

Managing Biological Risks for Human Benefit

I. The Initiative

This initiative is unique in that it develops a predictive early warning system across disease, invasive species, potential bioterrorism and other biological phenomena, rather than a post-facto response. The appropriate preventative measures can be targeted based on risk assessment, thus enabling resources to be allocated efficiently in terms of cost and efficacy. Direct economic benefits will occur as a result of having predictive models that provide information required to manage risk and make proactive strategic decisions that benefit human health. Such information is of great value to governments, companies, individuals and economies impacted by potentially harmful events. As an example, such a system would help mitigate devastating losses that result from the spread of agriculture plights due to the spread of invasive pests or disease, or human diseases spread by insects and migratory species, as well as other specialized bioterrorism catastrophes.

In addition, the foundation for the intellectual and technical resources already exists to develop a new service industry in Kansas. Such an industry would assimilate the associated data, perform required analysis, make projections, and summarize results for customers to make strategic business decisions. This potentially could build on the international research reputation of the Biodiversity Institute to build a global service industry based in Kansas.

This initiative is *managing biological information* in order to

- Model and predict the potential spread of emerging diseases across the United States and beyond
- Model and predict the potential spread of agricultural pests across the United States and beyond
- Identify, model and predict the potential spread of the top 100 bioterror and agroterror agents across the United States and beyond
- Model and predict the potential spread of biological threats to natural resources
- Model and predict the effects of environmental perturbations on environmentally-based economies (e.g., agriculture, natural resources, etc.)
- Integrate the models/predictions with social system information (population, economics, etc.)
- Provide decision makers in the agricultural, economic, natural resources, health and security arenas with an early warning system

II. Long-Term Goal—global (hub/node)

- (a) **Importance**—The ability to model and forecast biological events in the areas listed above is critical to economic stability, national security, human health, management of natural resources and the quality of life. It enables proactive responses rather than much more costly reactive responses. The importance is to turn the unexpected into the anticipated.
- (b) **Current Assets**—Includes leadership (global and national) research and applications positions at University of Kansas (Biodiversity Research Center, ITTC) and Kansas State University in these sectors, with funding from major federal and international agencies. Kansas is an international leader in this niche area of biological informatics.
- (c) **Future Assets**—
 - (1) Informatics and disciplinary personnel to extend the density, robustness and accuracy of the modeling architectures
 - (2) Capture and integration of relevant environmental data sets to increase accuracy and coverages of models
 - (3) High-performance compute clusters for analysis; Early warning network for information dissemination

III. Impact 1, Innovation Attributes—Significant impact initially on formation, with immediate cascading impact on growth and maturity. Much of the conception already exists, as does some of the formation at the two universities, all funded by federal dollars. Investment is needed for rapid growth to continue Kansas R&D leadership in this niche area and to assume maturity.

IV. Impact 2, Innovation Lifecycle—Impact will multiply/attract our supply of intellectual, human and financial capital, if only because expertise in managing/using biological information is critical to areas of social capital: i.e., economic stability and growth, improving human health, ensuring national security, managing our natural resources, maintaining quality of life.

V. Implementation—

- (a) Greater collaboration and integration among units with expertise and resources at KU, K-State, industry, government;
- (b) Identification of strategic plan with goals and actions and milestones directed at areas described in section I above;
- (c) Recruitment of people and resources required to achieve goals in I and II above.
- (d) identification of tech transfer/marketing of products;
- (e) A collaborative of distributed “homes” for implementation according to expertise

VI. Resource Requirements—

- (a) Team leaders at each node of collaborative, e.g., at KU, K-State, industry partner, government partner.
- (b) Infrastructure—high-compute and visualization lab capabilities, IT/disciplinary personnel, integrated network architecture for data integration and analysis;
- (c) Investment—research dollars for personnel and physical infrastructure/equipment.

VII. Sustainability—Leadership position should translate into federal center of excellence (e.g., S&T center in biological informatics) funded by federal agencies or government/private partnership, as well as private sector investment in marketable analysis and forecasting products.

VIII. Performance Metrics—

- (a) Increase in high-paying jobs: this is a high-tech exploding field that will create an R&D opportunity area in Kansas.
- (b) Increased investment by federal agencies and the private sector (domestic and foreign) in general and targeted areas of predictive modeling of environmental events and economic, security, health, etc. consequences. Opportunities for federal S&T centers, etc.
- (c) New startups from research spin-offs, particularly to targeted areas of predictive modeling, both in contracts and products. Increase in university-industry partnerships.
- (d) Brain gain of expertise in IT and biological sciences — see #1
- (e) Increase internships for students