

➤ River bioengineering for bank protection in urban context: measured and perceived ecosystem services

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> Context

Urban river planning in Anthropocene:

A RAISING
CHALLENGE

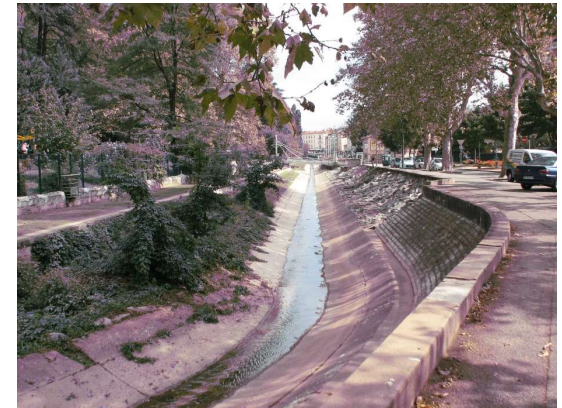
- Flood protection, riverbank stabilization
- Increasing biodiversity, and ecosystems services:
 - Biodiversity support,
 - Climate mitigation,
 - Socio-cultural services.

➔ Nature-based Solution:

Restoration of riparian ecosystems with soil bioengineering techniques:

- High level of biodiversity,
- Key ecological services,
- Improvement of the living environments of residents.

Yzeron



Before soil bioengineering in 2012



6 years after soil bioengineering



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> Context

Urban river planning in Anthropocene:

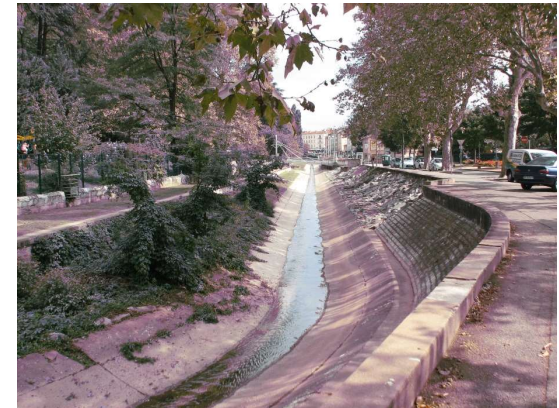
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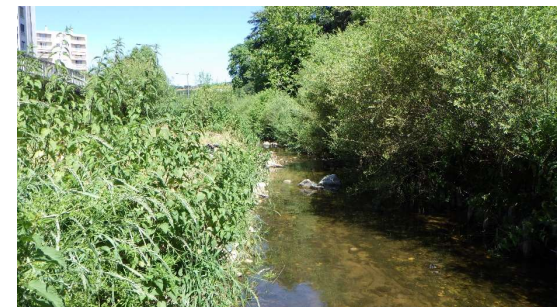
Restoration of riparian ecosystems with soil bioengineering techniques:

- High level of biodiversity,
 - Key ecological services,
 - Improvement of the living environments of residents.
- Marginal role in river management, even more in urban context
 - ➔ Only on small rivers, with gentle slope in urban environments

Yzeron



Before soil bioengineering in 2012



6 years after soil bioengineering



➤ Objectives

In an urban context, what do river bioengineering for bank protections really bring?

Geni-Eaux Project : an interdisciplinary approach to assess urban river bioengineering

- What are benefits of bioengineering on biodiversity and other ecosystem services (ES) ?

Ecological field measurements



- How these soft bank protections are perceived by urban residents?

Social photo questionnaire



- Are these perceptions consistent with measured ES ?

Statistical analysis



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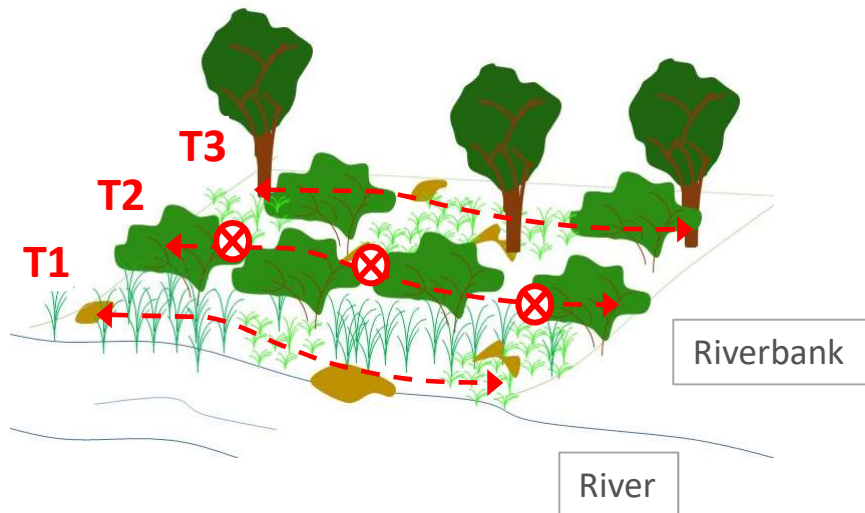
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➤ Methods: Ecological field survey

Plant biodiversity and climate mitigation



- 3 longitudinal 20 m transects
- 20 pin-points / transect
- 3 stratas : herbaceous, shrub, tree
- Shade under structure



Communities indicators by structure:

- Average of frequencies,
- Average of Species Richness,
- Average of Shannon index,
- Average of Invasive alien species frequencies



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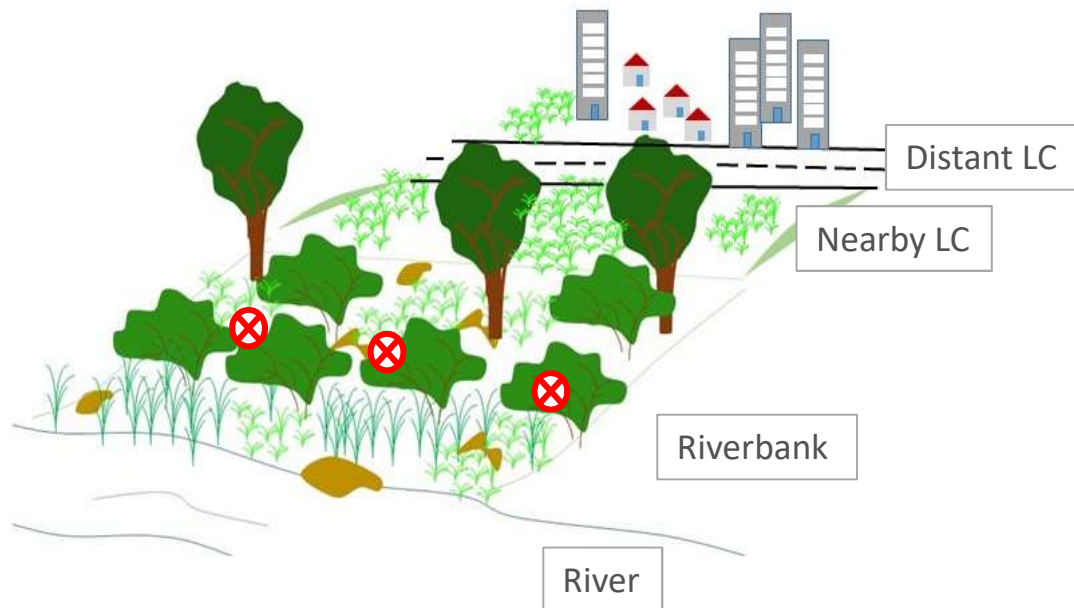
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➤ Methods: Ecological field survey

Transversal connectivity and Landscape information



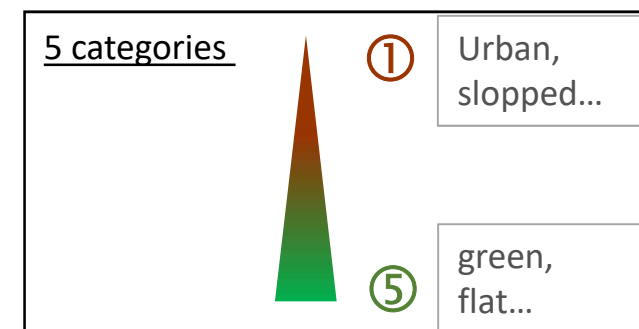
- Average of structure's slope measured in three points
- Average shrub and tree cover measured on the structure
- Landscape indicators just off the structure
 - Slope
 - Level of vegetal cover
- Human access at the structure
- Urbanization level of Nearby and Distant context



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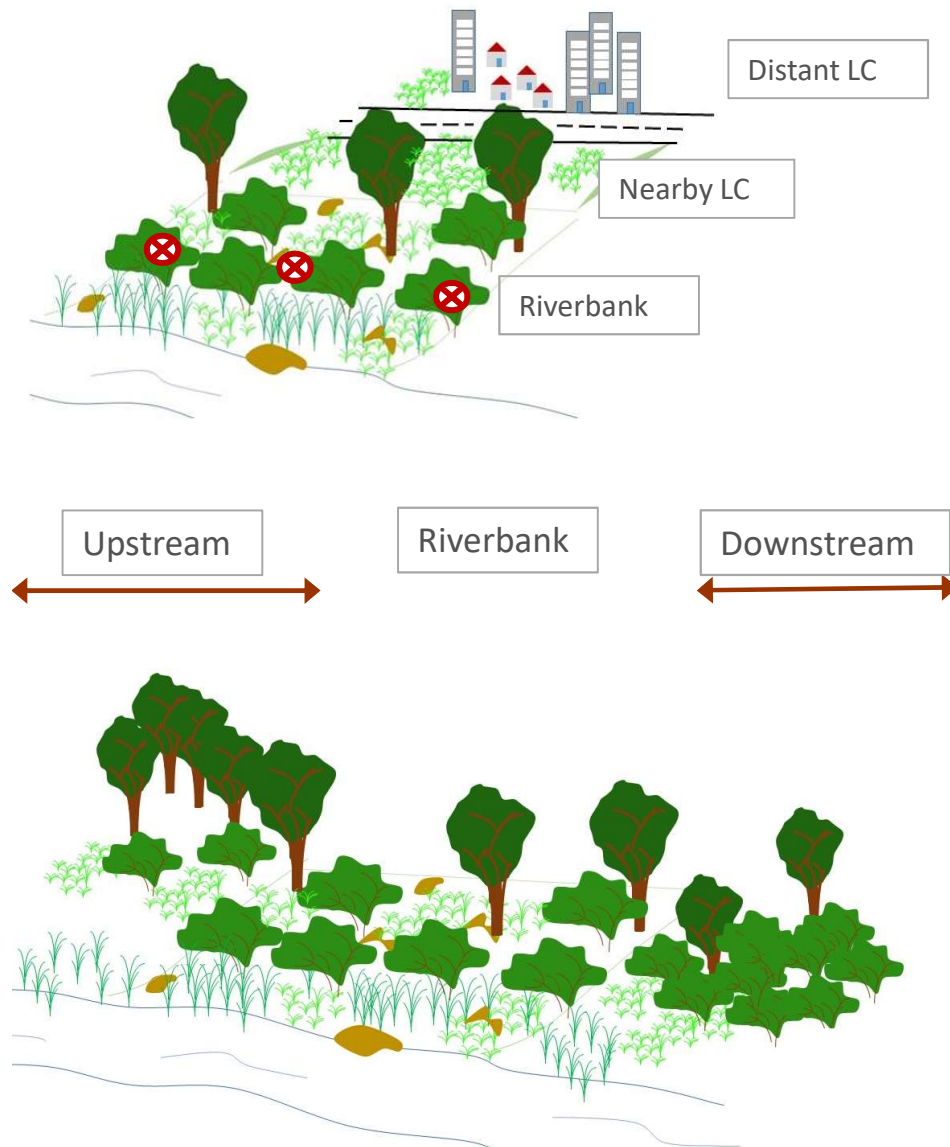
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➤ Methods: Ecological field survey

Longitudinal connectivity and Landscape information



- Average of structure's slope measured in three points
- Average shrub and tree cover measured on the structure
- Landscape indicators just off the structure
 - Slope
 - Level of vegetal cover
- Human access at the structure
- Urbanization level of Nearby and Distant context
- Upstream and downstream shrub and tree stratas

➤ Methods: Social photo questionnaire



Etes-vous d'accord avec les affirmations suivantes ?

(0 : pas du tout d'accord / 10 : tout à fait d'accord)

*

Veillez sélectionner au moins 3 réponses

Choisissez la réponse appropriée pour chaque élément :

	0	1	2	3	4	5	6	7	8	9	10
Cette berge constitue un beau paysage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cette berge est vulnérable à l'érosion, ce qui peut occasionner des inondations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cette berge est adaptée aux loisirs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- **Online photo questionnaire**
- 3 closed questions on the structure previously sampled
 - Is this riverbank an aesthetics landscape ?
 - Is this riverbank vulnerable to erosion ?
 - Is this riverbank suitable for recreation?
- 1 open question whose content is analyzed by a qualitative semantic analysis to identify the criteria of a successful riverbank protection
 - Among these structures, which one do you find the most successful? And, why?



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➤ Methods: Sampling

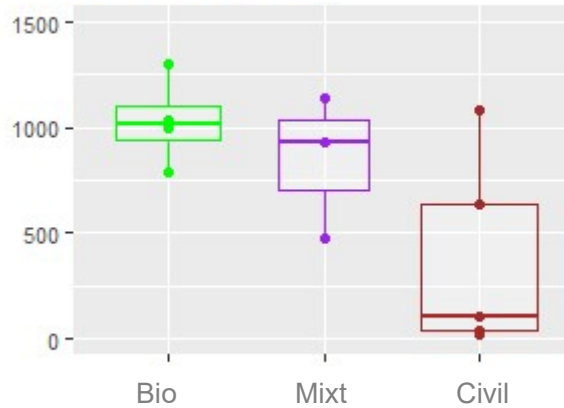
12 riverbanks distributed on three classes



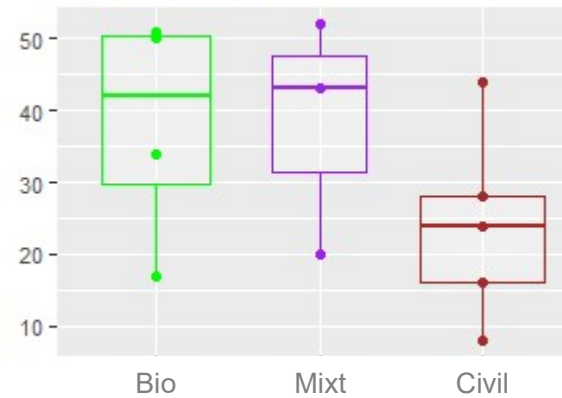
➤ Results: Ecological field survey

- **Plant biodiversity**

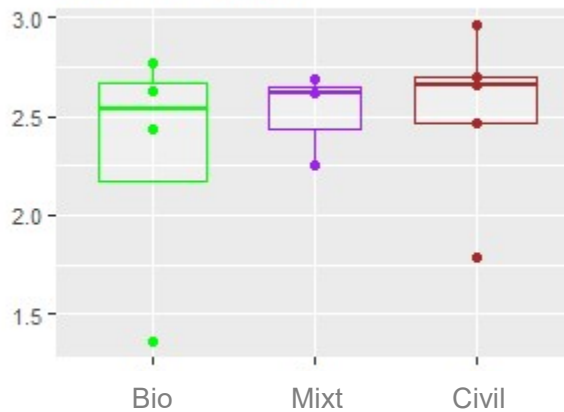
Plant cover frequency



Species richness



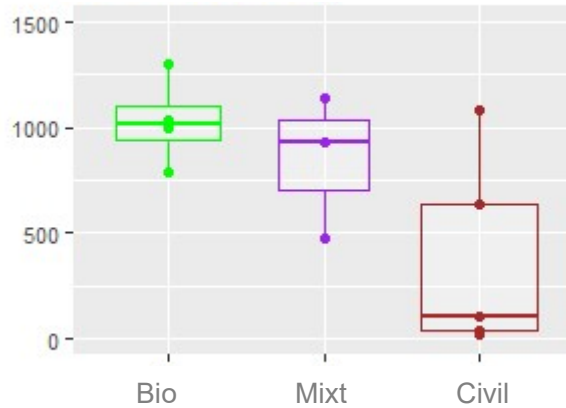
Shannon index



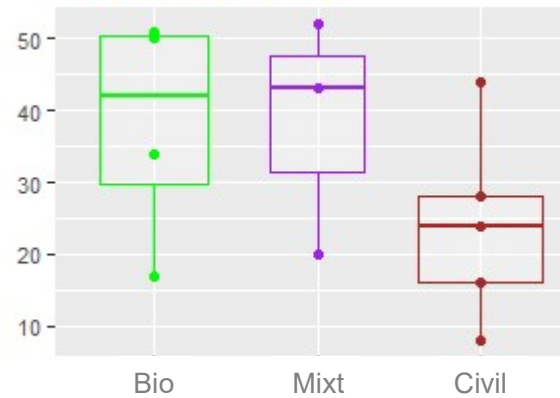
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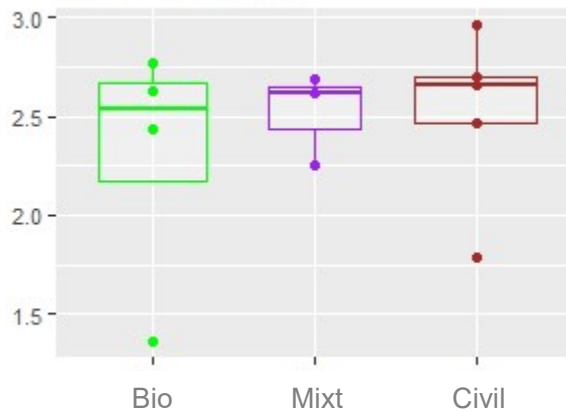
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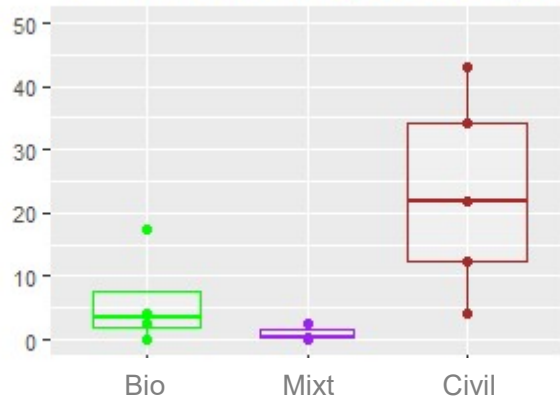
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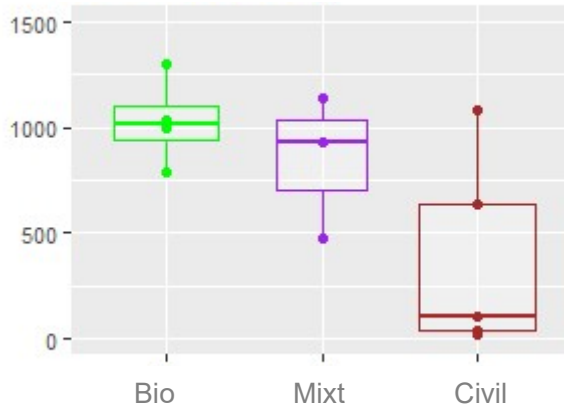
Invasive alien species frequency



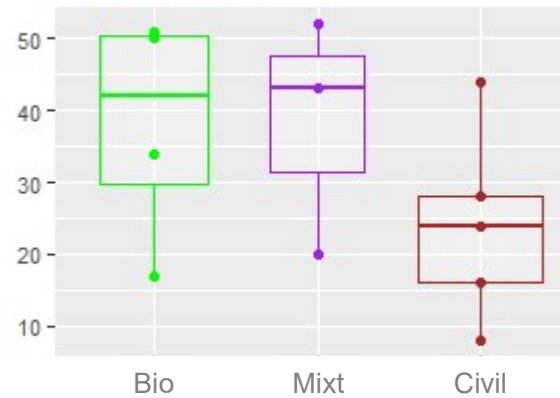
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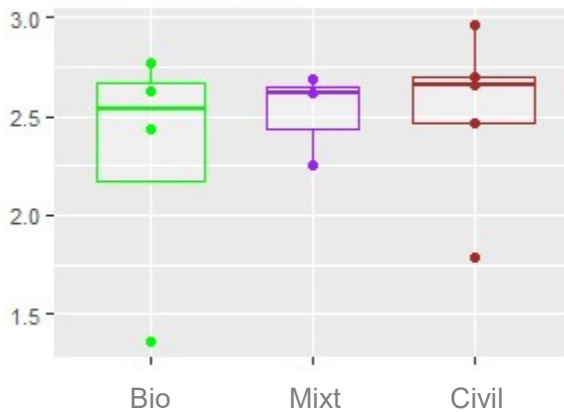
Plant cover frequency



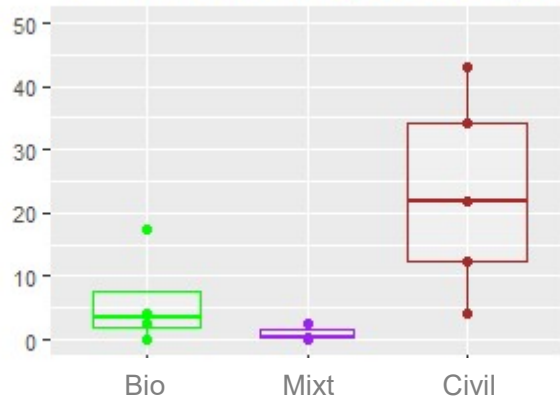
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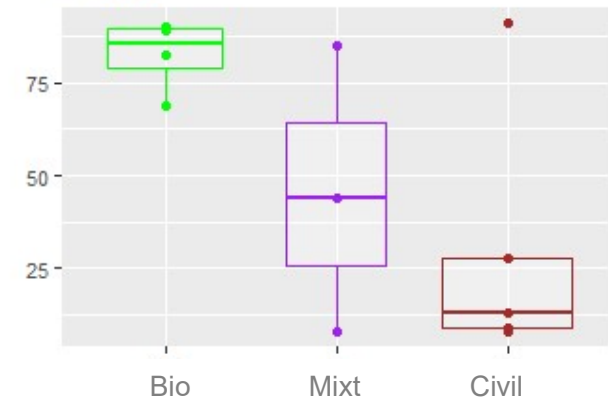


Invasive alien species frequency



- **Climate change mitigation**

Shade

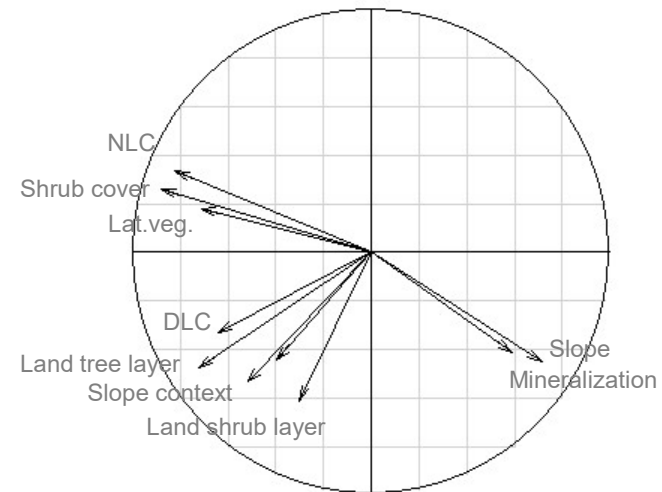
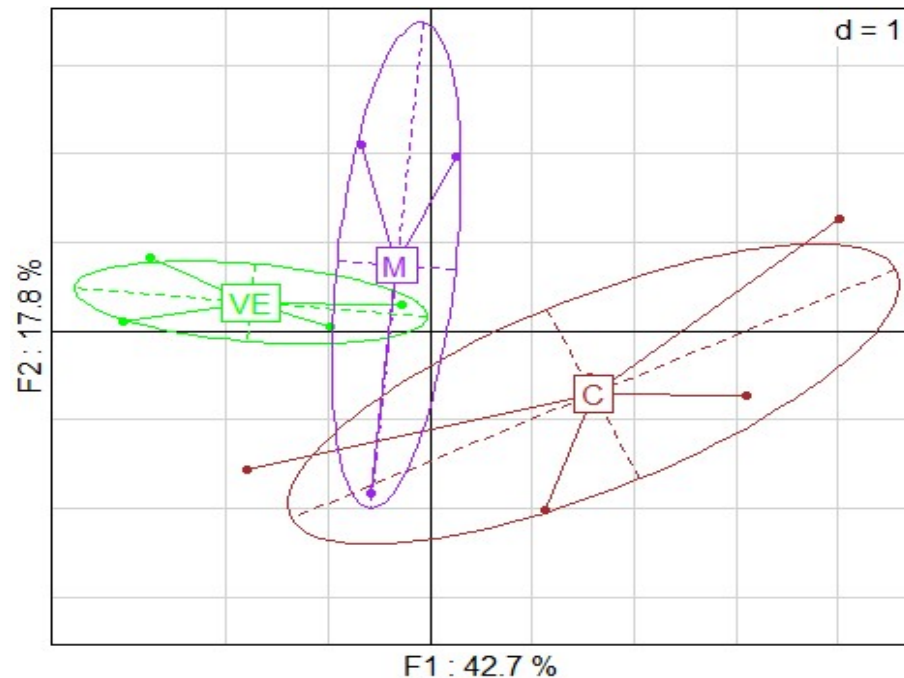


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➤ Results: Ecological field survey

Connectivities and Landscape information

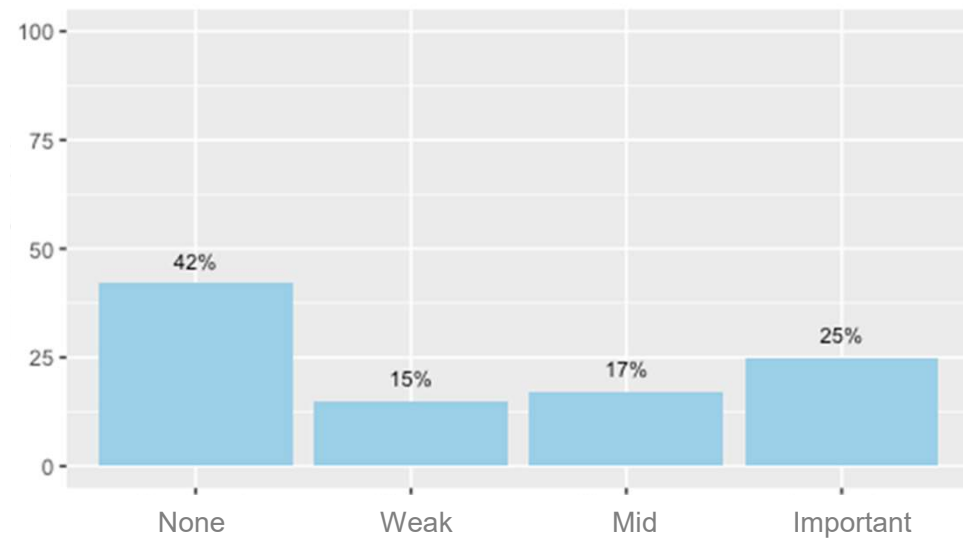


- Bioengineering structures are already in green and accessible environments, (Gentle slope, Tree and Shrub cover, Green Nearby and Distant context...)
- Lateral and longitudinal connectivities are presents in bioengineering structures,
- Civil structures are built in all types of environments, but most in anthropic context

➤ Results: Social photo questionnaire

- 500 responses received,
- Different levels of expertise in the management of aquatic environments.

Frequency of the level of expertise of the respondents



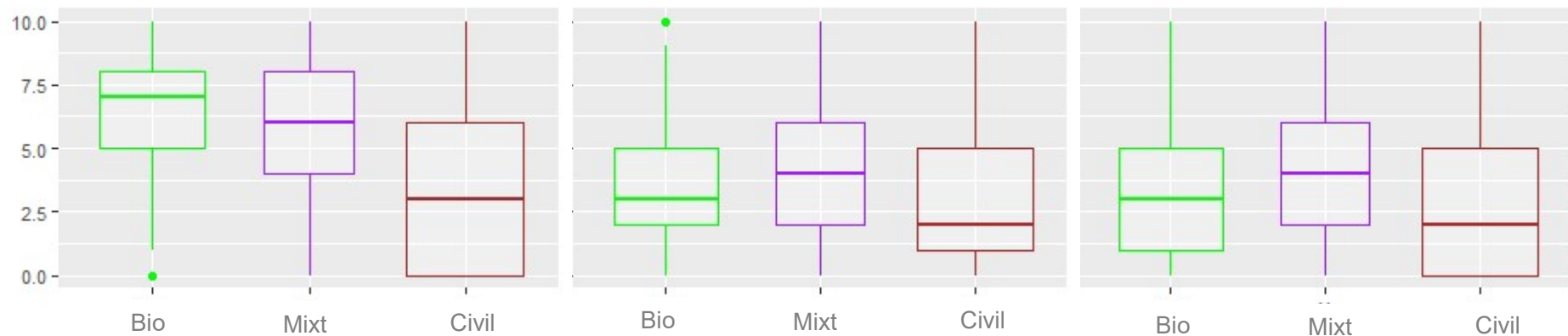
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➤ Results: Social photo questionnaire

Is this riverbank:

- an aesthetics landscape ?
- vulnerable to erosion ?
- suitable for recreation?



- Bioengineering structures are clearly more appreciated by residents for their aesthetics landscape,
- No differences for other uses or functions.



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➤ First conclusions:

Geni-Eaux define first ecological and social performances of urban bioengineering structures

- They maximise plant biodiversity and regulate invasive alien species,
- They provide shade in urban environments and can participate in the creation of island of freshness,
- They can play the role of ecological riparian corridors,
- They are more appreciated aesthetically by urban water residents; presence of vegetation induces a higher perceived naturalness,
- But they seems only integrated in a context already soft and green.



> Perspectives

We would like to:

- Deepen the analysis of social multi-criteria to define what is a successful riverbank protection for residents,
- Link these perceptions with measured ES,
- Confront the perceptions according levels of expertise;
Do managers of aquatic environments and novice residents have the same perception of bioengineering?
- Increase the set of structures in an broader project.

Project RIPAMOTION / *ANR project submitted*
With near 60 works



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