Historische Auen als Potenzialflächen

5. Österreichisches Auendialogforum

St. Virgil, Salzburg, 22. Jänner 2025

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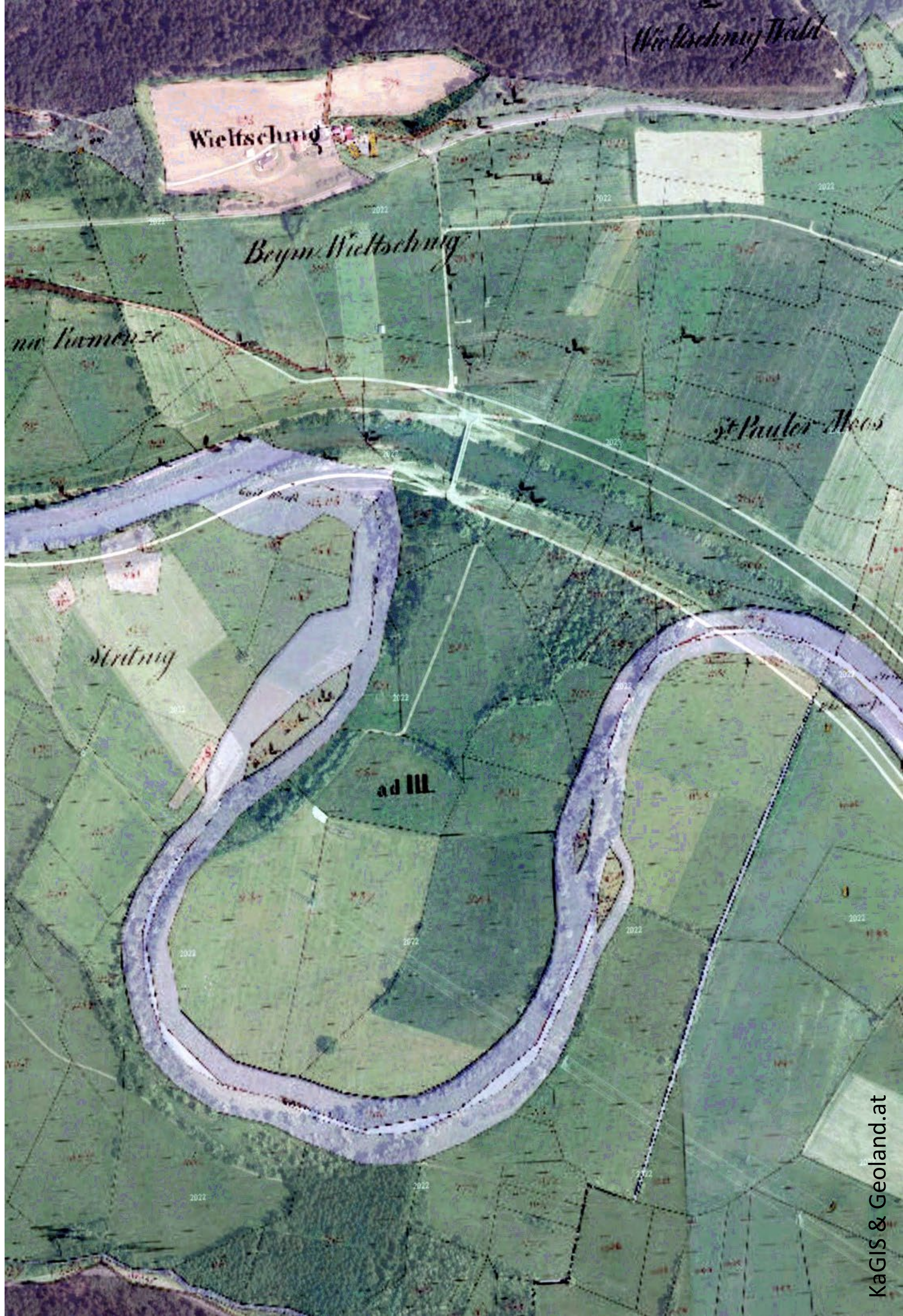


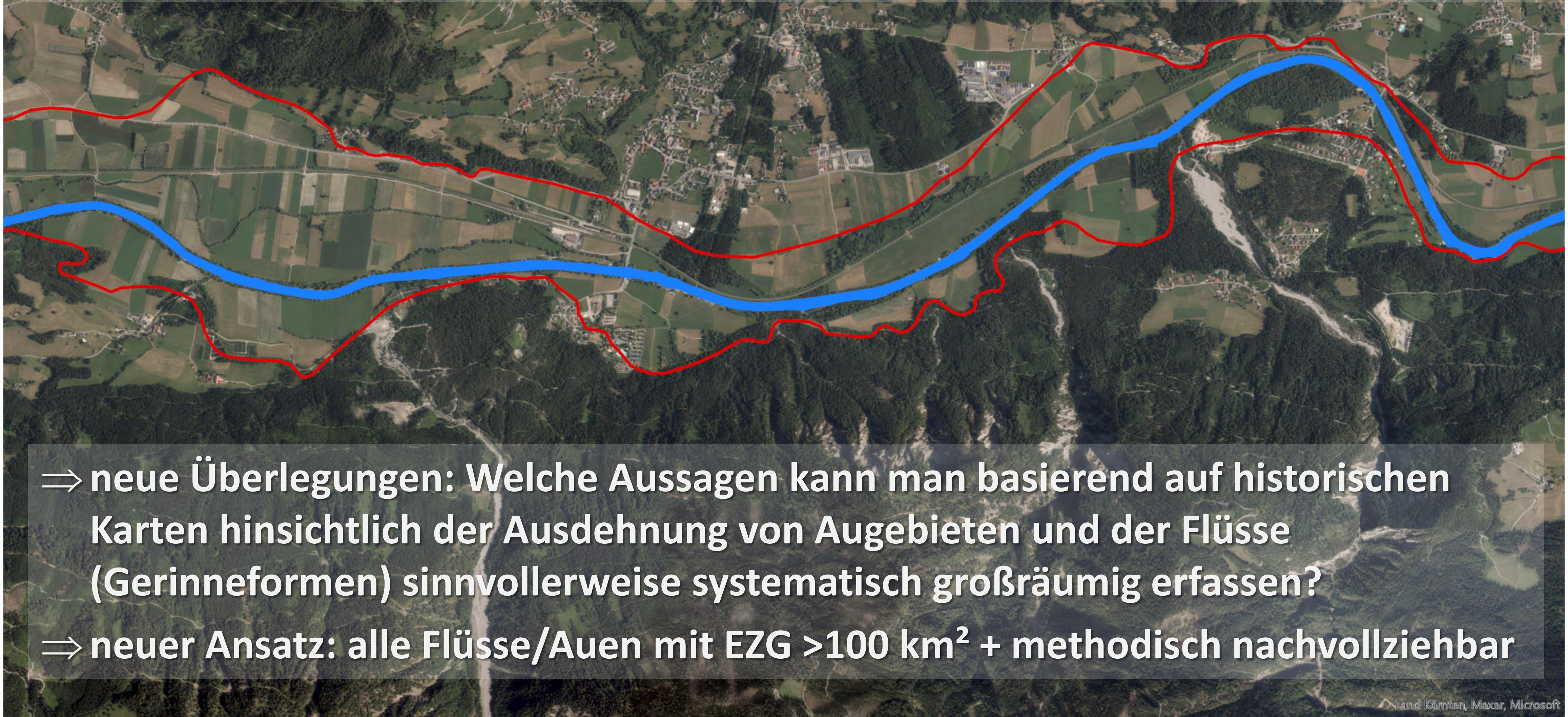
KaGIS & Geoland.at

Umfassende Eingriffe in Flusslandschaften seit dem frühen 19. Jahrhundert

(teils bereits im späten 18. Jhdt.)

⇒ **bisher meist anlass-/projektbezogener Blick auf das historische Potenzial von Fließgewässern und Augebieten**

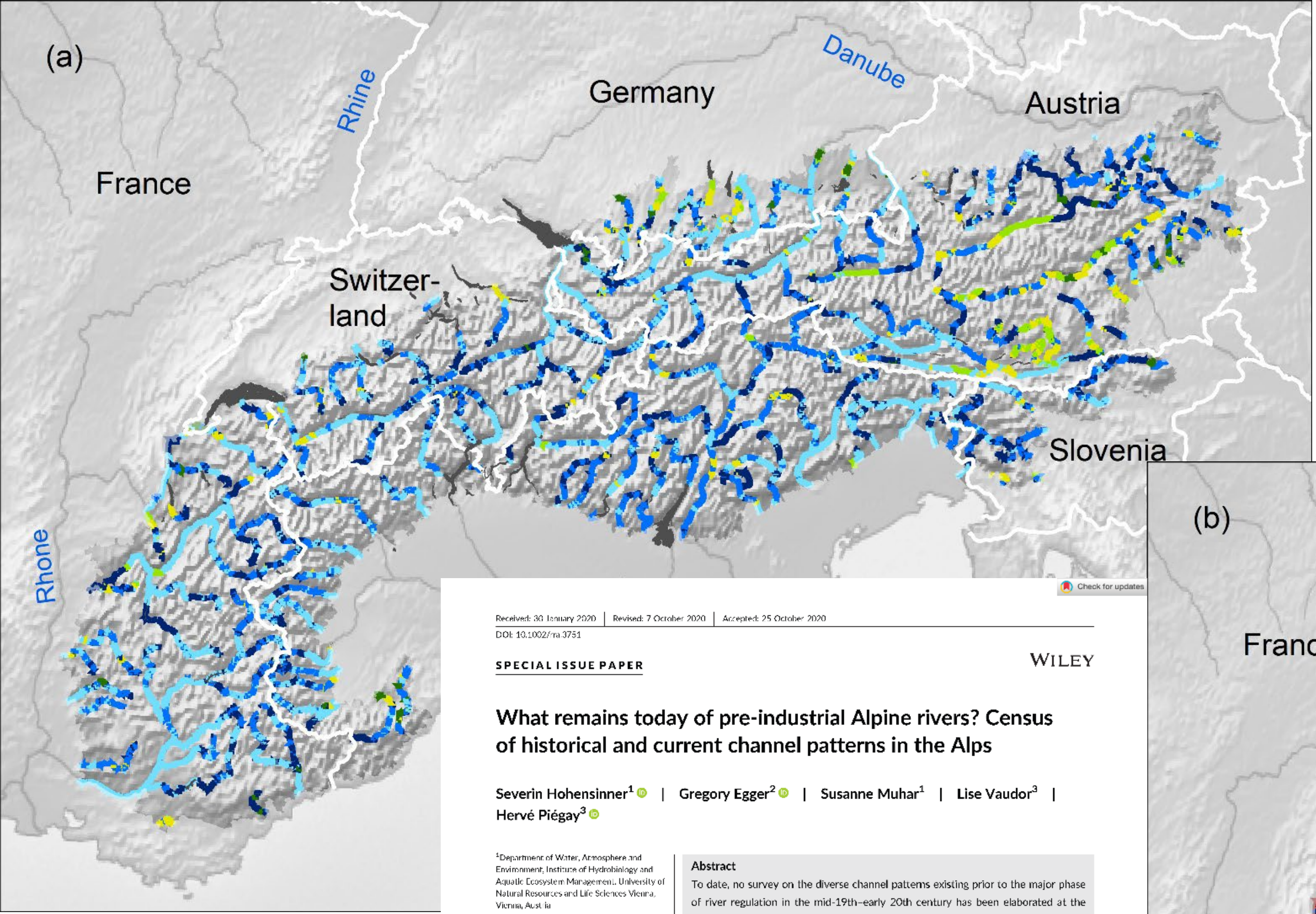
⇒ **1990er – 2000er: Ausweisung naturnah erhalten gebliebener Fließgewässer-abschnitte für Flüsse mit EZG >500 km² (ANF)** (Muhar et al. 1998, 2008)



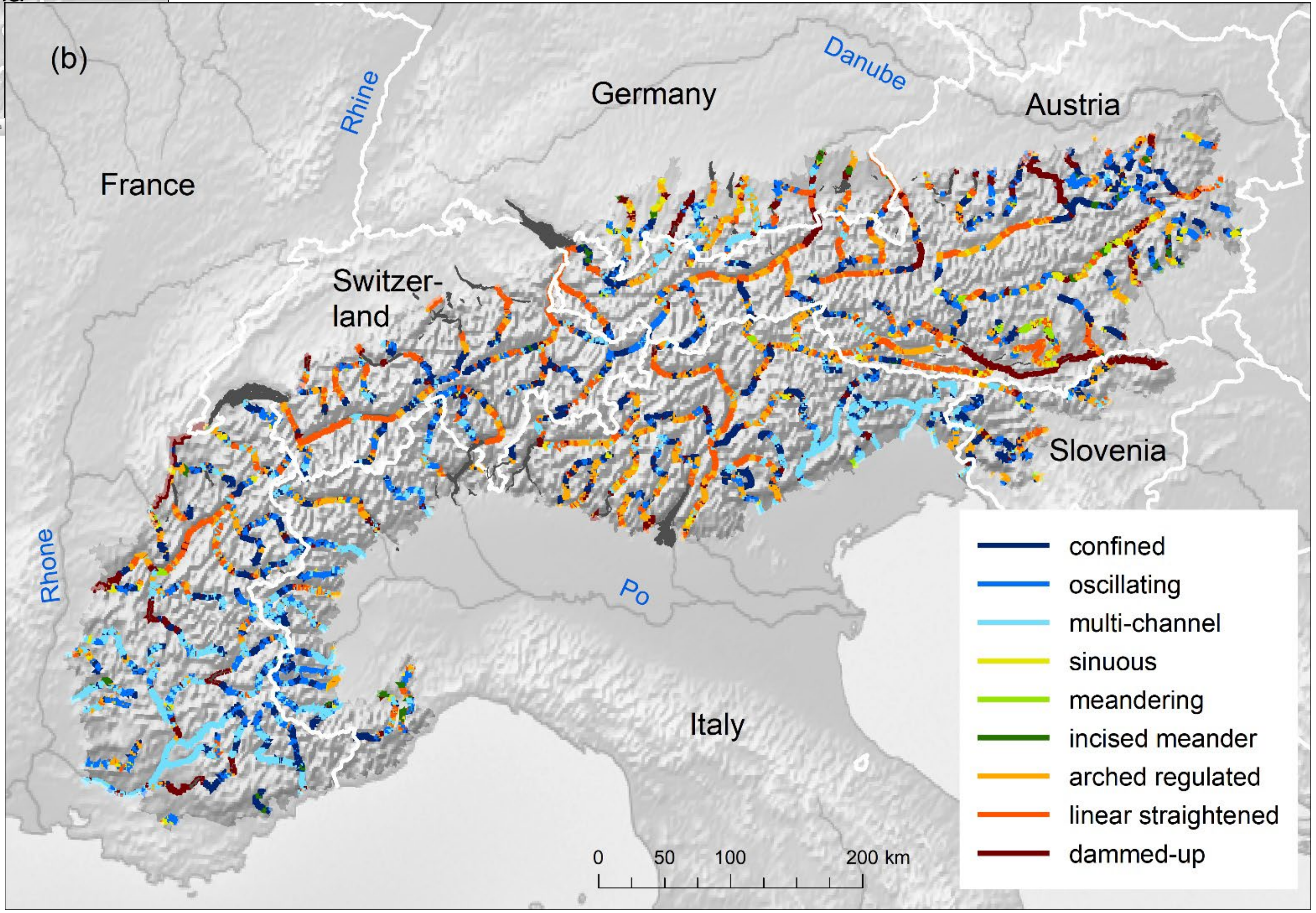
⇒ **neue Überlegungen: Welche Aussagen kann man basierend auf historischen Karten hinsichtlich der Ausdehnung von Augebieten und der Flüsse (Gerinneformen) sinnvollerweise systematisch großräumig erfassen?**

⇒ **neuer Ansatz: alle Flüsse/Auen mit EZG >100 km² + methodisch nachvollziehbar**

Vorarbeiten:
Gewässertypen vor der systematischen Regulierung in den Europäischen Alpen



Gewässertypen aktuell



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SPECIAL ISSUE PAPER

WILEY

What remains today of pre-industrial Alpine rivers? Census of historical and current channel patterns in the Alps

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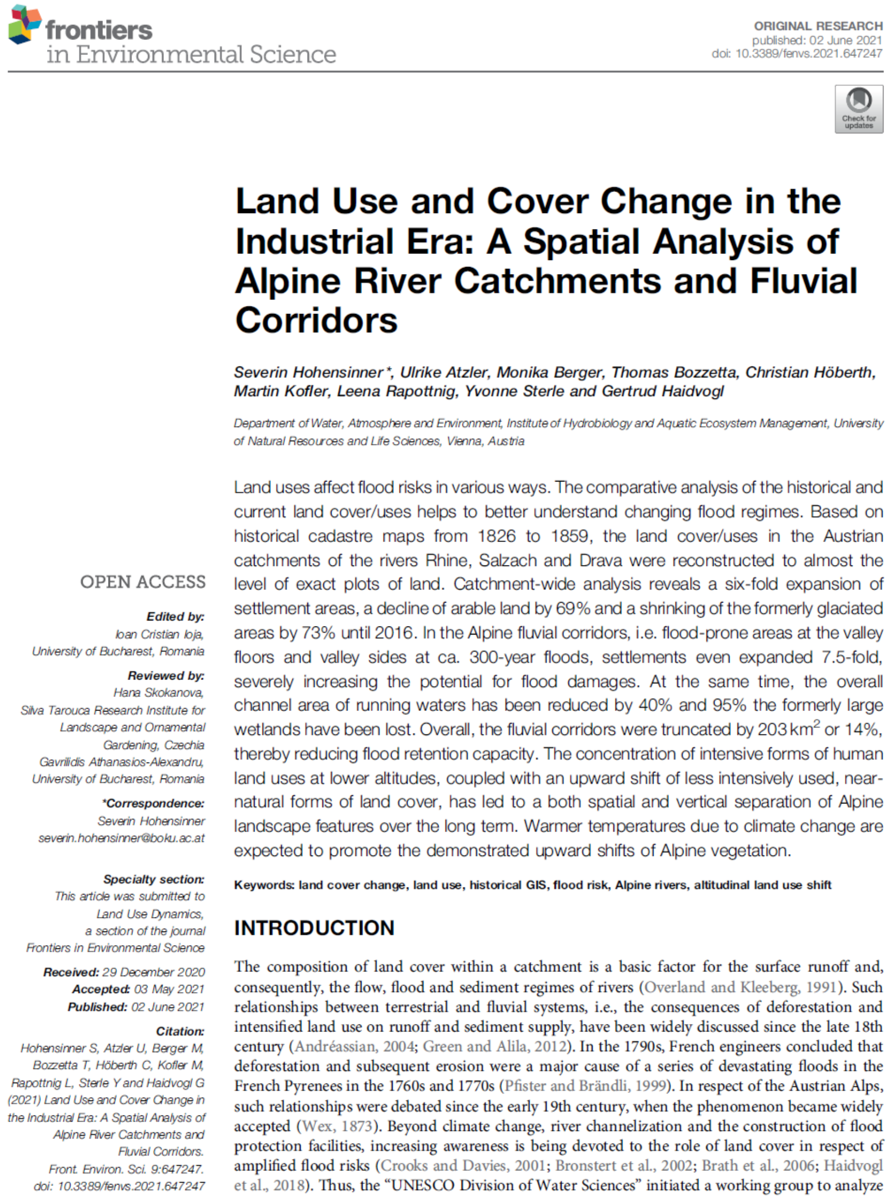
Abstract
To date, no survey on the diverse channel patterns existing prior to the major phase of river regulation in the mid-19th–early 20th century has been elaborated at the scale of the whole European Alps. The present paper fills this knowledge gap. The historical channel forms of the 143 largest Alpine rivers with catchments larger than 500 km² (total length 11,870 km) were reconstructed based on maps dating from the 1750s to 1900. In the early 19th century, one-third of the large Alpine rivers were multi-channel rivers. Single-bed channels oscillating between close valley sides were also frequent in the Alps (28%). Sinuous and even more so meandering channels were much rarer. Historical river patterns generally followed an upstream–downstream gradient according to slope condition, floodplain width and distance from the sources. The local occurrence of certain channel patterns, however, primarily reflected the tectonic/orographic conditions. Multi-channel reaches were widespread within the whole Alpine area, alternating with confined and oscillating reaches. This demonstrates that most areas were mainly transport-limited rather than supply limited. Sinuous and meandering reaches were more frequent in the north-eastern Alps and were characterized by lower denudation rates and less sediment delivery.
Channel straightening caused the loss of about 510 km of river course length, equivalent to 4.3% of the historical extent. Multi-channel stretches are currently a mere 15% of their historical length, and 45% of the larger Alpine rivers are intensively channelized or have been transformed into reservoirs. Channelization measures differed from one country to another. Human pressures directly affected both local channel geometry and the upstream controls (i.e., sediment supply). Accordingly, individual multi-channel reaches also evolved into single-thread channels without any local human interventions.

KEYWORDS
Alpine rivers, channel patterns, historical GIS, historical state, river training

Hohensinner et al. (2021)
basierend auf
Muhar et al. (1996/98, 2008)

Historische Landbedeckung und Abgrenzung historischer HQ_{300}-Raum



frontiers in Environmental Science

ORIGINAL RESEARCH
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Land Use and Cover Change in the Industrial Era: A Spatial Analysis of Alpine River Catchments and Fluvial Corridors

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Land uses affect flood risks in various ways. The comparative analysis of the historical and current land cover/uses helps to better understand changing flood regimes. Based on historical cadastre maps from 1826 to 1859, the land cover/uses in the Austrian catchments of the rivers Rhine, Salzach and Drava were reconstructed to almost the level of exact plots of land. Catchment-wide analysis reveals a six-fold expansion of settlement areas, a decline of arable land by 69% and a shrinking of the formerly glaciated areas by 73% until 2016. In the Alpine fluvial corridors, i.e. flood-prone areas at the valley floors and valley sides at ca. 300-year floods, settlements even expanded 7.5-fold, severely increasing the potential for flood damages. At the same time, the overall channel area of running waters has been reduced by 40% and 95% the formerly large wetlands have been lost. Overall, the fluvial corridors were truncated by 203 km^2 or 14%, thereby reducing flood retention capacity. The concentration of intensive forms of human land uses at lower altitudes, coupled with an upward shift of less intensively used, near-natural forms of land cover, has led to a both spatial and vertical separation of Alpine landscape features over the long term. Warmer temperatures due to climate change are expected to promote the demonstrated upward shifts of Alpine vegetation.

Keywords: land cover change, land use, historical GIS, flood risk, Alpine rivers, altitudinal land use shift

OPEN ACCESS

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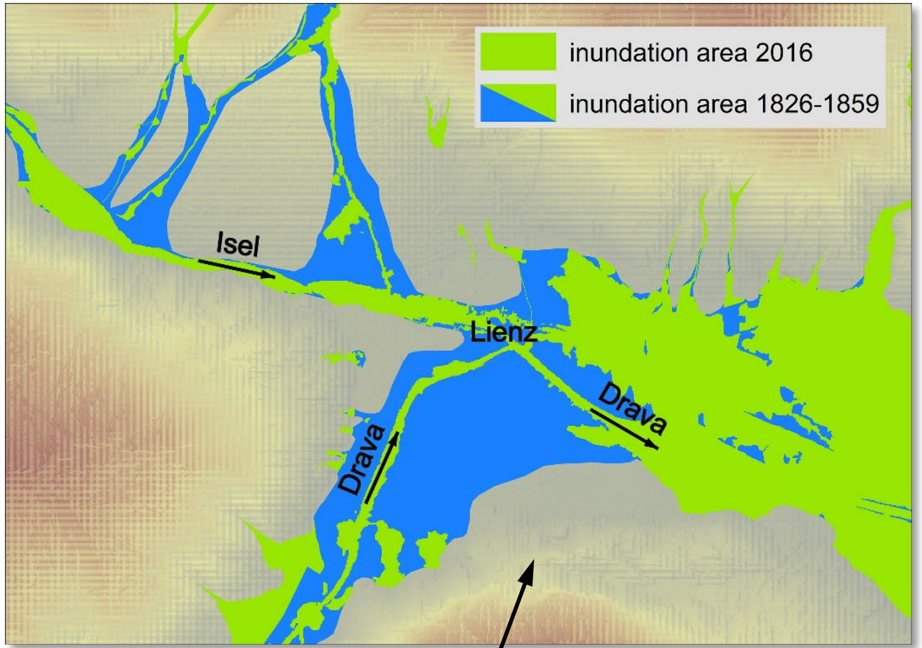
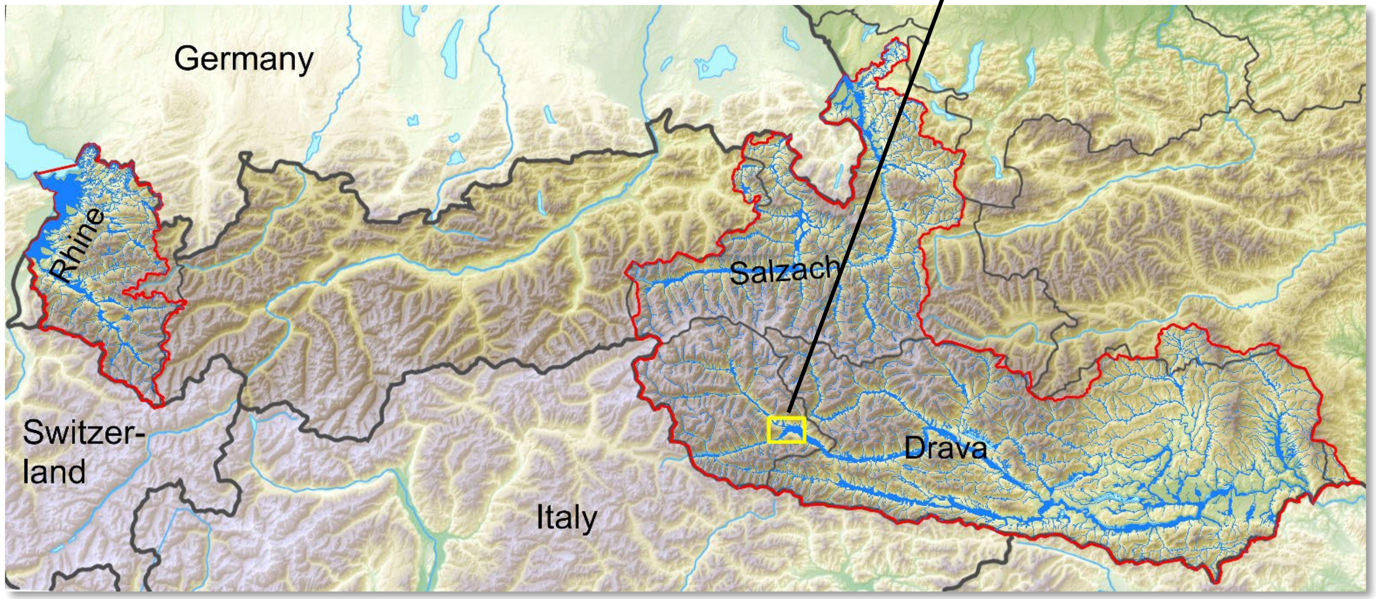
INTRODUCTION

The composition of land cover within a catchment is a basic factor for the surface runoff and, consequently, the flow, flood and sediment regimes of rivers (Overland and Kleeberg, 1991). Such relationships between terrestrial and fluvial systems, i.e., the consequences of deforestation and intensified land use on runoff and sediment supply, have been widely discussed since the late 18th century (Andréassian, 2004; Green and Alila, 2012). In the 1790s, French engineers concluded that deforestation and subsequent erosion were a major cause of a series of devastating floods in the French Pyrenees in the 1760s and 1770s (Pfister and Brändli, 1999). In respect of the Austrian Alps, such relationships were debated since the early 19th century, when the phenomenon became widely accepted (Wex, 1873). Beyond climate change, river channelization and the construction of flood protection facilities, increasing awareness is being devoted to the role of land cover in respect of amplified flood risks (Crooks and Davies, 2001; Bronstert et al., 2002; Brath et al., 2006; Haidvogl et al., 2018). Thus, the "UNESCO Division of Water Sciences" initiated a working group to analyze



Hohensinner et al. (2021)



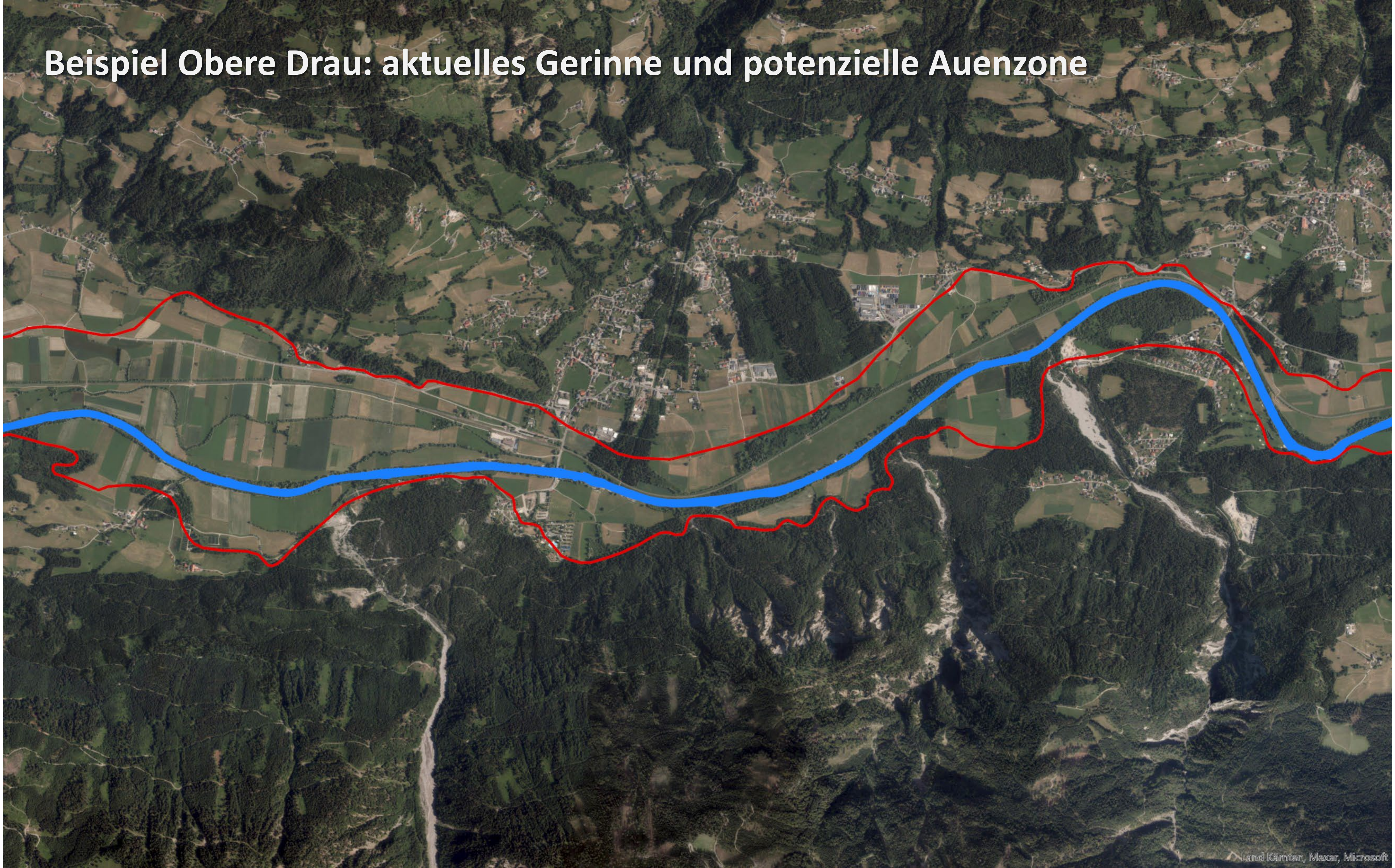
Wichtigste historische Quelle:

⇒ **Franziszeischer Kataster (1817-1861)**

⇒ **Problem:**
mehrere Flussabschnitte bereits reguliert

⇒ **ältere Karten erforderlich**

Beispiel Obere Drau: aktuelles Gerinne und potenzielle Auenzone

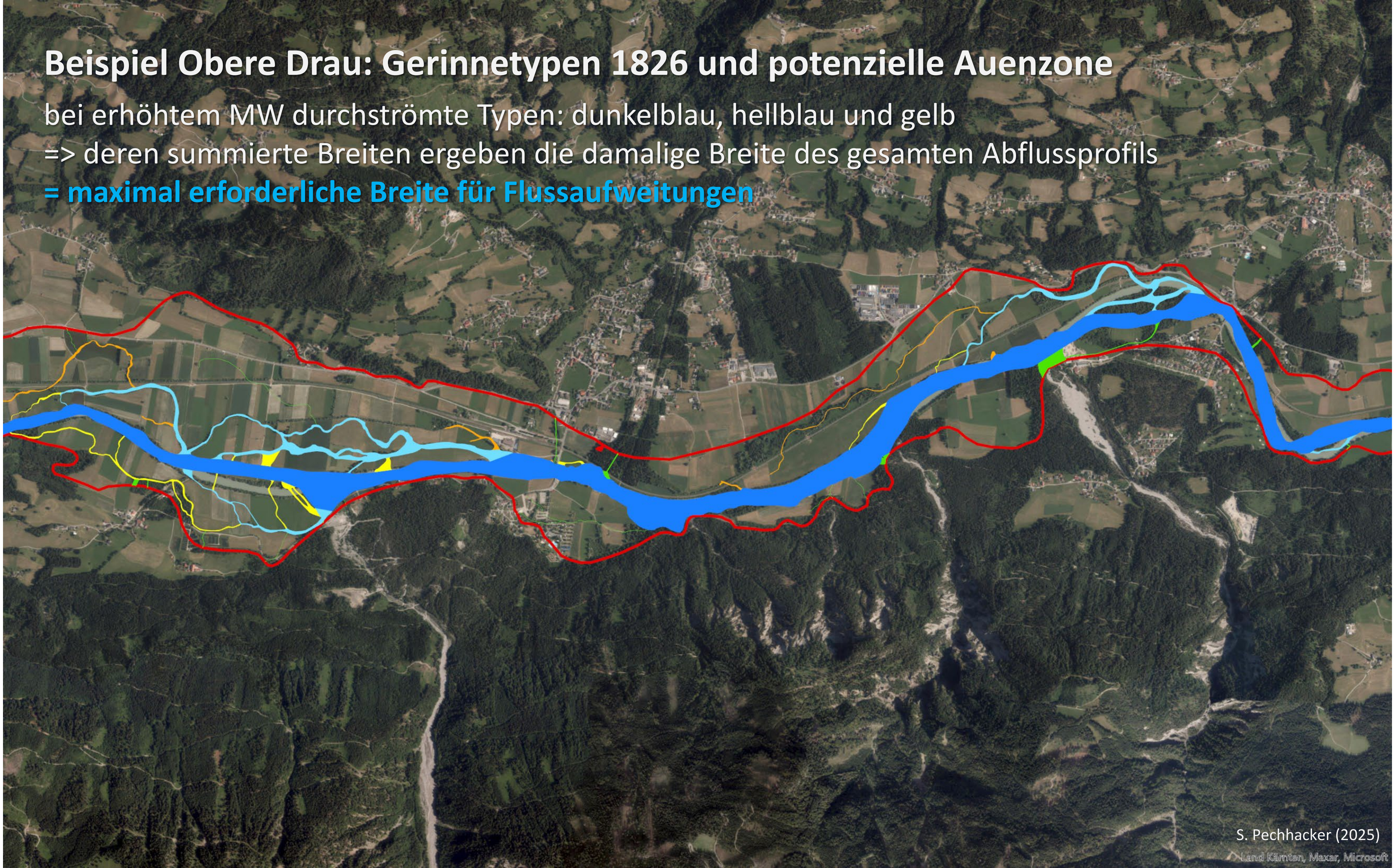


Beispiel Obere Drau: Gerinnetypen 1826 und potenzielle Auenzone

bei erhöhtem MW durchströmte Typen: dunkelblau, hellblau und gelb

=> deren summierte Breiten ergeben die damalige Breite des gesamten Abflussprofils

= maximal erforderliche Breite für Flussaufweitungen

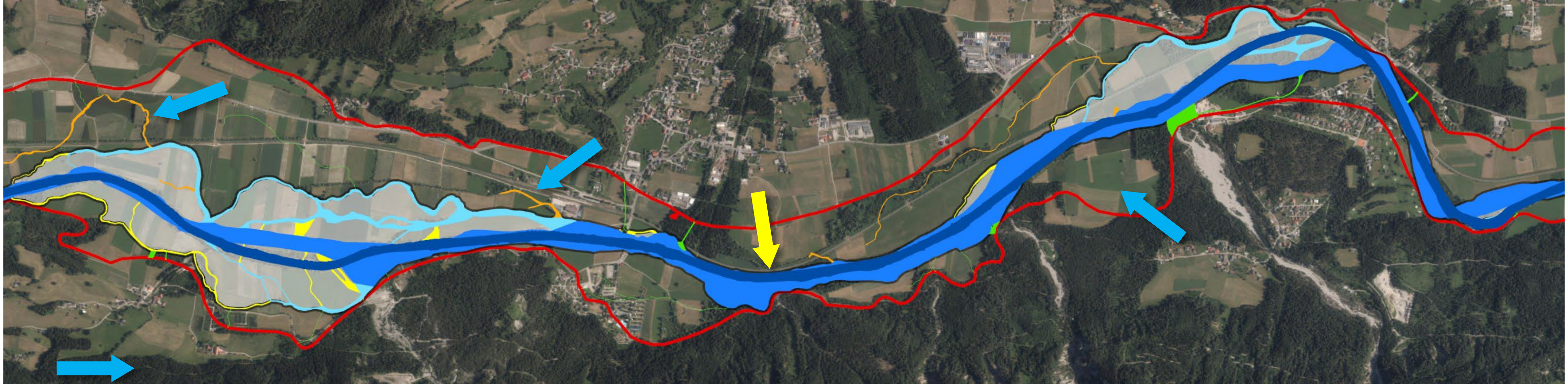


Beispiel Obere Drau: Gerinnetypen 1826 und dynamischer Korridor

=> umhüllendes hellgraues Polygon der bei erhöhtem MW durchströmten Gerinne inklusive dazwischen liegender Inseln

= minimaler typspezifischer flussmorphologischer Raumbedarf

(zugleich minimale Ausdehnung der potenziellen Weichen Au)



- blaue Pfeile: langfristiger typspezifischer Raumbedarf größer (wegen Verlagerungen seit 18. Jhdt.)
- Altarme (orange/rot) würden dazugehören, aber meist unklar wann entstanden (18./19. Jhdt.?)
- ebenso potenziell in Aubereichen wo um 1826 keine Gewässer waren

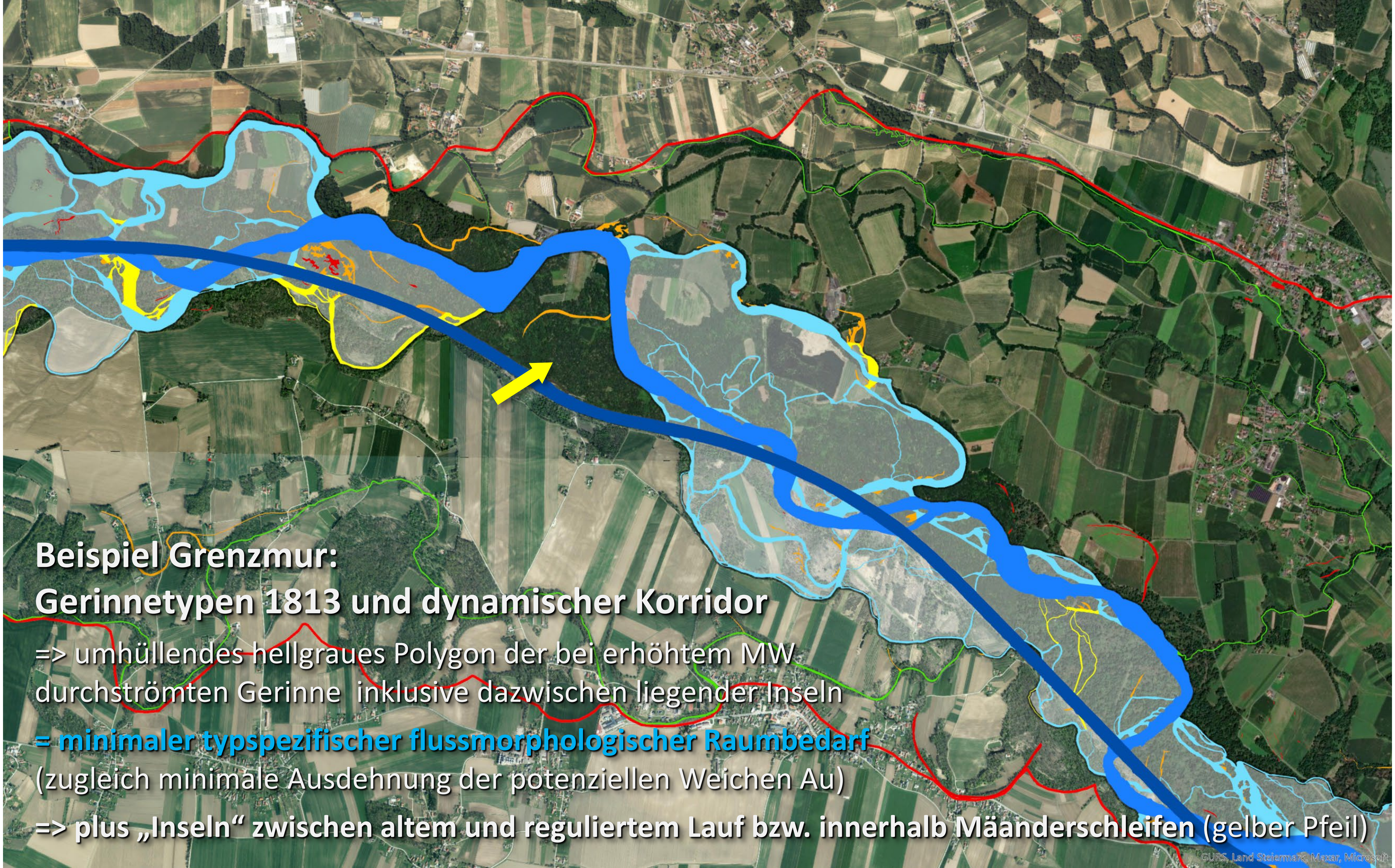
=> plus Puffer wo der aktuelle Flusslauf direkt ans Umland stößt? (gelber Pfeil)

S. Pechhacker (2025)

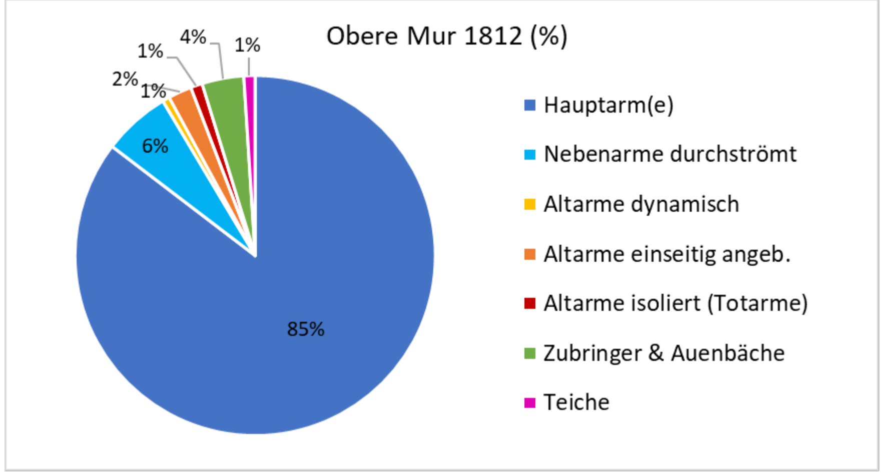

Beispiel Grenzmur:
aktuelles Gerinne und potenzielle Auenzone
E. Mann (2025)
GURS, Land Steiermark, Maxar, Microsoft

Beispiel Grenzmur:
Gerinnetypen 1813 und potenzielle Auenzone

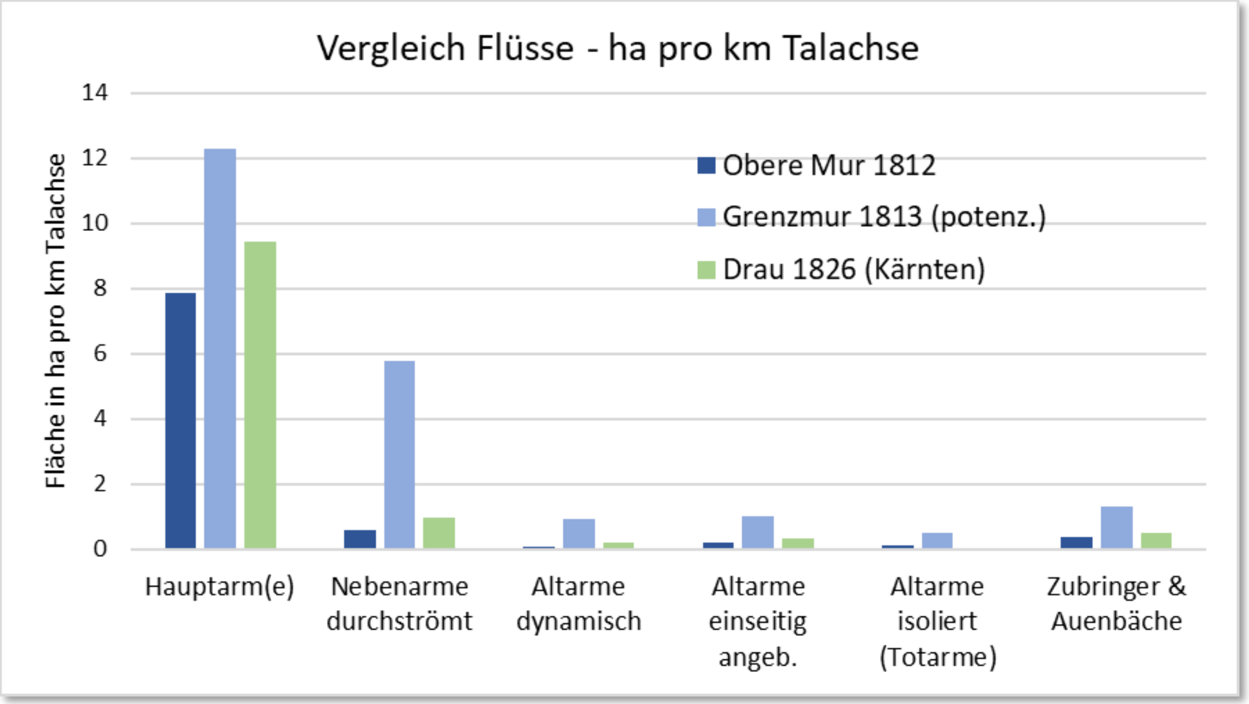
bei erhöhtem MW durchströmte Typen: dunkelblau, hellblau und gelb
=> deren summierte Breiten ergeben die damalige Breite des gesamten Abflussprofils
= maximal erforderliche Breite für Flussaufweitungen

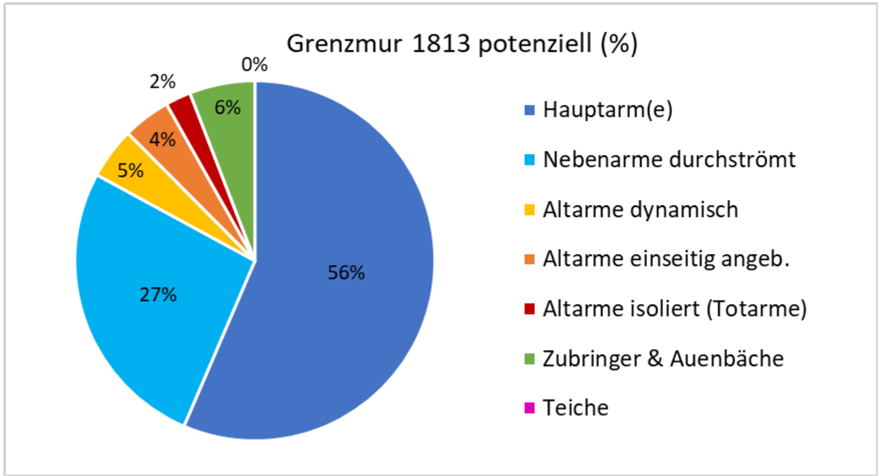

Beispiel Grenzmur:
Gerinnetypen 1813 und dynamischer Korridor
=> umhüllendes hellgraues Polygon der bei erhöhtem MW
durchströmten Gerinne inklusive dazwischen liegender Inseln
= minimaler typspezifischer flussmorphologischer Raumbedarf
(zugleich minimale Ausdehnung der potenziellen Weichen Au)
=> plus „Inseln“ zwischen altem und reguliertem Lauf bzw. innerhalb Mäanderschleifen (gelber Pfeil)
GURS, Land Steiermark, Maxar, Microsoft

Flusstypen und anteilige aquatische Makrohabitate im Vergleich

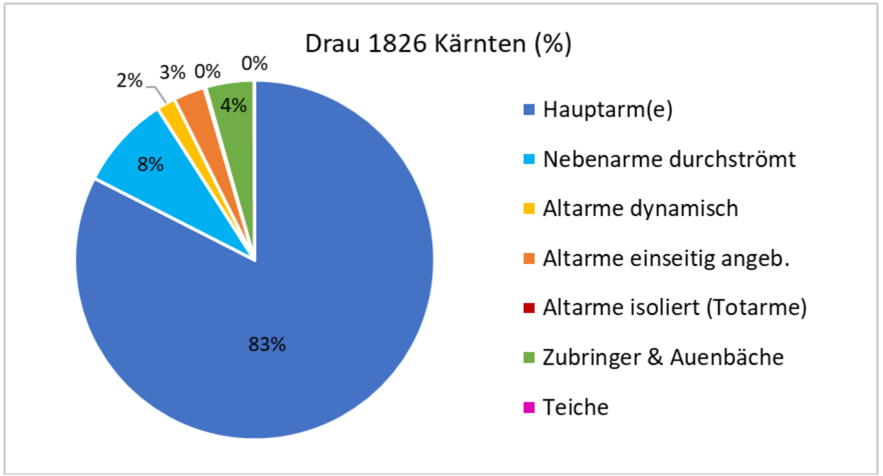


Flusstyp:
großteils gewunden





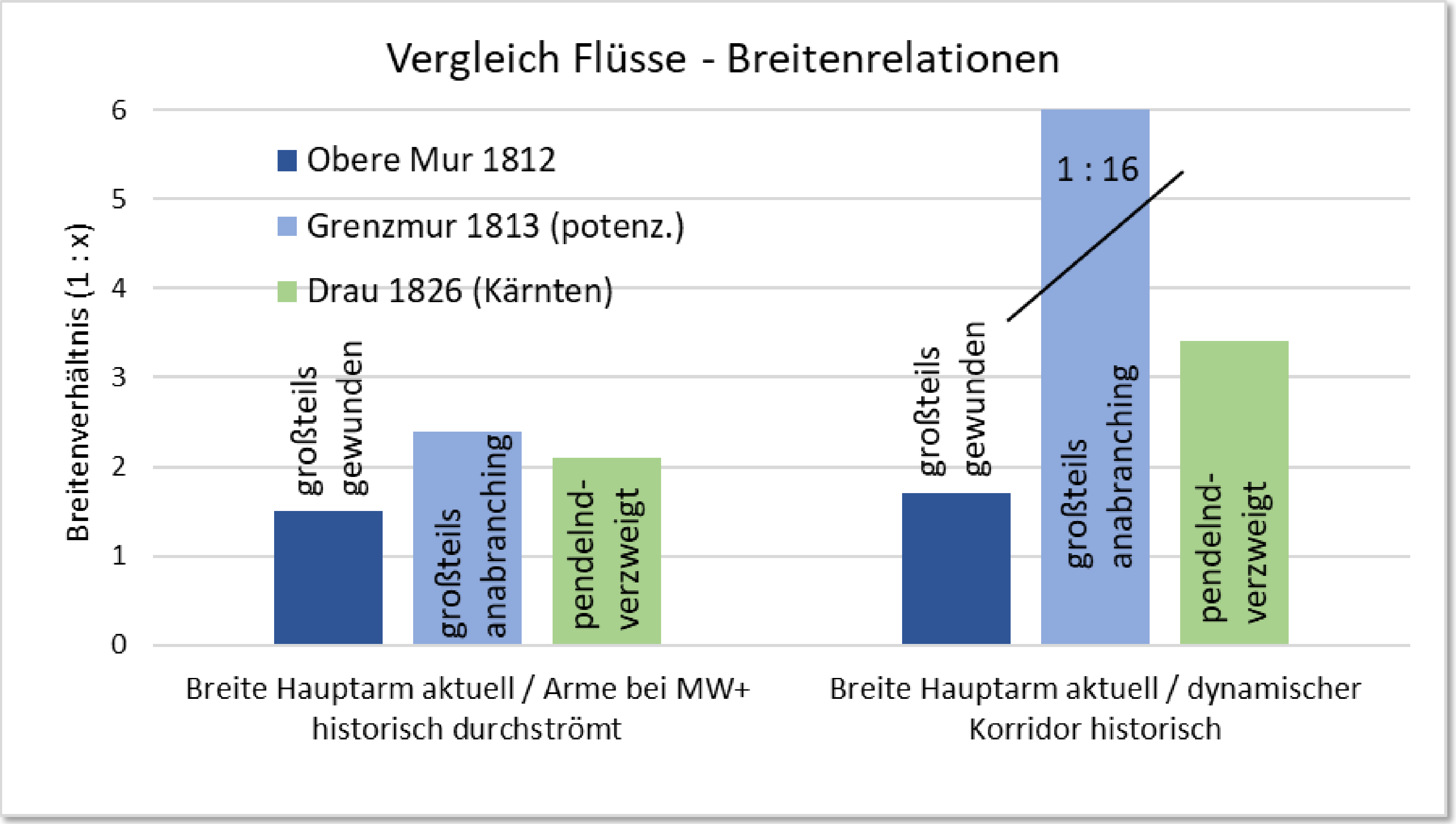
Flusstyp:
großteils anabranching



Flusstyp:
pendelnd-verzweigt

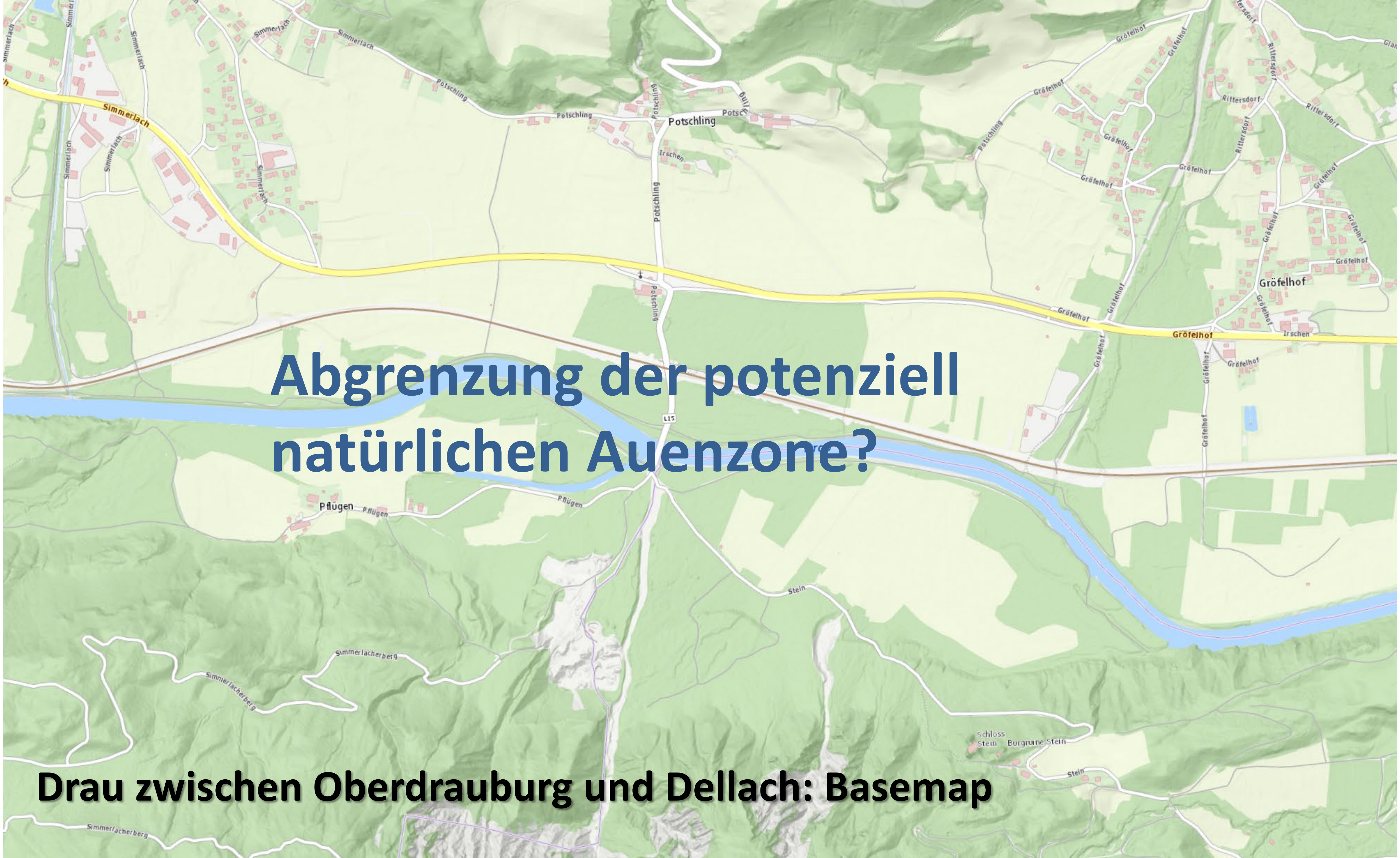
=> um 1785 noch stärker verzweigt (mehr Nebenarme)

Flusstypen im Vergleich



⇒ **Grundlagen für Gewässer-Renaturierungen (LIFE-Projekte)**

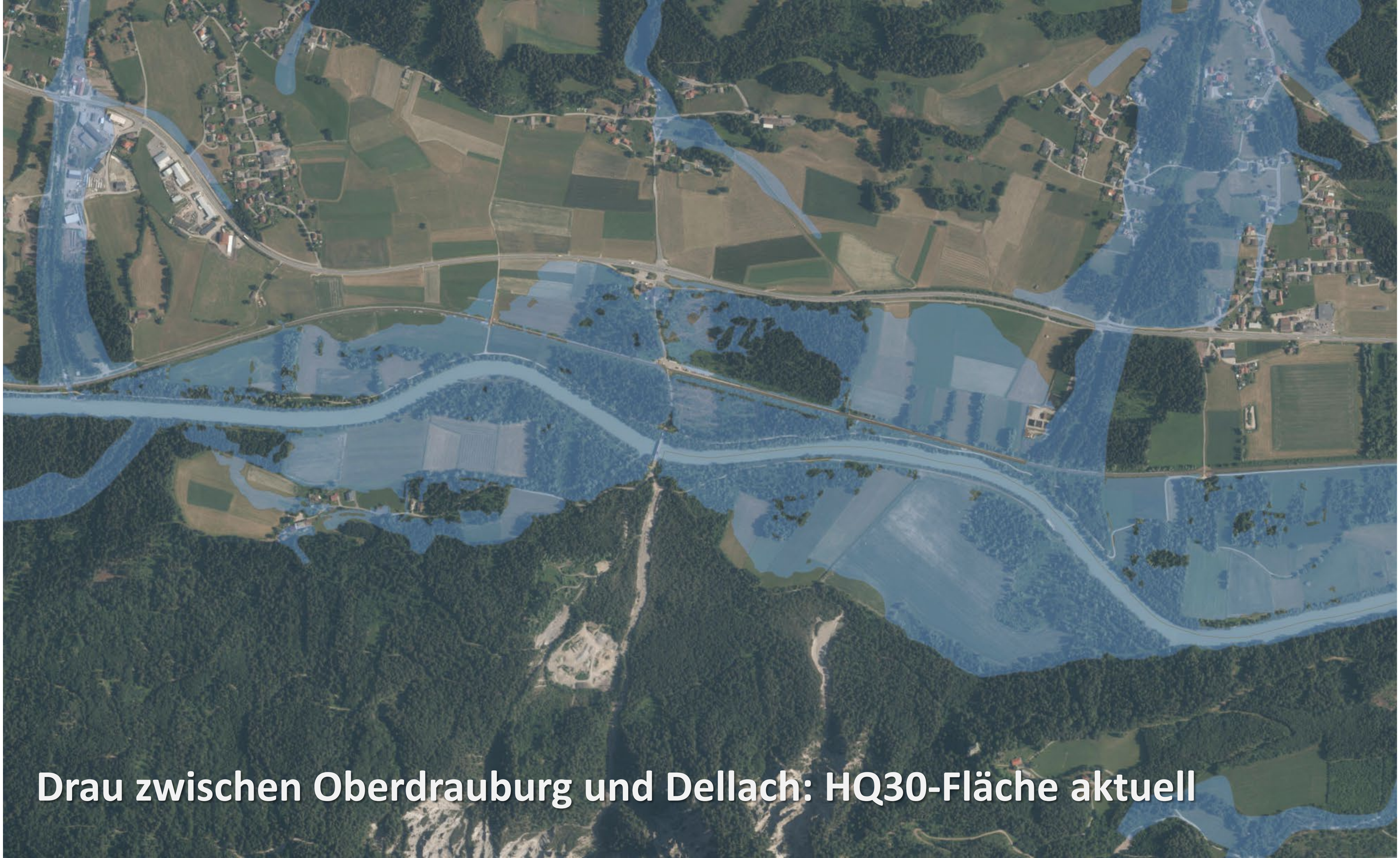
Abgrenzung der potenziell natürlichen Auenzone?



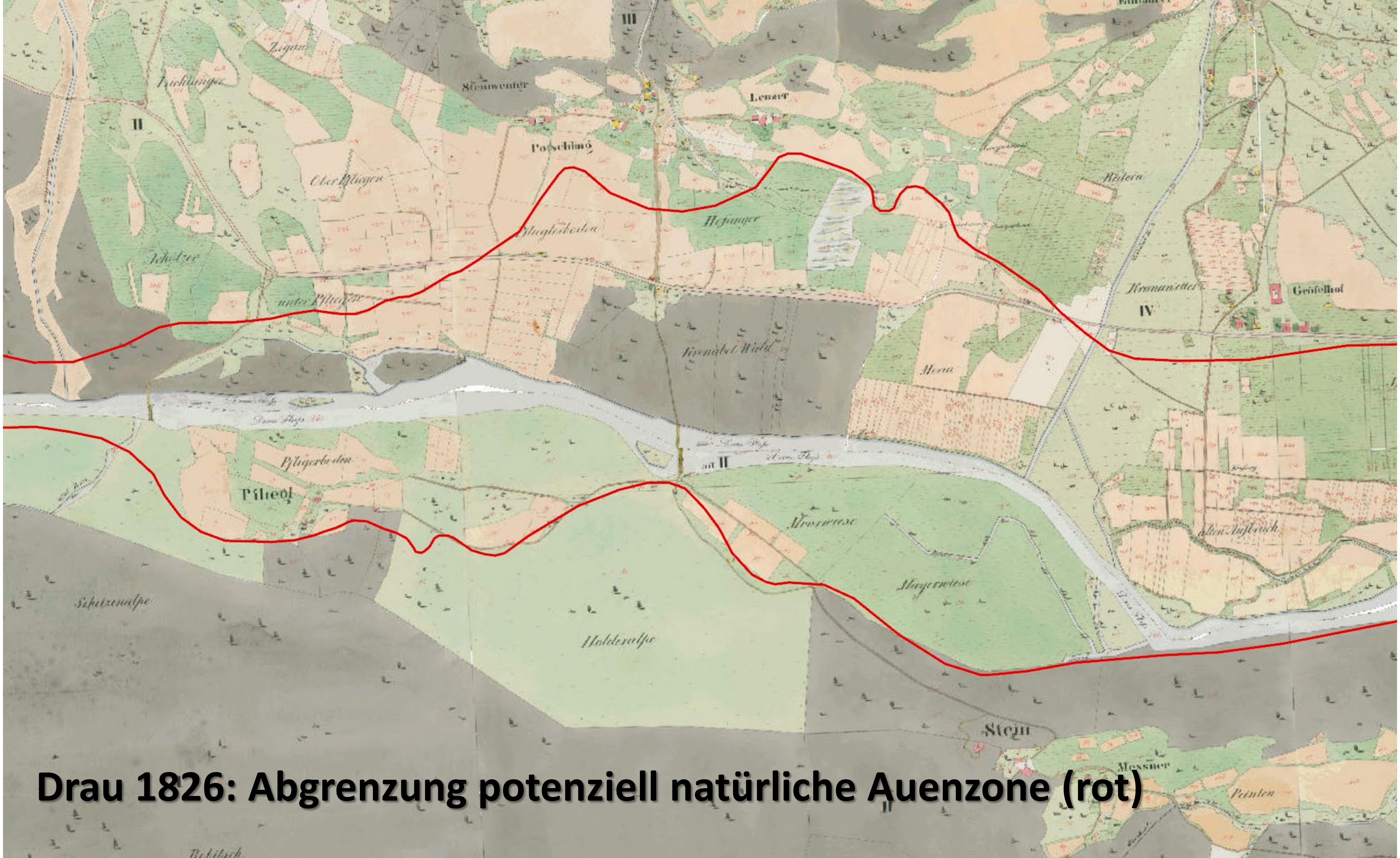
Drau zwischen Oberdrauburg und Dellach: Basemap

Drau zwischen Oberdrauburg und Dellach: Geologischer Untergrund

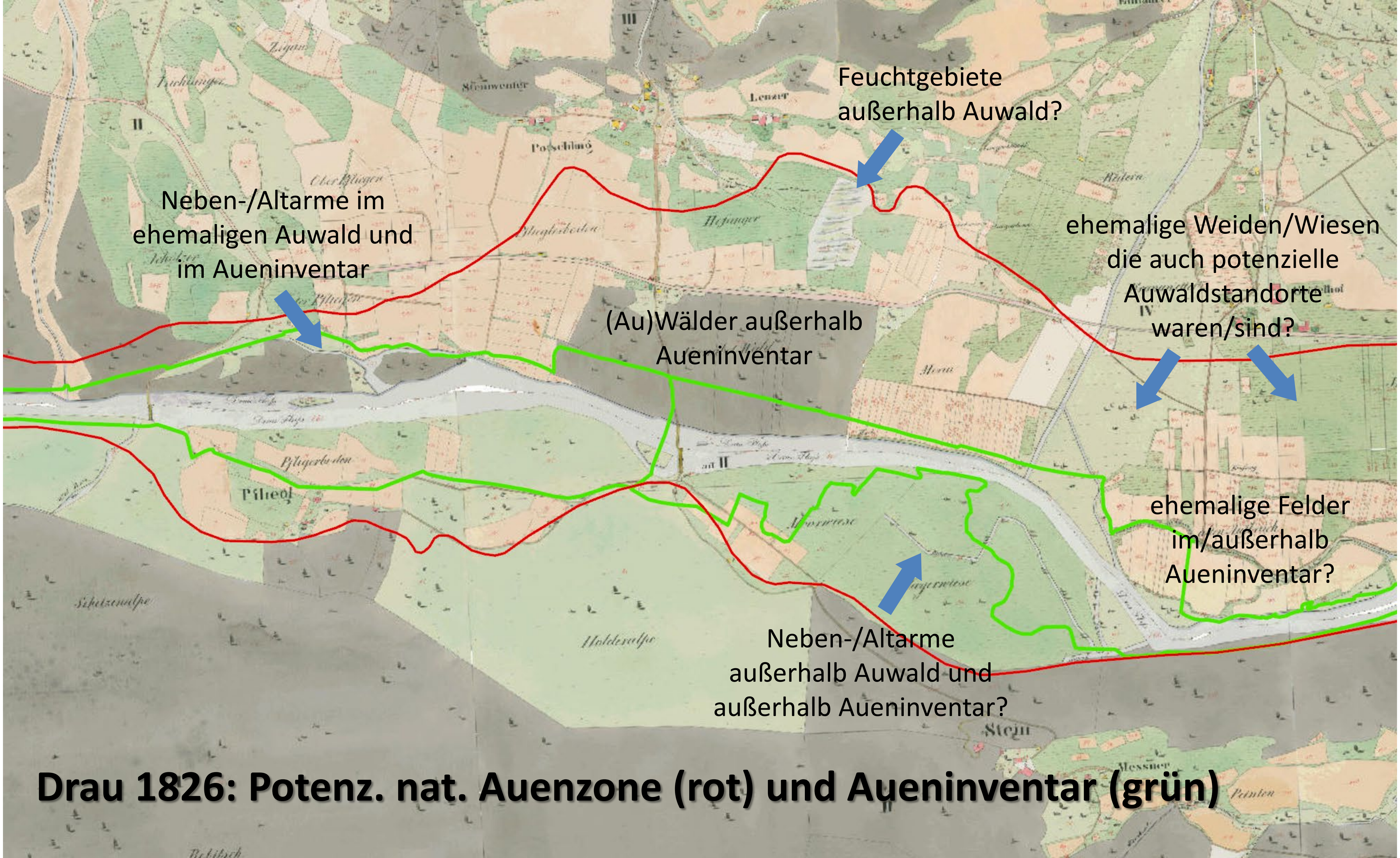
Drau zwischen Oberdrauburg und Dellach: Geländestrukturen


Drau zwischen Oberdrauburg und Dellach: HQ30-Fläche aktuell

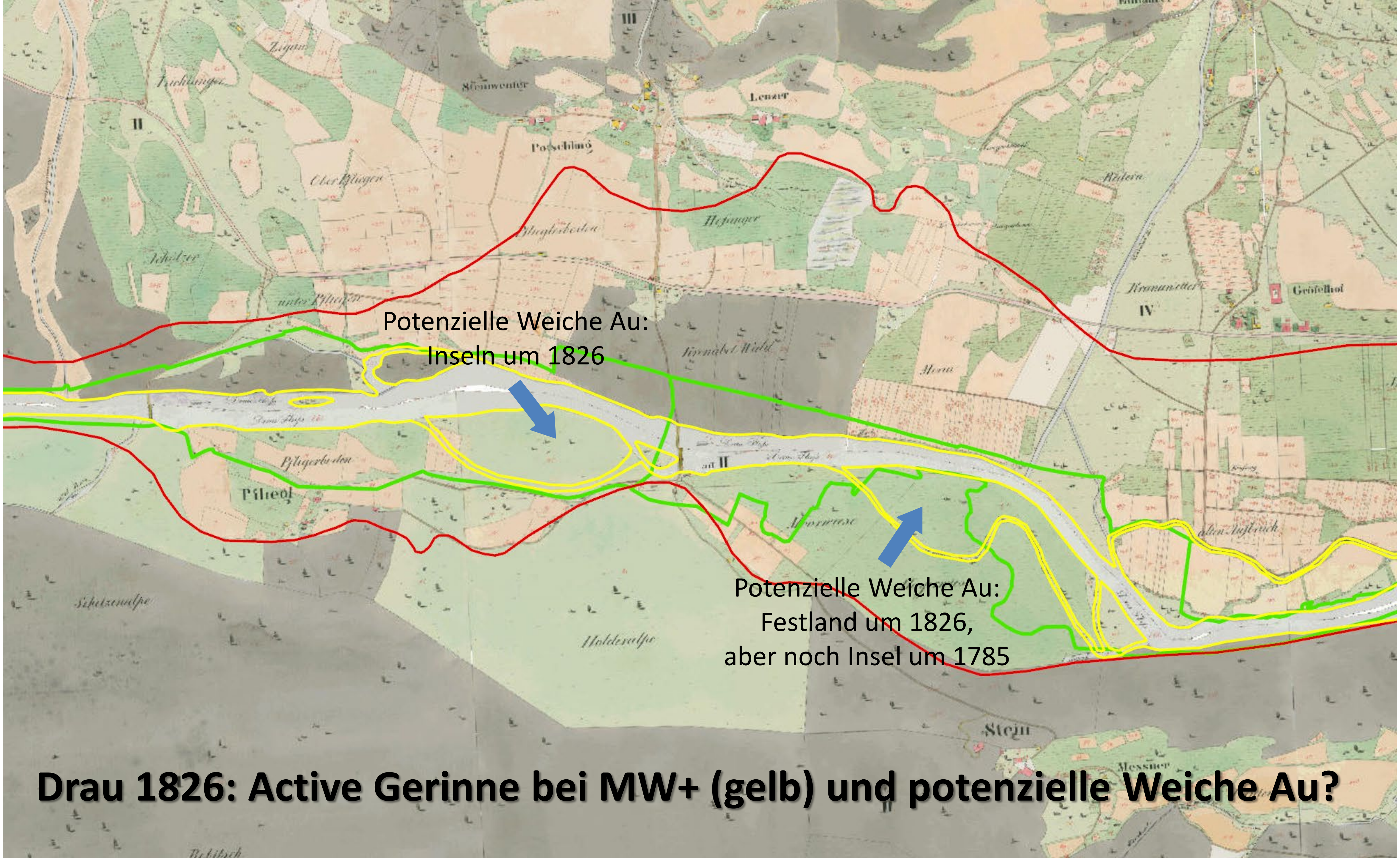
Drau zwischen Oberdrauburg und Dellach: historisch um 1826



Drau 1826: Abgrenzung potenziell natürliche Auenzone (rot)



Drau 1826: Potenz. nat. Auenzone (rot) und Aueninventar (grün)



Drau 1826: Active Gerinne bei MW+ (gelb) und potenzielle Weiche Au?

Grundlagenprojekt „Identifikation von historischen Gewässerläufen und Auwaldstandorten in Österreich“

(1) potenziell natürliche Auenzone als äußerste Abgrenzung der Fluss-/Auenlandschaft

(= potenziell natürlicher Umlagerungsraum = tiefstes postglaziales/rezentes Auenniveau abzüglich älterer Flussterrassen)

(2) durchströmte Flussarme (aktives Gerinne = Wasser- und unbewachsene Sedimentflächen)
=> maximal erforderliche Breite für Flussaufweitungen

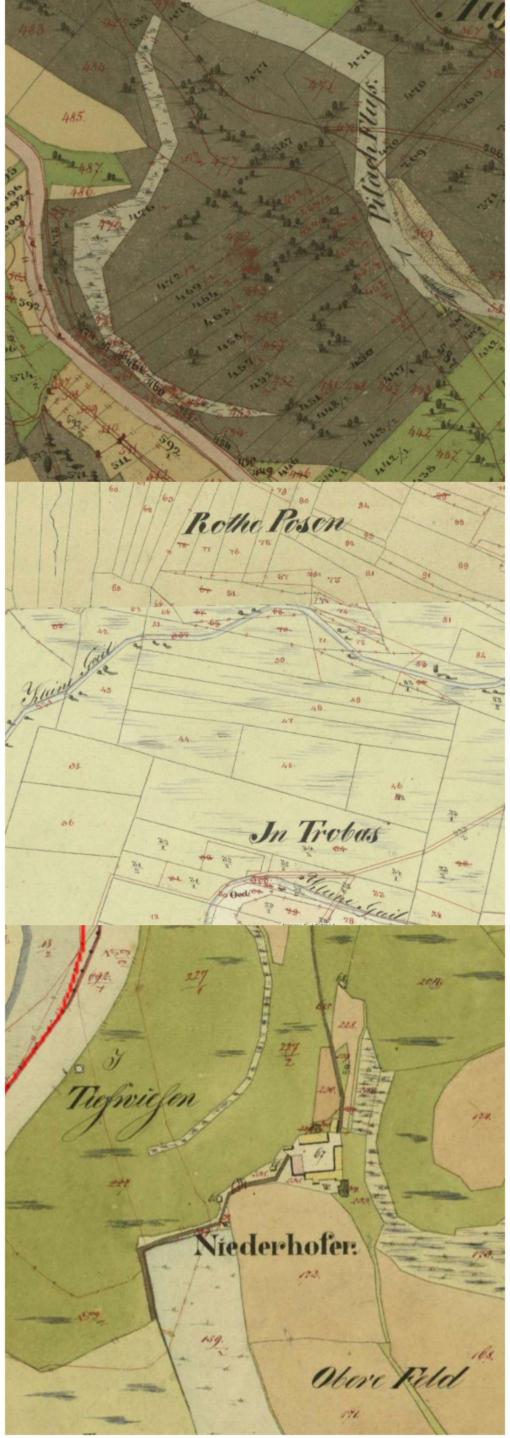
(3) dynamischer Umlagerungsbereich (potenzielle Weiche Auwaldstandorte)
(umhüllendes Polygon der durchströmten Flussarme inklusive der bewachsenen Inseln und Festlandbereiche zwischen ausgeprägten Flussbögen) => minimaler typspezifischer flussmorphologischer Raumbedarf

Grundlagenprojekt „Identifikation von historischen Gewässerläufen und Auwaldstandorten in Österreich"

(4) historisch ausgewiesene Auwälder innerhalb der potenziell natürlichen Auenzone

(5) historisch ausgewiesene Feuchtflächen (feuchte Wiesen/Weiden/Moore/Sümpfe)

(6) historisch stark von angrenzenden Flussarmen beeinflusste Ackerflächen
(durch Böschungen bzw. Abbruchskanten in historischen Karten als solche ausgewiesen)



Ziele des Projekts „Identifikation von historischen Gewässerläufen und Auwaldstandorten in Österreich“

- ⇒ **einheitlicher standardisierter GIS-Datensatz für Flüsse/Auen mit Einzugsgebiet >100 km²**
- ⇒ **unterschiedliche räumliche Abgrenzungen innerhalb der potenziell natürlichen Auenzone (z.B. dynamische versus stabile Au)**
- ⇒ **verschiedene Subeinheiten (Raumeinheiten) für unterschiedliche Fragestellungen bezüglich der Auenstrategie und Flussrenaturierungen**