

IMPACT OF HYDROLOGICAL HAZARDS ON THE ECOLOGICAL STATUS OF RIVERS ACCORDING TO THE EU-WFD

I. Schnauder

TU Wien, Dept. Hydraulic Engineering

E-mail: ingo.schnauder@tuwien.ac.at



8th Bulgarian-Austrian Seminar

„Not as resilient as we thought“

„Nicht so resilient, wie wir dachten“

„Der diesjährige heiße und trockene Sommer ist ein Weckruf, denn er ist ein Vorgeschmack auf die Wetterbelastungen, die noch kommen werden“, sagt de Vries. „Unsere Arbeit hat gezeigt, dass solche Sommerdürren die Bodenbiologie nachhaltig verändern. Die Bakteriengemeinschaften im Boden sind nicht so widerstandsfähig und resilient, wie wir dachten.“ Das habe auch für die Landwirtschaft und die Sicherung der Nahrungsmittelversorgung eine enorme Bedeutung.

18. Oktober 2018 14:03



Dürre-Alarm

© Victoria Bichler

Seen und Flüsse in Österreich ausgetrocknet

Die Seen drohen nach Hitze-Rekord auszutrocknen: Auch Deutschland ist betroffen

Österreich trocknet aus. Seen und Flüssen geht das Wasser aus. In der Donau fließt derzeit nur 41 % der üblichen Wassermenge. Der Spiegelsee in der

30-31 May 2019-Sofia

Trockenheit gefährdet Fischbestände

Seit Monaten mangelt es in weiten Teilen Oberösterreichs an Wasser - und das wirkt sich auch auf die Fischbestände aus. Der Landesfischermeister Siegfried Pilgerstorfer spricht von „katastrophalen Zuständen“ in den Quellgebieten.

In vielen Bächen sollten die Bachforellen dieser Tage ablaichen - doch wo zu wenig Wasser, da kein Laichplatz, so Alfred Kirnbauer, Obmann des Fischereireviereviere Innbach: „Das Laub, das derzeit in die Bäche fällt, dichtet die Bäche ab. Die Fische benötigen aber eine Strömungsgeschwindigkeit und einen Schotterlückenraum. Aber das ist nicht mehr gegeben.“

ORF



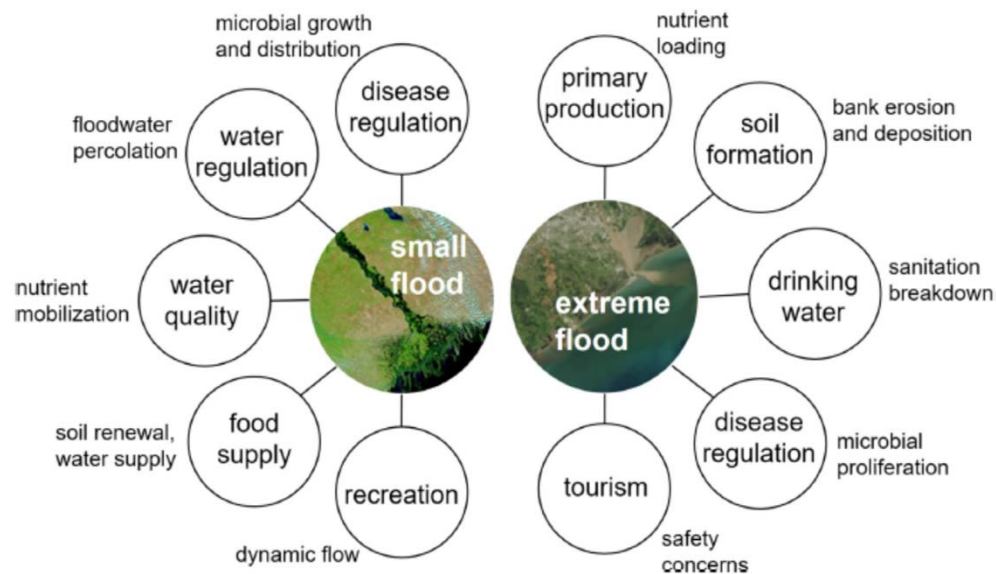
Some ecological effects of droughts:

- Loss of connectivity
- Waterbodies falling completely dry
- Loss of spawning habitats (sediment / organics)
- Water quality change (temperature, nutrients, oxygen)
- Algal bloom + toxins



Some ecological effects of floods:

- Loss of connectivity
- Loss of organisms (irreversible drift)
- Input of sediments, nutrients
- Dispersal of litter and pollutants (e.g. oil, dioxins)
- Habitat loss due to morphologic changes



Talbot et al. 2018, Biogeochem

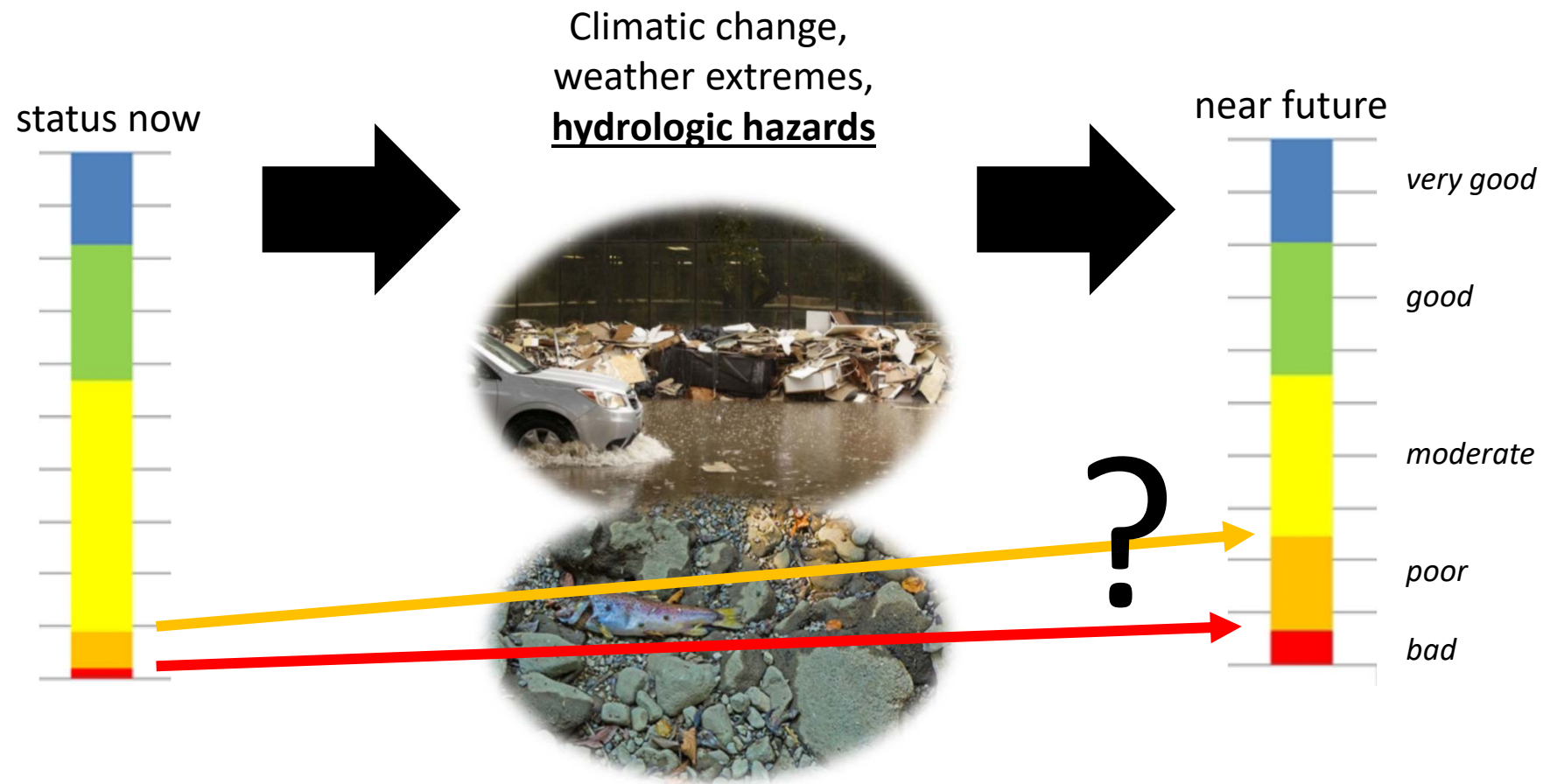
Ausgerechnet Fische stört das Hochwasser

Ein Ökosystem aus dem Gleichgewicht bringen kann so ein Hochwasser aber durchaus – und zwar vor allem dort, wo der Mensch die Natur verändert hat. Das zeigt sich ausgerechnet an Fischen, von denen man meinen könnte, Wasser mache ihnen wenig aus.

Das Hochwasser spült sie häufig aus ihrem Lebensraum heraus. In natürlichen Flussläufen und Auen wäre das kein großes Problem: Die Fische fänden auch woanders im Fluss genügend Nahrung und könnten problemlos in ihren angestammten Lebensraum zurück schwimmen.

8th Bulgarian-Austrian Seminar

EU-WFD: ecological status of rivers



8th Bulgarian-Austrian Seminar

EU-WFD: overview



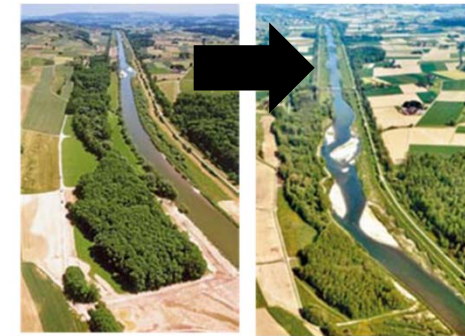
- EU directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies
- Very ambitious piece of environmental legislation
- Aquatic ecology put in the centre of water management
- Huge efforts in assessment of water bodies, e.g. all rivers > 10km²
- Standards and methods for evaluation (+EU intercalibration)
- What did it bring us...?



Money + jobs!



awareness



River Thur before restoration

River Thur after restoration

better rivers

30-31 May 2019-Sofia

8th Bulgarian-Austrian Seminar

EU-WFD: parameters of the ecological status

decisive
components

- Phytoplankton (algae)
- Macrophytes and phytobenthos
- Benthic invertebrate fauna
- Fish fauna



Hydromorphology

- Hydrological regime
- Morphology
- River continuity



supplementary
components

Physico-Chemical Parameters

- Thermal conditions
- Oxygenation conditions
- Acidification conditions
- Nutrient conditions
- Salt content
- Specific synthetic pollutants
- Specific non-synthetic pollutants

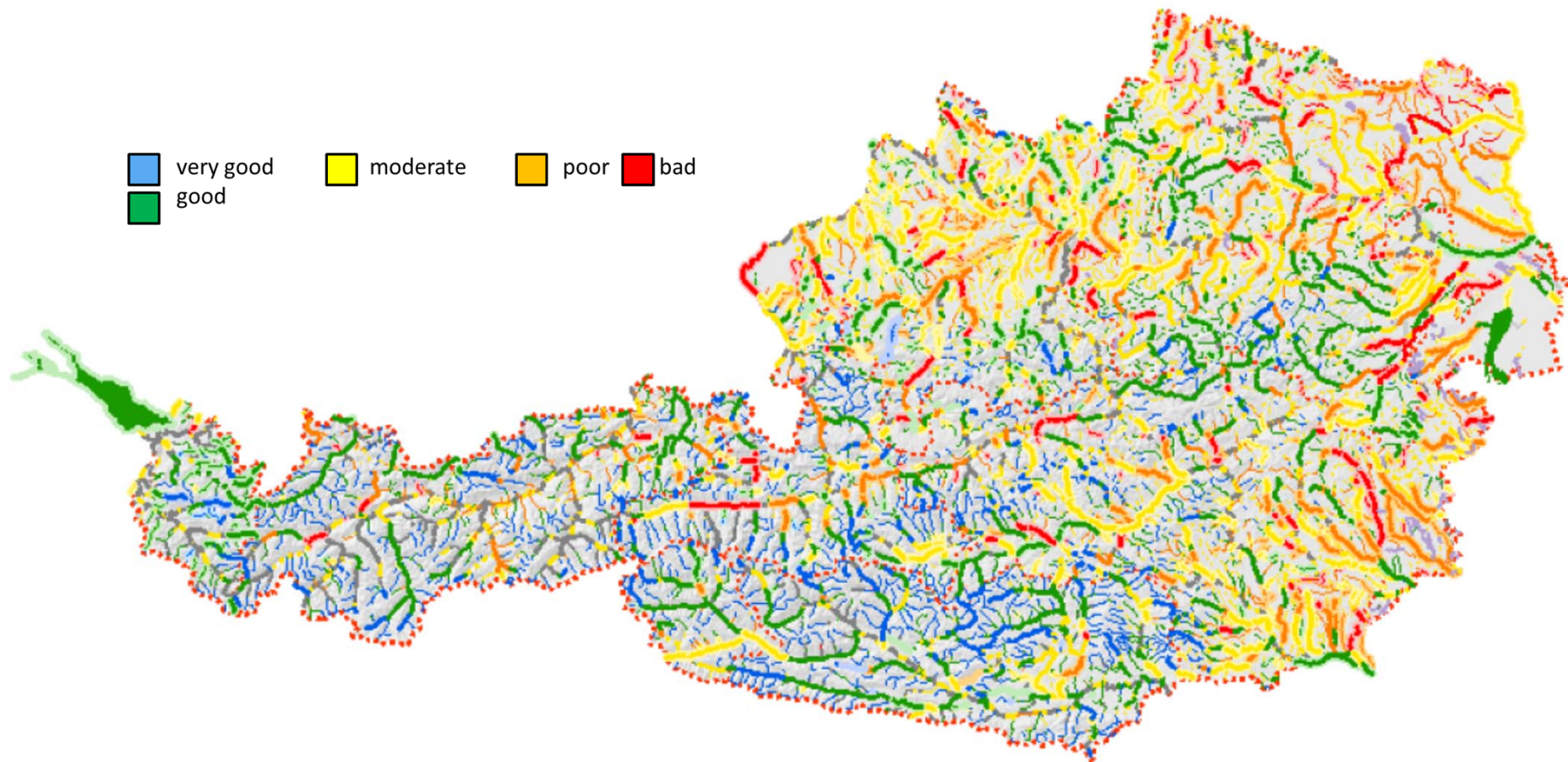
*Water
quality*

pollutants

30-31 May 2019-Sofia

8th Bulgarian-Austrian Seminar

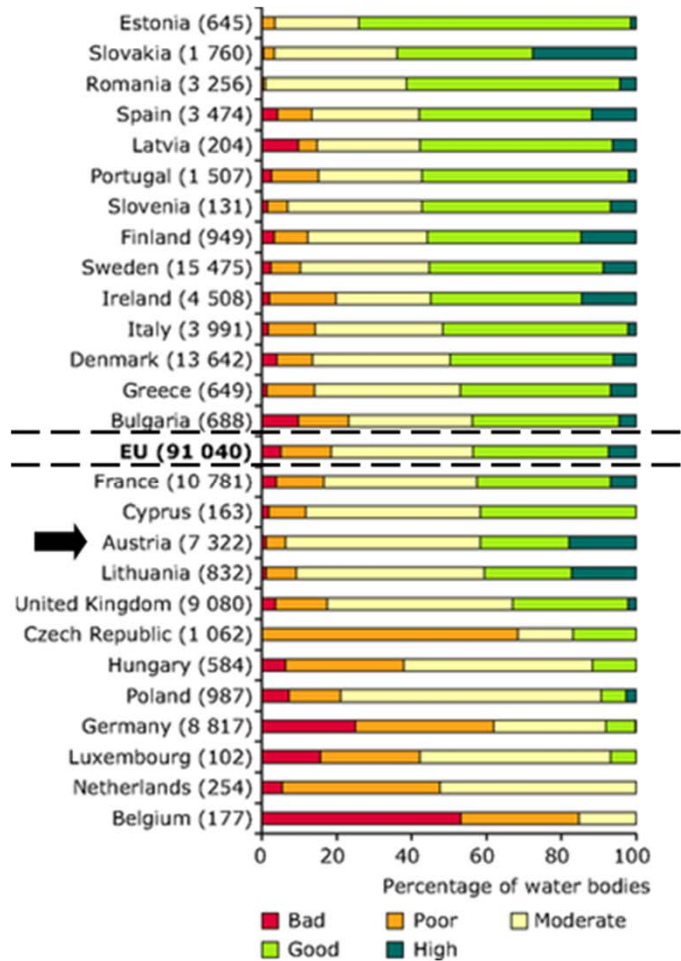
Austria 2015: rivers + lakes ecological status



30-31 May 2019-Sofia

8th Bulgarian-Austrian Seminar

Austrian rivers in comparison EU

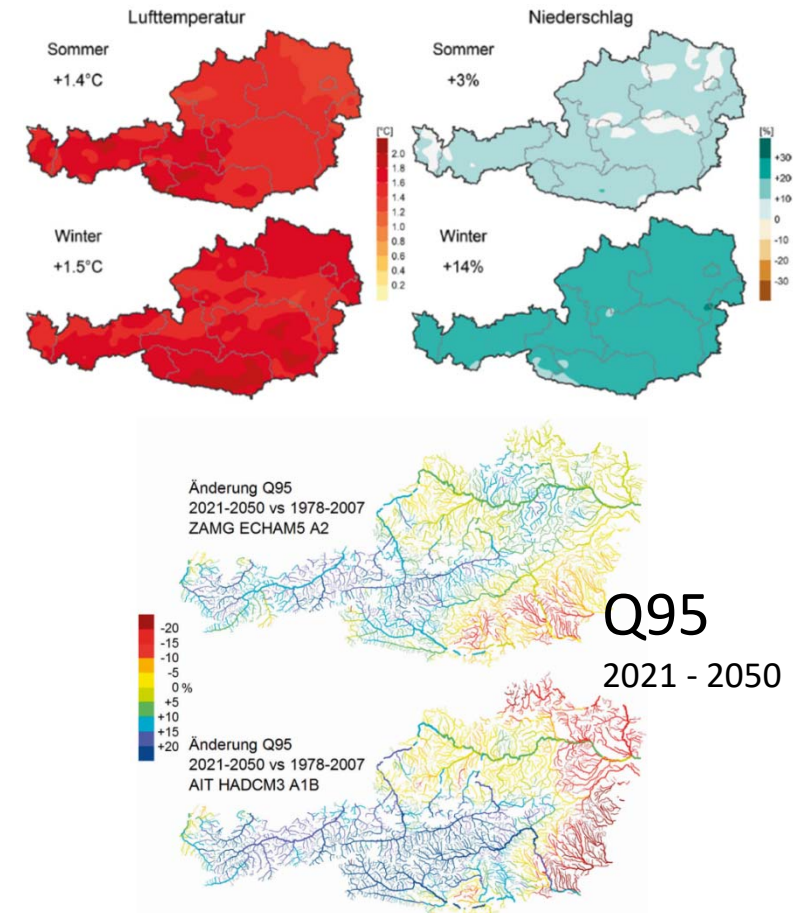


37%
achieved

30-31 May 2019-Sofia

Climatic changes and weather extremes from Blöschl et al. (2018)

- Strong precipitation events may remain in frequency but increase in magnitude, causing an increase in flood discharges.
- In the lowlands in eastern and south-eastern Austria, low discharges as well as mean annual discharges may decrease. Consequently, groundwater recharge over the year may tendentially decrease, particularly in the east.
- Low discharges during winter will increase in the Alps. Groundwater recharge will thus remain constant or increase.
- (Flashy) Floods due to pluvial surface runoff will become increasingly important.



Blöschl et al., ÖWaWi (2018)

30-31 May 2019-Sofia

8th Bulgarian-Austrian Seminar

Significance of pressures – floods and droughts

Quality components	Physical and chemical quality elements	Hydromorphological quality elements	Phytoplankton *	Phytobenthos	Makrophytes	Benthic invertebrate fauna	Fish fauna
Pressures							
Material pollution							
Nutrient	x		(x)	x	(x)	(x)	
Oxygenation conditions	x			(x)		x	(x)
Temperature	x					(x)	x
Salinization**	x			(x)		(x)	(x)
Acidification	x			(x)	(x)	x	(x)
Pollutants	x						
Hydromorphological pressures							
Morphological changes		x			(x)	(x)	x
Only changes in the streambed		x				x	(x)
Residual flow		x			(x)	(x)	x
Hydropeaking		x			(x)	(x)	x
Impoundment		x			(x)	x	(x)
Continuity interruption		x				(x)	x

Not easy
on the
species
level...

floods and
droughts

floods

droughts

floods

droughts

Qualitätszielverordnung
Ökologie
Oberflächengewässer - QZV
Ökologie OG, Annex B
(2010). Bundesministerium
für Land- und
Forstwirtschaft, Umwelt und
Wasserwirtschaft,

x – highest significance,
(x) – lower, yet still pronounced significance.

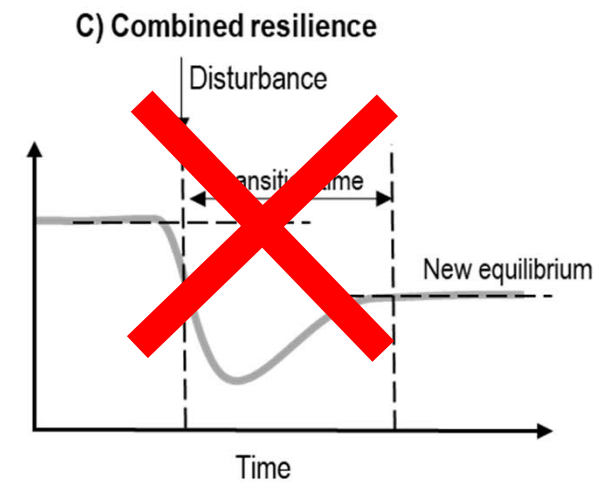
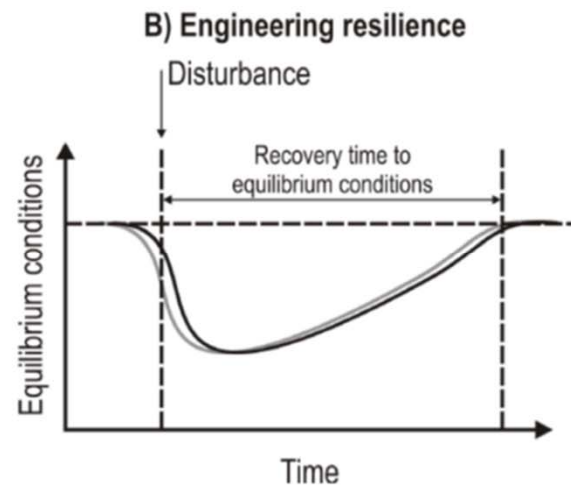
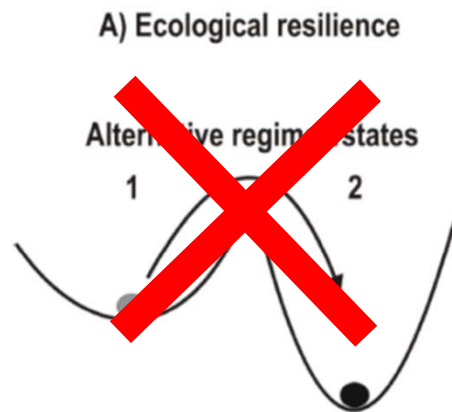
30-31 May 2019-Sofia

Translation into potential ecological impacts (general level)

- Strong precipitation events may remain in frequency but increase in magnitude, causing an increase in flood discharges.
 - In the lowlands in eastern and south-eastern Austria, low discharges as well as mean annual discharges may decrease. Consequently, groundwater recharge over the year may tendentially decrease, particularly in the east.
 - Low discharges during winter will increase in the Alps. Groundwater recharge will thus remain constant or increase.
 - (Flashy) Floods due to pluvial surface runoff will become increasingly important.
- Increase soil erosion and fluxes of fine sediments and nutrients into the rivers
 - Intensity of droughts will increase and rivers running dry will more often be the case in the lowlands.
 - Groundwater exfiltration into the rivers will tendentially decrease and alter nutrient and temperature regimes due to the lacking dilution (lowlands).
 - Low discharges may increase during winter in the Alps. This may stabilise ecological conditions.

8th Bulgarian-Austrian Seminar

EU-WFD: how to deal with floods + droughts?



before = after

from Angeler, 2013

30-31 May 2019-Sofia

8th Bulgarian-Austrian Seminar

Austrian guidelines: floods and droughts



www.lebensministerium.at

component	Recommendations in guidelines
Biological components (general)	Wait with sampling Expert judgement
Fish	Consider 3 years prior to sampling Expert judgement
Benthic invertebrates	Wait 4-6 weeks Consider floods, droughts, spills
Phytobenthos (benthic algae)	Consider conditions prior to sampling Wait 3-4 weeks Consider sediment transport (HQ1)
Macrophytes	Wait 4 weeks Consider flow conditions during sampling
GPC parameters	No specific statements Take fish as indicator organisms
Hydromorphology	No statements

30-31 May 2019-Sofia

Can EU-WFD handle the impact of hydrologic hazards?

- The “hydrologic regime” (parameter of hydromorphology) according to the EU-WFD does **not include** all of the ecologically relevant parameters to characterise **natural flow regimes and regime shifts** due to floods and droughts.
- “Morphology” (parameter of hydromorphology) in the EU-WFD follows a static approach of the structural inventory of the rivers. It does **not consider morphodynamics and sediment transport** – which are strongly impacted by floods and droughts.
- The best practice according to the guidelines is to **suspend sampling and data collection** of biological quality components during and after floods and droughts – until representative (pre-event) conditions reestablish.

Благодаря !

[blagodarya]



I. Schnauder
TU Wien, Dept. Hydraulic Engineering
E-mail: ingo.schnauder@tuwien.ac.at

