

Wright State University

CORE Scholar

Academic Program Review Reports

Accreditation & Assessment

3-5-2015

Earth & Environmental Sciences Academic Program Review, 2014

Wright State University College of Science and Mathematics

Follow this and additional works at: https://corescholar.libraries.wright.edu/academic_program_review_reports

Repository Citation

(2015). Earth & Environmental Sciences Academic Program Review, 2014. .
https://corescholar.libraries.wright.edu/academic_program_review_reports/31

This Report is brought to you for free and open access by the Accreditation & Assessment at CORE Scholar. It has been accepted for inclusion in Academic Program Review Reports by an authorized administrator of CORE Scholar. For more information, please contact library-corescholar@wright.edu.

College: ***Science and Mathematics***

Department: ***Earth & Environmental Sciences***

Academic Programs Reviewed

Program 1. ***B.A. Earth & Environmental Sciences***

Program 2. ***B.S. Earth & Environmental Sciences***

Program 3. ***B.S. Environmental Health Sciences Concentration***

Program 4. ***M.S. Earth & Environmental Sciences***

Program 5. ***M.S.T. (Earth Science)***

Program Review Committee

David Dominic

David Schmidt

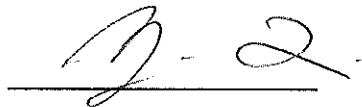
William Slattery

Submitted March 5, 2015

Department Chair, David Dominic



Dean, Yi Li,



Program 1. BA Earth and Environmental Sciences

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	24	21	22	19	11
Graduates	7	5	12	6	4

Program description

The BA in Earth and Environmental Sciences comprises the following degree concentrations: (1) *EES-BA-Earth Sciences*; (2) *EES-BA-Life and Earth Sciences Education*; and (3) *EES-BA-Earth Sciences and Chemistry Education*.

The BA in Earth and Environmental Sciences is designed to provide students with a high quality of education that will prepare them for studies at the graduate level or for professional career employment. The program provides a thorough foundation of knowledge in the earth and environmental sciences via a combination of lecture, lab, and field experiences. The program also provides students with training in mathematics, statistical analysis, supporting sciences, scientific writing, and opportunities to participate in research. The *EES-BA-Earth Sciences Concentration* is further designed to allow students sufficient flexibility for electives outside of the major so that students may pursue a double major, a dual degree, a minor or certificate program, or complete courses relevant to a specialized graduate program or career interest.

Alignment with university mission, strategic plan

The BA in Earth and Environmental Sciences aligns with Wright State University's mission and strategic plan by incorporating and promoting all University core values. The *EES-BA-Earth Sciences Concentration* encourages scholarly research (e.g., as *EES 4960 – Senior Thesis Research*) and the overall BA Program directs students toward clear career paths in the geoscience, environmental, and educational sectors. The EES Department has a diverse faculty and staff with a demonstrable commitment to service learning and to the economic revitalization of our region. Program faculty bring to the classroom research experience in energy exploration, hydrogeology, biochemistry, and environmental protection and remediation, which all represent areas of current societal needs. In addition, the program's faculty have collaborated with several regional partners in addressing regional needs related to water supply, environmental management, education, and economic revitalization.

Program distinctiveness

- Solid research opportunities for undergraduate students
- Active recruitment of program graduates by energy companies
- High-grade laboratories, equipment, and software provide program students with industry-standard training
- Unique field experiences for students because of Wright State University's location near a wide array of natural field sites

- Program faculty expertise in water- and energy-related technologies. This knowledge base is exceptional among Ohio universities and important for Ohio's current and emerging water- and energy-based opportunities

Recognitions of quality of the program

- Program faculty are nationally and internationally recognized for their research expertise and regularly invited to present at professional meetings
- Program faculty obtain external grants supporting undergraduate students and are joined by student co-authors on peer-reviewed papers
- Program students provide presentations at national professional meetings
- Program students are actively recruited for internships and career positions by industrial leaders such as Horizon Well Logging, LLC (Tulsa, OK) and Hess Corporation (New York City, NY)
- Program students are awarded external scholarships (e.g., recent awards include the Choose Ohio First Scholarship and the Central Ohio Mineral, Fossil, Gem, and Jewelry Show Scholarship)

Program learning outcomes

- Students will acquire the knowledge to understand fundamental concepts of geology and be able to solve problems applying that knowledge
- Students will master fundamental field techniques necessary to the solution of geological problems
- Students will demonstrate the ability to write in a style consistent with that found in a scientific journal

Description of description of learning outcomes assessment program

Students are required to complete requirements in field geology or other geospatial-type courses. Students are evaluated on their mastery of fundamental field and laboratory techniques and writing reports based on their classroom, lab, and field experiences. These reports are evaluated for their content and writing style.

Summary of assessment findings for past five years

The information obtained about program graduates indicates that these alumni have been able to secure employment with companies in earth and environmental fields or to attend graduate schools, which signifies that program graduates have indeed mastered the BA Program's fundamental concepts. However, the instructor for a significant departmental capstone course (*EES 4350 – Field Mapping*) has indicated that students who have not taken specific geoscience courses (e.g., *EES 3160 – Stratigraphy and Sedimentology*; *EES 4210 – Structural Geology and Tectonics*) tend to struggle with understandings of geologic concepts in the field. This indicates that students should be directed to obtain a solid background in geoscience courses prior to taking EES 4350.

Regarding writing proficiencies, program students have favorable pass rates for upper-level program course having rigorous writing requirements. This suggests that program students are indeed developing solid writing skills.

Major curricular changes since last review (or past five years)

As part of Wright State University's conversion to a semester-based academic calendar during 2012, the EES Department: (1) restructured the upper-level requirements in the *BA-Earth Sciences Concentration* to include fewer required courses and more electives; (2) strengthened the *BA-Earth Sciences Concentration's* mathematics requirements to include at least one semester of calculus (taken as either *MTH 2240 – Applied Calculus* or *MTH 2300 – Calculus I*); (3) included *EES 4960 Senior Thesis* as a *Core Elective* within the curriculum for the *BA-Earth Sciences Concentration*; and (4) restructured the curricula for the *EES-BA-Life and Earth Sciences Education Concentration* and the *EES-BA-Earth Sciences and Chemistry Education Concentration* to maintain all relevant proficiency guidelines for adolescent/young adult educators.

Graduate placement data, employer satisfaction

The EES Department has determined the post-graduation experiences or intentions for 10 students from the 2009/2010–2013/2014 academic years inclusive. Of these students, 3 (30%) have pursued study at the graduate level. All three of these students have entered the EES-MS Degree Program; two are currently active in the program and in good academic standing and one has left the program with unfulfilled requirements. Five graduates of the EES-BA Program have entered professional employment that directly draws on the proficiencies they acquired in the EES-BA Program; three of these graduates are performing environmentally-related work with private companies and two graduates have entered employment in the energy sector. Finally, two graduates of the EES-BA Program have entered branches of the United States Armed Forces.

If program has professional accreditation, attach most recent review findings and recommendations

N/A

Program 2. BS Earth and Environmental Sciences

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	15	17	25	48	58
Graduates	1	3	2	1	7

Program description

The BS in Earth and Environmental Sciences comprises the following degree concentrations: (1) *EES-BS-Earth Sciences*; (2) *EES-BS-Environmental Sciences*; and (3) *EES-BS-Environmental Health Sciences*. However, the *EES-BS-Environmental Health Sciences Concentration* is a fairly specialized degree program with professional accreditation and is therefore addressed in a separate report.

The BS in Earth and Environmental Sciences is designed to provide students with a high quality of education that will prepare them for studies at the graduate level or for professional career employment. The program provides a thorough foundation of knowledge in the earth and environmental sciences via a combination of lecture, lab, and field experiences. The program also provides students with training in mathematics, statistical analysis, physics, chemistry, scientific writing, and opportunities to participate in research.

Alignment with university mission, strategic plan

The BS in Earth and Environmental Sciences aligns with Wright State University's mission and strategic plan by incorporating and promoting all University core values. The program encourages scholarly research (e.g., as *EES 4960 – Senior Thesis Research*) and directs students toward clear career paths in the geoscience and environmental sectors. The EES Department has a diverse faculty and staff with a demonstrable commitment to service learning and to the economic revitalization of our region. Program faculty bring to the classroom research experience in energy exploration, hydrogeology, biochemistry, and environmental protection and remediation, which all represent areas of current societal needs. In addition, the program's faculty have collaborated with several regional partners in addressing regional needs related to water supply, environmental management, education, and economic revitalization.

Program distinctiveness

- Solid research opportunities for undergraduate students
- Active recruitment of program graduates by energy companies
- High-grade laboratories, equipment, and software provide program students with industry-standard training
- Unique field experiences for students because of Wright State University's location near a wide array of natural field sites
- Program faculty expertise in water- and energy-related technologies. This knowledge base is exceptional among Ohio universities and important for Ohio's current and emerging water- and energy-based opportunities

Recognitions of quality of the program

- Program faculty are nationally and internationally recognized for their research expertise and regularly invited to present at professional meetings
- Program faculty obtain external grants supporting undergraduate students and are joined by student co-authors on peer-reviewed papers
- Program students provide presentations at national professional meetings
- Program students are actively recruited for internships and career positions by industrial leaders such as Horizon Well Logging, LLC (Tulsa, OK) and Hess Corporation (New York City, NY)
- Program students are awarded external scholarships (e.g., recent awards include the Choose Ohio First Scholarship and the Randolph and Cecile Bromery Undergraduate Scholarship)

Program learning outcomes

- Students will acquire the knowledge to understand fundamental concepts of geology and be able to solve problems applying that knowledge
- Students will master fundamental field techniques necessary to the solution of geological problems
- Students will demonstrate the ability to write in a style consistent with that found in a scientific journal

Description of learning outcomes assessment program

Students are required to complete requirements in field geology or other geospatial-type courses. Students are evaluated on their mastery of fundamental field and laboratory techniques and writing reports based on their classroom, lab, and field experiences. These reports are evaluated for their content and writing style.

Summary of assessment findings for past five years

The information obtained about program graduates indicates that these alumni have been able to secure employment with companies in earth and environmental fields or to attend graduate schools, which signifies that program graduates have indeed mastered the BS Program's fundamental concepts. However, the instructor for a significant departmental capstone course (*EES 4350 – Field Mapping*) has indicated that students who have not taken specific geoscience courses (e.g., *EES 3160 – Stratigraphy and Sedimentology*; *EES 4210 – Structural Geology and Tectonics*) tend to struggle with understandings of geologic concepts in the field. This indicates that students should be directed to obtain a solid background in geoscience courses prior to taking EES 4350.

Regarding writing proficiencies, program students have favorable pass rates for upper-level program course having rigorous writing requirements. This suggests that program students are indeed developing solid writing skills. In addition, several program students had abstracts of their research published in conference proceedings and similar publications, which further attests to the students' writing abilities. These publications were associated with the students' presentation of their research at conferences and other public forums.

Major curricular changes since last review (or past five years)

As part of Wright State University's conversion to a semester-based academic calendar during 2012, the EES Department: (1) restructured the upper-level requirements in the BS-Earth Sciences Concentration to include fewer required courses and more electives; (2) developed the *EES-BS-Environmental Sciences Concentration*; and (3) included *EES 4960 Senior Thesis* as a *Core Elective* within the BS curricula.

Graduate placement data, employer satisfaction

The EES Department has determined the post-graduation experiences or intentions for 7 students from the 2009/2010–2013/2014 academic years inclusive. All 7 of these students have pursued, or are intending to pursue, study at the graduate level. Five of these students have entered the EES-MS Degree Program; two have completed the program, two are currently active in the program and in good academic standing, and one has left the program with unfulfilled requirements. One graduate of the EES-BS Program has recently been accepted by the University of North Dakota Space Studies Program and one recent graduate is currently applying to graduate programs.

If program has professional accreditation, attach most recent review findings and recommendations

N/A

Program 3. BS Environmental Health Sciences Concentration

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	46	51	49	33	22
Graduates	10	3	15	12	9

Program description

The BS-Environmental Health Sciences (EHS) Concentration is designed to provide students with understanding of how humans and ecosystems interact and how to solve environmental problems that can affect both human and ecosystem health. This requires giving students a strong foundation in: (1) the interdisciplinary nature of environmental sciences, which include public health, industrial hygiene, worker safety, environmental protection, and the management of natural resources; and (2) strong competencies in biology, chemistry, physics, mathematics, and statistics. Another important component of the EHS Concentration is the EHS Internship Program, which has allowed students to obtain specialized training, interact with peers, supervisors, and the public in professional settings, and gain other practical experiences that are unavailable in the classroom.

Alignment with university mission, strategic plan

The BS-EHS Concentration aligns with Wright State University's mission and strategic plan by incorporating and promoting all University core values. The program includes an internship (as *EES 3660 – Environmental Health Internship*) and directs students toward clear career paths. The EES Department has a diverse faculty and staff with a demonstrable commitment to service learning and to the economic revitalization of our region. Program faculty bring to the classroom professional experience in public health, occupational health and safety, and environmental protection, which all represent areas of current societal needs. In addition, the program's faculty have collaborated with several regional partners in addressing regional needs related to public health, occupational health and safety, environmental management, education, and economic revitalization.

Program distinctiveness

The curriculum for the BS-EHS Concentration meets the rigorous standards for accreditation specified by the National Environmental Health Science and Protection Accreditation Council (EHAC). Accreditation under EHAC, which the EHS Program has maintained since 1977, requires offering a high-quality curriculum, maintaining proficient instructors, providing modern facilities, submitting annual reports to EHAC, and passing a thorough review of the EHS Program by EHAC every six years.

The EHS Internship Program has been a valuable route to career employment or entry into graduate programs. EHS internships have provided: (1) technical training and other work experiences that have led directly to career employment; and (2) research experiences that have been determining factors for students who have gained entry into graduate programs.

Recognitions of quality of the program

- The BS-EHS Concentration is one of only 32 undergraduate degree programs in the United States accredited under EHAC
- Agencies such as Public Health-Dayton and Montgomery County, the US Army Corps of Engineers, and the Ohio Environmental Protection Agency have provided internships to program students on a regular basis
- At least one program student has been awarded an external scholarship (the Ohio Environmental Health Association's George Eagle Memorial Scholarship)
- Two program students have each been chosen as Student of the Month by the Association of Environmental Health Academic Programs

Program learning outcomes

- Students will possess a broad knowledge of the environmental sciences with the necessary skills in mathematics, statistics, chemistry and biology for supporting and integrating into environmental applications
- Students will be capable of adequately solving on-the-job problems dealing with environmental issues
- Students will have communication skills, both oral and written, for technical, administrative, and public arenas
- Students will have the ability to be flexible and adaptable to the many changing environmental sub-disciplines they will encounter; performing in a competent manner in each

Description of learning outcomes assessment program

- Program students are required to have their internship supervisors complete a 3-page final evaluation of the student's internship performance
- Program students are given a comprehensive examination during their senior year (in EES 4700 – Environmental Intern and Career Analysis) that provides a general evaluation of the EHS curriculum near the point of graduation
- Program accreditation under EHAC qualifies EHS students to take the State of Ohio Sanitarian Registration Exam. The scores earned by EHS program graduates on this exam are analyzed and reviewed.

Summary of assessment findings for past five years

- Internship supervisor comments indicate that EHS students are well prepared for their duties
- Students during the recent past have achieved similar scores on the EHS comprehensive exam, indicating the program continues to be effective
- Program graduates taking the Ohio Registered Sanitarian Exam during recent years have achieved a 100% pass rate, with approximately 90% passing on their first attempt. In contrast, the statewide average pass rate during the same time period was only 43%.

Major curricular changes since last review (or past five years)

The BS-EHS Concentration underwent only minor modifications during Wright State University's conversion during 2012 to a semester-based academic calendar. The most significant curricular change was to combine two upper-level courses (*EES 360 – Environmental Aspects of Water Quality* and *EES 364 – Solid and Hazardous Waste Management*) into a single course (*EES 3600 – Water, Wastewater, and Solid Waste*).

Graduate placement data, employer satisfaction

The EES Department has determined the post-graduation experiences or intentions for 25 students from the 2009/2010 – 2013/2014 academic years inclusive. Of these students, 13 (52%) have pursued, or are intending to pursue, study at the graduate level. Students who have opted to pursue employment directly after graduation have mostly entered professional employment that directly draws on the proficiencies they acquired during their undergraduate experience. This employment includes positions with private companies, governmental agencies, and educational institutions.

If program has professional accreditation, attach most recent review findings and recommendations

Per the attached documents, the most recent review by EHAC of the BS-EHS Concentration occurred during 2012. At that time, EHAC extended a conditional accreditation to the degree program and identified a need for the program to develop an advisory committee. An advisory committee, consisting mainly of members of the Kitty Hawk Chapter of the American Society of Safety Engineers, was developed for the degree program during 2013. Following this, EHAC granted full accreditation to the BS-EHS degree program for the remainder of a six-year accreditation cycle, which ends during 2018.

Program 4. MS Earth and Environmental Sciences

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	28	26	28	33	31
Graduates	6	6	8	11	11

Program description

The MS in Earth and Environmental Sciences is designed to provide students with a high quality of education that will prepare them for professional career employment or continuation into a doctoral degree program, either at Wright State or at another prominent Research 1 institution. The program provides a thorough foundation of knowledge in the earth and environmental sciences via a combination of lecture, lab, field, and research experiences.

Alignment with university mission, strategic plan

The MS in Earth and Environmental Sciences aligns with Wright State University's mission and strategic plan by incorporating and promoting all University core values. The program requires scholarly research (e.g., as *EES 8990 – Thesis Research*) and directs students toward clear career paths in the geoscience and environmental sectors. The EES Department has a diverse faculty and staff with a demonstrable commitment to service learning and to the economic revitalization of our region. Program faculty bring to the classroom research experience in energy exploration, hydrogeology, biochemistry, and environmental protection and remediation, which all represent areas of current societal needs. In addition, the program's faculty have collaborated with several regional partners in addressing regional needs related to water supply, environmental management, education, and economic revitalization.

Program distinctiveness

- Solid research opportunities addressing questions of societal relevance
- Active recruitment of program graduates by energy companies
- High-grade laboratories, equipment, and software provide program students with industry-standard training
- Unique field experiences for students because of Wright State University's location near a wide array of natural field sites
- Program faculty expertise in water- and energy-related technologies. This knowledge base is exceptional among Ohio universities and important for Ohio's current and emerging water- and energy-based opportunities

Recognitions of quality of the program

- Program faculty are nationally and internationally recognized for their research expertise and regularly invited to present at professional meetings
- Program faculty obtain external grants supporting undergraduate students and are joined by student co-authors on peer-reviewed papers

- Program students provide presentations at national professional meetings
- Program students are actively recruited for internships and career positions by industrial leaders such as Horizon Well Logging, LLC (Tulsa, OK) and Hess Corporation (New York City, NY)

Program learning outcomes

- Students will acquire the knowledge to understand fundamental concepts of earth and environmental sciences and be able to solve problems applying that knowledge
- Students will master fundamental field techniques necessary to the solution of problems in areas of earth and environmental sciences
- Students will demonstrate the ability to write in a style consistent with that found in a scientific journal

Description of learning outcomes assessment program

The capstone of the M.S. degree program is the public presentation and defense of the research thesis. At the time of the defense, the principal advisor and members of the student's advisory committee (usually two) complete a rubric that evaluates the student in nine areas: (1) Quantitative Interpretation; (2) Quantitative Representation; (3) Quantitative Application / Analysis; (4) Quantitative Assumptions; (5) Quantitative Communication; (6) Explanation of Issues; (7) Evidence; (8) Influence of context and assumptions; (9) Conclusions and related outcomes (implications and consequences). Evaluators rate the students as reaching "benchmark ability" (rating of 1, the lowest achievement level), "lower milestone ability" (rating of 2), "higher milestone ability" (rating of 3), or "capstone ability" (rating of 4, the highest achievement level).

Summary of assessment findings for past five years

The assessment program evaluates the degree to which graduates of the M.S. degree program understand and can communicate quantitative information. It evaluates their understanding of assumptions, both stated and implied, that underlie their conclusions. It also evaluates their ability to reason beyond their stated conclusions. Of the 15 students evaluated using this assessment tool, most received a mix of ratings of (4) *capstone ability* and (3) *higher milestone ability* in all nine factors. None received ratings lower than (2) *lower milestone ability*.

Major curricular changes since last review (or past five years)

As part of Wright State University's conversion to a semester-based academic calendar during 2012, the EES Department converted the quarter-based credit-hour requirements in the M.S. degree program to equivalent semester-based credit hours. The program now requires 30 semester credit hours divided into 24 credit hours of courses and 6 credit hours of Thesis research. No other changes were made to the program.

Graduate placement data, employer satisfaction

Graduates from our M.S. degree program are actively recruited in the area of energy exploration by companies directly exploring for resources (for example, BP and Chesapeake Energy Resources) and major service companies in exploration (for example, Schlumberger). Others are employed by state regulatory agencies, such as Ohio EPA and the Ohio Department of Natural Resources Division of Geological Survey. Many others find employment in the field of environmental consulting.

Approximately 10% of our graduates continue in Ph.D. degree programs. The success of graduates from this program can be judged by the fact that the department chair and individual faculty members continually receive inquiries about new or recent graduates that could apply for open employment positions.

If program has professional accreditation, attach most recent review findings and recommendations

N/A

Program 5. Master of Science in Teaching (Earth Science)

Enrollment and Graduate History

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
Enrollment	12	12	12	10	15
Graduates	7	7	3	7	3

Program description

The Master of Science in Teaching (Earth Science) program is one of the few such programs for K-12 teachers in existence in the United States. The Department of Earth and Environmental Sciences has offered the Master of Science Teaching (Earth Science) Program for over 30 years. The vast majority of MSTES participants have been K-12 classroom educators. The MSTES program is an interdisciplinary graduate program totaling 30 semester hours containing at least 20 semester hours of science content and up to 10 semester hours of pedagogy courses. The program is non-thesis, but a substantial independent capstone project is required. For the past decade Department of Earth & Environmental Sciences faculty have developed and delivered on-line courses to allow MSTES participants from outside the Wright State University sending area to take high-quality, on-line, science-content courses. College of Education and Human Services faculty have also developed on-line courses for their graduate population and Master of Science in Teaching (Earth Science) students may take these courses and apply them to their programs of study. The addition of a new low-residency option has allowed the recruitment of students from outside the traditional Wright State University sending area.

Alignment with university mission, strategic plan

The Master of Science in Teaching (Earth Science) program aligns with Wright State University's mission and strategic plan by incorporating and promoting all University core values. For example, the program builds a solid foundation for student success through high-quality, innovative courses in science content and pedagogy and provides educators with the tools necessary to teach and assess their k-12 students' progress in science. Program science courses are taught by Earth & Environmental Sciences research faculty and required education courses are taught by College of Education and Human Services faculty experts in educational research. Faculty from both colleges serve on Master of Science in Teaching (Earth Science) students capstone project committees, ensuring a diverse and high quality educational experience for Master of Science in Teaching (Earth Science) program participants. Having teachers with strong STEM science and assessment backgrounds empowers our students and alumni to develop professionally, intellectually, and personally.

The Master of Science in Teaching (Earth Science) program stands at the center of the university's 2013-2018 strategic plan by helping students meet career goals, and giving students a total university experience that includes online opportunities.

The EES Department has a diverse faculty and staff with a demonstrable commitment to service learning and to the economic revitalization of our region. Program faculty bring to the classroom research

experience in energy exploration, hydrogeology, biochemistry, and environmental protection and remediation, which all represent areas of current societal needs. In addition, the program's faculty has collaborated with several regional partners in addressing regional needs related to water supply, environmental management, education, and economic revitalization.

Program distinctiveness

- The Master of Science in Teaching (Earth Science) Program is unique, in that it develops multi-faceted professional educators by combining scientific content targeted towards state and national science education standards with assessment and pedagogical courses.
- The Master of Science in Teaching (Earth Science) Program courses are available online during the academic year and as field-based courses during the summer.
- A new low residency option has enabled the Master of Science in Teaching (Earth Science) Program to reach out to educators across the globe to provide high quality science education in a convenient format.
- The Master of Science in Teaching (Earth Science) Program final capstone projects are opportunities program participants to engage in scientific research with EES department faculty and in educational research with College of Education and Human Services faculty
- Active recruitment of program graduates by energy companies

Recognitions of quality of the program

- Program faculty are nationally and internationally recognized for their research expertise and regularly invited to present at professional meetings.
- Program faculty obtain external grants supporting STEM workforce development and K-12 teacher professional development and are joined by student co-authors on peer-reviewed presentations and papers.
- Master of Science in Teaching (Earth Science) students provide presentations at state, regional and national professional meetings.
- Students graduated from the Master of Science in Teaching (Earth Science) Program have become school district superintendents, have been employed as science specialists by the Ohio Department of Education and as administrators in many school districts.
- Master of Science in Teaching (Earth Science) students have become faculty at two year community colleges.
- Many Master of Science in Teaching (Earth Science) graduates hold elective office in learned societies and professional organizations.

Program learning outcomes

- Program Level Student Learning Outcome 1: "Through the Master of Science in Teaching (Earth Science) courses, graduates will be able to acquire the Earth Science content knowledge and assessment skills consistent with the National Science Education Standards and needed to teach students in K-16 settings".
- Program Level Student Learning Outcome 2: "Through the Master of Science in Teaching (Earth Science) courses, Graduates will be able to develop and teach inquiry-based integrated science activities in K-16 settings".

- Program Level Student Learning Outcome 3: “Through the Master of Science in Teaching (Earth Science) courses, graduates will be able to show evidence of continuing to be effective teachers and leaders in their schools”.

Description of learning outcomes assessment program

The Master of Science in Teaching (Earth Science) assessment of program student learning outcomes sets three key points to measure *program* objectives. These points are based on new students entering the program, students graduating from the program and at a point one year after graduation. During this reporting period the following assessment measures were employed:

- a. Master of Science in Teaching (Earth Science) entering and graduating from the program in the reporting period were assessed using the Group Assessment of Logical Thinking (GALT) instrument.
- b. Master of Science in Teaching (Earth Science) participants entering and graduating from the program during the reporting period were administered the Geoscience Concepts Inventory (GCI) assessment instrument to determine their content knowledge.
- c. Final Master of Science in Teaching (Earth Science) capstone projects required of students graduating from the MST program were examined by program faculty for evidence of inquiry. The assessment was performed by review of the written reports and by means of oral examination during the report presentation.
- d. Former students that had graduated in the prior assessment period were asked to respond to a post graduation survey.

Summary of assessment findings for past five years

Program Level Student Learning Outcome 1: Thirty-eight entering MST students were administered a pre-program Geoscience Content Inventory assessment during this five year reporting period. The twenty-seven students graduating during the assessment period increased their concept knowledge as measured on the post-program GCI assessment.

Program Level Student Learning Outcome 2: Twenty-seven MST students graduated during the reporting period. The analysis of pre and post assessment of the Group Assessment of Logical Thinking score indicated that the students increased their scores in this measure of logical thinking skills over the period of their participation in the Master of Science in Teaching (Earth Science) program. In addition, the graduating student’s Master of Science in Teaching (Earth Science) projects were examined by program faculty for evidence of knowledge and use of inquiry-based science for their K-12 students in their final projects. Their projects displayed a substantial use and knowledge of inquiry-based science. The Master of Science in Teaching (Earth Science) project is developed with the support of a faculty committee. Although not a thesis, it is a substantial independent project is submitted and a presentation to faculty and students is required. All candidates for graduation must complete a capstone project and their efforts are judged by faculty in the areas of Research Procedure, Mechanics, Literature Review

and Analysis of Research Data according the rubric below. The results are factored into the students' final grade for EES7810 MST Project. Their faculty committees judged all student presentations in the reporting period as satisfactory or professional.

	Unsatisfactory	Satisfactory	Professional	Score
Research Procedure	1 The candidate conducted the research with significant changes from the procedures outlined in the project proposal	2 The candidate conducted the research using almost all procedures outlined in the project proposal	3 The candidate conducted the research using all procedures outlined in the project proposal	3
Mechanics	1 The candidate has not written a report that is of appropriate breadth. The report does not have a clear and appropriate organization.	2 The candidate has written a report that topic is of appropriate breadth, with clear and appropriate organization.	3 The candidate has written a report that topic is of appropriate breadth. The report contains clear and appropriate organization, with effective transitions, introduction, and conclusion.	3
Literature Review	1 The candidate based their report on the work of others cites few sources used in the text of the report, does not use a chronological organization of sources and shows scant knowledge of the use of information technologies to gain background information on the problem	2 The candidate based their report on the work of others, cited many sources used in the text of the report, used a chronological organization of sources and showed knowledge in the use of information technologies to gain background information on the problem	3 The candidate based their report on the work of others cited all sources used in the text of the report, used a chronological organization of sources and showed effective use of information technologies to gain background information on the problem	3
Analysis of research data	1 The candidate did not demonstrate that the conclusions are supported by the data collected	2 The candidate demonstrates that the conclusions are significantly supported by the data collected	3 The candidate demonstrates clearly that the conclusions are supported by the data collected.	

Program Level Student Learning Outcome 3: Fifteen former MST's responding to surveys indicated that they were continuing to teach and advance in their careers and as critically engaged citizens. Evidence of these advances were, for example, graduates hired as consultants in the Ohio department of Education, elected president of the regional chapter of the National Association of Geoscience Teachers, chosen as an Ohio School District Superintendent and continuing professional development experiences as the NASA "Teacher in an High-Altitude Airplane Observatory, that was featured on the Wright State University website."

Major curricular changes since last review (or past five years)

As part of Wright State University's conversion to a semester-based academic calendar during 2012, courses in the Master of Science in Teaching (Earth Science) program were restructured to a semester framework. New National and State of Ohio science were developed but no new courses needed to be added to the program curriculum as a result of these new standards documents. The new low-residency option required the addition of a new seminar course (EES7750) to be offered each summer semester.

Graduate placement data, employer satisfaction

The EES Department has determined the post-graduation experiences or intentions for 15 Master of Science in Teaching (Earth Science) program graduates from the 2009/2010–2013/2014 academic years. All 15 of these former MST's responding to surveys one year after their graduation indicated that they were continuing to teach and advance in their careers and as critically engaged citizens. See Program Level Student Learning Outcome 3 above for additional detail.

If program has professional accreditation, attach most recent review findings and recommendations

N/A

Departmental Summary

Faculty demographics

	2008	2009	2010	2011	2012
Full	3.00	4.33	4.33	3.33	3.92
Associate	6.00	4.67	4.67	4.67	5.00
Assistant	1.84	2.83	2.83	1.83	0.83
Inst/Lect	1.49	3.00	3.00	1.00	1.00
Total	12.33	14.83	14.83	10.83	10.75

Staffing Summary

	2008	2009	2010	2011	2012
Unclassified	1.50	1.50	1.50	1.50	1.50
Classified	2.26	2.26	2.26	2.26	1.51
Total	3.76	3.76	3.76	3.76	3.01

Student/faculty ratio

	2008	2009	2010	2011	2012
Student FTE/Fac FTE	11.45	10.60	11.63	17.78	14.76

Weighted Student/faculty ratio

	2008	2009	2010	2011	2012
Student FTE/Fac FTE	25.63	22.99	24.15	35.27	29.30

Average class size

	2010	2011	2012
Lecture	37.69	37.38	48.38
Lab only	24.8	25.6	24.8
Lecture/Lab	34.84	34.48	36.88

Total of student data for all programs in unit

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	131	157	168	169	155
Graduates	31	28	43	40	30

Total courses taught and credit hours generated for unit

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Undergraduate	7292	8231	8237	8034	5969
Graduate	1108	1047	1125	955	895
Total	8400	9278	9362	8989	6864

Course completions

	2008	2009	2010	2011	2012
Undergraduate	90.4%	90.5%	88.8%	89.0%	84.5%
Master's	93.0%	96.6%	96.7%	96.2%	98.5%

Expense per student and revenue to expense ratio

	2008	2009	2010	2011	2012
Expense per student WFTE	\$3753	\$3851	\$3481	\$3282	\$3642
Rev/Expense	1.706	1.779	2.025	2.197	2.060

Research and External Funding

	2008	2009	2010	2011	2012
External funding	\$666,025	\$381,001	\$794,752	\$384,157	\$402,595

Future employment projections for discipline (to be provided to unit)

The occupations available to graduates of our degree programs include natural sciences managers, geoscientists, and hydrologists. Projected growth in jobs is 4.5% for the region, 6.3% for the state, and 6.7%.

Description of how unit programs and curricula are "mission critical" to the core Wright State educational experience

Five strategic goals are identified as planning objectives of the University. The Department supports these objectives through all of its endeavors. The Department of Earth & Environmental Sciences defines our mission in this way: *We offer research and educational programs that focus on earth processes and complex ecosystems. We explore interactions among processes that involve the biosphere, lithosphere, atmosphere, and hydrosphere, fostering a cross-disciplinary perspective to meet the current and future challenges of resource development, conservation, and environmental health and quality.*

The first two strategic goals of the University address **Academic Distinctiveness And Quality and Educational Attainment**. Our focus on earth processes and complex ecosystems helps distinguish

Wright State as focusing academic programs on areas and issues of regional, national, and global importance. The third strategic goal of the University focuses on **Research And Innovation**. The Department's current strengths in energy exploration, hydrogeology, and biogeochemistry all represent areas of current societal needs. The first two relate to necessary resources and the third builds our understanding of the links among biology, chemistry, and geology in ongoing processes. It seems clear that the effects of global climate change will alter earth processes in ways that may not be predicted by our current understanding. The fourth strategic goal of the University focuses on **Community Transformation**. The Department has recently collaborated with these regional partners: *U.S. EPA National Risk Management Research Laboratory, Confluence Water Technology Innovation Cluster, Dayton Development Coalition, SOCHE, AFIT, Miami Conservancy District, Ripley Union Lewis Huntington School District*. The goal of this collaboration is for the department to engage in transforming the communities we serve. The fifth strategic goal of the University focuses on **Valued Resources**. The Department recently obtained donations of software totaling over \$10.1 million. This software is utilized in both teaching and research and represents a substantial resource.

Faculty accomplishments and recognitions

William Slattery was recognized for *Distinguished Service, Geoscience Education Division*, from the Geological Society of America, 2010.

Robert Ritzl received the 2014 *George Burke Maxey Distinguished Service Award*, Hydrogeology Division, Geological Society of America, the 2010 *Outstanding Alumni Award* by the School of Graduate Studies Wright State University, and in 2004 was made a *Fellow* of the Geological Society of America.

Chad Hammerschmidt received the 2011 *Award for Excellence in Teaching*, Southwest Ohio Council for Higher Education (SOCHE), the 2010 *Presidential Award for Faculty Excellence: Early Career Achievement*, Wright State University, and the 2008 *Rada Distinguished Alumni Award*, University of Wisconsin-La Crosse.

Stacey Hundley received the 2011 *General Education Excellence in Teaching Award*, Wright State University.

Programs and areas of recognized excellence with supporting evidence

In 2011, the *American Association of Professional Geologists* recognized the Department with a donation of \$10,000 to support student activities. We are one of five departments in the U.S. recognized in this way.

Capacity for growth of programs

We have identified two areas in which the Department can increase both course offerings and scholarship.

1) Atmospheric Sciences. Courses and research should be focused on atmospheric processes and the interaction between the atmosphere, hydrosphere, and lithosphere. This will add a new facet to research and teaching in the department, a facet which both complements and expands beyond existing strengths in hydrology and geology. It will allow the department to have more comprehensive coverage of the earth and environmental sciences. External funding opportunities exist for atmospheric sciences

due to societal interest and concern over global climate change, and the consequent priorities that have been established for research in this area within federal funding agencies.

2) Soil Science. Courses and research focused on soils as interrelated with the earth and environmental sciences. Environmental issues such as water quality, wetlands preservation, and global climate change (carbon cycle and the role of carbon storage in soils) have expanded the focus of research in soil science well beyond agronomy. There are outstanding opportunities for extramural funding in this area from federal funding agencies such as USDA and NSF.

New program opportunities

The Master of Science in Teaching (Earth Science) program is one of the few such programs for K-12 teachers in existence in the United States. Although earth science is included in the national science education standards and in forty-nine of the fifty state standards, earth science has the lowest number of teachers that are considered "highly qualified" under the No Child Left Behind Act. Therefore we are convinced an audience exists for a high-quality, low-residency, distance-learning program for K-12 classroom educators designed to improve their science content and classroom teaching methods. We now offer this degree program in format that requires limited residency on campus. The innovative approach is to combine distance-learning courses with hands-on learning in field studies during the summer. The first students enrolled from outside the traditional Wright State sending area began Spring Semester 2015.

Proposals to enhance programs (if desired)