Pacific Northwest NATIONAL LABORATORY

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Technosocial Simulations: Where Climate Change Meets National Security

Climate change outcomes such as desertification, melting glaciers and rising sea levels constitute a serious threat to national security. Analysts have raised the specter of increased occurrence of humanitarian crises, destabilization and radicalization of politics and populations, mass migrations, famines caused by arable land loss, and wars over water, energy and other natural resources. However, actual impacts depend upon the ability of countries and societies to understand the complexities of climate change and respond effectively.

Global and regional models of climate change and land use are invaluable in assessing the gravity and velocity of ensuing physical changes. However, insights on human response to climate change are indispensable to calibrate the impact of these changes on national security and design effective policies to counter adversities. For example, experts estimate that by 2080 51 to 97 million people living in coastal zones of Bangladesh may have to leave because of rising sea levels. Where will these people go? How will they adjust to the move? How will the people and governments in the receiving and neighboring nations react to such a large migration? How will the migration flow evolve through time? We cannot begin to address these and related questions without due consideration of how factors such as cultural sensitivities, quality of governance, local socio-political discrepancies, regional conflicts and foreign interests may influence human choice in the affected areas.

The integration of climate change, land use and energy production/use models with social, cultural, political and behavioral models of human motivation and intent is central to understanding the complex relationship between climate change and national security. These integrated models need constant updating with relevant knowledge so that our assessment can be always informed by ongoing change to achieve maximum fidelity. They also have to be

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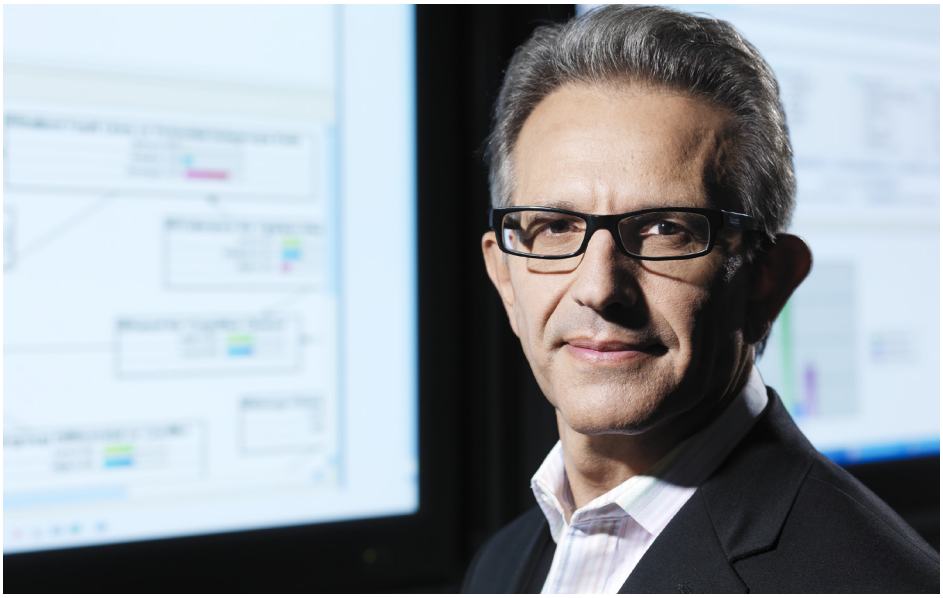
made understandable and accessible to end users who may not have sufficient background in the relevant mathematical, natural and social sciences to interpret and manipulate the direct model outputs. Finally, it is critical to articulate the use of these integrated models and their associated knowledge management processes within a workflow that increases the reliability of human reasoning by stimulating creativity and overcoming cognitive biases and limitations on human judgment. These are the objectives we have been pursuing in the development of the *Technosocial Simulation Software Platform* (TSSP) at the Pacific Northwest National Laboratory.

TSSP offers a collaborative visual analytic interface with user-friendly access to integrated models of climate change and national security that are informed by knowledge management processes. TSSP promotes model integration through



innovative algorithms that enable the combination of diverse modeling paradigms such as probabilistic evidentiary reasoning and system dynamics. Integrated modeling is informed by a Knowledge Encapsulation Framework that facilitates the distillation and vetting of relevant knowledge from heterogeneous data streams, including social media. The TSSP collaborative working environment enables analysts and policymakers to stress-test the validity of their analysis and policy plans using techniques such as role-playing and serious gaming.

ABOUT PNNL

PNNL is located in Richland, Wash., employs more than 4,700 staff, and conducted more than $1.2 billion in research in fiscal year 2009. In the quest for energy and environmental solutions, PNNL marshals interdisciplinary research teams, collaborates with a range of partners, and leverages research funding to maximize results. Our staff, facilities, capabilities, and approach to inquiry and innovation have established PNNL as a premier science and technology enterprise.

For more information about the Technosocial Simulations Software Platform, please contact:

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