Ordinary nature: the value of exploring and restoring nature in everyday life

Stephen Kellert

A great deal has been accomplished during the past decade in the area of urban wildlife conservation, restoration, and management. Natural resource managers and agencies have been responsible for initiating a wide variety of ambitious and innovative programs and policies, helping to gain new awareness and appreciation of the value of conserving and enhancing wildlife habitat and species in urban areas. Despite this progress, my impression, based on many years of related research (Kellert 1996) and personal experience, is that the great majority of the urban public, decision-makers, and developers remain largely indifferent and incognizant of the value of a healthy and diverse natural environment in the modern city.

Open spaces in most urban areas are still often managed with considerable indifference and callous disregard for their natural functions and amenities. Their value, when acknowledged, is largely measured in the currency of economic development and environmental disfigurement. More egregiously, environmental damages associated with industrial and housing development, building, and road construction are seldom systemically considered and incorporated in a serious and sustained way. Few urban developers and municipal leaders recognize the connection between a city's natural environment and the quality of life, long-term prosperity, and stability of these areas. Restoration and protection of urban biological diversity is typically viewed as a noisome regulatory obstacle, afforded little planning or budgetary consideration, and often disappears from sight at the slightest sign of political and economic distress.

My hometown of New Haven provides a typical illustration, despite recent improvements and lofty policy pronouncements to the contrary. Most symbolic of the long-term disregard for the natural environment, New Haven and the state of Connecticut built a major interstate highway along its remarkable harbor (the third largest in New England), an almost impenetrable physical and psychological barrier from the city's waterfront, which is still distinguished for its natural beauty and diversity. The roughly 18% of New Haven remaining in park and open space is usually treated with apathy, as a safety hazard, or potential development site. Only a minority of municipal leaders and developers perceive these areas as offering opportunities to connect with a host of important physical, emotional, and intellectual environmental values and benefits.

The prevailing assumption in New Haven, as in most other cities, is that the promise of economic and civic renewal resides in new industrial development, shopping malls, construction and, of course, an expanded and improved highway system. Despite these assumptions, New Haven, like so many other cities, has failed to attract or retain businesses solely on the basis of generous tax and infrastructural incentives. Most urban leaders, developers, and the general public fail to recognize that businesses, like people, often choose to locate and settle in areas for reasons beyond simply financial and logistical considerations. This attraction frequently, albeit obscurely, is related to a profound underlying biological affinity for healthy natural process and diversity.

The prevailing disconnect between people and nature in urban areas largely originates in 2 widely held assumptions. First, that wildlife - at least, healthy, abundant species and habitats - are not an integral component or part of modern urban life. Second, that city life and economics have largely transcended human dependence on nature, and urban existence is no longer reliant on ongoing contact with healthy natural environments to achieve lives of meaning, satisfaction, and prosperity.

The first assumption of nature and the city as separate, even mutually exclusive, phenomena is, a fallacy that many of you have confronted and often

Author's address: Yale University, School of Forestry and Environmental Studies, New Haven, CT 06511

dispelled. You have courageously disproved the notion that meaningful and extensive opportunities for contact with wildlife cannot occur in urban settings. You have attacked the false dichotomy of the city in the absence of nature, as if the natural environment was a phenomena of the bucolic or wild, occasionally experienced by urban dwellers during brief but superficial forays into the countryside or wilderness areas. You have instead, revealed a surprising abundance of biological variability in most, if not all cities, and brought meaning to Edward Wilson's (1984) observation of there being more biological richness and structure in a handful of urban soil than in the rest of the universe as we know it; or Aldo Leopold's (1966) observation that the lessons of ecology can as easily be encountered in a city lot as in an ancient redwood grove. In the city of New Haven, people are beginning to recognize the presence of an abundance of vegetative and faunal diversity, even large and striking vertebrates like roosts of black-crowned night herons, nesting great horned owls, red foxes, and even an occasional river otter. The average urban dweller, let alone municipal leader, planner, and developer; may have far to go before becoming sufficiently appreciative of the presence of nature and wildlife in the city, but at least, because of your efforts, the data base is emerging and a glimmer of recognition spreading.

The second widespread assumption representing a huge obstacle to urban wildlife conservation and management is the view of wildlife and natural processes as a peripheral phenomenon of little significance to the long-term health and vitality of the modern city. This assumption, unfortunately, is more deeply held and pernicious. It will, in my opinion, be far more difficult to dispel, and will remain the critical roadblock to the eventual success of urban wildlife efforts and objectives. It is this second assumption that is the focus of this paper, offering recent limited evidence indicative of its erroneous and short-sighted premise, and some reasons why this might be so.

THE GREATER NEW HAVEN WATERSHED STUDY

I want to start by sharing with you some preliminary findings from a major research project we are conducting in the New Haven area to examine the link between human and natural processes in urban and non-urban settings. The Greater New Haven Watershed Project (or "The Mastodon" as we affectionately call it, recognizing how we are like the blind men trying to take measure of the extinct elephant) is supported by National Science Foundation and Environmental Protection Agency, and represents the collaborative effort of 6 faculty in the chemical, hydrological, biological, economic, and social sciences. Our objective in this study is to examine how ecological and social systems shape each other, and particularly, how the structure and function of natural systems, human values, and socioeconomic behaviors, affect each other. Our central hypothesis is that the health and integrity of natural ecosystems causes and, in turn, is the consequence of enhanced human performance and productivity. Conversely, that damaged and degraded natural systems precipitate and, in turn, foster diminished human performance and productivity. In other words, we view humans as an integral component of natural systems, not an exogenous or alien force which, once coming into contact with nature either inevitably perturbs it or constitutes some separate external layer somehow above or added to natural systems. We believe ongoing positive and negative feedback loops persist between natural and human systems, and thus, occur wherever people are found, including urban as well as non-urban settings. Our basic premise is that ecological and social systems are inextricably connected; exercising reciprocal influence through powerful, albeit poorly understood relations.

How do we hypothesize these connections occur? As Figure 1 suggests (see appendix), we believe the health and function of natural systems significantly influences human environmental values (i.e. the meanings people attach and the benefits they derive from natural systems), which eventually become manifest in a range of economic, social, and psychological relations among people, which then feed back to and affect ecosystem structure and function, and the cycle continues. Natural systems characterized by relative states of health or disturbance encourage the emergence of certain environmental values that thwart or facilitate the realization of diverse socioeconomic benefits.

These relationships are being explored in an area we call the Greater New Haven Watershed defined by the drainage of 3 river systems that converge at their terminus in New Haven harbor (see Figure 2). This area encompasses approximately 400 square kilometers or 260 square miles, and includes 275 local drainages, part or all of 22 towns and cities, and is home to approximately 400,000 people in a landscape that is 13% urban, 24% suburban, 11 % agricultural, and 41% forested. This study area has been divided into approximately 18 sub-watersheds where an extraordinary amount of chemical, hydrological, plant, animal, economic, and social data have been collected.

Insufficient space is available to review the methods used in this study or the results beginning to emerge. I only wish to note at this time some pre-

liminary data which, in the crudest and most qualified sense, suggests a very limited and initial corroboration of the hypothesized relationship between the relative health and disturbance of natural systems, varying levels of human relationship to nature, and physical and mental well-being in urban and non-urban areas (Table 1 and Figure 3). As indicated, especially in Figure 3, subwatersheds characterized by relative health and integrity (e.g. greater species richness and lower levels of fecal coliform and phosphate) were more likely to reveal positive environmental values (e.g. greater outdoor recreational interest and environmental stewardship), greater environmental knowledge, and higher quality of life. Conversely, subwatersheds of lower environmental quality often reported lower quality of life, less interest of outdoor recreational contact or ethical stewardship for the natural environment, and a greater inclination to support the dominance and control of nature. The measurement of environment values, quality of life, environmental knowledge, and environmental affinity were based on scales consisting of statistically clustered attitudinal and behavioral questions.

THE CONCEPT OF BIOPHILIA

These highly suggestive results raise again the question of what causal processes might explain the relationship between varying states of natural health or disturbance, environmental values, and human quality of life. To my knowledge, no definitive answer exists for this complicated and important question. Nonetheless, as indicated earlier, we believe that natural systems characterized by relative states of health and integrity encourage varying values or benefits people derive from nature which, in turn and over time, either thwart or facilitate the realization of diverse socioeconomic benefits.

The concept of "biophilia" can be employed to elucidate why this might be so (Wilson 1984; Kellert and Wilson 1993; Kellert 1997). The "biophilia" hypothesis posits a "weak" biological dependence and affinity humans possess for nature manifesting in 9 values (ways of attaching meaning and deriving benefit) toward natural process and diversity. The occurrence of these 9 values collectively reveals how the meaningful and satisfying experience of nature can function as an anvil on which human fitness is forged. Conversely, the biophilia notion suggests that when people impoverish and degrade the natural world, most particularly their meaningful and satisfying experience of it, they diminish their potential material, emotional, and intellectual capacity. As indicated, these values of biophilia are viewed as "weak" biological tendencies, necessitating an adequate diet of experience, learning, and sociocultural support to become functionally manifest. Moreover, the dysfunctional expression of any of the values can result not only from their being insufficiently manifest or atrophied, but also from their excessive and exaggerated occurrence. Insufficient space exists to elucidate these values in detail and, thus, only very brief descriptions will be provided to illustrate how each can be related to varying aspects of human physical and mental well being.

UTILITARIAN

The first value is labeled "utilitarian," although this is something of a misnomer as all the values described possess utility insofar as enhancing human fitness and adaptive capacity. The utilitarian term used here is employed in the conventional and narrow sense of material and commodity advantage derived from exploiting nature. In this regard, people have always used the natural world as an indispensable source of material sustenance and physical security. Despite this ancient material dependence, modern society often prides itself on having domesticated the wild and, in the process, achieved large food surpluses, material affluences, and physical health largely by eliminating wild competitors and converting natural into cultivated and artificial landscapes. This belief in human material independence from nature, however, is an illusion. Modern society continues to rely extensively on natural process and diversity as an indispensable source of basic food stocks, medicines, scientific discoveries, building and decorative supplies, and in other areas of commodity production. Moreover, healthy ecosystem function sustains a variety of life support processes on which humans and all species depend, including decomposition, oxygen and water production, pollination, and more.

Even employing a narrow economic calculus, biophysical process, and variability annually yields more than $300 billion to the U.S. economy and nearly 3 trillion dollars or 11% to the global GNP. Moreover, this utilitarian dependence on natural process and diversity will exponentially expand in the near future. Only an estimated 15% of the world's species have been identified, and rapid developments in taxonomy, biochemical prospecting, and bioengineering will soon unleash a revolution in new product development derived from exploiting a nearly limitless array of species solutions to survival fashioned over millions of years of evolutionary trial and error.

But, just as importantly, for individuals and groups the recognition and experience of their utilitarian dependence on nature remains a well-

spring of physical and mental well being. People derive satisfaction and confidence from nurturing their material relation to the natural world. They remain biologically inclined to respond to natural process and diversity with an abiding interest in discovering and exploiting its practical utility. We participate in utilizing nature, even in the absence of necessity, because these pursuits nourish a passion for extracting with skill a portion of our needs and well being from the land. Beyond the practical material gains, we also harvest physical fitness and an emotional connection. By engaging our utilitarian dependence on nature, we affirm our capacity to persevere and sustain ourselves with craft and skill.

SCIENTIFIC

As a species, people also need to know and understand their world with authority – a tendency, independent of culture and history, where intellectual capacity is nurtured and developed through study and observation of natural process and diversity. The natural world provides an especially suitable setting for sharpening critical thinking skills, problem-solving abilities, and analytical capacities. We observe this in modern society, but also witness it among so-called primitive peoples. For example, professor Jared Diamond of UCLA noted the Fore of New Guinea possess 110 names for 120 scientifically-classified bird species in their forest home, most of these birds having no apparent practical value, and similar statistics can be noted among other preliterate peoples.

What the natural world offers all people are unrivaled opportunities for developing intellectual capacity and critical thinking skills. Observing and examining natural process provides people with an array of challenging situations for acquiring knowledge, developing understanding, and honing evaluative aptitudes. These cognitive capacities can, of course, be advanced in other learning contexts, such as the modern world of technology and computers, but natural diversity has always provided an especially accessible and stimulating context for pursuing intellectual competence, especially for the young and inquiring mind.

Additionally, over time and simply by chance, the knowledge and understanding obtained from these intellectual pursuits often yields tangible benefits. Exploring the mysteries of even a fraction of the natural world expands the realization of how much people can learn from the extraordinary ingenuity of the biophysical enterprise. Moreover, the more people learn and benefit from studying natural functioning and process, the more they tend to recognize the virtue of its healthy perpetuation.

AESTHETIC

Nature and other creatures also constitute an essential source of beauty and physical attraction. Few experiences in life exert as powerful an impact on people as the aesthetic appeal of certain features of nature. Even the most hardened criminal kept in solitary confinement for years, if suddenly exposed to a magnificent sunset or the extraordinary beauty of a tropical isle, would be unable to resist feelings of aesthetic attraction no matter how fitfully manifest. This universal tendency exists because it has fostered a range of adaptive benefits linked to the consistency and intensity of its response.

Beauty in nature also engenders the recognition of harmony, balance, and grace. People discern unity and order in certain natural features, and these aesthetic expressions inspire and instruct. Natural beauty and symmetry can function as a quasi-design model where through understanding the prototype, people capture analogous opportunities for excellence and refinement in their lives. The ideal provides a template for action, a means where through mimicry and ingenuity people discern clues to a more rewarding existence. We perceive harmony and beauty in a flowering rose, a snow-capped mountain, a large elk at the height of its breeding prowess, and each image inspires an ideal of perfection in a world where frailty, shortcoming, and death are far more normative.

The aesthetic preference for certain natural features can also be linked to the increased likelihood of attaining safety, sustenance, and security. People aesthetically favor landscapes with water; that enhance sight and mobility; which offer a greater chance for way-finding, for perceiving danger, and for locating shelter; that have bright flowering colors – all features which, over evolutionary time, have proven functional in enhancing human survival. It is no accident people typically aesthetically favor houses and dwelling places with a view, located near rivers, lakes, or seashores, or that possess the bright colors of fruiting trees and plants.

Aesthetic preference for natural diversity – the simple attraction to nature – also fosters interest and curiosity. We are undeniably attracted to the beauty of nature and in the process become more aware and drawn to its many details and diversity. This attraction to the most information rich environment people will ever encounter encourages wonder and curiosity which, in turn, enrich our capacities for exploration, creativity, and discovery.

HUMANISTIC

Nature also represents a powerful source for emotional bonding and attachment, especially

through companionship with other creatures, but also by strong attraction to certain plants and landscapes. The natural world constitutes a subject of deep affection for people. These feelings of affection provide people with opportunities for experiencing intimacy, for expressing trust, and for achieving feelings of relationship and kinship. Isolation and aloneness, by contrast, represent heavy burdens for a largely social creature like ourselves. With rare exceptions, people crave the affection and companionship of others. By affiliating with other species, even landscapes, we achieve a valued source of relationship and a means for expressing trust and affection.

Bonding and affiliation also remain critical pathways for developing the capacities for cooperation and sociability, evolutionarily important for a species lacking particular physical strength or prowess. Humans covet relationships and the responsibility for others and, in return, gratefully receive their allegiance and affection. Caring and sometimes being cared for by another creature and, more generally, by nature offering a chance for expressing affection and achieving companionship. These benefits can accrue under normal circumstances, but become especially pronounced during moments of crisis and disorder. The nurturing responses of others, including other creatures and nature, more generally, is mentally and physically restorative. When distressed, people often seek the restorative powers of flowers, gardens, seashores, companion animals, and living abundance.

DOMINIONISTIC

Despite these elements of kinship and affection, people also hone their physical and mental fitness through subduing and mastering nature. People seek opportunities for outcompeting and outwitting others, as well as overcoming challenge and adversity. Natural process and diversity provides a valued context for developing these more competitive traits in the human animal. We may no longer rely on besting prey or eluding menacing predators or surviving in the wild, but the strengths and prowess obtained from challenging nature remain critical pathways for developing physical and mental fitness.

People can achieve feelings of self-confidence and self-esteem by testing themselves in nature. By demonstrating the ability to function under challenging circumstances, they emerge surer and more certain of themselves. By besting a formidable opponent, they enhance their ability to adapt under unfamiliar and difficult circumstances. Through contesting nature, they can cultivate the willingness to take risks, to face adversity, and to master the unknown. Perhaps this explains why so many young people in ever growing numbers seek outdoor adventure opportunities, frequently at great risk to themselves, and often speak highly of the experience. The following comments are illustrative:

"The outdoor experience, while isolated and out of the realm of everyday life, was applicable to everything I do . . . much of what I faced . . . had to do with my own fears and weaknesses. Overcoming them changed me as a person." Another participant remarked: "The experience gave me the opportunity to take a risk. It strengthened my sense of self. It gave me a feeling of purposefulness, self-respect, and strength that I had never had before. When you have confidence in yourself it affects every aspect of your life."

MORALISTIC

Nature is also deeply significant to people as a source of moral and spiritual inspiration. Despite 1.7 million scientifically classified and an estimated 10 to 100 million living species, the extinction of 99% of all species that ever existed, and the extraordinary capacity of life to attain a unique adaptive foothold on the ladder of existence, people are equally astonished by a basic similarity which seemingly unites so much of life on earth. Most living creatures share common molecular and genetic structures, analogous circulatory and reproductive features, and parallel bodily parts. A remarkable web of relationship connects a beetle on the forest floor, a fish in the ocean, an elephant on the savanna, and a human in the modern metropolis.

This unity and connection offers people a sense of underlying meaning and a cornerstone of spiritual belief. Perceiving universal pattern in creation provides a foundation for morality that gives definition and shape to our existence. Through the shared conviction in life's underlying relation, we achieve a sense of cohesion and mutual commitment. These sentiments encourage the belief that at the core of our existence may lie a fundamental logic, harmony, and even goodness. We derive faith and confidence through discerning a unity in creation that transcends our individual aloneness and separation.

These convictions also foster the inclination to conserve natural process and diversity. The willingness to protect nature derives as much from moral and ethical destructive tendencies. Deference and respect for nature arises as much from recognizing its capacity to defeat and destroy us as from feelings of kinship and affection. A sense of awe includes fear as well as reverence and wonder. Nature stripped of its power and strength, like a lion pacing in a cage, can become a mere object of condescension and

superficial amusement. Species and habitats utterly subdued and mastered rarely provoke much admiration, humility, and respect.

SYMBOLIC

Finally, the natural world constitutes an indispensable source for developing our unique human capacity for communication and thought. People employ natural diversity as a raw material for expediting the exchange of information and understanding among and between our kind. We accomplish this through metaphor, analogy, and abstraction, and by using the media of language, story, myth, fantasy, and dream.

Nature as symbol remains especially instrumental in language acquisition. Language relies on the capacity for sorting objects into ever more refined categories and distinctions. Where does the young and inquiring mind encounter numerous, readily available, emotionally salient, and especially distinguishable objects for practicing the act of classification? Natural diversity has always provided this powerful source of imagery and distinction. We should not be surprised, thus, when we learn that most of the characters in preschool books on speech and math are animals and natural depictions.

Symbolizing and fantasizing nature also assists adolescents in confronting basic issues of identity and selfhood. Symbolizing nature enables all peoples and cultures a means of addressing universal dilemmas like authority and independence, order and chaos, good and evil, love and sexuality, in a tolerable yet instructive manner. This occurs in children's stories and fairy tales, in legends and myths, in totems and taboos, in fantasies and dreams. These images allow people to encounter themselves through a glass darkly, rendering more tolerable the difficult and enigmatic issues of conflict, need, and desire.

Symbolizing nature further assists in everyday communication. We employ natural imagery in the language of the street, in the metaphors of the marketplace, in oratory and debate. These images are frequently trivial, but at times eloquent and inspiring. Their occurrence in all cultures and ages reflects a universal and indispensable tendency. Natural diversity provides a substrate for symbolic creation analogous to the way genetic variability offers a biochemical template for laboratory discovery. Each use represents the exploitation of nature's clay from which people mold and fabricate solutions to life's varied challenges.

A New York Times business article on the Super Bowl provides a curious but instructive example of our symbolic use of nature. The article noted (Elliot 1996): "The Rams, Bengals, and Eagles were missing from Super Bowl XXX along with the Colts, Jaguars, and Cardinals. But in their absence, advertisers unleashed an ark's worth of animals upon the game's record estimated audience of 138.5 million viewers. The beasts conscripted into pitching products on what is considered the biggest day in advertising included frogs, buzzards, horses, a penguin, cattle, lions, elephants, zebras, wolves, a spunky goldfish, not to mention the pigs, the skeleton of a dinosaur, and the animated panther and coyote. Animals accounted for almost ¼ of the 47 spots that ran during the game. Clearly, most people love animals, particularly when portrayed in an anthropomorphic manner."

The seeming triviality of this quote reveals how any of the values of biophilia, when viewed individually or separately, might be dismissed as insignificant, dispensable, or perhaps rendered obsolete by modern technology. Regarded collectively, however, these 9 expressions of our inherent inclination to affiliate with natural process and diversity shed light on the extraordinary diversity of ways we continue to rely on and benefit physically, emotionally, intellectually, and morally from the richness of our associations with the natural world.

CONCLUSION

This array of empirical evidence and conceptual perspective hopefully begins to elucidate the hypothesized relationship between healthy natural process and diversity and human physical and mental well being. The results of the Greater New Haven Watershed Study and the various dimensions of biophilia intimate the extraordinary subtlety of ways benefit from a complexity of associations with the natural world. "These findings and observations suggest how celebrating nature can in fact celebrate the human condition. From this perspective, the health and vitality of the city ultimately depends on our experiencing nature in aesthetically attractive, ecologically sound, and materially accessible ways. Assuming this, cities will elicit their greatest loyalty, commitment, and stability when they function as places where people can confidently and consistently encounter satisfying connections with natural as well as economic and cultural wealth.

The current lack of meaningful and adequate contact with healthy natural process and diversity in the modern city constitutes a design deficiency rather than an intrinsic flaw of modern urban life. What are needed are urban planners, developers, and leaders committed to the goal of healthy natural process as an integral and essential component of the modern city. But, effective environmental design will require more than just energy efficiency, contaminant removal, or better waste disposal. It will also necessitate capturing the many ways nature enriches the human physical, mental, and even spiritual condition. Effective environmental design includes not just material

sustainability that seeks to minimize natural resource use or the export of adverse impacts from the built to the natural environment. It also must include inspired "organic" design, where the integration of nature or nature as a design metaphor becomes powerfully manifest. It should still further include a kind of "vernacular design," where the city celebrates its "spirit of place" through meaningfully connecting with both its culture and local ecology.

Many believe the modern city is in no position to afford the presumably peripheral and merely cosmetic luxury of extensively restoring connections with healthy, diverse, and attractive natural environments. This view constitutes a narrow and short-sighted calculus. Cities paralyzed by despair over the degraded state of their natural environment, the presumed costs of its restoration, or the meaning integration of nature into the fabric of urban life may actually impede their development. Some of America's most vital and fastest growing cities – places like Denver, Salt Lake City, San Francisco, Boise, Tucson, and others – represent areas characterized by the perception and allure of natural beauty and wildlife diversity, no matter what people may perversely do to degrade these amenities once they arrive there.

Good economics is, I believe ultimately good ecology. Great opportunities await those planners, developers, and political leaders imaginative enough to capture the aesthetic and ecological virtues of nature in the built environment, and weave them creatively into the neighborhoods, schools, and work places of the modern city. The experience of healthy natural process and wildlife diversity must be changed from rare and transient aspect of urban life to a thread woven deeply into the garment of everyday city existence. I recently encountered a powerful expression of this potential for compatible and complementary relation between humans and nature in the urban environment in a nearly forgotten book by the late Nobel Prize – winning biologist, Renee Dubos (1980), "Wooing of the Earth." In this book, Dubos remarked (1980: 175-6)

> "People want to experience the sensory, emotional, and spiritual satisfactions that can be obtained only from an intimate interplay, indeed from an identification with the places in which they live. This interplay and identification generate the spirit of [a] place. The environment acquires the attributes of a place through the fusion of the natural and the human order. This process of reciprocal adaptation occurs in ordinary life through continuous minor changes in the people and their environment, but a more conscious process of design [can] preside . . . [These designs] can be successful, only if they [are] ecologically viable and also satisfy instinctive needs that human nature has derived from its evolutionary past.
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> The phrase 'wooing of the earth' suggests that the relationship between humankind and nature should be one of respect and love rather than domination. Ecological management can be effective only if it takes into consideration the visceral as well as spiritual values that link us to the earth . . . Ecological thinking must be supplemented by humanistic value judgments concerning the effect of our choices and actions on the quality of the relationship between humankind and earth . . .
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> The wooing of the earth means . . . preserving natural environments in which to experience mysteries transcending daily life . . . With our knowledge and a sense of responsibility for the welfare of humankind and the earth, we can create new environments that are ecologically sound, aesthetically satisfying, economically rewarding, and favorable to the continued growth of civilization. But the wooing of the earth will have a lastingly successful outcome only if we create conditions in which both humankind and the earth retain the essence of their wildness. The symbiosis between these two different but complementary expressions of wildness will constantly engender unexpected values and new hopes, in an endless process of evolutionary creation."

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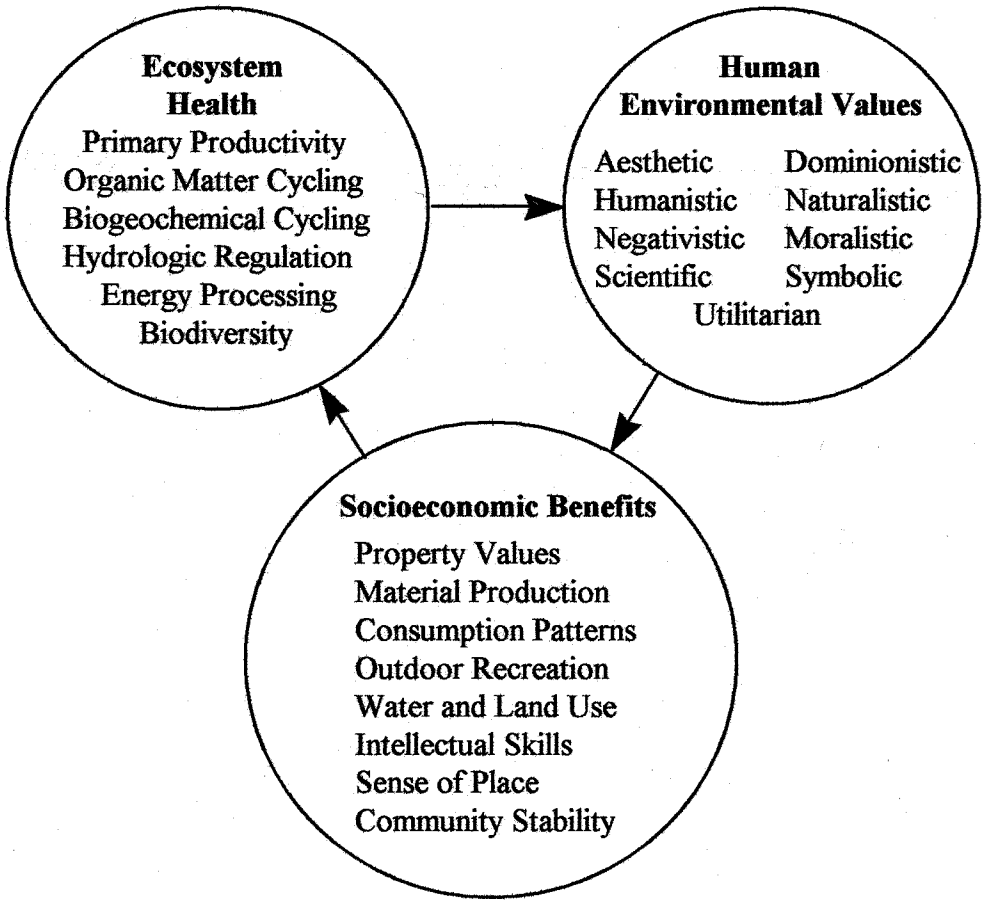

Figure 1
Hypothesized Feedback Loop Linking Ecosystem Structure and Function, Environmental Values, and Socioeconomic Benefits

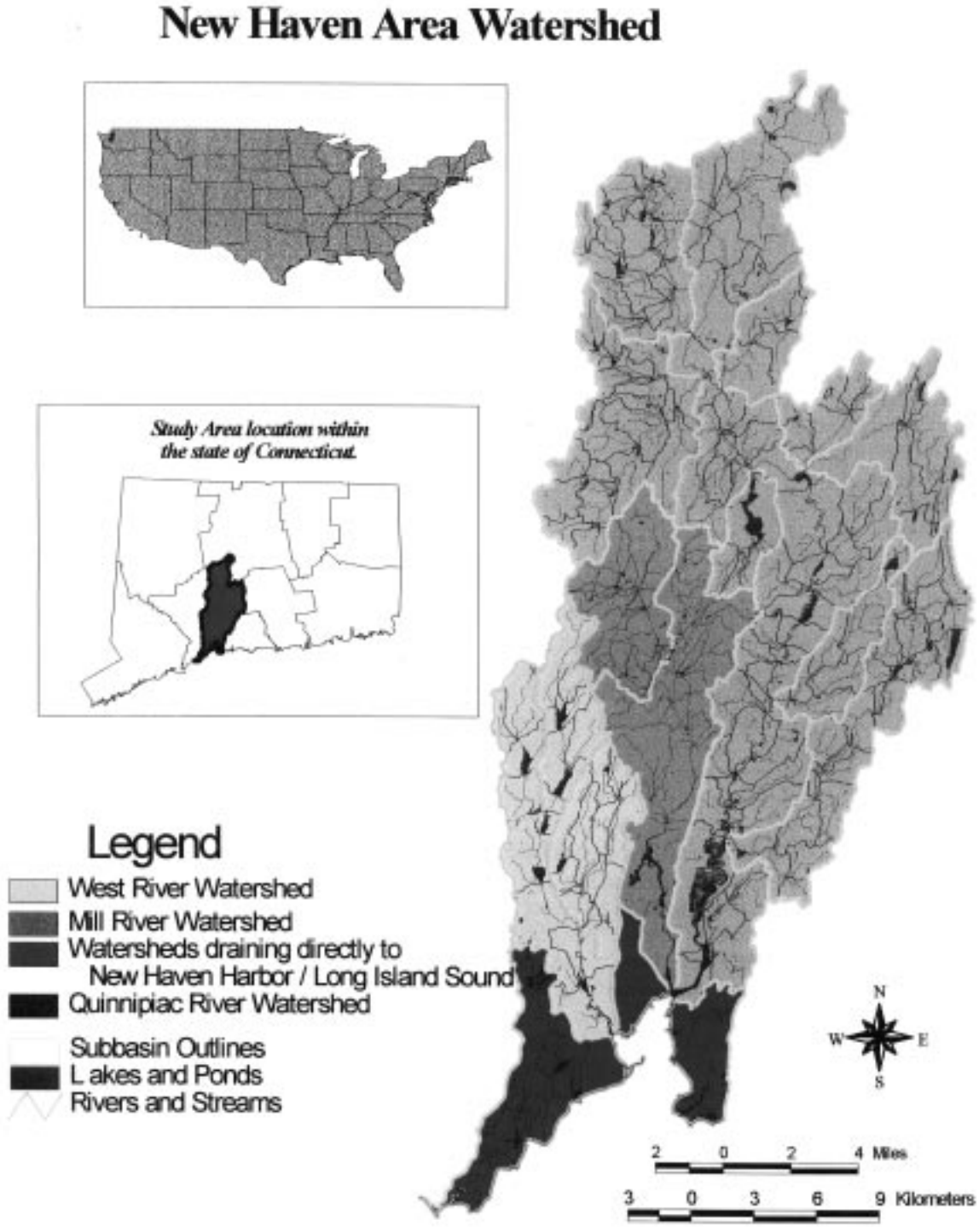
New Haven Area Watershed
Study Area location within the state of Connecticut.
Legend
West River Watershed
Mill River Watershed
Watersheds draining directly to New Haven Harbor / Long Island Sound
Quinnipiac River Watershed
Subbasin Outlines
Lakes and Ponds
Rivers and Streams
N
W
E
S
2 0 2 4 Miles
3 0 3 6 9 Kilometers

Figure 2

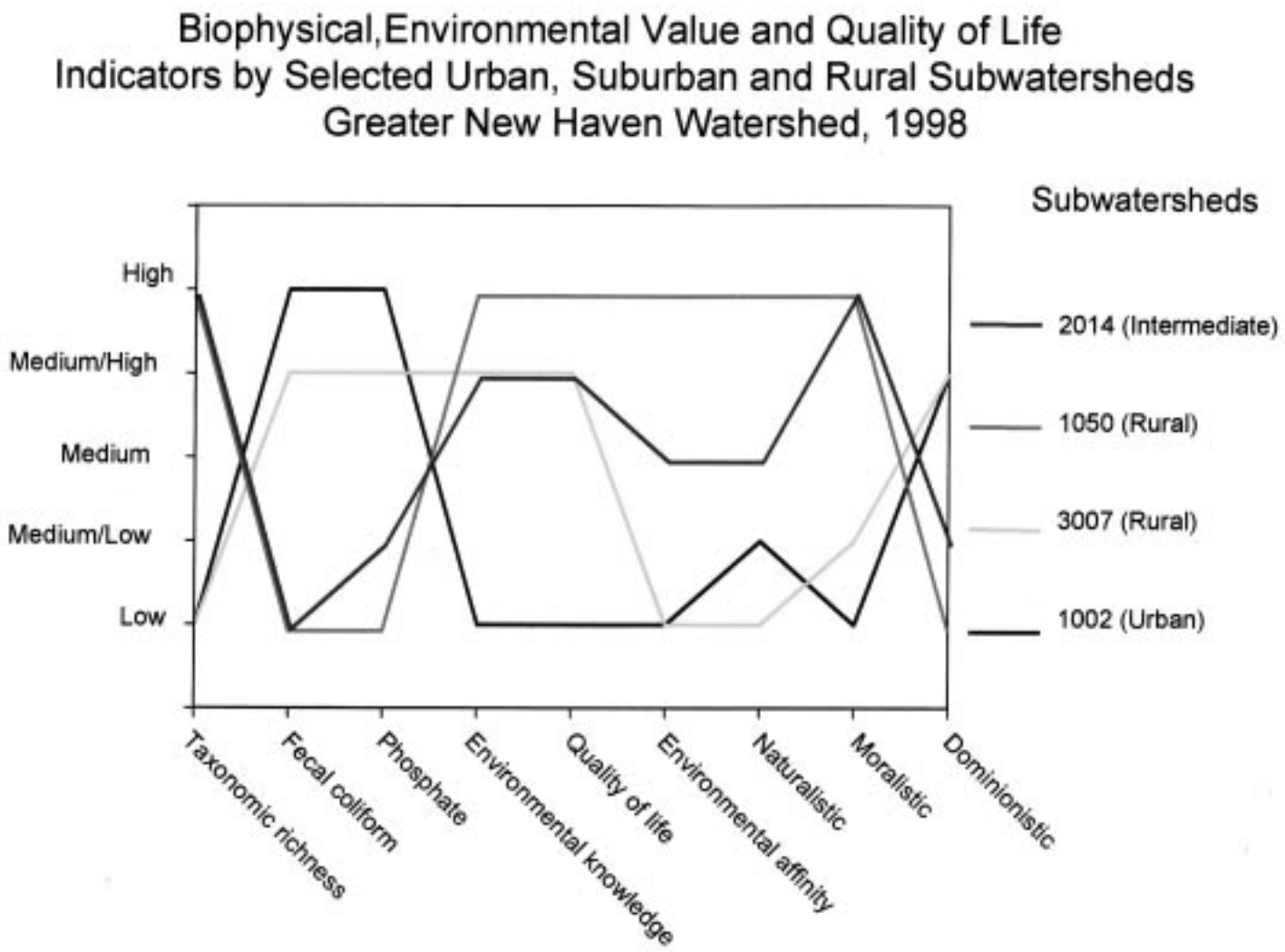
Biophysical,Environmental Value and Quality of Life
Indicators by Selected Urban, Suburban and Rural Subwatersheds
Greater New Haven Watershed, 1998
Subwatersheds
2014 (Intermediate)
1050 (Rural)
3007 (Rural)
1002 (Urban)
High
Medium/High
Medium
Medium/Low
Low
Taxonomic richness
Fecal coliform
Phosphate
Environmental knowledge
Quality of life
Environmental affinity
Naturalistic
Moralistic
Dominionistic

Figure 3

Table 1

SUBWATERSHEDS BY SELECTED BIOPHYSICAL AND ENVIRONMENTAL KNOWLEDGE VALUE, AND QUALITY OF LIFE INDICATORS, GREATER NEW HAVEN WATERSHED, 1998

Human Density	U	R	I	I	U	R
Subwatershed	1002	3007	2040	2014	3001	1050
Taxonomic Richness	9	11	13	43	24	39
Fecal Coliform	8974	680	185	173	306	146
Phosphate	1.5	0.38	0.56	0.56	1.23	0.22
Knowledge	57.4	65	67.5	64.6	66.4	66.2
Quality of Life	68.3	77.4	80.3	76.9	79	78.8
Environmental Affinity	39	38.4	40.3	40	39.4	48.2
Naturalistic	3.9	3.7	4	4.1	4.1	4.6
Moralistic	5.7	5.9	6.4	6.7	5.9	6.5
Dominionistic	4	4	4.2	3.9	4.2	3.7