

# Welcome at the HTW Dresden

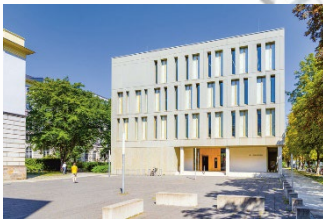
## Teaching, Studies, Research & Transfer Internationalization

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Sustainability and Transfer  
HTW Dresden – University of Applied Sciences



# Two Locations

## ▲ Campus Dresden City



## ▲ Campus Pillnitz



# Campus Dresden City



# Campus Pillnitz



# More than 40 Study Programmes in 8 Faculties

- Civil Engineering
- Electrical Engineering
- Agriculture/Environment/Chemistry
- Informatics/Mathematics
- Spatial Information
- Mechanical Engineering
- Business Administration
- Design





# Clean water in a changing Mongolia: floodplains, plastics and people

## From nomadic material cycles to urban plastics: a nexus view

23.10.2026

Vjosa floodplain (Albania) in April 2026



# Mongolia's water system

## Mongolia in transformation

- From nomadic life and natural material fluxes to modern urban life with plastics and other novel entities
- From reuse and durable natural materials to single-use packaging and uncollected waste
- Floods, frost-thaw and strong UV break plastic down: rates not measured



Schematic map, boundaries approximate. Shares of water resources and area: Davaa et al. (2007), Fig. 5.

### Arctic basin: 49 % of the water

- 20 % of the area, incl. Ulaanbaatar
- Selenge, Orkhon, Tuul → Baikal → Yenisei → Arctic Ocean

### Pacific basin: 11 % of the water

- 12 % of the area
- Onon, Kherlen → Amur → Sea of Okhotsk

### Internal basin: 40 % of the water

- 68 % of the area
- Khovd, Zavkhan, Gobi: no outlet to the sea



# Mongolia: clean water under pressure

## Drinking water

- Withdrawals (1996): 80 % groundwater, 20 % surface water
- Population: 31 % tap water, 25 % tanks (mostly groundwater), 36 % own wells, 10 % rivers
- Ulaanbaatar tap water: bank filtrate from the Tuul

## Rivers and floodplains

- Rivers, lakes and floodplains are habitats
- Plastic reaches the Tuul and Selenge directly or by wind across the steppe
- Snowmelt floods move it into floodplains: stored, remobilised, broken down

## People and society

- Cities, farms and herders meet the river
- Waste systems lag behind urban growth (ger districts of Ulaanbaatar)
- Novel entities: plastics, chemicals, other human-made substances (Persson et al. 2022)

**What happens to novel entities on their way from the river to the well? How can floodplains protect our water?**

**Our approach: nature-based solutions (preserving floodplains, riverbank filtration) can secure ecosystem services, deliver clean drinking water and engage people.**

Sources: Davaa et al. (2007); Batsaikhan et al. 2018; Persson et al. 2022.

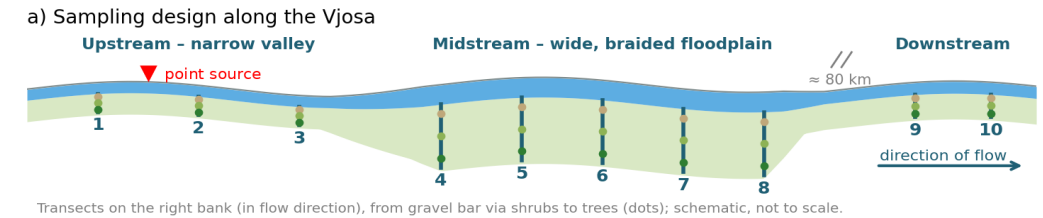
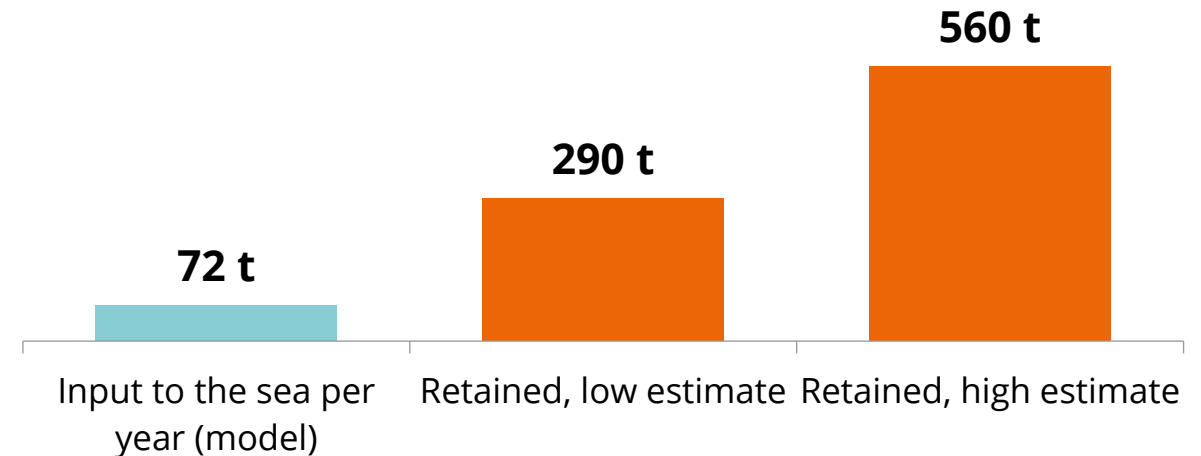
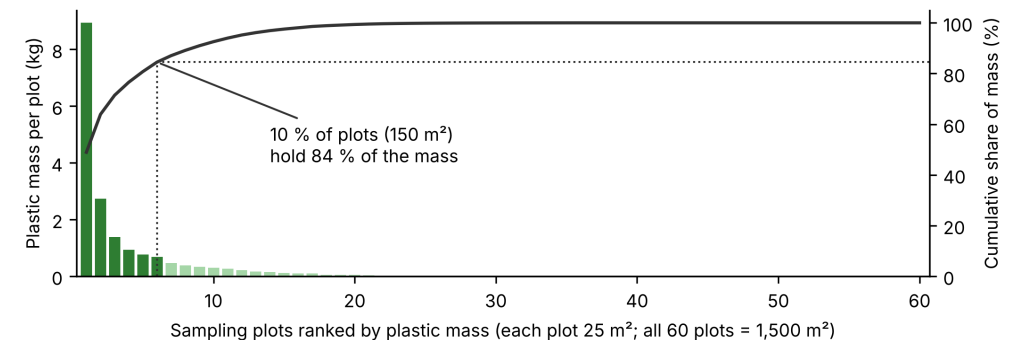
# Competence 1: floodplains retain macroplastic

## Pilot study Vjosa, Albania

Arne Cierjacks (vegetation, biodiversity), Kathrin Harre (plastics),  
Sajmir Beqiraj (Vjosa expert, Uni Tirana)

- **290–560 t** macroplastic deposited in a single flood season
- **4–8×** the estimated yearly plastic input of the river into the sea (about 72 t)
- **84 %** of the plastic mass lay in 10 % of the plots: hotspots are real
- Illustrative example: after a flood, 1,000 volunteer days of targeted clean-up could recover roughly 20–70 t

input to the sea: model estimate (Meijer et al. 2021). Plastic deposits: own results by Seidel, Cierjacks, Harre, Beqiraj.





## Competence 2: plastic transformation, macro to nano

### Fragmentation by abrasion

- We study fragmentation by bed-load transport (German LAWA guidance, Water Framework Directive)
- Real river energy input data
- Abrasion data from lab experiments

### Reference materials

- Micro 100–1000  $\mu\text{m}$ : number-accurate, uniform, single-size
- Small micro to submicro 800 nm – 10  $\mu\text{m}$
- Nano 200 nm to  $< 1 \mu\text{m}$
- Many polymers
- UV ageing
- Electron beam: accelerated, large quantities

### DSC: all size classes

- Low cost, suited to monitoring
- Detects macro-, micro- and nanoplastic
- Applied to the Elbe (42 plots) and the Vjosa (60 plots)

**Our approach: predict abrasion from river energy input and lab data, and ageing from radiation; test both in Mongolia.**

**Round-robin test with partner laboratories: same reference materials, comparable results from the Vjosa and Elbe to the Biobío and the Tuul.**



# Competence 3: riverbank filtration and water protection

## Riverbank filtration and managed aquifer recharge

- Prof. Thomas Grischek, Water Sciences: projects in India, Thailand, Vietnam, Egypt, Jordan, Europe
- Idea: efficacy and resilience of riverbank filtration in Mongolia, under floods and droughts
- Low-cost IoT wells, clogging, groundwater model
- Micropollutants, mining substances, microplastics
- GIS study on aquifer recharge
- Nature-based solutions + post-treatment

## Rainwater harvesting and storage

- Assess existing structures in Mongolia
- Adapt German concepts: rainwater infiltration and treatment

## Preventing water pollution by mining

- Heavy metals and other pollutants, incl. tailings
- Surface and groundwater monitoring
- HTWD low-cost automated water sampler
- Attenuation in Mongolian soils and aquifers: field sampling, column experiments



# Competence 4: geoinformation, people and the nexus

## Geoinformation

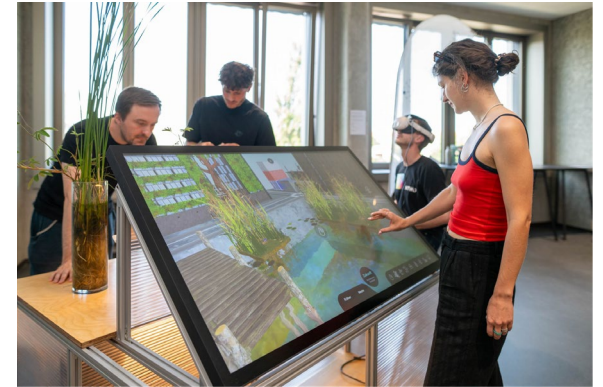
- Prof. Danilo Schneider
- 3D capture of landscape change
- UAV, laser scanning: terrain models
- Repeated campaigns: erosion, sedimentation

## Design and citizen science

- Diana Simon, HTWD design
- XR instrument: water ecology
- Citizen science, local knowledge
- Artistic formats, science communication

## Humanities and social sciences

- Partners wanted: Mongolian studies, anthropology
- Consumption, cleanliness norms
- How can traditional river norms and citizen science increase participation?



## Natural and technical sciences meet design, art and social science.

Partners: GMIT (Prof. Gantuya Ganbat, environmental engineering): interested in joining, DSC capacity to be built together. UNU-FLORES: nexus approach to water, soil, waste



# Expected outcomes

## Water quality

- What reaches rivers, floodplains and wells
- How to protect them, from source to tap

## Nexus understanding

- River, landscape, water, soil, groundwater, people: one system
- From the Tuul floodplain to the well

## Novel entities

- Shared methods and reference materials
- Comparable results: Vjosa and Elbe to Biobío and Tuul
- Data Mongolia can use itself

**Protect floodplains: protect rivers, groundwater and drinking water.**

**Next steps: joint Tuul sampling, DSC sample exchange with GMIT, social-science workshop, DFG cluster application**

Side effect: what stays in the floodplain does not reach Lake Baikal (UNESCO World Heritage) or the ocean. Ocean protection starts inland.

Thank you!



Team briefing on the Vjosa



Field equipment ready for the next campaign



Sampling frame on a gravel bar

**Thank you to all who work on environment and water nexus together with us!**

**Thank you for your attention!**

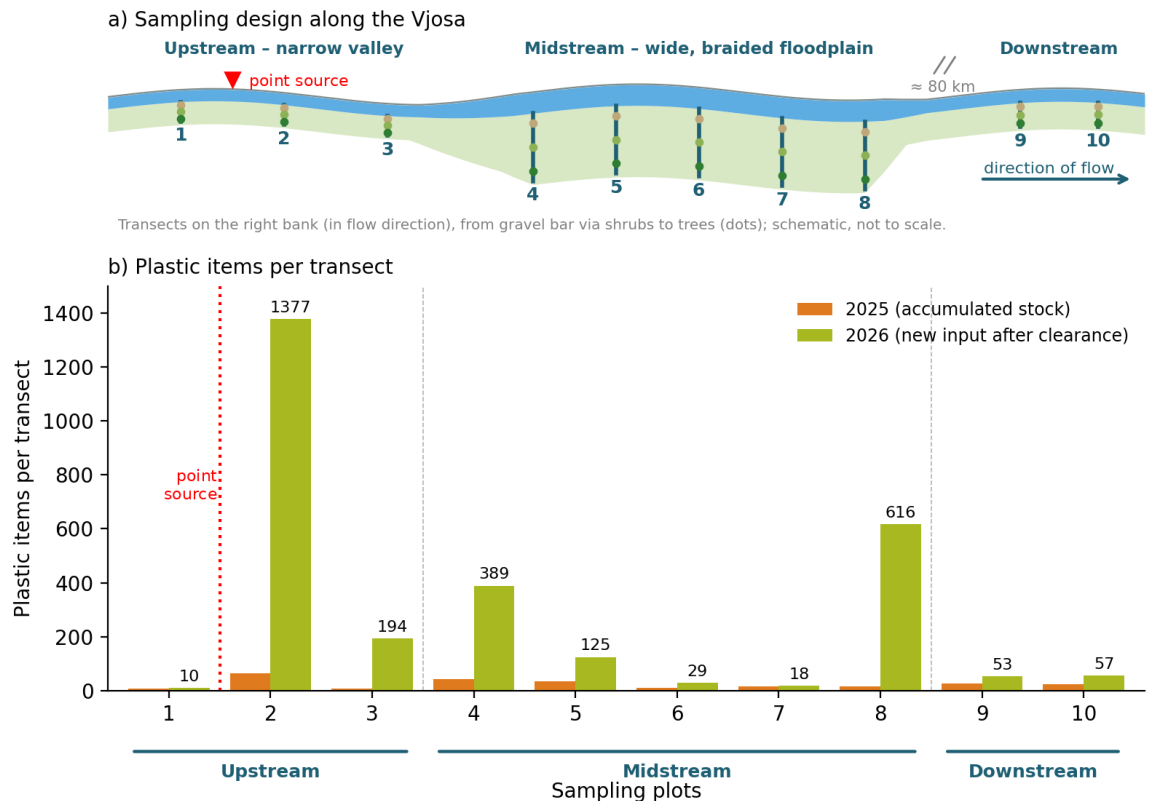
**We look forward to cooperating with you.**

Thomas Grischek, Arne Cierjacks, Danilo Schneider, Diana Simon, Kathrin Harre, HTW Dresden. Daniel Karthe, UNU-FLORES

# Backup: plastic collects in a few predictable hotspots

- **84 % of the plastic mass lay in 10 % of the plots**
- **Below a point source:** almost 1,400 items, then 86 % fewer at the next transect
- **Mostly everyday packaging:** films, foils, bags and strings
- Dense woody vegetation held more than open gravel bars (follow-up brief)

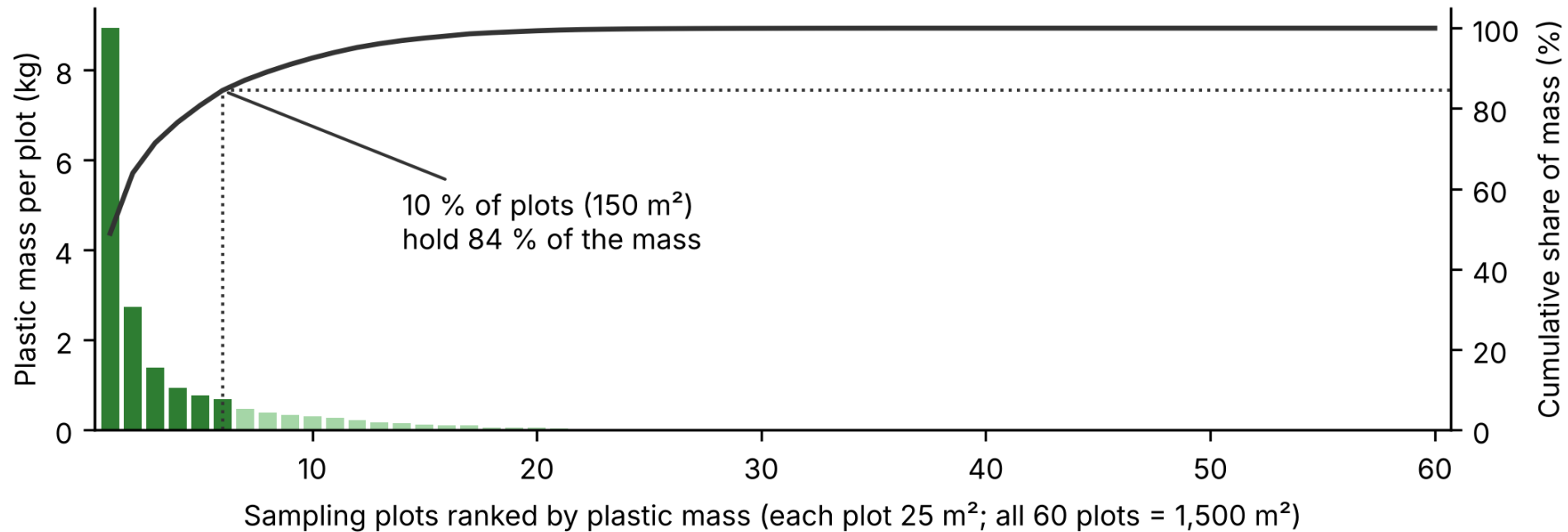
Policy Brief 1: Floodplains for Ocean Protection (Harre, Cierjacks, Seidel, Beqiraj, Karthe 2026).



Plastic items per transect: stock 2025 (orange), new input 2025/26 (green)



# Backup: hotspots make clean-ups efficient



Illustrative calculation for the Vjosa: 1,000 volunteer days of targeted clean-up after a flood could recover roughly 20–70 t, up to the river’s entire estimated yearly input to the sea.

Policy Brief 1: Floodplains for Ocean Protection (Harre, Cierjacks, Seidel, Beqiraj, Karthe 2026). Clean-up figures are illustrative.