**Institutional Effectiveness**
**2024-2025**

**Program:** Geosciences BS
**College and Department:** College of Arts & Sciences, Geosciences
**Contact:** Jeannette Luna
**Mission:**
The Earth Science Department strives: (1) To provide a robust undergraduate learning and research experience for geoscience students; (2) To demonstrate the importance of the geosciences to society; and (3) To promote faculty research, scholarly activity, and interdisciplinary collaboration.

**Attach Curriculum Map (Educational Programs Only):**
Attached Files: See Appendix 1

## PG 1: Number of majors and graduates

**Define Outcome:**
The number of geoscience majors and graduates will be reviewed annually to ensure that program enrollment is sustainable with an average of more than 40 majors and 10 graduates per year.

**Assessment Methods:**
The Department tracks the number of geosciences majors and graduates each semester.

**Criteria for Success (Thresholds for Assessment Methods):**
*Majors:* The number of geoscience majors will average more than 40 majors per year for the preceding 5-year period.

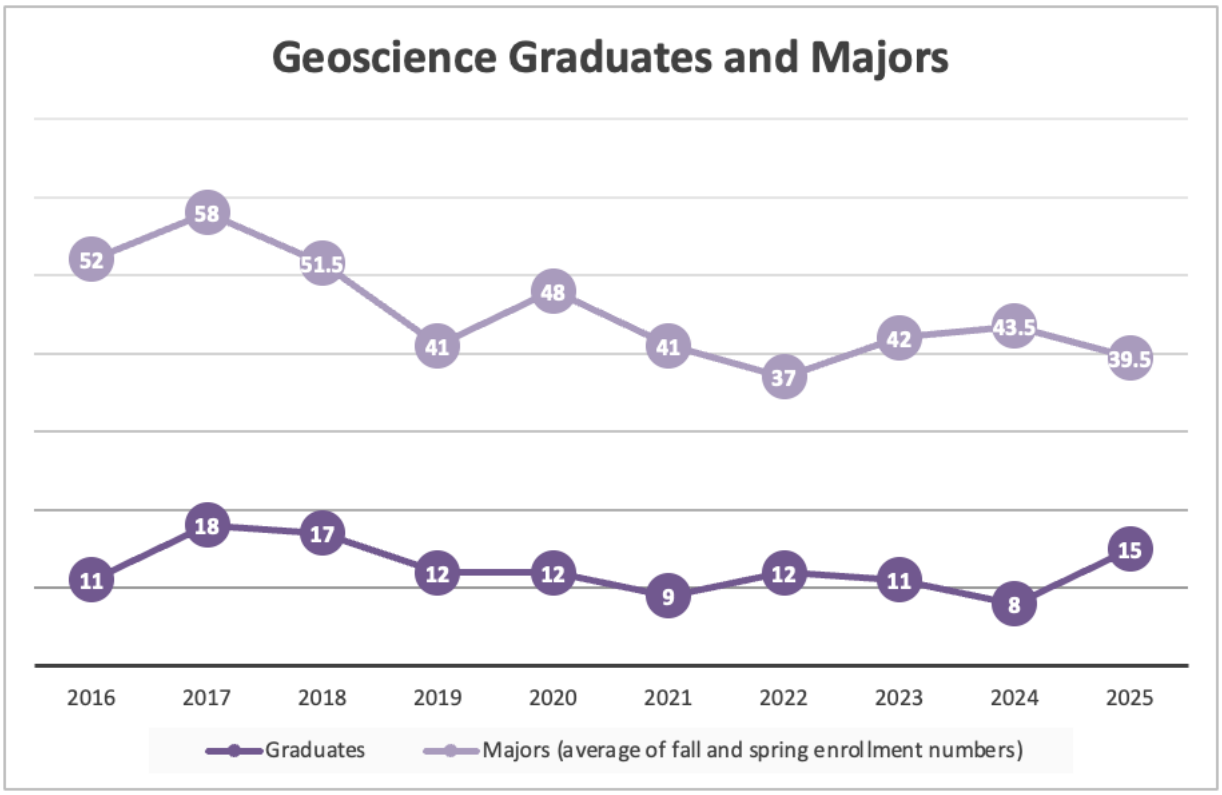
*Graduates:* The number of geoscience graduates will average more than 10 graduates per year for the preceding 5-year period.

*Justification:* The Earth Sciences faculty established these thresholds to: (1) ensure sufficient graduation rates to sustain and grow the geosciences major; (2) maintain low to moderate student-to-faculty ratios (5:1 to 30:1) in upper division courses; and (3) provide individual attention and support for undergraduate senior thesis research projects.

**Link to 'Tech Tomorrow' Strategic Plan:**
3.A Efficiency and Effectiveness,4.B Programs, Certificates, and Training

**Results and Analysis:**
*Majors:* The number of majors in the Fall 2024 semester was 41; it decreased to 38 in spring 2025. The average number of majors over the preceding 5-year period is 40, which meets (but does not exceed) the targeted threshold of 40 majors.

*Graduates:* The number of geoscience graduates during the 2024-2025 academic year was 15. As of summer 2025, the average number of geoscience graduates over the preceding 5-year period is 11, above the targeted threshold of 10 graduates.




**Use of Results to Improve Outcomes:**

*Concentration Name Change:* Effective beginning fall of 2024, the Earth Sciences department renamed the Geographic Information Systems (GIS) major to Geospatial Data Analysis (GDA). This change better aligns with job opportunities, such as geospatial analysis positions. We expect this name change to increase enrollment in the GDA concentration over the next five years.

*New Concentration:* Additionally, the Earth Sciences department began offering a new concentration in the fall of 2024. The Planetary Geology concentration combines courses in earth sciences, remote sensing, and astronomy to meet the growing demand for space science careers. The new concentration attracted four geoscience students in 2024-2025. It is expected to grow to 5-10 majors over the next academic year 2025-2026.

**SLO 1: Sufficient geoscience knowledge**

**Define Outcome:**
Graduates will demonstrate sufficient geoscience knowledge that allows them to either pursue a graduate degree or enter the geoscience workforce.

**Assessment Methods:**
Exit exams are used to assess a student's understanding and retention of fundamental knowledge and help us identify content gaps in our curricula.

1. *The Department Exit Exam for all Majors* is administered to geoscience graduates in all concentrations.
2. *The National ACAT Exam* is administered to geology concentration students.
3. *An Environmental Geology Concentration Exam* is administered to environmental geology concentration students.
4. *A GDA/Geography Concentration Exam* is administered to GDA and geography concentration students.

**Criteria for Success (Thresholds for Assessment Methods):**
*Department Exit Exam*: All graduates will meet or exceed expectations (>70%) on the common departmental exit exam. The departmental exit exam evaluates core knowledge for all students in geoscience concentrations.

*ACAT Exam*: GEOL concentration graduates should score above the 50th percentile on the national ACAT Geology exam. The ACAT measures multiple areas of geology knowledge including Geomorphology, Stratigraphy, Physical Geology, and Structural Geology.

*Environmental Geology and GDA/Geography Exams:* The EGEO and GIS/GEOG exams have less than 5 years of data. A threshold will be set once additional data is collected.

*Justification:* The Earth Sciences faculty established these scoring thresholds to: (1) ensure that graduates are well-versed in core areas of geology, environmental science, and geography; (2) identify and improve curriculum gaps in concentration subjects; and (3) allow flexibility as data is collected for EGEO and GDA/GEOG concentrations.

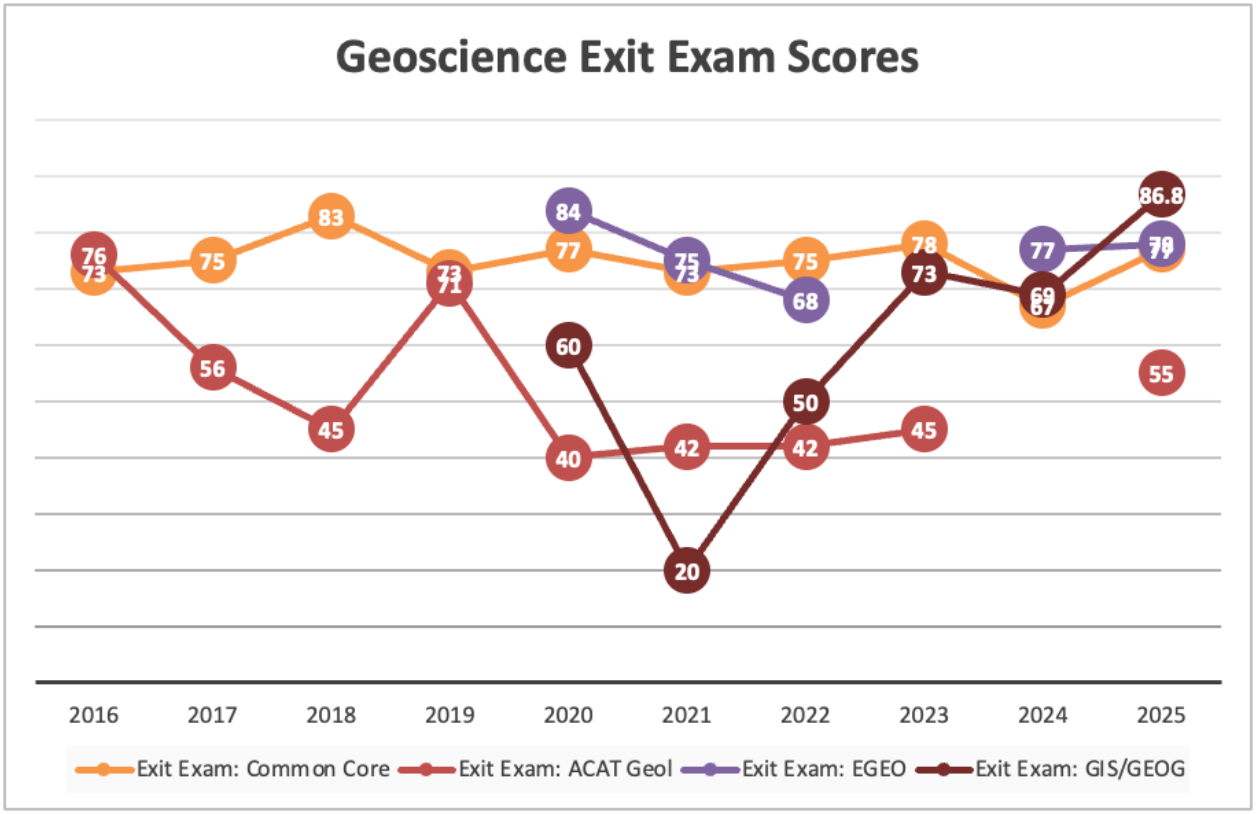
**Link to 'Tech Tomorrow' Strategic Plan:**
1.D High Impact Practices,4.B Programs, Certificates, and Training

**Results and Analysis:**

*Department Exit Exam:* All graduating seniors took the department exit exam in academic year 2024-2025. The exam average increased from the previous academic year, from 67% to 77%. This is above the targeted threshold of 70%.

*ACAT Exam:* For the 2024-2025 academic year, GEOL concentration majors (N=7) scored in the 55th percentile on the national ACAT Geology exam, an increase from the previous year. This is above the targeted threshold of 50%.

*Environmental Geology and GIS/Geography Exams:* For the 2024-2025 academic year, the EGEO mean exit exam score was 78 (N=3), an increase from an average of 77% (N=3 in 2023-2024). The GIS/GEOG mean exit exam score was 86.8**%** (N=5), an increase from an average of 69% (N=5 in 2023-2024).




**Use of Results to Improve Outcomes:**

*Assessing the Geology Concentration:* The department reviewed assessment strategies during our 5-year Self-Study in 2024-2025. Going forward, the faculty discussed the option to align the geology concentration exam with the ASBOG exam (taken for Tennessee geology licensure) rather than the ACAT exam. The faculty thought the ASBOG could be an appropriate measure of

graduates' preparedness for licensure. The department will explore this option more in 2025-2026.

*Improving Exit Exam Scores:* For all concentrations, the biggest challenge in improving exit exam scores is encouraging graduating seniors to take the exams seriously. One way to approach this challenge, which we will do in 2025-2026, is to administer the exams to all seniors at the same time rather than scheduling it for individuals at multiple times. Taking the exam alongside students who are focused on doing well may encourage students who otherwise might not give their best to take the exit exam seriously.

## SLO 2: Proficiency in communication and critical thinking

**Define Outcome:**
Graduates will demonstrate proficiency in communication and critical thinking.

**Assessment Methods:**
The California Critical Thinking Skills Test (CCTST) is used to evaluate critical thinking. The test is administered to all graduating students at TTU.

Graduates are also required to complete a thesis project: Senior Thesis 1 and 2 (GEOL 4930 and 4931). The course grade issued by the advisor reflects a student's critical thinking and communication ability, as well as their thoroughness, initiative, and effort. To better assess only the critical thinking and communication components, faculty use the grading rubric below.

**Communication Skills**

- 90-100 - Graduate School level of communication proficiency, strong technical writing skills, strong oral communication skills.
- 80-89 - Above-average ability, technical writing required editing, oral communication needed some improvement.
- 70-79 - Average ability, technical writing required significant editing, oral communication skills needed improvement.
- 60-69 - Below average ability, weak technical writing skills, weak oral communication skills.
- < 60 - Little to no ability, very weak technical writing skills, very weak oral communication skills.

**Critical Thinking Skills**

- 90-100 - Student exhibited creativity and independent motivation to complete research.
- 80-89 - Student needed some guidance with research but generally worked independently.
- 70-79 - Average research abilities.
- 60-69 - Student required significant guidance throughout the entire research project.
- < 60 - Abilities below that of a D.

**Criteria for Success (Thresholds for Assessment Methods):**
*CCTST Results:* Geoscience graduates should score at or above the TTU mean for the current academic year.

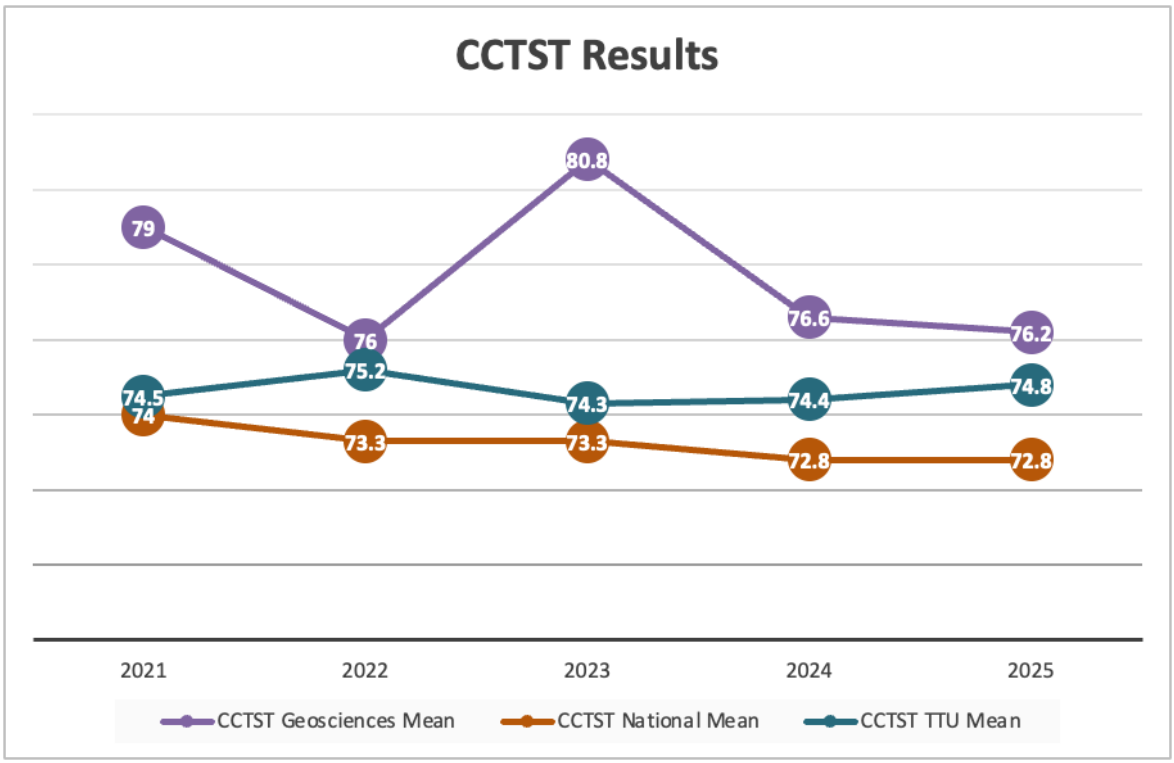
*Communication Skills:* Geoscience graduates should score at or above 70% for the current academic year.

*Critical Thinking Skills:* Geoscience graduates should score at or above 70% for the current academic year.

*Justification:* The Earth Sciences faculty set these scoring thresholds to ensure that graduates are: (1) equipped with critical thinking skills necessary for success in geoscience careers; and (2) proficient in scientific communication, including both oral and written skills.

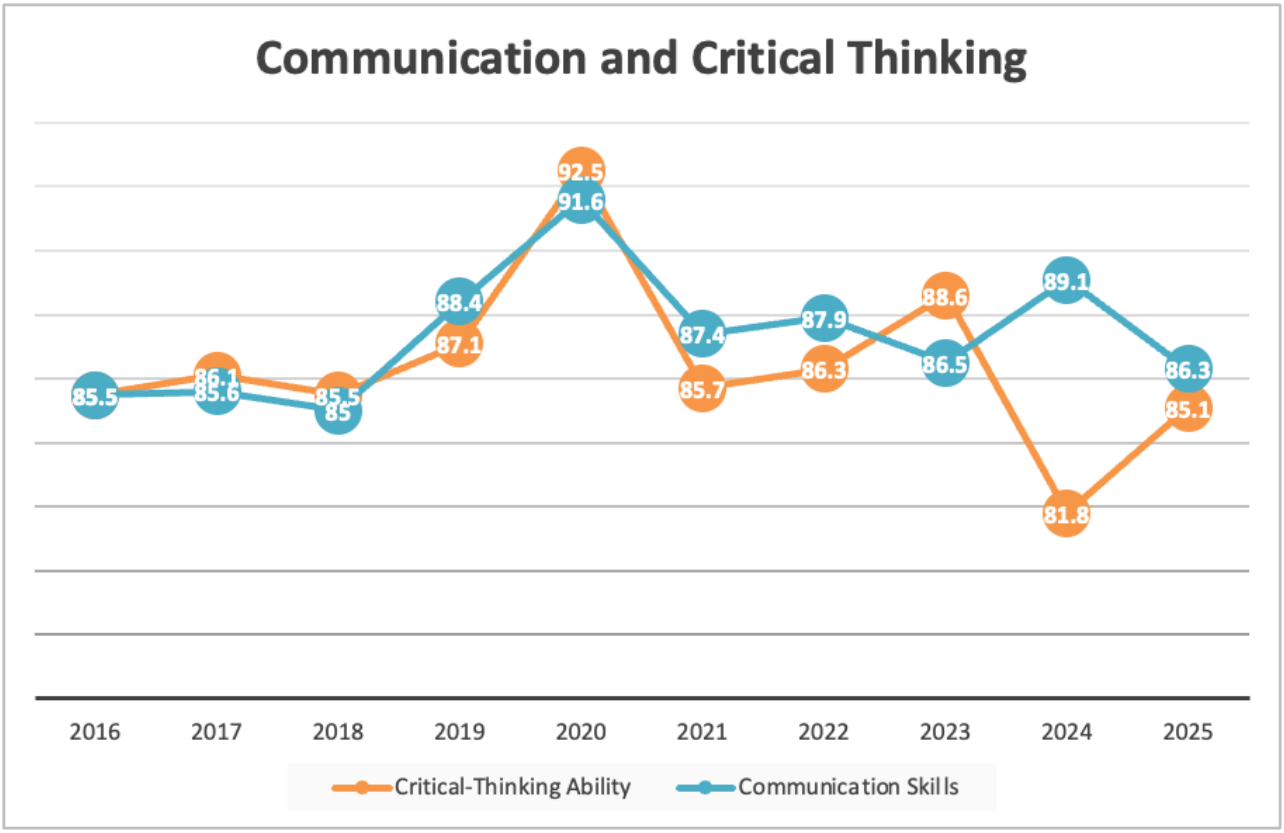
**Link to 'Tech Tomorrow' Strategic Plan:**
1.D High Impact Practices,2.B Research, Scholar, Intellect, and Creativity

**Results and Analysis:**
*CCTST Results:* For the 2024-2025 academic year, geoscience graduates who took the CCTST (N=11) scored an average of 76.2**%** on the CCTST. This is higher than the national mean score of 72.8% and exceeds the threshold TTU mean score of 74.8**%**. Note that the scoring system was changed to a 100-point system in 2021 so only five years of data are shown below.




*Critical Thinking Skills:* For the 2024-2025 academic year, geoscience graduates achieved a mean critical thinking score of 85.1%, higher than the threshold of 70%.

*Communication Skills:* For the 2024-2025 academic year, geoscience graduates achieved a mean communication score of 86.3%, higher than the threshold of 70%.




**Use of Results to Improve Outcomes:**

*Senior Thesis Common Syllabus:* In discussing this outcome and during the Earth Sciences 5-year review in 2024-2025, faculty commented that the absence of a common syllabus for senior thesis may result in varying grading standards among instructors, especially to assess critical thinking and communication skills. The goal for 2025-2026 is thus to adopt a standardized syllabus that emphasizes these skills and supports better assessment of critical thinking and communication proficiency for graduating seniors.

## SLO 3: Undergraduate research

**Define Outcome:**

Graduates will demonstrate the ability to independently develop, conduct, and complete a novel research project.

**Assessment Methods:**

*Senior Thesis:* The Department tracks the number of students presenting thesis research outside the department.

**Criteria for Success (Thresholds for Assessment Methods):**

*Senior Thesis:* The percentage of geoscience graduates presenting research outside the department should be >70%.

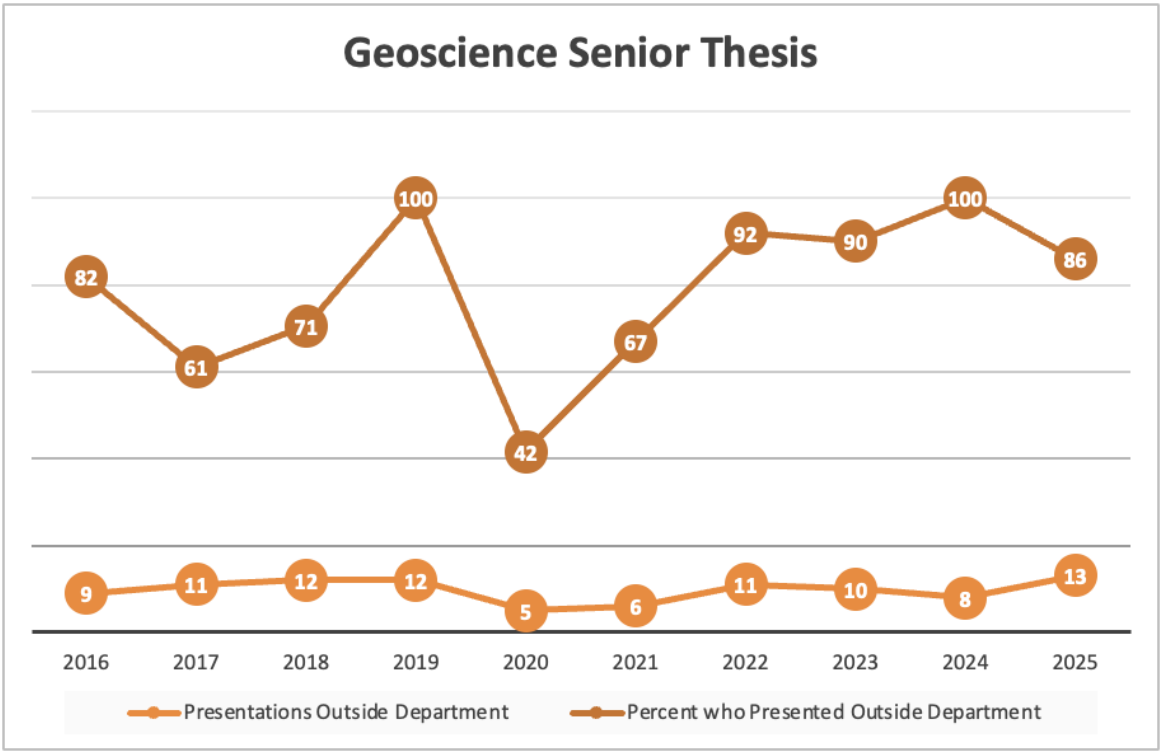
*Justification:* The Earth Sciences faculty set this threshold to ensure that students actively engage with the professional community, which helps build communication skills, fosters networking, and ultimately supports their success in geoscience careers.

**Link to 'Tech Tomorrow' Strategic Plan:**

2.B Research, Scholar, Intellect, and Creativity,4.C Network of Scholars

**Results and Analysis:**

*Senior Thesis:* For academic year 2024-2025, 13 out of 15 graduates presented their research outside the department. This is above the threshold of 70%. Graduates presented research at TTU Student Research Day, Cookeville GIS Day, the Tennessee GIS Conference, the Tennessee Water Resources Symposium, and the Geological Society of America National Conference.




**Use of Results to Improve Outcomes:**

*Travel Funding:* Over the past five years, travel funding for students to attend national conferences has been a challenge. Sources such as the TTU Undergraduate Research and Creative Activity (URECA) program are capped at $1,000, and although this amount used to be sufficient, it sometimes does not cover the full travel request. To meet this challenge, the department worked with a donor to develop a new endowment in 2024-2025, the *Hugh Mills Research and Travel Endowment*. Dr. Mills was a beloved faculty who passed away in 2022, and this endowment both honors his memory and enables students to attend conferences outside of TTU. The faculty are planning a fundraising event in 2025-2026 to grow this endowment and provide additional travel opportunities for students.

**Summative Evaluation:**

PG 1: The department updated the Geospatial Data Analysis concentration (formerly Geographic Information Systems) program name and introduced a new Planetary Geology concentration in 2024. Both changes are expected to attract new majors. Geoscience classes also highlight career opportunities and curriculum pathways in geology, environmental geology, geographic data analysis, geography, and planetary geology.

SLO 1: The faculty identified strategies to improve scores on all geoscience concentration exit exams, e.g. administering the exam at a set time for all seniors. The department is also exploring the option of using the ASBOG exam, typically used for TN geology licensure, to measure student knowledge in the geology concentration.

SLO 2: Earth sciences faculty will create a standardized syllabus in 2025-2026 for the senior thesis course to emphasize critical thinking and professional communication skills, and to ensure consistent grading across different instructors.

SLO 3: Faculty continue to encourage graduating students to present their senior thesis research outside of the department. To support this, the department worked with a donor to establish a new travel endowment in 2024-2025.

**Assessment Plan Changes:**

We do not anticipate changing geoscience assessments for the next assessment cycle.

**List of Appendices:**

Appendix 1: Geosciences BS Curriculum Map

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**Curriculum Map.** Alignment of required geoscience courses with student-learning outcomes. Core courses common to all concentrations are shaded in blue. Geology concentration courses (4/5 required) are shaded in red; GIS concentration in green; environmental geology in purple; and geography in orange. The courses at the bottom of the table (unshaded blocks) are regularly offered directive elective courses.

| Course | Title | SLO 1: Communication and critical thinking | SLO 2: Geoscience knowledge | SLO 3: Undergraduate research |
|---|---|---|---|---|
| GEOL 1020 | Field Experiences (freshmen only) | | x | |
| GEOL 1040 | Physical Geology | | x | |
| GEOL 1045 | Earth Environment, Resources and Society | | x | |
| GEOL 2500 | Geologic Fundamentals | | x | |
| GEOG 4510 | Theory of GIS I | | x | |
| GEOL 4930 | Senior Thesis I | x | x | x |
| GEOL 4931 | Senior Thesis II | x | x | x |
| GEOL 2000 | Earth Evolution and Life History | | x | |
| GEOL 3110 | Principles of Mineralogy and Petrology | | x | |
| GEOL 3230 | Structural Geology and Tectonics | x | x | |
| GEOL 3830 | Field Geology | x | x | x |
| GEOL 4110 | Sedimentation and Stratigraphy | x | x | |
| GEOG 4210 | Cartography | | x | |
| GEOG 4650 | Environmental Applications of GIS | | x | x |
| GEOG 4850 | Advanced GIS | | x | |
| GEOL 4410 | Remote Sensing | x | x | x |

Appendix 1: Geosciences Curriculum Map, cont.

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|---|---|---|---|---|
| GEOL 3200 | Water Resources | x | x | |
| GEOL 4150 | Geomorphology | x | x | |
| GEOL 4200 | Geological Exploration Techniques | x | x | |
| GEOL 4410 | Remote Sensing | x | x | x |
| GEOL 4711 | Hydrogeology | x | x | |
| GEOL 4650 | Environmental Applications of GIS | | x | x |
| GEOG 1012 | Cultural Geography | x | x | |
| GEOG 1130 | Geography of Natural Hazards | | x | |
| GEOG 2100 | Meteorology | | x | |
| GEOG 3200 | Water Resources | x | x | |
| GEOG 4210 | Cartography | | x | |
| GEOG 4650 | Environmental Applications of GIS | | x | x |
| GEOG 1100 | Global Climate Change | x | x | |
| GEOG 4511 | Theory of GIS II | | x | x |
| GEOL 3310 | Planetary Geoscience | x | x | x |
| GEOL 3350* | Paleobiology | x | x | x |
| GEOL 3410* | Paleontology | | x | |
| GEOL 3550 | Paleoclimates | x | x | |
| GEOL 3750 | Stable Isotope Geochemistry | x | x | |
| GEOL 4300 | Environmental Aqueous Geochemistry | x | x | |
| GEOL 4810 | Special Problems: Techniques in X-ray Diffraction | x | x | |
| GEOL 4820 | Special Problems: Geobiology Field Trip | x | x | |

*offered until the spring 2017 semester.