

# Final remarks and recommendations for the future

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## Main remarks and recommendations

Further original research is absolutely indispensable, notably in the Mediterranean basin to assess climatic changes and their related health impacts (Hosking and Campbell-Lendrum 2012). Accomplishing this requires the establishment of a pan-Mediterranean research coordinating institution (Trans-Mediterranean CDCs) with ties to international funding organizations, stakeholders in the region and abroad, and established international and national scientific communities. The research groups involved in climate change and its impacts should be the promoters of this trans-regional programme that aims to train researchers to conduct longitudinal studies, in data acquisition and comparative analysis, and should guide research toward priority topics like observational studies, transdisciplinarity, analytical and epidemiological studies, and statistical analysis on spatio-temporal series of disease cases. They are few or no studies addressing important topics such as water supplies and waterborne diseases, food and malnutrition, and the health risks of extreme events other than the effects of heat (Hosking and Campbell-Lendrum 2012). In the same vein as that proposed by Negev et al. (2015), epidemiological data on major infectious diseases morbidity and mortality should be collected systematically, and consolidated with

environmental, socio-economic, demographic and ecological data. Environmental management of infectious diseases like vector-borne diseases, which can require the elimination of breeding sites for mosquitoes through the use of insecticides, should be discussed regionally and weighed against pesticide toxicity through structured-decision making. Relevant examples could be adopted by other countries in the region. Ideally, health system preparedness for climate change-sensitive diseases should be evaluated regularly, specifically when environmental signals like the El Niño phenomenon occur.

In the Mediterranean region where climate change may add to existing problems (drought, water scarcity, traffic, etc.), non-communicable diseases (NCDs) are strongly challenged by changes in the climate via both direct and indirect pathways (Cecchi et al. 2010). Climate change, and its driver greenhouse gas emissions, affect NCDs through: 1) an increased number of cardiorespiratory deaths and acute morbidity due to heatwaves; 2) increased frequency of cardiorespiratory events due to higher concentrations of ground level ozone; 3) changes in the frequency of NCDs due to transboundary long-range air pollution by particulate matter (e.g. related to fires and aerosols); 4) increased incidence of skin cancers due to excessive sun exposure of the skin; and 5) altered spatial and temporal distribution of allergens that increases the risk of allergic diseases. These pathways will not only affect patients with existing NCDs by causing their aggravation but may also influence the incidence and hence the prevalence of NCDs. People who are very young, old, poor, or who live in vulnerable areas are more fragile (McMichael et al. 2006). However, it is not easy to evaluate the impact of climate change and related factors on the prevalence, the severity and the incidence of NCDs. Research on the adverse impacts of climate change on NCDs should have the following goals: 1) Improve our understanding of the climate system and its drivers; 2) Improve our understanding of climate impacts and vulnerability; 3) Increase our understanding of adaptation pathways and their putative health costs; 4) Identify the mitigation options that reduce the risk of longer-term climate change; 5) Improve decision support and integrated assessment; 6) Link environmental, socioeconomic and health datasets through an exposomic approach that will provide new insights into the potential associations between climate change and human health and wellbeing.

These goals have to be based on cross-cutting research capacities: 1) Integrate medicine, toxicology, natural and social science, engineering, and other disciplinary approaches; 2) Ensure availability of observations, monitoring, and infrastructure for critical data collection and analysis; 3) Build capacity for climate assessment through education, training, and workforce development; 4) Enhance the development and use of scenarios; and 5) Promote international research and collaboration. These capacities are achievable in the Mediterranean region where important resources and competences exist.

Regarding training, researchers, medical doctors and public health epidemiologists should be trained to climate change risks and to long-term understanding of processes at work in human health outcomes, and not solely to short-term, molecular-based approaches. Public education and communication is essential

and should be strengthened in the Mediterranean region with public involvement in prevention of outbreaks and in combating infectious disease foci like breeding sites for mosquitoes (Negev et al. 2015). Evaluation and assessment of the implementation of adaptation plans to climate change and health should be conducted according to structured-decision making and sustainable practices, and the French example of climate change and health assessment (Guégan and Pocher 2010) is a start in this direction. The Mediterranean should benefit from adopting an ecosystemic approach, the so-called OneHealth-EcoHealth concepts, to reach the sustainable development goals, and at least numbers 3 (good health and human well-being) and 13 (climate action). Health and well-being in the Mediterranean, whatever the borders and the sub-regions should be the unifying theme that enables crystallization of a trans-national initiative such as the Mediterranean Union. We also would like to stress the assets of the Mediterranean region with regard to health outcomes. Indeed, the Mediterranean diet displays a number of health benefits compared to other diets and it should be preserved at least to partially offset some of the detrimental effects that climate change may have. As previously mentioned another asset in the Mediterranean region is the wide range of skills and facilities that already exist. An integrative public health approach with investments in regional public health infrastructures should be applied here.

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# The Mediterranean Region under Climate Change

A Scientific Update

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# The Mediterranean Region under Climate Change

A Scientific Update

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### AllEnvi

AllEnvi, the French National Alliance for Environmental Research, is tasked with making the great environmental transitions work, coordinating French research into major societal issues such as food, water, climate and territories. AllEnvi i) sets policy guidelines and research priorities for advance planning before approaching funding agencies, ii) supports the emergence and structuring of research organizations, iii) coordinates innovation and technology transfer policies between public research operators, businesses and industries, and iv) contributes to the European research environment and international programme development.

Alliance nationale de recherche pour l'environnement, AllEnvi coordonne la recherche française sur les enjeux des grands défis sociétaux que sont l'alimentation, l'eau, le climat et les territoires pour réussir les grandes transitions environnementales. AllEnvi i) définit les orientations et priorités de recherche pour la programmation à l'amont des agences de financement, ii) soutient l'émergence et la structuration d'infrastructures de recherche, iii) coordonne les politiques d'innovation et valorisation entre opérateurs publics de la recherche, entreprises et industries, et iv) participe à l'Europe de la recherche et favorise l'émergence de programmes internationaux.

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