ACADEMIC PROGRAM REVIEW GUIDELINES

Departmental Section

Department: Geography & Geology

NOTE: Departments with multiple programs undergoing academic program review in the same year should complete sections I through IV only once. Sections V and VI should be completed for each program undergoing review.

Names of Individual Preparing the Report: **Dr. David J. Keeling, Department Head**
With contributions from individual faculty

I. Departmental Context:

Department Vision Statement: The Department aims to be the region's outstanding Geoscience department, with effective international reach. It aims to produce exceptional undergraduates and graduates in its major programs, to engage them in critical thinking and meaningful problem solving, and to build the reputation of the Department through meaningful research and community engagement.

Department Mission Statement: The Department of Geography and Geology prepares students to be productive, engaged, and socially responsible citizen-leaders of a global society. It provides research, service, and life-long learning opportunities for its students. The Department is responsible for stewarding a high quality of life for its faculty, students, and alumni so that they:

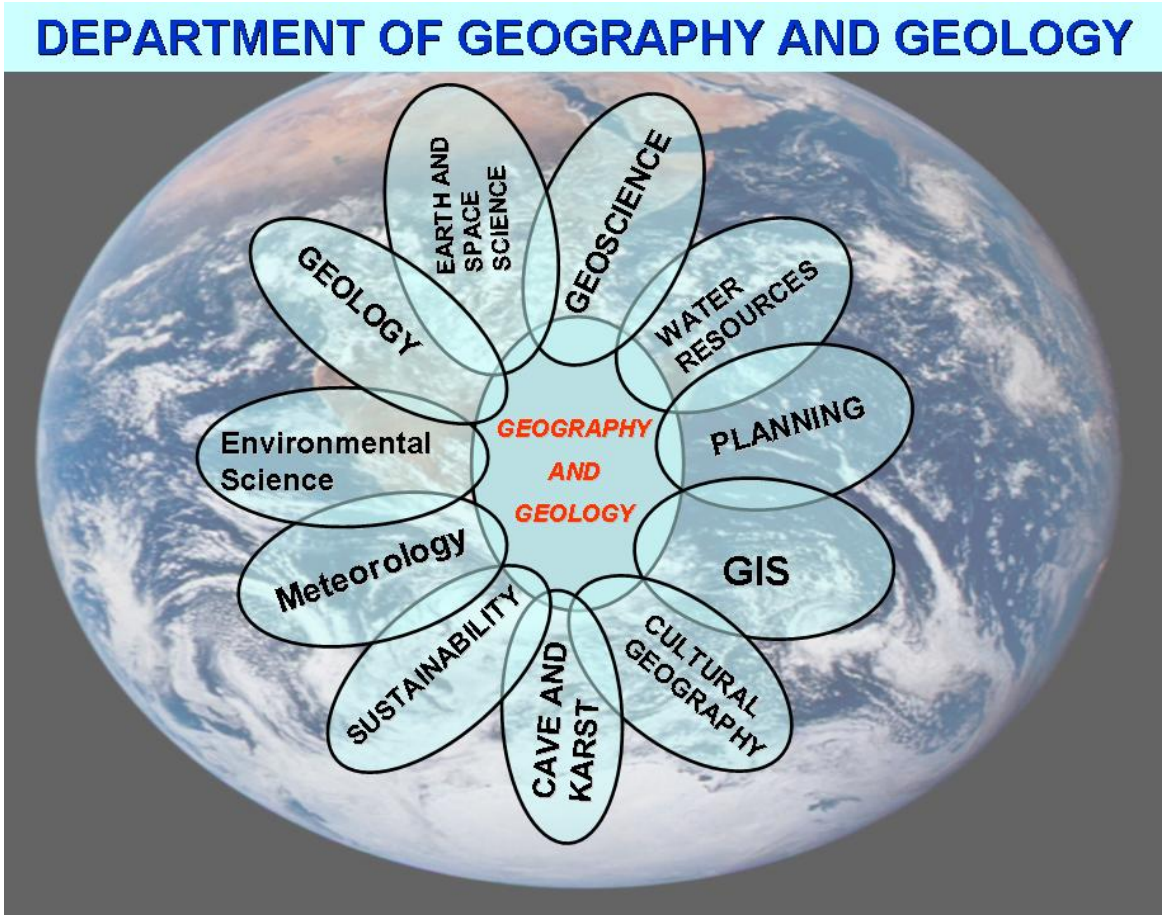
- Recognize science as a way of knowing, including its values and limitations;
- Achieve a depth and range of knowledge and skills in their discipline or in a multidisciplinary area;
- Develop abilities of reason and imagination; collect and analyze data, synthesize and draw conclusions; effectively communicate with others;
- Experience discovery, design, or application within the discipline and beyond;
- Evidence a commitment to an examined and evolving set of values and professional ethics, leading to informed decisions and including contributions to the discipline and to society;
- Become knowledgeable in the discipline, prepared for the future, and competitive in a global environment.

The Department of Geography and Geology offers four majors (Geography, Geology, GIS, and Meteorology) and eight minors (Geography, Geology, Planning, Earth Science, Environmental Studies, Water Resources, GIS, and Sustainability). In addition, undergraduate and graduate GIS Certificate programs are offered, along with a research-thesis based graduate program in the geosciences and an MAE in Geography Education for Teacher Leaders (with Cultural Geography and Earth Science Education emphases). The Department co-oversees the Latin American Studies minor (Dr. David Keeling and Dr. Marc Eagle (History) are co-advisers) and also contributes to the general education mission of WKU, Leadership Studies, the Floodplain Management minor, and a number of other majors and minors across the institution.

The majors and minors are traditional science programs that require 36-60 credit hours and 21-24 credit hours respectively. The Geography (674) and Geology majors (677, 676) both require a minor or second major. The professional Geology (577), Meteorology (578), and GIS (Geographic Information Science, 576) majors do not require a minor or second major. Several of our students are double majors; some majoring in both Geography and Geology, while others major in one and have a major in another department. Many of our students also major and minor within the Department, such as a Geology major and Geography minor, or a Geography major with a Sustainability minor. Within the Geography major, five options are available to students: Cultural Geography; Planning and GIS; Environment and Sustainable Development; Land, Weather, and Climate; and Honors. A sixth option – Karstic Studies – is in development and will be inaugurated in Fall 2011. These options recognize the significant diversity of geography as a discipline and permit students to focus on a specific area of interest. Each option within the Geography program requires a common set of technical courses and a common set of foundational and capstone courses, with electives varying by program option. The curricula options for Meteorology, Geology, and GIS are prescribed, but with electives appropriate for each major. The Geology major offers both a B.S. (677) and a B.A. (676) option. Students choosing the B.A. Geology program have two emphases: Earth and Space Science and General Geoscience. The majority of students choosing the B.A. program aim to become P-12 teachers or have no ambitions to work as a professional geologist. The B.A. Geology program requires fewer Math, Chemistry, Physics, or Biology courses as supporting coursework, compared to the B.S. Geology programs (577, 677).

In its major programs (as well as the minors), the Department attempts to strike an important balance between the theoretical and the practical-applied aspects of the disciplines. Many of our students pursue work in GIS, Geology, Meteorology, or Geography because of a strong passion for the subject matter, and do not always see their studies directly related to a future profession. Nonetheless, the Department annually has students go on to graduate programs or careers in these disciplines and faculty realize that the programs should prepare them for that level of academic and professional work. Finally, many courses in the Department also fulfill General Education requirements and students end up in classrooms primarily for this reason. The multiple purposes that the Department's courses and curricula serve make the faculty's work challenging and rewarding.

The image below provides a visual summary of the depth and breadth of the Department's teaching, research, and service activities. The geosciences are holistic in nature and the various sub-disciplines under the departmental umbrella examine a broad range of human-environment issues and challenges.



II. Departmental Enrollment, Faculty, and Resource Data:

Table II-A: Student Credit Hours Produced (SCHP)

	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
TOTAL SCHP	7,054	6,766	6,820	6,667	5,992
% on Main Campus	89%	92%	92%	91%	89%
% at Regional Campuses	11%	8%	8%	9%	9%
% Distance Learning	0%	0%	0%	0%	2%
% by Full-time Faculty	79%	82%	85%	82%	83%
% by Part-time Faculty	21%	18%	15%	18%	17%
% Undergraduate	97%	98%	97%	97%	97%
% Graduate	3%	2%	3%	3%	3%

SCHP is calculated by multiplying the number of students enrolled in a course by the credit hours offered for the course. (e.g., 30 students enrolled in a three-credit hour course would be equivalent to 90 SCHP.) On-Campus includes courses taught at WKU's main and south campuses. Extended Campus includes courses taught in Glasgow, Elizabethtown, and Owensboro. Distance Learning includes all other courses, including correspondence, Web, KVU, SPAN courses and courses taught at special locations.

The key trend to note in Table II-A is the decline in total SCHP between 2005 and 2009 (Fall 2010 numbers are 6,696). As detailed in the previous program review (which merited an **"enhance"** rating from the review committee), beginning in 2003-2004, the Department began to invest significant resources and faculty time in building a GIS program. The GIS courses, along with many meteorology, geology, and geography courses are lab-based, with enrollments typically capped at 15-20 students per section (compared with a general education course that typically enrolls 40-60 students). Although the Department's overall FTE faculty lines have increased, the Department since 2004 has placed **significant emphasis on graduate instruction** (the program is research-thesis based), **student research engagement beyond the classroom** (meeting WKU's QEP requirements), and **smaller, more focused course sections** (technique courses). In addition, the Department in 2004 began a program of major room renovation, reducing the number of seats in all of its instructional classrooms by 25% to **eliminate overcrowding** (for example, EST 337 was reduced from 80 crammed-in, 1950s-style desk-chairs to 48 lab-format table-chairs) and to facilitate more hands-on use of maps, physical materials, and other relevant learning tools. Beginning also in 2004, the Department raised its expectations of students in terms of applied study and supporting coursework. Historically, the faculty in the Department supervised graduate thesis research or undergraduate independent research projects in addition to their regular load without workload compensation. Since 2004, the Department has credited faculty according to the formula provided in the WKU Faculty Handbook for this non-standard coursework. At the beginning of the Fall 2010 semester, for example, the Department owed faculty 37 workload hours (the equivalent of twelve 3-hour courses) in compensation for SCHs generated from graduate theses and independent research projects. For Fall 2010, for example, the faculty generated 157 SCHs in graduate thesis and undergraduate research projects, equal to about 11 full-time students, requiring one full-time faculty member for supervision.

Finally, changes to the General Education structure in 2004-2005 resulted in fewer hours needed in categories C and D respectively. Consequently, enrollment in GE0G 101 Human Geography (category C), for example, dropped from over 200 students per semester to about 50 each semester. Accordingly, the Department has chosen to reduce the number of sections of general education courses offered each semester in order to focus on coursework for its majors and graduate students. Lower division general education credit hours since 2004 have declined steadily, whereas upper division and graduate hours are increasing. For example, in Spring 2010, the Department generated 2,078 SCHs at the upper-division level, compared to 1,642 in Spring 2005. Overall, the Department has reduced its offerings of general education courses by about 750-1000 SCHs each semester, depending on available adjuncts, graduate students, and full-time faculty.

Table II-B: Average Class Size for Lower Division, Upper Division, and Graduate Courses:

Division	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Lower	36	38	36	35	33
Upper	16	14	15	14	15
Graduate	7	3	5	3	4

Lower division consists of 0-299 level courses, upper division consists of 300-499 level courses, and graduate courses consist of 500+ level courses. All 400G course counts are rolled up under their respective master 400-level section. Excludes applied music, coop, independent study, internship, correspondence, research, and maintaining matriculation courses.

No significant change in average class size over the review period. The Department has balanced the loss of available seats in the renovated EST classrooms by scheduling more large (100 seat) sections for general education courses.

Table II-C-1: Number of Faculty Holding Rank in the Department:

Budgeted FTE Faculty Positions	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Budgeted FTE	22	22	23	24	24

Sources: WKU Salary Lists. Department Heads and Optional Retirees count as 0.5 FTE faculty members.

Full-time Faculty by Rank	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Professor	5	6	6	5	5
Assoc. Professor	4	4	3	5	5
Asst. Professor	7	7	8	6	8
Instructor	6	6	7	8	7
No Rank	0	0	0	0	0
Total Full-time	22	23	24	24	25

Data are taken from Workload and include only full-time faculty in the fall semester.

Table II-C-2: Full-time instructional Faculty

Faculty Member	Primary Program(s) Supported	Other Program(s) Supported
Algeo, Katie	Geography (Cultural and GIS)	GIS, Geoscience
All, John	Geography (Environment)	Geoscience
Blackburn, Will	Geography (General Education)	
Cary, Kevin	GIS	Geography (GIS and Planning)
Celestian, Aaron	Geology	Geoscience
Crowder, Margaret	Geology (General Education)	
Dobler, Scott	Geography	Meteorology, GIS
Durkee, Joshua	Meteorology	Geography, Geoscience
Fan, Xingang	Meteorology	Geography, Geoscience
Florea, Lee	Geography (Physical)	Geology, Geoscience
Foster, Stuart	Geography	Meteorology, Geoscience

Goodrich, Greg	Meteorology	Geography, Geoscience
Gripshover, Peggy	Geography (Cultural)	Geoscience
Groves, Chris	Geography (Physical)	Geology, Geoscience
Keeling, David	Geography (Cultural)	Latin American Studies, Geoscience
Kreitzer, Debbie	Geography (General Education)	GIS
Kuehn, Ken	Geology	Geoscience
Mahmood, Rezaul	Meteorology	Geography, Geoscience
May, Mike	Geology	Geoscience
Nemon, Amy	Geography (General Education)	
Polk, Jason	Geography (Physical)	Geology, Geoscience
Reader, Daniel	Geography (Environment)	Sustainability
Siewers, Fred	Geology	Geoscience
Wulff, Andrew	Geology	Geoscience
Yan, Jun	GIS	Geography, Geoscience

Table II-C-3: Student Credit Hours per Full Time Equivalent Faculty

Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
344	335	330	338	315

SCHP is calculated by multiplying the number of students enrolled in a course by the credit hours offered for the course. (e.g., 30 students enrolled in a three-credit hour course would be equivalent to 90 SCHP.) FTEF is calculated according to WORKLOAD definitions: 1 FTEF = 12 credit hours per semester.

Credit hours per FTEF have declined over the past five years primarily because of smaller class sections required for new GIS courses and other lab-based courses, and an increase in the number of graduate and undergraduate research courses that require significant faculty supervision. In addition, changes in the capacity of primary instructional rooms and caps on specific courses (especially online GIS and general education courses) have reduced the overall SCH/FTEF ratio. This reduction is in line with the underlying philosophies of WKU's Quality Enhancement Program (QEP), which emphasizes student engagement and quality over quantity.

Table II-C-4: FTE Part-time Faculty:

Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
4.33	4.42	3.33	3.67	3.17

FTEF is calculated according to WORKLOAD definitions: 1 FTEF = 12 credit hours per semester.

The Department has reduced its reliance on part-time faculty by hiring a full-time instructor to serve the Glasgow and Elizabethtown campuses, and by hiring a full-time instructor to teach several courses each semester on the Glasgow campus. The Department also has developed a number of online GIS and general education courses now taught by both regular and adjunct faculty. Adjunct faculty are still needed for course offerings at Owensboro and to supplement main campus general education and specialty course offerings.

Table II-D: Student/Faculty Ratio

Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
22:1	21:1	21:1	21:1	20:1

Student/Faculty Ratio is calculated as FTES/FTEF. 1 FTES= Undergraduate SCHP/16 or Graduate SCHP/12.
FTEF is calculated according to WORKLOAD definitions: 1 FTEF = 12 credit hours per semester.

Reductions in the student-faculty ratio have been achieved by restructuring room capacities and by focusing on student engagement beyond the traditional classroom in credit-generating research courses. The Department aims to reduce the overall student-faculty ratio to 16:1, which is the benchmark for lab- and research based geoscience programs across the U.S.

Table II-E: Total Student Credit Hours Produced in Summer and Winter Terms

	2005	2006	2007	2008	2009
SUMMER	909	655	479	489	451

	2006	2007	2008	2009	2010
WINTER	195	150	198	143	121

Fewer students are enrolling in winter and summer courses overall, based on these data. The Department offers study away and study abroad programs during these terms, and has introduced a variety of non-general education courses in recent years to boost summer-term enrollment. An additional consideration is that many faculty have declined to teach a course during these terms, especially those who are funded by external grants and need to focus their time during these terms on research and publication efforts.

III. Qualifications and Credentials of Departmental Faculty:

Table III-A: Rank of Full-time Faculty:

Faculty Member	Rank	Graduate Faculty Status	
Algeo, Katie, Ph.D.	Associate Professor - Tenured	Associate	10/11/2013
All, John, Ph.D., J.D.	Associate Professor - Tenured	Associate	11/11/2016
Blackburn, Will, M.S.	Instructor, Continuing		
Cary, Kevin, M.S., GISP	Instructor, Continuing	Adjunct	11/11/2012
Celestian, Aaron, Ph.D.	Assistant Professor – Tenure Track	Associate	12/13/2011
Crowder, Margaret M.S.	Instructor, Continuing		
Dobler, Scott, M.S.	Instructor, Continuing		
Durkee, Joshua, Ph.D.	Assistant Professor – Tenure Track	Associate	10/9/2012
Fan, Xingang, Ph.D.	Assistant Professor – Tenure Track	Associate	10/15/2013
Florea, Lee, Ph.D.	Assistant Professor – Tenure Track	Associate	10/9/2012
Foster, Stuart, Ph.D.	Professor - Tenured	Regular	10/1/2010
Goodrich, Greg, Ph.D.	Assistant Professor – Tenure Track	Associate	4/8/2014
Gripshover, Peggy, Ph.D.	Assistant Professor – Tenure Track	Associate	10/15/2013
Groves, Chris, Ph.D.	Professor - Tenured	Regular	2/8/2013
Keeling, David, Ph.D.	Professor - Tenured	Regular	7/9/2015
Kreitzer, Debbie, M.S.	Instructor, Continuing		
Kuehn, Ken, Ph.D.	Professor - Tenured	Regular	2/8/2013
Mahmood, Rezaul, Ph.D.	Associate Professor - Tenured	Associate	11/9/2012
May, Mike, Ph.D.	Professor - Tenured	Regular	2/1/2010
Nemon, Amy, M.S.	Instructor, Continuing		
Polk, Jason, Ph.D.	Assistant Professor – Tenure Track	Associate	10/15/2013
Reader, Daniel, M.S.	Instructor, Temporary		

Siewers, Fred, Ph.D.	Associate Professor - Tenured	Associate	8/31/2010
Wulff, Andrew, Ph.D.	Associate Professor - Tenured	Associate	11/9/2010
Yan, Jun, Ph.D.	Associate Professor - Tenured	Associate	2/12/2013

B. Number and Overall Percentage of Full-time Faculty with Terminal Degrees in the Discipline They are Teaching:

Eighteen faculty in the Department have the terminal doctoral degree in their respective programs, which equals 72% of the full-time faculty and 100% of tenure-track and tenured faculty.

C. List Faculty Holding Rank in the Department who have Non-teaching Assignments (e.g. Research, Administrative, Grants) and Provide an Indication of the Nature of the Alternate Assignment:

Aaron Celestian, Director, Applied Materials Institute.
Xingang Fan, P.I., NASA modeling project.
Stuart Foster, Director, Kentucky Mesonet and Kentucky Climate Center (grant funded), and State Climatologist.
Chris Groves, Director, Hoffman Environmental Research Institute and China Environmental Health Program (grant funded).
David J. Keeling, Department Head
Ken Kuehn, Interim Department Head, Interdisciplinary Studies, University College.
Rezaul Mahmood, Associate Director, Kentucky Mesonet and Kentucky Climate Center (grant funded).
Jason Polk, Associate Director, Hoffman Environmental Research Institute (grant funded).

D. Participation of Faculty in Multiple Programs within the Department or Other Departments:

Refer to the faculty listing in Table II-C-2 above. There is significant interdisciplinary teaching and collaboration in the Department, with several courses cross-listed with geography and geology. A course dealing with Africa and African-American culture is cross-listed with African American Studies, Latin American courses contribute to the Minor in Latin American Studies, and the Geography of Asia and the Geography of the Middle East courses contribute to the Asian Studies major. Historic Preservation is cross-listed with a Folk Studies course of the same name, and several courses are cross-listed or available through the Leadership Studies program. Geography, Geology, and GIS courses are required in Teacher Education, Engineering, International Affairs, Social Studies, International Business, Computer Information Systems, and other majors and minors across campus. The faculty also teach courses that count toward the Women's Studies minor, Kentucky Studies certificate, the Southern Studies minor, and the new

major in Popular Culture. Several faculty members regularly teach Honors sections of General Education courses and the department offers HEEC components to several courses. Faculty have served on Honors thesis committees, as well as Master's thesis committees in other departments.

E. Number/Utilization of Part-time Faculty:

The department utilizes a small number of part-time faculty (three to five each semester), mostly to meet the demand for lower level General Education courses on campus and specialty courses at Owensboro. Two of our adjunct instructors teach online classes.

F. Other Indicators of Faculty Quality:

Table III-F: Faculty Awards, Recognitions, and Certifications

Faculty Member	Awards and other Recognitions	Licensure, Certification
All, John, Ph.D., J.D.	Fulbright to Nepal 2009-2010	Licensed Attorney
Cary, Kevin, M.S., GISP	KAMP Outstanding GIS 2009-10	Certified GIS Professional
Celestian, Aaron, Ph.D.	First Director of the Advanced Materials Institute at WKU	
Crowder, Margaret M.S.	Ogden Public Service, 2007-2008 SGA Ogden Professor of the Year Young Careerist of south-central Kentucky, 2006	
Dobler, Scott, M.S.	Kentucky State Geographer, 2006	
Durkee, Josh, Ph.D.	Awardee, North American Association of Summer Sessions Creative and Innovative Program, 2010.	
Foster, Stuart, Ph.D.	Kentucky State Climatologist	
Goodrich, Greg, Ph.D.	Friend of KAP Award, Kelly Autism Program Professor of the Year, Phi Eta Sigma Honor Society SGA Advisor of the Year 2009	
Gripshover, Peggy, Ph.D.	Co-Editor of *FOCUS on Geography*	
Groves, Chris, Ph.D.	University Distinguished Professor Ogden Public Service 2009-2010 Project Leader & Board of U.N. Water Programs President, Cave Research Foundation, 2006-2007 Board, Karst Waters Institute, 05-07	
Keeling, David, Ph.D.	American Geographical Society Board of National Councilors	

Kreitzer, Debbie, M.S.		GIS Certified
Kuehn, Ken, Ph.D.	University Distinguished Professor Emeritus Distinguished Service – Society for Organic Petrology	Professional Geologist (PG)
Mahmood, Rezaul, Ph.D.	Editor, *Earth Interactions* WKU Research Award 2005-2006 Ogden Research Award 2005-2006	
May, Mike, Ph.D.	Ogden Public Service 2003-2004	Professional Geologist (PG)
Wulff, Andrew, Ph.D.	WKU Teaching Award 2006-2007 Ogden Teaching Award 2006-2007	
Yan, Jun, Ph.D.	2010 Michael Breheny Prize for Best Journal Paper, *Environment & Planning B.*	

G. Special Qualifications of any Faculty Member (Full or Part Time) Whose Credentials do not Meet SACS Guidelines for the Level and Discipline They are Teaching:

All faculty members meet SACS guidelines.

IV. Departmental Faculty Productivity 2004-2010:

A. Scholarship:

The Department enjoys an excellent national and international reputation for research and scholarly activity. Over the past six years, faculty have published 92 peer-reviewed journal articles, 25 chapters in academic books, 13 articles in conference proceedings, 22 nationally published Op Ed commentaries, four field guides, 50 articles in newsletters, non-peer-reviewed journals, and other academic or community outlets, and served as editors or contributing editors to a number of academic journals (see Table IV-A-1 in the Appendix, p.14). Many of these publications are in high-impact journals, and demonstrate the tremendous increase in the overall level of scholarly productivity of the faculty compared to the previous program review period. The Department conducts and publishes research at the intersection of the human-environment condition. With expertise in climate processes, water resources, geology, historical geography, transportation, geographical information science, karst landscapes, planning, cultural geography, materials, and environmental policy, to name just a few of the Department's research themes, faculty conduct applied and basic research in the local, national, and international arenas. With widely recognized research centers - the Hoffman Environmental Research Institute, the China Environmental Health Program, the Applied Materials Institute, the Kentucky Mesonet, and the Kentucky Climate Center - faculty and students are actively engaged in research projects in local and regional communities (water, radon, karst, environment, fossil fuels, transport, etc.) and internationally in Asia (China, Nepal), Latin America and the Caribbean (Argentina, Colombia, Barbados, Bahamas, Jamaica, Haiti, Belize), Africa (Botswana), and Europe (U.K., Slovenia). See Table IV-A-2 in the Appendix (p. 15) for details of individual faculty research statements.

An important element in the Department's educational mission is the dissemination of knowledge to scientific peers and the wider community through conferences, talks at other universities, and presentations to community constituencies. During the review period, faculty gave 256 scientific presentations at local, regional, national, and international conferences, including meetings convened in China, Slovenia, Nepal, and destinations across North America. Faculty gave talks at 29 other universities, and 265 presentations at workshops and in the community for such organizations as the Rotary Club, Far Away Places, and community groups.

In addition, several faculty are engaged in the scholarship of teaching, with research aimed at understanding how, why, and when students learn basic and advanced material. Many faculty have developed and use "comfort" surveys and foundational data to understand the preparation of students coming into general education or introductory courses. Understanding how students engage with, retain, and apply relevant information in any course is critical to improving pedagogical methods and motivating students to perform at a higher level.

Faculty International Reach:

The Department of Geography and Geology has long been a leader in extending the international reach of WKU. During the current review period, faculty and students have lectured, conducted research, taken classes, and explored **over 50 countries on all six continents** (Dr. Trapasso, now in transitional retirement status, has previously visited Antarctica, giving the Department a physical presence on all seven continents). Since 2004, the Department has led study abroad programs to Australia, Argentina, the Bahamas, Belgium, Chile, Egypt, France, Greece, Ireland, Italy, Mexico, Slovenia, Tanzania, Turkey, and the United Kingdom. Currently active research programs in China, Botswana, Nepal, Colombia, Argentina, England, Barbados, Belize, Haiti, Puerto Rico, and Jamaica give the Department a research presence on five continents. The Department partners with the Kentucky Institute of International Studies (KIIS) to offer a summer program in Argentina (2010 and 2011) led by Dr. David Keeling, and has developed a departmental program to China for summer 2011 led by Dr. Jun Yan.

B. Service 2004-2010:

For many decades, the Department of Geography and Geology has enjoyed an enviable reputation for service to the institution, the local and regional community, and to society at large. Faculty contribute to the governance of WKU in a variety of important ways, from service on the University Senate to departmental and college committees that address myriad day-to-day issues. In their local and regional communities, faculty are actively engaged in helping to steward a high quality of life, lending expertise to many cultural, social, political, and economic endeavors. Faculty also excel in providing service to their respective disciplines, with contributions to advisory councils and boards of directors at the regional, national, and international levels. Faculty routinely peer review manuscripts and book proposals for professional journals and academic publishers. The list of service activities detailed in Table IV-B-1 in the Appendix (p. 20), coupled with a statement of service relevance by each faculty member (Table IV-B-2, Appendix, p. 25)), summarizes the significant contributions that department faculty, along with students in many instances, make to their respective communities.

C. Grant and Contract Activity 2004-2010:

The Department is very active in seeking extramural funding, with over $10 million in funding received since Fall 2004. Faculty in the Department consistently compete for grant funding at the regional and national level, in addition to internal funding opportunities. **There are too many grant submissions to detail individually** (over 200 individual proposals during the review period), as many of these submissions do not get funded but they eventually lead to other opportunities that do get funded. Details of successful faculty funding are listed in Table IV-C-1 and Table IV-C-2 in the Appendix (pp.31-33).

In addition, the Department actively seeks internal funding from a variety of recurring and non-recurring sources, such as PIE grants, Academic Quality grants, equipment and room renovation funds, Gatton Academy and Honors program funds, and various Science Alliance sources. Most of these grants are non-competitive, although each grant application requires justification and are reviewed for relevance by the funding department or unit. During the review period, the Department received in excess of $250,000 in internal funding from sources not listed in the table below for equipment and classroom/laboratory improvements. Another measure of departmental success as an academic unit is the annual **Unit Productivity Award** – since the Award's inception in the 1998-1999 academic year, the Department has been awarded $61,750, an amount that places the Department in the top tier of awardees historically and surpassed by only four other departments. In recent years, the Department has regularly been awarded the highest amount available, in recognition of its overall excellence in faculty productivity and student engagement.

APPENDICES (Supporting Data Tables)

Table IV-A-1: Faculty Scholarship and Creative Activity

Faculty Member	Publications Fall 2004-2010	Presentations
Algeo, Katie, Ph.D.	3 Articles (PR) 2 Book Chapters 1 Proceedings 1 Other Articles	17 Conferences 1 University 7 Other Talks
All, John, Ph.D., J.D.	7.5 Articles (PR) 4 Book Chapters 1 Proceedings 7 Other Articles	21 Conferences 8 Other Talks
Blackburn, Will, M.S.	N/A	2 Conferences
Cary, Kevin, M.S., GISP	1 Article	6 Conferences 11 Other Talks
Celestian, Aaron, Ph.D. (Since Fall 2007)	5 Articles (PR) 1 Book Chapter 1 Other Article	3 Conferences 4 University
Crowder, Margaret, M.S.	N/A	6 Conferences 6 Other Talks
Dobler, Scott, M.S.	1 Article (PR)	16 Conferences 15 Other Talks
Durkee, Joshua, Ph.D. (since Fall 2008)	6 Articles (PR) 2 Book Chapters 1 Proceedings	4 Conferences 18 Other Talks
Fan, Xingang, Ph.D. (Since Fall 2009)	N/A	2 Conferences 6 Other Talks
Florea, Lee, Ph.D. (Since Fall 2008)	2 Articles (PR) 4 Book Chapters 1 Proceedings	6 Conferences 2 Universities
Foster, Stuart, Ph.D.	7 Articles (PR) 1 Book Chapter	22 Conferences 1 University 37 Other Talks
Goodrich, Greg, Ph.D. (Since Fall 2005)	15 Articles (PR) 1 Proceedings	15 Conferences 7 Other Talks
Gripshover, Peggy, Ph.D. (Since Fall 2009)	1 Journal Editorship	3 Conferences 1 Other Talk
Groves, Chris, Ph.D.	8 Articles (PR) 4 Book Chapters 4 Proceedings 8 Other Articles	38 Conferences 4 University 10 Other Talks
Keeling, David, Ph.D.	7 Articles (PR) 2 Book Chapters 22 National Op Eds 9 Other Articles	9 Conferences 7 University 70 Other Talks
Kreitzer, Debbie, M.S.	N/A	8 Conferences 3 Other Talks
Kuehn, Ken, Ph.D.	1 Article (PR) 1 Proceedings 14 Other Articles	16 Conferences 1 University 9 Other Talks

Mahmood, Rezaul, Ph.D.	21 Articles (PR) 2 Book Chapters 5 Other Articles	11 Conferences 2 University
May, Mike, Ph.D.	1 Article (PR) 1 Book Chapter 2 Other Articles	16 Conferences 1 University 26 Other Talks
Nemon, Amy, M.S.	N/A	3 Conferences
Polk, Jason, Ph.D. (Since Fall 2009)	1 Article (PR)	1 Conference 1 University 7 Other Talks
Reader, Daniel, M.S.	N/A	3 Conferences 3 Other Talks
Siewers, Fred, Ph.D.	1 Article (PR) 1 Proceedings (ed.) 2 Proceedings 3 Other Articles	15 Conference 3 Other Talks
Wulff, Andrew, Ph.D.	1.5 Articles (PR) 1 Other Article	7 Conferences 4 University 10 Other Talks
Yan, Jun, Ph.D.	5 Articles (PR) 2 Book Chapters 3 Proceedings 1 Other Article	12 Conferences 1 University 2 Other Talks

Table IV-A-2: Faculty Research Focus

Katie Algeo Associate Professor Cultural Geography and GIS Ph.D. Louisiana State	Katie Algeo's scholarship focuses on the historical geography of the Mammoth Cave region. This research agenda has two components: 1) the development of tourism to the cave (which so far has resulted in one book chapter, three articles, fifteen conference presentations, and a book in preparation); and 2) creation of a web-accessible historical GIS of the communities that existed in the area before Mammoth Cave National Park was created (which so far has resulted in one book chapter, two graduate student theses, five presentations, and an article under review). This body of work is starting to attract the attention of the scholarly community, for a presentation at an October 2010 conference has just elicited an unsolicited contract from an academic publisher to turn the conference paper into a monograph. The Mammoth Cave Historical GIS is a work of great interest to the local community, as evidenced by enthusiastic receptions to presentations at four annual Mammoth Cave Homecoming events and one at the Barren County Historical Society. Moreover, the expertise gained during work on this project is being leveraged to the benefit of students in the form of a new class on Historical GIS to be offered during Spring 2011. Dr. Algeo's research interests also include the pedagogy of teaching cultural geography, an effort that has resulted in one article, another article accepted for publication pending minor revisions, and two conference presentations.
John All Associate Professor Environmental Geography Ph.D. Arizona	Evaluating Environmental Response to Climate Variability Utilizing Remote Sensing—The general purpose of Dr. All's research is to evaluate anthropogenic climatic disturbance and environmental response utilizing remote sensing technologies. Calculation and prediction of policy ramifications and outcomes responding to climatic change are important aspects of his research program that enables him to utilize his background in

	environmental law to develop societal response scenarios cognizant of environmental perturbations. One specific research focus involving global climate change is the impact of recent climate variability on both natural and managed vegetation, especially in mountain regions.
Aaron Celestian Assistant Professor Materials Characterization (since Fall 2007) Ph.D. Stony Brook	Dr. Aaron Celestian is a mineralogist interested in Earth materials, material synthesis, and the determination of atomic arrangements in condensed matter. A primary goal of his research efforts is to quantify the mobility and reaction mechanisms of molecular species in, on, and around natural and engineered materials in a wide variety of environmental, geological, and planetary applications. Molecular scale processes are the basis for macroscopic properties, and understanding the controls of those processes will lead to new discoveries of molecular interactions and the development of new materials. In order to determine how materials behave under environmental conditions, Dr. Celestian and his group develop custom experimental cells that allow real-time studies to be performed in situ under extreme environmental conditions (pH, temperature, pressure, etc.). At WKU, the Crystal Kinetics Laboratory, and the Advanced Materials Institute provide undergraduate and graduate students with state-of-the-art analytical and computational facilities. Dr. Celestian and his group frequently travel to national and international laboratories to take advantage of unique experimental capabilities at the brightest neutron and X-ray sources in the world.
Joshua Durkee Assistant Professor Climate, Meteorology (since Fall 2008) Ph.D. Georgia	Dr. Durkee's initial studies on precipitation, mesoscale convective complexes (MCCs), and non-convective high-wind events (NCWEs) have led to a total of five peer-reviewed publications in leading atmospheric science journals, two book chapters, and one conference proceeding since Fall 2008. This work has served as a foundation for continuing research and collaboration in these areas of research. Currently, he is finishing a third manuscript relating to MCCs in South America. He presented the initial findings at the American Geophysical Union conference in Brazil in August 2010, which were well-received. Also during that conference, Dr. Durkee met some potentially new collaborators from South America and Europe that expressed interest in working with him to continue the research on South American MCCs. He has also submitted an internal grant at WKU to have two undergraduate students work on constructing a new thunderstorm dataset for South America. He is also currently finishing a diagnostic case study of a NCWE, as well as an NCWE climatology for the eastern U.S., both of which will be submitted for peer review.
Xingang Fan Assistant Professor Climate Modeling (since Fall 2009) Ph.D. Lanzhou, China	With the ongoing NASA-funded grant and the recent appointment of a visiting research scholar, the climate modeling and regional impact project is proceeding as scheduled. Three potential papers are expected to be published in 2011. Dr. Fan has several grant proposals are under development. One will be submitted to NOAA, one is in preparation for submission to the NSF. Dr. Fan has also applied for two internal grants, with one granted and one pending.
Stuart Foster Professor Methods, Climate, Cultural Ph.D. The Ohio State	Dr. Stuart Foster's research focuses on analysis of climatological data for Kentucky. Given public interest in historical climate and climate change, Dr. Foster and Dr. Mahmood, associate director of the Kentucky Climate Center, have published peer-reviewed research involving field work and statistical analysis of historical climate data to assess the effects of micro-scale forcings associated with instrument exposures that produce biases in weather and climate observations. He has also developed a suite of interactive, web-based data visualization software applications that enable users of the Kentucky Climate Center website to acquire and explore climate data. Along with colleagues, he has published and presented research highlighting challenges and lessons learned from building and operating the Kentucky Mesonet. Recently, his efforts have increasingly focused on identifying opportunities for

	applied research using data from the Kentucky Mesonet to bring value to public- and private-sector entities.
Gregory Goodrich Assistant Professor Meteorology (Since Fall 2005) Ph.D. Arizona State	Greg Goodrich's research focuses on how multi-decadal climate teleconnections, such as the Pacific Decadal Oscillation (PDO) and the Atlantic Multidecadal Oscillation (AMO), influence precipitation patterns associated with interannual teleconnections such as the El Niño-Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO). He is especially interested in the impact of drought and precipitation patterns on any number of variables affected by climate, including forest fires, wine quality, and air pollution. Dr. Goodrich is also interested in climate regionalization and has developed seasonal drought models based on a number of climatic variables. Much of his research has focused on the drought-plagued Colorado River Basin, where ENSO and other teleconnections play such an important role in annual climate. From 2004-10, Dr. Goodrich has published 15 articles in a number of peer-reviewed Journals, including *Climate Research*, *Bulletin of the American Meteorology Society*, and *Weather and Forecasting*.
Peggy Gripshover Assistant Professor Cultural Geography (since August 2009) Ph.D. UT Knoxville	Dr. Gripshover's scholarly presentations relate to her research interests in cultural geography and her long-standing dedication to geography education. Her research on Chicago is reflected in her presentations on the city's annexation and baseball history. Both of her papers on Chicago are an outgrowth of her book project centered on the life and times of Charles H. Weeghman, the man who built Wrigley Field. Dr. Gripshover's presentations on geographic education and the history of geography are a continuation of previous research initiatives and public outreach efforts. Her scholarship contributions also extend to her co-editorship of the international journal *FOCUS on Geography*. She has also served as a manuscript reviewer for other journals.
Chris Groves Professor Karst, Water, Landscapes Ph.D. Virginia	Dr. Chris Groves is a WKU Distinguished Professor of Geography and director of the Hoffman Environmental Research Institute. He received a Ph.D. in Environmental Sciences at the University of Virginia in 1993. Since coming to WKU, Groves has received the Ogden College Awards for Outstanding Teaching (1995), Research and Creative Activity (2000) and Public Service (2010). Over the years he has developed an active international research program specializing in karst hydrogeology, geochemistry, and water resources, with recent peer-reviewed papers appearing in the *Journal of Environmental Quality*, *Journal of Hydrology*, *Journal of Contaminant Hydrogeology*, and *Environmental Geology*. Over the past decade, much of this effort has been working with colleagues to understand and improve karst water resources in southwest China through the programs of the China Environmental Health Project. Currently, Groves is Project Leader of the UNESCO/IUGS International Geoscience Program Project *Global Study of Karst Aquifers and Water Resources*, and he also serves on the Board of Governors of the International Research Center on Karst under the auspices of UNESCO. In 2010 he was nominated by China's Ministry of Land and Resources for the *China Friendship Award*, China's highest award for "foreign experts who have made outstanding contributions to the country's economic and social progress."
David J. Keeling Professor and Dept. Head Geography Ph.D. University of Oregon	David Keeling is a cultural geographer who addresses issues of transportation, sustainable development, globalization, urban growth, and regional change, with Latin America and Europe his primary areas of research. His recent research projects include a three-year long decadal assessment of research on transportation issues (published in *Progress in Human Geography)*, globalization's impact on Latin American societies (published in the *Journal of Latin American Geography)*, global transport infrastructure challenges (recently published in *FOCUS on Geography*), transportation challenges for

	Latin America (published in the *Journal of Latin American Geography (2008)*), landscape changes in World Cities, and the cultural geography of Rock and Roll music. Dr Keeling serves as the webmaster for the American Geographical Society and is also the Society's Assistant Treasurer. In his role as a Fellow and Councilor of the AGS, he contributes Op Ed pieces on issues of geopolitical or economic change (published in national and international media), and lectures around the world on AGS-sponsored educational geography expeditions. Dr. Keeling also frequently leads departmental study abroad programs to various corners of the globe, with recent programs visiting Argentina, Turkey, Greece, Italy, Slovenia, Mexico, England, Belgium, Egypt, and France, with future programs in Argentina (2011) and Southeast Asia (2012). Both undergraduates and graduates are encouraged to participate in research projects underway in the Department, including those available through the Hoffman Environmental Research Institute and through the new Kentucky MesoNet initiative. Dr. Keeling recently directed a research project in Colombia with the support of the American Geographical Society's Bowman Expeditions, and is currently studying a rail bypass project in Lincolnshire, UK.
Ken Kuehn Professor Geology, Fossil Fuels Ph.D. Penn State	Dr. Kuehn's current scholarly activity primarily involves evaluating the status of significant biotic and abiotic natural resources at three park units within the National Park Service. These projects are highly interdisciplinary by their nature and have provided unique opportunities to work with professionals from environmental science, ecology, geography, geology, and GIS for him and his students.
Rezaul Mahmood Associate Professor Climate, Soils, Modeling Ph.D. Oklahoma	Research activities are an integral part of the overall educational experience. Dr. Mahmood's research activities involve students significantly, as engagement in cutting-edge research makes a student more competitive in the job market. Student success beyond the university also helps the program recruit potentially high quality students. Dr. Mahmood's research activities addressed these issues and helped to fulfill departmental, OCSE, and WKU missions. His research objectives encompass national, regional, and international issues. The research topics include both basic and applied work. He is also very much involved in building a significant research infrastructure here at WKU. Over the years his research evolved around several themes, including: (1) modeling impacts of soil moisture on boundary layer atmosphere and soil moisture climatology; (2) land-use change and land-atmosphere interactions; (3) gaseous emissions from livestock facilities and air quality; and (4) meso-scale modeling of flash flooding and flash flood climatology of the Appalachians. He is also building the Kentucky Mesonet and WKU's HPCC. Both of these have provided significant opportunities for expanding Dr. Mahmood's and his students' research.
Michael May Professor Environmental Geology Ph.D. Indiana	Mike May's research efforts focus on the integration of surface (outcrop) rock data and subsurface data from the Mississippian and Pennsylvanian strata in south-central Kentucky in an effort to continue characterizing the Mississippian-Pennsylvanian unconformity and its associated geomorphic, climatic and structural (tectonic) variables that influenced development of incised valleys. Correlation of outcrop to subsurface data is resulting in construction of cross sectional views, 3-D block diagrams, as well as various maps. Many of the resulting products generated by this investigation can be linked to the Kentucky Geological Survey's GIS based interactive geologic map service available online. This research involves one MS student and at least three undergraduates who are also earning independent research credit by being engaged in this project. Research is also linked to the Reynolds Foundation proposal for development of a student centered cooperative-internship technology and research center to be networked with oil and gas

	companies prospecting and developing energy resources in the WKU service region.
Jason A. Polk Assistant Professor Hydrology, Geomorphology (since Fall 2009) Ph.D. South Florida	Jason Polk's research interests lie at the intersection of four core areas: (1) climate and environmental change, (2) water resource issues, (3) human-environment interaction, and (4) karst geomorphology. His current scholarly activities engage undergraduate (2 advisees) and graduate students (4 advisees) in projects that integrate some or all of these topics, including examining karst disturbance and human impacts in Puerto Rico, cave and karst water resource management in Florida, hydrological investigations in Jamaica, Mayan socio-cultural environmental interactions related to climate change from cave deposits in Belize, agricultural contaminant transport in epikarst and caves in Kentucky, cave resource inventory and survey at Dale Hollow Lake Resort State Park, and the geospatial environmental implications of White-nose Syndrome in bats. Since his arrival at WKU in 2009, Dr. Polk has published an article on cave resource inventory, has 4 in preparation or under review on subjects ranging from the Asian Monsoon to nitrate levels in groundwater, is working on a co-edited book chapter on drought and societal collapse, and has submitted 4 additional research grants under review this year.
Fred Siewers Associate Professor Sedimentary Geology Ph.D. Illinois	Dr. Siewers is a sedimentary geologist with interests in carbonate sedimentology, paleontology, and paleo-environmental change. His research in sedimentary geology focuses on diagenetic studies of carbonates and field studies of sedimentary successions. His current research in sedimentary geology is focused on two areas: 1) diagenetic and taphonomic studies of Pennsylvanian age peats (as preserved in "coal ball" concretions), and 2) sedimentary, geochemical and faunal analyses of saline lakes in the eastern Bahamas. Both research areas are in collaboration with faculty at WKU and other universities and involve undergraduate students working on independent research projects and honors theses. Dr. Siewers also has research interests in geoscience education - in particular experiential learning in the geosciences and the promotion of student engagement in geology curricula.
Andrew Wulff Associate Professor Geology, Volcanology Ph.D. UM Amherst	Dr. Andrew Wulff's recent research interests include the petrogenetic history of volcanic rocks in the Chilean Andes and Mojave Desert, the health effects of residential radon and airborne particulate quartz dust, geothermobarometry of various rocks in the Appalachians, and models of ore genesis. He is also interested in connections to anthropology/archeology such as the sourcing of chert artifacts using trace-element signatures, and modeling paleoenvironments associated with early hominid finds in Java. These research interests involve quantitative analysis of a wide variety of geological materials using XRF, XRD, ICP-MS, SEM and electron microprobe, and he is pleased to have both undergraduate and graduate students as colleagues in all aspects of these investigations. Dr. Wulff also has a strong interest in developing innovative teaching strategies for all levels and is active in contributing to the earth science curricula in the local school districts. He is the recipient of the WKU University Award for Excellence in Teaching and is active in training and leading workshops for pre- and in-service earth science teachers. Dr. Wulff serves as a research advisor for both graduate and undergraduate research projects of a wide diversity of topics. Students are expected to become proficient in analytical techniques, write grants, abstracts, and papers - and present research results at professional meetings.
Jun Yan Associate Professor GIS, Transportation	Dr. Jun Yan's research interests range from theoretical developments of GIScience, particularly in the area of spatio-temporal data mining, to the applications of GIS technologies and spatial quantitative methods in the fields related to urban and regional analysis, transportation, public safety and environmental studies. In recent years, he has devoted his efforts to exploring

Ph.D. Buffalo	the applicability of geo-computational methods in uncovering spatio-temporal patterns in various geographic fields, including transportation, public health, and climate research.

Table IV-B-1: Faculty Service

Faculty	University Service	External Service
Algeo	Ogden Dean's Advisory Committee Ogden Library Committee. Ogden Sabbatical Committee. Ogden Student Complaint Committee. Ogden Undergraduate Curriculum Com. MCNP Center for Science and Learning, Strategic Planning Committee	Friends of Dumont Hill Preservation Society, Board of Directors. Heart of Scottsville Main Street Program. Allen County Middle School Tutor. Allen County Historical Society Guide. SEDAAG Board, 2004-present. Webmaster, AAG Rural Geography Specialty Group. Judge, State GeoBee. Manuscript Reviewer, 4 journals.
All	Geography Program Leader, 2010-2012 WKU Leadership Fellow (Inaugural Selection), 2004–05 University Senate Member, 2003–08 Vice Chair, WKU Senate, 2005–08 Executive Committee, Senate, 2005–08 Institute for Sustainable Energy and Environment Executive Committee, 2008 - Present University Energy Conservation Task Force, 2008 - Present University Senate Faculty Welfare and Professional Development Committee Member, 2003-05 University Graduate Council, 2006-07 University Senate Subcommittee on Faculty Liability, Chair, 2004-06 Ogden College Space Utilization Committee, 2003 - Present University-wide Environmental Science Committee, 2003 - Present Faculty Advisor for the Graduate Geoscience Society, 2003 - Present	Member, International Union for the Conservation of Nature (IUCN), World Commission on Protected Areas (WCPA), Mountain Protected Areas Network. 2009–present American Association for the Advancement of Science, Committee Member for the Geology and Geography Section, 2004 - present American Alpine Club, Representative to the AAAS, 2004-present. National Conservation Committee Member (Science Advisor), American Alpine Club, 2006 - Present Editorial Review Board, The Open Remote Sensing Journal, 2008-present
Cary	Director, WKU Center for GIS GIS Program Leader, 2008-09	GIS Certification Reviewer KAMP Committee Southern KY GIS User Group, Past President
Celestian	Director, Advanced Materials Institute, 2010 –Present Materials Characterization Center Faculty, 2007–2010 Geology Program Webmaster, 2009–10 Department Library Liaison, 2008–10	Oak Ridge National Laboratory Science Review Committee, 2010–Present Associate Editor: *American Mineralogist*, Summer 2008 – Present Session Chair, GSA Conference, 2010 Manuscript Reviewer, academic journals

	Faculty Scholarship Council, 2008 –09 Member, Institute for Energy and Environmental Sustainability, 2008–09 Geography & Geology Senator, 2009–10 Faculty Welfare Committee, 2009–10	Examiner for the Kentucky State Science Olympiad, 2007–Present Community Service, identification of precious gems, 2009-10
Crowder	Science Alliance Chair, 2005-present Western Kentucky Math Science Partnership Advisory Board Committee member SKyTeach Steering Committee member Elementary Science Education Curriculum Committee member Ogden College Student Awards Banquet Committee, 2006, 2007 United Way Departmental Representative, 2006, 2010 SCATS Instructor (Hollywood Geology), 2009, 2010 Super Saturdays Instructor (Hollywood Geology), 2002-2009	McGraw-Hill Higher Education, 2009-2010 Section Chair, KAS, 2007 Section Secretary, KAS, 2006 Textbook reviews, McGraw-Hill Higher Education, 2004, 2006, 2007 KAS, Manuscript Reviewer, 2008 Christian Stewardship of the Environment, Franklin Presbyterian Church, 2009 Girls in Science (Volcano!), 2005-2010 VAMPY Instructor, 2008 Science Olympiad Tutor for Allen County Scottsville High School, 2007 Simpson County Democratic Party, Executive Committee member
Dobler	FaCET: Advisory Committee, 2004-10 Taiwanese Student Association Advisor: Faculty Mentor 2004-today	Kentucky Science Olympiad: Judge, Content & event coordinator, and State Finals coordinator 2004-today Kentucky Council for Geographic Names Authorities: 2004-today Chair, 2010 Kentucky Council for Social Studies: Steering Committee 2004-today Kentucky Geographic Alliance: Co-coordinator 2005-today Kentucky Army National Guard: Activated February 2009 – GIS Technician Emergency Management.
Durkee	Ogden College Faculty Awards Committee Member, 2010. Meteorology Technology Program Chair, 2009-2011. Faculty Liaison, WKU/WCEM Sky Warn Storm Spotter, "Storm Topper Network" 2008-Present. Faculty Liaison, Meteorology Club, 2008-present Graduate Council, 2008.	Numerous media contributions including WKU News, Bowling Green, KY Daily News, surrounding newspapers around KY and TN, local radio station WKCT, local television WNKY, WeatherBrains podcast radio, The Weather Channel, and the WKU Scholar, 2010 Cumberland Trace Elementary School, Severe Storms Awareness and Safety Workshop, Host, 2010. Science Olympiad, Site Exam Creator and Administrator, 2009-Present. CLIMLIST Administrator, 2009-Present. The First Lego League Robotics Tournament Judge, 2009 Manuscript Reviewer for 12 journals. Book proposal reviewer for publisher.
Fan	Focus on Western, recruiting, 2010 Judge, 40th annual WKU Research Conf.	Manuscript Reviewer for 2 journals. NASA external grant reviewer.
Foster	Director, Kentucky Climate Center Director, the Kentucky Mesonet	State climatologist for Kentucky Director, Kentucky Climate Center

		Director, the Kentucky Mesonet Mammoth Cave Biosphere Reserve Advisory Council Policy and procedures committee of the American Association of State Climatologists Co-chair of the Climate and Water Resources Data Team, Kentucky Drought Mitigation & Response Plan Advisor, Barren River Area Development District for natural hazard planning
Goodrich	Meteorology Program Leader, 2008- Graduate Program Committee, 2008- New Hire Committee, 2009 Ogden Faculty Awards, 2007-09 Cultural Geography Faculty Search Committee, 2008-09 Meteorology Faculty Search Committee, 2007-09 B.S. Meteorology Curriculum Committee, 2006-08	B.G. Snowfall Observer, NWS, 2009- Author, Kentucky Monthly Climate Summary, 2008- Young Scholar Director, Climate Specialty Group, 2007-09 Moderator, NWA meeting, 2008 Judge, Kentucky Science Olympiad, 06- Judge, AAG Student Competition, 2009 Judge, Lego Robotics, 2008-09 Judge, Kentucky Geography Bee, 06-07 Judge, Southern KY Middle School Science Fair, 2006 Judge, KAS Geology Poster, 2005 Manuscript reviewer for 8 journals
Gripshover	Departmental Senator (2010-11)	Co-editor, *FOCUS on Geography* Manuscript Reviewer for 2 journals Judge, Kentucky Science Olympiad SEDAAG Committees AAG World Geography Bowl Board Kentucky Geographical Alliance Board
Groves	Judge, WKU Student Research Conference Director, Hoffman Environmental Research Institute Director, China Environmental Health Project	Judge, Kentucky Geography Bee Board of Trustees, Kentucky Chapter of The Nature Conservancy President, Cave Research Foundation Board of Directors, Cave Research Foundation Project Leader, UNESCO International Geoscience Program Project 513 Board of Directors, International Research Center on Karst Academic Committee, International Research Center on Karst Board of Directors, Karst Waters Institute Organizing Committee, Karstological Academy (Slovenia) Co-Organizer, International Conference on Karst Hydrogeology & Ecosystems
Keeling	International Education Council Department Heads Advisory Council	Webmaster, American Geographical Soc. Councilor, American Geographical Soc.

	Leadership Advisory Council Ogden College Curriculum Committee Ogden Graduate Curriculum Committee Chair, Engineering Head Search Chair, Agriculture Head Search International Director Search Committee WKU Student Engagement Committee Graduation Ceremony Announcer Department Head	FOCUS Editors Search, Am. Geo. Soc. Websites Editor, Journal Latin Am. Geo. Editorial Board, Journal Transport Geog. MC, State Geography Bee Finals Reviewer for > 30 manuscripts Community Media Interviews
Kreitzer	Geography Club Advisor Honor's Day Program Producer Homecoming Organization Faculty Senator Faculty Welfare Committee SAGL Search Committee Ogden International Committee Senate Executive Committee	Science Olympiad Moderator 2003-2008 National Geographic Bee Moderator or Judge 2004-2009 Textbook reviewer for 4 textbooks Grant reviewer for one grant Study Abroad presenter at Warren Central High School AAG Geography Bowl Judge, 2009
Kuehn	WKU Education for Sustainability Steering Committee, Co-chair WKU Committee on Credits and Graduation, Vice-Chair Honorary Doctorate Selection Commte. FaCET Faculty Advisory Council Women's Studies, Faculty Fellow FaCET Faculty Fellow Men's and Women's Bowling Clubs, Faculty Advisor Ogden Graduate Council Ogden WKU Institute for Sustainable Energy and Development	Association of State Boards of Geology (ASBOG), Council of Examiners Kentucky Society of Professional Geologists, Executive Committee The Society for Organic Petrology (TSOP), Archivist, National Park Service, Geological Resources Division, Reviewer Karst Environmental Education and Protection Steering Committee. Friends of Lost River
Mahmood	Member, Dean's Advisory Committee, Ogden College. Chair, WKU HPCC committee.	Editor, *Earth Interactions* External Dissertation Committee, The University of New South Wales, Sydney, Australia, 2009. Panel Chair and session organizer, AAG conference, 2010. Co-organizer, NSF Workshop, 2007. Co-organizer, KY Mesonet Workshop, 2008. Organizer, KY Mesonet consortium. Session Organizer, AAG. 2004 & 2005 Manuscript Reviewer, 17 journals. Editorial Board, *Geography Compass* Editorial Board, *Physical Geography* Proposal Reviewer, NSF Community media interviews
May	Geology Program Leader, 2009-2011 Ogden Curriculum Committee Ogden Sabbatical Committee Graduate Studies Committee	President, Past President and Executive Committee of the KSPG Manuscript Reviewer for journals Content Advisory Board, *Living With*

	Chair, Ogden Sustainability Committee	*Earth*, NAGT, AGI, and Pearson Southern Appalachian Cooperative Ecosystem Unit (SA- CESU) member
Nemon	WKU Gifted Studies Program, Super Saturdays workshop organizer.	Kentucky Geographic Alliance, steering committee member, 2008-2010 State GeoBee competition, Coordinator, 2010 State GeoBee Finals, Judge, 2005-10 Kentucky Council of Social Studies board member 2010
Polk	Associate Director of Science (Hoffman) Member Human Subjects Review Board (HSRB) Faculty Advisor, Green River Grotto Student Organization; Judge, WKU 40th Annual Student Research Conference;	Vice President, Karst Conservancy Moderator, State Geographic Bee Reviewer for 6 journals (6 manuscripts) SEDAAG Honors Committee AGU Science Committee, Copenhagen Climate Conference Co-convener Wuming County, China Environmental Justice Workshop; Director, Weeki Wachee Springs Science Program; Director and Volunteer, Withlacoochee State Forest Karst Management Div.
Reader	Faculty Advisor, Club Orlov, WKU.	Executive Director, A New Story Foundation
Siewers	Academic Program Review Committee, S'08-S'10 Cultural Enhancement Committee, F'04-present Ogden Curriculum Committee, F'10 Ogden Sabbatical Review Committee Judge, WKU Student Research Conference, 2005-present Environmental Science group, Fall 2004 Preparer, Earth and Space Science Program Review (PRD), 2009 Preparer, NCATE folio, Earth & Space Science Certification, Summer '07 Faculty Sponsor, Geology Club Kentucky Science Olympiad - '04 to '07.	Co-chair, 14th Symposium, Geology of the Bahamas, 2008. Secretary/Treasurer, KSPG, '06-'10. Manuscript Reviewer, academic journal Kentucky State Representative, Central Section, NAGT, Spring '06-present. ACT Science Content Review Panel. Fall, 2004 GSA Campus Representative to WKU SEPM Campus Representative, WKU Kentucky Education Professional Standards Board Earth Science Content Area Reviewer. '04-'10 Co-founder, Christ Episcopal Church, Earth Ministry. Fall '06-present Volunteer, Green River Watershed Watch. Fall '04-Present
Wulff	Center for Leadership Excellence – Faculty Fellow FaCET – Faculty Mentor General Education Review Task Force Ogden College Curriculum Committee Ogden Innovation in Instruction Comm. Goldwater Scholarship Review Comm. Geological Society of America – WKU representative	Kentucky Society of Professional Geologists – President; Geosciences Councilor, National CUR American Association of Petroleum Geologists – National Delegate Manuscript Reviewer, journals CERT – Neighborhood Group Leader Community Media contributions Potter Gray Elementary School – Science

	Geology Club – Faculty Advisor Men's and Women's Lacrosse Teams – Head Coach	Committee Bowling Green Schools – numerous Science presentations
Yan	GIS Program Leader and Committee Executive Committee, Bioinformatics & Information Science Center (BISC) Judge, WKU Student Research Conf. Fulbright Interview Committee Ogden Faculty Awards Committee Ogden Sabbatical Review Committee Departmental Rep. Focus on Western;	Committee of International Association of Chinese Professionals in Geographic Information Sciences (CPGIS) Citizen Advisory Committee, Bowling Green-Warren County Metropolitan Planning (BGWCMPO) Technical Advisor, Crime Analysis & Intelligence Task. Bowling Green Police Department (BGPD); Manuscript Reviewer (2 journals) Judge, Student Illustration Paper Competition by AAG GIS and Remote Sensing Specialty Groups

Table IV-B-2: Faculty Service Statements

Faculty	Statement of Service Relevance
Algeo	Katie Algeo's public service focuses on the community of Scottsville and Allen County where she lives. This regional focus was deliberately selected to lend professional expertise to a smaller community outside the immediate orbit of WKU. Katie has served in a number of capacities within this community: Board of Directors (Friends of Dumont Hill Preservation Society), Design Committee member (Heart of Scottsville Main Street Program), Participant in Planning Focus Group for Re-Use of the historic J.L. Turner & Son Warehouse, Facilitator for Heart of Scottsville Community Visioning Meeting, Tutor for the Allen County Middle School Science Olympiad Team, Guide for the Allen County Historical Society Graveyard Tour. She also developed a walking tour of historical downtown Scottsville that the Heart of Scottsville Main Street Program published in brochure form, and she led guided walks during Scottsville's Jacksonian Days festival. These efforts have contributed to historic preservation, community awareness of the area's unique cultural resources, and, in at least a small way, community revitalization. Dr. Algeo's professional service has focused on the Southeastern Division of the Association of American Geographers, where she has taken on a variety of leadership roles in recent years, included Kentucky State Representative, Honor Committee Chair, and Treasurer, and on the parent organization, the Association of American Geographers, where she has served as a Director and as Web Master of the Rural Geography Specialty Group. The SEDAAG regional meeting is one of the leading venues for students to present their research, and her efforts on behalf of that organization have contributed to the running of the annual meeting for the past six years. Katie has also served on the editorial board of *Southeastern Geographer*, as a reviewer for four academic journals and regularly serves as a moderator and judge at the Kentucky State Geography Bee. Her service to WKU includes many committee memberships, including the Ogden College Dean's Advisory Committee, Odgen College Library Committee, Odgen College Sabbatical Committee, Ogden College Student Complaint Committee, Ogden College Curriculum Committee, and the Strategic Planning Committee for the Mammoth Cave International Center for Science and Learning. She has also served on four search committees, chairing two of them.
All	Nationally, Dr. All serves on the Geology and Geography committee for the American Association for the Advancement of Science (AAAS) and organized two symposia (2007 and 2008) - a press conference associated with the 2007 AAAS symposium brought national press attention to WKU. He also works with the American Alpine Club as a member of their

	executive conservation committee and helped to create national and international alpine conservation programs. At WKU, as a member of the University Senate, the Ogden Space Committee, the University-wide Environmental Science Committee and the University Graduate Council, Dr. All has led efforts to ensure adequate liability coverage for faculty leading off-campus University activities, adequate pay raises for tenure and promotion, equitable teaching loads, and developed several courses to implement the new Environmental Science multi-disciplinary Masters. Additionally, he was one of the inaugural University Leadership Fellows. Locally, Dr. All has been especially involved with the City and County as they try to meet new storm-water regulations, and his efforts have included assisting with both cave research and legal expertise. This has been a fruitful relationship both for these agencies and for over a dozen of his students that have been involved in community outreach through these efforts.
Blackburn	Will Blackburn typically participates in the annual State Geography Bee held at Western Kentucky University. He also participates in the Science Olympiad that challenges Middle and High School students to compete against their peers in scientific concepts and knowledge. He has judged the presentation portion of the Lego Robotic Competition. He participates in Department functions both of an academic nature and those that include extracurricular themes, such as Seniors Night, Homecoming, and various social events that do not have faculty or staff specified, but require work. He supports the University and the mission.
Cary	Kevin has continued to serve as a reviewer for the professional certification in GIS (GISP) for the GIS Certification Institute since October of 2008. He is a current member of the Kentucky Association of Mapping Professional (KAMP) since 2003. He served a one-year term as President of the Southern KY GIS User Group ending in January of 2005. He was the leader of WKU's GIS program until last year.
Celestian	At the national level, Dr. Celestian is actively engaged in promoting new directions of mineralogy and materials science. As a member of the Science Review Committee for the world's brightest neutron generation facility, and also as an associate editor of the American Mineralogist, as well as a scientific reviewer for many national and international journals, Dr. Celestian is a proactive contributor for guaranteeing that state-of-the-art novel science is always being performed. At WKU, Dr. Celestian is also ensuring that scientific innovation can be continued by serving as the departmental library liaison, as a member of the University Senate for assessing faculty welfare, a reviewing member of the Faculty Scholarship Council, and being established as the first Director of the Advanced Materials Institute. Dr. Celestian has also established several new courses that are aimed at challenging studies from having minimal scientific background to majors and graduate students in Chemistry and Geology. Dr. Celestian's service to the community also follows those goals by educating the public through hands-on rock, mineral, and precious gem identification using modern scientific equipment that he has acquired through his grant activities.
Crowder	Margaret Crowder's public service is at the heart of what she does at WKU – service to the university, department, profession, and community are paramount. From classroom experiences and teaching, to myriad extra-university activities, service for her just *is* because at the end of the day, it is through the support of others that we find true success in life. As a faculty member, Margaret wants to give back part of what she received while growing up in south central Kentucky. She believes the only way we improve as a society is by helping one another. She loves this community and knows the need to reach out to express and instill the incredible value of education. She wants to help create in people a desire to reach out, and lift someone else up, either through academics or community volunteerism and activism. The reason why Margaret chose to teach and why, in addition, she participates in so many extra service activities for relatively little, and often no money, is many-faceted, but all sides are connected with the one theme of helping others, of making a difference. She loves to see the 'light bulb' go on over a student's head as they understand a concept for the very first time, or have made a meaningful connection with something we are studying – something that may stay with them for the rest of their lives. Her experiences interacting with students on a daily basis are priceless.

Dobler	Scott Dobler has four major service activities that are related to his position as an instructor in the Department of Geography and Geology. As the Faculty advisor of the Taiwanese Student Association, he provides counseling in financial and leadership issues in the campus organization. Scott is the committee chair of the Kentucky Geographic Names Committee and he acts as a liaison between local interests and federal decision makers in regards to naming physical and cultural place locations in Kentucky. As the co-chair of the Kentucky Geographic Alliance, he organizes and implements a relationship between K-12 school teachers and state and national interests in geography. Scott was appointed the State Geographer for the Commonwealth of Kentucky by the governor, and used his position to forward geographic interests at the state level in relationship to his other duties. Last but not least, Scott has been elected to the advisory committee of the Kentucky Council for the Social Studies, and he acts as a representative of the KGA and ensures that all of the social studies are represented in the classroom.
Durkee	Josh has observed that a strong university and department relies on service from its students and faculty. As such, he has strived to make positive contributions to the university, department, discipline, and the surrounding community through various relevant efforts. Such efforts include professional service endeavors such as manuscript reviewing for several top atmospheric journals, one weather and climate text book, and the appointed position as the international climatology listserv, CLIMLIST. This listserv represents nearly 3,000 members from a number of countries from around the world, and serves as a gateway for information including job and graduate student vacancies, new and existing datasets, scientific inquiries, and newly published articles. Dr. Durkee has also served as a departmental representative and committee member at the university and college level, respectively. Within the department, he is an active advisor and mentor, and independent research advisor to undergraduate and graduate students, while serving as the administrator to over 100 GEOG 121 Laboratory students each semester, all while maintaining a regular teaching load. He also serves as the faculty representative to two student-led organizations, and the existing Meteorology Technology Program. Lastly in terms of community support, he has contributed to the annual Science Olympiad contest, First Lego League Robotics Tournament, given severe weather safety and awareness workshops at local elementary schools, and has provided a number of media contributions to the local and surrounding communities, as well as around the nation. It is these relevant and valuable contributions that he feels contribute to the positive, lasting image of the department, college, university, and the student body.
Fan	As a new faculty member, Dr. Fan views service to the department, college, university, and professional communities in support of missions of the organization as critical elements of professional growth.
Foster	Dr. Stuart Foster is state climatologist and director of the Kentucky Climate Center, so service to the Commonwealth of Kentucky is a primary focus of his professional activity. He serve's as a point of contact and source of professional advice regarding matters relating to Kentucky's climate. He serves as co-chair of the climate and water resources data team designated in the Kentucky Drought Mitigation and Response Plan and is tasked with monitoring drought conditions and advising the Governor when executive action may be appropriate. As director of the Kentucky Mesonet, Dr. Foster oversees the operation of the Commonwealth's official network for climatological observations. This network provides essential data used by the Kentucky Transportation Cabinet, the Kentucky Division of Emergency Management, and Kentucky Energy and Environment Cabinet, and other state agencies. In addition, the Kentucky Climate Center operates a public website and provides data and information to various federal agencies and affiliates, including the National Weather Service, the Natural Resources Conservation Service, and the Farm Service Agency. Finally, he serves as a frequent media contact for newspaper, radio, and television outlets throughout Kentucky.
Goodrich	Greg Goodrich's service is related primarily to the administration of the Meteorology Program**.** As Meteorology Program Leader, he works as an academic advisor to over 70 students and to obtain resources for the meteorology program to allow it to continue to expand. For example, in order to help students gain summer internships and potential career opportunities he has developed strong relationships with area offices of the National Weather Service. The

	Meteorology Program hosts an annual National Weather Service Career Seminar that helps students understand career paths in meteorology. As a result, the WKU Meteorology Program is among the national leaders in paid internships with the National Weather Service. Within the department he has taken a leadership role by serving on the Graduate Committee, numerous faculty searches, and other ad hoc committees. His continued service at recruitment events and science competitions increases the exposure of the Department of Geography and Geology as well as Western Kentucky University.
Gripshover	Dr. Gripshover is active in service to her department, university, discipline, and community. She is the thesis advisor for two graduate students and is a committee member on seven student thesis committees. She serves the discipline by being active in national and regional organizations. Dr. Gripshover is on the World Geography Bowl board for both the Association of American Geographers and the Southeastern Division of the Association of American Geographers (SEDAAG). She also serves the SEDAAG Endowment, Education, and Nominating committees. As part of her service to the discipline and the community, Dr. Gripshover was a judge (2010) for the Kentucky Science Olympiad and for the 2010 Kentucky State Geography Bee. Dr. Gripshover serves on the Board of Advisors for the Kentucky Geography Alliance.
Groves	Chris Groves has contributed to service activities at a range of levels, but over the program review period this work has had a significant focus on international service within both the scientific community and development programs. In some aspects this culminated in his 2010 nomination by China's Ministry of Land and Resources for the *China Friendship Award*, China's highest award for "foreign experts who have made outstanding contributions to the country's economic and social progress" following extensive training efforts in water resources of the country's rural southwest. Groves has also served in several leadership roles for United Nations scientific programs associated with water resources, including a current position as a member of the Board of Governors and of the Academic Committee for the International Research Center on Karst. Nationally, over the review period Groves served as a member of the Board of Directors for both the Cave Research Foundation (CRF) and Karst Waters Institute, with a two-year appointment as CRF President. Within Kentucky he currently serves on the Board of Trustees for the Kentucky Chapter of The Nature Conservancy.
Keeling	David Keeling's service work at WKU relates primarily to his position as department head, with service on multiple college and university committees, including the Leadership Committee and the Department Heads Advisory Council. The primary goal of his institutional service is to improve the governance of the department and university leading to efficiencies and more productive outcomes for policies and procedures. His service work in the discipline includes a long-term position on the board of councilors of the American Geographical Society (the oldest professional geography society in the U.S.) as Assistant Treasurer and society webmaster. He also serves the AGS as an educational lecturer for voyages of exploration and discovery. Within the discipline, he serves as websites editor for the *Journal of Latin American Geography* and on the international board of editors for the *Journal of Transport Geography*. He also serves as a peer reviewer for multiple academic journals and publishers. In the community, he gives talks at Rotary, Barnes & Noble, Village Manor, and other locations, and has appeared regularly on WKYU-TV and WKYU-FM.
Kreitzer	Debbie Kreitzer's service is directed toward student engagement and quality teaching. The success of the study abroad program in the Department is due, in part, to the many programs she has helped to plan and execute. She has attended several Study Abroad Fairs on the behalf of the Department and served on committees to promote internationalization on campus. She also has been instrumental in promoting student engagement locally and has co-led the semi-annual field-trips to Mammoth Cave National Park that continues to be a part of many classes in the Department of Geography and Geology. Debbie was the Geography Club advisor for several years and is now working on Gamma Theta Upsilon, an international honors society for Geography majors. Another way she focuses on students and quality teaching is by participating in faculty governance. Debbie has served as University Senator for three years and as an alternate for one year. She has also served on the Faculty Welfare Committee and is currently serving on the Senate Executive Committee.

Kuehn	Dr. Kuehn's professional service activities are performed at the international, national, state, and local levels, which help to promote WKU's name and renown. On the national level, the discipline of geology benefits from his contributions to the professional examinations and other standards required of professional geologists. His students benefit directly by learning the expectations of professionalism in a course that is designed to assist in their college-to-career transition.
Mahmood	Dr. Mahmood's service activities strive to contribute to the profession, institution, and community. His goal is to contribute to all of the above arenas. His service-related activities and student engagement in these services fulfill the 'primary mission of the Department' by providing *'relevant, up-to-date, and integrative undergraduate and graduate educational experiences'* and help to *'prepare students for engagement with local, national, and global issues'* and allow them to *'develop a set of integrated theoretical and practical skills that can be applied to solving community issues and problems.'* Furthermore, engagement of students in these services addressed the demands of the marketplace and prepared *'students for careers in the public and private sectors or for advanced graduate study.'* As a part of Dr. Mahmood's service to the profession, he organized and chaired many special sessions at the professional national meetings. He has been successful in mentoring students to present papers in *these special sessions*. In other words, these service activities helped to fulfill *increased student learning (WKU goal #1).* He promoted the department by organizing and chairing many special sessions at national professional meetings. He has been invited to serve on the proposal review panel of the National Science Foundation. Participation of students at the national, regional, and local meetings facilitate the recruitment of more students in the program *(WKU goal #2; develop student body)*. Dr. Mahmood has been conducting grant-supported research projects that focus on 'Kentucky Issues.' *All of these are service to the community* and provide *'enhanced responsiveness to constituents' (WKU goal#4).* In combination all of the above services helped to *'improve institutional effectiveness' (WKU goal #5).*
May	Internal service provides the framework to move the geology program forwarded, better engage students especially through independent studies/research, and to change curricular offerings to provide a springboard for continued geology program growth as well as being relevant to the changing careers arena, of particular great interest to students seeking employment. Additional internal service provides a means through which curricular changes move forward from the department and the college, and also addresses colleagues being hired for future departmental expansion and assurance of quality instruction. Furthermore, this service also provides colleagues with awards and how we may best move the university forward in a sustainable way. External service provides better recognition of the geology discipline and environmental science discipline within the service area of WKU, the state, and the nation. The relevance and value of external service is that it provides the public with greater recognition of the societal value of geoscience via discussing and researching energy, the environment, or societal interaction with the environment.
Nemon	Amy Nemon has been a steering committee member of the Kentucky Geographic Alliance from 2008 to the present. As a member of the KGA she has participated in a variety of activities to promote geographic content and education. Those activities include serving as a judge for the National Geographic Geography Bee state finals between 2005 and 2009. In 2010 she began to work on the organization side of the Bee and in 2011 will be one of the co-coordinators of the state Bee. Amy was recently asked to be the KGA representative on the KCSS (Kentucky Council of Social Studies) board and recently attended her first meeting. Working with Kay Gandy, a co-coordinator of the KGA, she helped Kay teach GIS in EDY/GEOS 507 to K-12 teachers working on their Master's degrees. She has also worked with WKU's Gifted Studies Program, organizing two Super Saturdays workshops for 3rd-6th grade students. She currently is working on a new 'geography related program' for the winter 2011 Super Saturdays. Amy holds memberships in the Association of American Geographers and the Kentucky Association of Environmental Educators and has attended conferences and presented professionally.
Polk	Dr. Polk's service work contribute to the overall University, College, and Departmental missions in various ways, with the most direct being his involvement with the Hoffman Institute, which has provided him the opportunity to engage with undergraduate and graduate

	students, international scholars, the National Park Service, and other governmental or educational entities related to research and educational activities, such as the Wuming County workshop and the Green River Grotto organization. Dr. Polk's involvement with the HSRB also provides him an avenue for input to and awareness of the various types of research projects and student engagement activities happening at WKU. Service on the SEDAAG Honors committee allows him to represent WKU as an evaluator of scholarly work in his discipline and provide accolades to those who are excelling in their field. Additionally, several of his activities, including work with the Karst Conservancy, Withlacoochee State Forest, and State Geographic Bee help disseminate the research and teaching aspects of his position into the community through interaction with public officials, K-12 students, and the community. Dr. Polk believes that his service roles have actively contributed to the overall mission of the Department by being actively engaged in the community, serving at all levels of the University and community, and focusing Departmental efforts to addressing the human-environment condition in karst regions around the world. He has represented the Department in various capacities from P-12 through graduate-level functions to promote active recruitment of high-quality students and engagement with the public to focus his teaching and research efforts to better serve the Commonwealth and its citizens.
Reader	Daniel is actively engaged in curriculum development designed to provide a realistic approach to the study of sustainable development and environmental science that is applicable to the lives of students. Raising awareness of resource limitations and other challenges better equips the student and community to compete in today's increasingly globalized world.
Siewers	Dr. Siewers is primarily engaged in professional service at local and regional levels. At WKU, he is the principal liaison between the Department of Geography and Geology and the School of Education and Behavioral Sciences, particularly in the realm of Earth Science education and teacher certification. He is actively engaged in curricular issues within the Department and College and he has taken leadership roles in the areas of faculty hiring, programmatic development, and faculty mentoring. At the University level, Dr. Siewers is a long-time contributor to the Cultural Enhancement Series and he has recently concluded a three-year rotation on the Academic Program Review committee. He held the position of Secretary and Treasurer of the Kentucky Society of Professional Geologists and contributes to the scholarship and research vitality of the Gerace Research Centre, San Salvador Island, Bahamas. Locally, he brings his geological expertise to elementary schools and church groups and has for many years volunteered for the Green River Watershed Watch.
Wulff	Dr. Wulff has been active in service to the discipline at all levels. Examples of service at the national level include: President and Councilor for Kentucky Society of Professional Geologists, national Councilor in Geosciences for CUR, campus representative for the Geological Society of America and the American Geophysical Union, chairing or co-chairing sessions at national conferences, giving invited Presidential (KSPG) addresses at two conferences, and serving as a national delegate for American Association of Petroleum Geologists. Examples of service at the local level include: teaching geosciences activities for grades K-12, serving as a member of local school Science Committees, making presentations at area schools for Science Day, Science Fair activities, and special assemblies, leading church youth groups, singing concerts, and serving as the leader of a local CERT group. Examples of service to the university include appointments as a Faculty Fellow at the Center for Leadership Excellence, Faculty Mentor for Faculty Center for Excellence in Teaching; committee work includes WKU General Education Review Task Force, Ogden Curriculum Committee, Geology Enhancement Committee, and Goldwater Scholarship Review Committee, as well as several search committees both in and outside the department; additional service includes: research and academic supervisor to both undergraduate and graduate students, and coaching both the men's and women's lacrosse teams.
Yan	Dr. Jun Yan has been actively contributing his services to the profession, the department, the University, and the community through various activities. As a member of several regional, national and international professional associations, he has served as member of various committees, journal reviewers and judges for several student paper competitions. Currently he is the leader of the Department's GIS Program, helping it develop into the most comprehensive

	GIS program in Kentucky. Dr. Yan also provided technical services to local and regional communities, serving as technical advisors for several local and regional government agencies. At the international level, Dr. Yan has devoted his expertise to training Chinese scholars and student in the areas of GIS and spatial analysis. He has held a number of workshops in several Chinese institutions in recent years.

Table IV-C-1: External Grants

Faculty	Years	Competitive External Grants	
Algeo	2007-08	Filson Historical Society, Filson Fellowship	**$500**
	2005-06	NEH, Landmarks of American History and Culture, Co-PI	**$113,000**
All	2009-10	Nepal Research Grants	**$2,500**
	2008-09	Fulbright Research-Teaching Award, Nepal	**$50,000**
	2004-05	National Academy of Science	**$22,824**
Cary	2009-10	Logan County GIS Services (3rd year @$800 per year)	**$2,400**
		Spencer, S. L. (PI), with others, "Blueways in Warren County" Operations, Recreation Trails Foundation	**$100,000**
Celestian	2010-11	American Chemical Society – Petroleum Research Fund.	**$50,000**
	2009-10	Advanced Materials Institute (with co-PIs)	**$2,000,000**
	2008-09	Kentucky EpSCOR Equipment Grant	**$90,646**
Crowder	2010-11	NSF CCLI (co-PI)	**$175,000**
Dobler	2008-9	Co-PI National Geographic Alliance Award (with Teacher Ed.)	**$50,000**
	2007-8	Co-PI National Geographic Alliance Award (with Teacher Ed.)	**$50,000**
	2006-7	Co-PI National Geographic Alliance Award (with Teacher Ed.)	**$50,000**
Durkee	2009-10	NSF (REU with Mahmood and others)	**$349.806**
Fan	2009-10	NASA Climate Modeling Grant (team with U.Miss)	**$359,776**
Foster	2009-10	NOAA Kentucky Mesonet (Co-PI)	**$699,330**
	2008-09	NOAA Kentucky Mesonet (Co-PI)	**$668,997**
	2007-08	NOAA Kentucky Mesonet (Co-PI)	**$400,000**
	2005-06	NOAA Kentucky Mesonet (Co-PI)	**$1,500,000**
Groves	2009-10	NSF REU (Faculty mentor and Co-PI)	**$349,806**
	2009-10	USDA (Ferrell PI)	**$158,246**
	2008-09	US Agency for International Development (PI)	**$150,000**
	2007-08	USDA (Ferrell PI)	**$87,150**
	2007-08	ENVIRON Foundation (PI)	**$100,000**
	2006-07	KY Heritage Land Conservation Fund (PI)	**$167,500**
	2006-07	US Agency for International Development (PI)	**$2,000,000**
	2005-06	National Park Service/USDA/BRADD (PI)	**$15,766**
Keeling	2008-09	Department of Defense/FMSO (Colombia Violence Project)	**$103,000**
Kuehn	2008-09	US Department of the Interior, National Park Service (NPS)	**$13,000**
	2006-07	US Department of the Interior, National Park Service (NPS)	**$99,357**
	2006-07	US Department of the Interior, National Park Service (NPS)	**$45,390**
	2009-10	City of Bowling Green, Select Neighborhood Action Plan (SNAP)	**$2,500**
	2008-09	City of Bowling Green, Select Neighborhood Action Plan (SNAP)	**$4,489**
	2007-08	City of Bowling Green, Select Neighborhood Action Plan (SNAP)	**$3,323**
	2006-07	City of Bowling Green, Select Neighborhood Action Plan (SNAP)	**$5,000**
Mahmood	2009-10	NSF (REU with Durkee and others)	**$349,806**
	2009-10	US Dept of Education (Co-PI)	**$2,379,000**

	2009-10	NOAA Kentucky Mesonet (Co-PI)	**$699,330**
	2008-09	USDA	**$147,306**
	2008-09	NOAA Kentucky Mesonet (Co-PI)	**$668,997**
	2008-09	USDA	**$135,259**
	2007-08	NOAA Kentucky Mesonet (Co-PI)	**$400,000**
	2007-08	USDA	**$112,000**
	2006-07	NSF	**$15,000**
	2005-06	USDA	**$47,000**
	2005-06	NCDC/NOAA	**$1,900**
	2005-06	NOAA Kentucky Mesonet (Co-PI)	**$1,500,000**
	2005-06	USDA	**$45,000**
	2005	Kentucky EpsCOR Grant	**$75,000**
	2004-05	Perkins Equipment Grant	**$10,000**
	2004-05	NSF REU (Co-PI)	**$254,000**
May	2010-11	DOST AAPG Grant	**$10,000**
	2010-11	NSF Multi-Instructional (contributing-PI)	**$175,000**
Polk	2009-10	Alphawood Foundation Grant, Belize	**$343,178**
	2009-10	USDA- ARS (Co-PI)	**$164,903**
Wulff	2006-07	EPsCOR ERTL	**$10,422**

Table IV-C-2: Internal Grants

Faculty	Years	Competitive Internal Grants	
All	2008-09	OSP Regular Faculty Grant	**$2,000**
	2007-08	OSP Research Improvement Grant	**$6,000**
	2005-06	OSP Junior Faculty Grant	**$4,000**
	2004-05	OSP Proposal Incentive Fund	**$8,279**
Cary	2005-06	WKU IT Telephone mapping	**$10,000**
	2003-04	WKU Telecommunications	**$10,000**
Celestian	2008-9	Junior Faculty Grant OSP	**$4,000**
Durkee	2010-11	RCAP, OSP	**$12,000**
	2009-10	Summer Faculty Grant OSP	**$5,624**
	2008-09	New Faculty Grant OSP	**$3.530**
Fan	2009-10	Junior Faculty Grant OSP	**$4,000**
Florea	2008-9	Junior Faculty Grant OSP	**$4,000**
Goodrich	2009-10	Summer Faculty Grant OSP	**$5,000**
	2006-7	Summer Faculty Grant OSP	**$5,000**
	2005-6	Summer Faculty Grant OSP	**$5,000**
Groves	2007-08	Conference Support Grant ARTP	**$3,000**
	2006-07	Faculty Research Grant OSP	**$2,000**
	2006-07	Proposal Incentive Fund OSP	**$5,000**
Mahmood	2008-9	Summer Faculty Grant OSP	**$5,000**
	2006-7	Faculty Research Grant OSP	**$5,000**
	2005-6	Summer Faculty Grant OSP	**$5,000**
	2004-5	Summer Faculty Grant OSP	**$5,000**
	2004-5	WKU ARTP Pilot Grant	**$24,000**
Polk	2009-10	Summer Faculty Grant OSP	**$6,000**
		Junior Faculty Grant OSP	**$3,992**

Siewers	2007-8	Summer Faculty Grant OSP	**$6,000**
Wulff	2005-6 2005-6	Junior Faculty Grant OSP Summer Faculty Grant OSP	**$4,000** **$5,000**
Yan	2008-9 2006-7 2005-6	Summer Faculty Grant OSP Summer Faculty Grant OSP Junior and Summer Faculty Grant OSP	**$6,000** **$4,000** **$9,000**

ACADEMIC PROGRAM REVIEW GUIDELINES

Undergraduate Program Section

NOTE: The following sections (i.e. V and VI) should be completed for each UNDERGRADUATE academic program within the Department undergoing review.

Program: Geology, A.B./B.S. Reference Codes: 577/676/677

The geology major at WKU provides students with a range of possible degree options depending upon interest. The Bachelor of Arts (BA) options are for those students interested in a general education in Geology (General Geoscience-676 option 2) or becoming certified to teach Earth and Space Science at the high school level (Earth & Space Science -676 option 1). The Bachelor of Science (BS – 677/577 professional major/minor or professional extended major) options are for those students interested in becoming a professional geologist or for continuing their geology education in graduate school.

V. Program Enrollment and Student Data:

A. Majors:

	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
577 Majors (BS)	4	6	9	9	22
676 Majors (BA)	6	4	10	18	16
677 Majors (BS)	43	43	32	31	26
Total Majors	**53**	**53**	**51**	**58**	**64**

The combined total number of students declaring geology as a major has remained steady over the review period with a significant growth trend ranging from 15 to 20 percent in the last two years relative to the 2005-2007 enrollments. Enrollment growth overall is expected to continue or minimally remain steady commensurate with enrollment trends at WKU. As of December 7, 2010, there were 86 total majors enrolled in the various geology programs. Since Fall 2001, the geology program has enjoyed a 160 percent growth in majors. Increased enrollment in the geology program and in the number of majors is attributable to curricular changes (including establishment of B.A. degrees) just before the 5-year review period began, and the faculty's reputation for excellence in the classroom. Significant upward trends in geology (to 86 majors) reflects the growing need and perhaps societal recognition for geologists as environmental project managers, energy exploration and development experts, and development of other resources such as metals. Furthermore, geology is playing an important role in the development of some alternative energy resources, such as geothermal and environmental stewardship for combustion of fossil fuels (carbon dioxide sequestering in the subsurface geologic environment). A number of students also recognize the need for geosciences teachers as new national standards for academic excellence require Geoscience Education for K-12 students.

B. Degrees Awarded:

	2004/05	2005/06	2006/07	2007/08	2008/09
577 Graduates (BS)	-	-	1	1	4
676 Graduates (BA)	-	2	1	6	6
677 Graduates (BS)	9	2	4	6	6
Total Degrees	**9**	**4**	**6**	**13**	**16**

The Geology Program is enjoying an upward trend in baccalaureate degrees awarded, with the average number of students graduating more than doubled over the past two years relative to the first three years of the review period. New program options were introduced in Fall 2004 (577/676), with the first degrees not awarded until 2006/7. Eleven degrees were awarded at the Spring and Summer 2010 commencement ceremonies in total, which puts the combined geology programs on a pace to exceed recent annual graduation rates. This increase in degrees awarded is attributable to diversified course offerings, opportunities for student research, engaging field and laboratory experiences, and a favorable employment outlook for geologists. Honors College and Gatton Academy students have increased learning and competitiveness in the Geology Program.

Comparisons with External Data:

Program Enrollments in similar programs at Kentucky public universities

Baccalaureate Enrollments (CIP Code 40.0601)	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
WKU	**52**	**50**	**50**	**57**	**62**
UK	33	57	43	40	51
EKU	30	23	33	38	48
NKU	28	36	43	39	41
Morehead	14	10	17	29	35
Murray*	42	57	52	43	0
KSU	-	-	-	-	-
U of L	-	-	-	-	-

Source: Kentucky Council on Postsecondary Education Comprehensive Database.

* Murray State University does not offer a geology major per se but several different "options" in the Earth Sciences. Therefore, it is difficult to represent the number of Geology majors and faculty.

WKU has consistently had the highest Geology Program enrollments relative to all other state universities in the Commonwealth (with only one minor exception where UK had a few more enrollees in Fall 2006). By Fall 2009, however, WKU had approximately 22 percent more students enrolled in its geology program than did UK. The WKU Geology Program has established itself as the institution of choice for the undergraduate degree in the

Commonwealth as evidenced by the comments and accolades provided by colleagues in academia, state government, and industry.

Degrees Awarded in similar programs at Kentucky public universities

Baccalaureate Degrees Awarded (CIP Code 40.0601)	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**
WKU	**9**	**4**	**5**	**13**	**16**
UK	9	9	5	16	7
NKU	7	6	8	8	7
EKU	5	8	5	7	6
Morehead	5	4	2	1	1
Murray	5	6	11	0	0
KSU	-	-	-	-	-
UofL	-	-	-	-	-

Source: Kentucky Council on Postsecondary Education Comprehensive Database.

The Geology Program at WKU is comparable to UK in terms of the number of degrees awarded over the period of review. The number of WKU graduates in 2008-2009 was more than double that of UK and NKU. The Geology Program expects to award approximately 15 to 16 degrees in 2010-2011 and anticipates similar rates of degree production through 2013.

Degrees Conferred in similar programs at Benchmark Institutions

Benchmark Institution	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**
WKU	**9**	**4**	**6**	**13**	**16**
Ball State University	6	7	4	10	1
California State University-Chico	10	20	12	8	15
California State University-Fresno	4	3	6	5	5
Central Missouri State University	3	1	4	2	8
Eastern Illinois University	1	7	4	5	8
Eastern Michigan University	10	12	18	8	17
Florida Atlantic University	4	9	9	8	14
Indiana State University	1	6	5	5	2
Middle Tennessee State University	17	15	14	12	17
Missouri State University	4	7	4	10	14
Montclair State University	10	8	3	4	2
Northern Arizona University	19	12	10	12	13

Benchmark Institution	2004/05	2005/06	2006/07	2007/08	2008/09
Stephen F Austin State University	8	5	7	11	11
Towson University	3	4	3	5	2
University of Northern Iowa	21	20	15	21	15
Western Illinois University	4	5	10	6	6
Wichita State University	4	6	9	2	9
Youngstown State University	8	4	5	2	3

Source: Integrated Postsecondary Education Data Systems (IPEDS).

WKU compares quite favorably with geology programs at benchmark institutions in terms of total number of degrees awarded. Several benchmark institutions have higher average enrollments (CS-Chico, EMU, MTSU, NAU, UNI); however, these institutions also have higher numbers of faculty (e.g. CSU-Chico with 18, CSU-Fresno with 17, NAU with 15) compared with only six total full-time faculty in the geology program at WKU. Furthermore, WKU has fewer full-time faculty than all but three benchmark institutions, all of which have far lower enrollments than WKU (e.g. Towson University with 3.4 average degrees and four full-time faculty, Wichita with 6 and five full-time faculty, and Central Missouri with 3.6 and four full-time faculty). The Geology Program at WKU is very competitive amongst benchmark institutions in regard to degrees conferred and produces a relatively high number of graduates with lower numbers of total faculty.

C. ACT Scores of Students Admitted to Program:

Avg. ACT	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
577 Majors	22.5	21.2	26.2	26.3	22.4
676 Majors	20.8	23.3	22.5	21.8	21.6
677 Majors	22.3	22.3	22.9	22.5	23.8
All Ref # Average	**22.1**	**22.2**	**23.3**	**22.8**	**22.8**
OCSE Average	22.2	22.4	22.5	22.8	23.1
University Average	21.4	21.5	21.6	21.9	22.3

The average ACT score of Geology Program students is slightly lower than the OCSE average, but it exceeds the University average.

D. Undergraduate GPAs of Program Graduates:

Ugrad GPA	2004/05	2005/06	2006/07	2007/08	2008/09
577 Graduates (BS)	-	-	N/A*	N/A*	3.29
676 Graduates (BA)	-	N/A*	N/A*	2.72	2.40

Ugrad GPA	2004/05	2005/06	2006/07	2007/08	2008/09
677 Graduates (BS)	3.36	N/A*	2.90	2.89	3.04
All Ref # Average	**3.36**	**2.90**	**2.98**	**2.79**	**2.86**
OCSE Average	3.16	3.15	3.16	3.12	3.14
University Average	3.12	3.13	3.14	3.12	3.14

*Averages are not calculated for fewer than three graduates to ensure student confidentiality.

The undergraduate GPAs of students admitted to the program are lower than both the university and OCSE averages. The GPA average in each of the program tracks is variable. Students with the highest GPAs are attracted to the most rigorous track of the program (577 – extended major), whereas those with lower GPAs tend to enroll in the BA option, which has lower-level cognate science and math requirements. The average GPA of the BS tracks (3.17) compares quite favorably to program GPAs across OCSE.

VI. Program Description and Self Study

A. Mission Statement/Relation of Program to University Mission:

Program Vision Statement: The program aims to be the region's outstanding geology major, with effective international reach. It aims to produce exceptional undergraduates in its major programs, to engage them in critical thinking and meaningful problem solving, and to build the reputation of the geology program through meaningful research and community engagement.

Program Mission Statement: The Geology program prepares students to be productive, engaged, and socially responsible citizen-leaders of a global society. It provides research, service, and life-long learning opportunities for its students. The program is responsible for stewarding a high quality of life for its faculty, students, and alumni so that they:

- Recognize science as a way of knowing, including its values and limitations;
- Achieve a depth and range of knowledge and skills in their discipline or in a multidisciplinary area;
- Develop abilities of reason and imagination; collect and analyze data, synthesize and draw conclusions; effectively communicate with others;
- Experience discovery, design, or application within the discipline and beyond;
- Evidence a commitment to an examined and evolving set of values and professional ethics, leading to informed decisions and including contributions to the discipline and to society;
- Become knowledgeable in the discipline, prepared for the future, and competitive in a global environment.

B. Teaching and Learning:

1. Undergraduate Students

Since the Geology program is open to all WKU students, the quality of the students is comparable to the average WKU and OCSE student. There are no special entrance requirements for the BA or BS degree in Geology.

2. Indicators of Teaching and Advising Quality

Innovative features, special awards and accomplishments:

The Geology program values hands-on laboratory and field experiences for its students. Both of these components are blended into coursework for each major concentration. With the expansion of the geology curriculum in 2004, students get an early immersion experience through two hands-on courses: Introductory Field Techniques (Geol. 380) and Analytical Techniques (Geol. 270). The Field Techniques course provides weekly opportunities for field-work throughout south-central KY and middle TN, including the Karst Plain, Dripping Springs Escarpment, Mammoth Cave Plateau, Nashville Dome, Cumberland Saddle, and the Western Kentucky Coal Field. Additionally, faculty in the program provide more extensive weekend trips to regional locations such as Falls of the Ohio in the Louisville area, Pound Gap on the KY-VA border, and the Fluorspar Mining District of far western Kentucky and southern Illinois.

The Analytical Techniques course provides hands-on experience with a wide array of analytical instrumentation not typically available in other undergraduate programs in the Commonwealth and beyond. Students are exposed to XRD, XRF, SEM, Raman microscopy, gamma ray scintillometery and laser diffraction particle size analysis. These techniques are in addition to standard sample preparation and sample analysis techniques (e.g. thin section preparation and analysis). Students not only learn and write standard operating procedures for each instrument or technique, but they also compose grant proposals based on their new expertise.

Fieldwork is a key component of the undergraduate geology experience at WKU with local and regional field trips being offered in most upper-division courses during the semester. As an example, the Structural Geology and Petrology classes combine on an annual three-day, 800-mile transect across the Appalachian Mountains through a variety of structural settings and geologic terrains. Longer field experiences are offered during semester breaks, the winter term, and over the summer. Examples include field geology trips through the Mojave, a two-week exploration of Hawaii, and a ten-day field course in the Bahamas, which has been offered four times since 2004. Moreover, during the period of review, twenty-five students completed an intensive six-week geology field camp in Wyoming and South Dakota. The field camp, which is strongly encouraged for all the BS program majors, provides a capstone experience in geological mapping and field interpretation. Students earning an A in that course have been awarded prestigious internships with the National Association of Geoscience Teachers and the U.S. Geological Survey.

The geology faculty have been awarded for their teaching efforts. During the review period, Dr. Andrew Wulff received both the OCSE and University Faculty Award for Teaching. Margaret Crowder received the 2008 Student Government Association OCSE Professor of the Year and the 2005 Young Careerist of South-Central Kentucky Award (Margaret also received

the 2007-2008 Ogden Public Service Award). Kenneth Kuehn was chosen as a University Distinguished Professor. In addition, over the past year, Dr. Aaron Celestian became director of the Advanced Materials Institute (AMI), and he and other faculty have been responsible for additional acquisition of high-tech instrumentation that has been used to further engage students in curricular offerings and independent research. With geology faculty directly connected to the AMI, the geology program is positioned to provide truly 'graduate study-like' opportunities for its undergraduate students at WKU. Faculty reflecting on their own undergraduate research or exposure to research all agree that the opportunities within the WKU Geology program are a point of pride. The opportunities provided by the analytical capabilities of the program are a significant factor in the growth of the program in recent years. This research infrastructure will serve as a catalyst for future programmatic growth and research initiatives.

Advising quality: Geology program average scores on the WKUSES data on advisement are consistently above University average scores, with some scores up to +0.8 (close to a full point – which is 20%) above the WKU averages. The only year and category in which the program fell short of the WKU average was in category E (advisor's knowledge of degree requirements) for Spring 2008. We have made some broad changes to our various tracks in the past few years, and this likely reflects the growing pains of those changes. Nevertheless, the WKUSES data reflect consistent and strong student satisfaction with our program advisement.

WKUSES DATA

Thinking about the ADVISING you received in your major, rate the following:	**Spring 2005**		**Spring 2006**		**Spring 2007**		**Spring 2008**		**Spring 2009**	
	N	**Avg**	**N**	**Avg**	**N**	**Avg**	**N**	**Avg**	**N**	**Avg**
Responses from Baccalaureate Geology Majors										
a. Overall quality of advising	3	3.67	17	3.47	10	3.20	13	3.62	14	3.43
b. Availability of advisor	3	3.67	17	3.41	10	3.60	13	3.54	14	3.43
c. Advisor's help with developing your schedule each semester	3	3.67	17	3.41	10	3.50	13	3.38	14	3.21
d. Advisor's help with career planning	1	3.00	17	3.12	10	2.90	13	2.92	13	2.69
e. Advisor's knowledge of degree requirements	3	4.00	17	3.53	10	3.50	13	3.77	14	3.29
Responses from All University Students										
a. Overall quality of advising	3001	2.92	2295	2.96	2194	2.95	2511	3.02	2115	3.10
b. Availability of advisor	2986	2.97	2283	3.03	2189	3.03	2503	3.08	2109	3.18
c. Advisor's help with developing your schedule each semester	2933	2.85	2247	2.87	2159	2.90	2456	2.96	2077	3.03
d. Advisor's help with career planning	2775	2.46	2096	2.52	2058	2.53	2320	2.60	1958	2.63
e. Advisor's knowledge of degree requirements	2979	3.23	2278	3.28	2187	3.27	2484	3.33	2109	3.35

Scale: 1=Poor, 2=Fair, 3=Good, 4=Excellent.

3. Indicators of Student learning

i. Intended Learning Outcomes:

The Department has adapted WKU's Quality Enhancement Program outcomes as a general framework to guide individual program assessments.

QEP Outcome #1 - *Students can demonstrate the capacity to apply discipline-centered knowledge and training to address relevant concerns in community or society.*
QEP Outcome #2 - *Students understand the diversity of peoples, ideas, and cultures and can demonstrate how these shape the world around them.*
QEP Outcome #3 - *Students can demonstrate awareness of their opportunities as responsible citizens living and working in a global society.*

In addition, the Department has adopted the general learning philosophies outlined in Ambrose et al. (2010) (refer to the Appendix). These philosophies guide the assessment process.

ii. Means of Assessment and Criteria for Success:

1. Inquiry and Analysis
2. Critical Thinking
3. Creative Thinking
4. Written Communication
5. Oral Communication
6. Quantitative Literacy
7. Information Literacy
8. Teamwork
9. Problem Solving
10. Civic Knowledge and local-global engagement
11. Intercultural competence
12, Ethical Reasoning
13. Skills for lifelong learning
14. Integrative Learning

The Department has generally adopted a 14-point framework for the assessment of learning outcomes. This framework has been applied primarily to the assessment of general education courses, but is applicable to all of the coursework offered in the Department. Although all of the 14 criteria for assessment are relevant at the meta-level, some are more relevant to specific courses. In the Geology programs, for example, advanced courses typically focus on specific areas such as applied problem solving (9), critical thinking (2), and teamwork (8), among others, whereas these three criteria may receive less focus in large general education courses. In the Introduction to Geology course (GEOL 102), for example, criteria 1, 7, and 14 are stressed, along with others, as this often is the only exposure that many WKU students will ever have in their college careers to geology.

Assessment takes place in a number of ways. Each spring, the Department assesses its general education courses using the 14-point framework or other methods to determine if the course is meeting general education learning outcome goals. Other assessment methods include comfort surveys, benchmark knowledge surveys at the beginning and end of individual courses, group projects, independent student learning, practica experiences, and the culminating professional development course (499).

iii. Data Collection Methods

Assessment data are generated each spring in the general education courses using a variety of methods, including capstone essays, a set of multiple-choice questions measured against beginning-of-semester benchmarks, and other methods. In advanced courses, students are

assessed using team projects, presentations at conferences, internship evaluations by supervisors, thesis committees, and the capstone professional development course. All graduating seniors take a comprehensive assessment examination as part of the capstone GEOL 499 course.

iv. Assessment Results

At the end of each course, faculty typically conduct a personal assessment of course delivery and other indicators of learning success. SITE evaluations can help to identify specific issues with examination formats and textbooks, etc. The Department subscribes to the general philosophy that short-term, snapshot evaluations of learning outcomes are statistically suspect and do not provide robust enough data to suggest meaningful improvements. Consequently, the Department takes a longer view of course assessment and learning outcomes, preferring to look at trends over time and to survey graduates from time to time to determine what worked and what needed improvement.

v. Use of results to improve the Program

Each program has a curriculum committee that assesses on a regular basis individual course relevance and overall program relevance. Data gathered from faculty course assessment, from alumni surveys, from SITE evaluations, and from the discipline generally are used to make program improvements. Individual faculty evaluate trends in the discipline to determine whether courses need changing, or whether new courses need to be added. In Geology, for example, assessment of learning outcomes, feedback from employers, and from alumni, suggested that exposure to basic spatial mapping and statistical analysis would enhance the skill package of graduates. Consequently, the geology faculty, when revising the curriculum several years ago, added two basic GIS courses and a geostatistics course to the supporting requirements for the professional majors. Faculty also saw a need for early immersion in enhanced hands-on learning experiences driven by changes in technology and employment needs. Therefore, two hands-on courses were developed - Introductory Field Techniques (Geol. 380) and Analytical Techniques (Geol. 270) - that provide students an early immersion experience into core geologic techniques. As a result, many geology majors engage in some type of research before they graduate, either course-centered or as an independent project, intramural or extramural, in the laboratory or in the field.

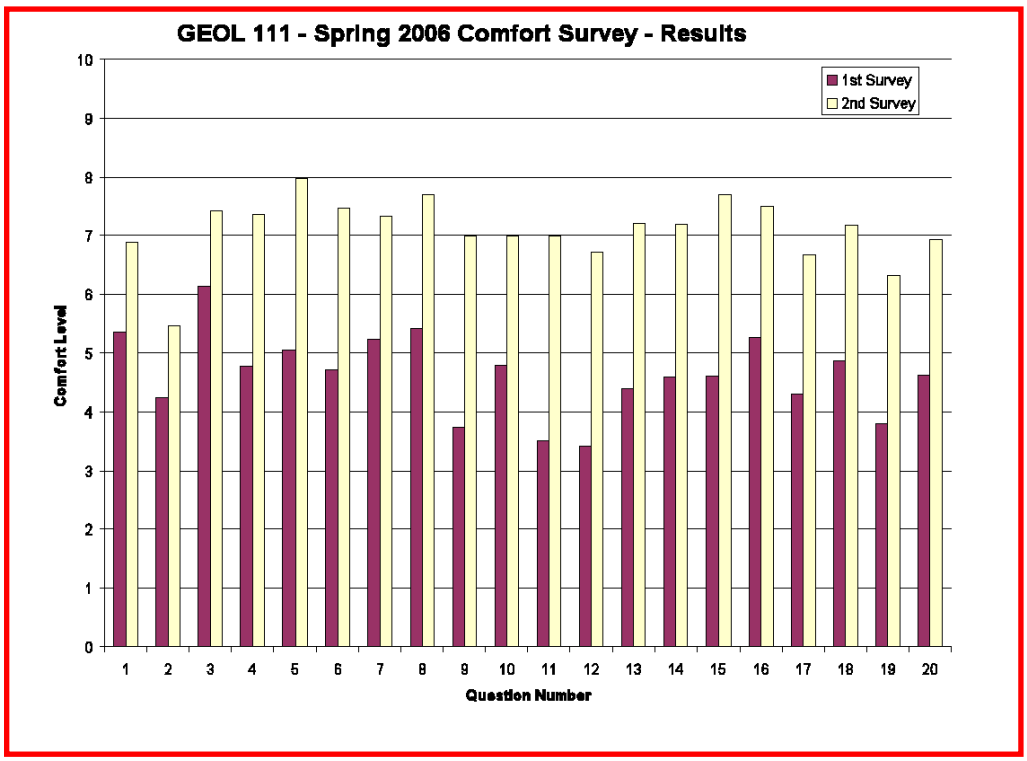
a. Assessment of currently enrolled students

One outcome of successful student research is the creation and ***presentation of oral papers and posters*** at professional meetings. Over the past five years, geology students made nearly 70 presentations at local, regional, national, or international scientific conferences. These presentations garnered 13 awards or recognitions for our students as well (refer to Table VI-B-3a in the Appendix). One recent example is the outcome of the 2010 Annual meeting of the Kentucky Academy of Science where three WKU students took first, second and third place respectively for best oral presentations in the Geology division. Two other WKU students took second and third place in the geology poster competition.

In Geology 499 (Professional Preparation), every senior student is required to take the ***standardized Area Concentration Achievement Test (ACAT)*** in Geology, which covers nine content areas. Over the past five years, the average percentile score achieved by the 39 B.S. students taking the test was 55.2 %, significantly above the national average. Twelve of the 39 scored above the 70th percentile nationally with five of those at the 90th percentile or above. Results of the ACATs, together with course evaluations and other student feedback, are used to enhance student learning through program and course revisions.

Geology faculty use a variety of ***methods to assess student learning***. One example is the use of "comfort surveys" by Dr. Wulff. These surveys are offered on the first and last days of each course and examine student confidence in their knowledge of material by asking, for example, "how comfortable are you discussing the concept of …." In this fashion, students are introduced on the first day of class to topics covered in the class, but are not required to assess content mastery directly. Questions on exams and quizzes during the courses may be directly linked to these survey questions, and certain questions are used as internal standards, dealing primarily with topics not covered in the course. The results of post-class surveys may be used to demonstrate student confidence in their mastery of course materials. Figure 1 shows results for an introductory Geology course (GEOL 111) with average scores for each of 20 questions, for both the pre- and post-course surveys. These results show an average increase of approximately 40% in student confidence of the course material. Results such as these inform modifications to aspects of the course by the instructor.

Figure 1. Example of a Comfort Survey



As part of the Program Review process, the Department contacted currently enrolled majors and invited them to complete a short survey. Students were asked to comment about program strengths, weaknesses, and improvements that could be made. These comments form part of the program's assessment process and are incorporated into deliberations that faculty make each academic year about changes and improvements to the program. Selected comments are:

Strengths:

- Great Professors. Always willing to help.
- Excellent advising. Professors are all very helpful and push each student to do their best.
- Faculty thoroughly enjoy their work, which encourages students to want to learn.
- Very well prepared for careers in geology.
- Program is large enough to have international reach but small enough to know all the professors personally.
- Faculty are passionate about the program and eager to help and instruct.

Weaknesses:

- Labs are small, no printers available.
- Not enough opportunities for students to pursue individual interests or be teacher aides.
- Not enough opportunities for field trips.
- Lack of variety in course offerings.
- Not enough advertising of the equipment and resources available to students.
- Need more lab space.

Improvements:

- Provide more financial support to the Geology Club for field trips.
- Coordinate and implement a wider variety of field trips.
- Offer required classes more frequently, with a wider variety of offerings.
- More opportunities for study abroad and study away programs.
- Provide more hands-on opportunities to work with minerals and rocks.

b. Other Indicators of Success

Special experiences, internships, REUs, etc.

Many geology undergraduates pursue additional paraprofessional experiences such as internships and co-op placements. During the review period, nine students were successful in landing a spot with the National Science Foundation's Research Experience for Undergraduates (REU) program, a highly competitive national program. These summer-long experiences took them to other universities across the country and to places such as the American Museum of Natural History and NASA. Additionally, students have received summer internships with the United States Geological Survey, Bureau of Land Management, analytical labs (e.g. ERTL at University of KY), and industry. Over a number of years, several students have participated in environmental consulting projects, particularly through ENSAFE, Inc. of Bowling Green, KY. Many of these projects have resulted in long-term employment opportunities for students.

c. Program Graduates:

The geology program has kept up with 48 of its 61 Spring '04 to Fall '10 program graduates (Table VI-B-3c in the Appendix**)**. Fifty-eight percent of those graduates are currently employed in geology or in a related environmental science field. Eleven students have either earned or are currently pursuing a graduate degree. Four have passed the national geology board exam (ASBOG), which is required for higher-level long-term employment (but not a mandatory requirement in the profession).

As part of the Program Review process, the Department contacted program alumni and invited them to complete a short survey. Alumni were asked to comment about program strengths, weaknesses, and improvements that could be made. These comments form part of the program's assessment process and are incorporated into deliberations that faculty make each academic year about changes and improvements to the program. Selected comments are:
Strengths:

- Provided usable knowledge and experience that could be used immediately upon starting a career in geology.
- Faculty challenge students to go beyond the ordinary.
- Travel opportunities with faculty and field experiences.
- Concern that each faculty has for the students.

Weaknesses:

- Back to back classes leave little time for studying and completing assignments.
- Too much emphasis on memorization rather than comprehension.
- Lack of funding for analytical equipment and labs.
- Lack of resources for field-trip vans and not enough fancy equipment.

Improvements:

- Provide access to more lab areas.
- More real-world exercises. Encourage students to get more involved in additional activities.
- Develop a program where students could shadow non-academic working geologists.
- Provide a dedicated field-trip van or bus for the program.

4. Indicators of Student Engagement

QEP Outcome #1 - *Students can demonstrate the capacity to apply discipline-centered knowledge and training to address relevant concerns in community or society*.

- ***Assistance to in-service teachers involved in earth science instruction***
  During the review period, Andrew Wulff has taken 37 Geology and Education undergraduate majors with him to help teach students in local K-12 classes (Minerals, Rock Properties, Volcanoes, Earthquakes, Limestone Dissolution, and Fossils). WKU students have contributed approx. 145 hours teaching K-12 students at 10 different area schools. Student groups working with school districts

address a very real concern in society, namely the lack of important knowledge in geology.

- ***Engagement in public education***
  Students and faculty are engaged in public education via presentations for various civic organizations and clubs and by providing guidance for public education/ information such as designing signs for the Corps of Engineers at geological points of interest at Nolin Reservoir.

QEP Outcome #2 - *Students understand the diversity of peoples, ideas, and cultures and can demonstrate how these shape the world around them.*

- **Study Away and Study Abroad Programs**
  Students are engaged in various field trips where they learn about different physical and cultural worlds.

Figure 2. Student Field Trip to the Mojave

QEP Outcome #3 - *Students can demonstrate awareness of their opportunities as responsible citizens living and working in a global society..*

- ***Involvement in sustainability issues***
  Seth Cude led the WKU Chase "Go Green" team in a national contest and won a $40,000 endowment for environmental friendly improvements around the university.

  Students in Margaret Crowder's GEOL 102 courses participated in 165 hours of community service (2006-2007). Students from her GEOL 311 course researched climate change and presented posters dealing with the impacts of climate change on Earth's oceans at the 2009 Campus Community Partnerships conference.

Another example of student engagement includes independent research, which provides close faculty supervision of students' work in the field and/or laboratory. There is enhanced learning that occurs through these independent research opportunities with multiple outcomes such as production of posters and oral presentations (see Table VI-B-4 in the Appendix)

C. Program -Other Indicators of Program Achievement and Contribution

1. Program Viability:

Geology is a growing and vital program with steadily increasing enrollments, graduate rates and sustained geology-related employment for students upon graduation. Geology Program graduates have the expertise and skills to solve pressing environmental, natural resource, and energy problems. Within Geology, a number of collaborative projects are being developed with faculty at Ph.D. granting institutions, including such projects as novel heterosilicates for catalysis, paleoclimate reconstructions from fossils, planetary mineralogy, and nanoporous/ nanostructured materials characterization. Expanding beyond WKU, Geology professors are collaborating with faculty and scientists from institutions including Vanderbilt University, University of Kentucky, Indiana University, Jet Propulsion Lab, California Institute of Technology, Brookhaven National Lab, Oak Ridge National Lab, Stony Brook University, University of California at Berkeley, Virginia Tech, Queens College, University of Texas, University of Akron, and the Pennsylvania State University.

2. Contributions to University Programs:

All Geology faculty teach General Education courses that contribute to the General Education mission of the University. These courses include: GEOL 102, 111-113, 112-114. The Geology Program contributes to the Geography major, the Civil Engineering major, the Astronomy minor, and electives for Environmental Science. New upper-level course offerings are attractive to other majors, such as crystallography for Chemistry majors. Faculty have taught Honor's College colloquia. Margaret Crowder has developed and offered courses for the Center for Gifted Studies, she taught courses for Super Saturdays, VAMPY, and SCATS. Ms. Crowder has also offered courses for Women in Science and Engineering's Girls in Science Day.

3. Use of Technology:

Andrew Wulff and other faculty have purchased site licenses for geochemical, modeling use on program computers. Students enjoy a state-of-the-art GIS instructional lab, running the most advanced GIS software, ArcGIS, as well as a separate production lab with dedicated research computers and specialized peripherals, including scanners, GPS units, and a large-format plotter. A dedicated server acts as a license server for ArcGIS and hosts internet GIS services. Geology students and faculty have used these facilities for a variety of research and professional projects. Many program faculty maintain webpages and use Blackboard for course delivery. Both Dr. Siewers and Ms. Crowder have offered Earth System Science courses to pre- and in-service teachers through a NASA-funded educational alliance in the earth sciences. The introductory sequence of geology courses – GEOL 111, 112, 113, and 114 - is also available online, primarily for distance learners.

Technology plays a significant role in the education of Geology students. The program is unique in the region as it offers access to a wide array of research equipment. For example, the Crystal Kinetics Lab is home to variety of state-of-the-art research equipment geared at solving geological and industrial challenges associated with the characterization of crystalline materials under adverse conditions. Several key instruments, including the dispersive Raman microscope, powder X-ray diffractometer, and a thermal analyzer are used to probe the chemistry and atomic structure of materials. In addition to materials characterization, the CK Lab hosts facilities for crystal engineering/design that gives students and faculty the opportunity to study materials from inception to application. The CK Lab is also part of the newly created ARTP POD, the Advanced Materials Institute, which houses the larger pieces of equipment used for precise chemical and atomic structure characterization of highly functional materials and Earth minerals. Once trained, any students can have access to these research facilities for use on their research project. Ongoing projects range from modeling the behavior of radioactive isotopes on and in minerals, mineral ore formation conditions as a compass for continued exploration, and determining the structures of novel engineered materials for the decontamination of soils and air. Some of these projects have required addition analytical facilities that are only available at national laboratories (such as Brookhaven National Lab in New York and Oak Ridge National Lab in Tennessee), and our students have traveled to these facilities to obtain data that cannot be collected anywhere else in the world.

4. Uniqueness of Program:

The Geology program provides a unique collection of degree options in the Commonwealth of Kentucky, which includes both B.A. and B.S. degrees (the only program at WKU to offer both). In particular, the B.A. in Earth and Space Science certification provides the only such degree opportunity in Kentucky. Historically, WKU functioned as a teachers college and now the Geology program provides advantages to students seeking to be teacher certified in earth and space science. Although there are many teachers being certified, such as in elementary education, middle grades, or in integrated science, the Geology program working with Education programs on campus broadens the teacher certification base. Perhaps the greatest specific advantage for the institution is that the earth and space science certification provides a springboard for educating teachers in a discipline that will in turn provide awareness for K-12 students, something lacking heretofore. Eventually it is hoped that this awareness of the physical earth by students being

taught by teachers possessing this disciplinary knowledge will begin feeding back into the Geology program as majors and potential graduates of the program. In the program at the undergraduate level, as noted above, students have high-tech equipment access, and this is typically only available for graduate students. Additionally, the program is unique in that it has a fixed affiliation with a geology field camp experience for students in the Rocky Mountain West.

5. Contributions to Diversity Goals:

The geology program is attractive to a diverse student group and enjoys a great gender balance, which is not as common in allied sciences and engineering (37 percent of the program's majors are female). Every effort is being made to promote diversity via scholarship applications to the Geological Society of America, Girls in Science, school service, encouragement for women to join Association of Women Geologists. Margaret Crowder is a member of the WKU chapter of Women in Science and Engineering (WISE) and teaches a course on volcanoes for WISE's Girls in Science Day each year (2005-2010). Ms. Crowder also participated in the Leadership Initiative for Faculty Enhancement (LIFE) program session for minority faculty. Group discussions and participation in a Ropes course were part of this program, which was designed to help women and minority faculty develop leadership skills. Ms. Crowder is also involved in research into gender issues in science, technology, engineering, and mathematics (STEM) disciplines in post-secondary education as part of her doctoral studies.

A recent American Geological Institute report provides a realistic statement of overall diversity challenges in the geosciences (p.3 of report):

> *"Compared to the success story of female student graduates, the participation of under-represented minorities in the geosciences is extremely poor. Compared with other science & engineering fields, the geosciences confer the lowest percentage of Bachelor's and Master's degrees to underrepresented minorities. The percentage of all science & engineering degrees conferred to Hispanics and non-Hispanic African Americans is 8 percent, whereas the percentage of geoscience degrees conferred to these minorities is approximately 2 percent. In comparison, Hispanics and non Hispanic African Americans comprise 29 percent of the U.S. population (14% Hispanic and 15% non-Hispanic African American). The percentage of degrees conferred to Native Americans and Alaskan Natives from all science & engineering programs and from geoscience programs is approximately the same (0.8%). These minorities comprise only 2 percent of the U.S. population."*

6. Accreditation Status :

Although there is no accreditation associated with the program academically, the Geology program actively prepares students for teaching careers (which require certification) and professional service (which require licensing and/or registration). In the latter case, the curriculum is broad enough to aid students taking the ACAT exam in geology (used as an exit or senior content exam) as well as the American State Board of Geologists (ASBOG) exam, the national exam leading to the professional geologist registration or licensed professional geologist (PG).

7. Planning, Development, and Other Areas:

The Geology Program has proposed the creation of the William G. Reynolds Geological Resources Center to be used as an applied research and teaching center for geology students and faculty engaged with the petroleum industry. The proposal was not initially funded but will continue to be reviewed by the Reynolds Foundation of Virginia. The Geology Program benefited significantly during the review period from a grant contribution by William Dost that greatly enhanced the research and teaching capacity of the program via the creation of the William F. Dost, Jr. Endowment for Energy Studies. This online subscription, containing over 105,000 articles was provided through the American Association of Petroleum Geologists Foundation Digital Products Fund. The program has also benefited from the financial support of the Gildersleeve family, which established an endowment to support geology students in field work, research, study abroad, conferences, and other activities.

From a development perspective, alumni historically have been generous in their financial support of the Department and its programs. During the review period, the Department received approximately $140,000 in alumni contributions and other gifts. The Department circulates an annual alumni newsletter (http://www.wku.edu/geoweb/info/geogramindex.htm) – the GEOGRAM – which keeps alumni of the Geology program informed about research, faculty accomplishments, and their peers' activities. Historically, program graduates have contributed financially to the Department through regular donations and gifts-in-kind. Although graduates remain financially loyal to the program over many decades, there have not been any new opportunities in recent years to identify funding for an endowed professorship or other significant gift.

8. Additional Indicators for Career Preparation Programs

All geology majors conclude their degree program with a unique course called *Professional Preparation* which is designed to assist them in the college-to-work transition. This course, designed by Dr. Kuehn, was presented to the Association of State Boards of Geology (ASBOG) in his work at the national level with the credentialing and professional registration of geologists. It was circulated by ASBOG as a model for other universities to follow.

D. Factors Inhibiting Program Achievement and Contribution:

Some of the expanded courses offerings, especially those with rock and mineral collections, are in need of space for prolonged display of materials on table tops or benches for student labs and projects beyond regular class meeting times. There is also a need for expanded lapidary (saws, grinding and lapping surfaces) space for processing rocks and other earth materials. A safe X-Ray space for XRD and locations to put additional analytical equipment are needed. There is also a need for additional instructional staff so that Geology faculty can contribute more to the MS in Geosciences Program, while also continuing to expand undergraduate offerings including those involving the Honor's College and the Gatton Academy.

E. Response to Previous Program Reviews or Other Assessments:

Evaluation from last program review:

> *"The Geology program at WKU is a healthy, viable program with a strong track record of majors and graduates, and excellent prospects for future growth. The program average of eight graduates per year is somewhat below the CPE benchmark of twelve. However, of the six universities in the state to offer a geology degree, WKU consistently ranks a close second behind UK in annual graduates. Positive program attributes are numerous. The program has an impressive portfolio of teaching and advising quality indicators, including a University Distinguished Professor, a variety of teaching awards, sabbatical leaves for improvement of teaching quality, and a number of program graduates pursuing advanced degrees at Research I institutions. The assessment program is maturing and alumni surveys indicate that a majority of graduates are finding jobs in the field. The program also has a strong record of student-centered collaborative research which is consistent with the "student engagement" focus of the institutional Quality Enhancement Plan. The program possesses an impressive array of state-of-the-art laboratory equipment, including a modern GIS laboratory. Even more noteworthy is that this equipment is extensively utilized by the students in a variety of "hands on" laboratory courses. Program faculty clearly have a forward looking orientation and are actively seeking to be more responsive to constituents with respect to program structure and curriculum. Finally, the Academic Program Review report is* ***exemplary*** *and could be used as a model for programs undergoing future reviews."*

During the review period, the Geology program was fortunate to have hired an additional faculty member and has continued greatly to expand its array of state-of-the-art laboratory equipment. This expansion significantly diversifies the program's analytical capabilities and provides additional means for teaching and research. The program has truly engaged its students via its curriculum and independent research opportunities and it has exceeded the old CPE suggestion of 12 graduates per year noted in the previous review (now UK is a second to WKU geology). Additionally, graduates of the program have continued to find employment in the field.

F. Future Directions:

Within the last three years, the program has secured more than $700,000 in analytical equipment for student training and student/faculty research. This equipment has allowed for the integration of the Geology Program with the Advanced Materials Institute (an ARTP Program of Distinction) - a truly one-of-a-kind student learning environment. Students at WKU in the Geology Program have the opportunity to train using the most advanced laboratory and field-based materials characterization tools. The geology curriculum has responded by adding and modifying courses such as Crystallography, Optical Mineralogy, Petrology, Field Techniques, and Advanced Analytical Techniques to enhance further student learning and competitiveness for graduate schools and industry.

Currently the Geology Program offers online courses to pre- and in-service teachers. In the coming years the Geology Program anticipates ***significantly increasing its online course offerings*** through new technological innovations and web-based course delivery.

There are several Ph.D. granting universities currently planning on conducting research at WKU in collaboration with Geology faculty. In the future, ***industrial partnerships*** within AMI-Geology will include physical and chemical characterization of ore deposits, oil and gas reservoir characterization via the Reynolds Geological Resources Center, and training opportunities, through WKU, that are attractive to scientists and engineers in industry. An important goal of the Geology program is to ***expand research partnerships*** and ***student internships*** and we expect Geology students to directly benefit by being a part of these partnerships.

The Geology Program looks forward to becoming more involved with Honors College Programs and the Department's MS in Geoscience Program. Such involvement ***will require additional human and physical resources***. As the existing undergraduate program continues its growth, there will be increased demands on space in EST, facilities, and faculty time. Considering the viability of the program and its position as a leader in geological education in the Commonwealth and beyond, the foundation is set for programmatic enhancement.

Appendix Tables

Table VI-B-3a: Student Presentations 2005-2010			
Student	**Year**	**Conference Presentation**	**Award**
Newton, Melanie	2010	Kentucky Academy of Science	First Place – Geology
Toney, Chris	2010	Kentucky Academy of Science	Second Place – Geology
Moyers, Austin	2010	Kentucky Academy of Science	Third Place - Geology
Downen, Matt	2010	Kentucky Academy of Science	Second Place – Poster
Kenderes, Stuart	2010	Kentucky Academy of Science	Third Place - Poster
Matt Downen	2010	GSA national conference	
Downen, Matt	2010	WKU Research Conference	
Moyers, Austin	2010	KSPG annual conference	
Flynn, Elaine	2010	WKU Research Conference	
Marsh, Danielle	2010	WKU Research Conference	
Williams, Heather	2010	WKU Research Conference	
Rader, Shelby	2010	WKU Research Conference	
Stinson, Chasity	2010	WKU Research Conference	
Leftwich, Kristin	2010	WKU Research Conference	
Mitchell, Holly	2010	WKU Research Conference	
Downen, Matt	2010	Posters at the Capitol	
Elder, Courtney	2010	WKU Study Abroad Symposium	
Williams, Heather	2010	WKU Study Abroad Symposium	
Downen, Matt	2009	Kentucky Academy of Science	
Leftwich, Kristin	2009	Kentucky Academy of Science	First Place - Geology
Kenderes, Stuart	2009	Kentucky Academy of Science	First Place: Science Ed.
Downen, Matt	2009	Portland GSA	
Stinson, Chasity	2009	Portland GSA	
Smith, Dalene	2009	Interntnl Speleology Congress	
Stinson, Chasity	2009	Interntnl Speleology Congress	
Dame, Heath	2009	WKU Research Conference	
Brunner, Chelsea	2009	WKU Research Conference	
Downen, Matt	2009	WKU Research Conference	
Kramer, Kelly	2009	WKU Research Conference	
Dias, Vidal B.	2009	WKU Research Conference	
Moyers, Austin	2009	WKU Research Conference	
Moore, Robert B.	2008	Kentucky Academy of Science	
Brunner, Chelsea	2008	Houston GSA	
Monohan, Heather	2008	Houston GSA	
Brunner, Chelsea	2008	Meteoritical Society in Japan	
Henderson, Jake	2008	WKU Research Conference	Honorable Mention
Brunner, Chelsea	2008	WKU Research Conference	
Elrod, Ronson	2008	WKU Research Conference	
Brunner, Chelsea	2008	Regional GSA Evansville	
Monohan, Heather	2008	Regional GSA Evansville	

Brunner, Chelsea	2008	Posters at the Capitol	
Monohan, Heather	2008	Posters at the Capitol	
Brunner, Chelsea	2007	Interntl-KarstHydro-Ecosystems	
Monohan, Heather	2007	Interntl-KarstHydro-Ecosystems	
Moore, Robert	2007	WKU Research Conference	
Hawkins, Daniel	2007	Keck Symposium	
Campbell, Ben	2007	WKU Research Conference	
Burns, Jennifer	2006	Kentucky Academy of Science	
Moore, Robert	2006	Kentucky Academy of Science	
Williams, Ashley	2006	Kentucky Academy of Science	First Place - Session
Hawkins, Daniel	2006	Kentucky Academy of Science	Second Place - Session
Burns, Jennifer	2006	GSA Southeastern Knoxville	
Williams, Ashley	2006	Posters at the Capitol	
Hawkins, Daniel	2006	Posters at the Capitol	
Tallent, Jeremy	2005	NCKM Symposium Albany, NY	
Williams, Ashley	2005	Kentucky Academy of Science	First Place – Geology
Hawkins, Daniel	2005	Kentucky Academy of Science	Second Place – Geology
Tallent, Jeremy	2005	Kentucky Academy of Science	Third Place – Geology
Woodcock, Brandy	2005	GSA Salt Lake City	
Williams, Ashley	2005	GSA Salt Lake City	
Hawkins, Daniel	2005	GSA Salt Lake City	
Tallent, Jeremy	2005	Int Congress Speleology Greece	
Hawkins, Weldon	2005	Int Congress Speleology Greece	
Bergman, Crystal	2005	Regional GSA Biloxi	
Hawkins, Daniel	2005	WKU Research Conference	
Hawkins, Weldon	2005	WKU Research Conference	
Bergman, Crystal	2005	WKU Research Conference	
Williams, Ashley	2005	WKU Research Conference	

Table VI-B-3c: Program Graduates –Employment/Career Status

Student	Current Position
Abbey, Jeremy R.	Geologist, Quadra FNX Mining, Ltd, Arizona
Adair, Christopher R.	Geologist, American Engineering, Glasgow, KY
Barnett, Seth J.	Geologist-Technician, Vector Engineers, Shelbyville, KY
Brewer, Joshua	MS program, WKU Geosciences
Brunner, Chelsea	MS program, Geochemistry (meteorites), University of New Mexico, Albuquerque
Burns, Jennifer L.	Environmental Scientist, SpecPro Inc., Cape Canaveral Air Force Station
Burton, Grigory J.	Geologist, Sunburst Consulting, Inc, Pittsburgh, PA
Cary, Brent C.	Geologist, KY Dept of Environmental Protection,

	Div. Waste Management, Frankfort, KY
Chalmers, Patrica T. (MS, Geological Sciences, RPI, 2007)	Geologist (PG), Environmental Consulting, URS Corporation, Houston, TX
Clark, Paul D.	Geologist, Sunburst Consulting, Inc, North Dakota & Wyoming
Coleman, Melinda D.	Geologist, Independent Contractor, Sunburst Consulting, Wyoming
Corn, Tyler	Law School (Environmental Law & Policy), University of Vermont
Cude, Seth	Geologist Sunburst Consulting, Inc; currently endangered species habit protection, FL
Dame, Heath A.	Contract geologist, Universal Investment Group/Masters of Divinity Program, Southern Baptist Theological Seminary
Doyel, Michael S.	Second BS degree, Engineering, WKU
Dycus, Matthew N.	Geologist, Newfield Exploration Company, Tulsa, Oklahoma
Hawkins, Daniel	PhD. Candidate at Univ. MD-College Park
Hawkins, Weldon T	Farmer, sustainable agriculture, KY
Holbrook, Cody (MS, Geology, New Mexico State University, 2008)	Geologist, Shell Exploration & Production Company, Houston, TX
Hunt, Stephen H.	Middle Grades Earth Science Teacher, TN
Johnson, Gregory A.	Scientist, Quantum Technology Sciences Inc., Cocoa Beach, FL.
Kuykendall, Jason D.	Geologist (PG), EnSafe, Bowling Green, KY
Land, Isaah D.	Geologist, Sunburst Consulting, Inc, Pittsburgh, PA
Leftwich, Kristin M.	Environmental Chemist, Test America, Nashville
Lindsey, Jodi B.	GIS Specialist & PG, AMEC Earth and Environmental, Nashville, TN
McCue, Robert Bo	Geologist/Appalachian District Manger (Partner 2010), Sunburst Consulting, Inc, Pittsburgh, PA,
McKee, Molly M.	Tour Guide, Grand Canyon, Angels Gate Tours, Flagstaff, AZ
Monohan, Heather	Geologist, Sunburst Consulting, Inc, Pittsburgh, PA
Moore, Bradley K.	Geologist: AAI Environmental
Mullen, Amanda M.	Geologist, Barrick Gold, Nevada
Munday, Cody C.	Geologist, TPM Environmental, Bowling Green, KY
Reeder, Andrew D.	MS program, WKU Geoscience, start in S'11
Reynolds, James K.	Geologist, Sunburst Consulting, Inc, Pittsburgh, PA

Scott, Julie J.	MS Program, Homeland Security Science, WKU
Skees, Catherine	MS program, Hydrogeology, Univ. Kentucky
Smith, Darlene F.	MS Program, Geosciences, WKU
Smith, Neil A.	PhD program, vertebrate paleontology, University of Texas, Austin
Sprouse, Ryan D.	Odd jobs, Portland, Oregon; formerly Sunburst Consulting, Inc, North Dakota
Tallent, Jeremy A.	Underground Mine Geologist, Oceanagold, New Zealand
Thomas, Kyle M	Geologist, Sunburst Consulting, Inc, Pittsburgh, PA
Thompson, Kristy L.	Optometric assistant, Breiwa, Jeskie, and Tucker, Scottsville, KY
Wanta, Adam B.	Geologist, EnSafe, Bowling Green, KY
Williams, Ashley N. (MS, Geology, Univ. of KY, 2010)	Geologist, Army Corps of Engineers, Nashville, TN
Williams, Heather R.	homemaker, Todd County, KY
Wolford, Laura	Elementary Science Teacher, Columbia, KY
Wood, Devin	National Guard, Afghanistan
Woodcock, Brandy	GIS specialist (PG), AMEC, Nashville, TN
Yates, Amber M.	homemaker/mother/works retail, Lawrence, KS,

Table VI-B-4: Independent Student Research Projects, Spring 2005 to Fall 2010

Student	Project	Supervisor	Term
Bowles, Rachel	Ostracode Shell Geochemistry	Siewers (399)	F 2010
Brunner, Chelsea	Crystallization of K-alum	Celestian (399)	F 2008
Brunner, Chelsea	Matlab Programming	Celestian (399)	S 2008
Burns, Jennifer	Development of Geology GIS	Wulff (399)	F 2006
Burns, Jennifer	Development of Geology GIS	Wulff (399)	F 2006
Downen, Matthew	Mirabilite Weathering	Celestian (399)	F 2008
Downen, Matthew	Mirabilite Crystallization	Celestian (399)	S 2009
Elder, Courtney	Ostracod Shell Geochemistry	Siewers (399)	F 2010
Elrod, Ronson	Sedimentary Petrology	Siewers (399)	S 2009
Flynn, Elaine D.	Petrography and Geochemistry	Wulff (399)	S 2010
Flynn, Elaine	Petrogenesis of lava flows	Wulff (399)	F 2009
Hawkins, Daniel	Evolution of a Mafic Sheet	Wulff (399)	S 2007
Hawkins, Daniel	Database of Volcano metrics	Wulff (399)	F 2005
Hawkins, Weldon	Acid Mine Drainage	Groves (399)	S 2005
Henderson, Jake	Differentiating Top Soil	Wulff (399)	S 2008
Hunt, Stephen	Geoscience Education issues	Wulff (475)	S 2007
Jolly, Christian	Heterosilicate Mineralogy	Celestian (399)	F 2010

Leftwich, Kriss	Tunnel Structures	Celestian (399)	F 2008
Leftwich, Kriss	Synthesis of Tunnel Structure	Celestian (399)	S 2008
Marsh, Danielle	Sediment Evaluation Green Riv	Wulff (399)	F 2009
Mitchell, Holly R.	Gamma Ray Characterization	May (399)	S 2010
Moore, Bradley K.	Limestone Dissolution Rates	Florea (399)	F 2008
Moore, Robert D.	Stratigraphic Frameworks	May (399)	F 2008
Moyers, Austin	Ore Mineral Assemblages	Wulff (399)	F 2010
Reeder, Andrew	Advanced Sediment Analysis	Siewers (399)	F 2007
Rucks, Melinda	Heterosilicate Mineralogy	Celestian (399)	F 2010
Samples, Rebecca	Petrography of Oolite	Siewers (399)	S 2005
Smith, Hunter A.	Zeolite Mineralogy	Celestian (399)	S 2010
Stinson, Chasity	Water Resource Investigations	Florea (399)	F 2010
Stinson, Chasity	Cave Biofilms in Florida	Florea (399)	S 2010
Toney, Chris A.	Tufa Mineralogy	Celestian (399)	F 2010
Toney, Chris A.	Tufa Mineralogy	Celestian (399)	S 2010
Walter, Anna V.	Zeolite Mineralogy II	Celestian (399)	S 2010
Walter, Anna	Zeolite Mineralogy I	Celestian (399)	F 2009
Wanta, Adam	Geoscience Curricula for K-8	Wulff (399)	S 2008
Webb, Layne	Planetary Mineral Dehydration	Celestian (399)	F 2010
Webster, Jeffrey R.	Environmental Geology	Groves (399)	Sm 2010
Williams, Ashley	Interpreting Stable Isotopes	Wulff (399)	F 2005
Williams, Heather	Sediment Evaluation Green Riv	Siewers (399)	F 2009

DEPARTMENT OF GEOGRAPHY AND GEOLOGY
ACADEMIC PROGRAM REVIEW
Undergraduate Program Section

NOTE: The following sections (i.e. V and VI) should be completed for each UNDERGRADUATE academic program within the Department undergoing review.

Program: Geography, B.S. Reference Code: 674

[Note: includes information for Meteorology (578) and Geographic Information Science (576) as these new programs were a key component of the Geography (674) major during the program review period. As these two programs are new, they are not officially part of the current program review.]

V. Program Enrollment and Student Data

A. Majors:

Table V-A-1: Number of Majors

Program	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
674 Majors	144	121	110	85	65
578 Majors	0	0	13	41	52
576 Majors	0	0	2	7	15

Double majors are counted in each major a student declares.

Since 2007, the Geography Program has developed two new programs within the Department – a B.S. in Meteorology (#578) and a B.S. in Geographic Information Science (#576). While the Geography program (#674) has seen a decline in the number of majors, the Department overall has seen a net increase as many former geography majors have moved into the new programs, and have been joined by additional students who otherwise would not have come into the Department or, in many cases, to WKU at all. Because many faculty from the Department are now more directly responsible for these new majors, the actual student-faculty ratio has not appreciably changed over time. Also, students in the GIS and Meteorology Programs are required to take several courses within the Geography Program as part of their degree, and thus the Geography Program faculty generate a sizable number of student credit hours beyond what is reflected by the actual number of 674 majors. As this process has stabilized, 2010 numbers (not included in Table V-A-1 above) indicate a rebound in 674 major numbers as students are being attracted by new offerings including sustainability, cultural geography, and karst science. We expect the number of 674 majors to grow substantially during the next 2010-2017 Program Review period.

The Department currently has 74 majors enrolled in geography (#674), 54 majors in Meteorology (#578), and 12 majors in GIS (#576), with an additional 74 students enrolled in Minors in geography, sustainability, and related programs.

B. Degrees Awarded:

Table V-B-1: Number of Graduates

	2004/05	2005/06	2006/07	2007/08	2008/09
Degrees Awarded	27	37	36	26	22

Double majors are counted in each major a student declares.

While the number of Geography Program students (Table V-A-1 above) has declined due to new program offerings, the number of graduates has remained more constant. While this is partially an artifact of the time it takes students to work through the system, it is also reflective of the fact that many students find Geography relatively late in their academic careers after they have tried other Departments and find that Geography is the best fit. Many entering freshmen do not realize that within the Geography Program there are concentrations such as cultural geography, environment and sustainability, and planning and, once they discover these opportunities, they move into the Geography Program and are able to graduate more quickly because they have already met their General Education requirements. As our program offerings become better known, we expect more students to begin committing to the 674 Program earlier in their academic career. Thirteen students graduated with degrees in Geography during the Spring and Summer 2010 ceremonies, along with six students in the Meteorology program (the first cohort to complete the new program).

C. Comparisons with External Data:

Table V-C-1: Program Enrollments in similar programs at Kentucky public universities

Baccalaureate Enrollments by First Major Only (CIP Code 45.0701)	**Fall 2005**	**Fall 2006**	**Fall 2007**	**Fall 2008**	**Fall 2009**
WKU	138	117	107	80	59
EKU	31	24	29	42	32
KSU	-	-	-	-	-
Morehead	20	21	26	23	27
Murray	-	-	-	-	-
NKU	18	18	19	15	15
UK	72	88	75	75	58
UofL	63	55	52	49	54

Source: Kentucky Council on Postsecondary Education Comprehensive Database.

Note that the Department had 54 Meteorology majors and 12 GIS majors, in addition to the 74 Geography majors, as of Fall 2010. At most institutions, including at WKU, these majors are captured under a different CIP code. The University of Louisville recently began to market a new program emphasis in meteorology, but this program is housed in the Physics Department, with data captured under a different CIP code.

Table V-C-2: Degrees Conferred in similar programs at Kentucky public universities

Baccalaureate Degrees Awarded by First Major Only (CIP Code 45.0701)	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**
WKU	24	35	35	24	21
EKU	8	6	9	2	16
KSU	-	-	-	-	-
Morehead	5	6	5	10	8
Murray	-	-	-	-	-
NKU	3	6	5	5	7
UK	23	25	23	30	31
UofL	11	13	13	20	11

Source: Kentucky Council on Postsecondary Education Comprehensive Database.

Table V-C-3: Degrees Conferred in similar programs at Benchmark Institutions

Benchmark Institution	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**
WKU	**27**	**37**	**36**	**26**	**22**
Ball State University	22	25	41	39	31
California State University-Chico	20	25	26	15	20
California State University-Fresno	12	12	13	23	15
Central Missouri State University	7	3	5	7	9
Eastern Illinois University	6	15	19	11	20
Eastern Michigan University	10	13	10	10	15
Florida Atlantic University	6	11	9	8	11
Indiana State University	5	9	7	3	10
Missouri State University	12	16	13	9	11
Montclair State University	5	2	7	9	8
Northern Arizona University	6	5	4	4	5
Stephen F Austin State University	12	7	4	4	8
Towson University	23	19	29	22	22
University of Northern Iowa	17	14	10	11	13
Western Illinois University	7	2	3	6	8
Youngstown State University	13	15	12	6	3

Source: Integrated Postsecondary Education Data Systems (IPEDS).

While the numbers of Geography 674 students has declined as other programs within the Department expanded, the WKU Geography Program is still substantially larger and more successful at graduating students than any programs in our region or among our national benchmarks. This is a function of the diverse offerings within the Program that appeal to a wide range of students and offer an equally large number of employment opportunities.

D. ACT Scores of Students Admitted to Program *(for baccalaureate programs)***:**

Table V-D-1: Average ACT Scores of Admitted Students

Avg. ACT	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
674 Majors	21.0	21.5	21.4	21.6	22.2
OCSE Average	22.2	22.4	22.5	22.8	23.1
University Average	21.4	21.5	21.6	21.9	22.3

The ACT scores for Geography Program students are in line with WKU averages. The Department serves a large segment of the student body by offering courses for a diversity of students. The ACT scores have increased through time slightly, but we are committed to serving all students at WKU.

E. Undergraduate GPAs of Program Graduates *(for baccalaureate programs)*:

Table V-E-1: Undergraduate GPAs for Program Graduates

Ugrad GPA	2004/05	2005/06	2006/07	2007/08	2008/09
674 Graduates	2.87	3.02	3.00	3.07	2.71
OCSE Average	3.16	3.15	3.16	3.12	3.14
University Average	3.12	3.13	3.14	3.12	3.14

The Geography program is committed to serving all WKU students who have an interest in the discipline, including majors, minors, and those seeking general education courses and electives. While we have many honors graduates who continue on to prestigious Masters and PhD programs, we also offer a quality education in a variety of programs to ensure that students can gain a valuable education and the knowledge to success in a variety of careers. Geography 674 program student GPAs have remained relatively constant throughout the review period. The Department is aware of the grade inflation pressures that are well documented throughout the nation and is committed to resisting them, ensuring that students are held to rigorous standards that exemplify the best within the discipline. The average undergraduate GPA of the first cohort of Meteorology students who graduated in Spring 2010 was 3.45, which is significantly higher than both Ogden and WKU GPA averages, despite the rigorous coursework required of these students. This average GPA is indicative of the quality of students recruited to the new Meteorology Program, most of who come to WKU with AP credits, higher Math skills, and a stronger science background overall.

VI. Program Description and Self Study

A. Mission Statement/Relation of Program to University Mission:

Productive citizens have the ability to adapt to a changing world and often rise to become leaders in their communities. Processes of globalization, reflected by technological innovation and cultural diffusion, are drivers of rapid change in the structure of society. At the same time, issues of sustainability challenge society from the local to the global scale. Now, more than at any time, an informed geographic perspective is an asset in society. Further, there is a growing need for people with knowledge and technical skills to analyze and understand the massive volume of geospatial data that is being collected each day to support decision making in both the public and private sectors. The geography program is focused specifically on providing students with an educational experience that meets their needs and those of society. The geography curriculum has evolved through the years to emphasize substantive issues of globalization, cultural awareness, and sustainability, while expanding opportunities and expectations for students to acquire technical skills involving the analysis and interpretation of geospatial data.

Program Vision Statement: The Department aims to be the region's outstanding undergraduate Geography program, with effective international reach. It aims to produce exceptional graduates from its major programs, to engage them in critical thinking and meaningful problem solving, and to build the reputation of the Department through meaningful research and community engagement.

Program Mission Statement: The Geography major prepares students to be productive, engaged, and socially responsible citizen-leaders of a global society. It provides research, service, and life-long learning opportunities for its students. The geography program is responsible for stewarding a high quality of life for its faculty, students, and alumni so that they:

- Recognize science as a way of knowing, including its values and limitations;
- Achieve a depth and range of knowledge and skills in their discipline or in a multidisciplinary area;
- Develop abilities of reason and imagination; collect and analyze data, synthesize and draw conclusions; effectively communicate with others;
- Experience discovery, design, or application within the discipline and beyond;
- Evidence a commitment to an examined and evolving set of values and professional ethics, leading to informed decisions and including contributions to the discipline and to society;
- Become knowledgeable in the discipline, prepared for the future, and competitive in a global environment.

B. Teaching and Learning:

1. Undergraduate Students:

Geography students are engaged in the learning process and have a broad understanding of geography as well as its interconnections with other disciplines. Geography has linkages with other fields including anthropology, biology, ecology, economics, history, resource management, sustainability and sociology. Geographers also gain expertise in a variety of research quantitative and qualitative research techniques including GIS, statistics, and fieldwork. Geography students focus on the linkages between human activity and the natural world. Graduates from the program have the tools and expertise to tackle real-world problems and to contribute to their communities. Many of the program's students are involved in research projects with their faculty mentors and/or are engaged in internships to develop their professional skills. Geography students have numerous opportunities to participate in "Study Abroad" and "Study Away" programs, as well as local field work experiences as part of their regular coursework. The Department also offers "honors enhancement" coursework to students in the WKU Honors Program. Students who participate in these programs come away with new perspectives of the world as well as their place within it.

The Geography Program has numerous students who are involved in WKU's honors programs, and it attracts both current Gatton Academy participants and its alumni who go on to study at WKU. Many Honors and Gatton Academy students come to Geography to work on service learning projects and end up becoming our most engaged students. Our students earn both University and National awards for scholarship and research. Every year, members of our Program enter the national Geography honor society Gamma Theta Upsilon. Overall, we are proud of the students in our program and of their achievements as both students and alumni.

2. Indicators of Teaching and Advising Quality:

The Geography Program requires that all faculty engage students in real world, hands-on problem solving. Every faculty member involves students in experiential learning during both coursework and independent study projects. As a result of these efforts, over 100 students have presented at local, regional, and international conferences and attended academic workshops, and over 20 papers have been published with students as co-authors (see Table VI-B-2 in the Appendix).

Faculty help students examine the complexities of the ethics of research, such as research involving human subjects. In Cultural Geography, for instance, students collaborate in teams to devise a survey that they then take through the Human Subjects Review process. This teaching strategy meets the QEP goals of cultivating a participatory learning environment, incorporating active learning into the classroom, developing a sense of social responsibility towards research subjects, and enhancing professional skills.

An example of student research and service learning is when Dr. All's Environmental Planning course spent a semester working with Habitat for Humanity and the City of Bowling Green to create a plan for a residential 'eco-village' based on sustainability science principles. Students planned everything within the complex to minimize the ecological footprint – from solar panel use to stormwater management – and a grant for over $600,000 was received by Habitat for Humanity from the Kentucky Division of Water to fund the project.

Geography Program faculty lead a variety of local fieldtrips for students. For example, some introductory courses take students on trips to Mammoth Cave National Park as part of the park's Environment Education program. On this trip, students are able to see in the real world what they've been discussing in the classroom. Upper division courses take students on field excursions on campus and through downtown Bowling Green to analyze natural and cultural landscapes. Other courses, such as Geography of Kentucky and Tourism Geography afford students both local and regional field experiences. Many students enrolled in these courses are education or social studies majors, and these experiences prove invaluable as they, in turn, teach Kentucky geography to their K-12 students.

Geography Program students' assessments of their advising experiences are in-line with overall WKU advising (Table VI-B-2 below). Nowhere do the scores between Program and WKU advising significantly differ. It is important to recognize that the Program has steadily improved in all facets of advising. In order to increase our Program 'help with career planning,' the Geography Program instituted a mandatory senior capstone seminar that both gauges student outcomes from the Program and offers professional development skills, including resume writing, interviewing, and job search strategies Since that time, we have seen a twenty percent increase (2.29 to 2.69) in student responses on this question, which now positions the Program's score on this measure above the average WKU response

Table VI-B-2: WKUSES DATA

Thinking about the ADVISING you received in your major, rate the following:	**Spring 2005**		**Spring 2006**		**Spring 2007**		**Spring 2008**		**Spring 2009**	
	N	**Avg**	**N**	**Avg**	**N**	**Avg**	**N**	**Avg**	**N**	**Avg**
Responses from Geography Majors (ref. #674)										
a. Overall quality of advising	18	2.83	22	2.82	22	3.00	27	2.89	17	3.18
b. Availability of advisor	18	2.67	22	3.00	22	3.23	28	3.07	17	3.24
c. Advisor's help with developing your schedule each semester	17	2.59	22	2.50	21	2.90	27	3.00	17	3.12
d. Advisor's help with career planning	17	2.24	20	2.20	18	2.22	24	2.29	16	2.69
e. Advisor's knowledge of degree requirements	18	3.33	21	3.10	21	3.24	27	3.41	17	3.35
Responses from All University Students										
a. Overall quality of advising	3001	2.92	2295	2.96	2194	2.95	2511	3.02	2115	3.10
b. Availability of advisor	2986	2.97	2283	3.03	2189	3.03	2503	3.08	2109	3.18
c. Advisor's help with developing your schedule each semester	2933	2.85	2247	2.87	2159	2.90	2456	2.96	2077	3.03
d. Advisor's help with career	2775	2.46	2096	2.52	2058	2.53	2320	2.60	1958	2.63

planning										
e. Advisor's knowledge of degree requirements	2979	3.23	2278	3.28	2187	3.27	2484	3.33	2109	3.35

Scale: 1=Poor, 2=Fair, 3=Good, 4=Excellent.

3. Indicators of Student Learning:

i. Intended Learning Outcomes:

The Department has adapted WKU's Quality Enhancement Program outcomes as a general framework to guide program assessments.

QEP Outcome #1 - *Students can demonstrate the capacity to apply discipline-centered knowledge and training to address relevant concerns in community or society*.
QEP Outcome #2 - *Students understand the diversity of peoples, ideas, and cultures and can demonstrate how these shape the world around them.*
QEP Outcome #3 - *Students can demonstrate awareness of their opportunities as responsible citizens living and working in a global society.*

In addition, the Department has adopted the general learning philosophies outlined in Ambrose et al. (2010) (refer to Table VI-3i in the Appendix). These philosophies guide the assessment process.

ii. Means of Assessment and Criteria for Success:

The Department has generally adopted a 14-point framework for the assessment of learning outcomes. This framework has been applied primarily to the assessment of general education courses, but is applicable to all of the coursework offered in the Department. Although all of the 14 criteria for assessment are relevant at the meta-level, some are more relevant to specific courses. In the Geography program, for example, advanced courses typically focus on oral communication (5) and teamwork (8), whereas these two criteria may be less relevant or applicable in large general education courses. In the interdisciplinary Introduction to Latin American Studies course (LAS 200), for example, criterion 14 is stressed, as this team-taught course integrates themes, theories, and methodologies from geography, history, and political science.

1. Inquiry and Analysis
2. Critical Thinking
3. Creative Thinking
4. Written Communication
5. Oral Communication
6. Quantitative Literacy
7. Information Literacy
8. Teamwork
9. Problem Solving
10. Civic Knowledge and local-global engagement
11. Intercultural competence
12, Ethical Reasoning
13. Skills for lifelong learning
14. Integrative Learning

Assessment takes place in a number of ways. Each spring, the Department assesses its general education courses using the 14-point framework or other methods to determine if the course is meeting general education learning outcome goals. Other assessment methods include comfort surveys, benchmark knowledge surveys at the beginning and end of individual courses,

group projects, independent student learning, practica experiences, and the culminating professional development course (499).

iii. Data Collection Methods

Assessment data are generated each spring in the general education courses using a variety of methods, including capstone essays, a set of multiple-choice questions measured against beginning-of-semester benchmarks, and other methods. In advanced courses, students are assessed using team projects, presentations at conferences, internship evaluations by supervisors, thesis committees, and the capstone professional development course. All graduating seniors take a comprehensive assessment examination as part of the capstone GEOG 499 course.

iv. Assessment Results

At the end of each course, faculty typically conduct a personal assessment of course delivery and other indicators of learning success. SITE evaluations can help to identify specific issues with examination formats and textbooks, etc. The Department subscribes to the general philosophy that short-term, snapshot evaluations of learning outcomes are statistically suspect and do not provide robust enough data to suggest meaningful improvements. Consequently, the Department takes a longer view of course assessment and learning outcomes, preferring to look at trends over time and to survey graduates from time to time to determine what worked and what needed improvement.

v. Use of results to improve the Program

Each program has a curriculum committee that assesses on a regular basis individual course relevance and overall program relevance. Data gathered from faculty course assessment, from alumni surveys, from SITE evaluations, and from the discipline generally are used to make program improvements. Individual faculty evaluate trends in the discipline to determine whether courses need changing, or whether new courses need to be added. In Geography, for example, assessment of learning outcomes in GEOG 391 (Data Analysis and Interpretation) suggests that changes need to be made to this course. Over the past few years, course instructors have seen a trend in students' inability to grasp the basic concepts of descriptive statistics. This trend has been revealed through group project results, incoming graduate student weakness in statistics, and a weakness in statistical presentations. Faculty have initiated a proposal to require STATS 201 as a prerequisite for GEOG 391, which would remove about 40% of the current descriptive statistics content in GEOG 391 and provide more time to develop the concepts of spatial, analytical, and inferential approaches to geostatistics.

Changing technologies (such as in Geographic Information Science), new equipment, employer demands, and other circumstances can influence how a program is changed. For example, the addition of a new Cultural Geographer this past academic year has encouraged a revamping of the Cultural Geography concentration in the program and has spurred a re-evaluation of several supporting courses. On the physical side of geography, faculty have realized that the creation of the new B.S. in Meteorology program has left a gap in the physical focus of the Geography program. Consequently, faculty are currently developing a new

concentration in Karstic Studies that will support ongoing research in several centers (Hoffman Institute, etc.), meet a growing demand for these skills in the workforce, and help students to hone their technical skills with more relevant coursework.

a. Assessment of Currently Enrolled Students:

The Geography program requires that every student participate in a capstone seminar. The course teaches essential professional skills such as résumé writing and public presentation. Additionally, a senior assessment attempts to determine the relative level of Program success in achieving intended educational outcomes for each student. The senior assessment for geography majors has four components. First, a set of multiple-choice questions addresses some basic concepts in the discipline. The second section contains a set of short essays that tests the student's critical thinking skills and general knowledge of the discipline. Third is a short map quiz of general knowledge. Finally, the students are provided the opportunity to make comments, suggestions, and critiques about the geography program in general. The senior assessment is tailored for each of the sub disciplines in geography: Cultural Geography; Land, Weather, and Climate; Environment and Sustainable Development; and Planning and GIS. Separate assessments are conducted for the B.S in Meteorology and the B.S. in GIS programs. The results of the assessment are shared with the program leaders for sub-discipline outcome analysis.

GIS Analysis & Modeling (GEOG 417) serves as a capstone course for the GIS major, minor and certificate. Students enrolled in GEOG 417 are expected to carry forward all skills and knowledge acquired in the prerequisite courses - GEOG 316 and GEOG 317. GEOG 417 is a project-based course where students are engaged in real-world GIS applications on an individual and group basis. Projects emphasize both application of technical skills and communication of project results in written and oral form.

Program learning outcomes are also assessed through independent projects, internships, and publications. Program students enrolled in 93 independent research courses during the review period, covering a wide range of human-environment issues (see Table VI-B-3a-1 in the Appendix). Each student signs a research contract with the supervising faculty member that details project requirements, deliverables, deadlines, and the assessment method. During the review period, 78 students in the geography, meteorology, and GIS programs participated in internship or practicum experiences in the local and regional community (see Table VI-B-3a-2).

As part of the Program Review process, the Department contacted currently enrolled majors and invited them to complete a short survey. Students were asked to comment about program strengths, weaknesses, and improvements that could be made. These comments form part of the program's assessment process and are incorporated into deliberations that faculty make each academic year about changes and improvements to the program. Selected comments are:

Strengths:

- Some great professors who are knowledgeable and passionate.
- Wide variety of required courses.
- Course and content diversity.
- Excellent advising.
- Application of knowledge with many opportunities for independent research.

- Best program in the region – I am getting a very good education and I learn a lot.
- Faculty really try and get to know you personally.
- Outstanding professors, and most of the class work was very beneficial.

Weaknesses:

- Too many classes do not offer appropriate material for the concentration.
- Not enough geography courses offered at the Glasgow campus.
- Trigonometry and geostats are not applicable to me.
- Not a lot of help in locating job opportunities.
- No printers in the small student laboratory.
- The number of faculty teaching upper-level courses is small.
- Advisor only advises through email – needs to meet face-to-face with students.
- You don't know most of the students that are in the program with you.
- More funding for classes and research.

Improvements:

- Require green architecture classes to open up career opportunities.
- More teachers for environment and sustainability courses.
- Provide more online geography courses or ITV to Glasgow.
- Link students and alumni together for information about job openings.
- More integration with Mesonet and Climate Center during classes.
- Improve the advising process.
- Provide more opportunities to get to know other students in the program.
- Focus more resources on the Meteorology program.

b. Other Indicators of Success:

Each student in the Geography major (as well as students majoring in Meteorology and GIS) is required to complete a capstone experience that may include a study abroad program, a study away program, an internship or practicum experience, or an independent research project supervised by a faculty member (typically a GEOG 475 course). Specific examples of faculty-directed student research include:

- Sara Ferguson created a Cave Management Plan proposal for Lost River Cave with input from the University President, the Bowling Green Mayor, and the Bowling Green City Council as well as a variety of other local stakeholders.
- Jim Eubanks and Travis Keown examined WKU student commuting patterns using GIS to help with sustainability initiatives.
- Twelve students worked with the Barren River Health District examining residential radon and environmental planning techniques to minimize risks for Commonwealth citizens. Another eight students have worked with Bowling Green and Warren County Stormwater Management offices to help develop Best Management Practices for Stormwater in Karst areas.

- As part of his Honors Augmentation for "Geography of the South," Stephen Mattingly undertook a semester-long research project that focused on urban planning strategies in Virginia. Stephen combined his interests in urban geography and Virginia for this project.
- For his Honors Augmentation in "Economic Geography," Stephen Mattingly wrote a semester-long research paper on, "Economic Development Strategies for Virginia." This paper was a follow-up project to his research on urban planning in Virginia from the "Geography of the South" class.
- Sean Hutchinson received a grant for his project titled "Evaluating Resource Management Decision-Making in the Face of Climate Change using Remote Sensing in Protected Areas of Kentucky."
- Jennifer Schultz examined Water Resource Implications for Florida – a supervised independent undergraduate student project examining the impacts of phosphate mining on groundwater and ecosystems in west-central Florida.

Students are encouraged to present the results of their research at local, regional, national, and international conferences, and many choose to do so. During the review period, 62 presentations were given at a variety of conferences, with students receiving twelve presentation awards in competitive environments (see Table VI-B-3b-1 in the Appendix). Recent examples of the high level of participation by program students in conferences include:

- In November, 2010, three students presented posters at the annual South Eastern Division of the Association of American Geographers (SEDAAG) conference in Birmingham, AL.
- In November, 2010, five students presented research at the annual Kentucky Academy of Science conference convened at WKU.
- In April, 2010, three students presented 2 posters at the Association of American Geographers annual meeting in Washington, D.C.
- In January, 2010, five students presented five posters at the American Meteorological Society annual meeting in Atlanta, GA.
- In November, 2009, six students presented five posters at the Southeastern Division of the Association of American Geographers conference in Knoxville, TN.
- In October, 2008, ten students presented posters at the National Weather Service annual meeting in Louisville, KY.

Honors Program participants include Margaret Wilder, William "Joey" Coe (a Semester at Sea participant), Hannah Morris, Daniel Price (also a former Gatton Academy student), and Brenna Tinsley.

Five WKU students have secured summer internships with ConnectKentucky, a nonprofit organization specializing in technology infrastructure expansion. These opportunities promise to build professional GIS experience and actively engage these students with building tomorrow's world. ConnectKentucky was subsequently renamed ConnectedNation, an organization whose goal is universal broadband internet access. It has employed a number of students who have come through the Department's GIS and M.S. Geoscience programs.

External Scholarships and Awards:

Over the past nine years, the Department has had significant success with students winning ESRI scholarships to attend the annual International Users Conference. Students are selected by ESRI from a pool of international applicants for the competitive scholarships, which support 60 graduate and fourth-year undergraduate students from universities and colleagues throughout the U.S. and around the world. Other successes include the Moe Udall Scholarship, numerous highly competitive prestigious internships, and professional recognition at conferences and workshops.

Table VI-B-3b-2: Geography, Meteorology, and GIS Student Awards

Student	Year	Scholarship or Award
David Evans	2010	ESRI
Mattingly, Kyle	2010	NOAA E.F. Hollings
Bedel, Tony	2010	Ogden Scholar – 4.0 GPA
Coe, Joey	2010	Moe Udall Award (2nd Year)
Gonzalez, Astrid	2010	Honors College Graduate
Wix, Jane Marie	2010	Honors College Graduate
Blaylock, Ian	2010	NWS SCEP Internship
Roberts, Sam	2010	NWS SCEP Internship
Whitehead, Brittany	2010	NWS SCEP Internship
Cary, Melissa	2009	ESRI
Coe, Joey	2009	Moe Udall Award
Gonzalez, Astrid	2009	Louis Stokes Alliance for Minority Participation Award
Gonzalez, Astrid	2009	NSF REU Internship
Bedel, Tony	2009	Midwest RCC Internship
Gant, C. Danny	2009	NWS SCEP Internship
Wix, Jane Marie	2009	NWS SCEP Internship
Fowler, Brandon	2007	ESRI

c. Program Graduates:

Geography is a holistic discipline, with both intensive and extensive approaches needed to build skill sets appropriate for the global economy. Unlike other science disciplines such as Engineering, Chemistry, Physics, etc., there are few career paths designated simply “geography.” Geographers are employed throughout society as planners, environmental consultants, location analysts, transportation specialists, GIS analysts, meteorologists, business leaders, diplomats, and scientists. Basketball star Michael Jordan earned a B.S. in Geography from U.N.C., and the future King of England, William, earned an undergraduate geography degree! Graduates of the Geography program at WKU are employed by federal, state, and local governments in a variety of careers; they work for companies like BGMU, Ford, Ensafe, Sumitomo, and UPS; they have careers in business and industry addressing planning, locational, and environmental issues; and several they have gone on to earn Ph.D.s for careers in teaching. Nearly all of the students who

have graduated with the B.S. Geography - Meteorology track with a minor or double major in Broadcasting have found jobs and are advancing in their careers. Examples include:

Justin Logan KAIT-TV Jonesboro, AR
Cassie Heiter WQAD-TV Quad Cities, IA
Shane Smith WOAY-TV Oak Hill, WV
Stephanie Midgett WBKO-TV, Bowling Green
Melanie Niemann WCAV-TV, Charlottesville, VA

The Geography program is an important supplier of graduate students to the M.S. Geoscience program, with the Meteorology and GIS programs expected to increase the number of new graduate students in the future as these new programs mature. Eighteen students from the 48 currently enrolled in the M.S. Geoscience program earned their undergraduate degree from WKU (37.5%), and eleven of these 18 students graduated from the Department of Geography and Geology. However, of the 39 students who completed the M.S. Geoscience program during the review period, only nine came from WKU undergraduate programs (and six from the Department's programs). Recent Geography, Meteorology, and GIS program graduates have gone on to Master's or Ph.D. programs at institutions like Penn State, University of Georgia,

As part of the Program Review process, the Department contacted program alumni and invited them to complete a short survey. Alumni were asked to comment about program strengths, weaknesses, and improvements that could be made. These comments form part of the program's assessment process and are incorporated into deliberations that faculty make each academic year about changes and improvements to the program. Selected comments are:

Strengths:

- Lots of hands-on lab work in GIS, with solid integration of decision making strategies.
- Learning the fundamentals and applying the lectures to the laboratories.
- Small program size allowed for more productive interaction with professors.
- Scope of geography prepares you to tackle a wide range of problems analytically.

Weaknesses:

- Lacking thorough training in applied statistical methods.
- Not enough hands-on training with equipment.
- Need more advanced technology and software.
- Broad nature of geography makes it difficult to go directly into the workforce.

Improvements:

- Develop more inter-departmental research opportunities.
- Do more with the weather forecasting lab.
- Add more elective classes in specialized areas.
- More statistics classes and an improved senior seminar course.

4. Indicators of Student Engagement:

WKU's mission is to prepare students to be productive, engaged leaders in a global society. Students are exposed to the interregional and global connections between places and learn to understand their role in these relationships. Through this understanding, students are able to build tolerance for the growing diversity seen locally, regionally and globally. For some students, taking college-level geography courses may be the first exposure to the diversity of the world. The Department has adopted these modified QEP outcomes to guide its student engagement practices and to provide a philosophical framework for its activities:

- **QEP Outcome #1** - *Students can demonstrate the capacity to apply discipline-centered knowledge and training to address relevant concerns in community or society*.
- **QEP Outcome #2** - *Students understand the diversity of peoples, ideas, and cultures and can demonstrate how these shape the world around them.*
- **QEP Outcome #3** - *Students can demonstrate awareness of their opportunities as responsible citizens living and working in a global society.*

Geography program students have regular opportunities through independent study projects, regular coursework, and other supervised projects such as through the Geography club, the Meteorology club, the Green River Grotto, etc, to engage with campus, local, and regional communities. For example, Club Orlov WKU is a new student organization interested in exploring alternatives in sustainability and community engagement along those lines. Typical student engagement projects include:

- October 2010- Two students (independent study) participated in a mapping and inventory resource project for the Southwest Florida Water Management District, Marion County, FL, and the Withlacoochee State Forest, FL.
- May/June 2010- Eleven WKU students participated in a $100 Solution service learning project during the GEOG/GEOL475 and GEOS 510 Semester at Sea "Waters of the Caribbean" study abroad, during which they visited a potential show cave on Barbados and engaged with the government to perform a resource inventory and develop educational materials related to karst groundwater protection and the importance of caves.
- March 2010- Five students in Geomorphology (GEOG/GEOL 420 & GEOS 521) participated in a field trip to the Withlacoochee State Forest, in conjunction with member from the Karst Conservancy, to perform a cave and sinkhole clean-up and map several caves on public land related to resource management and research development in west-central Florida.
- Ongoing since 2009- Hoffman Institute students have led other departmental students to conduct various cave clean-up, invasive species mitigation, and research activities at the Cave Springs Cavern (Crumps Cave) educational site.
- 2006 - The Geography Club was involved in fundraisers, service opportunities, and a field-trip to the Association of American Geographers annual meeting in Chicago, IL Students also participated in the Kentucky State Geography Bee held at Western

Kentucky University on March 29, 2006, and have continued to participate in this annual event.

- 2005 – The Geography Club was involved in several fundraisers, helped with set-up and clean-up at the annual Homecoming festivities, and April 1, 2005, volunteered at the Kentucky State Geography Bee held at Western Kentucky University.

The StormTopper Network (STN) is a group of meteorology students who take classroom knowledge of radar meteorology and severe weather and then provide volunteer storm spotting services to Warren County Emergency Management (WCEM) and the National Weather Service (NWS) during severe weather events. A typical activation usually consists of about six trained storm spotters that are deployed to various areas in Warren County that have good vantage points to the south and west, as well as identifying safe shelters for spotters while the storms pass through. Approximately six STN members are also at Central Command in the EST building during any given activation, monitoring radar and radio communications. Since its inception in January, 2009, STN has activated numerous times and has provided invaluable weather warnings to the community. Severe weather reports from STN members have been communicated to the public by Chris Allen of WBKO television and have been relayed to the National Weather Service and the Storm Prediction Center in Oklahoma. STN has gained publicity that started with an appearance by Crystal Bergman, former Director of STN, and Ronnie Leeper, outgoing Director of STN, on WNKY TV's *Bowling Green Today* show on January 29th, 2009. On March 26th, 2009, a WKU news release was circulated and a View from the Hill segment was aired on WBKO about STN. When STN is not on active status, it provides bi-weekly weather updates, created by Ronnie Leeper and other STN forecasters, on STN's website. All students associated with STN receive advanced storm spotter training from the National Weather Service and are also trained to perform damage assessment on the day following a severe weather outbreak.

C. Other Indicators of Program Achievement and Contribution

1. Program Viability

The Geography program remains a strong and popular major at Western, with the average numbers of majors (including the new Meteorology and G.I.S. majors) hovering between 130 and 140 over the past seven years. The majority of majors in Geography are recruited directly from the introductory, general education courses. The strength of the program is based on student-centered learning, excellent advising, excellent teaching, and faculty/student research that is integrated into the curriculum. Although geography enrollments have suffered nationally over the past generation of students as a consequence of P-12 systems failing to appreciate the importance of a geographically centered education, several changes have occurred that continue to strengthen the discipline and draw more students to our programs. First, the national Advanced Placement test in Human Geography has been introduced into several more high schools in Kentucky. Second, the development of advanced spatial mapping techniques, encapsulated in Geographic Information Science (GIS), and new satellite-based locational tools, such as Global Positioning Systems (GPS), have captured the imagination of the latest generation of students. This interest in advanced spatial mapping tools and techniques will translate into a growing demand for spatially centered courses and programs over the coming years.

Since the Meteorology Program first began accepting freshman in 2007, there has been an annual range of 10-15 freshmen who have pre-declared for the B.S. degree in Meteorology. The majority of these students are from Kentucky, but students from Tennessee, West Virginia, Virginia, Illinois, and Indiana have all been attracted to the Meteorology Program. Some out-of-state students receive in-state tuition from the Academic Common Market (TN, WV, VA) while other out-of-state students receive reduced tuition from the Tuition Incentive Program that is comparable to in-state tuition in their home state (IL, IN). The Meteorology Program also receives 1-3 transfer students each year, most of whom have already completed the calculus and physics prerequisites at their original school. Unfortunately, the mathematical rigor of the calculus and physics prerequisites causes more than 50% of all freshman Meteorology majors to change majors by the end of their sophomore year, although a large number of those students stay within the Department of Geography and Geology by changing to the B.S. degree in Geography – Land, Weather, Climate concentration. This produces a typical senior class of between 6-10 graduates per year, which is in accordance with the goals of the Meteorology Program when it was developed in 2006. The goal of 6-10 graduates per year is appropriate considering the total number of B.S. degree in Meteorology graduates per year is around 600 (Knox 2008), which is less than 1% of the number of engineering graduates per year. Of the roughly 60 universities that have B.S. degree in Meteorology programs, nearly half of them graduate less than 10 students per year, while over 75% graduate less than 20 students per year.

The latest analysis of the meteorology job market suggests that only 50% of all meteorology graduates each year find employment in the atmospheric sciences or continue their education, which has moved some to call for a limit on new meteorology programs (Knox 2008). This relative scarcity of meteorology jobs has actually helped the WKU Meteorology Program, since it serves an underserved region. The lack of meteorology programs in the Mid-South region is one of the reasons the program had a 100% job placement rate for its first cohort of graduates in May 2010. Of the six rising seniors on track to graduate during the 2010-11 academic year, three already have secured permanent employment, primarily through the NWS SCEP internship program. By maintaining a rigorous curriculum and providing program students with numerous research and internship opportunities, we feel the WKU Meteorology Program is in an excellent position to maintain a strong and vibrant program well into the future.

Knox, J.A., 2008: Recent and future trends in U.S. undergraduate meteorology enrollments, degree recipients, and employment opportunities. *Bulletin of the American Meteorological Society*, 89(6):873-883.

2. Contributions to University Programs

The Geography Program provides many general education courses on the main and regional campuses that provide a solid foundation in the humanistic and scientific concepts that are intrinsic to the principles of general education. A large number of education majors take general education geography courses, highlighting the Program's contribution to K-12 education in Kentucky. The Program offers general education courses in:

Social and behavioral sciences

- Principles of Human Geography

- Geographic Information Science and Society
- Economic Geography
- Geography of North America
- Natural Resource Management
- Urban Geography

Natural sciences

- Introduction to the Physical Environment
- Meteorology
- Introduction to Environmental Science

World Cultures and American Cultural Diversity

- World Regional Geography
- Introduction to Latin American Studies

Distance learning and on-line courses have expanded during the review period. For instance, all courses for the GIS Certificate are now offered on-line, making them available to students throughout the Commonwealth and beyond. The following courses are offered online:

- GEOG 110 World Regional Geography
- GEOG 316, 317, 417, 419 (GIS Certificate)
- GEOG 474 Environmental Planning
- GEOG 487 Environmental Law and Policy

The Program's Cultural Geography offerings have been part of the Popular Culture Studies program since its inception, and several newly developed cultural geography courses have been added as electives to the popular culture major.

The Meteorology Program contributes to both general education and the Honor's College through the lab-designated course, GEOG 121 – Meteorology, which is a Category D science course. Each semester, several sections of GEOG 121 are offered that enroll a total of around 140 students on average. Each fall, one of those sections is offered as an Honor's College general education course. Other upper-division meteorology courses are augmented as Honor's College electives by demand. While the high level of calculus and physics prerequisites prevents most students from other University programs from taking upper-division meteorology courses, there are occasionally students from other programs who take courses in the Weather Instrumentation sequence.

The GIS program has become popular with students in many academic disciplines because of GIS's use as an analytical tool in a variety of fields. To date, students from over 22 different majors have taken GEOG 317, the second course in the four-course series. This course is a milestone for students' GIS capability because upon completion of it, they have a complete basic set of GIS creation and analysis skills. Since Fall 2002, 159 GIS certificates have been awarded. A graduate GIS certificate was subsequently developed and first offered in the fall of 2005. Figure 1 displays a period of time where there were over 15 certificates earned in each academic year. Since Fall 2008, a decline is noticeable due to the nature of fulfilling the "backup" demand of those students needing a certificate to complement their skills and knowledge in GIS. Some of these students already held a Bachelors degree and needed to formalize their training in GIS.

Figure 1. G.I.S. Certificates Awarded

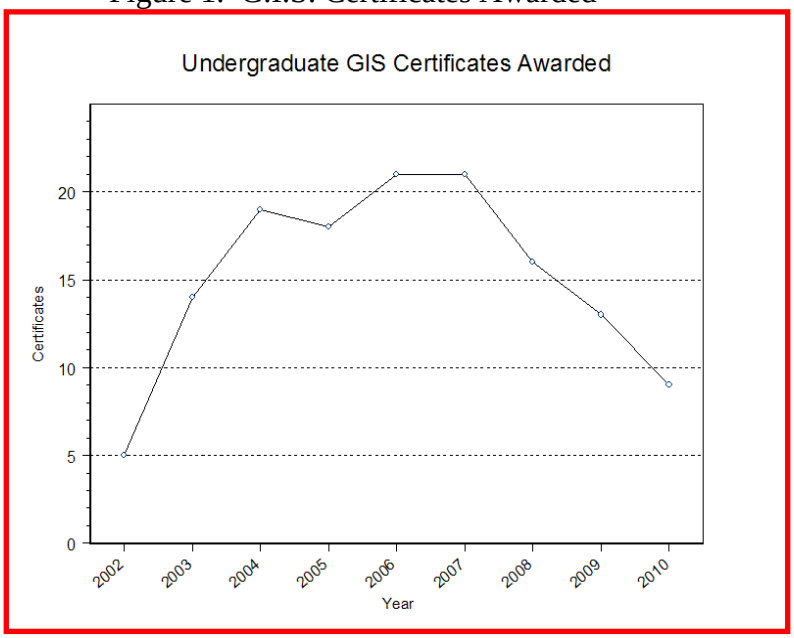
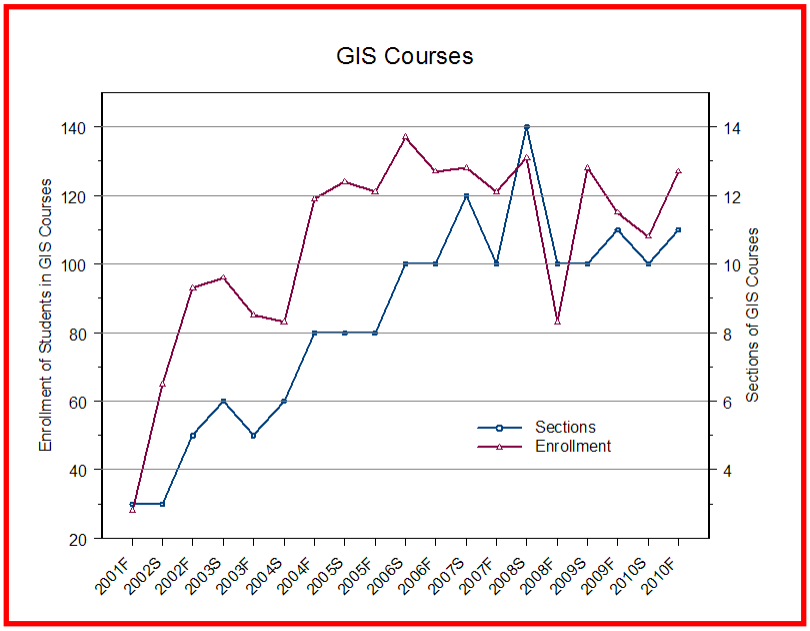


Figure 2. GIS Courses Offered Since Fall 2001.



GIS is in high demand by a variety of academic programs. Since 2001, when WKU first offered GIS courses, a total of 160 sections of GIS courses have been offered, with a total of 2,019 students. Many of those students were pursuing a variety of majors, including business, social studies, public health, sociology, biology, engineering, computer sciences, political science etc. Thus, the program not only serves the needs of the Department but the needs of the entire university.

With the development of a GIScience major, a number of new GIS courses have been developed without adding a new faculty line. The GIScience major is designed for students pursuing GIS as a profession. WKU is the first university in the Commonwealth to offer a GIS certificate, a minor in GIS, and a major in GIScience. The WKU GIS program was recently recognized at the 2009 Kentucky GIS conference with the *Exemplary System Award for GIScience*.

3. Use of Technology

Geography and related disciplines have been radically impacted by the Information Age. The explosion of geospatial data, resulting primarily from the development and growth of technologies including remote sensing, global positioning systems, geographic information systems, and statistical and data mining, requires today's geographers to be much more technology savvy. Toward this end, the geography program requires students to complete a core curriculum that includes computer lab-based courses in geographical information systems and data analysis and interpretation. In addition, numerous elective courses are available that build technical expertise in these areas. Through the various centers housed in the Department, students can pursue opportunities to engage in applied research and service work using scientific instruments and computing hardware and software to collect, process, analyze, and interpret data. These course and internship experiences have led to numerous opportunities for students to then participate in state and national conferences to present findings of their work. Graduates of the program have developed a strong track record of success in gaining admission to graduate programs and landing jobs in a competitive market.

The Department is home to the Kentucky Mesonet, an initiative of the Kentucky Climate Center. The Kentucky Mesonet integrates scientific instrumentation for environmental monitoring, a custom, secure wireless communications network operated through a commercial cellular communications provider, and a network operations center that includes a suite of computer servers to ingest, process, archive, and disseminate environmental data collected in near real time from remote monitoring stations. Over the course of a year, more than 100 million data values are collected by the Kentucky Mesonet. This system provides rich opportunities for student engagement. Since its inception in 2006, the Kentucky Mesonet has provided opportunities for students majoring in geography, geographic information science, meteorology, computer science, mathematics, graphic design, and public relations. As the project continues to grow, opportunities for students will expand both in number and in breadth.

The Kentucky Climate Center also houses the Climate Research Laboratory. This facility includes networked computer servers that are configured to run meso-scale weather and climate models designed to answer research questions regarding climate change related to land-atmosphere interactions. This facility provides unique opportunities for students. While a similar lab at a Research I institution would employ doctoral students to conduct research, the Department trains undergraduate and graduate students to conduct research using these models. This research frequently leads to conference presentations and even publications on which students are co-authors. Upon graduation, these students are extremely competitive when seeking admission to graduate programs.

- The GIS *facilities* at WKU include the WKU Center for GIS, which provides GIS services to the college, the university and local communities, one 20-seat GIS teaching lab (for classroom teaching for student to work on their projects). In the Center for GIS, there are 9 computer workstations, 1 flatbed scanner, 1 large format printer/plotter, 2 Trimble Pro XRS GPS units, and 3 computer servers.
- The main teaching *software* used by WKU GIS programs, Environmental Systems Research Institute (ESRI)'s AcrGIS-series software (including both desktop and server capability), is the leading GIS software in the world. We are currently migrating to the newest version of ArcGIS software, ArcGIS 10. In addition to ArcGIS software, our GIS Center and GIS teaching lab are installed with a collection of state-of-art GIS and other software, including ERDAS's Imagine (leading Remote Sensing software), TransCAD (leading GIS for Transportation software), Pathfinder Office, CorelDRAW(leading mapping and cartography software), S-Plus (statistics software), SPSS, etc…

Technology plays a large role in the education of meteorology students. In 2009, the WKU Meteorology program received $52,450 in internal classroom improvement and classroom equipment funding to renovate EST 425, the Meteorology lab. All upper-division meteorology courses now have the capacity to be taught in the room, in addition to the GEOG 121 Meteorology lab. The classroom features a fully-recorded security system, 52" flat screen TV, ceiling mounted proxima, a high-end AV system, and 20 student computers. The student computers contain National Weather Service quality satellite and radar viewers as well as meteorological visualization software that allows students to view severe weather in 3-D. All student computers also feature fully integrated GIS software and SPSS statistical software. Future plans for the lab include mounting an automated weather station on the roof of EST and installing a web-cam on the roof of PFT to track incoming severe weather. Upper-division meteorology students who assist faculty with research projects also have access to the Climate Research Lab in EST, which has around a dozen high-speed Linux workstations capable of running various mesoscale climate models. Students can also use software on the Linux workstations to write computer programs in FORTRAN for data analysis purposes. Students taking GEOG 325 – Meteorological Instruments have access to the full suite of instruments deployed on a standard Kentucky Mesonet station and learn the theory and perform hands-on lab experiments on those instruments, which include dataloggers, pyranometers, thermometers, hygrometers, anemometers, and barometers. All faculty in the Meteorology Program utilize computers in the classroom to engage students in the curriculum, often in the from of meteorological case studies or map discussions. Blackboard is also used by the faculty to place curricula online for student access and to allow students track their progress in the course.

In GIS courses, the issues of digital data and the sometimes conflicting goals of data accessibility and privacy rights are addressed with an active learning exercise that poses a variety of scenarios that a GIS data manager might face. Each scenario incorporates an ethical dilemma that lacks a clear-cut right or wrong answer. Students debate the potential actions a GIS manager may take in regard to release or use of the data and reach a consensus decision on an appropriate course of action.

Faculty members regularly use Blackboard to deliver course materials to students, enhancing the interactivity and accessibility of the course's core components to students. In

Geomorphology (Spring 2010) and Karst Environments (Fall 2010), students used www.weebly.com to create project websites resulting from student research projects. Our faculty on the extended campuses come in contact with individuals, both traditional and nontraditional students, that have minimal technology exposure. Some of these students are the first in their families to go to college and support systems are not as strongly in place. The Department requires all students to become familiar with a variety of technology to prepare them for success in future classes and work outside of the university. Students are required to use both Microsoft Word and Powerpoint, and to know how to save compatible files if not using Microsoft files. Students are also expected to research, cite work, use Google Earth, and present research findings in front of their classmates.

Online teaching to place- and time-bound students is a challenge, because Geography is traditionally a 'hands-on' learning experience, using maps and other visual material. Students normally conduct simple field based tests and observations to draw conclusions concerning physical landscapes, or examine topographic and geographic maps to discover and analyze human impacts on the Earth. In the online environment, a different approach is needed to take full advantage of the computer-based learning. For example, Google Earth is a powerful freeware program that uses high-resolution satellite imagery of Earth (Moon and Mars), with quantitative tools to measure vertical, horizontal, and temporal relations of objects in space. Therefore, many of the traditional location identification exercises have been moved from base-map identification to contextual identification, whereby students analyses the terrain (topographic relief, biology, landforms, etc.) to determine how human impacts have shaped a particular area. This top-down approach takes students from landforms to built environments, instead of static map analysis, which has been the traditional path. These online introductory and skill-based courses have only been taught online for the last two years, so it will be a few more years before we see any measurable outcomes from this teaching approach. To date, World Regional Geography 110, along with the GIS Certificate courses (GEOG 316, 317, 417, 418), has been taught online. Adding additional online courses have been considered, but may not be implemented for a few years.

4. Uniqueness of Program:

Western Kentucky University offers the only undergraduate degree program in Kentucky or Tennessee with a specialization in cultural geography. The only institutions in those states to offer cultural geography concentrations do so at the graduate level, making WKU unique in the educational opportunities extended to undergraduates. WKU graduates more education majors than any other university in the state of Kentucky. The Department is well-positioned to offer education majors an excellent opportunity to become highly qualified to teach geography.

The Department's B.S. degree in Geographic Information Science (GIScience) is the first and only GIScience degree program in Kentucky. It has the goal of educating students to a level that they may achieve national GIS certification by the GIS Certification Institute. No other program in the Commonwealth incorporates sustainability issues to the extent that the Department of Geography and Geology does. The focus on sustainability has become a primary recruiting factor for the concentration.

The WKU Meteorology Program is the first and largest such program in the Commonwealth. The only other meteorology program in Kentucky is at the University of Louisville in the Department of Physics and Astronomy, and it has a focus on space weather. The WKU Meteorology Program is home to the Kentucky Mesonet and Kentucky Climate Center. The Kentucky Mesonet is a network of automated weather and climate monitoring stations that serves diverse needs in communities across Kentucky. The Kentucky Climate Center is the State Climate Office for Kentucky recognized by the American Association of State Climatologists. As a member of the National Climate Services Partnership, the Kentucky Climate Center is a partner with the National Climatic Data Center, the Midwestern Regional Climate Center, and the National Weather Service. Meteorology Program students are engaged in research and internship opportunities with both the Kentucky Mesonet and Kentucky Climate Center and have presented their research at national conferences. As there are no meteorology programs in Tennessee, West Virginia, Arkansas, and Virginia, it can be said that the WKU Meteorology Program is the leading program in the entire Mid-South region.

5. Contributions to Diversity Goals*:*

Geography courses are focused on understanding and valuing diversity. From a global to a local scale, students in the geography program are exposed to a wide variety of ideas relating to ethnicities and world cultures. Geography majors gain invaluable understanding of the complexity of the world in terms of people and environments and the analytical and technical skills needed to apply their expertise in their careers. For instance, Cultural Geography includes a learning module on international migration, ethnicity, and identity that uses the film *Bend It Like Beckham* to help students understand the betweenness of cultures experienced by first and second generation migrants, and how women, in particular, face conflicting expectations from traditional cultures and modern industrialized society. World Regional Geography enhances students' awareness and respect for the diversity of peoples, ideas, and different cultures in a global society, as measured by an exit essay.

A recent American Geological Institute report provides a realistic statement of diversity challenges in the geosciences (p.3 of report):

> *"Compared to the success story of female student graduates, the participation of under-represented minorities in the geosciences is extremely poor. Compared with other science & engineering fields, the geosciences confer the lowest percentage of Bachelor's and Master's degrees to underrepresented minorities. The percentage of all science & engineering degrees conferred to Hispanics and non-Hispanic African Americans is 8 percent, whereas the percentage of geoscience degrees conferred to these minorities is approximately 2 percent. In comparison, Hispanics and non Hispanic African Americans comprise 29 percent of the U.S. population (14% Hispanic and 15% non-Hispanic African American). The percentage of degrees conferred to Native Americans and Alaskan Natives from all science & engineering programs and from geoscience programs is approximately the same (0.8%). These minorities comprise only 2 percent of the U.S. population."*

In general, diversity and gender issues are addressed primarily in the non-physical course curriculum, especially from a planning, culture, and mobility perspective. As a science program, many of the program's courses focus primarily on research theories and methodologies, and are gender/diversity neutral – ethnic and gender backgrounds are irrelevant to the process of developing a research proposal, although they are very relevant in terms of how they might influence the choice of research topics. Moreover, socio-cultural backgrounds do become important in terms of preparation for advanced research, the types of research projects that minorities or females might consider, and opportunities for funding support.

6. Accreditation Status

Students who receive the B.S. in GIScience at WKU satisfy GIS Certification Institute (GISCI) qualifications for the title of "GIS Professional." In addition, the GIS programs at WKU are recognized by the Urban and Regional Information Systems Association (URISA), a nonprofit U.S. association of GIS and mapping professionals. GIS certificates were first awarded in the fall of 2002. A total of 159 students have earned the GIS certificate, with an annual average of 17. In other programs, there are no national, regional, or discipline-based accreditation organizations.

7. Planning, Development, and Other Areas

From a development perspective, alumni historically have been generous in their financial support of the Department and its programs. During the review period, the Department received approximately $140,000 in alumni contributions and other gifts, with a significant portion of these contributions donated directly by alumni of the geography program. The Department circulates an annual alumni newsletter – the GEOGRAM – (http://www.wku.edu/geoweb/info/geogramindex.htm), which keeps alumni of the program informed about research, faculty accomplishments, and their peers' activities. Historically, program graduates have contributed financially to the Department through regular donations and gifts-in-kind. Although graduates remain financially loyal to the program over many decades, there have not been any opportunities in recent years to identify funding for an endowed professorship or other significant gift.

8. Additional Indicators for Career Preparation Programs

Geospatial technologies have been identified by the U.S. Department of Labor (2010) as one of three technologies that will see explosive job growth over the next decade. The market is growing at an annual rate of almost 35%, with the commercial subsection of the market expanding at the rate of 100% each year (http://www.gita.org/). Many of our graduates with GIS skills are hired by both public and private sector employers. For instance, one of the largest broadband mapping service providers in the U.S., Connected Nation GIS Division, currently employs a total of nine GIS technicians and analysts, with six of them graduated from WKU with either an undergraduate degree in GIS or a graduate certificate in GIScience. Our graduates have a reputation for being well-trained and well-prepared with a variety of geospatial skills.

The WKU Meteorology Program has developed strong relationships with local National Weather Service offices in order to help students gain summer internships and potential career opportunities. The Meteorology Program hosted the first ever NWS Media Relations seminar in May 2008 and the NWS Roadshow Career Seminar in March 2009. WKU Meteorology students also served as the official NWS snowfall observers for Bowling Green, KY during the winter of 2008-09. This strong relationship with the NWS has paid dividends as five Meteorology students have received paid SCEP internships with the NWS since 2009 that guarantee employment upon graduation. The SCEP internships are a key factor in the 100% job placement rate of the Meteorology Program in May 2010.

D. Factors Inhibiting Program Achievement and Contribution

The Kentucky Climate Center and Kentucky Mesonet provide Western Kentucky University with programs of national prominence. WKU is the only comprehensive university in the United States that is home to a state climate office. As an affiliate of the Midwestern Regional Climate Center, WKU stands on a par with such institutions as the University of Wisconsin, the University of Illinois, Michigan State University, The Ohio State University, Purdue University, and the University of Missouri. However, funding to support the Center and its initiatives is at such a minimal level that opportunities cannot be capitalized. State climate offices housed at other universities typically have support staff to assist the state climatologist in carrying out service and research activities, while WKU provides only two months of summer salary for the state climatologist, with no funding for support staff. In addition, WKU has not committed to any line funding to support ongoing operation of the Kentucky Mesonet, a project that has brought $3 million of funding through the National Weather Service, aided in acquiring $2 million for a high-performance computing center, and provided the university and state with vital cyber-infrastructure that promises to attract grant dollars and state funding support.

Over the course of twenty years the curriculum in geography has come to require students to develop significantly greater technical and math-related abilities. These abilities are critical to areas including geographic information science, meteorology, and climatology. A high percentage of students majoring in geography are poorly prepared for the curriculum. For example, since the Department began keeping statistics on students who transfer out of the department to another major at WKU or who drop out of WKU for whatever reason, 40 percent failed one or more required Mathematics courses and 38 percent had taken one or more development courses in Mathematics, English, and Reading. The average GPA of all students dropping from the department's programs during the review period was 2.34 on a 4.0 scale, with 28 percent of all students dropping the Department's programs recording a GPA of below 2.0 on a 4.0 scale.

Another limitation comes from the need for additional teaching facilities, especially an additional teaching laboratory. Currently, the only GIS teaching lab, IE 301, is used not only for GIS courses but also other computer-related courses, such as GEOG 391, making IE 301 one the most fully-used classroom in the Department. As a result, in each day there are often back-to-back classes in IE 301, which leaves only minimal time in between classes for students to use the lab computers for computer exercises and GIS projects. As a result, many students have to delay their work and can only use these computers in the evening times and weekends. A new GIS teaching lab would certainly enhance the learning of our students as well as allowing the

Department more flexibility in scheduling classes and allocating time for students to work on their homework exercises and projects.

A lack of properly equipped laboratories and sufficient work space inhibits student research opportunities. The Department needs more modernized facilities with clean teaching labs, built-in water, electrical, and ventilation infrastructure, and additional improved work/office space for students and visiting research scholars/post-docs in order to allow the programs to grow.

There are future challenges that could potentially inhibit program achievement. The biggest challenge to the long-term success of the Meteorology Program is recruiting students into the program who are capable of completing the challenging calculus and physics prerequisites. Many of our most successful students are from states other than Kentucky, most notably Tennessee. These students are allowed to pay in-state tuition to WKU through the Academic Common Market because their home states do not have meteorology programs. With the number of meteorology programs increasing nationwide (Knox 2008), the development of meteorology programs in states such as Tennessee could lead to a drastic reduction in the number of qualified freshman coming into the WKU Meteorology Program. The Meteorology Program also faces in-state competition for students from the new program at the University of Louisville. Since the Meteorology Program cannot control the development of new meteorology programs in other states, it is imperative that the Meteorology Program continues to achieve a high level of success, especially in job placement for graduating students.

E. Response to Previous Program Reviews or Other Assessments

The Geography program received a recommendation to "**enhance**" in the previous program review process. The summary review is shown below:

> *"This is a strong and popular program that is the leader in the state. It has capitalized on WKU's proximity to the karst region to offer unique opportunities for academic research and professional skills. It also has developed facilities such as the new GIS facility and restructured curriculum to enable students to acquire the meteorology "Seal of Approval." Faculty appears to do an admirable job of juggling teaching and research and incorporating students into department projects.*
> *Its APR report thoroughly documents the program's accomplishments and contributions. The committee supports enhancing this program to make needed improvements in its physical plant so that it remains the leading geography program in Kentucky. A concern is that student enrollment figures lack evidence students are seeking out the meteorology degree or GIS certification despite improvements to facilities and curriculum. The department should raise awareness of these offerings with expanded outreach and recruitment efforts."*

F. Future Directions:

In order to maintain its strength and better serve our students, the Geography program is moving to emphasize its core expertise in karst, cultural geography, sustainability, environmental management, and watershed management, while providing a strong partner for the departmental GIS and Meteorology programs that have spun off from the original program. Faculty will continue revising the curriculum to best meet the needs of students and keep abreast of

disciplinary changes. For example, karst and water science are integrally related and of great importance for local stakeholders. Faculty will develop this aspect of Geography and in the future will be able to offer a Karst and Watershed Management track to accentuate our other tracks.

As the Department's new Environment and Sustainability offerings have now begun to reach a critical mass of students, faculty will develop a website and other promotional material to attract students to WKU to take advantage of these course offerings. Faculty are investigating an on-line Master's in Sustainability Science, which would be a natural follow-on to the undergraduate curriculum. Faculty continue to work with students and the local community on stormwater issues, on cave and karst planning, on urban and regional planning, and providing GIS expertise for the Commonwealth. Most importantly, the Department will continue to monitor career and discipline changes that affect program students and will ensure that Geography Program graduates are highly qualified for their careers and well educated citizens.

GIS and mapping professionals in both Kentucky and Tennessee have indicated increasing demands in the region for professionals with high-level GIS and spatial analysis skills since the technologies by nature are under constant evolution. The Department's long-term goals thus include the development of an M.S. in GIScience, with a possibility of an online degree option, that offers up-to-date education and training in advanced GIS topics, skills, spatial analysis to GIS and mapping professionals in Kentucky as well as Tennessee. To support the M.S. degree program in GIScience program, a second tenure-track faculty member with a specialty in Physical Geography, such as hydrology and environmental studies, is needed and significant release time will also be needed for the GIS faculty to accommodate the research needs of both the graduate students and undergraduate students.

An additional tenure-track faculty line in cultural geography is desired to meet the programmatic needs of the cultural geography concentration in light of the fact that one of the graduate faculty members who is a core part of the cultural geography program also contributes heavily to the GIS program. After Dr. Peggy Gripshover was hired in 2009 as a core contributor to the cultural geography program, Dr. Katie Algeo's course load has shifted to teaching more GIS classes, where there has also been a programmatic need.

Other needs include additional laboratory facilities, office space for new faculty, additional research students, and post-doctoral researchers. Current accommodations in EST are inadequate and are past capacity. Any future growth must consider additional space, equipment, and faculty resource needs.

Appendices (Supporting Data Tables and other Material)

Green River Grotto

- located and documented over 45 caves in Dale Hollow State Resort Park (DHSRP) area
- mapped 23 caves and drafted 19 in DHSRP
- cave safety training
- cave survey training in DHSRP
- cave survey training on campus
- vertical (SRT technique) training
- Karst Resource Inventory for Barn Cave, Cindy Cave, and Hole #8 cave
- 2 members (Ben Miller & Josh Brewer) took on positions as county coordinators for KSS.
- Several members attended regional cave events and several also attended the NSS/International Conference of Speleology in TX in summer 2009.
- 2.4 miles of Hoy Cave in Franklin, KY have been mapped.
- Members participated in clean-up of Hidden River Cave after the flood event in May 2010
- Members have participated in Watershed Watch program (taking water samples & general water chemistry) for karst areas.

Hoffman Environmental Research Institute

In March 2005, sponsored cave survey/inventory/cartography training workshop for Cuba Speleological Association

2005-2009 - Coastal karst inventory, Puerto Rico - in cooperation with Foundation of Speleological Investigations of Puerto Rican Karst (FIEKP) - field work activities involving cave inventory/survey (resulted in oral and poster presentations at NSS Convention 2006-2008 and 2006 Congress of the Federation of Latin American and Caribbean Karst held in Aguadilla, Puerto Rico - Kambesis presented. Student participation: Jodi Lindsey)

Sponsored field work in Cuba 2007 to Caguanes National Park (CNP). Worked with CNP and Groupo Sama to conduct coastal karst inventory, geologic assessment of Cayo Caguanes. (presented results at 2009 International Congress of Speleology, in Kerrville, Texas)

Haiti Project, 2007, 2008, 2009 (series of week-long expeditions) -Worked with Haiti ministry of tourism, conducted eco-tour assessment of Grotte Marie Jeanne in Port a Piment (south coast of Haiti). Cave mapping and geologic assessment, provided preliminary cave management plan. (Presention at 2008 NSS Convention, Lake City, Florida). Student involvement: 2008-Ben Miller and Dan Nolfi participated in field work and they did a departmental presentation on the project in 2008)

October 2007 - collaboration with Dr. Jak Njoku (WKU) to work with Nigerian National Commission for Museums and Monuments (NNCMM) - cave assessment in support of Dr. Njoku's ethnography studies in Igboland, Nigeria.

In 2009, Field expedition to Mulu National Park at the invitation of park management. Conducted a detailed resurvey of Deer Cave.
Student participation: Josh Brewer

Co-sponsor of Isla de Mona Project - 2005-2009 - in cooperation with Puerto Rico Department of Natural Resources - karst inventory/cave survey of the Isla de Mona. Presentation at NSS Conventions (2006-08). Dr. John All and Narcisa Pricope participated in 2008 field season.

Hoffman student participation (oral and poster presentations) at National Cave and Karst Management Symposium 2005 (Florida) and 2007 (New York).

Hoffman students presenting research projects at Posters at the Capitol: 2005-2009

2009 - Co-sponsored International Congress of Speleology post convention field trip to the Mammoth Cave area.

Karst 2007 International Conference held at WKU -Karst Hydrology and Ecosystems (over 100 participants)

Sponsor and organizer of Summer Karst Field Studies at Mammoth Cave National Park 2007-2010.

Research and recon trip for karst hydrological investigation in Jamaica 2009. Two graduate student participants.

Participation in an environmental justice workshop co-sponsored by the UNESCO International Research Center on Karst, Vermont Law School, and Woodrow Wilson Center that addressed environmental justice issues related to a karst spring in Wuming County, China (Jason Polk and Leslie North-August 2010)

Student participants in 39th Annual WKU Student Research Competition (Ben Miller-Outstanding Graduate Poster Presentation) 2009

Student participants in 40th Annual WKU Student Research Competition (Brandon Porter, Ben Miller (Outstanding Graduate Research Presentation) 2010

Graduate Student Award- Benjamin Miller, CRF Fellow 2010

Signed Memorandum of Understanding with governments of Barbados and China in September 2010 for cooperative research in karst education, hydrology, and climate change.

Work with Withlacoochee State Forest and Southwest Florida Water Management District on karst resource management 2009-2010.

REU student research (Katie Rush and Stevie Holmes worked in CHL and on Crump's Cave USDA project summer 2010).

Pat Kambesis had two Gatton students in Spring 2010 work on GIS for Lost River Cave

Recent Grants Received
Dalene Smith- GSA Southeastern Section $400 (Jamaica hydrology)

Dalene Smith- Karst Waters Institute $1000 (Jamaica Hydrology)

KENTUCKY CLIMATE CENTER

• The Kentucky Climate Center (kyclim.wku.edu) is a unique asset of Western Kentucky University, supporting teaching, research, and service missions of the institution. Under the direction of the State Climatologist, the Kentucky Climate Center serves as the State Climate Office for Kentucky. It participates in the National Climate Services Partnership though its affiliation with the Midwestern Regional Climate Center and the National Climatic Data Center, part of the National Oceanic and Atmospheric Administration within the U.S. Department of Commerce. The partnership also includes working relationships with the five National Weather Service forecast offices (Louisville, KY; Paducah, KY; Jackson, KY, Wilmington, OH, and Charleston, WV) that serve portions of Kentucky. The Kentucky Climate Center helps Western Kentucky University to realize its vision as "A Leading American University." Along with WKU, state climate offices affiliated with the Midwestern Regional Climate Center are located at the University of Wisconsin-Madison, the University of Illinois, Purdue University, Michigan State University, and the University of Missouri.)

• Energy and Environment Cabinet

In addition to its federal partners, the Kentucky Climate Center works in conjunction with state government. Within the Energy and Environment Cabinet of the Executive Branch, the Division of Water is tasked with implementing the Kentucky Drought Mitigation Plan, and the Kentucky Climate Center plays a major role. The state climatologist serves as co-chair of the Climate and Water Resources Data Team that advises the Governor during episodes of drought and serves as a lead point of contact for public and media inquiries when the Governor issues statements on drought status and response. In the past year, representatives of the Kentucky Climate Center were also invited presenters to the board of directors of the Cabinet's Center for Renewable Energy Research and Environmental Stewardship to discuss the value of the Kentucky Mesonet to the commonwealth.

• The Kentucky Division of Emergency Management (KDEM) has partnered with the Kentucky Climate Center to provide education and support to county emergency managers and first responders throughout Kentucky. The 2010 Kentucky Weather Conference was jointly sponsored by KDEM and the Kentucky Climate Center. In addition, the Kentucky Climate

Center provides near-real-time weather conditions from the Kentucky Mesonet to the emergency operations center of the Division of Emergency Management.

- Kentucky Mesonet

The Kentucky Mesonet, is an automated, near real-time weather and climate-monitoring network that includes more than 50 stations serving people in communities throughout Kentucky. Sensors monitor air temperature, relative humidity, solar radiation, wind speed and direction, precipitation, soil moisture and soil temperature. Data are collected every five minutes, pass through quality assurance checks, and disseminated via a website, www.kymesonet.org. Basic data are freely available to the public and a wide variety of stakeholders in education, government, and business and industry.

Collaborating with the Commonwealth Office of Technology and the Division of Geographic Information, the Kentucky Climate Center integrated data from the Kentucky Mesonet into the Kentucky Event Mapping and Analysis Portal and the Kentucky Weather Mapping website. The site provides emergency managers and other first responders with access to near-real-time weather data. This application received a Best of Kentucky Award for Best Application Serving Public Agencies.

Development of the Kentucky Mesonet was funded via federal appropriations of $2.9 million through the National Weather Service. The Kentucky Legislature unanimously passed and the Governor signed a joint resolution recognizing the Kentucky Mesonet as the official source of climatological observations for the Commonwealth of Kentucky.

- The Kentucky Mesonet also played a key role in helping Western Kentucky University to secure funding for a high-performance computing center that is scheduled to become operational in 2011. While the center will serve a variety of users at WKU, the Kentucky Climate Center will tap the new computing resources to expand the capabilities of its Climate Research Laboratory. Specifically, the computing center will enable data from the Kentucky Mesonet to be incorporated into near-real-time meteorological models used in both research and in operational forecasting and analysis of weather systems. These capabilities will help WKU achieve is mission of teaching, research, service and promoting regional economic development and quality of life.

- Presently, the Kentucky Climate Center's Climate Research Laboratory conducts both basic and applied research using meso-scale models that integrate land use and land cover data with atmospheric data to model meso-scale weather and climate responses under variety of conditions. A unique aspect of the laboratory is engagement of undergraduate and graduate students who are trained to use models and conduct research that would normally be done only by doctoral students at other universities. The success of the laboratory is evident in the number of student research presentations, publications, and theses that have been produced. It is further highlighted by the successful placement of students in graduate programs and professional jobs.

• The Kentucky Climate Center has built a track record of student engagement. Because of its active role in both service and research, students have access to unique learning opportunities, involving anything from fieldwork with weather and climate observing systems to climate modeling. Undergraduate and graduate students have conducted basic and applied research analyzing historical data in areas involving climate-related natural hazards and using meso-scale climate models to study significant weather events and scenarios related to land-atmosphere interactions and climate change. Over the past six years, students have authored or co-authored eight peer-reviewed publications and made 49 presentations.

• Upon graduation, students have been successful in landing professional positions and gaining admission to selective graduate programs. Over the past six years, two graduating students have entered doctoral programs. Two graduates started their careers with the National Weather Service, and two others landed positions affiliated with the National Climatic Data Center. Other graduates are employed by the U.S. Army Corps of Engineers, Connected Nation, the Lincoln Trail Area Development District, and private engineering and environmental firms.

Funding

• Over the past five years, faculty engaged with the Kentucky Climate Center have submitted proposals requesting more than $4.8 million and have received $3.3 million dollars of funding through grants and federal appropriations. These funds have enabled the Kentucky Climate Center to build an environmental monitoring infrastructure and conduct research, providing opportunities for students and directly benefitting federal, state, and local governments, as well as numerous private businesses. The Kentucky Climate Center plays a prominent role in helping Western Kentucky University to realize its vision as “A Leading American University with International Reach.” Yet, the future is clouded by a lack of resources to support day-to-day operations and enable the Kentucky Climate Center to capitalize on opportunities created by its success.

Supporting Data Tables

Table VI-B-3i – Learning Assessment Philosophies

The following seven key points about learning assessment come from "Tomorrow's Professor" (Stanford Center for Teaching and Learning (2010), posting #1057), citing Ambrose et al. (2010). **These fundamental philosophies about learning and assessment serve to guide the Department's overall approach to assessment**:

"(1) Student's prior knowledge can help or hinder learning:
Students come into our courses with knowledge, beliefs, and attitudes gained in other courses and through daily life. As students bring this knowledge to bear in our classrooms, it influences how they filter and interpret what they are learning. If students' prior knowledge is robust and accurate and activated at the appropriate time, it provides a strong foundation for building new knowledge. However, when knowledge is inert, insufficient for the task, activated inappropriately, or inaccurate, it can interfere with or impede new learning.

(2) How students organize knowledge influences how they learn and apply what they know:
Students naturally make connections between pieces of knowledge. When those connections form knowledge structures that are accurately and meaningfully organized, students are better able to retrieve and apply their knowledge effectively and efficiently. In contrast, when knowledge is connected in inaccurate or random ways, students can fail to retrieve or apply it appropriately.

(3) Students' motivation determines, directs, and sustains what they do to learn:
As students enter college and gain greater autonomy over what, when, and how they study and learn, motivation plays a critical role in guiding the direction, intensity, persistence, and quality of the learning behaviors in which they engage. When students find positive value in a learning goal or activity, expect to successfully achieve a desired learning outcome, and perceive support from their environment, they are likely to be strongly motivated to learn.

(4) To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned:
Students must develop not only the component skills and knowledge necessary to perform complex tasks, they must also practice combining and integrating them to develop greater fluency and automaticity. Finally, students must learn when and how to apply the skills and knowledge they learn. As instructors, it is important that we develop conscious awareness of these elements of mastery so as to help our students learn more effectively.

(5) Goal-directed practice coupled with targeted feedback enhances the quality of students' learning:
Learning and performance are best fostered when students engage in practice that focuses on a specific goal or criterion, target an appropriate level of challenge, and is of sufficient quantity and frequency to meet the performance criteria. Practice must be coupled with feedback that explicitly communicates about some aspect(s) of students' performance relative to specific target criteria, provides information to help students progress in meeting those criteria, and is given at a time and frequency that allows it to be useful.

(6) Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning:
Students are not only intellectual but also social and emotional beings, and they are still developing the full range of intellectual, social, and emotional skills. While we cannot control the developmental process, we can shape the intellectual, social, emotional, and physical aspects of the classroom climate in developmentally appropriate ways. In fact, many studies have shown that the climate we create has implications for our students. A negative climate may impede learning and performance, but a positive climate can energize students' learning.

(7) To become self-directed learners, students must learn to monitor and adjust their approaches to learning:
Learners may engage in a variety of meta-cognitive processes to monitor and control their learning--assessing the task at hand, evaluating their own strengths and weaknesses, planning their approach, applying and monitoring various strategies, and reflecting on the degree to which their current approach is working. Unfortunately, students tend not to engage in these processes naturally. When students develop the skills to engage these processes, they gain intellectual habits that not only improve their performance but also their effectiveness as learners."

Again, drawing from material on the Tomorrow's Professor listserv, the following statements about student learning inform the program's approach to assessment (Ambrose et al. 2010):

*"A. Learning is a process, not a product. However, because this process takes place in the mind, **we can only infer** that it has occurred from students' products or performances.*
B. Learning involves change in knowledge, beliefs, behaviors, or attitudes. This change unfolds over time; it is not fleeting but rather has a lasting impact on how students think and act.
C. Learning is not something done to students, but rather something students themselves do. It is the direct result of how students interpret and respond to their experiences -- conscious and unconscious, past and present."

Ambrose, S.A., Bridges, M.W., DiPietro, M., Lovett, M.C., and Norman, M.K. (2010). *HOW LEARNING WORKS: Seven Research-Based Principles for Smart Teaching*. New York, Jossey-Bass.

Table VI-B-3a-1: Student Independent Research Projects:

Student	Project	Supervisor	Term
Barnes, Joe	Mammoth Cave Surveys	Sides (475)	S 2007
Barnes, Joe	Lost River Cave Surveys	Crawford (475)	S 2006
Bastien, Christiane	Geography of South America	Keeling (462)	F 2004
Batson, Kylie	Snowstorm Teleconnections	Goodrich (475)	S 2007
Batte, Dorothea	Analyzing Flood Plains in BG	All (475)	S 2005
Batte, Dorothea	RCRA and GIS Program Design	All (475)	S 2005
Bedel, Anthony	Meteorology Weather blog	Goodrich (475)	S 2010
Bedel, Anthony	Meteorology Weather blog	Goodrich (475)	F 2009
Bergman, Crystal	NWS Polygon Networks	Mahmood (475)	F 2005
Bergman, Crystal	Pilot Testing GAPS software	Wulff (475)	F 2004
Berry Kyle	Historic Mid-South Flood	Durkee (475)	F 2010
Berry, Kyle	Meteorology Blog	Goodrich (475)	F 2010
Biache, Brian	Teleconnections Snowstorms	Goodrich (475)	S 2007
Bishop, David	Geography of the Andes	Keeling (475)	F 2007
Bratcher, Brandon	Comparison of Tornadic Event	Foster (475)	F 2003
Broyles, Lucas	Internet GIS	Cary (475)	S 2005
Broyles, Lucas	IMS Drought Monitoring	Foster (475)	F 2005
Burns, Jennifer	Lichens Weathering Influence	Groves (475)	F 2004
Campbell, Lee	Historic Mid-South Flood	Durke (475)	F 2010
Campbell, Lee	Meteorology Blog	Goodrich (475)	F 2010
Chism, Reese L.	Drought Impacts	Mahmood (475)	Sm 2006
Clark, Rachel	Meso-American Culture	Keeling (475)	S 2007
Critchelon, Robert	Remote Sensing Climate	All (414)	F 2008
Dillingham, Robert	Floods and Droughts	Dobler (208)	F 2008
Douglas, Matt	Hierarchy of GIS Professionals	Cary (475)	S 2007
Ebelhar, Jessica	Study Abroad Education	Kreitzer (475)	S 2007
Erbhart, Marbelis	Indigenous Meso-America	Keeling (454)	F 2008
Estes, Benjamin	Waters Analysis Education	Groves (475)	S 2005
Eubanks, Jim	Habitat for Humanity Ecovillage	All (475)	S 2009
Evans, David	GPS Inventory Arboretum	Cary (477)	F 2010
Evans, David	Spatial Database Management	Yan (443)	F 2010
Evans, David	Internet GIS	Cary (418)	F 2010
Ferguson, Sara	Cave Management Planning	Reader (475)	F 2009
Fisher, Gabrielle	Carbonate Chemistry	Groves (275)	S 2010
Foster, Benjamin	Rift Valley Geography	Kreitzer (475)	S 2006
Freeman, Sean W.	Soil Moisture Impacts	Mahmood (275)	F 2010
Freeman, Sean W.	Soil Moisture Impacts	Mahmood (275)	S 2010
Fulkerson, Nick	Lost River Cave Surveys	Crawford (475)	S 2006
Gant, Danny	Storm Analysis Jan-Feb 2008	Goodrich (475)	F 2008
Goldsmith, Jeremy	Stormwater Management	All (475)	F 2006
Hampton, Landon	Meteorology Weather Blog	Goodrich (475)	S 2010
Hart, Susan Conde	Middle American Geography	Keeling (454)	S 2007
Heartsill, Lisa	Remote Sensing Climate	All (475)	S 2008
Heartsill, Lisa	Planning Theory and Analysis	Foster (240)	S 2009
Heartsill, Lisa	BRAC Planning in Vine Grove	Keeling (484)	F 2009
Henry, Mark	GIS Map Creation & Distribution	Cary (475)	S 2005
Hughes, Benjamin	Central Kentucky Cave Survey	All (475)	F 2005
Hutchison, Sean	Climate Change Impacts	All (475)	S 2009
Hutchison, Sean	Web Programming for GIS	Cary (475)	F 2009

Ingram, Brooks	Media & Science of Hurricanes	Dobler (475)	F 2005
Johnston, Crystal	Central Kentucky Cave Survey	All (475)	F 2004
Jordan, Dustin	Historic Mid-South Flood	Durkee (475)	F 2010
Keown, Travis	WKU Transportation Analysis	All (475)	S 2009
Kerr, Brandon	GIS for Cave Protection	Kambesis (275)	S 2010
Lewis, Robert	GIS Mapping Australia	Yan (477)	S 2007
Love, Alex	GIS Web Applications	Cary (477)	F 2006
Lynch, Alden	Geography of the Kurds	Kreitzer (475)	S 2006
MacDonald, Kami	Central Kentucky Cave Survey	All (475)	F 2005
Malapote, Kenneth	Geography of the Philippines	Keeling (475)	Sm 2006
Mattingly, Kyle	Meteorology Blog	Goodrich (475)	F 2010
McCann, Sarah	Bias Correction Study	Fan (475)	F 2010
McCord, James	Internet GIS	Cary (477)	S 2006
McCord, James	Internet Mapping Services	Cary (475)	F 2005
Motley, Monica V.	Boundary Layer Weather	Mahmood (475)	S 2008
Payne, Matthew	Flash Flooding Appalachia	Mahmood (475)	F 2010
Phelps, Tony M.	Karst Hydro-geography	Crawford (475)	F 2006
Phillips, Jessica	Appalachia Flash Floods	Mahmood (475)	F 2004
Pruitt, Jordan	Winter Storm Weather Analysis	Goodrich (475)	F 2009
Ray, Bret	WKU Sustainability Analysis	All (475)	S 2009
Roberts, Robert S.	Meteorology Weather blog	Goodrich (475)	S 2010
Roberts, Robert S.	Meteorology Weather blog	Goodrich (475)	F 2009
Robertson, Lindsy	Central Kentucky Cave Survey	All (475)	F 2004
Rodgers, William	Hydrological Modeling & GIS	Yan (477)	S 2008
Rodgers, William	Teleconnections Snowstorms	Goodrich (475)	S 2007
Rush, Katherine	Hydrology Research	Groves (275)	F 2009
Sangoi, Tejas	GIS for Cave Protection	Kambesis (275)	S 2010
Schultz, Jennifer	Water Source Implications	Polk (475)	S 2010
Shive, Corey	Central Kentucky Cave Survey	All (475)	F 2004
Spitaleri, Joshua	Geography of Tanzania	Keeling (475)	S 2005
Thomas, Daniel	Central Kentucky Cave Survey	All (475)	F 2004
Thompson, Amish	Ethics in Leadership	Keeling (475)	F 2005
Thompson, Kyle	Modeling Fluxes	Mahmood (475)	F 2008
Thompson, Kyle	Internet GIS	Cary (418)	F 2008
Torres, Ryan	Urban Precipitation Data	Mahmood (475)	S 2010
Torres, Ryan	Urban Heat Island Assessment	Mahmood (475)	F 2009
Towery, Susan	Ecotourism in Latin America	Keeling (475)	S 2007
Wahl, Jonathan	Meteorology Blog	Goodrich (475)	F 2010
Whitaker, Amanda	Cellular Storm Analysis	Mahmood (475)	S 2007
Wilson, Chad	Geography of Mexico City	Keeling (475)	S 2007
Wilson, Joseph	Kentucky Mesonet Webcontent	Foster (475)	S 2008
Wilson, Joseph	Climate Variability and Snow	Goodrich (475)	S 2008
Wix, Jane Marie	GIS and Tornadoes	Cary (477)	S 2010
Wood, Jason	Internet Mapping Service	Cary (477)	Sm 2006

Table VI-B-3a-2: Student Internship and Practicum Experiences:

Student	***Internship***	***Term***
Baines, Courtney	BRADD GIS	F 2006
Barnes, Joseph	Biggerstaff, Ward	S 2007
Batte, Dottie	US Fish and Wildlife Serv.	S 2005

Bergman, Crystal	WC Emergency Mgt	F 2004
Bradley, Chelsea	WKRN-TV Nashville	Sum 2009
Brock, Kevin W.	New Story Foundation	S 2007
Broyles, Lucas J.	BRADD GIS	S 2005
Broyles, Lucas J.	BR Development Center	Sum 2005
Burns, Jennifer	BG Public Works Dept	F 2004
Coleman, Troy	Boy Scouts America	S 2004
Conder, Evan O.	BRADD Planning	S 2009
Cox, Brian	WBKO-TV Weather	S 2007
Cox, Joseph	State of Tennessee	Sum 2008
Douglas, Matthew	City Elizabethtown	Sum 2005
Douglas, Matthew	City Elizabethtown	Sum 2006
Druen, Eric D.	City-County Planning	S 2008
Eaton, Robert	J&L Chemical Co	F 2004
Ede, Sarah	Nat. Weather Service	Sum 2005
Ferguson, Sara	Office of Sustainability	S 2010
Flory, Joseph	Davey Resource Group	F 2008
Goldsmith, Jeremy	New Story Foundation	F 2007
Gossage, Kevin	Water Resource Center	S 2008
Griggs, Brittany	News 25 Evansville	Sum 2009
Hamner, Jess A.	SDI Louisville	S 2006
Heck, Leslie	Travis Coleman Farm	Sum 2010
Heiter, Cassie M.	WEHT-TV Evansville	Sum 2008
Henry, Mark A.	BG Police Department	F 2004
House, Scott	Christian County	F 2008
Hughes, Tassall A.	Ogden Water Lab	Sum 2004
Humphrey, Rebeca	Mammoth Cave NP	S2008
Katz, Marshall H.	Fall Productions CA	Sum 2004
Keown, Patrick A.	BRADD	S 2008
Keown, Patrick A.	US Corps of Engineers	Sum 2008
Keown, Patrick A.	US Corps of Engineers	Winter 09
Lafferty, Alan W.	KY Climate Center	S 2009
Link, Allison	Kail Consulting, WY	S 2006
Logan, Justin W.	WKYT-TV Lexington	Sum 2007
MacDonald, Kami	SOKY, Soccer	S 2005
Mattingly, Amanda	WKYT-TV Lexington	Sum 2010
McCord, James A.	City of Franklin, KY	Sum 2005
McCord, James A.	City of Franklin GIS	S 2006
McCord, James A.	BG Police Department	F 2005
McNicholls, Joelle	National Weather Service	S 2008
Midgett, Stephanie	WKRN-TV Nashville	Sum 2009
Miller, Michael	Hamilton City - GIS	F 2004
Moers, Jennifer	Connected Nation	F 2007
Moreland, Cara B.	BG Radon Study	F 2005
Nguyen, Dan	New Story Foundation	F 2007
Noffsinger, Spence	Attorney TJ Fridy	S 2010
Noffsinger, Spence	KY Geographical Alliance	S 2009
Osborne, Samntha	FOX 41 WDRB	Sum 2005
Pendley, Leah S.	BRADD GIS	S 2005
Pendley, Leah S.	BRADD GIS	S 2006
Phelps, Mark	Biggerstaff, Ward	S 2007
Rhoads, Matt	BRADD Planning	Sum 2004

Roberts, Jason N.	Simmons Surveying	S 2010
Roberts, Jason N	Simmons Surveying	S 2009
Roberts, Jason N.	Simmons Surveying	F 2009
Scarlett, Nathan	National Weather Service	Sum 2008
Scott, Amy	BRADD GIS	S 2006
Scott, Larry L.	Fox 17 Nashville	Sum 2005
Shepard, Robert V.	WKY-TV Lexington	Sum 2006
Simmons, Jason	Land Surveying CA	F 2007
Skees, William C.	BRADD GIS	Sum 2006
Skees, William C.	BRADD GIS	F 2006
Skinner, Jonathan	Fox 17 News	Sum 2009
Southard, Andrew	Diversified Institute	F 2005
Stewart, Patrick	Off. Sustainability	S 2010
Stinson, Chasity L.	Crawford Laboratory	Sum 2009
Storey, Alanna	WATERS Lab MCNP	F 2005
Teckenbrock, Jess	WPSD-TV Paducah	Sum 2007
Thieneman, Justin	WLKY Louisville	F 2006
Wahl, Jonathan	WBKO-TV	Sum 2010
Wanta, Adam B.	BLM Nevada	Sum 2008
Watson, Eric R.	WEHT-TV Evansville	Sum 2007
Weber, Jeremy	Office Local Govern TN	Sum 2004
Wood, Jason	Texas Gas – GIS	F 2006
Young, Justin C	FCR Wilderness	Sum 2009

Table VI-B-3b-1: Student Presentations at Local, Regional, and National Conferences

Student	Year	Conference Presentation	Award
Berry, Kyle	2010	SEDAAG Poster	
Campbell, Lee	2010	SEDAAG Poster	
Torres, Ryan	2010	SEDAAG Poster	
Evans, David	2010	Kentucky Academy of Science	First Place - Geography
Campbell, Lee	2010	Kentucky Academy of Science	Second Place - Geog
Berry, Kyle	2010	Kentucky Academy of Science	First Place – Geo Poster
McCann, Sarah	2010	Kentucky Academy of Science	Second Place - Poster
Mattingly, Kyle	2010	Kentucky Academy of Science	Third Place - Poster
Malone, TJ	2010	WKU Research Conference	
McCann, Sarah	2010	WKU Research Conference	
Torres, Ryan	2010	WKU Research Conference	
Malone, TJ	2010	Association American Geography	
Gonzalez, Astrid	2010	Association American Geography	
Wix, Jane Marie	2010	American Meteorological Society	
Malone, TJ	2010	American Meteorological Society	
Gonzalez, Astrid	2010	American Meteorological Society	
Wix, Jane Marie	2009	SEDAAG	
Torres, Ryan	2009	SEDAAG	
Malone, TJ	2009	SEDAAG	
Gonzalez, Astrid	2009	SEDAAG	
Gonzalez, Astrid	2009	WKU Research Conference	First Place - Poster
Wix, Jane Marie	2009	WKU Research Conference	

Bryant, Chris	2009	WKU Research Conference	
Gant, C. Danny	2009	WKU Research Conference	
Roberts, Sam	2008	National Weather Assc. 23rd Conf.	
Wix, Jane Marie	2008	National Weather Assc. 23rd Conf.	
Elder, Taylor	2008	National Weather Assc. 23rd Conf.	
Gant, C. Danny	2008	National Weather Assc. 23rd Conf.	
Gonzalez, Astrid	2008	National Weather Assc. 23rd Conf.	
Bedel, Tony	2008	National Weather Assc. 23rd Conf.	
Ferguson, Sarah	2008	American Democracy Project Utah	
Wilson, Joseph	2008	WKU Research Conference	
Rodgers, Nicholas	2008	WKU Research Conference	
Thompson, J. Kyle	2008	WKU Research Conference	
Motley, Monica	2008	WKU Research Conference	
Rodgers, Nicholas	2008	Association Amer. Geographers	
Rodgers, Nicholas	2007	SEDAAG	
Rodgers, Nicholas	2007	Kentucky Academy of Science	
Lawalin, Nicholas	2007	Association Amer. Geographers	
Rodgers, Nicholas	2007	Association Amer. Geographers	
Goldsmith. Jeremy	2007	WKU Research Conference	
Biache, Brian	2007	WKU Research Conference Poster	
Rodgers, Nicholas	2007	WKU Research Conference Poster	
Lawalin, Nicholas	2007	WKU Research Conference Poster	
Goldsmith, Jeremy	2007	Posters at the Capitol	
Littell, Ashley	2006	Kentucky Academy of Science	First Place - geography
Lawalin, Nicholas	2006	Kentucky Academy of Science	
Rogers, Nicholas	2006	Kentucky Academy of Science	
Rodgers, Nicholas	2006	SEDAAG	
Lawalin, Nicholas	2006	SEDAAG	
Hughes, Benjamin	2006	Int. Society Environ. Education	Joint First Place – Poster
Miller, Michael	2006	Int. Society Environ. Education	Joint First Place – Poster
Leeper, Ronnie	2006	WKU Research Conference	Honorable Mention
Hughes, Benjamin	2006	WKU Research Conference Poster	
McDonald, Kami	2006	WKU Research Conference Poster	
Crockett, Cari	2006	WKU Research Conference Poster	
Biache, Brian	2006	WKU Research Conference Poster	
Lawalin, Nicholas	2006	WKU Research Conference Poster	
Rodgers, Nicholas	2006	WKU Research Conference Poster	
Hughes, Benjamin	2006	Posters at the Capitol	
Moreland, Cara	2005	Kentucky Academy of Science	First Place – geography
Brewer, Joshua	2005	Kentucky Academy of Science	Second Place –geogrphy

ACADEMIC PROGRAM REVIEW GUIDELINES

Graduate Program Section

NOTE: The following sections (i.e. V and VI) should be completed for each GRADUATE academic program within the Department undergoing review.

Program: Geoscience, M.S. Reference Code: 072
Geography Education, M.A.E. Reference Code: 133

**Note that the M.A.E. in Geography Education has been dormant during the review period, with no students enrolled. Effective Fall 2010, the M.A.E. program is undergoing revision, with concurrent revisions to all the content-based M.A.E. programs in Ogden College and elsewhere, as part of the new Teacher Leader program changes driven by the Kentucky Education Professional Standards Board (EPSB) restructuring. The new M.A.E. in Geography Education for Teacher Leaders will be effective Fall 2011, after approval by the relevant committees and councils. Accordingly, the data that follow refer solely to the M.S. Geoscience program (072).

V. Program Enrollment and Student Data:

A. Number of Majors:

	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Majors	42	40	36	35	39

Enrollment has remained steady over the review period. The MS Geoscience program is research-thesis based and, as such, students who might not be motivated by a research-intensive approach to graduate study often choose other programs. Nonetheless, the Department has recruited some well-qualified students in recent years, including students from Romania, Colombia, China, Ghana, and Nepal, and from universities such as Pennsylvania, UT-Knoxville, UK, Louisville, Miami-Ohio, and Memphis. The Department recognizes an opportunity to develop an MS in Climate Studies, which may well attract a significant number of new students to WKU as there is no similar program in Kentucky or the general region. The Department also has begun a revision of the Master of Arts in Education – Geography Education for Teacher Leaders – program as part of the general revision of MAE programs at WKU. This 30-hour, teacher-focused program will be offered effective Fall 2011, and will require 18 hours of geography or earth science coursework, along with 12 hours of Teacher Leader coursework in the Education Department. The number of majors that can be mentored successfully by the faculty is very much determined by available resources, with less than 2 FTEF on average currently available to contribute to the graduate program. As a thesis-based program, a significant time investment is required by faculty for each graduate student, especially in terms of research and thesis supervision. The Department has purposefully maintained the average number of enrolled students at 40 in any given academic year, even though the potential could be much higher in terms of potential demand given adequate resources to manage the program.

B. Number of Graduates:

	2004/05	2005/06	2006/07	2007/08	2008/09
M.S. Degrees	5	2	13	6	7

The graduate program is research-thesis based, which requires a significant time investment by students. The average completion time is about three years from first enrollment. During the review period, the MS Geoscience program has produced 47 research theses, with several students publishing their research in professional journals as co-authors with faculty advisors. Graduation rates and times are not linear, as student research projects vary by scope and complexity. For example, nine theses were produced in the 2009/10 academic year, and eight students are scheduled for December 2010 graduation (six of which are thesis students). The Department limits the total number of students admitted to the program as there have been insufficient resources and an inadequate institutional workload model to support expansion of the graduate program.

C. Comparisons with External Data:

Table V-C-1: Program Enrollments in similar programs at Kentucky public universities

Masters Degree Enrollments by First Major Only (CIP Code 45.0701)	**Fall 2005**	**Fall 2006**	**Fall 2007**	**Fall 2008**	**Fall 2009**
WKU	42	40	36	35	39
EKU (40.0601)	18	18	10	8	1
KSU	-	-	-	-	-
Morehead	-	-	-	-	-
Murray (40.0601/0699)	12	9	10	9	10
NKU	-	-	-	-	-
UK	15	13	8	10	9
UofL (40.0401)	0	0	0	0	2

Source: Kentucky Council on Postsecondary Education Comprehensive Database.

Table V-C-2: Degrees Conferred in similar programs at Kentucky public universities

Masters Degrees Awarded by First Major Only (CIP Code 45.0701)	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**
WKU	**5**	**2**	**13**	**6**	**7**
EKU (40.0601)	3	2	4	5	2
KSU	-	-	-	-	-
Morehead	-	-	-	-	-
Murray (40.0601/699)	7	8	3	16	12
NKU	-	-	-	-	-

Masters Degrees Awarded by First Major Only (CIP Code 45.0701)	2004/05	2005/06	2006/07	2007/08	2008/09
UK	4	8	2	4	3
UofL (40.0401)	-	-	-	-	-

Source: Kentucky Council on Postsecondary Education Comprehensive Database.

As these two tables illustrate, the MS Geoscience program at WKU is one of only two graduate programs in the Commonwealth under the 45.0701 CIP code, and is four times larger in enrollment than U.K. Murray State and EKU offer an M.S. in Geology (40.0601/699), and Louisville has just started an Atmospheric Science program through the Physics Department (40.0401). This difference is driven, in part, by the focus in the Department on applied research and the reputation that the program enjoys internationally for cave and karst, water resources, GIS, and other interrelated research themes. Note that the University of Kentucky offers both an M.A. in Geography (data above refer to this degree) and an M.S. in Geology (geology data are not reflected in the table above). The M.S. geology program at EKU has experienced a significant decline in enrollment and degrees granted over the past five years, and it does not appear to be in good health.

Table V-C-3: Degrees Conferred in similar programs at Benchmark Institutions

Benchmark Institution	2004/05	2005/06	2006/07	2007/08	2008/09
WKU	**5**	**2**	**13**	**6**	**7**
Ball State University	2	5	0	6	3
California State University-Chico	4	3	5	4	1
Eastern Michigan University	8	12	8	14	9
Florida Atlantic University	8	7	5	6	5
Indiana State University	8	5	5	4	4
Northern Arizona University	6	2	3	7	2
Towson University	7	12	6	7	8
University of Northern Iowa	9	8	2	1	4
Western Illinois University	7	2	6	3	2

Source: Integrated Postsecondary Education Data Systems (IPEDS).

Indiana State also confers Ph.D. degrees in Geography, so its MS degree likely is a feeder to that program. The Department compares favorably with benchmark institutions offering MS/MA degrees in geography and/or the geosciences. Eastern Michigan University offers an online MS in Earth Science Education (similar in nature to the proposed revision of the MAE in Geography Education), an MS in Urban and Regional Planning, an MS in GIS, and an MS in Historic Preservation. EMU does not offer a stand-alone M.S. degree in geography, so it is likely that the benchmark data in Table V-C-3 above reflect graduation rates in all these programs combined.

D. GRE Scores/Undergraduate GPAs of Students Admitted to the Program:

Table V-D-1: GRE Score comparisons

Avg. GRE*	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Major Avg.	1096	984	1033	983	975
College Avg.	1086	1060	1044	1023	1034
University Avg.	963	963	950	948	961

*Includes only Verbal and Quantitative sections of the GRE due to the change in the scale of the Analytical section of the exam. The maximum score is 1600.

Graduate students in the geosciences compare favorably with graduate applicants in Chemistry, Biology, Mathematics, Computer Science, and AMS. Although the Department generally follows the minimum GAP-score requirement for admission to the program, it has admitted students with a lower GPA from time to time, and these students historically have gone on to graduate. The Department does not use the GRE score as the sole measurement of likely success. Rather, it requires every newly admitted student to pass GEOS 500 Research Methods and Literacy in the Fall semester, and this course typically "weeds" out those students who are not academically prepared for the rigors of graduate research in the geosciences.

Table V-D-2: Undergraduate GPA comparisons

Avg. Ugrad GPA	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Major Avg.	3.38	3.32	2.98	2.92	3.11
College Avg.	3.32	3.24	3.23	3.11	3.11
University Avg.	3.22	3.25	3.25	3.24	3.19

The average undergraduate GPA compares favorably overall with the average GPA for Ogden College. In terms of admissions criteria, the Department places a higher value on coursework in the undergraduate major than on overall GPA, with special attention paid to coursework in the sciences generally. Each admitted graduate student is required to have taken an introductory geostatistics and GIS course at the undergraduate level, as there are prerequisites for the advanced data modeling course taught each Spring. Many incoming graduate students take these deficiencies in the summer or concurrently with the research methods course in the Fall semester.

E. Graduate GPAs of Program Graduates:

Graduate GPA	2004/05	2005/06	2006/07	2007/08	2008/09
Major Avg.	3.67	3.56	3.79	3.85	3.81
College Avg.	3.53	3.43	3.60	3.43	3.62
University Avg.	3.73	3.72	3.74	3.70	3.74

The GPAs of graduates from the MS Geoscience program compare favorably with overall GPAs in the college and institution. All of the program's students take analytically rigorous course-work, including spatial modeling and GIS, with a research thesis required of all graduates.

VI. Program Description and Self Study

A. Mission Statement/Relation of Program to University Mission:

Program Vision Statement: The program aims to be the region's outstanding Geoscience Master's program, with students conducting meaningful and relevant applied and basic research in local and international settings. It aims to produce exceptional graduates, to engage them in critical thinking and meaningful problem solving, and to enhance the reputation of the program through meaningful research and community engagement

Program Mission Statement: The program prepares students to be productive, engaged, and socially responsible citizen-leaders of a global society. It provides research, service, and life-long learning opportunities for its students. The program is responsible for preparing students for advanced graduate study or positions of leadership in their chosen profession, with the aim that they:

- Recognize science as a way of knowing, including its values and limitations;
- Achieve a depth and range of knowledge and skills in their discipline or in a multidisciplinary area;
- Develop abilities of reason and imagination; collect and analyze data, synthesize and draw conclusions; effectively communicate with others;
- Experience discovery, design, or application within the discipline and beyond;
- Evidence a commitment to an examined and evolving set of values and professional ethics, leading to informed decisions and including contributions to the discipline and to society;
- Become knowledgeable in the discipline, prepared for the future, and competitive in a global environment.

B. Teaching and Learning:

1. Graduate Students:
   a. Selectivity:

The M.S. Geoscience program does not employ admission standards beyond those required by Graduate Studies. Despite that fact, we consistently attract students from competitive schools with high GRE scores and GPAs. Selectivity is primarily used in the awarding of graduate assistantships. Priority is given to students with high GAP scores (undergraduate GPA

times GRE scores) or to students that are recruited to contribute to a funded research project in the Department (such as the USDA, Mesonet, Hoffman, or CEHP projects). The GAP scores for students admitted for Fall 2010 ranged from a low of 2530 to a high of 4082. The Department requires a minimum 3.5 score on the GRE Analytical Writing component, as past experience suggests that students scoring poorly on the GRE writing component do not perform well in the research methods course and typically struggle with their thesis writing.

b. Description of Students*:*

In the Fall 2010 semester, 48 students were actively enrolled in the M.S. Geoscience program. Of these, 24 students were full-time in the program, and 24 students either were completing coursework part-time or were writing their thesis. At any given period, at least 50% of the program's students are working full-time in the region while taking classes part time, conducting research, or actively writing the thesis. Accordingly, the average time frame for completing the program, from first enrollment to graduation, exceeds four years. Several students have completed the program in the scheduled two-year time frame, but many research projects are complex enough that a full year of field work often is required. Those students who then take full-time positions in the region find that writing up the thesis takes much longer than anticipated. Accordingly, one-third of the students enrolled in the program at any given time are close to their six-year time limit for program completion.

Eighteen students from the 48 currently enrolled earned their undergraduate degree from WKU (37.5%), and eleven of these 18 students graduated from the Department of Geography and Geology. Four foreign countries (Nepal, Ghana, Saudi Arabia, and China) and 13 U.S. states are represented by the current student body in the M.S. Geoscience program. The majority of students come to WKU directly from their undergraduate programs, but one-third of the currently enrolled students had significant work experience before arriving at WKU (China, National Park Service positions around the country, school districts, U.S. Army Corp of Engineers, etc.).

Table VI-B-1b-1: Background of currently enrolled graduate students

Student	Year	Undergraduate Institutions
Brizendine, Jamison	F2010	Earlham College, Indiana – B.A. Geosciences
Davis, Celia	F2010	Grinnell College, Iowa – B.A. Biology
Humagain, Kamal	F2010	Tribhuvan University, Nepal – B.S.& M.S. Botany
Lawhon, Nicholas	F2010	Western Kentucky University – B.S. Geography (Environment)
Young, Jeremy	F2010	University of Kentucky – B.S. Mathematics
Almudaris, Sami	F2009	King Abdul Aziz University, Saudi Arabia – B.S. Earth Sciences
Arpin, Sarah	S2010	Creighton University, NE – A.B. Environmental Policy
Blinn, Chris	F2009	Western Kentucky University – B.S. Geography (Meteorology)
Cary, Melissa A.	F2009	Western Kentucky University – B.S. Geography (Meteorology)
Craft, Kortney	F2009	Eastern Kentucky University – B.S. Geography
Gaines, Mitchell	F2009	University of Kentucky – B.S. Geography
Gilliland, Joshua	F2009	The Ohio State University – B.S. Geography (Atmospheric Sci)
Hetzler, Rachel	F2009	Miami University, Ohio – A.B. Urban and Regional Planning
Hoette, Adam	F2009	Bellarmine College, KY – B.B.A. Business Administration
Hollon, Chrissie	F2009	Morehead State University, KY – B.S. Geology

Hutchison, Sean	F2009	Western Kentucky University - B.S. Geography (Environment)
McKaughan, Drew	F2009	Florida State University – B.S. Meteorology
Oris, W. Nate	F2009	Miami University, Ohio – A.B. Urban and Regional Planning
Porter, Brandon	F2009	Western Kentucky University – B.S. Geography
Smith, Dalene	S2010	Western Kentucky University – B.S. Geology
Thompson, J. Kyle	F2009	Western Kentucky University – B.S. Geography (Meteorology)
Vanderhoff, Sean	F2009	Indiana State University – A.B. Geography
Zhang, Huajian	F2009	Dalian University of Technology, China – B.S. Software Eng.
Aryee, Frank	F2008	University of Ghana – B.A. Psychology
Fowler, Brandon	F2008	Western Kentucky University – B.S. Computer Information Sys
Miller, Benjamin	F2008	University of Missouri-Columbia – B.S. Parks & Recreation
Nolfi, Daniel	F2008	Washington & Jefferson College, PA – B.S. Biology
Rodgers, Nicholas	F2008	Western Kentucky University – B.S. Geography (Meteorology)
Cary, Nathan J.	F2007	Western Kentucky University – B.A. General Studies
Earles, Jennifer	F2007	University of Southern Indiana – B.S. Geology and Biophysics
Fattic, Jana	F2007	Western Kentucky University - B.S. Geography (Environment)
Gandy, Kay	F2007	University of Louisiana-Monroe – Ed.D. Education
Kramer Samantha	F2007	Western Kentucky University – B.S. Chemistry
Lynch, Erin	F2007	California Institute of Technology – B.S. Physics
Tracy, Mark W.	F2007	College of Oneonta, NY – B.S. Water Resources
Peng, Hsuan-Jung	F2006	Feng Chia Univesity, China – B.S. Land Management
Minnich, Andrew	F2006	Western Kentucky University – B.S. Geography (Meteorology)
Williams, Heather	F2006	Western Kentucky University – B.S. Geography (Environment)
Edwards, Amy E.	F2005	James Madison University, VA – B.S. Geology & Environment
Epperson, Ann	F2005	Middle Tennessee State University – B.S. Geoscience
Hall, Jonathan	F2005	University of Louisville – B.A. History and Social Science
Hatcher, Bruce	F2005	University of Kentucky – B.A. Geology
Lee, Ju-Yu	F2005	Western Kentucky University – B.S. Computer Information Sci
Simpson, Shawn	F2004	Western Kentucky University – B.A. Advertising
Benneyworth, Laura	F2004	Western Kentucky University – B.S./M.S. Physics
Rehkopf, Sarah	F2004	University of Memphis – B.S. Geography
Schmitz, Elizabeth	F2004	University of Oregon – B.S. Geography
Shelton, Catherine	F2004	Western Kentucky University – B.S. in Secondary Education

The M.S. Geoscience program recruits locally, nationally, and internationally. Attracted by the strong research reputations of faculty in the Hoffman Institute, Kentucky Climate Center, and other areas of research, recent graduates from the program came to WKU from three foreign countries (Colombia, Romania, and Ghana) and from 18 different U.S. states. Of the 39 students who completed a research thesis during the review period, only nine came from WKU undergraduate programs, with the remaining 30 coming from other national and international undergraduate experiences. Twenty of these graduates came to the M.S. Geoscience program with strong undergraduate backgrounds in the geoscience disciplines. The other 19 students came from disparate disciplines, ranging from creative writing to chemistry, and from aerospace to journalism. The holistic, integrative nature of the geosciences often proves attractive to

students from non-science backgrounds and, as the table detailing the various titles of completed theses suggests, many of these non-science-background students do well in the program.

Table VI-B-1b-2: Background of Recent Program Graduates

Student	Year	Undergraduate Institutions
Greunke, Erin	2010	Western Kentucky University – B.A. Political Science
Grogan, D. Michael	2010	Middle Tennessee State University – B.S. in Aerospace
Jeng, Shwu-Jing	2010	Western Kentucky University - B.S. Geography
Otoo, James	2010	Kwame University, Ghana – B.S. Environmental Engineering
Russell, Scot	2010	Pennsylvania State University – B.S. Geology
Bergman, Crystal	2009	Western Kentucky University – B.S. Geography (Honors)
Bourette, Cari	2009	California State University, Fullerton – B.S. Counseling
Brunt, S. Matt	2009	Western Kentucky University – B.A. English Literature
Ham, Brian	2009	Western Kentucky University – B.S. Geography (GIS)
Leeper, Ronnie	2009	Western Kentucky University – B.S. Geography (Meteorology)
Meredith, Johnny A.	2009	Western Kentucky University – B.S. Geology
Ross, Allison	2009	Montana State University, Bozeman - B.S. Environmental Sci.
Baker, Ted	2008	Colorado State University - B.S. Biology
Broome, John	2008	Black Hills State University, SD – B.S. Social Science
Cesin, Gina	2008	Embry-Riddle Aeronautical University - B.S. Aerospace Studies
Rinehart, Nathan	2008	Brigham Young University, Utah – B.S. Geology
Schenk-Brown, Julie	2008	Kutztown University of Pennsylvania – B.A. Social Welfare
Baldwin, W. Mark	2007	Tennessee Technological University – B.A. English-Journalism
Chaney, James P.	2007	University of Tennessee, Knoxville – B.S. Geography
Hager, Caitlin	2007	University of Alaska, Fairbanks – B.A. Business Administration
Herrera-Escobar, J.	2007	La Universidad de Caldas, Colombia – B.S. Geology
Kambesis, Pat	2007	Southern Illinois University – B.S. Geology
Kovarik, Johanna	2007	Western Michigan University – B.A. English (Creative Writing)
Littell, Ashley	2007	Western Kentucky University – B.S. Geography (Meteorology)
Nemon, Amy	2007	Western Michigan University - B.S. Geography
Tobin, Benjamin	2007	University of New Hampshire – B.S. Earth Science
Walker, John	2007	University of Louisiana, Monroe – B.S. Atmospheric Science
Croskrey, Andrea	2006	Northwest Missouri State University – B.S. Geology
Dalton, Sara E.	2006	Rutgers University, NJ – B.A. Geography
Despain, Joel	2006	University of Maryland – B.A. Journalism
Hendrickson, Mel	2006	University of Maine – B.S. Chemical Engineering
Henry, Christina	2006	University of South Carolina - B.A. History
Islas, Joseph	2006	Austin Peay State University – B.S. Geology
Pricope, Narcisa	2006	Babes-Balyai University, Romania – B.S. Geoscience
Reader, Daniel R.	2006	Western Kentucky University - B.A. Philosophy
Schoefernacker, S.	2006	Vanderbilt University - B.S. Anthropology and Geology
Sharp, Scotty	2006	Western Kentucky University – B.A. Social Studies
Kendrick, Dasen	2005	Loyola University, New Orleans – B.S. Chemistry
Russ, James A.	2005	Middle Tennessee State University – B.S. Geoscience

c. Information about Graduate Assistantships:

The program receives an annual budget for graduate assistantships through its allocation from Ogden College. These and other assistantships are supplemented through grants and external agencies (Mammoth Cave, USDA, etc.). Those students not on assistantship and enrolled full-time in the program find hourly-paid work on campus or in the community. Most of the program's part-time students have full-time positions in the regional community. Typically, the program funds 12-15 assistantships a year, so that over 50% of enrolled students (and a greater percentage of full-time students) receive funding. Because many of the program's students come from out of state, assistantship funding is vital to attract the top students, yet **WKU is not competitive at all in the sciences** when it comes to assistantship stipends. Since 2007, the program has been able to offer a small number of partial tuition waivers. Priority for funding goes to students with high GAP scores or who have agreed to work for the various grant-funded projects in the Department.

Most graduate assistants work as research and/or teaching assistants with individual faculty members. This allows students to gain experience in research skills, as well as undergraduate teaching in a supervised atmosphere. Graduate assistants who complete the Graduate Teaching Associate training through FaCET, and who complete the teaching practicum program offered by the Department, typically take full responsibility for teaching a general education course in the second year of their program. Data show that students who receive assistantship support, who are actively engaged in a research project with faculty, and who remain enrolled full-time during the course of the program, generally complete the program within two-to-three years (95%). Students who take a full-time position outside the department after completing required coursework typically either drop out of the program or can take up to six-to-seven years to complete the thesis (95%). Based on a review of comprehensive exam responses over the past five years, those students enrolled full-time in the program and actively engaged in a research project with a faculty member perform at a higher level on the exam compared to those students who are not active in the department for several years. Accordingly, data suggest that students have better overall retention of course material when enrolled fulltime through to the completion and defense of the research thesis.

2. <u>Indicators of Teaching and Advising Quality</u>:

It is not possible to separate graduate teaching specifically from the undergraduate programs, as there are no faculty solely allocated to the M.S. Geoscience program. Every graduate faculty member contributes in some way to teaching and advising in the graduate program. For example, Dr. Chris Groves has been selected as University Distinguished Professor for 2010-2015 in large part because of his many accomplishments in the graduate program (teaching, research, grants, thesis mentoring, and service). Dr. Mahmood won both the Ogden and WKU Research awards in 2006 in large part because of his work with graduate students on grant-funded projects that engage them in research and publication activity. Foundational coursework in the M.S. program is taught primarily by Drs. Yan (GEOS 520 and GEOS 523), Algeo and Gripshover (GEOS 530); Keeling and Goodrich (GEOS 500); and Polk and May (GEOS 502). Other graduate faculty contribute by teaching "G" sections of advanced undergraduate courses, supervising independent research projects (refer to table VI-B-3b-1 below), and mentoring graduate students. Several faculty carry a heavy graduate advising load,

with only minimal reductions in their average teaching load, in part because of inadequate support for graduate programs at WKU.

Table VI-B-2: Graduate Thesis Workload Distribution
by Graduate Faculty, F2004-F2010 (Completed Theses)

Faculty	Thesis Chair	Thesis Reader
Groves, Chris	12	4
Algeo, Katie	7	2
Mahmood, Rezaul	7	1
Keeling, David	4	12
Yan, Jun	3	10
May. Michael	2	8
Kuehn, Ken	2	2
Foster, Stuart	1	20
Goodrich, Gregory	1	6
All, John	1	4
Polk, Jason	1	1
Wulff, Andrew	1	1
Siewers, Fred	0	7
Gripshover, Peggy	0	2
Durkee, Joshua	0	1
Celestian, Aaron	0	1
Other Faculty	5	57
TOTAL	**47**	**139**

3. Indicators of Student Learning:

The Department has adapted WKU's Quality Enhancement Program outcomes as a general framework to guide program assessments.

QEP Outcome #1 - *Students can demonstrate the capacity to apply discipline-centered knowledge and training to address relevant concerns in community or society.*
QEP Outcome #2 - *Students understand the diversity of peoples, ideas, and cultures and can demonstrate how these shape the world around them.*
QEP Outcome #3 - *Students can demonstrate awareness of their opportunities as responsible citizens living and working in a global society.*

In addition, the Department has adopted the general learning philosophies outlined in Ambrose et al. (2010) (refer to Table VI-3 in the Appendix, p.24). These philosophies guide the assessment process.

i. Means of Assessment and Criteria for Success:

1. Inquiry and Analysis
2. Critical Thinking
3. Creative Thinking
4. Written Communication
5. Oral Communication
6. Quantitative Literacy
7. Information Literacy
8. Teamwork
9. Problem Solving
10. Civic Knowledge and local-global engagement
11. Intercultural competence
12, Ethical Reasoning
13. Skills for lifelong learning
14. Integrative Learning

The Department has generally adopted a 14-point framework for the assessment of learning outcomes. This framework has been applied primarily to the assessment of general education courses, but is applicable to all of the graduate coursework offered in the Department. Although all of the 14 criteria for assessment are relevant at the meta-level, some are more relevant to specific courses. In the Geoscience program, for example, advanced courses typically focus on oral communication (5), problem solving (9), and teamwork (8), while foundational courses typically focus on literacy (6 and 7) and written communication (4). In the capstone thesis, integrative learning (14) becomes critical, as do creative and critical thinking (3 and 4).

Assessment takes place in three key ways. First, students in the foundational Geoscience Research and Literacy course must demonstrate competency in the first seven criteria. Second, students must complete a research thesis that is assessed (juried) by a committee of four or more faculty. Finally, students must complete a comprehensive examination (passing three of five questions) and defend their research publicly in a seminar presentation and in front of a graduate committee. Other assessment methods include comfort surveys, benchmark knowledge surveys at the beginning and end of individual courses, group projects, independent student learning, practica experiences, and potential publication of the culminating graduate thesis.

In assessing intended educational outcomes, faculty are guided by the following assumptions:

a. Students will demonstrate the capacity to apply knowledge and training to address relevant concerns in community or society. Students will demonstrate a clear understanding of the core content areas of geoscience, a capacity for critical thinking, and concept synthesis. Graduates from the program are prepared for success in the geosciences (QEP 1).

b. Students can gather and utilize geoscience information to enhance knowledge, and can use communication skills to convey meaning effectively and accurately. Communications skills are assessed through examinations and presentations (QEP 1 & 3).

c. Students have developed the cognitive processes and dispositions necessary to think critically, to analyze problems in context, and to make sound and intelligent decisions (QEP 1,2,3).

d. Students have learned, and can apply, the technological knowledge, skills, attitudes, and flexibility needed to analyze and solve problems in a rapidly changing environment (QEP 1,2,3).

ii. Data Collection Methods

Assessment data are generated at the end of each student's program, including the capstone thesis, a comprehensive examination, a public presentation, and a public thesis defense. In many graduate courses, students are assessed using team projects, presentations at conferences, internship evaluations by supervisors, peer review of manuscripts for publication, and graduate teaching assistantship reviews.

iii. Assessment Results

At the end of each course, faculty typically conduct a personal assessment of course delivery and other indicators of learning success. SITE evaluations can help to identify specific issues with examination formats and textbooks, etc. The Department subscribes to the general philosophy that short-term, snapshot evaluations of learning outcomes are statistically suspect and do not provide robust enough data to suggest meaningful improvements. Consequently, the Department takes a longer view of course assessment and learning outcomes, preferring to look at trends over time and to survey graduates from time to time to determine what worked and what needed improvement. A key measure of program success is graduate student placement post-graduation and publication of their research results.

iv. Use of results to improve the Program

The M.S. Geoscience program has a curriculum committee that assesses on a regular basis individual course relevance and overall program relevance. Data gathered from faculty course assessment, from alumni surveys, from SITE evaluations, and from the discipline generally are used to make program improvements. Individual faculty evaluate trends in the discipline to determine whether courses need changing, or whether new courses need to be added. In the graduate program, for example, assessment of learning outcomes in a number of courses suggested a need for a non-thesis-based M.A.E. program for P-12 teachers. Students currently teaching in the P-12 system or anticipating a career in P-12 teaching do not always benefit from a research-intensive approach. Accordingly, in partnership with the new Teacher Leader program in the College of Education, the Department has developed a new M.A.E. in Geography Education (with emphases in Earth Science and Cultural Geography (Social Studies)). Over the past five years, the increasing diversity of, and comments by, entering graduate students who typically enrolled in GEOS 502 Field Methods suggested that alternate "field methods" options were needed to recognize the three core clusters in the graduate program (Physical Cultural, and GIS). Faculty subsequently developed two new four-hour foundational courses for students focusing on cultural themes (GEOS 530) and for those focusing on GIS-related themes (GEOS 523).

Changing technologies (such as in Geographic Information Science), new equipment, employer demands, and other circumstances can influence how a program is changed. For example, the addition of a new Cultural Geographer this past academic year has encouraged a revamping of the Cultural Geography concentration in the program and has spurred a re-evaluation of several supporting courses. On the physical side of geography, faculty have realized that the creation of the new B.S. in Meteorology program will develop a group of students who desire to continue graduate study at WKU. Thus, faculty are designing a new M.S. in Climate Studies program that should meet this and other needs.

a. <u>Assessment of Currently Enrolled Students</u>:

One measure of graduate student success is the ability to communicate a well-structured research project through an oral or poster presentation at an academic conference. Conferences such as the Southeastern Division of the Association of American Geographers have rigorous acceptance standards, including peer-review of written versions of the papers that are to be presented.

Simply to be accepted for presentation at such a conference is a notable achievement. In addition, many conferences have graduate student competitions, and the Geoscience program has seen increasing number of students win such competitions in recent years. Students gave 91 presentations and local, national, and international conferences during the review period, with several students recognized for their exceptional work (Table VI-B-3a in the Appendix, p.26).

As part of the Program Review process, the Department contacted currently enrolled graduate students inviting them to complete a short survey. Students were asked to comment about program strengths, weaknesses, and improvements that could be made. These comments form part of the program's assessment process and are incorporated into deliberations that faculty make each academic year about changes and improvements to the program. Selected comments are:

Strengths:

- Excellent courses, rigorous requirements.
- Excellent advising, Hoffman Institute, and faculty
- Professionalism and experience of the faculty, diversity of course offerings, course offerings that are relevant and up to date.
- Diverse staff and courses, international reach, karst research center, and dedicated GIS lab with lab manager.
- Excellent advising and willingness to get things done for the graduate students.
- Lots of different interests and research foci in the department.
- Ability to take courses from highly qualified faculty who are specialized in the field.
- Flexibility to incorporate independent study courses and to work closely with faculty to learn material specific to your research area.
- Great faculty, great GIS program, student-faculty ratio is small enough to be advantageous to the student.
- Excellent advising and mentoring overall.
- Extremely knowledgeable faculty, helpful, department staff are awesome.

Weaknesses:

- Wish I had time to take more courses.
- Lab spaces and research resources.
- GIS programming.
- Too few faculty with expertise in policy, energy, etc.
- Too focused on the physical side of the department.
- All classes should be taught strictly at the graduate level, not as G sections.
- Not enough courses offered for the environment and sustainability option.
- Not enough resources for the research projects (i.e. computing power for models).

Improvements:

- More opportunities to hear from other students in the program.
- More job opportunities for students.
- More writing experiences and opportunities.
- Provide networking or job fair events
- Offer meteorology courses on a more regular basis.

- Offer non-thesis option with a language requirement.
- Develop an introductory course on writing grant proposals.
- Develop course on mitigation techniques for environmental problems.
- More fieldwork options and lab experiences.
- Encourage every student to participate in some kind of study abroad or field camp.
- Obtain more grants for research and projects that can support students.

b. Other Indicators of Success:

The M.S. Geoscience program is structured around three core courses (12 hours), four elective courses (12 hours), and a six-hour research thesis project. The program encourages, supports, and values independent, supervised research for all students. Accordingly, many students take independent courses in addition to regularly scheduled classes in the department – these independent courses provide an opportunity for students to explore topics and methodologies not addressed in a regularly scheduled course. During the review period, 92 independent courses were developed for graduate students, with many of these projects supporting or leading to the development of the research thesis, and many resulting in presentations at professional meetings (see Table VI-B-3b-1 in the Appendix, p.28).

During the review period, thirteen students participated in the Department's graduate student teaching practicum program, in addition to completing a required set of seminars and workshops at FaCET, to earn the designation of Graduate Teaching Associate (GTA). Students "shadow" an instructor during the seminar and develop the skills necessary to take full responsibility for a general education course in subsequent semesters. Twenty-one other students participated in an internship experience in planning, climate, or other government-related agencies. These experiences provide students with important skills and contacts that can facilitate job placement after graduation (refer to Table VI-B-3b-2 in the Appendix, p 30).

The program graduated 40 students during the review period, of which 39 produced a research thesis and one student completed the program's non-thesis teacher-education concentration. Included in Table VI-B-3b-3 (Appendix, p.30) are five students who have defended their thesis recently and who were scheduled to receive the M.S. Geoscience degree in December, 2010. Another student was scheduled to graduate in December 2010 from the non-thesis Teacher Education program in Geography. Effective with the introduction in Fall 2011 of the MAE in Geography Education program, the MS Geoscience degree will be strictly research thesis-based. Of the 45 students currently enrolled in the program (Fall 2010), all of them are developing, or are in the process of writing up, a thesis research project.

A stated goal of the MS Geoscience program is to conduct research that is meaningful and relevant to society, and to disseminate the results of said research to appropriate audiences. This often entails providing a copy of the research results to the appropriate constituency, but the faculty also aim to publish student research results in journals, conference proceedings, monographs, and other appropriate outlets. Table VI-B-3b-4 (Appendix, p. 32) details the 25 publications in academic journals, books, and other outlets authored and co-authored by graduate students during the review period. The graduate faculty are proud of the growing number of academic publications by students, and faculty continue to explore ways to get students published in appropriate academic and other outlets.

External Scholarships:

Over the past nine years, the Department has had significant success with students winning ESRI scholarships to attend the annual International Users Conference. Students are selected by ESRI from a pool of international applicants for the competitive scholarships, which support 60 graduate and fourth-year undergraduate students from universities and colleagues throughout the U.S. and around the world.

Table VI-B-3b-5: Graduate Student Scholarships and Awards

Student	Year	Scholarships and Awards
Hetzler, Rachel	2010	ESRI
Aryee, Frank	2010	ESRI
Almudaris, Sami	2010	ESRI
Winchester, Dustin	2010	KIIS Argentina
Smith, Dalene	2010	William Wilson Award
Leeper, Ronnie	2009	OCSE Outstanding Graduate
Brunt, S. Matt	2008	ESRI
Tracy, Mark	2008	Cave Research Foundation
Leeper, Ronnie	2007	ESRI
Simpson, Shawn Marie	2006	ESRI
Hall, Jonathan	2006	ESRI
Pricope, Narcisa	2006	IGERT Scholarship
Hendrickson, Melissa	2006	William Wilson Award
Jeng, Shwu-Jing	2005	ESRI
Pricope, Narcisa	2005	ESRI

c. Program Graduates:

Of the thirty-nine students who graduated during the review period, eight are currently pursuing a Ph.D. in geography, geology, or related disciplines (21%), one is enrolled in further Master's coursework, and four are currently teaching at a university (33% total). A significant majority (96%) of the twenty-six other recent graduates are employed in positions related to their degree specialty (geography, geology, meteorology, GIS, or planning) (see Table VI-B-3c, Appendix, p34).

As part of the Program Review process, the Department contacted alumni inviting them to complete a short survey. Alumni were asked to comment about program strengths, weaknesses, and improvements that could be made. Selected comments are:

Strengths:

- So many resources and assets when it came to gaining knowledge…professors were always available for assistance.
- The opportunity to participate in current and real cave-related research, projects, management; use of GIS.
- Research opportunities, quantitative analysis, involving multiple fields of study.
- Very influential faculty who had knowledge of the working world. Incorporation of GIS into curriculum as this is one of the most important tools for a geologist/geographer to know.

- The quality of the teaching staff and the research opportunities with the Mesonet. WKU prepared me very well for a position with TEMA.
- Faculty experience, available resources, approachable faculty, friendly environment.

Weaknesses:

- EST has bad heating/air conditioning, which can make it difficult to concentrate, study, take tests, etc.
- Would be beneficial to have more experience with technical equipment.
- Some mandatory classes that did not seem so useful.
- Need more field methods (hydrogeology, soils/sediments).
- A bit behind on modernizing the program.
- Needed to encourage students to publish papers and invite industry specialists to the program.

Improvements:

- Invite past graduates to speak to the fresh experience/senior seminar classes to offer advice and experiences.
- Have more time available with hydrologic field equipment and do more real-world analysis.
- More internships and practical applications of research methods, along with more public speaking and presentation skill-development opportunities.
- Make all majors take at least one GIS course; focus on report writing skills.
- Better climate lab facilities.
- Have weekly seminars for graduate students on specific topics and themes.

4. Indicators of Student Engagement:

The Department requires graduate students to present their research in the regular faculty/student seminar series that convenes bi-weekly (see Table VI-B-4-1, Appendix, p. 35). Public presentation and peer review of research results are important elements in a student's graduate education, as they allow students to engage with the research of others, to critique the research process, and to understand more clearly the importance of sharing research with others. Students enrolled in the undergraduate professional development course (required of final-semester seniors majoring in the department) also participate in the bi-weekly seminar series, as it provides them also an opportunity to be exposed to research at a higher level (see Table VI-B-3b-2 in the Appendix (p. 30) for details of student internship experiences in the community).

Graduate student teaching is an important part of the M.S. Geoscience program, with students who demonstrate a capacity for instruction of general education courses encouraged to participate in the Department's GTA training. Fifty general education sections were taught by GTAs during the review period (refer to Table VI-B-4-2 in the Appendix, p. 38).

As all M.S. Geoscience graduate students are required to conduct independent research, students naturally will engage with a general or specific community and/or issue. In addition, students work closely with faculty on externally funded research projects. For example, Benjamin Miller and Sarah Arpin performed paleoclimate fieldwork in Belize, collecting and

examining sediments for evidence of drought and Maya collapse. This is a collaborative project with three other universities and the Belizean Department of Archaeology.

B. Other Indicators of Program Achievement and Contribution

1. Program Viability:

The M.S. Geoscience program in the Department of Geography and Geology is the only one of its kind in the Commonwealth. Other institutions offer Master's degrees in geography, geology, or the geosciences, but none has the level of interdisciplinarity offered by our program. The key theme of the program is human-environment interaction, with four main foci – Climate Studies, Cultural Geography (planning, society, and place), Physical Geoscience (geology, karst, water, geomorphology), and Geographic Information Science (GIS). The annual summer Karst Field Studies program also attracts potential students and is internationally known for the quality of its instruction and instructors.

As the program is very interdisciplinary in nature, there are no comparative statistics against which to measure enrollment or employment trends. For example, the American Geological Institute (AGI) prepares a periodic report on the state of the geosciences nationally, with significant discussion about enrollment and employment trends: (http://www.agiweb.org/workforce/reports/2009-FourYearInstitutions.pdf). However, these reports primarily capture data reported by "traditional" geosciences graduate programs (geology and other physical geosciences areas), and do not capture geography, GIS, or research areas that fall outside this traditional definition of geosciences. As noted by the AGI report (p.2):

> *"The number of students enrolling in geoscience programs in U.S. colleges and universities has remained relatively steady over the past few years, with 19,216 undergraduates and 7,944 graduates enrolling in 2007. Degrees granted in the geosciences have remained relatively constant since 2000, with one exception of new doctorates in 2007 which increased by over 30 percent. This sharp increase mirrors the influx of entering graduate students in 2003 and 2004 following the bust of the dot-com bubble. When compared with other science & engineering fields, the geosciences have lower degree completion rates for Bachelor's degrees (13% compared to 59%), comparable rates for Master's degrees (20% compared to 19%) and higher doctoral degree completion rates (20% compared to 9%)."*

Enrollment in the M.S. Geoscience program reflects national data, with the number of students remaining fairly constant over the review period (an average of 40 students enrolled).

The program is now exclusively research-thesis based, which has increased the quality and preparation of entering students. The average GAP score (GRE x undergraduate GPA) for students admitted in Fall 2010 was 3431 (eight students), a 600 point increase over the 2,831 average for the Fall 2009 entering class (14 students). Over the review period, GAP scores have averaged about 3000 for entering students, with GRE scores during the review period averaging approximately 1000 points. The department does not give inordinate weight to student GRE or GAP scores in the admissions process, as historically these have not been accurate predictors of success in the program. The most important indicators of potential graduate student success are GRE Writing component scores of 3.5 or higher, at least 15-18 hours of undergraduate coursework in the sciences (with preference to coursework in the geosciences), and a demonstrated passion for research. The department historically awards graduate assistantship

funding only to those students who demonstrate the above success indicators, with all other students required to be self-supporting. Although the program is willing to give any qualified student an opportunity to be successful, in practice many of the students who drop out of the program do so because they cannot complete the foundational course GEOS 500 Research Methods and Literacy, which incoming students are required to take in the Fall semester. The remainder of the program dropouts are students who have completed required coursework but, for one reason or another [usually employment], fail to make adequate progress on the thesis research and writing required to complete the degree.

2. Contributions to University Programs:

Not applicable for the graduate program. However, students from other graduate disciplines enroll in the Graduate GIS Certificate program, a four-course sequence which provides them with spatial analytical tools. The Department also contributes to the graduate Leadership Certificate program with specialized course offerings. For example, in Summer 2009, Dr. Keeling offered Contemporary Leadership Issues for graduate students, and in Spring 2011 the Department is offering Environmental Sustainability for the graduate Leadership Certificate program taught by Dr. Polk. The Department also allows students to count six hours of approved graduate courses from other graduate programs on campus (Chemistry, Public Health, etc.) where the course content appropriately supports the students' program of study.

3. Use of Technology:

Technology plays a significant role in the education of Geoscience graduate students. The program is unique in the region as it offers access to a wide array of research equipment. For example, the Crystal Kinetics Lab is home to variety of state-of-the-art research equipment geared at solving geological and industrial challenges associated with the characterization of crystalline materials under adverse conditions. Several key instruments, including the dispersive Raman microscope, powder X-ray diffractometer, and a thermal analyzer are used to probe the chemistry and atomic structure of materials. In addition to materials characterization, the CK Lab hosts facilities for crystal engineering/design that gives graduate students and faculty the opportunity to study materials from inception to application. The CK Lab is also part of the newly created ARTP POD, the Advanced Materials Institute, which houses the larger pieces of equipment used for precise chemical and atomic structure characterization of highly functional materials and Earth minerals. Once trained, any student in the Geoscience graduate program can have access to these research facilities for use on their thesis project. Ongoing projects range from modeling the behavior of radioactive isotopes on and in minerals, mineral ore formation conditions as a compass for continued exploration, and determining the structures of novel engineered materials for the decontamination of soils and air. Some of these projects have required addition analytical facilities that are only available at national laboratories (such as Brookhaven National Lab in New York and Oak Ridge National Lab in Tennessee), and our students have traveled to these facilities to obtain data that cannot be collected anywhere else in the world.

All upper-division and graduate-level meteorology and climatology courses now have the capacity to be taught in the recently renovated Meteorology laboratory. The classroom features a fully-recorded security system, 52" flat screen TV, a ceiling-mounted Proxima, a high-end AV

system, and 20 student computers. The student computers contain National Weather Service quality satellite and radar viewers as well as meteorological visualization software that allow students to view severe weather in 3-D. All student computers also feature fully integrated GIS software and SPSS statistical software. Future plans for the lab include mounting an automated weather station on the roof of EST and installing a web-cam on the roof of PFT to track incoming severe weather. Geoscience graduate students who assist faculty with climate research projects also have access to the Climate Research Lab in EST, which has around a dozen high-speed Linux workstations capable of running various mesoscale climate models. Students can also use software on the Linux workstations to write computer programs in FORTRAN for data analysis purposes. Students interesting in Meteorological Instrumentation have access to the full suite of instruments deployed on a standard Kentucky Mesonet station and learn the theory and perform hands-on lab experiments on those instruments, which include dataloggers, pyranometers, thermometers, hygrometers, anemometers, and barometers.

Students enjoy a state-of-the-art GIS instructional lab, running the most advanced GIS software, ArcGIS, as well as a separate production lab with dedicated research computers and specialized peripherals, including scanners, GPS units, and a large-format plotter. A dedicated server acts as a license server for ArcGIS and hosts internet GIS services. Graduate students and faculty have used these facilities for a variety of research and professional projects, including development of an innovative web-based Mammoth Cave Historical GIS; traffic and accident analysis of congested urban areas; and campus infrastructure mapping and management.

As a research thesis-based program, the M.S. in Geoscience is not designed for online offerings. However, students can take online versions of GEOG 417G and 419G, which contribute to the graduate GIS certificate program. In partnership with the Teacher Education program, the Department offers GEOS 507 online, a course designed for P-12 teachers that serves as the foundational course in the new M.A.E. in Geography Education program (cultural geography emphasis). GEOS 511 Dynamic Earth is offered occasionally online for P-12 teachers, as it serves as the foundation course in the Earth Science emphasis of the new M.A.E. in Geography Education. Other online courses include GEOG 474G Environmental Planning and GEOG 487G Environmental Law and Policy.

4. Uniqueness of Program

The M.S. Geoscience program is unique in the region because of its interdisciplinary nature (see 1. above). As the titles of recent research theses demonstrate, students address a wide variety of human-environment problems in local, regional, and international community settings (see Table VI-B-3b-3, Appendix, p. 30). Prospective students are attracted primarily by the international reputation of the Hoffman Institute and the Center for Cave and Karst Studies, and by the research potential offered by the Kentucky Mesonet and the Kentucky Climate Center. For example, of the 83 theses produced over the past twenty years, thirty-four theses were directly related to karstic studies (41%), with University Distinguished Professor Dr. Chris Groves supervising 25 of these projects. Of the 39 graduate research theses formally completed during the review period, 21 (54%) addressed physical geoscience themes, seven (18%) addressed climate-related themes, seven (18%) addressed cultural-environmental themes, and four (10%) addressed GIS-related themes.

The program also is unique in the region for the breadth and reach of scholarship. Engaging both graduate and undergraduate students in applied and basic research is a core

philosophy of the department. Table VI-C-4 (Appendix, p. 39) summarizes the myriad outlets for faculty publications on a wide variety of human-environment-Earth issues, including traditional academic journals and books, and non-traditional media outlets and discipline-based newsletters:

5. Contributions to Diversity Goals:

The recent AGI report (p. 17 above) provides a realistic statement of diversity challenges in the geosciences (p.3 of report):

> *"Compared to the success story of female student graduates, the participation of under-represented minorities in the geosciences is extremely poor. Compared with other science & engineering fields, the geosciences confer the lowest percentage of Bachelor's and Master's degrees to underrepresented minorities. The percentage of all science & engineering degrees conferred to Hispanics and non-Hispanic African Americans is 8 percent, whereas the percentage of geoscience degrees conferred to these minorities is approximately 2 percent. In comparison, Hispanics and non Hispanic African Americans comprise 29 percent of the U.S. population (14% Hispanic and 15% non-Hispanic African American). The percentage of degrees conferred to Native Americans and Alaskan Natives from all science & engineering programs and from geoscience programs is approximately the same (0.8%). These minorities comprise only 2 percent of the U.S. population."*

Of the 48 students currently enrolled in the M.S. Geoscience program, 22 are female (46%) and five are from foreign countries. Two African-American students enrolled during the review period, with one graduating in 2005 and the other dropping out of the program in 2010. Of the 39 students completing the program during the review period, 17 were female (43.5%) and four (10%) were foreign students (one African).

Diversity and gender issues are addressed primarily in the non-physical course curriculum, especially from a planning, culture, and mobility perspective. As a science program, many of the program's courses focus primarily on research theories and methodologies, and are gender/diversity neutral – ethnic and gender backgrounds are irrelevant to the process of developing a research thesis proposal, although they are very relevant in terms of how they might influence the choice of research topics. Moreover, socio-cultural backgrounds do become important in terms of preparation for graduate research, the types of research projects that minorities or females might consider, and opportunities for funding support.

5. Accreditation Status:

There are no accreditation bodies for the geosciences. Students can take appropriate coursework to prepare them for the professional examinations necessary to become a licensed Professional Geologist (PG), for GISP designation (Geographic Information Science Professional), or to enter government employment (National Weather Service, etc.).

6. Planning, Development, and Other Areas:

From a development perspective, alumni historically have been generous in their financial support of the Department and its programs. During the review period, the Department received approximately $140,000 in alumni contributions and other gifts, with at least $10,000 of

these contributions donated directly by alumni of the graduate program. The Department circulates an annual alumni newsletter (http://www.wku.edu/geoweb/info/geogramindex.htm) – the GEOGRAM – which keeps alumni of the graduate program informed about research, faculty accomplishments, and their peers' activities. Historically, program graduates have contributed financially to the Department through regular donations and gifts-in-kind. Although graduates remain financially loyal to the program over many decades, there have not been any opportunities in recent years to identify funding for an endowed professorship or other significant gift.

One long-term goal for the Department includes the development of an M.S. in Climate Studies program that can capitalize on a recent National Oceanic and Atmospheric Administration (NOAA) proposal to the White House regarding the creation of the National Climate Service (NCS). This would combine data from the research and analysis work done by several agencies, as well as coordinate climate information for the government. The creation of the NCS could result in new opportunities for scientists with training in applied climatology. Universities that are quick to develop graduate curricula specifically geared and marketed towards developing applied climatologists should have a distinct advantage as the demand for applied climatologists increases. Presently, the only graduate program in the United States with the title of M.S. or Ph.D. in Climate Science or Climate Studies is the M.S. of Climate Science and Policy located at the Bard Center for Environmental Policy in New York, although this is primarily a climate policy degree.

The Department of Geography and Geology is well-suited to house the nation's first M.S. in Climate Studies program that focuses primarily on climate science. The growing B.S. degree in Meteorology program is quickly becoming recognized for producing excellent students. The Kentucky Mesonet and Kentucky Climate Center, staffed by the official state climatologist, provide expertise in climate services and can act as a platform for applied climatological research. The Meteorology program faculty have a successful track record of high-level publications, external funding, and engagement with students. The Meteorology program faculty also have developed strong relationships with several of the Regional Climate Centers (Midwest and High Plains, specifically), which figure to play a prominent role in the proposed NCS. To support the M.S. in Climate Studies program, a fifth tenure-track faculty member with a specialty in Physical Meteorology or Dynamic Meteorology would be needed. In addition, the growing computer infrastructure for both the B.S. in Meteorology and M.S. in Climate Studies programs drive the need for a full-time computer laboratory administrator. The laboratory administrator would devote 50% effort to administering the lab and the remaining 50% effort to teaching 100-level courses in meteorology as well as courses in meteorological computing. Significant release time will be needed for the five meteorology/climatology faculty to accommodate the research needs of both the graduate students in the proposed M.S. Climate Studies program and the undergraduate students in the B.S. Meteorology program. Competitive stipends for graduate students will be necessary to attract highly qualified students.

7. Additional Indicators for Career Preparation Programs:

Program graduates develop careers in myriad areas (refer to graduate placement information in Table VI-B-3c, Appendix, p. 34). There are no specific career preparation strategies for the program. Career opportunities in climate studies, GIS, environmental management, water resources, and similar areas are likely to show growth in the near future, especially as new

technologies are linked with sophisticated spatial analytical techniques. The M.S. Geoscience program is well placed to take advantage of these opportunities.

D. Factors Inhibiting Program Achievement and Contribution

The major limiting factor in achieving program goals is the lack of growth in the size of the graduate faculty and the increased undergraduate teaching responsibilities placed upon graduate faculty. Pressures to increase SCHP because of continued growth in the undergraduate student body, and to meet the needs of General Education, have led to graduate faculty teaching larger sections of undergraduate classes. While the graduate faculty are pleased to support the undergraduate programs, accommodating these pressures has been at the expense of further developing the graduate curriculum and exploring new options such as online graduate certificates and the MAE in Geography Education for Teacher Leaders program.

Further limiting factors include **uncompetitive funding for graduate assistantships**, which limits the pool of highly qualified applicants who might assist faculty on grant-funded research and who might be trained as graduate teaching associates. Other challenges include a significant deficit in available office and laboratory space to accommodate growth in the graduate program and to support grant-funded research.

E. Response to Previous Program Reviews or Other Assessments:

The program review report for the cycle 1998-2003, submitted in May 2004, recommended "maintain but review" primarily because of graduation rates below the [artificial] CPE benchmark of eight graduates annually for a graduate program. Here is the report in its entirety:

> *"The Masters of Science in Geoscience makes an important contribution to WKU's graduate program offerings. The Geoscience Masters has well articulated student learning outcomes, which appear to be assessed via appropriate assessment tools. Alumni survey data indicate that a majority of graduates (approximately 2/3rd of respondents) find employment in the field within two years of graduation. In spite of various disadvantages such as low graduate assistantship packages, the program has done a commendable job of recruiting qualified students. The program boasts an excellent record of research/creative activity, service, and grant activity. Through the department's three Applied Research and Technology Center (POD) units, the program offers students excellent opportunities to be engaged in applied, collaborative research. Looking forward, the program appears in a very positive strategic position in terms of capitalizing on the renewed national and international interest in spatial mapping techniques and satellite-based locational tools (GIS/GPS). Finally, the Academic Program Review is **exemplary** and could be used as a model for programs undergoing future reviews. Although the department appears to maximize faculty resources in delivering the instructional program (i.e. 1.25 FTE devoted to the program), the program's average of five graduates/year is less than the CPE benchmark of eight/year. For this reason, the recommendation for this program is MAINTAIN BUT REVIEW for enrollment issues."*

The Department has long maintained that CPE benchmarks for graduation numbers are **artificial and statistically meaningless**. For example, if a society requires three water-resource specialists and the program graduates eight, then it's likely that five of these graduates will be unemployed or employed in a different field. Moreover, if the program only graduates one water-resource specialist, then society will face problems or will have to recruit two specialists from beyond the region. Currently, the M.S. Geoscience program graduates an average of six students annually from the program, with all of them completing a rigorous, thesis-based research project. Since the last review, research and grant productivity by the graduate faculty has increased tremendously, with 219 total faculty and student publications during the review period, compared to less than 100 total publications during the previous review period. Moreover, the graduate faculty generated over $10 million in grants during the review period, compared to approximately $3.5 million in grants during the previous review period.

F. Future Directions:

Graduate assistantships need to be enhanced through the increase of stipends and the awarding of partial and **full tuition waivers**. This would vastly improve our ability to recruit highly qualified students. Inadequate assistantship funding has been the major factor inhibiting program growth. We typically lose most of our top applicants, especially those who have GAP scores well above the university averages, because we cannot offer full tuition waivers and competitive assistantships.

The ability of the program to increase the number of students enrolled in the M.S. Geosciences program, and thus graduate eight or more students annually on average as determined by CPE benchmarks, depends on the provision of additional faculty lines dedicated to the graduate program and a meaningful increase in graduate assistantships at least to national benchmark levels. Currently, the M.S. program is at its maximum capacity, with approximately 2 FTEF dedicated to instruction and thesis supervision. In practice, this workload is distributed across the 18 graduate faculty who serve on thesis committees, teach graduate-level courses, and supervise graduate student research projects.

As discussed above, the Department has developed a new M.A.E. in Geography Education (with cultural geography and earth science emphases) for Teacher Leaders as part of a state-wide initiative to enhance the competency and quality of teachers in the P-12 system. This new program will recruit new students effective Fall 2011. The Department also is developing a new M.S. in Climate Studies to become effective Fall 2012.

Other needs include additional laboratory facilities, office space for new faculty, additional graduate students, and post-doctoral researchers. Current accommodations in EST are inadequate and are past capacity. Any future growth must consider additional space, equipment, and faculty resource needs.

Long-term goals include the **development of a Ph.D. program** in Climate Science. There are considerable challenges to overcome to develop a doctoral program, including state politics. At this point, the climate is not conducive to the expansion of new programs, but many of the elements are already in place for the creation of a doctoral program in Climate Science or Climate Studies. Additional resources required (once the program is underway) would be the addition of at least two more tenure-track lines and possibly an instructor position to handle preparatory and laboratory courses, thus relieving the burden on research faculty. Any proposed doctoral program would need competitive assistantship allocations.

Appendices

Table VI-B-3: Learning Assessment Philosophies

The following seven key points about learning assessment come from "Tomorrow's Professor" (Stanford Center for Teaching and Learning (2010), posting #1057), citing Ambrose et al. (2010). **These fundamental philosophies about learning and assessment serve to guide the Department's overall approach to assessment**:

"(1) Student's prior knowledge can help or hinder learning:
Students come into our courses with knowledge, beliefs, and attitudes gained in other courses and through daily life. As students bring this knowledge to bear in our classrooms, it influences how they filter and interpret what they are learning. If students' prior knowledge is robust and accurate and activated at the appropriate time, it provides a strong foundation for building new knowledge. However, when knowledge is inert, insufficient for the task, activated inappropriately, or inaccurate, it can interfere with or impede new learning.

(2) How students organize knowledge influences how they learn and apply what they know:
Students naturally make connections between pieces of knowledge. When those connections form knowledge structures that are accurately and meaningfully organized, students are better able to retrieve and apply their knowledge effectively and efficiently. In contrast, when knowledge is connected in inaccurate or random ways, students can fail to retrieve or apply it appropriately.

(3) Students' motivation determines, directs, and sustains what they do to learn:
As students enter college and gain greater autonomy over what, when, and how they study and learn, motivation plays a critical role in guiding the direction, intensity, persistence, and quality of the learning behaviors in which they engage. When students find positive value in a learning goal or activity, expect to successfully achieve a desired learning outcome, and perceive support from their environment, they are likely to be strongly motivated to learn.

(4) To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned:
Students must develop not only the component skills and knowledge necessary to perform complex tasks, they must also practice combining and integrating them to develop greater fluency and automaticity. Finally, students must learn when and how to apply the skills and knowledge they learn. As instructors, it is important that we develop conscious awareness of these elements of mastery so as to help our students learn more effectively.

(5) Goal-directed practice coupled with targeted feedback enhances the quality of students' learning:
Learning and performance are best fostered when students engage in practice that focuses on a specific goal or criterion, target an appropriate level of challenge, and is of sufficient quantity and frequency to meet the performance criteria. Practice must be coupled with feedback that explicitly communicates about some aspect(s) of students' performance relative to specific target criteria, provides information to help students progress in meeting those criteria, and is given at a time and frequency that allows it to be useful.

(6) Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning:
Students are not only intellectual but also social and emotional beings, and they are still developing the full range of intellectual, social, and emotional skills. While we cannot control the developmental process, we can shape the intellectual, social, emotional, and physical aspects of the classroom climate in developmentally appropriate ways. In fact, many studies have shown that the climate we create has implications for our students. A negative climate may impede learning and performance, but a positive climate can energize students' learning.

(7) To become self-directed learners, students must learn to monitor and adjust their approaches to learning:
Learners may engage in a variety of meta-cognitive processes to monitor and control their learning--assessing the task at hand, evaluating their own strengths and weaknesses, planning their approach, applying and monitoring various strategies, and reflecting on the degree to which their current approach is working. Unfortunately, students tend not to engage in these processes naturally. When students develop the skills to engage these processes, they gain intellectual habits that not only improve their performance but also their effectiveness as learners."

Again, drawing from material on the Tomorrow's Professor listserv, the following statements about student learning inform the program's approach to assessment (Ambrose et al. 2010):

*"A. Learning is a process, not a product. However, because this process takes place in the mind, **we can only infer** that it has occurred from students' products or performances.*
B. Learning involves change in knowledge, beliefs, behaviors, or attitudes. This change unfolds over time; it is not fleeting but rather has a lasting impact on how students think and act.
C. Learning is not something done to students, but rather something students themselves do. It is the direct result of how students interpret and respond to their experiences -- conscious and unconscious, past and present."

Ambrose, S.A., Bridges, M.W., DiPietro, M., Lovett, M.C., and Norman, M.K. (2010). *HOW LEARNING WORKS: Seven Research-Based Principles for Smart Teaching*. New York, Jossey-Bass.

Table VI-B-3a: Student Presentations at Local, Regional, and International Conferences

Student	Year	Conference Presentation	Award
Gilliland, Joshua	2010	Kentucky Academy of Science	First Place - Geography
Schmitz, Elizabeth	2010	Kentucky Academy of Science	Second Place - Geography
Gaines, Mitchell	2010	Kentucky Academy of Science	Third Place - Geography
Epperson, Ann	2010	SEDAAG	Runner-up MS competition
Craft, Kortney	2010	SEDAAG Poster	
Gaines, Mitchell	2010	SEDAAG Poster	
Gilliland, Joshua	2010	SEDAAG Poster	
Rogers, Nicholas	2010	SEDAAG Poster	
Cary, Melissa	2010	SEDAAG Poster	
Rodgers, Nicholas	2010	American Meteorological Society	
Thompson, J Kyle	2010	American Meteorological Society	
Arpin, Sarah	2010	Semester at Sea Onboard	
Rodgers, Nicholas	2010	Association of American Geog	
Epperson, Ann	2010	WKU Research Conference	First Place – Social Science
Miller, Benjamin	2010	WKU Research Conference	First Place - Graduate
Porter, Brandon	2010	WKU Research Conference	
Brunt, Matt	2009	SEDAAG	
Thompson, J Kyle	2009	SEDAAG	
Brunt, Matt	2009	WKU Research Conference	
Lynch, Erin	2009	International Speleology Congrs	
Miller, Benjamin	2009	International Speleology Congrs.	
Nolfi, Dan	2009	International Speleology Congrs.	
Kramer, Samantha	2009	WKU Research Conference	Second Place - Graduate
Miller, Benjamin	2009	WKU Research Conference	First Place - Grad Poster
Tracy, Mark	2009	WKU Research Conference	
Kramer, Samantha	2009	Posters at the Capitol	
Ham, Brian	2009	Posters at the Capitol	
Ham, Brian	2008	Int. Karstological in Slovenia	
Schenck-Brown, J	*2008*	Int. Karstological in Slovenia	
Tracy, Mark	2008	Int. Karstological in Slovenia	
Kramer,Samantha	2008	WKU Research Conference	Honorable Mention Posters
Rinehart, Nathan	2008	Regional GSA Evansville	
Kramer, Samantha	2008	Regional GSA Evansville	
Ham, Brian	2008	Regional GSA Evansville	
Schenck-Brown, J	2008	WKU Research Conference	
Kramer, Samantha	2008	WKU Research Conference	
Brunt, Matt	2008	WKU Research Conference	
Bergman, Crystal	2008	Association Amer. Geographers	
Bourette, Cari	2008	Association Amer. Geographers	
Leeper, Ronnie	2008	Association Amer. Geographers	
Leeper, Ronnie	2007	SEDAAG	
Walker, John	2007	Kentucky Academy of Science	First Place – geography
Leeper, Ronnie	2007	Kentucky Academy of Science	Second Place – geography
Bergman, Crystal	2007	Kentucky Academy of Science	Third Place – geography
Kovarik, Johanna	2007	Int. Karst Hydrogeology Ecosys	
Hendrikson, Mel	2007	Int. Karst Hydrogeology Ecosys	

Ham, Brian	2007	Int. Karst Hydrogeology Ecosys	
Chaney, James	2007	Association Amer. Geographers	
Leeper, Ronnie	2007	Association Amer. Geographers	
Littell, Ashley	2007	Association Amer. Geographers	
Littell, Ashley	2007	WKU Research Conference	First Place - Graduate
Herrera, Juan	2007	WKU Research Conference	
Walker, John	2007	WKU Research Conference	
Leeper, Ronnie	2006	SEDAAG	
Littell, Ashley	2006	SEDAAG	First Place – Grad Honors
Walker, John	2006	Kentucky Academy of Science	
Littell, Ashley	2006	Kentucky Academy of Science	
Leeper, Ronnie	2006	Kentucky Academy of Science	
Herrera, Juan	2006	GSA 118th Philadelphia	
Sharp, Scotty	2006	WKU Research Conference	First Place – Geoscience
Chaney, James	2006	WKU Research Conference	Second Place – geoscience
Kovarik, Johanna	2006	WKU Research Conference	Third Place - geoscience
Broome, John	2006	WKU Research Conference	
Croskrey, Andrea	2006	WKU Research Conference	
Hatcher, Bruce	2006	WKU Research Conference	
Hendrickson, Mel	2006	WKU Research Conference	
Baldwin, Mark	2006	WKU Research Conference	
Littell, Ashley	2006	WKU Research Conference	
Pricope, Narcisa	2006	WKU Research Conference	
Rehkopf, Sarah	2006	WKU Research Conference	
Pricope, Narcisa	2006	Association Amer. Geographers	
Rehkopf, Sarah	2006	Association Amer. Geographers	
Baldwin, Mark	2006	Association Amer. Geographers	
Bourette, Cari	2006	Association Amer. Geographers	
Reader, Daniel	2006	Association Amer. Geographers	
Chaney, James	2006	Association Amer. Geographers	
Littell, Ashley	2006	Association Amer. Geographers	
Kambesis, Pat	2005	NCKM Symposium Albany, NY	
Kovarik, Johanna	2005	NCKM Symposium Albany, NY	
Hendrickson, Mel	2005	NCKM Symposium Albany, NY	
Littell, Ashley	2005	Midwest Extreme Weather	First Place - Poster
Simpson, Shawn	2005	Kentucky GIS Conference	
Pricope, Narcisa	2005	Kentucky GIS Conference	
Jeng, Shwu-jing	2005	Kentucky GIS Conference	
Islas, Joe	2005	Kentucky GIS Conference	
Tope, Shweta	2005	Kentucky GIS Conference	
Dalton, Sara	2005	Kentucky GIS Conference	
Cesin, Gina	2005	Int Congress Speleology Greece	
Sakofsky, Brian	2005	Int Congress Speleology Greece	
Kambesis, Pat	2005	Int Congress Speleology Greece	
Tobin, Ben	2005	Int Congress Speleology Greece	

Table VI-B-3b-1: Independent Graduate Projects (excluding thesis work)

Student	Project	Supervisor	Term
Aryee, Frank	Internet GIS	Cary (577)	F 2009
Baker, Ted	Applied Hydrogeology	Groves (510)	F 2007
Benneyworth, Laura	Distributed GIS Services	Cary (590)	S 2005
Bergman, Crystal	Arc IMS and Internet GIS	Foster (577)	S 2008
Bergman, Crystal	Drought Impact Assessment	Foster (510)	F 2007
Bergman, Crystal	Drought Vulnerability Analysis	Foster (510)	S 2007
Blaylock, Ian	Meteorology Blog	Goodrich (510)	F 2010
Blinn, Christopher	Geodatabases	Yan (517)	F 2010
Broome, John	Experimental Design in GIS	Cary (590)	S 2004
Brunt, Matthew	Internet GIS	Cary (577)	F 2008
Brunt, Matthew	Arc IMS and Internet GIS	Cary (577)	S 2008
Brunt, Matthew	Demographic Analysis GIS	Algeo (510)	S 2009
Cary, Melissa	Culture and Society	Gripshover (510	F 2010
Cary, Melissa	Regional Geography N.Am.	Bell (540)	F 2010
Cary, Nathan Jess	Resource Wars	Schlosser (510)	S 2008
Cary, Nathan Jess	Internet GIS	Yan (577)	F 2009
Cesin, Gina	Geoscience Developments	Crawford (501)	F 2005
Croskrey, Andrea	Statistics of Spring Chemistry	Groves (510)	F 2005
Ellis, Joshua	Ecotourism in Costa Rica	Deal (540)	S 2005
Epperson, Ann	GIS Database Management	Yan (517)	S 2008
Epperson, Ann	Internet GIS	Yan (577)	F 2007
Gaines, Mitchell	Meteorology weather blog	Goodrich (510)	F 2009
Gandy, Kay	Geography Teachers Capstone	Keeling (510)	F 2010
Gandy, Kay	Historical Geography	Algeo (540)	S 2008
Greene, Erin	Geodatabases	Yan (517)	F 2010
Grogan, Mike	GIS for Meteorology/Mesonet	Foster (577)	S 2009
Grogan, Mike	Interactive GIS Development	Foster (590)	F 2009
Hall, Jonathan	Experimental GIS Design	Foster (590)	Sm 2006
Hall, Jonathan	GIS and Crime Analysis	Yan (510)	S 2009
Ham, Brian	Connectivity and Dyetracing	Groves (510)	F 2007
Harrison, Sarah	Vegetation Change in Africa	All (543)	S 2009
Henderson, Jake	Analyzing Soil Characteristics	Wulff (510)	F 2008
Henry, Christina	Flash Flooding	Mahmood (510)	S 2005
Herrera-Escobar, J	Green River Sediments	Kenworthy (510	F 2005
Hetzler, Rachel	Spatial Databases	Yan (517)	F 2009
Hoette, Adam	Environmental Geoscience	Polk (506)	S 2010
Hollon, Chrissie	Field methods Green River	May (502)	F 2009
Hutchison, Sean	Environmental Science Concpt	Kuehn (543)	F 2009
Jeng, Shwu-Jing	Experimental Design in GIS	Cary (590)	S 2005
Kambesis, Patricia	Stormwater management	All (510)	S 2004
Kennedy, Barry	Resource Wars	Schlosser (510)	S 2008
Kennedy, Barry	Tourism Geography	Algeo (510)	S 2007
Kovarik, Johanna	Karst Hydrogeochemistry	Groves (501)	S 2005
Kramer, Samantha	Advanced Rietveld Method	Celestian (510)	F 2009
Kramer, Samantha	The Rietveld Method	Celestian (510)	S 2009
Lawhon, Nicholas	Water Resource Investigations	Florea (510)	F 2010
Lee, Ju-Yu	Experimental Design	Cary (590)	F 2005
Leeper, Ronnie	Experimental Design	Cary (590)	S 2008
Leeper, Ronnie	Atmospheric Modeling & GIS	Yan (577)	S 2008
Leeper, Ronnie	Land Use Cover Change	Mahmood (510)	F 2007

Legates, Sarah	Experimental Design in GIS	Cary (590)	F 2006
Lynch, Erin	Advanced Geostatistics	Yan (520)	F 2008
Lynch, Erin	Geochemistry of Tiankengs	Groves (475G)	S 2008
Lynch, Erin	Nahm Sinkhole Modeling	Campbell (510)	F 2007
Marklin, Susan	Environmental Policy in the US	Keeling (510)	F 2009
McKaughan, Andy	Equivalent Diurnal Temperatur	Mahmood (510)	F 2010
McKaughan, Andy	Climate Data Analysis	Mahmood (510)	S 2010
Minnich, Andrew	Rain-Gauge Networks	Mahmood (510)	S 2007
Nahar, Mehul	Internet GIS	Cary (577)	S 2009
Nolfi, Daniel	Federal Cave Resource Mgmnt	Groves (510)	S 2008
Oris, W. Nathan	Geodatabases	Yan (517)	F 2010
Peng, Hsuan-Jung	Hot Spot Crime detection	Yan (510)	Sm 2006
Phillips, Jessica	Flash Flooding	Mahmood (510)	S 2005
Prater, Chris	Experimental Design in GIS	Cary (590)	F 2005
Quarles, Ramsey	Distributed GIS services	Cary (577)	S 2008
Reader, Daniel	Globalization in Chile	Keeling (510)	Sm 2006
Reader, Daniel	Teaching Globalization	Keeling (501)	Sm 2006
Rehkopf, Sara	Geoscience Developments	Kenworthy (501	F 2005
Rodgers, William	Modeling Fluxes	Mahmood (510)	F 2008
Rodgers, William	Internet GIS	Cary (577)	F 2009
Ross, Allison	Distributed internet GIS	Cary (577)	S 2008
Russell, Scot	Quaternary Stratig. Bahamas	Florea (510)	W 2009
Sakofsky, Brian	Karst Hydrogeology	Crawford (473G	F 2005
Schoefernacker, S	Stratigraphy of Carboniferous	May (510)	F 2004
Scott, Larry	Air Pollution Meteorology	Durkee (510)	S 2009
Shields, Melissa	Geology Huckleberry Knob	Kuehn (475G)	F 2007
Simpson, Shawn	Arcweb Server analysis	Cary (510)	S 2006
Simpson, Shawn	ArcGIS Server integration	Yan (577)	S 2006
Smith, Dalene	Isotope Geochemistry	Polk (510)	F 2010
Smith, Petrina	Tennessee Tornado Climate	Goodrich (510)	S 2008
Taylor, Daniel	Experimental GIS Design	Cary (590)	S 2004
Thompson, Kyle	Microclimatology	Mahmood (510)	S 2010
Tobin, Benjamin	Central Kentucky Cave Survey	All (510)	S 2004
Tope, Shweta	ArcIMS GIS Designer	Cary (590)	S 2005
Tracy, Mark	Geophysical Karst Methods	Groves (510)	F 2008
Vanderhoff, Sean	Isotope Geochemistry	Polk (510)	F 2010
Vanderhoff, Sean	Env. Field Techniques	Polk (501)	F 2010
Walker, John	Internet GIS	Cary (577)	F 2007
Walker, John	Kentucky Climate Changes	All (515)	S 2007
Williams, Heather	Climate Change in Kentucky	All (515)	S 2007
Zhang, Huajian	Internet GIS	Cary (577)	F 2010
Zhang, Huajian	Geodatabases	Yan (517)	F 2010

Table VI-B-3b-2: Graduate Internship Experiences

Student	Internship	Practicum	Term
Almudaris, Sami		Departmental Teaching	F 2010
Baldwin, William M.	National Weather Service		Sum 2005
Baldwin, William M.	Kentucky MesoNet		F 2006
Baldwin, William M.	Tennessee EMA		S 2007
Benneyworth, L	Nashville Met. Government		Sum 2004
Bergman, Crystal		Departmental Teaching	S 2007
Bhatt, Shailen P.	KY Transportation Cabinet		F 2007
Blinn, Christopher		Departmental Teaching	F 2010
Bourette, Cari	New Story Foundation		S 2007
Broome, John	Metro Planning Nashville		F 2004
Cary, Melissa		Departmental Teaching	S 2010
Cary, Nathan J.		Departmental Teaching	S 2008
Craft, Kortney		Departmental Teaching	S 2010
Earles, Jennifer	Oak Ridge Nat. Laboratory		F 2008
Gilliland, Joshua		Departmental Teaching	F 2010
Greunke, Erin		Departmental Teaching	S 2007
Harrison, Sarah	Barge Waggoner Nashville		Sum 2008
Hetzler, Rachel	City-County Planning BG		F 2010
Hetzler, Rachel		Departmental Teaching	S 2010
Hoette, Adam	KEEPS Louisville		F 2010
Jeng, Shwu-Jing		GIS Campus Digitizing	S 2004
Kendrick, Dasen	National Weather Service		Sum 2005
Leeper, Ronnie	Kentucky Mesonet		F 2006
Leeper, Ronnie		Departmental Teaching	S 2007
Minnich, Andrew	WBKO-TV weather		S 2006
Nahar, Mehul	NASA Development		F 2008
Porter, Brandon		Departmental Teaching	F 2009
Robb, Elizabeth	Downtown Redevelopment		F 2003
Rodgers, W. Nick	McCreary County 911		Sum 2009
Ross, Allison	US Army Corps Engineers		F 2008
Thompson, J. Kyle	City Bowling Green		S 2010
Thompson, J. Kyle		Departmental Teaching	F 2009
Vanderhoff, Sean		Departmental Teaching	S 2010
Williams, Heather	Downtown Redevelopment		F 2007

Table VI-B-3b-3: Graduate Theses Formally Approved, Fall 2005-Fall 2010

Student	Year	Thesis Project
Epperson, Ann	2010	*Internet GIS as a Historic Place-Making Tool for Mammoth Cave National Park* (Algeo)
Greunke, Erin	2010	*The Global Project: Observing Geographic Literacy Obtained By Study Abroad Learning* (Keeling)
Grogan, D. Michael	2010	*Information Technology Implementation Decisions to Support the Kentucky Mesonet* (Mahmood)
Hall, Jonathan	2010	*Geographic factors of residential burglary: A case study of Nashville, TN* (Yan)
Jeng, Shwu-Jing	2010	*Geographic Information System Analysis of Changing Demographic Patterns and Ethnic Restaurant Location in Bowling Green, Kentucky, 1940-2005* (Algeo)

Miller, Benjamin	2010	*The Hydrology of the Carroll Cave –Toronto Springs System* (Groves)
Otoo, James	2010	*Suspended Sediment Transport Dynamics and Sediment Yields in relation to Watershed Characteristics, Upper Green River Basin, KY* (May)
Porter, Brandon	2010	*An Application and Refinement of the Karst Disturbance Index Through Evaluating Variability in Island Karst Disturbance in Puerto Rico* (Polk)
Russell, Scot	2010	*Geophysical Investigation of Fresh Water Occurrence in the Line Hole Well Field, San Salvador Island, The Bahamas* (Florea)
Schmitz, Elizabeth	2010	*Farmers' Markets in Kentucky: A Geospatial, Statistical, and Cultural Analysis* (Algeo)
Bergman, Crystal	2009	*A Survey of Drought Impacts and Mitigation Planning in Kentucky* (Foster)
Bourette, Cari	2009	*Using Archetypal Metaphor to Analyze Cultural Landscape: A Chilean Case Study* (Keeling)
Brunt, S. Matt	2009	*Before the Park: Creating an Historic GIS of Mammoth Cave Area Communities, 1920* (Algeo)
Ham, Brian	2009	*Using Conservative and Biological Tracers to better understand the Transport of Agricultural Contaminants from Soil Water through the Epikarstic Zone* (Groves)
Leeper, Ronnie	2009	*Near-surface Atmospheric Response to Simulated Changes in Land-cover, Vegetation Fraction, and Soil Moisture over Western Kentucky* (Mahmood)
Meredith, Johnny A.	2009	*Vadose Zone Hydrology near the Vicinity of Edna's Dome, Mammoth Cave, Kentucky* (Groves)
Ross, Allison	2009	*Modeling Stormwater Pollutant Transport in a Karst Region - Bowling Green* (Yan)
Baker, Ted	2008	*Water Quality Impacts from Agricultural Land-Use in the Karst Groundwater Basin of Qingmuguan, Chongqing, China* (Groves)
Broome, John	2008	*Simulation Modeling of Karst Aquifer Conduit Evolution and Relations to Climate* (Groves)
Cesin, Gina	2008	*The Application of Electrical Resistivity and Microgravity to Locate Tunnels along the U.S.-Mexico Border at Calexico* (Wulff)
Rinehart, Nathan	2008	*Assessment of Natural Resource and Watershed Conditions at Little River Canyon National Preserve, Alabama* (Kuehn)
Schenk-Brown, Julie	2008	*Atrazine Contamination and Suspended Sediment Transport within the Logsdon River, Mammoth Cave, KY* (Kenworthy)
Baldwin, W. Mark	2007	*An Analysis of Key Aspects of Warm and Cool Season Flash Flooding in the Southern Appalachians* (Mahmood)
Chaney, James P.	2007	*The Rise of an Hispanic Enclave in Davidson County, Tennessee* (Algeo)
Hager, Caitlin	2007	*Commuting Analysis in a Small Metropolitan Area: A Case Study of Bowling Green/Warren County, Kentucky* (Yan)
Herrera-Escobar, J.	2007	*Late Quaternary Geomorphic History of the Upper Green River - Inferred from Alluvial Deposits* (Kenworthy)
Kambesis, Pat	2007	*A Systems Approach for Understanding Agricultural Contaminant Sources and Transport in a Karst Groundwater Basin*

		(Groves)
Kovarik, Johanna	2007	*Modeling the Effects of Timber Harvesting on Karst Watersheds in a Temperate Rainforest using Runoff Response Rates, Tongass National Forest, Alaska* (Groves)
Littell, Ashley	2007	*Modeling Soil Moisture using Precipitation from Rain Gauge Observations and Radar Estimations* (Mahmood)
Nemon, Amy	2007	*Overcoming Global Ignorance: Developing Geographic Literacy in a World Regional Geography Course* (Keeling)
Tobin, Benjamin	2007	*A Quantitative Analysis of Relationships between Land-Use and Base-Level Conduit Sedimentation in south-central KY* (Kenworthy)
Walker, John	2007	*Ground-Level Ozone Across Kentucky: Modeling and a Synoptic Analysis of High Concentrations* (Goodrich)
Croskrey, Andrea	2006	*Groundwater Sensitivity and Vulnerability Mapping in Kentucky using GIS* (Groves)
Dalton, Sara E.	2006	*Strategies for reducing mosquito-borne disease vulnerability in equine populations: A Kentucky case study* (Algeo)
Despain, Joel	2006	*Hydrochemistry in an Alpine Karst System, Sequoia and Kings Canyon National Parks, California* (Groves)
Hendrickson, M.	2006	*The Influence of Organic Acid on the Dissolution Rate of Limestone: Beaver Falls-Mop Spring, Tongass National Forest, Alaska* (Groves)
Henry, Christina	2006	*Flash Flooding in Eastern Kentucky: An Analysis of the 3-4 August, 2004, Event* (Mahmood)
Islas, Joseph	2006	*The Identification, Characterization, and Analysis of Wrench Faulting in southwestern Warren County, Kentucky* (Kuehn)
Pricope, Narcisa	2006	*Modeling Soil Erosion in the Upper Green River Basin, Kentucky* (Kenworthy)
Reader, Daniel R.	2006	*Sustainability with Globalization: An Unsustainable Proposition?* (All)
Schoefernacker, S.	2006	*Spatial Characteristics of Paleochannels in Association with the Mississippian-Pennsylvanian Systemic Boundary in Western and South-Central Kentucky* (May)
Sharp, Scotty	2006	*Assessment of Atrazine in a Rural Water Source: Rough River Lake, Kentucky* (Groves)
Kendrick, Dasen	2005	*The Relationship Between Meteorological Patterns and Rural Ground Ozone Concentration* (Mahmood)
Russ, James A.	2005	*Globalization, Urban Competitiveness, and Human Capital: Where does Davidson County, Tennessee, Fit into the Equation?* (Keeling)

Table VI-B-3b-4: Other Graduate Student Publications (current and alumni)

Student	Year	Other Graduate Publications
Epperson, Ann and Brunt, Matt with co-author	2011	Historical GIS as a Platform for Public Memory at Mammoth Cave National Park. Special issue on "Past Informing Place" in the *International Journal of Applied Geospatial Research (accepted, in press).*
Bourette, Cari	2010	Earthquake Anxiety May Point to Future Trouble. Op Ed

		published in the *Jackson Sun* (TN) on April 11, 2010, in the *Salida Mountain Mail* (CO) on April 12, 2010, in the *Chronicle* (Willimantic, CT) on April 13, in the *NWTN Today* (Union City (TN) on April 20, and in *Maui Weekly* on August 12.
Gandy, S. Kay	2010	Public lands in the Elementary Curriculum. *Stewardship of Public Lands: A Handbook for Educators* Washington, D.C.: American Association of State Colleges and Universities, pp. 151-160.
Gandy, S. Kay with co-author	2010	Origin Stories: Geography, Culture, and Belief. *Social Studies and the Young Learner* 22(4): 25-28.
Leeper, Ronnie and co-authors	2010	Impacts of land use land cover change on climate and future research priorities. *Bulletin of the American Meteorological Society* 91(1): 37-46.
Baker, Ted	2009	Water Quality Impacts from Agricultural Land Use in Karst Drainage Basins of SW Kentucky and SW China, pp. 103-116 in Webb, R.M.T., and Semmens, D.J. (eds.) *Planning for an Uncertain Future—Monitoring, Integration, and Adaptation*, US Geological Survey Scientific Investigations Report 2009–5049, pp. 103-116
Gandy, S. Kay with co-authors	2010	Writing a Successful Fulbright Group Projects Abroad Grant: Voices from a Journey to South Africa. *Journal of Geography* 108(4): 102-116.
Gandy, S. Kay with co-authors	2010	Whatever Happened to Social Studies in the Elementary Curriculum? *Southern Social Studies Journal* 35(1): 16-50.
Kambesis, Pat with co-authors	2009	Stormwater Remediation in a Karst Watershed: Bowling Green, KY. *Stormwater* 10(3): 1-3.
Leeper, Ronnie	2009	Near-surface Atmospheric Response to Simulated Changes in Land-cover, Vegetation Fraction, and Soil Moisture over Western Kentucky. *Publications in Climatology* LXII(2): 1-41 (Middletown, DE: Legates Consulting LLC).
Pricope, Narcisa	2009	Assessment of Spatial Patterns of Sediment Transport and Delivery for Soil and Water Conservation Programs. *Journal of Spatial Hydrology* 9(1): 21-46.
Croskrey, Andrea with co-author	2008	Groundwater sensitivity mapping in Kentucky using GIS and digitally vectorized geologic quadrangles. *Environmental Geology* 54(5): 913-920.
Iovanna, A.J. with co-authors	2008	Using Geoinformatics to Examine Residential Radon Vulnerability. *Southeastern Geographer* 48(1): 97-109.
Leeper, Ronnie with co-authors	2008	Increase in near surface atmospheric moisture content due to land use changes: Evidence from the observed dew point temperature data. *Monthly Weather Review* 13:1554-1561.
Nelson, Jenna Medlin with co-authors	2008	Remote Sensing Quantification of Wetland Habitat Change in South Carolina: Implications for Coastal Resource Policy. *The Geographical Bulletin* 49(2): 87-102.
Walker, John with student co-authors	2008	Development of a Kentucky Snowfall Impact Scale. FOCUS on Geography 50(4): 15-17.
Hager, Caitlin with co-author	2007	*Commuting Analysis in a Small Metropolitan Area: Bowling Green, KY*, pp. 86-95 in Harrington, L. and Harrington, J. (eds.) *Papers of the Applied Geography Conferences*, Vol. 30, 2007.
Despain, Joel with co-	2006	Hydrology and rock/water Interactions of an Alpine Karst

authors		System: Spring Creek, Mineral King, Sequoia National Park, California. *Proceedings of the 8th International Conference on Limestone Hydrogeology*, Neuchâtel, Switzerland. Vol. 1, N. Goldscheider et al. (eds.). Besançon, France: Presses universitaires de Franche-Comté.
Hendrickson, M. with co-authors	2006	A Template for Academic/NGO Partnership in the Evaluation of Cave and Karst Resources. *Proceedings of the 8th International Conference on Limestone Hydrogeology*, Neuchâtel, Switzerland. Vol. 1, N. Goldscheider et al. (eds.). Besançon, France: Presses universitaires de Franche-Comté.
Leeper, Ronnie with co-authors	2006	Impacts of irrigation on 20th century temperature in the northern Great Plains. *Global and Planetary Change* 54(1-2): 1-18.
Sharp, Scotty with co-authors	2006	Assessment of the Herbicide Atrazine within a Karst-Influenced Drinking Water Source: Rough River Lake, Kentucky, USA. *Proceedings of the 8th International Conference on Limestone Hydrogeology*, Neuchâtel, Switzerland. Vol. 1, N. Goldscheider et al. (eds.). Besançon, France: Presses universitaires de Franche-Comté.
Baldwin, W. Mark with co-authors	2005	*An assessment of key aspects of warm and cool season severe flash flooding in the Southern Appalachians*, pp. 1-12, Section 6C.3, in Proceedings of the 2005 Meeting of the American Meteorological Society, Washington, DC.
Henry, C. with co-authors	2005	*The Evolution of a Warm-Season Severe Eastern Kentucky Flash Flood*, pp. 1-11, Section 6C.2, in Proceedings of the 2005 Meeting of the American Meteorological Society, Washington, DC.
Kambesis, Pat	2005	"Collapsed Sinkhole at Dishman Lane, Kentucky," pp. 277-282 in T. Waltham, F. Bell, and M. Culshaw (eds.), *Sinkholes and Subsidence: Karst and Cavernous Rocks in Engineering and Contruction*. Chichester, UK: Springer.
Kambesis, Pat	2005	"Lechuguilla Cave, New Mexico," pp. 339-346 in D.C. Culver and W. B. White (eds.), *Encyclopedia of Caves*. London: Elsevier

Table VI-B-3c: Placement of Program Graduates

Student	Year	Employment Status
Greunke, Erin	2010	Coursework in M.A. Communications – WKU (Adjunct)
Grogan, D. Michael	2010	Lead Systems Engineer at the National Climatic Data Center.
Jeng, Shwu-Jing	2010	GIS Analyst, ESRI, Redlands, California
Otoo, James	2010	Ph.D. program in Env. Engineering, University of Missouri
Russell, Scot	2010	Planning to enroll in Geophysics Ph.D. at Penn State, Spring 11
Bergman, Crystal	2009	Ph.D. program in Climate Studies, University of Nebraska
Bourette, Cari	2009	New Story Foundation Director & WKU Adjunct instructor
Brunt, S. Matt	2009	Connected Nation, GIS Analyst, Bowling Green
Ham, Brian	2009	Environmental Consultant
Leeper, Ronnie	2009	Just gained research position at North Carolina State
Meredith, Johnny A.	2009	Mammoth Cave National Park interpreter, Kentucky

Ross, Allison	2009	GIS Analyst, U.S. Army Corps of Engineers, Nashville
Baker, Ted	2008	Hydrologic Technician, Bureau of Reclamation, California
Broome, John	2008	GIS Analyst, Nashville Metro Planning Department
Cesin, Gina	2008	Geospatial Analyst, National Geospatial Intelligence Agency
Rinehart, Nathan	2008	Ensafe, Nashville, TN. Environmental Analyst
Schenk-Brown, Julie	2008	Environmental Engineering, Chattanooga, TN
Baldwin, W. Mark	2007	Ph.D. program in Meteorology at Mississippi State University
Chaney, James P.	2007	Ph.D. program in Geography at Louisiana State University
Hager, Caitlin	2007	Instructor, Austin Peay State University, History & Philosophy
Herrera-Escobar, J.	2007	Ph.D. program, Environmental Engineering at Purdue University
Kambesis, Pat	2007	Ph.D. program in Geology at Mississippi State University
Kovarik, Johanna	2007	U.S. Forest Service, Tongas National Forest, Alaska
Littell, Ashley	2007	GIS Services Manager, Connected Nation, Bowling Green.
Nemon, Amy	2007	WKU Geography instructor for Glasgow and E-Town campuses
Tobin, Benjamin	2007	National Park Service scientist, Sequoia Kings Canyon, CA
Walker, John	2007	GIS Analyst, Connected Nation, Bowling Green, KY
Croskrey, Andrea	2006	National Park Service GIS scientist, Lakewood, Colorado
Dalton, Sara E.	2006	U.S. Census Bureau, Kansas City, KS
Despain, Joel	2006	National Park Service scientist, Sequoia Kings Canyon, CA
Hendrickson, Mel	2006	Ph.D. Program in Geography, University of Ontario
Henry, Christina	2006	Elementary Education teacher, Bowling Green
Islas, Joseph	2006	CEO American Southern Energy, KY; Adjunct instructor WKU
Pricope, Narcisa	2006	Assistant Geog Professor (ABD), Western Oregon University.
Reader, Daniel R.	2006	WKU Instructor in Environment and Sustainability
Schoefernacker, S.	2006	Ph.D. program in Hydrology at the University of Memphis
Sharp, Scotty	2006	Kentucky State Trooper
Kendrick, Dasen	2005	Analyst, URS Corporation, Houston, TX
Russ, James A.	2005	Geographer, US Army Environmental Command, San Antonio

Table VI-B-4-1: Student-Faculty Seminar Presentations

Presenter	Year	Presentation Title
Schmitz, Elizabeth	2010	*Farmers' Markets in Kentucky: A Geospatial, Statistical, and Cultural Analysis*
Gandy, Dr. Kay	2010	*Cultural Vignettes from Geoscience Research*
Porter, Brandon	2010	*An Application and Refinement of the Karst Disturbance Index Through Evaluating Variability in Island Karst Disturbance in Puerto Rico*
Miller, Ben	2010	*The Hydrology of the Carroll Cave –Toronto Springs System*
Epperson, Ann	2010	*Internet GIS as a Historic Place-Making Tool for Mammoth Cave National Park*
Hall, Jon	2010	*Geographic factors of residential burglary: A case study of Nashville*
Semester at Sea	2010	*Learning Outcomes of the Semester at Sea Summer Program*
Professor Chen		

Weihai, China	2010	*China's Tiankeng: The World's Largest Sinkholes*
Greunke, Erin	2010	*The GLOBAL Project: Observing Geographic Literacy Obtained by Study Abroad Learning*
Dr. Jason Polk	2010	*Clues from Karst: Implications Regarding Climate Change, Land Use, and Water Resources*
Russell, Scot	2010	*Geophysical Investigation of Fresh Water Occurrence in the Line Hole Well Field, San Salvador Island, The Bahamas*
Hollon, Chrissie	2010	*Altering Perspectives of Life and Water, A Student Study Tour of China's Yunnan Province Karst Region*
Bob Ward, MCNP	2010	*Science and Learning in Mammoth Cave National Park*
Brunt, Matt	2009	*Before the Park: Creating an Historic GIS of Mammoth Cave Area Communities*
Dave Cooper	2009	*Mountain Roadshow and coal-mining techniques*
Ham, Brian	2009	*Using Conservation and Biological Tracers to Better Understand the Transport of Agricultural Contaminants in the Epikarstic Zone*
Dr. Matt Nee	2009	*Snow and Marine Impacts on Tropospheric Conditions: Assessing the Reactions That Happen at Earth's Wet Sur*
Jeng, Shwu-Jing	2009	*Geographic Information System Analysis of Changing Demographic Patterns and Ethnic Restaurant Location in Bowling Green, Kentucky, 1940-2005*
Dr. Dorien McGee	2009	*How Mighty is the Microbe? Combining ?^13 C Surveys with Environmental Monitoring in Caves to Identify Microbial Sources of Dissolution*
Dr. Lee Florea	2009	*Nuclear Magnetic Resonance Imaging of Groundwater Flow within the Rock Matrix and within Centimeter-Scale Macroporosity of the Biscayne Aquifer of Southeast Florida*
Cary, Nathan Jess	2009	*Bosnians on the Diaspora: A Comparison and Contrast of Bosnian Refugees in Bowling Green, KY, and Dublin, Ireland*
Ross, Allison	2009	*Modeling Stormwater Pollutant Transport in a Karst Region - Bowling Green*
Christine McCoy	2009	*Waste Not, Want Not: Managing Solid Waste to Mitigate Global Warming.*
Scott Dobler	2009	*Georeferencing Civil Air Patrol Photographs of the January 2009 Ice Storm: The Odyssey of a Spatial Sergeant* and *Teaching Geography is Fundamental: Federal Legislation (HR 1240).*
Pat Kambesis and Ben Miller	2009	*Research Reconnaisance in Haiti: Karst, Culture, and Cooperation.*
Otoo, James N.	2009	*Suspended Sediment Transport Dynamics and Sediment Yields in relation to Watershed Characteristics, Upper Green River Basin, KY*
Baker, Ted	2009	*Water Quality Impacts from Agricultural Land-Use in the Karst Groundwater Basin of Qingmuguan, Chongqing, China*
Bourette, Cary	2009	*Tasting Chile: Using Archetypal Metaphor to Map Cultural Landscape by Sampling Restaurants in Five Chilean Cities*
Schenck-Brown, J.	2009	*Atrazine Contamination and Suspended Sediment Transport within Logsdon River, Mammoth Cave, Kentucky*
Dr. Lee Florea	2009	*Visualization of Groundwater Flow Within Touching-Vug and Matrix Porosity in an Eogenetic Karst Aquifer*
Geology students	2009	*Summer Rocks: What I did on my summer vacation*

Cesin, Gina	2008	*Application of Electrical Resistivity and Microgravity to Locate Tunnels Aloing the U.S. - Mexico Border at Calexico*
Chuck Decroix MCNP	2008	*Max Kamper and the Mammoth Cave Connection*
Alejandro Emperador	2008	*Speleological Research in Cuba (Cuban Speleological Society)*
Rinehart, Nathan	2008	*Assessment of Natural Resource and Watershed Conditions at Little River Canyon National Preserve, Alabama*
Dr. Nico Goldschnedr	2008	*Origin, Transport, and Monitoring of Microbial Contamination of Karst Aquifers*
Dr. Lee Florea	2008	*Studies in Eogenetic Karst*
Dr. Marvin Russell	2008	*Tornadoes in Kentucky with reference to Agricultural Communities*
Otoo, James N.	2008	*Groundwater Development in Africa*
Dr. Kolson Schlosser	2008	*Environmental Security: Looking Back, Glancing Ahead*
Dr. Michael Trapasso	2007	*The Indian Ocean Tsunami Revisited*
Dr. JAK Njoku Dr. Chris Groves	2007	*Following the Slave Trade Underground: Exploring Nigeria's Ancient Cave Temple Complex of Arochukwu*
Walker, John	2007	*Ground-Level Ozone Across Kentucky: Modeling and a Synoptic Analysis of High Concentrations*
Dr. Aaron Celestian	2007	*Radioactive Waste Separation and Discovering Ion Exchange Mechanisms*
Dr. David Keeling	2007	*Mega-Geography: Connecting People and Places*
Geology Students	2007	*Summer Rocks! What I Did on my Summer "Vacation*
Escobar, Juan H.	2007	*Late Quaternary Geomorphic History of the Upper Green River - Inferred from Alluvial Deposits*
Baldwin, W. Mark	2007	*An Analysis of Key Aspects of Warm and Cool Season Flash Flooding in the Southern Appalachians*
Littell, Ashley	2007	*Spatio-Temporal Analysis of Observed Soil Moisture Data from Nebraska*
Kovarik, Johanna	2007	*Storm Response and Water Balance of Two Temperate Rainforest Karst Environments*
Hager, Caitlin	2007	*Excess Commuting in a Small Metropolitan Area: Bowling Green, Kentucky*
Chaney, James	2007	*The Rise of an Hispanic Enclave in Davidson County*
Dr. Chris Groves	2007	*Karst Water Resource Challenges in Southwest China*
Scott Dobler	2007	*Geoscience Education in Kentucky*
Henry, Christina	2006	*Flash Flooding in Eastern Kentucky: An Analysis of the 3-4 August, 2004, Event*
Meredith, Johnny	2006	*Vadose Zone Hydrology in the Vicinity of Edna's Dome, Mammoth Cave, Kentucky*
Hendrickson, Mel	2006	*The Influence of Organic Acid on the Dissolution Rate of Limestone: Northern Prince of Wales Island, Alaska*
Dr. Michael Trapasso	2006	*Easter Island: Not So Mysterious*
Dr. Alexander Klimchouk	2006	*From Deep Seated Karst and Long Caves to High Mountain Karst and Deep Caves*
Broome, John	2006	*Computer Modeling of Karst Evolution*
Sharp, Scotty	2006	*Assessment of the Herbicide Atrazine within a Rural Drinking Water Source: Rough River Lake, Kentucky*
Dalton, Sarah	2006	*Strategies for reducing mosquito-borne disease vulnerability in equine populations: A Kentucky case study*

Dr. Elena Bartosova	2006	*Modeling the Fox River Watershed.*
Pricope, Narcisa	2006	*Modeling Soil Erosion in the Upper Green River*
Reader, Daniel	2006	*Sustainability with Globalization: An Unsustainable Proposition?*
Glen Conner, KCC	2006	*156 Years of Weather Observations in Bowling Green*
Dr. John All	2006	*Land Use and Climate Variability in Chile*
Dr. Stuart Foster and Dr. Rezaul Mahmood	2006	*The Mesonet Project and its National Consequences*
Kendrick, Dasen	2005	*The Relationship Between Meteorological Patterns and Rural Ground Ozone Concentration*
Despain, Joel	2005	*Hydrochemistry in an Alpine Karst System: Sequoia and Kings Canyon National Parks, California*
Croskrey, Andrea	2005	*Groundwater Sensitivity and Vulnerability Mapping in Kentucky using GIS*
Tobin, Ben	2005	*Land Use and Cave Sedimentation in South-Central Kentucky*
Dr. Elerly Hamilton-Smith	2005	*Thinking about Karst and World Heritage*
Dr. Chris Groves	2005	*Quantitative Evaluation of Agricultural Land-Use and Karst Groundwater Reso*
Dr. John Marquart	2005	*Caves: Worlds within the World. An Introduction to the Chemistry, Geology, and Ecology of Caves*
Dr. Angel Fernandez	2005	*Protecting the Giant Geode in Spain*
Schoefernacker, Scott	2005	*Spatial Characteristics of the Mississippian-Pennsylvanian Systemic Boundary in South-Central Kentucky with Special Reference to Paleochannels*
Islas, Joe	2005	*The Identification, Characterization, and Analysis of Wrench Faulting in southwestern Warren County, Kentucky*
Dr. Carol Wicks	2005	*Flow and Solute Transport through the Salem and Springfield Plateaus of Missouri*
Russ, James	2005	*Globalization, Urban Competitiveness, and Human Capital: Where does Davidson County, Tennessee, Fit into the Equation?*
Tim Slattery, BGMU	2005	*Keep it Clean, Bowling Green*
Chuck DeCroix MCNP	2005	*Mapping the Longest Cave: A History of Exploration*
Dr. Michael Trapasso	2004	*Following the Vikings to North America*
Chris Smallcomb NWS	2004	*Significant Weather Events of 2004*
Dr. Jerry Daday	2004	*The Spatial Distribution of Crime*
Dr. Alan D. Howard	2004	*Geomorphic Evidence of Martian Water*
Taylor, Daniel	2004	*Evaluating Spatial Variability of Precipitation in Kentucky with Exploratory Data Analysis*

Table VI-B-4-2: Graduate Student Teaching Assignments

Student	Supervisor	Course Taught
Dalton, Sara	Dr. Katie Algeo	GEOG 110 (2) S05
Baldwin, Mark	Dr. Rezaul Mahmood	GEOG 121 F05
Chaney, James	Dr. David Keeling	GEOG 110 F05
Pricope, Narcisa	Dr. Chris Groves	GEOG 100 F05
Rehkopf, Sarah	Dr. Steven Kenworthy	GEOG 110 F05
Sakofsky, Brian	Dr. Nick Crawford	GEOG 100 F05

Sharp, Scotty	Dr. Steve Kenworthy	GEOG 280 F05
Simpson, Shawn	Dr. Katie Algeo	GEOG 317 F05
Baldwin, Mark	Dr. Rezaul Mahmood	GEOG 121 S06
Chaney, James	Dr. David Keeling	GEOG 110 S06
Pricope, Narcisa	Dr. Chris Groves	GEOG 100 S06
Reader, Daniel	Dr. John All	GEOG 110 S06
Sharp, Scotty	Dr. Steve Kenworthy	GEOG 280 S06
Simpson, Shawn	Dr. Katie Algeo	GEOG 317 S06
Littell, Ashley	Dr. Rezaul Mahmood	GEOG 121 F06
Hendrickson, Melissa	Dr. Chris Groves	GEOG 100 F06
Simpson, Shawn	Dr. Katie Algeo	GEOG 217 F06
Littell, Ashley	Dr. Rezaul Mahmood	GEOG 121 S07
Chaney, James	Dr. David Keeling	GEOG 110 (3) S07
Bergman, Crystal	Dr. Rezaul Mahmood	GEOG 121 F07
Bergman, Crystal	Dr. Rezaul Mahmood	GEOG 121 S08
Cary, Nathan Jess	Dr. David Keeling	GEOG 110 (2) F08
Kramer, Samantha	Dr. Aaron Celestian	GEOL 113 F08
Cary, Nathan Jess	Dr. David Keeling	GEOG 110 (3) S09
Kramer, Samantha	Dr. Aaron Celestian	GEOL 113 S09
Russell, Scot	Dr. Lee Florea	GEOL 113 S09
Cary, Nathan Jess	Dr. David Keeling	GEOG 110 (3) F09
Cary, Nathan Jess	Dr. David Keeling	GEOG 110 (3) S10
Thompson, J. Kyle	Dr. Stuart Foster	GEOG 121 S10
Porter, Brandon	Dr. Jason Polk	GEOG 100 S10
Cary, Melissa	Dr. Peggy Gripshover	GEOG 110 F10
Craft, Kortney	Dr. Gregory Goodrich	GEOG 121 F10
Hetzler, Rachel	Dr. Peggy Gripshover	GEOG 110 F10
Thompson, J. Kyle	Dr. Stuart Foster	GEOG 121 F10
Vanderhoff, Sean	Dr. Jason Polk	GEOG 100 F10
Almudaris, Sami	Dr. Peggy Gripshover	GEOG 110 S11
Blinn, Chris	Dr. Jason Polk	GEOG 100 S11
Cary, Melissa	Dr. Peggy Gripshover	GEOG 110 S11
Gilliland, Josh	Dr. L. Michael Trapasso	GEOG 121 S11
Vanderhoff, Sean	Dr. Jason Polk	GEOG 100 S11

Table VI-C-4: Publication Outlets for Faculty Research

Faculty Member	Academic Publications	Other Publications
Algeo, Katie, Ph.D.	Geographical Perspectives (chapter) Int. Journal Applied Geospatial Research Journal of Geography Material Culture Proceedings of Max Kamper Rural Change & Sustainability (chapter) Southeastern Geographer Southern Cultures	Walking Tour Guide Scottsville
All, John, Ph.D., J.D.	Botanica Orientalis Current Issues in Stormwater (chapter) Encyclopedia of Geography (chapter)	American Alpine News (2) National Speleological Soc. News

	Environmental Informatics Environmental Management (2) Journal of Natural Resources and Law Mountain Views Natural Resources Forum Proceedings Speleology Conference Stormwater Southeastern Geographer The Geographical Bulletin	
Cary, Kevin, M.S., GISP	Kentucky Recreation and Park Society	
Celestian, Aaron, Ph.D. (Since Fall 2007)	Chemistry of Materials Handbook of Crystal Growth (chapter) Inorganic Chemistry Journal of Materials Chemistry Journal American Chemical Society (2)	Synchrotron Radiation News
Durkee, Joshua, Ph.D. (since Fall 2008)	Geography Compass Encyclopedia of Geography (2 chapters) International Journal of Climatology Journal of Climate Theoretical and Applied Climatology	
Florea, Lee, Ph.D. (Since Fall 2008)	Cave and Karsts of America (4 chapters) Ground Water Isotopes in Environment and Health	
Foster, Stuart, Ph.D.	Focus on Geography Global and Planetary Change Historical Climate Variability (chapter) International Journal of Climatology Journal of Geophysical Research (3 artcls) Monthly Weather Review	
Goodrich, Greg, Ph.D. (Since Fall 2005)	Climatic Change Climate Research (3 articles) Focus on Geography Geography Compass International Journal of Climatology Journal of Applied Meteorology Monthly Weather Review Proceedings of 2nd Fire Behavior Conf. The Professional Geographer Weather and Forecasting	
Gripshover, Peggy, Ph.D. (Since Fall 2009)	Focus on Geography (Editor)	
Groves, Chris, Ph.D.	British Cave Research Assc. (chapter) China Environment Series (chapter) Environmental Earth Sciences Environmental Geology Geomorphology Journal of Contaminant Hydrology Journal of Environmental Quality Journal of Hydrology Methods Karst Hydrogeology (2 chapters) Planning for an Uncertain Future (Chapter) Proceedings, Limestone Hydrogeology (4) U.S. Geological Scientific Inves. (chapter)	Circle of Blue Water News Field Guides NSS News

Keeling, David, Ph.D.	Cities and Urban Geography (chapter) Encyclopaedia Britannica (entries) Focus on Geography (5 articles) Geographical Review Microsoft Encarta Encyclopaedia Journal of Latin American Geography (3) Progress in Human Geographer (3 articles)	Ashley County Ledger Bakersfield Californian (2) Bowling Green Daily News Bucks County Courier-Times Calhoun Times Chicago Sun-Times Circumpolar Musings Cleburne News Daily Press, Newport News Deer Park Tribune Durham Herald-Sun (3) Foire d'Opinions Haitiennes Free Lance-Star Hawaii Reporter (6) Henderson Gleaner Joplin Independent (2) Manhattan Mercury News Mexico Online Northwest Arkansas Times Pravda, Moscow (2) San Francisco Chronicle San Juan Islander South Florida Sun Sentinel Spectrum, Utah Star-Telegram, Ft. Worth Ubique (AGS) (2) Washington Times
Kuehn, Ken, Ph.D.	International Journal of Coal Geology World Oil Magazine	Exploring Teaching Scholarship Multiple Field Guides The Department Chair The KY Geologist Newsletter (2)
Mahmood, Rezaul, Ph.D.	Agricultural and Forest Meteorology Applied Engineering in Agriculture Atmospheric Environment Boundary-Layer Meteorology Bulletin of the Am. Meteorological Soc. Corn and Climate Report (chapter) Earth Interactions (Editor) EOS – Transactions of the AGU Focus on Geography Global and Planetary Change (2 articles) Historical Climate Variability (chapter) Hydrological Processes International Journal of Climatology Journal of Applied Meteorology Journal of Environmental Quality Journal of Geophysical Research (3) Journal of Hydrologic Engineering Land-Use Policy Monthly Weather Review Physical Geography Publications in Climatology Theoretical and Applied Climatology Transactions of the ASABE Water, Air, and Soil Pollution	

May, Mike, Ph.D.	Palaeontographica Americana World Oil Magazine	Multiple Field Guides
Polk, Jason, Ph.D. (Since Fall 2009)	Journal of Cave and Karst Studies	
Siewers, Fred, Ph.D.	Proceedings of 14th Symposium (ed. + art.) Quaternary International	
Wulff, Andrew, Ph.D.	Southeastern Geographer	Academic Leader
Yan, Jun, Ph.D.	Atmospheric Environment Computers, Environments, and Urban Sys Environment and Planning B Environmental Earth Sciences Papers Applied Geography Conf. (2 chpts) Proceedings World Transport Research Self-Organizing Maps (chapter) Water, Air, and Soil Pollution	