

# Ecosystem-based solutions in drought risk management Platform, January 2018





- 1. Drought is more than a lack in precipitation
- 2. Healthy ecosystems are key for ecological and socio-economic drought resilience
- 3. Ecosystems themselves are threatened by droughts
- 4. ...so what should we do?

1.Drought is more than a lack in precipitation

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*Meteorological drought* = significantly less than average precipitation

Blue water drought = deficiency in water stored in lakes, rivers, aquifers and wetlands

Green water drought = deficiency in water stored in soil and/or vegetation

Sayers et al.(2016): Drought risk management: A strategic approach. Published by UNESCO on behalf of WWF and GIWP



Graphic from Tague, N.(2016): "How above-ground forest structure and below-ground water storage interact to determine forest sensitivity to changes in climate and forest management practices"; https://tagueteamlab.org/category/presentations/

#### Green water storage capacity



WWF at Alpine Convention Water Management Platform, 23.01.2018

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2. Healthy ecosystems are key for ecological and socio-economic drought resilience





- è Resilient ecosystems can provide services to increase individual and economic resilience to drought, e.g.
- regulation of local climate
- water storage/supply
- fertility despite water deficiency
- provision of alternative food / income

### e.g. Beaver "services"



- reduce discharge peaks
- increase (blue) water storage capacity e.g. by elevating the water table
- increase wood debris on the soil surface
- influence the vegetation dynamics
- increase the diversity of habitats and species in riparian areas
- Beaver ponds act as refuge for fish in times of drought

Rosell et.al (2005): Ecological impact of beavers Castor fibre and Castor canadensis and their ability to modify ecosystems. Mammal Review Volume 35 DOI: 10.1111/j.1365-2907.2005.00067..



### **Ecosystem resilience**

Ecosystems tend to be more resilient to stress (drought or other), when

- they are **diverse** in species and structure
- the **flows** (of water, nutrients, energy, etc.) are not interrupted
- the life cycles are not interrupted





### **Environmental Flow**

Pluvio-nivales Regime



Nivo-pluviales Regime Abb. 4: Jahresverlauf (Jänner - Dezember) von Abflussregimetypen alpin geprägter Flüsse: glaziales, glazio-nivales, nivo-glaziales, nivales, nivo-pluviales und pluvio-nivales Regime (modifiziert nach Mader et al. 1996).



Abb. 10: Schlüsselmerkmale und deren Änderung im Längsverlauf eines schematisierten Fließgewässersystems. Dicke und Länge der Pfeile zeigen die Intensität der Interaktionen und Austauschprozesse in der longitudinalen, vertikalen und lateralen Erstreckung (Pfeile) (verändert nach Jungwirth et al. 2003).



Abb. 16: Lebenszyklus und Habitatansprüche der Äsche (Thymallus thymallus) (Quelle: Jungwirth et al. 2000, nach Sempeski & Gaudin 1995a, b, c).



Abb. 9: Das natürliche Temperaturregime eines Flusses beeinflusst die Biodiversität durch verschiedene Mechanismen auf unterschiedlichen räumlichen und zeitlichen Skalen. Dargestellt sind Fische (kursive Schrift), Makroinvertebraten (normale Schrift) und Vegetation (unterstrichene Schrift) (Quelle: Olden & Naiman 2010).

Hayes et al. (2017). E-flow Alps – Ökologisch funktionsfähige Abflussmengen (e-flows): Wissenschaftliche Grundlagen und Vergleich der Bestimmungen in den Alpenländern. Studie im Auftrag des WWF Schweiz, Zürich.

WWF at Alpine Convention Water Management Platform, 23.01.2018

Nivales Regime



# 3.Ecosystems themselves are threatened by droughts



#### ...so what to do?

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- è Ecosystems must be drought resilient, in order to stabilize socioeconomic drought resilience
- in the long term, before drought events, ecosystems/e-flow must be conserved rsp. restored to a good level, and taken into account in spatial/landscape management
- In case of drought, e-flow must be the first parameter taken into account, before dedicating water to different uses; this include all e-flow parameters, not only volume (temperature!)
- è The best way to guarantee this, is the ecosystem as reference basis for an integrated river basin management (IRBM)



map © Wikipedia

è Study in 2015: water flow scenarios due to climate change



### e.g. IRBM Engadin

#### Changes in Annual Water Flow (moderate scenario)



Bernhard, L. et al (2015), Auswirkungen des Klimawandel auf den Wasserhaushalt des Engadiner Inns und seiner Teileinzugsgebiete, Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft (WSL)



### e.g. IRBM Engadin

#### Changes in Summer Water Flow (moderate scenario)



2085

Bernhard, L. et al (2015), Auswirkungen des Klimawandel auf den Wasserhaushalt des Engadiner Inns und seiner Teileinzugsgebiete, Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft (WSL)

## e.g. IRBM Engadin



è Study in 2015:

water flow scenarios due to climate change

è Analysis of problems and opportunities with experts and stakeholders



è cross-sectoral planning for water supply for settlements, tourism, agriculture and hydropower,

based on protection of water resources

