**Contact: Diana Gonzalez**

## BACHELOR OF SCIENCE PROGRAM IN GEOGRAPHIC INFORMATION SCIENCE NEW PROGRAM REVIEW REPORT

**Action Requested:** Consider receiving the new program review report for the Bachelor of Science Program in Geographic Information Science at the University of Northern Iowa in the Department of Geography in the College of Social and Behavioral Sciences.

**Executive Summary:** In 2010, a new program was approved to create high levels of applied knowledge and competency in the technologies, methods, applications, and theory of geographic information science. The purpose of this new program review is to present evidence that the program is addressing the goals, objectives, projected student data, and resources identified in the 2010 program proposal. This program review addresses the Board of Regents Strategic Plan priorities to "provide educational excellence and impact as well as economic development and vitality" and Goal #8 – "Iowa's public universities and special schools shall be increasingly efficient and productive."

**Background:**

- Description of program. The Geographic Information Science (GISc) program is designed to give students in-depth knowledge and advanced training in applied skills required for the geospatial technology industry. GISc is comprised of four interrelated technologies, including geographic information systems; remote sensing; global positioning systems; and cartography. The program provides advanced training in the four areas and is among the most comprehensive in the nation. GISc is a high-tech, in-demand field that is used to monitor, question, analyze, understand, and predict the world. These powerful tools can be used to understand and predict human activities and natural processes in virtually any field including environmental analysis, business analytics, rural and urban planning, security and intelligence, sustainability, transportation, and everywhere else.

- Need identified for program. The 2010 program proposal indicated that there was significant interest in the Bachelor of Arts Program in Geography with an emphasis in GISc. Total revenues of geospatial technology sales, service, and spending grew by 500% between 2000 and 2006. Employment sectors that now depend at least partially on GISc continue to expand, including fields as diverse as civil engineering, public health, environmental science, urban and regional planning, and the geosciences. The U.S. Department of Labor lists Geospatial Technology as one of the top three "emerging industries" for the 21st century and invested $6.4 million to address workforce needs.[1]

- Program review. During the 2014-15 academic year, the Department of Geography underwent an Academic Program Review. This Program Plan is the departmental response for the B.A. and B.S. programs to the recommendations and discussions that evolved from the internal self-study report and the External Review report. The recommendations are included in Attachment A together with the institution's responses. The proposed actions for each of the recommendations represent the goals that the Department will work toward during the next few years.

[1] DOL, 2007, www.careervoyages.gov/spatialtechnology-mail.cfm.

The curriculum has undergone a complete change since the last program review and no program that was reviewed last time still exists. Prior to program closures in 2012, the department was growing and had established what seemed to be a successful curriculum. The external reviewers recognized those challenges and commended the way in which we have worked to recover.

- Changes in goals and objectives from program proposal. None.

- Projected and actual headcount enrollment for past five years. Enrollments have increased since the start of the program to an average in the low 20s. The growth was expected and is the result of active recruitment into the program. GISc is still a relatively unknown field despite the strong career opportunities; the department has worked to increase student awareness. The goal is to continue the steady growth.

| Fall 2011 | | Fall 2012 | | Fall 2013 | | Fall 2014 | | Fall 2015 | |
|---|---|---|---|---|---|---|---|---|---|
| **P** | **A** | **P** | **A** | **P** | **A** | **P** | **A** | **P** | **A** |
| 15 | 12 | 20 | 18 | 25 | 24 | 30 | 21 | 30 | 20 |

The enrollment has not met the projection described in the proposal of 15 students in Year 1, increasing to 40 students per year by Year 7. There appear to be three reasons for the slower than expected growth, none of which is related to job markets as evidenced by the placement rate of graduates:

- It is related to general awareness of the field as a career option. The GISc industry is not currently represented in STEM program in high schools and students are unaware of the opportunities. To remedy this, the department has recently worked on two ways to increase student exposure to the field.
  - The department has been working with a National Geographic program to expose high school students to GISc. The department has developed curriculum and hosted several workshops for Iowa high school teachers to train them how GIS can be incorporated into STEM and the social science curriculum.
  - The department has developed promotional materials in collaboration with the Geographic Alliance of Iowa and distributed them to high school counselors to provide an information resource not previously available.
- The second impediment has been the recent closure of GIS programs at some Iowa community colleges which affected the number of transfer students. It is likely that the closures are related to the challenge of finding instructors in a highly competitive job market. Until recently, community colleges have been an important resource for students to discover the GISc industry which is now going unfilled. This is particularly concerning because the Department of Labor and, more recently, the National Science Foundation, has provided financial support for the expansion of GISc in community colleges because at the national level there are an insufficient number of four-year programs to fill market needs.[2]

[2] http://www.doleta.gov/BRG/pdf/Geospatial_Advanced%20Skills%20Center.pdf
http://tncc.edu/neews/nsf-grant-helps-community-colleges-train-geospatial-technicians-employment-high-growth-industry

⇨ The third reason enrollments may be lower than anticipated is the imbalance between under-class and upper-class students; 80% of the students are at the junior or senior level. The department anticipated that students would start the major as freshmen and they would be counted in the enrollment for four years. In fact, for a variety of reasons, students are not declaring the major until their junior, or even senior year. This has a significant impact on the semester-to-semester enrollment counts. Although this does not change the overall throughput of the program, it does produce an artificially low snapshot view of enrollments.

◈ Total number of credit hours delivered during the past five years.

| Fall 2011 | Fall 2012 | Fall 2013 | Fall 2014 | Fall 2015 |
|---|---|---|---|---|
| 403 | 531 | 400 | 353 | 397 |

◈ Number of graduates during the past five years. Graduation trends have been steadily increasing as enrollments have grown and students have matriculated through the program. The growth represents more than 20% change. This is expected and should continue to increase as the program matures.

| Fall 2011 | Fall 2012 | Fall 2013 | Fall 2014 | Fall 2015 |
|---|---|---|---|---|
| 3 | 2 | 6 | 6 | 11 |

◈ Number of graduates employed in field.

| AY 2011 | AY 2012 | AY 2013 | AY 2014 | AY 2015 |
|---|---|---|---|---|
| | | 100% | 100% | 100% |

Graduates find employment within the GIS field that they studied. Some of the employers that have hired graduates include SenseFly UACV; Deere & Co.; ESRI; Apple; Aerial Services, Inc.; SRA International; Iowa Department of Natural Resources; Garmin International; Sanborn; National Geographic; Des Moines County; Polk County; City of Grinnell; and Iowa Regional Council of Governments.

Several students have also continued to graduate programs at the University of California, Santa Barbara; Penn State University; Louisiana State University; University of Tennessee; University of Colorado, Colorado Springs; and the University of Northern Iowa.

◈ Program strengths. This program is the only such program in the state. It consists of a comprehensive and in-depth series of courses covering the full range of GISc fields, including GIS, remote sensing, GPS, cartography, and programming. The major is applied, career-focused, and provides students with a strong range of practical skills and theoretical knowledge. All students are required to conduct a research project and internships are strongly encouraged. The applied and integrated nature of the program provides strong career opportunities for graduates and is a major strength of the curriculum. During the 2015 external program review, the program was compliment for staying on the cutting edge of the discipline with the recent addition of new courses in Web Mapping, GIS Programming, and Unmanned Aircraft Systems applications.

The external reviewers complimented the department on the collegiality and collaboration across all levels in the department from undergraduates to faculty. They specifically mentioned the high level of access students have to faculty outside of the classroom. The program was complimented for its structure and quality. The department was also acknowledged for efforts to create cross-department connections through efforts like the NSF funded Research Experience for Undergraduates (REU) program in hyperspectral remote sensing. Efforts to develop research facilities and obtain grant funds to support student research were also noted.

- Program concerns. The GISc program has a strong curriculum but there is a need to keep pace with the rapidly evolving field of geospatial technology. Programming and internet-mapping have been added to meet evolving job market demands. An unmanned aircraft systems class has been investigated. Maintaining expertise and facilities to remain a premier program is a primary concern.

- Recommendations. The program is one of the best in the nation, but there is a need to remain on the leading edge of the field. There are plans to make an experimental class in Web Mapping permanent. There is interest in expanding into the area of unmanned aircraft systems applications with a Low Altitude Remote Sensing track within the major. This addition would expand the program's marketability and supply Iowa employers with highly skilled, in-demand employees.

  The market demand for GISc graduates is larger than the current program. The primary impediment to growth is student awareness of the Geospatial Technology industry. The department has taken moves to better market to current students and has partnered with National Geographic to help develop GIS in high school STEM curriculum. Market analysis suggests that the GISc field will grow by more than 11% annually through 2020 and even higher within the agricultural sector. The US Department of Labor also listed it as a High Growth Industry.[3] This suggests the need to increase student awareness of the career opportunities in the field.

  The geospatial industry has become pervasive in modern life with the proliferation of location-based apps, software, and hardware available for consumers. Therefore, there is a need to increase awareness by making sure students are mindful of the scope, implications, and applications of geospatial technology. This will be done through the newly redesigned Digital Earth class which should also serve as a tool for recruitment into the program.

  The external reviewers recommended continued general growth in the program. They suggested adding approximately 15 students to the program. They also recommended continuing and strengthening efforts toward linking with community colleges for GIS transfer students and to begin marketing directly to high school students.

  The reviewers also recommended capitalizing on the strong research focus in GIS by writing a new REU grant (which has already been accomplished) and better utilizing campus resources to promote GIS research.

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- [3] http://www.prnewswire.com/news-releases/global-geographic-information-system-gis-market-expected-to-grow-at-11-cagr-during-2015---2020-ps-market-research-567650721.html
- http://fohboh.com/profiles/blogs/global-precision-farming-market-growth-industry-trends-to-2022-by
- http://www.doleta.gov/BRG/Indprof/geospatial_profile.cfm

The most significant recommendation was to add unmanned aircraft technology and applications to the program in a more comprehensive manner. A research program in Unmanned Aircraft Systems was developed in the graduate program. They recommended building a line item in the department's budget to support equipment and establish a new faculty line dedicated to the field.

- Conclusions. The GISc program is near its target for goals set for the first five years. The program will now move into its next phase and the department intends to further develop enrollments and to maintain a leading-edge curriculum and expand professional development.

- Program improvements. During the first five years, several improvements were made to the original program. In an effort to refine the curriculum and maintain a high-level of career-readiness for graduates, one class was added and several other experimental classes in the curriculum were explored. A review of job ads has noted an increase in demand for GIS students with experience in customization. To meet this market demand, a GIS Programming class was added to the curriculum; this has had a significant impact on students' ability to get high-quality jobs. An experimental class in Internet GIS was taught; this is a field that has become important in the industry in the past few years. There was experimentation with an unmanned aircraft class which will continue to be developed as that job market matures.

  The program originally had four career application tracks. One of the original tracks had a low interest level among student. As a result, that track was eliminated; the program was streamlined during the 2014 curricular process.

  To help with student awareness of the ubiquitous – but still largely unknown – presence of geospatial technology within modern society and STEM fields, a *Maps & Map Interpretation* class was redesigned into a *Digital Earth* class. This is now an introductory class that informs students how Geospatial sciences are increasingly relevant to their lives and careers; how locational information has exploded in a short time; how such data can be used by individuals, governments, and businesses for a wide range of beneficial purposes; and the questions it raises in terms of security and privacy.

- Program cost. The program proposal indicated that the projected annual cost for Years 1-7 would be approximately $21,000. The sources of funds were expected to be department reallocations. Funds for undergraduate stipends were expected to be acquired through reallocations from either College or elsewhere in academic affairs.

- Major changes planned for the next 2-3 years. The primary changes anticipated during the next 2-3 years is the inclusion of a track in UAS applications. UAS are tools for collecting remotely sensed imagery and topographic data for a variety of uses. The relatively low cost, rapid deployment, and high resolution data are likely to make UAS a significant business and career opportunity in the near future. There are several reasons for adding a UAS track to the program:

  - ⇨ UAS are a perfect link with precision agriculture, which is a booming business application of GIS and GPS technology.
  - ⇨ Development of a research program in UAS as part of two public-private partnerships is underway.

- ⇨ The future of UAS applications is wide open and the department needs to stay on the leading edge as the technology and applications development during the next few years.
- ⇨ Unmanned planes are unique and high-profile tools that can provide positive visibility for the department and UNI.
- ⇨ A UAS program can link with other departments in application fields, such as surveillance for military science and criminology.

- ◈ Program accreditation. None.

- ◈ Program revenue (tuition) for last year of enrollment data. It was $317,600 based on the rate of $397 per credit hour for tuition and fees and 800 credit hours generated from the required and elective courses listed in the GISc program offering during the 2014-2015 academic year.

- ◈ Program expenditures for last year of enrollment data. It was $153,600 based on 800 credit hours generated from the required and elective courses listed in the GISc program offered during the 2014-2015 academic year and a per credit hour cost of $192. The per credit cost is based on the department's 2014-2015 budget of $1,155,566 to generate a total of 6,034 credit hours for all classes, leading to a rate of $192 per credit hour.

- ◈ Assigned program faculty. Faculty in the Department of Geography are not allocated specifically to the GISc program. All faculty teach courses that are included in all three programs in the department, the Liberal Arts Core, and, in some cases, other majors. Likewise, there are few courses in the GISc major that are exclusively limited to that program. Most courses in the GISc major are also included in other programs, such as the Geography degree or the Certificate in Geographic Information Systems and Cartography program. There are five courses that are included only in the GISc major and GIS certificate with no overlap in other programs. Based on the frequency of offering classes that are exclusive to the GISc major/GIS certificate, approximately 0.75 FTE per year are allocated exclusively to the GISc program.

- ◈ Additional information. This is the only GISc program in the state; it fills an underserved role in workforce development for Iowa. GISc is a highly applied and interdisciplinary field that has helped to drive one of the most productive research programs at UNI. During the past seven years, more than $9.2 million in external funding has been generated, largely related to GIS research. This equates to more than $150,000 per FTE per year.

  Approximately 40% of GISc students participate in funded collaborative research with faculty. Students are employed through faculty grants, GeoTREE Center projects,[4] the Geographic Alliance of Iowa, ARCSES and Iowa Space Grant Consortium fellowships. These opportunities have provided students with higher skill sets and greater professional readiness.

[4]The GISc has a synergistic relationship with the Geoinformatics Training, Research, Education, and Extension Center (GeoTREE) at UNI. The GeoTREE Center is a statewide extension and technology transfer resource that also provides internal internships and extracurricular professional development opportunities for students.

## ACADEMIC PROGRAM REVIEW

During the 2014-15 academic year, the Department of Geography underwent an Academic Program Review. This Program Plan is the departmental response for the B.A. and B.S. programs to the recommendations and discussions that evolved from the internal self-study report and the External Review report authored by Dr. Susan Hume, Southern Illinois University, Edwardsville and Dr. Timothy Hawkins, Shippensburg University.

Recommendations are listed in the same order as the original self-study report. The proposed actions listed below for each of the recommendations represent the goals that the Department will work toward over the next few years.

Our curriculum has undergone a complete change since the last program review and no program that was reviewed last time still exists. Prior to program closures in 2012, our department was growing and we had established what seemed to be a successful curriculum. The external reviewers recognized those challenges and commended the way in which we have worked to recover.

### *General comments on the strengths of the program*

The external reviewers complemented the department on the collegiality across levels from undergraduates to faculty. They specifically mentioned the high level of access students have to faculty outside of the classroom. The BS-GISc major, which has been added since the last program review, was complemented in both its structure and quality. We were praised for staying on the cutting edge of the discipline with the recent addition of new course in Web Mapping, GIS Programming, and Unmanned Aircraft Systems applications.

We were also acknowledged for efforts to create cross-department connections through efforts like the Crime Mapping & Analysis certificate with Criminology, the Environmental Resource Management major that is in progress, and the REU program. Our efforts at developing research facilities and obtaining grant money to support student research was also noted.

### *General comments on weaknesses of the program*

The primary point of weakness identified by the external reviewers was the recent decline in enrollments following closure of our Geography programs. It was acknowledged that the root circumstances were outside of our control and that overall university enrollment declines likely contributed to the department's challenges. This is the most important issue we will address in the coming years and the underlying theme for most of the specific recommendations in this document.

General communication with students regarding course schedules and extra-curricular opportunities was also noted as something in need of improvement and specific cases are dealt with throughout this document.

### *Our Recommendations From the Self-Study That Were Not Duplicated by the Outside Reviewers*

**Assessment:** We have realized that our once marquee assessment program has become outmoded. We would like to redesign our assessment program at both the undergraduate and graduate levels to update our SLO, data collection, and use of data.

Proposed Action: Drs. Pease and Oberle have agreed to take the lead on this project and both attended a conference and workshops on assessment methods. They will spearhead development of a new model of embedded assessment and work with the rest of the department to implement the new plan within one year.

**Initiate an interdisciplinary program:** We will finalize and submit a proposal for the new program in Environmental Resource Management. Drs. Dahms and Pease are working in consultation with HPLS, Biology and Earth Science. This is an inter-departmental, cross-disciplinary program.

**Consider a name change for the Department:** "Geography", unfortunately, conjures up images of capes, bays, and state capitols, especially in a state where K-12 geography is only taught in a portion of school districts. We wish to evaluate whether a name change might draw more students and visibility across the university and state, especially given our strong STEM and education foci within the department.

### *Recommendations From External Reviewers*

**Recommendation 1:** *Increase enrollment in the BA in Geography degree to pre-closure levels by the next program review and continue to steadily increase enrollment in the BS in GISc degree. We believe the undergraduate program could accommodate a combined BA and BS degree enrollment of 60-75 majors given the Department's financial and faculty resources.*

The department agrees that we have capacity for more majors. Prior to program closures and reorganization we had a larger number of students and had created an infrastructure that was yielding a steady growth trend. Given the situation we were forced into, we are working to get back to that position. We had developed an effective curriculum and recruitment tools but, unfortunately, they were taken away and we are still working toward finding alternatives. It is also worth noting that, historically, our enrollments have closely followed the trends of the campus-wide enrollment. Recent losses in students at the university level have impacted us. As university enrollments turn around we anticipate increasing departmental enrollments as well.

Proposed Action: As we work on a new equilibrium, we plan to continue or adopt multiple strategies for marketing our programs. We will assess those at 3-year benchmarks. At the end of the first 3- year benchmark our goal is to be back to pre-closure enrollment numbers of around 50-55 undergraduate majors. We will continue to focus primarily on growing the GISc major for which we are already well prepared for recruitment. During this time we would put additional effort into creating the recruitment infrastructure for the new BA. We then anticipate a shift in the second 3-year period with a stronger effort in growth in the BA program. At that mark we would anticipate being able to reach the 65-75 student range. We also hope to have the ERM major in place by that point which will further drive new enrollments.

**Recommendation 2:** *Since geography is a found major, the largest pool of potential majors continues to be students enrolled in the department's 1000-level courses (World Geography, Physical Geography, and Human Geography) to fulfill the University's LAC curriculum requirements. Therefore*,

**2a)** *place strong teachers in these courses that can generate enthusiasm for the discipline and are willing to actively recruit majors*;
We do not feel we can adopt this recommendation directly for several reasons. We understand and agree with the principle of creating excitement in the LAC classes, but will have to address it in an alternate fashion. Our departmental and disciplinary culture is that all faculty should contribute, to as great a degree as possible, to all levels of teaching from LAC to graduate. We do not currently hire faculty who we don't believe can succeed and contribute to the LAC. We also have a small faculty which makes it nearly impossible to be fully isolated in either LAC or upper- level classes. Lastly, in some cases specialties require certain faculty to have a higher teaching load in upper-level classes making it difficult to increase their LAC load, even if we wanted to do so.

Our classes have been significantly impacted by changes in the LAC which we did not support. We are still learning the new patterns and making adjustments. The new configuration has thus far had a negative impact on our program and recruitment efforts, but we intend to develop new strategies to adapt our efforts. For example, we are experimenting with education-only sections of Human Geography in an effort to open up other sections for deciding majors.

Proposed Action: Since we cannot restrict the teaching of low-division courses to certain people and we are adapting to negative changes in the LAC which have changed the patterns of enrollment on which we had built our previous recruitment efforts, we instead will adopt new tactics to help all faculty improve their recruitment strategies in lower division classes. We will continue to work toward strategies that open LAC seats to deciding majors. We will also try to better represent our most career-based major in the LAC by adding our newly redesigned Digital Earth class. Many people express that they work toward recruitment in small ways; however, we collectively agreed we can do better at linking the course content to careers.

**2b)** *inform students throughout the semester of career paths/employment opportunities, upper-level geography courses, and current geography student projects by tying these to related curriculum in each of these courses (i.e. through a slide show running before the beginning of class, as an introduction to a new lecture topic, through student assignments, etc.);*

Proposed Action: Each area (Physical, Human, World) will create materials and resources to share for in class recruitment. These may take different form for each class but initial ideas are short highlights on recent/ongoing department research, especially when students are involved; profiles of alumni working in a variety of fields; short videos or vignettes that highlight careers but still mesh with the curriculum; a discipline/career overview that briefly covers all major areas of geography and careers that can be used as an introduction to topics at the start of all classes.

**2c)** *continue with A/B emails from the department head personally inviting high performing students in these courses to consider the department's degree, minor, and certificate programs;*

This is a method we have tried intermittently over the years. We originally felt sending paper letters was the most impactful method, but this proved to be too costly in both time and money and was not sustainable. Recently the department head invested time learning how to create personalized email-based letters which, although still somewhat time consuming, doesn't cost money. We have little information on how effective this method is at recruitment, but given the low cost we agree it should continue.

**2d)** *have GEOG 1310 Maps and Map Interpretation reinstated as an option in the LAC curriculum requirements.*
Geospatial sciences are increasingly relevant to student lives and careers and we agree that such a class should be part of the LAC. We also think this is a strategic method to introduce students to geospatial technology and gain interest in the major.

Proposed Action: The department will complete its work on redesigning the Maps & Map Interpretation class to create a new introductory geospatial technology awareness course tentatively titled Digital Earth. The redesign was tested in the spring and we are now making final modifications based on student feedback on the class. We will also propose the class be entered into the LAC this year.

**Recommendation 3:** *Given the historical importance of transfer students as a source of undergraduate majors: continue to build and strengthen relationships with community colleges throughout the region; and identify and implement strategies to actively recruit transfer students (i.e. hosting an annual department open house, having faculty and undergraduate student representatives visit community college classes, etc.).*

We agree with this recommendation and are, in fact, already doing this. Working with community colleges is difficult because of a high turnover rate of faculty and programs. We have found that the only thing that works is personal relationships with individual instructors but the high turnover rate means that those have to be continually renewed.

Proposed Action: The department will continue to make contacts with instructors at community colleges and try to foster relationships. We will invite instructors to bring students to visit campus. We can pursue funds to perhaps cover those costs making it more likely that students will visit UNI campus.

**Recommendation 4:** *Market the BA in Geography and the BS in GISc, undergraduate fieldwork and research opportunities, and careers in geography directly to high school students by sending Geography Club members to visit high school classrooms in the local area or in their hometowns. Classroom visits might be arranged through the Geographic Alliance of Iowa or personal contacts, and could be scheduled during Geography Awareness Week or GIS Day*.

Getting information to high school students would be a great way of laying a foundation for long-term, future enrollments. However, this is challenging and potentially costly. There are many barriers to gaining access to high school classrooms which we have limited knowledge of how to navigate and we have no travel budget to send faculty to schools.

Proposed Action: Working with the Geographic Alliance of Iowa, we will develop a one-page handout to promote GISc technologies and careers to high school students and guidance counselors. Making an easy to distribute product that councilors can keep on hand may be the most effective way to make students aware of the discipline. Following the creation of the informational material, we will work with the GAI to find a distribution network to get the flyers in schools.

**Recommendation 5:** *Increase enrollment in 3000- and 4000-level courses (and possibly the frequency of these course offerings) by using course-specific flyers or other marketing methods to recruit students in other departments (e.g. students in Earth Science for GEOG 3210 Natural Hazards and Disasters, History for GEOG 4160 Historical Geography, Computer Science for GEOG 43390 GIS Programming, etc.)*.

This is a reasonable recommendation, but one that we have already tried with varying degrees of limited success over the years. Our business-related geography classes are routinely advertised to CBA students but the success in recruitment of those students to our classes seems to relate mostly to how advisers in CBA promote classes. We also know that in many cases the majors mentioned in this recommendation tend to be long and both students and their advisers indicate there is little time or flexibility to take electives from other departments. This is actually a systemic problem across campus and a concerted effort to reduce the length of majors would be a significant step in promoting interdisciplinary work. That is, however, beyond our control.

Proposed Action: We feel the most likely way to make this recommendation successful is to specifically target the advertisement to those courses that are listed as electives in other majors. Making the students more aware of options already open to them outside of their home department may promote those enrollments.

A second strategy we will pursue is targeting general studies majors. We will try to find out who primarily advises those students and explore ways to promote our classes as options within those customized majors.

**Recommendation 6:** *Build on current student interest and market demand for unmanned aerial vehicle (UAV) technology by:*

- *adding UAV technology as an application focus area in the existing BS in GISc degree program;*
- *proposing a UAV certificate program;*
- *building a line item for UAV equipment into the department's budget to insure that existing equipment can be maintained or replaced; and*
- *investigating restoration of a faculty line lost since the 2007 program review to support teaching and research in cutting edge geospatial technologies, including UAV*.

We concur with this recommendation and are pursuing options; unfortunately we do not have the resources available to move as quickly as we should to stay on the leading edge within the state.

The department submitted a proposal for a faculty line dedicated to low-altitude remote sensing and UAS technology, along with general support for the creation of a program in UAS technology and application. We were unsuccessful this year in gaining support for the effort. We believe the interest in UAS technology can drive an enrollment increase that will justify the expenses related to the requested line and resource. No other field has as much public interest and media coverage at the moment and we would be well positioned to be on the leading edge of this field.

Proposed Action:

1. We will continue to request a line and appropriate resources to focus on UAS technology and applications. We do not feel we can move forward with a program without at least one hire in the area. Our hope is that, as resource limitation are eased in the future, the proposal will receive full consideration.
2. We will continue offering the experimental class Introduction to Unmanned Aircraft Systems.
3. We will continue to encourage individual student research in the area. Currently we have two MA students working on UAS thesis projects. One student is working on a precision agriculture project funded by John Deere & Company; the second is working on a project in conjunction with biofuel research being conducted in the Department of Biology. We also currently have an undergraduate working on another project funded by Deere & Company looking at improvements in UAS image processing.

**Recommendation 7:** *Submit another NSF proposal to build on the department's success as a 2012-2014 Research Experience for Undergraduates (REU) site*.

The REU proposal has been submitted with Dr. Bingqing Liang as the primary PI and Drs. Petrov, Pease, and Dahms as collaborators. The departments of Physics, Biology, Computer Science, and Earth Science are also involved as affiliates.

The REU program is part of our larger commitment and growing emphasis on undergraduate research. This is a major strength of our department and one that we believe sets us apart on campus and among our peers across the county. Not only do we have high participation rates in undergraduate research, but many of the students are paid and working on externally funded projects. A research experience is required in our BS-GIS major and encouraged in our BA-Geography major. About 40% of our undergraduates participate in funded collaborative research with faculty and graduate students. Students are employed through faculty grants, GeoTREE Center projects, the Geographic Alliance of Iowa, and Iowa Space Grant Consortium fellowships.

Proposed Action. The recommendation is accomplished. No further action needed at this time.

**Recommendation 8:** *Strengthen student advising using a two-prong approach. One, in addition to indicating the frequency of course offerings in the course catalog, keep current and incoming students apprised of course availability, particularly for those courses labeled as "intermittent" or "variable." Two, prior to registration, survey current undergraduate majors and graduate students to gage their interest in taking intermittent or variable course offerings*.

This recommendation seems to reflect an older problem which is, at least partially, already addressed. We had drifted off of the schedule that was listed in the catalog but have been working for a while to standardize our course offerings and correct the catalog notes. For the most part, classes are now on a regular and predictable 2-4 semester rotation. That said, we know students don't make good use of the catalog and some of this concern likely stems from student anxiety about finishing their degree on-time. Therefore, we can take some steps to make the course rotations more transparent.

Proposed Action:

1. We will continue to review and update the catalog to ensure that the offerings match the expected sequence.
2. We will post an expected 4-semester schedule of classes on the webpage to create a known location to find the information accessible to both advisors and students.
3. We will explore the viability of posting notices about upcoming classes, prior to registration, on our social media sites.

We will do a better job letting students know that the department can make course substitutions to allow for a timely graduation if classes are not offered in an acceptable timeframe. We are aware that the degree to which students understand this issue, and are comfortable asking for substitutions, is uneven.

**Recommendation 9:** *Investigate opportunities to increase field experiences by*:

**9a)** *utilizing campus and surrounding area for shorter, more frequent, class-based field experiences*;

Although this is an excellent suggestion, it misrepresents our efforts because we already use campus and local resources fairly heavily for classroom work. That is not to say we can't do more, but the rising cost of motor pool vans has forced us to be more creative in our local use over that past few years. To illustrate, the following is a list of our current/recent use of local settings for education.

- Our introductory Physical Geography class uses Dry Run Creek for in-class exercises.
- Physical Geography Lab students conduct map & compass exercises on campus.
- Physical Geography Lab students take a field trip to the relatively close Backbone State Park in the fall semester.
- The Global Positioning System (GPS) Field Survey Methods class uses campus as a field-site for data collection.
- The Web Mapping class uses campus locations in "story map" exercises.
- The Maps & Map Interpretation class uses campus for exercise like GPS data collection
- The Soils class uses campus landscapes as well as field trips to nearby sites for short field exercises and sample gathering.
- North American Cities visits downtown Waterloo
- When we teach the class Methods of Teaching Social Studies, students are taken on a field trip to downtown Cedar Falls
- Several MA students have used campus as a test field-site for projects including thermal remote sensing of energy loss from buildings, use of hyperspectral data for tree species identification, and natural disaster planning on university campuses.

Proposed Action: Despite the fact that we already use campus resources heavily for classes, we will set an aspirational goal that at least 75% of our classes will have some component of out-of-class experiences.

**9b)** *increase visibility of internship and employment opportunities beyond Iowa and beyond GIS (e.g. NPS, NGS, EPA, NASA, NGA, USACE, BLM, USGS, NRCS); and*

This is a good suggestion. Several faculty indicate that they already do this informally with individual students or as announcements in class. However, we can do it more systematically.

Proposed Action: We will compile a spreadsheet of in-state and out-of-state internship and employment opportunities and create a page on our website. This will give us one, central location to maintain those links that both students and advisors will be aware of and able to access.

**9c)** *better incorporating study abroad opportunities. Investigate whether students can earn UNI Geography credit for study abroad experiences*.

Yes, of course students can earn credit in study abroad. We typically have one or two majors at any given time pursuing those options. We can certainly promote it better and probably should be more actively pushing students to get international experience. Presently International Programs representatives are invited to speak in one of our upper-level classes and occasionally other classes are open to their staff for promotion.

Proposed Action:

1. We will make discussion of study abroad a standard part of advising students earlier in their program. This will include gathering materials to have on-hand to give students.
2. Several faculty have agreed to explore offering capstone or other classes through international programs to provide unique curriculum to students.
3. We will make sure students know that they can get credit for GAI sponsored travel abroad trips.
4. We will create an international opportunities page on our website that compiled study abroad schools with geography programs. This will serve as one, central location to maintain those links that both students and advisors will be aware of and able to access.

**Recommendation 10:** *Investigate implementing a department-specific career fair. Students do not feel the University-sponsored events are particularly helpful. Perhaps a multi-department career fair with Earth Science, Biology, or other related disciplines would make sense. Reach out to alumni to participate.*

We view this as both unrealistic and unproductive. As a smaller department, our faculty and staff are stretched thin and have no experience with organizing this kind of event. We already staff 22 events per year organized by UNI. Although those events have a different purpose, we don't feel we have the capacity to add another. We would be better served by suggesting specific companies be invited to the central event.

Proposed Action:

1. During the next year we will compile a list of companies we know of that hire geography graduates and forward that to the UNI career fair organizers.
2. We also feel we can do better linking student and employers directly through our continued effort to send job ads directly to our students through our list serve, Facebook, and twitter accounts. We can add to that by also posting jobs on our webpage. We will create a new webpage space for those postings which can also serve as a way to build a long list of potential employers.

3. Perhaps the most useful efforts are recent efforts spearheaded in our Professional Seminar class required of all seniors. Dr. Strauss has begun an effort to create a strong LinkedIN presence for our department and establish an alumni network. We intend to foster this into a strong career network for new students to connect with alumni in many fields, and as a way for alumni to communicate job opportunities to current students.
4. Related to this topic, we will continue to develop job-search skills with students in the professional seminar with career preparation work including resume writing, mock interviews, and professional portfolio development.

**Recommendation 11:** *Install recycling bins throughout the department and advocate for better recycling across campus. Perhaps the Geography Club can work with the Office of Sustainability on this matter as a service project. Sustainability and human/environment interactions are central to geography. Geography faculty and students can model being good environmental stewards*.

Recycling bins have been installed throughout the 2nd floor of ITTC.

Proposed Action: No further action is needed. The recommendation is completed.