

# **Report of the Committee to Investigate the Potential for an Earth System Science Program at the University of Wyoming**

## **Introduction**

The University of Wyoming, by virtue of its faculty strengths and physical location, is eminently suited to serve as a regional and national leader in earth systems science. Earth system science has emerged in the last decade as an integrative and interdisciplinary field that encompasses the physical, life, and social sciences, notably geology, geography, climatology, and ecology. The primary concern of the field is how physical, biological, and social systems interact and evolve at timescales ranging from social to geological. Earth systems science is playing the leading role in understanding how global-scale human activities (e.g., greenhouse-gas emissions, land use, international trade) influence the environment and how environmental changes in turn impact and constrain human activities. A broad suite of federal agencies, including NSF, DOE, USDA, NOAA, USGS, and NIH, have identified global change studies and earth systems science as priority areas for funding. Several leading universities, including Stanford, Arizona, Columbia, Penn State, and Maryland have developed formal research and training programs in earth systems science.

To date, no universities in the Rocky Mountain or Northern Plains region have developed programs in earth systems science. The region faces unique problems associated with global change. As a leading producer of oil, gas, and coal, the region is economically vulnerable to curtailment of greenhouse-gas production. As a semiarid region, its agricultural, industrial, and urban activities are particularly vulnerable to climate change and variability, especially drought. As a region encompassing the headwaters of most of the major drainage systems of the continent, its hydrological and biogeochemical processes have a cascading influence downstream to the Gulf of Mexico, the Gulf of California, and the Columbia Estuary. An integrative program aimed at understanding the consequences of global change and mitigating its impacts (as well as impacts of efforts to retard or reverse global change) is urgently needed for the Rocky Mountain/Northern Plains region.

The University of Wyoming is poised to fill this niche. We have a long-standing tradition of nationally and internationally recognized research and leadership in several key disciplines that contribute to earth systems science, including geology, atmospheric sciences, ecology, geography, soil science, hydrology, and anthropology. We also have a core of 20-30 faculty ranging from new assistant professors to seasoned senior faculty who are committed to participating in an earth systems science program. The University is situated at the plains/mountain interface, with active research underway from the summits of the Snowy to the arid interior basins and the high plains. Finally, the state of Wyoming is one of the nation's leading fossil-fuel producers and encompasses a diversity of environments, including the headwaters of several of the continent's great river systems.

A committee, comprised of Jim Steidtmann (Geology and Geophysics, Chair), John Allen (Geography), Jeff Hamerlinck (SDVC), Steve Jackson (Botany), Bob Kelly (Atmospheric Sciences), Larry Munn (Renewable Resources), and Bill Reiners (Botany) met several times during the past academic year to discuss this. The committee members talked with numerous other faculty on campus, and with Jonathan Overpeck (Director, Institute for the Study of Planet Earth, University of Arizona), Pamela Matson (Director, Earth Systems Program, Stanford University) and Julie Kennedy (Academic Coordinator, Earth Systems Program, Stanford University).

### **Committee Recommendations**

- Establish a presence in Earth System Science (ESS) with an initial modest graduate research program that is similar in approach to the one at Arizona. That program is essentially one in which a facilitator encourages researchers (and in some cases stakeholders) to undertake interdisciplinary earth system science projects by organizing personnel, writing proposals and providing financial support. Our program should be developed in such a way as to permit growth in both complexity and size. This program will provide a firm foundation and complement for the undergraduate degree program being discussed by Atmospheric Sciences and the revived B.S. program in Geophysics being developed by the Department of Geology and Geophysics. Should these undergraduate programs go forward, their development can proceed in coordination with the ESS program we propose.
- The UW ESS program should not try to "be all things to all people" but focus on global issues as they are manifested in our particular setting in an intermountain, headwaters region with its particular geology, geography, soil, plant and animal communities, climate, resources, human culture and effects on downstream areas. We anticipate that development of an ESS program would facilitate large-scale collaborative projects among UW faculty at a scale similar to the recent NSF-funded TEECO project involving Botany, Atmospheric Sciences and Renewable Resources. Examples of such studies might include integrated assessment of (a) drought variability and its consequences for agriculture, water supply and ecosystem dynamics (e.g. fire), (b) interactions of climate, land use and coal bed methane extraction on water quality in the Powder River Basin, (c) the interplay of climate change, ecosystem dynamics and land management on invasive species, and (d) alternative, non-combustive uses and markets for Wyoming coal in the event that fossil-fuel combustion is curtailed because of carbon emissions.
- It will be important to the success of an ESS program to have missions and goals that are completely separate and distinct from those of ENR and IENR. This approach will be furthered by identifying those participants in Earth System Science as the "ESS Group" and by having a formal statement that

clearly spells out the distinction between ESS and ENR (IENR) missions and goals. At this point we see the ESS Group as one that will conduct scientific investigations on Earth System Science problems as manifested in our focus area (as defined above) while ENR (IENR) will continue to concern itself mainly with issues of policy and consensus building on environmental topics. Failure to establish a clear distinction between the ESS Group and ENR (IENR) would most likely have serious consequences for both.

- Departments that have faculty members who have indicated an interest in participating in ESS projects include Anthropology, Atmospheric Science, Civil Engineering, Botany, Geography, Geology and Geophysics, Renewable Resources and possibly Zoology and Physiology.
- The most important key to the success of an ESS program is selecting the right person for the "directorship." The director should have a vision of the direction and goals for ESS. At the same time this vision should fall within the "framework" of UW with regard to its scope, focus and setting. Whereas the director should have freedom to "wheel and deal" as needed and to make her/his own decisions, there should be an oversight committee that advises the ESS director regarding major issues. This committee should consist of faculty members with interests and expertise in ESS as well as *ex officio* members from the administration. There are pluses and minuses for both finding an appropriate director within UW and for conducting a search for someone not now at UW. Hiring from within would provide us with a "known quantity" but the field is limited. At this time the committee has identified only one possible candidate presently at UW who may be both qualified and interested in the job. Conducting a search would provide a larger pool from which to select and bring "new blood" to the University while at the same time leaving us with a somewhat "unknown quantity."
- Finally, it will be critical to the success of ESS to provide the director with the necessary financial and personnel support. The right person for the job will require a rather substantial salary, seed money to start ESS projects, at least a half-time secretary and technical support for proposal writing, web site development and setting up a first class distinguished lecture series. There should be faculty positions made available in several key areas and departments (to be identified by the director in consultation with the oversight committee) and funding to support "start ups" to aid in the recruiting of the very best new faculty. Our estimate of a realistic cost is a minimum of \$500,000 each year for the first three to four years, after which time indirect costs from projects could be "plowed back" into the ESS program.