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Convention on Wetlands (Ramsar, Iran, 1971)

*“Healthy wetlands, healthy people”*

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**Healthy wetlands, healthy people - a review of wetlands and  
human health interactions**

**Draft Executive Summary and Key Messages**

(see also COP10 DR 23, “Wetlands and human health and well-being”)

**Background**

1. Resolution IX.2 of the 9<sup>th</sup> meeting of the Conference of the Contracting Parties (COP9, 2005) instructed the Scientific and Technical Review Panel (STRP) as a priority task to undertake a review of the issues and interactions between wetlands and human health, in recognition of the fact that these matters had not previously received significant attention under the Convention. This topic has subsequently attained further significance with the adoption of the theme for COP10 as “Healthy Wetlands, Healthy People”.
2. The Panel established an expert Working Group to progress this task, under the initial leadership of the STRP Chair and the Deputy Secretary General. The Panel established a scope, approach and outline contents for this review report, and it invited a number of additional human health and wetlands experts to contribute to the drafting. The report drafting team has been led by Professors Philip Weinstein, Max Finlayson, and Pierre Horwitz, and the report preparation has received significant input from Robert Bos and Martin Birley from the World Health Organization, Professor Chris Skelly, and a number of other invited experts, STRP members (notably Rebecca D’Cruz and Ritesh Kumar), and observers as contributing authors.
3. The STRP and Secretariat are most grateful for financial support for this work from the governments of the Republic of Korea and Sweden, which enabled members of the report drafting team to meet in three writing workshops to progress its work: in Changwon, Republic of Korea (November 2007), Perth, Australia (January 2008), and Kuala Lumpur, Malaysia (April 2008).
4. The STRP determined that its initial report should focus on providing advice to wetland managers and decision-makers on the range of often complex issues concerning wetlands and human health interactions, but it has also recognized that this report should be the first stage of exploration of the issues and is recommending (in COP10 DR 10 and DR 23) that it should be asked to undertake further work on a number of aspects of the issues that have emerged as gaps. Amongst these the Panel has recognized, especially in relation to the COP10 theme, a need to further assess and provide a better understanding of what is

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meant by “wetland ecosystem health”, including in relation to the commitments under the Convention concerning the maintenance of the ecological character of wetlands.

5. The full draft report is nearing completion and will be peer-reviewed before publication as a *Ramsar Technical Report*. This Information Paper provides a draft of that report’s Executive Summary and Key Messages, in support of discussion during COP10 of DR 23 on “Wetlands and human health and well-being”.

## Draft Executive Summary and Key Messages

This review describes the extent and importance of the links that exist between wetlands and human health and well-being. The importance of these links is represented by the theme ‘healthy wetlands, healthy people’, which is used to highlight the need to promote wider cross-sectoral support for further consideration of the scientific and social aspects of human health and wetlands.

The review, setting these issues within the context of the Ramsar Convention’s approach to wetland conservation and wise use, is designed to inform those responsible for the conservation and wise use of wetlands, including wetland managers and national and international decision-makers, about the importance of wetlands for human health and well-being and the need to engage more closely with their colleagues in the public and environmental health sectors, so as to work to ensure that wetland management and health-related interventions maximise the maintenance of wetland ecosystems and support for human health and well-being.

### 1. Introduction

1. The report reviews the complex relationships and issues concerning the wise use of wetland ecosystems and human health, including:
  - public health principles and practices;
  - wetland health and ecological character of wetlands;
  - human health and wetland ecosystem services;
  - the effects on human health of disruptions to wetland ecosystem services;
  - economic values and incentives for supporting human health;
  - global trends affecting wetlands and human health; and
  - responses and interventions for maintaining the ecological character of wetlands and supporting human health.
2. The report is designed to assist those responsible for the conservation and wise use of wetlands, from wetland site managers to national and international decision-makers, in understanding the policy and management issues, so that they can engage more closely with their colleagues in the public and environmental health sectors and work to ensure that wetland management and health-related interventions maximise the maintenance of wetland ecosystems and their continued delivery of services.
3. Over millennia wetland ecosystems and humans have had an intrinsic relationship, with people obtaining many valuable services from wetlands, including direct and indirect support of human well-being and health. The increasing rate of human exploitation and

modification of the environment has adversely affected the health of wetlands, many of which have been lost or degraded to an extent where they no longer provide the ecosystem services that previously supported human well-being and health. This situation has developed to the extent where failure to tackle the loss and degradation of wetland ecosystems could undermine progress toward achieving the Millennium Development Goals (MDGs).

4. An underlying part of the relationship between wetland health and human health is its complexity, as shown by the paradoxical situation in which wetlands provide many valuable services to people but also support many disease vectors. Taking into account this complexity, the report focuses on human health as a component of human well-being that is linked inextricably with wetland health.

## 2. Public health principles

5. Today's definition of health was agreed sixty years ago and adopted by the founding Member States of the World Health Organization (WHO) as part of its Constitution. It emphasizes the public health principles and concepts that evolved during the second half of the 19<sup>th</sup> and the first half of the 20<sup>th</sup> century: *Health is a complete state of physical, mental and social well-being and not merely the absence of disease and infirmity.*
6. Public health is underpinned by three principles:
  - First, **the highest duty of public health is to protect populations from risks and dangers to health.** It includes the performance of basic public health functions, such as ensuring the quality of medicines and the safety of food, water, and blood supplies. It also includes a responsibility to ensure that populations have the information and the means to protect their health. Obviously, it includes regulatory functions and requires the investment of public funds.
  - Second, **the highest ethical principle of public health is equity.** This can be expressed in simple terms. People should not be denied access to life-saving or health-promoting interventions for unfair reasons, including those with economic or social causes.
  - Third, **the greatest power of public health is prevention.** Medicine focuses on the patient, but public health seeks to address the causes of ill health in ways that provide population-wide protection.
7. Health determinants are factors that influence our state of health. These are classed in three broad levels:
  - Individual/family determinants, such as poverty;
  - Physical and social environmental determinants, such as exposure to pollutants and employment opportunities; and
  - Institutional determinants, such as the capacity of health protection agencies, including utilities and medical care.

8. Many of the health determinants can change in both positive and negative directions, and in so doing, they can enhance or diminish the health outcomes experienced by the community. Some health determinants can be managed so as to enhance community health, for example the quality of water supplies. Others, such as age, cannot be managed. The three hierarchical levels can be seen as three concentric spheres that move progressively outwards from the individuals, to their environment, to the institutions regulating that environment. These categories, and subcategories, of health determinants can form a framework for structuring assessments of the associations between particular wetland types and health in specific settings.
9. Describing current thinking on public health principles must be informed by an understanding of the concepts in a historical perspective. Spanning the 60 years between 1948 and 2008, it becomes clear that the issues addressed by public health have not changed. The first World Health Assembly in 1948 established as the four priority areas for the WHO's Programme of Work: the control of malaria and tuberculosis; the improvement of mother and child care; the reduction of child mortality due to vaccine preventable diseases; and the management of health risks through environmental sanitation.
10. Four of the eight Millennium Development Goals (MDGs) that emerged from the 2000 UN Millennium Declaration have specific public health targets (highlighted below in bold text):
  - Goal 1: Eradicate extreme poverty and hunger
  - Goal 2: Achieve universal primary education
  - Goal 3: Promote gender equality and empower women
  - Goal 4: Reduce child mortality**
  - Goal 5: Improve maternal health**
  - Goal 6: Combat HIV/AIDS, malaria and other diseases**
  - Goal 7: Ensure environmental sustainability**
  - Goal 8: Develop a Global Partnership for Development
11. Apart from the recent arrival of HIV/AIDS, the associated MDG targets to be achieved by 2015 could be applied with ease to the priority areas that were set back in 1948. In other words, despite the many and dramatic changes the world has witnessed over the past 60 years, public health priorities have remained remarkably constant.
12. In the context of wetlands and actions for their conservation, obvious health issues include water-associated illnesses, such as malaria and the other vector-borne diseases whose transmission depends on vector species that are inextricably linked to the aquatic environment. The link between safe drinking water and wetland ecosystem services is also easily perceived.
13. Less obvious is the role that wetland-specific social determinants of health may play in the transmission of HIV/AIDS, but nevertheless it is clear that wetland communities burdened by HIV/AIDS, malaria, tuberculosis or a range of water-borne diseases will have less capacity to contribute to maintaining and benefiting from wetlands and their services. The bi-directional nature of the links between health and wetland systems must be considered at all times.

14. Least clear for non-health professionals may be specific links between wetland determinants and maternal/child health and the burden of childhood illness. These will be closely associated with institutional health determinants, i.e., the capacity of the health services to reach wetland-dependent local communities and the possibility of members of the wetland communities to have access to the health services. Constraints and opportunities in this connection require location-specific analysis during the different seasons of the year.
15. While the eradication of hunger is a prime MDG, nutrition is not specifically referred to – yet the nutritional status of individuals and communities is a key component of their overall health status, and several aspects of the wetland ecology have their influence on the nutritional status of local communities.
16. To inform understanding and assessment of wetlands and human health interactions, it is useful to distinguish between different health outcomes. Main health outcome categories are:

<b>Main categories of health outcomes</b>	<b>Examples</b>
Communicable diseases	Malaria and other vector-borne diseases, diarrhoeal diseases, sexually transmitted infections / HIV/AIDS, respiratory infections.
Non-communicable diseases	Acute and chronic poisoning from hazardous chemicals and minerals, cancers, cardio-vascular diseases, and dust induced lung disease
Nutritional problems	Protein-energy and micro-nutrient deficiencies and excesses; food safety
Injuries	Drowning, traffic-associated accidents, accidents related to the use of machinery in agriculture and construction
Psychosocial disorders and well-being	Suicide, depression, (communal) violence, substance abuse, stress, fear of disasters; happiness, fulfilment, social integration

### **3. Ecological character and ecosystem health**

17. A composite approach for assessing the ecological character of wetlands has been devised and adopted by the Ramsar Convention, with particular application for assessing the reference or baseline condition of wetlands listed as internationally important. In addition to including the ecological components and processes that are generally seen as comprising a wetland, explicit attention is given to the ecosystem services provided by a wetland.
18. **People derive benefits from wetlands both individually and collectively, and directly and indirectly.** Such benefits from wetlands include the services of: *provisioning* (drinking water, food, genetic material, structural products, medicinal products, irrigation and industrial water), *regulating* (groundwater recharge, water purification, flood control, soil, sediment and nutrient retention, local climate regulation, carbon storage), *cultural* (recreational hunting and fishing, water sports, tourism and education, heritage, other livelihoods, aesthetic and spiritual values), and *supporting* (those ecosystem components and processes that underpin all of these).

19. **By incorporating ecosystem services within ecological character, the Convention has recognized human well-being as being inextricably associated with ecological character through the services that a wetland provides.** As human health is encompassed by human well-being, it is also linked with the ecological character and the services provided by wetlands, and not just limited to an absence of disease or illness. Furthermore, human health can be seen as commencing with the basic right to sufficient water for health and well-being through hydration, nutrition, and sanitation.
  20. **Ecological character and ecosystem services are subject to change through natural processes, gradual seasonal, successional or evolutionary changes, or more dramatic large-scale episodic events, and all these changes may or may not occur with human complicity. Such changes may themselves feed back to human health and well-being.** Drivers of change in wetlands have been seen as natural processes but also as anthropogenic actions that come from well-defined areas of human endeavour, or systemic effects of which humans are a part.
  21. **Numerous examples exist of the link between changes in ecological character and human health.** A change in hydrological regime, nutrient status, or trophic structure may enhance population numbers of vectors of human pathogens; changing hydrological regimes might mobilise chemicals toxic to humans or agricultural products. Some changes to wetland ecosystems render them less productive, with direct or indirect health consequences for people whose livelihoods depend upon that productivity.
  22. **Ecosystem health is a conceptual approach that seeks to be explicit about human well-being and human health as a part of an ecosystem, not separate from it. It covers both an ecosystem approach to dealing with matters of human health, and using a metaphor of health for ecosystem assessment.** It offers ways of measuring that go beyond other ecosystem indicators: what is the *vigour* (the activity, metabolism or productivity of the system), the organization (the vital signs of a system, diversity, specialisation), and *resilience* (measures of robustness, buffering). It is a whole systems view, where systemic thinking is required to understand not just the upstream causes of change, but also the downstream consequences of action. Taken from this view, human health can become an important indicator for the health of a wetland ecosystem.
  23. **Adopting a ‘healthy wetlands, healthy people’ theme therefore has multiple and beneficial messages, allowing wetland ecosystem assessment to enhance our understanding of ecological characters, embrace ecosystem services more fully, recognize the centrality of the link between wetlands and human well-being, and ensure a systems approach to wetland management.**
- 4. Ecosystem services and benefits for human health**
24. **Ecosystem services provided by wetlands form the basis of a range of human health and well-being benefits.** Effective recognition and communication of these benefits could form the basis of meaningful cooperation between wetland and health managers, leading to the development of more effective holistic management strategies.

25. **Food security is one of the most significant contributions of wetlands to human health.** Wetlands support all three elements of food security, i.e., availability, access, and nutrient sufficiency, and they directly support the health and livelihood of many people worldwide through the provision of important food items such as rice and fish. Future food security is also dependent on the genetic materials contained in plants, including those in wetlands. Wetlands can also support integrated food production systems producing carbohydrates as well as animal proteins, thereby providing options for balancing food security and human health with sustainable livelihoods. The importance of food security from wetlands has been underestimated in many places.
26. **Wetlands play an important role in ensuring water security and are fundamental to human health and well-being.** The role played by wetlands within the hydrological cycle provides an important opportunity for linking local public health concerns to wetland conservation. The fundamental importance of the supply of high quality fresh water for people is well recognized. The role of wetland vegetation in nutrient reduction has promoted the use of highly modified or artificial wetlands in many countries, with their relative efficiency in addressing diffuse sources of pollution.
27. **Wetlands also provide products that form the basis of subsistence incomes for local communities.** For rural people wanting to enter the cash economy, harvesting wild resources from wetlands (salt, fish, shellfish, useful plants) is an important option, as local knowledge and skills can be used to harvest products for trade to form an important part of their subsistence incomes. Complex trade networks commonly characterise this hidden economy, and the income received provides some buying power, which is an important component of food security. In many developing countries where there are limited government social security systems, these resources provide a form of “green social security”.
28. **Wetlands are one of the most productive sources of traditional medicines and new natural products.** Traditional community medicines derived from wetlands are commonly used to treat parasitic diseases, diarrhoea, and oral hygiene in developing and underdeveloped economies, thus forming important parts of the health infrastructure. Wetland-based medicinal and aromatic plant species form a significant segment of global trade in these materials. New natural products derived from wetlands have wide range of applications ranging from medicine to agriculture.
29. **By reducing human vulnerability to disasters and extreme events, many wetlands provide “insurance” value through the formation of natural buffers.** Wetlands act as natural buffers against disasters in several circumstances, thus securing lives and property. By storing water and slowing movement, wetlands buffer surrounding areas from storms and floods. In several countries, conversion of wetlands has been cited as one of the primary reasons for enhanced vulnerability to disasters. Efforts to contain them, on the other hand, through structural and hard engineering measures have often proven to be costly and ineffective. This has prompted several governments to integrate wetlands in disaster reduction strategies.
30. **Wetlands through their spiritual, recreational, inspirational and educational values contribute to the psychological and social well-being of human communities.** Many religions attach spiritual and religious values to aspects of wetland ecosystems. The contributions made by wetland ecosystems to well-being by recreational use are best

represented by the health benefits of physical activity, although some literature now documents substantial mental health benefits as well.

## 5. Health effects of disrupted wetland ecosystems

31. **The disruptions to a wetland ecosystem through human activity can diminish the capacity of the wetland to deliver any of a variety of ecosystems services that contribute to human health:**
- **The disruptions to wetland ecosystems can produce effects that act indirectly, directly, additively or synergistically.** For example, drainage of wetland ecosystems may i) alter breeding activities of vectors, thus altering disease patterns; ii) influence changes in local and regional climates, potentially affecting disease vector distributions over time; iii) mobilize pollutants; and iv) place stresses on agricultural production or the integrity of coral reefs and coastal fisheries, increasing vulnerability of populations to diseases or pollutants.
  - **Water scarcity jeopardizes food production, human health, economic development, and geopolitical stability.** One third of the world's population now lives in countries experiencing moderate to high water stress. This will continue to increase as both population size and per capita water demand grow. Within the next 20 years, the amount of water available per capita worldwide is expected to drop by a third, and this will be exacerbated by climate change. The increasing pressures on fresh water and the expected reduction in availability are expected to fuel competition and conflict and increase the global burden of disease.
  - **Pollution of wetland ecosystems puts people at great risk, directly by affecting human health, and indirectly by degrading the resource base on which many people depend.** Faecal and organic pollution related to untreated human wastewater continues to be a problem in rapidly industrialising countries, as well as in tropical countries where wastewater treatment systems are insufficiently developed. Organic and inorganic chemicals, and microbial toxins, can contaminate wetland ecosystems beyond their capacity to assimilate them. Atmospheric particles or chemicals emanating from wetland ecosystems (such as particulates in dust and smoke from dry or burning wetland sediments) can be particularly problematic for human health. Excessive flows of nitrogen contribute to eutrophication of freshwater and coastal marine ecosystems and acidification of freshwater and terrestrial ecosystems (with implications for biodiversity in these ecosystems).
  - **Wetland ecosystem disruption and socio-economic factors will continually interact to produce health effects.** For instance, disruption of ecosystems may lead to the emergence or resurgence of disease, while local factors such as poverty, inadequate housing, poor water treatment, and heightened susceptibility may lead to local establishment of transmission. When these events combine with human activities related to globalization (such as international trade and travel), global pandemics can arise, as illustrated already by the development and spread of HIV/AIDS and, potentially, by the appearance in human populations of other new infectious disease strains, e.g., avian influenza.

32. **While wetlands can be associated with an increased incidence of globally significant and locally important infectious diseases (such as malaria and schistosomiasis), the removal of wetlands or alteration of their water regimes is not generally the only disease management option that should be considered.** The incidence of many of these diseases can instead be reduced through provision of clean water, improved sanitation, and – importantly – good management of wetlands.
33. **There is a need to broaden the traditional perspectives of public health and their epidemiological approaches into one more closely aligned with the science of ecology, an area where wetland managers have a significant contribution to make.** Infectious diseases include water-borne, vector-borne pathogens and come from a diverse range of biotic groups, all requiring an ecological understanding of the conditions that allow proliferation, resurgence, or emergence of the pathogen.
34. **Wetland managers need to acknowledge people's awareness and perception of change as mediating variables when examining the effects of their decisions on local environmental quality.** This awareness and perception of change can have a pathological extension, for instance the pain or sickness caused by the loss of, or inability to derive, solace connected to the present state of one's home environment.
35. **The consequences for human health may persist or arise over the long term, so interventions must operate with all relevant temporal scales rather than just the short or medium term.** For instance, communities that have experienced natural disasters can suffer from physical injury, exposure to microbial and chemical contaminants, increased disease vector activity, over the shorter term, but the mental health effects can be persistent and long-term and potentially affect several generations.
36. **Since many of these matters operate at, or are driven by factors at, the global scale, the attention of wetland managers must also be focused beyond the local and regional scale.** Freshwater ecosystem disruptions at the global scale will affect both developed and developing countries, and the same holds for the consequences of climate change on human health.

## 6. Economic values and incentives

37. **Despite an important role of wetlands in providing ecosystem services that support human health and well-being, there is a significant danger that these will be overlooked or underconsidered in decision-making processes.** Policy makers are often faced with the need to choose between alternatives to support effective resource allocation. The given scarcity of some ecosystem services and need to choose between alternatives posits the unavoidable question of relative values. Quantification and valuation of wetland ecosystem services in a way that makes them comparable with the returns derived from alternative uses can facilitate improved policy and decision-making.
38. **Application of economic valuation techniques have yielded useful economic estimates of the contribution of wetlands towards health objectives to guide sound decision-making.** Case studies from across the globe have yielded region-specific to global economic estimates indicating the significant contribution of wetlands to local, national, regional and global economies and local livelihoods. Several assessments also indicate that when both marketed and non-marketed economic benefits are included, the

total economic value of an unconverted wetland is often greater than a converted wetland. However, further research needs to be directed at integrating tradeoffs that emerge at various scales and across a multitude of stakeholders. Recent advances in ecological-economic modeling show interesting applications to address these issues in line with the principles of wise use.

39. **Disruption and/or loss of wetland ecosystem functions impose huge economic costs.** Staggering economic estimates of damages due to destruction of wetlands, particularly emerging from the recent disasters, and of restoration costs, indicate the relative cost effectiveness of investments in the conservation and wise use of wetlands.
40. **Valuation of health and well-being outcomes of disrupted wetland ecosystem services has been under-researched, though theoretical frameworks are apparently well developed.** Assessment approaches have focused on tradeoffs made by individuals, governments and/or decision-makers between changes in probability of mortality and/or morbidity and other marketed goods. Measures such as willingness to pay per Quality Adjusted Life Year (QALY), Value of Statistical Life (VSL), or modelled economic behaviour to undesirable health conditions have been applied to air and water pollution. Review of empirical evidence reveals a gap in terms of application to wetlands.
41. **The development of sustainable incentive systems is an important opportunity for wetland managers and policy makers to promote the conservation and wise use of wetland ecosystem services and realize health and well-being outcomes.** The ‘public good’ character of wetlands (by virtue of which many wetland ecosystem services are seen as free and markets fail to correctly reflect the full value of costs and benefits of changes in their levels of provisioning) is one of the key reasons for wetland degradation and their unsustainable use, leading to an undermining of their contributions in decision-making and policy processes. Recently there is a growing focus on the valuation of environmental services through payments for environmental services (PES). Though applications have not been specific to wetland services, several case studies indicate the adoption of a landscape as a unit of service provision, which has the potential for affecting the various factors that influence wetland functioning. Encouraging such incentive systems can promote stewardship and create a basis for public/private partnership for continued provisioning of wetland ecosystem services.

## 7. Global trends affecting human health

42. **There are a number of direct and indirect drivers of change to ecosystems whose historical, current and projected trends have affected, are affecting and are expected to continue to affect wetlands, largely through issues of changing (often decreasing) water availability and quality.** These include the availability of freshwater; river fragmentation; sanitation; agriculture expansion and intensification; aquaculture expansion; land conversion and urbanization; population and demographic change; and global climate change. Although each has specific implications for wetlands and human health, there are of course many interactions and links between such drivers, and all of them will be further influenced by trends in global climate variability and change.

43. **Much of the available information comes from water and human health assessment, rather than from interactions between wetland ecosystems themselves and human health.**
44. **Many of the current and continuing pressures on wetlands and driving trends in human health nevertheless occur chiefly through the medium of water,** or rather the increasing lack of water availability, and of water of suitable quality, to meet the needs for food production, sanitation, and drinking purposes.
45. **Whilst in the industrialized world the disease burden has shifted from infectious diseases and specific nutrient deficiencies to one that is driven by exposure to environmental hazards and toxins, a more sedentary lifestyle, and over-consumption, a further disease burden shift now seems to be occurring to one driven by global ecosystem disruptions, notably in water and wetlands.** Increasing pressure on freshwater and the expected reduction in its availability has led water to be called “the next oil”, where scarcity and demand will fuel conflict and increase the global burden of disease.
46. **About 2.8 billion people currently face water scarcity. More than 1.2 billion of them live in areas of physical water scarcity and 1.6 billion in basins that face economic water scarcity. Some 1.2 billion people are estimated to live in river basins where human water use has surpassed sustainable limits, with another 500 million people in river basins that are fast approaching this situation. Yet water withdrawals are predicted to increase by a further 50% in developing countries by 2025, and 18% in developed countries, much of this for food production.** Worldwide, water quality conditions have degraded in almost all regions with intensive agriculture and large urban and industrial areas, and even the best developed drinking water supplies can pose a health risk. Increasing river fragmentation and upstream water abstraction is jeopardising the provision of water and other ecosystem services downstream, yet this is where the increasingly urbanised human population is moving. Although there has been some progress in improving sanitation, there is an increasing deterioration of water quality due to industrial and urban waste, agricultural runoff, and insufficient investment in the domestic water supply infrastructure. Contaminated water remains the greatest single cause of human sickness and death globally.
47. **So at the same time we are striving to meet the MDG on food security, the decreasing availability of water for wetlands, the diminishing capacity of wetlands to continue processing and delivering the water vital for drinking and food production, and the increasing demand for this water is projected to further add to the disease burden and related human health problems.** Less developed countries and poorer people are expected to continue to face greater health-related impacts. Competition between water for food production and water for other sectors will intensify, but food production will remain the largest water user worldwide.
48. **Climate change has exacerbated, and is expected to continue to exacerbate, health impacts in relation to wetlands and water, both by affecting the wetlands themselves,** for which it is projected that there will be more adverse than beneficial impacts (particularly affecting reefs, atolls, mangroves, and wetlands in prairies, tropical and boreal forests, and arctic (including permafrost) and alpine ecosystems), **and by affecting disease burdens** through increased death and disease from climate extremes,

through climate change and variability changing distributions of vector-borne disease, and through more widespread drought decreasing food production in low latitudes, thus increasing the number of undernourished people in the low-income world.

## 8. Responses and interventions

49. **Wetland management actions can result in positive or negative consequences for human health.** For instance, wetland restoration in an urban area may involve re-establishing a hydrological connection that might then provide the habitat for a vector where a water-borne disease occurs. The reciprocal of this is that by attending to human health and well-being matters, societal actions may directly or indirectly result in ecosystem disruption. Wetland managers therefore will need to respond appropriately in both cases.
50. **Wetland managers need to engage actively with the health sector at the local and national levels.** Some of the key approaches, tools and instruments likely to be used by the health sector to respond to health effects and health outcomes of disruption to ecosystem services should be understood. Monitoring, surveillance and intervention, burden-of-disease assessments, health impact assessments (HIA), risk assessments, community and stakeholder engagement are commonly used.
51. **One valuable strategy to achieve cross-sectoral action may lie in using human disease burden data as a bio-indicator to help target and prioritise wetland remediation.** Human health data are generally collected more widely and more reliably than are ecosystem health data, and closer collaborations between wetland ecologists and health researchers could therefore help to demonstrate the sustainable provision of wetland ecosystem services.
52. **Many of the possible response options for addressing ecosystem change and human well-being lie primarily outside the direct control of the wetland sector, or even the health sector.** Instead they are embedded in areas such as sanitation and water supply, education, agriculture, trade, tourism, transport, development, and housing. Inter-sectoral and cross-sectoral integrated options are therefore needed to reduce the potential health impacts of ecosystem change. In this regard, it is important to identify the principal cross-sectoral partners and responsible stakeholder groups required to achieve appropriate outcomes. These integrated interventions will necessarily address existing social values and cultural norms, existing infrastructure, and the social, economic, and demographic driving forces that result in ecosystem change.
53. **Wetland managers need to recognize that different approaches (involving different instruments and forms of engagement) are available to plan or implement the intervention.** For instance, plans aimed at improving water sanitation will require developing appropriate participation of parents, particularly women, in local communities in the planning and implementation phases.
54. **Wetland managers need to be involved in building coping capacity in human communities, and to recognize that these responses will need to operate at local, national, or regional levels.** This is because the forces that place populations at risk (such as poverty and high burdens of disease) in many cases also impair the capacity of these

populations to prepare for the future, or in this instance, manage their wetland ecosystems appropriately.

55. **In the context of ecosystem management, interventions need to be designed at spatial and temporal scales appropriate to the ecosystem disruption and the health outcome of concern.** They can focus on local, national, regional, and international scales and, within any of these scales, on vulnerable subgroups. Overall factors affecting the choice of responses include the knowledge and understanding of the underlying processes or causes; the capacity to predict, forecast, and warn; the capacity to respond (institutional and otherwise); how the risk might change over time and with ecosystem change; and ethical appropriateness.
56. **Where interventions or responses involve tradeoffs, it is important to understand the consequences of taking one path in preference to another.** Recognizing the potential for tradeoffs is the important first step in this understanding. Undertaking a *process* by which tradeoffs can be negotiated becomes the central concern: representation of marginalised stakeholders, increased transparency of information, and engaging with the core pursuits of other sectors will be key components of such processes.
57. **Response options and specific interventions to address classes of health effects and health outcomes resulting from diminished ecosystem services, include:**
  - **Institutional and governance reforms:** interagency collaboration, integrated adaptive management approaches, development of institutions that devolve decision making, resolve market and ecosystem interactions, and involve concerned stakeholders in decision-making processes.
  - **Economics and incentives:** elimination of subsidies (and perverse incentives) that promote excessive use of ecosystem services (and, where possible, transfer of these subsidies to payments for non-marketed ecosystem services), and greater use of economic instruments and market-based approaches in the management of ecosystem services.
  - **Social and behavioural:** measures to reduce consumption, raise awareness, develop curricula, empower communities, promote participation, all to entrench societal understandings of wetland and water management not just as a technical issue, but also a social and political one.
  - **Technological:** dramatically improve irrigation efficiencies and promote other technologies capable of productivity gains in agriculture without concomitant upscaling of water, ecosystem and energy costs.
  - **Knowledge and cognitive:** develop human and institutional capacity to ensure that a broader range of knowledge-bases are called upon in decision-making, including indigenous and local knowledge, not just scientific-technical knowledge. Continue to refine the correlations between water and wetland indicators and the indicators for childhood illness/mortality and nutritional status.
58. **Managing wetland ecosystem services to improve human health will help achieve the Millennium Development Goals.** This can be demonstrated by the close relationship between food production, water use and water extraction, and wetland management.

## 9. Conclusions and recommendations

59. The report reaches a number of conclusions and recommendations for future action, including:
- **Identify and implement interventions that benefit both wetland ecosystem health and human health *concurrently*.**
60. In support of this recommendation, it would be useful to:
- pursue multidisciplinary research to provide an evidence base a) to identify appropriate interventions and b) monitor the efficacy of those implemented (including human health outcomes);
  - apply the principles of conservation through sustainable use to wetlands where conservation needs and human needs are in apparent conflict (with particular emphasis on disease suppression);
  - engage with ecological economists and health economists to establish dollar values for the wetland ecosystem services conserved;
  - engage with wetland ecosystem managers to demonstrate the *value* of best practice in terms of a) economic gain from maintaining wetland ecosystem services (including human health) or b) other paradigms that resonate with the particular communities concerned.
- **In the first instance target wetlands that are high on the priority list for *both* their conservation value *and* their human health benefit.** Successful demonstration projects that include quantifiable environmental, societal and economic benefits should provide the necessary leverage to gain support for then expanding the type and number of wetlands involved.
61. One possible strategy for identifying target wetlands involves the use of human health surveillance data as bio-indicators of disrupted wetland ecosystem services.
- **Take action to improve the health and well-being of people in harmony with wetland conservation and wise use objectives**, in particular:
    - i) by identifying and implementing actions that benefit both wetland ecosystems and human health concurrently or, in case of any perceived conflict between these objectives,
    - ii) by applying as appropriate the guidance on wise use adopted under the Convention;
  - **Address the causes of declining human health linked with wetlands by maintaining or enhancing existing ecosystem services that can contribute to the prevention of such declines, and ensure that where possible any necessary disease eradication measures in or around wetlands are undertaken in ways that do not jeopardise the maintenance of the ecological character of the wetlands and their ecosystem services.**

- **Encourage strengthened collaboration and the seeking of new partnerships between the sectors concerned with wetland conservation, water, health, food security and poverty reduction within and between governments, non-government organizations, and the private sector.**
- **Encourage countries and development sectors, including mining, other extractive industries, infrastructure development, water and sanitation, energy, agriculture and aquaculture, transport and others, to take all possible steps to avoid direct or indirect effects of their activities on wetlands that would impact negatively on those ecosystem services of wetlands that support human health and well-being.**
- **Make the interrelationship between wetland ecosystems and human health a key component of national and international policies, plans and strategies, including by definition of specific wetland targets and indicators that link sustainable wetland management to the World Summit on Sustainable Development (WSSD, Johannesburg, 2002) targets for water, energy, health, agriculture and biodiversity (“WEHAB”) and to the Millennium Development Goals, notably goals 1 (“eradicate extreme poverty and hunger”), 4 (“reduce child mortality”), 5 (“improve maternal health”) and 6 (“combat HIV/AIDS, malaria and other diseases”).**
- **Bring information on the scientifically-proven contributions that naturally-functioning wetland ecosystems make to good health and well-being to the attention of national ministries and agencies responsible for health, sanitation, and water supply.**
- **Encourage improved collaboration amongst the wetland management sector, the human health sector, and all relevant stakeholders in assessing the consequences of wetland management measures linked with human health, including the identification of appropriate tradeoffs in decision-making.**
- **Consider ways and means of assessing more directly the interactions between inland and coastal wetlands and human health, since much of the available information on the trends in interactions between human health and wetlands is derived from analyses of health and water interrelationships, rather than on those between the wetland ecosystems themselves and human health.**
- **Ensure that decision-making on co-managing wetlands and human health issues takes into account current understanding of climate change-induced increases in health and disease risk and maintains the capacity of wetlands to adapt to climate change and continue to provide their ecosystem services, since changing climate is expected to continue to increase risk of human health problems, including disease burden.**
- **Wetland authorities, working with their health sector counterparts and others, should seek to:**
  - i) **be vigilant for the emergence or re-emergence of wetland-linked diseases;**

- ii) **act preventively and proactively in relation to such diseases; and**
  - iii) **develop scientifically-based responses taking into account current good practices, where instances of such diseases are identified.**
- **Dedicate resources to building capacity for more integrated approaches to wetland and water management and health, including the application of local and traditional knowledge.**
  - **Identify, with the World Health Organization, ways and means of strengthening collaboration with the Ramsar Convention, including on technical issues of common interest, and make available the finding of this report to the relevant parts of the human health community.**
  - **Further investigate the links between wetlands and health, working with the World Health Organization, the COHAB Initiative, and other relevant bodies concerned with human health and ecosystems, in particular by:**
    - i) developing from this report and other relevant sources further products for the human health sector concerning human health and wetlands;
    - ii) further assessing the interactions between wetland ecosystems and their services and human health and well-being, including issues related to impacts on relevant ecosystem services from pollution, degradation, and loss of wetlands, as well as the role of wetlands in relation to waterborne diseases and disease vectors;
    - iii) developing interpretations and conceptual thinking in a Ramsar context of the applicability or otherwise of “health” to wetland ecosystems, the relationship of wetland ecosystem health to the concepts of ecological character and ecosystem services, and the implications for implementing and monitoring wise use and ecological character objectives under the Convention, taking into account both socio-economic and ecological considerations;
    - iv) identifying gaps in knowledge and information on wetlands and human health for different regions, and finding ways and means of filling such gaps;
    - v) identifying opportunities to promote the value of Ramsar sites that have high positive values for human health; and
    - vi) preparing guidance for wetland managers and the human health sector on processes for identifying appropriate responses to the co-management of wetlands and human health issues, including tradeoffs as well as the application of health impact assessment approaches, increased transparency of information, representation of marginalized stakeholders, and engagement with the core business of other sectors such as water management.
  - **Encourage governments, non-governmental organizations, research institutions and others to make available, in appropriate forms, including to the Ramsar Secretariat and the STRP, the results of research and**

**demonstration projects on good practice in integrated approaches to wetland ecosystem conservation and wise use and human health**, so that demonstrations of the practical value of such good practices can be made available to those directly involved with wetland management.