Appendix A

Uncertainty mapping tool. In this uncertainty matrix , classify uncertainties you expect to play a role in the considered problem, just simply by writing down - in terms of the A,B,C,D,E-code given below - their conjectured importance in the appropriate box of the matrix. Scores: A= crucial B= major C=medium D=minor E= neglegible

	Locus	*Sociopolitical and institutional context (moral, legal, societal, institutional, proprietary, situational)*	*System boundary*	*Problem framing*	*Scenario framing*	*Indicators*	*Conceptual model struct. /assumptions*	*Technical model structure*	*Parameters*	*Input scenarios*	*Input data*
Sort	*Can stem from*										
Inexactness	*Intrinsic: uncertainty* • Variability / heterogeneity *Technical limitations:* • Resolution error • Aggregation error • Linguistic imprecision / unclear definitions										
Unreliability	*Methodological limitations* Limited internal strength (as reflected, for instance, by expert disagreement) in: ▪ Use of proxies ▪ Empirical basis ▪ Methodological rigour (including management of anomalies) ▪ Validation Limited external strength in: ▪ Completeness of set of relevant aspects ▪ Exploration of rival problem framings ▪ Management of dissent ▪ Extended peer acceptance / stakeholder involvement ▪ Transparency ▪ Accessibility Future scope										
	Bias / Value ladenness Bias in knowledge production ▪ Motivational bias (interests, incentives) ▪ Disciplinary bias ▪ Cultural bias ▪ Choice of (modelling) approach (e.g. bottom up, top down) ▪ Subjective judgement Bias in knowledge utilization ▪ Strategic/selective knowledge use										
Ignorance	*Epistemological limitations* Limited theoretical understanding System indeterminacy ▪ Open-endedness ▪ Chaotic behavior Intrinsic unknowability Active ignorance ▪ Model fixes for reasons understood ▪ Limited domains of applicability of functional relations ▪ Numerical error ▪ Surprise A Passive ignorance ▪ Bugs (software error, hardware error, typos) ▪ Model fixes for reasons not understood ▪ Surprise B										