IWRM Action Hub

IWRM TOOL - C1.02

Vulnerability Assessment

Summary

Water vulnerability is contingent upon biophysical and social drivers operating at multiple scales and is difficult to assess. Vulnerability assessment evaluates a system's sensitivity to potential threats, and to identify key challenges to the system in reducing or mitigating the risk associated with the negative consequences from adversarial actions. It supports to generate important evidence for the decision and policy makers for identifying and planning proper adaptation plan of action. Vulnerability indices are used to quantify the range and extent of vulnerability in a system.

Defining Vulnerability in the Water Context

Vulnerability is generally defined as the characteristics and circumstances of an individual, community, or system that makes it susceptible to the damaging effects of a challenge(s)/hazard(s). In relation to the disaster, the United Nations Office for Disaster Risk Reduction defines vulnerability as the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to impact of hazards (UNDRR, 2017). Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes (IPCC, 2001). In social sciences, vulnerability typically refers to a set of socio-economic factors that determine people's ability to cope with stress or change.

Water is becoming a vulnerable resource as pressure increases on the hydrological systems due to a combination of various climatic and anthropogenic factors. The vulnerability of

water resources can be classified into several vulnerability factors, such as water-shortage, water pollution, and water-related natural disaster, i.e., flood or drought. The evaluation and identification of these key vulnerability factors of water resources in each river basin can help trace the local water resources vulnerability situation and provide guidance for adaptive water management. There are some other factors that makes community or water management systems vulnerable are:

- **Physical factors**: It includes water system infrastructures (pipelines, civil structures-dams and reservoirs), land use and land cover, water quality and quantity.
- **Social factors**: They are related to social conditions, poverty, social inclusion, gender discrimination, allocation, and access to water, reach to organization and power.
- **Economic factors**: The factors such as, physical, and natural assets, insurance, livelihood, economic diversity, degree of access to loan and credit.
- **Environmental factors**: It includes natural resource depletion and degradation, poor environment management, toxic and hazardous pollutants, reduced access to clean water, and sanitation.

The Need to Assess the Vulnerability

Investigating vulnerability is an analytic process which carefully evaluates a system's sensitivity to potential threats, and to identify key challenges to the system in reducing or mitigating the risk associated with the negative consequences from adversarial actions. Understanding the sources and the extend of vulnerability of the water resources is the very first step to design appropriate strategies aimed at securing water for various uses, including human and environment. The vulnerability assessment is an essential tool which links bio-physical aspects of water to the socio-economic issues such as poverty reduction and diversification of livelihoods. Vulnerability assessment of water resources generates important evidence for the decision and policy makers for identifying and planning of water resources management interventions and developing adaptation strategies for dealing with climate change impacts.

Methods for Vulnerability Assessment

There is no "one-size fits-all" vulnerability assessment (VA) methodology. VAs should be adjusted to the purpose of the assessment and should be tailor-made for the water management objectives or water services of a particular basin. Generally, VAs include the following steps:

- **Scoping**: Formulation of scope and structure of VA. Identification of scenarios, defining objectives and identification of stakeholders.
- **Mapping**: Identification of vulnerable groups, systems, and areas of potential climate change damage.
- **Indicators**: Identifying vulnerability indicators and critical threshold.
- **Scenario**: Assessment of current/future vulnerability in terms of exposure, sensitivity, and coping ability.

The dimensions of climate vulnerability assessment are exposure, sensitivity, and adaptive capacity. **Exposure** is usually driven by climatic extremities and hazards while, **sensitivity**

and **adaptive capacity** are influenced by economic, political, cultural, and institutional factors. Therefore, the focus of any vulnerability reduction activity should aim at reducing exposure to climate variation and people's sensitivity towards it increasing people's adaptive capacity through various interventions. Vulnerability assessment is associated with risk assessment (Tool C1.01). The outcome of the vulnerability and risk assessment helps in the preparation of effective National Adaptation plans (Tool C4.08).

Vulnerability Index

Vulnerability is a multidimensional and multi-faceted construct which arises from varied stresses and drivers. Vulnerability assessment methodology are heavily influenced by data availability, data reliability, extent, scale, rating methods of vulnerability indicators. Thus, the vulnerability indicators are attributed to the specific context, objective, space, and circumstances. The scale of vulnerability assessment can differ within national, basin, watershed, and catchment level. The extent and exposure of population and system to hazard is determined with the help of vulnerability index. Vulnerability index is a composite of multiple indicators that delivers single numerical value. Practically, it is a quantitative representation of vulnerability of a system in comparison to other similar systems. Vulnerability index value provides a quantified perception used for ranking/prioritising vulnerability extent of a system. Some of the commonly used vulnerability indices are:

- **Climate Vulnerability index (CVI)**: The climate change vulnerability index evaluates the vulnerability of human populations to extreme climate events. It evaluates 42 social, economic, and environmental factors to assess national vulnerabilities across three core areas. These include exposure to climate-related natural disasters and sea-level rise; human sensitivity, in terms of population patterns, development, natural resources, agricultural dependency and conflicts; and at last, the index assesses future vulnerability by considering the adaptive capacity of a country’s government and infrastructure to combat climate change.
- **Water Stress Index**: Water stress index evaluates total water use relative to annual available flow on a catchment level across the globe, enabling users to assess inherent water stress in a particular business location. This index also considers different levels of combined domestic, industrial, and agricultural water demand to give you a big picture view of where your operations are most at risk.

Vulnerability can be reduced by decreasing the impact of the hazard itself where possible (through mitigation, prediction and warning, preparedness); building capacities to withstand and cope with hazards; tackling the root causes of vulnerability, such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihoods. The reference section of the tool consists of a vulnerability sourcebook as well as guidelines, frameworks, and methodologies for VAs specially focused on climate change and adaptation. It also includes detailed factors and drives influencing the vulnerability indicators.

Thematic Tagging

Gender , Youth
