Improvements of microbial community toxicity tests to assess in situ perturbations following a PICT (pollution-induced community tolerance) approach

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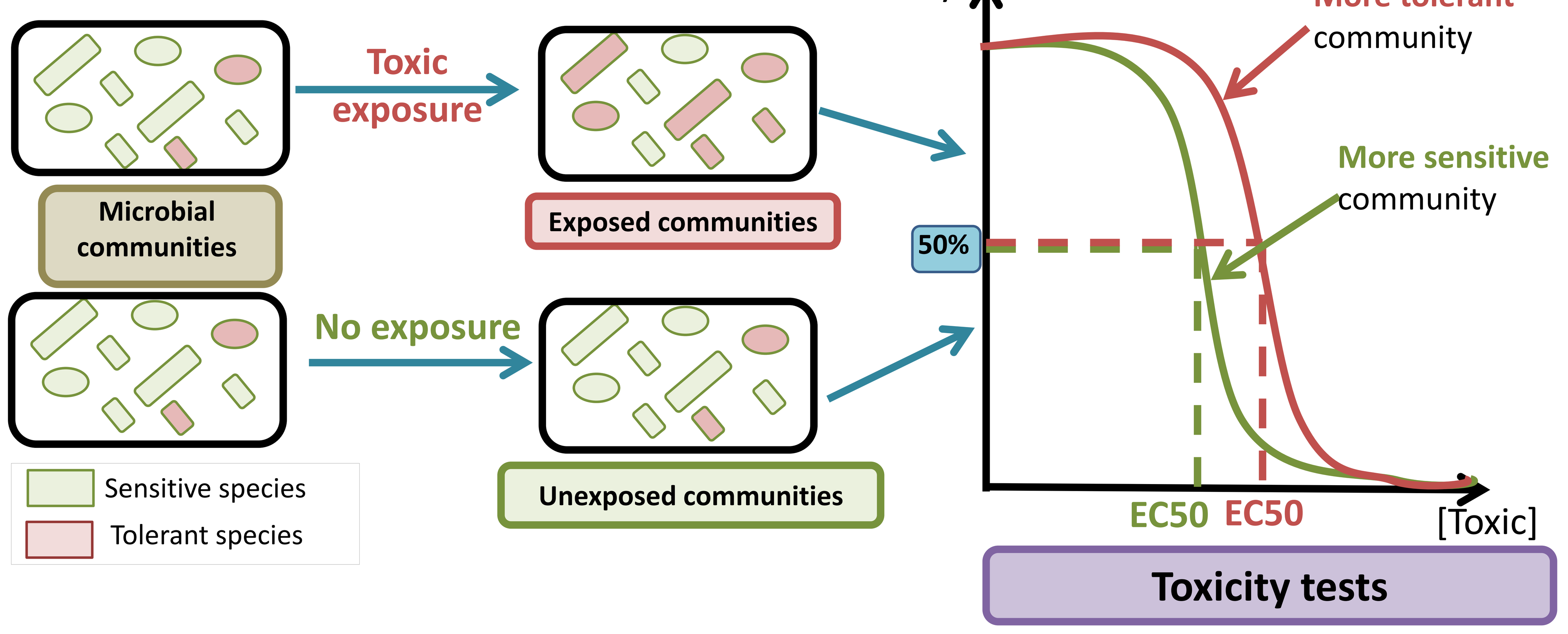
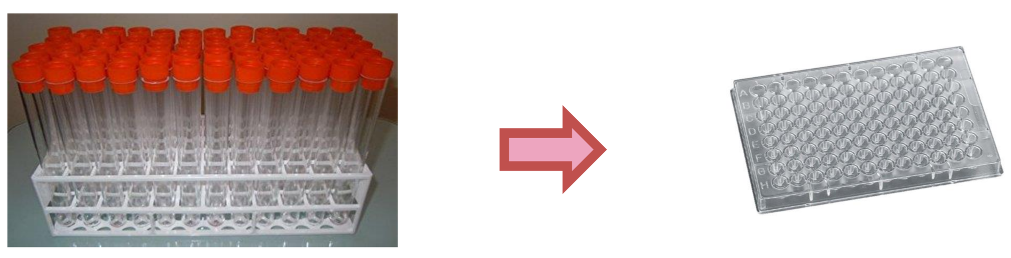
In the past decades, an increasing number of anthropogenic contaminants (pesticides, antibiotics, drug residues…) have reached the aquatic ecosystem, leading to chronic chemical perturbations. In this context, the PICT approach (Pollution Induced Community Tolerance) is a promising bio-indication tool which allows detecting chronic exposure to specific contaminants based on microbial communities' adaptation capacities.

The aim of this work was to :
- Optimize toxicity tests used to estimate tolerance level to facilitate the systematic application of PICT approaches;
- Perform an *in situ* PICT approach to apply and validate the methods developed.

PICT Principle



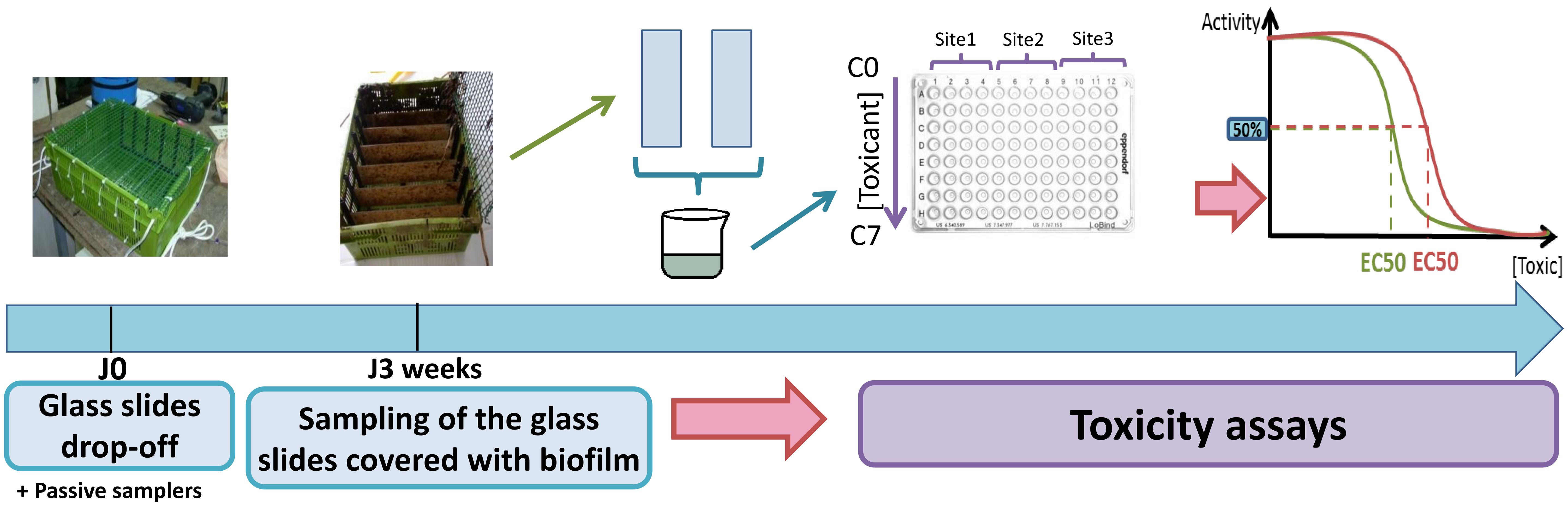
Selection of appropriate assays for metals and pesticides with different modes of action



Miniaturization of toxicity tests

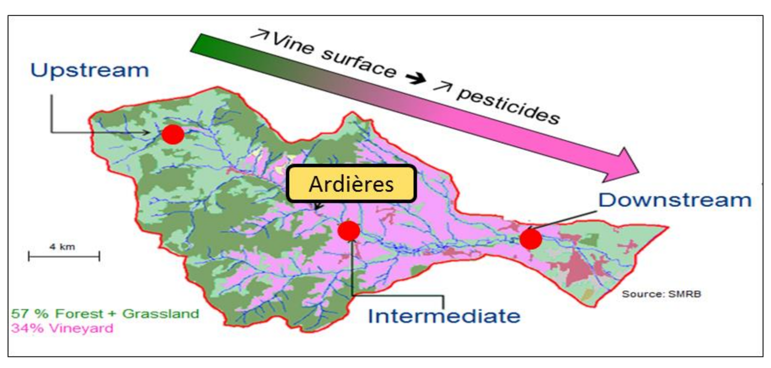
Assays tested	Toxicants tested	Assays selected
Betaglucosidase activity **Photosynthetic** efficiency **Esterase** activity **Catalase** activity **Dehydrogenase** activity Growth	Copper	**Betaglucosidase** activity
	Diuron	**Photosynthetic** efficiency
	Glyphosate	**Esterase** activity & **Photosynthetic** efficiency
	Metolachlore, Acetochlore Nicosulfuron Spiroxamine , 2,4D	Toxicity not detected by the assays tested

Application of PICT approach in river monitoring

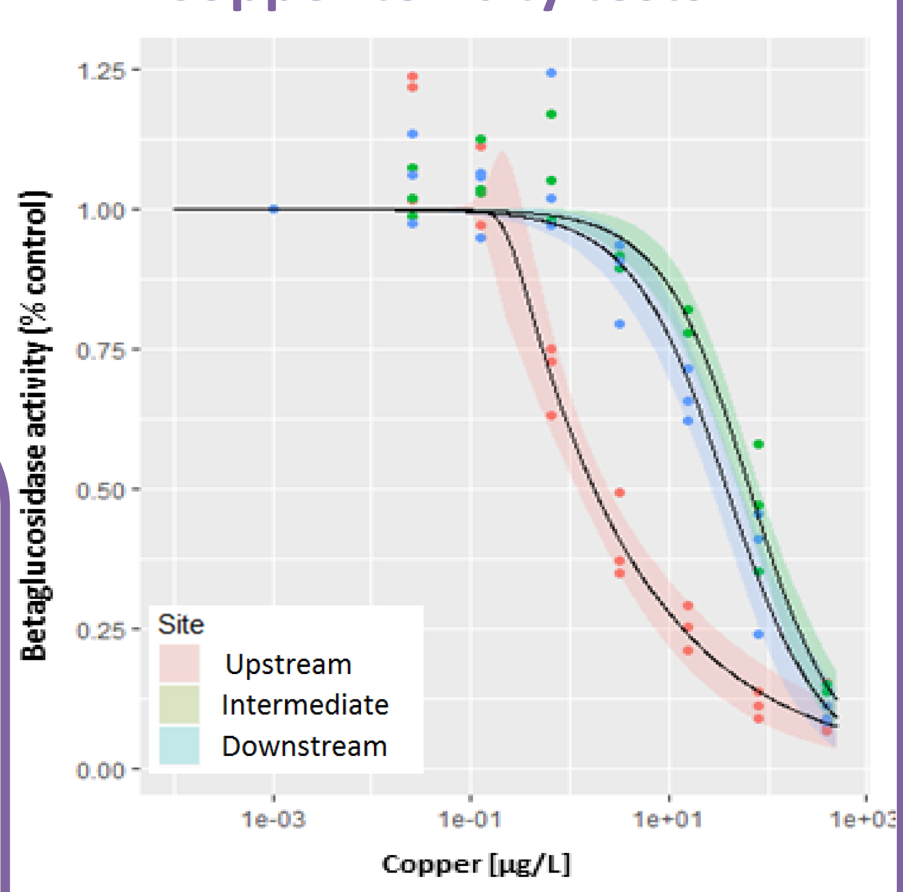


Toxics tested	Parameters monitored
Copper	Betaglucosidase activity
Diuron	Photosynthetic efficiency
Glyphosate	Photosynthetic efficiency & Esterase activity

Ardières



Copper toxicity tests

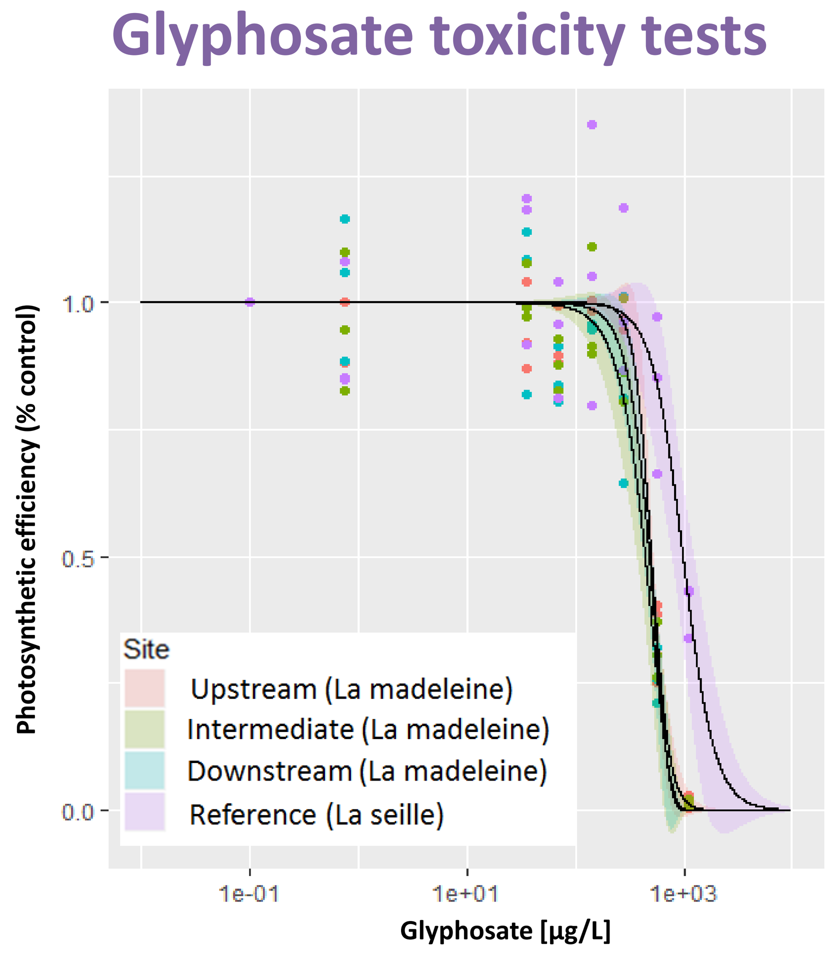


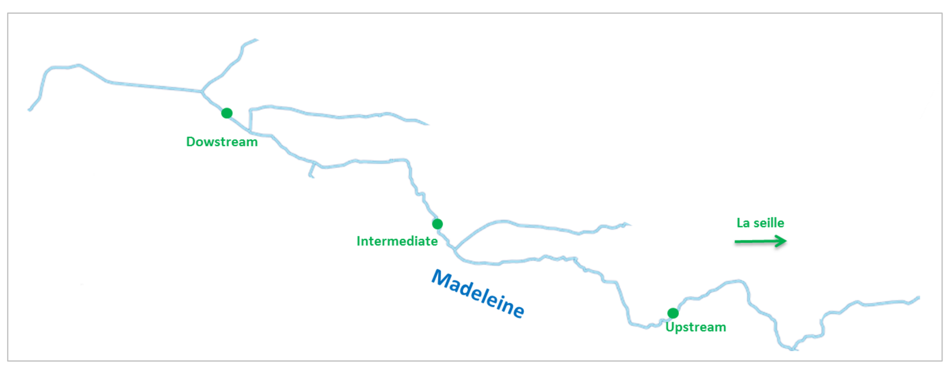
Upstream communities are more sensitive to Cu (EC_{50} : 1,76mg/L) than intermediate (EC_{50} : 65,9mg/L) and downstream (EC_{50} : 38,6mg/L) communities.

-> Tolerance acquisition at downstream sites reflects Cu contamination likely due to vine treatments.

Madeleine

Glyphosate toxicity tests





The Seille river communities are more tolerant (EC_{50} : 1,5mg/L) to glyphosate than the Madeleine river communities (EC_{50} : 0,7mg/L) .

-> A very low contamination was expected at la Seille, therefore targeted chemical analyses are on-going to confirm these results

Conclusion & Perspectives

The work carried out enabled to reduce toxicity tests completion time and to develop toxicity tests for other pesticides. We are currently working on the development of toxicity tests for other contaminants : antibiotics, HAP… Together these methodological improvements shall offer new opportunities of applying PICT approaches at large geographical and temporal scales. While PICT approach informs about chronic contamination affecting microbial communities, further analyses are still needed to assess the impact of contamination on microbial biodiversity and functions and on ecosystem functioning.

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