# Effect-based nationwide water quality assessment

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IBED

Freshwater and Marine Ecology

BioDetectors Conference 2018, Aachen

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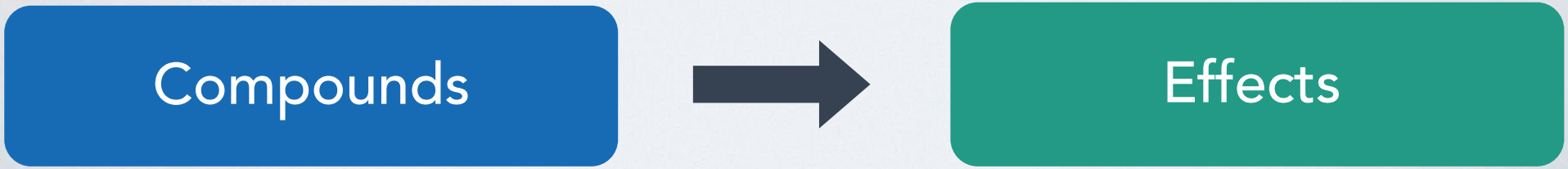


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- Compounds are often present below detection limits of chemical or bioanalytical analyses
- Passive sampling can overcome these limitations by exposing a sorbent to the target environment, accumulating compounds from the water over time[4]

[4] Jones *et al*. *Anal. Methods* **2015**

# Aim

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Identify drivers of ecological risks in an effect-based nationwide water quality assessment

# National monitoring campaign

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- September - November 2016

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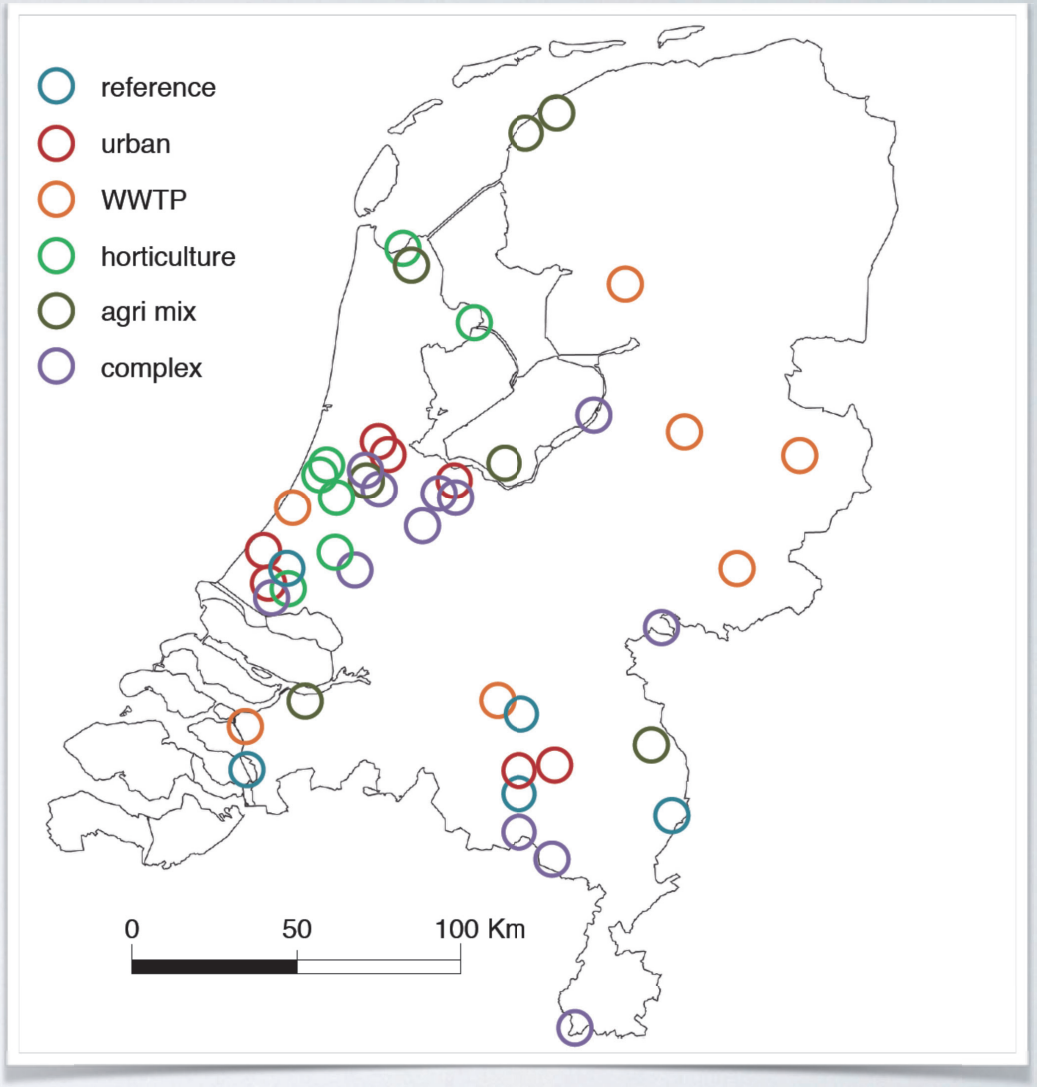

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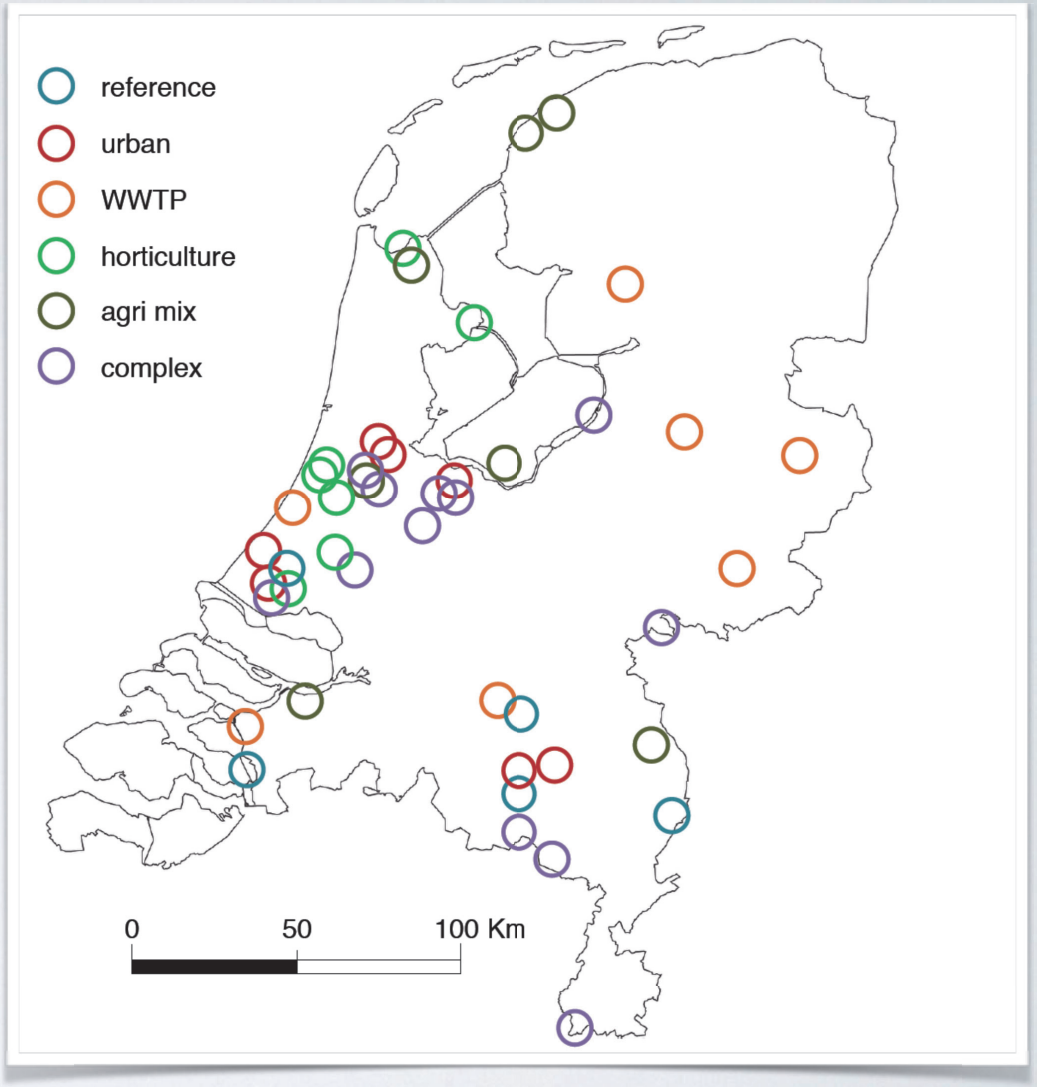

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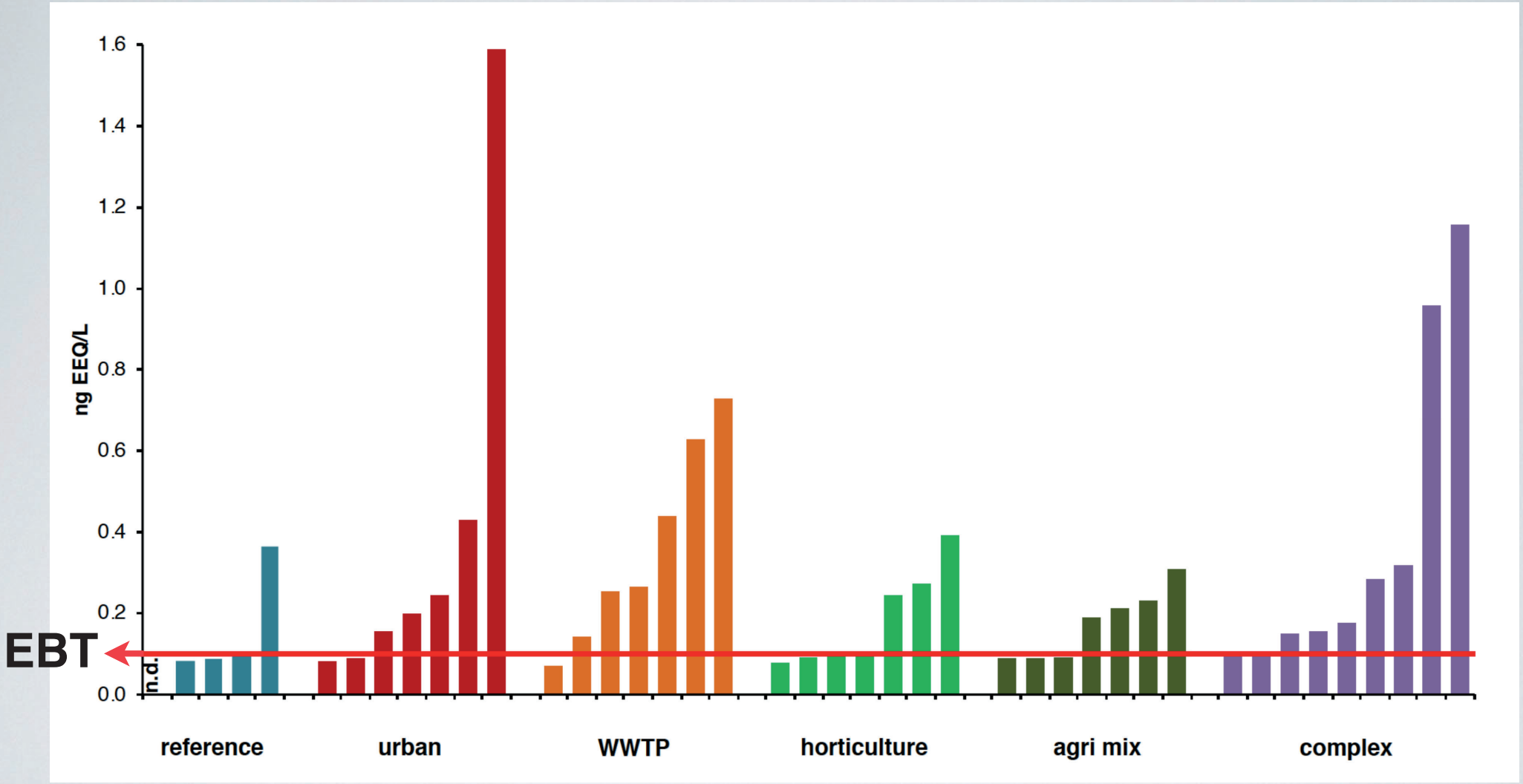
  - 10 *in vitro* CALUX assays
- Bioanalytical responses were compared to effect-based trigger values (EBT)[5,6]

[5] Van der Oost *et al. Environ. Toxicol. Chem.* **2017**
[6] Escher *et al. Sci. Total Environ.* **2018**

# A representative example: ERα CALUX



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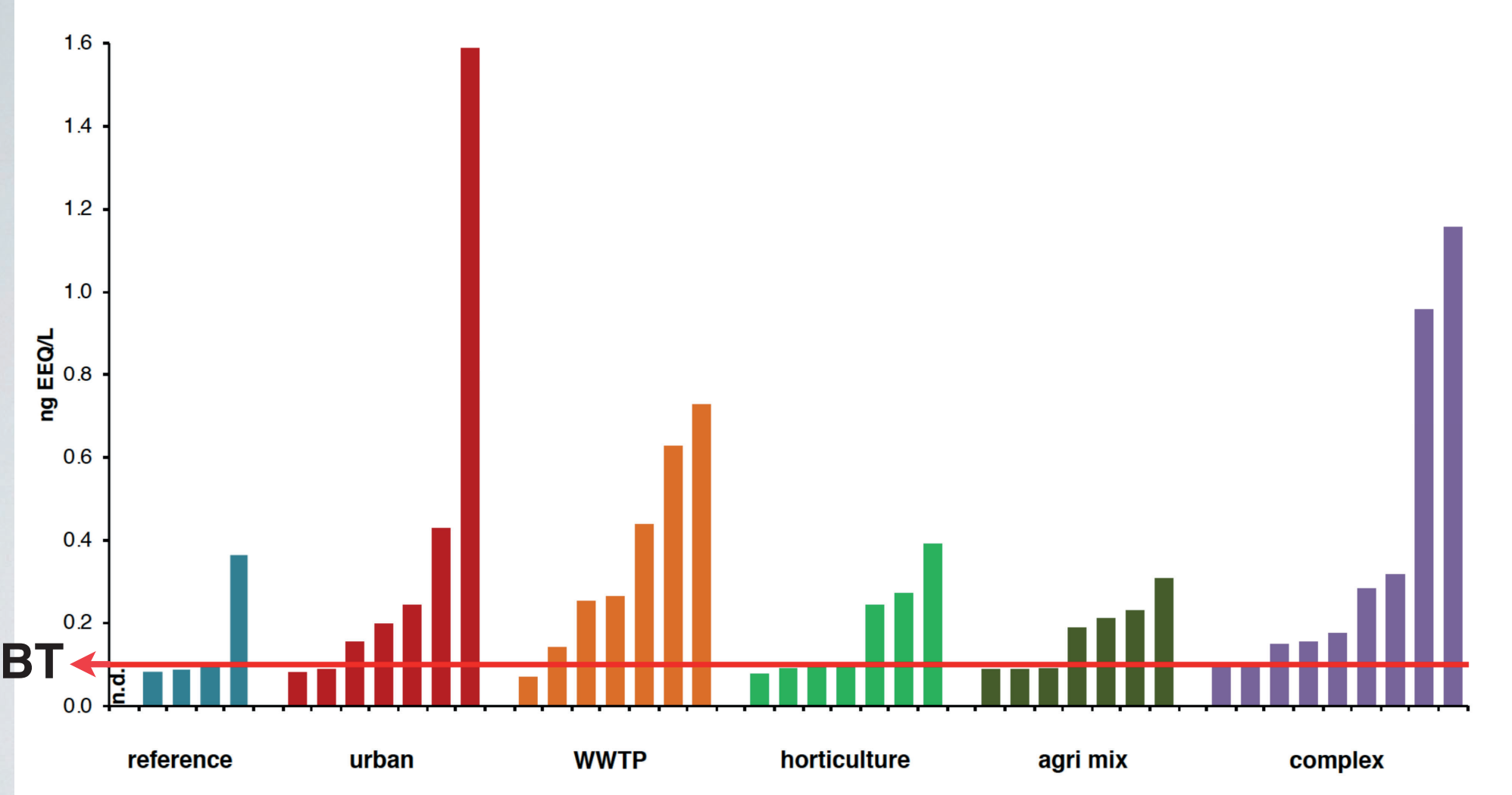
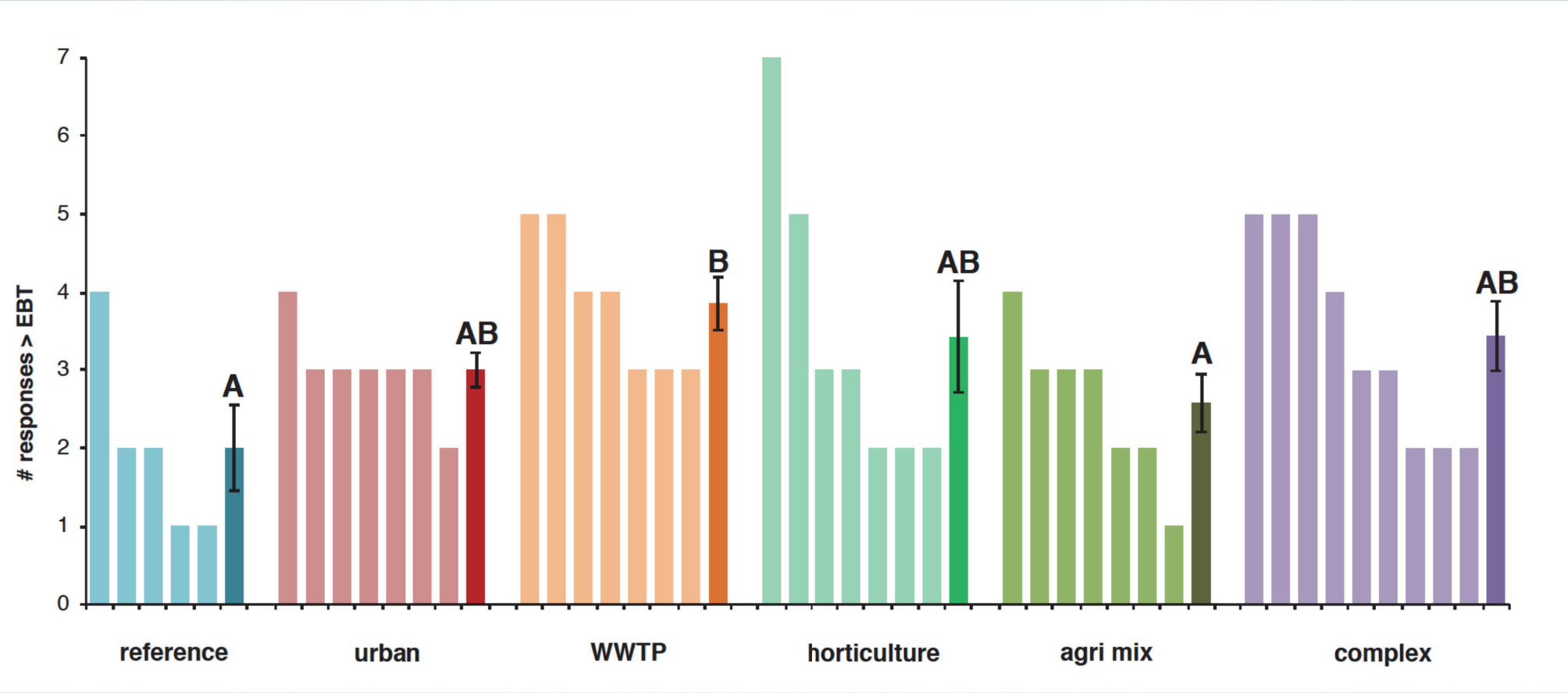



A wide range of bioassay responses were observed, from non detect to EBT exceedance

# EBT exceedances per land use



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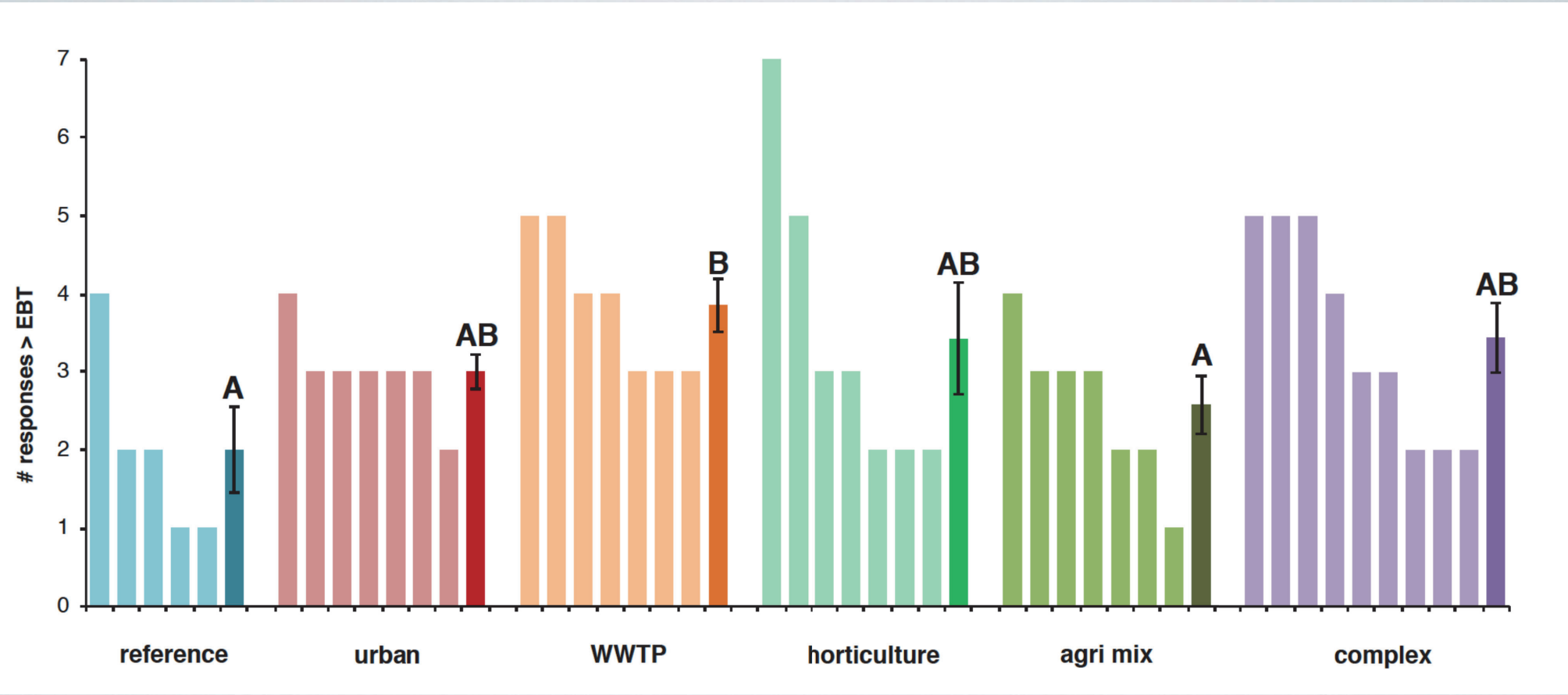
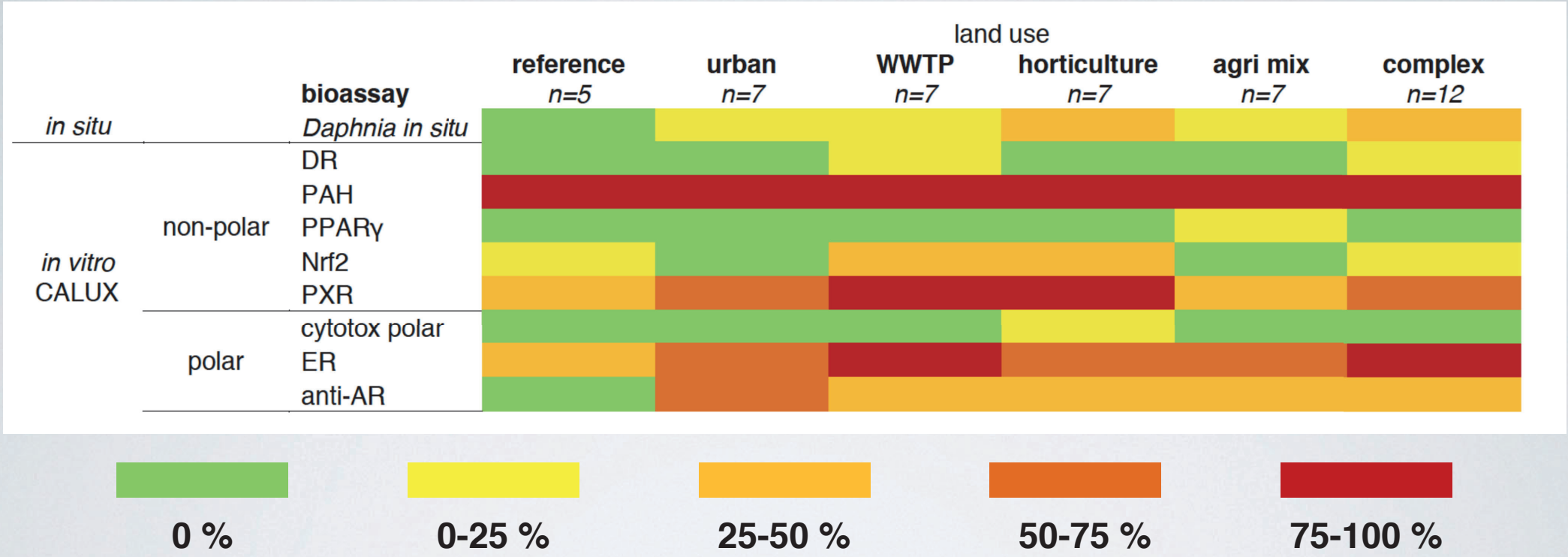



The number of EBT exceedances was highest for WWTP locations, however, variation was larger between sites within land use than between land uses

# EBT exceedance frequency



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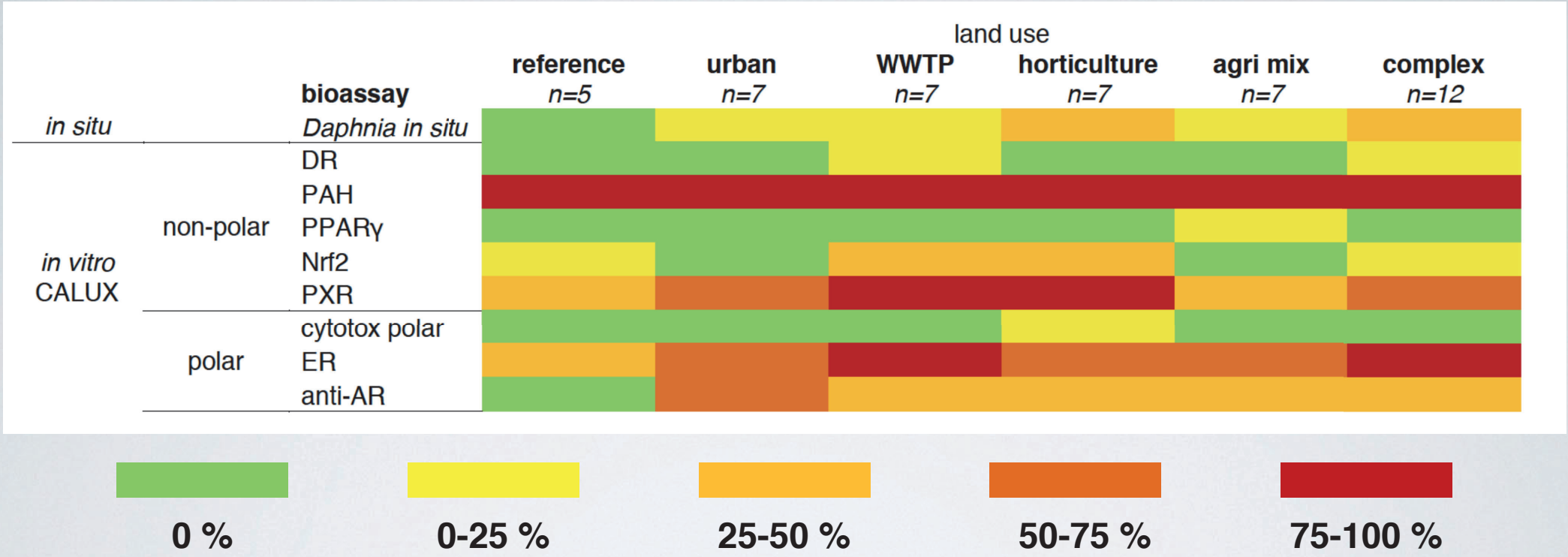
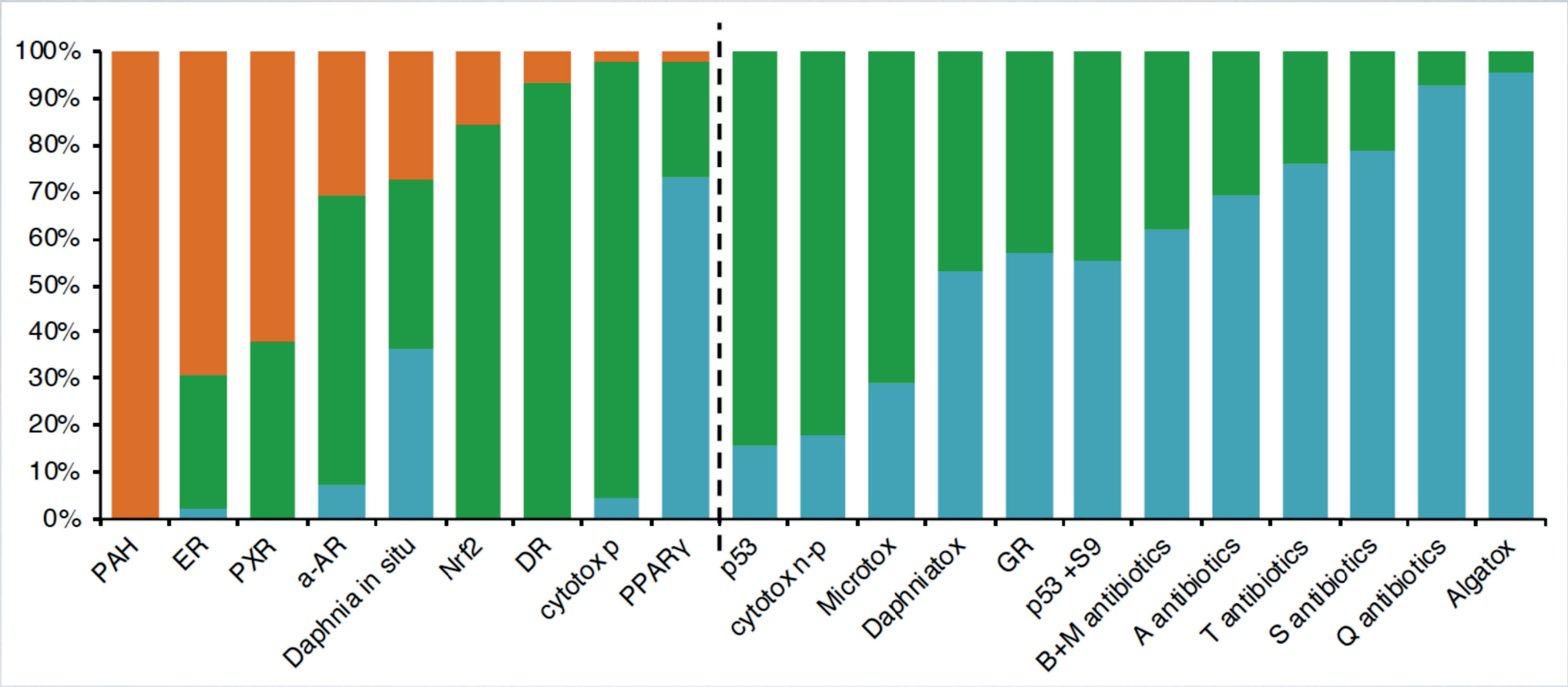



Several assays indicated ecological risks at all or the majority of locations, while others were land use specific

# EBT exceedances per test




**> EBT**

**< EBT**

**no response**

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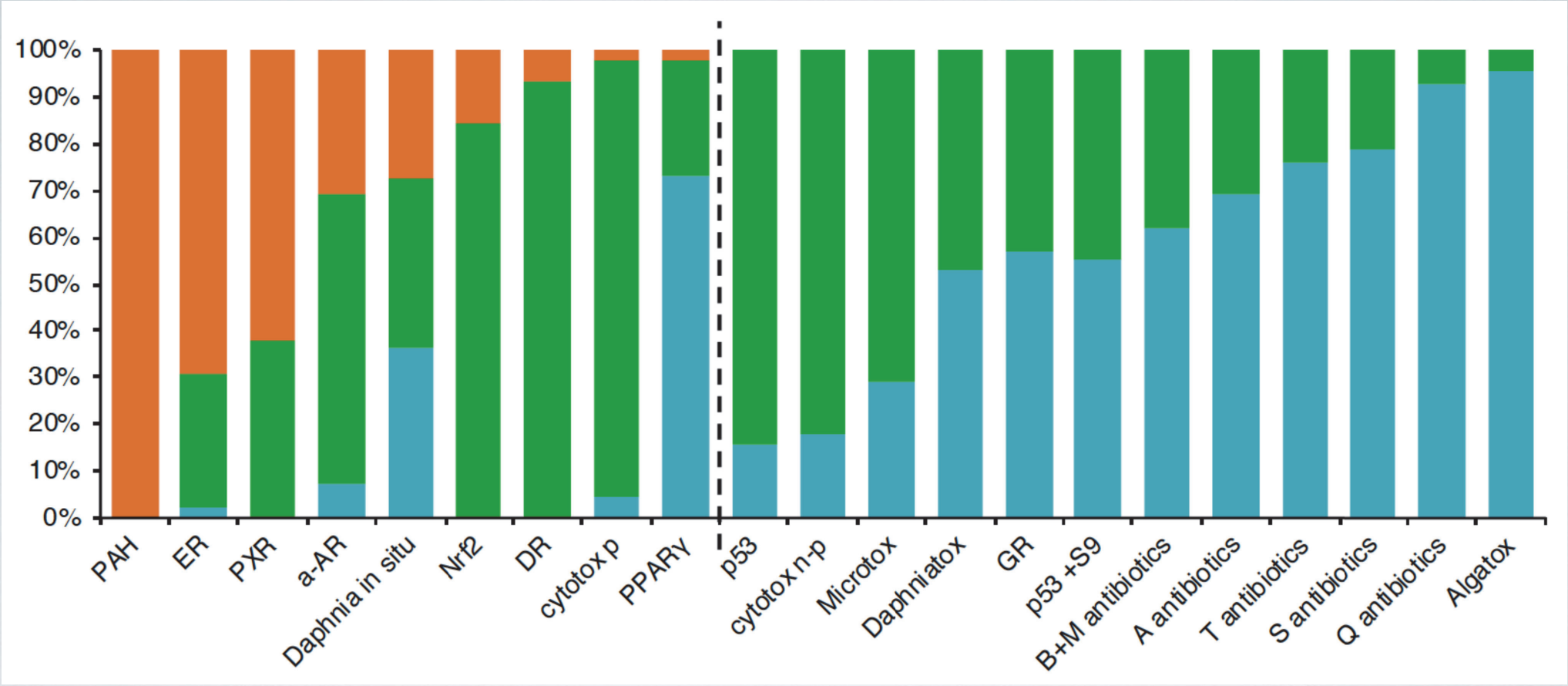
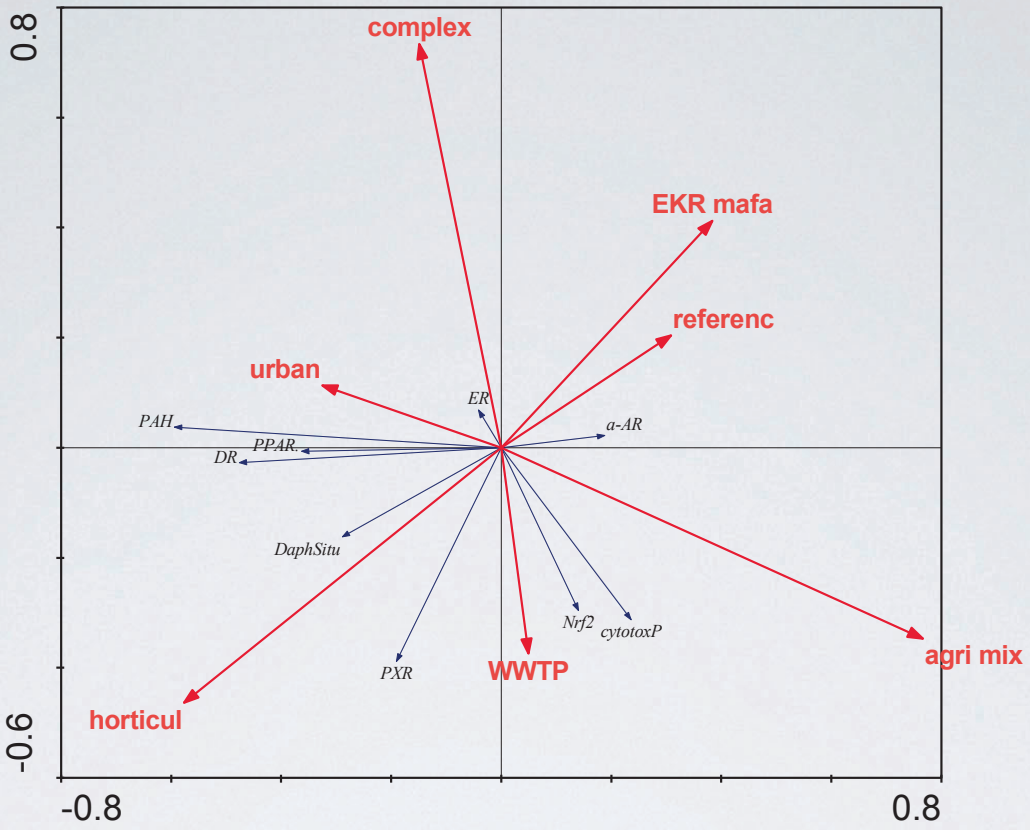



**> EBT** **< EBT** **no response**

Effectiveness of bioassays to elucidate ecological risks varied widely

# Land use specific drivers?



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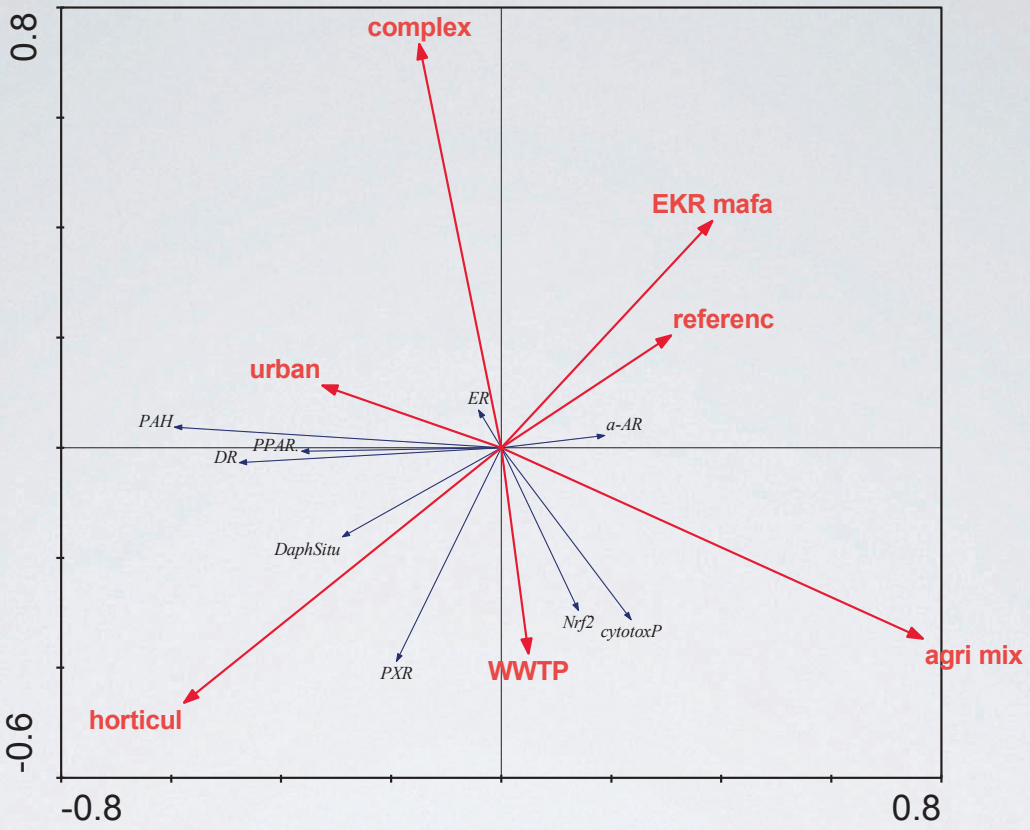


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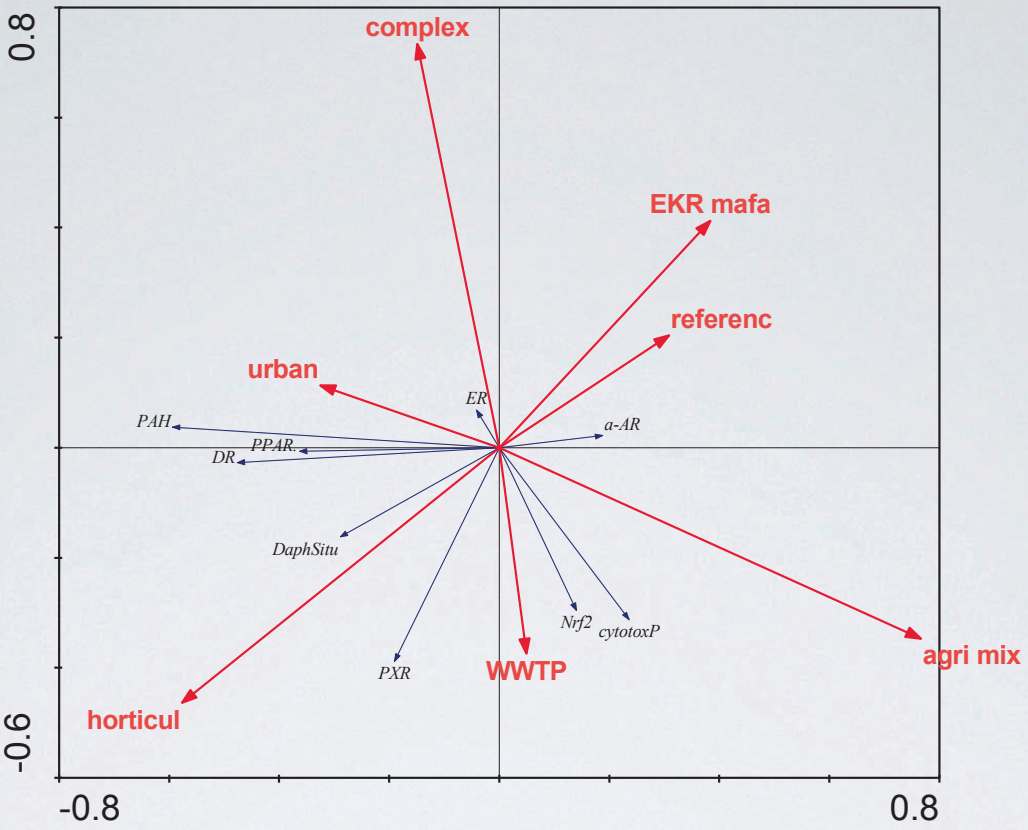


- Multivariate analysis (RDA) indicated no significant land use specific effects on bioanalytical responses
- However, there appears to be a negative correlation between chemical risk and ecological quality status

# Discussion

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- We were not able to identify land use specific drivers of ecological risks
- Nonetheless, several discriminating bioassays allowed for the identification of locations at risk from chemical stressors

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➡ Streamlining and expansion of the bioanalytical toolset is necessary to enable balanced and ecologically relevant effect-monitoring

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**And we will…**

# Outlook

*National monitoring campaign 2018*




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- 20 sites within 4 land use categories (*n=5*)

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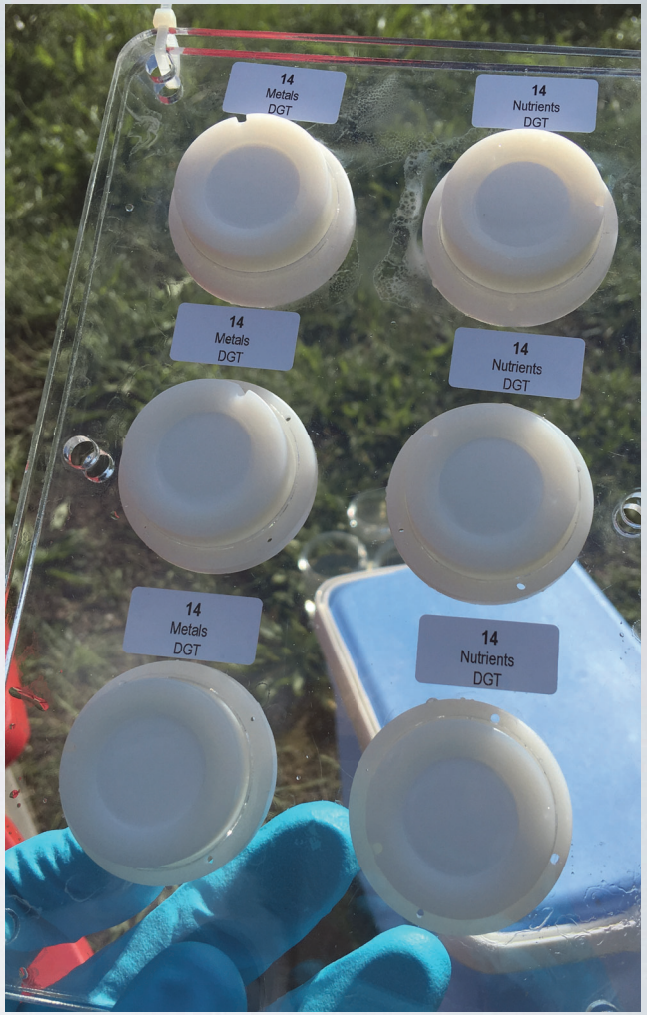
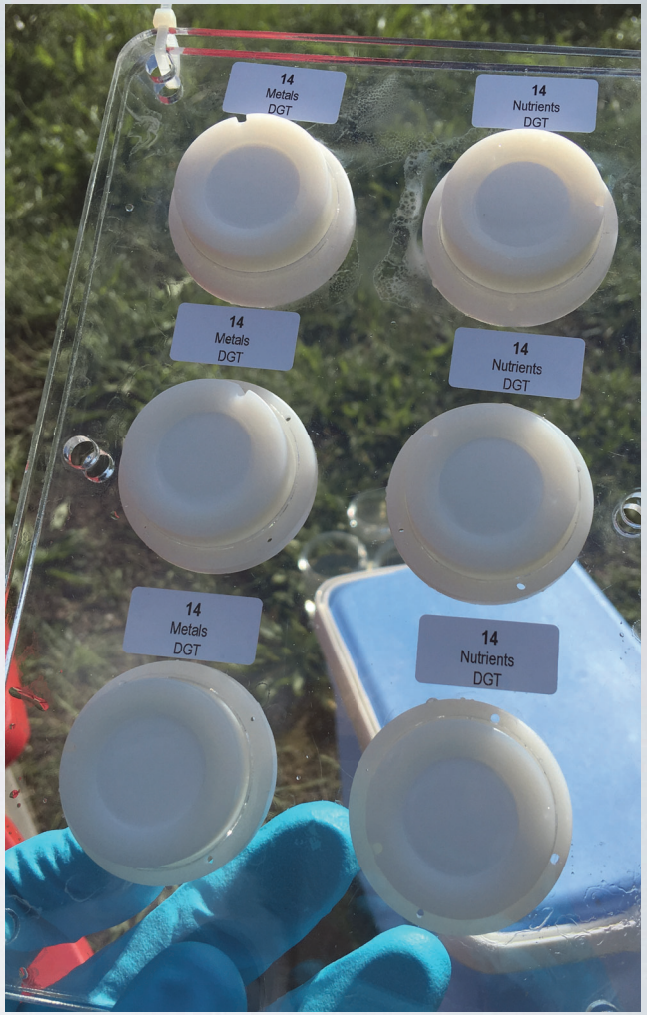
- Passive sampling of metals and nutrients



# National monitoring campaign 2018

- 20 sites within 4 land use categories (*n=5*)
- Passive sampling of metals and nutrients
- Expansion of the bioassay battery with insects and improved antibiotics and algal toxicity tests

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## Nationwide screening of surface water toxicity to algae

M.L. de Baat [a,*], D.A. Bas [a], S.A.M. van Beusekom [a], S.T.J. Droge [a], F. van der Meer [b], M. de Vries [b], P.F.M. Verdonschot [a,c], M.H.S. Kraak [a]

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[b] Wetterskip Fryslân, Fryslânplein 3, 8914 BZ Leeuwarden, the Netherlands
[c] Department of Freshwater Ecology, Wageningen Environmental Research, Droevendaalsesteeg 4, 6708 PB Wageningen, the Netherlands

# National monitoring campaign 2018

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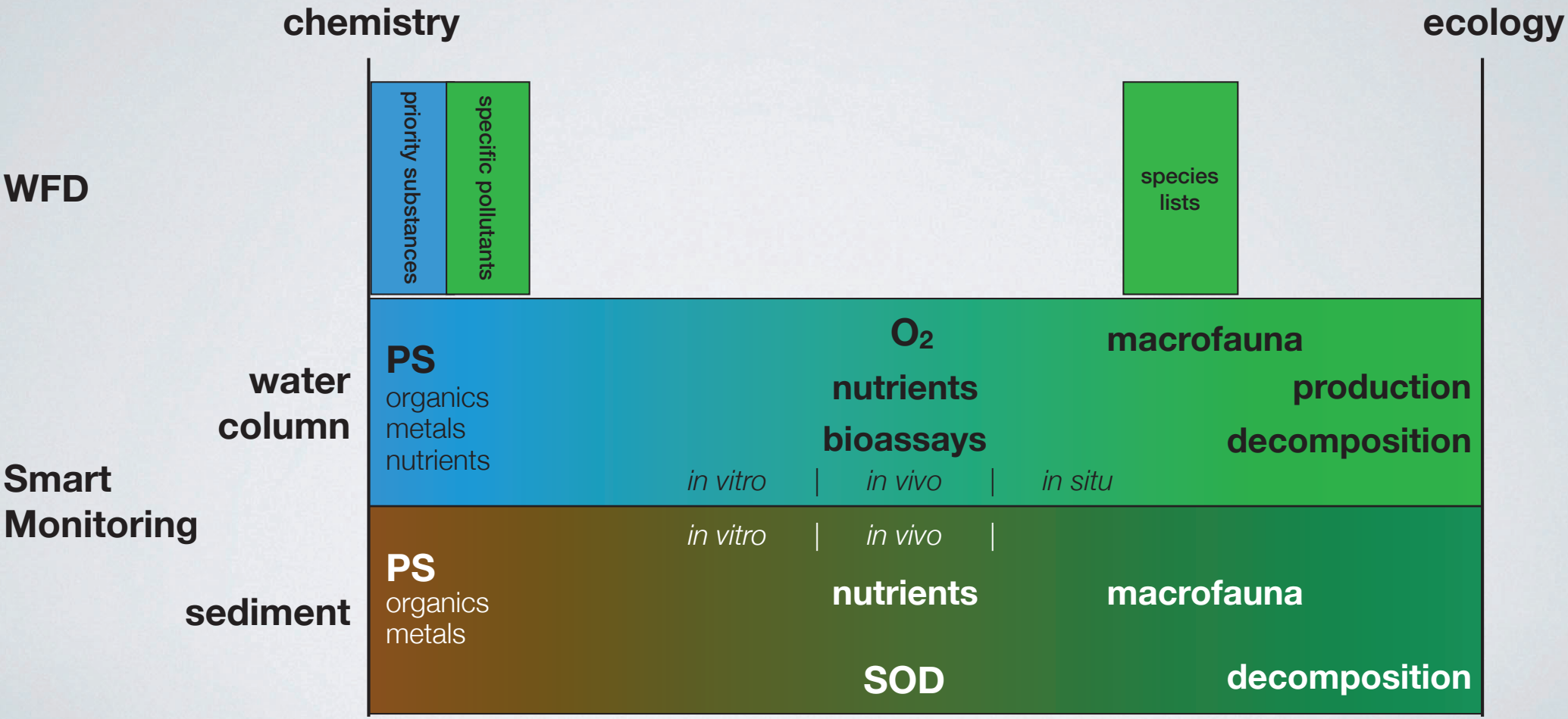

| | Bioassay |
|---|---|
| *in situ* | Daphnia in situ |
| *in vivo* | Daphniatox |
| | Algatox |
| | Microtox |
| *in vitro* CALUX non-polar | cytotox nonpolar |
| | DR |
| | PAH |
| | PPARγ |
| | Nrf2 |
| | PXR |
| | p53 -S9 |
| | p53 +S9 |
| *in vitro* CALUX polar | cytotox polar |
| | ER |
| | anti-AR |
| | GR |
| *in vitro* antibiotics | T |
| | Q |
| | B+M |
| | S |
| | A |