COST Action CONVERGES

Working group 2: Visualization of European responses to riparian degradation

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Presentations

- Filip Alimpic on genetic conservation of riparian plant species
- Antonis Kavvadias on remote sensing of riparian vegetation
- Mart Külvik – Workshop in Tartu (Estonia) March 18-19, 2020 on social awareness and stakeholder issues

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Objective: **To identify the responses to degradation of riparian vegetation**

Three types of responses:

- production of knowledge (What do we know, what are the gaps, need for knowledge?)
- management practices and tools (Which measures have been used?)
- social responses (Legislation, institutions, stakeholders)

Objective: **To identify the responses to degradation of riparian vegetation**

Tasks:

- Map of scientific knowledge
- Map of management practices and tools
- Map of social awareness

Overview of WG2 activities

- Review of riparian restoration methods
- Remote sensing of riparian zones
- Conservation of riparian genetic resources
- Riparian zones in legislation and stakeholder issues

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Scientific knowledge regarding responses to degradation of riparian vegetation

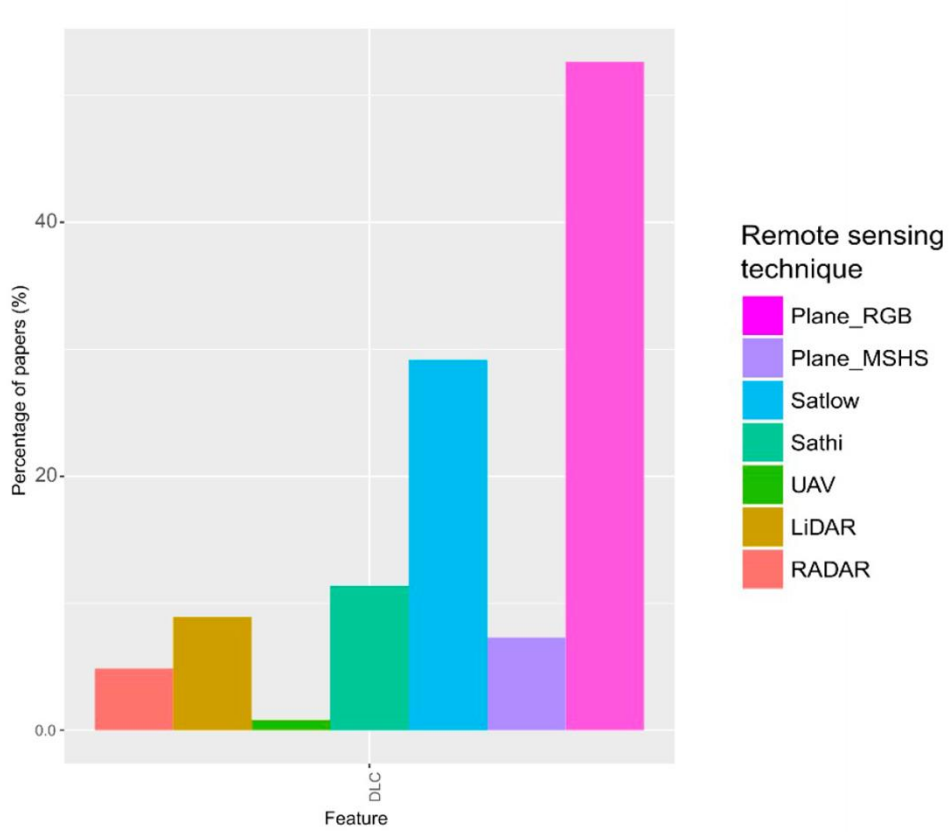
- Review the scientific literature
- Which restoration methods targeting riparian vegetation have been used? Where are the knowledge gaps?
- What is the evidence for the effectiveness of different methods?
- Is there a need for new types of actions?
- Technological and methodological development – advances in remote sensing techniques

Scientific knowledge regarding responses to degradation of riparian vegetation

Ongoing activities on remote sensing of riparian vegetation:

- Presentation by Antonis Kavvadias (Remote sensing applications on riparian ecosystems, STSM report)

- Report (CONVERGES website): Using remote sensing to characterize riparian vegetation: a review of available tools and perspectives for managers (Leo Huylenbroeck and coworkers)
- Submitted manuscript



- MSc thesis – Potential of Copernicus riparian layers to assess riparian zone integrity with landscape metrics by Jean-Phillippe Ugille
- Report on CONVERGES website

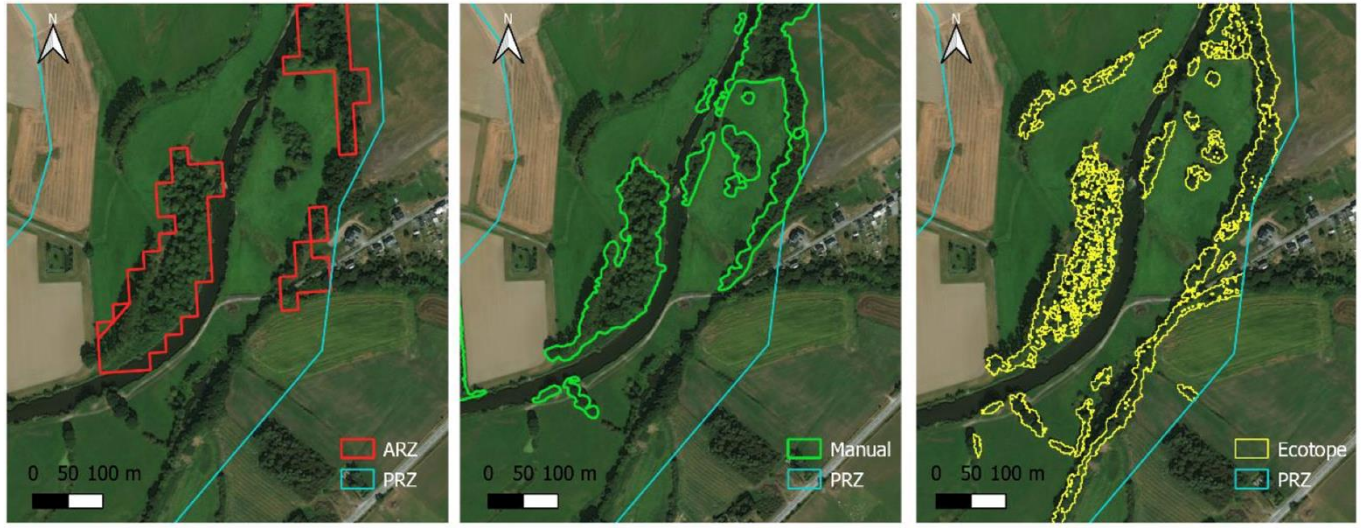
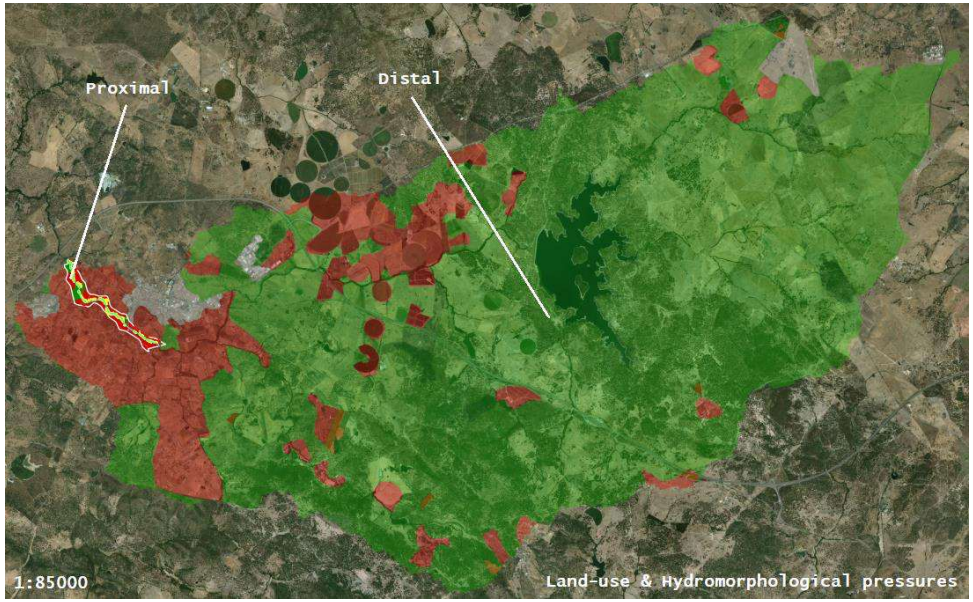
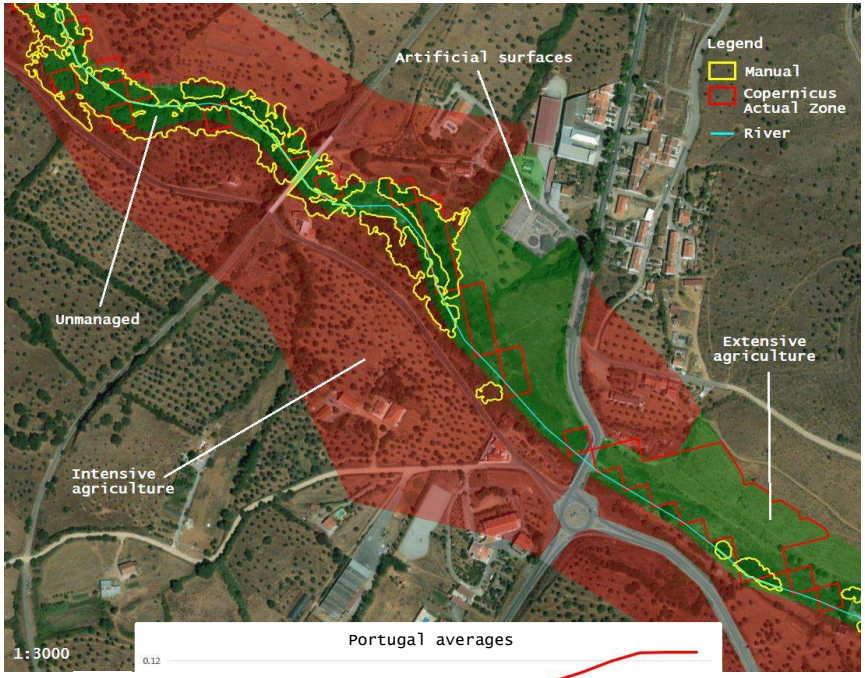


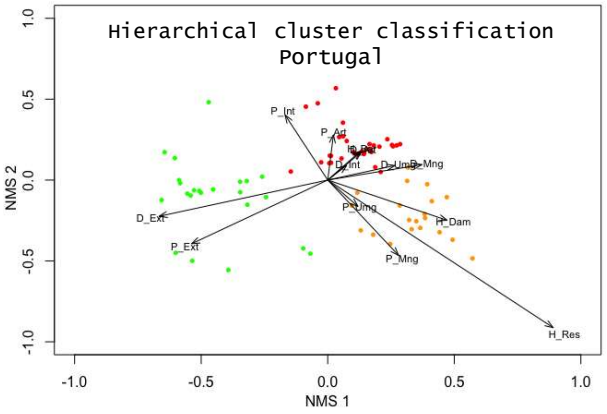
Figure 6 - Example of woody delineation for the three resolutions (Polygons > 200 m²). In red : ARZ layer, in green : Manual layer, in yellow : Ecotope layer

- Manuscript in preparation: Riparian connectivity assessment across a gradient of human disturbance: the potential of Copernicus data in Mediterranean and temperate river systems (Andre Fonseca)
- Deadline: March

Riparian connectivity assessment across a gradient of human disturbance: the potential of Copernicus data in Mediterranean and temperate river systems (Andre Fonseca)



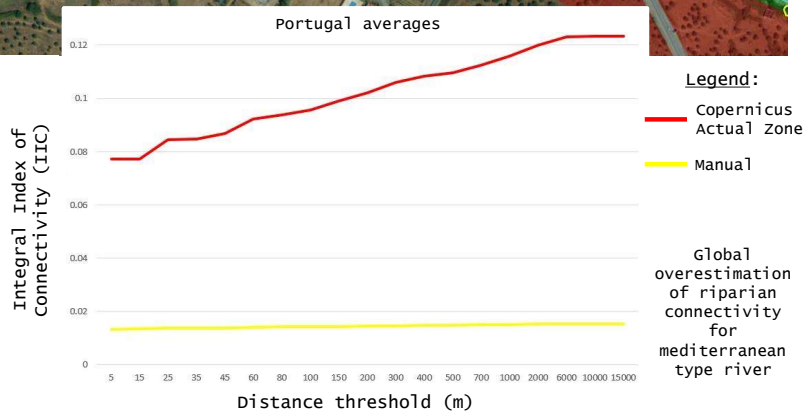




Variables:
8 land-use land-cover
3 hydromorphological

76 points – Portugal
80 points – Belgium

3 levels of distrubance



Conservation of riparian genetic resources across Europe

- Review the state of art in genetic conservation of riparian ecosystems/species at the European level
- Identify knowledge gaps, conservation barriers and future research and management needs
- List of experts
- Species
- Genetic conservation projects
- Presentation by Filip Alimpic

Social responses to riparian vegetation degradation

- Role of riparian vegetation in legislation
- Relevant EU directives such as the Species and Habitat directive, Floods Directive and the Water Framework Directive
- Member State legislation and policies
- Questionnaire to country representatives, riparian vegetation in legislation
- Paper: Riparian vegetation restoration: Does social perception reflect ecological value? (Pedro Arsénio and coworkers, River Research and Applications)
- Workshop in Tartu, Estonia March 18-19, 2020
- Presentation by Mart Külvik

Map of riparian restoration methods

- Types of methods
  - *Extensification (space for riparian vegetation)*
  - *E-flow measures*
  - *Connectivity*
  - *Structural habitat measures*
  - *Native species introduction/Species removal*
- Reasons for degradation
- Riparian functions or processes promoted
- Spatial scale
- Reference conditions, target conditions, recovery process
- Evaluation of success

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Riparian restoration methods – variables and definitions

Aspect	definition	method of collecting information
Restoration measure	types of restoration actions.process-based, structural, or species-based	literature review
Reasons for degradation	drivers and pressures causing degradation motivating restoration	literature review
Have drivers of degradation been alleviated or are they ongoing?	spontaneous recovery	expert evaluation based on literature review; need of a database of restoration actions
Riparian ecological processes or conditions promoted	ecological and environmental benefits of the restoration actions	literature review
Ecosystem functions and services	ecosystem functions and services expected to be promoted by the restoration actions	literature review
Spatial scale	local; reach; catchment	expert evaluation based on literature review
Reference condition	Pristine conditions; traditional management	expert evaluation based on literature review
Target conditions or goals	full recovery, partial recovery, reinstate some specific structure or function	expert evaluation based on literature review
Recovery process	Is spontaneous recovery due to removal of pressures expected?	expert evaluation based on literature review
Evaluation of success	Classes in falling degrees of certainty	literature review
Geography	region or biome within Europe	questionnaire or project database needed
Water course types	types of water course	expert evaluation based on literature review
Catchment land cover	Dominating landcover types in the catchment	Corinne land cover classes?
Climate change	Expected effects of climate change on goals for restoration, reference conditions, restoration benefits, relevance and efficacy of the restoration method	expert evaluation based on literature review

Papers on riparian restoration - database

Hydrology and Earth System Sciences

Hydrol. Earth Syst. Sci., 21, 5763–5780, 2017
https://doi.org/10.5194/hess-21-5763-2017
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Importance of considering riparian vegetation requirements for the long-term efficiency of environmental flows in aquatic microhabitats

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Abstract. Environmental flows remain biased toward the traditional biological group of fish species. Consequently, these flows ignore the inter-annual flow variability that rules species with longer lifecycles and therefore disregard the long-term perspective of the riverine ecosystem. We analyzed the importance of considering riparian requirements for the long-term efficiency of environmental flows. For that analysis, we modeled the riparian vegetation development for a decade facing different environmental flows in two case studies. Next, we assessed the corresponding fish habitat availability of three common fish species in each of the resulting riparian landscape scenarios. Modeling results demonstrated that the environmental flows disregarding riparian vegetation requirements promoted riparian degradation, particularly vegetation encroachment. Such circumstance altered the hydraulic characteristics of the river channel where flow depths and velocities underwent local changes of up to 10 cm and 40 cm s^{-1}, respectively. Accordingly, after a decade of this flow regime, the available habitat area for the considered fish species experienced modifications of up to 110 % when compared to the natural habitat. In turn, environmental flows regarding riparian vegetation requirements were able to maintain riparian vegetation near natural standards, thereby preserving the hydraulic characteristics of the river channel and sustaining the fish habitat close to its condition. As a result, fish habitat availability

1 Introduction

Freshwater ecosystems provide vital services for human existence but are on top of the world's most threatened ecosystems (Dudgeon et al., 2006; Revenga et al., 2000), primarily due to river damming (Allan and Castillo, 2007). The ability to provide sufficient water to ensure the functioning of freshwater ecosystems is an important concern as its capacity to provide goods and services is sustained by water-dependent ecological processes (Acreman, 2001). The relevance of this subject compelled the scientific community to appeal to all governments and water-related institutions across the globe to engage in environmental flow restoration and maintenance in every river (Brisbane Declaration, 2007). Actually, this issue is a global research topic, as all dams, weirs, and levees change the magnitudes of peak flood flows of rivers to a certain extent (e.g., FitzHugh and Vogel, 2010; Maheshwari et al., 1995; Miller et al., 2013; Nilsson and Berggren, 2000; Uddin et al., 2014a, b). As a result of this, there are still opportunities for the implementation of environmental flow restoration at hundreds of thousands of these structures worldwide (Richter and Thomas, 2007).

Environmental flows can be defined as "the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems, and the human livelihoods and wellbeing that depend upon these ecosystems" (Brisbane Declaration, 2007) and play an essential role in the conservation of freshwater ecosystems (Arthington et al., 2006; Hughes and Rood, 2003). It is now agreed that environmental

...pain: Theoretical and Practical Approach
...ropean Water Framework Directive

...ished online: 9 May 2012

Keywords River restoration · Spain · Water framework directive · Water resources management · Forecaster · National strategy

Introduction

River restoration is an emergent activity in many countries for several reasons (Clewell and Aronson 2006; Feld and others 2011). First is the perception of the loss of landscapes, ecosystems and species that has occurred in many areas during the last century as a result of intense demographic and economic growth, which has produced ecological and social ...ption by limiting the availability of water resources, ...ing the natural biodiversity and contributing to the ...of important environmental services (Nilsson and ...n 2000; Tockner and Stanford 2002; Meybeck 2003; ...05; Mooney and others 2009).

...er understanding of the effects of the environ... ...gradation of rivers on the well-being of people ...d in various legislative measures to prevent ...adation and assure biological conservation. In ...ntries, recent directives such as the Water ...irective (WFD) (2000/60/EC 23 October ...d Directive (2007/60/EC 23 October 2007) ...de Directive (2009/128/EC 21 October ...require the Member States to produce ...sin management plans (RBMPs) which ...ms of restoration measures to prevent ...and ameliorate the ecological status of ...

...ears, since the restoration of rivers ...s have been considered ...

...available at ScienceDirect
...ironmental Management
...e: www.elsevier.com/locate/jenvman

...ion: A global review of implementation ...h the international, peer-reviewed

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ABSTRACT

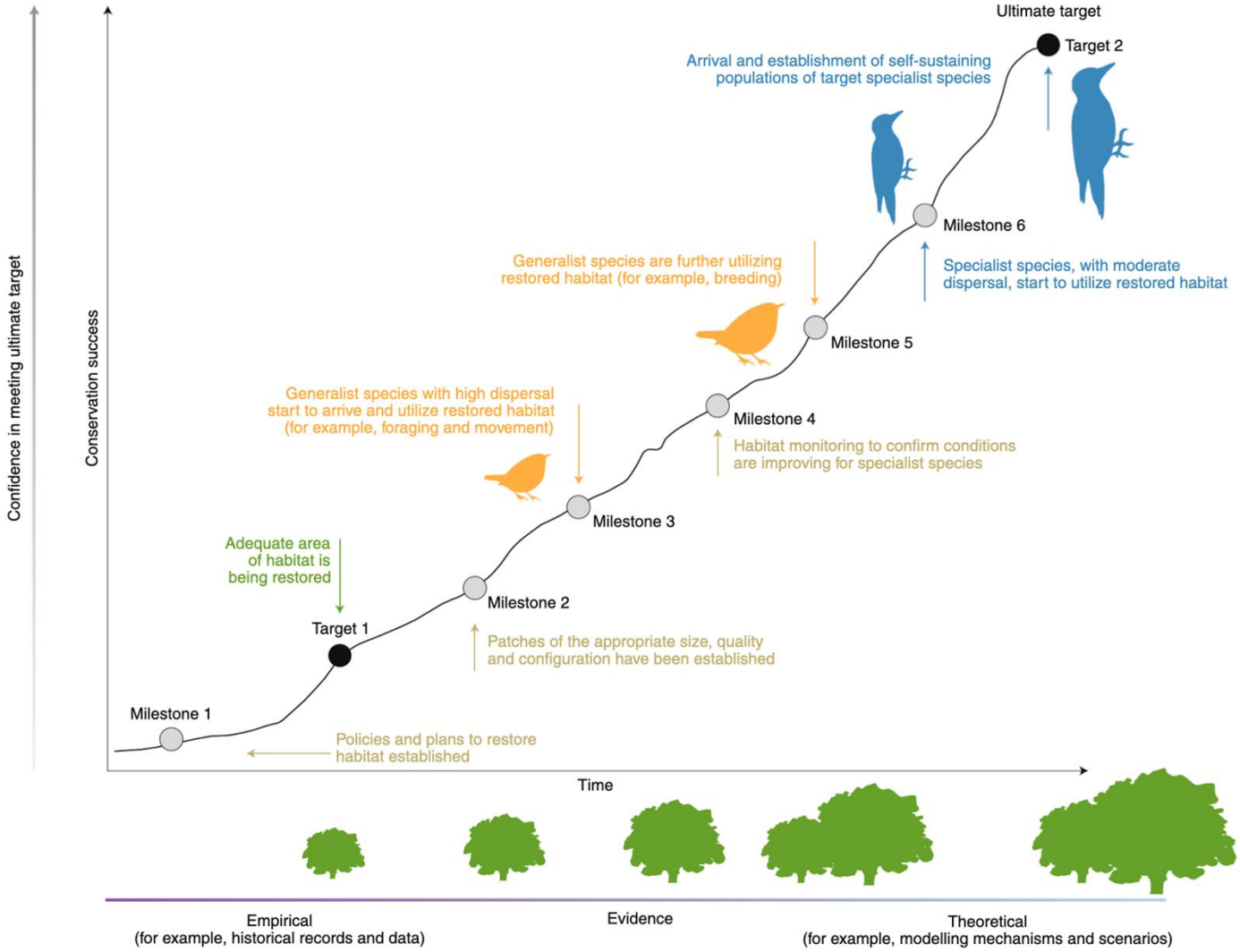
We examined how restoration of riparian vegetation has been implemented ...entific literature during the past 25 years. A total of 169 papers were re... ...formation about the following: 1) restoration strategies applied, 2) ... ...reference sites, 3) metrics used for evaluation, and 4) drivers of success ...(e.g., dam operations, controlled floods, landform reconfiguration) were ...active plant introduction, exotic species control, natural floodplain con... ...control. Our review revealed noteworthy limitations in the spatio... ...evaluation. Evaluations were mostly from one single project a... ...dimensional nature of rivers; landscape spatial patterns were rarely ...assessed locally (i.e., ≤meander scale). Monitoring rarely lasted for ...evaluated were usually not more than six years old. The impact of ...assessed by tracking change over time rather than by comparing ...reference sites (12%), and few projects (30%) did both. Among th... ...evaluated, vegetation structure (e.g., abundance, density, etc.) w... ...vegetation processes (e.g., biomass accumulation, survival, etc.) ...papers). Success was attributed to hydro-geomorphic factors ... ...would benefit from incorporating emerging concepts in ecol... ...covery of functionality, more rigorous experimental design... ...longer term monitoring and reporting failure.

...Kondolf et al., 2007), ...adaptive management ... ...restoration ecology a... ...2007; Shafroth et ...

Review of riparian restoration success

- Growth in number of studies (update of previous reviews, e.g. by REFORM project)
- Restoration reviews failing to document response
- Time lags
- True for riparian vegetation?

Time lags and milestones in restoration



Watts et al. (2020) Nature Ecol. Evol.

Work plan

- Agree on protocol
- Call for input in evaluating papers in database
- STSM by Philippe Janssen
- Map of restoration measures
- Success of riparian vegetation restoration
- Meta-analysis

Type of restoration

- Choose from list
- Reasons for degradation
- Pressure alleviated or ongoing? (more often ongoing)

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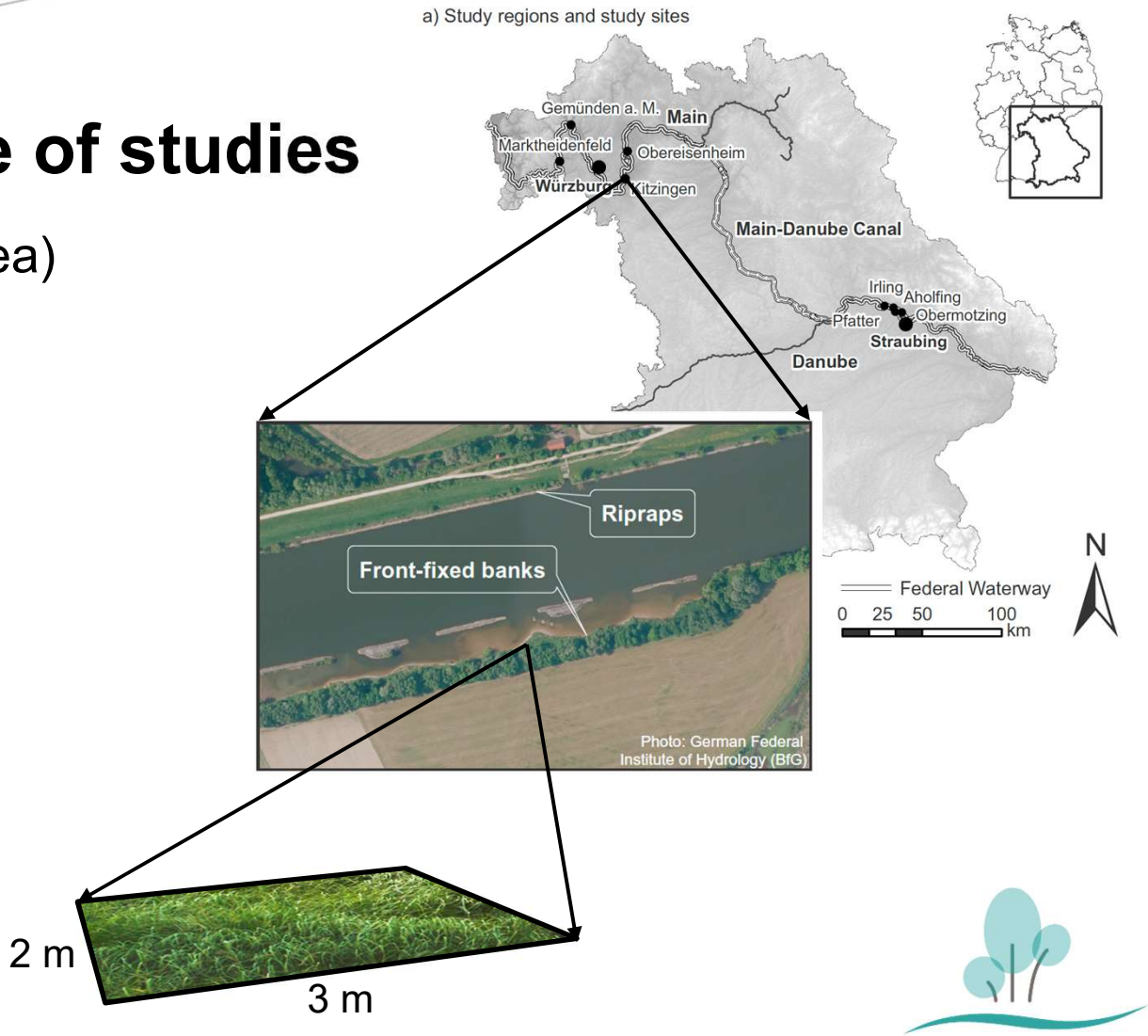
Spatial scale of studies

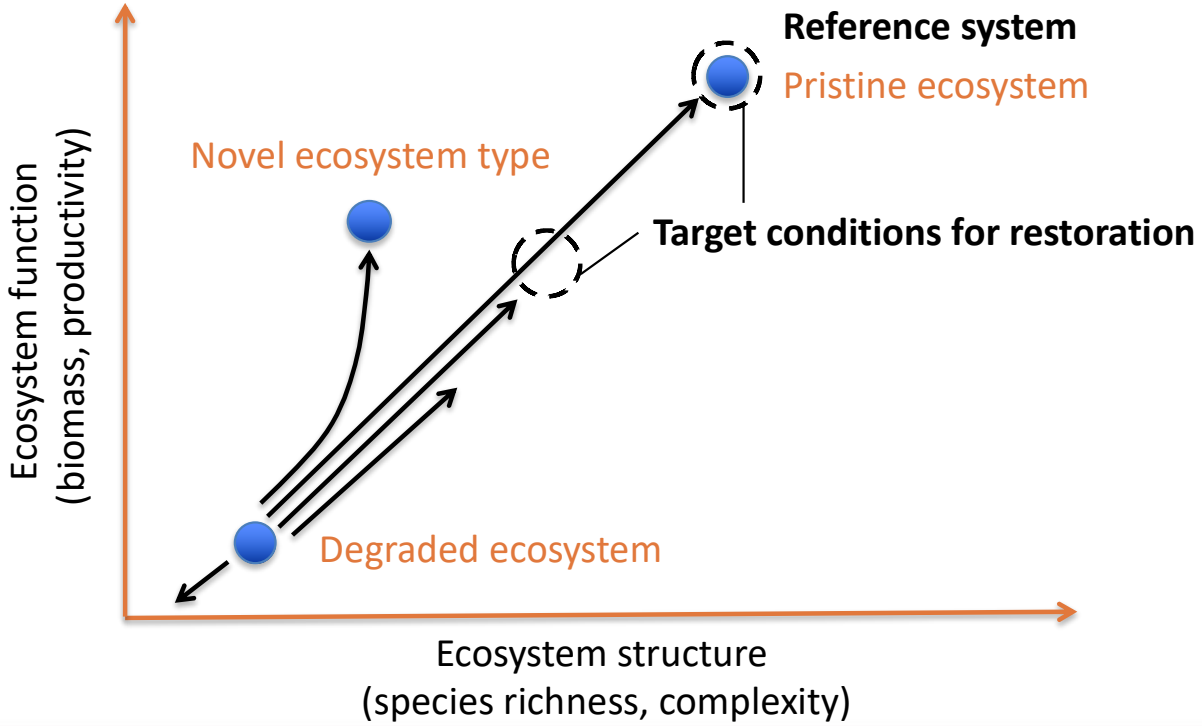
- Extent (study area)
- Site
- Grain (plot)



Wollny et al. (2019) Ecol. Eng.

References and expectations

- Definition of restoration (*not given*)
- Reference conditions (*not mentioned*)
- Target conditions (*vague*)
- Expectation (*hypothesis; always present*)



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THE RESTORATIVE

CONTINUUM

Improving biodiversity, ecological integrity, and ecosystem services

REDUCING SOCIETAL IMPACTS

IMPROVING ECOSYSTEM MANAGEMENT

REPAIRING ECOSYSTEM FUNCTION

INITIATING NATIVE RECOVERY

PARTIALLY RECOVERING NATIVE ECOSYSTEMS

FULLY RECOVERING NATIVE ECOSYSTEMS

REDUCED IMPACTS

REMEDIATION

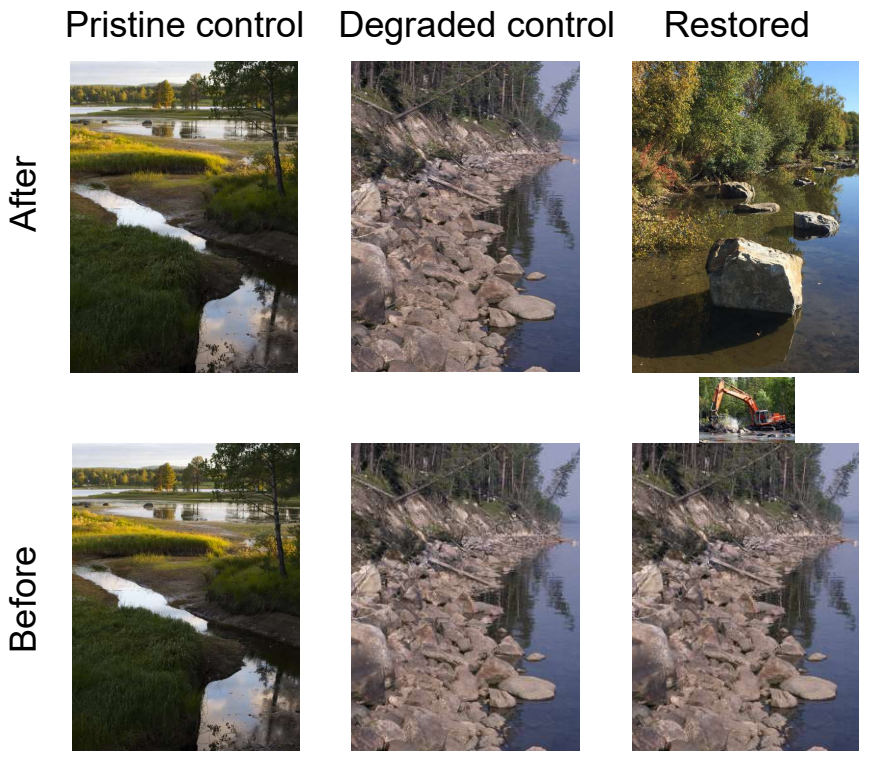
REHABILITATION

ECOLOGICAL RESTORATION

SER SOCIETY FOR ECOLOGICAL RESTORATION

Study design

- Comparison with unimpacted sites?
  Often
- Comparison with unrestored sites?
  Always
- Before/after restoration investigation?
  Seldom
- Passive or active recovery?
  Passive more common
- Time since restoration?
  Not always explicit



Response to restoration

- Response variable(s) – richness, functional diversity, cover etc.
- Magnitude of difference
- Statistical significance
- Replication
- Effect size – calculated for subset of studies/restoration types
- Evaluation of success – based on collective evidence, grading vs. statistical evaluation in meta-analysis

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Context

- Geography – simple biogeographic classification
- Type of water course – discharge based on external data
- Dominant land use in catchment/around sites – sometimes
- Climate change – discussion based on results

Best practice of restoration and restoration evaluation

- Assisted vs. passive restoration
- Pressures removed or not
- Relevant pressures targeted by restoration

- Type of evaluation: before/after, control impact
- Reference and target conditions
- Expectations
- Time lags

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Deliverables

- Review of riparian restoration methods – Mapping of restoration methods report
- Remote sensing of riparian zones – reports available
- Conservation of riparian genetic resources –
- Summary report
- Riparian zones in legislation and stakeholder issues

Presentations

- Filip Alimpic on genetic conservation of riparian plant species
- Antonis Kavvadias on remote sensing of riparian vegetation
- Mart Külvik – Workshop in Tartu (Estonia) March 18-19, 2020 on social awareness and stakeholder issues