

TERRACED VITICULTURE OF THE CEMBRA VALLEY IN ITALY: TOWARDS THE INCLUSION OF SUSTAINABLE LANDSCAPE MANAGEMENT IN QUALITY-ORIENTED DEVELOPMENT ACTIONS

Viticultura en terrazas del Valle de Cembra en Italia: hacia la inclusión de la gestión sostenible del paisaje en las acciones de desarrollo orientadas a la calidad

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ABSTRACT: Terraces represent the most wide-spread solution for steep hillslope cultivation. The elevated number of positive ecosystem services produced by the derived terraced landscapes when-well maintained are threatened by ongoing land-abandonment and landscape-irrespective agricultural transformation processes. In this manuscript, we analyzed the current state of the terraced area of Val di Cembra (Trentino-Italy). We aimed to analyze the reason behind the high rate of active maintenance of the terraced viticulture, discuss the main risks related to the introduction of intensive land management practices and list possible solutions for ensuring a long-term sustainable development of the area. We identified the wine-quality oriented development of viticulture, the realization of important infrastructure to ensure mobility and irrigation, and the strong sense of belonging still present also among young generations, the main factors determining the high rate of active maintenance of the terraced landscape. Besides the risk of

obsolescence that affects the most marginal terraced areas of the valley, other risks are associated with the possible diffusion of landscape-indifferent land-arrangement and to the adoption of not traditional training systems, which may affect negatively the landscape value.

Future perspectives need to enlarge the quality-oriented process undertaken in wine production to the whole territory. Including landscape in land management planning will ensure long-lasting sustainability of viticulture, matching the increasing demand for environmental services from the community and the consumers. Ongoing action in the Valley, that involve both private stakeholders and local authorities, are indicating the intention of the community to move in this direction.

KEY WORDS: Terraced landscape; land degradation; abandonment; mechanization; ecosystem services; dry-stone walls

RESUMEN: Las terrazas representan la solución más extendida para el cultivo en pendientes escarpadas. El número elevado de servicios ecosistémicos positivos producidos por paisajes con terrazas cuando están bien mantenidos se ve amenazado por el abandono continuo de la tierra y la transformación agrícola que no tiene en cuenta el paisaje. En este artículo, hemos analizado el estado actual de la zona de terrazas de Val di Cembra (Trentino-Italia). Nuestro objetivo fue analizar las causas detrás de la alta tasa de mantenimiento activo de la viticultura en terrazas, examinar los principales riesgos relacionados con la introducción de la gestión intensiva de la tierra y proponer posibles soluciones para garantizar un desarrollo sostenible a largo plazo de la zona. Hemos identificado los principales factores que determinan la elevada tasa de mantenimiento activo del paisaje en terrazas: el desarrollo de la viticultura orientado a la calidad del vino, la realización de infraestructuras importantes para garantizar la movilidad y el riego, y el fuerte sentido de pertenencia todavía presente también entre las generaciones jóvenes. Además del riesgo de obsolescencia que afecta a las zonas de terrazas más marginales del Valle, otros riesgos están asociados con la posible difusión de la transformación del territorio indiferente al paisaje y a la adopción de sistemas de cultivo que no son tradicionales, que pueden afectar negativamente el valor del paisaje.

Las perspectivas futuras deben ampliar el proceso orientado a la calidad en la producción de vino en todo el territorio. La inclusión del paisaje en la planificación del manejo de la tierra garantizará una sostenibilidad duradera de la viticultura, respondiendo a la creciente demanda de servicios medioambientales por parte de la comunidad y de los consumidores. Proyectos en curso en el Valle, en los que participan tanto actores privados como autoridades locales, están indicando la intención de la comunidad de avanzar en esta dirección.

PALABRAS CLAVE: Paisaje de terrazas; degradación de la tierra; abandono; mecanización; servicios ecosistémicos; muros de piedra seca.

1. Introduction

Terraced landscapes are known as one of the most representative anthropic landscapes, the result of a long-lasting process of domesticating high-steep landscapes to support agriculture and they are nowadays often identified as agro-ecological and cultural heritage (Agnoletti *et al.*, 2015; Tarolli *et al.*, 2014; Zoumides *et al.*, 2017). They safeguard the hydrological and geological integrity of the land (Alberti *et al.*, 2018), reduce slope and soil erosion, increase infiltration water and enhance cultivable areas in difficult environmental conditions (Bonardi & Varotto, 2016; Tarolli, 2018). On the other hand, they are among the most endangered land use types. Both technical (unfavorable agricultural conditions, difficulties to access the fields, low possibilities for mechanization), and socio-economic (higher maintenance costs, lower production and competitiveness, scarce appeal for young generation) reasons, caused a diffused abandonment of terraced areas in Europe and around the world starting

from the second half of the 20th century (Arnáez *et al.*, 2015; Barbera *et al.*, 2015; García-Ruiz & Lana-Renault, 2011; Lasanta *et al.*, 2017; Tarolli *et al.*, 2014). The loss of a terraced landscape, meaning the interruption of the active cultivation of the benches, causes a series of detrimental effects that go well beyond the loss of a productive system. It is indeed extended to the hydrogeological stability and to their roles of keepers of traditional knowledge, biodiversity, local identity and distinctiveness (Brandolini *et al.*, 2018; Di Fazio & Modica, 2018; Tarolli *et al.*, 2015)

A landscape is both heritage and memory, recognized by the European Landscape Convention (Council of Europe, 2000) as a political and legal subject for the individual and for the community (Déjeant-Pons, 2006). As a result, landscape and community are linked in an indissoluble entity (Bonesio, 2014). This concept is reiterated by the *UNESCO World Heritage Convention (WHC)* that in the operational guidelines for its implementation, considers landscape as the “outcome of a combined action

between nature and man, witness of the evolution of societies and human settlement under the influence of opportunities and limits posed by the natural environment as well as social, economic, and cultural forces” (UNESCO, 2008). According to this interpretation, as pointed out by Agnoletti *et al.* (2015), there is a need to overcome the narrow definition that identifies terraces only as the result of the practice of interrupting steep slopes of mountain sides by creating sub-flat plains for agricultural purposes. This definition should instead be extended to include different sustainability functions provided by a terraced landscape, such as the economic-productive, the environmental-ecological and the historical-cultural ones, coming together to determine the territorial quality (Gisotti, 2003). The correct functioning of this complex system requires the active presence of human beings that farm the terraces, maintain the walls to avoid landslides and land degradation, and keep memory of the traditional knowledge, thus perpetrating sustainable land management (SLM) that lasted for centuries (Tarolli *et al.*, 2014; Zoumides *et al.*, 2017). The aims of this paper are: (i) to analyze the main reasons behind the active maintenance of the terraced agricultural area of the Cembra Valley (situated in the province of Trento -Italy), (ii) to discuss the main risks associated with current dynamics in land management; and (iii) to evaluate possible strategies to meet the current demand of improving the sustainability of land management.

2. The terraced viticulture of the Cembra Valley

Within the Italian side of the Alps, the Cembra Valley, is located in the Trentino-Alto Adige Region. It begins South of the Fiemme and Fassa Valleys, following the course of the river Avisio, which, over the centuries, has dug a steep canyon into the porphyry all the way up to the river Adige, the second largest river of Italy. The valley, that extends beyond a total surface of 135 km², is affected by agricultural activity mainly on the orographic right, while the opposite side is dominated by the presence of porphyry quarries, nicknamed *Red Gold* for the profitability deriving from its extraction and processing (Figure 1). This activity has had a pivotal role in promoting the economic development of the Valley and indirectly sustains the terraced vineyards on the other side of the valley. Here, the combination of a favorable exposition (South-East) and a considerable slope has meant that the gradual transformation from woodland to arable land has gone through an enormous work of agricultural interventions, mainly for creating terraces supported by dry stone containment walls (Folgheraiter & Zotta, 2018). These land modeling operations defined a unique landscape, characterized by the perfect symbiosis between terraced structures necessary to sustain cultivation, and the sinuous and articulated natural course of the valley (Spaini, 2013).

Viticulture has been practiced in this area since immemorial times, as evidenced by the discovery of the *Situla*, a bronze container for wine dating back to the VI century

BC, and other discoveries of minor importance found in the countryside of Cembra (Marzatico, 1994).

It has been estimated that over the years, along the 33 km of the valley, a linear extension of dry stone walls ranging between 500 and 700 km were built (Cosner *et al.*, 2019; Nardin *et al.*, 2002). Together with the numerous agricultural artifacts built with the same local stone, they give to this landscape an overall sensation of aesthetic harmony; a value witnessed even by the German painter Albrecht Dürer in his watercolor paintings (Ceolan, 2004; Piel, 1992).

Today's landscape is strongly characterized by the wine-growing destination of the cultivated areas, which, with its 704 hectare (Table 1), has an impact on half of the Usable Agricultural Area of the entire valley (1415 hectares, approximately 10 % of the whole territory (PAT, 2010)). Starting from the second half of the 1970s, the valley developed a rather mono-cultural profile that is visible still today.

Table 1. Distribution of grapevines among the 6 (out of 7) municipalities of the Cembra Valley (year 2018, personal communication from the Service of Rural Development of the Autonomous Province of Trento).

Tabla 1. Distribución de la vid entre los 6 (de 7) municipios del Valle de la Cembra (año 2018, comunicación personal del Servicio de Desarrollo Rural de la Provincia Autónoma de Trento).

Municipality	Viticultural land use	
	ha	%
Giovo	305	43.3
Cembra Lisignago	236	33.5
Altavalle	93	13.3
Segonzano	55	7.8
Albiano	12	1.7
Lona Lases	3	0.4
Total	704	100.0

The agricultural economy of the valley was able to evolve from a subsistent character, supported by the synergy of crops such as chestnut, buckwheat, rye, and corn, to a real competitiveness on markets outside the confines of the valley. This process was supported by the contribution of several factors, including the advisory service of the local Agrarian Institute of San Michele all'Adige (now Edmund Mach Foundation), the outcome of a specific research project aimed at identifying the most suitable area for each vine cultivar (Falcetti, 2007), local conferences and exhibitions devoted to promoting an iconic product such as the Müller Thurgau wine grape and the introduction of new, high-valued, products such as the “Spumante Trento DOC metodo classico”. A quality-oriented process that improved the local viticulture was the key of this successes. A process that involved 805 out of the total 876 farms actively operating in the valley. They are mainly small companies, with an average surface of 1.2 ha (PAT, 2010) and the main varieties cultivated are listed in table 2.

Table 2. Principal grapevine cultivars cultivated in the Cembra Valley (Data refers to the year 2018 as personally communicated from the Service of Rural Development of the Autonomous Province of Trento).

Tabla 2. Principales cultivares de vid cultivados en el Valle de Cembra (Los datos se refieren al año 2018 según lo comunicado por el Servicio de Desarrollo Rural de la Provincia Autónoma de Trento).

Cultivar	Colour	Surface (ha)	Production (t)	t/ha
Müller Thurgau	white	275	3710	13.5
Chardonnay	white	219	2864	13.1
Schiava	red	60	808	13.4
Pinot Nero	red	51	525	10.2
Traminer Aromatico	white	28	298	10.7
Pinot Grigio	white	13	156	12.3
Piwi Bianco	white	13	141	11.2
Sauvignon Blanc	white	11	141	13.0
Riesling	white	10	121	11.9
Lagrein	red	5	65	13.0
Others	-	20	240	12
Total		704	9069	12.2

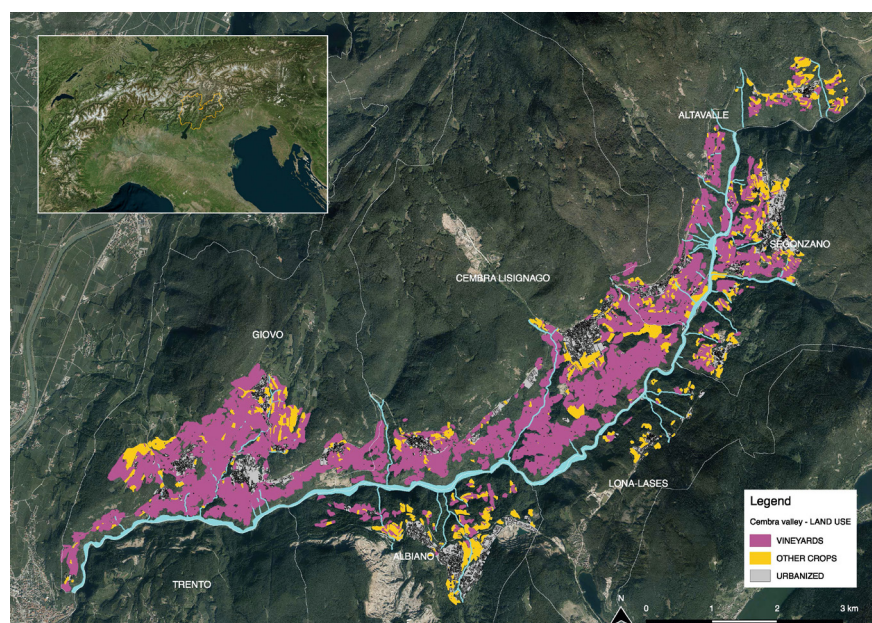


Figure 1. Map of the traditional terraced viticulture in the Cembra Valley: the coordinates of the north-east corner of the map are: 46°12'49.5"N 11°16'38.8"E; those of the south-west corner are: 46°08'19.3"N 11°06'38.3"E).

Figura 1. Mapa de la viticultura tradicional en terrazas en el Valle de la Cembra: las coordenadas de la esquina noreste del mapa son: 46°12'49.5 "N 11°16'38.8 "E; las de la esquina suroeste son: 46°08'19.3 "N 11°06'38.3 "E).

3. Problems and opportunities of viticulture in the Cembra Valley

The Cembra Valley suffers from the problems that affect most of the agricultural mountain areas: (i) high

production costs, with an estimate of 800 hours/ha (200 more than in valley-floor); (ii) high maintenance costs for the traditional dry-stone terraces; (iii) high levels of property fragmentation and (iv) a general low size of the properties which decrease competitiveness; (v) ageing

rural populations, with lower propensity to introduce innovation; (vi) lower possibilities for mechanization, although the presence on the market of small-sized machines that adapt to mountain viticulture improves the possibilities for their beneficial introduction in vineyard management. All these aspects represent historical structural issues that lower the overall profitability of local viticulture and pose serious questions about its sustainability in the future. Nevertheless, the degree of land abandonment in the Cembra Valley is very low compared with other terraced areas also in Trentino Region (Tecilla *et al.*, 2017). Therefore, besides the weak points, there must be other strengths that has allowed the local viticulture to be actively maintained. These aspects were recently investigated by Vettori (2018) with a survey among local farmers and administrators. Among the elements influencing positively the local territory we can list the presence of a wine cooperative (Cantina Lavis-Valle di Cembra), that provides good incomes also for owners of small parcels of land that only allow for part-time jobs, and contributes to maintain a strong sense of belonging, still quite high also among the youngest generation (Vettori, 2018). There have been important changes from both the oenological and agronomical point of view. In the cellars, innovation in the methods and materials used, mainly promoted by the local enology school in the near “Istituto Agrario di S. Michele all’Adige”, allowed an increase of the wine quality, with peaks of performances that ensured international awards for several wineries. This process was extended in the field, with the adoption of new cultivars supported by important research works aimed to increase the knowledge in the lo-

cal environment (Falcetti, 2007). Moreover, agronomical practices have been adopted, partly mechanized, that facilitated the hard work in the fields. The associations of wine producers and growers has contributed with traditional local exhibition and events, like the “International Exhibition of Müller Thurgau” and the festival “Festa dell’Uva” to increase the reputation of the Valley as an area of excellent wine production. Besides the innovation process toward high-quality viticulture, important infrastructures were built. Starting from the 1970^{ies} the traditional unpaved roads were adapted to allow larger tractors to reach the countryside with a good degree of capillarity, while, in the first years of the new millennia, an irrigation system able to serve the vineyards of the entire valley was built (Rosa *et al.*, 2015), avoiding problems related to summer water stress which, especially in mountain contexts, may entirely threaten grape production (Wenter *et al.*, 2018).

Being still an actively cultivated mountain area, the adaptation of the vineyards to the changes of the societal needs in the last decades, caused a number of dynamics that brought new threats for the overall beauty and harmony of the traditional terraced landscape. The planting of new varieties and the need to mechanize some agricultural practices led to the introduction of the espalier training system “Guyot”, which has a different impact on the landscape with respect to the traditional “Pergola trentina” (Figure 2). The arrival of new materials and construction methods has led to the appearance of a series of “personalized” solutions for the reconstruction and maintenance of the traditional dry stone walls (Paolazzi, 2018). In no cases do these solutions appear to improve



Figure 2. Coexistence of the traditional training system “Pergola trentina” with the relatively new introduced espalier system “Guyot” on the terraces of the Cembra Valley (courtesy of Luciano Lona).

Figura 2. Coexistencia del sistema de conducción tradicional “Pergola trentina” con el relativamente nuevo sistema de espaldera “Guyot” introducido en las terrazas del Valle de Cembra (cortesía de Luciano Lona).

the aesthetic and ecological profile of original dry-stone walls, but they are preferred by growers because of the low of the low construction costs and the believed higher resistance and capacity to support the weight of heavy machines. The ultimate risk is the adoption of both these practices aimed at maximizing only the productive function of the field by reducing the operational costs, with the vineyard trained as *Guyot* and planted along the lines of maximum slope after the removal of the traditional terraces. This landscape-indifferent management, has a severe impact on the overall architecture of the wine-growing area of the Valley (Zottele & Delay, 2014). On the other hand, the risk of obsolescence or land abandonment due to the low remuneration is still an issue, especially where the fields are not easily accessible or too small (Cosner *et al.*, 2019), with a consequent loss also of the agriculture-correlated environmental and socio-cultural ecosystem services (Di Fazio & Modica, 2018). Climate change is also seen by many farmers as a potential threat to the terraced landscape. In particular, the major concerns are expressed regarding the tendency of meteoric phenomena to concentrate both in terms of frequency and intensity, with consequences on the cultivated slopes that can be observed in terms of increased rill erosion and landslides (Vettori, 2018).

A new opportunity for the local viticulture can be found in the new recognition of the “Valle di Cembra” as a specific sub-area within the regional DOC (Denomination of Controlled Origin) Trentino protocol, which can contribute to increasing the final price of the grapes (Assovini, 2016). The overall good quality of the environment, with riparian and other natural vegetation zones, well integrated with the most intensively cultivated area (Caldonazzi *et al.*, 2014), has to be considered as an opportunity. This especially in the light of the growing importance in the public opinion of agro-environmental issues (Vallés-Planells *et al.*, 2014), which are pushing the policymaker to subsidize the adoption of agro-ecological measures (Wezel *et al.*, 2014). Similarly, it has been statistically demonstrated that consumers associate extraordinary landscapes with high wine quality. The value of the landscape, if properly communicated, may contribute thus to add value to the final product (Tempesta *et al.*, 2010) and possibly create opportunities for income-generating activities related to rural tourism (Di Fazio & Modica, 2018; Vettori, 2018).

4. The impact of policy

Due to their location in remote areas, their complexity, and overall low productivity, terraced landscapes rarely benefit from ad hoc policy measures designed to preserve these territories and make use of the new opportunities they may offer. It emerges the need to promote community-based participatory processes for planning and delivering direct actions (Zoumides *et al.*, 2017) and to reinforce Local Authorities, bringing decision-making and management centres closer to terraced territories

and which possibly subsidies relevant activities (Fontanari *et al.*, 2016; Nardin *et al.*, 2002).

At the regional level, farmers in the Cembra Valley can benefit from agricultural measures foreseen in the PSR (Rural Development Program, within the framework of Pillar 2 – Rural Development Programme of the European CAP – Common Agricultural Policy). PSR is managed by the Autonomous Province of Trento to promote the implementation of the measures foreseen by the CAP for development of agriculture. Both private and public entities can obtain financial support in activities aimed to: promote knowledge transfer and innovation; enhance the profitability and competitiveness of all types of agriculture and promote innovative technologies for farms and sustainable forest management; promote the organization of the food supply chain, animal welfare, and risk management in the agricultural sector; preserve, restore and enhance ecosystems related to agriculture and forests; encourage the efficient use of resources and the transition to a low-carbon and climate-resilient economy in the agri-food and forestry sectors; promote social integration, poverty reduction, and economic development in rural areas (<http://www.psr.provincia.tn.it/>). Although PSR is crucial for the survival of mountain agriculture, no specific measures are foreseen for terraced areas.

A way to get closer to the specific needs of a homogeneous territory and encourage the development of participatory processes is foreseen by the CAP through the LEADER (Liaison Entre Action de Developpement de l’Economie Rurale) programme. The LEADER programme, managed under the umbrella of the PSR, is conceived to promote rural development actions elaborated and shared locally in order to revitalize the territory, creating employment, and improve the general living conditions in rural areas. A LEADER measure is currently open in the Cembra Valley together with other surrounding areas for the 7-years period of the active CAP (2014-2020).

The Autonomous Province of Trento, in the exercise of its special autonomy, has adopted a new regulatory framework with the institution of the “Comunità Di Valle” (CdVs). They are local public authorities provided by the Provincial Law of Institutional Reform (16 June 2006, No. 3), which has identified them as the appropriate institutional level for the exercise of important administrative functions, such as those related to social welfare activities, housing and the right to study, and urban planning. They include several municipalities of the valley in a sort of “umbrella government” bridging the gap between the usually small municipalities and the central Regional government (Guella, 2019). The new CdV of the Cembra Valley brings together 7 municipalities for a total of approximately 11.600 inhabitants (Folgheraiter & Zotta, 2018). It was an important step forward for the territory, allowing the adoption of policies that best meet the particular needs of this area included the peculiarity of the terraced landscape and the need to keep it alive. A successful example is represented by the specific measure adopted by the local CdV to ensure an economic support for repairing terraces failure, counteracting progressive

obsolescence of the landscape. In 5 years, this political measure allowed to support more than 200 direct maintenance and reparation interventions on the terraces of the Cembra Valley (Table 3).

The presence of a recognized local authority may help to design proper policies adapted to the specific needs of the territory, working in closer contact with the economic activities to reach important goals in term of land promotion and certification or product development.

5. Future perspective for the local development

Given the complexity of a terraced territory, the solutions for its maintenance cannot be simple. One sure thing is that it is imperative to preserve the conditions for the continued presence of human activity. All the actors, public and private have thus to develop tools and strategies to guarantee a decent remuneration of the labor on the terraced fields.

The path undertaken by the local viticulture since the 1970s with the adoption of specific production protocols (DOC Trentino, recently evolved in the recognition of the sub-area Valle di Cembra, Assovini, 2016), the adoption of new varieties based on zoning (Falcetti, 2007), the innovation in the enological sector and grape processing, and the promotion of local high-quality wines undoubtedly contributed to increase successfully the intrinsic quality of wines and the derived income for the growers. Nevertheless, as reported by the farmers interviewed by Vettori, (2018), the higher production and maintenance costs in terraced areas are not yet matched by higher product prices, resulting in a lower competitiveness of the terraced viticulture. To reduce this imbalance, the sole solution cannot be an attempt to reduce production costs. Although some margin do exist by introducing a certain degree of mechanization, and the consequent adaptation of the land to improve its functionality to allow small-sized machines to enter the fields has to be accepted, there will be no chances to compete on this side with viticulture of the

low-land districts. Forcing the new vineyards in this direction would cause a distortion of the territory, arising hydrogeological issues and compromising the other social and environmental values of the traditional terraced landscape.

A more promising solution, able to influence positively the wider community, is to start a new path which focuses on the landscape, extending the concept of quality from the wine to the whole territory. Taking advantage from the current institutional and socio-economic state-of-art of the valley and the increased attention of the consumers on ethical and environmental issues (Di Fazio & Modica, 2018), we encourage a sort of collaboration public-private for the adoption of landscape management practices able to improve the environmental and social ecosystem services of the terraced landscape, increases the long-term sustainability of viticulture, improves the social acceptance of agricultural practices, and enhance the ability of the territory in attracting people both as visitors and as inhabitants. This process should concentrate on keeping the aesthetic and cultural value provided by the traditional landscape, without impairing the productive nature of viticulture. Concrete steps in this direction were taken in the Cembra Valley though several initiatives: (i) the constitution of a committee made of local public authorities together with private companies aimed to certify the “heritage status” of the local rural landscape by applying to the initiative of the Italian Ministry of Agriculture “National Register of Historic Rural Landscape” (Agnoletti, 2011) and possibly to the FAO initiative “Globally Important Agricultural Heritage System” (<http://www.fao.org/giahs/en/>); (ii) the adoption of the tool “Rete di Riserve” over the wider area of the Valley, that will help to manage and preserve the natural areas within or close to the wine-growing area of the Valley (Figure 3) in accordance with the agricultural needs and with the active participation of farmer representatives (Caldonazzi *et al.*, 2014); (iii) the constitution of a provincial school of dry stone building to preserve and promote the culture of this building art in the Province of Trento (Sarzo *et al.*, 2017), well before it was inscribed

Table 3. Summary of the local measures to support the maintenance and reparation of dry-stone walls adopted by the “Comunità Valle di Cembra” (personal communication of the CdV technical officer ing. Franco Marchi).

Tabla 3. Resumen de las medidas locales de apoyo al mantenimiento y reparación de los muros de piedra seca adoptadas por la “Comunità Valle di Cembra” (comunicación personal del oficial técnico del CdV ing. Franco Marchi).

Calls	Number of applications	Total amount of the requests (€)	Number of applications accepted	Budget financed (€)	Number of interventions completed	Total loans granted (€)
2014	40	97,712.10	40	97,712.10	39	95,115.30
2016	67	173,461.00	67	173,461.00	62	158,627.00
2017	56	140,226.60	28	68,409.00	20	49,621.58
2018	40	102,805.28	40	102,805.28	30	78,075.28
2019	65	159,624.88	47	114,541.88	–	–
Total	268	673,829.86	222	556,929.26	151*	381,439.16*

* the total amount is referred to four years only. The application accepted in 2019 have not yet been accounted for.

on the Representative List of the Intangible Cultural Heritage of Humanity in 2018 (<https://ich.unesco.org/en/RL/art-of-dry-stone-walling-knowledge-and-techniques-01393>).

All these participatory processes, which include farmers as pivotal stakeholders, may significantly increase the overall quality of the landscape, allowing the rural community to correctly interpret the new roles is charged to, in terms of keeper of traditions, biodiversity, local identity and distinctiveness. A proper management of rural landscape, which ensure a future to the past, may not only have a positive return of the primary wine production function, but also support new activities in the field of tourism, recreation, environmental education and so forth, ultimately improving the livability of the territory.

6. Conclusions

Terraced landscapes are the result of the continuous interaction between human labor and nature, with the objective of making possible food production based on native resources despite unfavorable environmental conditions. The product of such a collective, long-lasting project is as

complex and evocative landscape, intrinsically sustainable and capable to produce several positive ecosystem services (Di Fazio & Modica, 2018; Lasanta *et al.*, 2017; Paolazzi, 2018; Tarolli, 2018; Zoumides *et al.*, 2017).

Modern agriculture has imposed new challenges over the years. For its part mountain agriculture must, therefore, adapt to new requirements, taking care not to compromise the original heritage character of the landscape, including the positive environmental and socio-cultural ecosystem services it provides for the community. Subsidies may be a good option to overcome the higher costs when starting a new farm business as well as to sustain the building and maintenance of infrastructures (like dry stone walls, roads, irrigation system), but in general, the system must be able to maintain itself on the market. For this reason, innovation in the production system should follow the principle of “sustainable intensification” (Baulcombe *et al.*, 2009; Rockström *et al.*, 2017; Tagliavini *et al.*, 2019), introducing more knowledge per hectare in order not to impair yield quantity and quality, and applying low labor-intensive agroecological practices to ensure the long-term sustainability of viticulture (Wezel *et al.*, 2014). Innovation in the products is also welcome, especially if it allows to increase the added value of the



Figure 3. Winter view of the Cembra Valley's central part (courtesy of Nicola Piffer).
Notes: (a) the terraced wine area is comprised between the level of the villages (Cembra and Faver in the picture) and the canyon formed by the river Avisio; (b) the presence of snow highlights the different slope aspect of the fields, creating conditions for different varieties to be grown; (c) the areas covered by forest surround the vineyards and spots of natural vegetation are present within the terraced cultivated area; (d) the mountain chain on the backside is the UNESCO heritage Dolomiti di Brenta.

*Figura 3. Vista invernal de la parte central del Valle de la Cembra (cortesía de Nicola Piffer).
Notas: a) la zona vinícola en terrazas está comprendida entre el nivel de los pueblos (Cembra y Faver en la foto) y el cañón formado por el río Avisio; b) la presencia de nieve resalta el aspecto de las diferentes pendientes de los campos, creando condiciones para el cultivo de diferentes variedades; c) las zonas cubiertas de bosque rodean los viñedos y hay manchas de vegetación natural dentro de la zona cultivada en terrazas; d) la cadena montañosa en la parte posterior es patrimonio de la UNESCO Dolomiti di Brenta.*

products and the income for the farmer. Adopting the proper management practices to ensure a quality landscape is thought to represent a driving force for sustainable, long-term development, capable to improve the awareness of local identity and to foster the multifunctional nature of agriculture.

Political actions, especially from the closer local authorities, have a pivotal role in reaching goals of development, increase the competitiveness and attractiveness of the whole territory and improve the well-being of the local population. The “*Comunità di Valle*” public entity seems to have the right level of proximity to the territorial needs, to perform this activity successfully. The adaptation process of modern agriculture on terraces have to be monitored, in order not to compromise the traditional setting of the terraced viticulture and ensure, or possibly enhance, the production of positive environmental externalities for the whole community also in the future.

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