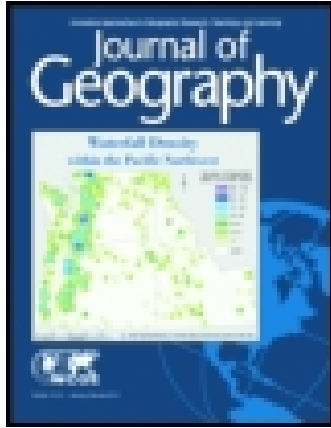


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Using a Local Greenway to Study the River Environment and Urban Landscape

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Using a Local Greenway to Study the River Environment and Urban Landscape

Kirsten Lackstrom and Laura J. Stroup

ABSTRACT

Greenways are prominent features of many urban landscapes and synthesize several geographic topics: human–environment interactions, urban ecosystems, and the promotion of sustainability within riverine corridors. Greenways are easily accessible and provide an opportunity for students at various grade levels to study interactions across physical and human systems. Students can gain an appreciation of the natural and cultural resources located in a local river environment while building skills linked to the National Geography Standards. Greenway-related activities can be designed so that students practice the acquisition, interpretation, and integration of geographic information obtained from a variety of sources and methods.

Key Words: *greenway, river, water resources, human impacts, urban landscape*

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INTRODUCTION

Greenways provide an entry way for multiple education levels and audiences to study rivers and human impacts on river systems. Greenways are public trails generally located in protected open space and/or parks. They often follow water features and link natural and urban areas. Greenways can provide a unique and accessible space to investigate geographic relationships and improve understanding of how physical and human processes interact to shape riverine landscapes.

Communities develop greenways for multiple reasons, with implementation and specific goals varying according to the community's natural and cultural characteristics. In many areas, interest in greenways has coincided with ecological restoration and conservation efforts (Riley 1998). These landscapes demonstrate a range of resource management approaches, from highly engineered to restored natural systems. Objectives include the maintenance of wetlands and floodplains, preservation of environmentally sensitive areas in order to protect habitat and biodiversity, and restoration of water quality (Downs and Gregory 2004).

Greenway developments also have a human component and represent just one stage in a community's environmental and economic history. Greenways provide an up-close view of a river's built environment and close investigation may reveal the historical uses and alteration of a river system, that is, flood control levees, hydroelectric dams, canals for navigation, and water and wastewater treatment infrastructure. In the past two decades many communities have linked greenway development to the revitalization of downtown central business districts. Other communities have developed greenways as alternative transportation routes or recreational areas.

The impetus for this article comes from our participation in a graduate-level course designed to research the physical and human features of the Columbia, South Carolina, riparian environment. The project's objective was to provide an environmental and historical perspective on the importance of the Saluda, Broad, and Congaree Rivers for the Columbia region. With the Three Rivers Greenway used as a platform for investigation, students prepared a walking field trip and related materials (booklet, posters) for attendees of the Binghamton Geomorphology Symposium in October 2006.¹ Although this particular experience occurred in the context of a graduate program and academic conference, we contend that geography teachers can adapt this project for many educational levels as an integrative assignment. Insights gained from our experience indicate that greenways are an accessible venue to a river environment, provide opportunities for students to utilize a range of geographic methods and techniques, and can enrich existing learning approaches centered on environmental issues.

This article is organized as follows. First, we discuss the challenges of studying river systems and discuss other learning projects that similarly address rivers, water resources, or urban landscapes. Second, we highlight the benefits and opportunities a greenway-related project can offer geography teachers and students. Third, we suggest several topics that can be investigated through a greenway, or broader-based river or urban landscape, study. Activities are divided by educational level and incorporate the National Geography Standards (Geography Education Standards Project 1994). To conclude, we identify linkages between current research needs, as identified by river specialists, and the potential

lessons to be learned about nature-society interactions through experiences such as a greenway-centered study.

LEARNING ABOUT RIVER ENVIRONMENTS AND HUMAN IMPACTS

The complex nature of environment-society interactions makes teaching and learning about such interactions a challenging proposition. Both physical and social sciences are required to understand environmental processes, yet traditional academic disciplinary divisions have often lacked the necessary integration to investigate the linked physical and human aspects of river systems. Kimmel (1996) advocated the use of rivers as a basis for teaching about multidisciplinary environmental issues. Such a study can integrate many of the National Geography Standards and incorporate various activities appropriate to geographic investigation. Easily researched subjects include river location, rivers as significant and defining features of places or regions, the physical environment and processes that shape a watershed, and environment-society relationships (e.g., what benefits do we receive from rivers, how do human activities impact and modify riverine ecosystems) (Kimmel 1996). A literature search, however, revealed few documented examples of water-related educational experiences and even fewer that integrated a range of geographic perspectives.

Several reports discuss methods that can facilitate learning about geographic relationships and are applicable to a study of a river environment. For a coastal morphology course, Mossa's (1995) students used data collected during a participatory field excursion in conjunction with secondary data sources to develop a field guide. This exercise not only provided opportunities for class discussions and interactions, but also resulted in a finished product that could serve as a resource for other students interested in the research area. While fieldwork is critical for helping students comprehend physical geography concepts (Ellis and Rindfleisch 2006), similar methods can be employed to appreciate the urban landscape. Martin (2003) developed a field study for a course on Atlanta's urban landscapes and emphasized that fieldwork studies need not occur in faraway places. Rather, field studies can be developed that take advantage of a home city or local area, and thus "provide students with the opportunity to understand concepts in a landscape in which they are already familiar" (Martin 2003, 36). Mayfield and Morgan (2005) examined how a river landscape developed into a popular or vernacular region and suggested that middle- and high-school students can explore the development of regional labels and perceptions through surveys, construction of mental maps, review of local publications, and Internet searches for references to the region.

Established approaches to geographic inquiry also can complement or be integrated into broader-based studies. Eflin and Sheaffer (2006) emphasize the merits of using a watershed-based approach to improve students'

understanding of environmental and sustainability issues. Local watershed concerns and related water management issues are often "specific to a landscape and steeped in sense of place" (Eflin and Sheaffer 2006, 36). The instructors organized a service-learning project where undergraduates worked with watershed stakeholders to develop community outreach materials. Students learned about the multiple layers of water resource management and planning, the frequent mismatches between physical and political boundaries, and the many ways that humans alter and impact natural processes. Similarly, Smith, Edwards, and Raschke (2006) discussed an undergraduate course that combined technology with inquiry-based learning to improve student understanding of human impacts on water resources. The course integrated data and information pertinent to water resources, geology, and human activities.

One drawback of the examples described above is that most of these educational experiences were conducted with college-aged students. Building on Kimmel's recommendations and the literature discussed earlier, the next section discusses how greenways can be used as a platform from which multiple educational levels can study a river environment.

LESSONS FROM THE THREE RIVERS GREENWAY PROJECT: BENEFITS OF USING A LOCAL GREENWAY FOR TEACHING AND LEARNING

To conceptualize the range of greenway developments around the country and the potential educational benefits of using a greenway as a learning tool, the authors reviewed information available from other regions. Appendix 1 offers links to organizations that maintain databases of trails and greenways. While we found that greenways are prominent features of many urban landscapes, the range of development varies greatly. Additionally, many communities use the term "riverwalk" rather than "greenway." While "riverwalk" may connote a highly urbanized environment, a relationship between the name and the type of development (i.e., focus on restoration of natural areas versus emphasis on commercial or cultural amenities) was not always immediately discernible. Such a determination would require a different type of study and was not the objective of this article. Greenway landscapes exhibit some of the following characteristics:

- highly built, commercially-oriented (San Antonio, Texas; Fort Lauderdale, Florida)
- restored natural areas, recreational amenities, access to cultural sites (Chattanooga, Tennessee; Columbia, South Carolina)
- restoration of the riparian corridor as a flood control strategy (Napa, California)
- park created to provide relief from urban stresses in the 19th century (Emerald Necklace, Boston, Massachusetts)

- extensive project designed to enhance natural, cultural, and recreational resources around the confluence of the Mississippi and Missouri Rivers (St. Louis, Missouri)

While greenway landscapes generally exhibit diversity in terms of their purpose and physical extent, we identified some common elements to support using a greenway as a learning tool.²

1. *Greenways provide opportunities to study interactions across both physical and human systems.* Within a greenway landscape, students can investigate a variety of geographic concepts based on the National Geography Standards, including:

- **The World in Spatial Terms:** Students can use a variety of maps and images to investigate a greenway's location and linkages within watershed or political boundaries.
- **Places and Regions:** Cultural features located along greenways may reflect the distinct human activities that occur along a waterway and provide clues as to how a river landscape can shape a region's identity (Platt 2006).
- **Physical Systems:** Hydrology, climatology, geomorphology, geology, and ecology all contribute to the formation and characteristics of a river system.
- **Human Systems:** Greenways can provide a venue to observe how rivers sustain a wide range of economic activities by providing suitable conditions and sites for agriculture, industry, trade and transportation hubs, and recreation.
- **Environment and Society:** A greenway may exhibit the different ways in which rivers benefit humans by providing services such as food and water supply, water purification and waste assimilation, flood mitigation, nutrient transport, aesthetics, and biodiversity (Platt 2006; Postel and Richter 2003; Chin 2006; Gregory 2006). At the same time, a greenway can allow students to analyze how human activities alter or degrade these benefits, for example, through pollution, the alteration of river channels, the construction of dams and levees, and the introduction of nonnative species (Postel and Richter 2003, Graf 2006).
- **The Uses of Geography:** Students can investigate the changes that have occurred in the human uses of the river and adjacent land-based resources. Historic sites are often located along rivers and shorelines (Fabos 1995), and students may be able to observe aspects of a community's development that are imperceptible from other vantage points.

2. *Greenways allow students to engage in a variety of learning activities and expose students to an array of geographic methods.* Greenways allow students to study both the physical and human aspects of a river environment. Although particular methods often predominate in different geographic subfields, a comprehensive study of a river system would expose students to the diverse methods of geographic inquiry and give them an opportunity to practice integrating various approaches. A study of physical processes might include quantitative data derived from stream or groundwater gages or precipitation records from local weather service offices. A study of human systems or human-environment interactions might include both quantitative (e.g., population figures, land use/land cover statistics) and qualitative (e.g., histories, personal accounts) information. Students could also learn how to acquire and interpret data provided by different sources and in different formats (e.g., maps, satellite images, aerial photography). Significantly, teachers also can include a field study component, where students gather information through direct observation or fieldwork on the greenway.

Appendix 2 provides a list of links to national-level agencies and organizations which work in river environments or with water management more generally. These links can serve as a starting point to explore the multitude of resources available and relevant to geographic studies. While the Internet is increasingly used for research purposes, students also will benefit from searching local and state libraries, historical societies, and archive collections for books, photos, maps, diaries, reports, and periodicals.

As a greenway project lends itself to a potentially wide range of topics, classes could divide into small groups in order to focus on several aspects of the river environment. More advanced students (middle-school students and above) can be given responsibility for determining how best to present their river study as a unified product. Students also can explore the most appropriate ways to display spatial information that they have collected, through different kinds of maps, graphs, and charts. Final projects could be presented as posters, PowerPoint presentations, a class anthology, or a field guide for subsequent students or audiences.

3. *Greenways provide access not only to the riparian environment but also to other community resources as well.* A greenway does not have to be the focal point of study or primary destination. Rather, it can provide access to a portion of the riparian environment or be integrated into a related field trip activity. As many greenways are developed in conjunction with urban revitalization—or ecological restoration—projects,



Figure 1. South Carolina State Museum, a renovated textile mill, adjacent to the Three Rivers Greenway, downtown Columbia.

open space, parks, and educational opportunities are often located adjacent to or in the vicinity of a greenway. For example, the Three Rivers Greenway in Columbia features the South Carolina State Museum (located in a renovated textile mill; see Fig. 1), EdVenture Children's Museum, and an outdoor amphitheater. An environmental education center, focused on the river ecosystem, was located upstream on the Saluda River with long-range plans to connect to the greenway through a regional trail system. All are popular field trip destinations, particularly for elementary and middle-school students. While primarily used to support science and social studies curricula, a field trip to these venues could also include a river study or visits to nearby, lesser known historic sites, such as the Columbia Canal dating from 1824 (Fig. 2), the city's original waterworks built in 1906, and a hydropower dam used by nearby textile mills dating to 1895.

4. *Greenways allow students to apply geographic concepts to their local community and environment.* One advantage of using a greenway to launch a river

or regional study is that each greenway—and accompanying river system—has a unique environmental and economic history. Lessons and activities can be adapted so students can reflect on their community's interests and values regarding water resources. Students can gain a richer understanding of their region's history and the important role rivers can play in the development of a place or region. Students can also learn about a wide range of locally-based natural, cultural, and information resources. High-school and college students, often required to perform service hours, may be able to participate in activities such as stream clean-ups. After completing a greenway- or river-project, students could make presentations to community groups, civic leaders, or younger children. This may be an additional skill-building exercise as students learn how to present information tailored to diverse groups and age-appropriate levels.

GREENWAY ACTIVITIES FOR DIFFERENT EDUCATIONAL LEVELS

This section presents ideas for greenway-related activities relevant for different educational levels. The authors drew upon their experience with the Three Rivers Greenway field excursion, the literature review, and the National Geography Standards (Geographic Education Standards Project 1994). The aim was to link resources available through a greenway to exercises that would: (1) advance students' geographic skills and proficiencies and (2) promote field-based studies or excursions. Table 1 specifies content areas accessible through a greenway and activities appropriate to different educational levels.

Elementary Education

For this education level, a greenway can best be used to supplement other field trip activities and be integrated with other subject areas. A local greenway could be part of a field trip stop to observe a river ecosystem or the human structures and activities that characterize the river landscape. A science unit could include a case study of the different animal and plant species that live in or along the river. A social studies unit could evaluate the role of the river in the state's or nation's history. For example, many East Coast cities were established along the Fall Line, cities in the Midwest grew along major river transportation routes, and the alteration of rivers for irrigation played an important role in the development of the western United States. The elementary-level content areas focus on regional hydrology, human uses of the river, and river ecosystems.

Middle School

Middle-school students should be able to undertake a more in-depth study of the physical and human processes that shape a river environment. A third activity would require students to integrate knowledge about physical



Figure 2. Historical dam and canal structure dating to the 19th century, located on the Three Rivers Greenway.

and social processes in considering flood hazards and management. The geographic themes presented for the middle-school level are intended to complement earth science, as well as state (or U.S.) history, curricula. Agencies involved with various aspects of river and hazard management—regional offices of the U. S. Army Corps of Engineers or U. S. Environmental Protection Agency, local emergency officials, and water utilities—may be able to supply educational resources relevant to the river-based studies described in Table 1.

Teachers also could adapt these activities to secondary courses focused on the earth sciences or environmental studies. High-school students should demonstrate more sophisticated understanding of physical and social processes and ability to interpret geographic information through exercises requiring hypothesis-development, comparative case studies, or policy analysis.

Advanced Placement (AP) Human Geography

AP Human Geography teachers can use a greenway to supplement readings and activities related to two of the major content areas: (1) Industrialization and Economic Development and (2) Cities and Urban Land Use (College Board 2007). Through a greenway project students can analyze the features of a local landscape, observe current trends in urban planning and development, and develop a deeper understanding of the economic history of an urban

area and its environs. How a greenway project is integrated into an AP Human Geography course may depend on the purposes for which the greenway was developed. Where ecological restoration has been a major factor in driving greenway development, students may have an opportunity to investigate the impacts of urbanization on pollution levels, regional biodiversity, and overall quality of life in the community. In locales where urban amenities have been emphasized, students can trace the efforts to revitalize downtown neighborhoods and businesses (Bryant 2006) or assess how landscape changes along the greenway reflect broader-based economic trends or shifting demographics in the region.

A third option for AP students would entail a history of the greenway movement, using their local greenway as a case study. Despite the current, widespread interest in greenway development, such landscapes are not a new idea. This unit could include an investigation into

the history of landscape architecture in the U.S., or within the students' region. Domestically, during the mid- to late-nineteen century, landscape architecture and the development of public parks represented a reaction to urbanization, overcrowding, and poor living conditions (Walmsley 1995; Fabos 2004). From about 1900 to 1945 landscape architects developed open space and park plans to guide urban development (Walmsley 2006; Fabos 2004). In the 1960s and 1970s increased environmental awareness led to interest in protecting river corridors and to the recognition that green spaces could enhance economic development and a community's aesthetics. The last twenty years have witnessed additional growth of the U.S. greenway movement. Two publications, the U.S. President's Commission on American Outdoors Report (1987) and Charles Little's *Greenways for America* (1990), contributed to the increased interest (Fabos 2004).

Advanced high school students should be able to employ, and integrate, a variety of geographic tools and methods. A field study of the greenway can be supplemented by historical documents and images, maps produced for different purposes and during different time periods, economic and population data, and land use/land cover information.

Undergraduate Project

A greenway project at the college level could be relevant to a number of undergraduate geography courses,

Table 1. Sample greenway activities by educational level.

Elementary School

Theme 1: Regional Hydrology

- Use the greenway as a starting site from which to place your community within its local and regional watershed.
- Have students use maps to identify major rivers, determine watershed area, and calculate river length.
- Students can learn about streamflow, how it is measured, and why it varies at different sites and seasons by reading hydrographs.
- Make connections between the water cycle and regional water availability and demand.
- Students can also learn how natural events (storms, drought) and human modifications (dams) affect regional and local hydrology by using charts, graphs, images, and newspaper accounts.

Theme 2: Human Uses of the River

- Discuss how the community uses the river and for what purposes: irrigation for agriculture, water supply, habitat protection, recreation, navigation and transportation, hydroelectricity.
- Identify the various ways humans modify the river through built infrastructure such as canals, dams, levees, bridges, and water and wastewater treatment plants. (Water utilities often have educational programs and offer tours of their facilities for students to learn about local water and wastewater treatment.)
- Trace the evolution of transportation technology and infrastructure; technologies could range from dugout canoes to steamboats; infrastructure includes canals constructed to facilitate navigation and the extensive railroad networks that made transport of goods and resources faster and more efficient. Students can learn how transportation routes linked regions and created centralized trade hubs and explore how their community participated in the country's economic development.

Theme 3: Ecosystem Study

- Discuss river habitats, the species of plants and animals that live on your river, and the conditions they need to survive and flourish.
- Identify indicator species; endangered species, invasive species (and their impacts on biodiversity).
- Learn about river management and efforts to conserve natural resources (e.g., through construction of fish passage facilities, establishment of natural areas and wildlife refuges).

Middle School

Theme 1: How Physical Processes Shape the River Environment

- Describe and analyze the hydrological, meteorological, and geological processes (e.g., weathering, deposition, erosion) that have created and shaped the river system.
- Identify and describe regional geologic features through aerial photography, satellite images, and topographic maps; describe how and when they formed, the types of raw materials and soils prevalent in the region.
- Describe the different processes involved in the location and movement of water; understand connections between surface-water drainage basins, wetlands, and groundwater resources.
- Explain how natural riparian corridors benefit a river environment (e.g., by improving water quality, recharging groundwater, reducing downstream flooding, preventing soil erosion, enhancing native biodiversity and wildlife habitat).

Theme 2: How Human Actions Shape the River Environment

- Explain how human activities threaten riparian habitats through floodplain development, pollution, storm water runoff, exotic and invasive species, and dam operations.
- Identify sources of water pollution (agriculture, industry, domestic waste, transportation) and evaluate or develop reduction strategies.
- Describe the services provided by wetlands and understand the environmental history behind their destruction (drainage for agriculture, urbanization) and more recent restoration efforts.

Theme 3: Managing Natural Hazards

- Describe the natural phenomena—weather events and climatic conditions—that produce flooding hazards.
- Explain how and why humans are vulnerable to flooding hazards.
- Compare the advantages and disadvantages of various flood control approaches; options could range from soft engineering and corridor restoration approaches to armored or covered concrete embankments and channels. Evaluate features of the built and natural environment across different time periods in terms of flood vulnerability.
- Trace historic flooding events and compare impacts and responses in the community through newspaper and personal accounts.

AP Human Geography

Theme 1: Industrialization and Economic Development

- Trace the river's role in the economic history of the community and region; analyze the benefits provided by the river for transportation, trade, industrialization, energy production, recreational businesses.

(Continued on next page)

Table 1. Sample greenway activities by educational level. (Continued)

- Evaluate the impacts of industrialization on the river environment and on the community or region as a whole.
- Assess how proximity to the river has affected current—and historic—land values and locational decisions.

Theme 2: Cities and Urban Land Use

- Research how and when urbanization occurred in the community or region; compare local examples with national patterns.
- Conduct a landscape study using the greenway as a starting point; identify and assess landscape features from past decades or centuries; investigate their history as well as their current status—how do they reflect changing communities, economies, and populations; evaluate how the community has rehabilitated or revitalized infrastructure, neighborhoods, business districts.

Theme 3: The Local Greenway as a Case Study

- Trace the history of the greenway movement through its different phases; investigate the history of landscape architecture.
- Place the local greenway within the broader historical context of urban and landscape planning; create an environmental history of the community; consider how uses and perceptions of the urban (including the greenway or river) environment have changed through time.

including those pertaining to water resources, landscape studies, economic or urban geography, natural resources, environmental history, and regional planning. An instructor can tailor a greenway study to course objectives by adapting many of the activities described above to more advanced students. A water resources course could use a greenway to focus on connections between hydrological processes and human activities, strategies to reduce non-point source pollution, or impacts of dam operations on downstream ecosystems. In a cultural landscape course, students could assess the evolution of a river landscape in response to changing economic or social conditions

or consider how the greenway serves as a public space. Additionally, a greenway assignment can be used to promote a collaborative working environment among diverse students.

In terms of course design, the instructor should organize an early field excursion to the greenway so that course participants can brainstorm potential topics, identify the most appropriate and relevant topics based on the greenway's features, determine how topics would flow together, and divide into teams based on common interests or expertise and to reduce duplication of effort. Although each individual or team is responsible for a singular component

of the overall project, class members should be encouraged to provide feedback to one another, thus allowing students to practice integrating the various methods of inquiry used by geographers.

Students can develop posters, presentations, or a field guide for community residents, future students, or visitors to participate in formal or self-guided trips. For the project to commence in an efficient manner, the instructor or a class participant should develop a format in a program such as Microsoft PowerPoint to ensure a uniform layout and design in the final, collective product. Posters or a field guide can serve as visuals and talking points during the execution of a field trip. Final production will depend on the purpose and potential longer-term use of the project. Posters can be displayed within a classroom or academic department to serve as a record and continuing education resource.

Community Goals for The Three Rivers Greenway
The Columbia Riverwalk
 Laura Stroup and Kirsten Lackstrom

The Three Rivers Greenway is an ongoing project of the Columbia River Alliance, a regional public-private partnership seeking to utilize the Broad, Saluda, and Congaree Rivers for public benefit. The 19.3 km (12 mi) linear park system was first proposed in 1996, and the first segment was completed in November 1998 at Granby Park. The project has been financed by tax increment districts in Cayce, West Columbia, and the Congaree Vista and through federal funding.

Columbia Greenway Objectives

- Improve recreational opportunities on and off the rivers
- Preserve the natural riverine environment and watershed health
- Strengthen residential communities in the downtown area
- Promote Columbia's river-related history

Greenways serve multiple purposes, and communities must find a balance that best addresses their needs.

Greenway Importance to Columbia

The Three Rivers Greenway is a key component of the revitalization of the Congaree Vista. Important projects include the downtown infill with residential and commercial development, a USC research campus, and museum cluster.

References:
 Deane, P.V. and J.A. Grigg. 2004. River Channel Management: Towards Sustainable Catchment Hydrosystems. London: Oxford University Press.
 Edwards, J.L., 2006. The relationship of historic city form and morphology patterns: implications for transportation. Department of Urban and Environmental Design (Canada), Landscape and Urban Planning, 06/2006. 100-124. http://www.cmu.edu/urbanplanning/pubs/2006_06_2006_CityFormPlanning.pdf
 National Geographic Society. 2004. A Guide for Planners, Policymakers, and Citizens. Washington, D.C.: Island Press.
 Rice, A. 2004. <http://www.missouri.edu/~cedmiller/river.htm>
 South Carolina Department of Archives and History. 2003. <http://www.southcarolinahistory.com/> (accessed November 11, 2003).
 The View on the River. 2006. <http://www.viewontheriver.com/about-us.html> (accessed December 26, 2006).

Figure 3. Sample poster created for the Three Rivers Greenway field excursion.

For other students and audiences, they provide an innovative application of a broad geographic study related to the local region. If standardized and presented as a cohesive set, such posters are visually pleasing and encourage the casual visitor to view them as a group (Fig. 3). Depending on financial resources, field guides can be printed or provided in a format that can be displayed by community groups on their Web sites.

LINKING A GREENWAY STUDY TO SUSTAINABILITY ISSUES

This article demonstrates the advantages of using a greenway and river environment to develop a collaborative activity appropriate for multiple educational levels. Greenways can facilitate efforts to improve students' geographic skills and proficiencies in several ways. First, several key themes in geography can be introduced and linked in an innovative fashion, in particular environment-society interactions and human impacts on the environment. It is nearly impossible to find a river system that has not been affected by human activities. Humans and nature are inseparable and interconnected within the fluvial landscape (Graf 1996). Second, greenways can provide access to a local river environment and/or an urban landscape, and thereby allow students to participate in field-based activities. Such activities could be easily modified for diverse communities, courses, and/or audience levels. Third, a greenway study provides an opportunity for students to learn about the local landscape, discover resources available at the local and regional level, and explore an array of data sources ranging from individual fieldwork and observations to stream gage data to historical accounts taken from personal diaries. Finally, activities can be tailored to individuals, for small collaborative groups, or to an entire classroom. Teachers thus have flexibility to adapt the project to student abilities or to other curriculum standards and requirements. For example, a greenway project could complement an earth science unit, ecosystem study, or regional economic history lesson.

This study also suggests that a greenway-river project as elaborated here can effectively lend itself to the study of sustainability issues. Sustainability generally refers to the

use of resources that minimize damages to environmental and social systems and also strives to ensure the availability of those resources for future generations. Academic interest is growing in the emerging field of sustainability science, which focuses on the "dynamic interactions between nature and society, with equal attention to show how societal change shapes the environment and how environmental change shapes society" (Clark and Dickson 2003). Sustainability science necessitates integration of multiple areas of expertise and collaboration across disciplinary boundaries (James and Marcus 2006; Gregory 2000).

As public awareness of impacts on the environment continues to grow, interest in promoting sustainable urban environments has increased. Communities have come to recognize the ecological, as well as socio-cultural, benefits of restored natural landscapes for urban residents (Platt 2006). In fact, themes evident in discussions of urban sustainability parallel the greenway movement's interest in ecological restoration, improved quality of life, and the linking of cultural and physical components of river systems. Using the National Geography Standards as a foundation, a greenway project could effectively allow students to practice integrating the diverse interests, perspectives, and methods relevant to natural resources management. As students chronicle the history of human uses of a river system, they can gain invaluable insight into a region's environmental history, observe empirically how their community balances multiple uses and goals, and link their findings to current concerns about promoting sustainable urban landscapes.

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APPENDIX 1: GREENWAY RESOURCES AND INFORMATION

These organizations and Web sites offer information about many kinds of multiuse trails, including greenways, and are a good starting point to research resources available in your area. Many of the database entries offer comments regarding possible safety and/or access issues. We would advise teachers to investigate a greenway route personally in preparing for a student trip to ensure that the environment is safe and the terrain accessible and appropriate for the planned activity.

Organization	Links
American Trails	<p>http://americantrails.org/</p> <ul style="list-style-type: none"> • Provides information on a wide-range of trails (from backcountry to urban) and diverse activities (hiking, biking, horseback riding, skiing, paddling) <p>http://americantrails.org/resources/statetrails/index.html</p> <ul style="list-style-type: none"> • An online directory of trails and greenways, searchable by state and then subdivided by trail category (e.g., biking, paddling, hiking); provides links to statewide agencies, organizations, and trail-related resources, but does not necessarily give a comprehensive list of a state's entire inventory of trails or greenways <p>http://americantrails.org/resources/greenways/index.html</p> <ul style="list-style-type: none"> • Information specific to greenways; highlights specific projects
Rails-to-Trails Conservancy	<p>http://railstrails.org</p> <ul style="list-style-type: none"> • Focuses on preservation of unused rail corridors and transformation into trails, creation of trail networks • Promotes trails as alternative transportation routes as well as the recreation benefits • Provides technical assistance to communities interested in trail building <p>http://www.trailink.com/</p> <ul style="list-style-type: none"> • Provides a database of over 1,400 trails and greenways • Users can search by city and state, sort by type of activity available on the trail • Entries include trail descriptions, surface type and trail length, maps and directions; some have photos and reviews submitted by trail users
National Park Service	<p>http://www.nps.gov/ncrc/programs/rtca/</p> <ul style="list-style-type: none"> • The Rivers, Trails, and Conservation Assistance Program provides assistance to local and state organizations in developing conservation and recreation space, trails, and parks <p>http://www.nps.gov/ncrc/programs/rtca/whatwedo/wwd_2008_proj.pdf</p> <ul style="list-style-type: none"> • Lists 2008 projects and partners, landscapes range from urban to rural

APPENDIX 2: SUGGESTED RESOURCES FOR GREENWAY-RELATED LEARNING ACTIVITIES

This list is intended to demonstrate some of the ways in which greenway-related activities can be connected (1) to the National Geography Standards and (2) to resources that provide data, already-developed learning activities and modules for different educational levels, and links to comparable state and local agencies.

Examples of Greenway-related Activities and Relevant National Geography Standard(s)	Suggested Resources
<p>The World in Spatial Terms Standard 1</p> <ul style="list-style-type: none"> • Determine location of the greenway, city, or watershed • Describe connections with other town, cities, regions; measure a land or water route 	<p>United States Geological Survey (USGS):</p> <p>http://water.usgs.gov/wsc/map_index.html Science in Your Watershed: locate your local watershed, provides links to data sources (surface, groundwater) and local or state agencies</p> <p>http://ngmdb.usgs.gov/Other_Resources/rdb_topo.html Obtain links to paper and digital topographic maps, other maps and imagery</p>

<p>Understanding Places and Regions Standards 4, 12, and 17</p> <ul style="list-style-type: none"> ● Illustrate landscape changes through paintings, photographs ● Examine and compare populations, economies, cultural activities, and land use over several time periods 	<p>National Park Service: http://www.nps.gov/history/NR/twhp/descrip.htm "Teaching with Historic Places" offers activities and links to maps, readings, photos</p> <p>National Register of Historic Places: http://www.nationalregisterofhistoricplaces.com/ Database of historic and cultural resources; teachers and students can search by state and county</p> <p>U.S. Census Bureau: http://www.census.gov/</p> <p>University of Virginia: http://www.lib.virginia.edu/scholarslab/resources/index.html Provides listings of sites with geospatial and statistical resources; includes links to national, state, and local sources</p>
<p>Regional Hydrology Standard 7</p> <ul style="list-style-type: none"> ● Describe the characteristics and hydrology of the watershed ● Identify major geologic features and processes 	<p>USGS: http://waterdata.usgs.gov/nwis National Water Information System; obtain real-time data for groundwater, surface water, water quality</p> <p>http://water.usgs.gov/waterwatch/ Find current water resources and streamflow conditions by state, individual gaging stations</p> <p>http://ga.water.usgs.gov/edu/index.html Water Science for Schools; provides learning activities</p> <p>Environmental Protection Agency (EPA): http://www.epa.gov/students/ Student-oriented resources and activities</p> <p>http://epa.gov/watersense/water/drop.htm Water cycle-related activities</p>
<p>Flooding Hazards Standards 7, 14, and 15</p> <ul style="list-style-type: none"> ● Describe the natural phenomena—weather events and climatic conditions—that produce flooding hazards ● Explain how and why humans are vulnerable to flooding hazards ● Compare the advantages and disadvantages of different flood control approaches 	<p>National Oceanic and Atmospheric Administration: http://www.ncdc.noaa.gov/oa/climate/regionalclimatecenters.html Regional climate centers maintain databases, links to climate and weather information, state climate offices</p> <p>http://docs.lib.noaa.gov/rescue/dwm/data_rescue_daily_weather_maps.html Historical daily weather maps from 1871–2002</p> <p>USGS: http://www.usgs.gov/hazards/floods/ Information about flood hazards</p> <p>Federal Emergency Management Administration: http://www.fema.gov/hazard/flood/index.shtml Information about flood hazards, floodplain mapping, and management</p>
<p>Wetlands Study Standards 7, 8, and 14</p> <ul style="list-style-type: none"> ● Describe the services provided by wetlands ● Understand the environmental history behind their destruction and more recent restoration efforts 	<p>U.S. Fish and Wildlife Service: http://www.fws.gov/nwi/ National Wetlands Inventory provides links to maps, images, data, and student activities</p> <p>EPA: http://www.epa.gov/owow/wetlands/ A comprehensive overview of wetlands</p>

Human Impacts on River Environments

Standard 14

- Identify the various ways humans modify the river through built infrastructure such as canals, dams, levees, and bridges
- Explain how these modifications benefit humans and impact the river environment
- Identify sources of water pollution in your community (agriculture, industry, domestic waste, transportation) and evaluate or develop reduction strategies

Army Corps of Engineers (ACE):

<http://www.usace.army.mil>

ACE is involved in many water management activities including the construction of infrastructure (canals, dams, levees), environmental preservation and restoration (wetlands in particular), and natural disaster response

Bureau of Reclamation:

<http://www.usbr.gov>

Operates in the western half of the U.S.; helped to develop the West through construction of dams, power plants, canals; maintains hydrologic and meteorological database

EPA:

<http://cfpub.epa.gov/surf/locate/index.cfm>

“Surf Your Watershed” provides water quality and other environmental information

<http://www.epa.gov/owow/nps/>

Information about nonpoint source pollution, impacts on rivers and watersheds

River as a Resource

Standards 11, 16, and 17

- Describe the major uses of, and economic activities associated with, the local river; discuss how activities have changed throughout the community’s history
- Assess the built and natural features of the river landscape; how do these features reflect the interests and values of the community

State-level Resources:

Natural resource and environmental protection agencies, historical archives, university or college collections

Local-level (city, county) Resources:

Libraries, planning departments, historical societies, tourism bureaus, local chapters of environmental groups, newspaper accounts, diaries

NOTES

1. The 37th annual Binghamton Geomorphology Symposium was hosted by the Department of Geography at the University of South Carolina in October 2006. Entitled “The Human Role in Changing Fluvial Systems,” the meeting convened international experts specializing in nature-society interactions and focused on the geomorphology and hydrology of rivers. An important component of each Binghamton symposium is a local field trip related to the conference theme.
2. While this article focuses on greenways and riverine environments, some readers may be more familiar with other movements. For example, the Rails-to-Trails Conservancy focuses on the rehabilitation of railway corridors. These trails can offer similar opportunities to study human impacts on the environment and changes in land use over time, particularly as these trails are often developed with other open space initiatives and preservation of historic sites. Learning activities could focus on the importance of the transportation corridor to the economic history of the region or adapt other ideas presented here to utilize the locale’s resources.

REFERENCES

- Bryant, M. M. 2006. Urban landscape conservation and the role of ecological greenways at local and metropolitan scales. *Landscape and Urban Planning* 76(1–4): 23–44.
- Chin, A. 2006. Urban transformation of river landscapes in a global context. *Geomorphology* 79(3–4): 460–487.
- Clark, W. C., and N. M. Dickson. 2003. Sustainabilityscience: The emerging research program. *Proceedings of the National Academy of Sciences* 100 (14): 8059–8061.
- College Board. 2007. Human Geography: Course Description. http://apcentral.collegeboard.com/apc/public/repository/ap07_humangeo_coursedes.pdf (accessed July 15, 2008).
- Eflin, J., and A. L. Sheaffer. 2006. Service-learning in watershed-based initiatives: Keys to education sustainability in geography? *Journal of Geography* 105(1): 33–44.
- Ellis, J. T., and P. R. Rindfleisch. 2006. A coastal environment field and laboratory activity for an undergraduate geomorphology course. *Journal of Geography* 105(5): 216–224.

- Fabos, J. G. 2004. Greenway planning in the United States: Its origins and recent case studies. *Landscape and Urban Planning* 68(2–3): 321–342.
- . 1995. Introduction and overview: The greenway movement, uses and potentials of greenways. *Landscape and Urban Planning* 33(1–3):1–13.
- Geography Education Standards Project. 1994. *Geography for Life: The National Geography Standards*. Washington, D.C.: National Geographic Society Committee on Research and Exploration.
- Graf, W. L. 2006. Downstream hydrologic and geomorphic effects of large dams on American rivers. *Geomorphology* 79 (3–4): 336–360.
- . 1996. Geomorphology and policy for restoration of impounded American rivers: What is “natural”? In *The Scientific Nature of Geomorphology*, ed. B. L. Rhoads and C. E. Thorn, pp. 443–473. Proceedings of the 27th Binghamton Symposium. New York: J. Wiley and Sons.
- Gregory, K. J. 2006. The human role in changing river channels. *Geomorphology* 79 (3–4): 172–191.
- . 2000. Cultural Physical Geography. In *The Changing Nature of Physical Geography*, pp. 254–271. New York: Oxford University Press.
- James, L. A., and W. A. Marcus. 2006. Preface: The 2006 Binghamton Geomorphology Symposium on the Human Role in Changing Fluvial Systems. *Geomorphology* 79(3–4): 144–147.
- Kimmel, J. R. 1996. Using the National Geography Standards and your local river to teach about environmental issues. *Journal of Geography* 95: 66–72.
- Little, C. E. 1990. *Greenways for America*. Baltimore: John Hopkins University Press.
- Martin, D. G. 2003. Observing Metropolitan Atlanta, Georgia: Using an urban field study to enhance student experiences and instructor knowledge in urban geography. *Journal of Geography* 102(1): 35–41.
- Mayfield, M. W., and J. T. Morgan. 2005. The “oldest river” as an Appalachian popular region. *Journal of Geography* 104(2): 59–64.
- Mossa, J. 1995. Participatory field guides and excursions. *Journal of Geography in Higher Education* 19(1): 83–90.
- Platt, R. H. 2006. Urban watershed management: Sustainability, one stream at a time. *Environment* 48(4): 26–42.
- Postel, S., and B. Richter. 2003. *Rivers for Life: Managing Water for People and Nature*. Washington, D.C.: Island Press.
- President’s Commission of American Outdoors. 1987. Report and Recommendation. Reprinted as: American Outdoors: The Legacy, the Challenge. Washington, D.C.: U.S. Government Printing Office.
- Riley, A. L. 1998. *Restoring Streams in Cities: A Guide for Planners, Policy Makers, and Citizens*. Washington, D.C.: Island Press.
- Smith, J. M., P. M. Edwards, and J. Raschke. 2006. Using technology and inquiry to improve student understanding of watershed concepts. *Journal of Geography* 105(6): 249–258.
- Walmsley, A. 1995. Greenways and the making of urban form. *Landscape and Urban Planning* 33(1–3): 81–127.