Chapter E.7

Conclusions

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We have provided a stark contrast between two approaches to assessing the potential effects of future environmental change. The first approach, the scenario approach, relies on computer model outputs, typically from General Circulation Models, to develop a set of scenarios for the future state of the Earth's environment. This scenario approach usually assumes that weather is the dominant, and sometimes only, forcing factor of concern, and focuses primarily on long-term change at global scales. The vulnerability approach, in contrast, focuses on multiple stresses at local and regional scales (primarily) and more immediate, shorter-term impacts. There are strengths and weaknesses in both approaches but the scenario approach, which is the most widely used, must start with vulnerability assessments. Only once we know what are the specific threats to our environment do we need to estimate (using scenarios) whether environmental change is likely (or possibly) large enough to cause these threats to be realised, as well as to have a measure of the uncertainty attached to these scenarios. A vulnerability approach will better prepare the public for variable future weather, abrupt atmospheric shifts in any direction, and other urgent and costly environmental stresses. Table E.7 summarises the differences between the two approaches.

Specific examples of the vulnerability assessment procedure, with respect to water resources, were presented in this chapter. Vörösmarty and colleagues showed that the increase in human population in the next few decades is much more likely to threaten the availability of

Table E.7. General characteristics of the scenario and vulnerability approaches as typically used

Approach	Scenario	Vulnerability
Assumed dominant stress	Climate, recent greenhouse gas emissions to the atmosphere, ocean temperatures, aerosols, etc.	Multiple stresses: climate (historical climate variability), land use and water use, altered disturbance regimes, invasive species, contaminants/pollutants, habitat loss, etc.
Usual timeframe of concern	Long-term, doubled CO_2, 30 to 100 years in the future.	Short-term (0 to 30 years) and long-term research.
Usual scale of concern	Global, sometimes regional. Local scale needs downscaling techniques. However, there is little evidence to suggest that present models provide realistic, accurate, or precise climate scenarios at local or regional scales.	Local, regional, national and global scales.
Major parameters of concern	Spatially averaged changes in mean temperatures and precipitation in fairly large grid cells with some regional scenarios for drought.	Potential extreme values in multiple parameters (temperature, precipitation, frost-free days) and additional focus on extreme events (floods, fires, droughts, etc.); measures of uncertainty.
Major limitations for developing coping strategies	Focus on single stress limits preparedness for other stresses. Results often show gradual ramping of climate change-limiting preparedness for extreme events. Results represent only a limited subset of all likely future outcomes – usually unidirectional trends. Results are accepted by many scientists, the media, and the public as actual "predictions". Lost in the translation of results is that all models of the distant future have unstated (presently unknowable) levels of certainty or probability.	Approach requires detailed data on multiple stresses and their interactions at local, regional, national and global scales – and many areas lack adequate information. Emphasis on short-term issues may limit preparedness for abrupt "threshold" changes in climate some time in the short- or long-term. Requires preparedness for a far greater variation of possible futures, including abrupt changes in any direction – this is probably more realistic, yet difficult.

potable water than any of the climate change scenarios created by the general circulation models. Brad Bass and colleagues, and Changming Liu, documented the similar importance (and threat) associated with increasing population pressures in China. Roland Schulze shows hydrological risks exemplified for South Africa with special consideration of aridity and difficulties in management practices due to uncertainties in the prediction of seasonal weather such as ENSO events. Tom Stohlgren and colleagues document the range of threats to a pristine park area, in which invasive exotic plant species and air pollution are major threats. Other integrated assessments are also taking place (Becker et al. 1999; Stohlgren 1999b, and others). As shown in this chapter, the vulnerability assessment procedure is a more inclusive evaluation method than relying on scenarios at the start of an impact assessment. The scenario approach is only required once specific environmental threats are recognised. Once we identify environmental risk, the scenario approach can be used to determine if there is a possibility that the threat could be realised and, if possible, quantify the probability of the risk. Hutchinson shows how the strong topographic coherence of weather can be used to reduce some of the uncertainty in constructing fine scale scenarios and assessing vulnerability. Even without quantification and the ability to predict the future, however, the vulnerability perspective provides useful information for policy-makers (Sarewitz et al. 2000).