



# PREDICTING STRESSOR EFFECTS ON ECOSYSTEMS AND THEIR SERVICES IN A CHANGING WORLD: IMPLICATIONS FOR RISK MANAGEMENT AND RESTORATION.

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# 5 QUESTIONS:



## Problem formulation

- What are the key challenges for assessing the ecological consequences of multiple stressors arising from global urbanization, climate change, demographic shifts and spatial disconnect between resource use and production? (Q10)
- Biodiversity and ecosystem services: what are we trying to protect where, when, why and how? (Q17)

## Risk assessment

- How do we improve risk assessment of environmental stressors to be more predictive across increasing environmental complexity and spatiotemporal scales? (Q13)
- How can we improve the communication of risk to different stakeholders? (Q16)

## Risk management

- How can we develop, assess and select the most effective mitigation measures to protect and restore the environment and human health? (Q20)



# 1. KEY ENVIRONMENTAL CHALLENGES.

- More people
  - EU-28 population of 510 million is predicted to increase 4% by 2050, then slowly decline.
- Aging population
  - The ratio of people over 65 to those under 65 will increase from 0.29:1 in 2015 to 0.5:1 in 2050
- Increased urbanization
  - Almost 75% of people live in urban areas and this could increase to just over 80% by 2050.
- Climate change
  - Projected 1.4 - 3°C raise in temperature by 2070.
- Disconnect between resource use and production
  - Europe is a major importer of goods and exporter of impacts



# 1. WHAT IS NEEDED



- Interdisciplinary approaches that account for complexity and connectivity of environmental systems and incorporate appropriate spatial and temporal scales.
- System-based approaches to ERA that incorporate multiple stressors.
- Consideration of environmental risk in a global context to ensure that national/regional policies do not have unintended adverse global consequences.
- Step change in the scientific basis of, and approach to, regulatory ERA.



## 2. WHAT ARE WE PROTECTING & WHY?



- European landscapes are highly managed
  - 80% land mass used for settlements, infrastructure or production. Most of rest managed for nature and recreation
- Effective land management and environmental protection requires clear protection goals
  - What is being protected in a specific location (what & where?), over what time scales (when?) and for what purpose (why?).
- Not possible to protect everything, everywhere all of the time. Landscapes are managed to meet human needs.
  - Trade-offs between protecting ecosystem integrity and meeting human well-being needs.
- The direct and indirect contributions of nature to human well-being = ecosystem services (ES).



## 2. WHAT IS NEEDED



- Understanding which species and processes deliver the desired ES and how stress-induced changes in these ecological components translate to changes in ES delivery.
- Robust ecological production functions translating what we can measure to what we want to protect (i.e. ES).
- Building on the work of EFSA to develop and ES-based approach to ERA that provides a framework for landscape-scale risk assessment and targeted risk management.



# 3. COMPLEXITY AND SCALE IN ERA



- Stressors may be transported considerable distances and across habitats.
- Spatio-temporal variation in stressor exposure is superimposed on variation in distribution of species and ecological processes at risk.
- Current ERA frameworks do not account adequately for this scale and complexity of exposure and potential effects.
- How much complexity needs to be incorporated into ERA?



# 3. WHAT IS NEEDED



- Landscape ecotoxicology to provide a conceptual framework for mechanistic exposure and effect modelling.
  - Interactions between model complexity, sensitivity and uncertainty may reduce model relevance.
- Landscape-scale, scenario-based approaches that incorporate aspects of complexity and variability
- Mapping and modelling tools based on spatially and temporally explicit datasets.
  - Provide more predictive risk assessments and enable more targeted risk management interventions.



# 4. IMPROVING RISK COMMUNICATION



- Risk assessment is undertaken to inform societal decisions.
- ERA is generally based on the testing of a chemical against a limited number of lab species or comparing field measurements to environmental standards.
- Communication of risks based on ERA methods are often challenged with the “so what” question.
  - What does this lab toxicity or exceedance mean?
- Stakeholders are also concerned about environmental impacts and critical levels being observed for chemicals that have undergone regulatory ERA.



# 4. WHAT IS NEEDED



- Communication of risk in terms that matter to people.
- Assessment of risk to entities that matter to people.
- A focus on natural capital and the benefits people get from nature (ecosystem services) may provide an effective framework for risk communication and risk assessment.



# 5. EFFECTIVE RISK MITIGATION AND RESTORATION



- Mitigation measures are becoming increasingly important to protect and restore the environment from stressor impacts.
- Risk mitigation measures are recommended for the majority of PPP active substances approved in Europe.
- The SETAC-European Commission MAgPIE workshop developed a toolbox of risk mitigation methods.
- SETAC-Society for Ecological Restoration workshop recommended moving from a remediation-restoration approach to a focus on restoration of impaired ecosystem structure and function from the outset.





## 5. WHAT IS NEEDED

- Application of an integrated risk assessment (IRA) concept to efficiently characterize an overall risk to humans and the environment.
- Use of a common currency for IRA evaluations (e.g. ecosystem services and human wellbeing).
- Realistic environmental scenarios that consider multiple stressors.
- Evaluation of mitigation methods in higher tier risk assessment.



# COMMENTS



- The environmental impacts and health risks from chemicals and climate change have been highlighted as areas of major concern (EEA, 2015).
- SETAC Europe members have prioritized the need for:
  - Robust protection goals and effective mitigation measures to protect and restore the environment.
  - Methods to account for ecological complexity and different spatio-temporal scales in risk assessment.
  - Risk communication and risk assessment to focus on environmental entities that matter to people and for a more integrated risk assessment.
- The science challenges and associated research needs have been outlined.

