March 7, 2022

To: GFEC, Dean Wilcots, and L&S APC

Re: Response to 10-year review of the Geoscience programs

The Department of Geoscience response regarding recommendations from the Graduate Faculty Executive Committee (GFEC) and College of Letters & Science Academic Planning Council (APC) on improving our undergraduate and graduate programs is outlined below.

Geoscience MS program
Both the L&S APC and GFEC recommendations question the nature of our Master's degree program and imply that a program significantly different than what we offer (and have offered for many decades), perhaps in the form of a professional MS degree, is worth considering. On this issue we believe there are misunderstandings about our MS degree program. Many graduate students matriculate into our program specifically to pursue a research-oriented, thesis-based, MS degree. A large fraction of these MS students also continue on to pursue a PhD degree, and this is common among Geoscience Departments at many research-intensive peer universities (of our 19 Geoscience faculty, only three do not hold a two-year, thesis-based, MS degree). It is a rare student who matriculates directly from a BS degree into our PhD program. Our self study indicates that nearly every Geoscience MS student publishes a paper in the scientific peer-reviewed literature, thus our MS program is pivotal to successfully meeting our mission to advance knowledge, and forms a vibrant pipeline into our PhD program for many students. Both MS and PhD students are eligible for, and receive, Research Assistantships commonly from extramural funding sources. MS degrees from our Department are not “consolation prizes” for those who cannot complete a PhD. Those who plan to earn a terminal MS degree had been traditionally sought after by the fossil fuel energy industry, but as this industry has turned down, our MS students remain highly sought after to pursue careers in hydrogeology, environmental consulting, geotechnical engineering, mining, and in state geological surveys. Several graduate students move to PhD programs at other Universities, and we admit many students into our program who have completed a Masters elsewhere. Our faculty have discussed whether there is a market for a professional MS degree for several years, and whether diversion of faculty research time and organization of a curriculum is worthwhile. During this time, our Board of Visitors have advised repeatedly that students who earn MS degrees in our research-intensive program remain highly sought after to pursue careers in many industries because they emerge as well-rounded scientists with strong communication and interpersonal skills. It is our view that the nation needs to produce more MS students with the research skills and training that our program currently offers in order to meet myriad environmental-, resource-, and climate-related challenges that lie ahead. We address the possibility of new professional MS programs in geoinformatics and engineering geology in further detail below.

Geoscience Doctoral Minor
We agree with the L&S APC that since few, if any, doctoral minors are pursued in Geoscience, it is appropriate that this program be terminated. This would still allow students to complete a distributed minor in Geoscience, and we think this remains an important option.
Diversifying the Geoscience graduate student body

To promote diversifying our graduate student population, we have taken several steps and will monitor how these steps are working over the next several years: (1) We abandoned the use of GRE test scores to evaluate prospective graduate students beginning in 2021 based on research that these tests are biased against underrepresented and financially disadvantaged groups (many Geoscience departments at our peer universities also abandoned the GRE during the past two years); (2) We decided in 2020 to use gift funds to ensure that all incoming graduate students are provided with Summer support as a Research Assistant during their initial year. This means that all incoming graduate students receive guaranteed support during the initial 21 months after they arrive in Madison. Our research indicates that apprehension about moving to Madison, knowing that the first Summer could be financially challenging if support is not guaranteed, is a deterrent to matriculating and retaining students from populations underrepresented in STEM fields; (3) Our graduate studies committee has been asked to look more broadly at the entire pool of applicants to our graduate program each year. The charge is to alert individual faculty, and the faculty as a whole, about student candidates from underrepresented groups who might be overlooked as individual faculty decide, and the entire faculty votes, on which students should receive multi-year offers of guaranteed support; (4) Department faculty, students, and staff are actively engaged in several campus and national efforts to identify bias, and develop the level of awareness required to make equitable and inclusive decisions when recruiting new Geoscience graduate students (https://geoscience.wisc.edu/community/diversity-and-inclusion/); and (5) The Department recently established an internal funding exercise named for a distinguished alumna, Kay Fowler-Billings. Gift funds are used annually to support Fowler-Billings proposals from graduate students, staff, or faculty, aimed at building community, eliminating biases, and promoting an equitable department climate.

Perhaps the most impactful way to diversify our graduate student population is to diversify our faculty. Accordingly, we are aggressively attempting to further diversify our faculty with respect to both ethnicity and gender via regular faculty hiring and the TOP program (we are currently attempting to recruit two TOP candidates, one male, one female, and 8 of 9 finalists in two other searches underway are female).

Expanding strength in the broad area of (geo)informatics and possible professional MS degree

The field of Geoscience has been transformed by advancements in computational methods and big data informatics. Similarly, the transition in the energy sector represents both a challenge and an opportunity for enhancing our geoscience curriculum and training future geoscience leaders. Our department is poised to lead in these subfields given: (1) Our particular research strengths and our relationships with other on-campus entities, including the Center for High Throughput Computing, the new School of Data Science, the Nelson Institute, and the Wisconsin Geological and National History Survey; and (2) The prominent involvement of several faculty members in cyberinfrastructure for the Earth Science (mainly supported by the EarthCube Initiative of the National Science Foundation). We are actively discussing two possible pathways for taking advantage of these opportunities. First, we are exploring the development of a 5th-year professional MS for UW-Madison Geoscience majors which would focus on integrating geoinformatics and quantitative field methods. This degree would incorporate coursework in Geoscience, but also include courses in other departments (Data Science, Geography). We aim to conduct market research on the viability of such an MS program. Secondly,
we are exploring updates to our undergraduate curriculum including consistent incorporation of geoinformatics themes across several courses and, possibly, new courses focused in this area.

**Partnership with the Geological Engineering Program (GLE) and possible professional MS degree**

As a minor correction to the program review, we note that nearly all (not half) of GLE students double major in Geoscience, and these GLE majors have traditionally represented roughly half of students receiving Geoscience degrees (the other half being Geoscience-only majors). As another minor correction, the move of the GLE program into Civil and Environmental Engineering occurred years ago, so the turbulence associated with that transition is passed. The program review correctly notes, however, that a shift in College of Engineering policies — particularly the change to “direct admit” incoming freshmen to Engineering sub-disciplines — has had negative impacts to GLE undergraduate enrollments and represents a challenge. Under the new direct admit approach, Engineering students have received less exposure to Geological Engineering options, with a corresponding decline in enrollments. This change represents a challenge to maintaining undergraduate enrollments in Geoscience. Despite these issues, Geoscience remains strongly committed to our relationship with the GLE program, which we feel benefits both departments and both Colleges. Areas of interest in research strongly overlap between Geoscience (where some faculty hold engineering degrees) and Geological Engineering (where some faculty hold Geoscience degrees), and collaboration in these areas of interest is facilitated by the GLE program. As a concrete example of these benefits, several major, externally funded research projects including the multi-million dollar PoroTomo and WHOLESCALE projects, both supported by the Department of Energy, have been successful due to collaboration by co-PIs and graduate students from both programs. It is also worth noting that Geoscience historically has a component of a “boom-bust” cycle, and it is not always correlated to the rest of the economy. We are currently in a downturn that is likely affecting the GLE program, but this may not continue.

The Geoscience Department will work to address the risk of impacts to the Geoscience undergraduate major program. One action will be to work with GLE faculty to ensure that this program is advertised in introductory Geoscience coursework, particularly to those students that have been admitted to the College of Engineering. In addition, we are actively exploring other ways in which the Department of Geoscience can assist in advertising and growing the GLE undergraduate program. Third, we are in discussions with the GLE faculty in Civil and Environmental Engineering about additional options — such as a professional MS degree in Engineering Geology. As with geoinformatics, this will demand a careful market analysis and strategic planning by the faculty who might organize the salient curriculum. Finally, it is important to note that we produce excellent geological engineers *because* of their strong Geoscience background. These graduates are highly sought by employers and needed by society, because they understand the interaction between human-designed and natural systems. While current administrative decisions may make this collaboration more difficult, we affirm that this is a strong program that our university should take pride in. We agree with the Review Committee report that a College-level exploration aimed at strengthening the GLE program would be helpful.

**Field experiences for undergraduates**

A final recommendation involved expanding field experience options for undergraduate students. The Geoscience department has been particularly affected by the pandemic in our involvement of undergraduate students in field-based teaching and research. Because of the inherent health risks involved in group travel during a pandemic, much of our field-based education and research at the
undergraduate level has been curtailed, particularly during the last two summers. We feel that, during a non-pandemic situation, we do an excellent job in providing field-based opportunities to the undergraduates in formal (class), informal (spring break), and external (field-camp) conditions. Further, we have already formalized fieldwork policies in our new code of conduct. The Geoscience department has also started a new class (Geoscience 402) that is open to all majors, that engages students in authentic field-based research and satisfies Comm B requirements specifically for science communication. This class has only been offered once because of our inability to take a group of students to the field. In short, we think that we have already addressed concerns over undergraduate opportunities for field experiences, and we anticipate renewed success in this area once the pandemic restrictions ease.

I am happy to respond further, or to answer any questions that this response raises among the GFEC and the L&S APC members.

Sincerely,

Brad S. Singer
Department Chair
Vilas Distinguished Achievement Professor
December 6, 2021

TO: Bradley Singer, Professor and Chair, Geoscience
FROM: Eric M. Wilcots, Dean
RE: Completion of Review of Academic Programs housed in Department of Geoscience:
- BA/BS Geology and Geophysics
- MS-Geoscience
- Doctoral Minor, Geoscience
- Ph.D., Geoscience

ATTACHED: Report of the Geoscience Review Committee

CC: Jenna Alsteen, Assistant Dean, Grad School
    Elaine M. Klein, Associate Dean for Academic Planning
    Gloria Mari-Beffa, Associate Dean for Natural and Mathematical Sciences
    Karen Mittelstadt, Academic Planner, APIR
    Parmesh Ramanathan, Associate Dean, Grad School

On October 19, 2021, the Letters & Science Academic Planning Council discussed the review of the academic programs offered in the Department of Geoscience. We provided many materials as a foundation for this discussion: the self-study prepared by the department, the report of the faculty review committee, the department’s response to the report, and the October 18 memorandum conveying Dean Karpus’ and the Graduate School response to the report. Associate Dean Gloria Mari-Beffa led the council’s discussion.

First, we think it is important to convey the council’s appreciation for the thoughtful work the department undertook to address issues identified in the previous review. In particular, the APC noted the change in culture informed by efforts to continually work on issues of diversity, equity, and inclusion in the department and – by extension – in the discipline. You and your colleagues know well the challenges of encouraging and increasing the presence of underrepresented groups in STEM disciplines, and we urge Geoscience to continue this important work. We agree with the recommendation (also endorsed by the Graduate School) that Geoscience should build on its successful efforts to diversify the faculty and continue to plan and improve the diversity of the graduate student population. Members also noted that the department is also considering more global issues about the future of the discipline (and of the globe), and that Geoscience is at a crossroads, and must study the current focus of research and curriculum on fossil fuel applications,
and how that may need to change in the future and adapt to new urgencies as the climate and world change.

The review committee offered a number of useful observations and recommendations, and the APC trusts that the department will act on these (as it responded to the advice offered in the prior report). With respect to efforts to assess student learning, the review committee noted that the expectation to have an assessment plan and procedures is met: L&S review of the 2016 plans found them to be robust and likely to be very useful. At the undergraduate level, regular use of departmental and AGI senior exit survey information, course evaluations, and in-class assessments at different levels of the curriculum should contribute much to the department’s understanding of how comprehensive. At the graduate level, the department’s plans to capture data from standard milestones in graduate education is also a practical and useful approach to assessment; however, the review committee suggests that this work would be improved if additional, standardized metrics for graduate-level assessment were used. Finally, assessment reports were provided in the self-study, but do not offer insight into whether the department is using these assessment exercises to understand and improve programs (which may be a flaw in the reporting system). We note the review committee’s observation that the department might do more with assessment of student learning – which could mean using the result more effectively or documenting more clearly that the results do inform programmatic decisions.

There are two issues that warrant further consideration. The first was discussed at some length by the APC, and was noted too, in Dean Karpus’ memo: a large number of graduate students do not persist in the doctoral program, departing with a master’s degree. We understand that a research-focused master’s degree is highly valued by students and industry and think it would be useful to the department to interrogate this phenomenon. We know Geoscience has already been advised to consider whether an audience of “masters-only” students would be served better by a program dedicated to them and would suggest that this situation warrants consideration of a dedicated, research-focused and research-intensive terminal master’s program. Creation of a program in this area would create opportunities to develop learning outcomes well-aligned with master’s level research, to incorporate fieldwork and research experience or internships in very intentional ways, and to address more directly the career goals of these students. The second issue also relates to program management: given the very few doctoral minors awarded, we suggest that the graduate faculty consider whether it makes sense to continue to offer a program and credential that students do not seem interested in pursuing. Though the administrative burden of managing an unused PhD minor may seem small, all of the aspects of administering an academic program are the same: Guide pages and programming still need to be maintained, and the program needs to be monitored and reviewed. Is this an opportunity to slightly lighten your load?

None of these matters were so grave as to prevent the L&S APC from unanimously approving a motion to accept the report as complete. Council members were pleased to learn more about Geoscience and admired the many strengths of the department. You have much to be proud of, and we thank you for all you do to support the excellence of the college and university. We look forward to reviewing the follow-up report Geoscience will submit to the Graduate School next semester, and to continued conversations about Geoscience programs.
18 October 2021

Bradley Singer, Ph.D.
Professor and Chair, Geoscience
College of Letters and Science
University of Wisconsin–Madison
Sent Electronically

Dear Professor Singer,

When the College of Letters and Science (L&S) assembled a review committee to conduct a ten-year program review of MS, PhD, and Doctoral Minor in Geoscience, Professor Yu Hen Hu was asked to serve as the Graduate Faculty Executive Committee (GFEC) representative. Professor Hu led a discussion of the review at the GFEC meeting on October 8, 2021.

In this letter, I summarize the committee's discussion.

The GFEC learned of the many strengths of the program including increasing faculty diversity, strong career placement, and an engaged student association (Geoscience Graduate Student Association) and has the following recommendations.

• Expand the strength in the broad area of informatics.
• Study the risks and opportunities of continuing partnership with the Geological Engineering program.
• Explore the option of creating a new professional master’s degree program.
• Following on the success of increased faculty diversity, develop a plan to improve the diversity of the graduate student population.
• Examine data to better understand why large fraction of the doctoral students leave the program with a master’s degree. What opportunities and career plans are they pursuing? The Graduate School exit survey data is a valuable resource for this purpose (grad.wisc.edu/data).

The GFEC requests that the program engages in efforts to address the recommendations of the review committee. Please provide a written response by March 1, 2022 on how the recommendations are being addressed, which will be discussed at a subsequent GFEC meeting. Thank you for your commitment to graduate education.

Sincerely,

William J. Karpus
Dean of the Graduate School
Professor of Pathology and Laboratory Medicine

Cc: Eric Wilcots, Dean, L&S
Gloria Mari Beffa, Associate Dean for the Natural, Physical and Mathematical Sciences, L&S
Elaine Klein, Associate Dean for Academic Affairs, L&S
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