and Health Action Plan and Information System project summary (CEHAPIS). WHO Regional Office for Europe with the support of DG SANCO.

¹⁸ Kronenberg ME, Cross Hansel T, Brennan AM, Osofsky HJ, Osofsky JD, Lawrason B, Children of Katrina: Lessons Learned about Postdisaster Symptoms and Recovery Patterns, *Child Development* 81 (4), p 1241-1259,2010.

¹⁹ Osofsky HJ, Osofsky JD, Kronenberg M, Brennan A, Cross Hansel T, Posttraumatic Stress symptoms in Children After Hurricane Katrina: Predicting the Need for Mental Health Services, *American journal of Orthopsychiatry* 79 (2), 212-220,2009.

²⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:288:0027:0034:EN:PDF>

²¹ CSWD 'Adapting infrastructure to climate change' accompanying the document 'An EU Strategy on adaptation to climate change'

²² CSWD 'Climate change adaptation, coastal and marine issues' accompanying the document 'An EU Strategy on adaptation to climate change'

²³ Food-borne diseases: an infection acquired by consuming contaminated food or drink. Myriad microbes and toxic substances can contaminate foods. Most of the 250 known food-borne diseases are infectious and are caused by bacteria, viruses, and parasites. Other food-borne diseases are essentially poisonings caused by toxins, chemicals contaminating the food. Nausea, vomiting, abdominal cramps and diarrhoea are frequent in food-borne infections.

²⁴ Kovats RS, Ebi KL, Menne B. Methods of assessing human health vulnerability and public health adaptation to climate change. Copenhagen: WHO/WMO/Health Canada.; 2003.

A great deal of attention has been devoted to changes in vector-borne disease patterns in relation to climate change. The IPCC foresees climate change leading to changes in infectious disease transmission by vectors such as mosquitoes and ticks, as a result of changes in their geographic range, seasons of activity and population size.²⁵ Land use changes and socio-economic factors (e.g. human behaviour, the movement of people and goods) will continue to be important too. A number of models have investigated the potential increase of malaria risk in parts of Europe. Although accurate predictions are difficult at the present time, there is agreement nevertheless that the overall risk of transmission of malaria related to localised climate change is very small, especially where there are adequate health services and good management of mosquito control²⁶.

Nonetheless, new challenges may emerge, as changes in vector distribution and capacity - particularly in combination with increased human mobility – could facilitate the introduction and local transmission of new emerging pathogens. As regards other mosquito-borne diseases, this phenomenon was seen in the 2007 **Chikungunya virus outbreak in Europe**.

Climatic upheavals are currently increasing the risk of, and vulnerability to, tropical diseases in the outermost regions, where the spread of vector born disease is one of the most notable adverse effects of climate change¹⁴. Currently, a dengue outbreak is taking place in Madeira, Portugal since 4th October 2012, with 1,993 confirmed cases (as of 2nd December 2012). The Caribbean region, where Guadeloupe and Martinique are located, has seen a marked increase in the incidence of dengue fever over the last 10 years. Increases in insect-borne diseases threaten ecological and human health. - French Guiana, where the Amazonian rainforest is, expected to be severely affected by drought²⁷.

Changes in tick distribution have also been observed. The limit of tick distribution in the EU is shifting northwards and also to higher altitudes; the shift towards milder winters may lead to an expansion of the tick population and, consequently, to an increase of human exposure to Lyme borreliosis and tick-borne encephalitis. There are also reports²⁸ of changes in the geographical distribution of sand flies, which are a vector of *Leishmania* sp. Further work needs to be done to determine the role of climate change in the future epidemiology of other diseases and it may take many years before accurate estimates are available.

The **EDEN project**²⁹ has demonstrated that in general, climate change alone cannot explain the upsurge or emergence of vector borne diseases in Europe. Socio-economic factors, human behaviour, different environmental drivers and even the management of agriculture combined with climate change can also have an impact on upsurge and emergence of diseases like tick-borne encephalitis or malaria.

²⁵ Confalonieri U, Menne B, Akhtar R, Ebi KL, Hauengue M, Kovats RS, et al. Human Health. In: Parry ML, Canziani OF, Palutikof JP, Hanson CE, van der Linden P, editors. Impacts, Adaptation and Vulnerability Working Group II contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Cambridge, United Kingdom and New York, NY, USA.: Cambridge University Press; 2007. p. 391-431.

²⁶ EEA/JRC/WHO, 2008; EEA/ECDC/WHO Climate Change Indicator Report 2012.

²⁷ Jérôme Petit & Guillaume Prudent. Changement climatique et biodiversité dans l'outre-mer européen. 2008; <http://www.cbd.int/islands/doc/idr/Climate%20Change%20and%20Biodiversity%20in%20EU%20overseas%20entities/Reunion%20publication-fr.pdf>.

²⁸ T. J. Naucke, B. Menn, D. Massberg, S. Lorentz, Sandflies and leishmaniasis in Germany. Parasitol. Res. 103.(Suppl. 1), S65 (2008).

²⁹ www.eden-fp6project.net.

There is now evidence that adult mosquitoes (*Culex_spp.*) can ensure overwintering of the West Nile virus (WNV) in several European territories, including Romania and Spain. Understanding and quantifying this risk, and thorough surveillance of WNV strains circulating in Europe and Africa, is of major importance to prevent or alleviate large scale WNV epidemics.

Considerable progress has been made for integrating low and high resolution satellite imagery, as well as statistical and mathematical modelling, to build quantitative prediction models for the establishment of vector borne diseases³⁰.

2.3. Feed and food safety issues

Whereas there are many factors involved in mycotoxin (toxic substance produced by fungi) contamination, climate is the most important. The presence of mycotoxins on feed and food is highly dependent on environmental factors (e.g. temperature and moisture) pre- and/or post-harvest. Consequently climate change might have a significant influence on the presence of mycotoxins in feed and food. Climate change represents the key agro-ecosystem driving force of fungal colonization and mycotoxin production. Climate change may threaten feed and food safety and might also affect the availability of feed and food as mycotoxins are present on major staple crops (e.g. cereals, oilseeds).

As an example, the fungal disease head blight of wheat caused by a complex of *Fusarium* species affecting quality and food safety can be cited. Some climate-related changes are already influencing wheat production. *Fusarium culmorum* and *Microdochium (Fusarium) nivale* have been the prevalent species in cooler temperate climates of Europe, but in the last decade *Fusarium graminearum* has become the dominant species causing head blight of wheat in northwest Europe, because its higher temperature optimum favours its dominance in the disease complex. Since *M. nivale* is non-toxicogenic and *F. culmorum* generally produces less mycotoxin than *F. graminearum*, mycotoxin concentrations in wheat may consequently increase³¹.

A public health threat of particular concern for the territory of La Réunion is the development of toxic micro-algae that are harmful to human health and marine breeding grounds, and already caused massive fish kills or human poisonings²⁴.

2.4. Water-related issues

Heavy precipitation has been linked to a number of outbreaks of water-borne diseases, due to the mobilising of pathogens or extensive water contamination from overflowing sewage pipes. Increased faecal bacteria contamination is also likely to affect drinking water intakes and areas of water used for recreation. Reductions in summer water flows may increase the potential for bacterial and chemical contamination. Higher water temperatures may also result in increased occurrence of harmful algal blooms.

³⁰ European Research on Environment and Health Funded by the Sixth Framework Programme. Snapshots of final results. European Commission; 2012. Available online: http://ec.europa.eu/research/environment/pdf/european_research_on_environment_and_health_fp6.pdf#view=fit&pagemode=none.

³¹ S. Chakrabortya and A. C. Newton, 2011. Climate change, plant diseases and food security: an overview. *Plant Pathology* 60, 2–14.

2.5. Air quality

Whilst air pollution levels have fallen dramatically in recent decades in Europe, the health risks of air pollution are still significant, primarily from particulate matter and ozone (Thematic Strategy on Air Pollution, TSAP^{32,33}).

The most significant effects of climate change are likely to be in relation to ozone – which is a major pollutant in many parts of Europe. The EEA/JRC/WHO study²⁶ reports that climate variability and climate change have contributed to an increase in ozone concentration in central and south-western Europe, and the climate-induced increase in ozone levels might be hampering current ozone abatement efforts.

Climate change and the levels of ozone have a reciprocal effect. Temperature, humidity and wind currents influence the formation and levels of ozone. The presence of ozone, in turn, affects those atmospheric variable.

The epidemiological studies published by the Climate-trap project³⁴ have shown the manifold effects of ground-level ozone on health resulting in increases in daily levels of morbidity and mortality. Significant negative health effects have been demonstrated for different causes, mainly for respiratory and, to a lesser extent, cardiovascular diseases.³⁵ These epidemiological studies have concentrated on acute health effects due to short-term very high levels of ozone. The relationship between acute effects of ozone appearing as short-term mortality has been shown in several studies^{36,37,38,39}. The epidemiological evidence of chronic effects is much less conclusive.

Climate change might also impact indoor and outdoor air quality, the level of air pollution and the nature, severity and timing of air allergens, such as pollen or mould. In order to reach children, who are particularly vulnerable, the two-year SINPHONIE⁴⁰ work was commissioned. The partners have prepared guidelines and recommendations on indoor air quality in schools, taking into account the impact of the changing climate (increase of heat waves, cold waves and ambient air pollutants) and the road traffic situation, in order to improve the air that children breathe and to create a healthier school environment.

2.6. Allergies

Climate change might potentially increase the seasonability and duration of allergic disorders like hay fever or asthma with implications for direct costs in terms of care

³² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0446:FIN:EN:PDF>.

³³ There are an estimated 21000 premature deaths from ozone each year in the EU, as well as over an estimated 100 millions respiratory symptoms days, see the TSAP.

³⁴ <http://www.meduniwien.ac.at/umwelthygiene/hanns.moshammer/index.html>.

³⁵ Anderson HR, Atkinson RW, Peacock JL, Marston L, Konstantinou K. *Meta-analysis of time-series studies and panel studies of particulate matter (PM) and Ozone (O3)* Report of a WHO task group. Copenhagen, WHO Regional Office for Europe, 2004.

³⁶ Bell ML, McDermott A, Zeger SL, Samet JM, Dominici F. Ozone and short-term mortality in 95 US urban communities, 1987-2000. *Jama*. 2004 Nov 17;292(19):2372-8.

³⁷ Gryparis A, Forsberg B, Katsouyanni K, Analitis A, Touloumi G, Schwartz J, et al. Acute Effects of Ozone on Mortality from the "Air Pollution and Health: A European Approach" Project. *Am J Respir Crit Care Med*. 2004 November 15, 2004;170(10):1080-7.

³⁸ Ito K, DeLeon SF, Lippmann M. associations between ozone and daily mortality: analysis and metaanalysis. *Epidemiology*. 2005; 16:446-457.

³⁹ Levy JI, Chemerynski SM, Sarnat JA. Ozone exposure and mortality: an empiric bayes metaregression analysis. *Epidemiology*. 2005 Jul;16(4):458-68.

⁴⁰ <http://www.sinphonie.eu/>.

and medicines, as well as lost working hours. 'Progressively increasing temperatures may modify the global pollen load and affect the rate of allergic sensitization across long periods'.⁴¹

Temperature increase and changes in weather patterns will have an impact on the incidence of allergies, the prevalence of allergic persons and on exacerbations or severity of allergic illness. Allergic diseases to airborne allergens have been steadily increasing over the past few decades. The general population is at risk, especially children. People already suffering from chronic respiratory conditions such as asthma, serious allergies or chronic obstructive pulmonary disease (COPD) will particularly suffer from increases of aeroallergens. The European Academy of Allergy and Clinical immunology has estimated that by 2040, 40% of the population will present an allergic predisposition in Europe.

2.7. Ultraviolet radiation

Another indirect impact of climate change on health comes from potentially changing ultraviolet radiation⁴². Stabilisation of ozone levels in the stratosphere leads to a reduction in average UV radiation levels. However, increased temperatures in the stratosphere favour faster chemical reaction times which combined with more frequent weather events create "ozone mini-holes" generating higher UV radiation levels.

Excessive ultraviolet exposure has been correlated with the incidence of skin cancers, including malignant melanoma and cataracts⁴³. EUROSUN⁴⁴ findings indicate clearly that the total cumulative UV exposure is mainly acquired at the place of residence. For example in late spring and early summer, Nordic countries are as much exposed to UV radiation as Germany or even France.

2.8. Increase of health inequalities

Climate change may significantly worsen health inequalities within and among countries and put additional stress on poorer groups. In this way it jeopardizes the results and impacts of many development efforts and further compromises the achievement of key development goals, including the Millenium Development Goals (MDGs) in particular in the Eastern part of the WHO European region and in the European Neighbourhood countries. The lack of achievement will aggravate consequences for the most vulnerable populations, but also contribute to rising inequalities¹⁷.

2.9. Vulnerable groups

As already estimated in relation to the impact of heat waves, the overall health effects of climate change will be unevenly distributed across the regions of Europe. Since health and well being are also strongly related to socio-economic drivers such as income, housing, employment, education, gender and lifestyle, the impacts of climate change should alter health inequalities within and between countries, and

⁴¹ Ariano R et al (2010): Possible role of climate changes in variations in pollen seasons and allergic sensitizations during 27 years. *Ann Allergy Asthma Immunol.* 104(3):2012-222.

⁴² Andrady A et al. For the United nations Environment Programme, Environmental Effects Assessment panel (2010): Environmental effects of ozone depletion and its interactions with climate change progress report 2009, *Photochem Photobiol Sci.* 9(3):275294.

⁴³ Moreover, since early 1980's, the European Code against Cancer recommends "to avoid excessive sun exposure," supporting European Commission policies of cancer prevention. (http://www.cancercode.org/code_06.htm).

⁴⁴ <http://www.eurosun-project.org/>.

lead to uneven distribution and additional burdens for lower income groups and certain vulnerable groups, such as children, those working outdoors, the elderly, women, the homeless and people with a pre-existing illness and/or disability.

As an example, current heat related mortality has been shown to reveal a strong socio-economic dependence. For some effects, e.g. mortality related heat and to air pollution, the elderly are far more vulnerable, and there may be additional factors affecting this group which are linked to socio-economic status.

2.10. Environmentally induced migration

The complex relationship between climate change, environmental degradation and international migration is explored in the specific Staff Working Paper⁴⁵ on this topic which is accompanying the EU Strategy on adaptation to climate change. Current evidence suggests that although future environmental change is likely to significantly impact on population movements, most environmentally induced migration will occur within or between developing countries rather than towards the EU.

The potential impacts of climate change on internal mobility of EU citizens remain poorly understood. The growing needs for humanitarian assistance and health protection of vulnerable groups migrating within the EU territory could require an enhanced capacity of Member States' health systems. National health systems in the EU could benefit from preparedness planning to improve their capacity to deal with such challenges.

3. EU CAPACITY TO REACT TO IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH

3.1. Legal base

The Lisbon Treaty (TFEU) addresses human health protection through different prescriptions (articles 6, 9, 56 and 191); it empowers the EU to support, coordinate or supplement the action of Member States in the area of the protection and improvement of human health and stipulates that “Community actions shall complement national policies, shall be directed towards improving public health, preventing human illness and diseases, and obviating sources of danger to human health”.

In application of the general principle of subsidiarity defined in Article 5 of the TFEU and by the legal base in the field of health, most health adaptation measures would be most appropriate at national, regional, and local level. Nevertheless, effects of climate change and their impacts are transboundary by nature, as neither the spread of infectious diseases nor extreme weather events are hindered by political frontiers (CEHAPIS)⁴⁶. This requires the EU to exert the coordinating role it has been granted by TFEU with minimal interference in the competences of Member States. As the normal functioning of the European internal market could be affected by extreme cases (especially when considering issues such as food and water security in a changing climate), measures will need to be taken at EU level, “to encourage cooperation between the Member States”⁴⁷ in the field of health, and to support European solidarity. This is particularly important in the framework of sharing best practice and experiences between the Member States.

⁴⁵ CSWD 'Climate change, environmental degradation, and migration' accompanying the document 'An EU Strategy on adaptation to climate change'

⁴⁶ Climate, Environment and Health Action Plan Information System.

⁴⁷ Article 168 of The Treaty Establishing the European Community.

3.2. The International Health Regulation

All European Union Member States adopted and are implementing the International Health Regulations (2007). This is a multilateral agreement to manage collective defences to detect disease events and to respond to public health risks and emergencies, including those resulting from climate change events. This would include some events resulting from extreme weather conditions, if considered of international concern, and would also play an important role in the early detection of disease distribution as a result of climate change.

3.3. Political context

In its Conclusions on Environment and Health⁴⁸ the Council urged the Commission and the Member States to develop tools for anticipating, preventing and responding to potential threats from climate change⁴⁹.

With Resolution of 24 September 2008 on the mid term review of the Environment and Health Action Plan, the European Parliament called for enhanced multi-agency cooperation 'in order to boost the early warning system and thus to curb the harmful effects which climate change has on health'⁵⁰. It also called on Member States and the Commission to respond adequately to the new threats posed by climate change, such as the increased presence of emerging viruses and undetected pathogens, and therefore to implement new existing pathogen reduction technologies that reduce known and undetected viruses and other pathogens transmitted by blood⁵¹.

Furthermore, the Joint Decision of the European Parliament and the Council established the Second Programme of Community action in the field of health (2008 – 2013)⁵², addressing specifically that 'Environmental pollution is a serious risk to health and a major source of concern for European citizens. Special action should focus on children and other groups which are particularly vulnerable to hazardous environmental conditions.

International Cooperation

All EU Member States endorsed the first (Frankfurt in 1989), third (London in 1999) and fourth (Budapest in 2004) WHO Ministerial Conferences on Environment and Health declarations highlighting the need for action on climate change and health. In 1999, it was recommended: to establish a Europe-wide interagency network for monitoring, researching and reviewing the early human health effects of climate change; support the development of indicators and monitoring activities and national health impact assessments, and to review mitigation and adaptation options and strategies⁵³. In 2004, further action was recommended to reduce the current burden of disease resulting from extreme weather and climate events through a proactive and

⁴⁸ http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/envir/97852.pdf :20.12.2007.

⁴⁹ Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee. "The European Environment & Health Action Plan 2004-2010". Volume I. Brussels, 9.6.2004.

⁵⁰ Paragraph 24 of European Parliament Resolution of 4 September 2008 on the mid-term review of the European and Health Action Plan 2004-2010 (2007/2252(INI)).

⁵¹ Paragraph 26 of European Parliament Resolution of 4 September 2008 on the mid-term review of the European and Health Action Plan 2004-2010 (2007/2252(INI)).

⁵² Decision N° 1350/2007/EC of the European Parliament and of the Council of 23 October 2007, establishing a second programme of Community action in the field of health (2008-13).

⁵³ WHO, 1999. Declaration Third Ministerial Conference on environment and Health. London, 16–18 June 1999, p.10.

multidisciplinary approach, as well as to promote healthy energy efficient approaches in other sectors.

At the Fifth Ministerial Conference on Environment and Health in Parma, Italy, in 2010, all WHO European Member States adopted the Declaration endorsing a “Commitment to act” which welcomes the European Regional Framework for Action⁵⁴ entitled *Protecting health in an environment challenged by climate change*.

The Commission endorsed its conclusions⁵⁵, including:

- Integration of health in all climate change mitigation and adaptation measures, policies and strategies at all levels and in all sectors.
- Strengthening of health, social welfare and environmental systems and services to improve their response to the impacts of climate change.
- Development and strengthening of early warning surveillance and preparedness systems for extreme weather events and disease outbreaks.
- Development and implementation of educational and public awareness programmes on climate change and health.
- Collaboration on increasing the health sector’s contribution to reducing greenhouse gas emissions and management of energy and resources in a more efficient manner.
- Encouraging research and development

3.4. The European Environment and Health Action Plan 2004-2010

The European Environment and Health Action Plan 2004-2010⁵⁶ specifically addressed climate change and human health under Action 8 and foresaw identification of emerging issues on environment and human health. It did not result in a follow-up programme.

3.5. The EU Health Strategy 2008-2013

The EU Health Strategy⁵⁷ acknowledges climate change and its impact on human health as an important challenge in terms of protecting citizens from health threats. The principles and objectives of the Health Strategy remain valid. The Member States have concluded that cooperative action at Union level is indispensable in areas such as major health threats and issues with a cross-border or international impact (for instance pandemics and bioterrorism), as well as those relating to free movement of goods, services and people.

3.6. The EU Health Programme

The Health Programme (Second Programme of Community Action in the field of Health 2008-2013) has three objectives: 1. Improve citizens' health security 2.

⁵⁴ *Protecting health in an environment challenged by climate change: European Regional Framework for Action*. Copenhagen, World Health Organization Regional Office for Europe, 2010. http://www.euro.who.int/_data/assets/pdf_file/0005/95882/Parma_EH_Conf_edoc06rev1.pdf

⁵⁵ Declaration of the European Commission. Fifth Ministerial Conference on Environment and Health. Parma 10-12 March 2010. Available online: http://ec.europa.eu/health/healthy_environments/docs/parma_declaration_en.pdf

⁵⁶ Available at: http://europa.eu/legislation_summaries/public_health/health_determinants_environment/128145_en.htm

⁵⁷ http://europa.eu/legislation_summaries/public_health/european_health_strategy/c11579_en.htm.

Promote health and reduce health inequalities 3. Generate and disseminate health information and knowledge.

The Health Programme financed projects on health impact of climate change under its three strands. It supported projects⁵⁸ and actions to improve health information and knowledge for the development of environmental health information systems: addressing environmental exposures, urban air pollution or monitoring of ultraviolet exposure and its effects on incidence of skin cancers and cataracts.

Under the second strand, emphasis is given to measures on the prevention of major diseases and focus on EU added-value action in areas such as gender issues, children's health or rare diseases. In addition the health effects of social and environmental determinants are addressed.

The actions under the Health Security strand focus on the development and coordination of early warning and surveillance systems in specific areas (e.g. cold spells, health effects of flooding, airborne allergens, ultraviolet radiation and vector-borne and other human and animal infectious diseases).

In the areas of preparedness planning, risk assessment and response, a co-ordinated response during a public health emergency requires linking the relevant health crisis centres at the level of Member States, Commission and EU and international agencies. This requires proper command and control including situational awareness of casualties and resources, co-ordination of the response and of communications, information analysis and management and simulation for event-analysis and training.

In order to be prepared for any emergency or crisis, all of the abovementioned aspects have to be evaluated and tested. Specific focussed training events and exercises were organised to identify the gaps in the preparedness of the European Union. Since October 2009 seven exercises have been organised (**Table 1 in Annex D**).

Table 2 in Annex I provides a rapid overview of all projects financed under the Health Programme 2008-2013 that focused on the health impact of climate change. A detailed presentation of the projects funded by the Health Programme can be found on the website of the Executive Agency for Health and Consumers (EAHC)¹⁵.

3.7. The EU Statistical Programme

The European Health Interview Survey (EHIS) – of which the first wave was implemented during the period 2006-2009 in the European Statistical System (ESS) - monitored health including environment related variables as part of Eurostat's data collections on health status and health determinants. The second wave will be implemented in the period 2013-2015.

The implementation of the Regulation 1338/2008⁵⁹ "establishing a framework for Community statistics on public health and on health and safety at work" is key for a sustainable health monitoring system, which inter alia includes data on human health in relation to climate change.

⁵⁸ Public Health programme: <http://ec.europa.eu/eahc/>.

⁵⁹ The Regulation 349/2011 further defines the implementation of Regulation 1338/2008.

3.8. Network for epidemiological surveillance and control of communicable diseases

The Decision 2119/98/EC⁶⁰ "setting up a network for the epidemiological surveillance and control of communicable diseases in the Community" is the preamble of the European Union's effort to set up a pan-European collaboration on infectious diseases. The network is responsible for the surveillance of communicable diseases and has established an early warning and response system for the prevention and control of these diseases (EWRS).

3.9. The Health Security Committee (HSC)

The (HSC) was set up by the EU health ministers in the aftermath of the 11 September 2001 terrorist attacks in the United States as an informal committee to address preparedness for and responses to major health threats, such as CBRN (chemical, biological, radiological and nuclear) events or pandemic influenza. Its mandate was limited to tackling bioterrorism, but it has subsequently been extended to cover all types of health-related crisis. It focuses on three areas, each assisted by a section consisting of representatives of the Member States:

- (1) generic preparedness and response for public health emergencies;
- (2) response to chemical, biological and radionuclear (CBRN) attacks,
- (3) influenza preparedness and response.

On the basis of the work of the HSC, the Commission adopted a Communication (COM 2005/605 final of 28.11.2005) on strengthening coordination of generic preparedness planning for public health emergencies at EU level.

3.10. The European Centre for Disease Prevention and Control (ECDC)

One of the areas of competence of the European Centre for Disease Prevention and Control⁶¹, concerns emerging health threats. The ECDC's mandate covers surveillance and risk assessment of threats to human health from communicable diseases and illnesses of unknown origin. ECDC has taken over the epidemiological surveillance of communicable diseases and the operation of the EWRS from the network for epidemiological surveillance and control of communicable diseases referred to at point 3.9 above.

Within its terms of reference, the ECDC has thoroughly investigated the topic of impacts on health caused by climate change. The ECDC developed a comprehensive feasibility study for an European Environment and Epidemiology Network (the E3 network) scheduled to be launched in early 2013, which will facilitate European early warning for climate-related disease events by supporting the risk assessment and rapid detection of emerging public health threats related to environmental factors.

In addition to the E3 network, ECDC has launched the following projects focusing on the impacts of climate change on the spread of communicable diseases. ECDC has commissioned numerous projects aimed at assessing the magnitude and significance of priority vector-borne diseases in Europe. This has included the

⁶⁰ Two Commission Decisions, 2003/534/EC and 2007/875/EC were introduced in order to amend Decision 2119/98/EC.

⁶¹ Established by Regulation 851/2004/EC; <http://www.ecdc.europa.eu/en/Pages/home.aspx>.

development of risk maps for Dengue⁶² in the EU⁶³ as well as projects specifically focused on Chikungunya, West Nile Virus, Tick-borne Encephalitis, and Lyme disease. In addition, ECDC has conducted a risk assessment for malaria transmission in Greece based on environmental factors.

Meanwhile, ECDC has also published a comprehensive risk assessment specifically focusing on the impact of climate change on food- and water-related diseases in the EU⁶⁴. This project assessed and helps prioritise the anticipated short- and long-term impacts of climate change on the patterns of transmission of food- and water-borne diseases, including salmonellosis, listeriosis, cryptosporidiosis and campylobacteriosis. Based upon the findings of this project, ECDC is now developing tools for Member States to facilitate their own similar risk assessments in this field.

ECDC has also published a Handbook⁶⁵ for EU Member States on how to conduct vulnerability and adaptation assessments related to climate change and communicable diseases. The Handbook provides Member States with scientifically robust methodologies and decision-making algorithms for conducting vulnerability assessments and developing adaptation strategies focused on mitigating the transmission of communicable diseases. The next phase of this project is to attempt to pilot test the toolkit in selected Member States, and to update the Handbook with evidence-based adaptation options. In parallel, ECDC has embarked upon a project seeking to identify EU-wide vulnerabilities.

The emergence of new diseases may call for the establishment of new advanced centres for microbiological research and monitoring in areas where disease is endemic. These centers would enable rapid and reliable diagnosis of pathogens and the assessment of the risks of their emergence and spread. The outermost regions already have, and remain in a position to further develop, research infrastructures that may be used to enhance health protection in their regions as a whole, as well as in continental Europe.

3.11. Food safety response mechanisms

The EU legislative framework and policies, which aim at ensuring a high level of food safety for European consumers and citizens are constantly challenged in its capacity to respond to future threats to global Food safety. This notably includes challenges related to climate change and the subsequent impacts on human, animal, and plant health as well as production resource scarcity and resource competition.

The European Commission manages the Rapid Alert System for Food and Feed (RASFF)⁶⁶ which is an effective tool for exchanging information between competent authorities of Member States and EEA countries on consignments of food and feed in cases where a risk to human health has been identified and measures have been taken. Should climate change related impacts on food or feed safety occur, RASFF

⁶² Dengue fever is a virus-based disease spread by mosquitoes. It is caused by several related viruses (four different arboviruses), and is spread by the bite of mosquitoes, most commonly the mosquito *Aedes aegypti*, which found in tropic and subtropic regions.

⁶³ ECDC, 2012a Climatic suitability for dengue transmission in continental Europe.

⁶⁴ ECDC, 2012b; Assessing the potential impacts of climate change on food- and water-borne diseases in Europe.

⁶⁵ ECDC, 2010 Climate change and communicable diseases in the EU Member States; handbook for national vulnerability, impact and adaptation assessments.

⁶⁶ http://ec.europa.eu/food/food/rapidalert/index_en.htm

will continue to play its role to rapidly circulate the information related to the findings of serious risks identified in food and feed in order for competent authorities to take the appropriate and immediate actions to safeguard public health.

The Commission works on a further harmonisation of data collection for food-borne infections and zoonoses in food and animals to allow a better comparison of data between Member States. Member States are obliged to monitor the most important zoonoses and zoonotic agents at the most relevant stages of the food chain in accordance with Directive 2003/99/EC (Salmonella, Listeria, Campylobacter, parasites ...).

3.12. European Food Safety Authority (EFSA) – Zoonoses and other foodborne risks

Besides the prominent task of carrying out risk assessments the EFSA⁶⁷ coordinates the EU-wide data collection on zoonoses, zoonotic agents and antimicrobial resistance in food and animals as well as on food- and water-borne outbreaks. The monitoring of temporal trends in prevalence of the agents (including food-borne pathogens and vector-borne zoonoses) and the numbers of outbreaks in Member States are continuously further developed and harmonised. To this end the outcome of a project on an inventory of available data on vector-borne zoonoses in animals in Member States and on proposals for harmonised data reporting was published in 2011⁶⁸.

The Commission has mandated EFSA to collect and compile, inter alia, the occurrence of mycotoxins in feed and food. The trends in prevalence of mycotoxins in feed and food are closely followed up and if necessary the appropriate measures will be taken to address occurring mycotoxin problems as regards safety and/or availability of feed and food.

3.13. The EU Framework Programmes for Research in relation to human health

Table 3 in Annex I provides a rapid overview of all finalised projects financed under the 6th⁶⁹ and 7th Framework Programmes for Research and Development (FPRD) that focused on the health impact of climate change.

The 6th FPRD mainly concentrated on the development of an integrated impact assessment methodology, the relationship between temperatures and air pollution and the health impact of floods.

- The concept of integrated environmental health impact assessment was developed through several projects (INTARESE⁷⁰, URGENCHE⁷¹, PURGE⁷²); clear analytical procedures providing the framework for all the other outputs and results were established. An extensive series of case studies have been done and a full integrated assessment of health impacts of climate change mitigation and adaptation policies was conducted .
- CIRCE⁷³ assessed the effect of climate change in the Mediterranean and looked in particular at the temperature and air pollution relationship in ten Mediterranean cities, as well as the risks of infectious diseases. Climate

⁶⁷ <http://www.efsa.europa.eu/>.

⁶⁸ <http://www.efsa.europa.eu/en/supporting/pub/234e.htm>.

⁶⁹ http://ec.europa.eu/research/environment/pdf/eur23460_en.pdf.

⁷⁰ <http://www.intarese.org/>.

⁷¹ <http://www.urgence.eu/>.

⁷² <http://purge.lshtm.ac.uk/node/3>

⁷³ <http://www.circeproject.eu/>.

sensitive infectious diseases have been identified and state of the art knowledge has been gathered for each of them. A generalised additive model to study the relationship between zoonotic cutaneous leishmaniasis (seasonal vector-borne disease) incidence and rainfall was used. Full climate change and health risk assessments have been achieved for Malta and Turkey.

- MICRODIS⁷⁴ developed an integrated protocol with a social, health and economic core section, providing a descriptive analysis and mapping of various health impacts of floods across Europe and third countries. These protocols were then adapted to the specific country and site context.
- VIROCLIME⁷⁵ focused on the interrelationships between waterborne viruses of importance in human diseases and predicted effects of climate change. The project developed an operational model forced by environmental and water management changes based on five case studies performed at environmentally sensitive sites (Spain, Hungary, Sweden, Greece and Brazil).
- Most projects funded in the area of health are only indirectly related to climate change such as projects on influenza, where changes in weather patterns might affect bird migration routes and the length of the cold season, which in turn might affect onset and severity of influenza pandemics. Few collaborative projects specifically deal with diseases which are directly affected by climate change and where the climate change component is particularly addressed by the research consortia. Currently the European Commission funds three projects on Dengue Disease (DENFREE⁷⁶, DENGUETOOLS⁷⁷, and IDAMS⁷⁸), one on West Nile and Chikungunya Virus (VECTORIE⁷⁹), and one aiming at a generic response to emerging vector borne diseases (EDENEXT⁸⁰). The projects deal with various issues related to emerging climate dependent vector borne diseases such as modelling of vector spread due to climate change, vaccine development, disease and vector surveillance, vector ecology, clinical measures to improve care for patients, improved diagnostics, and public health measures for vector control to be implemented in affected areas.

Topics presented in the third call for proposals under the 6th FPRD deal with climate change and water-related health issues with the quantification of climate change impacts on health in low income countries. A substantial number of projects have been added on *air pollutants and climate-related factors; exposure* under the 4th and 5th calls of the 7th FPRD.

The 7th FPRD includes on-going projects with focus on human health impact of climate change, presented in **Table 4 in Annex I**.

On **food safety** the Commission is actively contributing to the DG RTD FP7 projects: 'Resilient Food systems' looks at the development of more resilient food production and consumption in Europe and globally. 'CamCon' 'Campylobacter control - novel approaches in primary poultry production' aims at improving the control of Campylobacter in primary poultry production in various parts of Europe possibly

⁷⁴ <http://www.microdis-eu.be/>.

⁷⁵ <http://www.viroclime.org/>

⁷⁶ <http://denfree.eu/about/>

⁷⁷ <http://www.ncbi.nlm.nih.gov/pubmed/22451836>

⁷⁸ <http://www.idams.eu/index.php/idams>

⁷⁹ http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCN=11618413

⁸⁰ <http://www.edenext.eu/the-project>

leading to *Campylobacter*-free/low level contaminated chickens for meat production. It will also investigate the effect of different climates and environments on the epidemiology of this agent. The Commission is also currently examining together with JRC the appropriate approach to develop scenarios of future change of the main challenges to food safety, including climate change impacts, for the period until 2030 and 2050.

4. DIRECT AND INDIRECT IMPACTS OF CLIMATE CHANGE ON ANIMAL HEALTH

There are new challenges to face such as animal diseases that are influenced by climate change and have become more prevalent, are occurring outside their usual range of distribution or have newly emerged. Therefore there is a need to continuously re-evaluate priorities based on careful risk assessment and solid scientific advice.

Recent evolutions have shown that climate change has an impact on animal health. Direct impacts on the animal's wellbeing derive from increased ambient temperature, floods and droughts. Indirect impacts result from reduced availability of water and forage and changes in the environment that promote the spread of contagious diseases through increased contact between animals, or increased survival or presence of the agent or its intermediate host. Emergence and re-emergence of infectious diseases transmitted by vectors are highly dependent on climatic conditions.

Recent changes in the epidemiology, seasonality and geographic distribution of helminth infections have been attributed to climate change, which may increase the developmental success of parasites. Increased knowledge in this area is still needed.

The timing of recurring seasonal biological cycles of some plant and animal species has already been affected by climate change⁸¹. Some migratory birds have changed their migration patterns in response to climate change by arriving earlier than historic records show.

During early 2006 it is thought that harsh weather conditions and feed scarcity had forced wild migratory birds off their normal flyways and therefore the **H5N1 highly pathogenic avian influenza** epidemic was spread to Europe through a higher density of wild birds in waters that remained unfrozen⁸². Virus persistence in the environment including in water may also be influenced by changes in temperature⁸³.

In recent years, there have been reports of increased **mortality in bees** in the EU and elsewhere. A report published by EFSA⁸⁴ suggests and all concerned agree that there are many factors such as stress linked to changes in nutrition and climatic conditions that are involved in the causes for the decline in the bee population. In 2012 new scientific information and their assessment by the EFSA directed the focus of attention to certain systemic pesticides (neonicotinoids) which are thought to play a role in higher than normal colony losses in the EU.⁸⁵

⁸¹ Walther, GR, Post, E, Convey, P, Menzel, A, Parmesan, C, Beebee TJC, Fromentin, JM, Hoegh-Culdberg, O and Bairlein, F, 2002, Ecological responses to recent climate change: Nature, v. 416, no. 6879, p. 389-395.

⁸² Hesterberg et al., 2009, Avian influenza surveillance in the European Union in 2006, Influenza and Other Respiratory Viruses, 3, 1-14.

⁸³ <http://www.efsa.europa.eu/en/efsajournal/pub/715.htm>.

⁸⁴ <http://www.efsa.europa.eu/en/supporting/pub/27e.htm>.

⁸⁵ http://ec.europa.eu/food/animal/liveanimals/bees/pesticides_en.htm

Changes in the distribution and prevalence of **vector-borne animal diseases** may be the most significant effect of climate change. Those most frequently referred to as influenced by climate change are bluetongue, Rift Valley Fever, West Nile Fever and African Horse Sickness.

Bluetongue, a viral disease of ruminants (e.g. cattle, goats, sheep, deer), is present in large parts of the world (USA, Australia, Africa and Asia) and has previously also occurred in Southern Europe. However, the emergence of a new serotype of the Bluetongue virus in the summer of 2006 in the Netherlands and its spread to several other Member States up to Sweden - outside its usual/known geographic distribution range - is thought to be linked to increased temperatures, which allow the insects to carry the virus to new regions and transmit it more effectively⁸⁶.

End of 2011 a newly emerging livestock virus caused by the **Schmallenberg virus (SBV)** was detected in Germany which is transmitted by insect vectors, such as midges and mosquitoes. The virus infects ruminants during vector-active season. It is often asymptomatic but it may cause transient mild clinical signs and congenital malformations. It has since been spreading throughout central and Western Europe and was most recently also detected in Scandinavia. There is no evidence that this virus may affect humans and the World Animal Health Organisation (OIE)⁸⁷ has also recognised the very limited impact of the SBV infection on animal health.

The abovementioned recent experiences with viral vector-borne infections of animals have clearly shown the difficulties to control their rapid spread throughout Europe. However, these unexpected events may increase in the future due to climate change and they should therefore be considered as a clear warning inducing better preparedness and adaptation.

5. EU CAPACITY TO REACT TO CLIMATE CHANGE IN RELATION TO ANIMAL HEALTH

"Preventing rather than reacting to animal diseases" is the focus of the **EU Animal Health Policy** (2007-2013)⁸⁸. It aims at reducing the likelihood of animal disease occurrence and spread, and at minimising the impact of outbreaks of diseases including those influenced by climate change. Early detection and reaction are key to avert later damage costs. The Strategy's Action Plan foresees enhanced data gathering and exchange and the strengthening of existing animal disease surveillance systems.

Harmonised EU legislation and **Member States' contingency plans** are in place to ensure an effective and immediate response to animal disease outbreaks. A longstanding and **well established network** between the Commission and veterinary authorities of Member States already exists to manage animal health crises based on crisis preparedness, rapid exchange of information and close collaboration. In particular in emergency situations the Commission often makes use of its wide regulatory powers by adopting urgent protection measures to swiftly respond to outbreaks in Member States or third countries.

⁸⁶ <http://rsif.royalsocietypublishing.org/content/early/2011/06/22/rsif.2011.0255.full?sid=f860402b-1cc6-41e8-8784-1d8b133e582f>.

⁸⁷ <http://www.oie.int/en/our-scientific-expertise/specific-information-and-recommendations/schmallenberg-virus/>.

⁸⁸ http://ec.europa.eu/food/animal/diseases/strategy/index_en.htm.

The development of the **Animal Disease Information System (ADIS)**⁸⁹ will provide better and more comparable epidemiological data to risk managers, enabling them to better identify, evaluate and respond to changing or emerging disease situations. Existing data gathering systems were evaluated and a prototype will become available in early 2013. ADIS will interoperate with the World Animal Health Information System (WAHIS)⁹⁰ of the World Organisation for Animal Health (OIE)'s notification and information system, and with TRACES (TRAde Control and Expert System), the Commission's IT management system on imports, exports and trade in animals and animal products.

The **task force of epidemiological experts on animal disease surveillance (TFADS)**⁹¹ is an ad hoc expert group which advises the Commission on improvements to current EU systems for animal disease surveillance and on new surveillance strategies as done e.g. for West Nile Fever.

Another task force group has issued a paper on the possibilities and feasibility of the establishment of further **vaccine banks** for certain infectious animal diseases⁹² which is currently under scrutiny by Member States and the Commission. Such banks should ensure better preparedness in case of animal health emergencies.

The **network between the EU and the national reference laboratories** is crucial to ensure harmonised and reliable diagnosis of disease agents by Member States' laboratories. In case of the emergence of a new disease the quick development and dissemination of suitable testing methods is essential. In 2011 an EU Reference Laboratory was designated for bee health to provide diagnostic and scientific support to the Commission and Member States to improve surveillance of bee colony mortalities.

The **EU Veterinary Emergency Team (CVET)** can be quickly called upon to support the authorities of the Member States or Third Countries in dealing with animal disease outbreaks that occur in a country for the first time.

Better Training for Safer Food (BTSF) is a Commission training initiative covering food and feed law, animal health and welfare and plant health rules. It trains national authorities' staff in Member States and candidate countries involved in official controls to ensure harmonized controls compliant with EU law. The training's scope has been further expanded to include emerging animal diseases.

The European Food Safety **Authority's (EFSA)** panel on animal health and welfare (AHAW) carries out independent risk assessments and gives scientific advice on animal health and related food safety issues to risk managers including the European Commission, European Parliament and Member States. EFSA provided for valuable scientific information on the role and geographical distribution of tick species in the epidemiology of African swine fever and Crimean-Congo Haemorrhagic Fever (zoonosis) in Eurasia⁹³ and for a data collection proposal for vector-borne zoonoses

⁸⁹ See action 20 of the programming document:

⁹⁰ http://ec.europa.eu/food/animal/diseases/strategy/index_en.htm

⁹¹ <http://www.oie.int/en/animal-health-in-the-world/the-world-animal-health-information-system/the-oie-data-system/>.

⁹² http://ec.europa.eu/food/animal/diseases/surveillance/index_en.htm.

⁹³ http://ec.europa.eu/food/animal/diseases/strategy/pillars/antigen-vaccine-banks-task-force_en.htm.

Scientific Opinion on the Role of Tick Vectors in the Epidemiology of Crimean-Congo Hemorrhagic Fever and African Swine Fever in Eurasia (2010)
<http://www.efsa.europa.eu/en/efsajournal/pub/1703.htm>.

in animals⁹⁴. EFSA is also regularly consulted on an ad hoc basis e.g. for vector-borne animal diseases such as bluetongue, Schmallenberg virus and Rift Valley Fever^{95,96}.

The EU Framework Programme for Research with projects focussing on animal health including climate change impacts are financed under the European Research Co-operation 7th Framework Programme (**Annex I, table 5**).

6. DIRECT AND INDIRECT IMPACTS OF CLIMATE CHANGE ON PLANT HEALTH

Climate change is considered to be one of the main problem drivers in plant health, along with globalisation of trade in plants and plant products and evolutionary adaptation of harmful organisms to new host plants⁹⁷. The increased influx of new pests and diseases of plants through international trade causes ever increasing health problems in agriculture and forestry, which are exacerbated by climate change.

Climate change may adversely affect plant health in the Union. Higher temperatures allow pests to have multiple, instead of single, life cycles per year, resulting in more frequent and more severe epidemics, and to expand their range. At the same time, crops and trees become physiologically more vulnerable to certain pests and diseases as a consequence of climate change.

New pests and diseases from other continents are more apt to survive European winters with increased average temperatures, allowing them to establish where this was not the case in the past. The increased influx of new pests and diseases into the EU that were not present in the past, combined with more favourable conditions for survival, multiplication and spread of those pests and enhanced vulnerability of crops and trees, has been shown to stimulate the adaptation of pests and diseases to new hosts and to overcome previous genetic barriers to plant infection. New biotypes and hybrids of pests and diseases are evolving, affecting crops and trees that previously had no serious health problems at all. For example, European alders are suffering from the evolution of new hybrids of certain species of *Phytophthora*, a genus of damaging fungi that spread via waterways and kill the alders where no such disease of alders existed before⁹⁸.

Threats exist in particular as regards the health of Europe's trees and forests⁹⁹. For example, Europe's pine forests are threatened by the pine wood nematode, a pest that probably reached Europe with wood packaging material (pallets) and is spread with native vector beetles. Spread of the pine wood nematode from Portugal, where it is now widely established, throughout the Union would result in losses of €39-49

⁹⁴ <http://www.efsa.europa.eu/en/supporting/pub/234e.htm>.

⁹⁵ <http://www.efsa.europa.eu/en/publications.htm>.

⁹⁶ Scientific Opinion on Geographic Distribution of Tick-borne Infections and their Vectors in Europe and the other Regions of the Mediterranean Basin(2010), <http://www.efsa.europa.eu/en/efsajournal/pub/1723.htm>.

⁹⁷ Waage, J.K., Mumford, J.D., Leach, A.W., Knight, J.D. & Quinlan, M.M., 2007. Responsibility and cost sharing options for quarantine plant health. Report to Department for Environment, Food and Rural Affairs, London, United Kingdom. Centre for Environmental Policy, Imperial College London, Ascot, United Kingdom.

⁹⁸ [http://www.forestry.gov.uk/pdf/fcin6.pdf/\\$FILE/fcin6.pdf](http://www.forestry.gov.uk/pdf/fcin6.pdf/$FILE/fcin6.pdf)

⁹⁹ Moore, B. & Allard, G., 2008. Climate change impacts on forest health. FAO, Rome.

billion¹⁰⁰ Increased average temperatures due to climate change would allow pine wood nematode to move further northwards and cause even more damage.

Plant pests have caused massive damage before. During the 20th century, the European elm was subject to mass extinction due to the entry, establishment and spread of a fungus from Asia, which reached Europe and spread inside it with vector beetles¹⁰¹. In that same period, the vast North-American chestnut forests have disappeared because of the entry of a fungal pathogen of Chinese origin¹⁰². Currently, Europe's ash trees are being decimated by a new fungus from Asia¹⁰³.

Massive forest death may itself stimulate climate change. In western Canada, the mountain pine beetle in recent years killed 70-80% of the pine forests of British Columbia. The extent of the extinction is such that these forests have changed from a carbon sink into a carbon source¹⁰⁴. This was due to climate change; normally, the beetle is killed by winter frost but average winter temperatures in British Columbia have gone up. The beetle does not occur in Europe; if it would reach Scandinavia or central Europe, it could similarly cause mass death of Europe's main pine forests.

Varieties of plants and crops currently cultivated in the Union may be impacted by the expected increased frequency and intensity of drought episodes across Europe, potentially leading to significant reductions in yield and/or product quality.

7. EU CAPACITY TO REACT TO CLIMATE CHANGE IN RELATION TO PLANT HEALTH

The legal basis for action in the field of plant health is provided by Article 43 TFEU.

The European Union capacity to react to the impact of climate change on plant health relies on its legislation concerning plant health, plant reproductive material, the placing on the market of plant protection products and their sustainable use, and the legislative framework for the placing on the market of Genetically Modified Organisms (GMOs).

Council Directive 2000/29/EC¹⁰⁵ provides the legal framework to inhibit the entry, establishment and spread in the Union of organisms that are harmful to plants. It was developed to protect the Union against the incursion of new harmful organisms from other parts of the world, and to help prevent spread of harmful organisms present in the EU only locally to the rest of the Union. It provides powerful tools for this purpose; however it cannot address problems from common European pests. Thus, Directive 2000/29/EC allows mitigating the impacts of climate change on plant health only to the extent that those impacts relate to the introduction and spread of new pests and diseases.

Under the ongoing Seventh Framework Programme for Research (FP7), one project, **ISEFOR** (Increasing Sustainability of European FORests: modelling for security

¹⁰⁰ Available at:
http://ec.europa.eu/food/plant/plant_health_biosafety/rules/docs/fcec_final_report_economic_study_plant_health_en.pdf

¹⁰¹ Brasier, C.M. & Buck, K.W., 2001. Rapid evolutionary changes in a globally invading pathogen (Dutch elm disease). *Biological Invasions* 3: 223-233.

¹⁰² http://ec.europa.eu/environment/forests/pdf/FBD_report_2012.pdf.

¹⁰³ http://www.eppo.int/QUARANTINE/Alert_List/fungi/Chalara_fraxinea.htm.

¹⁰⁴ Available at:
http://ec.europa.eu/food/plant/plant_health_biosafety/rules/docs/fcec_final_report_economic_study_plant_health_en.pdf.

¹⁰⁵ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF>.

against invasive pests and pathogens under climate change), developing modelling software enabling the prediction of geographical areas at risk of attack by alien invasive pests and pathogens under climate change scenarios, has been launched in 2010¹⁰⁶.

Twelve so-called Marketing Directives on seed and plant propagating material¹⁰⁷ (now 'plant reproductive material') are in force, which offer further instruments to mitigate plant health impacts of climate change. These Directives ensure the availability at the start of the production chain of healthy plant material of good overall quality and adapted to the local conditions. These Directives offer the possibility to direct plant breeding efforts towards drought and disease resistant varieties and adaptation to agro-climatic conditions.

The active participation of the EU in the work of the International Treaty for Plant Genetic Resources for Food and Agriculture in terms of inclusion of genetic resources under the umbrella of the Treaty and of funding shows the importance of conserving, characterising, evaluating and using plant genetic resources for further breeding, in order to enhance the sustainability of agricultural systems and the adaptation to climate change.

EFSA provides with its Panel on Plant Health scientific advice to risk managers on the risk to plant health for the EU territory posed by new plant pests and diseases. The assessment of risks can also include future climate change scenarios, which are particularly important for forestry trees. Climate change as a driver of emerging plant health risk has been thoroughly discussed at the EFSA Scientific Colloquium on emerging risks in plant health.

In addition, for the control of pest and diseases, which are established in the EU and which risk to further spread as a result of climate change, plant protection products will continue to play an important role. The legal framework enables Member States not only to react quickly to emergency situations without compromising consumer safety but also to take preventive and appropriate measures. The compulsory introduction of "Integrated Pest Management"¹⁰⁸ as of 1 January 2014, which aims at a careful consideration of all available plant protection methods and a subsequent integration of appropriate measures that discourage the development of populations of pests and diseases, will improve the capacity of professional users to take appropriate control measures. Member States have to ensure that professional users have at their disposal information and tools for pest monitoring and decision making as well as advisory services.

Biotechnology can be used for developing varieties of crops that are resistant to insect pests (e.g. corn borers) and plant diseases (e.g. viruses or fungi), or are more tolerant to hydric stress or degraded soils. The EU legislation on GMOs¹⁰⁹ provides a comprehensive framework to assess these crops for risks for health and the environment, before they are authorised to be placed on the market. This type of crops could be part of the range of options made available to farmers to address the emerging plant health risks linked to climate change.

¹⁰⁶ <http://www.isefor.com/>.

¹⁰⁷ http://ec.europa.eu/food/plant/plant_propagation_material/eu_legislation/index_en.htm

¹⁰⁸ Article 55 of Regulation (EC) No 1107/2009 and Article 14 of Directive 2009/128/EC.

¹⁰⁹ Directive 2001/18/EC and Regulation (EC) No 1829/2003.

8. EVOLUTION OF THE UNION ACTION ON HUMAN, ANIMAL AND PLANT HEALTH IMPACT OF CLIMATE CHANGE

Despite the raising awareness of climate change impacts and the mobilisation of health authorities and stakeholders, a certain number of knowledge gaps still need to be bridged. For instance consistent and comparable epidemiological studies and analysis including urban effects of heat related phenomenon and heat waves are still lacking.

Further analysis is also needed on possible interactions between climate change and air pollution on ozone; on food-borne diseases, on salmonella, on the prevalence of mycotoxins in feed and food, on the necessity to envisage financial support in areas where existing financial capacities might not be adequate to address health risks correctly.

8.1. Tools for action: Human Health

8.1.1. *The CEHAPIS project*

The “Climate, Environment and Health Action Plan and Information System” (CEHAPIS) project was a co-funded project established by the WHO Regional Office for Europe and the European Commission to provide an evaluation of policy options for a successful health adaptation to climate change and monitor trends. It has identified three main areas for action:

- Area 1: Health intelligence and awareness on climate change and health with the objective to reinforce European citizens' knowledge and awareness on climate change and health for responsive action.
- Area 2: Integration of climate change into health policies with the specific objective to increase health sector and system action on climate change and health.
- Area 3: Integration of health into climate change related adaptation and mitigation policies with the specific objective to better aim at population health benefits when developing climate change related adaptation and mitigation measures in a variety of sectors.

The definition of these areas is based on the White Paper "Adapting to climate change: Towards a European framework action" as well as the Parma commitment, the WHO European Framework for Action, the WHO Regional Committee Resolution and the World Health Assembly Resolution.

The CEHAPIS project also recommends to further improve cooperation between European Member States and with European and international Agencies. A more detailed presentation of the results including specific objectives identified by area is available in **Annex II**¹¹⁰.

8.1.2. *Serious cross-border threats to health*

The *proposal for a decision on serious cross-border threats to health* emphasises that cross border health threats can be events caused by communicable diseases, biological agents responsible for non-communicable diseases, and threats of chemical, environmental, or unknown origin. Threats deriving from the effects of

¹¹⁰ Objectives should be specific, measurable, achievable, realistic and timed (SMART); Related to the timeframe for implementation the objectives should be achieved three years after adoption of the proposal.

climate change are included in the scope of this Decision and are covered under the same heading as environmental threats.¹¹¹

This inventory will require identification of following components as regards management of outbreaks related to climate change:

- Core capacities
- Awareness raising and communication to ensure availability of rapid data and information for European citizens
- Structures put in place to ensure preparedness, risk-assessment and risk management in terms of governance and responsibilities
- Existence of cross-sector action and integrated policies including considerations of links between plant, animal and human health issues

The proposal foresees strengthening cooperation with WHO through coordination at EU level and implementation of the International Health Regulations.

8.1.3. *Reinforced role of the Health Security Committee*

The Health Security Committee is currently an informal structure at EU level for the coordination of public health risk assessment and the management of serious cross-border threats to health. Due to the informal nature of the Committee, the involvement and commitment of Member States is voluntary and there is insufficient coordination of public health responses and no cross-sectoral interlinking of decision-making processes in public health. The Decision on serious cross-border threats to health aims at formalising the existing Health Security Committee. As a result public health preparedness planning and crisis management can be taken forward in a more consistent and comprehensive manner at EU level. In addition Member States will benefit from pooling scarce resources related to risk assessment or crisis management. The Health Security Initiative will appropriately take into account the EU external cooperation activities for health crises prevention and responses with third countries and activities supported under the Union's programmes for research, and explore synergies with the numerous bilateral EU assistance and cooperation programmes with a significant health component.¹¹¹

8.1.4. *Reinforced Early Warning and Response System (EWRS)*

A system enabling notification at the EU level of alerts related to serious cross-border threats to health in order to ensure that competent public health authorities in Member States and the Commission are duly and timely informed should be given further consideration as to whether it is appropriate.. Therefore the Early Warning and Response System (EWRS), established under Decision No 2119/98/EC for communicable diseases, could be extended to all the serious cross-border threats to health covered by the forthcoming decision. The notification of an alert could be required only where the scale and severity of the threat concerned are or may become so significant that the coordination of the response at the Union level is necessary.¹¹¹

8.1.5. *Health for Growth*

The Health for Growth Programme¹¹² does not specifically address the environmental and health challenges posed by climate change. Instead a more

¹¹¹ COM(2011) 866 – SEC(2011) 1519.

¹¹² COM(2011) 709 - SEC(2011) 1322.

holistic approach is being targeted by the programme, aiming at the inclusion of climate change and environmental factors in a wider category which encompasses a number of serious threats for human health.

One of the four specific objectives of the upcoming Health for Growth Programme is to develop common approaches and demonstrate their value for better preparedness and coordination in health emergencies in order to protect citizens from cross border health threats. Actions planned under this objective will help develop common approaches to prepare for possible health emergencies, to co-ordinate a response to such health emergencies at European level, and to support national capacity building in preparedness and management of health crisis taking into account international initiatives. Actions will also support measures designed to protect and improve human health against communicable diseases, major cross-border health scourges; measures concerning monitoring, early warning of and combating serious cross-border threats to health required by or contributing to the objectives of EU legislation in these fields.

8.2. Tools for action: Animal Health

8.2.1. Emergency response to animal disease outbreaks

The EU rapid response network, crisis management and communication capacity regarding certain transmissible diseases has recently been evaluated by an external consortium¹¹³. It concludes that the current system is effective in mitigating the impact of outbreaks of contagious animal diseases. Room for improvement was identified, such as enhanced collaboration between neighbouring Member States, increased stakeholder involvement in Member States' contingency planning and an increased role of the Commission's Food and Veterinary Office (FVO) in reviewing and checking these plans on the spot and exchanging experiences on best practices. Contingency plans should also better address possibly future emerging diseases. Retained recommendations will be addressed via an action plan.

8.2.2. The New EU Animal Health Law

Animal health legislation covers many different policy areas: intra-Union trade, imports of animals and their products, animal disease control, animal nutrition and animal welfare. These interrelated policy fields will be replaced by a single, simplified, transparent and clear regulatory framework, the new Animal Health Law. The respective Commission proposal is scheduled for adoption by early 2013¹¹⁴. It will consolidate the exhaustive existing animal health legislation, introduce the objectives of the Animal Health Strategy and thus put more emphasis on preventive measures such as early detection, surveillance and biosecurity. Climate change may play an important role in the emergence of new diseases, the prevalence of existing diseases and the geographic distribution of disease agents and vectors. Therefore the rules in the Animal Health Law will be flexible, allowing for adaptation of disease prevention and control measures, including those of surveillance and disease eradication, to the changes in disease patterns resulting from climate change.

8.2.3. Specific Animal health studies co-financed by the Commission

As part of a series of initiatives to closely monitor the development of the newly emerged **Schmallenberg virus (SBV)**, the Commission supports seven Member

¹¹³ http://ec.europa.eu/food/animal/diseases/strategy/pillars/docs/23_final_report_eu_rapid_response.pdf.

¹¹⁴ http://ec.europa.eu/atwork/pdf/cwp2013_annex_en.pdf.

States¹¹⁵ to carry out scientific studies aiming at filling knowledge gaps. The studies focus on the mechanisms by which the infection is caused, the transmission pathways, the role of vectors, their distribution and reservoirs and their host range also taking into account weather conditions. Furthermore, these studies should develop suitable analytical methods which allow large-scale testing. The studies are expected to be finalised by end 2013. Additionally, the 2013 call of FP7 launched a topic to promote research on emerging viral vector borne diseases, with a specific reference to Schmallenberg virus and to Rift Valley Fever.

In order to better determine the extent of **honey bee mortalities** and to better understand the causes and extent of the problem the Commission launched during 2012 and continuing throughout 2013 a programme to support 17 Member States¹¹⁶ for surveillance studies¹¹⁷ on honeybee colony losses. In addition a new research project on honeybee will be funded under a FP7 call and one objective will be to determine the role of environmental effects on bee populations and to protect their genetic diversity.

8.3. Tools for action: Plant Health

8.3.1. The new EU Plant Health Law

The EU plant health regime was reviewed with a view to its reinforcement and modernisation, so as to better address the increased challenges from globalisation and climate change to agriculture and forestry¹¹⁸ and a legal proposal is also scheduled by 2013. An Action Plan for the review of the legislation on seed and plant propagating material (now 'plant reproductive material') was adopted in 2009. The new legal proposal on plant reproductive material is scheduled by 2013.

The EU plant health regime was subject to an evaluation¹¹⁹ carried out in 2009-2010 to assess the success of the regime and to address the needs for change, given the increased globalisation of trade and climate change. In the preparation of the legal proposal, further consideration should be given as to whether it is appropriate to reflect the common understanding that the protection of the Union territory at import needs to be reinforced, that territorial surveys for new pests and diseases need to be put in place and that eradication measures in case of outbreaks require strengthening and harmonisation.

8.3.2. The new EU Plant Reproductive Material Law

The 12 Directives on marketing of plant reproductive material were externally evaluated in 2007-2008 to assess their efficiency and efficacy in the changing environment. The Action Plan of 2009 recognises the importance of improving the consistency with the other EU policies such as on environment to ensure action at the beginning of the production chain. In the preparation of the legal proposal, further consideration should be given as to whether it is appropriate to include tools to better steer plant breeding in a more sustainable direction.

¹¹⁵ Belgium, Germany, Spain, France, Italy, the Netherlands and the United Kingdom.

¹¹⁶ Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Slovak Republic, Spain, Sweden and the United Kingdom.

¹¹⁷ http://ec.europa.eu/food/animal/liveanimals/bees/bee_health_en.htm

¹¹⁸ http://ec.europa.eu/food/plant/plant_health_biosafety/rules/index_en.htm.

¹¹⁹ http://ec.europa.eu/food/plant/plant_health_biosafety/rules/docs/final_report_eval_en.pdf.

9. CONCLUSIONS FOR HUMAN, ANIMAL AND PLANT HEALTH

9.1. Human Health

The adoption of the Commission proposal on serious cross-border threats to health by the Council and the European Parliament could take place during the first semester of 2013. Its implementation will require the identification of Member States' preparedness, early warning and surveillance, risk assessment and risk management existing structures for the different serious cross-border threats to health including climate change.

9.2. Animal Health

Animal Health Law – the adoption of the Commission proposal is scheduled for 2013 and the adoption by the Council and the European Parliament indicatively by 2014/15. In the preparation of the legal proposal, further consideration should be given as to whether it is appropriate to take measures in relation to prevention and control of future animal diseases including those impacted by climate change.

Animal Disease Information System – ADIS – will provide better and more comparable epidemiological data for better identification, evaluation and response to changing or emerging disease situations. A prototype will become available in 2013 and the system should be fully operational by 2014.

EU's rapid response network and crisis management regarding certain transmissible animal diseases - the recommendations of the external evaluation of this mechanism will be followed-up by delegated and implementing acts to be adopted in the frame of the Animal Health Law.

9.3. Plant Health

Plant Health Law – the adoption of the Commission proposal is foreseen by 2013 and the adoption by the Council and the European Parliament indicatively by 2014/15. In the preparation of the legal proposal, further consideration should be given to providing a robust basis for preventing the entry, establishment and spread of pests of plants in the Union, as well as the necessary tools for action in case of outbreaks of those pests due to globalisation and climate change. The new law will allow the Commission to adopt measures in relation to prevention and eradication of particular pests of plants, including emergency measures.

Vigilance at EU borders – the controls at the Union borders will be especially enforced to ensure the timely detection of new pests on consignments of plants, imported from third countries that do not occur naturally in Europe and threaten the Union's forests, crops and ornamental plants.

Annex I

Table 1. Training and preparedness exercises to manage human health crisis

Project	Year	Participants	Type of project
AQUA UTOPIA	2011	HSC members, HSC communicators, ECDC, EMA, EFSA, WHO EURO, WHO HQ, DG HOME, DG SANCO	Table top exercise
IRIDIUM 1, 2, 3	2011	HSC members, ECHA, WHO EURO, SANCO	Table top exercise
HERMES	2011	Member States, ECDC, SANCO	Table top exercise
METIS	2011	HSC members, ECDC, WHO HQ, SANCO	Table top exercise
ECLIPSE	2010	GHSAG Countries, WHO HQ	Table top exercise
TOR 2	2010	Member States, ECDC, EMA, WHO EURO, WHO HQ	Evaluation exercise
TOR 1	2009	Member States, ECDC, EMA, WHO EURO, WHO HQ	Evaluation exercise
VACCINE	2009	HSC communicators, WHO HQ, EMA, Vaccine manufacturers, SANCO (ECDC was invited, but refused to attend because of the participation of the vaccine industry)	Table top exercise and workshop

Table 2. Projects funded under the EU Health Programme

Time period	Project	Coordinator
2005 - 2007	EuroHEAT ¹²⁰ (Improving Public Health responses to extreme weather: heat-waves)*	WHO – World Health Organization, Regional Office for Europe
2007 - 2010	EUROHEIS ¹²¹ (European Health and Environment Information System for Risk Assessment and Disease Mapping)	Imperial College of Science, Technology and Medicine, London
2007 - 2011	EUROSUN ⁴⁴ (Quantification of sun exposure in Europe and its effects on health)	International Agency for Research on Cancer (until 31/12/2009); International Prevention Research Institute (from 01/01/2010)
2009 - 2011	EuroMOMO ¹²² (European monitoring of excess mortality for public health action)	Statens Serum Institut, Denmark
2009 - 2012	HIALINE ¹²³ (Health Impacts of Airborne Allergen Information Network)	Klinikum rechts der Isar der Technischen Universität München
2009 - 2012	CLIMATE-TRAP ³⁴ (Climate Change Adaptation by Training, Assessment and Preparedness)	Public Health Services Gelderland-Midden (HGM) Arnhem, Netherlands
	CEHAPIS (Climate, environment and health action plan and information system)	WHO – World Health Organization, Regional Office for Europe
2008 - 2011	Aphekom ¹²⁴ (co-funded by the Community Action in the Field of Public Health programme: 2003-2008)	French Institute for Public Health Surveillance (InVS), France & Umea University, Sweden

* In line with the Environment and Health Action Plan, funding was provided for **EuroHEAT** which deals with actions at different levels: from health system preparedness coordinated with meteorological early warning systems to timely public and medical advice and improvements to housing and urban planning. Its work built

¹²⁰ www.who.dk.

¹²¹ <http://www.euroheis.org>.

¹²² <http://www.euromomo.eu/>.

¹²³ <http://www.hialine.com/>.

¹²⁴ <http://www.aphekom.org/web/aphekom.org/home>.

upon the results of the cCASHh¹²⁵ and took full account the progress and the outcome of the PHEWE, both projects funded by the 5th Framework Programme).

Table 3. Finalised research projects co-funded by Directorate General of Research & Innovation with focus on human health

Time period	Project	Coordinator
2005 - 2011	INTARESE ¹²⁶ (Integrated assessment of health risks from environmental stressors in Europe)	Imperial College of Science, Technology and Medicine, London (UK)
2007 - 2011	CIRCE ¹²⁷ (Climate change and impact research: the Mediterranean environment)	National Institute of Geophysics and Volcanology, Bologna (IT)
2004 - 2010	EDEN ²⁹ (Emerging Diseases in a Changing European Environment)	CIRAD (FR)
2007 - 2011	MICRODIS ¹²⁸ (Integrated Health, Social and Economic Impacts of Extreme Events: Evidence, Methods and Tools)	Centre for Research on the Epidemiology of Disasters, Catholic University of Louvain (BE)
2008 - 2010	COPACETIC ¹²⁹ (COPD Pathology: Addressing critical gaps, early treatment and innovative concepts)	University Medical Center, Utrecht, Netherlands
2010 - 2013	VIROCLIME ¹³⁰ (Impact of climate change on the transport, fate and risk management of viral pathogens in water)	University of Aberystwyth (UK)

Table 4. On-going research projects co-funded by Directorate General of Research & Innovation with focus on human health

Time period	Project	Coordinator
2009 - 2013	ARCRISK ¹³¹ (Arctic Health Risks: Impacts on health in the Arctic and Europe owing to climate-induced changes in contaminant cycling)	Arctic Monitoring and Assessment Programme (AMAP) Secretariat, Norway
2009 - 2013	CLEAR ¹³² (Climate change, environmental contaminants and reproductive health)	Aarhus University Hospital, Aarhus, Denmark
2009 - 2013	ICEPURE ¹³³ (Quantification of changing surface UV radiation levels and its impact on human health)	King's College London, UK
2008 - 2012	ESCAPE ¹³⁴ (European Study of Cohorts for Air Pollution Effects)	Institute for Risk Assessment Sciences (IRAS), Utrecht University, Netherlands
2010 - 2013	AIRMONTECH ¹³⁵ (Air quality monitoring technologies for urban areas)	Institute of Energy and Environmental Technology e.V. (IUTA), Germany
2010 – 2014	ATOPICA ¹³⁶ (Atopic diseases in changing climate, land use and air quality)	Medical University of Vienna, Austria
2011 – 2016	BREATHE ¹³⁷ (Brain development and air pollution ultrafine particles in school children)	Centre for Research in Environmental Epidemiology, Spain

¹²⁵ http://ec.europa.eu/research/environment/themes/projects_en.htm#2.

¹²⁶ www.intarese.org.

¹²⁷ www.circeproject.eu.

¹²⁸ www.microdis-eu.be.

¹²⁹ <http://www.copacetic-study.eu/english>

¹³⁰ www.viroclime.org/

¹³¹ www.arcrisk.eu.

¹³² www.inuendo.dk/clear.

¹³³ www.icepure.eu.

¹³⁴ <http://www.escapeproject.eu/index.php>.

¹³⁵ www.airmontech.eu.

¹³⁶ www.atopica.eu.

¹³⁷ This project is funded by the IDEAS programme and does not have a website. More info on http://cordis.europa.eu/projects/home_en.html.

2010 - 2014	CETIEB ¹³⁸ (Cost-effective tools for better indoor environment in retrofitted energy efficient buildings)	Stuttgart University, Germany
2010 - 2014	INTASENSE ¹³⁹ (Integrated air quality sensor for energy efficient environment control)	C-TECH INNOVATION LIMITED, UK
2011 - 2013	OFFICAIR ¹⁴⁰ (On the reduction of health effects from combined exposure to indoor air pollutants in modern offices)	University of western Macedonia, Greece
2011 - 2016	SPHERE ¹⁴¹ (Susceptibility to particle health effects, miRNAs and exosomes)	Università degli studi di Milano, Italy
2012 - 2017	EUPORIAS ¹⁴² (European Provision of Regional Impacts Assessments on Seasonal and Decadal Timescales)	UK Met Office
2012 - 2017	RAMSES ¹⁴³ (Reconciling Adaptation, Mitigation and Sustainable Development for cities)	PIK, Germany
2011 - 2015	IMPACT2C ¹⁴⁴ (Quantifying projected impacts under 2°C warming)	Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal research
2008 - 2012	EVA ¹⁴⁵ (Markers for emphysema versus airway disease in COPD)	German Research Centre for Environmental Research, Germany
2010 - 2015	PREDICTA ¹⁴⁶ (Post-infectious immune reprogramming and its association with persistence and chronicity of respiratory allergic diseases)	National and Kapodistrian University of Athens, Greece
2010 - 2014	MEDALL ¹⁴⁷ (Mechanisms of the development of allergy)	Institut National de la Sante et Recherche Medicale (INSERM), France
2012 - 2016	DenFree – Dengue research Framework for Resisting Epidemics in Europe	Institut Pasteur, Paris
2011 - 2015	Dengue-Tools – Innovative tools and strategies for surveillance and control of dengue	Umea University
2011-2016	IDAMS – International Research Consortium on Dengue Risk Assessment, Management, and Surveillance	University of Heidelberg
2010 - 2013	Vectorie – Vector-borne Risks for Europe: Risk assessment and control of West Nile and Chikungunya virus (VECTORIE)	Erasmus Medical Centre
2011 - 2014	EDENext - Biology and control of vector-borne infections in Europe	Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Montpellier, France

AIRMONTECH, ATOPICA, CETIEB, IMPACT2C, INTASENSE, OFFICAIR, SPHERE, RAMSES and EUPORIAS. Two projects, **ARCRISK** and **CLEAR** examining the health risks resulting for Arctic populations from climate change induced changes in the distribution of environmental pollutants have been launched in 2009¹⁴⁸. A project on the health effects of changing surface UV radiation levels **ICEPURE** started in 2012 as well¹⁴⁹. A number of studies have been published after the initiation of ICEPURE with significant findings: In a study by *Petersen et al.* it was emphasized that it is of vital importance to integrate both personal behaviour and

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www.cetieb.eu.

139

www.intasense.eu.

140

www.officair-project.eu.

141

<http://www.unimi.it/>.

142

<http://www.metoffice.gov.uk/>.

143

<http://www.pik-potsdam.de/>.

144

www.cosmostox.eu.

145

<http://www.eva-copd.eu/eva/english/>

146

<http://cordis.europa.eu/projects/260895>

147

<http://www.medall-fp7.eu/>

148

ftp://ftp.cordis.europa.eu/pub/fp7/environment/docs/catalogue_projects_2008.pdf.

149

ftp://ftp.cordis.europa.eu/pub/fp7/environment/docs/catalogue-projects-fp7envnmp_en.pdf.

ambient UVR levels/latitude in exposure assessment methodologies¹⁵⁰. In another study it was depicted that erythema is considerably underestimated and possibly neglected. Self-assessment of erythema from participants' diaries was unreliable and even researchers had difficulty in detecting erythema¹⁵¹. Finally, the integrated project **ESCAPE** will analyse air pollution effects on European populations.

Table 5. Research projects co-funded by Directorate General of Research & Innovation with focus on animal health

Time period	Project	Coordinator	Outcome
2008 - 2011	EMIDA Coordination of European research on emerging and major infectious diseases of livestock	Department for the Environment Defra UNITED KINGDOM	Systematic exchange of information, development of instruments for common calls
2012 - 2015	ANIHWA Era-Net Animal Health and Welfare	INRA Paris Cedex FRANCE	ANIHWA is an extension of EMIDA
2006 - 2012	EPIZONE Network of Excellence for Epizootic Disease Diagnostic and Control	Central Veterinary Institute Lelystad NETHERLANDS	Network for sharing knowledge and expertise, trainings and workshops, online databases
2009 - 2012	ARBOZOONET Network for Capacity Building for the Control of Emerging Viral Vector Borne Zoonotic Diseases	Institut Pasteur Paris FRANCE	Risk maps, databases and models on vector-borne arboviruses, surveillance and vector control, vaccine development
2007 - 2010	BTVAC Improved Vaccines for Bluetongue Disease	London School of Hygiene & Tropical Medicine UNITED KINGDOM	safe genetically inert vaccines for BTV, for serotypes identified in Europe
2008 - 2012	ASFRISK Evaluating and controlling the risk of African swine fever in the EU	Faculdade de Medicina Veterinária Universidade Técnica de Lisboa, PORTUGAL	Knowledge of the epidemiology and risk factors, prevention and control of ASF, diagnostic and vaccine development
2010 - 2011	BEEDOC Bees in Europe and the Decline Of honeybee Colonies	Martin-Luther University Halle-Wittenberg Halle (Saale) GERMANY	Diseases and colony losses
2012 - 2014	GLOWORM Strategies to mitigate the impact of global change on helminth infections in ruminants	Gent University Belgium	Control strategies and epidemiological model development
2012 - 2015	RISKSUR Scientific methodologies for cost-effective risk-based animal health surveillance	Royal Veterinary College UNITED KINGDOM	Science-based decision making frameworks for improving the animal health surveillance systems

¹⁵⁰ Dadvand P, Basagana X, Barrera-Gomez J, Diffey B, Nieuwenhuijsen M. Measurement errors in the assessment of exposure to solar ultraviolet radiation and its impact on risk estimates in epidemiological studies. *Photochem Photobiol Sci.* 2011;10(7):1161-8.

¹⁵¹ Petersen B, Thieden E, Lerche CM, Wulf HC. Validation of self-reported erythema: comparison of self-reports, researcher assessment and objective measurements in sun worshippers and skiers. *J Eur Acad Dermatol Venereol.* 2012.

Annex II

CEHAPIS PROJECT FUNDED UNDER THE EU HEALTH PROGRAMME

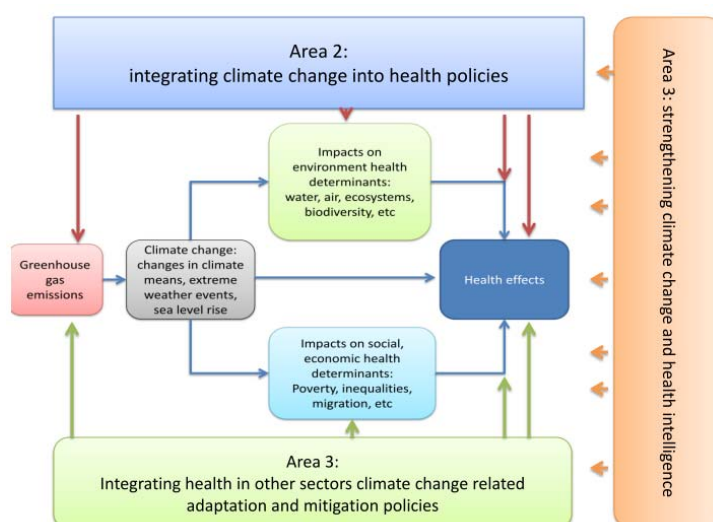
1. INTRODUCTION:

The “Climate, Environment and Health Action Plan and Information System” (CEHAPIS) project was a co-funded project established by the WHO Regional Office for Europe and the European Commission to provide an evaluation of policy options for a successful health adaptation to climate change and monitor trends.

Based on consultations with WHO Member States and experts, three areas for action have been identified:

- Area 1: Health intelligence and awareness on climate change and health;
- Area 2: Integration of climate change into health policies;
- Area 3: Integration of health into climate change related adaptation and mitigation policies;

Pathways of the health effects of climate change, and modifying potentials of the three EU policy areas.



2. GENERAL OBJECTIVES (for all three areas)

The overall general objectives for all three areas are, to protect European Union citizens' health from climate change, through:

- increase in knowledge and awareness on climate change and health;
- integration of climate change into health policies and mechanisms;
- integration of health into climate change related sectorial policies on mitigation and adaptation;
- improved cooperation between European Member States, and with European and international Agencies.

3. SPECIFIC OBJECTIVES BY AREA

3.1. Area 1: Health intelligence and awareness on climate change and health

The specific objective of this initiative is to reinforce European citizens' knowledge and awareness on climate change and health, for responsive action. A comprehensive, coherent and common approach needs to be developed for:

- Planning and implementing research and monitoring on climate change and health;
- A climate change and health European wide communication strategy;
- A climate change and health information platform to (between many other scopes's) feed the EU clearinghouse.

3.2. Area 2: Integration of climate change into public health policies and action

The specific objective of this initiative is to increase health sector and system action on climate change and health. A comprehensive, coherent and common approach needs to be developed for:

- Integrating climate change into EU Generic Preparedness Planning and policies on trans-boundary threats;
- Strengthening climate – sensitive disease surveillance and health targeted weather early-warning;
- Developing a European training module on climate change and health;
- Developing harmonized guidance and assessment procedures on greener and more sustainable and safer health services and piloting national and local case studies of application;
- Understanding health systems transformational change towards full health systems adaptation and sustainability.

3.3. Area 3: Integration of health into climate change related adaptation and mitigation policies

The specific objective of this initiative is to better aim at population health benefits when developing climate change related adaptation and mitigation measures in a variety of sectors. A more comprehensive, coherent and common approach needs to be developed for supporting European Member States in integrating health in all climate change related mitigation and adaptation policies in other sectors.

4. OPERATIONAL OBJECTIVES BY AREA

4.1. Area 1: Health intelligence and awareness on climate change and health;

In Planning and implementing research and monitoring on climate change and health, the following more operational objectives could be envisaged:

4.1.1. Increasing joint planning and financial investments on research, on:

- Health and social vulnerability, impact and adaptation assessment at regional, national and sub-national level;
- improved risk assessment (including scenarios) of the health effects of climate change and other environmental changes to inform decision-makers;
- comprehensive evaluation of the benefits and effectiveness and cost-effectiveness of interventions (including co-benefits for health of mitigation and adaptation decisions and interventions in other sectors);

- effectiveness of climate sensitive infectious disease surveillance, extreme events health action plans and other decision-support tools;
- Damage and adaptation costs;
- Social marketing, risk perception and risk communication;

4.1.2. Extending the Climate change and health monitoring systems

- the ENHIS-integrated information platform
- the pilot EU wide monitoring of the climate change
- identified health indicators.

4.1.3. Climate change and health European wide communication strategy

It would be important to develop a harmonized framework at EU level focusing in particular at:

- Targeting different communities e.g. policy, science, public;
- Expanding interaction and dialogue with stakeholders through dialogue workshops;
- Expanding the use of existing health information instruments and cooperation with journalists through European wide training;
- Enhancing preparedness for crises communication (e.g. have communication material ready on cold waves for winter; heat waves for summer; or on potential disease outbreaks);
- Building on existing frameworks, tools and processes, e.g. weather warning in TV news;
- Exploring the use of the European information platform for non-specialised users and innovative communication instruments.

4.1.4. Climate change and health information platform

In order to properly feed the existing EU clearinghouse, it is planned to develop:

- practical tools for health impact, vulnerability and adaptation assessments, health impact assessment of mitigation and adaptation measures, effective public health adaptation, effective preventive measures, economic tools for damage and adaptation health costs evaluation;
- preparedness and response actions for extreme events;
- early warning on extreme weather events and potential infectious disease threats, as well as relevant models of preparedness and response or action plans;
- adaptation/mitigation measures for assessment of the health co-benefits of adaptation and mitigation measures and identification of best practices;
- thorough indicator assessments on climate, environment and health impacts and response measures;

4.2. Area 2: Integration of climate change into public health policies and action

- 4.2.1. Integrating climate change into EU Generic Preparedness Planning and policies on trans-boundary threats
- Revise current integration of climate change into preparedness and response planning and collect good practices;
 - Update comparable and coherent generic preparedness and response planning;
 - Develop and agree shared standards and tailor-made EU criteria for notification;
 - To revise risk assessment, management and communication practices on climate change inclusion and agree on mechanisms for reinforced coordination among existing structures;
 - To provide public health advice at EU level in coordination with the WHO.
- 4.2.2. Strengthening climate-sensitive disease surveillance and health targeted related weather early-warning
- Explore necessity to reinforce compulsory disease reporting and explore advantages/disadvantages of current systems and agree on mechanisms for reinforced coordination among existing structures;
 - Analyse weather early warning for its applicability in seasonal or short term health early warning.
- 4.2.3. Developing a European training module on climate change and health
- Develop a European training module based on a revision of current systems in place and pilot test it;
 - Explore means of communication and potential inclusion into professional qualification.
- 4.2.4. Developing harmonized guidance and assessment procedures on greener and more sustainable and safer health services
- Revise current advice existing and identify essential elements, develop the guidance and test in pilot areas;
 - Cooperate with various EU agencies in standard setting, to develop essential input criteria and agree on mechanisms for reinforced coordination.
- 4.2.5. Understanding health systems transformational change towards full health systems adaptation and sustainability
- Develop a series of dialogue workshops of European Health system leaders, to identify which transformational changes are requires;
 - To revise innovation potential, standards and behavioural measures necessary to achieve a transformational change.
- 4.3. Area 3: Integration of health into climate change related adaptation and mitigation policies

To support European Member States in integrating health in all climate change related mitigation and adaptation policies in other sectors, the following initiatives might be required:

- Reinforce the impact assessment guidelines with greater emphasis on health and equity in adaptation and mitigation policies;
- Support pilot projects and collect lessons learnt and best practices;
- Identify how certain healthy practices (such as healthy, energy-efficient buildings and renewable energy) improved outdoor and indoor air quality and allowed innovative production practices to be developed;
- Ensure that health is properly addressed in national and European adaptation strategies through the development of national/European action plans.