

## Article

# Contribution of Conceptual-Drawing Methods to Raise Awareness on Landscape Connectivity: Socio-Environmental Analysis in the Regional Context of Trentino (Italy)

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**Abstract:** This paper deals with landscape understanding and connectivity from an ecological as well as a human perspective. It is based on a broader research study known as EIT Climate-KIC SATURN (System and sustainable Approach to virTuOUS interaction of Urban and Rural LaNdscapes) co-funded by the European Institute of Innovation & Technology (EIT), Climate-KIC and the institutions participating in this project. The aim of the study was to explore how landscape connectivity is perceived, on urban and regional scales, by decision-makers and key stakeholders as well as the impact this can have on building sustainable cities. The paper used a series of drawing and visualization workshops, community engagement methods, and participatory tools to identify the connection communities and decision-makers have with their landscape surroundings as well as the impact landscape connectivity has on our health and wellbeing. Through a series of specifically designed workshops following a landscape visioning approach, the paper explored how drawings and visualizations can support decision-makers to create a vision that addresses landscape connectivity, considering the socio-ecological factors in their area and creating a holistic regional approach between urban and rural landscapes. The study concludes that landscape connectivity is of major importance when creating visions for a sustainable future; however, a better connection between ecological and human elements needs to be established to improve landscape design.

**Keywords:** landscape; connectivity; health; wellbeing; landscape design; landscape vision; drawings; decision-makers



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## 1. Introduction

Sustainable cities are becoming a rather prominent topic, not only in relation to the climate crisis and the environmental challenges we face, but also as the medium to address socio-economic hurdles as well as improve the health and wellbeing of our communities. Connectivity is proving a key element to enhance the quality of the landscape as well as to improve the amount of ecosystem services. 'Landscape connectivity' relates to biodiversity conservation [1] or deals with ecosystem stability [2] and loss of natural habitat [3]. However, as urbanization is increasing habitat fragmentation, urban and rural landscapes are changing uses and new landscape patterns are being created [4–6]. The unregulated growth in density of urban population results in landscape fragmentation [7] and even though green spaces provide a home for biodiversity this is not addressed in a holistic way within the scale of our cities or regions.

In addition, the promotion of connectivity as a conservation tool to help adapt and mitigate climate change, land fragmentation, and habitat decrease continues [3], but addressing climate change requires more than a perfectly connected natural environment.

The change of climatic and environmental conditions does not only demand ecosystem stability and good connectivity between urban and rural patches [2], but for ways in which biodiversity can thrive in cities and dense areas. Even though evidence shows that landscape connectivity enhances biodiversity in green spaces [8] and that this can be improved with the creation of ecological networks within cities [2], less is being done in relation to human connectivity and how this affects the landscape as well as the habitat of an area. The fragmentation created by human activity needs to be addressed since the Anthropocene is rapidly changing ecosystems [9]. Urban and rural landscapes can be managed in more efficient and environmentally friendly ways by including social aspects into spatial planning and visioning for future territories [10].

Connectivity is not just about the connection between plants, animals, and other species, but about how these can thrive in an urban environment creating a new pathway for resilient territories that includes human interaction and a strong synergy with the landscape surroundings. Connectivity is about awareness as much as about education, but it is also about designing environmentally friendly regions that are integrated in the landscape and natural environment, without excluding biodiversity from their urban areas.

Most recent research on landscape connectivity is therefore calling for a more holistic and wider approach to management and planning to include the various components into more complex systems. As Schoon et al. suggest, the shift towards social-ecological system (SES) perspectives shows insights into the human-nature relationship [11] and that there is a need to explore this further, especially in relation to its influence on landscape planning and policies. To properly address sustainability, all local, regional and global scales must be considered accordingly [12]. Wu et al. [13] reveal that regional-scale integrates human-environment interactions while it requires multidisciplinary teams and cross-silo approaches between designers, planners, policymakers, and stakeholders for a sustainable approach to be agreed upon and implemented. For this to happen we need to develop adaptable frameworks to support sustainable coexistence between humans and the area's biodiversity, helping to mitigate the climate crisis.

The pan European EIT Climate-KIC project SATURN [14] aims to connect people with their landscape surroundings, improve knowledge and awareness, increase aspirations, and help address land and governance fragmentation to move all these factors one step closer to sustainable cities and regions. This paper presents a small portion of the results of the project, dealing with landscape connectivity and the ways in which these impact on urban and rural environments. The study explores how connectivity is understood in relation to different landscapes and urban areas and seeks to demonstrate the importance of human interaction, landscape design and the ways in which drawings and designs can change the public's and decision makers' perceptions on the way a city or region connects with its natural and human ecosystems.

A series of visioning, stakeholder engagement, and capacity building activities, over the course of SATURN's three-year project [15] has resulted in a shift in perceptions related to the understanding of the landscape surroundings as well as the value of the landscape connectivity.

## 2. Methodology

The wider research supporting this paper forms part of the SATURN project; a scheme co-funded by EIT and Climate-KIC alongside the cities and institutions (Appendix A) forming the consortium [14]. Exploring the value of the landscape as well as the impact of landscape and governance fragmentation in land, communities, and sustainable approaches, the project has run for 3 years from November 2018 to December 2021, aiming on changing perceptions about the importance of landscape surroundings and connectivity. The engagement with decision-makers, stakeholders, and researchers in order to assist in the creation of a new landscape vision for each area based on sustainable principles and improve the relationship of decision-makers and stakeholders with their land has played a major role in the SATURN project. This wide scope incorporates knowledge

and experience from three countries (Italy, United Kingdom, and Sweden) to explore a framework as well as best practices to understand the key steps to respond to a systemic change within our regions. The methodology of the broader project has been published previously with explanations of the full structure and process [14].

This paper focuses on one of the aspects of the broader SATURN project, that of ecological connectivity and human interaction within the landscape, and aims to demonstrate how these have changed throughout the duration of the SATURN project after the influence of a series of workshops and activities with key decision-makers, stakeholders and the community in the participating cities. It combines a theoretical overview on landscape values with a series of practical applications on the ground. The significance of this methodology lies upon the close collaboration and exchange of knowledge between the European cities. It starts with a review of the concept of the landscape and its connectivity to set the background on key ideas, then uses the workshops and integrated drawing activities to analyse how landscape connectivity can be spatially interpreted and to define what the role of the landscape is towards community wellbeing. Qualitative literature reviews often address broader topics in which many different study designs might be applicable providing evidence in relation to the landscape, connectivity, and health [16].

For the design of this study, three steps were involved in the collection, evaluation, and presentation of the data.

### *2.1. Definition of the Research Focus*

The methodology adopted by this paper includes an exploration of drawings and visualizations, as well as a series of workshops and case studies to test the results respectful of the SATURN principle, which calls for a more iterative relationship with stakeholders. The direct iterative process has driven towards the drawing and visualizations process, instead of computer-driven [17], online design tools [18], or Virtual Reality [19]. The examples presented here focus on ecological connectivity as well as human connectivity on a regional scale. Using several of the broader SATURN project tools (workshops, maps, drawings), this study discusses how landscape connectivity can be beneficial for communities by improving their health and wellbeing while preserving biodiversity. The focus turns on the ambitions of key stakeholders and decision-makers for their cities, and how these have raised awareness and influenced change by following the SATURN methodology. The following process is, based on the “Visioning and Capacity Building tools” created during the SATURN project, aiming to see the landscape in a holistic way and not as fragmented land, often dichotomized by ‘urban’ or ‘rural’ definitions.

### *2.2. The Workshops*

A series of (a) visioning/drawing, (b) stakeholder engagement, and (c) capacity building workshops to understand and analyse the significance of landscape connectivity on a regional scale have been conducted. The workshop series involved key concepts such as understanding of the landscape, pathways, ecology, human interactions, economy, food, and culture. The broader SATURN workshops were collaboratively organized by all three core countries of the project (Italy, UK, Sweden) and involved decision-makers, planners, professionals, and academics. The three SATURN hubs hosted 3–5 workshops each. Initially, each participant was given a brief alongside a series of questions, then was allocated time to develop their own approach. Group discussion had also been embedded in the workshop’s structure and with the help of a project facilitator, several key points and outcomes were discussed by the participants. This paper focuses on the outcomes coming from Trentino (Italy), in particular the areas around the city of Trento, Pergine Valsugana, Borgo Valsugana, Arco, and the Adige Valley, enhanced by findings of the UK workshops in Birmingham. This paper focused on the case of Trentino using the characteristic landscape of dense urban areas and highly productive farmlands as a medium to demonstrate how the SATURN project has helped to better understand the landscape and the way it connects with humans and biodiversity. In fact, in spite of the small territorial dimension and a

relatively low number of inhabitants (about 542,000 people), Trentino is known for its high attractivity in the tourism sector (with more than 1 million incoming tourists every year), the intensive agro-food production (around one-fifth of the total European apple produce is located in Trento), the transport corridors crossing the region and the wide forested areas (more than 56% of the overall 6207 Km<sup>2</sup> and around 30% of the territory covered by protected areas). A series of elements which should be taken into consideration when reflecting on the relationships between natural, rural, and urbanised landscapes.

Especially for the Trentino hub the workshops were based on SATURN's visioning approach, originally developed by the Critical Artistic Thinking in Design (CATiD) Centre of Birmingham City University. The visioning approach uses the idea of the landscape as well as concepts of landscape identity, climate emergency, social coherence, landscape interaction, and community engagement to develop a new approach for the landscape and its territory. This initial activity was then followed by further stakeholder engagement and capacity building workshops. During a series of meetings run between 2020 and 2021, local stakeholders were asked to envision the future of their territory and landscapes through maps and diagrams. Trento conducted 5 workshops of approximately 25 people each. The first workshop was conducted in person, where stakeholders from various places from Trentino participated. Three more online workshops followed with stakeholders from the communities of Pergine Valsugana, Rotaliana and the town of Arco. A final last workshop has been held in late Autumn 2021, in person, in Borgo Valsugana. Trento hub's workshops followed the same steps as described above for the three territories, starting with initial questions, demonstration of maps, group exercises, and discussion as well as an evaluation of each territory from the participants. The workshops were run by expert facilitators and SATURN partners.

### *2.3. Analysis of Workshop Outcomes*

The data collection includes drawings, maps, visual and audio material from the field visits to each of the locations, texts, notes and workshop recordings that have been analysed throughout the duration of the project. Progress reports, papers, videos, newsletters, and proposed frameworks are being produced and disseminated in order to allow wider opportunities to access the findings.

The analysis uses the drawings as exploration and communication tools to investigate if/how the visual forms have resulted in a better understanding and awareness of landscape connectivity by the local stakeholders. The several graphs, drawings, and sketches were hand-drawn by the participants and scanned by the research team. In some cases, maps of the territories were used as the basis to provide the context of the region. The study also uses the drawings to evaluate if they have helped to develop actions that support sustainable ideas to the territories involved. It communicates the significance of landscape connectivity to cities and residents by involving in the planning process, stakeholders (more than 30 external organizations and public institutions), the connectivity impact assessment as well as land-use planning scenarios. In addition, a graph with the key topics that emerged in comparison to the different areas in Trentino, is presented here, demonstrating the differences in perceptions in relation to the landscape and sustainability, health, wellbeing, and social equality. The scope of this analysis is to compare the topics that emerged during the workshops and further understand the importance of these topics for the participants and their links to connectivity. The size and colour intensity demonstrate how often these ideas have been mentioned by the participants and provide an initial assessment of the territories.

## **3. Results**

Despite the wide interest from the research community, landscape framework applications related to landscape connectivity are rare. There are several limitations in scope due to the higher complexity and the number of actors involved in the transformative process to achieve holistic landscape plans and strategies. The territory around Trento already shows

several geographical barriers to landscape and nature connectivity and several challenges in relation to human interaction are being discussed. The infrastructural transformations and the dynamics of urban growth around the Trentino area, have resulted in a series of challenges reducing the richness of biodiversity, community engagement with nature as well as increasing land fragmentation. The need to adopt a multidisciplinary approach that goes beyond isolated administration approaches (municipalities, local authorities, city councils) has been confirmed by most of the workshop comments and discussions taking place not only in Italy, but also in the UK and Sweden.

The use of maps, drawings, and the visioning approach has assisted in highlighting the existence of Socio-Ecological Systems (SES) and helped the participants to better understand the complexity of landscape connectivity beyond each discipline or professional boundary. The drawings have been instrumental in demonstrating how concepts can be translated into territorial visions and they have also become a strong communication tool between the designers/researchers and decision-makers.

### *3.1. Understand Landscape Connectivity through Drawings*

The three SATURN hubs hosted 3–5 workshops each, with some taking place in person and most of them online due to the pandemic restrictions (2020–2021). Engaging local stakeholders, requires a constant and time-consuming effort and a sophisticated process to help the selected stakeholders understand how to express their views and doubts about the sustainable development of a territory, and how they can visualize landscape connectivity through maps and graphics. At the same time, working on maps produced by the stakeholders themselves proved to be a very effective way to bring them out of their ordinary experiences and engage further into the sustainable city planning process. Starting reluctantly with the drawing activity, the participants explored their personal as well as community-wide connections with their landscape surroundings. Participants started exploring their physical surroundings visually, but they quickly moved to the dynamics of each territory, the values and connections between nature and society as well as projections for sustainable cities of the future (Figures 1 and 2). The comments from the workshops have been interesting, revealing that despite the initial resistance to the ‘act of drawing’ as well as the large scale (of the territory) the participants were encouraged to contemplate their interactions with their environment (relatively unusual activity compared to their previous experience), the exercise has allowed several stakeholders to interact and exchange ideas and also take a closer look at the broader landscape of their area. The landscape was seen as a whole, not just the neighbourhood, the streets, or even cycling routes and parks. As Figure 1 shows, participants worked in a hybrid way including both ‘realistic’ representation of the landscape features and more graphical visualizations of processes and relations. This observation demonstrates how this workshop format allowed participants to go beyond standard approaches while learning to interpret intangible concepts into the landscape. This activity has allowed participants to better understand and work on the territorial scale, identifying the various connections within the landscape, the importance and barriers to biodiversity, human interaction, culture and economy of our cities and their surroundings.

During this initial stage of identifying what landscape connectivity is, the participants discussed their views, their areas, and way of living, before moving to the main challenges and issues hindering a sustainable development of their territory. The territorial maps were used as a basis to create a vision for the sustainable city of the future. Each territory conducted an initial analysis of the landscape followed by a deeper evaluation of ecological and social connections and barriers within the territory. While identifying ‘landscape margins’ within their areas, the way these affected the landscape value but also their health and wellbeing, they started to discuss the impact on biodiversity as well as society. Participants worked individually and in teams where several topics were identified, with the most common being: ecological values, territorial biodiversity, green areas as well as some less expected ones such as sustainable mobility. Diagrammatic drawings and sketches

(Figure 3) were created focusing mostly on the exploration of the connection with the landscape from a nature as well as a human angle. In most cases participants were keen to include biodiversity within their city and create mixed-used neighbourhoods and regions. The topic of sustainable mobility proved to be an interesting ice-breaking point to start the discussion with participants, linking landscape connectivity issues with the limitations imposed by the absence of specific strategies for slow mobility and sustainable means of transport. Reducing the carbon footprint of mobility in relation to carbon emissions and soil consumption was seen as a crucial link to contribute to landscape connectivity. In addition, the importance of mixed uses, especially in rural and agricultural areas was also highlighted. In the Trentino hub, most of the agricultural areas are considered as non-freely accessible to citizens due to the highly intensive and industrial farming in the region. Therefore, the possibility to introduce alternative uses within these areas can result in an improved experience of these landscapes and was welcomed by the stakeholders participating in the workshops.

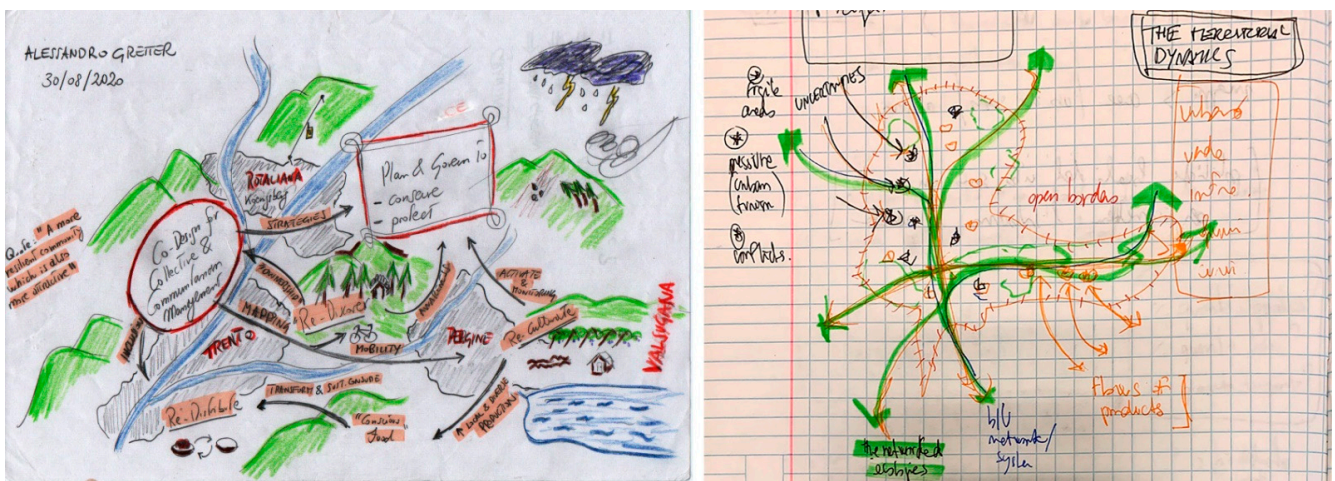


Figure 1. Hand drawings exploring the landscape surroundings and connection between nature and society produced during the SATURN workshops in Italy (Trentino).

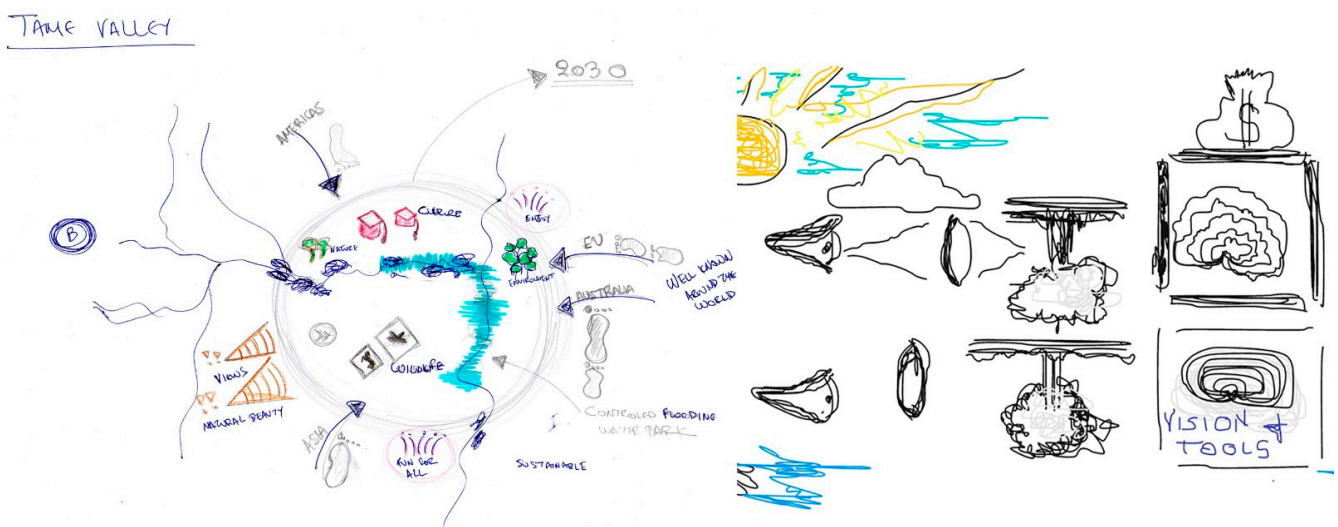
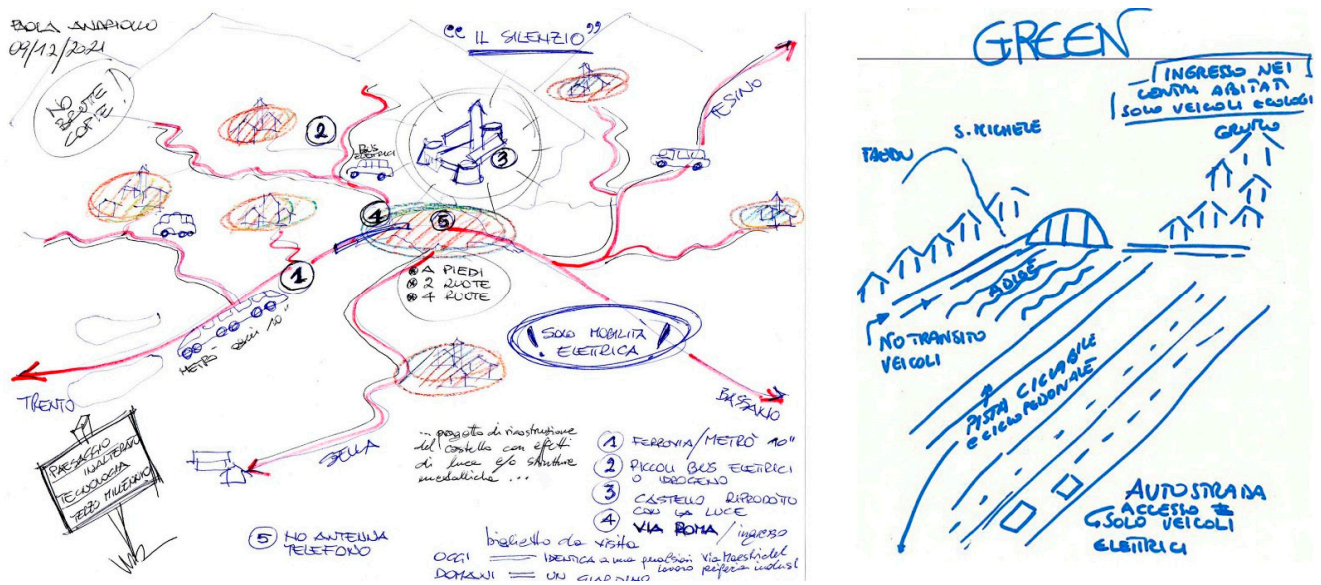


Figure 2. Hand drawings exploring the landscape surroundings and connection with nature and society produced during the SATURN workshops in the UK (Birmingham).

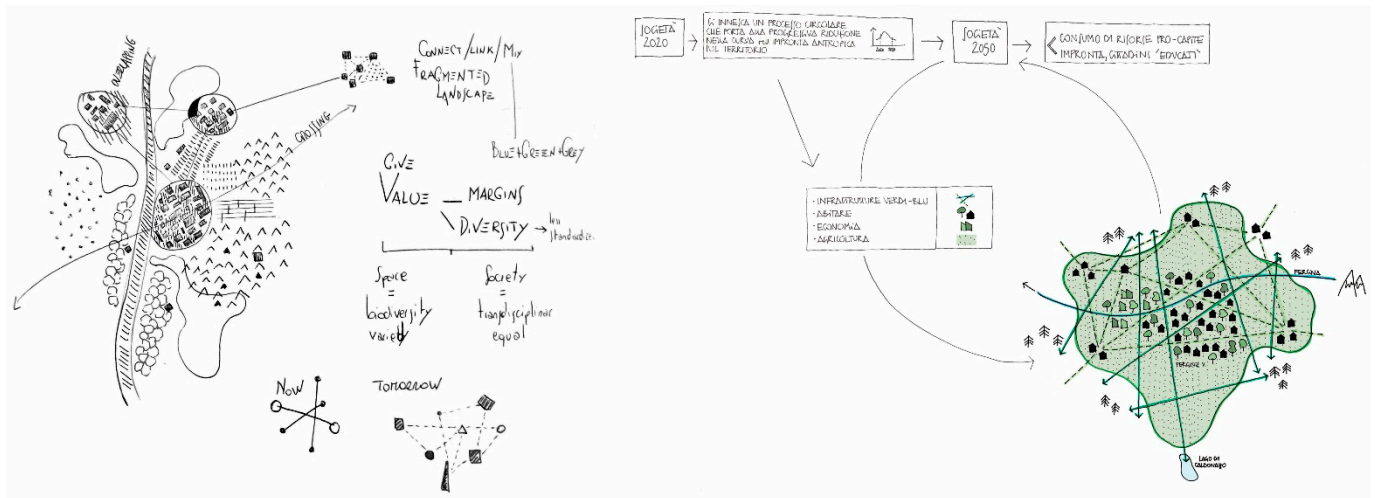


**Figure 3.** Sketches from local stakeholders exploring their landscape surroundings and how urban and rural environments connect to the landscape. The sketches were produced during the SATURN workshops.

It is very interesting to highlight that participant started sketching permeable routes and connections (Figure 4) for the landscapes of tomorrow instead of the hard and impermeable links and barriers existing in the urban centres we all currently live in. While being asked to think about what they would do to create a resilient city and how they would emphasize the cause of climate change, the issue of connectivity came to light. The ‘margins’ as some of the stakeholders have called them, create significant issues in landscape fragmentation as well as decreasing community engagement with nature. A strong point raised during the stakeholder workshops in Trentino was the form of these margins. It has been mentioned that such ‘margins’ are not only created by physical barriers such as infrastructure or built areas, but also by specific landscape uses such as areas dedicated to highly industrialized agriculture. This also creates further challenges for citizens to engage with natural and rural landscapes. For example, in the Trentino workshops, it was mentioned that in certain agricultural areas, locals and tourists are restricted from using the available network allowing them to cross the agricultural fields as a result of the use of agricultural chemicals and industrial cultivation methods.

Following several workshops and discussions between the participants and the SATURN consortium team, this study suggests that the visioning/capacity building process followed can reveal alternative ways of understanding landscape connectivity and identifying landscape fragmentation. There are cases where specific pathways and policies are already being put in place, such as the FPA—City of Nature project of Birmingham (UK) or the city of Arco (IT) that included the workshops and the visioning in their process to renew and enhance the European EMAS certification (Eco-Management and Audit Scheme) on sustainable management of resources and territory, where systemic change has made its appearance. In most cases though, even if their ‘pathway’ towards their vision is still in progress, it is understood that the process followed by SATURN has changed perceptions about landscape connectivity. As a result of the workshops, stakeholders have expressed their interest to further continue with work beyond the duration of SATURN. Especially the town of Arco (Trentino Hub—Italy) has taken steps towards a more innovative process to redraft their actual urban plan by including stakeholders from the beginning, indicating the first steps of a systemic change. Decision makers and key stakeholders have gained a different understanding of their city and region and there are discussions and potential projects aiming to address the connectivity issues not by introducing new infrastructure and engineering works, but by understanding the nature, biodiversity and needs of each

community. The visioning exercise supported the recognition of more holistic and tailored policies for each municipality, yet agreed and shared on a larger territorial basis instead of relying on superimposed spatial strategies.

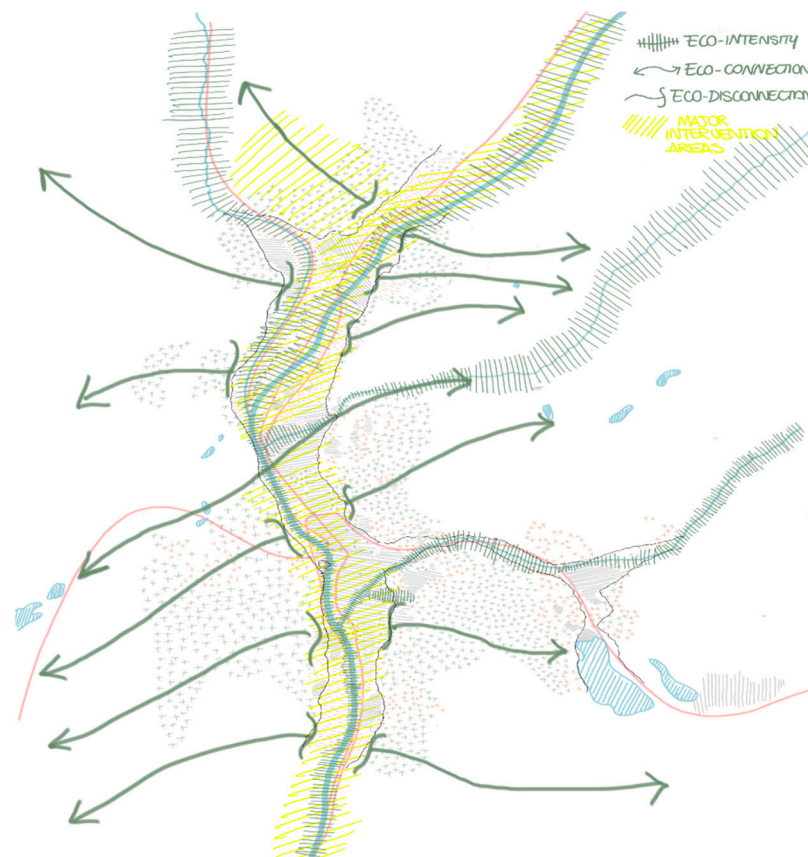


**Figure 4.** Sketch from local stakeholders exploring the importance of space and society. The issue of connectivity relates to the ‘margins’ as well as the permeable connections for the landscape of tomorrow. The sketches were produced during the SATURN workshops.

### 3.2. The Case of Trentino: The Impact of Drawings and Maps on the Ways in Which We Understand the Landscape

Aiming to identify the different ecological qualities and value of the landscape in the Adige valley of Trentino, we worked on maps using the contributions from the various stakeholders (researchers, decision makers, professionals, policy makers, activists) participating in the workshops. Starting with a simple exploration of the fragmented landscape the teams quickly moved onto an analysis of ‘connections’ and ‘disconnections’ across the given landscape. The whole ‘system’ of territories has been explored through three thematic maps: the green areas, the ecological dis-connections, and the social dis-connections. This paper uses the case of Adige valley of Trentino and its surroundings to demonstrate how landscape connectivity has been perceived through drawings. Supported by the Trento SATURN team, the workshop participants’ comments and analysis were incorporated into regional maps not only supporting their arguments visually but being transformed to strong communication and awareness tools. As seen in Figure 5, eco-intensity and connectivity have been analysed and depicted. It was found that even though the Adige valley is an area rich in biodiversity, including a major river and several minor water bodies and agricultural land, the most disconnected areas occur along the river route and within the existing agricultural system, creating issues with the crossing of different animal species. Densely populated areas, railroads and motorways create further issues with landscape connectivity together with the scattered and dispersed urban development, but this was not clear to decision makers prior to their involvement with the SATURN workshops and their drawings’ creation. The Trentino team used the information provided by the participants to try underline the most critical areas where different challenges overlapped or had been identified as interrelated during the workshops. These areas, which are named as ‘major intervention areas’ in Figure 5, are the results of an interpretation process that put together the findings of the various workshops and tried to identify the key challenges and the most delicate areas of the region. Most of the highlighted areas are located in the outskirts of dense urban centres and are cross-cut by important infrastructural networks related to mobility or energy. The proximity of such networks to urban centres and villages is creating barriers between the landscape and human connectivity as they impact on the ability of using or interacting with the land.

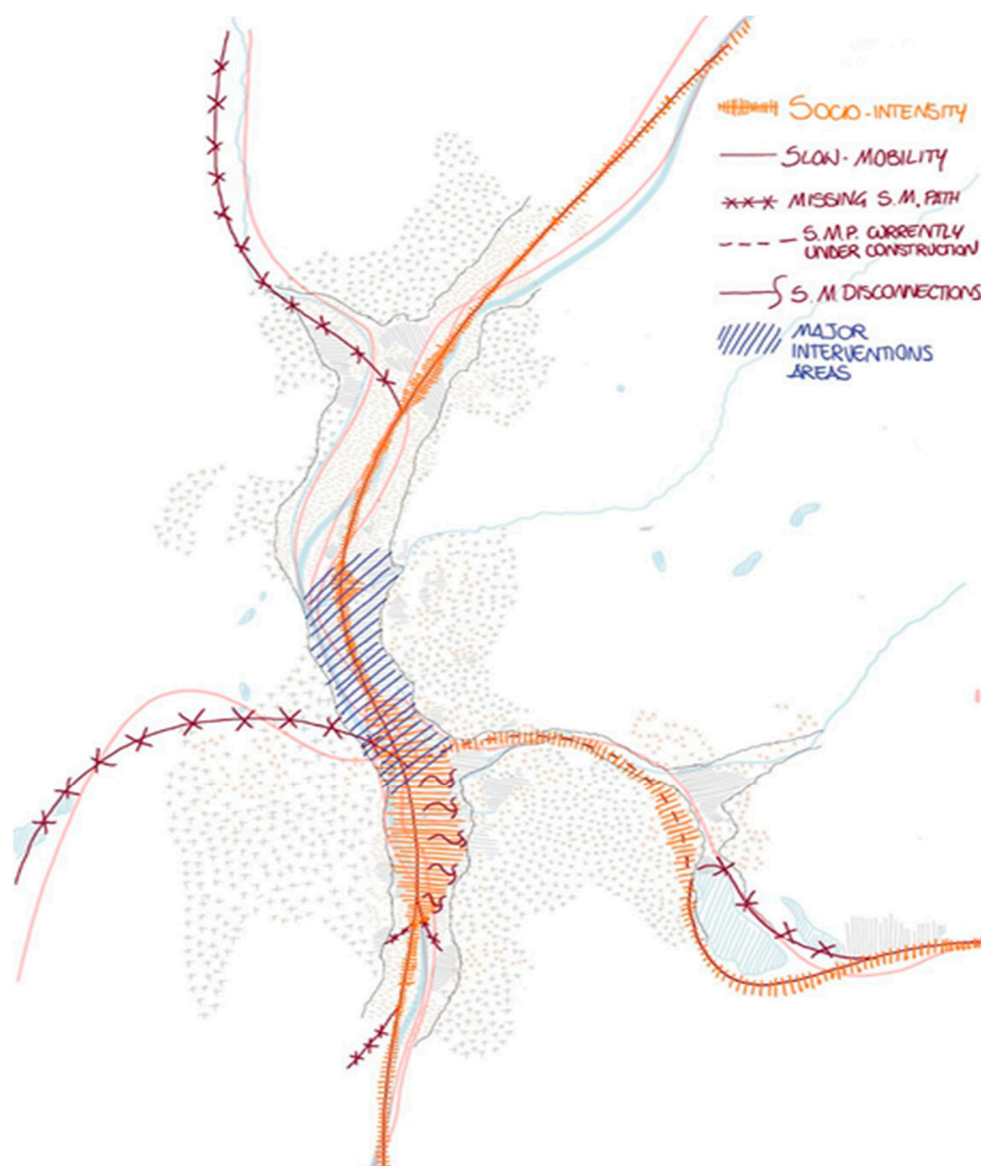




**Figure 5.** Ecological dis-connections, Adige Valley, Trentino. Drawing created as an outcome of the EIT Climate-KIC SATURN Project.

Even though the river acts more as a barrier than blue infrastructure in the area, there are several points that have been highlighted as very promising in terms of landscape connectivity by considering a holistic view on SES. Since the Adige River has been regulated for most of its path through the landscape, it represents a strong barrier to wildlife connectivity but also to peoples' movement across the area, as crossing points are limited mostly to motorized infrastructure (roads and rail bridges). Yet, along the river banks, this research has highlighted a certain 'socio-intensity' and a strong potential to combine social and ecological systems into more integrated landscapes (Figure 6). In particular, many workshop participants used drawings and maps to draw attention to the dense network of pathways and rural roads that crosses the countryside and reaches the river on both sides, offering a possibility to develop a multifunctional network of pathways and activities. One wonders then if, in order to achieve both biodiversity and human connectivity from a landscape perspective, we need to restructure and redesign our mobility mediums. The same map reveals a lower level of connectivity between the Adige valley and the surrounding valleys and territories resulting in limited movements of fauna along the North-South axis which also creates challenges in East-West connections.

Sustainability has become a prevalent theme that defines our era, but there is still not a clear framework or pathway, that cities can follow to improve the way of life/health and wellbeing of their citizens. Innovative research, new data and technologies as well as the introduction of new policies provide significant information, but a holistic spatial strategy is still missing. This is somehow understandable as there is no 'one size fits all' solution when it comes to landscape design, but we need to identify best practices and establish principles that allow the development of resilient cities and endorse landscape connectivity without excluding the human factor.



**Figure 6.** Social dis-connections, Adige Valley, Trento. Drawing created as an outcome of the EIT Climate-KIC SATURN Project.

Having sustainability and resilience high on the agenda, Trento has also created a visioning map (Figure 7) integrating the ideas of social coherence, ecological importance, and green infrastructure. The key aspects of the visioning map are multifunctionality, biodiversity, and connectivity, and even though it originated from the previous ‘understanding the landscape’ drawings (Figures 5 and 6), it has become the basis to discuss a proposal for a roadmap to the sustainable development of Trentino until the year 2050. Some of the key aspects could also be introduced in the recently approved climate agenda of the ‘Autonomous Province of Trento’ which seeks to enhance the contribution of bottom-up initiatives to sustainable development. Findings reveal that maps have impacted perceptions as well as awareness.



**Figure 7.** Trento 2050 Vision. Drawing created as an outcome of the EIT Climate-KIC SATURN Project.

Since the project ended in December 2021, translating the outcomes into practical actions will continue outside the SATURN project. Nevertheless, the findings and outcomes of this research remain a strong foundation for enhancing holistic city-regeneration projects. The drawings and the overall workshop process have been powerful in engaging with the community and key stakeholders, enhancing the idea of landscape connectivity and revealing the importance of a multilevel perspective that includes human interaction as well as natural resources. A key finding is the impact of the topics that emerged during the workshops in comparison to the locations of the workshops. This is an additional step in evaluating how concepts related to sustainability, health, and social equality are perceived in the areas explored by the Trentino hub.

The drawings presented above have been proven to be a valuable medium to support the process of raising awareness and understanding of the complexity and interrelations between social and ecological systems. Through these drawings, the concepts of landscape connectivity and socio-ecological systems have been interpreted into strategic maps highlighting expected challenges and barriers to a more holistic approach to the management of the landscape.

SATURN project has not been identified as a drawing-focused programme, but rather a pan-European collaboration aiming to support cities to tackle landscape fragmentation and climate change. However, the study argues that the pictorial forms produced during several activities have shed new light on how landscape connectivity is understood and perceived by local actors. Despite Urban and Keitt suggesting that graphical representation

is a useful tool to merge population processes with landscape patterns to arrive at ‘process-based measures of connectivity’ [20], the findings from this study suggest that drawings and graphs can provide much more than just conservation scenarios. Pictorial forms can be the medium used to engage with decision-makers or to become a strong communication tool to demonstrate the ways urban/regional areas are interconnected. This research supports the notion that “landscape graphs have a real potential for use at the science and policy interface through their balanced position between ecological reliability and ease of implementation for operational decisions” [21].

### 3.3. Trentino’s Approach to Landscape Connectivity through Drawings

In the five workshops (Table 1) held in Trentino (see Section 2) during the SATURN programme, three major topics were identified through the discussions and the development of the exercises with stakeholders.

**Table 1.** Workshops held in Trentino region.

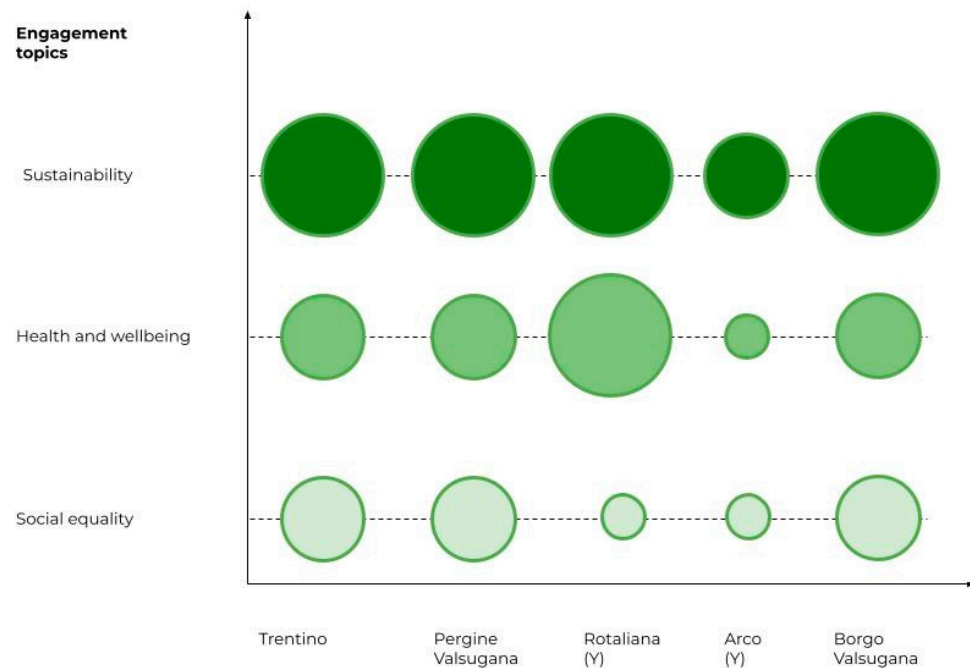
| Areas             | Number |
|-------------------|--------|
| Trentino          | 1      |
| Pergine Valsugana | 2      |
| Rotaliana         | 3      |
| Arco              | 4      |
| Borgo Valsugana   | 5      |

Topics such as ‘sustainability’, ‘health and wellbeing’, and ‘social equality’ were the most quoted during the workshops (Figure 8). In some cases, the definitions given by the workshop participants were different from those quoted in the previous sections and commonly found in the literature review. The ‘health and well-being’ topic was used to describe elements such as the access to specific care services or opportunities for the wellness of the community. In addition, many participants were only included in the definition ‘free access to green spaces and their role in comparison to private gardens’. In the same way, social equality was considered a characteristic of an inclusive community able to grant access to services to most of the population, however, participants also highlighted the need to include access to sustainable mobility methods as a way to measure the capacity of the community to achieve balanced development.

Overall, the topic of ‘social equality’ must be considered of primary relevance with respect to the future changes within the local communities, both for the aging population and migration. Yet, participants did not always agree with this approach and considered social equality as part of a broader definition of sustainability. An interesting finding is that landscape connectivity was mostly linked to sustainability and social equality and less to ‘health and wellbeing’ which is usually considered an isolated actual goal. This study argues that health and wellbeing are also a significant part of the landscape we live in and therefore a holistic approach is required.

The topic which had the largest engagement was ‘sustainability’ featured as a transverse concept that can structure the vision on landscape connectivity through its translation into different systems and by highlighting the connections between the systems. As an example, sustainability applied to mobility has been linked with the possibility to have more widespread and balanced access to landscape resources. This paper follows a qualitative evaluation, however, the identified topic is considered of major importance for the cross-generational and inter-sectoral group of participants of the event #1 “Trentino” and for the youth group based in Rotaliana during event #3. A larger group of young people, consisting of representatives of different economic sectors and with different backgrounds who participated at the event #4 in Arco considered the topic of minor importance. In contrast, they considered ‘sustainability’ as part of a whole ‘holistic’ approach within which

'health and wellbeing' and 'social equality' were both relevant. At the event #2 in Pergine Valsugana 'sustainability' emerged again as an important area but with social equality also playing a key role. At this event, the authors observed the impact of multidisciplinary stakeholder teams through rigorous discussion on the emerged topics as well as the willingness to the co-creation of solutions. The graph shown in Figure 8 is the result of the first phase of evaluation of the results. For every workshop, all the post-its and individual exercises were collected and clustered according to their topic and the position they reflected. Clusters were developed according to the different dimensions of landscape connectivity as they were interpreted by the project team. The holistic topic of 'sustainability' emerged together with the importance of social inclusion and equality creating links to natural resources and human well-being. The different sizes in Figure 8 are related to the times the topics have been mentioned during the workshops and the color gradient represents the level of engagement generated by the different topics. As mentioned in the previous sections, the aim of the workshops was to set a common field among the different stakeholders and understand how and which this engagement could be translated into more holistic planning tools. Therefore the evaluation method is not solely quantitative as the scope of the research was not to develop or set specific indicators to measure the most effective measures to be taken for better planning rural-urban landscapes.



**Figure 8.** Diagram showing the most cited topics in the five workshops in Trentino and their respective relevance according to the participants. (Large circle: more than 20 quotes, Middle-size-circle: between 10 and 20, Small circle: less than 10 quotes).

The following table reports some key evidence of the three major topics as emerged during the workshops held in Trentino.

The authors collected 233 quotes in total, with an average of more than 45 for each territory where the workshops have been held. For every activity concluded, the team gathered and recorded on the maps from 29 to 59 quotes clustered in the three main categories presented above. Clustering the quotes and identifying similar contexts has been challenging due to the wide variety of topics mentioned by the participants. We selected eleven main topics collecting and grouping the quotes and clustered each topic into one of the three categories.

The main topics that emerged from the participants are presented in the table below (Table 2).

**Table 2.** Number of quotes for each category gathered during the various workshops held in Trentino region.

|                   | Sustainability | Health & Wellbeing | Social Equality | # Evidence |
|-------------------|----------------|--------------------|-----------------|------------|
| Trentino          | 23             | 11                 | 10              | 44         |
| Pergine Valsugana | 24             | 13                 | 14              | 51         |
| Rotaliana         | 21             | 27                 | 2               | 50         |
| Arco              | 14             | 6                  | 9               | 29         |
| Borgo Valsugana   | 31             | 14                 | 14              | 59         |
| Overall           | 113 (48.5%)    | 71 (30.5%)         | 49 (21%)        | 233        |

The broader topic of sustainability is the most cited with half of the quotes or comments relating to sustainable practices such as electric mobility or the regeneration of underutilized areas. However, in many cases, these topics were linked to the increasing awareness of health and well-being concepts. The need to improve the management and the quality of river areas and embankments, is considered both in its role to improve landscape mitigation, but also as a way to increase accessibility to the river, leading to the population's well-being. In the same way, quotes mentioning farming or agricultural practices were clustered in different categories. For most of the stakeholders, the impact agricultural activity has on connectivity is linked to social equality and food security. Other findings suggest this is also linked to food production and how vegetable gardens support quality of life. Around 25% of stakeholders' comments (Table 3) include the concepts of 'farming' or 'agriculture' demonstrating how the topics are perceived in the Trentino area. Another 5% of the quotes (Table 4) are linked to the importance of raising awareness on food production, distribution, and consumption making 'agriculture' covering around one-third of the comments. The use of underutilized land to support sustainable farming (focused on multi-functionality, biodiversity, and local varieties) is important both to enhance the sustainable management and raise awareness of the role and the involvement of citizens in local supply chains.

**Table 3.** Topics emerged during the workshops and their connection to the three main categories.

| Topics  | Category           |
|---|--------------------|
| Food/Agriculture  | Sustainability     |
| Sustainable mobility  | Sustainability     |
| Urban regeneration/Reuse of abandoned spaces                        | Sustainability     |
| Mitigation/adaptation to climate change effects                     | Health & Wellbeing |
| Urban-rural connections/Territorial synergies                       | Sustainability     |
| Slow/Conscious tourism  | Health & Wellbeing |
| (conservation & restoration of)<br>Ecology/Biodiversity/Green areas | Health & Wellbeing |
| Participation/Involvement/Cooperation                               | Social Equality    |
| Youth engagement  | Social Equality    |
| Economic development/Jobs' innovation                               | Social Equality    |
| Education/Awareness raising   | Social Equality    |

**Table 4.** Some of the key quotes as examples of the main topics and challenges highlighted during workshops.

|                          | Sustainability  | Health & Wellbeing  | Social Equality  |
|--------------------------|---|---|--|
| <b>Trentino</b>          | <ul style="list-style-type: none"> <li>– “Light rail system to connect the main urban area with the valleys”</li> </ul>   | <ul style="list-style-type: none"> <li>– “Increasing the number of farmers’ markets in the city and support local farmers in bringing products”</li> <li>– “Increase the use of native species of trees in an urban environment”</li> </ul> | <ul style="list-style-type: none"> <li>– “Increase the cooperation between the provincial government and the municipalities”</li> <li>– Fair and accessible employment for young people in the green sector”</li> <li>– “De-localize services and reduce commuting needs”</li> </ul> |
| <b>Pergine Valsugana</b> | <ul style="list-style-type: none"> <li>– “Building a complete cycling path loop around the Caldonazzo lake”</li> <li>– “Increase territorial synergies among municipalities and reduce the separation between urban and rural areas”</li> </ul> | <ul style="list-style-type: none"> <li>– “Improve the management of riverbanks to reduce flooding damages and increase accessibility and leisure activities”</li> </ul>   | <ul style="list-style-type: none"> <li>– “Create meeting spaces for youth generations to share and create new ideas”</li> </ul>  |
| <b>Rotaliana</b>         | <ul style="list-style-type: none"> <li>– “Developing a tramline linking all the different municipalities”</li> </ul>  | <ul style="list-style-type: none"> <li>– “Recovering abandoned farmland to build vegetable gardens for all”</li> </ul>  | <ul style="list-style-type: none"> <li>– “Active involvement of citizens in creating climate-proof strategies at local level”</li> </ul>   |
| <b>Arco</b>              | <ul style="list-style-type: none"> <li>– “Increase reuse of farming waste and create connections between agriculture and industry”</li> <li>– “Promote use of recyclable packaging and eliminate plastic”</li> </ul>                            | <ul style="list-style-type: none"> <li>– “Adopt extended educational programs to teach kids how to reduce waste and consume local food”</li> <li>– “Enhance everyday use of bikes and sustainable mobility”</li> </ul>                      | <ul style="list-style-type: none"> <li>– “Create trust among young entrepreneurs and support the creation of innovative start-ups”</li> </ul>  |
| <b>Borgo Valsugana</b>   | <ul style="list-style-type: none"> <li>– “Recovery and transformation of the steel mill in hydrogen-powered factory”</li> </ul>   | <ul style="list-style-type: none"> <li>– “Reuse existing rural buildings to enhance slow tourism activities”</li> </ul>   | <ul style="list-style-type: none"> <li>– “Reuse rural buildings as co-living and working spaces with fair renting prices”</li> </ul>   |

#### 4. Conclusions

An alternative understanding of landscape connectivity, as well as its impact on communities and biodiversity, have been identified throughout this paper. The pan European SATURN project was set to explore the value of the landscape and its surroundings across three European territories and create tools and methods to support cities aiming for climate resilience. The significance of connectivity and the ways in which this can be better understood by the decision-makers of each territory have been assessed. The results of the broader SATURN project have been collected across all territories, however, this paper focused on the case of Trentino using the characteristic landscape of dense urban areas and highly productive farmlands as a medium to demonstrate how the SATURN project has helped to better understand the landscape and the way it connects with humans and biodiversity.

With the present study, the significance of connectivity and the ways in which this can be better understood by the decision-makers of each territory have been assessed identifying an alternative understanding of landscape connectivity as well as its impact on communities and biodiversity. The workshops across all three countries have helped the stakeholders participating to see their landscapes in a different way and to bond with their territories while recognizing the value of the landscape.

The goal to enhance the idea of landscape connectivity, and raise awareness of the value of the landscape has required the full commitment of the participants and has been endangered, in some cases, by pre-existing conflicts between the decision-makers.

The process of scientific analysis, mapping, and open debate with communities, created by SATURN, has succeeded in laying the foundations for future connections between decision-makers and researchers. The methods and tools used by this paper and from the broader SATURN project demonstrate that the improvement of ecological and human connectivity requires multidisciplinary teams with knowledge of the region as well as open discussions on the challenges that need to be addressed while designing for a sustainable future.

In particular, this study demonstrated that the process of raising awareness through drawings/visuals and visioning workshops is demanding and complex, yet it could produce very important and bold results. The maps and drawings produced during the workshops were used to develop tangible steps and strategies to realize the landscape vision for each area. The use of drawing and visualization techniques has revealed the fragmentation of the current landscapes as well as highlighted the lack of knowledge from locals and professionals.

The results showed that connectivity cannot be pinned down to urban or rural environments only and is limited to nature and biodiversity. At regional and territorial scales, human interaction, community engagement and economic dynamics are strongly interrelated in the ways in which the landscape is understood. The drawings presented above have revealed areas that were overlooked either due to their difficulty to reach or because of the density of infrastructure or agriculture.

In addition, it is explored how landscape connectivity could emerge. The conceptual-drawing methods and workshops especially designed to investigate the connection with the landscape, offer a new way of understanding and dealing with the urban and regional scales. The maps and drawings presented in this paper demonstrate the scale of landscape connectivity and highlight its relation to health and wellbeing as well as the sustainable development of our communities. The process followed by this paper has focused on the importance of understanding landscape connectivity as well as the way in which this can spread awareness about the value of landscape areas and territories. If we consider every single territory, different focuses and attitudes toward the landscape emerge. The topics of mobility and sustainable land use (with attention to less intensive agricultural uses) emerge clearly, especially in the most densely populated territories of Trento, Pergine Valsugana, and along the river Adige valley (the highly urbanized and infrastructure section of the region). In the nearby territory of Rotaliana, the group of stakeholders involved, have recognized the same issues but focused more on the individual and collective wellbeing, adopting measures and strategies to reduce the negative impact of urbanization, pollution, and a lack of social opportunities. Arco is a touristic town, and therefore the presence of visitors calls for specific measures to adopt sustainable approaches within the area. The findings of this research suggest that such actions should be supported with educational and awareness-raising activities from which the citizens can benefit. In Borgo Valsugana the topic of sustainability varies; it encompasses the transformation of a highly polluted industrial district, the revitalization of the town center, the fluxes of mobility, and a touristic approach to preserving the natural resources.

This study has not conducted a specific connectivity analysis across the three SATURN regions, but is looking into how the SATURN project has supported the future connectivity



of the areas, based on drawings and decision- approaches primakeror and following the workshop attendance.

There are still several gaps between the recognition of landscape values and the application of concrete measures to tackle existing challenges and enhance connectivity. This part of the process is beyond the scope of the SATURN project, yet it is a fundamental gap that requires investigation and consideration to reach a more sustainable relationship between humans and nature. This paper suggests that visuals, maps, and drawings can create a useful communication platform and can reveal elements that are not considered as important or overlooked by decision-makers. The use of visualization techniques and participatory workshops are significant tools to improve the understanding of the territory and help decision-makers to work in collaboration with designers, professionals, and researchers. Awareness is necessary for topics around environmental challenges and climate change, however, when it comes to the landscape a spatial dimension is important to build a vision for the cities and regions of the future.

The methods used by the SATURN teams have supported the communities to understand their territories as well as collect important data for the creation of a regional approach that integrates environmental elements, connectivity, and human factors. For this reason, some cities (e.g., Arco, Birmingham) have started implementing some of the ideas acquired during the SATURN project, demonstrating that despite the EU project coming to an end, a future continuation of this research and tools is entirely possible. This alternative way of exploring a territory has opened the mind of the decision-makers and it has given them a new approach that can lead to systemic change when it comes to regional planning and policy. The experience has been beneficial for all the hubs and their respective cities and has created a pathway to better understand our landscapes as well as to find alternative strategies to enhance ecological and human connectivity.

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## Appendix A

SATURN official website: [www.saturn-project.org](http://www.saturn-project.org).

SATURN consortium partners and logos:



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