Department of Geography
College of Social and Behavioral Sciences
University of Northern Iowa

5-Year Strategic Plan
Spring 2007
# Department of Geography
College of Social and Behavioral Sciences
University of Northern Iowa

## 5-year strategic Plan

### Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission and Brief History of the Department</td>
<td>1</td>
</tr>
<tr>
<td>Programs and Curriculum</td>
<td>3</td>
</tr>
<tr>
<td>Student Recruitment and Retention</td>
<td>5</td>
</tr>
<tr>
<td>Research and Scholarship</td>
<td>7</td>
</tr>
<tr>
<td>Teaching and Learning</td>
<td>8</td>
</tr>
<tr>
<td>Outreach and Community Embeddedness</td>
<td>8</td>
</tr>
<tr>
<td>Resources, Facilities, and Personnel</td>
<td>10</td>
</tr>
<tr>
<td>Appendix A: Extended justification for development of a degree program in geospatial technology</td>
<td>11</td>
</tr>
<tr>
<td>Appendix B: Background and Trends of Majors</td>
<td>16</td>
</tr>
</tbody>
</table>
"In a world so shrunken in distance and time that you can almost instantly communicate with any other city on any other continent, and in which you can fly to virtually its remotest corner in a matter of hours, a knowledge of different peoples and places can no longer be considered the luxury of a few but is, instead a necessity of the masses...Just to stay abreast of world events, much less to function effectively as informed global citizens, requires that we learn not only where these happenings are occurring but also why they are taking place there and how they will impact on our lives. Such considerations are the very essence of geography."

R.E. Huke & V. Malmstrom

Mission and Brief History of the Department

The mission of the Department of Geography is to assist the University and the College of Social & Behavioral Sciences in achieving their goals through maintenance of distinctive geographic programs of instruction and research. The Department is committed to developing clusters of integrated programs of instruction, research, and service that include, but are not limited to, physical and environmental geography, geographic information science, urban and rural studies, and human geography. Instructional goals include substantial opportunity for students’ skill development within the broader context of an innovative liberal arts environment, which assures assessment and encourages continuous improvement to benefit students at both undergraduate and graduate levels. Research goals provide for the development of coordinated agendas that include, but are not limited to, the collaboration of colleagues to address real problems within Iowa, the nation, and the world. We envision a community of scholars, faculty and students, who are free to question and act in an environment of trust.

The Department of Geography is a growing, energetic program that exemplifies contemporary, relevant geographic research and teaching. The department is at the forefront of intellectual and technological expertise. We currently have 10 tenure/tenure track faculty. We serve approximately 2,000 UNI students annually and currently have about 40 undergraduate majors and 15 graduate majors. The department houses three laboratories: the Environmental Sediment Analysis Lab, the Geospatial Analysis Lab, and GeoTREE. Departmental teaching and research covers a diverse range of subjects including environmental science, geographic education, geographic information science, and social science. Faculty members have funded their research, teaching, and service with grants from prestigious organizations such as NSF, NASA, USDOT, Fulbright-Hays, and National Geographic. Three faculty members have received Distinguished Teaching Awards from the National Council for Geographic Education and two have received teaching awards at UNI.

The Department plays a major role in general education, which is typical of Geography departments around the country. Three of our courses are part of UNI's Liberal Arts Core (LAC) program (World Geography, Human Geography, and Physical Geography). The demand for these courses (especially World Geography) is very high. Currently, two members of the faculty teach in the non-western cultures category within the LAC, and the department offers two separate courses in the capstone category. With respect to the undergraduate major, the Department offers four tracks: a general liberal arts version, a secondary-school teaching
degree, an environmental emphasis, and a geographic information science emphasis (the latter initiated in 2004). The GISc emphasis emerged from our increasing focus on geospatial information technologies within the discipline, and is a direct result of the success of our Program Certificate in Cartography and Geographic Information Systems (GIS), which was established in 1992.

The Department of Geography views the 5 year strategic plan as an opportunity to articulate an agenda for growth that will expand opportunities for our students, cultivate our reputation, and better serve the university and Iowa communities. The strategic priorities in this document reflect growth opportunities that we have identified as gateways to reach the goals that we envision.
1. Programs and Curriculum

Ensuring student success in a high-quality program is central to the goal of higher education. In recent years this has become more challenging as the role of higher education has changed and the job market has evolved. This is particularly problematic for comprehensive universities that must compete with the tremendous economy of scale at the research-intensive universities as well as the hands-on, job-market oriented approach of community colleges. As such, we believe that we need to regularly and systematically evaluate our programs and curriculum in order to not just compete but excel. We assert that the development of new programs as well as a review and restructure of curriculum will ensure the continued success of our department.

The following are initiatives we wish to consider and pursue in the coming years.

1.1. Consider a degree program in geospatial technologies

We will consider pursuing a separate degree program in geospatial technologies that includes a strong techniques core that is closely linked with existing departmental strengths in particular human and physical geography subfields.

1.1.1. Justification: Experience with geospatial technologies has proven to be a primary market strength of our graduates. This reflects a larger national trend highlighted by the U.S. Department of Labor and recently articulated by the National Research Council. This new program will also create or strengthen interdisciplinary connections among Geography and other departments, as well as recruit more undergraduates from elsewhere on campus.

1.1.2. We believe our current model of an emphasis limits our success for two reasons. First, students potentially interested in geospatial sciences and information technologies do not intuitively look to geography as the home discipline. Unfortunately, most people outside the discipline hold an antiquated view of the field, and they do not associate us with a high-tech degree option. By moving the geospatial program to a degree, we feel it will have more visibility to potential majors. Secondly, the emphasis currently lacks some of the professional credentials of a separate degree. We feel a degree will not only improve the quality of the student education, but will add significantly to their marketability following graduation. This program would be enhanced by development of a professional advisory committee made up of working geospatial professionals from around the state who could assist with creating a program which best meets the needs of the Iowa work force.

Please see Appendix A for an expanded justification for the degree in geospatial technologies.

1.1.3. Constraints: The successful development of this new degree program will require three additional faculty lines. Because technology-based courses mandate a small student/faculty ratio and rely on a limited number of work stations, additional faculty members are needed to teach more sections. These new faculty members will also expand our currently limited course offerings, particularly at the intermediate level. New faculty will bring additional expertise
and actively contribute to interdisciplinary teaching and research across campus as well as providing courses in the most up-to-date technological advanced topics in the field such as custom application development, system architecture design, and internet mapping systems. Constraints will also include the need for additional physical space in the near future; more equipment such as PCs, GPS units, and peripherals; as well as the growing recognition that wear and tear will require the replacement of existing equipment.

1.2. Complete a comprehensive review and potential restructure of current curriculum

The evolving nature of student interests and expectations, the external job market, and the role of higher education demand that we undertake an exhaustive, comprehensive review of our current curriculum. We anticipate that the results of this would prompt a crosscutting curricular restructure.

1.2.1. Justification: The current Geography Department curriculum lacks an optimal scope and sequence of courses. A comprehensive review and likely restructure would enhance student learning by streamlining courses and by developing curriculum around emphases or concentrations that reflect faculty expertise. It is also recognized that new societal interests in cultural and regional studies in the post-9/11 world and the emerging focus on global environmental change dictates that we consider the modernity of our programs.

1.2.2. General Tactics

1.2.2.1. As an initial step in this process we need to review courses and the particular content and objectives of each class.

1.2.2.2. Attracting and retaining quality students is essential in higher education, particularly with the proliferation of universities and degree programs. We believe that renaming, re-packaging, and marketing specialty emphases will greatly enhance the department’s visibility and provide students with more personalized learning experiences.

1.2.2.3. We strongly support liberal arts education and thus believe that the department can increase its LAC Core contributions. In particular, we wish to evaluate how the department might contribute additional capstone courses as well as continuing our existing commitment to the “social science”, “natural science and technology”, and “non-Western cultures” components of the LAC Core.

1.2.2.4. The department faculty believes that a revised curriculum should include greater flexibility in course credit hours. We find the current 3-credit hour per class structure constraining and feel that the addition of 1-credit and 2-credit hour classes would better serve the needs of our students. Similarly—as an institution whose central mission is student learning—we believe that team-taught courses and more flexibility in assigning and negotiating FTEs would enrich the student learning experience.

1.2.3. Constraints: The primary constraint is the length of time necessary to enact any changes to the curriculum as the curriculum cycle does not occur every year and committees may not approve course changes. In addition, scope and sequence remains challenging because we wish to have students in upper-division courses who have some prerequisites, but not at the expense of
enrollment. We are concerned that the 10-person minimum enrollment for courses presents a particular problem if we are to establish a more hierarchical scope and sequence. In any department the possible attrition of faculty members may also limit curricular changes particularly in specialized courses.

1.3. **Initiate an interdisciplinary program**

Interdisciplinary programs are rapidly emerging in both large and small universities across the country. Both university administrators and the general public recognize the value of a focused program that draws from more than one academic field. Geography is well positioned to contribute to these programs as it is a discipline that is well recognized for its ability to provide synthesis and address complex, multi-faceted issues. We plan to explore the viability of one or more interdisciplinary programs that would be based in geography but would connect with several departments/colleges on campus. Examples of possible programs include Global Change and Urban and Regional Spatial Analysis. Unlike similar programs at other universities, the primary mission of such interdisciplinary programs would be to enhance undergraduate teaching and learning through focused coursework and hands-on, real-world research experiences. These would be greatly enhanced by the simultaneous expansion of our geospatial technology offerings and the creation of a Center for GISc (see section 6.1)

1.3.1. **Justification:** An interdisciplinary program housed in the Department of Geography would enhance the visibility of the department across the campus and in the community. The program would be effective in attracting undergraduate majors because of its targeted focus—embedded within a cutting-edge topical area—and including tangible real-world skills. In addition, the associated collaborative research is well positioned to compete for large federal grants.

1.3.2. **Constraints:** The primary constraints are the same as 1.2.7 above. Other limitations may include the need to hire new faculty and/or staff as well as working out the distribution of FTEs among departments/colleges.

2. **Student Recruitment and Retention**

2.1. Recruiting and retaining high quality students is vital for all departments. Although the number of individuals seeking a college education is at an all-time high, there are multitudes of options for higher education as well as increasing numbers of competing degree programs. We assert that the Department of Geography can increase its undergraduate enrollment by establishing new programs, updating the curriculum, and enhancing marketing efforts. Similarly, the department will continue its strong graduate student commitment by pursuing additional assistantship lines and enhancing the visibility of the program.

2.2. **Increase number of undergraduate majors**

2.2.1. **Justification:** We believe that our department has the capacity to substantively increase the number of undergraduate majors. In addition, the department is aware that its continued success is dependent on expanding our undergraduate program, particularly in targeted areas.
2.2.2. New programs and curricular changes will help increase the number of undergraduate majors by ensuring that the curriculum is cutting-edge and in sync with the job market (cf. 1.1, 1.2).

2.2.3. **Constraints**: Attracting additional undergraduate majors is challenging because it is not a formulaic process. Multitudes of external factors effect enrollment and the numbers naturally ebb and flow. In addition, we must ensure that we are not sacrificing student quality for student quantity—we assert that our standards must remain quite high.

2.3. **Enhance marketing efforts towards undergraduate majors**

2.3.1. **Justification**: We assert that effective marketing is an important part of increasing undergraduate majors. As such, we plan to implement a broad-based approach that will attract more students as well as students of a higher quality.

2.3.2. We have identified several strategies or tactics that we believe will contribute to this marketing effort. The list is not exclusive and additional tactics will be implemented.

2.3.2.1. One of the most effective means of marketing is a well-designed departmental web page. While our current web page is satisfactory, we need a site that is more contemporary and better reflects the vitality of the department.

2.3.2.2. We feel that the development of promotional material will increase the department’s visibility, particularly in targeted areas. Presently the department has no formal brochures to use for advertisement and recruitment.

2.3.2.3. The Department of Geography serves a key role in providing LAC courses for UNI students. Yet, we believe that these courses can do more to recruit majors into the department. We will engage in discussions on how to better access that large market of potential students through course content and faculty efforts.

2.3.2.4. The department houses the Geographic Alliance of Iowa, a geography-based K-12 outreach program. Continuing strong support for this program will help attract graduating high school seniors as well as insuring that our discipline is represented in social studies curriculum in Iowa.

2.3.2.5. We are concerned about a lack of diversity in our department, particularly a gender imbalance. We wish to identify means for increasing female and minority student enrollment in our program.

2.3.2.6. Until recently, the student-run Geography Club has been inactive. We are currently assisting a new cadre of students who will energize the club and work to provide both social and professional opportunities for current and future geographer undergraduates.

2.3.2.7. A strong undergraduate education is a hallmark of UNI and the university and college strongly support hands-on research experiences for undergraduate students. We believe that we can do better at pursuing, promoting, and showcasing undergraduate research in our department.
2.3.3. **Constraints:** Effective marketing requires some additional resources, such as money for printing, as well as systematic long-term planning and sustained motivation.

2.4. **Continue strong commitment to graduate students and enhance competitiveness of graduate majors**

Although small, our graduate program is among the best in the university. We have an active program of about 15 students with an annual graduation rate of about 6 students. One strong indication of the quality of the program is exemplified by recent awards our students have received. In just the past three years we have had five students with four different advisors win first or second place awards for Outstanding Master’s Thesis or Research Paper from the UNI Graduate College.

2.4.1. **Justification:** The Department of Geography has a strong tradition of producing outstanding graduate students. We feel that there is additional room for growth in our Master’s program and that we can enhance the visibility of the program both within the university and among other geography programs elsewhere.

2.4.1.1. We must work to expand our funded TA lines if we are to remain competitive and continue our tradition of excellence.

2.4.1.2. Similarly, we must pursue additional research grant dollars to fund research assistantships.

2.4.1.3. We affirm the strength of our program but must boost the visibility of the department among other geography programs in order to attract the best students for our Master’s program. We believe that greater involvement in regional conferences will assist in accomplishing this goal.

2.4.2. **Constraints:** Both teaching and research assistantships are fluid and dependent on Graduate College funding and soft money from grants. We must recognize that a combination of long-term planning and a quick response to year-to-year fiscal fluctuations will be necessary to ensure sufficient assistantships.

3. **Research and Scholarship**

Research and scholarship are an essential part of our department and the mission of the university. Evolving expectations regarding research and grantsmanship demand that faculty members are supported in their efforts to publish research and secure external funding.

3.1. **Increase publication rate of department and promote grantsmanship**

3.1.1. **Justification:** Publications are a key indicator of intellectual production in an academic department and grants facilitate both publication and graduate student assistance. The department is active in publishing and grant writing, however, we believe actions can be taken by the administration and faculty to develop a support system for increasing overall publication rates. Like publishing, securing external grants is a protracted process that typically requires multiple submissions prior to funding. We wish to promote grantsmanship by recognizing and appropriately rewarding both grant success and grant submissions and encouraging training for novice grant writers.
3.1.2. **Constraints**: Publishing and grant writing are challenging and protracted processes. There should be a system of incentives for encouraging faculty to publish and secure external funding. Furthermore, regular and significant scholarship and major grant proposal submissions are greatly facilitated by a reduced service and/or teaching workload, something that may be limited by the institutional structure. There is an additional hurdle to grantsmanship in that external funding is ambiguously defined in regards to promotion and tenure. The value of significant external funding needs to be clearly outlined and included as a metric for P&T.

4. **Teaching and Learning**
The Department of Geography prides itself on excellent teaching and learner-centered curriculum. We believe that we can improve upon our outstanding teaching by better assessing the learning outcomes of our students and by implementing a portfolio program that will assist undergraduate majors with projecting their in-class and out-of-class accomplishments to potential employers or graduate programs. These initiatives are, of course, tied to principles laid out in the pending Comprehensive Program Review outlined in sections 1.2.

4.1. **Review Student Learning Outcomes Assessment**
4.1.1. **Justification**: The current student outcomes assessment is outdated and does not reflect the contemporary geography discipline or the present models for meaningful Student Learning Outcomes assessment. We need to reconsider our objectives and outcomes, and redesign the data collection instrument.
4.1.2. **Constraints**: There are no substantive constraints for this proposal.

4.2. **Develop a portfolio component to the undergraduate degree program**
4.2.1. **Justification**: Once on the job market, many of our students struggle to synthesize and communicate what they have learned during their undergraduate experience at UNI. We strongly believe that the initiation of a student portfolio as a required part of the degree program will assist students in articulating what they have learned and give them a significant edge in the job market or in their pursuit of an advanced degree. This would also provide an assessment tool related to the assessment initiative in section 5.1.

4.2.2. **Constraints**: In many programs, there is a separate 1-credit hour portfolio class. This is not currently possible because of our mandated 3-3 teaching load and 3-credit hour class structure.

5. **Outreach and Community engagement**
One of the critiques of higher education is that it is an isolated entity, cloistered from the public. Universities across the nation recognize this and have begun to aggressively promote higher educations’ involvement in the community. We assert that our department can do more to directly interact with the community at large and as such promote our discipline, the university, and the value of higher education in general.
5.1. Establishment of a GIScience research center

5.1.1. Justification: Many universities with Geography programs house largely self-funded centers that assist other campus researchers as well as off-campus entities with GIS and spatial data analysis. We wish to consider the charter of such a GIScience center as a means of both on-campus and off-campus outreach as well as a mechanism for employing both undergraduate and graduate students as well as providing valuable hands-on learning experiences for these students.

5.1.2. Constraints: This center would require considerable input in the form of space, personnel, and equipment. Current departmental space and equipment is likely inadequate for such a center. In addition, the center would require a director and it is unclear at this point if this person would be a current faculty member, new faculty line, or a new P&S staff hire. It is also likely that a self-funding status of such a center would take several years to achieve and would, thus, require a several year commitment from the university and college.

5.2. Recognizing and rewarding community engagement

5.2.1. Justification: Overall, our department is already very active in the community through such outreach as the Geographic Alliance of Iowa and GeoTREE. Yet, current P&T guidelines do not afford the level of credit they often deserve relative to other forms of service. The administration and faculty need to work to develop a system for rewarding these types of activities that are embedded within the community. Because of consistently declining state appropriations, we believe that it is vital that each department educate the public about the value and utility of the university.

5.2.2. The administration and faculty should work to reward and recognize those who are strongly engaged in community efforts, and support and encourage others, particularly those whose research or teaching predilections resonate with community interests.

5.2.3. Strong working relationships with employers are a central part of community engagement. As such, the department wishes to strengthen existing internships and initiate new partnerships with both private and public agencies.

5.2.4. Many faculty members in the department teach courses that have a substantive project component, often an accessible, local topic. We deem that many of these projects should be modified in such a way that they can be used to educate the public at large and attract positive attention to the department, discipline, and university.

5.2.5. The Geography Club is interested in becoming involved in community engagement. We will continue to encourage them to engage in visible projects that are of tangible value to the local community.

5.2.6. The Geographic Alliance of Iowa’s tradition of K-12 outreach is vital and should remain an integral part of the department. The GAI serves as a bridge between Geography and the College of Education and ensures that large numbers of teacher candidates are exposed to our discipline. This is particularly essential as geography may soon become one of the “core academic subjects” recognized by the federal government, a move that would have a significant trickle-down effect to K-12 education in Iowa. Despite this promising environment, granting
agencies such as National Geographic have shifted their priorities and the GAI has become stretched thin in recent years. The administration and faculty should develop a plan to ensure that the GAI remains robust.

5.2.7. **Constraints:** Effective community outreach needs to be rewarded and carry some substantive weight in the promotion and tenure process. Outreach is extraordinarily time-consuming and its success is difficult to measure over the short term. These aspects of community involvement need to be understood and the administration and faculty must work to find ways to better support these types of endeavors.

The effective functioning of any department is dependent on sufficient facilities and quality personnel. Although the Department of Geography recently moved into larger, cutting-edge facilities, we believe that further growth will require additional space and/or reallocated space. We also feel that new faculty lines should focus on increasing the diversity of the department.

6.1. **Increase departmental diversity through new faculty lines**

6.1.1. **Justification:** We feel that increasing the diversity of departmental faculty would thereby attract more diverse students to our department and hopefully to the university in general. One key issue is the lack of women faculty to serve as role models for majors and potential majors. Figure 3 in Appendix B serves as a reminder that Geography has done a poor job accessing the majority female population of students at UNI.

6.1.2. **Constraints:** Attracting diverse faculty hires is challenging as quality candidates are highly sought after. To realistically be competitive in hiring diverse faculty, the administration would need to have a central role in the negotiation process.

6.2. **Reallocation of departmental space**

6.2.1. **Justification:** Geography, because it is often a technology-oriented discipline that engages students in learner-centered educational experiences, requires a sizeable dedicated space. In particular, computer workstations for geospatial technology related courses require a great deal of space as do physical geography “wet labs”. While the current facilities are sufficient, some internal rearrangement of space in the department could better utilize underused space. In the future, the department may require additional space above and beyond current allocations.

6.2.2. **Constraints:** Realocating current space will likely require the approval of Facilities Management as well as additional capital for modifications. New space would likely be difficult to acquire, as it would require a commitment from several administrative offices.
Appendix A: Extended justification for development of a degree program in geospatial technology (1.1) with implications for the justifications for development of a Center for Geographical Sciences and Geospatial Technologies (6.1)

There is no doubt that demand in the diverse field of geospatial technology is growing faster than trained personnel can be added to the workforce. The need for geospatial technology experts runs the range from low-level technical skills to system design and multifaceted analysis. Although the public sector has historically driven the market, the private sector is rapidly catching up as commercial applications of geographical information and technologies continue to be developed. The scientific fields are also beginning to drive demand as disparate disciplines find value in geospatial data analysis. Rita Colwell, Former NSF Director, asserts that geography and geospatial technologies are “well poised at this watershed juncture to help shape the new landscape of science” (Colwell 2004, 703). The University Consortium for Geographic Information Science (UCGIS) similarly argues that these technologies “... have increasingly become the ‘glue’ which connects large-scale interdisciplinary research, including much that is funded by NSF and other federal agencies” (DeBiase et al., 2006).

Our department currently has an emphasis in Geographic Information Science which, despite difficulties in advertising the program, has seen rapid growth since its inception in 2004, relative to our other degree programs (fig 1).

![Figure 1. Geography majors by degree emphasis over the time the GISc emphasis has been offered.](image)

**Revenue Growth**

Determining revenue rates is made difficult by discrepancies in how “Geospatial Technology” is defined, which subfields are included, and if only core-businesses are considered or if total end-user revenues are estimated. Generally, the geospatial technology field should broadly include the three main fields: geographic information systems (GIS), remote sensing (including satellite and airplane based data), and global positioning systems (GPS) (DiBiase et al., 2005). The core-business of geospatial technology is typically defined as hardware and software sales and data generation and sales. The extended market of end-users includes services like value-added database generation, data analysis, and cartographic visualization. Despite the variations, all measures of productivity in geospatial technology fields show massive growth in the short and long term markets.

The Daratech market research firm has estimated core-business sales revenue in geospatial technology-based companies since 2000. Their estimates primarily focus on software, hardware, and data sales and demonstrate a nearly 300% growth in the core-
business revenue from 2000-2006 (fig. 2). Impressive as they are, these numbers only scratch the surface of the total end-user spending. Total revenues off all geospatial technology sales, serves, and spending has grown at an astonishing rate of 500% between 2000 ($5 billions) and 2006 to reach $30 billion (Richardson, 2004; Gaudet et al., 2003).

Figure 2. Annual revenue of geospatial technology core-business which include hardware/software sales, direct services, and data. These do not reflect total user spending which is estimate to be $30 billion in 2007. From Datatech.

**Work force Growth**

Estimates of work force size are also problematic due to inconsistencies in defining what is a geospatial-based job. Businesses which define their fundamental activities as geospatial-based make up the core of the industry; however, many more companies use geospatial technology and techniques to accomplish tasks not labeled as geospatial. Most of those companies do not define themselves as “geospatial”, yet they constitute a significant portion of the job market. The American Society of Photogrammetry and Remote Sensing conducted a survey-based study which estimated that there were 175,000 people employed explicitly in the “U.S. remote sensing and geospatial information industry” in 2003 (Mondello et al., 2004). Environmental Systems Research Institute (ESRI), producers of ArcGIS which is widely considered the industry standard GIS software and accounts for nearly half of the world GIS software market (Dibiase et al., 2005), estimated that in 2000 there were over 500,000 people in the U.S. regularly using their software at work (Phoenix, 2000). Worldwide, it is estimated that there are four million geospatial technology-related workers (Longley et al., 2005). Compounding this labor demand is the approaching retirement of the Baby Boomer Generation which is evident in the approximately 26% of NASA geotech-related employees who are expected to soon retire (Richardson 2004). Other employment sectors that now at least partially depend on geospatial technology continue to expand, including fields as diverse as civil engineering, public health, environmental science, urban and regional planning, and the geosciences. With the need for these tools and skill sets in the realm of homeland security, anti-terrorism and natural hazard mitigation applications will likely result in the further growth of geospatial technologies.
Inadequacy in Supply

As early as the mid-1990s it was clear that the supply of specialists in geospatial technology fields was not keeping pace with the industry demand. In 1997 NASA commissioned their National Workforce Development Education and Training Initiative to fill what they saw as a “serious shortfall of professionals and trained specialists who can utilize geospatial technologies in their jobs” (Gaudet et al., 2003). ESRI estimated at the beginning of this decade that there was already an annual shortfall of 3,000 to 4,000 trained geospatial technology specialists (Phoenix, 2000). The U.S. Department of Labor (DOL) estimated that current employers have difficulty filling 87% of jobs requiring skills in geospatial technology due to lack of qualified personal (DeRocco, 2004). Furthermore, the DOL is so confident in the future need for geospatial experts that it currently lists Geospatial Technology as one of the top three “emerging industries” for the 21st century (along with nanotechnology and biotechnology) and infused $6.4 million of investments to address workforce needs (DOL, 2007, http://www.careervoyages.gov/geospatialtechnology-main.cfm). The DOL also has the field of Geospatial Technology in it list of “Targeted Industries” as part of “The President's High Growth Job Training Initiative”, a “strategic effort to prepare workers to take advantage of new and increasing job opportunities in high growth, high demand and economically vital sectors of the American economy” (DOL, 2007, http://www.doleta.gov/brg/JobTrainInitiative/). The downside is that much of the federal efforts are targeted at community colleges (DiBiase et al., 2006) because 4-year universities have failed to react to this growing need.

As anecdotal support for the shortfall in the needed workforce, geography departments around the county constantly receive job ads with requests to have students apply. Even though we currently offer only a concentration in GISc, the department of Geography at UNI routinely receives 8-12 direct appeals each semester for qualified geospatial technology-trained students to apply for unfilled positions.

The Need for Geospatial Technology at the 4-Year Institution

One of the biggest concerns in the geospatial technology field, aside from quantity, is the lack of rigor and quality in the training that new employees have. Respondents to the American Society of Photogrammetry and Remote Sensing survey complained not only about the shortage of trained workers, but also about the “lack of the required skill sets among many of the graduates” (Mondello et al., 2004). This sentiment was echoed by the director of the local Cedar Falls-based company, Aerial Services in a personal conversation with the Head of Geography at UNI. DiBiase et al. (2004) attribute this largely to universities failing to develop comprehensive, rigorous geospatial programs of study. DiBiase et al. (2004) note that there are only four universities in the U.S. that offer an undergraduate degree in a geospatial field (DiBiase et al., 2003). There are only 24 additional universities that offer degrees in geography (or related field) with concentrations in geospatial technology (including UNI). However, these hybrid degrees don’t offer the depth needed in the current geospatial job market. Likewise, the explosion of technical-based GIS programs in community colleges have fail to produce geospatial experts and leader, instead creating a generation of technicians with low-level skills and limited advancement potential. DiBiase et al. (2004) clarified the limits of the current educational infrastructure to meet future geospatial technology demand, stating:

“Existing GIS education,’ Marble claimed, ‘fails to provide the back-ground in GIScience that is necessary to meet the needs either of the users of GIScience technology or of the scientific
community engaged in basic GIScience research and development’ (Marble, 1999, p. 31). Unlike students in the early days of GIS education, when the primitive state of the technology necessitated programming skills, Marble pointed out that latter day students and some instructors believe that all one has to do to become a GIS professional is to master the standard functions of commercial off-the-shelf (COTS) software. Thus, graduates are no longer prepared ‘to make substantial contributions to the ongoing development of GIS technology’ (Marble, 1998, p. 1). Advanced knowledge and skills in computer and information sciences are needed more than ever, he argued, to realize the full potential of GIS&T.”

Math & Science Teacher Education Emphasis
A significant repercussion of the lack of a comprehensive core of geospatial technology at UNI is found in the recent publication of Learning to Think Spatially, a National Academies collaboration that affirms the value of spatial thinking and calls for the incorporation of the visualization of spatial structures as an essential, systematic standards-based component within the K-12 curriculum (NRC 2006). This study outlines several recommendations for developing a spatial literacy curriculum, including the redesign of current geospatial technologies to better educate K-12 students, the promotion of research that highlights best practices for incorporating these technologies as an educational tool, and the establishment of guidelines for assisting pre-service teachers in effectively using these tools to enhance spatial thinking among students. Because of this and other initiatives, geospatial technologies will likely emerge as a key component of the K-12 curriculum, therefore creating a substantial future demand on higher education to promote spatial thinking and geospatial technologies as part of the teacher training program in science education fields. The leading software producer, ESRI is so bullish on the future of geospatial technologies in primary and secondary schools; it has developed a separate division focused on providing software, hardware, and support for K-12 teachers. The emerging lead UNI will take in science and math teacher training presents an opportunity to pick up the challenge laid out by the NRC and also take the lead in infusing geospatial technologies into the K-12 educational program.

References:


Appendix B: Background and Trends of Majors in reference to sections 2, Student Recruitment and Retention and 1.1, Development of a Geospatial Technology degree program.

One of the most important considerations for our program is the recruitment and retention of majors. Because of the lack of exposure to modern geography in secondary schools, most students don’t discover our discipline until mid-way through their time at UNI. Therefore, despite favorable post-graduation marketability, we are at a disadvantage to those disciplines which are more recognizable in terms of ease of major recruitment.

Reviews of enrollment trends will help to clarify our concerns about recruitment and retention. Between 1991 and 1998 we experienced a rapid increase in majors (fig. 3). Around 1999, however, the growth stalled and we experienced about four years of static growth. Beginning in Fall, 2004, we have seen our numbers begin to decline.

![Figure 3. Total number of majors (all concentrations) per semester with a 4-semester moving average.](image)

The rapid increase in majors during the 90’s might be attributed to three things. Primarily, a rapid increase in overall enrollment of the university likely translated to a larger pool of potential majors. The university enrollments began increasing in 1995 and peaked in 2001 at 14,070. Although it is easy to dismiss our declines as part of the larger trend, nihilistic complacency does no justice to the issue. Secondly, the rise in majors correlates with the arrival of a new department head; an event which typically facilitates change. Thirdly, the rise in majors over the 30 “benchmark”, coincided with the introduction of GIS to the department in 1992 and the beginning of the technological paradigm shift of the discipline. Following the rise, attributable to one or all of the preceding, we have failed to capitalize adequately on the growing public interests in geography-related topics (e.g. GIS, GPS, globalization, immigration, international strife, environmental studies …) and have become either stagnant in our appeal to students or they simply are unaware of our presence.
The exception to the downward trend in majors is the GISc emphasis. The GISc track has seen steady and impressive growth over its short life. However, it should be noted that the growth in interest in geospatial technologies has come at the expense of our traditional degree programs. This suggests that the GISc program has become a popular track for students who discover Geography, but that the program has the same exposure problems as the other Geography programs. This is implicit in our interest in moving this major to a degree program.

![Total Majors By Emphasis](image)

Figure 4. Total number of major per semester, separated by emphases.

An additional negative view of enrollment history can be seen in an analysis of gender (fig. 4). Women have always been grossly underrepresented in our program and the situation is getting worse. Our most positive period was in the mid-1990s when women represented about 30-35% of our majors (fig. 4). After 1996 the number of women fell sharply even as total enrollments remained relatively stable. Through the early 2000s we remained stable at about 20%, but have seen another sharp and worrisome drop in the past two semesters to levels not seen since the late 1980s. The decrease in women in our major may be exacerbated by our disciplines paradigm shift to a more technology-based field which historically have been underrepresented by women and minorities. With more recent increases in math and science opportunities for women in secondary schools, we hope this trend will begin to change.

Women make up 58% of the UNI student population but currently make up only 10% of Geography majors! One quick way to improve our numbers is to improve our access to this group of students. Women are underrepresented in geography nationwide (although this is changing elsewhere), so it is not an issue unique to UNI. All the same, as we look forward to increasing our total number of majors, we should be aware of ways to be more marketable to both genders.
Figure 5. Trends in gender distributions among geography majors, with a four-semester moving average.