6 CLEAN WATER AND SANITATION

SUSTAINABLE DEVELOPMENT GOALS

UN WATER

Integrated Monitoring Initiative for SDG 6

Environmental Flow Requirements

Monitoring of SDG 6.4 Indicators for the Countries of the Near East and North Africa
Cairo, Egypt 13 - 14 December 2023

Riccardo Biancalani – Project Coordinator
Integrated Monitoring Initiative for SDG6, FAO

UN environment United Nations Environment Programme | UN HABITAT | Food and Agriculture Organization of the United Nations | unicef | UNECE | UNESCO United Nations Educational, Scientific and Cultural Organization | World Health Organization | WMO

WATER STRESS SDG 6.4.2

$$\text{Water Stress (\%)} = \frac{\text{Total freshwater withdrawn}}{\text{Total renewable freshwater resource - Eflow}} \times 100$$

- Global reporting
- Voluntary National Reviews

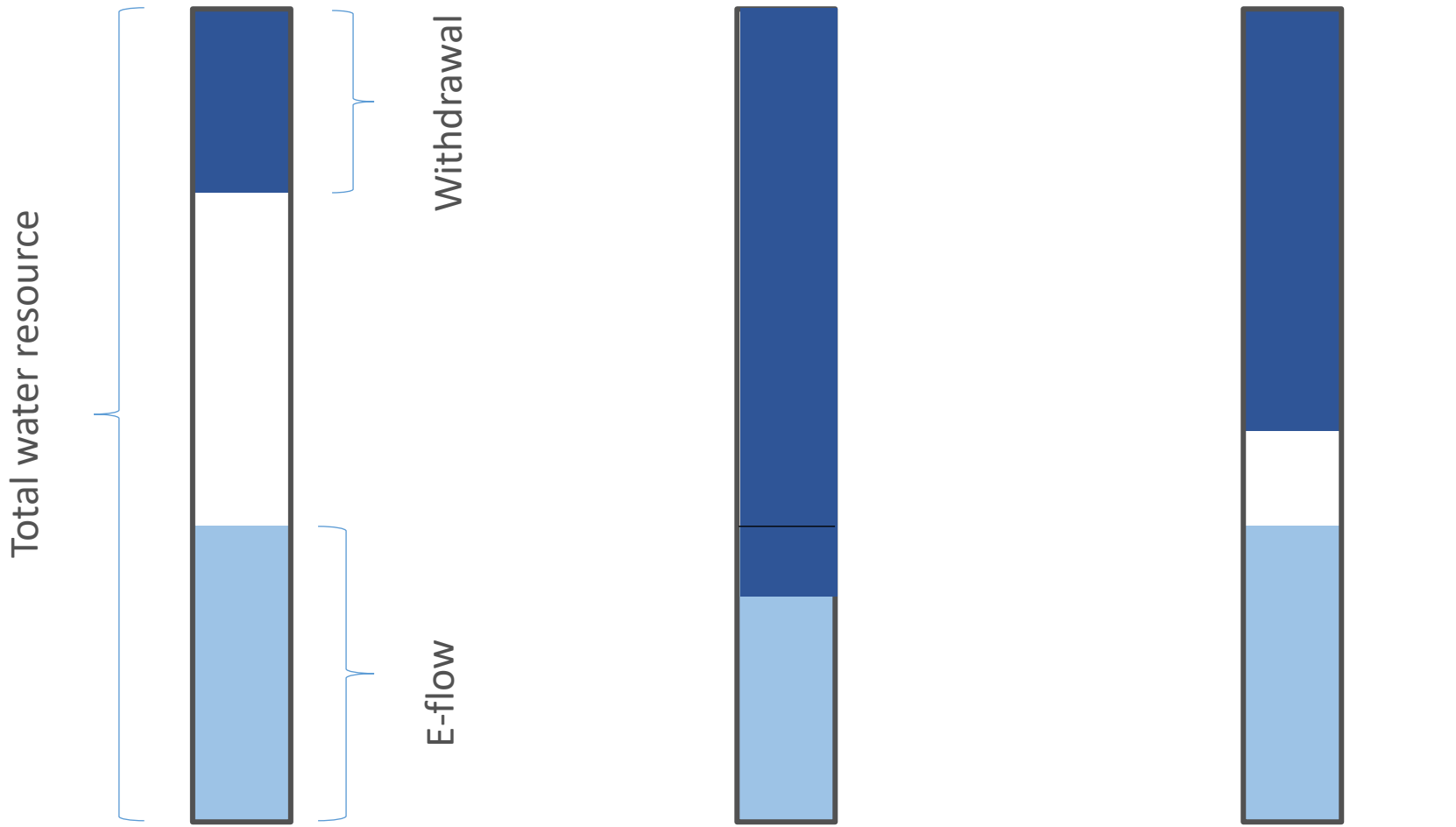
What are environmental flows?

The quantity and timing of freshwater flows and levels necessary to sustain aquatic ecosystems which, in turn, support human cultures, economies, sustainable livelihoods, and well-being (The Brisbane Declaration, adapted from Arthington et al 2018)

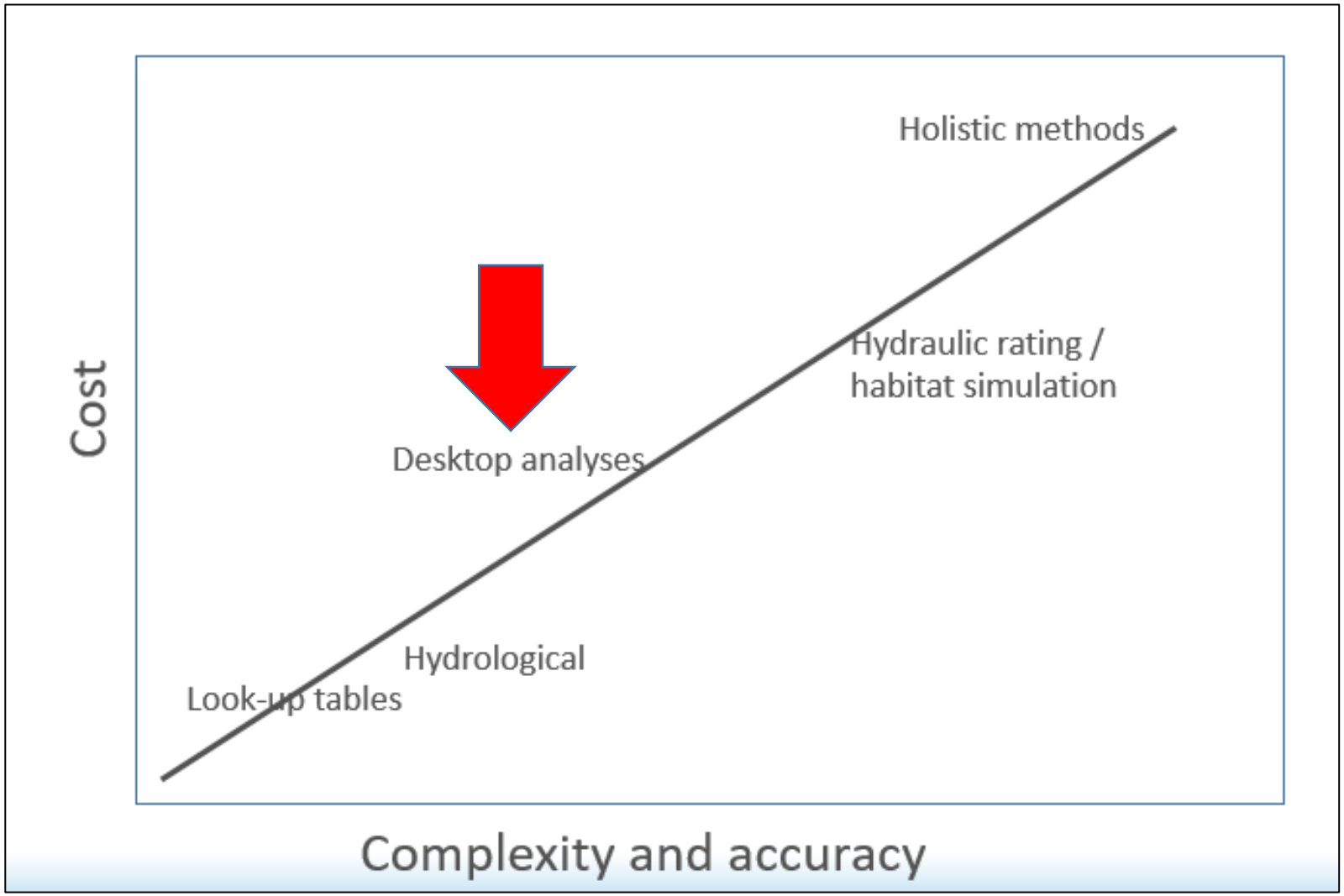
WHAT ARE E-FLOWS?

WATER STRESS

Smakhtin et al, 2004



ASSESSING THE E-FLOW FOR SDG REPORTING



ECOLOGICAL MANAGEMENT CLASSES

IN THIS REPORT THE PRESENT DAY EMC IS DETERMINED GLOBALLY ADAPTING THE APPROACH OF VÖRÖSMARTY ET AL. (2010) "INCIDENT BIODIVERSITY THREAT INDEX"

EMC	*Most likely ecological condition*	*Management perspective*
A (natural)	Natural rivers with minor modification of in-stream and riparian habitat	Protected rivers and basins. Reserves and national parks. No new water projects (dams, diversions) allowed
B (largely natural)	Slightly modified and/or ecologically important rivers with largely intact biodiversity and habitats despite water resources development and/or basin modifications	Water supply schemes or irrigation development present and/or allowed
C (moderately modified or "fair" condition)	The habitats and dynamics of the biota have been disturbed, but basic ecosystem functions are still intact. Some sensitive species are lost and/or reduced in extent. Alien species present	Multiple disturbances associated with the need for socio-economic development, e.g. dams, diversions, habitat modification and reduced water quality
D (largely modified)	Large changes in natural habitat, biota and basic ecosystem functions have occurred. Low species richness and enhanced presence of intolerant species. Alien species prevail	Significant and clearly visible disturbances associated with basin and water resources development, including dams, diversions, transfers, habitat modification and water quality degradation
E (seriously modified)	Habitat diversity and availability have declined. Ecosystems have been completely modified and basic ecosystem functions are failing. A strikingly reduced species richness. Only tolerant species remain. Alien species have invaded the ecosystem..	High human population density and extensive water resources exploitation is taking place with inadequate and/or polluted water in the ecosystem. This status is not acceptable from the management perspective. Management interventions are necessary to restore flow patterns and to 'move' the river to a higher management category

EFs to maintain the present day EMC

- The EFs required to maintain a river in a present-day EMCs are those EFs that will maintain the Earth's rivers in the same state that they are in today.
- EMCs will thus vary across rivers based on their existing state, ranging from A – E, and on the local presence of stressors that impact negatively on the river ecosystem, as well as on the resultant biodiversity to be found in that river.
- It is thus necessary to know the present-day EMC in advance and to use that EMC as a framework for setting the EFs.
- The *present day EMC* is used to calculate the water stress index in SDG 6.4.2

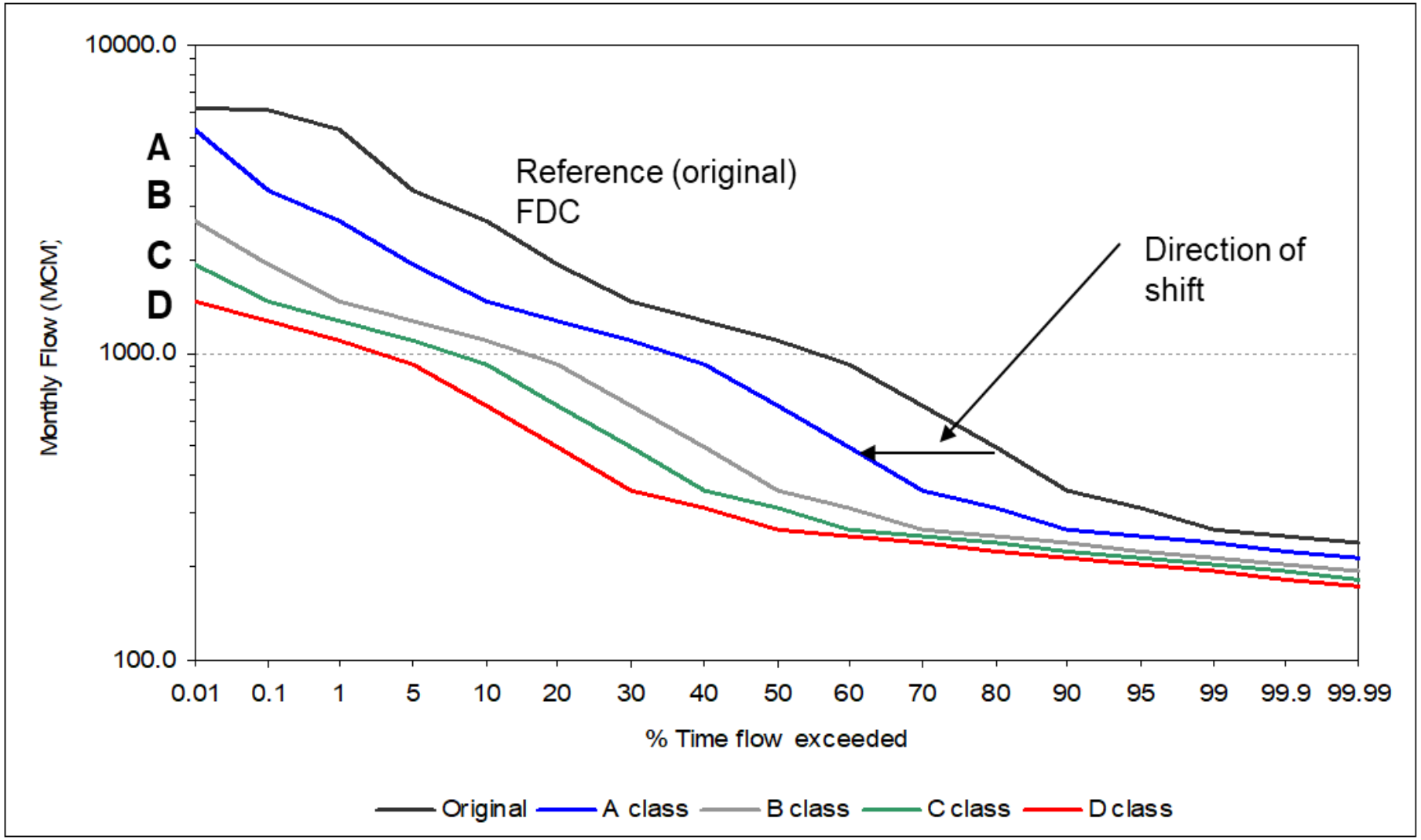
Flow duration curves

- A flow duration curve (FDC) is a plot that shows percentage of time the flow in a river is likely to equal or exceed a given flow value. A FDC is a simple measure of historic flow variability which is the key component in any EF concept and method, as it indicates seasonal and inter-annual variability

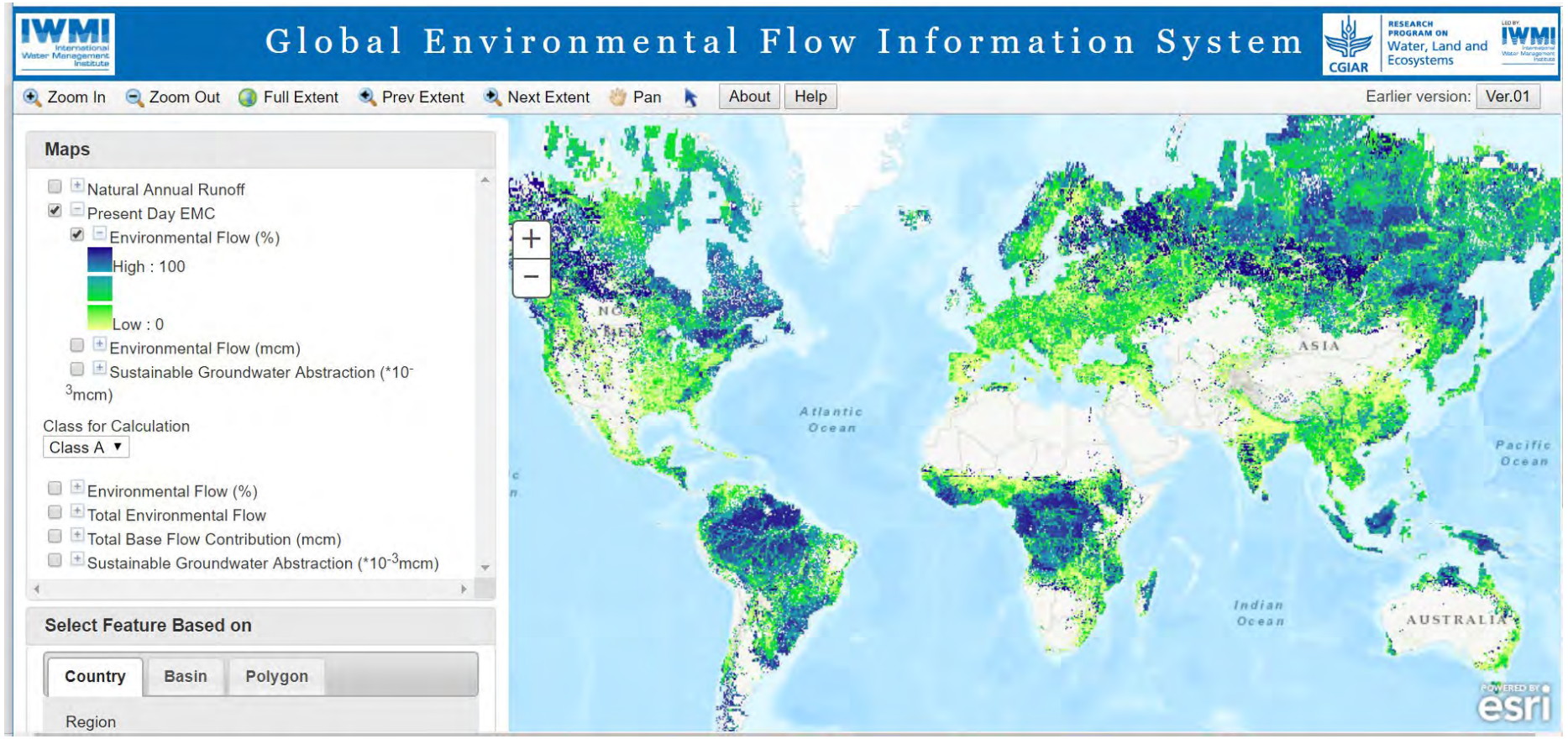
- These are then related to and represent prescribed / negotiated desired conditions of a river ecosystem i.e. the EMC

- In essence, it performs a stepwise shift of a FDC, so that the total EFs are reduced with declining EMC, while some features of natural flow variability are retained. The higher the EMC, the more water is needed for ecosystem maintenance and the more of the flow variability needs to be preserved.

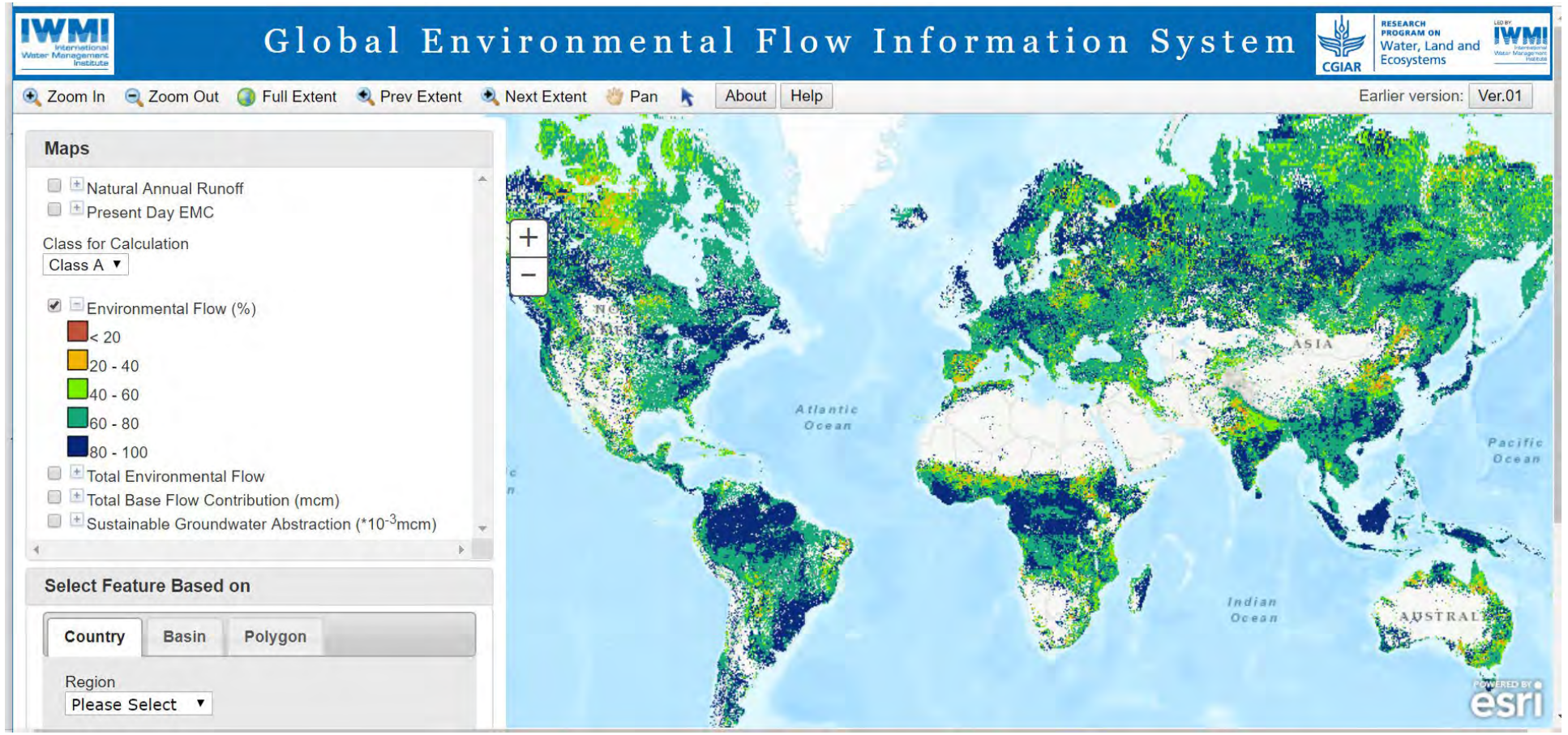
FLOW DURATION CURVES FOR DIFFERENT ECOLOGICAL MANAGEMENT CLASSES



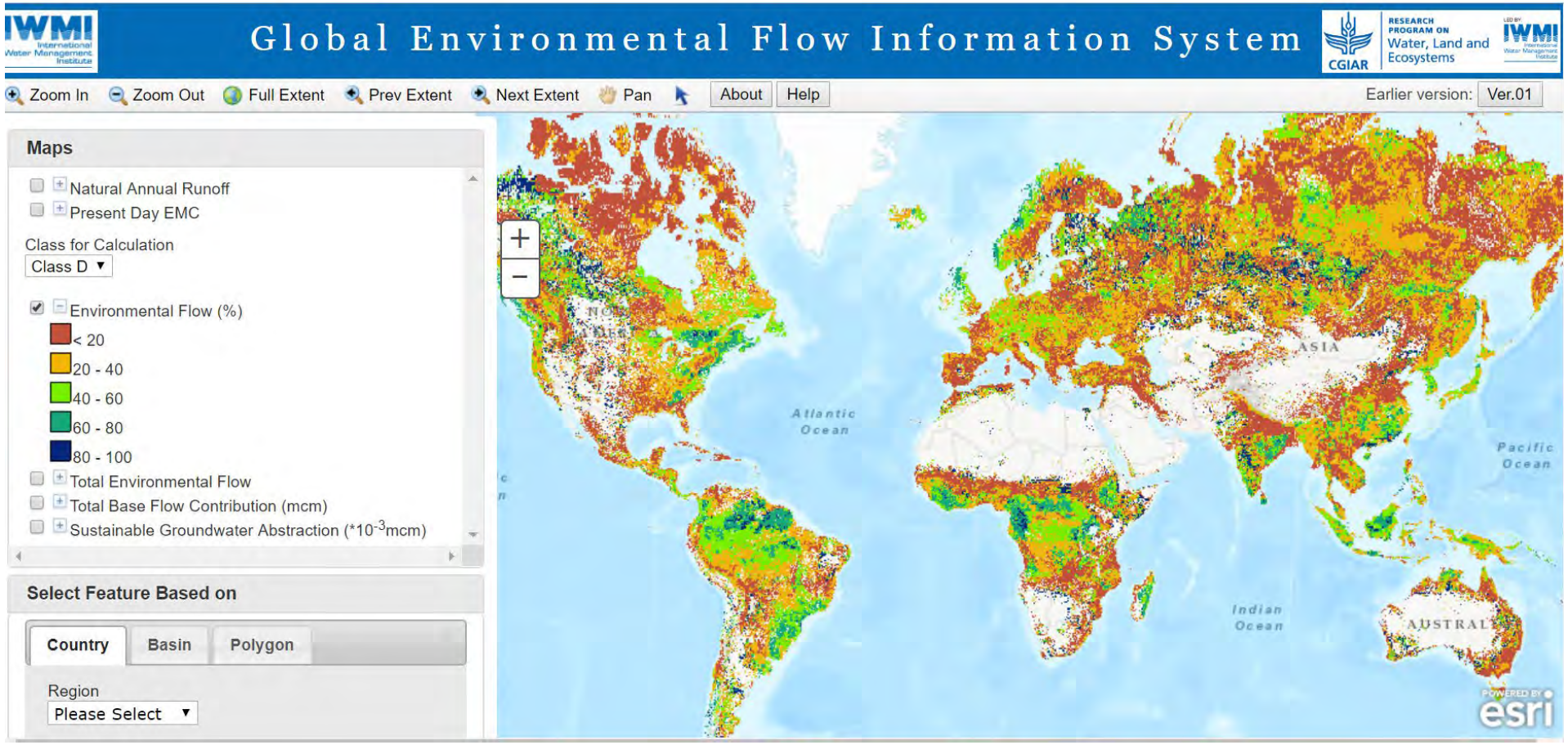
HTTP://EFLOWS.IWMI.ORG



“A” CLASS – THE NATURAL FLOW SITUATION



“D” CLASS – HARD WORKING



HOW GEFIS ESTIMATES THE EMC

From the **Incident Biodiversity Threat Index**

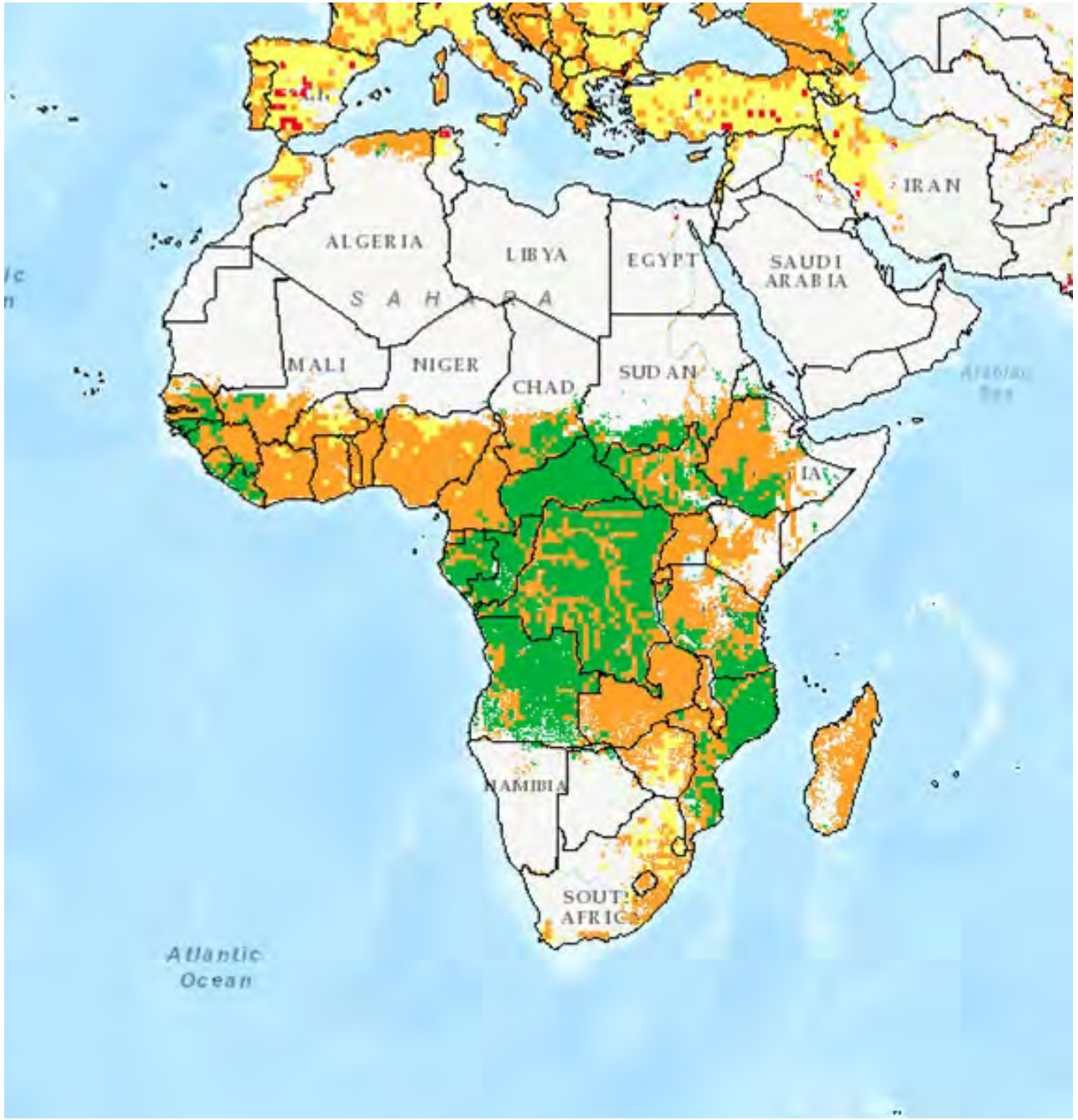
Water Resource Development	Water Resource Development
Dam density	Non native fish (%)
River fragmentation	Non native fish (#)
Consumptive water loss	Fishing pressure
Human water stress	Aquaculture pressure
Agricultural water stress	
Flow disruption	

Vörösmarty, C., McIntyre, P., Gessner, M. et al. Global threats to human water security and river biodiversity. Nature 467, 555–561 (2010). https://doi.org/10.1038/nature09440

HOW GEFIS ESTIMATES THE EMC

EMC	index
A (natural)	0 - 0.25
B (largely natural)	0.25 - 0.5
C (moderately modified)	0.5 - 0.65
D (largely modified)	>0.65

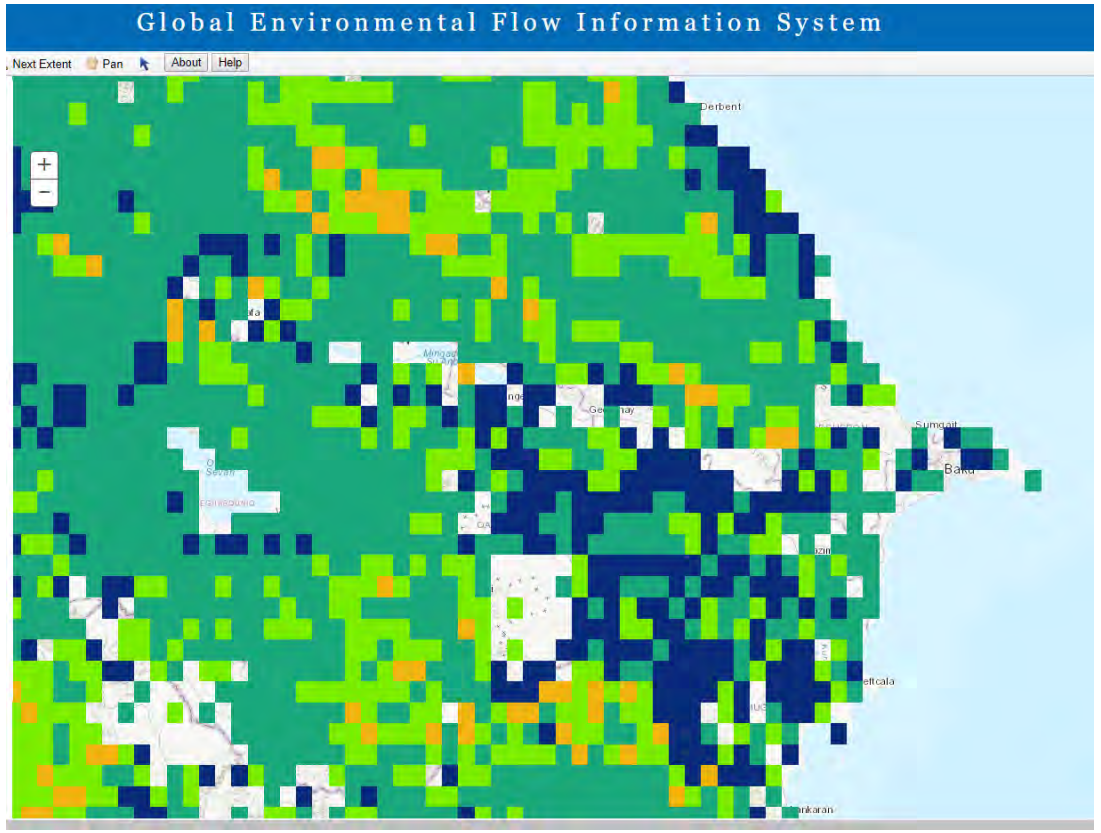
Actual EMC


Legend
CLASS A
CLASS B
CLASS C
CLASS D
ALGERIA
LIBYA
EGYPT
SAUDI ARABIA
IRAN
MALI
NIGER
CHAD
SUDAN
NAMIBIA
Atlantic Ocean

Actual EF = 33.3%; Class A EF = 66.2%

Global Environmental Flow in million cubic meters (Class A)

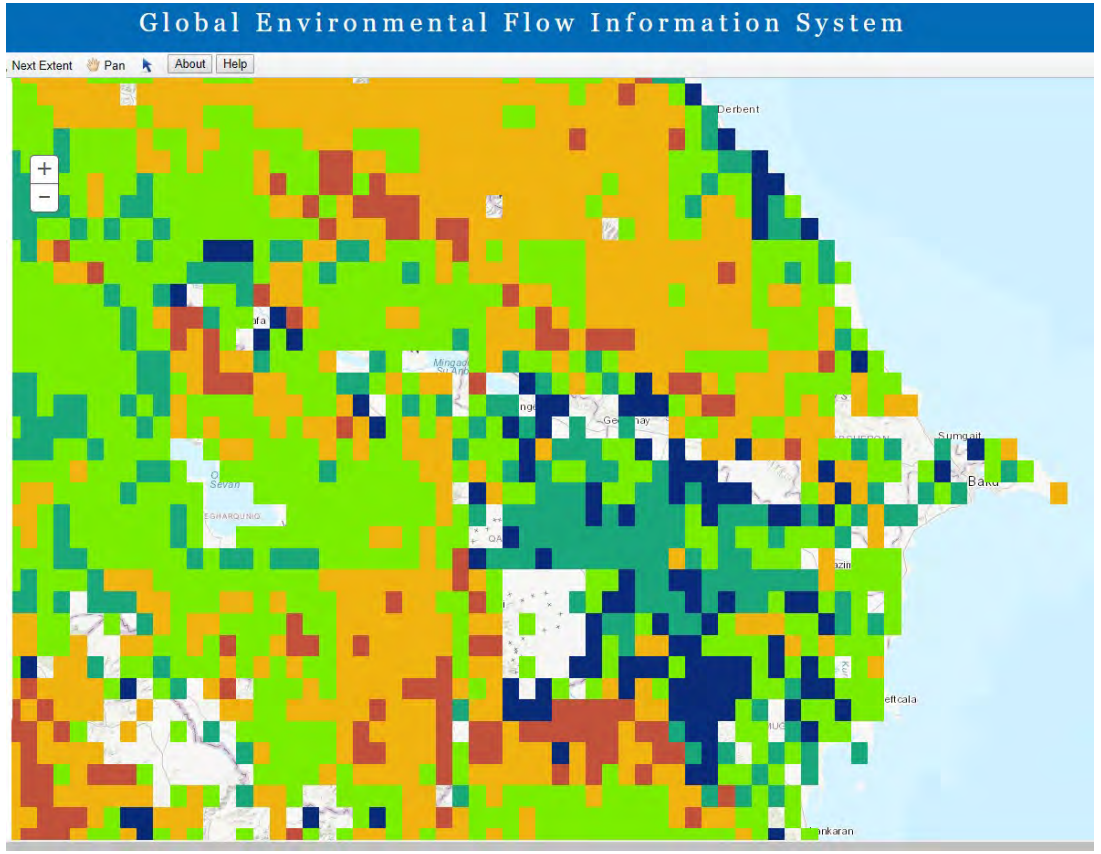
Type	Value
Environmental Flow (Class A)	7,042.56
Base Flow	2,146.53
Sustainable GW Abstraction	51.98
Present Day Environmental Flow	3,547.94
Present Day Sustainable GW Abstraction	89.92
Natural Annual Runoff	10,646.36



Actual EF = 33.3%; Class B EF = 42.8%

Global Environmental Flow in million cubic meters (Class B)

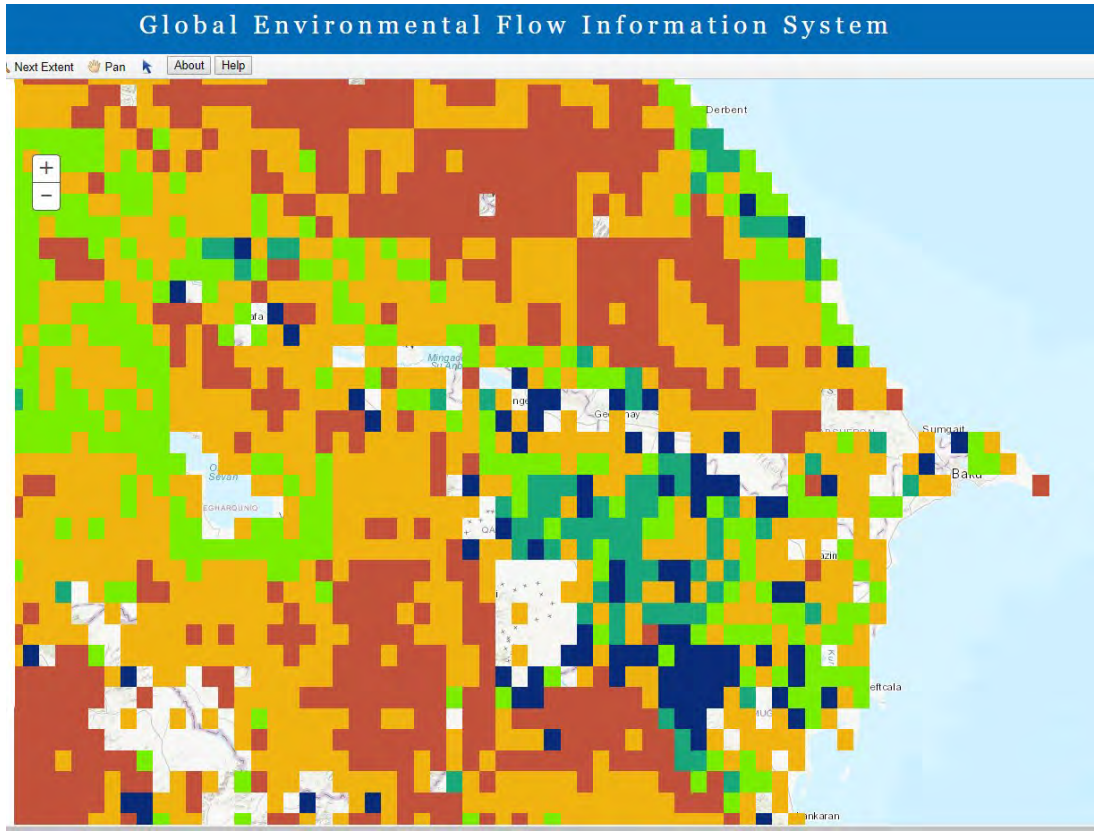
Type	Value
Environmental Flow (Class B)	4,556.00
Base Flow	1,335.04
Sustainable GW Abstraction	86.69
Present Day Environmental Flow	3,547.94
Present Day Sustainable GW Abstraction	89.92
Natural Annual Runoff	10,646.36



Actual EF = 33.3%; Class C EF = 27.5%

Global Environmental Flow in million cubic meters (Class C)

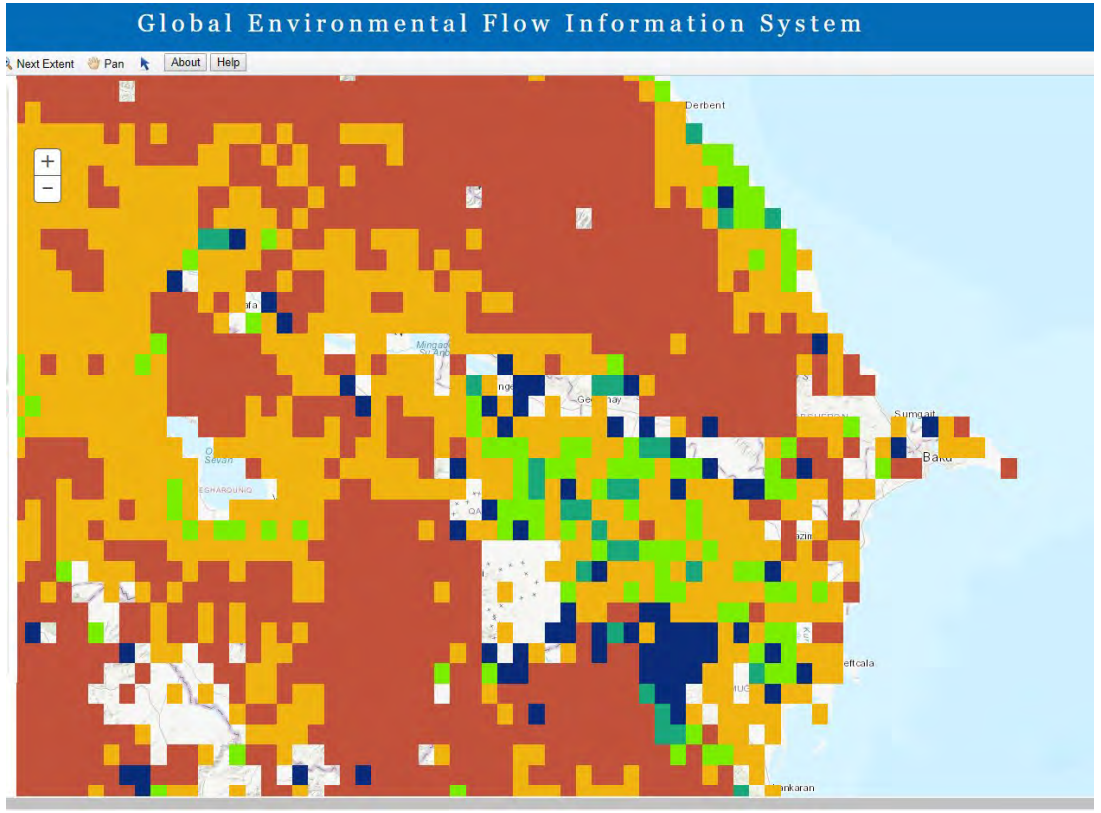
Type	Value
Environmental Flow (Class C)	2,925.69
Base Flow	841.85
Sustainable GW Abstraction	107.87
Present Day Environmental Flow	3,547.94
Present Day Sustainable GW Abstraction	89.92
Natural Annual Runoff	10,646.36



Actual EF = 33.3%; Class D EF = 17.9%

Global Environmental Flow in million cubic meters (Class D)

Type	Value
Environmental Flow (Class D)	1,907.73
Base Flow	542.06
Sustainable GW Abstraction	120.67
Present Day Environmental Flow	3,547.94
Present Day Sustainable GW Abstraction	89.92
Natural Annual Runoff	10,646.36



External resources

- IWMI – **GEFIS**
  http://eflows.iwmi.org/
- IWMI- **Global Environmental Flow Calculator (GEFC)**
  https://www.iwmi.cgiar.org/resources/data-and-tools/models-and-software/environmental-flow-calculators/#Global
- IWMI - **Global Environmental Flow Information for the Sustainable Development Goals**
  http://www.iwmi.cgiar.org/Publications/IWMI_Research_Reports/PDF/pub168/rr168.pdf
- FAO-IWMI-UNU: **Incorporating environmental flows into "water stress" indicator 6.4.2**.
  http://www.fao.org/documents/card/en/c/CA3097EN
- FAO-IHE Delft: **Online course of environmental flows (EF)**
  - https://ocw.un-ihe.org/course/view.php?id=233 (English)
  - https://ocw.un-ihe.org/enrol/index.php?id=238 (Français)

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THANK YOU!