In the name of God

Research title: Wetland water resources resiliency and vulnerability under risk of climate change

Name: Dr. Bahram Malekmohammadi

Public e-mail: Malekb@ut.ac.ir

Home institute address: Graduate Faculty of Environment, University of Tehran , No. 25, Ghods Street, P.O. Box: 14155-6135, Tehran, Iran, e-mail: Malekb@ut.ac.ir

Host institute address: Department of Water Resources Engineering, Lund University, S-22100 Lund, Sweden, e-mail: bahram.malekmohammadi@tvrl.lth.se

Abstract: In many arid and semi-arid part of Middle East regions, environmental water flows are declining due to the over-allocation of water for human use, particularly for agriculture; these trends may be compounded by droughts and longer-term climatic changes. As a result, flows in many rivers and water volumes reaching downstream lakes and wetlands are greatly reduced, resulting in severe environmental, social and economic impacts. Salt- and dust-laden winds and degradation of lands are among the present consequences arising from the drying of wetlands, which are causing serious social, economic and health problems for the inhabitants of the basins. The main challenge behind these problems is the over-allocation and mismanagement of water. This can be seen through the recent combined impact of droughts, climate change and the consequences of the unsustainable management of water resources which has brought two of Iran's most precious wetlands, Lake Urmia and the Hamouns, to the brink of ecological catastrophe. Nor are these only wetland problems in Iran, some other wetlands have already completely disappeared and others are under immense threat. Therefore investigation in this topic is important issue in Iran and Middle East. The main objective of this research is to finding indicators for identifying water resources resiliency in wetland ecosystem under risk of exploitation and climate change. As climatic trends point to a hotter and drier in future, and even as population pressure increases the demand for declining water resources is more important. In this research some indicators, such as ecosystem services trends and vulnerability of wetland landscape were considered in implementing sustainable water and wetland management and mainstream ecosystems approach into IWRM processes in order to support poverty reduction, equitable development, resilience to climate change and conservation of biological diversity. Wetlands are essential in providing water-related ecosystem services, such as clean water for drinking, water for agriculture, cooling water for the energy sector and regulating water quantity (e.g. flood regulation). In conjunction with their role in erosion control and sediment transport, wetlands also contribute to land formation and therefore resilience to storms. Moreover, they

provide a wide range of services that are dependent on water, such as agricultural production, fisheries and tourism. In second part of this research, wetland vulnerability in terms of analysis of human and environmental systems from application of the driver-pressure-state-impact-response (DPSIR) framework was discussed. This assessment presented a systematic methodology for assessment of wetland vulnerability in a social-ecological approach applying broad-scale ecosystem services and vulnerability functions. The method combined the hydro-geomorphic approach with estimations of vulnerability indicators and DPSIR analysis. The aim was to assess vulnerability of wetland ecosystem services and characterize the threat indicators according to importance, severity, and probability of occurrence. Quantitative and qualitative methods were applied to characterize values for these three indicators. The Multi Criteria Decision Making (MCDM) method was used to prioritize threats and impacts of the wetland on the basis of experts' opinions. The proposed methodology was applied to the Choghakhor international wetland landscape in south-western Iran. Vulnerability assessment revealed that water requirement of the lowland and the water transfer system were the most important factors threatening the wetland. Agricultural activities, settlements and urban areas, drought, tourism, population growth, and mining activities in the upland were the next most important priorities, in that order. Hydrological balance was determined as the most vulnerable function and was considered as the most important function in the Choghakhor wetland. The DPSIR model was used to determine a management strategy to reduce vulnerability of ecosystem services in response to drivers, pressures, states and impacts indicated by modelling.

Key words: Water resiliency**,** Vulnerability Assessment, Wetland ecosystem Services, Wetland Functions, DPSIR, MCDM.