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7th Symposium for European Freshwater Sciences

Impacts of chronic and pulse pesticide exposures on periphyton communities

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Bernard MONTUELLE



Centre Alpin de Recherche sur les Eaux Trophiques et Ecosystèmes Lacustres



7th SEFS
27 June 2011

ALIMENTATION
AGRICULTURE
ENVIRONNEMENT



River biofilms

Eukaryotic
Prokaryotic

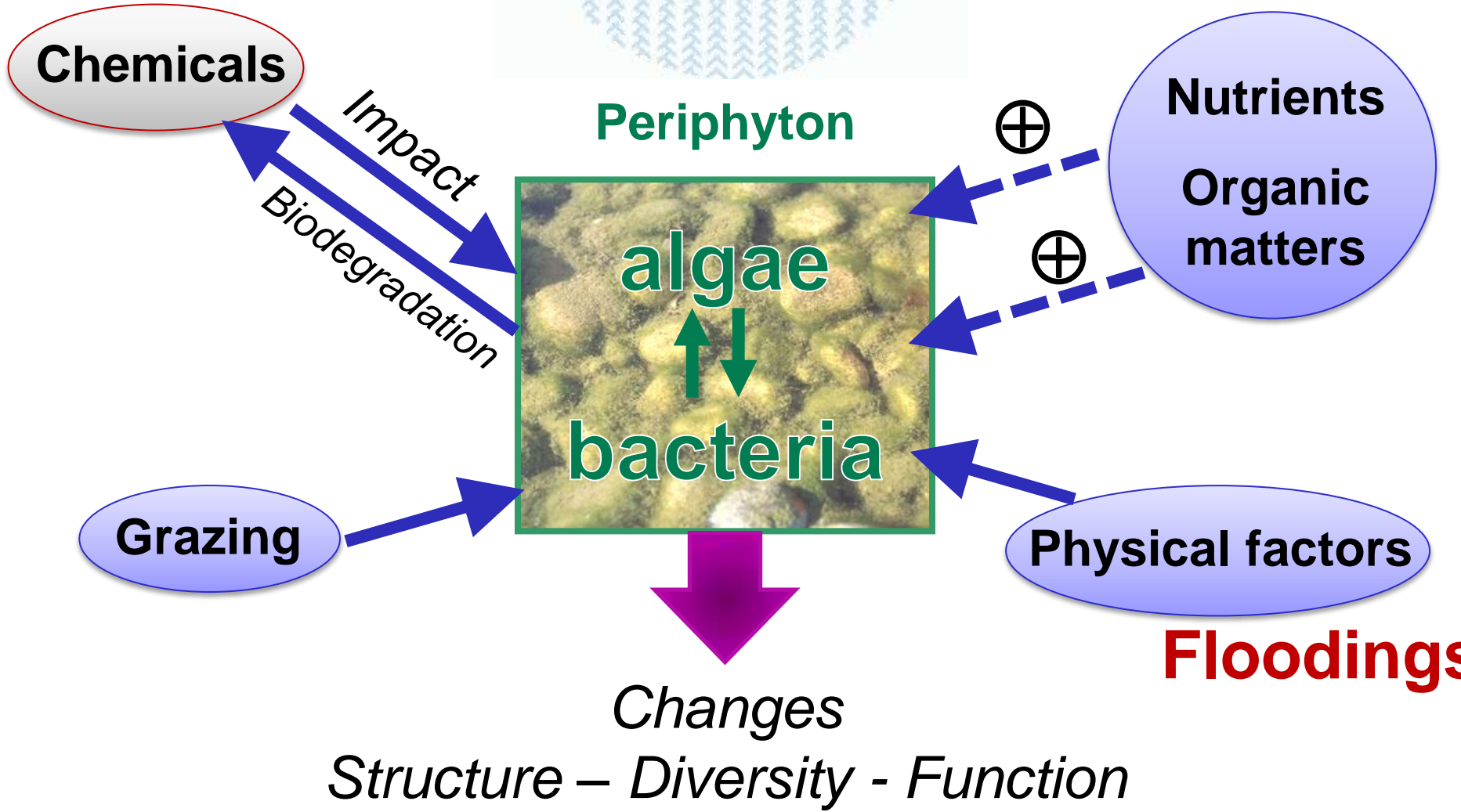


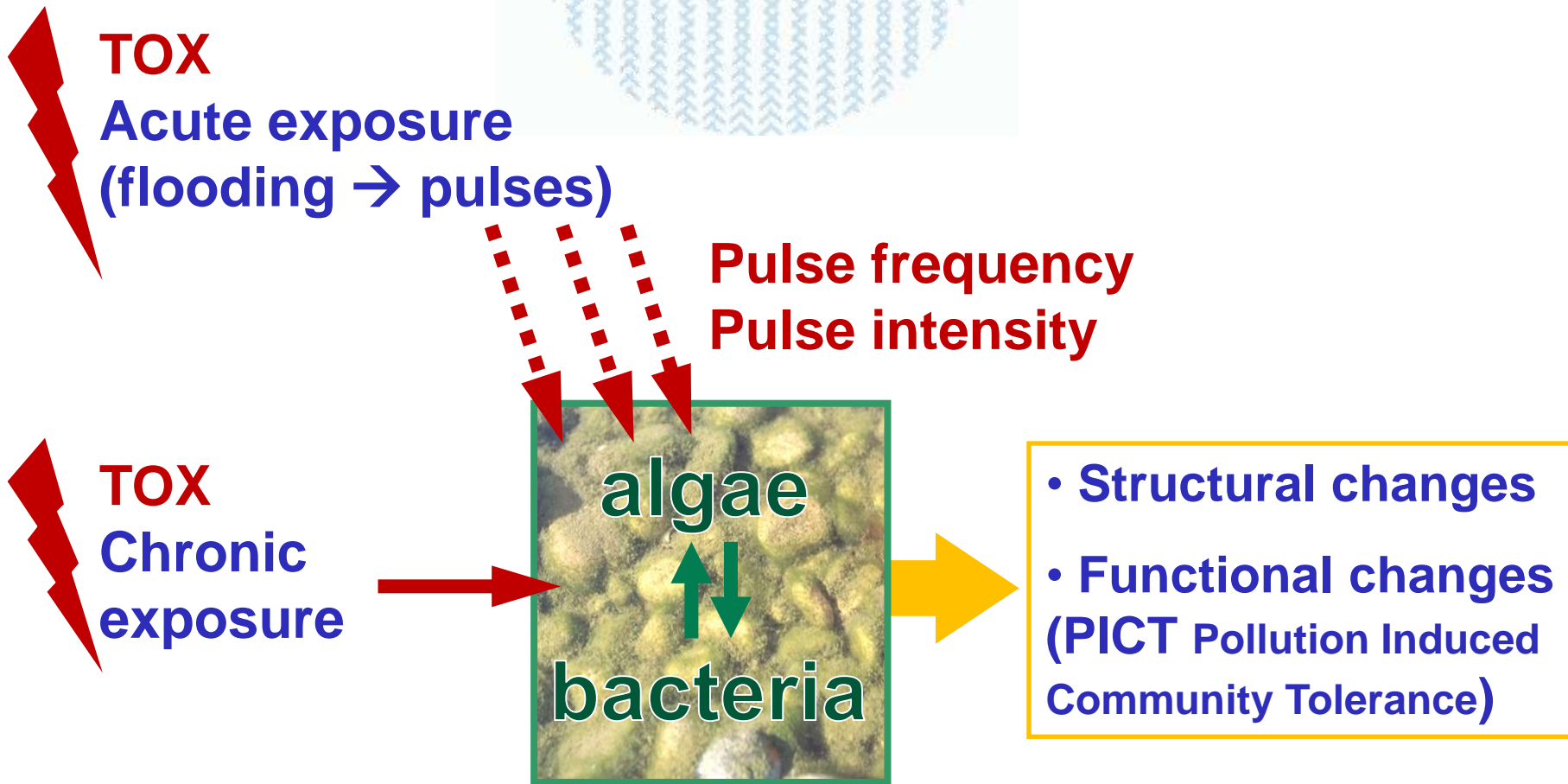
Phototrophic
Heterotrophic

Periphyton

- basic aquatic biocenosis
- key roles in aquatic ecosystems
- good bio-indicators of ecological quality


Pesticides





Intensity and frequency of the exposition to pesticides may modify their impact on the microbial communities.

4 artificial streams
INRA Thonon – France
(provided by LSE)



Herbicide: diuron
Fungicide : tebuconazol

Impacts on algae:
structural - functional

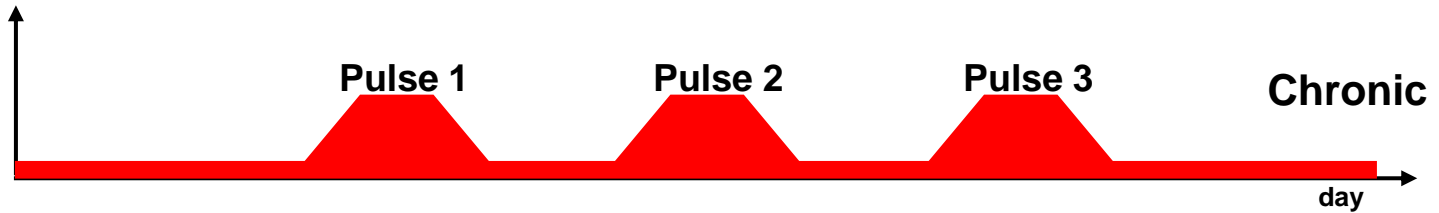
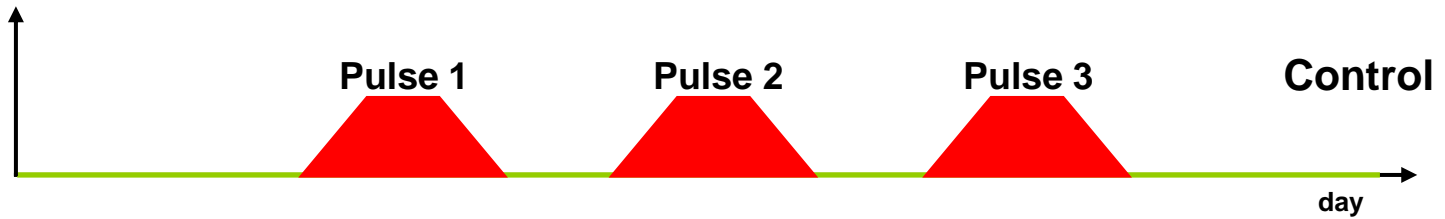


Fixed periphyton (glass plates)

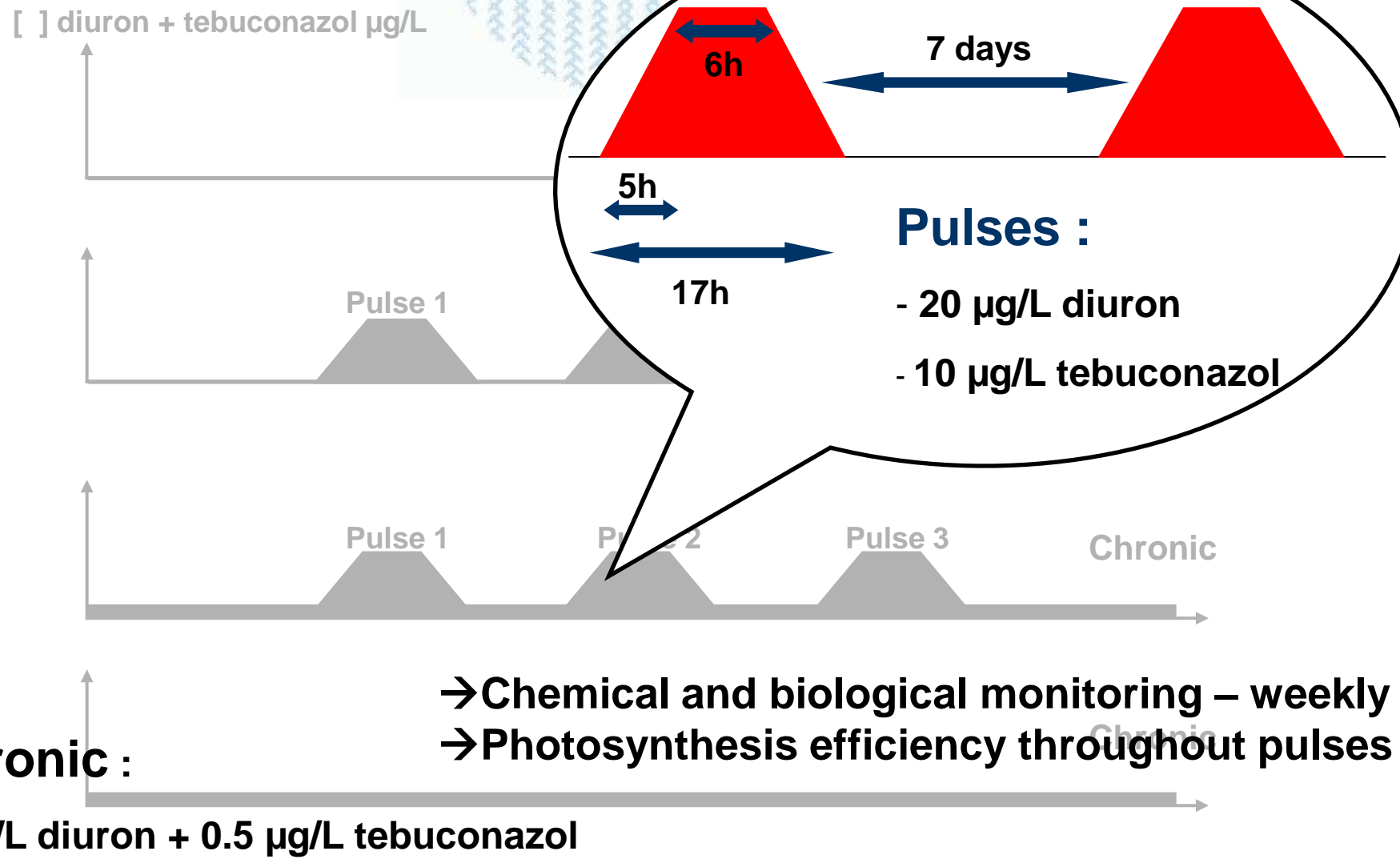
Contamination scenarios



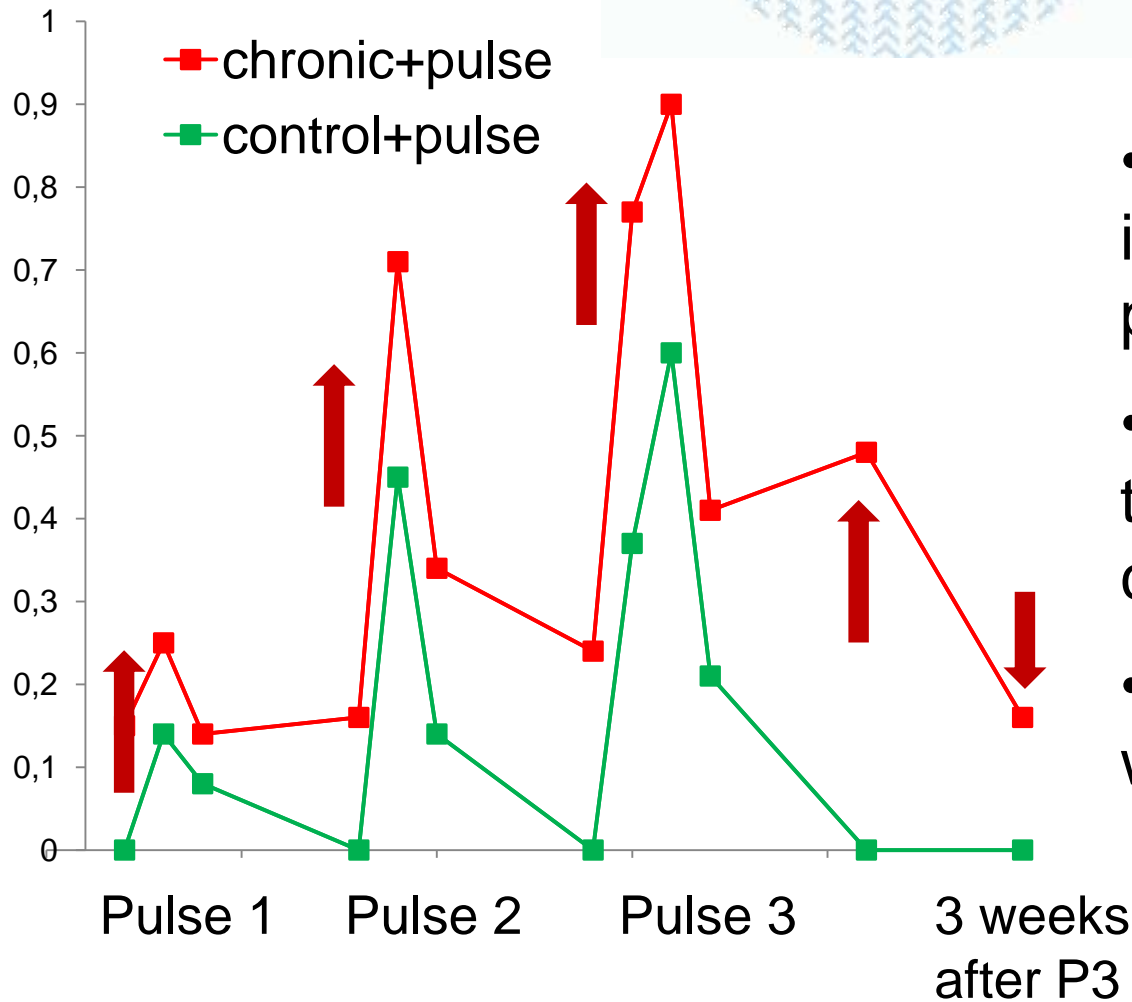
[] diuron + tebuconazol $\mu\text{g/L}$



Contamination scenarios

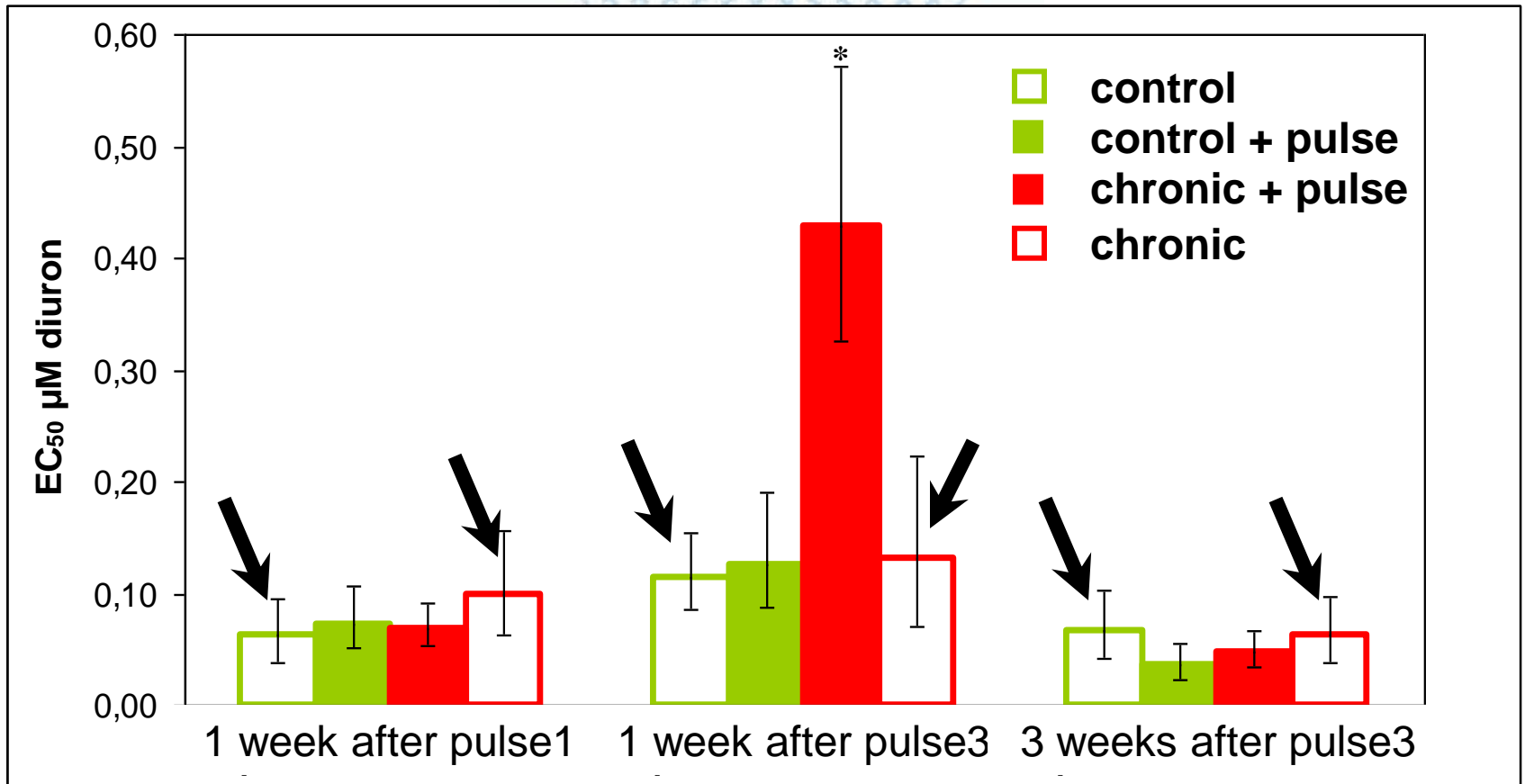


Diuron concentrations in periphyton



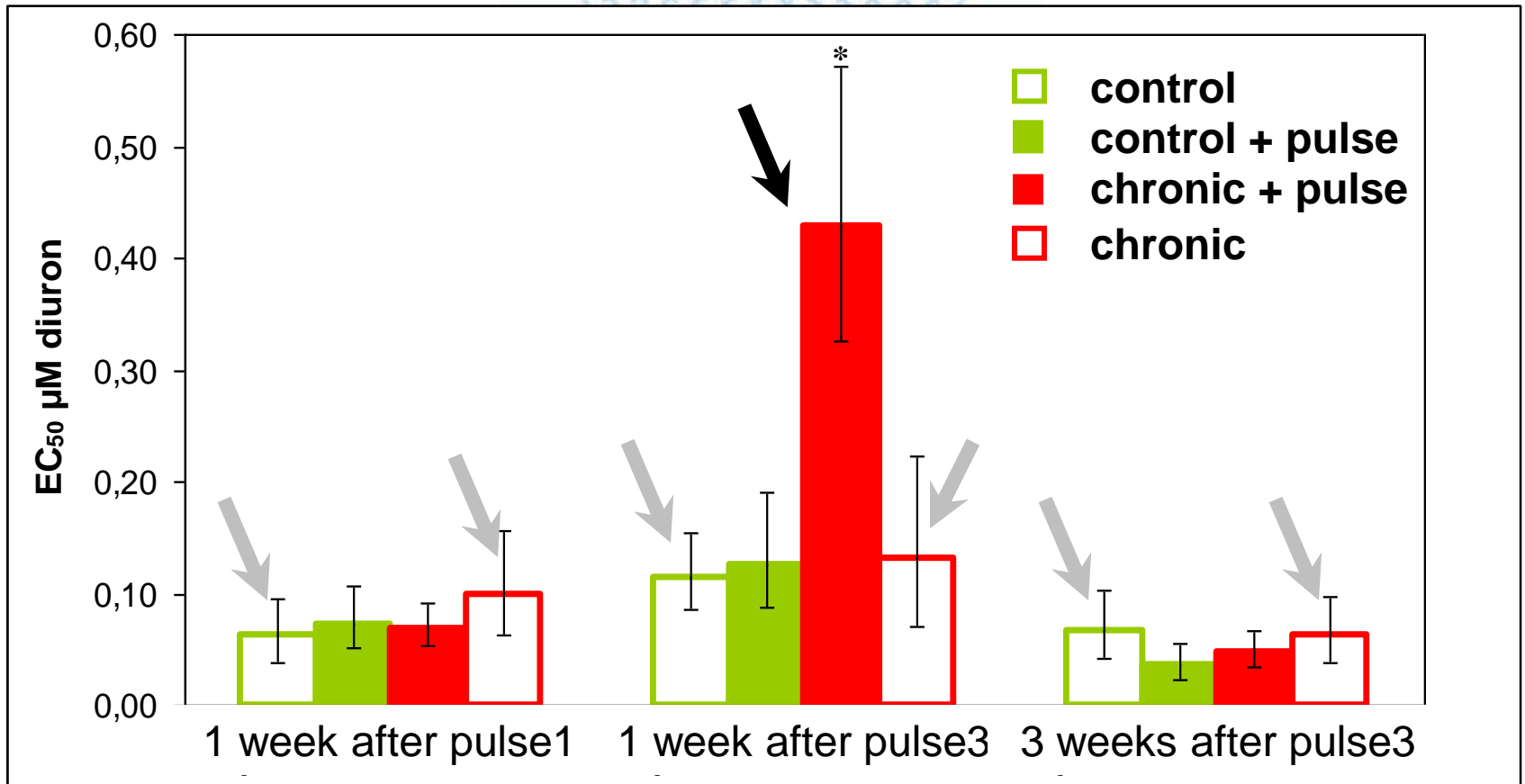
- accumulation of diuron in periphyton undergoing pulses (increasingly)
- persistent 1 week after the last pulse when chronic contamination
- back to chronic level 3 weeks after the last pulse

Diuron tolerance (biotests / photosynthesis)



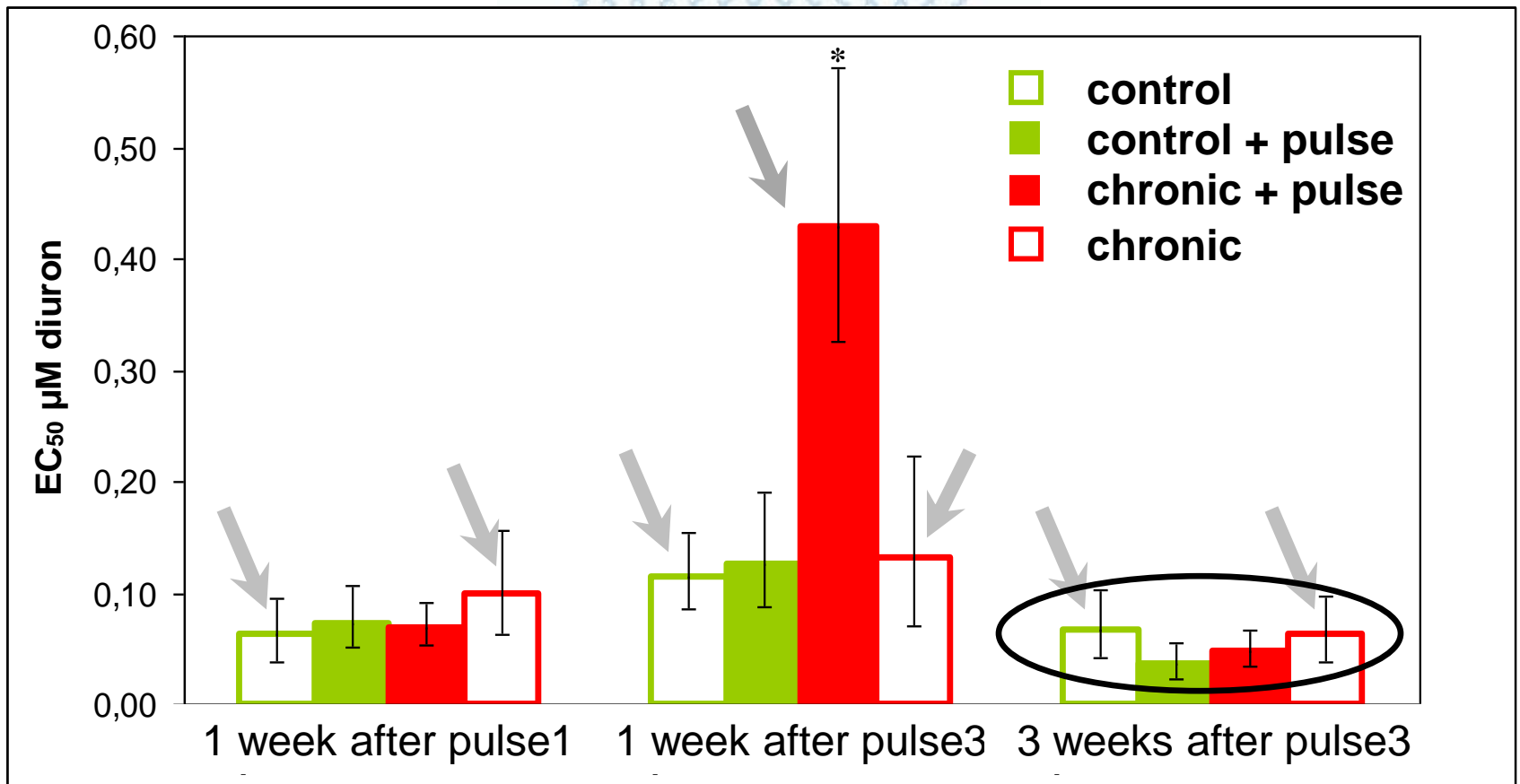
- the chronic exposure does not induce tolerance acquisition

Diuron tolerance (photosynthesis)



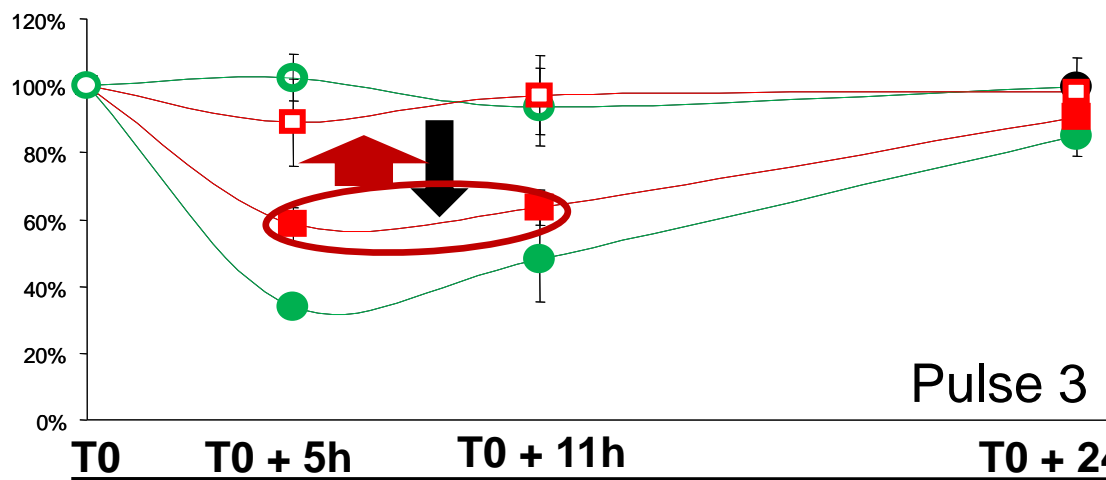
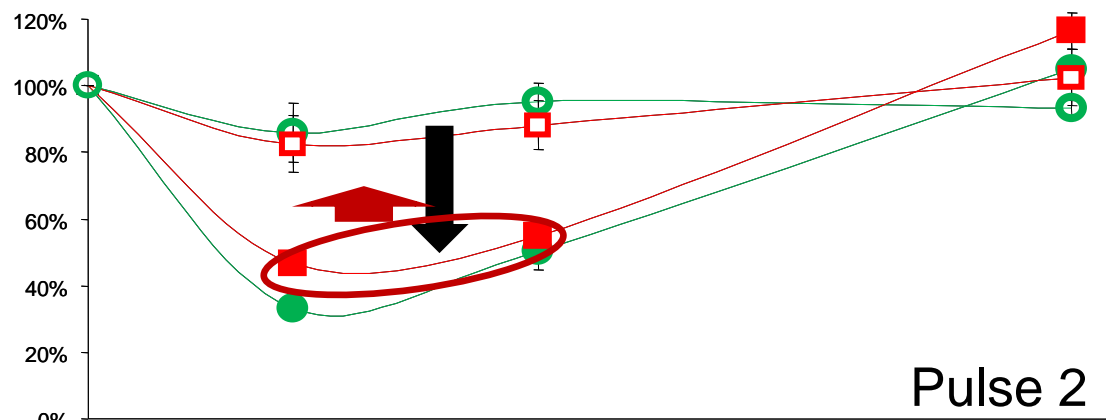
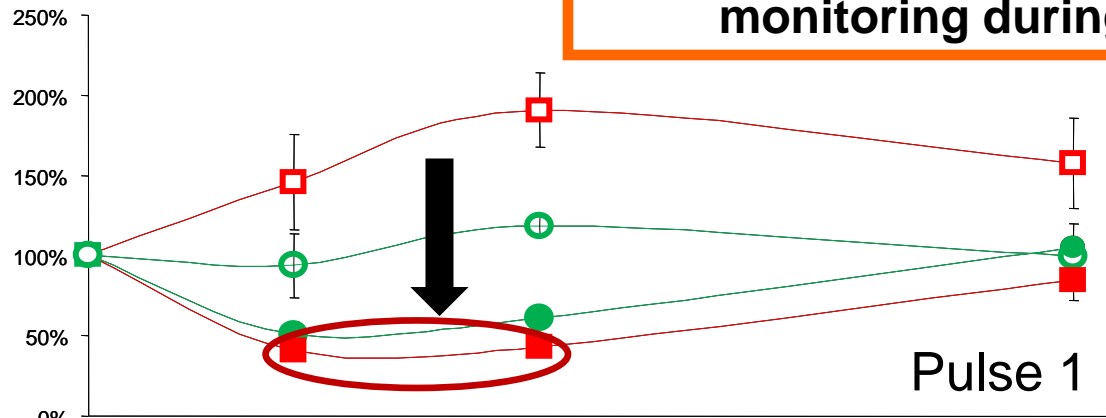
- the chronic exposure does not induce tolerance acquisition
- cumulative effect of chronic + acute exposure on tolerance acquisition

Diuron tolerance (photosynthesis)



- the chronic exposure does not induce tolerance acquisition
- cumulative effect of chronic + acute exposure on tolerance acquisition
- after 3 weeks disappearance of acquired tolerance

Photosynthetic efficiency monitoring during pulses



- Pulse effect : inhibition
- After successive pulses, chronically-exposed periphyton becomes less sensitive to pulses

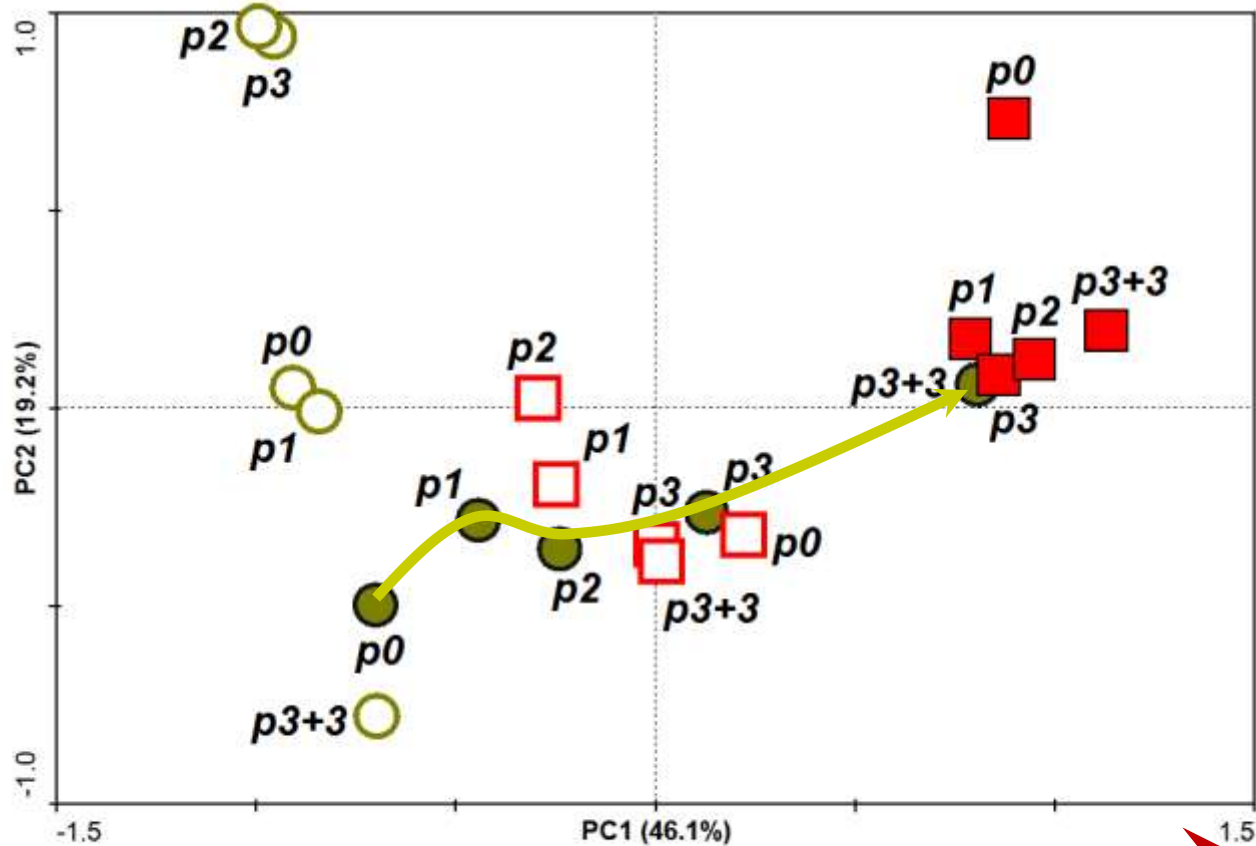
- control
- control + pulse
- chronic + pulse
- chronic

TATION

ONNEMENT



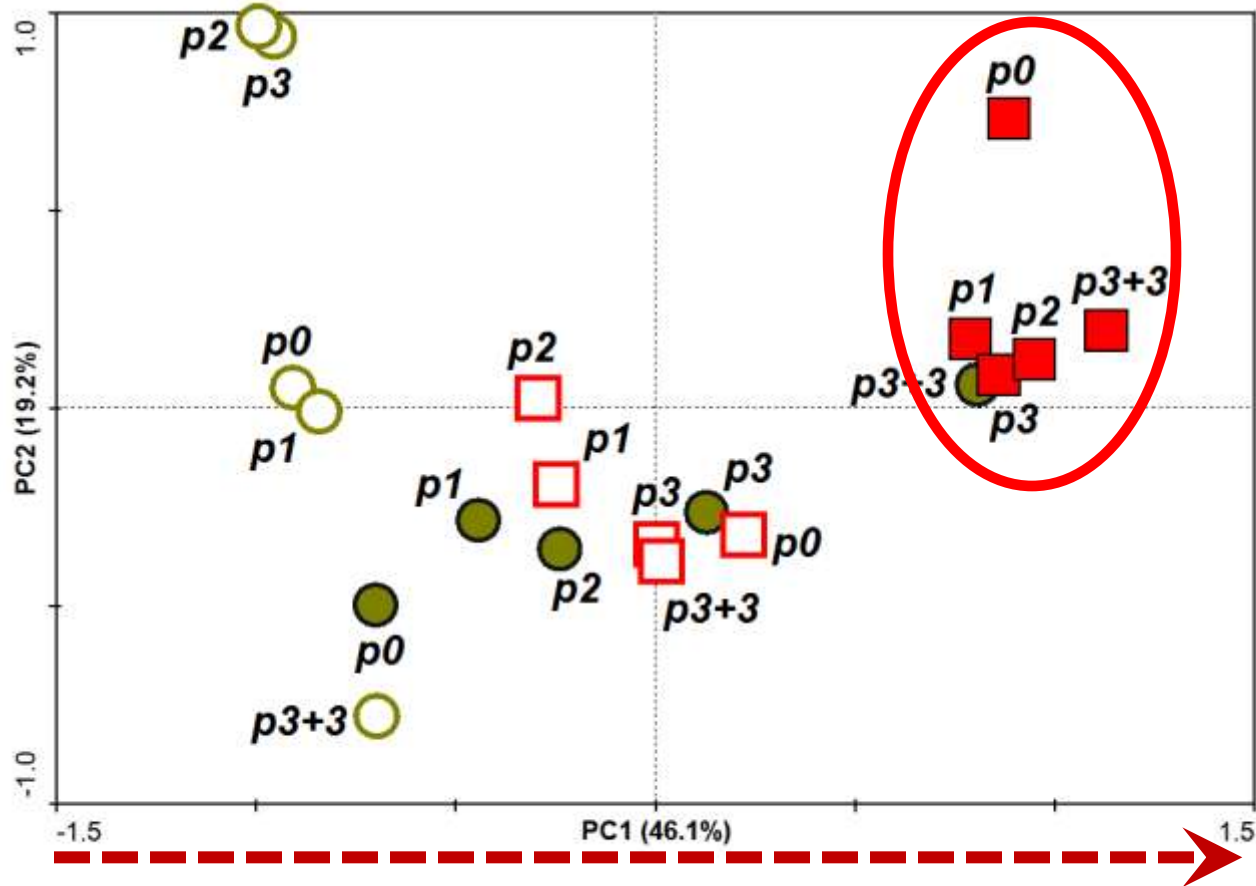
eukaryotic diversity (DGGE 18S)



diuron & tebuconazol in water
diuron in biofilm

- structuring effect of pulses on the diversity of the eukaryotic community

eukaryotic diversity (DGGE 18S)



- structuring effect of pulses on the diversity of the eukaryotic community
- no effect of pulses on eukaryotic diversity of biofilms submitted to the chronic exposure



- (1) **Acquired tolerance** to xenobiotics is strongly **modulated by the exposure history** of the biofilm microbial communities.
- (2) **Cumulative effects** of (i) **chronic** and **acute** exposures and (ii) **successive acute** exposures.
- (3) **Structural changes** of microbial communities **not necessarily induce functional changes** in these communities and vice versa.
- (4) **Functional restoration** within a few weeks, **remaining structural effect** on the algae community.



and then ?

- Combine pesticides exposure with hydraulic aspects of flooding
- *In situ* impacts



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