United Nations Educational, Scientific and Cultural Organization

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ITALIAN AGENCY FOR DEVELOPMENT COOPERATION

Intense channel modifications in the Erzen River, Albania

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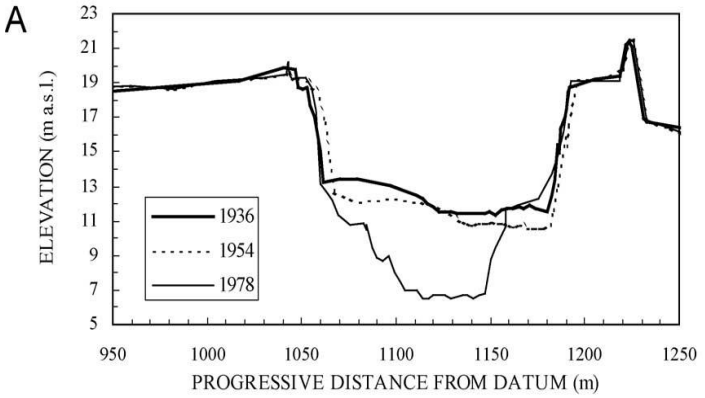
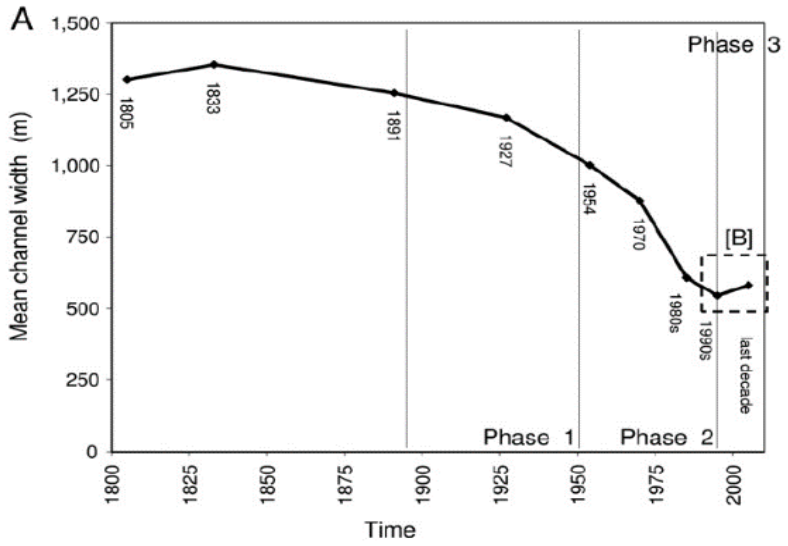
Tirana, 12 October 2022

River Channel Width and Incision

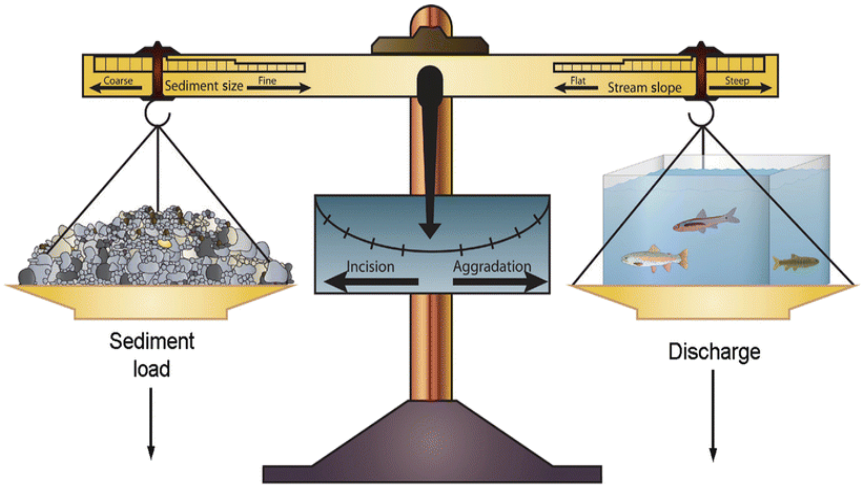
- River Trajectory Concept (Bed elevation / channel width on time (e.g Ziliani and Surian, 2012)
- Dynamic equilibrium and channel pattern (e.g. Eaton. et al, 2010)



N. Surian, M. Rinaldi 2002



L. Ziiani, N. Surian, 2012



Hohensinner et.al, 2018

Methods

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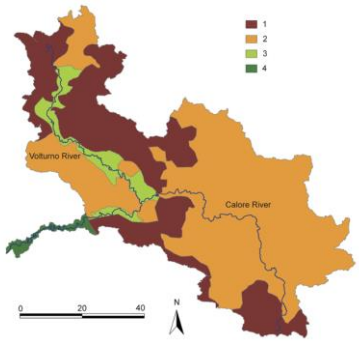
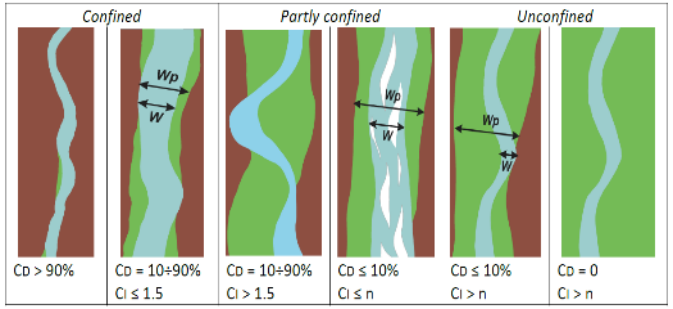
- IDRAIM - System for stream hydromorphological assessment, analysis, and monitoring (ISPRA, 2016)

I. **Physiographic setting** (Mountainous, Hill, Plain unit)
II. **Confinement** (Confined, Partly Confined, Unconfined)
III. **Channel morphology** (Straight, Sinuous, Meandering, Wandering, Braided, Anabranching)
IV. **Other elements for reach delineation** (Change in geomorphic units, Discontinuities in bed slope, Tributaries, Dams and other artificial elements, Change in confinement and/or size of the floodplain, Changes in sediment size)

I



II



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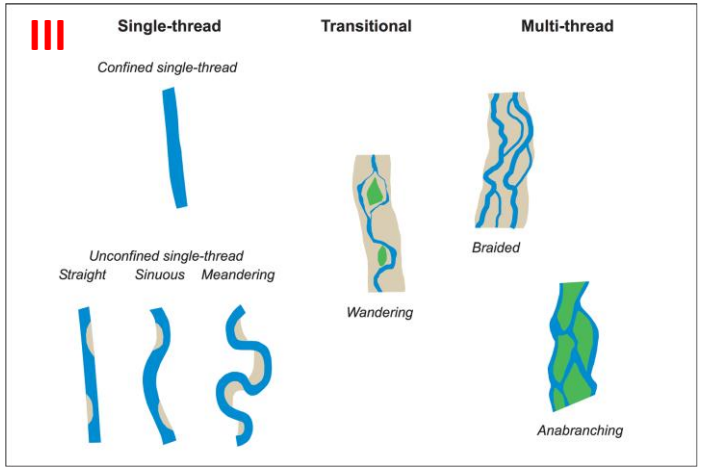
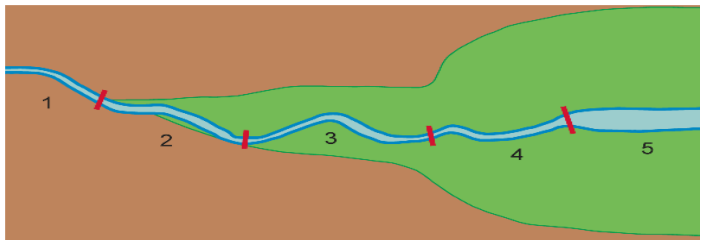


IV

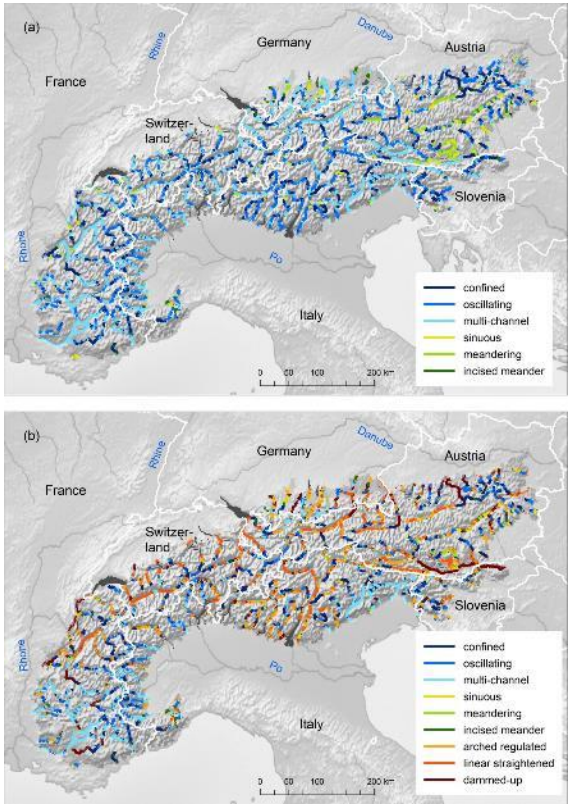


M. Rinaldi et.al., 2016

Alpine Rivers EU

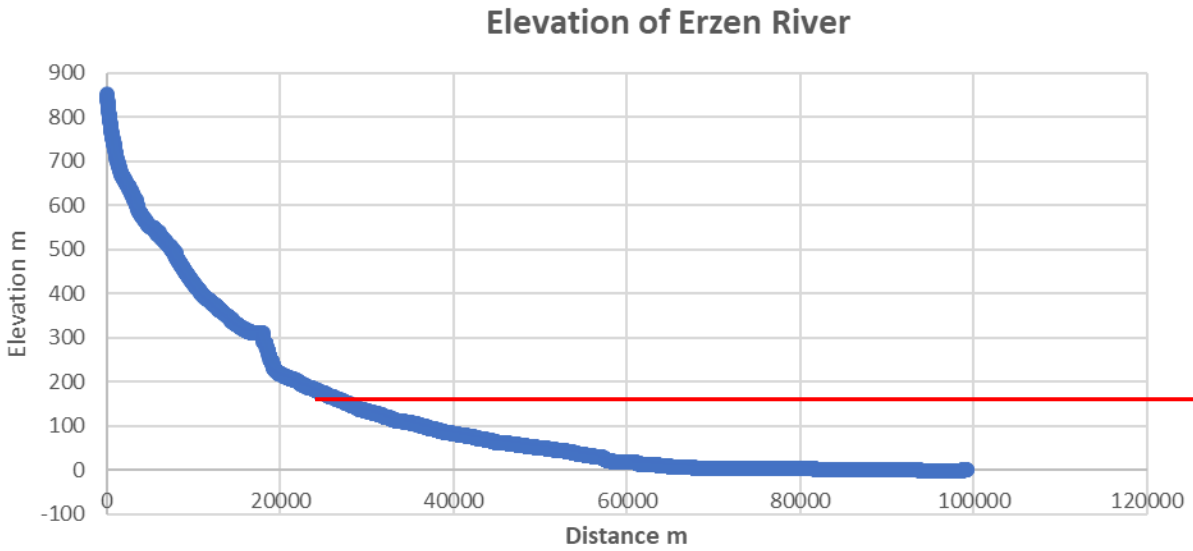
➢ What remains today of pre-industrial Alpine rivers? Census of historical and current channel patterns in the Alps (Hohensinnern et al., 2020).

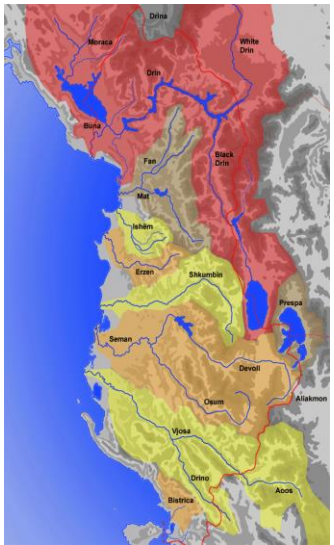
- No survey on the diverse channel patterns existing prior to the major phase of river regulation in the mid-19th–early 20th century at the scale of the whole European Alps.
- Human pressures directly affected both local channel geometry and the upstream controls
- Approximately 510-km-long river sections have been lost due to channel straightening.
- Strongest reduction of braided, sinuous or meandering ones.
- Today, 45% of the rivers are **linear or arch-shaped straightened or were transformed into reservoirs**.

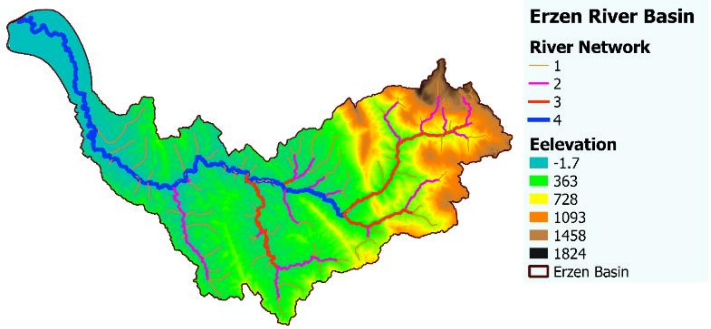


Hohensinner et.al., 2020

Erzen River Basin

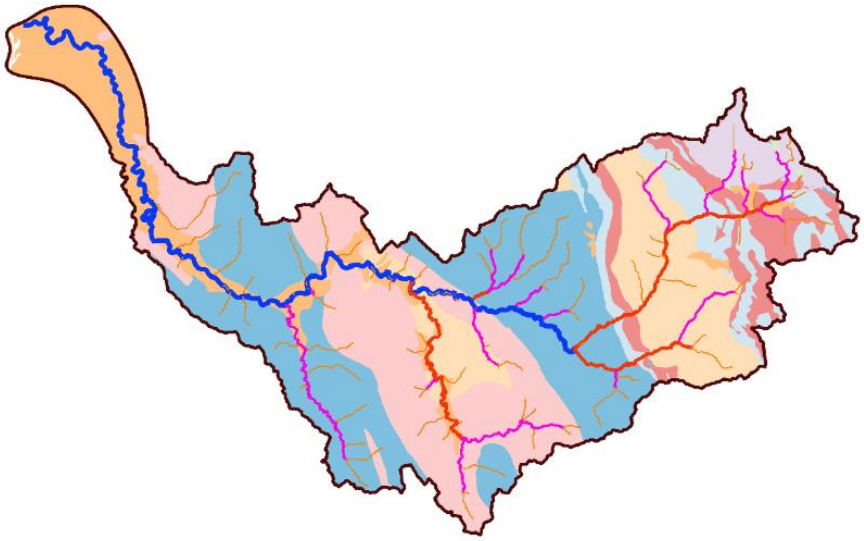


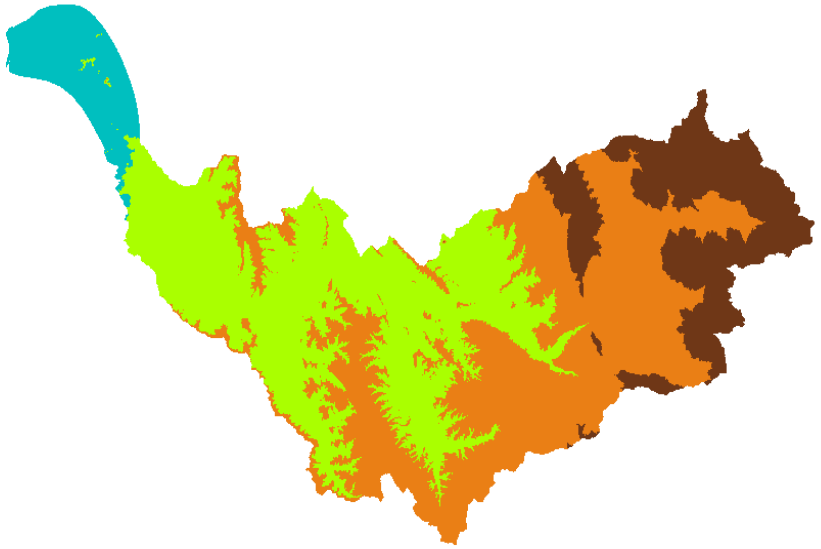




Erzen River is 109 km long
Basin surface 760 km2
Average discharge 18.1 m^3 / s
Average Elevation Riverbed 136 m
Average Basin Elevation 420 m

Erzen River Basin

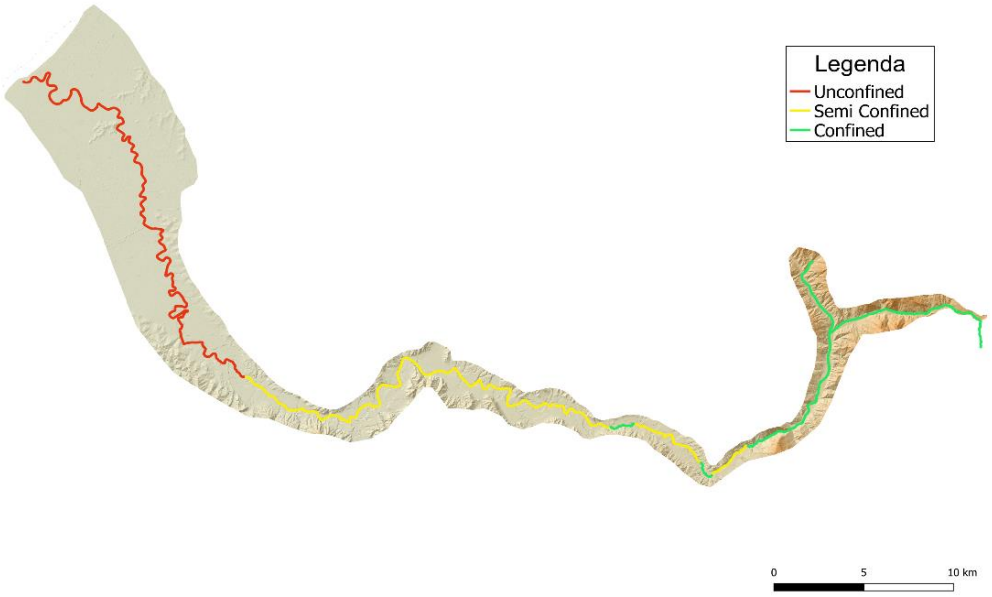




Cr, Cr1, Cr1al-Cr2cm, Cr1b-ap, Cr1be-v, Cr2, Cr2m, Cr2m-Pg2
Cr2sen, Cr2t, D, J, J1, J1-2, J2
J2-3, J3, J3-Cr1, J3k, J3t, J3t-Cr1v, J3t-Cr2cm
Lake, N1-2, N1-2l, N1-2s, N1-3, N1-3m, N1-3t
N1a, N1b, N2, N2-1h, N2-2rr, N2-Qp, O-S
P, P-T, P-T1, Pg1, Pg1-2, Pg2, Pg2-2
Pg2-Pg3, Pg3-1, Pg3-2, Pg3-3, Pg3-N11, Pg3-N1a, Pz2
Qh, Qp, Qp-h, River, S-D, T, T1
T1-2, T2, T2-3, T2-J2, T2l, T3, T3-J1
Tank, aJ2, bJ2, bT2-J1, dJ2, eP-T1, gJ2
gJ2-3, lJ2, laJ2, moJ2, msJ2, nJ2, nPz
ntJ2, pJ2, sJ2, sdJ2, shpJ2, slpJ2, tJ2

Flat Plain
Plain
Hill
Monatin

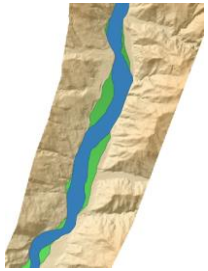
Confinement Degree



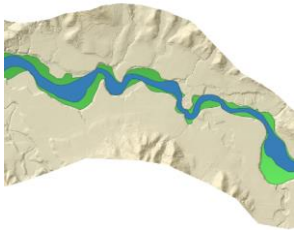
Unconfined = 35 %

Semi Confined = 37%

Confined = 28 %



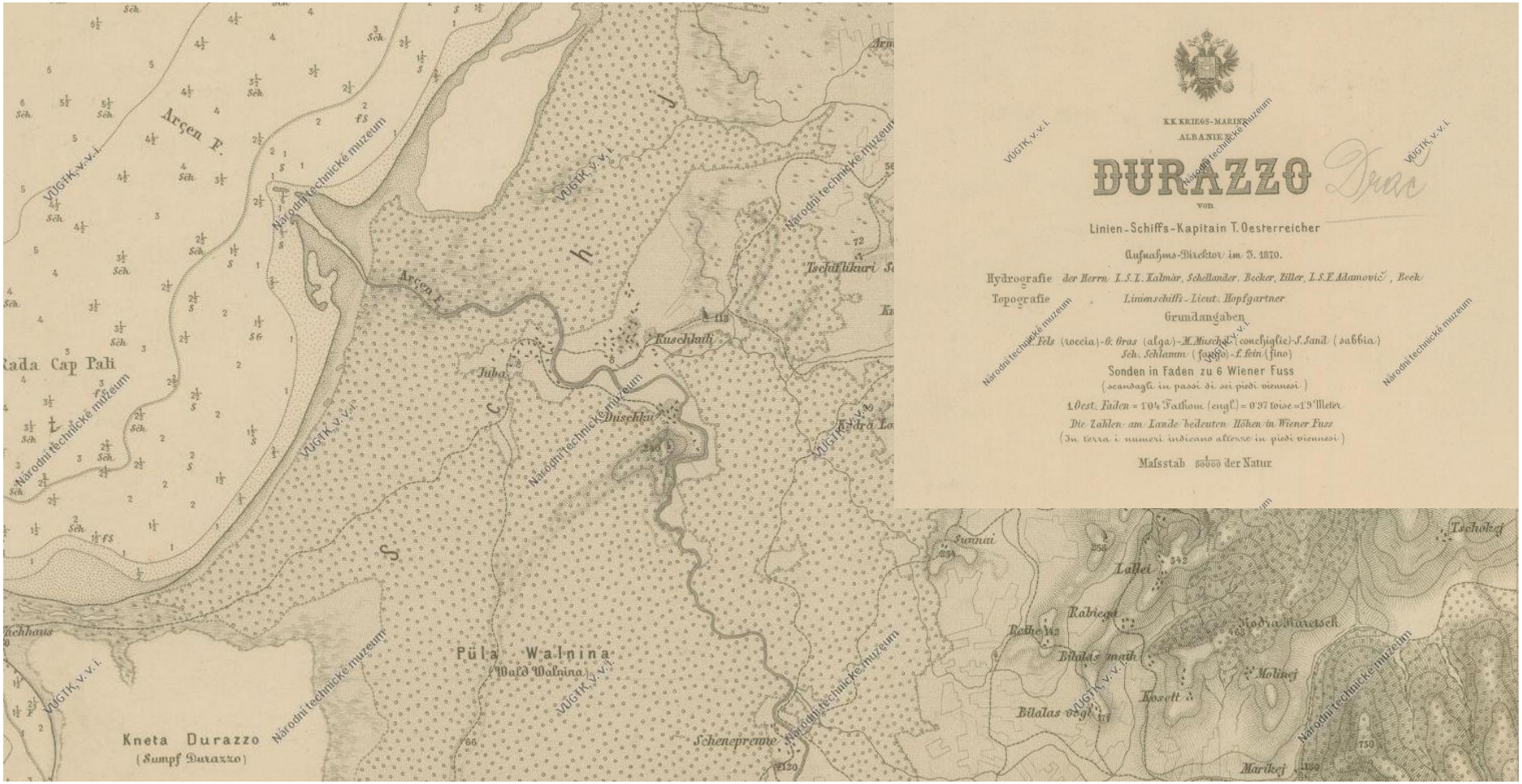
Confined



Semi-Confined

Unconfined

Old Map of Durres, 1870



https://www.oldmapsonline.org

1944

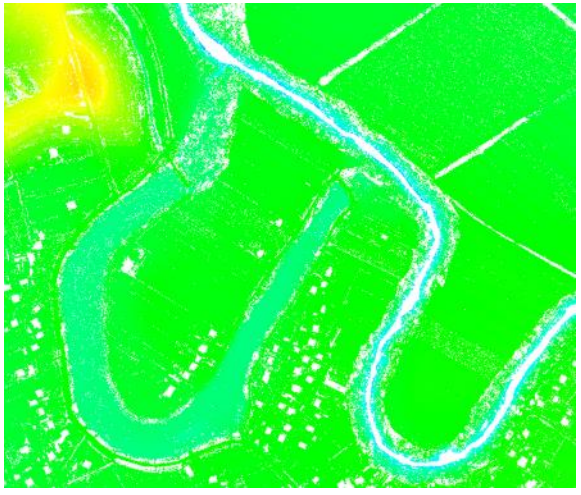
Corona-1968

1944- no Cut-off- Meandering
1968- Starting Cut-off
1994- Starting Incision
2015- Full Cut-off 3 m incision

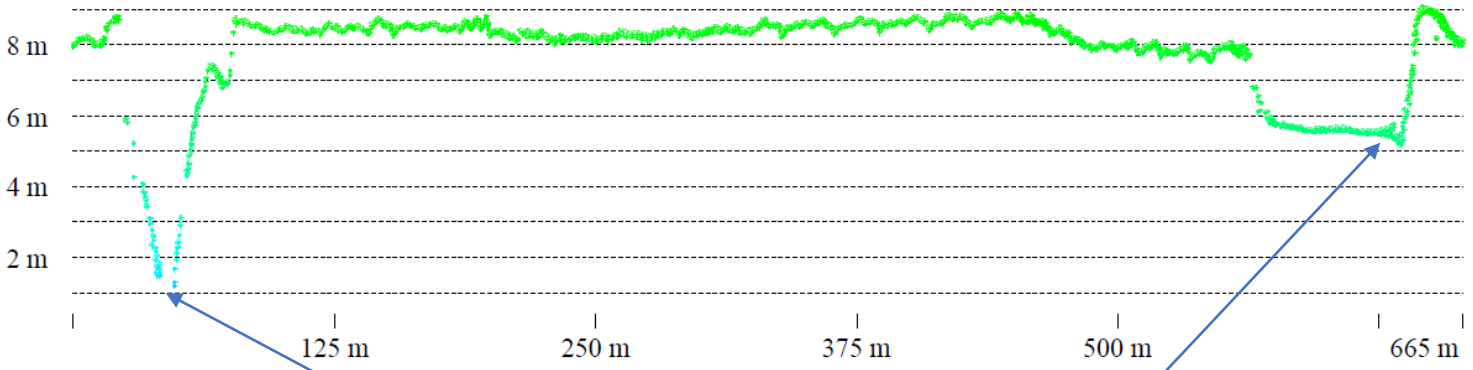
1994

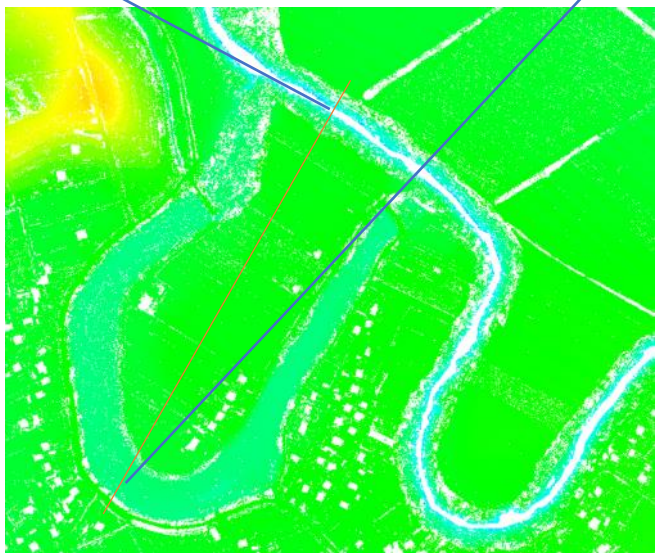
2015

LIDAR Data 2015- 2x2 m

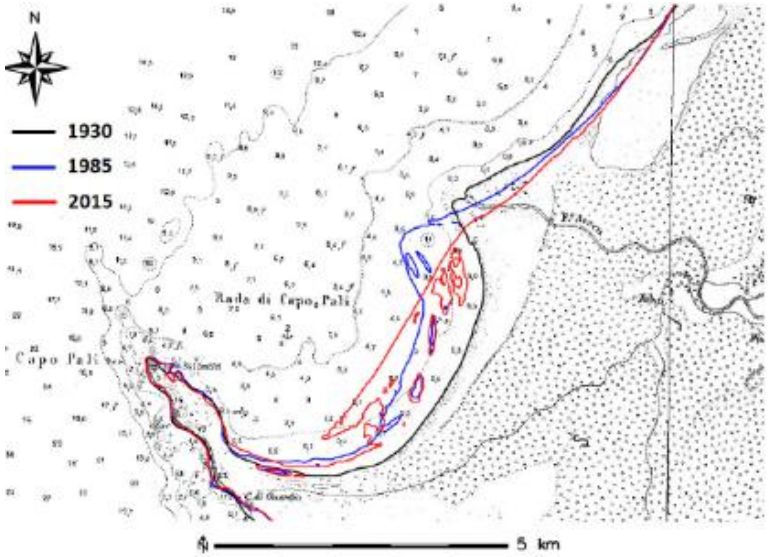


Incision 4-5 m





Effects of sediment supply reduction: Coastal Erosion and Channel Incision



Coastal erosion, F. De Leo et al, 2017

Mouth of Erzen River, 2020

Evidence of incision in a bridge of Erzen River, 2020

Channel Narrowing-Erzen River

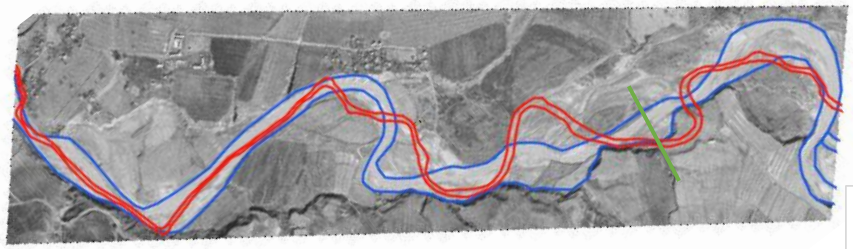
Active Chanel 137 m

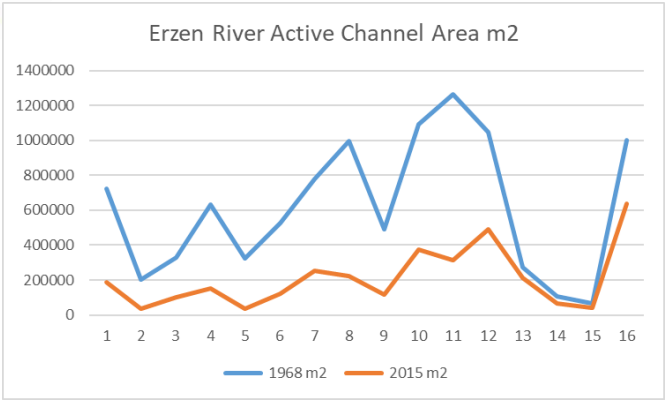
Corona 1968

Active Chanel 22 m

Ortofoto 2015

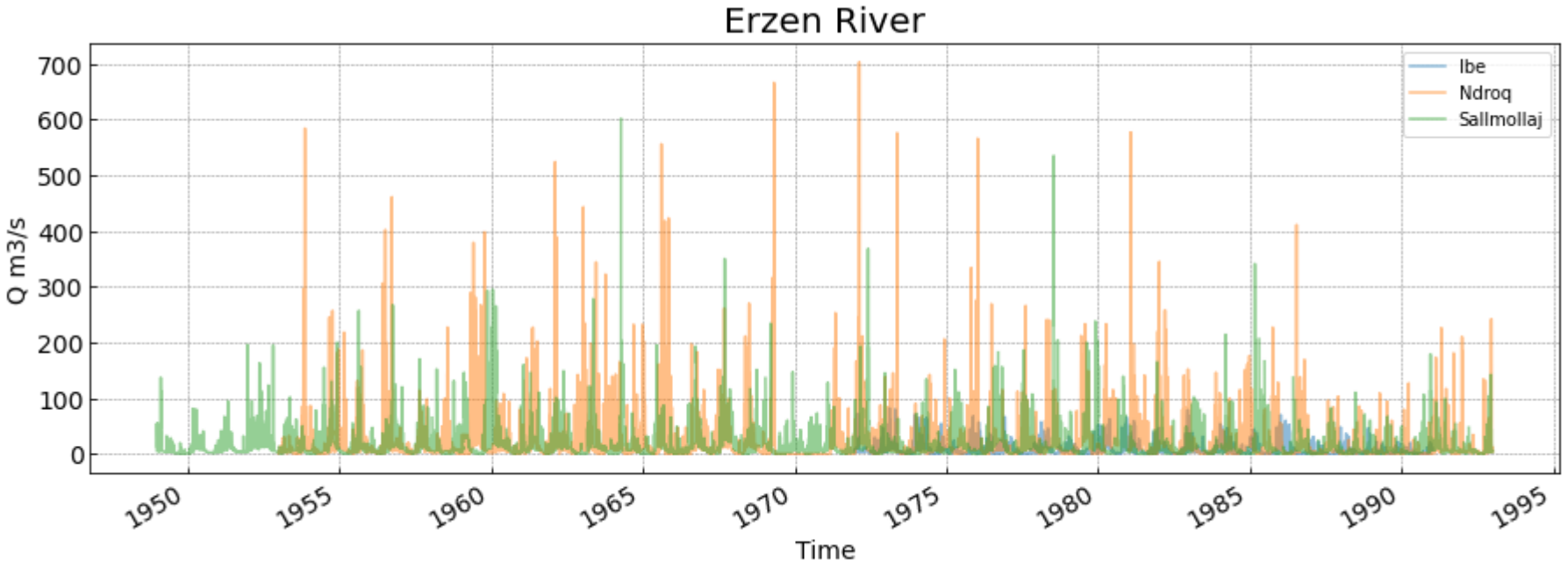
1968 2015



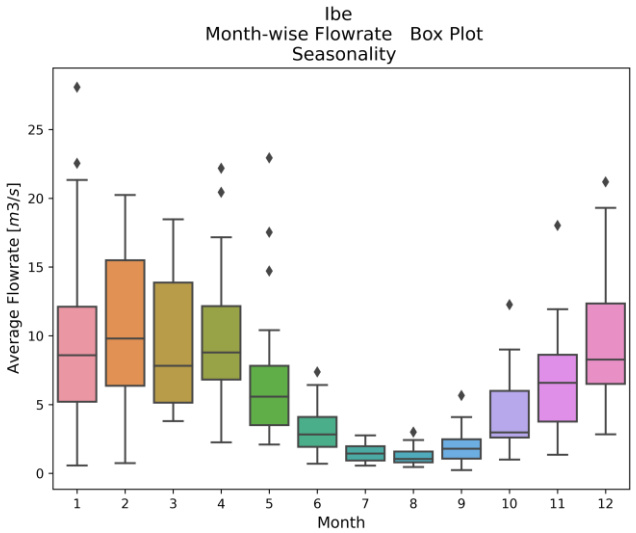


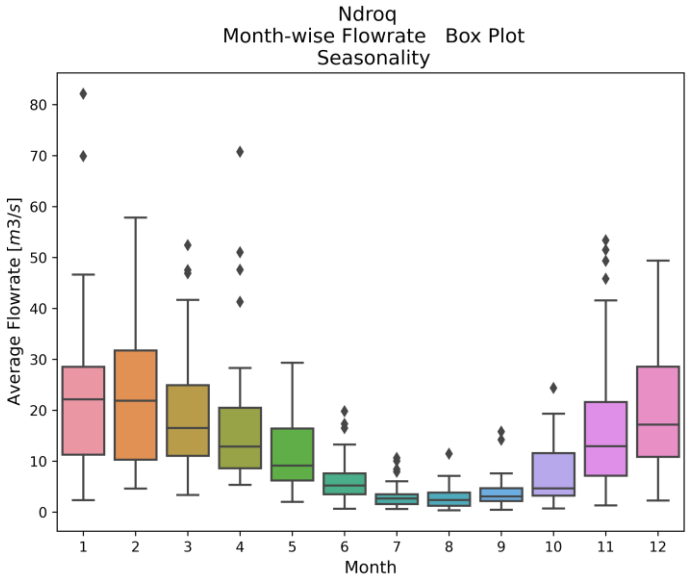
Around 6.5 km2 active channel has been lost
In 16 reaches analyzed along mainstream

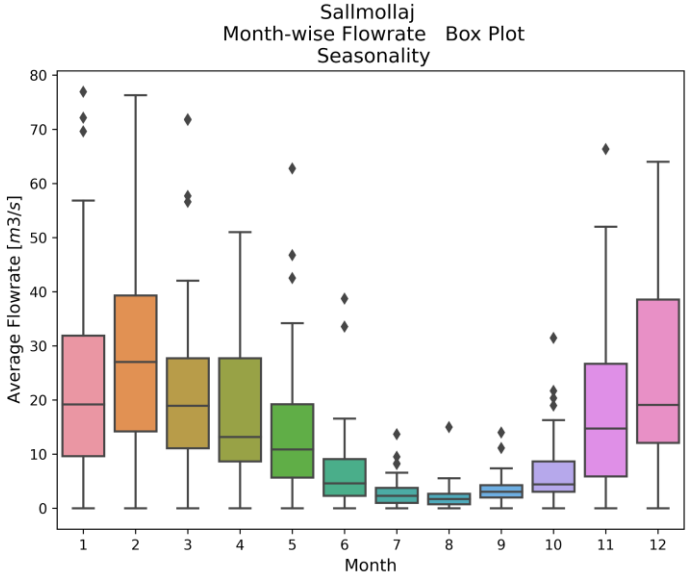
Discharge Erzen River



Discharge Erzen River



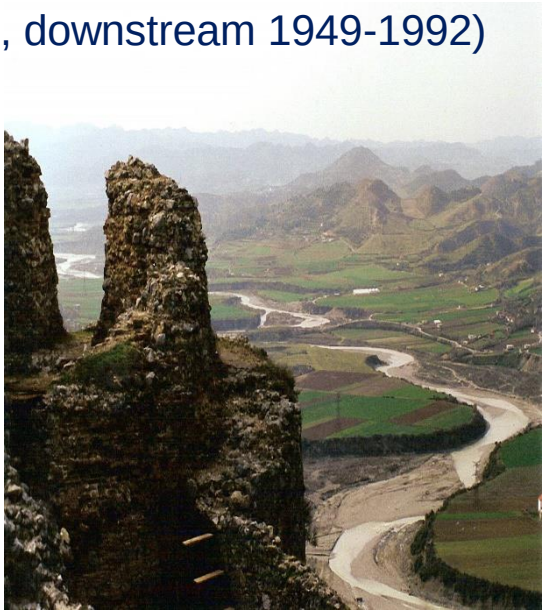




Prelemianry work in sediment size

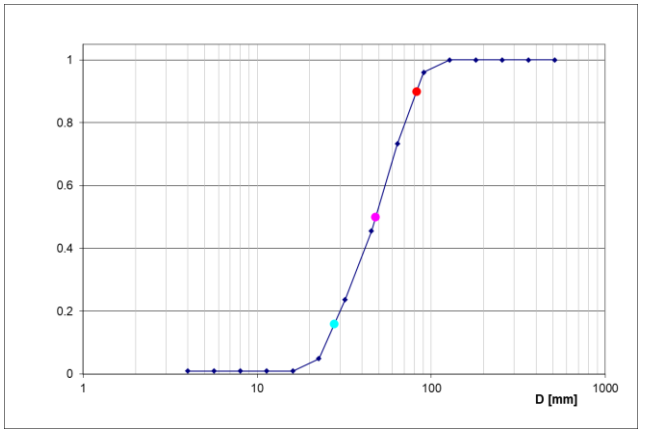
Erzen River

- Flow record (daily data in three station, upstream 1972-1990, downstream 1949-1992)
- Cross section located (4 places)
- Grain Size (4 places)
- Active channel



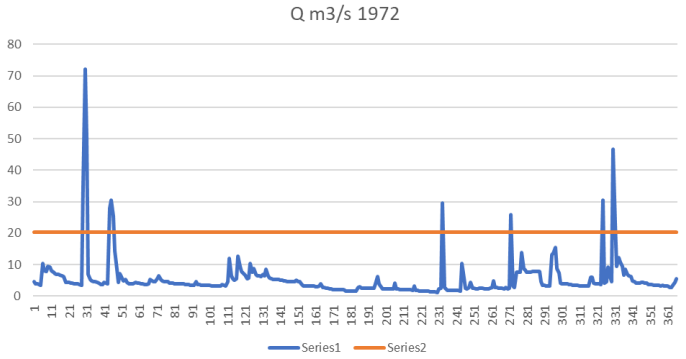
Computation of Sediment Transport

Erzen River, Ibe station, upstream



Q= 5.32 m3/s- Average 1972- Flow Data
W= 46 m (average river width)
S= 0.0036, d_{90} =82.6 mm, d_{50} =47.8 mm
D=? , θ , Φ , Qb

1- Assume wide, rectangular cross section Rh=D



D= $(Q/W*Ks*\sqrt{s})^{3}/_{5}$ = 0.36 m

Ks= $\frac{26.1}{d_{90}^{1/6}}$ = 39.56

$\theta = \frac{\tau_0}{\rho g \Delta d}$ Shields mobility parameter

$\tau_0 = \rho g R S$ Uniform flow $\theta = \frac{RS}{\Delta d}$ = 0.016 here we use d_{50}

$\Delta = \frac{\rho_s - \rho}{\rho}$ = 1.65 for silica (ρ_s = 2650 kg/m³) and water (ρ = 1000 kg/m³)

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