

## Article

# Greenways as Integrated Systems: A Proposal for Planning and Design Guidelines Based on Case Studies Evaluation

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**Abstract:** Greenways (GWs) can play a key role in the context of policies and strategies for sustainable territorial development because they contribute to the development of integrated plans and interventions for environmental safeguarding and socio-economic growth. As is generally understood, in their modern conception, GWs are not only develop soft mobility, but they also represent supporting elements of a new concept of development and use of territory, attentive to its particular characteristics and the needs of resident populations. Beginning with a critical analysis of the most significant case studies of greenways, the authors propose a system of design and evaluation guidelines useful in identifying specific GW-related actions. The identified actions are divided into two categories, which are tangible and intangible actions. The first category corresponds with concrete actions that are directly implemented through different design and construction phases; the second category corresponds with processes activated in the design phase and are concretized after the “commissioning” of the path and has repercussions on the sphere of place identity. These categories are often difficult to distinguish between because many actions can be considered to be both tangible and intangible.

**Keywords:** greenways; green infrastructures; active mobility; urban sustainability; landscape regeneration; project evaluation; design guidelines



**Citation:** Pinna, F.; Saiu, V. Greenways as Integrated Systems: A Proposal for Planning and Design Guidelines Based on Case Studies Evaluation. *Sustainability* **2021**, *13*, 11232. <https://doi.org/10.3390/su132011232>

Academic Editor: Marc A. Rosen

Received: 4 August 2021

Accepted: 5 October 2021

Published: 12 October 2021

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## 1. Introduction

Governments and local Administrations consider Greenways (GWs) as an opportunity to implement integrated sustainable development strategies in order to safeguard the environment and to improve the quality of peoples' lives [1–5]. It is well known that greenways represent a potentially “low cost” strategy that combines the protection of habitats and species and the socio-economic development of territories.

However, the definition and practical applications of the greenway concept have changed over time. So much so that many authors have tried to amend the concept by highlighting its main principles and specific characteristics [6–10], which also assists in defining guidelines for their design and implementation [11,12]. In this context, this paper, in accordance with these theoretical studies, focuses on the need to determine a series of meta-planning and design indications that are able to intervene on territory with infrastructure, conceived not only as an axis for the development of soft mobility, but also as a supporting element for a new concept of development and use of territory, attentive to a territory's peculiarities and to the needs of the resident populations. This has led to the definition of guidelines that are useful for designers and planners based on international experiences that are among the most attentive to the complexity of the problems that must be faced today.

More specifically, starting from a previous study conducted by the authors [13] and by using the case study method, a selection of relevant GWs projects are reviewed in order to analyze and systematize the main objectives underlying the interventions, by

highlighting the corresponding actions that have been taken. It is clear that each case study has peculiarities linked to the area of intervention, for which all the elements derived from the analysis are grouped into main objectives, sub objectives and related actions. It is from this general synoptic framework that the guidelines are derived. In this way, the guidelines proposed by this study represent a flexible and open tool that, through appropriate adjustments, is applicable in different territorial and socio-economic contexts.

This paper is divided into six sections. The first one reports the literature review with the theoretical framework of the research (Section 2); the second section presents the case study analysis with a synthesis of the main GWs characteristics and highlights their potentiality for territorial and urban regeneration (Section 3); the third section describes the main programmatic procedures and design actions, and specific design and regulatory guidelines (Section 4). Sections 5 and 6 present the discussion and conclusions.

## 2. Richness and Complexity of Greenway Project: Literature Review

The word “greenway” comes from the combination of the words “greenbelt” and “parkway”—respectively used for the first time by Ebenezer Howard and Frederick Law Olmsted to indicate a belt of green spaces around the city perimeter and a path intended for different types of traffic, with a defined structuring of the greenbelt, with a separation between vehicular flows, and the possibility of enjoying the surrounding environment. The origin explains the coexistence of multiple concepts that recall the evolution of urban planning from the 19th century to today. The concept of greenways, as is known, evolved as a response to the growth-needs of cities to the detriment of the landscape, the fragmentation of the territory and the protection of the environment, aspects that until that point were not considered in the process of urban planning.

It is significant that the term greenway appears for the first time in the literature by the end of the 1960s [14] in the book “The Last Landscape” written by William H. Whyte [15], highlighted the effects of unchecked urban expansion and provided many ideas and practical solutions for the better use of open space, and to link green spaces that had survived amid suburban sprawl for the benefit of the community. The 1960s marked a watershed between the second and third generations of greenways [7] as described below.

### 2.1. The First Two-Generation Greenways (Until 1960)

The first two phases of greenways development were built in the American context, originating as parks connected to urban and rural spaces and provide the first example of special and attractive corridors through cities [16]. Frederick Law Olmsted was one of the first researchers to develop the idea of a park system that takes shape through the connection of green corridors [17]. This idea was born in 1857 when, in collaboration with Vaux, he designed the first “parkway” model, New York’s Central Park. In 1865, following the examples of the wide boulevards of Paris and Brussels, they also designed the “Prospect Park” that is characterized as a rural landscape, completely different from a typical city park. At the end of the 19th century and in the early 20th century, connections of open spaces designed within the cities were born, linked to the topographic and hydrological models that characterized the landscape. In 1887, the Boston Park System, known as the “Emerald Necklace”, was the first greenway designed in the United States and can be considered the first significant greenway in the world. At 25-km-long, it connects the cities of Boston and Brooklyn to the city of Cambridge in Massachusetts State and the Charles River. This park system formerly known as “parkway” was renamed by Olmsted to “strip park” [18]. This Olmsted model was subsequently adopted by numerous landscape architects [19]. Among them, Charles Eliot, a pupil of Olmsted and pioneer of landscape architecture, suggested a large metropolitan park for the city of Boston. In 1908, H.W.S. Cleveland, with Theodore Wirth, designed the green network for the city of Minneapolis, the 23-mile-long Bronx River Park that still provides transportation infrastructure and picnic areas today.

After the Bronx River Park, the number of urban parks began to increase. Despite the controversial debate surrounding the interventions carried out by Robert Moses, as Little notes [18], they were significant for the evolution of the GW concept because for the first time, he had developed a recreational network connecting urban areas with all the rural regions including agricultural lands, rivers, streams, ponds and coastal areas.

## 2.2. The Third-Generation Greenways

The third-generation of GWs develops between 1960 and 1970, in the context of the great urban expansion caused by the suburbanization and sprawl processes. At this time, the interest in motor-free corridors increased and routes dedicated to pedestrians and cyclists became typical in many countries. This type of path helps to raise the awareness of citizens, creating an “environmental consciousness” and promoting the diffusion of the objectives of landscape cultural conservation, the control of the city’s development and redevelopment [18]. In this cultural and scientific context, GWs become a basis for landscape planning studies. The term “environmental corridor” was understood by Lewis as an element of protection for rivers and sensitive spaces and is still used in the planning of green systems throughout the United States [20]. In the 1960s, Philip Lewis Jr. proposed a design for the green spaces of the State of Wisconsin, beginning with an overlapping of thematic maps that represented different territorial resources. From this analysis he proposed a system of open green spaces connected through greenways (defined as “environmental corridors”), which were, for the most part, located along river axes [21,22]. With the pioneering work of Philip Lewis, the conceptual transition from the Olmstedian parkway to the modern greenway is considered complete.

## 2.3. From the Fourth-Generation Greenways to the Contemporary Concept

The fourth-generation of GWs develops from the 1980s in relation to the increase in environmental awareness favored by sustainable development policies [3,19,23–28].

The systemic concept for spatial planning, in fact, promotes actions aimed at integrating local resources, as well as recreational and economic activities through the creation of multifunctional green infrastructures and spaces, according to the definition proposed by Ahern: “... greenways are networks that contain planned linear elements, designed and managed for different purposes, including ecological, recreational, cultural, aesthetic or other purposes compatible with the concept of sustainable use of space ...” [19]. In this context, a greenway is a key method for the sustainable management of complex contemporary territories and economies, including habitat conservation, hydrogeological risk mitigation, the protection of historic sites, as well as in promoting education, so long as they are integrated with territorial planning.

## 3. Methods: Greenway’s Potential, Overview and Case Studies Analysis

In this section the authors propose a comparative qualitative analysis of a selection of case studies in order to identify common planning principles and project design characteristics that may be useful to formulate a set of GWs guidelines. Despite the different territorial context, the authors highlight how the multiple GW projects implement similar overall goals. Our study focuses on nine relevant GWs projects, including American and European case studies which are completed or ongoing, in order to collect sufficient data to document actions and results.

The authors conducted a spatial analysis (e.g., location, reused infrastructures, implemented services) considering financial and procedural project features (e.g., public policy makers and financial actors). Specific information on each case study has been attached to this paper. In “Supplementary Materials”, physical and dimensional characteristics, stakeholders, strengths, critical issues, targets and operational strategies have been highlighted for each case, and then the objectives, sub-objectives and the actions taken in each case are summarized in a table.

The joint analysis of the individual tables of each case study led to the determination of a summary table (Table 1). Projects located in high density urban environments (P1, P4, P5), in peri-urban areas and between urban and rural areas (P2, P3), and within low-density settlements (P6–P9) are included. The American case studies include (P1) The Baltimore Greenway Trails Network and (P2) the Chrysler Canada Greenway. European case studies include (P3) The Réseau Autonome des Voies Lentes (RAVeL-autonomous network of non-motorised paths); (P4) Véloroutes & Voies Vertes and (P5) The Two Tunnels Greenway. Finally, there are four Italian projects, (P6–P9) including (P6) The Greenway of the Battle of Pavia; (P7) The Greenway along the Martesana Naviglio; (P8) The Greenway of the Arno and (P9) The Greenway of the Nera River. Table 1 summarizes the main characteristics of these projects. For more details on the case studies, see “Supplementary Materials”.

**Table 1.** The main characteristics of the nine selected case studies.

Project	Location	Path Length	Infrastructures	Involved Actors	Fundings
P1. Baltimore Greenway Trails Network	Baltimore, Maryland	56 km	Urban and rural paths.	Municipality, Citizen Associations.	State
P2. Chrysler Canada Greenway	Essex County, Canada	50 km	Disused railway network	Conservation Authorities.	Donations
P3. Réseau Autonome des Voies Lentes (RAVeL)	Wallonie, Belgium	19 km	Disused railway network, canal and river towpaths, country roads.	Regions, Municipalities, Local Associations, Minister for Public Works.	EU, State
P4. Véloroutes & Voies Vertes	Chambéry, France	45 km	Disused railway network, canal and river towpaths, country and forestry roads.	Minister for Land Planning and Environment, Minister for Transport, Minister for Youth and Sport, Associations.	EU, State
P5. The Two Tunnels Greenway	Bath, United Kingdom	20 km	Disused railway network, canal and river towpaths, forestry roads, urban parks.	Minister for Transport and Health, Associations, Government organizations of citizens.	State, Private, Tourism Companies
P6. The Greenway of the Battle of Pavia	Pavia, Lombardia (Italy)	26 km	Canal and river towpaths, forestry roads, urban parks.	Region, Provinces, Municipalities.	Regional
P7. The Greenway along the Martesana Naviglio	Province of Milano (Italy)	35 km	Canal and river towpaths, forestry roads, urban parks.	Provinces, Municipalities Milan's local public transport company, Associations.	State, Local Associations
P8. The Greenway of the Arno River	City of Florence, Toscana (Italy)	350 km	Canal and river towpaths, forestry roads, urban parks.	State “Genio Civile”, Region, Provinces, Municipalities.	EU, State, Local Administrations, Private
P9. The Greenway of the Nera River	Umbria, Italy	180 km	Canal and river towpaths, forestry roads, urban parks.	Region, Provinces, Municipalities.	EU

According to the literature and the cases studies that have been reviewed, it is possible to highlight at least two essential and constant GW characteristics:

- (1) GWs are potential connectors between green areas, cities and rural areas, creating a synergy between the various existing territorial resources.
- (2) GWs are a potential network of multiple activities that can develop even without a specific design intention that can coexist with a prevailing and characterizing function.

What emerges from these two characteristics is the concept of movement, or rather a non-static nature, an aspect also highlighted by their historical evolution, both in terms of the uses of the greenway but above all, of their planning phase. The European Greenways Association defines these routes as a system of routes dedicated to non-motorized traffic. These paths must meet utility needs and should therefore be able to satisfy requests for movement that already exist; safety, in order to be used with peace of mind even by categories of weaker users; satisfaction, to ensure that the journey becomes a pleasant experience and not just the distance between a starting point and an arrival point.

Therefore, GWs allow people to reach places, services and other people, not only for recreational purposes, but also by presenting themselves as a real revolution in the relationship between communities and mobility. As is already known, these paths can be structured in such a way as to be a valid alternative to traditional types of travel in favor of soft mobility. They are routes designed for pedestrians, cyclists, people on horseback, land and aquatic fauna, and other types of non-motorized users (sometimes these routes can overlap, at other times they can be separated).

This aspect shows that places are intertwined with ecological and social networks, and the flows and inter-changes between natural processes and human decisions are crucial for the quality of the living environment [29]. Green infrastructures are a collective resource used to promote the socio-economic development of a territory and to improve social exchanges [30,31]. For this reason, the authors consider GWs as potentials cultural and ecological landscape corridors that are able to improve the sense of place and social interactions [24,32–34], agreeing with Little who states that “to make a greenway is to make a community” [18]. Greenways, indeed, are strong attractors of interest from people of all ages and social strata.

It is clear that GWs cannot be conceived as interventions provided from above, as they require both urban and socio-economic planning that take into consideration the available resources and above all, the critical issues of the territorial context in which they are implemented. This requires a complex approach to the issue of territorial transformation, as planning includes three dimensions (social, environmental and economic) of sustainable development, and requires the active participation of different social actors involved in the achievement of the outlined objectives [35–37].

### 3.1. Functional Characters

The main GW characteristics can be summarized through eight key points:

1. These are itineraries excluding motorized traffic in favor of slow mobility, capable of responding, integrating and enhancing connection requests already present in the area in a green (sustainable) manner. Each route has the main objective of connecting elements of interest and different areas of the territory. Therefore, particular attention is required in ensuring the visibility of points of access to such routes and the presence of intermodal hubs to facilitate the creation of the route with access to different public and private transport systems, and to also promote the coordinated use of bicycles and public transport.
2. These are itineraries designed in such a way as to safely accommodate all types of users. They must be spaces that can be safely used by people of all ages, pedestrians, cyclists or riders. In addition, these places can accommodate people with reduced mobility, guaranteeing the same possibility of use and enjoyment for all.
3. The use of GWs depends on good knowledge in the population of the routes and of the concept of a greenway. It is therefore necessary to accompany the design

with various advertising and dissemination tools such as the creation of websites for information purposes with maps and descriptions of the routes, the promotion of public meetings and the active involvement of citizens and volunteers in the enhancement of the territory.

4. These are itineraries built to meet the current requirements of urban planning in order to mend apparently fragmented territories, connecting areas that, due to the depopulation of cities, are characterized by a low territorial density and a strong presence of infrastructures that create margins between the various contexts, through a design that links elements that are divided. These routes are mainly developed with the aim of giving priority to the enhancement and recovery of existing road infrastructures such as disused railway lines, river towpaths, paths and agricultural roads and to minimize the construction of new routes. In this way, the movement does not only represent the necessity to cover the distance from a starting point to an arrival point, but it becomes above all, an experience.
5. Thanks to their location within areas with rich natural vegetation and along waterways, they can form the elements of an ecological network. According to their characteristics (width, connectivity between species, quality of vegetation and position in the territory) each greenway can perform different ecological functions: they can constitute a habitat, can act as a corridor for movement or a barrier, a filter, and a reserve from which plants and animals can turn outwards; in some cases, all the functions can be performed, in others only some can be performed.
6. They are itineraries able to respond to the needs of enhancement and improvement of the historical and cultural peculiarities of territories. In this way it is possible to improve the knowledge of the places and the protection of the existing heritage, to increase the sense of belonging of communities through an infrastructure able to respect and coexist with all the characteristic that historical elements present in the area.
7. The GWs design takes place following a study of the resources and criticalities present in the area so that it is possible to increase the development of the local economy over time through ad hoc projects and proposals, such as encouraging local activities, i.e., fishing and crafts; to promote the development of 0 km urban gardens and to increase tourist and recreational activities through specific services.
8. These are itineraries for which the design phase involves a careful study of the various territorial dynamics of the intervention area at different scales, and that are able to respond to all the needs of the various actors involved through partnership processes between entities and citizens. In this way it is possible to make the area more attractive and well-used, providing services such as rest areas, thematic routes and educational activities that allow people to learn about and discover the area in an active and engaging way.

### 3.2. Spatial Characters

Regarding spatial configuration, GWs are part of a large system suitable to protect those elements that physically show the continuity of the landscape, such as railways, canals and roads: the main concept is the “green corridor” which is capable of connecting spaces and species. In addition to transport, it is necessary to take into account the multiple functions that the greenway can perform such as the protection of water sources, the reduction of pollution, the protection of habitats and their biodiversity, protection from hydrogeological instability and the reduction of erosion along riverbeds, the availability of recreational activities, the formation of an environmental education, noise attenuation and the improvement of microclimatic effects. In essence, the key function of the greenway is its “special” way of integrating uses that are compatible, and to separate uses that are not.

Based on some authors’ considerations, we can divide greenways into 6 types:



1. Natural corridors of ecological importance are GWs that favor the protection of wildlife, the migration of species, biological sustainability, generally those “linked to biodiversity”.
2. Ecological systems and networks of ecological systems are GWs that connect different environmental systems at various scales (from the urban to the regional or national scale), improving the overall environmental quality and functioning of the ecosystem.
3. River urban greenways are GWs that cross urbanized areas using riverbeds, river corridors and towpaths as a support infrastructure with the aim of redeveloping and protecting wetlands.
4. Recreational greenways are GWs that accommodate different recreational activities and spaces (sometimes related to water) that cross landscape areas of high visual value.
5. Greenways with landscape and historical values are GWs that cross territories with important cultural and historical resources, and offer educational and cultural advantages, attracting tourists and offering economic opportunities.
6. Greenways designed to control urban development are GWs developed in urban and rural areas with the purpose of regulating and controlling urban expansion and preventing unplanned urban sprawl.

These characteristics often coexist in GW projects, and a valued project should aim to obtain all the given characteristics.

This aim distinguishes the most recent projects. The analyzed case studies, in fact, are characterized by the presence of an articulated set of spatial and functional elements that make it possible to satisfy many of these objectives. For example, the P1. Baltimore Greenway Trails Network can be considered a “natural corridor of ecological importance” (type 1) and above all a “network of different ecological systems” (type 2). In its 35 km, the P1 crosses different types of natural and urban landscapes that categorizes it as one of a types of “river urban greenways” (type 3), as exists in the route expanding along Drugg Lake, Ashburton Lake and Lake Montebello or along the Canton Waterfront Park; it is also one type of “recreational greenways” (type 4), especially so in the route closest to large urban parks such as Hill Druid Park where there are several schools (e.g., Baltimore City Community College, Coopin State University) and various recreational activities integrated into the path, such as the Maryland Zoo. In addition, the project plans to integrate 10 miles of route that will connect 75 neighborhood to the current path, helping to prevent the process of urban fragmentation that has been underway since the 1950s. From this point of view, P1 can also be considered a type 6 greenway.

The tables in Supplementary Materials highlight, in detail, which characteristics are present in each of the analyzed case studies.

This allows for advantages that no other infrastructure is able to provide, such as the increase in the quality of public life, as a result of the use of new spaces, the ecological and environmental protection of the sites, the cultural and historical enhancement of the places, without forgetting the economic implications. The benefits obtained in this area, therefore, are of an environmental nature as GWs make it possible to sustain the life of plants and animals and to ensure an increase in biodiversity and its protection. They are also important for the protection of urban ecological systems and the control of their development. There are, furthermore, cultural benefits as GWs enhance the historical and cultural characteristics of place by increasing user awareness; moreover, GWs can act as an open-air classroom that educates new generations on the importance of the natural environment. Among the economic benefits the first is the increase in the value of properties near the greenway given the increase in social interactions such as cycling, walking, fishing or tourism. The recreational needs of people generate an increase in commercial and tourism opportunities with implications throughout the territory [38]. No less important are the landscape benefits as greenways seems to constitute mechanisms that provides a means to preserve the open space and at the same time create a “green infrastructure” capable of increasing the pleasantness of a public spaces. Also important

are the recreational benefits that the construction of greenways offers due to the inclusion of organized sports areas, cycle paths, pedestrian paths and group activities [39,40].

Today, GWs are successful for numerous reasons, above all because they do not try to radically transform the landscape, but they adapt it by exploiting elements already present in the territory and enhance them. Besides the ecological services, GWs also provide multiple functions and services of importance for environmental quality and human wellbeing through the cross-landscape features.

GWs, in fact, are integrated infrastructures that combine and balance different territorial resources and can adapt to new uses over time. Their greatest advantage is in the ability to adapt to a wide range of landscapes [41] and to produce many positive inward and outward effects [42].

It is therefore important to (i) define a project on different scales, not focusing exclusively on a detailed scale, but reinforcing the study at regional, national and sometimes supranational levels; (ii) adopt a multiple-network design instead of a single path; (iii) evaluate each intervention in the territorial context in which it is carried out and proposed, in order to not waste the economic resources of the community to create useful, safe and pleasant paths and to (iv) highlight the characteristics of the territory and the needs of future users.

#### 4. Results: Towards Design and Regulatory Guidelines

The detailed case study analysis, reported in “Supplementary Materials” and summarized in the previous paragraph, led to the identification of the most recurrent GW project issues and the identification of the main goals that assist in defining a set of Guidelines applicable in different territorial contexts, that are useful in assisting administrators, planners and designer in the different phases of the process and to pursue integrated objectives, such as social quality, environmental protection and economic growth.

In this sense, the proposed system of Guidelines must be understood as an articulated system of strategies and actions that can be combined in a different way after a careful analysis of the priority objectives expressed through the specific geographical and socio-economic realities for which the project is intended. Only after a careful evaluation, can it be possible to build an effective long-term project.

Table 2 reports the key actions and sub-actions that have been identified as necessary to reach each goal, and the related design interventions.

**Table 2.** Goals, actions and sub-actions.

Goal	Code	Actions and Sub-Actions	Code	Design Interventions
Social Quality	A1	Increase inclusive mobility	T1	Universal Design for inclusive mobility
	A1.1	Create an integrated mobility system.	T1.1	Connect bus and bike stations and services, and pedestrian areas through intermodal hubs.
	A1.2	Promote universal accessibility.	T1.2	Remove obstacles and promote project solutions for people with disabilities, according to the principles of a design for all.
	A2	Ensure route safety	T2	Study specific characteristics for the routes



Table 2. Cont.

Goal	Code	Actions and Sub-Actions	Code	Design Interventions
	A2.1	Favor road orientation.	T2.1	Define clear road signage.
	A2.2	Provide access to separate routed networks.	T2.2	Define recognizable and dedicated accesses and paths for public transport, cyclable and pedestrian crossings.
	A3	Increase sense of belonging to a place	I1	Activate participation process with stakeholders to involve citizens in the participatory planning
	A3.1	Foster synergy among institutions, businesses, and citizens.	I1.1	Activate participation processes: organize, negotiate, and interact with different stakeholders in order to find realizable solutions for their different needs.
	A3.2	Support socio-cultural groups and associations.	I1.2	Promote and finance the activities of various groups, voluntary and civic associations, non-profit organizations and citizen committees, even with dedicated funds.
	A3.3	Promote education.	I1.3	Promote education campaigns and specific educational paths for public schools.
	B1	Improve the resilience of the territory	T3	Plan network on a grand scale
	B1.1	Improve the ecological impact of transportation system.	T3.1	Improve public transport systems, cyclable and pedestrian networks.
	B1.2	Reassemble fragmented territories.	T3.2	Dealing with fragmentation in road infrastructure planning: define new paths to connect existing routes and points of interest.
Environmental Protection	B2	Protect biodiversity and ecological values	T4	Activate landscape retraining through GWs
		Safeguard the native vegetation and environmental elements.	T4.1	Create protection barriers for sensitive areas.

Table 2. Cont.

Goal	Code	Actions and Sub-Actions	Code	Design Interventions
Economic Development		Promote the re-use of natural towpaths and navigable waterways.	T4.2	Integrated navigable rivers and navigable canals in the network mobility system.
	B3	Enhance the historical and cultural heritage	T5	Activate retraining of existing architectures through GW
	B3.1	Promote the requalification and the re-use of heritage.	T5.1	Promote public-private partnerships and facilitate administrative procedures for the historical and cultural buildings' re-use.
	B3.2	Revitalize historical paths.	T5.2	Establish thematic cultural routes.
	B3.3	Connect natural attractions, historical and cultural heritage.	T5.3	Define paths to connect/integrate different territorial resources.
	C1	Increase local economy	I2	Enhance local economic activities through their integration in network design
	C1.1	Ameliorate hospitality.	I2.1	Create new jobs in hospitality industry.
	C1.2	Promote agro-food industry.	I2.2	Improve farmers' and local food commerce.
	C2	Increase economic attractiveness	I3	Make places attractive through tangible and intangible services along the GW network
	C2.1	Improve communication and information.	I3.1	Advertise on dedicated web sites the various activities that can be undertaken within the itineraries.
	C2.2	Ameliorate the service quality.	I3.2	Create new rest points and services areas.
	C2.3	Enhance the tourism attractions.	I3.3	Create new recreational and leisure activities.

As shown in the previous table, classes of identified actions are linked with corresponding design interventions; these are divided into two categories, tangible and intangible. The first category corresponds with concrete actions that are directly implemented through the different phases of design and construction; the second category corresponds with processes activated in the design phase and concretized after path “commissioning” and has repercussions on the sphere of the place identity. In the Table 3 above, tangible actions are indicated with the letter T and intangible actions with the letter I.

**Table 3.** Design interventions and related tangible and intangible activities.

Design Interventions	Critical Issues	Opportunities/Strategic Activities
<p><b>T.1—Increase inclusive mobility</b> Routes must be part of a network capable of fully enhancing the territory and improving the living conditions of people. Provide a valid alternative to car use for daily commuting (home-work-school), encouraging the use of bicycles and walking. GWs can be built using existing infrastructures such as country roads, riverbeds, paths, abandoned railways, trying to connect sensitive and valuable points of the territory. One of the great strengths of the GWs projects is their integration with other transport, public and private. To do this, equipped spaces are needed to “exchange” transport systems (cars, bicycles, buses).</p>	<p>Specific characteristics of some routes not always adaptable to the needs of this mobility. The search for suitable routes necessarily involves a careful study of the site which, sometimes, could be hard for Administrations. Possible negative effects on the habitat caused by the increased use of a natural site. Risks arising from the integration of slow mobility with vehicular. Need for agreements between managing bodies of the routes and territorial contexts. Lack of adequate spaces for rest and for service areas near the route.</p>	<ul style="list-style-type: none"> <li>• Connect significant points for daily activities and sites of interest to promote a wider knowledge of the places and improve their protection.</li> <li>• Create parking and services areas such as restaurants, toilets, bike sharing, bike repairs, shopping, car parks, etc.</li> <li>• Make access to the paths visible and easily recognizable.</li> <li>• Retrial existing routes and create new routes without new negative environment impacts and ensuring a safe route for all users.</li> <li>• Provide public transport vehicles with devices suitable for transporting bikes without additional costs, bicycle storage and custody service with infrastructures that make mobility easier.</li> </ul>
<p><b>T.2—Study specific characteristics for the routes</b> The path layout represents the GWs in a "physical" way, it is what allows it to exist, therefore, it its usability must be guaranteed with total safety for all users. It must respond to precise geometric, technical and material characteristics (width, longitudinal and cross slopes) so that it is a suitable space for outdoor use. The design complexity of a GW requires a basic technical tool that can guide designers to create a safe path. The technical notebooks should illustrate the main analyses to be carried out, rules and directives useful for the creation of a safe and comfortable GW for all users with a high degree of territorial integration.</p>	<p>Morphological characteristics of crossed territories which often do not allow usability by all users. Lack of specific technical standards regarding pedestrian river crossings. Difficulty in mediating between the specificities of the crossed territories and the constraints specificity of a norm.</p>	<ul style="list-style-type: none"> <li>• Use appropriate materials for users' comfort and safety.</li> <li>• Comfort: seats, shaded and rest areas, rest supports; for which the positioning requires careful attention in the design.</li> <li>• Create river crossings that require ad hoc legislation and that are safe and respectful of the context with low environmental impacts.</li> <li>• Study specific signage for GWs with highly recognizable characteristics.</li> <li>• Create Guidelines applicable to different situations with the objectives to be pursued, maintaining a degree of flexibility for them to be adapted to specific contexts.</li> <li>• Provide information on the maintenance plans in terms of interventions and responsibilities of administrators and stakeholders.</li> </ul>

Table 3. Cont.

Design Interventions	Critical Issues	Opportunities/Strategic Activities
<p><b>T.3—Plan network on a grand scale</b></p> <p>Road infrastructures, barriers created by urban gardens, illegal construction, uncontrolled city sprawl are all elements that contribute to increasing the degree of territory fragmentation. Planning on a wide scale is necessary to guarantee the continuity of both anthropic and ecological flows. The inclusion of routes for alternative mobility connecting towns with workplaces, homes and services scattered throughout the territory allows the use of rural areas by the entire community and the discovery of still-hidden landscapes.</p>	<p>Difficulty in collaboration between stakeholders.</p> <p>Poor availability of competent resources to be used in the study of the territorial contexts.</p> <p>Presence of erroneous social, urban, cultural dynamics and habits now consolidated over time, difficult to eradicate.</p> <p>Lack of supporting standard that facilitates the functionalization of border areas.</p>	<ul style="list-style-type: none"> <li>• Study the context through site analysis, identifying criticalities and resources that allow regeneration for territory.</li> <li>• Analyse the social context by identifying user needs, know their daily movements and how to encourage them in soft mobility, identify weaker categories and study ad hoc interventions, propose mechanisms to attract new users.</li> <li>• Study a "strategic" way for territorial planning capable of reducing complexity by identifying functions, uses and morphology, capable of proposing alternative solutions to critical cases.</li> <li>• Re-functionalize the "border areas" ensuring territorial continuity.</li> </ul>
<p><b>T.4—Activate landscape retraining through GWs</b></p> <p>The GWs, as an instrument for safeguarding and enhancing the territory, could easily be used for the safety and retraining of places. The proposed interventions should have a significant ecological value through studies of vegetation, of areas subject to flooding, creating highly natural protection limit zones. These areas could contribute to the evolution of the natural habitat, performing an important hydrogeological safety function for the space, enhancing the environmental context.</p>	<p>Poor maintenance of water bodies subject to uncontrolled growth of vegetation, which makes them unsafe.</p> <p>Degradation derived from anthropic incivility, encouraged by a place's inaccessibility and lack of control.</p> <p>Areas subject to high hydrogeological risk.</p>	<ul style="list-style-type: none"> <li>• Arrange dams and canals through the recovery of river towpaths by inserting them within the GW network.</li> <li>• Protect sensitive areas or areas subject to flooding with suitable vegetation.</li> <li>• Requalify water bodies through regular cleaning, control and maintenance.</li> <li>• Study the natural habitat of the area aiming at its protection and safeguarding with targeted actions.</li> <li>• Carry out specific crossings for each river axis.</li> <li>• Include protected areas of ecological and landscape importance in the planning.</li> </ul>
<p><b>T.5—Activate retraining of existing architectures through GWs</b></p> <p>GWs are paths that are part of a consolidated and heterogeneous territory that could have elements of historical and cultural value. The enhancement of the territory, therefore, should be followed by the enhancement and retraining of these singular points, as elements characterizing the place, which can become important points of attraction.</p>	<p>Lack of funds for the recovery of all historical architecture, with the consequent necessity of choice of priority sites.</p> <p>Difficulty in identifying a new function appropriate to the historic building, though they can provide a support service to the GWs.</p> <p>Basic ambiguity relating to the ownership, financings, and management of such assets.</p>	<ul style="list-style-type: none"> <li>• Survey the historical architecture and their properties.</li> <li>• Study the historical evolution of architecture and analyse their state.</li> <li>• Activate scheduled maintenance plans that guarantee their usability over time and therefore their conservation.</li> <li>• Encourage collaboration between the various bodies involved in the retraining and management of the historical heritage with specific economic funds.</li> <li>• Promote the integration of the historical and cultural interest area with the route.</li> </ul>

Table 3. Cont.

Design Interventions	Critical Issues	Opportunities/Strategic Activities
<p><b>I.1—Activate participation process with stakeholders to involve citizens in the participatory planning</b></p> <p>Considering the complexity and variety of the issues addressed in a GWs project, a close collaboration between all the involved actors is necessary. Starting with the Administrations that should manage the regulation and planning of territories and who represent the first promoters of the project. However, this should not be perceived by the community as an imposition, but the result of close collaboration between citizens and local authorities, originating from community needs that, in this way, actively participates in the territory's improvement.</p>	<p>Difficulty of Administrations to identify their limit criticalities and to implement common strategies to overcome them.</p> <p>Local Administrations not always adequately trained for this kind of intervention.</p> <p>Consolidated sectoral approach of the professionals involved in the design.</p> <p>Difficulty in managing active participation by the community due to the prevalence of personal interests over community interests.</p>	<ul style="list-style-type: none"> <li>• Encourage collaboration between the local authorities involved to solve problems due to the system complexity.</li> <li>• Promote users' involvement in planning processes, stimulating participation.</li> <li>• Encourage the involvement of different professional figures (landscape architects, sociologists, botanists, engineers, etc.) with the aim of pursuing a common goal, namely the improvement of life quality of the community.</li> <li>• Propose the activation of programmatic agreements between the involved bodies.</li> <li>• Perform scheduled maintenance according to technical Standards and check the place's maintenance status.</li> </ul>
<p><b>I.2—Enhance local economic activities with their integration in network design</b></p> <p>The GW construction can become an opportunity to increase the local economy, beginning with the enhancement of the resources offered by the specific area. This requires an analysis of resources and the implementation of operational strategies involving all production activities (agriculture, sheep farming, fishing, crafts, tourism) with the common goal of promoting local production.</p>	<p>Restrictive regulations that become an obstacle to local production, which is already deficient.</p> <p>Unify the workers involved in production.</p> <p>Strong fragmentation and degradation of properties and agricultural areas.</p>	<ul style="list-style-type: none"> <li>• Study the resources and critical issues at an economic level, specific to each territorial context.</li> <li>• Promote tourism through the enhancement of sites of historical, artistic and cultural interest.</li> <li>• Promote agriculture through the revitalization of abandoned and degraded land, producing economic incentives.</li> <li>• Promote the sale of local products and to provide services suitable for needs.</li> <li>• Promote pastoralism through the sale of local products and to provide services suitable for needs.</li> <li>• Create websites and associations to advertise and support the new local production system.</li> </ul>

Table 3. Cont.

Design Interventions	Critical Issues	Opportunities/Strategic Activities
<p><b>I.3—Make places attractive through tangible and intangible services along the GWs network</b></p> <p>GWs are not born simply as infrastructures or connecting elements between points of interest and for transport. They are open spaces, where time can be spent in a landscape and environment of high value. All this is not enough: it is necessary to integrate rest areas and various services along the route that make a stay on the site more comfortable and adequate to the needs of different users. Furthermore, to make the route even more attractive, it is possible to insert themed routes that highlight the specific characteristics of the place, providing the opportunity to rediscover it in a new and engaging way.</p>	<p>Identify potentially attractive elements within apparently heterogeneous and degraded territories, and then enhance them.</p> <p>Identification of the correct funding for this type of intervention and sound use of resources.</p> <p>Correct promotion of thematic paths.</p>	<ul style="list-style-type: none"> <li>• Enhance the environmental and historical characteristics of the territory, the social habits of the local community and all the cultural traditions which are an important element of attraction for tourists.</li> <li>• Promote specific proposals for schools through the creation of areas for educational purposes, thematic itineraries and experiential paths that can enhance environmental respect and education starting with new generations.</li> <li>• Encourage the creation of areas for sport, play and free time that make the GWs not only a passageway, but a place to spend free time, also having opportunities for social meetings in a high-quality open space.</li> <li>• Provide services such as rest areas, refreshment areas, information points that make the route more comfortable and usable.</li> </ul>

## 5. Discussion

From what emerged in Paragraph 4, it is clear that GWs represent an opportunity for a general requalification of territories of which the potential has often been disregarded in favor of a classic approach that has presented limits when directing these territories towards real development from an environmental, social and economic point of view. This fact has been amply demonstrated by the analysis of the case studies which clearly showed the complexity of the issues that designers and planners may experience. Even the References illustrate the need for more complex approaches to the problem which, we have tried to summarize through the introduction of Guidelines useful to promote a design process that is attentive to all the aspects that make a place unique, not only for visitors but also, and above all, for residents, the first users of local resources.

The added value of this work lies in the construction of an operational framework able to systematize the multiple objectives that can be pursued through the creation of GWs and the actions required to achieve GWs. This complex set indicators emphasizes the need for greater integration between issues often neglected in evaluation processes, such as social equity, and other more traditional issues such as environmental protection and economic development, which are nevertheless reinterpreted in light of the most up-to-date principles of sustainability [43].

It should be underlined that the search for unitary Guidelines—performed through a study of real examples from different territorial contexts—defines a conceptual and operational framework which, however, requires an adaptation to local conditions, because the needs of specific locations can vary due to cultural differences, and local habits which set the priorities and can generate different objectives. The proposed Guidelines, therefore, must be interpreted as an aid to design and planning, an operational framework capable of guiding and supporting the decision-making process of local administrators and planners who will have to adapt them to their given context.



## 6. Conclusions

Usually, GWs elicit an image of paths surrounded by greenery; however, this study, highlights that GWs are not only paths that are used to travel from one point to another, but are spaces that create relationships between places, between environments and between people, that can play a leading role in the improvement of social quality, environmental protection and economic growth of the included territories.

For this type of infrastructure, planning for transport purposes alone is not enough to meet all the objectives that a GW can potentially attain. For this reason, the authors tried to develop an evaluation tool that can provide a series of design Guidelines capable of providing concrete answers to social, environmental and economic areas of concern, and which allows the specificities of individual places to emerge.

The aim of this study was to define, within the Guidelines, a set of actions applicable in different territorial contexts, helpful in assisting administrators, planners and designers in different phases of the process and to pursue integrated objectives, such as social quality, environmental protection and economic growth. In this study, the analysis of some international case studies proved useful, making possible the identification of an initial list of actions that led to the success of the investigated projects. Beginning with this analysis made it possible to generalize and identifying those actions that were most often implemented and which, above all, had proved their usefulness. As has been made evident, these include not only tangible actions, but for the success of GWs and for the territorial context of concern, it is also necessary to take into account the intangible actions, which are the elements that have often been underestimated by designers and planners. In this way, potential project actions were delineated, for which critical issues, potential opportunities and strategic activities were defined.

As the authors have already underlined, each CW project is unique. Therefore, the proposed system of Guidelines provides an articulated system of strategies and actions that must be selected and combined on the basis of the evaluation of the priorities defined within the specific geographical and socio-economic situation. For this reason, these Guidelines represent a first step towards a more conscious planning of CW paths that takes into account the potential contributions they can offer to a territory.

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/su132011232/s1>, Case Studies—Projects sheet: USA, State of Maryland, Greenway Trails Coalition, Baltimore; Canada, Exess Region, Chrysler Canada Greenway, Windsor; Republic of Singapore, The green corridor, Singapore; Belgium, RAVeL (Reseau Autonome de Voies Lentes) in Wallonia, Bastogne-Witz; France, Vèloroutes & Voies Vertes, Chamberie; Great Britain, Greenways and Quiet Roads, Bristol-Bath; Italy, Region of Lombardy, The Greenway of the Battle of Pavia; Italy, Region of Lombardy, The Greenway along the Martesana Naviglio; Italy, Region of Tuscany, The Greenway of the Arno; Italy, Region of Umbria, The Greenway of the Nera River.

**Author Contributions:** Conceptualization, F.P. and V.S.; methodology, F.P. and V.S.; formal analysis, F.P. and V.S.; writing—original draft preparation, F.P. and V.S.; writing—review and editing, F.P. and V.S. Both authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

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