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Coevolution between Terraced Landscapes and Rural Communities: An Integrated Approach Using Expert-Based Assessment and Evaluation of Winegrowers' Perceptions (Northwest Piedmont, Italy)

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Abstract: Terraced landscapes are characterized by many features but are also threatened by abandonment, with the loss of the historical landscape and increased hydrogeological risk. In this research, we developed an innovative integrated approach using expert-based assessment and evaluation of winegrowers' perceptions to investigate the coevolution between terraced landscapes and rural communities. The aims were as follows: (i) to identify the historical landscape elements, (ii) to identify the landscape dynamics, and (iii) to analyze winegrowers' perceptions about the historical landscape elements and future development prospects. The methodology was applied to a terraced vineyard landscape (545 ha) located in Piedmont (Italy). The expert-based assessment included historical analyses and field surveys. To evaluate winegrowers' perceptions, an online questionnaire was used to understand their perceptions about the landscape's historical elements and dynamics. The results suggest that unique historical landscape elements and traditional practices (vine pergolas supported by stone columns) are conserved in the area, but also highlight some dynamics, including new vine-breeding techniques (espaliers) and new land uses (olive groves, meadows, and woodland). Winegrowers (n = 49) recognized as identity elements the same identified as historical by experts. Regarding future prospects, almost all winegrowers preferred the conservation of vineyards and pergolas. The research methodology was able to show the mutual link between terraced landscapes and rural communities in coevolutionary terms and could be replicated in similar contexts. According to the winegrowers' awareness, future planning strategies will have to support dynamic conservation of the landscape.

Keywords: historical rural landscapes; agricultural heritage systems; landscape identity; agroforestry systems; traditional agricultural practices; dry stone walls; GIAHS; landscape dynamic conservation

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1. Introduction

1.1. Terraced Landscapes and Rural Communities

The scientific community recognizes that terraced landscapes have a high degree of multifunctionality and provide ecosystem services [1,2]. According to Ghersi [3], they represent important biocultural heritage and can preserve biodiversity. Indeed, dry stone walls create ecological niches where small animals and plants can live. Moreover, terraced landscapes often safeguard ancient and highly valued vine cultivars that in more mechanized agriculture practices have disappeared. Furthermore, this particular type of historical landscape preserves the know-how of rural communities; in 2018, the "art of dry stone walling, knowledge and tecniques" was added to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Representative List of Intangible Cultural Heritage

of Humanity for Croatia, Cyprus, France, Greece, Italy, Slovenia, Spain, and Switzerland. Recent research highlighted the importance of rediscovering this knowledge and raising public awareness in order to enhance the identity and social and cultural values of terraced landscapes and prevent abandonment by reconverting it into "useful heritage" [4].

Terraced landscapes belong to the category of historical rural landscapes and have multiple values. They are strongly anthropic landscapes, made arable only after great effort to modify the steep slopes and create the optimal conditions for growing crops. Indeed, soils of terraces are characterized by better water availability and nutrient conservation [5]. These anthropogenic soils were classified by Freppaz et al. [6] as Technic Cambisols (Escalic). Pijl et al. [7] observed the responses of different practices on steep slopes in Italy to extreme rainfall events and found that terracing practices were characterized by better mitigation of sediment flux than nonterracing practices. Along the same lines, recent research conducted in Morocco showed the important capability of agricultural terraces of increasing water infiltration and their important role in flood protection and runoff mitigation [8]. Chen et al. [9] showed that, in China, terraces have a strategic role in water erosion control, mainly where they are covered by tree crops. In order to take advantage of these important functions, a terraced system has to be continually managed [10].

Abandonment is the main factor that threatens terraced landscapes, due to a series of causes related to the difficulty of managing terraces and the social, economic, and cultural conditions of rural communities. In recent times, the viticulture practiced on terraced systems has been increasingly associated with the attribute "heroic", underlining the great efforts that this cultivation requires in these particular conditions where mechanization is quite impossible [11]. In Italy, the term was recognized for the first time at the regulatory level with an Inter-Ministerial Decree (no. 6899, 30 June 2020) that fixed four parameters, at least one of which must be satisfied to define a vineyard as "heroic": an altitude higher than 500 m above sea level, a slope greater than 30%, cultivation on terraces, and cultivation on small islands [12]. This was a positive step, because recognition at the national policy level indicates the importance of dedicating specific funds to this type of vineyard, preventing their abandonment. This phenomenon determines not only the loss of historical landscape but also increased hydrogeological risk.

Indeed, the lack of management of terraced systems causes spontaneous plant colonization and results in damage to water regulation, with consequent soil erosion and dry stone walls falling down [13,14]. Agnoletti et al. [15] showed that at Cinque Terre National Park (Italy), a terraced vineyard landscape designated as a UNESCO world heritage site, dramatic landslides during an extremely intense rainfall event occurred in 2011 caused by the presence of extensive abandoned terraces. Modica et al. [16] observed a drastic reduction (−85.4%) in cultivated terraces between 1955 and 2014 in Costa Viola (Calabria, Italy), confirming the negative trend and highlighting the importance of maintaining sustainable agriculture and enhancing terraced systems. In effect, enhancing terraced landscapes using an innovative regeneration approach from a past-to-future perspective is an important challenge to developing sustainable agriculture and reactivating a local circular economy [17]. Indeed, this particular type of rural landscape needs sustainable practices that highlight historical value and mitigate threats [18].

For this purpose, at the international level, since 2002 the Food and Agriculture Organization of the United Nations (FAO) has promoted the Globally Important Agricultural Heritage Systems (GIAHS) program, which is aimed at recognizing the universal value of traditional agriculture systems that are in continuous coevolution with rural communities [19]. Nowadays, 62 sites in 22 countries are included in GIAHS, and two of them are Italian terraced landscapes [20].

The interaction between humans and nature, which is the basis of coevolution and the key point of the FAO approach, has been studied by many authors [21–23]. Nan et al. [24] explored the interrelationship between agricultural biodiversity and traditional culture at GIAHS sites, underlining that there is mutual benefit in the ability to maintain food cultures and traditions and social relations. Zhang et al. [25] showed that rural communities con-

serve ancient culture strictly connected to the sense of belonging and traditional agricultural practices, which allows terraced landscapes to remain productive and managed. Terraced landscapes cannot exist without management, and rural communities need to cultivate the agricultural landscape in which they live to produce food and wine. Fusco Girard et al. [26] showed that when there is a gap in this relationship due to socioeconomic changes, the multifunctionality of terraced landscapes is threatened. The authors highlighted that terraced landscapes represent a circular model that can increase human well-being and are important driving forces for territorial development. In this direction, recent research on terraced landscape in Cyprus recognized the involvement of rural communities and farmers' cooperation as being key in the rehabilitation of abandoned terraces and collapsed dry stone walls [27].

In coevolutionary terms, a historical landscape, such as a terraced landscape, is characterized by elements that date back to different periods, with recognizable stratification of different epochs due to continuous agricultural activity [28]. This concept is the basis for the significance (the possibility to reconstruct different landscape elements to match a specific epoch) that is one of the parameters to assess, with integrity and vulnerability, for another important recognition strictly related to the GIAHS program in Italy [29]. Indeed, at the national level, the Italian Ministry of Agricultural, Food, and Forestry Policies instituted the National Register of Historical Rural Landscapes, Agricultural Practices, and Traditional Knowledge in 2012 with the aim of collecting rural landscapes managed with traditional agricultural practices. Today, 27 landscapes and four agricultural practices are included [30].

The threshold by which to define the historical value of landscape elements has been debated in the literature. Bastian et al. [31] recognized such elements as all of those that did not originate under present conditions, without defining a precise date, and considered historical landscapes as the result of coevolution between nature and man at different times characterized by different social and economic conditions. Other studies assumed the middle of the last century as the dividing line to consider previous elements (e.g., land uses) as historical [32,33]. Heider et al. [34] defined "traditional agricultural areas" as rural areas established over decades to centuries where the landscape's historical elements are integrated with cultural values. The UNESCO World Heritage List considers the permanence of historical landscape elements as the most important integrity indicator that should be preserved [35].

Furthermore, the importance of different stakeholders' involvement in the assessment, management, and policy planning of terraced landscapes has been recognized by many authors [36–38]. However, recent research showed a lack of studies on local farmers' involvement in decision making regarding the conservation of terraced landscapes [39]. The close link that has always existed, specifically between terraced vineyard landscapes and winegrowers, using an approach from expert-based assessment of historical landscape elements and dynamics to perceptive studies, is unexplored.

In this complex context, in this research, we developed and applied an innovative integrated approach using an expert-based assessment and evaluation of winegrowers' perceptions to investigate the close link between terraced landscapes and rural communities in coevolutionary terms. In particular, the aims of the research were as follows: (i) to identify the historical landscape elements, (ii) to identify the landscape dynamics, and (iii) to analyze winegrowers' perceptions about the historical landscape elements and future development prospects.

1.2. Case Study Area

The research was applied at a terraced vineyard landscape located in Northwest Piedmont (Italy), in the northern part of the Ivrea Morainic Amphitheatre, an important geological formation known worldwide. Located at the outlet of the Dora Baltea Valley (505 km^2), it is the third largest Italian amphitheater [40]. It characterizes the eastern part

of the Canavese area and its boundaries are defined by the Piedmont Regional Landscape Plan [41].

As shown in Figure 1, the Ivrea Morainic Amphitheatre consists of a flat center dedicated to the plain's agriculture (e.g., cereals) enclosed by glacial moraines in which there are tree crops and woods. In particular, on the slope to the hydrographical left of the Dora Baltea River, thanks to better sun exposure, there are many vineyards. Terraces are principally concentrated in the northern part because it has the greatest slopes. Ivrea city is the most extensive urban center within the amphitheater.

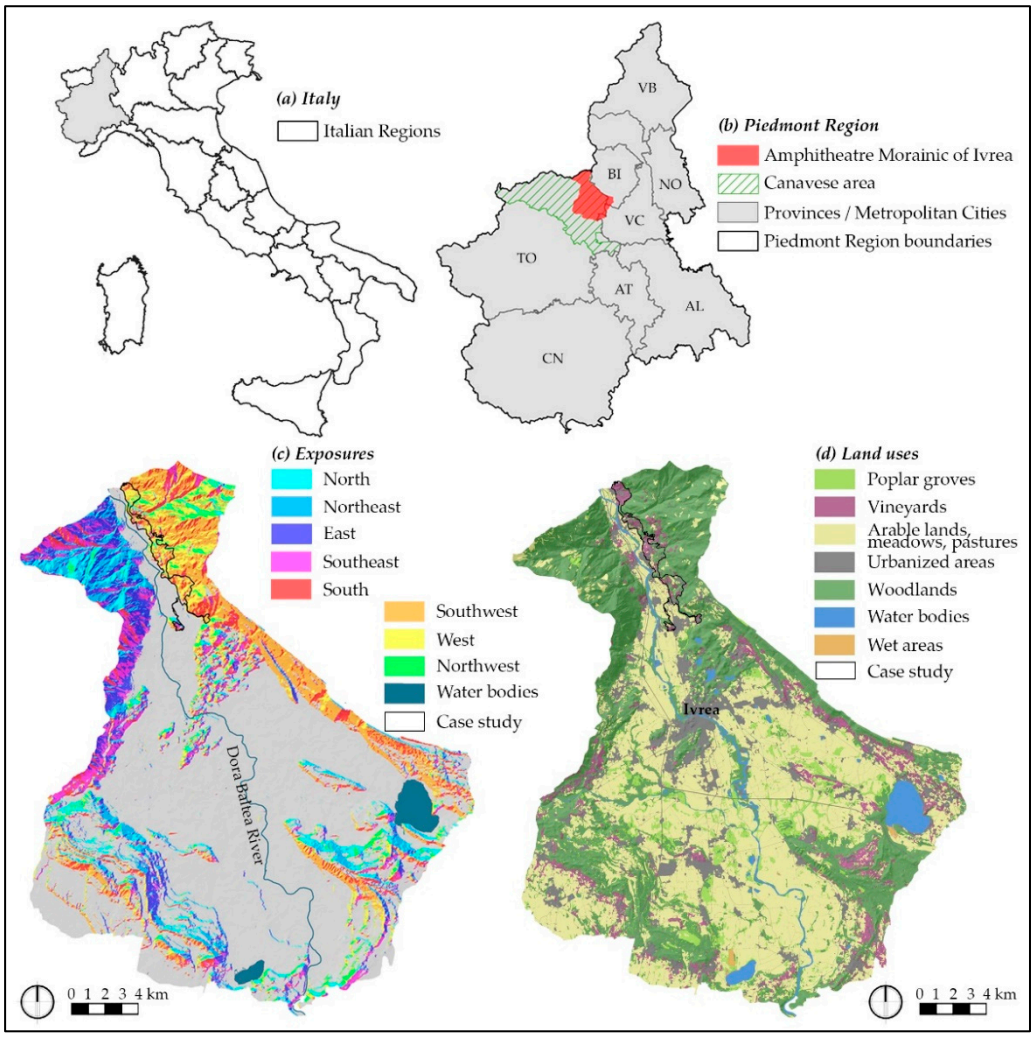

Figure 1. (**a**) Location of Piedmont region in Italy; (**b**) location of Ivrea Morainic Amphitheatre within Piedmont region; (**c**) exposure map of amphitheater; (**d**) land use map of amphitheater.

The case study area extends over 545 ha into four municipalities of the Metropolitan City of Turin: Borgofranco di Ivrea, Carema, Nomaglio, and Settimo Vittone. It is a candidate for the National Register of Historical Rural Landscapes for its terraced vineyard landscape, in which vineyards cover about 70 ha. Its relevance from an international point of view is demonstrated by the presence of unique elements, which will be discussed. Furthermore, it is an important area that preserves the art of dry stone walling, knowledge, and techniques, since the municipality of Carema is included on the list of community organizations or representatives concerned about safeguarding UNESCO's intangible cultural heritage [42].

About 6100 inhabitants live in the four municipalities. Table 1 reports the aging index and housing density. Considering the data of the Piedmont region, it is evident that in

the case study area, located in the rural part of the region, the aging index is higher. In all four municipalities, the most represented age range is 46–60 years, while the least represented is 18–30 years. This is a consequence of the aging of the rural community, which is one of the threats to historical landscape conservation. Carema, Nomaglio, and Settimo Vittone have lower housing density than the Piedmont region, while Borgofranco di Ivrea has higher housing density. The latter is the municipality nearest to Ivrea city and outside the case study area is characterized by recent urbanization. The case study area is located in a strategic point of connection between Turin and Aosta, the capital cities of the Piedmont and Aosta Valley regions, respectively. It is near state road SS26 (Strada Statale 26 della Valle d'Aosta), the A5 Torino-Aosta highway, which runs parallel to it in the north–south direction, and the historic Chivasso–Ivrea–Aosta railway (1870). The communication system and internet connectivity are good.

Table 1. Demographic characteristics of municipalities and Italian region of case study area (elaborations from ISTAT data [43]).

	Inhabitants (no.)	**Aging Index (no. of Inhabitants >64 Years Old Per 100 Inhabitants <15 Years Old)**	**Housing Density (Inhabitants/km^2)**
Borgofranco di Ivrea	3590	234	267
Carema	739	233	72
Nomaglio	291	273	95
Settimo Vittone	1513	245	65
Piedmont region	4,274,945	215	168

During 2019, the production of denomination of controlled origin (DOC) wines in the Piedmont region was worth EUR 980 million (6.4% more than 2018) and the Piedmont region was ranked third nationally after Veneto and Tuscany for the value of wine [44]. In the case study area, the primary source of income is agriculture, and vineyards are the most representative on terraces: 133 vine farms totaling 42.3 ha are recorded by the Piedmont region [45]. Most of these farms are run by nonprofessionals. It is important to highlight that in the case study area, there are many vineyards dedicated to self-consumption that are not included in the statistics, but they are an important part of the viticulture system of the area.

In addition to the elements unique in the world, the case study area is characterized by historical landscape elements to be preserved and dynamics that are the result of coevolution between the landscape and rural communities. Similar to other terraced systems, the abandonment of terraces and the introduction of invading woods are the main concerns. However, nowadays, there is increasing interest in local quality production, as evidenced by two DOC wines and one slow food presidium. In this context, experiential tourism and requests for wine from other countries are expanding. For these reasons, the terraced vineyard landscape of the case study area has to be studied and enhanced in order to preserve the historical landscape, recover abandoned terraces, and increase quality production. Winegrowers' perceptions need to be explored and considered for future planning strategies.

2. Materials and Methods

2.1. Methodological Framework

In the literature, it is recognized that assessing and enhancing the historical landscape elements are critical to maintain the social identity [46]. The European Landscape Convention defined the landscape as *an area perceived by people whose character is the result of the action and interaction of natural and/or human factors* [47], so studies and planning for rural landscapes have to consider bottom-up approaches. Antrop et al. [48] showed the importance of applying integrated and transdisciplinary approaches in landscape studies.

For these reasons, in order to investigate the close link between terraced landscapes and rural communities in coevolutionary terms, the research was conducted from two perspectives: expert-based assessment and evaluation of winegrowers' perceptions. The first allowed identification of historical elements and dynamics of the landscape, while the second allowed investigation of the perceptions of winegrowers about these elements and dynamics and about future development prospects. Figure 2 shows the methodological framework of the research.

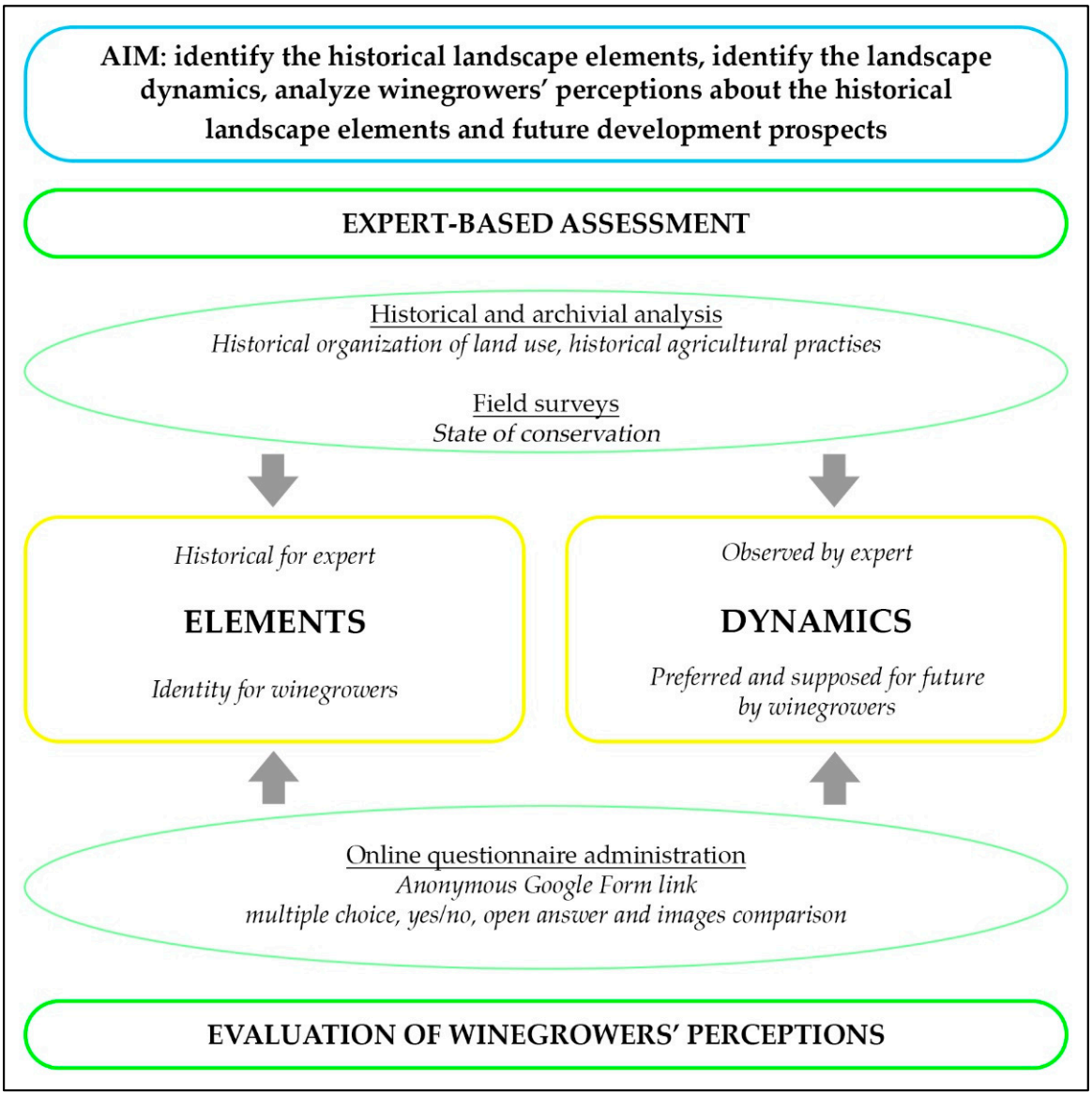

Figure 2. Methodological framework.

2.2. Expert-Based Assessment

The analysis of landscape elements based on expert assessment requires an integrated approach with preliminary desk studies and map analysis followed by field surveys [49]. Slámová et al. [50] highlighted the importance of archive and field research for identifying and assessing the characteristics of historical landscape as a tool for landscape planning in Slovakia. Historical cadastral maps are widely used to assess the structure of historical landscapes in terms of the organization of land use [51,52]. The literature also recognizes photographs as important sources of information for assessing historical landscapes and monitoring changes [53]. Other reliable sources that are useful to understand the ele-

ments of historical landscapes are art, iconography, and religious paintings, about which Tesfamariam et al. [54] indicated a need for more research in the future.

The expert-based assessment was performed by the authors, who, according to Arnés García et al. [55], are researchers with experience related to analyzing the historical landscape. The assessment was performed in two steps as suggested by the literature cited above. The first step was to conduct historical and archival analyses in order to identify elements of the historical landscape in terms of the organization of land use and agricultural practices. The GIAHS-FAO approach was assumed to define the time range for considering landscape elements as historic. According to Fuller et al. [56], GIAHS sites are very complex, characterized by elements with historical roots from different epochs. These various layers of history are more or less evident on the landscape, considering different periods of human evolution. Stabbetorp et al. [57] focused their research on the agricultural period, since farming societies modified the landscape more than the previous hunting/gathering societies. For these reasons, the time period considered in the present research started in the epoch during which the steep slopes were terraced and dedicated to viticulture. All of the agricultural elements that were defined as historical originated in the past and are still recognizable in their original configuration. Table 2 lists the documents found in local historical archives and libraries that were analyzed. These historical documents date from the middle of the 1600s to the beginning of the 1900s and include accurate references to the origin of historical landscape elements.

Table 2. List of historical documents found in local archives and libraries.

Archive Name and Location	Year	Original Name	Documentation
Historical archive of Carema municipality	1651	Lettere per Inibizione delle Vendemmie Istanti li Agenti della Comunità di Carema	Written letter
Historical archive of Carema municipality	1749	Cattastro della Molto Magnifica Comunità di Carema Provincia di Ivrea	Cadastral map
Historical archive of Settimo Vittone municipality	1789	Catastro della Molto Magnifica Comunità di Settovittone	Cadastral map of Savoy family
Historical archive of Carema municipality	1802	Libro Campagnolo Figurato di Tutto il Territorio di Carema	Cadastral map
Historical archive of Carema municipality	1802	Catasto del Commune di Carema	Cadastral map
Costantino Nigra Civic Library of Ivrea	1833	Saggio intorno alle viti ed ai vini della Provincia d'Ivrea e della Valle d'Aosta del Medico Lorenzo Francesco Gatta	Monograph
Costantino Nigra Civic Library of Ivrea	1910	I Vigneti ed il Vino di Carema. Indagini e Considerazioni del Direttore Prof. Dott. G. Chiej-Gamacchio	Monograph
Costantino Nigra Civic Library of Ivrea	1986	I Balmetti di Borgofranco di Ivrea	Monograph

In order to identify the historical organization of land use, cadastral maps were analyzed. Particularly, the Savoy family cadastral map (1789) was deeply studied. The map was found in the historical archive of Settimo Vittone municipality and was in an excellent state of conservation. Land uses were color-coded and all cadastral parcels included a number. All of the numbers corresponded to an accurate description of land use reported in the summary book. The map was reproduced through orthophotography and subsequently digitalized in Adobe Photoshop CC 2017. A representative area was selected, and land uses were reconstructed through digitalization. Figure 3 shows an image of the original Savoy family cadastral map, the orthophotographic reproduction process, and the sample area used for in-depth analysis of historical land use organization.

Figure 3. (**a**) Savoy family cadastral map (1789) found in historical archive of Settimo Vittone municipality. (**b**) Orthophotographic reproduction process. (**c**) Sample area used for in-depth analysis of historical land uses' organization. (**d**) Detail of sample area.

Other documents that were found included manuscripts, books, and letters. They were useful to identify the historical agricultural practices, traditional vine varieties, and characteristics of the historical landscape elements.

The second step of expert-based assessment involved organizing several field surveys aimed at assessing the state of conservation of terraced landscapes. The historical landscape elements identified during the historical and archival analyses were verified. Other signs of historical significance of the landscape were also found. During field inspections, different landscape dynamics were observed.

All of the analyses conducted for the expert-based assessment allowed us to list the historical landscape elements, the state of conservation, and dynamics of change. Regarding the historical landscape elements, the research identified both agricultural and architecture elements, but only the agricultural elements will be discussed below.

2.3. Evaluation of Winegrowers' Perceptions

To evaluate winegrowers' perceptions, an online questionnaire was administered to winegrowers operating in the case study area. This particular type of stakeholder was chosen according to Cicinelli et al. [39], who highlighted the strategic role of local farmers in maintaining terraced landscapes. The use of a questionnaire administered via the Internet is well established in the literature [58]. Different studies have used Google Forms, a very easy platform that allows researchers to reach respondents by sending a link without any contact between them or any type of influence on the answers [59]. The first paragraph of the questionnaire described the aims of the research. Respondents were not identifiable by their answers and consented to the use of their anonymous answers. According to many authors who showed the efficacy of using images in questionnaires focusing on landscape perception, a series of images were presented to the respondents [60,61].

The questionnaire underwent a pretest phase (8 completed questionnaires) to verify the content and wording of the questions. It was written in Italian and posed 34 questions of different types: multiple choice, yes/no, open answer, and image comparison. The questionnaire was divided into five sections:

I. General information (questions 1–7).
II. Farm characteristics (questions 8–20).
III. Product characteristics (questions 21–23).
IV. Landscape perception (questions 24–31).
V. Future development prospects (questions 32–34).

The questions and their answer choices are reported in Table 3.

Table 3. Questions and answers used in questionnaire.

Questions	Answer Choices
I. General Information	
1. Do you manage terraced vineyards?	Yes, professional activity; yes, non-professional activity; no
2. Age	(Years)
3. Sex (not mandatory)	Male, female
4. Education	Primary school, secondary school, high school, university degree
5. Among your family, is there anyone who wants to continue the viticultural activity?	Yes, no, do not know
6. Do you think you have a role in maintaining the terraced landscape?	Yes, no
7. What are the identity elements in the landscape?	(Open)
II. Farm's characteristics	
8. How many family members besides you work on the farm?	(Number)
9. Do you have permanent and/or seasonal employees?	(Number)
10. Are all the vineyards merged?	Yes, no
11. Age of oldest vineyards	(Number of years)
12. Age of youngest vineyards	(Number of years)
13. Total surface area of terraced vineyards	(m^2)
14. Which vine varieties are present?	Nebbiolo Picotendro, Nebbiolo Prugnet, other Nebbiolo, Barbera, Freisa, Bonarda, Neretto, Croatina, Erbaluce, Chardonnay, other
15. What is the main vine-breeding system?	Traditional high pergola (warp with wooden poles), modified high pergola; espalier, other
16. Are stone columns (*pilun*) present?	Yes, no
17. In addition to terraced vineyards, do you have any of the following categories?	Meadow/pasture, arable land and cereals, olive groves, chestnut groves, sheep and goats, bovines, no, other
18. What is the state of conservation of dry stone walls?	Intact, partially damaged, completely damaged
19. What type of agriculture do you practice?	Conventional, integrated, biological, other
20. Do you have problems managing terraced vineyards? If so, which ones?	(Open)

Table 3. *Cont.*

Questions	Answer Choices
III. Product characteristics	
21. Do you produce DOC wines?	(List of DOC wines produced in the area), do not produce DOC wines, give grapes to other cellars
22. What are the distribution channels for produced wine?	Direct sale on the farm, hotels/restaurants/cafes, big organized distribution (supermarkets), solidarity buying groups, online, give grapes to other cellars, not sold (family use), other
23. In which geographical area is the wine produced sold?	Piedmont/Aosta Valley, Northern Italy, Central and/or Southern Italy, Europe, non-EU countries, give grapes to other cellars, not sold (family use)
IV. Landscape perception	
24. Do you think the terraced landscape should be considered an added value to the wine produced there?	Yes, no
25. Do you think the terraced landscape could also be of interest from a tourist point of view?	Yes, no
26. Do you think dry stone walls are identity elements of the landscape?	Yes, no
27. Do you think stone columns (*pilun*) are identity elements of the landscape?	Yes, no
28. Do you think the pergola vine-breeding technique is an identity element of the landscape?	Yes, no
29. Do you think espalier vine-breeding technique is an identity element of the landscape?	Yes, no
30. Do you think vines are an identity element of the landscape?	Yes, no
31. Do you think olive groves are an identity element of the landscape?	Yes, no
V. Future development prospects	
32. Which future do you think is more possible for your terraced vineyards?	They will continue to be managed in the traditional way (pergola), the traditional vine-breeding technique will be modified (espalier), they will be converted to other crops (olive groves), they will no longer be cultivated but will be managed (mowed), they will be completely abandoned and invaded by woods
33. Between the two future prospects proposed in the following pairs of images, which do you like more? (indicate an answer for each pair)	A-B; 1-2; 1-3; 1-4; 2-3; 2-4; 3-4 *
34. Between the two future prospects proposed in the following pairs of images, which do you think is more likely in the future? (indicate an answer for each pair)	A-B; 1-2; 1-3; 1-4; 2-3; 2-4; 3-4 *

* Pictures are shown in Figure 4.

In agreement with Nederhof [62], the questionnaire was submitted anonymously. It was sent to winegrowers as a Google Forms link with the support of the municipalities and the only social cellar in the case study area. The winegrowers were invited to share the link with local colleagues. For this reason, it was not possible to know the actual number of winegrowers who saw the questionnaire, and the evaluation of their perceptions was based on the answers received.

A basic descriptive analysis was carried out in the form of percentages, in line with Santoro et al. [60]. The first part of the questionnaire was used to frame the sample and collect general information. This part included an open question about the identity elements in the landscape (#7) in order to collect the first thoughts that came to respondents' minds without being influenced by the specific questions that emerged from the expert assessments (parts IV and V). The second part was used to frame the farm characteristics and state of conservation. This part included an open question about problems with managing terraced vineyards (#20), which are a sign of vulnerability. The third part was used to highlight product characteristics in terms of DOC wine production, distribution channels, and basins. The fourth part presented specific elements detected on terraces

during the expert-based assessment in relation to terraces' construction features, vine-breeding techniques, and land use (#26–31). In the last part, one image for each dynamic on terraces observed during the expert-based assessment was selected in terms of different vine-breeding techniques and land uses. Images were restricted to the specific element proposed (type of vine-breeding technique or land use), without other elements present (e.g., mountains, sky, etc.), in order to not influence the respondents. These images were presented in pairs, and respondents were asked to choose which one they liked more and which was more likely in the future (#33–34). The pictures are shown in Figure 4. Pictures A and B show two vine-breeding techniques, historical pergolas and espaliers, respectively. Pictures 1–4 show land uses observed on terraces: picture 1 is related to the historical land use, vineyards, and 2–4 are related to observed dynamics: olive groves, meadows, and invading woods, respectively.

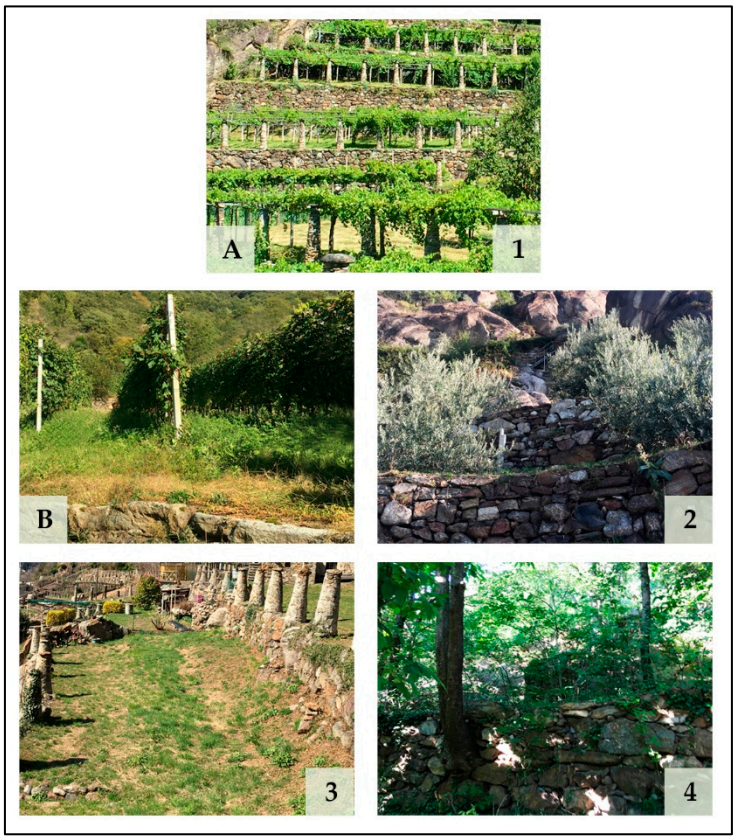

Figure 4. Images in the questionnaire presented in pairs (A-B; 1-2; 1-3; 1-4; 2-3; 2-4; 3-4) (questions 33 and 34).

3. Results

3.1. Expert-Based Assessment

The first phase of the expert-based assessment was historical and archival analyses. Regarding the historical organization of land use, the Savoy family cadastral map and the overlap of level curves suggested that historically, vineyards were located at an altitude range between 280 and 500 m above sea level. In the sample area selected for in-depth analysis, the historical land uses (1789) were reconstructed. As shown in Figure 5, historically, vineyards occupied the center of the system, on the lower part of the slope. The flat land was dedicated to meadows and arable land. Above the vineyards were woodlands, mainly chestnut trees. Many chestnut groves were described in the cadastral map's summary book as pasture chestnut, where trees were planted in a regular pattern and used for fruit production. Animals grazed under the plants. Woodland comprising chestnut also had

an important role in the production of poles used for the pergola vine-breeding system. Above the woodlands, the slope was very steep and there were rocks and pastures.

Figure 5. Land uses in sample area in 1789 (reconstructed from Savoy family cadastral map found in Settimo Vittone municipality's historical archive).

The other documents found in local historical archives and libraries allowed us to identify the historical agricultural practice, which is unique in the world. Historically, the technique for breeding vines used pergolas made with chestnut poles and supported by stone columns. Locally, this vine-breeding technique is called *tupiun*, and the stone columns are called *pilun*. These columns have two important roles. The first is to support the pergolas. The second is related to their ability to heat up during the day and release heat overnight, which reduces the temperature range between day and night. For this reason, they are also called stove columns. The historical vine-breeding technique is strongly linked to the case study area because it only exists there; it can also be called *pergola caremiese*. The main vine variety cultivated in the area is Nebbiolo, also known by its synonymous *Picotendro*. It is characterized by vigorous plants whose branches are prone to break in the wind. The pergola vine-breeding technique reduces this problem and allows better passage of light through the vegetative mass, especially where the terrace is very narrow. The historical monograph from 1833 described the characteristics of Nebbiolo and confirmed that it was historically the main cultivated vine variety in the case study area. Nowadays, the two main wines with denomination of controlled origin designation produced in the area (DOC Carema and DOC Canavese Nebbiolo) are composed of at least 85% Nebbiolo.

Indeed, statistical data of the Piedmont region show that in the four municipalities in the area, 85.29% of the total vine area is dedicated to Nebbiolo cultivation [45].

The historical documents highlighted that *pergola caremiese* originated during Roman times, while vines were introduced in the area during pre-Roman times. Barsimi [63] reported that the introduction of vines from the Middle East in the Dora Baltea Valley dates back to 3000 BC, with the presence of Neolithic settlements that were among the oldest in Italy. The main impulse for the development of viticulture in the area is attributed to the Salassi. They were a population of Celtic–Ligurian origin with Greek–Etruscan influences that inhabited the Canavese area before the arrival of the Romans. Since then, viticulture has seen moments of expansion and contraction in relation to different human social needs and phytosanitary problems (e.g., Phylloxera). The historical document from 1910 shows that in those years, viticulture was expanding, which also affected the part of the slope less suitable for vine cultivation or more difficult to cultivate. It is probable that these vineyards were the first to be abandoned in subsequent times of contraction in the last century, when industrialization deprived the countryside of manpower. A letter dated 1651 was found in the Carema historical archive. It talks of the grape harvest and attests to the historical presence of vines in the case study area.

The historical document from 1986 found in the Costantino Nigra Civic Library in Ivrea allowed us to identify another historical landscape element unique in the world: the Balmetti of Borgofranco di Ivrea, which comprises 213 cellars historically used for wine and cheese storage. They lean against the mountain, where natural faults from morainal rocks of the Mombarone massif, due to ancient glacier action, allow the passage of air currents called *ore*. These currents allow the dampness and temperature (7–8 °C) in the cellars to be maintained at constant levels throughout the year. The cellars are linked together; therefore, air currents flow between them. The first written attestation of the presence of these Balmetti dates back to the mid-1600s. They are important historical landscape elements strictly connected to viticultural activity in the case study area, but since they are elements of rural architecture, they will not be discussed further.

The second phase of the expert-based assessment was field surveys, which allowed us to verify the historical landscape elements found during archival analysis, and identify the state of conservation and dynamics. Regarding the historical landscape elements, a good state of conservation of terraces, dry stone walls, and pergolas was observed. As shown in Figure 6, the historical organization of land use described above was perfectly recognizable, with vertical landscapes where vineyards occupied the lowest part of the slope and the middle of the agricultural system (Figure 6a,c). Terraced vineyard landscapes showed an interesting dynamic throughout the seasons: green vegetative mass during spring and summer (Figure 6a), yellow/orange chromatic variations during autumn (Figure 6b), and the absence of vegetation in winter when the snow highlighted the presence of the terraces (Figure 6c). Winter was the best season to identify the structural characteristics of the historical landscape elements (Figure 6d). The historical presence and importance of vines in the case study area was evidenced by many elements identified during field surveys (e.g., art, iconography, and religious paintings). Representations of grapes were considered a sign of the historical presence of vines and rural communities' recognition of their importance.

As shown in Figure 7, a very rigorous structure of pergolas was observed, with four orders of chestnut poles perpendicularly overlapped (Figure 7a,d). Vines were planted along the terracing walls and grass between the rows. Stone columns were historically built on the top of the terrace walls. The pergolas' chestnut poles were supported by stone columns at the front and embedded in the wall of the terrace behind. Many columns show the date of construction (e.g., 1821 in the stone column shown in Figure 7c). This is further evidence of their historical presence in the case study area. Vineyards and pergolas supported by columns were integrated with other historically important elements of rural architecture; for example, the vineyard shown in Figure 7b evidently has a close relationship with a wash house, which historically had an important social and aggregation role.

Figure 6. Good state of conservation of terraced landscape observed during field inspections, with (**a**,**c**) perfectly recognizable historical organization of land use, (**a**–**c**) landscape dynamism during seasons, and (**d**) good identifiability of historical landscape structure during winter.

During field inspections, the historical presence of chestnut trees in the main woodland above vineyards in terms of composition and pasture chestnuts was verified. The presence of secular plants and an ecomuseum dedicated to chestnuts was noted. Figure 8 shows secular plants of chestnut designated as the oldest in Nomaglio municipality (Figure 8a) and a permanent chestnut grove that was already reported as pasture chestnut in the sample area according to the Savoy family cadastral map (Figure 8b). Today the historical structure is still recognizable, with chestnut trees intended for fruit production planted in a regular scheme where, historically, animals grazed.

During field inspections, another historical landscape element emerged: the historical presence of olive trees in the case study area. Indeed, they were not present as cultivation, but many plants were present principally at an important religious Romanic complex of Settimo Vittone, Battistero di San Giovanni e Pieve di San Lorenzo. The historical presence of these trees is also evidenced by a fresco from the late 1700s found in a church in Tavagnasco, a municipality bordering Settimo Vittone. Figure 9 shows the fresco and the secular olive trees.

Another result of field surveys was the identification of dynamics. As discussed above, a good state of conservation and maintenance of vines and the historical breeding system were observed. However, dynamics related to vine-breeding techniques and land uses were also identified, which were directly affected by the coevolution between man and the landscape and social changes (e.g., aging of rural communities).

Regarding the vine-breeding system, the introduction of some differences affecting more or less the landscape was observed. The first one was the permanence of pergolas supported by stone columns but constructed with less use of chestnut poles. The result is modified pergolas with only two orders of chestnut poles perpendicularly overlapped and one order of metal wires. Winegrowers explained that this type of modified pergola allows for reduced management costs, since metal wires are more durable than chestnut poles and do not intercept phytosanitary treatments. As shown in Figure 10, this change leads to low

impact on the landscape and is evident only in winter when there is no vegetative mass. In some cases, it was observed that vines were planted in the middle of terraces and not along the dry stone walls. Winegrowers highlighted that based on their experience, this nonhistorical handling of plants allows better aeration of the fields.

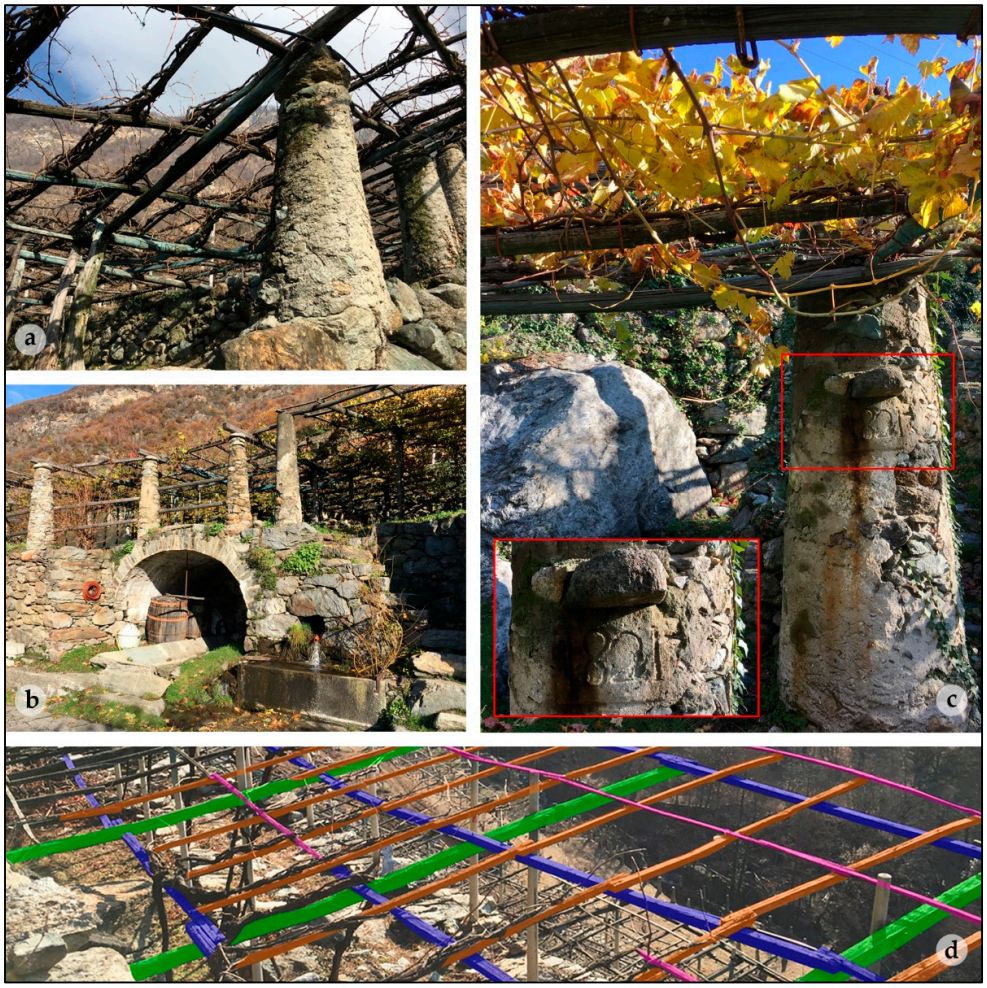

Figure 7. (**a**) Historical vine-breeding technique: pergola made of chestnut poles supported by stone columns. (**b**) Pergolas integrated with other important historical landscape elements of rural architecture. (**c**) Dated stone columns for pergola support (1821). (**d**) Detail of four orders of chestnut poles perpendicularly overlapped that make up pergolas (shown in green, blue, orange, and pink).

Figure 8. (**a**) Secular chestnut trees designated as the oldest in Nomaglio municipality. (**b**) Chestnut grove reported as pasture chestnut in sample area according to Savoy family cadastral map.

Figure 9. (**a**) Secular olive trees historically present at Battistero di San Giovanni e Pieve di San Lorenzo, a religious Romanic complex. (**b**) Evidence of historical presence of olive trees in case study area: a fresco dated late 1700s illustrating this religious complex and its olive trees.

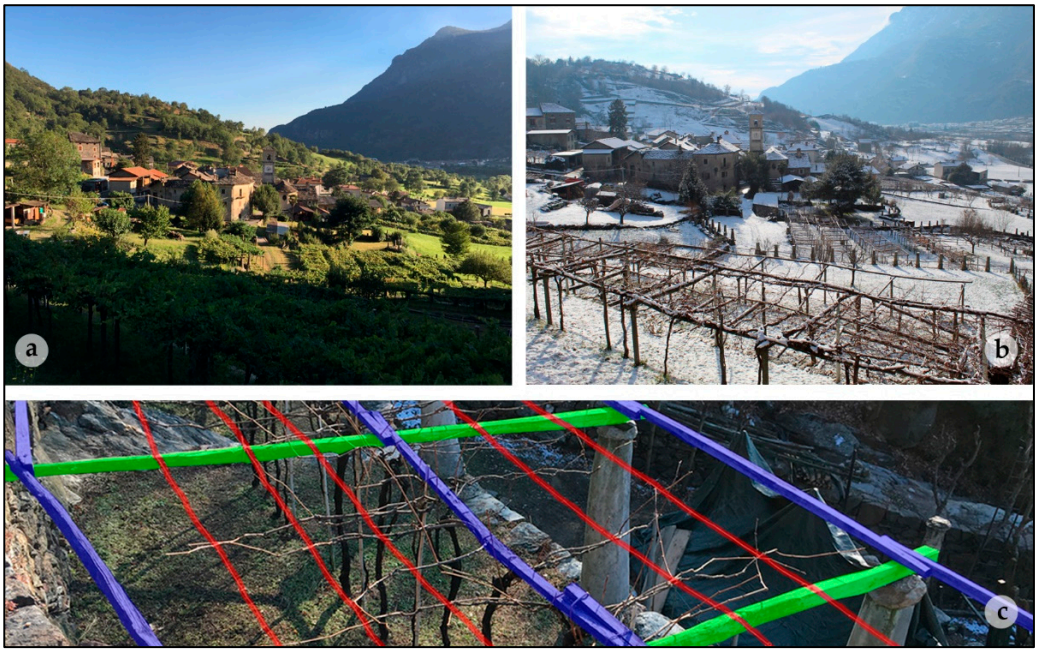

Figure 10. Modified pergolas in (**a**) summer and (**b**) winter, where (**c**) some orders of chestnut poles were replaced with metal wires and vines were planted in the middle of terraces.

The second change to the vine-breeding system that was observed during field inspections was the introduction of espaliers (Figure 11). This has more impact on the landscape than the modified pergola and has no historical value, since it was developed in recent times. Nowadays, the use of espaliers is limited to particular conditions where the slopes are reduced and the terrace area is more extensive, and there is no problem of one espalier shading the others. Stone columns remained in the field but lost their historical role of pergola support.

Regarding land uses, the consequences of abandoning vineyards were observed. Figure 12 shows the main dynamics that brought landscape change. The first one is the introduction of olive groves (Figure 12a). This dynamic is limited to a few contexts and is related to self-consumption, but is in the process of expanding. This cultivation was taken from the observation of olive trees at the Battistero di San Giovanni e Pieve di San Lorenzo complex, which were present for centuries thanks to the optimal climate of the case study area. Another dynamic that was related to the abandonment of cultivation was the continuous management of terraces that were mowed (Figure 12b). These dynamics

brought landscape change but allowed continuous management of terraces against the hydrogeological risk. The worst dynamic from a hydrogeological point of view that was observed during field surveys was related to the more or less recent total abandonment of terraces, with the presence of invasive shrubs or woodland (Figure 12c,d). In all of these cases, the stone columns historically used to support vine pergolas lost their role but remain as witnesses of the viticultural past.

Figure 11. (**a**) Use of espalier vine-breeding technique on lower part of slope and its impact on landscape. (**b**) Detail of espalier technique.

Figure 12. Consequences of vineyard abandonment: (**a**) introduction of olive groves; (**b**) abandonment of cultivation but continuous terrace management (moved); (**c**) recent terrace abandonment with the presence of invasive shrubs; (**d**) total terrace abandonment with the presence of invasive woodland.

3.2. Evaluation of Winegrowers' Perceptions

We obtained 49 completed questionnaires from winegrowers. Among the respondents, 77.6% manage their terraced vineyards at a nonprofessional level (question 1). Table 4 frames the sample in terms of age range, sex, and education (questions 2–4).

Table 4. Answers to questions 2–4.

Age Range (2) (%)				Sex (3) (%)		Education (4) (%)			
18–30	**31–45**	**46–60**	**>60**	**M**	**F**	**Primary School**	**Secondary School**	**High School**	**University Degree**
6	31	22	41	85.7	14.3	4	33	43	20

As shown in Table 4, most of the respondents were older than 60 years (41%), while the minority (6%) were young (18–30 years old); 31 and 22% of the respondents were 31–45 and 46–60 years old, respectively. Among them, 85.7% were male and 14.3% were female. Regarding education, 20% obtained a university degree, 43% graduated from high school, 33% from secondary school, and only 4% from primary school.

Just under half of the respondents (46.9%) reported that there was someone in their family who wanted to continue the viticultural activity, while 18.4% reported that there was not (question 5). Almost all respondents (98%) indicated that they were aware of their role in maintaining the terraced landscape (question 6).

Regarding the farm characteristics, the questionnaire allowed us to identify the respondents' farm workforce in terms of family members and employees (questions 8–9). Table 5 lists them.

Table 5. Answers to questions 8 and 9.

	How Many Family Members Besides You Work on the Farm? (8) (%)	Do you Have Permanent and/or Seasonal Employees? (9) (%)
0	49	89.8
1	26.53	8.16
2	12.24	-
3	10.2	2.04
4	2.04	-

As shown in Table 5, on just over half of the farms (51%), one or more family members worked besides the interviewed winegrower. In most cases, only one family member besides the respondent worked (26.53%). The greatest number of family members reported was four (2.04%). Among the farms, 89.8% were run only by the family, and the remainder had one (8.16%) or three (2.04%) permanent and/or seasonal employees.

Among the vineyards, 67.3% were not merged (question 10). The average age of the oldest vineyards was 57 years, and the youngest was 8 years (questions 11–12). The average vineyard area was 0.54 ha (question 13). The principal cultivated vine variety was Nebbiolo Picotendro, which was cultivated on 89.8% of farms (question 14).

The traditional high pergola (warp with wooden poles) was the main vine-breeding system on 77.6% of the farms (question 15). Other vine-breeding systems were less represented: modified high pergola (12.2%) and espalier (8.2%). On 79.6% of the farms, there were stone columns (question 16). Among the winegrowers, 65.3% had other agricultural categories in addition to terraced vineyards (question 17). In particular, just under half of the respondents (49%) also had meadows/pastures, followed by chestnut groves (34.7%), olive groves (24.5%), arable land and cereals (8.2), sheep and goats (8.2%), and bovines (2%).

Regarding the state of conservation of dry stone walls (question 18), in 59.2% of the cases they were intact, while 40.8% were partially damaged. No winegrower reported that their dry stone walls were completely damaged. Conventional agricultural was practiced by 61.2% of respondents, followed by integrated (30.6%) and biological (8.2%) (question 19). Most of the respondents (79.6%) reported problems with management of terraced vineyards (question 20). Table 6 lists them.

Table 6. Answers to question 20.

Do you Have Problems Managing Terraced Vineyards? If So, Which Ones?	
Reported Problem	**Number of Citations**
Terraces management	12
Accessibility	11
Poor mechanization	7
Difficulty with management	5
Water availability	5
Proximity to uncultivated lands	2
Too much time	2
Land pulverization	2
Management costs	2
Too much time for pergola management	1
Pilun management	1

As shown in Table 6, the main problems in the management of terraced vineyards reported by winegrowers were terraces management and accessibility (cited 12 and 11 times, respectively), followed by poor mechanization (7), difficulty with management (5), and water availability (5). Problems cited less frequently were proximity to uncultivated lands (2), too much time for cultivation (2), land pulverization (2), management costs (2), too much time for pergola vine-breeding technique management (1), and *pilun* management (1).

Regarding product characteristics, among possible DOC wines produced in the area, those most produced were DOC Carema, DOC Carema reserve, and DOC Canavese Nebbiolo, by 49%, 24.5%, and 24.5% of respondents, respectively (question 21).

The main distribution channels for the wine (question 22) were giving grapes to other cellars (44.9%), followed by selling directly on the farm (28.6%) and selling to hotels/restaurants/cafes (26.5%). About a quarter of respondents (24.5%) produced wine only for family use.

The wines produced were sold principally in the Piedmont and Aosta Valley regions (30.6%) and across all Italy (question 23). Moreover, many winegrowers reported that they also sold wine in Europe (24.5%) and in non-EU countries (20.4%).

Regarding the landscape, respondents reported many identity elements (question 7). They are listed in Table 7.

Table 7. Answers to question 7.

What Are the Identity Elements in the Landscape?			
Reported Element	**Number of Citations**	**Reported Element**	**Number of Citations**
Terraces	31	Pastures	1
Vineyards/viticulture	19	Woodlands	1
Pilun	14	Mixed agriculture	1
Pergolas	13	Uniqueness	1
Dry stone walls	7	Rocks	1
Chestnut groves	6	Fragility of terraces	1
Olive groves	6	Cows	1
Nebbiolo	2	Restaurants	1
Mule tracks	2	Cheeses	1
Architecture	2	Mountains	1
Meadows	1	People	1

Table 7 shows all of the identity elements in the landscape reported by winegrowers. The most cited elements were terraces (31) followed by vineyards/viticulture (19), *pilun* (14), and pergola vine-breeding technique (13). Dry stone walls were cited by seven respondents, while chestnut and olive groves were both cited six times. Other elements were Nebbiolo, mule tracks, and architecture (two each) and meadows, pastures, woodlands, mixed

agriculture, uniqueness, rocks, fragility of terraces, cows, restaurants, cheeses, mountains, and people (one each).

All of the interviewed winegrowers (100%) thought that the terraced landscape should be considered an added value for the wine produced there (question 24). Almost all of them (98%) thought that it may also be of interest from a tourist point of view (question 25). Table 8 reports the answers to questions 26–31 about winegrowers' perceptions of specific elements.

Table 8. Answers to questions 26–31.

Do You Think These Are Identity Elements of the Landscape?		
Proposed Element	**Yes (%)**	**No (%)**
Dry stone walls (26)	100	0
Stone columns (*pilun*) (27)	98	2
Pergola vine-breeding technique (28)	100	0
Espalier vine-breeding technique (29)	14.3	85.7
Vines (30)	98	2
Olive groves (31)	32.7	67.3

As shown in Table 8, most of the respondents perceived dry stone walls (100%), stone columns (98%), pergola vine-breeding technique (100%), and vines (98%) as identity elements of the landscape. On the contrary, they did not consider the espalier vine-breeding technique (85.7%) or olive groves (67.3%) as such.

Regarding future development prospects, most of the respondents (74.5%) reported that their terraced vineyards will continue to be managed in the traditional way (pergola), while 4.3% reported that they will modify the traditional vine-breeding technique (espalier) (question 32). Others thought that terraced vineyards will be completely abandoned and invaded by woods (12.8%), 6.4% thought that they will no longer be cultivated but managed (mowed), and 2% thought that they will be converted to other crops (olive groves).

Table 9 reports winegrowers' preferences for future prospects based on presented pictures of vine-breeding techniques and land uses (question 33).

Table 9. Answers to question 33.

Between the Two Future Prospects Proposed in the Following Pairs of images, Which Do You Like More? (Indicate an Answer for Each Pair) (%)					
A	**B**	**1**	**2**	**3**	**4**
95.9	4.1	-	-	-	-
-	-	93.9	6.1	-	-
-	-	98	-	2	-
-	-	98	-	-	2
-	-	-	63.3	36.7	-
-	-	-	89.8	-	10.2
-	-	-	-	89.8	10.2

As shown in Table 9, the future prospect the winegrowers most preferred was maintaining the historical landscape elements. Indeed, almost all of them (95.9%) preferred the pergola vine-breeding technique (A) to espaliers (B). Regarding land uses, 93.9% of respondents preferred vineyards (1) over olive groves (2) and 98% preferred them over meadows (3) and woodlands (4). Between olive groves and meadows, 63.3% preferred the former, and 89.8% preferred olive groves and meadows over woodlands.

Table 10 reports winegrowers' perceptions of future prospects based on pictures of vine-breeding techniques and land uses in terms of which ones they thought were more likely to occur in the future (question 34).

Table 10. Answers to question 34.

Between the Two Future Prospects Proposed in the Following Pairs of Images, Which Do You Think Is More Likely in the Future? (Indicate an Answer for Each Pair) (%)					
A	**B**	**1**	**2**	**3**	**4**
57.1	42.9	-	-	-	-
-	-	75.5	24.5	-	-
-	-	69.4	-	30.6	-
-	-	75.5	-	-	24.5
-	-	-	55.1	44.9	-
-	-	-	63.3	-	36.7
-	-	-	-	75.5	24.5

As shown in Table 10, winegrowers supposed the maintenance of historical landscape elements in the future, but the percentages of answers were less defined than the previous question. Indeed, just over half of them (57.1%) supposed that the pergola vine-breeding technique (A) would be more likely than espaliers (B). About three-quarters of the respondents (75.5%) thought vineyards (1) would be more likely than olive groves (2) and woodlands (4), while 69.4% thought vineyards would be more likely than meadows (3). Just over half of the respondents (55.1%) supposed that olive groves would be more likely in the future than meadows, while 63.3% thought they would be more likely than woodlands. Finally, 75.5% of winegrowers supposed that meadows would be more likely in the future than woodlands.

4. Discussion

The first part of the research allowed us to understand the rural history of the case study area, where a terraced vineyard landscape appeared as the result of the coevolution between rural communities and natural resources. Indeed, according to Bonardi et al. [64], terraces were developed together with man since prehistory. The analysis of the Savoy family cadastral map showed the historical organization of land use, highlighting a mutual link between different types: vineyards and chestnut groves were functionally linked because the latter provided wooden poles to sustain the former.

We described the historical vine-breeding technique, finding its origin in Roman times. It appeared as a unique element in the world in which vine pergolas were supported by stone columns. These columns, in addition to having a double role of vine pergolas' support and temperature range reduction, strongly characterized the landscape.

Field surveys allowed us to observe the good state of conservation of the terraced system and verify the maintenance of many historical landscape elements. The importance of vines to rural communities over the centuries was evidenced by their representation in art and iconography dating back to different epochs. Similarly, Aimar et al. [65] highlighted the strategic role of studying historical sources in order to assess historical landscapes. The presence of ancient chestnut groves and olive trees was also observed.

Signs of the coevolution between terraced landscapes and rural communities were assessed. Indeed, some dynamics of change in terms of new vine-breeding techniques or land uses were observed. The former were introduced by winegrowers in order to reduce management effort and cost. In similar conditions (pergola vine-breeding technique in Aosta Valley), Mazzarino [66] estimated 1200–1300 h of work/ha per year. The espalier technique requires a lower investment in terms of time and allows much more mechanization of the agricultural process. The same can be said about the introduction of olive groves. In the Piedmont region, olives were introduced by the Etruscans and spread by the Romans, and the Christian tradition allowed many secular trees to be maintained in religious complexes [67]. In the case study area, the oldest olive trees were in the religious Romanic complex of Settimo Vittone municipality. Therefore, the recent development of olive groves is linked with the past and allows productive terraces to be maintained.

Sakellariou [68] highlighted the importance of recultivating terraced landscapes on the Aegean Island of Andros (Greece), taking into account future environmental and social challenges and preventing abandonment. In the case study area, other consequences of abandonment were mowed meadows and invasive shrubs and woodlands. The different states of conservation, with vegetative sequences from shrubs to woodlands, are similar to other terraced landscapes at the international level threated by abandonment [69]. Figure 13 shows the different dynamics observed by experts (introduction of new vine-breeding techniques and new land uses) and their impact on the landscape. The dynamism of the landscapes that was assessed is in line with Tortora et al. [70], who analyzed rural landscape dynamics, understood as land use changes, based on historical maps. As evident in the figure, the dynamics observed in the case study area brought changes to the historical terraced landscape but, at the same time, allowed for abandonment to be prevented. For these reasons, in coevolutive terms, they can be accepted.

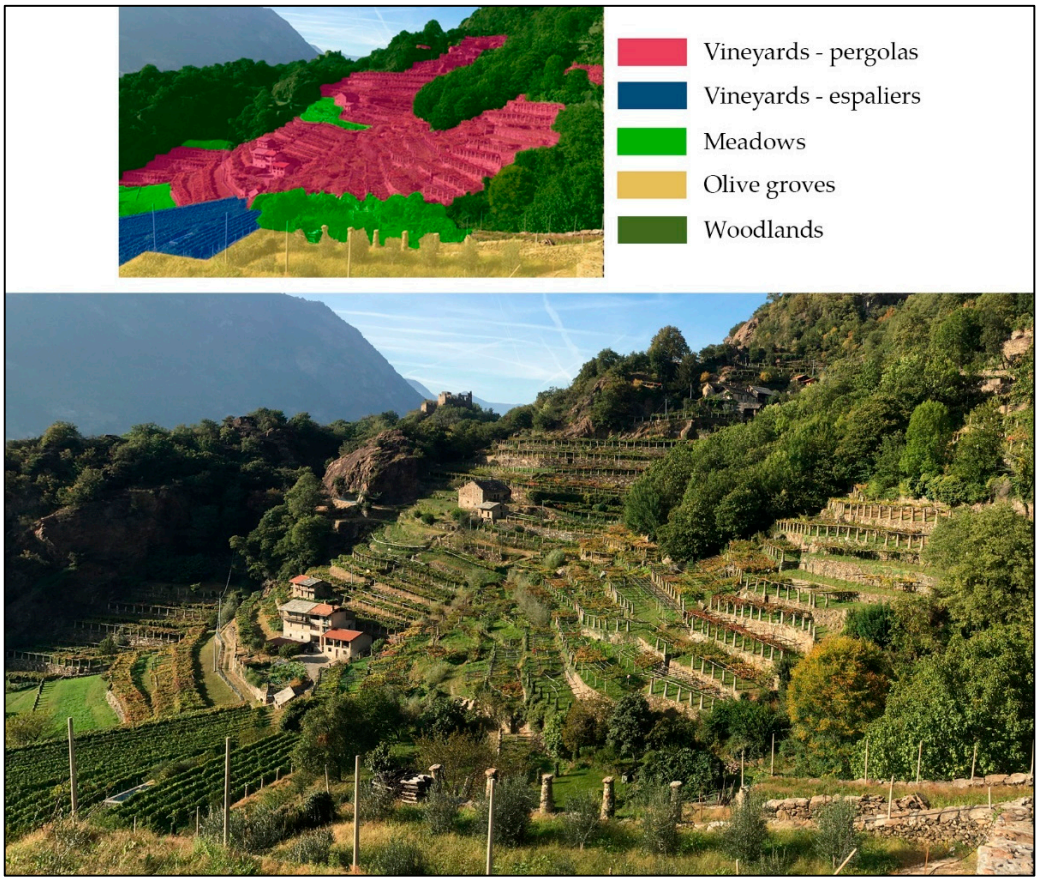

Figure 13. Presence of different dynamics: vineyards with historical vine-breeding technique (pergolas), vineyards with new breeding technique (espaliers), olive groves, meadows, and invasive woodlands.

The second part of the research allowed us to evaluate the winegrowers' perceptions about the landscape's historical elements and dynamics. The respondents' characteristics were representative of the case study area reality, with a majority of old, nonprofessional winegrowers. Farms were characterized by small size and mainly involved few family members. The presence of the historical vine-breeding technique (*pergola caremiese*) and stone columns on most of the farms confirmed the permanence of the historical landscape elements observed during field inspections, with a still-limited presence of espaliers. The presence of multifunctional agriculture characterized by different land uses was also confirmed. The relevance of the case study in an international context was confirmed by the production of DOC wines sold both in Europe and in non-EU countries.

The main problems with managing terraced vineyards, according to the winegrowers, were related to their intrinsic issues in terms of management, accessibility, and mechanization. Management difficulties are among the causes of terrace abandonment and human exodus from the countryside. For example, the number of residents in Carema municipality decreased by 46.8% from 1921 to 2022 (elaboration of ISTAT data [43]). Petanidou et al. [71] observed a similar occurrence on terraced Nisyros Island (Greece), where the abandonment of cultivation was accompanied by a population reduction since the beginning of the last century.

The evaluation of winegrowers' perceptions also suggests that they perceive as identity elements the historical landscape elements mainly related to terraces and traditional agricultural practices, while the answers to yes/no questions showed that most of them do not consider espaliers and olive groves part of this identity. Winegrowers recognized that the landscape adds value to the wine produced there. It is very important to transfer this awareness to consumers by emphasizing that the bottle contains not only wine but also the historical landscape in which it was produced. With this purpose, the important role of certifying the historical landscape's quality is recognized [72].

Some differences were observed in winegrowers' preferences and suppositions about future development prospects. Regarding vine-breeding techniques, the permanence of pergolas was both the preferred and supposed future scenario. However, 42.9% of winegrowers considered that pergolas would be less likely in the future than espaliers. The same trend could be observed for land use, with a preference for vineyards. Regarding other land uses, winegrowers preferred the ones that would allow them to maintain terraces' production and management: olive groves, and meadows. Olive groves may be preferred to meadows since they allow the production of olive oil for families and keep the terraces more productive. The least preference was for the scenario with total terrace abandonment (invasive woodlands), in accordance with Gao et al. [73]. They showed the risk awareness and perception of farmers of Honghe Hani rice terraces (China) regarding the hydrogeological risk of abandoning terraces. Regarding future prospects, the winegrowers thought the permanence of viticulture was the most likely and total terrace abandonment the least likely, but in a less convinced way. They are aware of issues that threaten terraces, but at the same time, they seem to be quite optimistic about their future enhancement. These results also agree with Santoro et al. [60], who reported that farmers in Cinque Terre recognized terraced vineyards as the most important land use.

5. Conclusions

This research proposes an innovative and integrated approach to evaluating the coevolution between terraced vineyard landscapes and rural communities. Terraces cannot be maintained without continuous management by man. In the context of historical rural landscapes, terraced landscapes are the most threatened by abandonment and invasive woodland, which increase the hydrogeological risk. Rural communities must manage terraced landscapes in order to reduce their vulnerability and preserve public health. At the same time, they need to cultivate terraces for production purposes and benefit from their high-quality products. The close mutual link between terraced landscapes and rural communities is demonstrated by their coevolution, in which each adapts to the needs of the other. For these reasons, terraced systems, like all rural landscapes, are dynamic systems that evolve with rural communities.

In the case study area, this dynamism is very clear, since the presence of historical landscape elements was mainly observed, but also the introduction of new vine-breeding techniques and land uses. More cartographic and quantitative studies about these dynamics are needed. Hara et al. [74] showed the importance of assessing landscape dynamics starting from the elaboration of past and present land use maps for the development of conservation measures. For these reasons, the research will be further developed in the future, focusing on land use mapping and dynamics assessment in quantitative terms.

The integrated approach including expert-based assessment and evaluation of winegrowers' perceptions allowed us to assess the historical landscape elements and dynamics

and evaluate perceptions. Since almost all winegrowers prefer maintaining the historical vine-breeding technique and land use (vine pergolas and vineyards), but not all consider them more likely to remain in the future, more enhancement actions are need. Future planning policies and resources will have to make maintaining historical landscape elements attractive for winegrowers by recognizing their added value. Greater efforts to continue traditional cultivation require higher remuneration.

In this context, including terraced vineyard landscapes in the National Register of Historical Rural Landscapes and the GIAHS-FAO program could be a strategic move. Indeed, such recognition of the landscape's value could bring its importance and uniqueness to a national and international level. New experiential tourism could be developed, and new consumer awareness about added value could be encouraged. Rediscovering locally produced food and reducing the gap between food producers and consumers could also encourage more sustainable consumption patterns and achievement of the second sustainable development goal (SDG) of the United Nations Agenda 2030 [75], aimed at ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture [76]. Finally, the action plan for the dynamic conservation of the landscape encouraged by GIAHS could support the coevolution between terraced landscapes and rural communities from the past into the future.

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