A River Runs Through It: A College-Community Collaboration for Watershed-based Regional Planning and Education[1,2]

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Abstract

It is estimated that humanity now uses more than one third of all accessible freshwater within the global water cycle. The complexity of water related issues has led the Environmental Protection Agency — and many other organizations — to encourage adoption of watershed-based regional planning as one way to address the balance of development and environmental needs. College of the Atlantic, located on Mt. Desert Island on the coast of Maine, is in the gateway to Acadia National Park. The area receives almost five million visitors a year and exemplifies the ecological and social infrastructure challenges faced by many communities. Within this regional context, the College has developed a collaborative watershed-based curriculum and educational partnership involving a multiplicity of community organizations and leaders. A significant part of this project has been the creation of a watershed coalition — The Union River Watershed Coalition (URWC) — that has successfully brought together a diverse cross-section of stakeholders, citizens and organizations throughout Downeast Maine. Digital mapping technologies — in the form of geographic information systems (GIS), publicly-accessible databases, and other partnership projects — have become critical features for integrating economic development, ecosystem viability and cultural values. Lessons from the current project have applicability for collaborative approaches by other educational institutions, watershed regions and communities elsewhere.

Keywords: *watershed planning, community collaboration, public participation, geographical information systems, human ecology education*

Introduction

From a complex and varied history, the field of human ecology has emerged as a powerful organizing framework for interdisciplinary theory and practice. In its initial phase, human ecology began as a way of linking concepts derived from the ecological sciences to various sub-fields within the human studies, e.g. sociology, anthropology, geography, etc. (cf. Tengstrom 1985; Young 1983). In its next phase, human ecology jumped beyond these disciplinary origins to adopt a broad integrative perspective for guiding interdisciplinary theory, education and research (Borden 1989; Suzuki et al. 1991). In recent years it has further matured to a secure footing, with substantive applications to practical problems in highly complex, participatory policy and collaborative planning contexts — as evidenced in the contents of *Human Ecology Review*.

College of the Atlantic in Bar Harbor, Maine was one of the first institutions of higher education to embrace the broad mandate of human ecology. Since 1972, the College has pioneered a distinctive program of student-centered education, based on the collaboration and support of a non-departmentalized, interdisciplinary faculty. A second feature of COA's mission, since the outset, has been a "problem-centered" focus for creation of faculty and student teams. Over the years, this approach has proven highly effective — both for shaping the College's curriculum, and for engaging with local community issues in diverse partnerships (Rabineau and Borden 1991; Hall 1994; Clark 1997).

The purpose of this paper is to report on a long-term project of college-community collaboration in watershed-based regional planning. The project, now in its fifth year, has achieved a substantial level of success. It has become a major integrative theme for applied human ecological studies within the College. In the region, it has resulted in a broad-based, watershed coalition that has brought together citizens, community leaders and local organizations. The project's third dimension involves the benefits of a two-way collaboration between a college and its surrounding community for exploring computer-assisted methodologies and models that strengthen the mission and accomplishments of both. We be-

lieve that many of the ideas and tools from this initiative can be applied elsewhere — within educational institutions, in other watershed regions, and especially, in the places where similar partnerships are already taking form or could be fashioned.

Context: Earth, Land and Water

The world from outer space is a shining orb of water, land and clouds. Seventy percent of its surface is oceans. The global water cycle is a closed system, always in circulation. Solar energy produces evaporation and winds which lift the water vapor. Condensation from clouds releases rain or snow, 80% of which falls back into the oceans; the rest falls on land where rivers and streams collect and return it to the ocean. Water is the primary agent of erosion of the soil and shaping of terrestrial landscapes.

Nearer Earth, we see a living planet. Every living thing is made of at least some water, and needs water to live. The patterns of the living world are significantly tied to water and its relation to land. Isolation of land masses by water is a primary bio-geographical factor in evolutionary biology and the formation of species (MacArthur and Wilson 1967; Mayr 1982). Conversely, the separation of landscapes into watersheds (i.e., water surrounded by land) is one of the clearest bio-physical boundaries identified by ecologists (Golley 1993; Adler 1995; Stakhlv 1996; Kenny 1997; Tarlock 2000b; Barham 2001).

Ninety-seven percent of the Earth's water is in the form of salt water. Only 3% is fresh, and two-thirds of that is ice or in underground sources too deep to be tapped. The total amount of fresh water in lakes, rivers and accessible ground water available for terrestrial life — including human use-is less than one-half of 1% of the world's total water supply. About one-third of this renewal supply of water is now used by the six billion people on Earth. On average, a human consumes two and a half quarts of water and uses another 70 gallons per day — although this varies dramatically by region and lifestyle (Postel et al. 1996; Kuylenstierna et al. 1998; Gleick 2002, 2004).

Water and Watersheds in Human Consciousness

Evidence of early human habitation is most apparent along coastal plains and river valleys. About 12,000 years ago hunter-gatherers began to return to fertile river valleys; and by 7000 years ago humans had invented irrigation and stable agricultural societies. Water themes are widespread and prominent in the creation myths and cosmogonies of these early civilizations. The Babylonian moon goddess Ishtar was associated with sacred springs, and the River Ganges embodies the water of life for the Hindus. In Taoism — which emphasizes dynamism over substance reductionism — it is the metaphor of water that provides the most effective way to comprehend the balancing of yin and yang. As Lao-Tzu taught: "The highest value is like water, the value in water benefits All Things....And therefore is close to Tao." When the Ionian Greeks sought to explain the world in concrete rather than mystical terms, Western philosophy was launched by Thales of Miletus, who in 600 BC suggested that everything was made of water (Panchenko 1993; Wolpert 2000; Lee 2001).

The concepts of a watershed and watershed management have likewise been around since ancient times. The early civilizations of Mesopotamia, Rome and China understood and managed the watersheds of significant river systems. Native Hawaiians and Abenaki natives in northern New England organized their social structure on the basis of watersheds. For nearly two centuries, scientists and planners have advocated watersheds as a basis for resource management in this country (Adler 1995). Some countries, such as France and Australia, have structured some of their land-use planning and management decisions around watersheds or catchment basins (Bates 1995; Kettunen 2000).

But watersheds have never become a widespread resource management or planning unit in the United States. With a few notable exceptions, attempts to align public policy and legal structures with ecological boundaries in this country have long been frustrated. Major John Wesley Powell's 1878 recommendation to Congress to organize the new states in the arid west along watershed boundaries may be the most spectacular rejection, but other initiatives in the Progressive era, New Deal, and in the 1960s suffered a similar fate. With the possible exception of the Tennessee Valley Authority, most government efforts to connect social and legal structures to the ecological processes of the landscape were turned back by the overwhelming force of political inertia and the jealous guardians of states rights. As Dan Tarlock has noted, this separation of the legal and policy frameworks from the ecology of the landscape has tended to "detach rivers from their surrounding ecosystems" (Tarlock 2000a, 71). This detachment and failure to integrate land and water use have had significant ecological and social costs.

Despite this troubled history, the imperatives of the physical connection between water and the land it drains have caused a resurgence of the watershed concept as a valuable planning tool (U.S. Department of Environmental Protection Agency 1993). The considerable success of the 1972 Clean Water Act in reducing point source pollution of our nation's waterways has largely been offset by an increase in pollution from non-point sources (Council on Environmental Quality 1996). Today nearly 40% of our nation's waters are impaired. The EPA and state environmental agencies have recognized

the essentiality of watershed-scale approaches to manage non-point source pollution (U.S. Environmental Protection Agency 1996). In a similar way, preservation under the Endangered Species Act for aquatic species (particularly salmonids) has required other federal agencies to begin managing public lands on a watershed scale (National Research Council 1992). The Clinton administration's natural resource agencies thoroughly embraced this idea with its ecosystem and watershed management approaches to federal lands (National Research Council 1999; Stakhlv 1996).

However, unlike many of the earlier top-down models of watershed governance from the Progressive and New Deal eras, this modern watershed movement is a decidedly different cast. Even on federal lands these watershed efforts have tended to be decentralized, local, and stakeholder driven (Kenny 1997). Moreover, they were not just limited to publicly owned lands or dam-managed rivers. Citizen groups, state agencies, cities, and other stakeholders have begun to see the value of the watershed as a coordinating entity. Increasing interest in bioregionalism has also supplied a renewed practical and ethical vision — and the watershed movement seems to be emerging with a new vitality (National Research Council 1999; Council on Environmental Quality 1996; Tarlock 2000b).

Still, despite the financial and material support of the federal government in the 1990s and the inherent logic of land-use management on a watershed scale, old habits die hard and the political balkanization of our landscape makes it very difficult to realign governance structures along hydrographic lines. Nowhere is this truer than in New England. Unlike the south and west where there is some degree of regional planning simply by the fact of larger county-based land-use decision structures, New England remains a bastion of town-based, land-use control. Although both Vermont and Maine have imposed some state-level planning requirements, it is still the local planning board, selectmen, and town meeting that control the fate of the landscape. The scale of their purview seldom exceeds the six-by-six mile squares laid out by the colonial surveyors and rarely does it have any relevance to the ecological systems functioning on the landscape. In fact, major ecological features such as rivers or bays have tended, instead, to be used as clear separation lines *between* these distinct political entities. This is an apt description of the focus of this project — the watersheds of Downeast Maine.

The Human Ecology of Downeast Maine

The State of Maine is a landscape of mountains and dense forests etched by numerous rivers that reach deep into its interior. Before European settlement, the region supported well-established native populations of Abenaki, Passamaquoddy, and Penobscot. For centuries these groups migrated along these rivers, with established inland communities and summer fishing encampments along coastal shores and islands (Russell 1980; American Friends Service Committee 1989). Following the explorations of Samuel de Champlain in 1604, early English and French colonists began settlements on the most habitable of Maine's 5000 coastal islands. With time, they too moved inland along the major navigable rivers where today we still find most of the state's largest communities at the furthest upstream point, which could be reached by an 18th century schooner (Caldwell 1983). Historically, the state's economy has been based largely on forestry, fishing, manufacturing and mining. Until the late 19th and early 20th century — when the railroads, and later automobiles, could bridge the state's many rivers — the patterns of life followed the rivers. Since then, these dramatic features of the landscape have been progressively erased from human awareness, as well as from economic, political and environmental decision making.

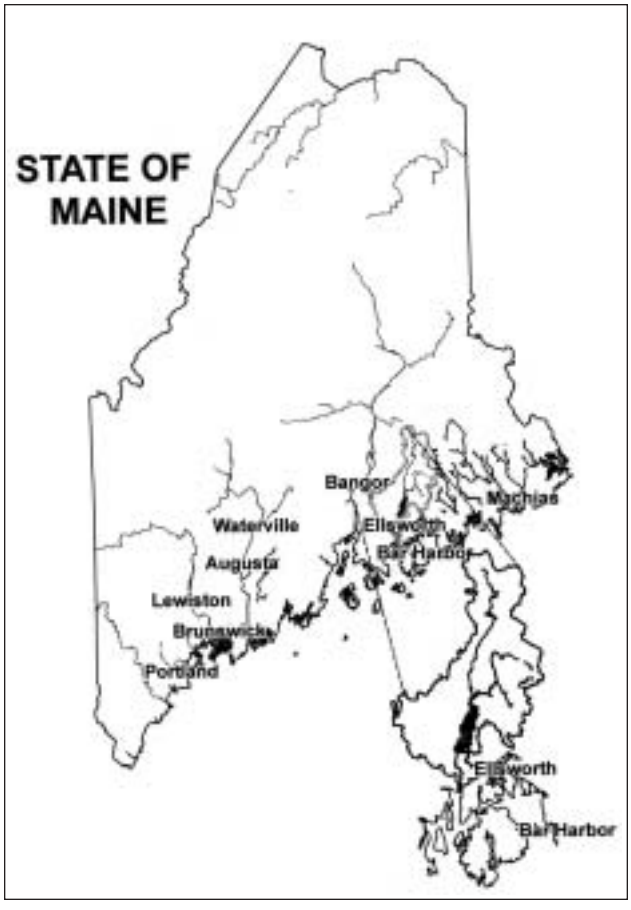

Figure 1. Union River and Acadia Region Watersheds

One of the most dramatic consequences of these historical changes has been the creation of "the problem of two Maines" (Barringer 2004). The advent of interstate highways has led to Maine's fastest growing economic sector: tourism. But virtually all of the state's tourist attractions — and dollars — follow the coastline. Inland towns and cities, most of which were thriving communities a century ago, lie off this tourist path and are struggling to survive. At the same time, the communities that do lie along major thoroughfares are themselves wrestling with issues of seasonal economic cycles, uncontrolled sprawl, and unmanageable 'gateway' entrepreneurism. In sum, where communities were once deeply integrated in the region's landscape, there now exists a profound schism between human affairs and the natural ecology of the region.

Watershed Based Regional Planning: A Return to Ecological Boundaries

Problems like these have made the idea of watersheds increasingly appealing in many sectors. On the national level, the U.S. Environmental Protection Agency has recognized that sprawl development is accompanied by negative environmental and economic outcomes. Because of this and the intractable problems of non-point source pollution, it has promoted watershed approaches to regional planning and management. This approach has also been endorsed by the National Research Council, the Nature Conservancy, and in Maine, by the State Planning Office and the Department of Environmental Protection. As a clear biophysical boundary on the landscape that exists free of social or political definition, watersheds are a crucial common denominator for ecosystem functions and management. They provide a bona fide ecological and geographical framework for research and practical on-the-ground boundaries for innovative regional planning.

The Role of Public Participation

Contemporary issues of watershed based planning require new forms of community interaction and often new social institutions that cross traditional political jurisdictions. In many cases, these must also become lasting institutions; and building them requires careful attention to citizen representation and involvement. The call for broader solutions to these interrelated problems has been a major stimulus for innovations in regional planning and natural resource decision making (See for example, Burch 1976; Sewell and O'Riordan 1976; Barber 1984). Development of methods for designing and implementing more coherent and holistic approaches — and issues of the fairness, legitimacy and representativeness of these methods — have become leading research areas for human ecologists (Webler 1997; Lauber and Knuth 1998; Raffensperger 1998). These questions have led to a growing sophistication about participatory processes in general, while also adding precision to comparison and evaluation of various methodologies (Halvorsen 2003; McKinney and Harmon 2002), special considerations and models for watershed approaches (Webler and Tuler 2001, 2003) and the significance of geographic scale (Grumbine 1994; Cutter et al. 1996; Cheng and Daniels 2003, 2005).

Many of these considerations have been incorporated into the curriculum development and community building strategies of this project. However, detailed discussion of the research issues themselves — including assessments and effectiveness of various methods and models utilized in this project — is beyond the scope of the present paper, but will be featured in subsequent publications.

The Setting: The Union River Watershed

The Union River flows out of the timberlands of eastern Maine and winds its way through a glacier-sculpted landscape of small towns and forests until it empties into the Gulf of Maine near Acadia National Park. The watershed of the Union River encompasses 550 square miles of a predominantly rural landscape. There are nearly 40 lakes in the watershed and several thousand miles of small streams. A section of the main branch of the river was dammed for hydroelectric power in the 1920s which creates an additional 12-mile long lake. At tidewater the character of the watershed changes as the river enters the town of Ellsworth, Maine. With a population of 6,500, Ellsworth is the watershed's largest municipality, and is the gateway to the heavily visited Acadia National Park. Ellsworth is under increasing development pressure as the service center for the surrounding area — replete with government offices, "big box" stores, and commercial strips. In many ways, the Union River watershed is a perfect microcosm of the State of Maine — with its generally poorer and undeveloped northern section with a historically natural resource based economy and a rapidly growing southern/coastal region with more wealth and concentrated commercial and residential development.

Rapid changes in both the rural and urban landscapes are altering the character of the Union River watershed. Open spaces are succumbing to increasing development pressure while large holdings of industrial forest lands (historically owned by paper companies) are being converted to smaller parcels, liquidation harvested, and developed as subdivisions. Such development has increased impervious surface area and altered natural drainage patterns and water quality. It also tends to fragment and degrade habitat for wildlife, and perhaps most significantly the development threatens to diminish residents' quality of life.

The faculty at the College of the Atlantic had started working with several towns and agencies in the Union River watershed in the mid 1990s. A few officials from state and federal agencies were also meeting to discuss natural resource issues in the region. The College initially attended these meetings as an additional technical resource. It became obvious to all participants that the issues confronting the region were broader than those represented around the table. With the support of the original agencies, the College brought a broader group of stakeholders together to discuss the range of issues affecting the region.

By sponsoring events that fostered non-traditional collaboration among natural resource managers, state and federal agencies, town managers and planners, major landowners, industry, private citizens, and nonprofit organizations, we were able to engender interest in a collaboration based on the ecological boundaries of the watershed, not around traditional political demarcations. Through use of College funds and Maine State Planning Office coastal grants, a watershed coordinator was hired to lend institutional support to the watershed level collaboration. In this process, many of the government agencies and institutions in the watershed began to gain a stronger understanding of the resources the College had to offer. Several course projects were designed to directly address watershed topics and students and faculty began to work with key people, town officials, and non-profit organizations located in the watershed. So on a very limited scale, we were able to test out our initial concepts for developing a curriculum that would simultaneously benefit the community, the environment, and COA students.

In December 2000, the catalytic work of the college culminated in a decision by the active stakeholders in the watershed to create The Union River Watershed Coalition (URWC). The Union River Watershed Coalition is a stakeholder group whose declared mission is to "provide leadership and assistance to organizations promoting the integrated social, economic and ecological values of the watershed." As a broad-based coalition of government, business, organizations, and individuals in the region and the only entity thinking on a watershed scale, the URWC was poised to play a unique role in the watershed.[4a]

College of the Atlantic's Watershed Project: Education and Collaboration

As noted above, the college had experimented with other models of community outreach and collaborative partnerships. In the early 1970s, it fostered creation of a "League of Towns" for facilitating communication and coordinated planning among officials from the four towns and Acadia National Park on Mount Desert Island (MDI) where the college is located. In the mid-1980s when GIS technologies became available, COA faculty and students expanded these partnerships and provided crucial "build-out scenarios" within an island-wide comprehensive planning effort. These collaborative functions continue under the guidance of *MDI Tomorrow*, a citizen-run forum for community studies and collaborative planning, which was also started through a college effort (Anderson et al. 1994, 1998; Howe et al. 1997). In 1989 the college sponsored an organization known as the ECO/ECO forum, a name combining the abbreviated words "economics" and "ecology." ECO/ECO's purpose was to afford Maine's business, environmental and state regulatory and political leaders a neutral setting to meet face-to-face to discuss differences and common interests. Supported by a grant from the U.S. Environmental Protection Agency, the forum evolved into the Maine Environmental Priorities Project (MEPP), which has carried out a comprehensive evaluation of threats to public health, the environment and the socio-economic quality of life in Maine (Koffman and Borden 1998).

Based on these successful models of community-college collaboration — one at the small-scale local level, and the other a state-wide initiative — the college's faculty, staff and students were eager to test new ideas within the challenges of a watershed-based regional framework. With support from town officials and stakeholder groups from across the watershed, the team applied for U.S. Department of Education funding to develop a watershed curriculum and outreach program focused on the Union River watershed. The College received the grant and began to implement the project. The goals of the project were:

1. to develop watershed studies as an area of concentration within the College of the Atlantic's curriculum;
2. to build community capacity for participatory regional planning and for community watershed education; and
3. to create an electronic network for GIS data sharing and interactive modeling for community land use planning.

The Watershed Curriculum

The operating premises behind the college's work on this project were threefold: (1) *hands-on learning* — a pedagogical belief that a curriculum that enables students to apply knowledge to real problems can provide superior training for the students; (2) *service-learning* — a commitment to use the talent and resources available at the college to benefit the people in the surrounding communities; and (3) *human ecological focus* — the planning, work, and analysis should be ecologically based.

During the grant period a full four-year undergraduate

Table 1. Courses and Watershed-based Student Projects

Representative courses:	
Human Ecology of the Union River Watershed	Community Planning and Decision Making
Advanced Seminar in Watershed Planning	GIS Modeling for Sustainable Landuse
GIS Modeling for Planning and Watershed Management	River Conservation
Practical Skills in Community Development	River Ecology
Environmental Education (water quality and watersheds)	Collaborative Leadership
American Cultural Landscapes	Hydropolitics in a Thirsty World
Environmental Chemistry: Water	Rural & Community Sustainability
Introduction to a Watershed Approach to Land Use Planning	Creating Commitment for a Cause: Marketing and Nonprofits
Selected individual and class student projects:	
Waterfront Redevelopment Plan for the City of Ellsworth	Land Use Planning & Community Development: A Road Show
Redesign of High Street Commercial Corridor	Taunton Bay Watershed Management Pilot Project
Union River Watershed education display and kiosk	A Comparison of Anadromous Fish Captured From a Stream on Mount Desert Island and in the Union River Watershed
URWC Mission graphic design posters	A study of the elevated incidence of breast cancer in the Union River Watershed
Conservation Feasibility Study: Union River Estuary	The Down East Rivers Land Trust: Land Protection in Eastern Maine
GIS maps of historic timber harvests	Application of CommunityViz software to zoning and conservation subdivisions in the Union River Watershed
Watershed Conservation Plan: Somes-Meynell Wildlife Sanctuary	A compilation of census data displayed as maps illustrating income, housing costs, rentals, and commuting times within the watershed
Source to Sea Curriculum Guide: Yuba River, California	Hydrological Models of the Major Watersheds of Hancock County
Outdoors in Hancock County: Environmental Program Assessment	
Using Conservation to Manage Growth in the Union River Watershed: A Case Study of Mariaville and Otis	

Note: A total of 38 new or revised courses were added to the curriculum and more than 100 individual or group projects were conducted.

curriculum was created through a combination of offering new courses taught by full-time faculty, re-designing existing courses to incorporate a watershed focus, and offering visiting courses taught by regional and national experts. New introductory courses like Community Planning and Decision Making and The Human Ecology of the Union River Watershed served as effective foundation classes for drawing students into the program during their first year at the College and stimulating interest in the program.

Expanding the course offering at the intermediate and advanced level, and the inclusion of geography and non-profit management classes proved to be successful in attracting broader participation from faculty colleagues and students from other related program areas such as conservation biology, environmental science, and education studies. Integration of Geographic Information Systems (GIS) directly into courses, such as Land Use Planning and Food Systems also got students using the technology sooner than they might have otherwise. This also demonstrated its power as an analytical tool and applied methodology to enhance decision making on a watershed scale. Other watershed-focused courses at the advanced level, along with expanded opportunities for independent study, internships, senior projects and graduate thesis research, have likewise enhanced the curriculum for upper level students.

Many of the new and redesigned courses worked directly with the URWC and individual watershed stakeholders to contribute to research and policy development issues in the watershed. These projects ranged from water chemistry studies, to graphic design displays for public watershed education, to multi-disciplinary planning studies that were later used by watershed towns in land-use and public policy decisions. In addition to class-based projects, individual students did exemplary work for watershed stakeholders through their own self-directed initiatives and in advanced-level independent studies. Certain advanced courses were opened to watershed stakeholders and other community participants where they could learn about issues of non-profit management, applications of digital mapping technology, or community leadership along-side College of the Atlantic students. These integrated courses proved particularly valuable for later collaborations, long-term relationships, and student learning.

Community Outreach

One of the biggest challenges facing the Union River and its accompanying watershed is that the river was largely invisible to the people in the communities through which it flowed. There was no formal or informal sense of shared stewardship or even a common interest among watershed residents. Many residents and visitors to the area did not know the name of the river, the extent of its reach, or its ecological, historical and social significance. At a very fundamental level a watershed is a physical entity, but as an idea it was outside of residents' consciousness. To a large extent, cre-

ation of watershed consciousness has been one of the biggest parts of the college-watershed coalition project. This change is both simple and radical. On the one hand, it requires little more than understanding the dynamics of gravity and a simple basin model; on the other, it asks people to see beyond generations of political lines drawn on maps and in their minds. The watershed concept helps to expand peoples' ordinary sense of reality. It draws attention toward a more human ecological perspective and suggests alternative approaches to problem solving and action.

The Union River Watershed Coalition was the primary mechanism for the College to engage stakeholders in the watershed. Since its inception, the URWC has grown to be widely respected for its ability to bring people together and for the forum it provides to share information and coordinate activities. The URWC has engaged organizations and individuals through a number of programs including a Baseline Study, volunteer water quality monitoring program, the Union River Watershed Spoken History project, watershed workshops for teachers in regional schools, youth programs, support for municipalities and planning initiatives throughout the region, speakers, radio features, public meetings, field trips, watershed awareness efforts, and community events. Projects such as the creation of a readily identifiable logo for the organization and placement of road signs throughout the watershed marking boundaries and major tributaries (both accomplished as student-community projects) have dramatically raised awareness of the watershed.

Although the URWC has grown to have its own identity, the College continues to provide significant support for staff and overhead for the organization. College faculty furnish oversight of the watershed coordinator's work and the URWC office is located at COA's Center for Applied Human Ecology (CAHE) — the primary research and outreach center for regional partnership activities.[4b] Over the term of the grant, the faculty and watershed staff helped develop the capacity of the URWC to govern its own affairs and the URWC has formed a steering committee made up of key watershed stakeholders. The watershed coordinator has raised additional funds for specific programs of the URWC, mostly through state watershed grants and private foundations. There are growing expectations that, as the coalition gains further community and financial support, it may evolve to independent, not-for-profit status.

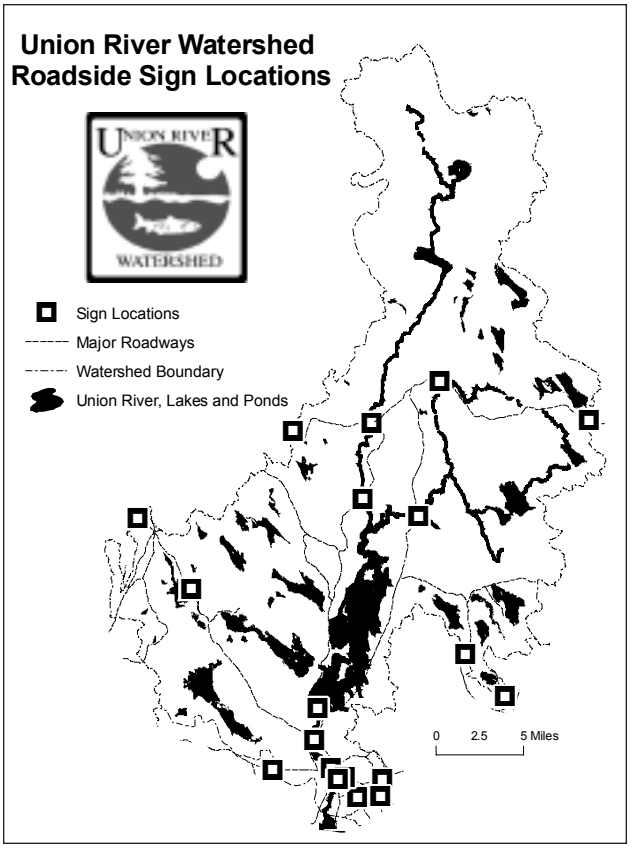

Figure 2. Union River and Acadia Region Watersheds

Technological Innovation and Support for Community-based Planning

Since the mid 1980s, the College has maintained a small, but sophisticated, Geographic Information Systems (GIS) laboratory with the capacity to provide state-of-the-art ESRI/ArcInfo GIS maps, spatial analysis, and modeling.[4c] The lab had a full-time director who taught classes, provided technical support for other classes, administered the lab and equipment, and oversaw outreach projects. Based on recommendations from external consultants, a GIS educator was hired during the second year of the Department of Education grant to broaden digital mapping skills among students and additional college faculty, and to investigate educational models used by other institutions to teach GIS. Consultant recommendations also encouraged us to hire a full-year visiting professor of geography to evaluate the contributions of that discipline for a watershed curriculum. Using these additional resources, we were able to offer a variety of expanded GIS workshops for faculty, students, and community members.

Opening classes and workshops to local stakeholders and community leaders strengthened our ties with local networks, and resulted in substantially more buy-in to collaborative work in the watershed and enhanced classroom discussions. GIS workshops for watershed community members have helped various stakeholders realize the potential applications of this software and of ways to use it within their own town planning efforts. Public access to the College's exten-

Table 2. Union River Watershed Coalition (URWC) Stakeholder Participation and Activities

A. Representative Partners (2001-2005)

Bangor Water District	Maine State Planning Office
Branch Lake Association	Natural Resources Conservation Service
City of Ellsworth	Osprey Guide Service
Downeast Chapter, Maine Audubon Society	PPL Maine
Eastern Maine Development Corporation	Riverside Cafe
Frenchman Bay Conservancy	Small Woodland Owners Association of Maine
Friends of Green Lake Nat'l Fish Hatchery	Trenton Elementary School
Green Lake Association	Union River Greens
Hancock County Planning Commission	Union River Healthy Communities Coalition
International Paper	Union Salmon Association
Maine Coast Heritage Trust	University of Maine
Maine Dept. of Environmental Protection	University of Maine Cooperative Extension
Maine Dept. of Marine Resources	US Fish and Wildlife Service
Hancock County Soil and Water Conservation District	Woodlawn Museum

B. Selected Activities (2001-2005)

- Non-point source pollution survey of a significant tributary of the Union River in commercial area of Ellsworth, Maine
- Human Ecological Baseline Study — a 5-year environmental and social data inquiry & monitoring project using volunteer monitors and researchers
- Watershed Festival for non-profits, businesses, community organizations, and government officials to learn about the Union River and watersheds in general
- Annual stream clean-up
- Union River Watershed sign project - installation of roadsigns at all major river crossings and at the boundaries of the watershed to raise awareness of the watershed as a feature on the landscape
- Land conservation projects with land trust coalition partners to protect significant river frontage and critical access points on the river
- Community watershed presentations to schools, non-profits, government agencies, municipal officials, and other stakeholders
- Website development
- Children's watershed placemat and activity sheet for local restaurants
- Spoken History Project interviews, presentations, trainings, and oral history transcriptions
- Educational brochure on the URWC & Card Brook
- Monthly business & presentation meetings
- Public canoe trips
- Weekly radio PSAs on watershed topics for local radio stations
- Girl Scout regional council watershed education event
- International, national and regional presentations on the URWC

Note: More than 115 regional organizations and businesses have been active stakeholders in the coalition

sive data base for the watershed was made available via a dedicated computer system at the public library in Ellsworth. This made geographic data readily available to interested citizens. However, further work with community members and teachers suggested that the distribution of "virtual watershed atlases" on CDs proved even more effective as a way to provide data and this technology in the community. By burning a CD that had watershed maps coupled with free GIS software, residents throughout the watershed could access information about the watershed from personal, institutional or business computers. Subsequently, the College has begun to develop a web-based GIS platform to further increase community access. Use of the visually and analytically powerful tool of GIS is no longer restricted to state agencies and wealthy developers. Town planning boards, citizen groups, students, and citizens across the region now have access to the same information about their watershed.

The College and its watershed partners experimented with some new computer-based planning tools. Through extensions to the GIS software program used by the college, we developed with the Maine Department of Environmental Protection a methodology for analyzing development suitability on the landscape. Graduate and undergraduate students at the College participated in developing and field-testing these models. In addition we have continued to explore experimental methods and modeling technologies, such as Community Viz, Map Junction, etc. These more advanced planning software systems have a growing utility to towns and some stakeholders. At their present level of development, however, they are not sufficiently user-friendly for volunteer citizen boards and non-profit organizations. Nevertheless, overall, these changing technologies have accelerated the level of community participation and sophistication in many ways, making collaboration between the College and the community — and within the community — a much more meaningful process.

Table 3. Community-based Technology Assistance, Workshops, and Networking (2001-2005)

Public Access to GIS: Explore your Watershed Using ArcExplorer
The College established a public access Geographic Information System (GIS) workstation in a local public library in the watershed. The workstation provides access to the watershed map layers using a software package called ArcExplorer. ArcExplorer is a free, easy-to-use program published by Environmental Systems Research Institute, Inc.
To further provide access to stakeholders and watershed citizens, the watershed data were placed on CD and given to interested individuals and groups. Over 100 CDs have been provided to residents, conservation and planning committees, students, and teachers.
Internet Mapping
The data and mapping capabilities of the "Explore your Watershed Using ArcExplorer" CD were subsequently published on-line in collaboration with the George Mitchell Center of Environmental Studies and Watershed Research at the University of Maine. http://h2o/arcims/website/acadia/viewer.htm Experimentation with public internet access continues through MapJunction©.
COA/DEP Collaboration on Suitability Analysis Methodology
The College in collaboration with the Maine Department of Environmental Protection developed a modeling process using ESRI GIS ModelBuilder capability and outlined a methodology to advance sustainable land use planning.
CommunityViz © Modeling for Local Communities
Students worked with Comprehensive Planning Committees and citizen groups to experiment with modeling software that can help local communities visualize future land-use and management scenarios.
Community GIS Citizen Training
College GIS staff and instructors held numerous community training sessions for educators, non-profit managers, municipal staff, and citizens on how to use ESRI GIS software and the college's watershed data.

Discussion and Wider Impacts

It is perhaps a truism that early human societies lived much closer to their sources of environmental support. Food, water and energy resources were consciously linked to the rhythms of everyday life. In the modern, industrial world these relations have been stretched beyond the boundaries of awareness, so much so that most people are no longer conscious of their own human ecological impacts. An important purpose of watershed-based models is to retrieve this knowledge and to remind us that we really do live in an ecologically, interconnected world. And thus, discovering these connections and learning how to guide and manage societal growth are essentially problems of education.

The project reported here is rooted in this assumption. But education about the relationships between watersheds and human affairs is complex and multi-layered. It requires an approach that goes far beyond individual learning. As a society, we must bring together and integrate a vast range of new knowledge. A truly human ecological perspective fits into all levels of education — from basic to advanced formal education, to education for decision makers and the public.

Over the past five years, faculty, staff and students from College of the Atlantic's Center for Applied Human Ecology have constructed a broad-based approach to these issues in the Downeast region of Maine. Within the College, a fully developed academic curriculum now exists for undergraduate and graduate students to create programs of study and career paths for themselves. In concert with the teacher education program, watershed ideas have been integrated into elementary and secondary curriculum studies — both within the College and in regional school systems. Through the activities of the Union River Watershed Coalition, a network of local decision makers and stakeholder groups has been firmly established that exemplifies this ecological framework. The two-way flow between the watershed coalition and the College has created a distinctive, mutually enhancing partnership. The quality of knowledge about watersheds and the capacity for collaborative planning have been dramatically enhanced through a shared application of innovative technologies. A growing on-the-ground awareness of the Union River is evident from roadway signage as well as in dedicated efforts of newspapers, radio, libraries and community events. Taken together, these varied strands are merging into a unified watershed perspective — not only toward existence of our local watersheds per se, but for long-term regional policy and planning issues.

It would be premature, at this stage, to declare an unqualified success. Nonetheless, many indicators are pointing in the right direction. The activities and achievements of this project have been a positive stimulus within the College itself. Since the project began, three endowed chairs have been funded — one in planning, another in government and polity, and a third in sustainability and green business leadership. At

least two more are near full funding. A solid core of faculty is established around the project's themes; and features of the model have influenced other program areas, such as international studies, teacher education and conservation biology. The College's partnerships are a permanent extension of our project-based pedagogy which is substantially enriched by local professionals. Students in the program have benefited directly by using their course work as preparation for advanced studies, while others have found opportunities for direct employment in related fields.

The inherently interdisciplinary and complex nature of the watershed initiative has also brought us in contact with a range of overlapping planning opportunities. Some of these are linked to other rapidly growing communities of interest on gateway communities, collaborative planning, sprawl, and smart growth — within Maine, nationally and internationally. These networks have added unforeseen ways for the college and the community to take part in dissemination of our own results and for learning about best practices elsewhere that reach well beyond our initial expectations. Within interdisciplinary education, for instance, COA has become a co-founder of the "EcoLeague" colleges. This is an innovative consortium of small, environmentally oriented colleges that share a commitment to project-based learning, and who support joint inter-institutional projects and student exchanges. Others include the national "River Network," the State of Maine's new "Smart Growth" forum, and the Society for Human Ecology.[5] The list goes on, but the point is that a wealth of new ideas is emerging. Moreover, the boundaries that define these new ventures are far more open than the traditional academic ones, which so long inhibited human ecology.

Paul Shepard (1967, 894) once declared that human ecology "will be healthiest perhaps when running out in all directions." This project confirms his belief. Our query into human ecology education has dissolved many educational boundaries. It has created bridges among areas of academic knowledge within the curriculum and crossed the borders between formal and public education. These new interdisciplinary and institutional relations have also demonstrated a meaningful conjunction of local and global concerns. In the end — by following a river, its watershed, and the water that falls within — a wider vision of humans and their place in the living world is disclosed.

Endnotes

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2. We greatly appreciate the consultation and evaluation support of James G. Speth (Dean-Yale School of Forestry and Environmental Studies; Robert Kates (Executive Director-American Association of Geographers; Dana Tomlin (Harvard University); Mark Sorensen (Principal-Geographic Planning Collaborative); Christopher Kroot (Maine Office of GIS).
3. Authors to whom correspondence should be directed: E-mail: rborden@coa.edu or ksc@coa.edu.
4. For additional project information see:
   a. The Union River Watershed Coalition (URWC) www.unionriver.org
   b. Center for Applied Human Ecology (CAHE) www.coa.edu/html/appliedhumanecology.htm
   c. Geographical Information Systems (GIS) Lab www.coa.edu/html/facilgislab.htm
5. Related networking and dissemination links:
   The EcoLeague (Consortium for Environmental Learning) www.ecoleague.org
   The River Network www.rivernet.org
   GrowSmart Maine www.growsmartmaine.org
   Society for Human Ecology (SHE) www.societyforhumanecology.org

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