

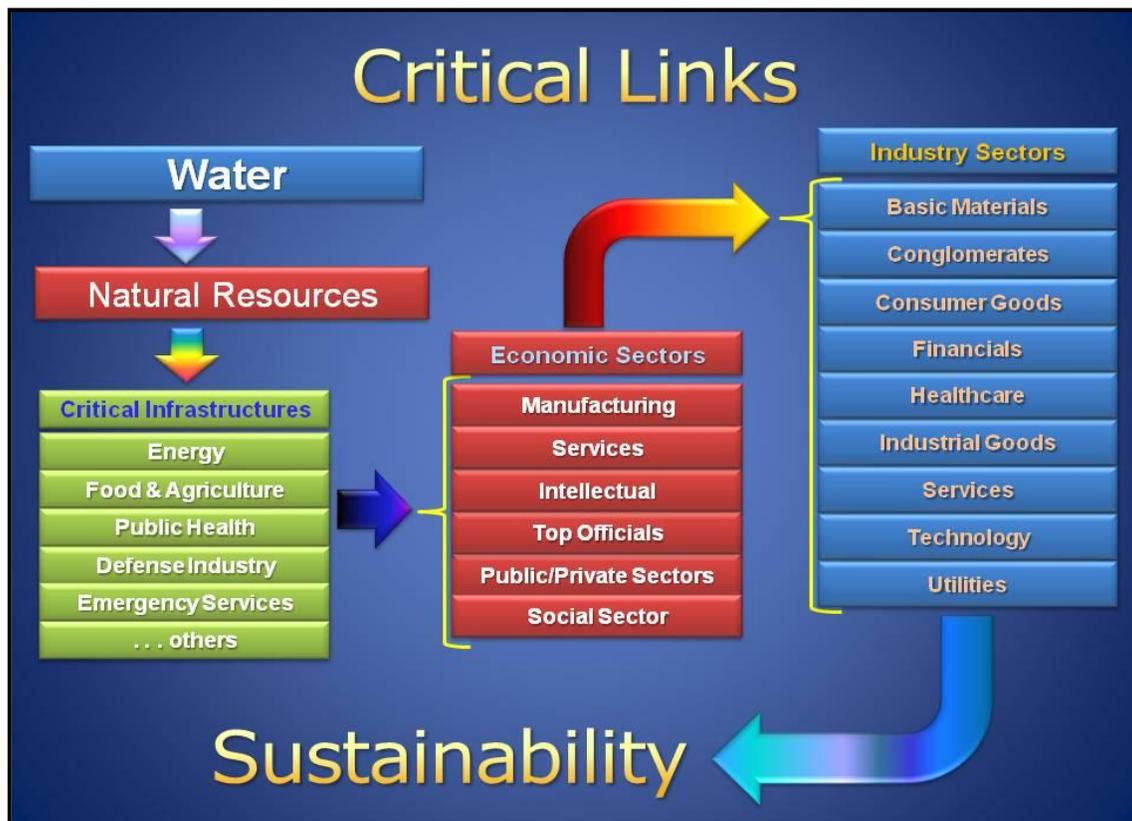
Welcome! People benefit from a multitude of resources and processes supplied by natural resources and ecosystems. These benefits include water supplies suitable for supporting economic development, agriculture, energy, manufacturing, public health, transportation, and many other sectors. Recent decades have brought substantive changes in land use and climate change around the world affecting entire societies and prompting the need to treat population and community ecology as dynamic processes for national security, resiliency, and other purposes. This has created an increasing need for capabilities that will reduce vulnerability and mitigate risk years forward, especially as natural resources and supplies such as water, energy, and food production diminish.

TinMore Institute (TMI), in addition to other services, relates climate variables to outputs and impacts on environmental systems accurately to predict climate and water-use across state, region, country, and global scales for advance warning of natural hazards such as droughts, floods and other hazards 7-years forward. The forecast includes relations and effects on the economy, economic sectors, and industry sectors, as well as critical infrastructure and energy use and also to national security issues as generally illustrated in Figure 1 (details not shown), which yields a sustainability or resiliency stress indicator for a region/country—analogueous to a stress test in the banking industry. This capability is perhaps the ultimate risk mitigation tool. Often, we are asked about scale; we recently performed this work on a land area of 1.1 million square miles or, slightly larger than Argentina (described below). How large do you wish to go?

How does the TMI forecast work? As one is familiar with a 7-day weather forecast; think of our 7-year forecast as similar, only much longer and more accurate. For example within the next 7-years, TMI can tell you when a drought will occur, how long it will last, and how severe it will be, as well as its effects on many interdependent processes. For a specific case, an insurance company in the Midwestern U.S. insures farmers at a 75 percent rate against yield loss due to drought for 3,000,000 acres of corn production. Without getting into tedious specifics, this rate guarantees the farmer \$700 per acre insurance return in event of total loss. The TMI forecast projects that in three years a moderately-severe drought lasting 11 months will ensue in which the harvest season is in the middle of the duration time frame. Corn-crop loss to drought is projected to be 80 percent. The end loss to the insurance company in this case would be about \$1.7 billion; the farmers will also be affected since premiums are adjusted annually based on previous years yield. Fortunately, because of the TMI 7-year forecast, the insurance companies and farmers were aware of the drought in advance and modified production goals to either not plant in specific cases, plant more drought tolerant corn such as varieties bred by Monsanto, or to plant other crops. Coupling their efforts with the TMI 7-year forecast, potential insurance and crop-production losses were reduced by 75 percent. The forecast also projected continued water use (allowing modification of water management processes for the region), drought mitigation procedures, and reactions within the economy, such as food and energy prices, job loss and migration, and market and industry sectors to project future resilience for the region. The 7-year forecast also included other far-reaching effects for other countries obtaining their food supply from this region and related commodity supply line, resources, and other issues.

Given that all of these areas are inexorably linked and that the Midwestern U.S. grain belt provides food for 110 world countries, such risk mitigation tools are a necessity. The TMI 7-year forecast tool is of extreme value to commodity brokers, farmers, agricultural suppliers such as Monsanto, Archer Daniels Midland, Cargill, and others, U.S. government agencies that provide national and foreign aid, banks, U.S. Department of Defense, CIA, U.S. Department of Homeland Security, and related areas in other countries. The TMI tool and process allows managers, policy makers, and governance the ability to reduce loss and ensure continuity of economic and social processes and thus, short- and long-term resiliency. TinMore can accomplish this process for any country or region in the world—no other group can currently do so.

Figure 1: Generalized linkage of TMI 7-year Forecast to Natural Resources, Critical Infrastructure, Economic, and Industry Sectors to develop a Resiliency Stress Indicator (specifics not shown).



Background:

The foundation of TinMore’s initial work was the ability to model financial analysis of the major markets for 6 months forward, originally looking at a daily basis until a breakthrough was made to project longer terms, which included modeling mass human behavior. This was for initial proof of concept, which we significantly built upon. As an example, the main limitation of general models and analytical tools used by most experts has been quantifying sources of uncertainty given the highly nonlinear nature of interactions between climate, economic, and environmental variables and natural and community-level processes. A key advantage of our hierarchical approach is that it incorporates various sources of observations and key variables, and includes established scientific knowledge and uncertainties associated with each, which is critical for monitoring effects of changing climates (for example, lakes and streams have been

identified as significant indicators of environmental change), for projecting human behavior on a mass basis, and natural shifts through time that are not discernible by other experts until after the fact, which also includes multiple wide-scale effects and interdependencies across regional to global systems. Additionally, TMI looks at the physical cause of a process or problem first and then applies appropriate solutions for model development. Our forecast and other processes gives you the ability to see forward in time (7-years) and mitigate risk that others will not observe until it is too late. ***Our process yields the ability to mitigate and control (years ahead) rather than to react and recover.***

Concisely, TinMore Institute methodology provides a key framework for describing potential consequences of local to global-climate changes on large-scale water use and on specific climate circumstances for 7-years forward, especially food production limitations due to precipitation change, drought and other resource shortages and natural hazards, thus alerting decision-makers to the most likely consequences with the potential to substantially mitigate risk to cope with these issues, which also include flooding, water and energy dual interdependencies, and economic effects across a specific state, region, or country. For example, the economic effects in our process include food and fuel prices, mass migration, energy costs fluctuation, cost changes across markets and industry due to interdependencies of the entire system (resources, infrastructure, economy, industry, and a host of other issues). TinMore Institute methodology provides explicit means to scale results for multiple hierarchical levels and associated uncertainty. The end result is a proprietary predictive model for evaluation of management options to cope with local, regional, country, and global climate-change consequences, mitigate risk, and assess the uncertainty of those predictions. No other group in the world can currently perform such work. As an example, we just performed our process on a land area slightly larger than Argentina (described later).

From a scientific and technology perspective, linking multi-scale climate models for system components together by formal rules of probability, as well as financial model and groundwater model coupling, allows accurately forecasting water use, scarcity, and supplies across entire states, countries, and regions and thus, also the effects of water and other natural resource shortages on economic development and related sectors, which is a critical need for all areas around the globe facing water shortages and the resultant effects on resilient and sustained economic development. Such areas include the Middle East, Africa, China, Pakistan, India, etc. Our forecast also allows evaluation of potential water-distributional changes in an ecological system, given distributional changes implied by a series of linked climate and system models under various land-use and other scenarios for evaluation of management options to cope with global economic and climate-change consequences. The process is particularly useful for looking at the trade offs of water used for extraction of minerals (is it viable or not), gas, and oil in various regions of world and the interdependent effects on the environment and economy related to that water and energy use and, also of virtual water.

TinMore Institute can forecast climate change, water and energy use, agricultural production, and other parameters for 7 years with about 80 percent accuracy, as well as their effects on all the areas as listed in figure 1, including relations to intelligence, homeland and national security, and overall resiliency. When coupled with our financial model, we can forecast coupled resource use and effects with the entire economy of a country and the various economic sectors to look

forward and mitigate risk by as much as 90 percent. This process can be accomplished across a variety of scales to develop an initial, accurate prediction, which can be constantly updated for the most precise assessment and thus, continually push the 7-year forecast forward.

Proof of Concept Completed

Economic Analysis and Coupling

For the economic relations we have developed a model to predict global currency flow that gives an indication of the strength of not only the economy, but accounts for natural events, as well as significant political and governance decisions.

As an example, using observed climate data from 1950-1999 for one of the world's largest river basins we have successfully developed a climate, surface, and subsurface water flow model to link with our proprietary economic and resiliency models. The process reasonably simulates (75 percent accurate without refinement) 1972 to 1995 observed discharge for the river system and major feeding tributaries from its headwater areas to major river confluence.

The most recently modeled area, to further prove concept and capabilities, covers approximately 520,000 square miles encompassing the entire watershed and all feeding tributaries. Put in perspective of size, this area is five percent larger than the entire country of Peru or almost two times larger than Afghanistan. The watershed was delineated into 116 sub-basins that ranged in size from 32 to 23,469 square miles. Approximately 8,584 miles of stream channels were simulated which includes 2,150 miles of the river main stem. Stream segmentation was determined by sub-basin boundaries. Additionally, our groundwater model was recently successful on over 1.1 million square miles (a little larger than the land area of Argentina), as was the coupling process generalized in Figure 1. The results are next coupled with critical infrastructure, economic, industry, national security, and other areas for a complete resiliency picture. Nothing further will be discussed here, but more can be gleaned from our website at www.tinmore.com.

The crises pictured below could have been mitigated by 40% or more using TinMore's forecasting methods and processes. Why? Because the reason for these circumstances would have been seen 7 years before they occurred. Contact us to learn more.



Consider TMI

We ask that you consider TinMore Institute as your think-tank resource. We are independent thinking, driven professionals that effectively address your needs in terms of resource and data driven capacity support and analysis for your governmental, agency or national interest. We are able to support endeavors on an international scope and able to assist your needs with precise project management and problem solving skills. And, we can perform assessments such as our proprietary 7-year forecast that no other group in the world can perform—***a mitigation tool of unparalleled value and capacity***. Ours is unmatched commitment to the client—we deliver what we say we will, when it was promised, and for the negotiated particulars—specific deliverables, timelines, etc. with total client transparency through the entire process. Please contact us at 303.522.0250, by fax at 720.287.2446 or at TinMore@tinmore.com.

Supporting Capabilities (Partial List):

Water Security — TinMore Institute's Center for Water Security can accurately forecast water use and climate change, including temperature and precipitation on a regional to country scale for 7 years somewhat similar to a 7-day weather forecast and linkage to all issues related to water such as economic development and national security.

Energy — the critical interdependence between water, energy, and other natural resources is inseparable. Also, the interdependence between these and life-sustaining systems is critical. TinMore couples these interdependencies to mitigate energy-resource problems and increase resilience of systems and countries.

Agricultural Production — TinMore has developed a small-scale agriculture system that will feed seven persons in a temperate climate and up to 21 in a tropical climate furnishing all nutritional requirements from a balanced diet for one year, as well as providing a cash crop for the farmer in efforts to assist the world's underserved. The system currently operates successfully in 12 countries.

Environmental Sustainability — TinMore couples the natural resource base, linked with population growth and resource use to project sustainability and resilience from local to regional and national scales.

Geographical Information System (GIS) — the ability to map earth science/spatial data issues and model environmental factors necessary for decision support and policy consideration that may require an understanding and over-standing of data management expertise that best represent matters in the most appropriate temporal and spatial resolutions. We maximize such tool use and proper implementation and data curation per project requirements. Moreover data curation support may be services if desired for data optimization and data sharing concerns.

Soil Processes — from the role of soils in food production and irrigation to hazard mitigation, TinMore provides requisite knowledge to farmers, policy providers, and organizations regarding soils in every phase of the environment and industry.

Water Quality and Contamination — whether it is waste-water systems, emerging contaminants, or drinking water supply, TinMore provides full consulting services in this area including obtaining greater supply and sustaining existing supply.

International Resource Use and Interdependencies — complete linkage of commodity-supply lines in natural resource and industry areas are performed to monitor resilience and forecast potential, short and long-term problems to resilience and continuity of the company or country of interest including food production, energy use, and water consumption in relation to economic development needs and sustainability.

Others such as intelligence/counterintelligence, relations of effects of/on terrorism and Homeland and National Security, and more are not described.