sustainability

MDPI

Article

An Operational Model to Downscale Regional Green Infrastructures in Supra-Local Plans: A Case Study in an Italian Alpine Sub-Region

Guglielmo Pristeri *, Viviana di Martino, Silvia Ronchi, Stefano Salata, Francesca Mazza, Andrea Benedini and Andrea Arcidiacono

Department of Architecture and Urban Studies (DAStU), Politecnico di Milano, via Bonardi 3, 20133 Milano, Italy; viviana.dimartino@polimi.it (V.d.M.); silvia.ronchi@polimi.it (S.R.); stefano.salata@polimi.it (S.S.); francesca1.mazza@polimi.it (F.M.); andrea.benedini@polimi.it (A.B.); andrea.arcidiacono@polimi.it (A.A.)

* Correspondence: guglielmo.pristeri@polimi.it

Abstract: In recent years, green infrastructure (GI) has increasingly become a strategic tool to integrate ecosystem services in spatial planning at different scales. GI has the potential to foster the achievement of environmental targets and landscape enhancement promoted by several planning instruments that act at different territorial scales. Despite this, the combination of the GI strategy with other ordinary plans is poorly investigated and developed due to the difficulty in making planning instruments dialoguing in a transversal approach. This paper presents a case study in an Italian alpine sub-region (Media and Alta Valtellina, Province of Sondrio) focused on a regional GI—defined by a landscape plan—used for testing a replicable methodology to downscale regional strategies by combining them with sub-regional environmental and landscape rules and recommendations derived from planning instruments. The aim is to create an organic connection between GI goals and other sub-regional planning instruments that would otherwise remain siloed within the hierarchical downscaling process of the top-down planning system. The result is the development of a comprehensive matrix that is useful for downscaling the strategies established by a regional landscape plan in sub-regional landscape units that relapse at the local scale; this is also achieved through GI deployment and the promotion of site-specific nature-based solutions.

Keywords: ecosystem services; strategic planning; landscape planning; landscape quality objectives; nature-based solutions

check for updates

Citation: Pristeri, G.; di Martino, V.; Ronchi, S.; Salata, S.; Mazza, F.; Benedini, A.; Arcidiacono, A. An Operational Model to Downscale Regional Green Infrastructures in Supra-Local Plans: A Case Study in an Italian Alpine Sub-Region. *Sustainability* **2023**, *15*, 11542. https://doi.org/10.3390/su151511542

Academic Editors: Corrado Zoppi and Sabrina Lai

Received: 28 April 2023
Revised: 14 July 2023
Accepted: 21 July 2023
Published: 26 July 2023

1. Introduction

Green infrastructures (GIs), as well as green and blue infrastructures (GBI), are increasingly becoming a common tool to provide ecosystem services (ESs) in spatial planning at different scales [1–3].

ESs may be described as "the benefits human populations derive, directly or indirectly, from ecosystem functions" [4]. According to the Millennium Ecosystem Assessment (MA), which was developed by the UN since the start of the XXI century, ESs include provisioning, regulating, supporting and cultural services, whereas the ability of ecosystems to deliver their services can be assessed using a variety of qualitative and quantitative methods [5].

The operational connection between ESs and GIs is clarified in the 2013 Green Infrastructure Strategy by the European Commission. There, GI is defined as "a strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings" [6].

GIs are based on the following five main principles: (1) integration, considering the grey–green combination of GI; (2) multifunctionality, which includes the ecological, social and economic/abiotic, biotic and cultural functions of green spaces; (3) connectivity between green spaces; (4) a multi-scale approach taking in all parcels, from the individual to the community, regional and state scales; (5) a multi-object approach including diverse types of (urban) green and blue spaces [7–9].

From a governance process perspective, GIs (1) consider a strategic approach in planning as they aim for longer benefits but remain flexible for changes over time; (2) promote social inclusion, standing for communicative and socially inclusive planning and management; and (3) adopt a transdisciplinary approach based on knowledge from different disciplines, developed in partnership with local authorities and stakeholders [9–11].

In relation to both objectives and spatial structure, GIs are strongly related to ESs as one of their main goals is to deliver and enhance ESs at different scales [12–15]. Hence, mapping and assessing the spatial ES provision has become one of the first stages in designing and implementing a GI or improving existing GIs according to different planning scenarios [16,17].

Therefore, a GI may be considered an environmentally compatible project aiming to promote the integration of ESs into planning processes and instruments [18–20] with considerable potential to advance the adoption of environmental best practices [21]. Moreover, GIs are the backbone of policies that preserve Europe's natural environment, including the EU Biodiversity Strategy for 2030 [22–24].

Despite that, Hansen and Pauleit [8] claimed that GI remains a broad and fuzzy concept when not incorporated in the design process. Studies carried out in recent years [25–27] show that albeit the gaps in operationalising GIs are still significant, there are promising examples and opportunities to transfer ES and GI research into good spatial planning practices [9–11,28,29].

Among the above-mentioned GI principles, the multi-scale approach seems particularly significant for GI spatial design and strategic contents or measures [30,31]. As stated by the European Commission, "Whilst elements of a GI network can operate at different scales, they must normally have a certain critical mass and connectivity potential to be able to contribute effectively to a GI. An individual tree may be an element of the system, but only if it forms part of a larger habitat or ecosystem that provides a wider function" [6], and connecting different planning scales is widely recognised as one of the common features of GIs [32,33]; thus, landscape is considered as "an overall system of ecosystems in which single components interact with each other through a multitude of ecosystems and landscape elements that contribute to create a Green Infrastructure" [34]. The multi-scale approach integrates individual analyses based on different scales in a combined synthesis [35]. An ES-based GI is composed of diverse physical features that are specific to each location and are scale dependent [23,36–38]; this allows for the assessment of ESs at multiple spatial scales and according to the most suitable size specificity of a phenomenon [39].

As defined by Hansen and Pauleit [8], "GI planning can be used for initiatives at different scales, from individual parcels to community, regional, and state. GI should function at multiple scales in concert". Hence, the structure of a GI should be intended as an open framework that is suitable for supporting a multiplicity of implementations at different scales. In a large-scale design, a GI covers a wide range of territories, dealing with a high complexity and variability of landscapes, infrastructures and human settlements [30,40,41] and acting as a framework to guide and connect future implementation at the local scale. The connection between these two dimensions requires a common list of recommendations, prescriptions and planning suggestions [42–44].

In this frame, the GI downscaling process towards local implementation requires addressing the following two major issues, respectively: the scalability of GI strategies concerning their spatial dimension, and the coherence within the different planning levels involved. On the one hand, the translation of broad principles and objectives into site-specific actions and strategies requires detailing and adapting the GI spatial design [45–47] as well as acquiring data required for local spatial knowledge and assessing the coherence between a large-scale spatial design and smaller-scale implementations. A further critical step is choosing proper and suitable solutions (including nature-based solutions—NBSs) to guarantee ecological, environmental, social and mobility benefits to people through ES improvement [21,48]. On the other hand, the operability of the GI at the local scale necessarily requires contextualizing the downscaling process within the regulatory and planning framework in force. This involves both verifying the respondence of the proposed local strategies to supra-local planning objectives and guidelines, and promoting the cooperation among different levels of governance as an application of the subsidiarity principle between the various planning scales [49,50]. In response to such issues, the multi-scale design of a GI combines objectives, spatial design, regulations and tangible solutions that should intertwine and find mutual correspondences to build environmental strategies [51–53]. In turn, strategies should help translate ES-based GIs into feasible land use planning tools and regulations [25,54].

This paper presents a pioneering example of downscaling a regional GI for future possible local implementation, developed within a regional landscape plan framework that identifies different landscape units to facilitate the scaling processes.

The aims of the study are the following: (i) setting a pilot methodology for downscaling the regional GI to a sub-regional scale; (ii) integrating GI principles and spatial design into the complex and fragmented framework of different supra-local planning strategies; (iii) showing how to reach a more detailed implementation of a multi-scale GI by adopting a set of local interventions (including NBSs) to specific landscape typology.

The materials and methods are illustrated in Section 2, with a preamble presenting the Italian planning framework. In Section 3, the main findings are illustrated, and in Section 4, they are discussed, providing possible future applications and defining some limits and critical aspects. Lastly, Section 5 hosts the conclusions.

2. Materials and Methods

2.1. Research Framework

2.1.1. The Italian Planning System and Lombardy Regional Framework

The Italian planning system is organised in four tiers, corresponding to the levels of administrative divisions as follows: (1) national; (2) regional; (3) provincial; (4) local [23].

At the national level, a planning law is in force; furthermore, the government provides guidelines for territorial development, with jurisdiction in the infrastructural system, heritage sites and landscape. The planning law in force was approved in 1942 and, in the following decades, underwent several reforms, shifting spatial planning topics to the local level and assuming the municipal development plan as the central planning instrument.

As for the regional level, Italian regions have the authority to approve regional planning laws. Furthermore, regional administrations are committed to approving the Regional Territorial Plan (RTP) and the Regional Landscape Plan (RLP), in cooperation with the National Ministry of Culture. Actually, regions can choose whether to have two separated plans or a single RTP with landscape value. In the Lombardy region, the RLP is included in the RTP, and it sets out guidelines for the preservation of landscape features and the restoration of historic and natural areas.

Moreover, the Lombardy RTP provides an additional in-depth planning tool, named the Regional Territorial Area Plan (RTAP), that could be applied to selected supra-local contexts involved in major development processes or interventions. It is a medium- to long-term strategic tool that promotes a multi-level governance approach to enhance territorial competitiveness and environmental quality.

At the provincial or metropolitan level, administrations prepare the Provincial Territorial Coordination Plan (PTCP)—or Metropolitan Territorial Plan for the metropolitan cities—which is often focused on environmental and infrastructural topics. Finally, land use decisions at the local level depend on the municipal Territorial Development Plan (TDP). In the Lombardy region, the regional law on urban planning establishes a regional framework for integrated planning and programming at different administrative scales to be implemented through inter-institutional collaboration.

In the recent process for the re-edition of the new RLP of Lombardy, the following two main innovations were introduced: (i) an ES-based approach was used for designing a GI that constitutes the strategic regional landscape spatial structure aimed at promoting and preserving the natural capital while delivering strategic guidelines for landscape enhancement and regeneration; (ii) sub-regional territorial units were introduced to allow for the definition of more site-specific landscape quality objectives [55] within the RLP's general framework.

The goals of the regional GI (RGI) are aligned with the guidelines provided by the European Commission [6]. Specifically, the ES mapping assessment used for RGI deployment included the following: (i) habitat quality, which is considered an overall indicator of environmental health; (ii) rural landscape value, which is based on agricultural productivity and biodiversity in rural land; and (iii) historical, cultural and anthropic heritage value, as a cultural ES, which includes the spatial distribution of protected and historical/identity elements in Lombardy [56]. By integrating the ES assessment, it was possible to determine and identify the areas to be included in the RGI strategic spatial design, which consists of the following three thematic components derived from the ES mapping: natural RGI, rural RGI and historical and cultural RGI. Based on ES values, further sub-articulations of each component were identified to improve the effectiveness of the large-scale GI structure, also considering the huge variety of landscapes in Lombardy, together with the diversity of risk and slow-burn factors affecting the region [57,58]. This operation enables the definition of RGI strategic guidelines that are useful for identifying common priority interventions at the regional scale.

The strategic design of the RGI also includes design proposals to set new landscape connections, to increase existing ones along linear elements (such as rivers or trails) and to improve the landscape integration of infrastructures (highways and railways).

At the same time, the need to target landscape quality objectives, thus fostering the connection between regional and local and supra-local scales, led to the definition of 57 subunits called geographic landscape units (GLUs). GLUs are based on homogeneous geographical, hydrological, geomorphological, environmental, ecological, anthropic, historical and cultural features; they are located within or between Lombardy's various landscapes, as defined by elements like mountains, hills, lakes, rivers, lowlands and metropolitan conurbations.

GLUs represent both analytical tools for identifying territorial qualities and dynamics and operational tools to define quality objectives and strategic priorities to activate multiscale landscape planning and regeneration processes [16].

The most relevant features, the landscape structural elements and the pressure or degradation factors characterising each GLU are identified in descriptive/orientating reports, which detail the list of landscape quality objectives to support local planning. The structural elements of the landscape, with their quality objectives, are organised according to the following four thematic macro-systems: (i) hydrological/geological/morphological systems; (ii) natural ecosystems; (iii) agricultural and rural systems; (iv) urbanised areas and historical and cultural systems.

2.1.2. Case Study Area

To test the validation of our methodological proposal in a highly complex spatial unit, the Media and Alta Valtellina were chosen as a pilot study area. They form a geographical and historical sub-region of the Central Alps, spanning along the river Adda in the northeastern sector of Lombardy, bordering on the north with the Grisons in Switzerland and on the east with South Tyrol in Italy. The area covers an extent of approximately 1348 km^2; it includes GLU 2.1 (Alta Valtellina) and GLU 2.2 (Valtellina di Tirano), characterised by different landscape values but, at the same time, are strictly connected and subject to common dynamics, as they are both involved in the landscape and regional transformations occurring in the Alpine territories [59–61]. In particular, the RTP for Lombardy recognises the need for a joint territorial and landscape development in the area, as testified by the

RTAP Media and Alta Valtellina in force since 2013. An overall strategic vision for the area is becoming even more interesting because of the Milan–Cortina Winter Olympic Games scheduled for 2026 [62]. As competition venues, the event will involve alpine towns like Bormio and Livigno in Alta Valtellina. Besides, Media Valtellina and Valtellina di Tirano will be relevant infrastructural hubs, thus undergoing significant transformations. Studies on past events show that the Winter Olympics partly integrated concepts of sustainable development in their organisation but may still raise concerns about their overall environmental impact [63–65]. Therefore, the choice of the study area was determined by the will to operate a stress test of the research methodology considering a critical context for the reasons set out above.

The national, regional and sub-regional geographical frameworks (i.e., GLU) for the pilot area are displayed in Figure 1.

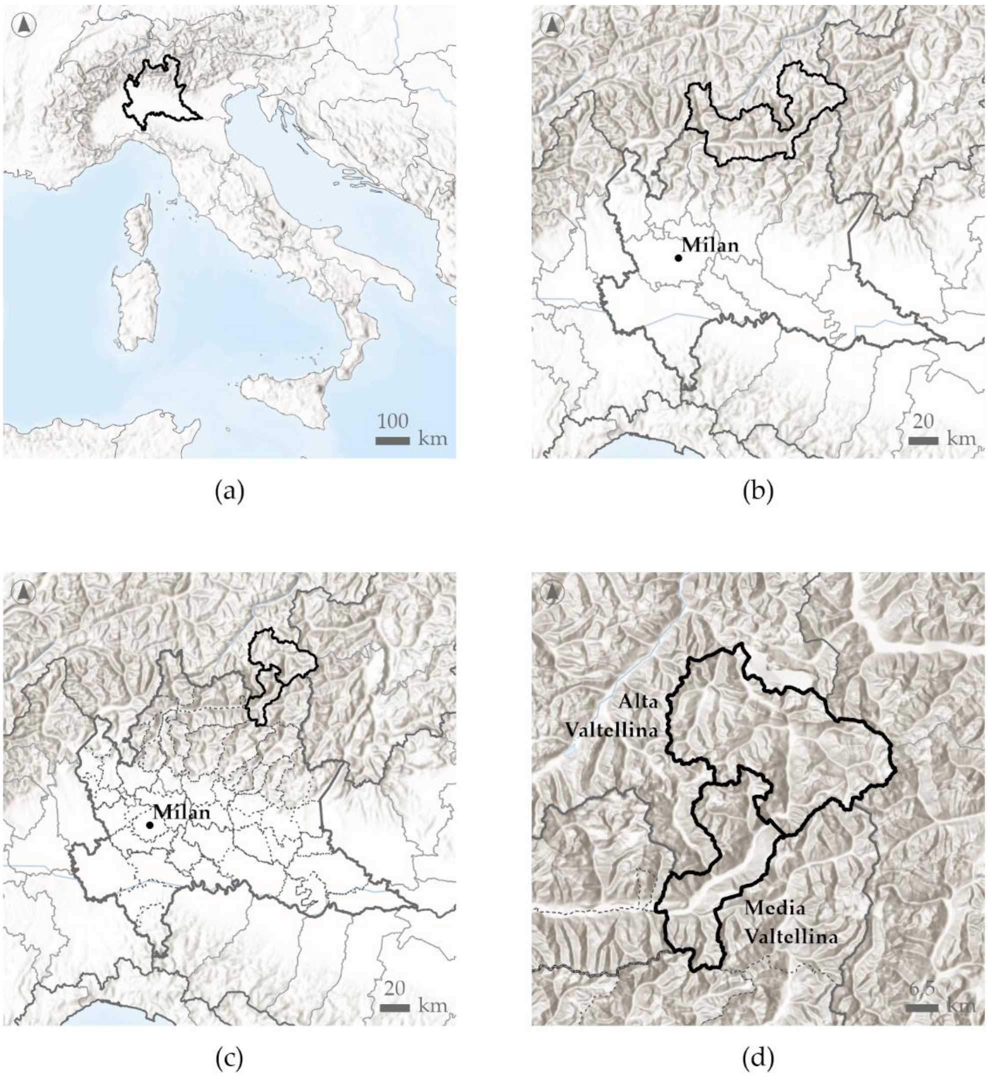


Figure 1. Study area. (**a**) The Lombardy region in Italy; (**b**) location of the province of Sondrio in the Lombardy region; (**c**) GLU subdivision and location of Alta Valtellina and Media Valtellina in the Lombardy region; (**d**) Alta Valtellina and Media Valtellina. (Source: authors' elaboration. World imagery sources: Earthstar Geographics).

2.2. Research Methodology

The working process was articulated into the following two main stages:

(i) Cross-reading and systematization of the extensive set of objectives, prescriptions and strategic guidelines provided by current planning tools (RLP, RTP, RTAP, PTCP) for the study area. Stage one moves from the spatial representation of the structural landscape elements identified by the GLU reports, integrated with the RGI spatial design components. As a result, a structural landscape map for the pilot area was outlined, combining GLU and RGI contents. Then, a cross-reading process of GLU landscape quality objectives, RGI guidelines and strategic orientations or prescriptions deriving from other supra-local planning tools were implemented to organise a Matrix of Planning Objectives. The aim of the matrix is to point out the correlations between each structural landscape element represented in the structural map and the several strategic objectives, guidelines or prescriptions directly affecting it, to allow for a synergic view of the different planning contents referred to spatialised elements.

(ii) Downscaling the RGI spatial design components, from regional scale to GLU scale, as a result of a further cross-reading process applied to the Matrix of Planning Objectives contents. While in the first research stage, the cross-reading process was carried out to point out an exhaustive list of strategic contents selected from different planning tools, the aim of this further step is to provide a synthetic overview of the whole strategic contents listed in the matrix, identifying the main priorities of intervention for the study area, and spatializing them according to the RGI spatial design components. In stage two, cross-reading allows us to identify cross-cutting issues in order to combine the several "Planning Objectives" listed in the matrix into more synthetic "Thematic Objectives". The so-called thematic objectives represent the strategic goals for the study area that can be applied to downscale the RGI, detailing both its spatial structure and the related guidelines, according to site-specific priorities and landscape features. Thematic objectives can be further ascribed to the following three key topics (KTs) identified as crucial issues for the entire Lombardy regional landscape: identity, natural capital, sustainable recreation. As a result of the RGI downscaling process, a pilot strategic operational map, articulated according to the three KTs, was created.

The methodological workflow presented in our study is graphically summarised in the following diagrams (Figures 2 and 3):

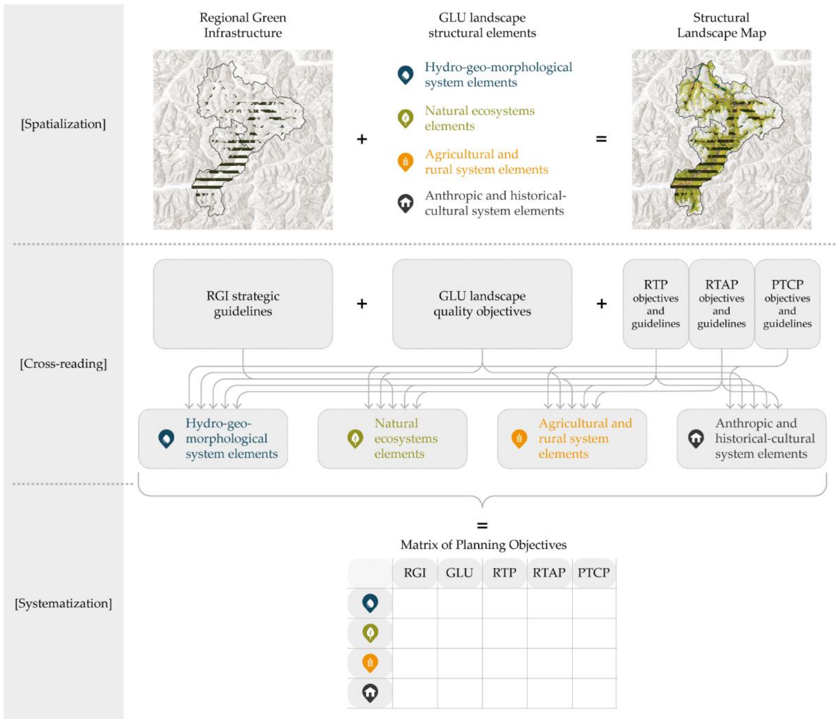


Figure 2. Stage 1 of the proposed methodology. Representation of the workflow performed to create a pilot structural landscape map and a Matrix of Planning Objectives derived by cross-reading of supra-local plans involving structural landscape elements (source: authors' elaboration).

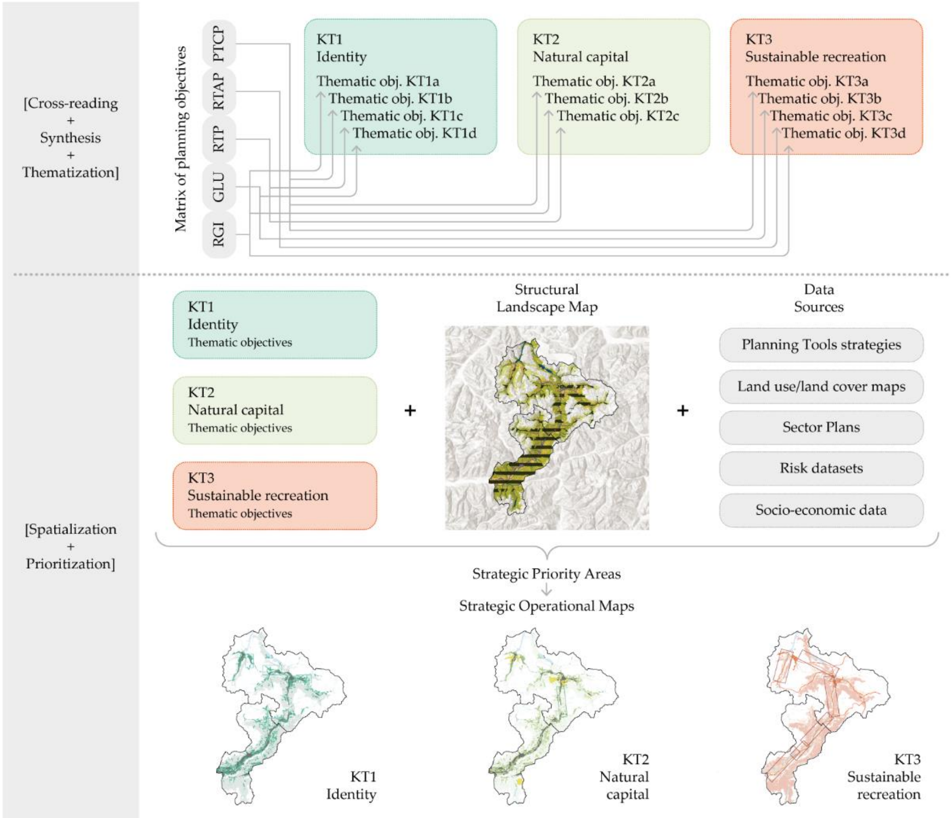


Figure 3. Stage 2 of the proposed methodology. Representation of the workflow performed to create three pilot strategic operational maps as a result of cross-reading, synthesis and thematization of the planning objectives into key topics and thematic objectives, and their spatialization and prioritization to accomplish the RGI downscaling process (source: authors' elaboration).

2.2.1. Assessment of Landscape Structure and Planning Objectives

The pilot structural landscape map was produced by representing all the significant landscape structural elements of the pilot area for each GLU's system (see Section 2.1.1). The hydrogeomorphological system represented, among others, glaciers, lakes, artificial basins, the hydrological network and environmental impact elements like ski resorts and quarries. Elements related to natural ecosystems included woodlands and ecological corridors belonging to the regional ecological network (REN) included in the RTP. Elements represented within the agricultural and rural system encompassed both the main agricultural features of the local rural landscape, e.g., terraced vineyards, chestnut groves, orchards and the higher mountain pastures. Finally, the anthropic and historical–cultural system included urbanised areas, historical settlements, heritage sites scattered along the area of interest and mobility infrastructures like roads and railways.

Then, the map was integrated with the RGI elements included in the pilot area including the three ecosystem-based spatial components—natural, rural and historical and cultural—also named "Enforcement and enhancement areas", and the proposals for new or improved connections and for landscape integration of new infrastructures, jointly named "Priority reinforcement projects"; thus, a close spatial relationship between RGI strategies and site-specific landscape context was created. Moreover, the structural landscape map is strictly related to the Matrix of Planning Objectives, which is an operational tool that aims to provide an overview of planning strategies and guidelines for the pilot area considering regional and supra-local levels of territorial governance. The matrix combines the GLU landscape quality objectives that refer to the landscape structural elements, the strategic guidelines related to the several components of the RGI, and the strategic contents of some of the most relevant supra-local planning tools including the RTP, the RTAP for Media and

Alta Valtellina and the PTCP for the Province of Sondrio, to which the study area belongs (see Figure 1).

Each of these plans is provided with one or more sets of planning objectives or addresses, aimed at guiding their implementation strategies. Each set of objectives was collected and classified by an alphanumeric code allowing us to identify which plan every objective belongs to.

Using the adopted alphanumeric codes, the whole range of planning objectives was classified in the matrix according to their relevance to one or more structural elements of the landscape included in the structural landscape map. Each row of the matrix corresponds to a landscape element, while the columns correspond to the considered supra-local plans. Therefore, an objective belonging to one of the considered plans may have one or more occurrences in the matrix, corresponding to the landscape elements to which it refers. The complete list of objectives used in the matrix, with the correspondence between their extended version and the alphanumeric tracking codes, constitutes an essential consultation tool that integrates the matrix.

The matrix follows the structure of the structural landscape map legend to allow for cross-reading between the map, the synthetic matrix and the comprehensive list of planning objectives.

As the result of an integration of different data, the knowledge and prescriptions that are declined at the GLU scale and are tightly related to the structural landscape map; the Matrix of Planning Objectives enables planners and policymakers to cross-read the objectives related to the local landscape's structural elements to find common themes and synergies to be handled.

The cross-reading and systematisation process also represented a crucial step in providing a synthetic framework for the pilot area to be implemented in the following stage of the research. Some strategic issues emerged during cross-cutting, bringing out possible common fields of action (or KT) to reorganise and merge the several objectives that are separately listed in the matrix.

2.2.2. Definition of Planning Strategies and Scaling GI: Data Sources and Spatialisation Process

Based on the common issues displayed in the Matrix of Planning Objectives, a set of thematic objectives was implemented for the study area. The thematic objectives were articulated into three main KTs to emphasise the strategy's character. KTs are a way to classify landscape planning objectives and strategies into more general and comprehensive issues to facilitate replicability of their implementation. The topics are defined by a short title and condensed into a single keyword to facilitate map reading; they promote a conceptual synthesis of the contents of the matrix, which is articulated and detailed, making it difficult to consult by a non-expert public. The topics are the following:

- Protection and enhancement of the structural elements that provide a substantial contribution in defining the landscape identity of the study area, classified as "identity" (KT1);
- Protection and reinforcement of natural capital and biodiversity, classified as "natural capital" (KT2);
- Promotion of leisure and recreational landscape activities compatible with the preservation of local identity and environmental values, simplified as "sustainable recreation" (KT3).

The topics were set to ideally encompass every possible strategy to be adopted in landscape planning. They can be matched with the fields in which, according to the preamble of the European Landscape Convention, the landscape has a significant public interest role [55]; specifically, "identity" corresponds to cultural values of landscape, "natural capital" represents ecological and environmental values and "sustainable recreation" embodies social values, as well as the definition of landscape as "a resource favourable to economic activity".

Among the three KTs, "identity" refers to what has been defined as "the perceived uniqueness of a place" [66], which means the combined result of multiple elements like physical features, spatial morphology, presence of cultural heritage and socio-economic image of a landscape [67].

"Natural capital" is a term that was introduced based on a definition of capital as "a stock that yields a flow of valuable goods or services into the future"; considering natural assets, their sustainable flow is "natural income", and the stock that yields the sustainable flow is "natural capital" [68]. For our purposes, it concerns ecological and environmental perspectives on landscape and strategies to integrate the preservation and enhancement of natural values in landscape management to create sustainable landscapes [69,70].

"Sustainable recreation" covers issues related to leisure activities in which visitors enjoy an experience involving morphological, ecological and cultural landscape features, and sets strategies both for promoting recreational uses of landscape and for tackling potential environmental or social threats linked to heavy tourist flows [71,72].

The definition of thematic objectives is the fruit of a cross-reading of the objectives classified in the Matrix of Planning Objectives; starting from the detection of thematic contents of each planning objective, a conceptual abstraction was performed to identify their thematic cores, to cluster them as subsets of the main strategic framework and express them in a synthetic formulation, to identify priorities of intervention in the study area and to promote the integration between the several planning levels. In this stage, GLU-scale landscape quality objectives from RLP were chosen as a baseline and looked for thematic correspondences in objectives derived from other planning tools. This allows for inner coherence, considering that the whole research process was framed into the RLP tools. Therefore, for example, thematic objective KT2a, which is "Promoting maintenance, reinforcement or reinstatement of ecological connectivity and high habitat quality" (see Supplementary File S1, KT2), is defined based on indications from GLU quality objectives for ecosystems, environment and nature, connectivity objectives from RGI and REN, territorial resilience objectives for the mountain territorial system from RTP and objectives for well-being and environment from RTAP.

Then, to achieve the RGI downscaling process, thematic objectives were spatially translated into one or more strategic priority areas, identified by specific mapping criteria and provided with a set of design solutions.

Priority areas coincide with those spatial extents, landscape elements or spatial landscape strategies that require a special focus based on scrutinised planning objectives. They allow us to detail or to integrate the RGI spatial design at the local scale. The whole list of priority areas and their correspondence to thematic objectives and key topics are illustrated in Figure 4.

Locating and mapping each priority area was a complex and challenging phase of the research, requiring a wide array of spatial data sources and different GIS processing. Different data were combined with RGI spatial components to accomplish the RGI downscaling process, i.e., (i) data from regional and supra-local plans (RTP, RTAP, PTCP) identifying core areas or elements involved in spatialised strategies or projects (e.g., natural protected areas and protected cultural heritage; regional ecological network corridors or core areas; planned mobility infrastructures; planned soft mobility networks; main viewpoints and scenic routes; other elements or areas specifically addressed by surveyed territorial planning tools); (ii) spatial data from land use/land cover maps; (iii) data from sector plans spatializing specific phenomena (e.g., forestry management data; quarries management data); (iv) data from ministerial or recognised scientific databases spatializing risk phenomena or occurred damages affecting landscape (e.g., landslide danger or hydrogeological instability maps; data on damaged or degraded natural areas); (v) socio-economic datasets provided by recognised national or regional research institutes or organizations (e.g., production sites of agricultural and food products protected by geographical indications; tourism data).

Key topics	Thematic objectives	Strategic priority areas
KT1_Identity	**KT1a**_*Preserving unity and perceivability of hydro-geo-morphological elements*	Glaciers to be supervised and protected in order to tackle climate change impacts
		Priority areas to tackle structural modifications and prevent risks on hydrographic network: 1. areas to safeguard of the river morphology and increase of the naturalistic values; 2. areas to prevent hydrological risk prevention and increase naturalistic values in urbanized context; 3. priority areas to prevent hydrological risk on minor hydrographic network
		Priority areas to prevent hydrogeological risk on mountain woodlands
		Peculiar hydro-geo-morphological features to be preserved
		High visibility mountain landscapes to be preserved
	KT1b_*Preserving landscape values of natural elements*	Priority areas to tackle vegetation diversity loss
	KT1c_*Preserving constitutive features of rural landscape*	Traditional and historical rural landscapes to be maintained, preserved and enhanced
		Priority areas where to tackle forest regrowth
		Priority areas where to tackle abandon and degradation of croplands
		Alpine rural buildings to be restored, enhanced or preserved
	KT1d_*Preserving features representing the identity of the anthropic landscape*	Valley floor historical urban settlements to be restored, enhanced or preserved
		Slope historical urban settlements to be restored, enhanced or preserved
		Historical and cultural heritage sites to be preserved
		Historical and cultural heritage clusters to be preserved
		Aggregations of buildings and areas with significant landscape quality
		UNESCO World Heritage Sites
KT2_Natural Capital	**KT2a**_*Promoting maintenance, reinforcement or reinstatement of ecological connectivity and high habitat quality*	Regional Ecological Network (REN) primary corridors
		REN passages
		Landscape enhancement connections from RGI with mainly environmental purposes
		Priority revitalization areas for damaged woodland ecosystems: 1. revitalization areas of woodland ecosystem damaged by windstorms; 2. revitalization areas of woodland ecosystem damaged by wildfires; 3. revitalization areas of woodland ecosystem damaged by beetle outbreaks
	KT2b_*Promoting reorganization and defragmentation of peri-urban landscapes tackling loss of biodiversity*	Peri-urban rural areas to be preserved: 1. areas with high environmental values; 2. areas with high historical and cultural values; 3. areas with high environmental, historical and cultural values
		Priority areas where to tackle linear conurbation trends
	KT2c_*Limiting, containing and mitigating impacts of anthropic activities*	Areas involved in mining activities whose impacts should be limited and mitigated
		Hydroelectric power plants and electrical power lines whose impacts should be limited and mitigated
		Industrial or commercial settlements and accommodation facilities whose landscape and environmental suitability should be increased
		Ski resorts to be involved in integrated redevelopment strategies
		Landscape mitigation and integration buffers for new infrastructures from RGI
KT3_Sustainable recreation	**KT3a**_*Promoting sustainable recreation in natural heritage, also through soft mobility networks and landscape connections*	Local trail network sections to be improved and enhanced
		Landscape enhancement connections from RGI with mainly recreational purposes
		Landscape connection projects from RGI with mainly recreational purposes
		Sustainable recreational enhancement of "Landscapes of Silence"
		Environmental systems to be enhanced, redeveloped and restored
	KT3b_*Supporting traditional and quality supply chains in farming, forestry and dairy products as multifunctional activities*	Priority multi-function enhancement areas: mountain pastures
		Priority multi-function enhancement areas: wine production
		Priority multi-function enhancement areas: typical dairy production
		Priority multi-function enhancement areas: apple orchards
		Priority multi-function enhancement areas: historical cereal production
	KT3c_*Promoting and enhancing recreation in historical and cultural heritage*	Structural soft mobility elements whose connections with local cycle path network should be increased
		Historical and cultural systems to be enhanced, redeveloped and restored
	KT3d_*Exploring and promoting alternative tourism and recreation*	Attention and mitigation areas linked to possible functionality loss of low altitude ski resorts
		Attention and mitigation areas linked to overtourism impacts
		Areas substantially depending on winter tourism

Figure 4. Key topics, thematic objectives and priority areas (source: authors' elaboration).

Selection and representation criteria adopted for strategic priority areas and the related data sources are reported in a table of strategies and criteria connected to the operational maps (see Supplementary File S2). Criteria can be subdivided into the following four main categories:

a. Representation of landscape elements in their spatial conformation: Natural, rural or anthropic landscape elements recognised as deserving specific strategies (e.g., glaciers, historical and cultural heritage, quarries, hydroelectric power plants, etc.) were represented, with geometric simplifications in some cases. They could be already included in the RGI spatial components, or they could interact with them. (Spatial data sources: regional and provincial geographic datasets, local socio-economic maps.)
b. Representation of planned spatial strategies: Strategies set by supra-local plans (e.g., corridors or passages from regional ecological network, RGI buffer zones mitigating planned infrastructures, focus areas to implement landscape or environmental strategies, etc.), provided with inherent values and allocated to proper KTs, were represented without modifications. They could allow us to better detail the RGI spatial components or to integrate RGI design at local scale. (Spatial data sources: strategic datasets derived from planning tools in force, such as RLP; RTP; RTAP.)
c. Elaborations by the authors combining RGI spatial components with datasets or elements involved in spatialised strategies: Starting from a group of territorial elements or spatial representations set by supra-local plans, the location of strategic areas descends from aggregation, filter and, in some cases, classification procedures (e.g., clip via RGI extent or risk areas, selection via contact with RGI, classification via landscape subtypes). They could allow us to better detail the RGI spatial components and the related strategic guidelines, or to integrate RGI design at local scale. (Spatial data sources: regional and provincial geographic datasets, national maps of hydrological instability areas, strategic datasets derived from the following plans: provincial forestry management plan; RGI; regional wildfire prevention plan; provincial quarries management plan.)
d. Elaboration by authors combining several datasets to spatialise and prioritise strategic actions facing ongoing territorial phenomena: With various degrees of complexity, strategic areas are identified by authors' elaborations consisting of, e.g., spatial analysis based on transformations in land use/land cover; selection of high visibility areas derived from GIS-based analysis; classification and interpretation of local socio-economic data. (Spatial data sources: regional and provincial geographic datasets, socio-economic data from the national institute for statistics, strategic datasets derived from RGI.)

The latter category includes complex elaborations aimed at identifying site-specific strategic solutions to the following four priority issues identified as crucial for a mountain context: the prevention of hydrogeological risk; the protection of the mountain landscape features; the limitation of agricultural soil sealing in the valley floor; the management of winter tourism impacts and criticalities. Therefore, the corresponding procedures require a broader methodological explanation than the synthetic one provided in the table of strategies and criteria available in Supplementary File S2. The following are extended descriptions of the articulated procedure to locate strategic areas:

- Priority areas to tackle structural modifications and prevent risks on the hydrographic network (KT1a): The regional land use/land cover (LULC) of Lombardy was resized on high hydrological instability areas provided at a national scale by ISPRA (Italian Institute for Environmental Protection and Research acting under the vigilance and policy guidance of the Italian Ministry for the environment and energy security), locating areas next to rivers and streams that are at risk of flooding. Then, the selection was classified by predominant LULC types to diversify strategic actions. Selected areas that were primarily permeable (rural or natural LULC) were classified as "areas of safeguard of the river morphology and increase of the naturalistic values", linking actions of increasing vegetation cover, supervised flooding or restoration of the natural river course. When waterways penetrated urban areas, priority areas were classified as "areas of hydrological risk prevention and increase of naturalistic values in urbanised context", with actions of desealing or creation of retention basins. Priority areas along minor hydrographic networks were classified regardless of LULC type; for those areas, strategic actions include maintaining riparian vegetation and increasing morphological diversity of riverbeds.

- High mountain landscapes visibility to be preserved (KT1a): With the aim of considering the perceptual characters of landscapes for preservation and enhancement purposes, a procedure to select high visibility reliefs in the pilot area was implemented, starting from a GIS-based visibility analysis. Using a digital terrain model (DTM) with a spatial resolution of 5 m, viewsheds from the main panoramic viewpoints, paths and routes were separately calculated. The procedure was integrated by calculating viewsheds from a selection of the most photographed points in the pilot area based on the visitation, recreation and tourism model of the free open-source suite of software models InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) [73], developed through a collaboration between different universities and international research and conservation centres for ES mapping and assessment. In particular, the visitation, recreation and tourism model aims to display the rate of visitation across landscapes using geotagged photos posted on the website Flickr as a proxy for the presence of visitors [74]. Raster viewsheds calculated from each layer of observation points were clipped to exclude valley floors and focus on mountains and slopes and then classified by visibility values adopting the natural breaks (Jenks) classification method to provide a consistent classification among the different viewsheds [75]. Finally, cells belonging to higher visibility classes were selected and aggregated, thus generating an overall map of high visibility areas in mountain landscapes, subject to specific preservation and enhancement actions.
- Peri-urban rural areas to be preserved (KT2b): Chosen with the aim of detecting rural areas along urban fringes, which can be considered at risk of being enclosed by anthropic elements. A GIS-based selection by share of contact was performed. Rural plots from the regional LULC map were selected as priority areas if more than 50% of their perimeter was in contact with urban fabric or infrastructures. Then, to diversify strategic actions, RGI values were used as a filter to classify rural plots. Most of the selected areas, in fact, were included in the rural component of RGI and provided significant environmental and/or historical and cultural values. This led to a three-sided classification where RGI values' co-presences are considered as vocations to guide strategic actions. In areas with high environmental values, local actions included the creation of allotments to be managed according to agroecology principles and increasing vegetation equipment for ecological restoration; in areas with high historical and cultural values, actions may also involve their reuse as public gardens or the refurbishment of abandoned rural buildings to support recreational uses. Areas with high values for both environmental and historical and cultural components are suitable to host actions related to both vocations.
- Priority areas to tackle linear conurbation trends (KT2b): Firstly, LULC transitions from rural or natural land uses to urbanised areas that occurred in the past two decades were detected by clipping urbanised areas from current regional LULC maps on areas that were rural or natural in 1999, according to a former regional LULC map; then, a visual analysis was performed to identify conurbation trends, considering the spatial distribution of new urbanised areas, their linear aggregation along mobility infrastructures and the presence of neighbouring urban settlements subject to conjoining trends at the expense of rural or natural open spaces. Linear conurbation trends were represented as two collinear lines with converging arrows, indicating the direction of urban expansion. Strategic actions to tackle such trends include green buffer zones, hedgerows or tree rows along peri-urban rural areas and incentives to reuse abandoned buildings or complexes to avoid land take.
- Attention and mitigation areas linked to possible functionality loss of low altitude ski resorts (KT3d): Present and future impacts of decreasing snowfalls on mountain activities are a risk factor for ski resorts, with increasing use of artificial snowmak-

ing [76,77]. Ski resorts that can be more affected by the snowfall reduction were identified, suggesting alternative recreation strategies. Because climate in mountain areas may substantially vary depending on local factors, a recognised and potentially replicable criterion was chosen, known as the line of snow reliability (LSR), defined as the altitude that allows for a snow cover that is sufficient for at least 100 skiing days per season in a ski resort. OECD [78] estimates an LSR rise of 150 m per 1 °C of warming, starting from an LSR of 1500 m in alpine areas. Based on a supposed future scenario where LSR is set at 1650 m, percentages of each ski resort in the pilot area located below this altitude were calculated. Looking at the results, resorts whose future functionality may be considered at risk were selected by adopting a threshold corresponding to 40% or more of ski resort area below 1650 m. Priority areas descending from this procedure include a ski resort next to the town of Aprica (GLU 2.1) and some cross-country tracks generally located at lower altitudes than alpine skiing tracks.

- Attention and mitigation areas linked to over-tourism impacts (KT3d): Since Media and Alta Valtellina territory relies considerably on tourism, issues related to tourist flows in fragile mountain contexts were highlighted, suggesting possible tackling strategies. In this case, tourism intensity—defined as the ratio of total overnight stays to total resident population [79]—was mapped at a municipality scale using data from Istat (the Italian National Institute of Statistics). The towns of Bormio and Livigno (GLU 2.1) show values remarkably higher than the other municipalities in the pilot area. They are, therefore, identified as attention and mitigation areas, where planning decisions that are able to combine the positive economic effects of tourism with environmental and landscape preservation must be adopted.
- Areas substantially depending on winter tourism (KT3d): These priority areas represent municipalities where the local economy is tied to winter tourism activities—a condition that, combined with vulnerability to decreasing snowfalls, shall be considered a risk factor for the economy. To select such areas, municipal Istat data were analysed, including variance between tourist flows in the high season (winter and summer) and in the low season; the variance between winter and summer tourist flows; share of tourist facilities on overall local businesses. As a result of this combination of factors, Aprica municipality stands out as the most dependent on winter tourism and may take future advantage of diversifying recreation strategies.

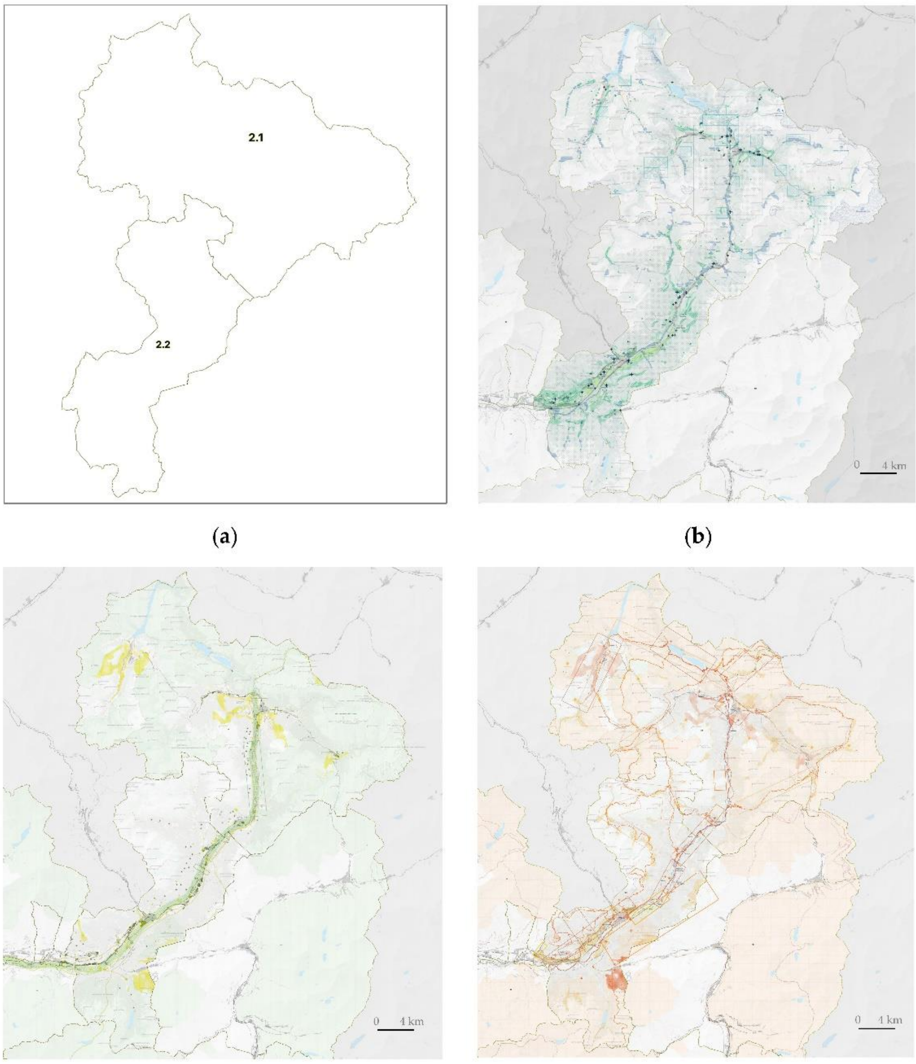
3. Results

3.1. Strategic Operational Maps for the Pilot Area

The outcomes of the described procedure are the strategic operational maps for the pilot area. During the design phase, the downscaling process of the RGI contents from the regional scale to the context of the study area was pivotal. In fact, several priority areas were identified by intersecting the RGI extent with the local landscape elements mentioned by the objectives in the matrix. In other cases, the RGI connection projects were classified according to their recreational or environmental primary purpose and added to the corresponding KT.

Three operational maps related to the major KT for the pilot area were produced. Their content frameworks are traceable by reading the Matrix of Planning Objectives.

Below, a combined representation of the operational maps is presented (Figure 5). A high resolution version of each map, including excerpts of a significant sub-area (municipality of Bormio in Alta Valtellina and its surroundings) and the legend of thematic objectives and priority areas, is available as Supplementary File S1.



(**a**) (**b**)

(c) (**d**)

Figure 5. Combined representation of the strategic operational maps, with the location of strategic priority areas identified to achieve the RGI downscaling process: (**a**) Identification of involved GLU (2.1 Alta Valtellina; 2.2 Media Valtellina); (**b**) KT1: identity; (**c**) KT2: natural capital; (**d**) KT3: sustainable recreation. High resolution versions of each strategic operational map, with related legends, are available as Supplementary File S1. (Source: authors' elaboration.)

The layout and contents of each KT are described hereinafter.

3.1.1. KT1: Identity

The first strategic operational map (Figure 5b) is designed to set and locate strategies for preserving and enhancing the elements of the landscape that assume relevance in defining the identity of the pilot areas. Since this KT mostly recalls landscape preservation and protection actions, referring to the maintenance of both the physical and perceptive features of landscape structural elements, the thematic objectives included in KT1 are the following:

KT1a. To preserve unity and perceptions of hydrogeomorphological elements;
KT1b. To preserve landscape values of natural elements;
KT1c. To preserve constitutive features of the rural landscape;
KT1d. To preserve the features representing the identity of the anthropic landscape.

Within this KT, the RGI—particularly its rural component with a co-presence of high historical and cultural values—defines the priority areas for preserving and enhancing the historically valuable agricultural landscape.

Moreover, the features representing the identity of the anthropic landscape coincide with the historical and cultural components of the RGI. At the same time, the panoramic paths identified as primary connective elements of the RGI are selected as strategic viewpoint sources to determine the high-visibility mountain landscapes to be preserved.

3.1.2. KT2: Natural Capital

The second strategic operational map (Figure 5c) promotes environmental preservation and reinforcement of biodiversity, including strategies to cope with anthropic impacts.

The priority areas belonging to this KT can be synthesised into the following three main thematic units: the first one is the preservation of natural or rural areas provided with relevant ecological/environmental values; the second one includes hybrid peri-urban landscapes distinguished by suitable biodiversity hotspots and/or corridors; the last one focuses on detecting anthropic elements and activities producing high impacts and threats on nature and biodiversity. In that case, the actions aim at tackling, limiting and mitigating potential impacts for natural capital conservation. Hence, the thematic objectives defined for KT2 are the following:

KT2a. Promoting maintenance, reinforcement or reinstatement of ecological connectivity and high habitat quality;
KT2b. Promoting reorganisation and defragmentation of peri-urban landscapes tackling loss of biodiversity;
KT2c. Limiting, containing and mitigating impacts of anthropic activities.

The RGI is widely used to define priority areas related to these strategies; RGI reinforcement connections and new connection projects that are primarily meant to increase ecological values are represented as a component of the KT2a objectives. In KT2b, fragmented rural areas scattered along urban fringes are selected based on their inclusion in the RGI rural component and then classified via vocation according to the co-presence of natural and/or historical–cultural values. In KT2c, the priority areas to contain the impact of quarries are identified by selecting those that are surrounded by the RGI; likewise, industrial, commercial and accommodation facilities are identified as priority elements to activate mitigation strategies when their area is larger than 50,000 m^2 and they are next to the RGI. Lastly, buffer zones for the mitigation and landscape integration of projected new mobility infrastructures become a further priority area for containing anthropic impacts.

3.1.3. KT3: Sustainable Recreation

This operational map (Figure 5d) collects strategies to harmonise the promotion of leisure and recreational values of local landscapes with the preservation of ecological and social values, fostering soft mobility connections and enhancing the quality of food and agricultural supply chains. Since Media and Alta Valtellina highly rely on winter tourism, which has multiple effects on landscape and risks related to temperature and precipitation patterns, strategies for alternative tourism solutions were added. The thematic objectives for KT3 are the following:

KT3a. Promoting sustainable recreation in natural heritage through soft mobility networks and landscape connections;
KT3b. Supporting traditional and quality supply chains in farming, forestry and dairy products as multi-functional activities;
KT3c. Promoting and enhancing recreation in historical and cultural heritage;
KT3d. Exploring and promoting alternative tourism and recreation.

Within this KT, as in KT2, a selection of RGI reinforcement connections and new connection projects is represented; here, the RGI connections that are mainly related to recreation and soft mobility are a component of KT3a. Moreover, mountain pastures with a high recreation potential are identified by selecting pastures within the RGI extent, according to the sustainable recreation purposes of the RGI of Lombardy.

As stated in Section 2, in addition to the strategic operational maps, a table of strategies and criteria was implemented, including KTs and thematic objectives, strategic priority areas, spatial data sources, descriptions of spatial selection and representation criteria adopted, and local NBSs or other design solutions related to each priority area. The table is available as Supplementary File S2.

3.2. From GI to NBS: A Set of Actions for Local Implementation

As already introduced, one of the most significant challenges in downscaling GI is transitioning from general/specific objectives to site-specific planning recommendations. This process has the following two main obstacles: selecting the contents represented in the tables, whose edits are traceable in the Matrix of Planning Objectives, and the cartographic representation for implementing planning strategies through local spatial design actions.

Since GIs are planning tools that aim to deliver and increase ESs, one of the most effective strategies to fulfil their goals at a local scale and to operationalise that strategy is to adopt design solutions based on the use of natural elements and/or principles, i.e., NBSs. NBSs "are designed to address various environmental challenges in an efficient and adaptable manner, while simultaneously providing economic, social, and environmental benefits" [80,81]. So, NBSs are greening design actions that can contribute to developing GIs in urban areas [21].

In the pilot area, design solutions, including NBSs, were selected to implement the thematic objectives and the related actions and strategies identified by the three strategic operational maps. By considering each priority area, a selection of possible alternative design solutions were identified to specifically respond to its objective, defining a framework for future projects. The design process at the local level is therefore not rigorously defined in advance but will be developed, for instance, based on available financial resources and by considering local peculiarities. The set of actions is structured as an implementable tool that can support local planning and design processes in identifying possible operational solutions.

NBSs and other solutions are strictly related to the purposes of the thematic objectives on which they are based (e.g., risk management, natural/cultural heritage conservation, ecological/landscape reconnection) and to the landscape elements involved. Examples of suggested solutions include creating tree rows along the border of rural areas, increasing riparian vegetation to prevent runoff, preserving or defragmenting ecological passages threatened by land take process through natural buffer zones, enhancing peri-urban rural plots by creating allotments or public green spaces and improving the energy efficiency of industrial or commercial sites and accommodation facilities.

The complete list of actions linked to each priority area is available in the table of strategies and criteria (Supplementary File S2).

4. Discussion

4.1. Main Findings of the RGI Downscaling Process

As stated in the introduction, the methodological approach developed for the Media and Alta Valtellina pilot area aims to enhance the GI's role as a multi-scale and multi-functional strategic planning tool. In this frame, the RGI downscaling process meets different purposes.

Firstly, it promotes a more integrated approach to territorial planning by implementing cross-reading procedures within different plans or components of the same plan. Specifically referring to the case study, the RGI guidelines and GLU landscape quality objectives were intended to be used as a framework to guide the systematisation of the contents provided by several supra-local plans that were analysed. As a result, the structural landscape map combined with the Matrix of Planning Objectives represents an operational tool that is able to emphasise the correlations and possible integrations between the different levels of the planning system that affect the pilot area. At the same time, the structural landscape map provides a connection between the physical landscape elements to which the planning objectives relate and the spatial dimension of the RGI. Identifying possible correlations and synergies at different scales could contribute to implementing the RGI guidelines at the local scale, both from an operational and an institutional point of view.

Secondly, the RGI downscaling process allows us to spatialise the several planning objectives within the priority intervention areas identified at the local scale through a selective and site-specific approach. The methodology aims to overcome some critical issues of the downscaling approach by proposing a step-by-step workflow. The spatial and multi-functional dimensions of the RGI played a crucial role in the process, combined with the elaborations of the datasets related to the KT that inform the three strategic operational maps. On the one hand, the spatial structure of the RGI was considered a strategic tool aimed to localise and select the priority areas of intervention within homogeneous territorial contexts deriving from the analysis of the dataset. On the other hand, several combinations of RGI values were considered to determine site-specific actions and strategies within the priority areas. Furthermore, while each strategic operational map is selective in the representation according to the priorities of its respective key issue, some priority areas are included in multiple strategies because of their multi-functional value.

Finally, the proposed methodology allows for regional spatial and landscape strategies to be operationalised, integrating NBSs and other design solutions in the planning process, and providing an effective cross-scale approach. The RGI downscaling process moves from a regional strategic overview to defining local priorities and actions. The three KTs and the respective thematic objectives define a common framework that allows for the achievement of both a site-specific approach to identify possible actions to implement at the local scale and a replicable approach that can even be adopted for other GLUs. In general, the research outcomes introduce some innovative elements that can be applied even to other planning processes.

The relevance of our findings for policy makers and practitioners may be highlighted from at least three points of view.

Firstly, the Matrix of Planning Objectives sets a punctual correspondence between landscape systems and elements, and supra-local planning objectives. Thus, at a local scale, it can be used as a consultation tool to verify the coherence between the objectives set by supra-local plans and the objectives defined during the local planning process.

Secondly, the strategic operational maps and RGI downscaling process aim to set specific intervention areas and planning priorities, whose extent and related strategies may be confirmed, detailed or modified according to further analysis in support of local planning. In particular, downscaling the RGI to provide more site-specific indications and to intersect local land uses or strategic areas may support the local design of GIs to be implemented in local plans and, at the same time, preserve a broader spatial design continuity given by the supra-local scale.

Lastly, the variety of design solutions linked to each priority area is an important catalogue that allows for policy makers and practitioners to choose the most suitable solutions based on local spatial contexts and issues.

4.2. Replicability and Further Implementation

The described workflow is conceived to be replicable in each GLU of the Lombardy region and, in a more general way, in each planning tool that requires a synthesis of different strategies for their implementation by local authorities.

Within the Lombardy region, the three KTs identified for the pilot area can deal with issues and planning needs coming from remarkably different spatial units. In particular, comparisons with GLUs provided with different landscape structures and features show that most of the thematic objectives identified for Media and Alta Valtellina are also suitable for driving strategic interventions while maintaining their structure. More significant differences may be expected when it comes to the criteria for selecting and identifying strategic priority areas, which are more dependent on geographic context, land use change dynamics and socio-economical characteristics.

Within the Italian national context, the most recent regional landscape plans [82] show several elements that are in common with the LRP and some differences in the approach. For instance, the landscape plans drawn up by the Tuscany, Apulia, Piedmont and Friuli Venezia Giulia regions identified quality objectives related to strategic guidelines that can be referred to homogeneous landscape contexts through descriptive/guiding reports. Except for the Piedmont plan, the reports present thematic maps that are representative of specific issues that detail the analysis carried out by the plan for the regional territory at the scale of the landscape unit, generally proposing some synthetic maps of landscape criticalities and structural elements. On the other hand, only the Piedmont plan has developed a proper regional "Landscape Connection Network", comparable to the multifunctional Lombardy RGI, to identify the relationships between ecological, historical and cultural or recreational territorial components [83]. In contrast, the other plans mentioned above mainly consider them separately. Finally, the plans are composed of several regulative and strategic tools or guidelines with different purposes and objectives that need to be related.

In this framework, the methodological approach developed for the Media and Alta Valtellina pilot area appears to be replicable to enhance the contents of the mentioned landscape plans, to achieve the following different goals: (i) to promote a more integrated approach to territorial planning, implementing cross-reading and systematisation processes within different plans or different components of the same plan (e.g., the Friuli Venezia Giulia plan); (ii) to spatialise the quality objectives according to the main regional strategic priorities (e.g., the Piedmont plan); (iii) to prioritise areas of intervention at the local scale, detailing the quality objectives identified for the whole landscape unit (e.g., the Tuscany plan); (iv) to operationalise regional landscape strategies integrating NBSs and other design solutions in the planning process, providing an effective cross-scale approach (all the mentioned plans).

In addition, it may be noticed that the proposed approach is applicable both in Italian regions with the RTP and RLP as different plans, and in regions with a single regional territorial and landscape plan, since both frameworks are supposed to have one or more sets of planning-related objectives to survey and classify in the Matrix of Planning Objectives.

At the same time, possible implementations of the proposed methodology are not limited to regional landscape planning and can be extended both to other forms of spatial planning in the Italian context and to other European planning systems that adopt GI strategies.

With regard to contextualisation and comparisons at the European scale, firstly, we focus on the European national planning frameworks, reporting data from the ESPON Compass project [84]. The project set the goal of conducting an integrated study of planning frameworks in Europe and their changes since the year 2000. According to the final report, in 21 of the considered countries, there are three administrative levels responsible for planning; in nine states, there are two competence levels; in three states, including Italy, there are four levels, while only Portugal reaches five levels. The relationships between the types of planning tools and the administrative levels show a mainly strategic or framework-setting character at the national level, a mainly regulatory character at the local level and a substantial variability at the sub-national, supra-local level. Except for some small-sized countries, where national-level plans can interact directly with the local level, all countries have one or more intermediate-scale instruments, which relate to the local scale. Despite the diversity of the planning principles and practices, it can therefore be assumed in the first instance that our methodological approach can be replicated in other European states. The same report also highlights how the EU legislation and guidelines have had a growing influence in guiding the planning activities of member states in recent decades.

As for the GI policies, Slätmo et al. [42] state that as of 2017, 11 of the 32 European states considered in their study (EU members plus Iceland, Liechtenstein, Norway and Switzerland) had adopted or were adopting national policies for GI and, moreover, that the perceived scope of GI covers, in particular, the sectors of land use and spatial development planning, water management, agriculture, forestry and fisheries, climate change mitigation and adaptation, environmental protection and rural development.

Within this framework, the ES approach adopted to develop the Lombardy RGI appears to be widely integrated in spatial and landscape planning [28,85].

With respect to the integration of GIs at different scales in planning, especially landscape-oriented planning, the study conducted by Hersperger et al. [86] shows how landscape-related contents of strategic plans are frequently linked to the concept of a GI as an operational tool to enhance the landscape setting, to support the creation of "landscape corridors", to increase landscape structural functions and to facilitate recreational activities. This widespread orientation of supra-local planning tends to confirm the opportunities for a GI downscaling towards the local level, within a broader strategic framework.

Finally, we report two European case studies dealing with the relationship between ES mapping, supra-local planning levels and GI implementation.

The first one [30] concerns the Barcelona Metropolitan Region in Catalonia, Spain. The area is regulated by the General Territorial Plan of Catalonia, under whose guidelines the Territorial Metropolitan Plan of Barcelona was developed. The authors map the supply and demand of two ESs (outdoor recreation and air purification) at the metropolitan scale and compare their results with the preservation and enhancement strategies envisaged by the metropolitan plan; they highlight the mismatches between the analysis and current planning strategies suggesting, among other things, how the Barcelona Green Infrastructure and Biodiversity Plan approved by the City Council in 2020 may offer a relevant opportunity to improve outdoor recreation.

The second study [87] describes the uneven development process of the French Green and Blue Network policy, a GI project with mainly environmental purposes. The policy was developed by national regulations and guidelines but shall be applied through the interaction with regional and sub-regional administrative levels, up to the transposition of supra-local strategic guidelines into local requirements and regulations (the authors show, as a good practice, the case of the Local Urban Plan of the Le Cheylas municipality, Grenoble urban area, Auvergne-Rhône-Alpes).

The cited analyses and examples show how, although planning frameworks in the European context may display remarkable diversities, testing the backbone of our methodological approach appears to be feasible in most European countries.

4.3. Methodological Limitations

In this frame, the methodology developed for the Media and Alta Valtellina pilot area shows some possible limitations in replicability, partly depending on the availability of data and information. One issue is related to performing analogous spatial processing to identify akin priority areas because of differences in spatial data sources for selection. For example, identifying woodlands with high landscape values is the output of the classification adopted by the forestry management plan for Alta Valtellina. In other areas of Lombardy, forestry management plans may have different classification layouts, leading to the adoption of different selection parameters. Furthermore, strategic plans like an RTAP do not always cover all the regional extent; therefore, in GLUs that are not provided with an RTAP, its contribution in identifying objectives and priority areas should be replaced with other sources.

Another critical issue is the need to set an operational threshold in comparing and matching objectives derived from involved tools to create a common Matrix of Planning Objectives. In other words, not all the hierarchical subsets of the objectives of each plan can be considered to avoid their excessive proliferation when composing the matrix. However, when the objectives matrix is properly used as a guide to manage a further consultation of planning tools, their in-depth contents can be recovered and employed in the strategy definition stage.

Considering other national or international territorial contexts, the above-mentioned issues related to data sources and spatialisation processes may be even more relevant. It is important to notice that such a process is inevitably partly based on a combination of data sources and analysis related to specific landscapes or spatial units; nevertheless, the general framework of the procedure—which consists of the recognition of structural landscape elements, the synthesis of relevant supra-local planning tools, the identification of common objectives and the spatialisation of planning strategies—may be tested and possibly adopted in remarkably different spatial contexts, using adequate planning contents and proper local data sources for spatial processing.

Regarding the systematisation of planning objectives and their transposition into strategies and design solutions, it may be useful to note that a common path to guide similar processes in a European context may be, once again, the European Landscape Convention [55]; in fact, its Article 6 urges the parties to undertake the definition of landscape quality objectives for landscapes that are identified and assessed. Multi-scale landscape-oriented planning procedures are therefore able to consider such objectives, recognised within national planning frameworks, as a cornerstone upon which to build strategies.

4.4. Future Development and Perspectives

The workflow integrates tools designed at different scales within an intermediate supra-local geographic unit to support local administrators and planners in operationalising large-scale goals and objectives.

Once GLU-based strategic priority areas and design solutions are defined at the pilot area scale, surveys and checks should be conducted to test the aptness of the outcomes and, if needed, they should be modified. Given the extent of the pilot area, it was impossible to fulfil this further task during the research stages conducted so far; however, in a long-lasting perspective, this may be considered a future workflow development.

Then, to implement the research outcomes and integrate them into local planning strategies, they should be discussed and further developed through round tables involving local authorities and public participation forums open to citizens and stakeholders. Thus, strategies and actions defined during the research stage will be validated, modified or integrated considering local knowledge and requests. This fine-tuning phase should be incorporated into the overall downscaling procedure for each GLU, or other territorial units where the described workflow should be adopted.

In this context, regional administration would have a coordinating role, with the task of managing and balancing local requirements within a large-scale planning framework, thus fulfilling an actual multi-scale approach.

Regarding NBSs and other local design solutions, it would be useful to classify them from a replication perspective, concerning their suitability in different landscapes. For this purpose, a development of the pilot research should include a targeted replication in GLUs representing diverse landscapes; for Lombardy, in addition to alpine landscapes addressed in the pilot area, hilly landscapes, plain landscapes, river landscapes and highly urbanised landscapes should be considered. In this way, NBSs and local actions defined in the different pilot areas can be assembled and linked to landscape types to create a global catalogue of landscape-specific design solutions to be used as a source to choose the proper local actions for each geographic unit.

5. Conclusions

Starting from raising the awareness of existing gaps in operationalising a landscape-oriented GI within actual planning tools, our research aims at setting a pilot, replicable methodology to downscale a regional GI into a sub-regional landscape unit; to integrate GI principles and designs into a complex framework of supra-local planning strategies, thus obtaining a spatialised set of common strategies; and to further detail their implementation by adopting site-specific design solutions, including NBSs. Media and Alta Valtellina, a mountainous sub-region in Lombardy, Italy, was chosen as a test area because of its geographical and environmental relevance and was also stress tested for the use of the methodological framework in a multi-layered fragile spatial unit.

Our methodological approach consisted in identifying and mapping the main territorial and landscape elements of the pilot area; assessing existing supra-local planning tools to match their objectives with landscape structural elements; and in combining them into strategic operational maps, in which the regional GI serves as the main spatial filter, together with other spatial data sources, to identify strategic priority areas.

The results show that the pursued methodology can provide effective operative outcomes; moreover, unlike other experimentations where a GI is integrated into a single planning tool, the novelty of the approach lies in the downscaling process of a regional GI as a strategic key to simultaneously implement multiple wider planning strategies towards a local size.

The whole process is designed to be replicable in other comparable landscape units, but its methodological principles may also be adopted at wider or smaller scales. The main critical issues and limitations affecting replicability are the potential dissimilarities in the planning and territorial data sources to be employed in the spatialising strategies, due to differences in the sub-regional planning frameworks or in the spatial data organisation, and the need to summarise the contents of each planning tool involved in the process by extracting comparable sets of planning objectives to be combined into common strategies, thus reducing their complexity.

As for comparisons with the international context, replicability is partly dependent on national planning frameworks and involves the overall methodology rather than specific strategic outcomes; the planning approaches and case studies comparable to our effort can be found in the literature. Moreover, the growing influence of EU regulations and guidelines could help with the integration and standardization of planning frameworks and practices.

Future development perspectives include the use of local surveys to test the aptness of the identified strategic priority areas and to properly select specific design solutions as the final operational level of the process, and discussing the research outcomes through round tables and participation processes involving local authorities, citizens and stakeholders.

Finally, the inherent and more general value of the adopted methodology lies in the opportunity to organise the implementation of supra-local planning tools from an ES-based planning standpoint, ensuring ES provision by integrating multiple plans with a GI acting as a strategic spatial key.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/su151511542/s1, Supplementary File S1: Strategic operational maps for the pilot area; Supplementary File S2: Table of strategies and criteria for the pilot area.

Author Contributions: All authors jointly contributed to the conceptualisation and methodology of the study. The individual contributions are as follows: software, G.P., F.M. and A.B.; investigation and data curation, G.P., V.d.M. and F.M.; writing—original draft preparation, G.P. and V.d.M.; writing—review and editing, S.S. and S.R.; visualisation, F.M. and A.B.; supervision, A.A.; project administration, A.A.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript.

Funding: This study was conducted in the framework of the research project "Esplorazioni progettuali per l'implementazione della Rete Verde regionale. Operatività e sperimentazioni pilota in contesti territoriali fragili" ("Planning explorations for the implementation of the Regional Green Infrastructure. Operability and pilot tests in fragile territorial contexts"), funded by the Lombardy region as part of a broader collaboration agreement established with the Department of Architecture and Urban Studies (DAStU) of the Politecnico di Milano, Italy. The agreement was established by the deliberation of the Lombardy Regional Cabinet (DGR XI/6628) approved on 4 July 2022.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are available upon request.

Acknowledgments: The authors acknowledge all the following components of the research group at DAStU, Politecnico di Milano who contributed to the process for the re-edition of the new RLP of Lombardy: Andrea Arcidiacono (research coordinator), Alberta Cazzani (coordinator for focuses on protected heritage assets), Andrea Benedini, Stefano Coloru, Viviana di Martino, Calogero Daniele Lentini, Francesca Mazza, Guglielmo Pristeri, Silvia Ronchi, Stefano Salata.

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

References

1. Dorst, H.; van der Jagt, S.; Raven, R.; Runhaar, H. Urban Greening through Nature-Based Solutions—Key Characteristics of an Emerging Concept. *Sustain. Cities Soc.* **2019**, *49*, 101620. [CrossRef]
2. Albert, C.; Schröter, B.; Haase, D.; Brillinger, M.; Henze, J.; Herrmann, S.; Gottwald, S.; Guerrero, P.; Nicolas, C.; Matzdorf, B. Addressing Societal Challenges through Nature-Based Solutions: How Can Landscape Planning and Governance Research Contribute? *Landsc. Urban Plan.* **2019**, *182*, 12–21. [CrossRef]
3. Meerow, S.; Newell, J.P. Spatial Planning for Multifunctional Green Infrastructure: Growing Resilience in Detroit. *Landsc. Urban Plan.* **2017**, *159*, 62–75. [CrossRef]
4. Costanza, R.; D'Arge, R.; de Groot, R.; Farber, S.; Grasso, M.; Hannon, B.; Limburg, K.; Naeem, S.; O'Neill, R.V.; Paruelo, J.; et al. The Value of the World's Ecosystem Services and Natural Capital. *Nature* **1997**, *387*, 253–260.
5. Millennium Ecosystem Assessment. *Ecosystems and Human Well-Being: A Framework for Assessment*; Island Press: Washington, DC, USA, 2003; ISBN 9780128096659.
6. European Commission. *Building a Green Infrastructure for Europe*; Publications Office of the European Union: Luxembourg, 2013; ISBN 9789279334283.
7. Benedict, M.A.; McMahon, E.T. Green Infrastructure: Smart Conservation for the 21st Century. *Renew. Resour. J.* **2001**, *20*, 12–17.
8. Hansen, R.; Pauleit, S. From Multifunctionality to Multiple Ecosystem Services? A Conceptual Framework for Multifunctionality in Green Infrastructure Planning for Urban Areas. *Ambio* **2014**, *43*, 516–529. [CrossRef]
9. Kambites, C.; Owen, S. Renewed Prospects for Green Infrastructure Planning in the UK. *Plan. Pract. Res.* **2006**, *21*, 483–496. [CrossRef]
10. Benedict, M.E.; Mcmahon, E.T. *Green Infrastructure. Linking Landscapes and Communities*; Island Press: Washington, DC, USA, 2006; ISBN 9781597267649.
11. Pauleit, S.; Liu, L.; Ahern, J.; Kazmierczak, A. Multifunctional Green Infrastructure Planning to Promote Ecological Services in the City. In *Urban Ecology: Patterns, Processes, and Applications*; Niemelä, J., Breuste, J.H., Elmqvist, T., Guntenspergen, G., James, P., McIntyre, N.E., Eds.; Oxford Scholarship Online: Oxford, UK, 2011; pp. 272–285.
12. Fisher, B.; Turner, R.K.; Morling, P. Defining and Classifying Ecosystem Services for Decision Making. *Ecol. Econ.* **2009**, *68*, 643–653. [CrossRef]
13. Langemeyer, J.; Gómez-Baggethun, E.; Haase, D.; Scheuer, S.; Elmqvist, T. Bridging the Gap between Ecosystem Service Assessments and Land-Use Planning through Multi-Criteria Decision Analysis (MCDA). *Environ. Sci. Policy* **2016**, *62*, 45–56. [CrossRef]
14. Ersoy Mirici, M. The Ecosystem Services and Green Infrastructure: A Systematic Review and the Gap of Economic Valuation. *Sustainability* **2022**, *14*, 517. [CrossRef]
15. European Commission. *Mapping and Assessment of Ecosystems and Their Services. Urban Ecosystems 4th Report*; Office for Official Publications of the European Communities: Luxembourg, 2016; ISBN 9789279361616.
16. Arcidiacono, A.; Ronchi, S.; Salata, S. Managing Multiple Ecosystem Services for Landscape Conservation: A Green Infrastructure in Lombardy Region. *Procedia Eng.* **2016**, *161*, 2297–2303.
17. Cortinovis, C.; Geneletti, D. Mapping and Assessing Ecosystem Services to Support Urban Planning: A Case Study on Brownfield Regeneration in Trento, Italy. *One Ecosyst.* **2018**, *3*, e25477. [CrossRef]
18. Maes, J.; Zulian, G.; Günther, S.; Thijssen, M.; Reynal, J. *Enhancing Resilience of Urban Ecosystems through Green Infrastructure (EnRoute) Final Report*; Publications Office of the European Union: Luxembourg, 2019; ISBN 978-92-79-98984-1.
19. Van Oijstaeijen, W.; Van Passel, S.; Cools, J. Urban Green Infrastructure: A Review on Valuation Toolkits from an Urban Planning Perspective. *J. Environ. Manag.* **2020**, *267*, 110603. [CrossRef]
20. Gómez-Baggethun, E.; Barton, D.N. Classifying and Valuing Ecosystem Services for Urban Planning. *Ecol. Econ.* **2013**, *86*, 235–245. [CrossRef]
21. Ronchi, S.; Arcidiacono, A.; Pogliani, L. Integrating Green Infrastructure into Spatial Planning Regulations to Improve the Performance of Urban Ecosystems. Insights from an Italian Case Study. *Sustain. Cities Soc.* **2020**, *53*, 101907. [CrossRef]
22. European Commission. *EU Biodiversity Strategy for 2030: Bringing Nature Back into Our Lives. COM(2020) 380 Final*; European Commission: Brussels, Belgium, 2020.
23. Zulian, G.; Ronchi, S.; La Notte, A.; Vallecillo, S.; Maes, J. Adopting a Cross-Scale Approach for the Deployment of a Green Infrastructure. *One Ecosyst.* **2021**, *6*, 1–29.

24. Hermoso, V.; Carvalho, S.B.; Giakoumi, S.; Goldsborough, D.; Katsanevakis, S.; Leontiou, S.; Markantonatou, V.; Rumes, B.; Vogiatzakis, I.N.; Yates, K.L. The EU Biodiversity Strategy for 2030: Opportunities and Challenges on the Path towards Biodiversity Recovery. *Environ. Sci. Policy* **2022**, *127*, 263–271. [CrossRef]
25. Cortinovis, C.; Geneletti, D. Ecosystem Services in Urban Plans: What Is There, and What Is Still Needed for Better Decisions. *Land Use Policy* **2018**, *70*, 298–312. [CrossRef]
26. Cortinovis, C.; Geneletti, D. A Framework to Explore the Effects of Urban Planning Decisions on Regulating Ecosystem Services in Cities. *Ecosyst. Serv.* **2019**, *38*, 100946. [CrossRef]
27. Di Marino, M.; Tiitu, M.; Lapintie, K.; Viinikka, A.; Kopperoinen, L. Integrating Green Infrastructure and Ecosystem Services in Land Use Planning. Results from Two Finnish Case Studies. *Land Use Policy* **2019**, *82*, 643–656. [CrossRef]
28. de Groot, R.; Alkemade, R.; Braat, L.; Hein, L.; Willemen, L. Challenges in Integrating the Concept of Ecosystem Services and Values in Landscape Planning, Management and Decision Making. *Ecol. Complex.* **2010**, *7*, 260–272. [CrossRef]
29. Mascarenhas, A.; Ramos, T.B.; Haase, D.; Santos, R. Ecosystem Services in Spatial Planning and Strategic Environmental Assessment-A European and Portuguese Profile. *Land Use Policy* **2015**, *48*, 158–169. [CrossRef]
30. Baró, F.; Palomo, I.; Zulian, G.; Vizcaino, P.; Haase, D.; Gómez-Baggethun, E. Mapping Ecosystem Service Capacity, Flow and Demand for Landscape and Urban Planning: A Case Study in the Barcelona Metropolitan Region. *Land Use Policy* **2016**, *57*, 405–417. [CrossRef]
31. Grêt-Regamey, A.; Altwegg, J.; Sirén, E.A.; van Strien, M.J.; Weibel, B. Integrating Ecosystem Services into Spatial Planning—A Spatial Decision Support Tool. *Landsc. Urban Plan.* **2017**, *165*, 206–219. [CrossRef]
32. Seiwert, A.; Rößler, S. Understanding the Term Green Infrastructure: Origins, Rationales, Semantic Content and Purposes as Well as Its Relevance for Application in Spatial Planning. *Land Use Policy* **2020**, *97*, 104785. [CrossRef]
33. Grădinaru, S.R.; Hersperger, A.M. Green Infrastructure in Strategic Spatial Plans: Evidence from European Urban Regions. *Urban For. Urban Green.* **2019**, *40*, 17–28. [CrossRef]
34. Lafortezza, R.; Davies, C.; Sanesi, G.; Konijnendijk, C.C.C. Green Infrastructure as a Tool to Support Spatial Planning in European Urban Regions. *iForest-Biogeosci. For.* **2013**, *6*, 102–108. [CrossRef]
35. Scholes, R.; Reyers, B.; Biggs, R.; Spierenburg, M.; Duriappah, A. Multi-Scale and Cross-Scale Assessments of Social–Ecological Systems and Their Ecosystem Services. *Curr. Opin. Environ. Sustain.* **2013**, *5*, 16–25. [CrossRef]
36. European Commission. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Green Infrastructure (GI)—Enhancing Europe's Natural Capital {SWD(2013) 155 Final}*; European Commission: Bruxelles, Belgium, 2013; Volume 51.
37. European Commission. *Review of Progress on Implementation of the EU Green Infrastructure Strategy. COM(2019) 236 Final*; European Commission: Brussels, Belgium, 2019.
38. European Commission. *The European Green Deal. COM(2019) 640 Final*; European Commission: Bruxelles, Belgium, 2019.
39. Ronchi, S. *Ecosystem Services for Spatial Planning. Innovative Approaches and Challenges for Practical Applications*; Green Ener; Springer: Cham, Switzerland, 2018; ISBN 9783319901848.
40. Kopperoinen, L.; Itkonen, P.; Niemelä, J. Using Expert Knowledge in Combining Green Infrastructure and Ecosystem Services in Land Use Planning: An Insight into a New Place-Based Methodology. *Landsc. Ecol.* **2014**, *29*, 1361–1375. [CrossRef]
41. Staccione, A.; Candiago, S.; Mysiak, J. Mapping a Green Infrastructure Network: A Framework for Spatial Connectivity Applied in Northern Italy. *Environ. Sci. Policy* **2022**, *131*, 57–67. [CrossRef]
42. Slätmo, E.; Nilsson, K.; Turunen, E. Implementing Green Infrastructure in Spatial Planning in Europe. *Land* **2019**, *8*, 62. [CrossRef]
43. Donati, G.F.A.; Bolliger, J.; Psomas, A.; Maurer, M.; Bach, P.M. Reconciling Cities with Nature: Identifying Local Blue-Green Infrastructure Interventions for Regional Biodiversity Enhancement. *J. Environ. Manag.* **2022**, *316*, 115254. [CrossRef]
44. Isola, F.; Lai, S.; Leone, F.; Zoppi, C. Strengthening a Regional Green Infrastructure through Improved Multifunctionality and Connectedness: Policy Suggestions from Sardinia, Italy. *Sustainability* **2022**, *14*, 9788. [CrossRef]
45. Herreros-Cantis, P.; McPhearson, T. Mapping Supply of and Demand for Ecosystem Services to Assess Environmental Justice in New York City. *Ecol. Appl.* **2021**, *31*, e02390. [CrossRef]
46. Kremer, P.; Hamstead, Z.A.; McPhearson, T. The Value of Urban Ecosystem Services in New York City: A Spatially Explicit Multicriteria Analysis of Landscape Scale Valuation Scenarios. *Environ. Sci. Policy* **2015**, *62*, 57–68. [CrossRef]
47. Salata, S.; Özkavaf-Şenalp, S.; Velibeyoğlu, K. Integrating Ecosystem Vulnerability in the Environmental Regulation Plan of Izmir (Turkey)—What Are the Limits and Potentialities? *Urban Sci.* **2022**, *6*, 19. [CrossRef]
48. Pauleit, S.; Ambrose-Oji, B.; Andersson, E.; Anton, B.; Buijs, A.; Haase, D.; Elands, B.; Hansen, R.; Kowarik, I.; Kronenberg, J.; et al. Advancing Urban Green Infrastructure in Europe: Outcomes and Reflections from the GREEN SURGE Project. *Urban For. Urban Green.* **2019**, *40*, 4–16. [CrossRef]
49. Minoia, P.; Zanetto, G. An Assessment of the Principle of Subsidiarity in Urban Planning to Face Climate Change The Case of Martellago, Venice Province. *Int. J. Clim. Chang. Strateg. Manag.* **2009**, *1*, 63–74. [CrossRef]
50. Cattivelli, V. Land Use Policy Planning Peri-Urban Areas at Regional Level: The Experience of Lombardy. *Land Use Policy* **2021**, *103*, 105282. [CrossRef]
51. Lennon, M.; Scott, M. Delivering Ecosystems Services via Spatial Planning: Reviewing the Possibilities and Implications of a Green Infrastructure Approach. *Town Plan. Rev.* **2014**, *85*, 563–587. [CrossRef]

52. Demuzere, M.; Orru, K.; Heidrich, O.; Olazabal, E.; Geneletti, D.; Orru, H.; Bhave, A.G.; Mittal, N.; Feliu, E.; Faehnle, M. Mitigating and Adapting to Climate Change: Multi-Functional and Multi-Scale Assessment of Green Urban Infrastructure. *J. Environ. Manag.* **2014**, *146*, 107–115. [CrossRef]
53. Arthur, N.; Hack, J. A Multiple Scale, Function, and Type Approach to Determine and Improve Green Infrastructure of Urban Watersheds. *Urban For. Urban Green.* **2022**, *68*, 127459. [CrossRef]
54. Zardo, L.; Geneletti, D.; Pérez-Soba, M.; Van Eupen, M. Estimating the Cooling Capacity of Green Infrastructures to Support Urban Planning. *Ecosyst. Serv.* **2017**, *26*, 225–235. [CrossRef]
55. Council of Europe. *European Landscape Convention*; Council of Europe Publishing Division: Strasbourg, France, 2000; Available online: https://rm.coe.int/16807b6bc7 (accessed on 13 July 2023).
56. Arcidiacono, A.; Ronchi, S. *Ecosystem Services and Green Infrastructure. Perspectives from Spatial Planning in Italy*; Springer International Publishing: Berlin/Heidelberg, Germany, 2020; ISBN 9783030543440.
57. Agnoletti, M.; Santoro, A. The Lombard Forest Landscape. A Historical Summary. In *Land Cover Changes in Lombardy over the Last 50 Years*; ERSAF Regione Lombardia: Milan, Italy, 2012; pp. 131–156.
58. Oppio, A.; Corsi, S.; Mattia, S.; Tosini, A. Exploring the Relationship among Local Conflicts and Territorial Vulnerability: The Case Study of Lombardy Region. *Land Use Policy* **2015**, *43*, 239–247. [CrossRef]
59. Schirpke, U.; Leitinger, G.; Tasser, E.; Schermer, M.; Steinbacher, M.; Tappeiner, U. Multiple Ecosystem Services of a Changing Alpine Landscape: Past, Present and Future. *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* **2013**, *9*, 123–135. [CrossRef]
60. Campagnaro, T.; Frate, L.; Carranza, M.L.; Sitzia, T. Multi-Scale Analysis of Alpine Landscapes with Different Intensities of Abandonment Reveals Similar Spatial Pattern Changes: Implications for Habitat Conservation. *Ecol. Indic.* **2017**, *74*, 147–159. [CrossRef]
61. Jiménez-Olivencia, Y.; Ibáñez-Jiménez, Á.; Porcel-Rodríguez, L.; Zimmerer, K. Land Use Change Dynamics in Euro-Mediterranean Mountain Regions: Driving Forces and Consequences for the Landscape. *Land Use Policy* **2021**, *109*, 105721. [CrossRef]
62. Bazzanella, F.; Bichler, B.F.; Schnitzer, M. Collaboration and Meta-Organisation in Event Tourism—Effects of the Olympic Agenda 2020 on Planning the 2026 Winter Olympics. *Tour. Manag. Perspect.* **2022**, *41*, 100939. [CrossRef]
63. Chappelet, J.-L. Olympic Environmental Concerns as a Legacy of the Winter Games. *Int. J. Hist. Sport* **2008**, *25*, 1884–1902. [CrossRef]
64. Song, S.; Zhang, S.; Wang, T.; Meng, J.; Zhou, Y.; Zhang, H. Balancing Conservation and Development in Winter Olympic Construction: Evidence from a Multi-Scale Ecological Suitability Assessment. *Sci. Rep.* **2018**, *8*, 14083. [CrossRef]
65. Zhang, H.; Yu, Y.; Zha, T.; Rodrigo-Comino, J. Assessing Previous Land-Vegetation Productivity Relationships on Mountainous Areas Hosting Coming Winter Olympics Games in 2022. *Sci. Total Environ.* **2021**, *788*, 147870. [CrossRef] [PubMed]
66. Stobbelaar, D.J.; Pedroli, B. Perspectives on Landscape Identity: A Conceptual Challenge Perspectives on Landscape Identity: A Conceptual Challenge. *Landsc. Res.* **2011**, *36*, 321–339. [CrossRef]
67. Kaligarič, M.; Ivajnšič, D. Vanishing Landscape of the "Classic" Karst: Changed Landscape Identity and Projections for the Future. *Landsc. Urban Plan.* **2014**, *132*, 148–158. [CrossRef]
68. Costanza, R.; Daly, H.E. Natural Capital and Sustainable Development. *Conserv. Biol.* **1992**, *6*, 37–46.
69. Vardon, M.; Bass, S. (Eds.) Natural Capital Accounting for Better Policy Decisions: Measuring and Valuing Natural Capital to Improve Landscape Management and Governance. In Proceedings of the 4th Forum on Natural Capital Accounting for Better Policy Decisions, Kampala, Uganda, 18–19 November 2019.
70. Blaschke, T. The Role of the Spatial Dimension within the Framework of Sustainable Landscapes and Natural Capital. *Landsc. Urban Plan.* **2006**, *75*, 198–226. [CrossRef]
71. Kulczyk, S.; Woźniak, E.; Derek, M. Landscape, Facilities and Visitors: An Integrated Model of Recreational Ecosystem Services. *Ecosyst. Serv.* **2018**, *31*, 491–501. [CrossRef]
72. De Valck, J.; Landuyt, D.; Broekx, S.; Liekens, I.; De Nocker, L.; Vranken, L. Outdoor Recreation in Various Landscapes: Which Site Characteristics Really Matter? *Land Use Policy* **2017**, *65*, 186–197. [CrossRef]
73. Nelson, E.; Ennaanay, D.; Wolny, S.; Olwero, N.; Pennington, D.; Mendoza, G.; Aukema, J.; Foster, J.; Forrest, J.; Cameron, D.; et al. *InVEST 2.0 Beta User's Guide: Integrated Valuation of Ecosystem Services and Tradeoffs*; Woods Institute for the Environment, Stanford University: California, CA, USA, 2011; Available online: http://data.naturalcapitalproject.org/nightly-build/invest-users-guide/html/ (accessed on 13 July 2023).
74. Keeler, B.L.; Wood, S.A.; Polasky, S.; Kling, C.; Filstrup, C.T.; Downing, J.A. Recreational Demand for Clean Water: Evidence from Geotagged Photographs by Visitors to Lakes. *Front. Ecol. Environ.* **2015**, *13*, 76–81. [CrossRef]
75. North, M.A.; College, J. A Method for Implementing a Statistically Significant Number of Data Classes in the Jenks Algorithm. In Proceedings of the 2009 Sixth International Conference on Fuzzy Systems and Knowledge Discovery, Tianjin, China, 14–16 August 2009; Volume 1, pp. 35–38. [CrossRef]
76. Steiger, R.; Scott, D.; Abegg, B.; Pons, M.; Aall, C. A Critical Review of Climate Change Risk for Ski Tourism. *Curr. Issues Tour.* **2019**, *22*, 1343–1379. [CrossRef]
77. Vorkauf, M.; Steiger, R.; Abegg, B.; Hiltbrunner, E. Snowmaking in a Warmer Climate: An in-Depth Analysis of Future Water Demands for the Ski Resort Andermatt-Sedrun-Disentis (Switzerland) in the Twenty-First Century. *Int. J. Biometeorol.* **2022**. [CrossRef] [PubMed]

78. Abegg, B.; Agrawala, C.; Crick, F.; de Montfalcon, A. *Climate Change in the European Alps*; Agrawala, S., Ed.; OECD: Paris, France, 2006; ISBN 9264031685.
79. Batista e Silva, F.; Marín Herrera, M.A.; Rosina, K.; Ribeiro Barranco, R.; Freire, S.; Schiavina, M. Analysing Spatiotemporal Patterns of Tourism in Europe at High-Resolution with Conventional and Big Data Sources. *Tour. Manag.* **2018**, *68*, 101–115. [CrossRef]
80. European Commission. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank "A Framework Strategy for a Resilient Energy Union with a Forward-Looking*; European Commission: Bruxelles, Belgium, 2015.
81. Maes, J.; Jacobs, S. Nature-Based Solutions for Europe's Sustainable Development. *Conserv. Lett.* **2017**, *10*, 121–124. [CrossRef]
82. Colavitti, A.M.; Serra, S. Regional Landscape Planning and Local Planning. Insights from the Italian Context. *J. Settl. Spat. Plan.* **2021**, *2021*, 81–91. [CrossRef]
83. Argenziano, M.; Deffacis, J.; Gamalero, B.; Paludi, G. La Struttura. *Atti Rass. Tec. Soc. Ing. Archit. Torino* **2018**, *3*, 27–33.
84. Nadin, V.; Fernández, M.; Maldonado, A.; Zonneveld, W.; Stead, D.; Dąbrowski, M.; Piskorek, K.; Sarkar, A.; Schmitt, P.; Smas, L.; et al. *COMPASS Final Report*; ESPON & TU Delft: Luxembourg, 2018; ISBN 978-99959-55-55-7.
85. Galler, C.; Albert, C.; von Haaren, C. From Regional Environmental Planning to Implementation: Paths and Challenges of Integrating Ecosystem Services. *Ecosyst. Serv.* **2016**, *18*, 118–129. [CrossRef]
86. Hersperger, A.M.; Bürgi, M.; Wende, W.; Bacău, S.; Grădinaru, S.R. Does Landscape Play a Role in Strategic Spatial Planning of European Urban Regions? *Landsc. Urban Plan.* **2020**, *194*, 103702. [CrossRef]
87. Perrin, M.; Bertrand, N.; Vanpeene, S. Ecological Connectivity in Spatial Planning: From the EU Framework to Its Territorial Implementation in the French Context. *Environ. Sci. Policy* **2022**, *129*, 118–125. [CrossRef]