DEMUR

DEciphering the fluvio-social Metabolism of the Upper Rhine area

SPP 2361
On the Way to the
Fluvial Anthropocene

INTRODUCTION

Study tributaries in the Black Forest (Kinzig river) and Vosgues mountains (Fecht river).

- Investigate the **fluvio-social metabolism** of smaller rivers prior to industrialization.
- Three sub-projects: dedicated to individual data and methods from historical and geo-sciences to **identify factors and actors of floodplain transformation**.

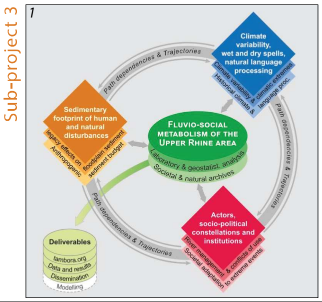
Core concept fluvio-social metabolism:

- Process-based social-ecological concept of material exchange throughout catchments.
- Captures systemic shifts in the floodplain through detection of radical changes in flow directions and volumes.
- Concept developed from a research perspective into a framework for analysis and interpretation.

PROJECT SET-UP

Sub-project 3

1

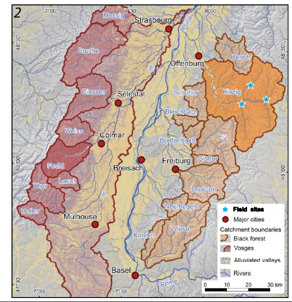


Sub-project 2

Sub-project 1

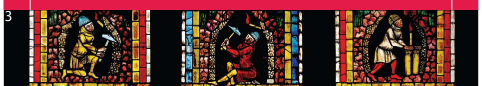
STUDY AREA

2



Actors, socio-political constellations and institutions

3



Goals:

- Aims to identify **societal players and structures** of land use affecting the floodplains, i.e. mining, rafting, and milling.
- Special interest: **conflicts in resource management** and societal adaptations to extreme events, since they are most revealing of socio-metabolic relations.

Foci (examples):

- Fluvio-social connectivity through wood commerce and catchment deforestation.
- River works as local indicators, causes and results of hydro-morphic change.

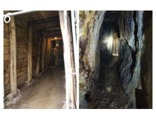
4

Timber rafting

5

Water-powered mills

6

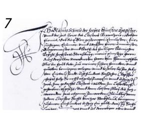


Ore mining

Data:

- **Sources**: Property contracts, tax registers, statutory laws and ordinances, tribunal case records, maps.
- **Archives**: Fürstlich Fürstenbergisches Achiv Donaueschingen, Generallandesarchiv Karlsruhe, Archives de la Ville et Eurométropole de Strasbourg.

7



Timber wood contracts

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Early printed maps

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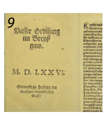


River-related ordinances

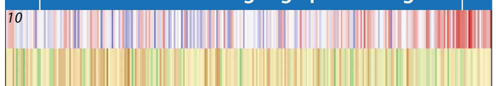
Methods and expected results:

- **Chronologies** of land use practice, infrastructure occurrences and crises ⟶ long-term trends from a socio-cultural perspective.
- **In-depth case studies** of conflict and crisis management ⟶ socio-political constellations and adaptations.

Figure 3: Schauinsland-Fenster, Liebfrauenmünster Freiburg i. Br., Lhs. S XIII, painted glass window of the Transfiguration of Christ, endowed by a silver miners' cooperative c. 1340 [3]
Figure 4: Schiltacher Flößer e. V., rafting re-enacting historical timber rafting on the Kinzig in 2018 and preserving the UNESCO Intangible Cultural Heritage since 2022 [2]
Figure 5: Hydraulic saw mill, construction according to the 12th century in Hinterzarten at the Rotbach in the Löffeltal, Black Forest [R. Longoni 2018]
Figure 6: Silver mine 'Segen Gottes' in Haslach-Schnellingen, operating 13th-18th century [R. Longoni 2018]
Figure 7: Receipt for a timber wood concession in the Kastelbach valley by the monastery of Rippoldsau for the city of Strasbourg, 19.06.1582 [8]
Figure 8: Map of the Upper Rhine area between Basel and Mainz, including the tributary catchements, by Waldseemüller (1513) [9]
Figure 9: Breisgau water law of 1576, issued by the Austrian bailiff of Upper Alsace and the margraves of Baden and Hochberg, 10.01.1547 [10]

Climate variability, wet and dry periods and natural language processing

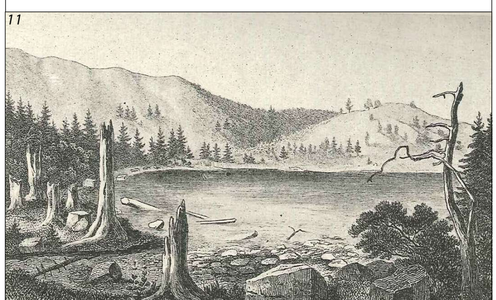
10



Goals:

- Aims to reconstruct **climatic time series** based on **historical sources**.
- Goal: increase the temporal and spatial **coverage** for the Medieval Warming Period (1000-1350), the Little Ice Age (1350-1850) and the Period of Instrumental Measurement (1850-today) for **calibration**.
- Time series will then be **correlated** to sedimentary data.

11



"Im Jahr 1800, den 4. August, entstand durch boshaftes Anzünden in den Waldungen am Diebelsbach, 3/4 Stunden östlich von dem wilden See, ein Waldbrand, der wegen der damals mehrere Wochen andauernden Hitze ungemein verheerend wurde. [...] Die Gluth war so heftig, daß die zum Löschen aufgebotene Mannschaft sich auf 1/4 Stunde den brennenden Stellen nicht nähern konnte, daher der Brand bis zum 21. August andauerte, an dem endlich ein starker Regen fiel, der es möglich machte, dem Feuer Grenzen zu setzen. Zwei Flöße, welche zur Zeit des Brandes in der Schönmünz am Fuß des Leimkopfs lagen, verbrannten im Wasser." Horst Issinger (1858) [4]

Data:

- Historical Sources: **Written documents** (chronicles, diaries, early newspapers) as existing in the Collaborative Research Environment tambora.org on descriptions of climate and weather phenomenons.
- **Natural Proxy Data**: Yearly time series.

12

i.e. Wine quality

13

Tree ring data

14

Grain harvest date

Methods and expected results:

- **Machine Learning** Methods, **Bayesian** Statistics and **Natural Language Processing** to refine text based reconstrcutions.
- Statistical Analysis to unite the different source types.
- Artificial **Neural Networks** to reconstruct **weather patterns** and derive temporal interpolations.

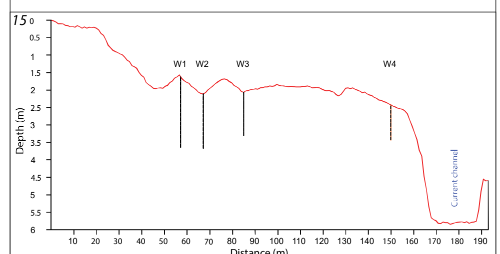
Figure 11: Above: "Der wilde See in der Schönmüntz". Below: Description of forest fire in 1800 by Horst Issinger (1858).

Sedimentary footprint of human and natural disturbances

Goals:

- Aims to identify the legacy effect of socio-ecological processes on **floodplain sedimentation**, identifying phases and hotpots of floodplain activity in different catchments.
- Hypothesis: contrasting socio-ecological processes result in significantly different sedimentary records.
- Aims to estimate an **anthropogenic sediment budget** of the Upper Rhine tributaries for quantifying the volume of stored legacy sediments.

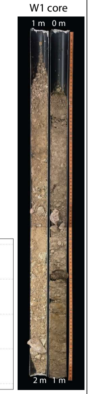
15



Data:

- Remote sensing: Digital elevation model (**DEM**), stream network
- Field campaign: Soil drilling, electrical resistivity tomography. (**ERT**), ground-penetrating radar (**GPR**).
- Regional core data: LUBW core repositories, maps.

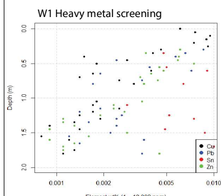
W1 core



Methods and expected results:

- Laboratory: Dating, **heavy metal concentration**, grain-size, organic matter content, pH.
- Subsurface visualisation: **validated** ERT and GPR data.
- **Modelling**: Distribution and volume of legacy sediments based on DEM, cores, chronological control from historic and sedimentary sources.

W1 Heavy metal screening



W1 Age screening

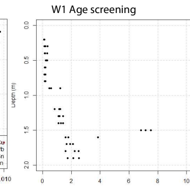


Figure 15: Floodplain elevation at the Wolfach location (top) with percussion hammer drilling depths. Photographic core W1 (middle right) from the Wolfach location. The heavy metal (XRF) screening outcome of the core W1 plotted over depth (bottom left). The age (IRSL) screening outcome of the core W1 plotted over depth (bottom middle).

DATA INTEGRATION

1. **Comparisons**: Identify correlations and discrepancies among the chronologies generated from each sub-project.
2. **Pathway and statistical analyses**: Identify decisive factors and actors of floodplain transformation.
3. **Quantification**: Rough assessment of mangitude of fluvio-social processes through indexed time series and periodised diagrams of material flows.

PERSONA

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Figure 4 https://rb.gy/fh3yks - 11.12.23
Figure 6 https://ansichtskarten-lexikon.de/ak-218226.html - 15.01.24
Figure 7 Scheifele, Max: Die Trift von Brenn- und Kohlholz. Landesforstverwaltung B-W/ DRW Verlag, Stuttgart 2004, 335 S.: 179.
Figure 8 https://www.dilibri.de/rlb/content/titleinfo/128034
Figure 9 Wasser ordnu[n]ng im Breyßgaw. M. D. LXXVI. [Erlassen durch den österreichischen Vogt v. Oberelsass und den Markgrafen von Baden und Hochberg am 10.01.[15]47, basierend auf der Ordnung von 1492]. Steffan Graff, Freiburg i. Br. 1576, [o. S.] 35 S.
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Figure 12 https://shorturl.at/alyFV - 15.01.24
Figure 13 https://shorturl.at/gFMXY - 15.01.24
Figure 14 https://shorturl.at/nqxzD - 15.01.24

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