Curriculum Development Grant Application
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Objectives and Significance of Project

In the Fall/Spring 2001-2002 semesters I will be teaching two courses for the first time: Ecology Lab (L474) and Environmental Biology (L350). In both of these fields, many of the questions are spatial in nature (e.g., What factors determine the distribution of a species?) and require integration of information occurring at different spatial scales (e.g., biology of species, migration of individuals between populations, distribution of other species, and environmental variables such as pH and temperature). One technique for addressing these questions is using Geographic Information Systems (GIS). GIS is a computer-based method of analyzing spatial questions by building multi-dimensional maps. For example, one might be interested in identifying factors that affect the spread of an invasive exotic such as fire ants. A GIS approach to this problem might consist of building a map that shows the distribution of fire ants, temperature isoclines, precipitation, distribution of open fields, and shipment of turf (or other item that may be involved in dispersal of ants). The relationships among these variables are then analyzed to determine the contribution each factor has on the pattern of spread in fire ants. In essence, GIS is a tool that is used to address spatial questions that involve manipulation of several layers of information. The objective of this project is to develop labs and assignments that provide students hands-on experience using GIS in L350 and L474. I am requesting funds to attend a NSF Chautauqua short course in the use of GIS and its application in teaching.

Recent advances in remote sensing technology, satellite imagery, and GIS have resulted in an explosion of electronic data sets on soils, geology, river flow, weather, agricultural land use, topography, land cover, and vegetation maps. The availability of such diverse data sets and advances in computer technology have made it possible to study issues such as habitat fragmentation and patterns of land use at a scale not previously possible. Many of these data sets are available on the Internet; for example, data on land cover, land use, hydrography, and human population density for the Great Lakes region are available at [http://mapping.usgs.gov/nsdi](http://mapping.usgs.gov/nsdi) and [http://www.cciw.ca/gl](http://www.cciw.ca/gl). These basic data sets can be combined with local data on species distribution, territory size of animals, and community composition. GIS has quickly become a standard tool in the conservation and management of species (in both private and governmental agencies), archaeology (structure of villages and landscape), urban development, U.S. population census, Department of Transportation, and business (e.g. studying the most efficient way to distribute products).

Introducing students to GIS is important for two reasons. First, the process of using GIS is important conceptually because it provides students practice integrating multiple levels of information. Most, if not all, basic and applied problems in ecological and environmental fields require the manipulation of complex data sets. Second, having some experience in the use of GIS will make our students more competitive for internships and job opportunities. Students who take L350 and L474 are typically planning to attend either graduate school or obtain jobs with governmental or environmental agencies. In basic ecological research, the use of GIS has been particularly important in advancing knowledge in the areas of habitat fragmentation, temporal change in community composition, landscape ecology, and biodiversity issues. In applied fields, entry-level jobs with the Department of Natural Resources, Department of Fish and Wildlife, Environmental Protection Agency, and the Nature Conservancy frequently list in their job ads that experience with GIS is desirable (or required). For students interested in environmental studies and graduate study in community or ecosystem ecology, knowledge of GIS is analogous to the importance of being proficient in molecular techniques for students interested in molecular, cellular, or population-level areas of biology.

My plan for implementing GIS technology into Ecology lab this fall is to have students learn the basics of collecting field data, develop a map, and analyze the data using GIS. Examples of questions that we could address include: What is the relationship between soil types and distribution of species within a
community? or "How does the severity of an insect pest outbreak depend on the plant species present in surrounding fields?"

In Environmental Biology, I will have students use GIS to study applied problems such as, "How many wetlands (or forested areas) are there within 200 m of the proposed I-69 highway?" L350 is a lecture course, thus I will develop assignments that use existing data sets rather than have students collect data and generate maps.

Incorporating GIS technology into L350 and L474 will benefit students both in terms of becoming more proficient in analyzing spatial problems and in exposing them to future career possibilities. Furthermore, the flexibility of GIS and its use in a diverse set of disciplines means that students who pursue careers outside of environmental fields are likely to find knowledge of GIS useful.

**Activities planned to meet project’s objective and Qualifications of Project Director**

The Biology department owns the computer hardware required to use GIS in laboratories. Thus, the main limiting factor at this point is having someone proficient in the use of GIS. I have background in implementing field mapping projects and in doing spatial analysis (Marr and Delph, 2001), although I have not used GIS. Learning GIS software is much like learning how to sequence DNA; it is far more effective to learn hands-on with the guidance of an expert, than trying to become proficient through reading. Consequently, an introduction to GIS software and its application to applied ecological problems from an expert who has worked extensively in this field will be key to developing labs that provide students with an appropriate introduction to GIS.

A NSF Chautauqua short course is being offered that focuses on the use of GIS software and its application to topics such as analyzing the impact of agricultural systems and effect of urbanization on wetlands. An abstract for the course is attached. NSF short courses are highly regarded and are specifically designed to help instructors incorporate new techniques and technology into their courses. Furthermore, much of the cost of the course is subsidized by NSF, which greatly lowers the cost of receiving such training.

**Project Schedule**

The Chautauqua GIS course is scheduled for May 24-26, 2001. In fall 2001, I will incorporate GIS into the Ecology labs and in spring 2002 the Environmental Biology students will be required to do one GIS project. Inclusion of GIS technology in these courses will be useful to students interested in careers in Biology, Environmental Sciences, and perhaps SPEA-related fields such as urban planning.

**Previous IUSB Grants and efforts to obtain additional funding for this project**

I started at IUSB in Fall of 2000 and have not received any IUSB grants at this point. The Biology department has invested in the computer equipment needed to incorporate this technology in the lab. UCET funding is no longer available for attending conferences related to curriculum development.

**Budget and Budget justification**

<table>
<thead>
<tr>
<th>Chautauqua GIS Short Course</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Airfare</td>
<td>$321</td>
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<tr>
<td>Hotel ($70 per diem * 4 days)</td>
<td>$280</td>
</tr>
<tr>
<td>Meals ($38 per diem * 3 days)</td>
<td>$114</td>
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<tr>
<td>Application fee</td>
<td>$40</td>
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1 copy of Arcview software  & $250 \\
Amount requested from Curriculum Development & $1005 \\

I am requesting funding for travel to the GIS short course being held in Memphis, TN, May 24-26, 2001. Travel and course costs include airfare, lodging and board, and an application fee. In order to keep airfare costs low (Saturday night stay-over), I plan to leave Wednesday, May 23 and return Sunday, May 27 (estimated cost of flight is $321). The per diem rates for Memphis, TN is $70 per night lodging (* 4 nights) and $38 / day in meals (* 3 days) for a total of $394. The cost of attending the course is $40. In addition, I need one copy of Arcview software, which is used in GIS analysis, in order to develop the lab projects and assignments this summer. The Biology department is supporting the additional costs of computer software and hardware required for the students to use GIS in the lab. The total amount requested for Curriculum Development Support from IUSB is $1,005.

References