FRESHWATER HEALTH INDEX

FRAMEWORK & INDICATORS

There is a critical gap in the understanding and monitoring of how we are altering the world's freshwater ecosystems—and how that, in turn, impacts people.

The Freshwater Health Index (FHI) tool measures ecosystem health by making clear connections between freshwater ecosystems and the benefits they provide to people. It is intended to help track freshwater health over time through an iterative process between scientists, end-users and other stakeholders so that the result is salient, credible and useful.

The FHI also can be used to evaluate potential impacts from climate change, land-cover change, population growth and water allocation decisions—thereby making trade-offs more explicit and helping direct policies and practices that maintain healthy watersheds into the future.

FHI Framework

The FHI is based on a framework that accounts for the interactions between the ecosystem, the services it provides to people, and the water governance and management systems in place in a basin.

It allows resource managers, engineers, policymakers and other interested stakeholders to transform data into commonly scaled indicators (on a 0-100 scale), providing a baseline diagnosis of a basin's health as well as a platform for analyzing changes over time. Users can evaluate scenarios, understand trade-offs, prioritize interventions and communicate about basin health with a broad audience.

FHI Approach

Data required to calculate the indicators are expected to come from a variety of sources combining on-site measurements, remotely-sensed information and modelled outputs. Each basin provides its own data monitoring sources and models based on local, regional and global factors such as capability of local authorities, institutional importance for certain physical variables such as water quality, or scale of the basin being studied.

A user manual describes the FHI assessment methodology to enable local stakeholders to conduct assessments in collaboration, with technical assistance provided as needed. Lessons learned from basin assessments help refine the tool and contribute to best practices.

Freshwater health is defined as the ability to deliver water-related ecosystem services, sustainably and equitably, at the drainage basin scale, thus linking the ecological function and condition of upstream areas of service generation (supply) with downstream communities (demand).

The FHI evaluates the health of a freshwater ecosystembased on three core components: Ecosystem Vitality, Ecosystem Services, and Governance & Stakeholders.

The Indicators

The FHI provides decision-support through a set of indicators that transparently assesses the health of freshwater systems in their ecological and social dimensions. Built on the best available science, the indicators and measurement protocols quantify and map the multiple benefits that fresh water naturally provides. The FHI identifies 11 key indicators of a healthy freshwater ecosystem. Their relative importance may vary from basin to basin, but together these indicators enable people and communities to survive and thrive.

Freshwater Health Index Components and Indicators

ECOSYSTEM VITALITY

Water Quantity
- Deviation from Natural Flow
- Groundwater Storage Depletion

Water Quality
- Suspended Solids
- Total Nitrogen
- Total Phosphorus
- Other Quality Parameters of Concern

Basin Condition
- Bank modification
- Flow Connectivity
- Land Cover Naturalness

Biodiversity
- Species of Concern
- Invasive & Nuisance Species

ECOSYSTEM SERVICES

Provisioning
- Water supply Reliability
- Biomass for Consumption

Regulation & Support
- Sediment Regulation
- Water Quality Regulation
- Flood Regulation
- Disease Regulation

Cultural
- Conservation Areas
- Recreation

GOVERNANCE & STAKEHOLDERS

Enabling Environment
- Water Resources Management
- Rights to Resource Use
- Incentives & Regulations
- Financial Capacity
- Technical Capacity

Stakeholder Engagement
- Information Access
- Engagement in Decision-making Processes

Vision & Adaptive Governance
- Strategic Planning & Adaptive Management
- Monitoring & Learning Mechanisms

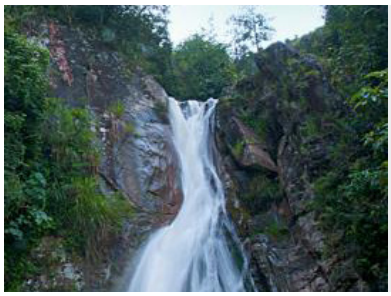
Effectiveness
- Enforcement & Compliance
- Distribution of Benefits
- Water-related Conflict

FRESHWATER HEALTH INDEX

ECOSYSTEM VITALITY

Ecosystem Vitality relates to the natural resources that exist within a freshwater ecosystem—aquatic as well as terrestrial ecosystems linked within a watershed, including both surface and ground water. Healthy ecosystems are fundamental to providing clean water, fish, protection from floods and a variety of other benefits that people rely on.

This component assesses the integrity and functioning of the streams, rivers, wetlands and forests within the basin by measuring indicators related to water quality, water quantity, basin condition and biodiversity.



WATER QUANTITY

The amount and flow of water through the basin. It is determined by assessing:

- **Deviation from Natural Flow:** degree to which current water flows have shifted from historic, natural flows.
- **Groundwater Storage Depletion:** changes in the availability of water stored in aquifers.

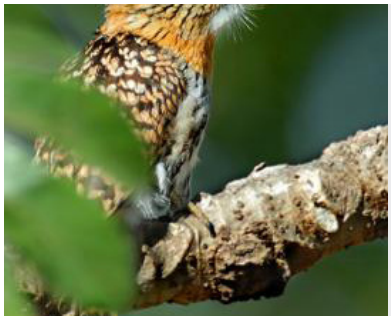
WATER QUALITY

The quality of water necessary for maintaining healthy aquatic ecosystems, rather than for human consumption. It is determined by assessing suspended solids, total nitrogen, total phosphorus and other quality parameters of concern.

BASIN CONDITION

The extent of physical modifications to land cover, streams, rivers and channels. It is determined by assessing:

- **Bank Modification:** the percentage of channelization or human-caused disturbance to stream banks, affecting the size and effect of floodplains.
  Flow Connectivity: the fragmentation of the stream network, due to natural and human-made obstructions that affect fish passage.
- **Land Cover Naturalness:** alteration of the land cover from its natural undisturbed state.



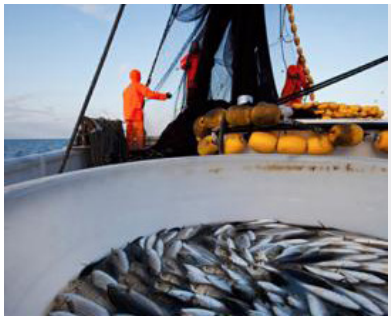
BIODIVERSITY

The population status and trends of species that depend on freshwater ecosystems. It is determined by assessing:

- **Species of Concern:** threatened aquatic or riparian species and other species of particular interest to the basin.
- **Invasive & Nuisance Species:** alien species in the ecosystem that thrive at the expense of native species.

ECOSYSTEM SERVICES

Ecosystem services refers to the various benefits that people receive from nature. Freshwater ecosystem services include water for drinking and crops, fisheries, protection from floods and other hazards, and recreational opportunities such as fishing or kayaking. Ecosystem Services is assessed by measuring indicators related to provisioning, regulation and support, and culture and aesthetics.



PROVISIONING

The physical outputs, primarily water and fish, of freshwater ecosystems for human benefit. It is determined by assessing:

- **Water Supply Reliability:** ability to meet water demand from various sectors, with respect to total water available.
- **Biomass for Consumption:** fish, wild food and other materials people harvest from freshwater ecosystems.

REGULATION & SUPPORT

The indirect benefits of freshwater ecosystem that either support provisioning services or reduce hazards. It is determined by assessing:

- **Sediment Regulation:** degree to which the basin regulates erosion and controls sediment transport and deposition.
- **Water Quality Regulation:** ability to deliver water of the required standards for different sectors.
- **Flood Regulation:** exposure of people and property to floods.
- **Disease Regulation:** exposure to water-associated diseases.

CULTURE & AESTHETICS

The non-material benefits or experiences that people receive from freshwater ecosystems. It is determined by assessing:

- **Conservation Areas:** water-related natural resources and structures that are under protection or formal management for science, culture or religion.
- **Recreation:** time spent engaging in recreational activities that depend on freshwater ecosystems.

GOVERNANCE & STAKEHOLDERS

Governance encompasses a region's multiple tiers of governments, including formal rules, informal norms such as community-established guidelines, and market mechanisms. Stakeholders are made up of decision-makers and communities–ranging from individuals and community groups to municipalities, corporations and international organizations–as well as other stakeholders who have an interest in or influence over decisions in a particular basin.

Stakeholders operate within the constraints of the governance system, but they also have the ability to influence or shape the governance system. Because of the close relationship between them, governance and stakeholders are combined into a single set of indicators. Governance & Stakeholders is assesses by measuring indicators related to enabling environment, stakeholder engagement, vision and adaptive governance, and effectiveness. (CONTINUED ON NEXT PAGE)

ENABLING ENVIRONMENT

The policies, regulations, market mechanisms and social norms used in governing and managing freshwater resources. It is determined by assessing:

- **Water Resource Management:** degree to which institutions are performing key management functions such as coordination, planning and financing, and conflict resolution.
- **Rights to Resource Use:** clarity of rights to water and water-related resources.
- **Incentives & Regulations:** availability of management instruments such as impact assessments and economic incentives.
- **Financial Capacity:** investment gap between allocated and required finances for water resource protection measures.
- **Technical Capacity:** number and skill level of professionals working in water resource management.

STAKEHOLDER ENGAGEMENT

The ways stakeholders interact and the degree of transparency and accountability around these interactions. It is determined by assessing:

- **Information Access:** accessibility of data on water quantity, water quality, resource management and development.
- **Engagement in Decision-Making Processes:** scope of stakeholders involved and the degree to which they have a voice in the cycle of policy and planning.

VISION & ADAPTIVE GOVERNANCE

The capacity to collect and interpret information, and then use this information to set goals for the basin and adapt to changing circumstances. It is determined by assessing:

- **Strategic Planning & Adaptive Governance:** degree to which comprehensive strategic planning takes place and whether the capacity to adapt plans to new information or changing conditions exists.
- **Monitoring & Learning Mechanisms:** adequacy and use of physical, chemical and biological monitoring of water resources, as well as socioeconomic data, to guide policy and planning.

EFFECTIVENESS

The outcomes from water-related policies and investment decisions. It is determined by assessing:

- **Enforcement & Compliance:** degree to which laws are upheld and agreements enforced.
- **Distribution of Benefits:** impacts of water resource management decisions, with special attention to vulnerable populations.
- **Water-Related Conflict:** presence of conflicts over water services, including allocation, access, pollution, diversion or infrastructure development.

For More Information
Visit www.freshwaterhealthindex.org
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