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Towards a Stakeholder-driven Planning Approach for Adaptation and Resilience in Food, Energy, and Water Sectors

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Abstract: As resources (e.g., water and land) become increasingly constrained and uncertain with growing populations, changing climate, and changing policies, inclusion of adaptation strategies in the management of natural resources is rapidly becoming a necessity. A major challenge in planning for adaptation at a basin-wide scale is coordination within the multiple food, energy, and water sectors that use common natural resources. Adaptation actions made by one sector may inadvertently impact availability and/or quality of natural resources used by other sectors as well as systems within the sectors. Hence, it is important to identify critical interconnections between sectors that share natural resources and relevant actions that may have the capability to increase and/or decrease resilience of linked systems to both sudden and chronic changes. Furthermore, long term planning for adaptation requires identification of a set of actions over time (i.e., adaptation pathways) for multiple sectors and decision-makers that result in increased resiliency of individual sectors and improved system-wide wellbeing for multiple socio-economic factors. While in theory, optimization of a set of actions for maximized resiliency and robustness is not exceptionally difficult; in practice, formulation and implementation of a system-wide and multi-sector optimization of adaptation pathways faces significant challenges, particularly engaging key sector stakeholders. This study demonstrates a “bottom up” and stakeholder-driven approach to formulating an adaptation planning problem for multiple sectors. The approach combines stakeholder engagement techniques with a multidisciplinary design optimization framework to develop adaptation pathways for food-energy-water stakeholders and systems in a northeast Oregon basin dominated by irrigated agriculture and stressed by declining groundwater levels. The resulting set of adaptation pathways identifies interdependencies between sectors and provides stakeholders with a wide set of options to aid in system-wide adaptation, as well as overcome coordination barriers that currently limit adaptation planning. The results also illustrate key innovations in creating an effective stakeholder outreach and engagement for interdependent food, energy, and water systems.

***Keywords**:* Adaptation, Food-energy-water nexus, Stakeholder, Integrated Modeling.