Department of Geosciences
2022 Assessment Report

All areas shaded in gray are to be completed by the department/program.
This document will be posted online and must be accessible electronically (including appendices).

MISSION STATEMENT

Our mission is to prepare students to address urgent challenges facing our natural environment and society through experiential learning and cutting-edge research at the intersection of Earth systems.

DEPARTMENT ALIGNMENT WITH PRIORITIES FOR ACTION

After listing each departmental objective, indicate which of the five Priorities for Action the objective supports. In this section, you may also briefly describe any innovative or noteworthy programs/initiatives that support the Priorities for Action.

1. Conduct earth and environmental science research and obtain substantial extramural funding to support applied and basic research that benefits society (DRIVE EXCELLENCE AND INNOVATION IN TEACHING, LEARNING, AND RESEARCH) The Department has focused efforts in climate change, water resources, and natural hazards and includes internationally recognized scientists in these fields. We have a strong extramural funding record and support many graduate students on research grants. Our research and external funding also support PLACE STUDENT SUCCESS AT THE CENTER OF ALL THAT WE DO and EMBODY THE PRINCIPLE OF "MISSION FIRST, PEOPLE ALWAYS."
2. Disseminate research findings by publishing in peer-reviewed journals and professional publications and presenting at regional, national and international scientific conferences (DRIVE EXCELLENCE AND INNOVATION IN TEACHING, LEARNING, AND RESEARCH).
3. Engage graduate and undergraduate students in research (PLACE STUDENT SUCCESS AT THE CENTER OF ALL THAT WE DO; DRIVE EXCELLENCE AND INNOVATION IN TEACHING, LEARNING, AND RESEARCH; PARTNER WITH PLACE). Each graduate student completes an original-research thesis or dissertation, and undergraduate students are encouraged to participate in independent studies and thesis research. Geosciences faculty advise and mentor these students throughout the research process.
4. Produce graduates who are competent across the geosciences, able to perform well in field, laboratory, and computational settings, and who are prepared to serve as high-quality professionals in geoscience and related fields (DRIVE EXCELLENCE AND INNOVATION IN TEACHING, LEARNING, AND RESEARCH; PLACE STUDENT SUCCESS AT THE CENTER OF ALL THAT WE DO)
5. Educate the general student population about science and basic scientific principles through the study of Earth and its natural systems (PLACE STUDENT SUCCESS AT THE CENTER OF ALL THAT WE DO; DRIVE EXCELLENCE AND INNOVATION IN TEACHING, LEARNING, AND RESEARCH PARTNER WITH PLACE). The Department offers successful, introductory, online courses: GEO 107N Natural Disasters and GEO 105N Oceanography, and we recently revised our introductory class as Earth Systems Science (ERTH 101N/103N). Students fulfill part of the General Education Natural Sciences requirement by completing these courses. We have also promoted the use of open educational resources (OER) in several courses.
6. Inform the public about important earth and environmental science issues through outreach (PARTNER WITH PLACE; PROUDLY TELL THE UM STORY). For example, Dr. Martens has participated in many UM outreach efforts specifically devoted to these PFAs, including presentations to high school classes, alumni, senior citizens, and in other fora.
7. Communicate who we are and what we do to a wide range of students and other stakeholders (PROUDLY TELL THE UM STORY). For example, Wilcox supported this PFA by representing UM as a Jefferson Science Fellow at the U.S. State Department during AY 2021-22; as noted above, Martens has engaged in scientific communication with multiple audiences.
8. Create a learning and work environment that promotes and embraces diversity, equity, and inclusion (PLACE STUDENT SUCCESS AT THE CENTER OF ALL THAT WE DO; EMBODY THE PRINCIPLE OF "MISSION FIRST, PEOPLE ALWAYS"). Geosciences faculty, staff, and students seek to build on our 2020 participation in Unlearning Racism in Geosciences, a nation-wide curriculum that is resulted in assessment of our past and current DEI efforts and plans for future improvements.

STUDENT LEARNING OUTCOMES and MEASUREMENT TOOLS

Because we offer B.S., M.S., and Ph.D. degrees, the following section is differentiated among these. The Department of Geosciences' previous assessment report was submitted in February 2021. To the best of our knowledge, we did not receive feedback. Although we have made curricular changes (discussed below), we have not made any specific changes to assessment practices.

BS Geosciences Student Learning Goals	Indirect Assessment – Review of Departmental Data	Direct Assessment – Feedback from Sources inside and outside the classroom	Direct, Summative Assessment	Direct, Formative Assessment
1. Apply scientific methods, technical knowledge and appropriate analytic tools relevant to geosciences to address problems of societal importance	Annually review curriculum goals and outcomes. Annually review curriculum map.		Comparison of before and after responses on the same or similar questions on assignments and exams. *Target: 85 % improvement rate on key concepts.*	Ongoing, in-class discussions of concepts, *Target: student participation in discussions improves 90 %.*
2. Apply creative and critical thinking skills			Semester-long capstone project or thesis and final presentations. *Target: 80 % of graduates complete an extended-duration project.*	Scaffolding analytical and computational skills.
3. Communicate effectively and professionally through oral, written, and graphical means and operate effectively both in individual and team-related activities.	Review of Course Assessment Practices and Syllabi. *Target: 100 % of syllabi list course outcomes.*	Student presentations, posters, maps, awards. Target: *80 % present their capstone project, independent study, or undergraduate thesis.*	Compare initial drafts with final papers for written assignments. *Target: 60 % improvement in scores on writing rubric.* Evaluate team class presentations.	Scaffolding skills and multiple drafts on written assignments and theses. Ongoing evaluation of team-based field and research projects.
4. Understand and practice ethical conduct in geoscientific endeavors.	Curriculum Review.			Ongoing, in-class discussions on concepts

Highlights of BS Learning Goals and Measurement Tools

The Department of Geosciences' learning goals and measurement tools are consistent with those presented in our 2021 assessment report. In 2021-22, we submitted a Level II Academic Request form to create a new degree in Earth, Water, and Climate Sciences (EWCS). The degree was approved and we are now delivering it. We continue to offer our previous degree, a BS in Geosciences.

Highlights of MS and PhD Learning Goals and Measurement Tools

The following assessment approach works well for our MS and PhD programs. Consequently, we have not modified this plan compared to the previous assessment report.

MS in Geosciences Student Learning Goals	Research Committee Review – Formative Assessment	MS Thesis Proposal and Document	MS Thesis Presentation	MS Thesis Defense
1. Use appropriate knowledge of and technical skills in a chosen core subdiscipline as part of an academic and/or professional career in the geosciences	Ongoing review and discussion with research committee	Review by research committee and department faculty		Testing and Review by research committee
2. Conduct research, exhibit creative and critical thinking, define and address scientific problems	Ongoing review and discussion with research committee	Review by research committee and department faculty		Testing and Review by research committee
3. Exhibit enhanced numerical skills and computer literacy	Ongoing review and discussion with research committee			
4. Communicate effectively and professionally through oral, written, and graphical means	Ongoing review and discussion with research committee	Review by research committee and department faculty	Review by UM faculty in attendance	Testing and Review by research committee
5. Understand the role of geoscience in the global societal context	Ongoing review and discussion with research committee			Testing and Review by research committee

PhD in Geosciences Student Learning Goals	Research Committee Review – Formative Assessment	Comprehensive Exam and Research Proposal	Dissertation Document	Dissertation Presentation	Dissertation Thesis Defense	Conference Presentations, Peer-reviewed Publications
1) Use cutting-edge knowledge of, and technical skills in, a chosen core discipline as part of an academic and/or professional career in the geosciences	Ongoing review and discussion with research committee	Written and Oral exam	Review by research committee and department faculty		Testing and Review by research committee	
2) Create new knowledge by collecting and interpreting geoscience data and communicating results to the professional society	Ongoing review and discussion with research committee		Review by research committee and department faculty		Testing and Review by research committee	Quantity and Quality
3) Communicate effectively and professionally through oral, written, and graphical means	Ongoing review and discussion with research committee	Written and Oral exam	Review by research committee and department faculty	Review by UM faculty in attendance		Peer-review manuscripts and conference review
4) Participate effectively in the workplace and in individual and team-related activities	Ongoing review and discussion with research committee					Peer-review manuscripts and conference review
5) Have the broad general education and an integrated knowledge needed to appreciate the role of geoscience in the global societal context	Ongoing review and discussion with research committee	Written and Oral exam			Testing and Review by research committee	
6) Conduct scientific work in an ethical and professional manner	Ongoing review and discussion with research committee		Review by research committee and department faculty		Testing and Review by research committee	Peer-review manuscripts and conference review

RESULTS and MODIFICATIONS

Student Learning Outcomes results	Modifications made to enhance learning
BS: Apply scientific methods, technical knowledge and appropriate analytic tools relevant to geosciences to address problems of societal importance	Proposed, and are implementing, new BS in Earth, Water, and Climate Science Modified introductory gen ed offering (formerly Physical Geology) into Earth System Science (ERTH 101N/103N). Developed a fully online version of the course with accessibility and multiple modes of learning designed in (with guidance from UMOnline) as well as lab course with in-house developed kit to parallel face to face lab learning experience. Modified prerequisites of several upper-division courses to broaden participation Modified/developed new "Global Water Crises" (Geo 491) advanced writing course that examines problems of societal importance relating to water at the global scale. Introduced "ungrading" assessment modifications in ERTH101, GEO 224, and GEO 491.
BS: Apply creative and critical thinking skills	Introduced new upper-division course, Energy and the Environment (Geo 322), which emphasizes systems science and critical thinking Creative project included in ERTH 101 course to communicate critical thinking through unconventional modalities.
BS: Understand and practice ethical conduct in geoscientific endeavors.	ERTH 101 course addition: "Day in a Life" series of career interviews with guests representing varying degrees of academic preparation and diverse humans employed in a wide array of sectors in the Earth sciences,
PhD: Participate effectively in the workplace and in individual and team-related activities	Created graduate-undergraduate mentoring program (this also applies to several BS and MS learning outcomes)

FUTURE PLANS FOR CONTINUED ASSESSMENT

The Department of Geosciences is in a time of transition, and the next phases of this transition will inform continued assessment. The transition comprises organizational, staffing, and curricular elements. Organizationally, we are slated to join the Franke College of Forestry and Conservation as part of UM Academic Renewal, following recommendations of the Matson report for advancing environment and sustainability research and teaching at UM. Staffing-wise, two of our faculty are on leave from UM (Bendick, Maneta), and one is in an administrative position (Baldwin). We have had multiple retirements without subsequent hires (two since our last assessment report; Sears and Hinman). Our lecturer (Bursztyn) is on a temporary contract. This limits our capacity to deliver, and assess, our curriculum, and to support students in achieving the learning goals identified above. We are now implementing a new B.S. in Earth, Water, and Climate Science. As part of our move to FCFC, we will reevaluate our curriculum to maximize synergies with environmental and earth systems science offerings in that major, and to adapt to staffing capacity and student, workforce, and societal needs. This will very likely entail reevaluation of some of the learning goals identified above, courses, and curriculum. We will be guided by strategic planning that we completed in spring 2021, by discussions with our new colleagues in FCFC, and by assessment of the effectiveness of changes implemented to our curriculum, communications, and advising in recent years. We note that frequent turnover in academic advising is not helpful with respect to assessment. Regardless we will continue to strive for effective assessment and to integrate learning outcomes across our curriculum, from lower-division to upper-division courses.

APPENDICIES

1. Curriculum Map, for new Earth, Water, and Climate Science B.S. (our old Geosciences B.S. degree is still in the UM Catalog. A curriculum map for that degree was included in our last assessment report).

UM Curriculum Mapping Template

Earth, Water, and Climate Science BS Degree, ERTH / GEO Courses

Course (Number, Credits)	Course Name	Outcome 1: Broad general knowledge of geosciences	Outcome 2: Basic scientific and mathematical competence	Outcome 3: Basic critical thinking and problem solving skills	Outcome 4: Field and laboratory technical competence	Outcome 5: Informational literacy	Outcome 6: Competence in communication	Outcome 7: Demonstrated professional and ethically-responsible conduct
ERTH 101N, 3++	Earth Syst Sci	I	I	I	I	I	I	I
ERTH 103N, 1	ESS Lab	I	I	I	I	I	I	I
GEO 103N, 3 ++	Intro Env Geo	I	I	I	I	I	I	I
GEO104N, 1	Env Geo Lab	I	I	I	I	I	I	I
GEO 105N, 3	Oceanography	I	I	I	I	I	I	I
GEO 107N, 3 ++	Natural Disasters	I	I	I	I	I	I	I
GEO 201, 4 *	Rocky Planet	D	D	D	D	I	I	I
GEO 202, 4 *	Water Planet	D	D	D	D	I	I	I
GEO 224, 5	Gen Sci: Physics & Earth Science	I	I	I	I	I	I	I
GEO 302, 4 **	Mineralogy:(	D	D	D	D	D	D	I
GEO 305, 4 **	Ig Met Pet:(	D	D	D	M	D	D	D
GEO 309, 4 **	Sed Strat	D	D	D	D	D	D	D
GEO 318, 3 **	Earth's Changing Climate	D	D	D	D	D	D	D
GEO 319, 3 **	Surface Proc	D	D	D	D	D	D	D
GEO 320, 4 **	Global Water:(	D	D	D	D	D	D	D
GEO 321, 4 **	Earth Resources & Sustainability	D	D	D	D	D	D	D
GEO 322, 3 **	Energy & Environment	D	D	D	D	D	D	D
GEO 323, 3**	Computational Methods	D	D	D	D	D	D	D
GEO 327, 3 **	Geochemistry:(	D	D	D	D	D	D	D
GEO 420, 4 **	Hydrogeology	M	M	M	M	M	M	M
GEO 421, 3 **	Hydrology:(	M	M	M	M	M	M	M
GEO 433, 3 **	Global Tect:(	M	M	M	M	M	M	M
GEO 439, 3 **	Geophysics	M	M	M	M	M	M	M
GEO 443, 4 **	Prin Sed Pet	M	M	M	M	M	M	M
GEO 460, 4 **	Proc Geomorph	M	M	M	M	M	M	M
GEO 488, 3 **	Snow, Ice, Clim. Change	M	M	M	M	M	M	M

KEY:

I = Introduced
D = Developed/reinforced, with opportunities to practice
M = Mastery
++ One of these required
* Required
** 18 credits required among these, including 3 courses numbered 400 or higher
:(Denotes that we currently lack faculty capacity to teach a course listed in this major, because of faculty leaves-of-absence or retirements