MERIDIAN
A MIDDLE SCHOOL COMPUTER TECHNOLOGIES JOURNAL

Introducing Geography and Technology into Science Via Biodiversity

Joseph Kerski

Abstract:

Incorporating geographic concepts into biology was accomplished through a biodiversity investigation project in Colorado. The project brought together scientists and educators from the US Geological Survey, the Colorado Division of Wildlife, the Colorado Natural Heritage Program, the University of Colorado, the University of Northern Colorado, and K-12 schools across Colorado's Front Range. Participants in the project created lessons, new maps, and new digital spatial data, which were used to conduct training sessions over a two year period for hundreds of teachers statewide. The project provides a model of collaboration across multiple organizations to improve inquiry-based, hands-on, interdisciplinary teaching and learning about the interaction among urban growth, climate, vegetation, transportation, rivers, wetlands, landforms, watersheds, and biodiversity of plants and animals.

Introduction

Through a grant from the National Geographic Society, geography and technology has been effectively spread into science curricula through a project entitled "Exploring Biodiversity Along the Front Range of Colorado."

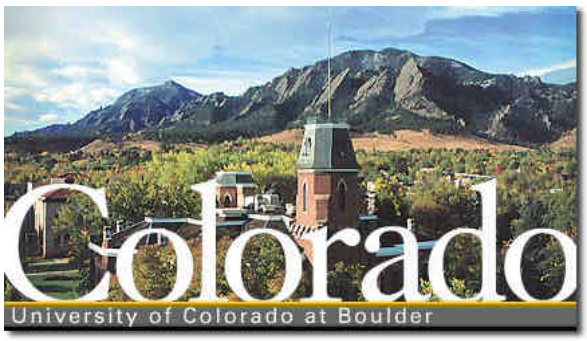
This project was innovative in four areas. First, it brought together federal, state, university, and K-12 researchers and educators to produce educational lessons based on biodiversity. Second, it brought concepts of biodiversity conservation to Colorado high school students, while simultaneously satisfying important state geography standards and providing a model for similar instructional activities in other regions. Third, it incorporated GIS technology and methods into some of the lessons, and resulted in the production of new spatial data and a new series of maps. Fourth, teachers and students began to use geographic concepts in

their biology and other science courses.

Biodiversity is the variation among life and its processes at all levels from genes and individual organisms, through species and ecosystems, to landscapes, regions, and continents. Global species biodiversity is now being lost at a rate similar to that of the mass extinction of the geological past, even though the goods and services that flow from biodiversity in the USA alone are worth hundreds of billions of dollars annually. Because many concepts pertinent to biodiversity conservation have spatial aspects, geography proved to be an excellent means of introducing students to biodiversity.

A group of a dozen teachers created the lessons. In a series of three workshops, they trained other teachers to incorporate the lessons into the curricula throughout the state.

The US Geological Survey, the University of Northern Colorado, the University of Colorado, the Colorado Natural Heritage Program, the Colorado Division of Wildlife, and dozens of school districts partnered to make this project a success.



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Meridian: A Middle School Computer Technologies Journal
a service of NC State University, Raleigh, NC
Volume 5, Issue 1, Winter 2002
ISSN 1097 9778
URL: http://www.ncsu.edu/meridian/win2002/515/
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The most efficient method for conserving large amounts of native biodiversity, including many poorly known species, is to conserve relatively large and/or connected samples of the full range of natural and seminatural ecosystems that provide habitats for species. This "coarse-filter" approach requires knowledge of the distribution, characteristics, diversity, productivity and classification of ecosystems.

Ecoregional planning for biodiversity conservation requires the use of biodiversity and socioeconomic databases that are incorporated into GIS. This GIs approach uses fundamental cartographic principles to analyze information involving the relationship between the physical and human systems of the Denver Metro Area.

This project has proven effective in Denver, which is one of the most biologically diverse metropolitan areas in the USA, and also is sprawling at the 6th fastest rate. However, the project could be used in other urban areas across the country.

The objectives of the project were to:

1. Raise student achievement in geography.

2. Prepare teachers and develop lessons that incorporate geography via biodiversity.

3. Produce maps and digital data that benefit planners and others outside this specific project.

4. Foster networking among teachers of geography and natural (biological, earth, and environmental) sciences.

5. After learning how different viewpoints produce conflict over territory and resources, students see how community-based conservation can influence the size, arrangement, and structure of urban areas.

6. Students learn how to evaluate policies for resource use and management, and how to apply the regional concept to study a geographic issue involving multiple criteria.

The topics covered in these lessons include:

(1) Global species and ecosystem diversity - value - status - threats with local emphasis.

(2) The Front Range conservation area system --its effectiveness in maintaining biodiversity, methods for strengthening it, and its relationship to regional human population growth patterns.

(3) Socioeconomic, political, and cultural aspects of biodiversity conservation.

(4) Student field projects, improved design of the conservation area system, and participation in community-based conservation efforts.

Sample questions in the lessons include:

- What is more important in terms of defining conservation areas: Availability of open space, political pressure, land development pressure, or some other factor? Why?
- What areas of Denver are underrepresented by protected land? Why?
- What animals and plants are the most threatened?

Debbie Lerch-Cushman of the Colorado Division of Wildlife, explaining her "Bottleneck Genes" lesson.

Image provided by the author.

Image provided by the author.

Teachers work through the GIs-based lessons at the first biodiversity workshop.

Examining aerial photographs of wetlands and urban development over time was key to several of the lessons.

Image provided by the author.

Meridian: A Middle School Computer Technologies Journal
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Volume 5, Issue 1, Winter 2002
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URL: http://www.ncsu.edu/meridian/win2002/515/2.html

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Teachers examine maps showing conservation areas, urban growth, and endangered species.

Images provided by the author.

Image provided by the author.

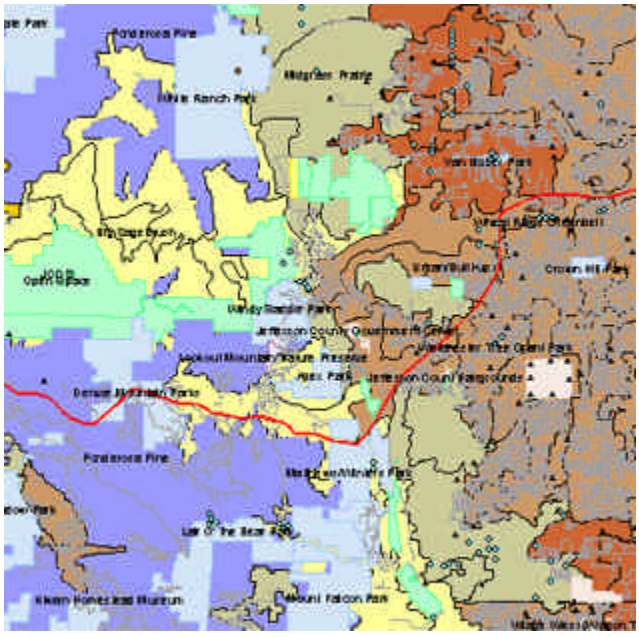
Karen Edgerly of the University of Colorado works through a lesson with participating teachers.

Image provided by the author.

Amy Lavender of the Colorado Natural Heritage Program produced all of the maps and digital spatial data for the project.

Image provided by the author.

Dr. Wilson Crumpacker, Principal Investigator, explains biodiversity concepts at the first workshop.



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A "first-of-its-kind" map of the Denver Metro Conservation System shows how the 8-county system of conservation areas, terrestrial and aquatic ecosystems, cities, and transportation corridors are spatially and functionally related.

a service of NC State University, Raleigh, NC
Volume 5, Issue 1, Winter 2002
ISSN 1097 9778
URL: http://www.ncsu.edu/meridian/win2002/515/3.html
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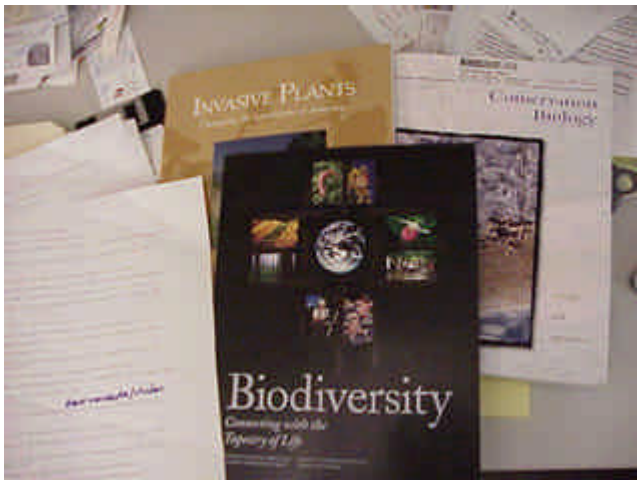

Workshop participants received a variety of biodiversity materials from the USGS and elsewhere.

Images provided by the author.

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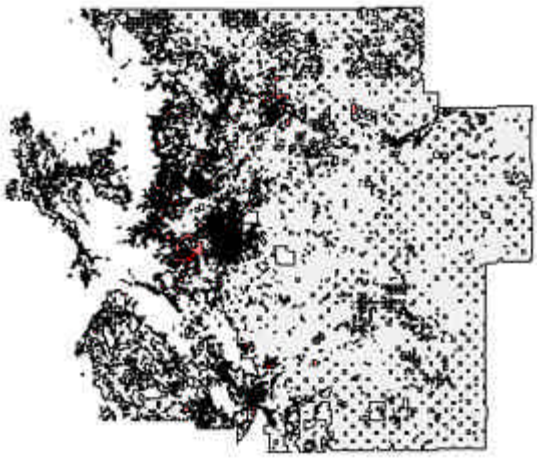
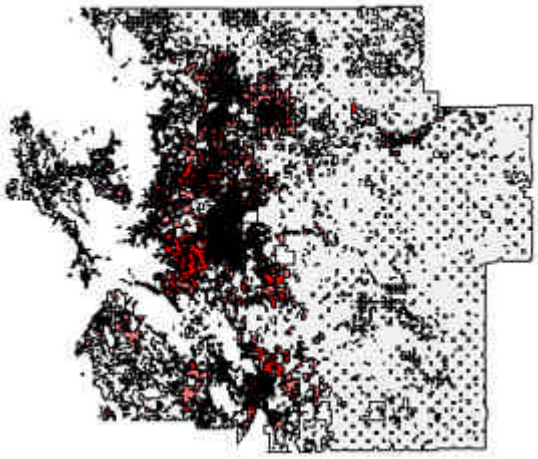
Joseph Kerski from the US Geological Survey helped develop lessons, provide data, and train teachers.

Students can examine growth of the Denver area from these population density maps from 1960 and 1990, produced from data generated for this project.



This project was and continues to be worthwhile because digital and scientific data were shared, new spatial information was produced, geographic concepts were introduced to science education, and people from state and federal government, K12, and universities networked in new ways.



Images provided by the author.

About the Author:

Joseph J. Kerski serves as education outreach geographer at the US Geological Survey in Denver, Colorado, and as an instructor of geographic information systems (GIS) at the University of Denver. He conducts 40 educational workshops each year for educators on the integration of scientific data and investigations into the curriculum. He holds a Ph.D. in Geography with an emphasis on GIs and Geography Education.

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a service of NC State University, Raleigh, NC
Volume 5, Issue 1, Winter 2002
ISSN 1097 9778
URL: http://www.ncsu.edu/meridian/win2002/515/4.html
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