SCOPE 27 - Climate Impact Assessment

Part II Biophysical Impacts

Kates, R. W., J. H. Ausubel, and M. Berberian (eds.), 1985. Climate Impact Assessment: Studies of the Interaction of Climate and Society, ICSU/SCOPE Report No. 27, John Wiley.

In the simplest of impact models, climate affects places, people and their activities, leading to a set of ordered consequences. The first set of consequences is designated as biophysical impacts, because their causal mechanisms (where known) or transfer functions (where inferred) are in the realm of physical and non-human biological relationships: crops grow, rainfall runs off, cattle graze, fish feed, and buildings cool.

As indicated in the previous chapter on climate sensitivity, all five of the sectoral chapters deal with highly climate-sensitive activities. But they do not exhaust the set of such activities; indeed they only illustrate them. Particularly missing are chapters on unmanaged, natural ecosystems, sensitive industrial activities such as construction and transportation, and service activities such as insurance and recreation. However, the five chapters well illustrate the range of methods available for determining first-order impacts, the comparative precision and validity of these methods, and some common directions for future investigation.

In Chapter 5, Nix suggests five methods for analyzing the impacts of climate on agriculture: trial and error, analogy, correlation, simulation modeling, and systems analysis. This typology serves well to describe not only methods employed in the agricultural sector, but also to compare the methods available in other sectors as well. Agriculture (Chapter 5), Water Resources (Chapter 8) and Energy Resources (Chapter 9) employ the full range of methodologies. The analysis of pastoralism (Chapter 7), as distinct from modern ranching, is with a few exceptions still at the level of analogy and simple correlation. The link between climate and fisheries (Chapter 6), with the possible exception of `El Niño' types of phenomena, is still trial and error, uncertain analogy and correlation.

Greater predictability of transfer functions is found in physical than biological functions and in small-scale, controllable human activities. Thus it is easier to predict temperature-energy or rainfall-runoff relationships than the climate yields of agriculture, pastoralism or fisheries. Similarly it is easier to predict the energy demand for a building than for a city, or the yield of a field than that of a grazing area or an ocean current. The chapter authors have not limited themselves to first-order impacts. Although concerned with biophysical impacts, all the authors work from a framework in which climate impact relationships are constrained or changed by human action. Thus as Nix (Chapter 5) shows, agricultural models must be confined to a particular crop, place and technology or specifically include changes in technology as a major variable in yield functions. Kawasaki (Chapter 6) explores the still indeterminate issue of whether fluctuations in fishery catch reflect natural (including climate) cause or simply overfishing. A similar issue is posed by LeHouérou relative to the success of human adjustment to drought. Nováky, Pachner, Szesztay and Miller (Chapter 8) argue for the need to consider water-related impacts of climate clearly within the context of socially related management activities. Similarly Jäger (Chapter 9) notes that climate-energy demand relationships are changing rapidly as conservation methods come into widespread use.

Thus a common research question for methodological development is posed by the need, in even the simplest of impact models, to allow for the interaction of climate and society. A second issue is posed most clearly in the analysis of Le Houérou, but is also evident in the chapters on water, agriculture and energy. Le Houérou traces the systematic amplification and dampening of impacts along the causal chain of the impacts model, suggesting that variability in climate is amplified in primary productivity of grazing lands, but in turn is dampened in livestock yield and in human impact. Similarly Chapter 8 shows that fluctuations in rainfall are amplified by fluctuations in streamflow but are dampened by water resource management measures. The systematic comparison of climate-yield-impact ratios for different sectors might well lead to improved understanding of the processes of interaction.

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