Uncertainty in Landscape Models: Sources, Impacts, and Decision-Making

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Increasingly, integrative spatial landscape models are being used by decision-makers to provide better information about the potential consequences of a given action. With the emergence of this tendency, there is an accompanying desire to have information about the quality of outputs so that decision-makers know, at the very least, if they are working in a high- or low-certainty environment. Whereas even non-expert consumers of model outputs have a non-specific awareness of uncertainties associated with models, even expert model users are rarely aware of some of the subtler sources of uncertainty that may affect model outputs.

This paper will describe the general sources of uncertainty that can impact model outputs. These will be discussed relative to map complexity, spatial scale, natural process variability and other data characteristics and how these impact model calibration and validation, and how model structure can be impacted by these. Finally, uncertainties in model outputs will be discussed relative to decision-making and risk assessment and a conceptual framework will be presented for determining the need to consider model uncertainty in a given decision.