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UIF Review

**The Puget Sound Regional Synthesis Model (PRISM):
An integrated vision of Puget Sound into the twenty-first century**

Review Committee

Chair: Peter Guttorp, Statistics, University of Washington
Woodruff Sullivan, Astronomy, University of Washington
Jerry Melillo, Marine Biological Laboratory, Woods Hole, MA

Summary

Based on our review of the PRISM UIF, we make the following recommendations about its future.

- 1) PRISM should become a permanent program.
- 2) The leadership of PRISM should be modified in two ways. First, the PRISM Director, Jeff Richey, should increase his time commitment to the project from 3 months to 4 months per year. Second, a co-leader should be appointed who has primary responsibilities for strengthening the human dimensions of the PRISM model and fostering the relationship between PRISM researchers and the policy makers who will use the modeling tools.
- 3) PRISM should define a unifying theme or goal to focus the project.
- 4) PRISM-associated faculty should develop an introductory undergraduate course built around their PRISM-related research.
- 5) PRISM should increase its on- and off-campus-wide visibility through a variety of devices such as a newsletter and a seminar series.
- 6) Database management should be significantly enhanced.
- 7) Several aspects of the research should be expanded, including uncertainty analyses, terrestrial ecology, and public policy.
- 8) The annual core budget should be increased from \$450,000 to \$800,000 (equivalent to the original request).

Outline of this Report. After a “big picture” overview, we present our basic findings. The final section contains further details and justification for each of the eight recommendations listed above.

The Big Picture

Protecting the environment while nurturing the economy is one of the greatest challenges facing Americans in the 21st century. To meet this challenge, a partnership is needed among scholars, resource managers, political and business leaders, and the public at large, that explores alternative futures and presents decision makers with an array of choices and insights into the consequences of those choices. Members of the academy have a special role to play in developing these scenarios.

We judge the PRISM UIF to be a successful example of the kind of partnership between the academy and the rest of society that America millennium needs. In fact, to our knowledge, PRISM is the most comprehensive regional integrated assessment research project in the nation. Among all the first-round UIF projects, PRISM is the one that legislators and the public can best understand as relevant to their concerns. In three years, PRISM has achieved many successes.

Within the University, PRISM has successfully fostered collaborations among faculty and opened new interdisciplinary opportunities for undergraduate and graduate students. The University investment in PRISM has been leveraged by about a factor of 5-10 with outside funding. The work of PRISM researchers has been shared with local, regional and state resource managers and decision makers in useful ways.

Over the longer term, the evolving predictive powers of PRISM's simulation tools will offer resource managers and decision makers of the Puget Sound region the opportunity to ask "what-if" questions that will help guide economic development in the region while maintaining its rich array of ecosystems on which people rely for their basic life support systems.

Findings

Changing the University Culture and Spawning New Research - The PRISM project is changing the University research culture in very fundamental ways. Throughout the review, we heard from numerous scientists that the PRISM project had catalyzed their interactions with scientists in other disciplines to an extent unparalleled in their experience. This multi-disciplinary research culture, which was one of the main selling points of the original UIF proposal, has been extremely successful. In addition, many of the subprojects associated with PRISM would simply not have taken place on their own.

Education - Both undergraduate and graduate students at the University have become involved in PRISM. PRISM has aggressively recruited students to work on its research agenda. The students that we talked to indicated that they had gained a great deal from their association with PRISM, and it was clear from the enthusiasm of a number of faculty that the students had made fundamental contributions to PRISM, especially in the area of computer science.

While PRISM has resulted in the enhancement of existing courses and the initiation of several new highly interdisciplinary upper-level seminars, its faculty has not yet followed through on the goal of developing an introductory-level course. Jeff Richey has confirmed that this is still a high priority and we have urged him to get on with this aspect of PRISM's educational program.

Leveraging Funding – PRISM has been fairly successful in leveraging research funds. A five to tenfold payback (depending on how one does the accounting) from UIF fund investments has been achieved. We see no reason that this should decline in the future.

Interaction with Agencies - PRISM has formed significant partnerships with at least three government agencies, but this number should be greatly increased. Present partnerships involve (1) geologists from the State Department of Natural Resources, one of whom is spending 10% of his time on the UW campus to further collaboration; (2) undergraduates, graduate students and postdoctoral researchers who are being supported by the King County Department of Water and Land Resources to work with agency staff to identify potential sites for a sewage treatment plant; and (3) an oceanographer from the State Department of Ecology who is also a UW Affiliate Professor and is fostering valuable university–state connections. But much more needs to be done in establishing such partnerships if PRISM’s powerful models are to be used to the full benefit of the public sector.

Outreach to K-12 – Data from the PRISM project and research questions defined by its scientists have been the basis for teaching modules involving visualization for K-12 students. These modules are being developed by faculty and graduate students in the School of Education, and tested at local schools in a four-county area.

Communications within the Project - For a project with many working groups, frequent communications in a variety of formats are essential. We recommend that more attention be paid to this, through mechanisms such as a newsletter, a colloquium series (for national-level speakers also), and regular “all-hands” half-day workshops.

Leadership – The current administrative structure of the project suffers from two problems: a lack of focus, such as could be obtained by concentrating on a single question or product, and insufficient time commitment on the part of the Director. At present, it is officially three months; we suggest at least four. Additionally, in order to ensure that the project maintains close ties to stakeholders such as local government agencies, we recommend the hiring of a scientist with policy background as co-director, with duties that include ensuring that the scientific questions studied in the project are relevant to the issues that the stakeholders are concerned about.

Uncertainty Assessment - There is very limited attention being paid to uncertainty estimates of the model outputs, and, more importantly, of the models themselves. In most of the PRISM submodels only sensitivity analysis is attempted, and we did not see any evidence of taking into account uncertainties in the basic data. The main exception to this is in the coupled atmosphere-hydrology model, where multiple runs of MM5 with varying initial conditions achieve an ensemble estimate of variability. In an ONR-funded project, joint between Atmospheric Sciences and Statistics, the MM5 model will be subjected to a much more rigorous uncertainty analysis, using the Bayesian melding technique. We recommend that similar analyses be made for the other PRISM submodels as well.

Terrestrial Ecosystems - The original PRISM proposal indicated that faculty from the College of Forest Resources would be involved in PRISM. Currently, this involvement is not strong if it exists at all. In the opinion of the review committee the lack of a strong terrestrial ecosystem component in the project is most unfortunate. Many of the future environmental management questions in the Puget Sound region will involve land ecosystems and land-water linkages. Every effort should be made to engage terrestrial ecologists in the PRISM project.

Public Policy – The UrbanSIM group is doing good work, but a stronger component of the human dimension in the PRISM model is needed if the model is to reach its full potential in the policy sphere. Expertise in the Evans School of Public Affairs should be tapped.

Recommendations

1. PRISM should become a permanent program.

PRISM is vital to the Puget Sound region and the University's research enterprise. Its connections with state and local agencies make it a valuable tool for these agencies by supplying both relevant research and vastly improved tools for decision making. Its multidisciplinary working groups are changing the University research culture. While PRISM has managed quite well to get research funding for developing its various submodels, the program has infrastructure needs that require permanent funding by the University.

2. The leadership of PRISM should be modified in two ways. First, the PRISM Director, Jeff Richey, should increase his time commitment to the project from 3 months to 4 months per year. Second, a co-leader should be appointed who has primary responsibilities for strengthening the human dimensions of the PRISM model and fostering the relationship between PRISM researchers and the policy makers who will use the modeling tools.

In order for PRISM to move into its next stage, we recommend a change in the leadership structure of the project. First, it is clear that the past and present success of the project is due to the inspired direction of Jeff Richey. His sense of the overall direction of the project and his ability to enthuse his co-workers has been indispensable, and will still be needed in the future. Professor Richey's other projects do, however, force him to spend extended periods of time out of town each year (a total of 4-6 months per year), and this is a concern to some of the project scientists. At this time, the project would greatly benefit from enhanced leadership. First, we suggest that Professor Richey add a fourth month to his leadership commitment. We also envision a full time co-director, preferably a scientist with a policy background, who will be in charge of the outreach aspect of communication with the stakeholders in local government agencies, in addition to maintaining communication between working groups and the details of day-to-day decision making.

3. PRISM should define a unifying theme or goal to focus the project.

The issue of focus came up repeatedly in our discussions with project researchers. While everyone agrees with the over-arching goal of producing a Virtual Puget Sound, we think that a thematic unity could be achieved by having everyone focus on a particular research

and policy issue, such as salmon or hydroelectric power production, or on a product, such as producing a volume of future scenarios (*Whither Puget Sound?*), say, five years from now.

4. *PRISM-associated faculty should develop an introductory undergraduate courses built around their PRISM-related research.*

The original PRISM proposal had a larger educational component than presently achieved. While some of the higher level courses have been implemented, we suggest that it is time to develop an introductory level course using data sets, visualizations, and models developed in the PRISM framework.

5. *PRISM should increase its on- and off-campus visibility through a variety of devices such as a newsletter and a seminar series.*

This program is surprisingly little known both on and off the campus. We suggest a seminar series, a public lecture series (then carried over to UWTV), and a newsletter as first steps towards making the campus community and the agencies and citizens of Puget Sound excited about the project.

6. *Data-base management should be significantly enhanced.*

We see the potential that, given appropriate resources, PRISM and the University Libraries jointly could produce a most important service to researchers, local communities, agencies and others, by making available over the worldwide web a variety of data sets regarding Puget Sound. This might include, for example, state agency data sets that the agency itself is unable to make publicly available for a variety of reasons. Our impression is that issues such as data formats, metadata, etc., were dealt with extensively early in the project, but have been somewhat neglected lately. It is important that this component be brought back with high priority.

7. *Several aspects of the research should be expanded, including uncertainty analyses, terrestrial ecology, and public policy.*

The potential for links with the Statistics Department, the College of Forest Resources, and the Evans School of Public Affairs seems substantial to us. The uncertainty analysis and the terrestrial ecosystem models are missing from the current program, while the public policy aspect needs significant strengthening, as discussed earlier.

8. *The annual core budget should be increased from \$450,000 to \$800,000 (equivalent to the original request)*

The increased funding is intended to support a co-director and increased time for the current director (\$125K), increased graduate student funding (\$125K), and personnel needs for data management and service (\$100K). The program has proven that it is able to leverage seed funding at about a factor of 10, and we expect this to continue.

There would seem to be a potential to interest various foundations in supporting this research, particularly if it is used to develop scenarios for planning purposes. It might also be possible to interest local industries and other stakeholders in developing an affiliates program that could fund part of the budget increase.