Environmental aspects of NAMs. Some reflections

José V. Tarazona, DVM, PhD

Research Professor on Environmental Health Risk Assessment Science

Spanish National Environmental Health Centre
Instituto de Salud Carlos III, Spain

Centro Nacional de Sanidad Ambiental

Instituto de Salud Carlos III

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NAMs and Plant Protection Products ERA

- NAMs for implementing 3Rs

- NAMs as source of mechanistic Next-Generation ERA
  - Additional opportunities/challenges
  - (Eco)toxicological mechanisms as drivers for predicting environmental impacts

NAMs for implementing 3Rs

- ERA includes a large set of organisms from different taxa
- Only vertebrate testing is considered “animal testing”
  - Fish
  - Birds
  - Mammals
- Embryos up to specific development stages are excluded
  - Embryo based NAMs

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Acute toxicity

- Fish Embryo Acute Toxicity (FET) – TG 236
- Fish Cell Line Acute Toxicity – TG 249
- In silico, QSAR, read-across
- Species sensitivity WoE

Chronic toxicity

- In silico, QSAR, read-across
- Species sensitivity WoE

Do you "really" need new fish data for C&L or Aquatic Toxicity PoD?

Bioaccumulation

- Hyalella azteca Bioconcentration Test (HYBIT)- Draft TG
- In vitro intrinsic clearance and extrapolation TG 280
- In silico, QSAR, read-across
- Species sensitivity WoE

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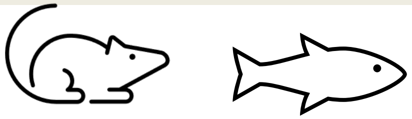
NAMs for Mechanistic Hazard assessment

20th Century paradigm



21st Century Toxicology

Apical endpoints
No Adverse Effect Level
Taxonomic groups

No Adverse Effect Level / AF

≠

Intermediate endpoints
Mechanistic connectors

Drivers for ecological impacts

Developing new paradigms for environmental risk assessment based on mechanistic understanding of biology and ecology at real environmental conditions

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Additional opportunities, challenges, and future

- For PPP ED Identification
- Amphibians

Endocrine Disruption

- NAMs focus on human relevance

Mammals

- Linking biology to ecology

NGERA

- Environmental aggregated and combined effects

Landscape

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Drivers for environmental effects

Biology

Ecology

Mechanistic
NGERA

Mechanisms
Molecular/Subcellular

Targets:

Susceptible species
Expected effects

Impacts:

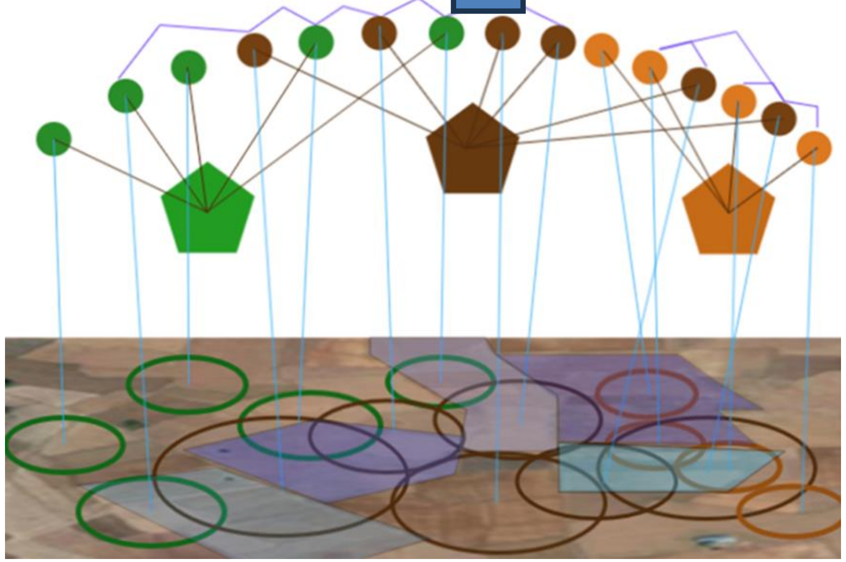
Populations
Communities

Pesticidal mode of action
(Eco)toxicological modes of action

Ecological consequences:

- **Ecosystem functions**
- **Ecosystem services**
- **Biodiversity**

Next Generation Protection Goals?



Realistic Landscape
Agricultural Conditions

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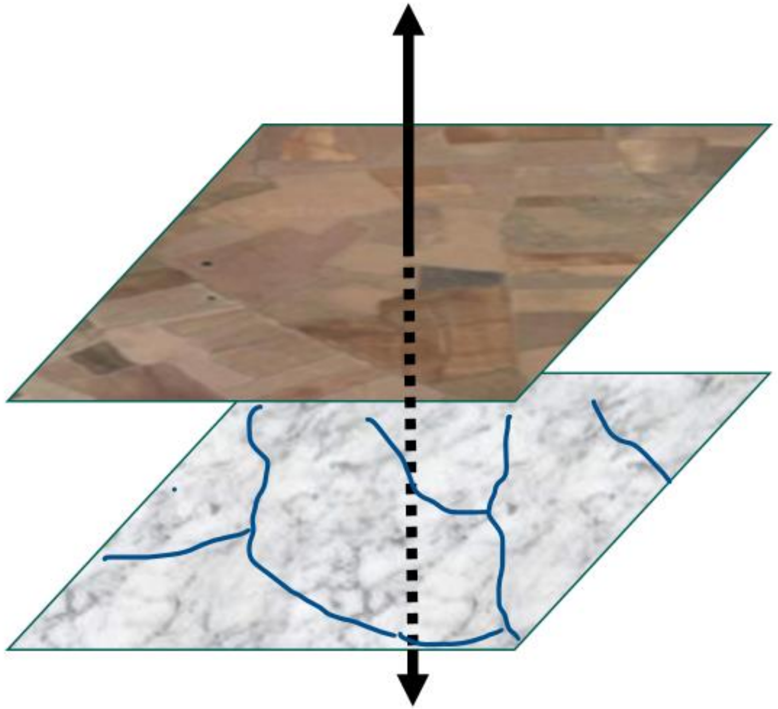
Spatial and temporal dimensions

Differentiation for terrestrial and aquatic

Exposure drivers linked to landscape structure in the XY plane

Effect drivers built on Z dimension



Temporal iterations

- Pesticide applications
- Fate and behaviour
- Exposure pathways
- Other agricultural management practices
- Individuals and populations behaviour
- Exposure dynamics
- …

Concluding remarks

- NAMs for implementing 3Rs
  - Focus on fish testing

- NAMs as source of mechanistic knowledge: pesticidal and toxicological modes of action
  - Additional opportunities: amphibians and endocrine disruption
  - Additional challenges: coverage of mammals
  - The future: Next-Generation and Landscape ERA
    - (Eco)toxicological mechanisms as drivers for predicting aggregated and combined environmental impacts
    - Science-based sustainability assessment of PPP use

Thank you!

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MDPI

Article

A Simplified Population-Level Landscape Model Identifying Ecological Risk Drivers of Pesticide Applications, Part One: Case Study for Large Herbivorous Mammals

David Tarazona [1], Guillermo Tarazona [2] and Jose V. Tarazona [3,*]

Ecotoxicology and Environmental Safety 266 (2023) 115577

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Environmental risk assessment of PPP application in European soils and potential ecosystem service losses considering impacts on non-target organisms

Erik Urionabarrenetxea [a], Carmen Casás [a], Nerea Garcia-Velasco [a], Miguel J.G. Santos [b], Jose V. Tarazona [c], Manu Soto [a,*]

[a] Cell Biology in Environmental Toxicology (CBET) Research Group, Dept. Zoology and Animal Cell Biology, Faculty of Science and Technology and Research Centre for Experimental Marine Biology and Biotechnology PIE-UPV/EHU, University of the Basque Country UPV/EHU, E-48080 Bilbao, Basque Country, Spain

[b] European Food Safety Authority (EFSA), Via Carlo Magno 1/A, 43126 Parma, Italy

[c] Risk Assessment Unit. Spanish National Environmental Health Centre, Instituto de Salud Carlos III, Madrid, Spain

Chapter 23

In Silico Methods for Environmental Risk Assessment: Principles, Tiered Approaches, Applications, and Future Perspectives

Maria Chiara Astuto, Matteo R. Di Nicola, José V. Tarazona, A. Rortais, Yann Devos, A. K. Djien Liem, George E. N. Kass, Maria Bastaki, Reinhilde Schoonjans, Angelo Maggiore, Sandrine Charles, Aude Ratier, Christelle Lopes, Ophelia Gestin, Tobin Robinson, Antony Williams, Nynke Kramer, Edoardo Carnesecchi, and Jean-Lou C. M. Dorne

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Current Opinion in
Environmental Science & Health

The use of new approach methodologies for the environmental risk assessment of food and feed chemicals

Matteo Riccardo Di Nicola [1,2], Irene Cattaneo [3], Alexis V. Nathanail [3], Edoardo Carnesecchi [3], Maria Chiara Astuto [3], Melina Steinbach [3], Antony John Williams [4], Sandrine Charles [5], Ophélia Gestin [5,6,7], Christelle Lopes [5], Dominique Lamonica [5], Jose Vicente Tarazona [8] and Jean Lou C. M. Dorne [3]

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Contact: jtarazona@isciii.es

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