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Navigating the Global Resource Nexus: Methods, Priorities, and Policies

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Measures which address the degradation and over-exploitation of natural resources are urgently needed, in individual countries and globally. However, the extraction and use of natural resources is highly interconnected, spatially and sectorally, within a complex web of interactions and feedbacks. Water supply requires land for storage and energy for pumping and treatment; energy supply requires water for cooling and land for generation; and, land requires water and energy inputs to supply agricultural products (food, fibre, and fuel). To this end, decisions concerning individual resource use have knock-on effects on other environmental systems in profound and often unintended ways. This new problem space of natural resource management is poorly understood owing to the discrete evaluation and management of environmental problems. To avoid problem-shifting between water, energy, land, and the climate system, a deeper understanding of their interactions is urgently needed. To address this gap, a Multi-Regional Input-Output model was developed to capture environmental system interactions in terms of the resource stocks, flows, and decisions connect different actors within the global economy. Insights from this model are used to investigate where, when, and how integrated resource management might be promoted in different consumption-and-production systems. Potential trade-offs and complementarities arising from resource interdependencies are discussed within the context of historical trends (1990-present), current resource policies, and future development scenarios. A variety of data visualisation approaches (interactive sankey diagrams and network graphs) are used to convey the complexity of 25 million supply chain and resource flow relations. Modelling principles and policy recommendations discussed will be salient to a range of disciplinary communities, not least, energy studies, complexity science, and the nascent field of nexus-based assessment.