Review Panel report of Oregon State University’s Graduate Programs in Geology and Geography

1. Overall Recommendation:

   **Expand** the Geography Graduate Program

   **Maintain** the Geology Graduate Program

2. Summary of Findings and Recommendations

Both graduate programs are small in size, but of very high quality and populated by excellent faculty and graduate students. Overall performance indicators, in terms of external funding productivity, research publication, and graduate placement, all compare favorably to competing programs in the Geosciences. Graduate education thrives within both programs despite resource constraints, especially within Geography. Program personnel in Geosciences, moreover, play a critical role in graduate training across campus, with teaching and advising efforts that benefit allied programs in natural resources and environmental sciences. We have identified five key areas in which these programs are in need of increased resources.

1. The Geography program requires an **infusion of new faculty FTE** in order to maintain its viability, but we also believe that faculty in other OSU graduate programs (e.g., Forestry, Marine Resource Management) could be recruited to teach dedicated graduate (as opposed to so-called “slash”) courses in support of graduate education and training.

2. The **high proportion of slash courses** in the Geology graduate program is also a problem, although this issue (as well as some others delineated throughout this report) may be resolved when the Geosciences graduate programs are integrated within COAS in the coming year.

3. Recruitment of the best students in both Geosciences graduate programs is compromised by the **inequity of TA and RA stipends** relative to those in other Colleges at OSU. This issue is also impacting the morale of the Geosciences student body and needs to be resolved prior to the merger into COAS.

4. The Geosciences graduate programs also have some key infrastructure needs that must be addressed soon: (i) increased **suitable space for research laboratories and graduate student offices**, and (ii) **enhanced computer technology capabilities and support**, specifically acquisition of both hardware and software, as well as better computer lab accessibility for students.

5. Finally, we believe Geosciences graduate students would benefit from further **professional development in the areas of teacher training and grant proposal preparation.**
Detailed findings

Introduction

This review of the Geography and Geology graduate programs in the Department of Geosciences at OSU was undertaken by a committee consisting of: Peter Schiffman (Geology, U.C. Davis), Paul Robbins (Geography, U. Arizona), Anne MacDonald (GeoEngineers, Portland), James Strittholt (Conservation Biology Institute, Corvallis), and Walt Loveland (Chemistry, OSU). The review is based upon an extensive self-study document prepared by Geosciences, as well as on meetings conducted with OSU administrators, faculty and students on February 27th and 28th, 2011. This report uses the organizational template suggested by the OSU Graduate Council.

Inputs

1. The fit of the mission etc.

Geography

The fit of the Geography program to both college and university mission is strong. Specifically, Geography faculty research and graduate training focuses closely on topics including: maintenance of sustainable marine ecosystems, measurement and provisioning of water resources, and the linkages between resource availability, natural hazards, and political conflicts. These match directly with OSU strategic initiatives in the area of a “healthy planet” and College of Science efforts to match basic research with practical policy to advance human and ecosystem health.

Geology

The fit of the Geology program to both college and university mission is similarly strong: Geology faculty research and graduate training focuses on topics including volcanic and tectonic hazards, economic geology, hydrogeology, Earth surface processes, and climate and biogeochemical cycles. The Geology faculty also has strong research and teaching ties with a wide range of groups on the OSU campus.

2. Quality of students

Data on student quality/admissions selectivity were provided for three graduate programs: Geography, Geology, and the interdisciplinary Water Resources program housed in the Graduate Council, but strongly supported by Geosciences faculty advisors. Objective measures of student quality (i.e., GPAs and GRE scores) were highest for matriculated students in Water Resources, lowest for Geography, and intermediate in Geology. This is explained by the dominant “audience” for each of these programs: the Water Resources program is relatively unique in the western United States, and completely unique within the Oregon higher education system.
The Geography program dominantly attracts students who intend to carry their graduate education only through a Master's level before embarking upon their professional careers. The Geology program attracts a more typical blend of Master's and Doctorate graduate students, with commensurately higher entering qualifications.

Selectivity on the part of the admitted students is also an important consideration. Relative student quality is measured as the average of GPA and GRE scores (exclusive of analytical writing, which is not uniformly available). The “quality” ratio of matriculated students to those who refused their OSU admissions offer was 99% in Geology, 96% in Water Resources, and 92% in Geography. This indicates that OSU is not losing their “best” applicants in Geology, but may be in Geography. Nonetheless, the overall quality of geography graduate students is consistent and strong. Students in this program have shown a notable ability to secure fellowships and scholarships, as well as external support from agencies including the National Science Foundation. There is some reported modest difficulty retaining the very best students in the area of human dimensions and social/environmental issues, owing to competition from parallel institutions, including University of Oregon. The overall success rate for students in finding external funding and their excellent post-graduation placement speaks to the strength of the program in maintaining a strong student pool this regard, however.

3. Admissions selectivity

Admissions selectivity can be measured in a number of ways. Geology has the highest applicant: matriculated ratio (nearly 11:1), while Geography and Water Resources are comparable (6:1 and 4:1, respectively). With respect to qualifications, as measured by the average of GPA and GRE category scores (exclusive of analytical writing), matriculated students are slightly (2-3%) better qualified than the entire applicant pool across all three programs. Using this same “quality” measure and comparing admitted to rejected students, the OSU programs are only slightly more selective: admitted students score 3% higher than rejected applicants in Geology, and 8 and-9% higher, respectively, in Geography and Water Resources.

Geography

The percentage of applicants admitted between 2005 and 2009 averaged 39% in Geography, and 51% in Water Resources. Compared to peer institutions, the Quantitative GRE scores of OSU Geography students is 30 points lower (see Table 3 of the self study report). No similar data are available for Water Resources students. Average quantitative GRE scores for admitted Geography students fall only marginally below those of peer institutions.
Geology

The GPA and quantitative GRE scores of admitted and matriculated students are very high, but the GRE scores are lower than those at peer institutions by nearly 80 points (see data from Table 3 of the self-study report). Between 2005-2009, 399 students applied to the Geology graduate program and 133 of these (or 33%) were granted admission.

4. **Level of financial support of students**

In the current and near-future economic climate, financial support for students is imperative. Geosciences graduate students are at the bottom of the pay scale on the OSU campus. This issue is affecting student morale and potentially will affect the ability to be competitive in recruiting the highest quality graduate students into these programs. Once student stipends are made comparable to those of other COAS students, we suggest that the OSU Geosciences program compare stipends to those of their peer institutions on an “affordability” basis as a means of evaluating the competitiveness of student support.

Geography

This program periodically admits some students without financial support but some of these students have been given teaching assistantships, so only a small proportion of students are self-funded.

Geology

This program does not admit students without a promise of financial support. Since 2005, 93% of graduate students have had either a TA or RA stipend, and 96% have had a tuition fee waiver. Students expressed concern regarding the security of their grants over their degree programs.

5. **Curriculum strength**

All students take a course in Geosciences Communication, which provides an introduction to research methods and provides the opportunity to develop a thesis proposal. This course also begins the development of a graduate student cohort. Cohort development is strengthened by an orientation field trip (Geology graduate students) or GEO534 (Field Research in Physical Geography). The Geology graduate students expressed interest in further tailoring of these courses to match the skill levels of incoming students.

The Geology graduate program has elected to maintain strengths in three main areas: (1) Volcanology and Igneous Petrology (VIPR) (i.e., volcanology, igneous petrology, economic geologic) (2) Structural Geology/Geophysics/Tectonics (including neotectonics and earthquake geology), and (3) Surface Earth processes
and history (i.e., Earth system history, hydrology and hydrogeology, geomorphology, and climate and biogeochemical cycles). The number and range of course offerings are good to strong in each of these categories: 10 courses listed for VIPR, 6 courses listed for structural geology/tectonics/geophysics, and 12 courses listed in surficial processes and history. The course offerings are strengthened when geography courses are included: geography course are useful to increasing degrees from areas 1 to 3. There are a significant proportion of offerings as joint upper division/graduate “slash” courses (an average of 46%, ranging from 33-52% per school year from 2005-2010), which proves somewhat problematic for Masters students interested in attaining a degree within 2 years. Students are sent to other departments as needed (e.g., mathematics, chemistry, civil engineering) for specialized advanced analytical training.

Geography graduate curriculum focuses largely in the area of physical geography, techniques, and resource management. In the area of Geographic Information Science, the curriculum is thoroughly rigorous and includes fully updated techniques and methods.

A crucial area of program success has been the creation and flourishing of the graduate program in Water Resources. That degree area has consistently attracted, retained, and graduated students with higher GREs and GPAs than the other units within Geosciences, and represents a signature program area for Oregon State University that is unavailable elsewhere. That program’s success has been predicated on utilizing already existing resources (especially faculty advising time and GTA lines), moreover, with little additional institutional support. Further modest investment in this area, therefore, will likely pay dividends in terms of matriculation, graduation, placement and increasing program and university profile.

6. Quality of personnel and adequacy to achieve mission and goals

Geography

The Geography program is extremely small in comparison to peer institutions, with 7 current FTE. These numbers are further constrained in their ability to deliver graduate teaching and advising, owing to faculty commitments to key programs, especially E-campus courses and the GIS certificate. Nevertheless, the program has maintained a relatively short time to graduation, successful pursuit of external funding sources support students, and excellent graduate placement.

Geology

There are currently only 10 faculty FTE in the Geology program, which is small relative to comparably ranked programs (most of which are in the 20+ range). The small size of the Geology faculty restricts its ability to comprehensively offer graduate courses in some programs areas (particularly structural geology/tectonics and stratigraphy/sedimentary petrology) and eliminates the option to provide
coverage in other Geoscience topics (e.g., paleontology, which is comprehensively provided at the University of Oregon).

7. Quality of organizational support

The impending merger with COAS should have a positive effect on the Geology graduate program as students will have more access to COAS courses, facilities, and faculty. The campus has created 32 new positions across campus of which one position will come to Geosciences, in Geography. The College of Sciences is trying to assist Geosciences with their space needs by providing storage space off-campus for collections, thus freeing up space in Wilkinson Hall.

Productivity

1. Level and quality of student performance

*Geography and Geology*

Completion and retention rates in the program meet and exceed those of comparable programs, with very good time-to-degree for both Masters and PhD students. These students, moreover, demonstrate high levels of productivity when involved in faculty research, with research presentation at international meetings (including venues like the Association of American Geographers and the Ecological Society of America, the Geological Society of America, and the American Geophysical Union) as well as co-authored publications (in outlets including *Land Use Policy*, *Bulletin of the Geological Society of America*, *Journal of Geophysical Research*, *Geophysical Research Letters*, *Earth and Planetary Sciences Letters*). Graduate students in Geology have also received prestigious national fellowships (i.e., NSF IGERT and Research Fellowships, NASA Space Grant Fellowships).

2. Level and quality of faculty performance

The Geography faculty maintains rates of publication and citations per publication (2.22 – double that of those programs compared) far higher than peer institutions, indicating an extremely high level of productivity as well as a very high individual and institutional profile. Publications are consistently in major and high profile outlets. Approximately 80% of faculty members hold grants, a high rate relative to peer institutions.

In terms of research productivity (e.g., % with extramural grants and publications/year), the Geology faculty ranks well with peer institutions (see compilation of data from recent NRC report on graduate programs, as summarized in Table 47 of the self-study document).
3. Viability of scholarly community within which students can interact

The scholarly community within the Geosciences graduate programs remains at a good size to represent a breadth of investigations. This provides a benefit to graduate students directly or indirectly; after OSU, these students are not likely to work in a professional world composed solely of those similarly trained. Continued efforts to build a cohort across the department are encouraged to provide a strong level of investment in their colleagues’ research. Furthermore, the OSU scholarly community has been robust and attractive to graduate students regionally for over 30 years thanks to the faculty, students, and programs in the Colleges of Oceanography and Atmospheric Sciences, Forestry, Agriculture, Engineering and Arts and Sciences, along with the contribution of the USDA Forest Services’ Forest Science Lab (FSL) and related facilities such as the HJ Andrews Experimental Forest. [n.b., Although it is not within the control of OSU, disinvestment in FSL by the federal government and key retirements by USFS personnel within the next decade could reduce the quality of this interaction in the area of surface processes.]

Geography

The high ratio of students to faculty, coupled with high levels of research and instructional commitments on the part of Geography faculty, make student interaction with faculty more difficult, though there is little evidence of an impaired intellectual atmosphere. Graduate students report very high satisfaction both with the quality of their interactions with their major professor as well as overall intellectual interactions with their peers. Then program also facilitates student access to linked research groups across campus.

Geology

Although there are only 10 faculty members in Geology, the close proximity between Geology and COAS greatly increases the number of potential scholars available to Geology graduate students. Also, the University of Oregon’s Geology Department is relatively close, and some OSU students have taken graduate courses in Eugene.

Outcomes

1. Professional viability of graduates

Geography and Geology

A central measure of program productivity and success is the excellent record of graduate placement. The direction and emphases of graduate employment reflects program strengths, moreover, specifically in crucial, applied, problem-solving areas in natural resource management. Graduates are consistently employed in key sectors, including state land management agencies (e.g. National Parks Service),
non-governmental and multi-lateral institutions (e.g. World Bank), and private sector areas (e.g. environmental consulting). The range and prestige of these institutions speaks directly to the overall success of the graduate training mission of the program, along with the list of peer institutions to which many students go on for further study or employment. Multiple specific elements contribute to this effective professionalization, including a well-established, cohort-centered approach (reflected in things like the annual field camp and student-student mentoring activities) as well as an effective effort to network students with potential employers. This has unquestionably produced a viable scholarly community.

2. Satisfaction of students and graduates

The Department of Geosciences can't guarantee office space to new graduate students, but has been able to do so to date. Most students don't like their assigned spaces because most offices have no windows. Some have expressed frustration with privacy issues, particularly as it pertains to accomplishing their research – some students reported conducting telephone interviews on their cell phones in the hallways or empty classrooms rather than in their crowded offices. There is also no communal space for graduate students to meet and, e.g., eat their lunch.

Geology

When interviewed, the Geology graduate students expressed their happiness with choosing the OSU graduate program, primarily because of the reputation of their research advisors. It was also pretty evident that they didn't choose this program because of the quality of the facilities or the financial support that was offered them. The TA stipend inequity issue is having an adverse affect on graduate student morale. The students also expressed concern about the seismic safety hazard in Wilkinson Hall. Students felt that laboratory safety issues are not well addressed, and that some are expected to establish these for their own labs. Students who work with rocks noted the lack of suitable space for rock crushing/sample preparation. Students expressed unhappiness with the limited number of graduate course offerings: many are so-called “slash” courses (offered to both grads and undergrads) but campus only allows 50% of grad courses for degree requirements. Curriculum in slash classes is generally less advanced. Courses offered through COAS help because none are slash. Students would welcome a dedicated proposal writing class in fall quarter. They felt that Geosciences 518, offered in winter quarter, is not filling their needs (e.g., many felt that many of the topics covered were too elementary). Students felt that they need more teacher-training to be better TA’s: they feel that the single day course they currently receive is not adequate. Students felt they have very little input into suggesting seminar speakers.
**Geography**

Geography students uniformly reported satisfaction in their choice to come to OSU, specifically citing the high caliber of the faculty. Some Geography students stated a concern about the uneven and low levels of assistantship stipends. Students also explicitly expressed concern about the work levels and work/life balance of their professors: "burning the candle at both ends".

3. **Rankings/ratings**

**Geography**

NRC rankings of the Geography program released in 2010 show a reputational rank range of 15-38, among 49 doctoral programs overall. Most notable in terms of comparative achievement, OSU’s program performed in the top-ten of smaller programs for Placement Rate of students, confirming internal assessment of the very high rate of success in training students for professional activities.

**Geology**

In the recent NRC survey of graduate programs, the OSU Geology program ranked well relative to peer institutions. Overall, it ranked 38th amongst 140 programs in the “reputational” category and 56th in the “statistical” category.

**Conclusion and recommendations:**

Both of these graduate programs are of excellent quality, but the Geography program is in dire need of FTE infusion to maintain its viability. We offer the following recommendations on issues we feel need to be addressed:

**1. Need for Geography FTE**

Across the university, but especially in any new CEOAS formation, there will be increasing demands for human dimensions expertise, spatial and spatiometric analysis, as well as synthesis experience and theory. Larger interdisciplinary solicitations from NSF (coupled natural human system research, LTER, ULTRA, etc.) and other agencies - which require human dimensions participation - will create further demand in these areas. Given the development of such solicitations and an overall increase in demand for science-society collaboration, as well as human dimensions and global change adaptation research and training, the need for ongoing development of faculty strengths in geographic science is not only desirable, but likely inevitable. In this sense, if there is not a strong Geography program when this area of critical work begins, the university and CEOAS will likely have to create one. The committee concludes, therefore, given the demonstrated current efficiencies and strengths of the graduate program in Geography, which will be the only PhD-granting unit performing human dimensions research in the new
unit, it would be advisable to “double-down” on the existing program and support its expansion precisely into these areas of human-environment research, environmental management, and spatially-explicit resource planning (the program’s historic strengths).

This would represent a reversal of the current trajectory. Despite dramatically increasing productivity of individual geography faculty, increasing advising by individual faculty, and a relatively short time to degree, the diminution of faculty FTE over time (from 11 to 7), has led to a decreasing GRA opportunities and funding, with a concomitant decrease in graduate admissions in the program. In terms of the overall resources and time available to meet multiple goals, the Geography unit has reached an apparent breaking point and requires reinvestment. Given the likelihood of an additional retirement within the next five-years, moreover, the window for retaining the program’s viability is time-limited.

To that end, there is a demonstrable need to expand the core Geography faculty if the program is to remain viable and crucial graduate training is to continue. There are several key areas where hires in geography might foster effective cross-campus collaborations and external funding flows, including biogeography, science / policy analysis, coastal marine spatial planning and the geography of food security. Most urgent, however, especially for leveraging synergies in allied units (e.g. the new climate center), three key hires would maintain the viability of the unit and its critical role across campus:

1) Human dimensions of global change adaptation and sustainability science
2) Environmental risks and hazards
3) Geographic information science, modeling, in the area of adaptation and risk

2. *Need to increase number of dedicated graduate courses in Geosciences.*

Geosciences can’t continue to rely on other units on campus to provide dedicated (i.e., non-slash) courses for Geology and Geography graduate students. This issue is less significant for Geology graduate students as they have access to courses offered through COAS. An infusion of faculty FTE for Geography would improve this situation for their graduate students.

3. *Need for resolving stipend inequity for graduate students*

This issue is undermining student morale and must be resolved prior to the merger with COAS. We recommend that stipends for Geosciences graduate students should be identical to those in COAS.
4. Need for increased laboratory and graduate space for teaching and research missions.

One of the principal challenges for the future health of the Geology and Geography graduate programs is the lack of adequate research and teaching space. The self-study reports that as of 2006, the Geosciences Department had 9563 ft² of research space and 10285 ft² of office space. The relevant University metrics for this department would indicate the research space should be 19194 ft² and the office space should be 11879 ft², deficits of 9631 and 1594 ft². In 2007, the department requested 1700 ft² of office space, 4200 ft² of lab space and 2900 ft² of storage space. In the intervening time, the situation has worsened, as the research funding of the department increased. Without new or renovated facilities, growth of the graduate and research programs will be limited. Additional space is needed for graduate student offices and laboratories, graduate instruction, graduate student communal space, and faculty research. Apart from computer facilities, the majority of space in Wilkinson Hall has not been renovated in four decades.

The space deficit is significant (11,225 ft²) but not overwhelming. The ultimate solution would be a new Geosciences building built in cooperation with other groups in the Earth Sciences Division. However, given this building is not on the current OSU building priority list, that solution is decades away.

The Department needs to develop a realistic plan to address space issues in the short and medium term. The forthcoming merger of Geosciences with COAS may offer opportunities to increase the space available for Geosciences. The review panel urges the Department to make a series of realistic shorter-term estimates for various plans to address space issues. One of these plans should deal with various options for the renovation/remodeling of Wilkinson Hall. (We understand Wilkinson Hall was built to accommodate the addition of another floor for the building although the need for seismic retrofitting may impact that option). The review panel encourages the Department to develop a set of smaller short-term projects that will improve the quality of the present space and increase it in modest increments. The Department needs to seek external funding for these improvements in cooperation with the College of Science, the Earth Sciences Division and the OSU Foundation.

5. Need for enhanced computing facilities

Geography and related disciplines are growing increasingly dependant on high-end computer mapping technologies including remote sensing and geographic information systems (GIS). Modeling and statistical software is becoming increasingly demanding as it keeps pace with rapid advances in computer hardware. In order to attract and keep high-quality students, it is imperative for any modern Geography department to remain at the forefront of these technologies.
Currently, students of the Department of Geosciences have various computer facilities for their use. There is 30-seat Digital Earth Classroom (Wilkinson 210), which is largely used for teaching, the small Terra Cognita Lab (Wilkinson 208), and even smaller Graduate Student Research Facility (Wilkinson 106). Graduate students working under some faculty also have access to additional computing facilities for their research. The Digital Earth facility is primarily for teaching but allows some use by students for research.

Based on the site visit, review of facility specifications, discussions with faculty, and interviews with graduate students, the current computing facility is not fully meeting the current demand by students and will deteriorate without clear planning for the future. There is an overwhelming sense of frustration by the students in terms of not having the computing tools available to do their best work. Students frequently reported that they had to resort to purchasing their own hardware and software in order to carry-out their classroom work and research, because these resources were not being provided or were not easily accessible by the department. In order to remain a strong Geosciences department, close and continued attention to the computing facility is fundamentally important.

The following recommendations are -

1. Consider developing a lab similar to Digital Earth (~15-20 stations) to be used exclusively for research. This would relieve pressure on the Digital Earth Classroom and dramatically improve the current demand for dedicated computer facilities for graduate students.

2. A hardware upgrade policy should be formalized that maximizes graduate student access to the most current technology.

3. Current hardware performance is generally good, but some number of machines should be dedicated as state-of-the-art machines and reserved for projects that are computationally demanding. Most computers are using fast processors but are beginning to lag on RAM and video card speed. Hard drive space is also limiting in some instances and relatively inexpensive to address. Computers built for spatial analysis and visualization need to keep pace with the technology.

4. Student access to current resources should be improved and the changes clearly communicated to students. Some facilities should be available to graduate students 24/7.

5. For those students with heavy computer needs, a dedicated workstation should be assigned for their research.
6. Software review should be regularly conducted with student involvement and the most useful packages maintained, including the high-end functions that are often not included in base packages.

6. *Need for improved professional development for graduate students in the areas of teacher training and proposal writing.*

We recommend that Geosciences establish a 1 unit, fall quarter-length TA training course that brings up real, on-going issues that TA’s are facing as well as topics such as syllabus development. Revise Geosciences 518 into 2 separate courses. Create a writing class for all new students, and a separate (NSF-style) proposal writing class for PhD students who have already completed a MS thesis.