



**Summary of the Work of the
Task Force on the Environmental Sciences**

The Ohio State University

September 21, 2009

Task Force on the Environmental Sciences Summary of Activities

Preface

This summary document is a record of the activities and deliberations of the Task Force on the Environmental Sciences and its working groups. It is intended to be a resource for the task force report, which presents the main findings and recommendations of the task force. The summary also provides links to the working group reports and other documents reviewed or prepared by the task force. Taken together, this material constitutes a complete record of the task force's efforts and provides a base for implementation activities.

Background

The Task Force on the Environmental Sciences¹ was convened by Provost Joseph Alutto in September 2008 in response to one of the top-level findings of the doctoral program assessment process carried out by the Graduate School and reported in April 2008. As stated in that report, there is a

tremendous opportunity for Ohio State to excel in the environmental and earth sciences. The organization and coordination of these efforts are currently suboptimal. Ohio State already has demonstrated strengths and faculty with international reputations in these important areas but the individual efforts are widely distributed across eight colleges on campus.

As a consequence, Ohio State is neither receiving the full recognition of its work in environmental sciences² nor achieving its full research and educational potential.

Based on these findings, the provost charged the task force to:

- Identify how Ohio State's academic programs in the environmental sciences should be optimally configured.
- Recommend appropriate organizational processes and arrangements to support high-quality educational and research efforts. The task force will look at overarching research themes, existing strengths, and opportunities for Ohio State.

The task force was co-chaired by **Joan R. Leitzel**, Interim Executive Dean for Arts and Sciences and Vice Provost, and **Patrick S. Osmer**, Vice Provost for Graduate Studies and Dean of the Graduate School. Members include:

Douglas E. Alsdorf, Associate Professor, School of Earth Sciences

Nicholas T. Basta, Professor, School of Environment and Natural Resources

Ralph E.J. Boerner, Professor, Department of Evolution, Ecology, and Organismal Biology

Timothy J. Buckley, Associate Professor, College of Public Health

Jay S. Hobgood, Associate Professor, Department of Geography

¹ The task force was initially named the Task Force on the Earth and Environmental Sciences based on the findings of the review of doctoral programs at Ohio State. The name of the task force was shortened to environmental sciences to encompass all activities, including relevant activities in the earth sciences, related to environmental sciences at Ohio State.

² The task force recognizes the interdisciplinary nature of environmental research and education. Its use of the term "environmental sciences" is meant to encompass the broad range of disciplines involved in environmental research and education. These disciplines include those that may, in other settings, be organized under such rubrics as environmental engineering or environmental studies.

William Berry Lyons, Professor and Director, Byrd Polar Research Center

Karen M. Mancl, Professor, Food, Agricultural, and Biological Engineering and director of the Environmental Sciences Graduate Program (on leave 2008-09)

Jay F. Martin, Associate Professor, Department of Food, Agricultural, & Biological Engineering

Bobby D. Moser, Vice President for Agricultural Administration, University Outreach, and executive dean for the College of Food, Agricultural, and Environmental Sciences

Matthew S. Platz, Distinguished University Professor and Interim Dean, College of Mathematical and Physical Sciences and College of Biological Sciences

Gregory N. Washington, Interim Dean, College of Engineering

Linda K. Weavers, John C. Geupel Professor, Department of Civil and Environmental Engineering and Geodetic Science

Caroline C. Whitacre, Senior Vice President of Research

W. Randy Smith, Vice Provost (Office of Academic Affairs liaison)

Task Force Activities

The full task force has met since October 2008 and formed six working groups, with the work of the first three leading to the activities of the second group of three. The first three working groups were established to provide basic data and information for the task force to carry out its charge.

In addition, the task force reviewed two prior documents related to the state of environmental science at the university. The first, [*Ad Hoc Committee on Environmental Sciences and Engineering*](#), was written in 1996. This committee was convened by then Provost Richard Sisson and Vice President for Research Edward Hayes with a charge similar to that given to the current task force. The committee found that Ohio State's "major challenge is structural and organizational," which led the committee to recommend the establishment of an entity it called "The Ohio Institute for the Environment" that would "facilitate academic enrichment and research program development, but given its non-degree granting character, its most important priority will be research....carried out by interdisciplinary groups" (2). The second document, [*The Environmental Consortium at Ohio State*](#) white paper (2001), proposes the creation of an environmental consortium that would build upon existing strengths, including existing centers, and "identifying new opportunities ... related to ... existing foci" (2).

The task force also hosted presentations from faculty and administrators representing three Ohio State entities involved with the environmental sciences: the Byrd Polar Research Center, the Institute on Energy and Environment, and the Ohio Agricultural Research and Development Center (OARDC)-Wooster. Berry Lyons, task force member and director of the Byrd Polar Research Center, gave an overview of the history and current research efforts at the BPRC, which is one of the oldest and most successful research centers at Ohio State. Lyons characterized the research effort as "earth system science," with the common focus of research being how the earth is changing. Its strengths are in glaciology, remote sensing, paleo-climatology, geo-chemistry, and global hydrology. The following are factors in the center's success: it started as an interdisciplinary center; all researchers are in the same physical location; researchers are all working on a global scale problem; and an inviting, energetic culture has been in place since its inception in 1960.

Kate Bartter, associate director, Institute on Energy and Environment, presented an overview of the activities associated with the IEE. The stated function of the IEE is to serve as the external window into all of Ohio State's energy and environment research programs and was created because of Ohio State faculty interest in developing alternatives to inexpensive fossil fuels and addressing environmental problems related to those fuels. Bartter summarized the IEE's development and administrative transitions under four interim directors.

Using the videoconferencing technology used to foster collaboration between faculty and programs at OARDC in Wooster and the College of Food, Agricultural and Environmental Sciences in Columbus, OARDC Director Steve Slack provided an overview of the Wooster campus and Ohio State's Agricultural

Technical Institute (ATI). Faculty members Richard Moore, Casey Hoy, and Larry Madden gave overviews of the Sugar Creek Watershed Project, Agroecosystems Management Program, and the use of video technology to link the two campuses, respectively.

Working Groups

The task force's first three working groups--research frontiers and directions, inventory of existing programs, and best practices--were established to provide basic data and information for the task force to carry out its charge.

Research Frontiers and Directions

This working group was charged with identifying research and academic opportunities for Ohio State and with identifying what directions Ohio State should take. The group examined environmental sciences research, academic trends, and directions identified by professional societies, funding sources, and other universities. The working group reviewed and summarized reports from the National Research Council, the National Science Foundation, the National Aeronautics and Space Administration, the National Institute of Environmental Health Sciences, the Environmental Protection Agency, and United States Department of Agriculture and prepared a [draft report](#).

The following frontier research areas were identified from the national documents:

- Water (including biogeochemical cycling, hydrologic forecasting, and access to safe water)
- Integrated and coupled natural and human systems (including complexity)
- Energy
- Large-scale observing
- Environmental change (climate change, landscape change)
- Infectious diseases
- Environmental impacts of emerging contaminants/technologies
- Cyber-infrastructure applied to environmental problems

The working group notes that *environment* is a research area of vast reach and fuzzy boundaries. Much of that work is interdisciplinary (or transdisciplinary) and requires approaches that are holistic and recognize the dynamics of complex environmental systems, both natural and human-made. The themes identified above cut across many traditional disciplines. The working group remarks that it would be strategically wise for Ohio State to be nimble enough to recognize the fuzzy boundaries of this work to meet student needs and to carry out dynamic and interdisciplinary research endeavors.

The working group identified several environmental sciences strengths at Ohio State, including three of the recently awarded Targeted Investments in Excellence (TIE) programs: Climate, Water, Carbon; Energy, Sustainability, and Environment; and Public Health Preparedness for Infectious Diseases. Also on the working group's list were:

- Glaciers, climate change, and sea level (including atmospheric sciences)
- Energy and carbon mitigation
- Integrated and coupled natural and cultural systems (including complex systems)
- Water quantity; hydrology and hydrodynamics; modeling and sensing
- Nutrients and pollutants; measurement, cycling, fate and treatment strategies
- Environmental agents and health; eco and human toxicity; environmental risk
- Infectious diseases is an emergent area at Ohio State with the TIE investments
- Natural, managed, and disturbed ecosystems; restoration ecology; biodiversity
- Sustainable food production; global food security
- Advanced bio-based products

In discussing the current strengths at Ohio State, the working group noted a number of outstanding researchers in the environmental sciences and the \$134,252,296 in OSURF research expenditures by ESGP faculty between 2002-2007.

Yet, the total research portfolio in the environmental sciences at Ohio State does not stand out. In the Graduate School's doctoral program review released in April 2008, many programs with environmental sciences faculty, and notably the interdisciplinary graduate programs, received ratings of reassess or restructure. These doctoral programs include: the Environmental Science Graduate Program (ESGP), City and Regional Planning, Civil Engineering, Soil Science, Entomology, Evolution Ecology and Organismal Biology (EEOB), Microbiology, and Plant, Cellular, and Molecular Biology (PCMB). The main factor in many of these cases was an organizational issue, which led to the formation of the Task Force on the Environmental Sciences. The current budget system is seen as one impediment for the interdisciplinary graduate programs. Measuring success based upon numbers of faculty and their productivity in an interdisciplinary graduate program is seen as another impediment because faculty in interdisciplinary research often split their efforts among different programs.

The working group also made observations about the importance of co-location of faculty working on common problems and the need for leadership and agility in defining areas of research and curricula addressing environmental concerns.

Inventory of Existing Programs

This working group was charged with creating an inventory of existing research efforts and instructional programs at Ohio State. The group surveyed departments, interdisciplinary programs, research centers, and other units at Ohio State with involvement in the environmental sciences, broadly defined. Responses were received from 16 departments and schools and from 12 centers and interdisciplinary programs. The [survey](#) supports the view articulated in the doctoral program review that environmental science efforts at Ohio State are very decentralized, especially at the undergraduate level. There are multiple links between units and other units, between units and research centers, and between research centers. The links appear to have developed as a result of congruence of interest between the entities and not as a result of central planning.

The graduate level is more complicated with [multiple hubs](#) of research activity; the Environmental Sciences Graduate Program, an interdisciplinary graduate program, is one of the large hubs. Eleven graduate programs identified a primary focus on environmental sciences: Evolution, Ecology and Organismal Biology; Entomology; Chemistry, School of Earth Sciences, School of Environment and Natural Resources; Food, Agricultural and Biological Engineering; Civil and Environmental Engineering and Geodetic Sciences; School of Public Health; Geography; Chemical and Biomolecular Engineering; and Agricultural Environmental and Development Economics) identified a primary focus on environmental sciences. The Environmental Science Graduate Program (ESGP) is a central interdisciplinary graduate program with 82 graduate faculty and eight affiliated scientists. It has 63 graduate students. Many units are involved in the ESGP. The involvement of other units with ESGP ranges from 22 graduate faculty in the School of Environment and Natural Resources to a single faculty member in Chemical Engineering.

On the undergraduate level, eight units have a primary focus on environmental sciences either as a major or as a minor. Those programs are: Evolution, Ecology and Organismal Biology; School of Environment and Natural Resources; Food, Agricultural and Biological Engineering; Civil and Environmental Engineering and Geodetic Sciences; Geography; School of Earth Sciences; Chemical and Biomolecular Engineering; and Agricultural, Environmental and Development Economics. Two units (School of Public Health, a minor, and Anthropology, the major or minor) identified having secondary foci in the environmental sciences. In addition, the School of Earth Sciences identified environmental science as a secondary focus in parts of the Geological Sciences major. Six units (Entomology; Chemistry; Animal Sciences; Microbiology; the John Glenn School of Public Affairs, and the School of Architecture) appear to have a peripheral focus on environmental sciences.

Best Practices Working Group

The best practices working group was charged with identifying organizational processes and arrangements at other institutions as well as those that already exist at Ohio State and are working well. The group reviewed organizational structures for environmental sciences at over 30 institutions, including Penn State, the University of Wisconsin-Madison, the University of Minnesota, Arizona State, and Colorado State and prepared a [report](#).

Pennsylvania State University, the University of Wisconsin-Madison, and the University of Minnesota all have coordinated or federated structures. Penn State's Institutes for Energy and Environment is affiliated with eight colleges. The IEE at Penn State is an "institute of institutes" where interdisciplinary research activities are presumably enhanced by the coordinating structure. The Nelson Institute for Environmental Studies at the University of Wisconsin-Madison coordinates interdisciplinary research activities (including grants), three graduate degree programs, five graduate level certificates, and an undergraduate environmental studies certificate. The Nelson Institute's faculty and research staff of approximately 160 represent more than 50 academic fields from the humanities, engineering, business, and law to the biological, physical, health, and social sciences. The University of Minnesota's Institute on the Environment is designed to promote interaction among academia, business, government, and nonprofits to solve environmental problems. Faculty membership in the institute is not permanent; appointments are eligible for renewal and are subject to rigorous review. Participants in the institute range across the disciplines. Incentives are provided so that all colleges and departments encourage their environmental faculty to participate in the institute. The institute invites University of Minnesota research centers and academic programs with work addressing environmental concerns to become affiliated institutional members. The institute does not manage academic degree programs.

Recently, colleges and universities have been exploring structures based on the theme of sustainability. The School of Sustainability at Arizona State University conducts research, education, and problem-solving related to sustainability, with a special focus on urban environments. This is a broader view than environmental sciences. Academic programs are administered by the school, and school faculty are a combination of those appointed in the school and those from other departments or colleges. The Colorado State University also has a new structure focused on sustainability—the School of Global Environmental Sustainability. The mission of the school is to "train the next generation of researchers, engineers, entrepreneurs, and big thinkers who will propel the clean energy revolution that is already underway" <http://soges.colostate.edu/>. Curriculum and programs are still in development at Colorado State. The expected start is 2010.

The working group identified several fundamental best practices needed for Ohio State, regardless of structure, to foster excellence, gain national/international visibility, and reduce/prevent duplication of human resources and capital expenditures in the environmental sciences.

- Research: Develop new environmental science research centers of excellence. The working group describes many environmental science research teams as "islands of excellence" but in the absence of connections and common agendas, these "islands" do not have the critical mass to achieve national/international excellence. Two examples at Ohio State that have successfully built interdisciplinary research teams and linked islands are the Ohio Agricultural Research and Development Center (OARDC) and the Byrd Polar Research Center.
- Curriculum: Restructure and deliver comprehensive environmental science curriculum. The working group recognizes the range of existing programs in environmental sciences across the campus and supports that diversity but recommends that unnecessary duplicate course offerings be addressed and that core curricula (for undergraduate and graduate degrees) be developed that can support this range of offerings.
- Rewards: Participation in a structure that rewards faculty and their units is essential for meaningful participation. The current model rewards departmental programs for the number of students enrolled and classes taught by the unit. In some units there is a disincentive for faculty

to allow their students to participate in an interdisciplinary degree program and IGPs, like the Environmental Science Graduate Program, are viewed by many faculty as a program that competes with departmental programs for fiscal resources and students.

- Space: Promoting Interactions between Faculty and Shared Research Facilities. Interaction between environmental science faculty is highly desirable, and a key way to achieve interaction is to give faculty access to physical space in a common facility. While the number of environmental science faculty at Ohio State is too large to be accommodated in one location, common space that supports interdisciplinary interaction between faculty members is desirable. In addition, the sharing of research facilities, technologies, and instrumentation necessary to support high quality environmental sciences would help increase research output and grant competitiveness, reduce duplication of resources, and support and share highly skilled technical staff.

Additional Input from Faculty and Students

During Winter Quarter 2009, the task force hosted three open forums (February 10, 11, and 16), for faculty, graduate students and researchers. The task force also hosted an open forum for graduate students on March 6. Summaries of the open forums are available. In general, attendees were interested in widening the scope of environmental concerns at Ohio State to include the social and behavioral sciences and policy, to improve the ability of faculty to know what their colleagues are doing across campus and to recognize the effort involved in and rewards structures necessary to support high quality interdisciplinary research. There was concern that the disciplinary structure at Ohio State does not encourage collaboration or interdisciplinary work in ways that really advance research and graduate education in the environmental sciences.

These general findings by the working groups and input from faculty and students set the stage for the task force's specific findings below:

1. There is a need to fix the financial and administrative structure for the interdisciplinary graduate programs (IGPs), specifically the Environmental Science Graduate Program. The IGPs and college/department programs at present compete for both financial and human resources. Furthermore there is a lack of ownership of the IGPs, which leads to them being regarded as cost centers without adding corresponding value to the individual colleges.
2. There is a need to ensure that department chairs develop written agreements with faculty who participate in cross-disciplinary centers and/or in interdisciplinary graduate programs. This expectation has been set by Provost Joseph A. Alutto in his March 20, 2009, memo to the faculty. The goal is to change the culture of deans, department chairs, and faculty members about the expectations, annual goals, and reward structures for faculty regarding their work within department and without, e.g., on interdisciplinary programs.
3. There is a need to design a process to review and update the curricula in the graduate programs (both departmental and interdisciplinary) with the expectation that this will also strengthen and broaden the research programs.
4. There is a need to expand forums, trans-university information and networking tools and knowledge management efforts and to develop and maintain web-based portals in support of interdisciplinary research and educational efforts and to attract prospective students.
5. There is a need to establish that a main expectation of broad university investments and initiatives is that they will, in time, to attract major external support. The internal support is not the end point.
6. There is a need to identify space requirements for appropriate co-location of offices, laboratories, and equipment that will facilitate interdisciplinary research and educational programs.
7. The campus itself offers an excellent opportunity to serve as a laboratory for environmental research and education.

8. There is a need to review and design a process to move from multiple undergraduate programs to a coordinated undergraduate curriculum that includes various options.³

The preliminary findings led to the establishment of three new working groups.

Working Group A

This group was charged with addressing the first two preliminary findings: fix the financial and administrative structure for the interdisciplinary graduate programs (IGPs) and ensure written agreements with faculty who participate in cross-disciplinary centers and/or IGPs. The [working group's report](#) describes environmental sciences as highly interdisciplinary with the consequence that excellent graduate training in the environmental sciences must embrace multidisciplinary. The working group further identifies the nature of the problem as one where the strength and breadth of Ohio State's core and ancillary programs in the environmental sciences are not fully optimized.

In addition, the working group noted that the Environmental Science Graduate Program, although intended to support interdisciplinary training, has not reached its full potential. The factors limiting the ESGP's development can be categorized into three broad areas: administrative, financial, and cultural. A prime administrative problem is how financial and service credit for students is assigned. Currently, the home departments/colleges of faculty who advise ESGP student do not receive credit for those students in their department program totals. Consequently, there is a perceived disincentive for faculty, departments, and colleges to invest in students for whom they do not receive service credit. Another administrative problem is that research and curriculum committees tend to be centered on department and college programs. A prime financial problem is the way funding for ESGP students is currently structured. The ESGP provides one year of funding for ESGP students in the first year; subsequent funding is assumed by ESGP faculty in departments and colleges. Furthermore, while general fund subsidy from courses offered by colleges and departments is a primary stream of support for those colleges and departments, this set-up discourages interdisciplinary cross-college courses. Finally, there is a general scarcity of resources to support graduate trainees, which has resulted in competition between departments and colleges rather than cooperation. There are cultural problems if ESGP students are isolated in departments and colleges, which diminish the interdisciplinary experience of those students. An additional problem is that some faculty view environmental sciences only from the perspective of their own discipline and not from an interdisciplinary or multidisciplinary point of perspective, again diminishing the interdisciplinary experience.

The working group outlined the essential characteristics of a successful graduate program in the environmental sciences: multidisciplinary will be embraced in the curriculum (students will have a broad range of emphasis areas to pursue with broad participation among relevant colleges and departments) and in research (committees will include broad representation in support of the student's research interests). Finally, financial and service credit for graduate programs in the environmental sciences will flow with faculty effort, and success will be rewarded.

Working Group B

Working Group B was charged with designing a process 1) to address issues associated with the undergraduate programs, 2) to review and design a process to update the curricula in the graduate programs (both departmental and interdisciplinary) with the expectation that this will also strengthen and broaden the research programs, 3) to address the need to expand forums, trans-university information

³ It became clear during the work of the task force that the undergraduate programs in environmental sciences needed attention and could not be completely separated from discussion of Ohio State graduate curricula, future research directions, and administrative structures to support the environmental sciences. While a full review of the undergraduate component was beyond the scope of the task force, the task force outlines the problems and makes recommendations for a more comprehensive review and possible approach.

and networking tools, and knowledge management efforts, and 4) to develop and maintain web-based portals in support of interdisciplinary research and educational efforts and to attract prospective students. The group was also asked 5) to address the use of campus as an environmental laboratory.

As a starting point for its [recommendations](#), the working group acknowledges that there has been significant strife among departments and colleges to capture student credit hours, programs, and “turf” in the environmental area. At present, the School of Earth Science, in particular, feels excluded from significant involvement in environmental curricula established by the School of Environment and Natural Resources. Similarly, the Department of Civil and Environmental Engineering and Geodetic Science and the Department of College of Food, Agricultural and Biological Engineering are still recovering from an ownership issue that occurred nearly 15 years ago.

On the undergraduate side, the working group notes that neither a major in environmental studies nor a minor in environmental science currently exists at Ohio State. These are standard majors and minors at many of our peer institutions. Currently, there is an existing B.S. in Environmental Science within the majors offered in the School of Environment and Natural Resources and a proposal for a B.S. in Environmental Engineering is being considered by the Ohio Board of Regents. A proposal is being considered in the College of Arts and Sciences for a minor in Environmental Studies.

The working group recommends that a faculty committee be formed to develop a coordinated undergraduate curriculum with an eye toward reducing redundancy among courses and to creating three core majors and minors in the environmental area: environmental science, environmental studies, and environmental engineering. The working group believes that such coordination would result in significant benefits: 1) more flexibility for students, 2) more students in courses and majors and minors, 3) more marketable undergraduate programs, and 4) better faculty interaction between departments and programs.

The group also recommends that departments offering environmentally focused majors (such as Earth Sciences, Evolution & Ecology, and others) be encouraged to develop specializations in environmental science, environmental engineering, or environmental studies that would be noted on the student’s transcript, as is currently possible for graduate students. Additionally, more attention to undergraduate offerings in the environmental area would likely lead to Ohio State’s ability to support more graduate students in the environmental sciences.

In terms of the graduate programs, the working group started from a consensus view of the task force that the current organization of graduate programs in the environmental sciences is far from optimal. Less clear was the degree of change that might be embraced in attempting to address the many needs identified by the task force. The working group identified several options for how to address this issue. Its preferred option is to develop an umbrella entity that would organize and support the functions of high quality graduate degree programs and research efforts in the environmental sciences. This entity might be called the Environmental Sciences Graduate Programs (plural intended). It would not be a degree program; rather, it would be a coordinating entity charged with serving as a portal for applications to all graduate programs with foci in the environmental sciences (including the ESGP), carrying out aggressive recruiting efforts for high quality and diverse graduate students, developing and maintaining a highly visible web presence, and developing interactive linkages among graduate faculty and students through seminar series, brown-bag lunches, and other activities.

The working group notes that many opportunities exist to use campus as a learning laboratory for the environment. Examples include working with facilities to reduce storm water runoff, determining energy use in buildings, testing water in the Olentangy River, and measuring nutrient levels and herbicides in campus wetlands. Appropriate uses for campus as an environmental laboratory would need to be addressed as would equipment, staff/TA support, and analytical instrumentation. Cross-disciplinary capstone courses could be developed, allowing undergraduates in different environmental disciplines to work side-by-side on environmental problems. Facilities has already shown an interest in student capstone projects and creating stronger ties with on campus facilities management would benefit everyone.

Working Group B feels strongly that such a revolutionary shift in graduate education in the environmental sciences would pay dividends almost immediately in national visibility and recruiting efficacy while removing many of the impediments and administrative issues that have limited the effectiveness of the current IGP, the Environmental Sciences Graduate Program.

Working Group C

This working group was charged with outlining a process/approach designed to address 1) the need to establish the understanding that a main expectation of broad university initiatives is that, in time, they will attract major external support, and 2) the need to clarify space requirements and to establish flexible, responsive administrative structures to enhance interactions, to strengthen existing groups, and to promote formation of new interdisciplinary groups and initiatives.

In its [report](#), the working group identifies major external support as including not only the usual sources of federal and state grants but also partnerships with donors, foundations, and industry. Priority should be placed on securing grants over \$1M and such grants should be aligned with Ohio State's research frontiers, with campus infrastructure (such as new or renovated facilities, co-location), with naming rights, and with providing scholarships and internships.

The working group notes that Ohio State's environmental research is represented by several National Academy members, many AAAS fellows, and long-standing and well-regarded multi-college centers such as the Byrd Polar Research Center and the Ohio Agricultural Research and Development Center. The working group further notes that the university has already made a significant financial investment in Ohio State's environmental science efforts. Just three of those efforts--the TIE in Climate, Water, and Carbon (CWC), the Center for Energy, Sustainability, and the Environment (CESE), and the Institute for Energy and the Environment (IEE)--represents nearly \$25 million in university support over five years. These internal funds should be leveraged to bring additional external funds to Ohio State and be used as evidence of Ohio State's active engagement in environmental research.

To achieve Ohio State's potential, the working group recommends unifying administrative, development, and research efforts and employing full-time, high-level staff to actively and continually seek external funding. In terms of space, the working group acknowledges that the goal is to foster new interactions, trust and collaborations. The working group recognizes that it would be expensive and unwieldy to put all faculty in one building and that building a new building may not be possible at this time. That said, co-location is a key strategy for achieving Ohio State's potential in the environmental sciences. Other options include a focused use of one building already designated for environmental sciences, identifying a cluster of buildings immediately adjacent, or a cluster of offices on one floor of a building adjacent to major environmental science activities and programs where large enough spaces exist for projects and where classroom space is available. The working group recommends that someone (or a small group) work directly with the Sasaki team to ensure that environmental research and education is represented in Ohio State's space planning.

In terms of administrative structure, the working group notes an administrative structure that enhances interdisciplinary research and education across multiple TIUs is the goal. Such a structure would be one that allows co-location, allows clear benefits for the home TIU of the co-located faculty, and is of benefit to the individual faculty member. It should have metrics that support evaluation of continued involvement of faculty and of the continuation of the program itself. The administrative structure should provide for a decrease in staff redundancy such as by having multiple lab technicians who are collectively under-utilized reduced to a smaller, full-utilized group. Further reductions in redundancy are found in the curriculum where multiple similar courses could be reduced to just one. The task force discussed these observations in connection with the recommendations presented by Working Group B.

Meeting with Sasaki & Associates

Sasaki & Associates are engaged in a major and comprehensive facilities planning project for the university. The task force met with the Sasaki planners concerning best ways to facilitate and support

interdisciplinary research and educational efforts in the environmental sciences. Major points of discussion included:

- Ohio State should take advantage of its campus environment as a laboratory for environmental education and research.
- Ohio State has a critical need for collaborative work space as well as quiet space for faculty, students, and postdocs to think and write. The ‘hotel concept’ in research building design, where occupants move in and out of laboratory space, would provide both open space for group interaction as well as space for personal endeavors.
- There is a lack of common space. There must be the opportunity for daily interactions among faculty and students. Such “collisions” can lead to new collaborations and research partnerships and provides an opportunity for collegiality and community. One strategy is to identify space for interdisciplinary work in every building now used for environmental-related research.
- Attention must be paid to the different needs of researchers, some of whom may need only a laptop and do not need to be in the same physical environment.
- Researchers work nationally and internationally as well as locally. Ohio State must build research environments that work for the individual and provide the maximum potential within a group dynamic. To increase the pace of science at Ohio State requires coming together as larger groups.
- The quality of current lab space in some areas is suboptimal.