

Recommendations from the workshop - *Synthesis by A.Ragas with the contribution of M.Hilden, J.Lahr, B.Münier, A.Pistocchi*

How to communicate (absolute and/or relative) risks to policy makers and the public?

- Maps can be useful tools to communicate cumulative risks and associated uncertainties to different target groups, e.g. the general public, policy makers and scientists.
- The purpose of the map, the target group, the endpoint and the rationale behind the map should always be clearly defined and explicitly stated. The terminology used should be clear and transparent to the users.
- Absolute risk maps provide information about the overall risk associated with certain activities and/or stressors, e.g. mortality risks in terms of deaths per million. They are useful to inform specific target groups and the general public about the potential impact of human activities. Absolute risk maps should be based on integrative endpoints (e.g. health effects) and always provide a frame of reference to interpret the results (e.g. a comparison with other risk levels or standards). Because uncertainty in absolute risk estimates may be large, the implications of this uncertainty should be carefully considered before producing and publishing the map.
- Relative risk maps provide information about intermediate risk parameters (e.g. emissions, concentrations or vulnerability). They can be useful (1) to illustrate the processes underlying high risk situations, (2) to identify potential high risk situations and (3) to select risk reduction measures and (4) to facilitate the selection of alternative management scenarios.
- Vulnerability maps (also called sensitivity maps) are a special type of relative risk maps. They display the potential impact of anthropogenic stress in an area before it actually occurs. Vulnerability maps are useful to facilitate planning, processes and decisions on development scenarios.

Can human and ecological risks be integrated in one map?

- Integration of human health and ecosystem health endpoints in one map can be realized by combining different layers of information (e.g. using different colors for different endpoints). Aggregation, i.e. merging ecological and human endpoints into one indicator, can be realized using reference values and a weighting procedure for both endpoints. This can support decision making by illustration of the different options to deal with conflicting targets. It is not the task of the scientist, however, to provide normative weights (i.e. subjective/political preferences) of the endpoints; rather, scientists should clearly identify the meaning of a given chemical distribution in terms of risk for each endpoint separately, and help clarifying the implications of different weighting choices in terms of policy consequences.
- Aggregation of human and ecosystem health endpoints is not recommended for communication to the general public because the aggregated endpoints are difficult to interpret and not easily related to real world effects.

How cumulative should cumulative risk maps be?

Cumulative risk mapping covers the analysis, characterization and possible quantification of the combined risks to human health or the environment from multiple agents or stressors. This may include multiple sources of (the same) pollution, multiple environmental compartments, multi-way exposure and/or multiple biological receptors (human and/or nature).

How cumulative a risk map should be depends on the purpose of the map and data availability. Cumulative integrative endpoints (e.g. health effects) are preferred for absolute risk maps. However, very often it is not possible to make “absolute” cumulative risk maps due to the ignorance of (1) chemical emissions, (2) the exact behavior and composition of chemical mixtures in the environment (3) effects in terms of human health or (4) effects on ecosystems. In these cases, the development of “risk indicator” maps based on the concept of pressure factors may be an option. For instance, in the case of pesticides it appears rather difficult to make a comprehensive overall assessment of the risk associated with uncertain emissions, chemical properties, and effects. However, useful indicators have been developed at different scale levels.

Should risk maps for Europe present absolute or relative risks?

Risk maps should have a degree of realism that is consistent with data availability and the degree of knowledge of the cause-effect relationships involved. As a provisional scheme, the following guidelines can be used:

- Presentation of absolute risks can be useful when emissions, fate, receptors and effects are known in detail or can be predicted reliably, e.g. in local scale risk assessments with extensive location-specific data.
- Communication of relative risks is the preferable option in cases of limited data availability or when detailed knowledge about cause-effect relationships is lacking, e.g. risk assessment of novel chemicals, mixtures and nano-particles. Relative risks can be useful to identify hot spots, but they should not be confused with absolute risks. This should be clearly stated in the transfer of such material to the target groups.

Research Recommendations

Additional research is required to develop a firm knowledge base to map cumulative risks and communicate them to different target groups, especially in the following areas:

- a. development of aggregation and visualization techniques to present and communicate complex risks and the associated uncertainties comprehensibly;
- b. clarification of different types of uncertainty that can be associated with complex risks, e.g. well-defined probabilistic uncertainty versus ignorance;
- c. techniques and tools to deal with (geographical) data gaps and for spatial data modeling and geo-statistics;
- d. the optimal scale of risk maps in relation to the type of environmental problems, policy/planning issues and risk perception;
- e. perception of cumulative risks (as opposed to risks of single substances) by the different target groups;
- f. the impact of communicating absolute risks versus relative risks on the different target groups, and how both approaches may be used to improve the political discussion and decision making in risk management.

The outcome of the research proposed above should be worked out into practical guidelines on how to make (cumulative) risk maps, how to keep them up-to-date and how to communicate cumulative risks to different target groups.

Suggested summary conclusions & recommendations

- Maps can be useful tools to communicate cumulative risks and associated uncertainties to different target groups, e.g. the general public, policy makers and scientists.

- The purpose of the map, the target group, the endpoint and the rationale behind the map should always be clearly defined and explicitly stated. The terminology used should be clear and transparent to the users.
- Absolute risk mapping can be a powerful instrument to inform specific target groups and the general public about the potential impact of human activities, but should be used only when the risks are known in sufficient detail or can be predicted reliably.
- In cases of limited data availability or when detailed knowledge about cause-effect relationships is lacking, relative risk mapping can be a useful instrument to identify potential high risk situations.
- Aggregation of human and ecosystem health endpoints is not recommended for communication to the public because the aggregated endpoints are difficult to interpret and not easily related to real world effects.