

Greenways in the USA: theory, trends and prospects

3.1 Introduction

Development in Europe and the USA have common roots, but to a great extent they went their own way owing to geographical, political and scientific differences. Whereas ecological networks are common in Europe, greenways are much more an American product.

This chapter is organised to address several objectives:

- to compare classic and emerging definitions of greenways
- to articulate greenway theory, and to link definitions with theoretical principles
- to review the origin and evolution of greenways in the USA
- to discuss future prospects and research needs for greenways

Greenways is a 'new' word with many meanings. Much confusion still exists around its definition, yet it continues to gain in popularity and to appear regularly in popular language and planning policy in the USA and internationally (Fabos and Ahern 1995). The many differing perspectives on greenways are reflected in these definitions and serve to emphasise the complexity of the greenway concept. A brief review of these definitions provides a useful introduction to the subject of greenways, and underscores the need for a common definition and taxonomy, to support international, interdisciplinary communication and collaboration.

Perhaps the most widely accepted contemporary definition or statement on greenways in the USA was included in the report of the President's Commission on Americans Outdoors in the USA (1987). The Commission advocated a greenways network:

to provide people with access to open spaces close to where they live, and to link together the rural and urban spaces in the American

landscape threading through cities and countrysides like a giant circulation system.

This statement emphasises the concept of spatial connectivity, of an integrated functional network, managed for multiple purposes, linking rural and urban environments. It also reflects the late twentieth century orientation in contemporary American land preservation, which focuses on open lands that are directly accessible to population centres, in contrast with the nineteenth and early twentieth century emphasis on the great, but more remote, national parks and other protected landscapes (Zube 1996).

A comprehensive set of definitions on greenways was provided by Charles Little, the author of the popular 1990 book *Greenways for America*. In his book a 'Greenway' is defined as:

1. A linear open space established along either a natural corridor, such as a riverfront, stream valley, or ridgeline, or overland along a railroad right-of-way converted to recreational use, a canal, scenic road, or other route.
2. Any natural or landscaped course for pedestrian or bicycle passage.
3. An open-space connector linking parks, nature reserves, cultural features, or historic sites with each other and with populated areas.
4. Locally, certain strip or linear parks designated as parkway or greenbelt.

(Little 1990)

Little's definition shares the same fundamental ideas as the President's Commission; in addition, it recognises specific types of greenway depending on their location, spatial configuration and purpose. Many other authors of greenway books, journal articles and reports cite the definitions of Little and the President's Commission (Smith and Hellmund 1993; Flink and Searns 1993; Erickson and Louisse 1997).

I proposed another greenways definition in the book *Greenways: the Beginning of an International Movement*, based on literature review and research and applications experience with Greenway planning projects in the USA:

Greenways are networks of land that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use.

(Ahern 1996)

This definition is intended to be comprehensive and inclusive. In this cited reference, I also propose a typology of greenways, structured to enable explicit,

Table 3.1. *Linkage of greenway definitions with theoretical principles*

Definitional themes	Questions/issues raised?	Theoretical principles
Greenways are a linked, or spatially integrated network of lands that are owned or managed for public uses including: biodiversity, scenic quality, recreation, and agriculture	Does this network produce an advantage due to an intrinsic pattern of resource distribution?	1. Hypothesis of co-occurrence of greenway resources
A presumed advantage, or synergy, resulting from spatial connectivity and linkage	How do the determining functions affect the spatial form and configuration of the greenway? Is there sufficient knowledge and information available to plan for connectivity?	2. Inherent benefits of connectivity for humans and for biodiversity
Planned to accommodate multiple uses and to achieve multiple goals	If the greenway is multi-purpose and multi-objective, which are the primary or determining uses/functions? Are the uses spatially compatible or conflicting? Who decides which uses take priority? Is the greenway spatial configuration intentional and deliberate, or is it opportunistic?	3. Compatibility and synergy of multiple use(s)?

comparative description and communication of greenways across physical, spatial, cultural and political contexts. The typology classifies greenways according to: spatial scale, purpose and goals, landscape context, and planning strategy (Ahern 1996).

These definitions illustrate the diversity that is inherent in greenways in concept and in reality. Perhaps this diversity helps to explain the popularity of greenways, and also emphasises the need for a greenway classification or typology to assure a clear and accurate communication between researchers and professionals. Table 3.1 relates greenway definitions with significant questions raised. The definitions and questions lead to three theoretical principles that

are posed as representing a theoretical basis in support of greenways: (1) the hypothesis of co-occurrence of greenway resources; (2) the inherent benefits of connectivity; and (3) the compatibility and synergy of multiple use in greenways. The following section (3.2) discusses and explores these three greenway principles, which represent an emerging theoretical basis in support of greenways.

3.2 Greenway theory

3.2.1 Hypothesis of co-occurrence of greenway resources

One of the common arguments in support of greenways is the hypothesis of co-occurrence of greenway resources. When discussing greenway resources, it is important to distinguish from earlier, conventional conceptions of protected landscapes. The USA's National Park system is well known for its spectacular natural scenery, typically remote from urban regions. Greenways embrace the concept of protected lands within urban regions, explicitly and intentionally located in close proximity to where people live and work. Greenway resources thus include the riparian/drainage network, large patches, small 'bits of nature', and linking corridors (Forman 1995). The hypothesis of co-occurrence posits that in any cultural landscape greenway resources are spatially concentrated along corridors. Cultural landscapes in the USA are understood differently from those in Europe. As a younger culture, American concepts of cultural landscapes are still emerging, rooted in the traditions of colonial agriculture, vernacular rural and suburban landscapes, and greenway corridors typically include riparian and linear upland areas, such as regional topographic ridges and small mountain ranges. Although the hypothesis warrants further and continued testing, several investigators' results support this hypothesis across a range of scales and contexts in the USA and in Europe. If the hypothesis is valid, greenways offer three strategic advantages:

- spatial efficiency: because they consist largely of corridors, where resources are concentrated, greenways can protect the most resources with the least amount of land area
- political support: political consensus and support is more likely to occur owing to the mutual benefits that diverse interests can realise from greenway protection (e.g. recreational, biodiversity, water quality)
- connectivity: if greenway resources are concentrated in corridors, the benefits of connectivity will be expressed in ecological, physical and cultural terms (see section 3.2 for a discussion of the inherent benefits of connectivity)

The earliest research on the hypothesis of co-occurrence of greenway resources is usually attributed to Philip Lewis, a landscape architecture professor and practitioner from Wisconsin, USA. Lewis' classic study for the Wisconsin Outdoor Recreation Plan surveyed and mapped the locations of 220 ecological, recreational, cultural and historic resources. Lewis' study found that over 90% of these resources occurred along corridors, which he labelled 'environmental corridors' (Lewis 1964). These corridors were used as the basis for the Wisconsin Heritage Trail Proposal (Figure 3.1). Lewis' work is well known in the USA as a precursor to modern greenways. Lewis recognised the importance of this co-occurrence, not only as a means towards efficient land protection, but also to show diverse public constituencies that their respective interests are often spatially coincident. The environmental corridors have also proven important for education by increasing awareness of connections among a variety of natural and cultural resources that tend to co-locate along greenway corridors (Lewis 1996).

A more recent study in the state of Georgia, USA, produced findings that also support the hypothesis of co-occurrence. The 1976 Environmental Corridor Study by the Georgia Department of Natural Resources included an extensive, statewide inventory of intrinsic (natural) and extrinsic (social) landscape resources (Dawson 1996). The study's research method included four steps:

- resource analysis
- corridor selection and priorities
- corridor planning and management options
- summary and conclusions

The resource analysis was followed by a series of assessments and map overlays that identified the preliminary corridors where the most significant greenway resources were located. These corridors became the priorities for greenway land acquisition. The mapped concentrations of greenway resources led to a statewide greenway plan, which has since begun to be implemented.

Since 1994, the Metropolitan Region of Lisbon, Portugal, has been developing a greenway plan (Machado *et al.* 1995). The plan has developed according to a broad and inclusive understanding of greenway resources, both natural and cultural. This work builds on the earlier work of Gonalo Ribeiro Telles, in his 'Continuum Natural' and the more recent 'Plano Verde de Lisboa', which articulated a continuum in which the spatial distribution of natural and cultural resources can be understood in a cultural landscape (Telles 1975, 1997). Telles' work anticipated the greenway concept, and identified the importance of green corridors, where resources are concentrated, to link natural and cultural landscapes in the region, including the city of Lisbon.

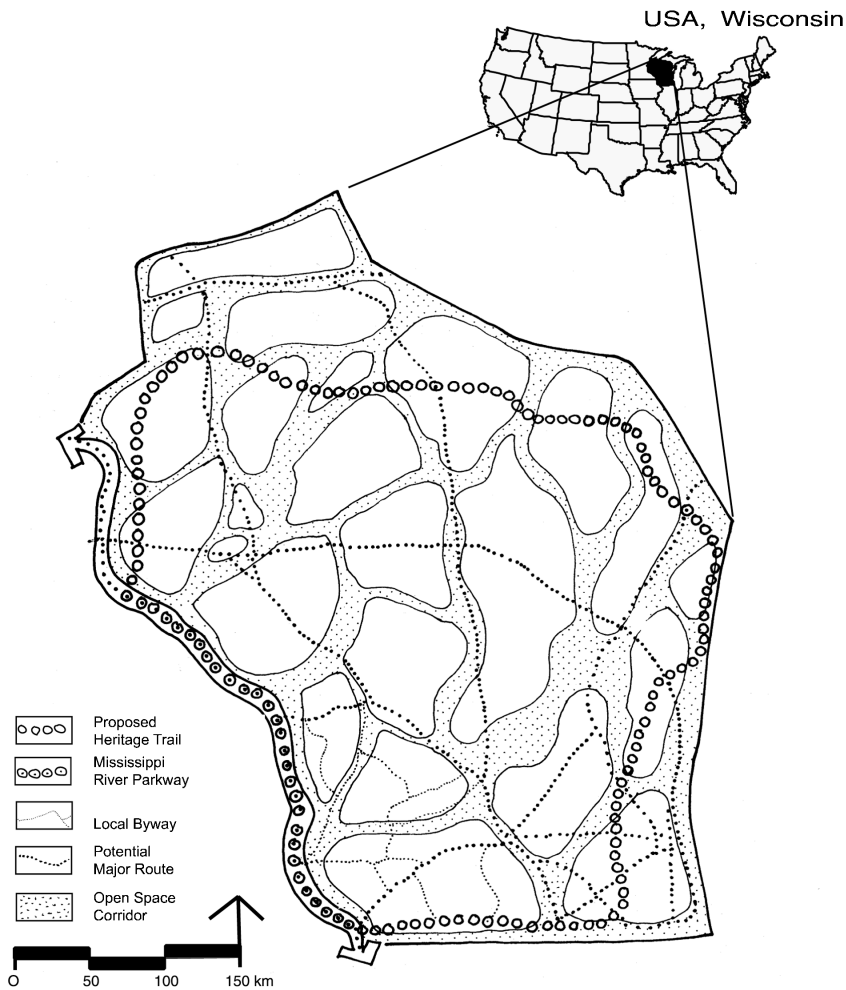


FIGURE 3.1.

Lewis' Wisconsin Heritage Trail Plan includes over 300 km of Environmental Corridors where ecological, recreational, cultural and historic resources are concentrated. (From Fabos 1985, p. 118.)

In the first phase of greenway planning for the Lisbon Metropolitan Area (Área Metropolitana de Lisboa, AML), broad scale spatial databases were used to identify 'greenway corridors' where natural resources were expected to be concentrated. The corridors were defined as coastlines, river and stream valleys, and major ridgelines. Several nationally significant and one UNESCO World Heritage Landscape (Sintra) are located in the AML region. Through spatial overlay analysis these cultural resources were found to co-occur within the 'greenway corridors' defined. A large gap in the data existed, however, because the spatial locations of cultural resources were not available for GIS (geographical information systems) analysis. Working with the Portuguese National GIS

agency (CNIG), Ribeiro (1998) compiled a spatially explicit database of over 3000 cultural resource sites in the North Bank of the Lisbon Metropolitan Area (AML). Ribeiro's analysis not only identified the corridors in which the significant cultural resources were located, but also articulated the causal linkage with the natural features and regions that influenced the historical development of these cultural resources, and pointed towards strategies for their interpretation in a regional greenway plan. His work also verified the hypothesis of co-occurrence of greenway resources at the regional scale, with particular emphasis on the spatial distribution of cultural greenway resources.

The Minute Man National Historic Park in Massachusetts, USA, provides another examination of the hypothesis of co-occurrence of resources in greenways. This park was established along a linear corridor that was determined and delineated for its historical and cultural significance relating to an early battle in the American Revolutionary War. In the context of a multi-purpose planning exercise, it was learned that a very significant concentration of biological (rare species habitats, unique or rare ecosystems) and abiotic greenway resources (prime agricultural soils, mature vegetation patches) occurred along the corridor. Subsequently a greenway plan was developed to delineate an interpretive route with the goal of interpreting both the natural and cultural history of the landscape (Gavrin *et al.* 1993; Ahern 1996).

These selected cases illustrate where the co-occurrence of greenway resources has been demonstrated through planning projects of differing scales and contexts. No contradictory findings were identified in a thorough review of greenway literature. However, it is recognised that additional research, structured by a clear hypothesis and executed in accordance with a consistent and replicable method, would yield a necessary examination of the hypothesis. For the purpose of this chapter, it is assumed that the hypothesis of co-occurrence is a reasonable and valid working hypothesis.

3.2.2 Inherent benefits of connectivity

Connectivity is defined here as a spatial characteristic of systems (i.e. landscapes) which enables and supports the occurrence of specific processes and functions, through adjacency, proximity or functional linkage and connection. The sustainability of certain landscape processes is dependent on connectivity. These processes include, for example, the movement of wildlife species and populations, the flow of water, the flux of nutrients, and human movement. Given this definition, it is argued here that providing or maintaining connectivity in a landscape supports particular processes and functions that may not otherwise occur. If these processes are beneficial and valued by humans, and are dependent on connectivity to some extent, then it

can be argued that connectivity is an important characteristic of, or a prerequisite for, sustainability.

The nature of the 'connection' implicit in the term connectivity is a function of the process or function that is being supported. For the flow of water, for example, a continuous, physically linked system is needed, because water moves according to physical laws under the influences of gravity and topography. For wildlife movement, the nature of connectivity is species-dependent. As conscious, mobile organisms, wildlife species demonstrate preference for, or avoidance of, certain landscapes or landscape features (Bennett 1998; Forman 1995). Some species (e.g. birds) can move across great distances between habitat patches using intermediate 'stepping stones', whereas other species (e.g. mammals) are often dependent on a physical corridor connection to facilitate movement. A habitat network for birds, then, may consist of a series of patches, each separated by kilometers of unconnected landscape. However, when the distance between the 'stepping stones' becomes too great, connectivity ceases to exist. A corresponding network for aquatic mammals (e.g. the river otter, *Lutra canadensis*), needs to have a virtually continuous, physically linked habitat. Connectivity must be understood in terms of the process or function that it is intended to support (Bennett 1998; van Langevelde 1999).

A great deal of the literature of landscape ecology addresses the inherent value of connectivity with respect to biodiversity (van Langevelde 1999; Bennett 1998; Forman 1995; Vos and Opdam 1993; Saunders and Hobbs 1991; Soulé 1991b; Turner 1989; Schreiber 1988). Much of this literature focuses on the importance of connectivity for maintaining biodiversity in landscapes that are urbanising, or otherwise experiencing a reduction in area or a fragmentation of species habitat. This argument has been criticised by others who maintain that the benefits of connectivity have yet to be scientifically established, that connectivity may, in fact, inadvertently enable the spread of disturbance, disease and invasive species, and that conservation funds may be more wisely spent on the acquisition of habitat patches (Simberloff and Cox 1987; Hess 1994). In a review article, Beier and Noss (1998) articulate a position, based on review of the empirical research, which supports the value of connectivity for habitat corridors in biodiversity protection as follows:

The evidence from well-designed studies suggests that corridors are valuable conservation tools. Those who would destroy the last remnants of natural connectivity should bear the burden of proving that corridor destruction will not harm target populations.

(Beier and Noss 1998)

This argument is consistent with the 'Precautionary Principle' contained in the Rio Declaration on Environment and Development, the comprehensive international policy statement that supports the international goal of sustainability:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

(IUCN 1992, Principle 15)

The value of ecological corridors has been widely accepted in recent European conservation planning and policy. The European Union's Habitats and Species Directive, adopted in 1992, proposes connectivity via corridors and stepping stones to link and to assure favourable status for special areas for conservation (SACs). The directive includes the plan 'NATURA 2000', which identifies the core areas and linkages necessary to maintain favourable status for the SACs:

European Union Member States should endeavour in their land-use planning and development policies to encourage and manage features of the wider landscape which are of importance for wild fauna and flora. Linear features, such as rivers and hedgerows, and isolated elements, such as lakes and ponds, are essential for migration, dispersal and genetic exchange of wild species.

(EU Habitats and Species Directive art. 10, 92/43/EEC)

The more recent Pan-European Biological and Landscape Diversity Strategy of 1995 (Council of Europe 1996) was prepared to enable implementation in Europe as it has been signed by 54 countries and is supported by the European Union. The strategy specifically proposes ecological network elements such as corridors, buffer zones and stepping stones to reduce the effects of isolation and to increase viability for small areas (Nowicki *et al.* 1996). This strategy explicitly addresses cultural and economic issues as part of the planning context. In this manner, they are similar to greenways in spatial organisation, and function. The spatial planning response to these policy directives and strategies are most often labelled ecological networks, often with rivers and streams as their principal spatial organising element.

An ecological network is successful if it sustains biological transition and landscape connectivity at all levels where fragmentation, isolation, and barriers to movements and fluxes occur. Rivers and water flows in

general can play an important role in this because of their function in supplying water and transporting sediments, nutrients, and organisms.
(Jongman 1998b)

Bennett (1998) points to a common confusion between connectivity and corridors, noting that connectivity can be achieved in some landscapes without 'corridors' *per se*. Others define this distinction as functional versus actual connectivity (van Langevelde 1994). This broader concept of connectivity in landscapes is a characteristic that is more widely accepted, and that is compatible with the greenway concept. National and international plans have been made, and are being implemented based on the importance of connectivity (Nowicki *et al.* 1996). The precautionary principle supports this approach.

The time scale needed to scientifically test the efficacy of habitat corridors in large landscapes is decades or centuries. In the time that would elapse during such a study, most landscapes would have changed fundamentally in terms of structure and function. This 'moving target' for research creates a fundamental dilemma for landscape planning. How can plans be made to address contemporary concerns and short-term goals with incomplete or imperfect knowledge? The concept of adaptive planning or management offers a conceptual solution to this dilemma. It is a flexible scientific framework for re-conceiving landscape plans, or management actions, as experiments which may, over time, yield new knowledge regarding the effectiveness of the plan or action. The adaptive approach is well suited to testing the efficacy of corridors in varying landscape contexts and for differing purposes (Peck 1998). A rigorous application of the adaptive planning approach is dependent on a proper monitoring protocol, adequate data, a robust analytical design, and a mechanism for the incremental knowledge gained to influence the future planning and management of the landscape in question.

Connectivity in hydrological systems is a key attribute. Water flows across landscapes under the influence of gravity, influenced by vegetation, geology, topography, and human engineering. The physics of hydrological flows across landscapes over time results in the formation of discrete channels and stream networks. These networks have been described as the river continuum, in which hydrological, physical and biological processes and structure change according to the position in the watershed (catchment) (Vannote *et al.* 1980; Naiman *et al.* 1987). For example, in the headwaters (i.e. low-order streams) food chains are based primarily on detritus, water temperature is cool, and stream flow rapid. In the lower sections of the watershed (i.e. higher-order streams), the food chain is based on micro- and macro-invertebrates, water temperature is warmer, and flows slower. The channels of the river continuum, and their associated border zones of hydrological influence, are together defined

as riparian corridors, which in most landscapes support a distinct floodplain vegetation adapted to the soil, hydrology and disturbances characteristic of the riparian zones. Riparian corridors contain important longitudinal and transverse ecotones (Pinay *et al.* 1990). The functions of these riparian ecotones include movement and retention of nutrients, exchange of organic material, and development of floodplain vegetation. The physical and functional connectivity inherent in riparian systems supports movements of materials and organisms between the main fluvial channel and its secondary channels and oxbow lakes. Through this process, nutrient spiralling, downstream nutrients are absorbed, utilised and released by organisms. Nutrient spirals are linked to regulate longitudinal movement and retention of nutrients in fluvial systems. These movements are critical for fish habitat. These functions are susceptible to interruption through dam or dike construction, which can reduce or eliminate the riparian zone bordering the channel and may interrupt the movement of materials and nutrients downstream.

The riparian zone contains, by definition, the zone of intersection of the surface and subsurface hydrological systems. Riparian corridors are fundamental to greenways for they provide connectivity, contain many resources, and support multiple uses and functions. Forman (1995) argues that riparian corridors anywhere in the world are 'indispensable' for the sustainable functioning of any landscape because the functions they provide cannot be provided by any other means or location in a landscape.

The laws of physics dictate that hydrological systems cannot be interrupted, for the water that flows downstream must be conveyed in a channel, or it will form a new channel. Human disturbance in riparian zones tends to constrict the channel, and 'disconnect' the riparian zone from the channel. In this common case, the channel provides only a conveyance function. The focus of much greenway work is to restore riparian zones along channels, thereby supporting the other functions and processes that occur when a continuous riparian zone exists. These collateral functions include stabilising surface and groundwater flows (recharge and discharge), wildlife habitat and movement corridors, nutrient and sediment buffering, human recreation, and support for cultural landscapes. The width of riparian corridor required to support these functions will vary as a function of the order of the stream channel (i.e. watershed position), the degree of human hydrological control, and hydrologic flow and disturbance regime (Forman 1995).

Other benefits of connectivity that can be supported by greenways include alternative forms of transportation, trail recreation, and the human need or preference for nearby nature and recreation (Kaplan *et al.* 1998). Comprehensive state-wide greenway plans have been developed that integrate these benefits explicitly (Florida Greenways Commission 1994). Transportation, by definition, involves locomotion between an origin and a destination.

Connectivity is essential for transportation to function. Greenways are often planned and implemented to support alternative forms of transportation, particularly pedestrian and bicycle travel. The benefits of this may be significant in terms of traffic reduction, reduced air pollutants, and a healthier population. In many regions of the USA, continuous, integrated bicycle trails are unusual, but when provided, prove to be immensely popular (Flink and Searns 1993). The same kinds of benefit occur from trail linkages. When greenways provide walking trail connections with other trail systems, their level of use and value is increased. Many greenways in the USA begin as single-purpose trail systems.

Perhaps the most abstract benefit of greenway connectivity is the psychological one – of linking people with nature, close to where they live and work. This goal is reflected in the President's Commission Report (1987). Kaplan *et al.* (1998) address the human need and preference for 'nearby nature', to experience the natural world as matter of course in everyday life. Providing this benefit has been shown to improve personal and social health. Historically, human–nature interaction was provided through large parks in cities (Fabos 1995). The greenway concept brings a new strategy to bear on this issue. By establishing 'fingers of green' in the urban and suburban areas where people live, a physical connection is made which supports this philosophical or spiritual need for human–nature contact. When the human–nature access links with other resources, the benefits are multiplied in a synergistic manner, at least in terms of space utilisation. This provision of multiple benefits is the subject of the next section.

3.2.3 Compatibility of multiple use

The final assertion of this section on supporting theory states that greenways are viable because they provide multiple functions within a specific and often limited spatial area, and that these uses can be planned, designed and managed to exist compatibly or synergistically. This argument is presented in three parts: (1) presumption of compatibility, (2) economic benefits, (3) building a base of political support through multiple use.

Presumption of compatibility

The claim that multiple uses can exist within a corridor of protected land presumes some degree of compatibility between the uses, for if the combination of two or more uses compromises the value or function of all, then no net benefit is gained. Testing this presumption is possible when the spatial requirements of the combined functions are well known. For example, protected wooded riparian corridors can provide emergency flood control function and routine recreational and scenic uses. In this case there is an inherent compatibility between the uses, with only an occasional disruption during periodic

floods. A more complex, but common, combination occurs when wildlife habitat functions are integrated with recreational access in greenways. Few species' spatial and habitat requirements are sufficiently well understood to be represented and modelled in a spatially explicit manner in greenway planning. Most species are not understood to this degree, making habitat planning a complex and uncertain process. Further, it is important to acknowledge that all habitats are not equally adaptable to multiple use. For example, forest-interior, disturbance-sensitive species are difficult to integrate into a greenway plan. When greenway management permits, timing of recreational access can reduce the impact of human presence and disturbance by managing the time, place, and intensity of the use. Examples include restricting access during nesting or breeding periods, or restricting access to forest patch margins or perimeter areas.

Economic benefits

The spatial efficiency inherent in the co-occurrence of greenway resources has an economic dimension. When multiple functions are provided in a single corridor, less land is pre-empted from other uses for these purposes. In addition, there are economic efficiencies in land acquisition, planning, design and management costs and expenses.

The broad economic benefits of protecting land for public use (including greenways) have recently been summarised by the US Trust for Public Land (TPL) (Lerner and Poole 1999). The TPL's report, 'The Economic Benefits of Parks and Open Space' identifies three categories of economic benefits related to land protection. Firstly, there is the 'Smart Growth' argument. Open land protection promotes more concentrated development patterns, thereby reducing the costs of providing infrastructure for low-density or sprawl-type development. This is a timely issue in the USA, where unplanned, decentralised urban development, or 'sprawl', is an important issue on the national agenda. Planning for integrated, linked protected lands within new urban developments is promoted as a prime 'quality-of-life' issue. Numerous studies cite access to natural areas and recreation as primary factors in people's preference for residences (Lerner and Poole 1999).

Secondly, open land protection promotes many forms of economic activity and investment. Parks and open space attract business and residents to communities, stimulating commercial growth, tax revenues and tourism. In many regions tourism is fast becoming the main economic activity. Open space is now recognised as an integral component of a sustainable economy.

Finally, open land protection provides a cost-effective means to safeguard the environment, producing a direct benefit for humans. These beneficial functions include: flood protection, water storage and purification, air cleaning,

degradation of organic wastes, and reducing urban heat island effects. These economic benefits can be attributed to any form of protected land, including greenways.

Building a base of political support through multiple uses

When greenways are integral to urban development, the opportunities and challenges for compatible multiple use come to the forefront (see Box 3.1). Clearly, choices and trade-offs need to be made to optimise any particular use. As these trade-offs become more explicit and intentional, new knowledge can be generated through monitoring and continued evaluation and research.

BOX 3.1. Guidelines for providing multiple functions in greenways

The test of compatibility of multiple uses is fundamental in greenway trails. New expertise is developing regarding the design of greenway trail corridors to support multiple functions, particularly wildlife habitat. The following is a summary of the key emerging concepts relating to greenway trail planning, design and management.

- A. Understand trail impacts. Greenway trails have specific zones of influence, which need to be planned with awareness of the timing, nature and intensity of trail use, and with the nature of the landscape through which the trail passes.
- B. Plan greenway trail routes carefully. Greenway trails should avoid crossing large natural areas. They should follow, not create, disturbance zones around protected core areas. Overall trail density should be kept as low as possible.
- C. Understand trail users. Trail users are a diverse and heterogeneous group, each with unique and important characteristics. For example, humans, dogs, and horses may all use a trail, and each has particular needs and impacts.
- D. Manage trail use. Greenway trail management is an ongoing process, which needs to employ a full range of management actions including trail closure, limits of use, and trail repair and restoration.
- E. Monitor trail impacts over time. Begin with an initial biological inventory, followed by monitoring. Enforce trail closures.
- F. Involve users and the public with trail management. Develop a sense of stewardship and engage volunteers in trail planning, implementation and management.

(Adapted from Hellmund Associates 1998; Smith and Hellmund 1993; Flink and Searns 1993.)

The greenway movement has been criticised for following a parochial 'parks and recreation' focus. Although this historical orientation produced many notable results and successes in rural areas, it reached its limits in urban areas. When greenways are conceived to provide multiple benefits, they hold the potential to engage multiple political constituencies in their implementation. This has proven to be an effective strategy in successful implementation of greenways in multiple cases across the USA (Erickson and Louisse 1997; Quayle 1996). In the USA the tradition of planning for land protection is much more developed in remote and isolated, spectacular landscapes than in urban centres and regions, particularly within metropolitan areas.

Once realised and implemented, multi-purpose solutions hold a greater potential to endure over time, as demographics, economics, environmental issues and landscape context change. In this respect, it is interesting to compare multi-purpose greenways with greenbelts. The former are inherently multi-purpose, the latter tend towards a single purpose, i.e. to contain urban expansion around urban areas. The greenbelt concept, because it was based on political boundaries and not natural features, became vulnerable to land use change, effectively becoming a 'bank' in which undeveloped land was held until development pressure demanded its use. In Canada's capital city of Ottawa, a greenbelt was established in 1950 as part of a regional plan. The greenbelt was incrementally compromised as pressure for land use change mounted over time (Taylor *et al.* 1995). In contrast, greenways that support multiple functions inherently enjoy a broader base of political support, and therefore can be more sustainable over time.

3.3 Historical development of greenways in the USA

A brief historical review of greenways in the USA illustrates an evolutionary process which parallels and reflects innovations in American landscape planning. In the public domain, vast areas of public land were added to the US National Park and US Forest systems over the past two centuries. These actions involved large pristine areas, far from human populations, which came under public control. Despite the monumental amounts of land involved, this was a relatively easy task because much of the land was never released from federal control, and much of it is mountainous and arid, thus less suitable for agriculture or urban uses. Greenways are quite different from these national parks for they focus on linear areas, are more often located near population centres, and are managed for multiple uses. This review articulates the issues, theories and policies that led to the development of greenways and serves as a basis for understanding their present situation and potential for future development.

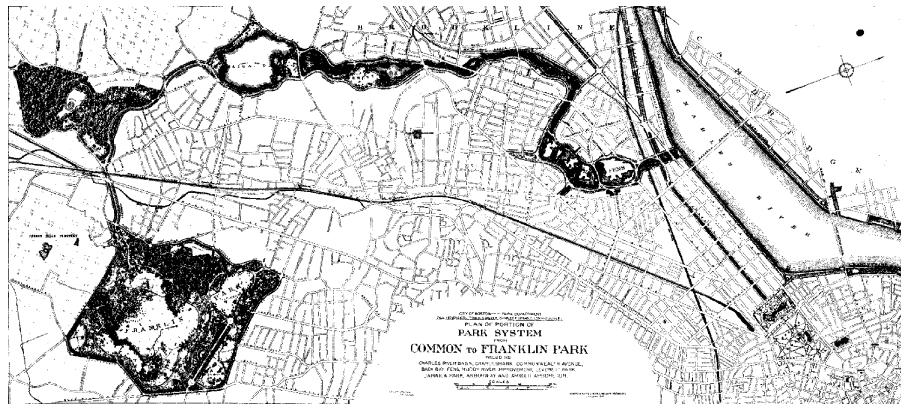


FIGURE 3.2.
Frederick Law Olmsted's 'Emerald Necklace' plan for the Boston Park System, the first greenway in the USA, 1880s. The black structure represents the Emerald Necklace, totally situated within the urban area of Boston.

Most of the literature on greenways points to their evolution from urban design concepts of the nineteenth century, including boulevards, axes and parkways. Searns (1996) labels these as first-generation or ancestral greenways. The first true greenways originated from the metropolitan open space systems of the late nineteenth and early twentieth centuries (Fabos 1995; Newton 1971; Zube 1996; Smith and Hellmund 1993). These were 'systems' in the sense that they involved a spatially linked network of mostly linear publicly owned lands. They were usually based on topographic and hydrological patterns in the landscape. Foremost among these systems was a built plan for the Boston Park System by Frederick Law Olmsted, Sr. (c. 1880s), the father of landscape architecture in America. His later work involved his sons as partners (Zaitzevsky 1982).

The Olmsted's plan for the Boston Park System, known as the 'Emerald Necklace', is regarded as a model of integration of existing protected lands, ecological corridors, and built linear elements (Figure 3.2). The system largely functions today to provide recreation, transportation, water quality and flood control, scenic amenity, and wildlife habitat. The 'necklace' is a fine example of a simple, yet powerful and enduring spatial planning concept. Under Olmsted's hand, several other American cities embraced this concept of linked linear parks, including Washington, D.C., Minneapolis, Kansas City, Buffalo and Cleveland.

The next historically significant greenway was the Metropolitan Boston Park System in the 1890s, planned by Charles Eliot, a protégé of Olmsted (Figure 3.3). Eliot's work greatly expanded Olmsted's 'emerald necklace', by creating a regional open space system, or greenway, structured by five principal landscape types which closely resemble contemporary greenway elements:

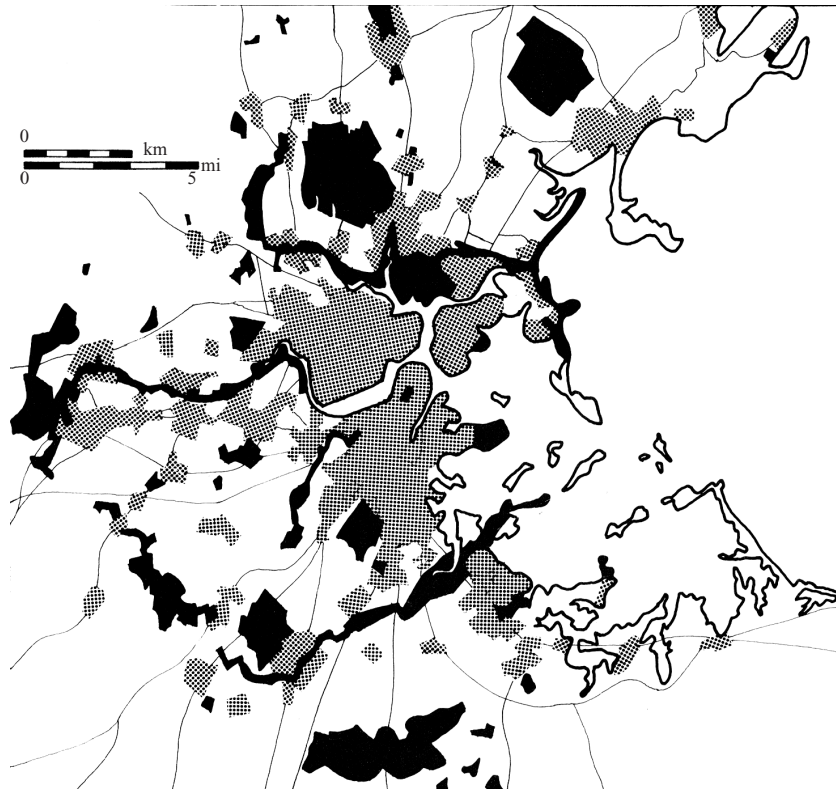


FIGURE 3.3.
Charles Eliot's Metropolitan Boston Park System, c. 1899. (Courtesy of Fabos 1985.)
Black, Metropolitan Park System; grey, built-up areas.

ocean fronts, river estuaries, harbour islands, large forests, and small urban squares.

Benton MacKaye (1928) expanded Olmsted and Eliot's urban park system concept in his book *The New Exploration*, in which he advanced, for the first time, the idea of a metropolitan system of protected lands conceived and configured to control urban expansion. Influenced by the earlier work of Ebenezer Howard in England, using the analogy of a river, he identified topographic ridges as 'levees' to contain and control the 'flow' of metropolitan urban expansion. The environmental planning movement of the 1960s marks the next significant development towards greenways. Ian McHarg's *Design with Nature* (1969) raised international awareness of the need for an ecological basis for planning and advanced a widely adopted method to accomplish it. McHarg argued that the major landscape planning issue was that of influencing the pattern of distribution of occupied and protected lands, not their absolute or relative areas. The work of Phil Lewis, mentioned previously,

integrated environmental planning through his 'Wisconsin Heritage Trail Proposal' (Figure 3.1).

The greenline concept of the 1970s introduced a new idea in land protection and management based on mixed public-private ownership. Greenline parks are mixed mosaics of public and private lands not defined exclusively by public ownership but rather by a 'green line' on a map. This idea, based on the national parks of England and Wales, responded to decreased federal funding for land acquisition, and the awareness of the need to protect open space within urban and metropolitan areas (Zube 1995). The greenline parks were represented by the Adirondack Mountains in New York, the New Jersey Pinelands, and many urban recreational areas within or adjacent to major cities.

As the concept of greenline reserves evolved, its emphasis shifted from large, park-like reserves to linear corridors including historic canals, railroads, and rivers. This was largely due to an emphasis on riparian corridors responding to the unprecedented expenditure made by the federal government to clean America's rivers in the 1960s. The effort brought attention to the problems of water pollution, and then when the rivers were once again clean, their recreational potential was rapidly rediscovered and developed. The Wild and Scenic Rivers Act of 1968 provided additional protection for rivers, wetlands and coastal zones, adding further interest to innovative models for the protection of linear landscape features. There was an emphasis on trail-oriented recreation during this period, which Searns (1996) labels the second generation of greenway evolution. Greenline reserves have evolved further into a planning-management entity known as National Historic Corridors (NHC), of which there are currently over 15 in the USA. NHCs are essentially greenways because they consist of linear areas, are spatially integrated and are managed for multiple uses. These third-generation greenways (Searns 1996) are truly multi-objective and demand an interdisciplinary planning and design approach.

In the 1980s, the loss of open space and increased need for recreation in urban and metropolitan areas focused attention on greenways. The President's Commission on Americans Outdoors (1987) found strong support for greenways to address the need for additional open space and recreational land and proposed a national system of greenways (see introduction).

Greenways have evolved into a flexible multi-purpose model for landscape planning and resource protection. In contrast with the 'crown jewels' of the US National Park System (e.g. the Grand Canyon, Yosemite), greenways protect 'working' landscapes in cities and regions where people live and work. The strategic nature of greenways suits them well to situations where land use must be spatially efficient and multiple uses are essential to gain political and economic support. The continuing evolution and adaptation of greenways is discussed in the following section.

3.4 Contemporary trends

Although US greenway history can be traced back over one hundred years, it is clear that greenway activity has never been as effective as in the contemporary time. An examination of this recent greenway activity is useful to understand the continuing evolution of greenways, to identify opportunities for applications and future research needs.

To gain a more accurate understanding of the nature, extent and location of greenway planning across the USA, a national survey of greenways was conducted by the University of Massachusetts, from 1996 to 1998. The survey was designed with the primary goal of identifying the nature and extent of greenways and greenway planning, at the state level, across the USA. The survey was conducted with assistance from the American Greenways Program, sponsored by the Conservation Fund (Washington, D.C.). Officials from each state were given a standardised telephone interview followed with a written request for information and responses to specific questions.

The survey found that whereas 48% of the states supported the concept of greenways, an equal number (48%) were not familiar with greenways at all. Not surprisingly, therefore, only 24% of the states had an official greenway plan, with 68% indicating that there was no plan. A similar response was obtained regarding the existence of a mapped inventory of greenways: 24% responded yes, 62% no and 14% did not know whether such an inventory existed for their territory. The survey also found a trend regarding the spatial distribution of greenway planning across the USA. Greenways were found to be most popular in the east and northeast where the states are small, population density is high, and the percentage of publicly owned land is low. The results of this survey also indicated that greenways are often initiated to support trail and recreational use, but evolve to support multi-purpose planning objectives. Finally, the survey found that greenways are increasingly integrated with comprehensive statewide planning.

The Rails-to-Trails Conservancy (RTC) has been active in greenway and trail creation since the 1980s. In the decade from 1988 to 1998, RTC helped to convert over 10 000 miles of abandoned railroads to greenway trails. Another recent greenways-related activity occurred in 1999 when the White House, the US Department of Transportation and the Rails-to-Trails Conservancy established the Millennium Trails Program. The goal of the programme is to recognise, promote and stimulate the trail movement in the USA and to reconnect communities with trails. Under this initiative, trails are designated in three categories: National Millennium Trails (12), Millennium Trails (52) and community trails (thousands). This programme will advance trail-based greenways, increase public awareness of all greenways, and most likely inspire future greenway development.

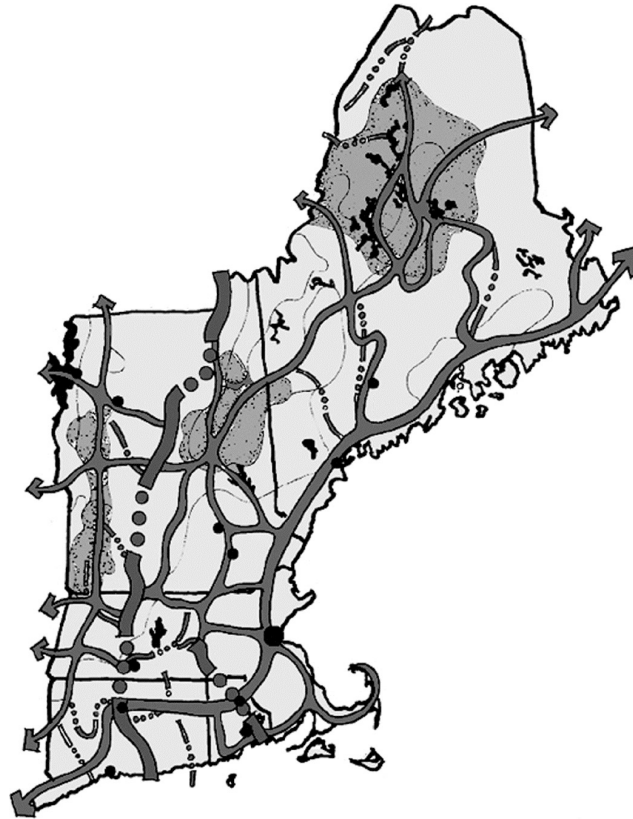


FIGURE 3.4.
New England Greenway Vision Plan (Fabos *et al.* 1999), showing the main greenway network.

At the regional level, the most significant greenway planning effort to date is the New England Greenway Vision Plan (Fabos *et al.* 1999). The plan co-ordinates greenway planning for all six New England states with a combined land area of over 42 million acres (*c.* 16 million hectares) (Figure 3.4). The plan, prepared in collaboration with the American Society of Landscape Architects, builds on the tradition of Frederick L. Olmsted Sr, Charles Eliot, and Benton MacKaye, who worked extensively in New England. The Plan was prepared through a co-ordinated, decentralised effort which integrated locally with statewide plans. Using GIS, the vision plan integrates single-purpose plans for nature protection, recreation and historic and cultural resources. The plan emphasises linear features, the importance of connectivity, and the imperative for multiple uses.

3.5 Conclusions and prognosis

Greenways represent an efficient and strategic method for protecting the most resources with the least amount of land (the hypothesis of co-occurrence).

The connectivity inherent in greenways supports numerous biological, physical, and cultural landscape functions that are important for sustainability. Within a spatial network of important and connected lands, greenways are planned and managed to support multiple compatible uses, thus assuring a broader base of political support and increasing the probability that the greenway lands may remain under protection for the future.

Greenways are becoming a popular international movement (Fabos and Ahern 1995). The theory of greenways and greenway planning presented in this chapter provides a rational basis for supporting greenways, and identifies future opportunities for application, and need for additional research. It is argued that these three ideas provide a rational basis of support, supported by published literature and case studies that transcend political context or geographic location.

Greenways are a strategic planning concept that has evolved over the past century in the USA in response to changing environmental, cultural, political and economic factors. The proliferation of decentralised, urban sprawl has motivated interest in alternative planning models and methods. The greenways concept addresses this need through its strategic approach, its record of successful integration of top-down and bottom-up approaches, and its emphasis on physical and organisational linkages. Physical linkages offer distinct advantages in terms of movement and transport of materials, species or nutrients. Greenways also provide a social and political network, which integrates people with diverse values and perspectives concerning land use and planning. This is perhaps the most significant characteristic of greenways, and distinguishes greenways from other landscape planning concepts.

The continued evolution and implementation of greenways is likely to produce three significant changes in the future.

Greenway planning will change the ways in which local and higher-level planning is co-ordinated and implemented. A major driver of this change is the emphasis on corridors, and the assumed value of connectivity, which together emphasise the need to link local plans to their larger landscape and regional context. This co-ordination will be accomplished, in part, through a new suite of land use controls and design guidelines in lieu of public ownership of land.

Greenways will inspire and motivate a new generation of partnerships and collaborations among individuals and organisations that formerly had some common interests, but with little record of co-operation (e.g. wildlife habitat and recreation, tourism, water resources). As Zube (1996) stated, 'Partnerships are a way of life in greenways.' Formal agreements for planning and technical assistance and for interagency and intergovernmental co-ordination will become more the norm than the exception.

Finally, greenways will promote an adaptive approach to the dilemma of landscape planning and management. Although greenways will continue to

apply the best available empirical knowledge and theory from landscape ecology in decision making, this knowledge, with respect to specific places and processes is inherently uncertain and incomplete. At the same time, social, political and environmental changes demand that actions be taken. The adaptive approach to planning and management offers a solution to this dilemma. Planning and management decision can be re-conceived as experiments, with the potential to add new knowledge as a result of their application. Greenways are well suited to this adaptive approach.