

# Douro wine-tourism engaging consumers in nature conservation stewardship: An immersive biodiversity experience

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**Abstract.** Wine tourism is a growing revenue side-stream for wine businesses and regions. It complements wine with a context of landscape, gastronomy, culture and history. Wine tourism generates an experience that transcends the material nature of wine. In 2022, the UN will hold the COP15 of the Convention for Biological Diversity (CBD) aiming to reverse nature and biodiversity loss, making the world nature-positive by 2030 and planning for full recovery by 2050. Wine tourism develops the engagement of consumers with wine in its intangible dimensions enriching the experience offer with a further field: biodiversity and nature stewardship. We propose wine tourism may be used to educate consumers about the need to protect nature, ecosystem and biodiversity of those places where wine is produced and the global sustainability benefits that may be derived from that protection. We created a wine tourism offer package for a biodiversity trail set in a 70-hectare vineyard in Douro, a UNESCO world heritage site. In this work, we describe how scientific information was used to create the trail elements and educational information, to engage consumers as nature conservancy stewards and advocates.

## 1 Introduction

Wine tourism is a growing revenue side-stream for wine businesses and regions. Besides complementing the wine product with a context in which landscape, gastronomy, culture and history enrich its tangible value with intangibles, wine tourism generates an experience that transcends the material nature of wine, converting it into an experience.

Even though the pandemic years represented a lull in the development of this activity, the return of tourists to Portugal since the end of 2021 promises to continue the growing trend wine tourism was knowing until 2019.

In 2022, the United Nations (UN) will hold the Conference of Parties (COP15) of the Convention for Biological Diversity (CBD) aiming to reverse nature and biodiversity loss and make the world nature-positive by 2030 and full nature recovery by 2050. At the same time, the European Union (EU) Biodiversity Strategy for 2030, a core part of the European Green Deal, proposes to reverse the decline of pollinators, restore degraded ecosystems, stop damaging nature and establish a minimum of 10% of farmland with biodiversity-rich landscape features.

Wine tourism may continue to develop the engagement of consumers with wine in its intangible dimensions furthering the experience offer and providing a further field to be added: biodiversity and nature stewardship. Sustainability has been increasingly referred as a major way to involve wine tourists with the wine regions they visit and to add a driver for trust in authenticity, quality and sustainable practices used by wine producers. Going one step further, we propose wine tourism may be used to educate consumers about the need to protect nature, ecosystem and biodiversity of

those places where wine is produced and the global sustainability benefits that may be derived from that protection. The goal being to convert wine tourists as stewards through their choice of wines produced in respect of nature, ecosystems and biodiversity and therefore promoting the choice of nature-positive wines. Combining all these elements, we have created a wine tourism offer package for a biodiversity trail set in a 70-hectare vineyard in the Douro wine region, a UNESCO-listed evaluative landscape world heritage site. Research conducted over more than 10 years on local biodiversity and nature conservation sustainable practices was used in the definition of the trail stops and the educational information provided at each stop totem. The trail was designed to provide a one-hour easy walk immersing visitors directly inside the vineyard and allowing them to see, hear and smell features of the species native to the surrounding ecosystem, while always ensuring their safety and comfort.

In this work, we describe how scientific information was used to create the trail elements and educational information, providing an extra, memorable dimension to wine tourists meant to engage them in sustainable choices as nature conservancy stewards and advocates.

## 2 Background

Sogrape is a leading wine company headquartered in Portugal and with production operations spanning 5 countries and 3 continents. Farming more than 1000 hectares in Portugal, of which 614 in the Douro Wine Region (DWR), Sogrape adopted integrated production (PRODI) certification across all its vineyards for more than 20 years.

In this scope, Sogrape has for long been promoting

functional biodiversity and ecosystem services as a part of its farming management strategies. One of the sites where several biodiversity-related projects were deployed was Quinta do Seixo, a 70-hectare property located in the central part of DWR, on the south bank of river Douro.

Between 2010 and 2015, in a partnership with different stakeholders, among which Associação para o Desenvolvimento da Viticultura Duriense (ADVID) and Universidade de Trás-os-Montes e Alto Douro (UTAD), Sogrape adhered to Syngenta's Operation Pollinator<sup>1</sup>, an international biodiversity program to boost the number of pollinating insects on commercial farms. At Quinta do Seixo, vineyard terraces and respective embankments were populated with several plant species (grasses, legumes, native shrubs) to create ecological corridors allowing for increasing the number of beneficial pollinating insects, supporting overall animal biodiversity and buffering soil and water resources against the effects of erosion, an action that was the subject of discussion in the European Parliament [1]. Concurrently, for LIFE+ BIODIVINE project [2,3] trials were setup in the same property for different types of inter-row ground covers, to assess arthropod diversity [4], landscape management and overall biodiversity and ecosystem services [5]. Results from these and other trials were progressively integrated in the farming practice at the property, becoming part of the practices deployed and certified under its Integrated Production strategy.

A third project, ECOVITIS - Maximizing Eco-services into Douro Demarcated Region Vineyards<sup>2</sup> executed in nearby vineyards, adapted potential ecological infrastructures, to create more tailored ones for the promotion of ecosystem services they provide. Knowledge from this project further enriched farming practices at the property and was fundamental in understanding the fundamental supporting role of biodiversity for local farming [6].

Consumer trends towards interest in sustainability and biodiversity together with awareness of the values of nature and ecosystems have also become a recent focus of research attention [7]. Recognizing this trend in markets, several wine companies have been using nature and biodiversity themes for the naming and branding of their wines. Coupled with tourism and hospitality facilities in wine regions, these cues become powerful vehicles for communication from producers to consumers, in line with the UN's Sustainable Development Goal number 12: ensure sustainable consumption and production patterns (SDG12).

### 3 Material and methods

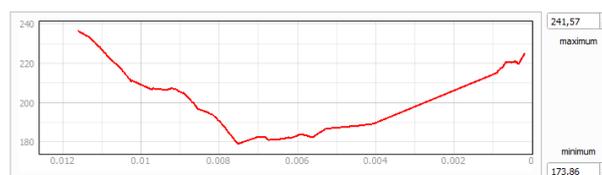
The elements of several trials made during projects Operation Pollinator (hedges, embankment covers) and Biodivine (endemic shrub trials, landscape elements, biodiversity assessments) that remained in Quinta do Seixo were mapped in a geomatic data model using

Quantum GIS (QGIS)<sup>3</sup> software together with all elements in the property that were identified during the latter project as relevant for functional biodiversity (dry stone walls, riparian zones, olive groves, orchards, social areas, water lines, scrubland). The model was completed with vineyard block limits, public, private and service roads and elevation contour isolines. All elements were integrated in shapefiles of point or polygon geometries according to the most convenient representation. A drone-based high-resolution (20 cm/pixel) RGB orthoimage of the whole property was added to the model as a raster file (GeoTIFF). The model used the coordinate reference system WGS84 (World Geodetic System 1984 as revised in 2004).

The model was used to analyse the distribution of all elements in the property ecosystem and specifically to design a pedestrian pathway that could be walked along them by the shortest route possible, so that visitors could use it as a self-guided visit to the property without becoming too time consuming. Other considerations were to lessen as much as possible the difference in elevation between the highest and lowest point along the pathway to make it accessible and inclusive, provide the best possible view over the surrounding landscape, and avoiding areas of farm vehicles traffic yet taking visitors as much as possible inside the vineyard. Finally, the pathway had to start and end near visitor facilities: reception, car parking areas, restrooms, tasting room and shop.

Information stations were defined at all points of relevance for local biodiversity. To be resistant and lasting under the extreme weather of the Douro region, information totems at each station point were made of 2-mm thick thermo-lacquered metal coated with epoxy resin, texts printed with silkscreen and high-resolution images printed on 3-mm Alubond<sup>TM</sup> 7-cm disks to be fixed on the totems. The sides of the 1,6-m tall totems were cut-out with animal figures and decorated on the top with a natural silhouette (leaf, bird, insect) and a basket for bird nesting.

The pathway resulting from the analysis was 1.15 kms long. Using a QGIS-based elevation profile analysis, we found the elevation difference between the highest and lowest points to be 67.7 metres and the average slope 5.9% (Fig. 1), higher in the descending leg than in the ascending one. These characteristics made for an accessible and inclusive trail adapted to children and senior visitors to conclude the pathway in little over one hour.



**Figure 1.** Elevation profile of the biodiversity pathway. x-axis indicates distance in 10<sup>2</sup> kilometres and y-axis indicates elevation in metres.

<sup>1</sup> <https://www.syngenta.com/en/sustainability/operation-pollinator>  
<sup>2</sup> <http://www.ecovitis.utad.pt>

<sup>3</sup> <https://www.qgis.org>

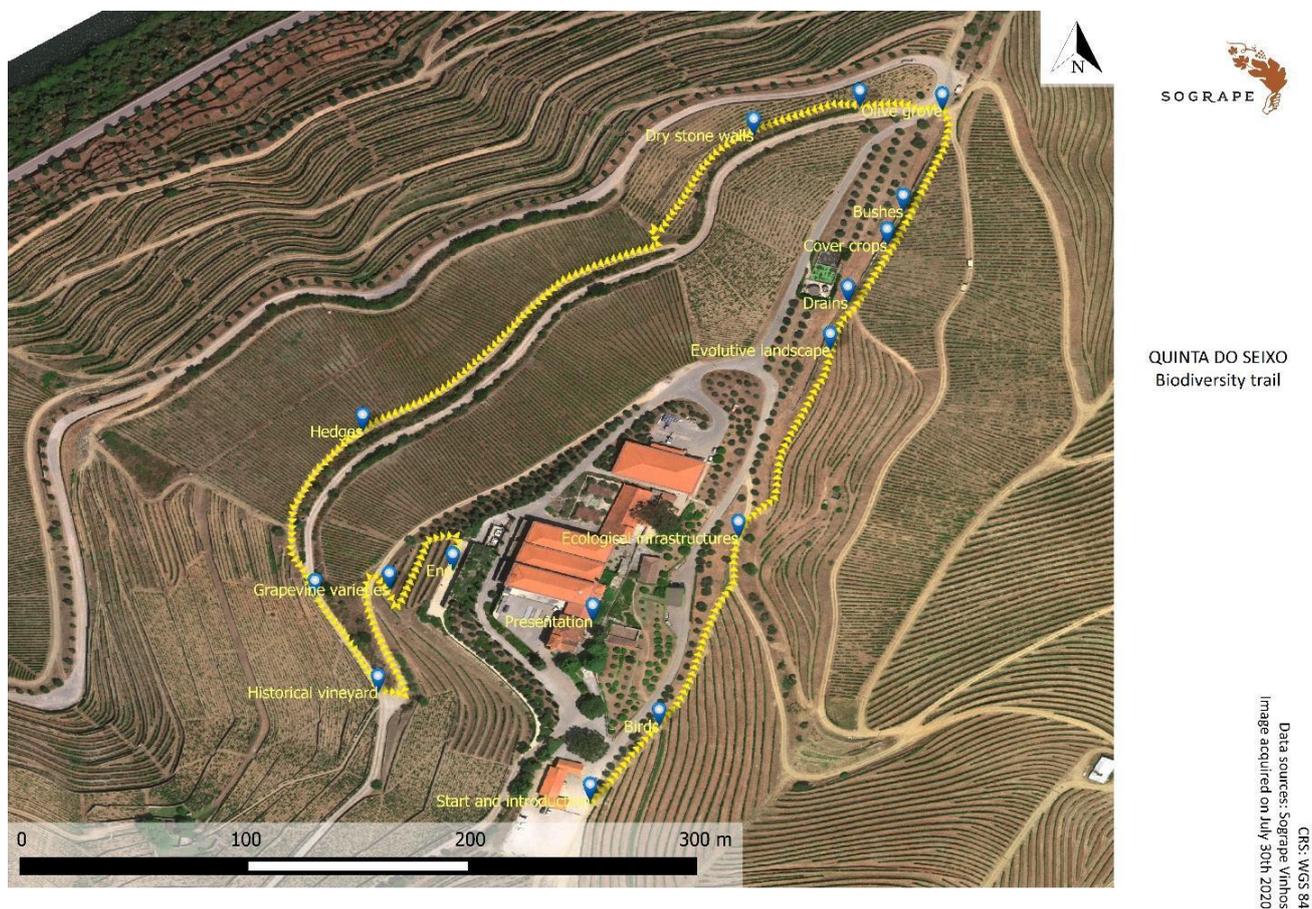
For safety reasons, the pathway was unavailable any time farming operations involving machinery traffic or plant protection products were active near it. Comfortable shoes were recommended by the hospitality staff onsite. A fee was charged to visitors wishing to take the trail who received a map, a bottle of water and hats and were proposed a wine tasting once they completed it. Along the pathway, 14 information station points were strategically chosen to place visitors in direct contact with biodiversity and ecosystem elements allowing them to have an immersive and educational experience of nature-based solutions being used for viticulture and wine production management (Fig. 2).

At each station point, an information totem was created with text and visual information. Bi-lingual (Portuguese / English) texts for each totem described the biodiversity and ecosystem elements to be appreciated at each station and pictures displayed the relevant species/features to be found there. Both texts and pictures were based on the scientific knowledge gathered from the three aforementioned projects, summarized and edited to

become accessible, attractive and pedagogical for non-technical people. An immersive sensory experience was proposed by incentivizing visitors to interact by seeing, hearing, smelling, and touching around them as they walked the pathway. Texts for each totem are detailed below.

### Totem 1: Introduction to biodiversity

The Portuguese valley of river Douro displays remarkable biodiversity because of relief, geology and climate and its remote history. Shaped geologically since more than 300 million years, it displays shale soils limited by granitic soils, both having adequate conditions to support plants from different species. Altitude climbing abruptly from the river level to above 1000 metres in steep slopes, with solar incidences from all compass points, conserving rainwater irregularly and through preferential paths, creates highly variable microclimates sheltering many diverse species.



**Figure 2.** Map of the biodiversity pathway (yellow line, arrows indicate sense) and placement of informative totems (blue pins).

Continental drift for last 100 million years brought this valley from equatorial latitude to a temperate zone, retaining tropical species, such as the strawberry tree. In the last million years, numerous other species were added. During many Ice Ages, soils freezing southwards in Europe pushed species such as cedars, maritime pines or birches ahead of them to the Douro narrow and protected valleys, a refuge from where they migrated

back northwards once the ice receded. Consecutive Ice Ages brought wave after wave of new species of plants, animals, fungi, lichens and microbes, climate refugees enriching local biodiversity in organized natural ecosystems.

Human influence from farming added to local biodiversity. Grapes, olives, almonds or figs in slopes and apples, cherries, chestnuts and cereals in high plateaus

were farmed as a landscape mosaic interspersing cultures and natural shrublands at harder or steeper soils and, especially, as a natural protection against erosion. Even in farmed areas, structures such as dry-stone walls or small water ponds became biodiversity refuges, offering shelter, water and nutrients. Farmers conserved the genetic diversity each crop developed over time to adapt to microclimates and soils, allowing for extending farming to all the valley and buffering against climate extremes, pests and diseases. Today, the Douro Wine Region has one of Europe's richest grape diversities, 115 varieties authorized to produce Port and Douro wines.

When hiking this biodiversity trail in Quinta do Seixo you will be immersed in the local nature and biodiversity riches. Be sure to see, hear, smell and touch as you go. In the end, you will understand how human and natural elements are harmonized in sustainable viticulture to conserve the vineyards and region's ecosystems. In this way, we keep the tradition of continuously innovating the tastes of our famous Sandeman Port wines.

### **Totem 2: Birds**

Birds play an important role in the control of pests associated with the vineyards, olive groves and other Mediterranean cultures, and provide ecological functions such as the dispersal of wild plant seeds, the maintenance of biodiversity and the attractiveness of the landscape, with their colours and sounds. These functions are enhanced through the protection of the natural and semi-natural habitats, including the maintenance of vegetation between vineyard rows, the creation of small clumps, the adequate management of hedges and walls and the sustainable use of plant protection. Birds are also indicators of ecological integrity, responding to different environmental pressures, thus revealing changes in the structure and functioning of ecosystems. Here, stop for a few minutes in silence and listen to birds, while trying to spot them.

### **Totem 3: Ecological infrastructures**

Ecological infrastructures (EI, Fig. 3) – also known as ecological compensation areas – are areas whose correct use increases the biodiversity facilitating ecosystem functions that promote sustainable agricultural production (e.g., protection against soil erosion and pests), and which also benefit the environment, at regional and global scales, and society as a whole (e.g., water conservation, climate regulation, conservation of aesthetic and cultural values). Examples of EI are cover crops in the soil, stone walls, woodlands, hedgerows and wild-flower strips, here visible in the landscape.

### **Totem 4: Evolutive landscape**

The evolution of the complex Douro's landscape entailed the transformation of the natural spaces and the conversion of many areas of natural vegetation into Mediterranean cultures such as vineyards, olive and almond groves. Several populations crossed this region, developing the knowledge of cultivating vineyards along

steep and rocky slopes in extreme environmental conditions. Stone removal and terraces supported by schist walls facilitated the implementation of the vineyard, now enhanced with new plantation systems ("terraces" and "vertical-row"). The construction of retaining walls, houses and small barns, roads and paths is indelibly linked to Douro's vineyards. Created in 1756 and consecrated in 1921, the Douro Demarcated Region is the oldest wine appellation in the world. It includes three sub-regions: Lower-Corgo, Upper-Corgo and Douro Superior totalling 250 000 hectares. In addition to the great economic importance of wine production, these landscapes have a particularly rich natural history. In 2001, 24 600 hectares were classified as UNESCO World Heritage Site, a "continuously evolving cultural landscape", the Alto Douro Wine Region. This is the scenery that can be appreciated from this overlooking point of the particularly beautiful landscape of the Torto River, one of the Douro's tributaries, winding at the bottom of a valley where high-quality wines are produced.



**Figure 3.** One of the 14 information totems along the pathway.

### **Totem 5: "Pilheiros"**

"Pilheiros" (drains) are holes at the base of stone walls that favour the flow of rainwater, maintaining the integrity of the wall, even in situations of heavy rain. These and other smaller holes on the walls play an important role in preserving the vineyards biodiversity, as they are places of shelter for numerous species of flowers and animals, some of them natural enemies of grapevine pests. These cavities and crevices provide favourable conditions for sheltering various species of reptiles (lizards, snakes), mammals (hedgehogs and shrews), birds, spiders and insects, including wild bees, beetles and ants. Looking carefully at the holes on the walls, you can see some of these animals and flowers, which vary throughout the year. Observe without disturbing them.

### **Totem 6: Cover crops**

It is common to find, in a vineyard in the Douro Region, around 10 to 30 species of plants. When this natural vegetation (natural cover or sward) has diversity and functional value, its growth is promoted, as it is perfectly adapted to the local soil and climate conditions. The existence of a vegetation cover helps to reduce erosion and preserve soil health, as it reduces the speed of raindrops before they reach the soil, preventing splash effects and loss of nutrients. On the other hand, the presence of a diversified cover crop shelters an abundant diversity of natural enemies of vine pests (predators and parasitoids), providing food (pollen, nectar, alternative prey, water) that keeps them in the vineyard block. Another advantage is the improvement of soil fertility, its structure and its capacity to retain water, a scarce resource in this region. Here, lean over the floor of the vineyard and enjoy the diversity of herbs that you can see. With a little luck, you will see some crawling insects (ants, beetles). Observe without disturbing.

### **Totem 7: Douro's vegetation – shrub layer**

The tall shrub layer is dense and biodiverse, with a dominance of Cistaceae, Ericaceae, Fabaceae, Fagaceae and Oleaceae. In “Lower Corgo”, junipers and strawberry trees (*arbutus*) accompany the more arboreal formations, while in the “Upper Corgo” and “Douro Superior”, due to increased continentality, junipers and smaller sized holm-oak and Portuguese-oak prevail. Near water lines some willows appear. Numerous species of Asparagaceae, Caprifoliaceae, Fabaceae, Ericaceae, Labiateae and Rosaceae dominate the medium-low shrub stratus. The allochthonous sumac establishes itself at the edges and disturbed areas. In this hedge, along the wall that follows the path down, you can see hawthorn trees, strawberry trees, dog roses, cistus, rockroses, typical shrubs of this area of the Douro, adapted to the semiarid conditions, prevailing here. In spring, its flowers are attractive to a large number of insects, providing them with food and shelter. These insects protect grapevines from the main pests affecting it, reducing the need to use protection products. Follow the hedge and observe, according to the moment of the year, the different leaves, flowers and fruits of each present and referenced species.

### **Totem 8: Olive grove**

In the Douro Demarcated Region, olive groves are traditionally exploited as a secondary crop, located in small patches or in rows planted along the limits of vineyards. This crop is important as an element of the landscape mosaic of Alto Douro Vinhateiro, classified by UNESCO as a World Heritage Site since 2001. At Quinta do Seixo, the olive grove occupies about 14.5 ha and the main varieties are Cobrançosa, Negrinha de Freixo, Molar and Preta. Scattered olive trees and patches of olive groves, which are farmed under integrated production mode, contribute to the biodiversity of the viticultural ecosystem, serving, for example, as shelter for arachnids and resting place for birds. Rest for a few

minutes in the shade of these trees, listen to birds singing and the whisper of wind in the leaves, but do not give in to the temptation of tasting an olive: it would be an unforgettable experience... for the worst reasons.

### **Totem 9: Arthropods – insects, spiders, mites**

Arthropods are one of the most diverse and successful groups of multicellular organisms on the planet. Although including numerous crop pests, many of them play a dominant and vital role in the functioning of ecosystems, contributing to important ecological functions. For example, by behaving as predators, parasites or parasitoids, many arthropods limit the development of populations of crop enemies, including of grapevines [6].

By breaking up and pre-digesting excrements, dead plant and/or animal matter, some species stimulate and accelerate the decomposition of organic matter, improving soil fertility. Many species are pollinators, assuming great importance in agricultural production and plant diversity.

Observe in these bushes the tireless work of pollinating insects.

### **Totem 10: Dry-stone walls**

The dry-stone walls are juxtaposed stone constructions made by man, without the use of connecting elements, just local stone, usually schist. These walls were hand-built in order to provide a less steep surface where grapevines could be farmed, being later filled with earth from the slope. These walled terraces are one of the manmade elements, which most contribute to the uniqueness of the Alto Douro Vinhateiro landscape. The dry-stone walls are essential to allow farming of vineyards on the slope. This is the most sustainable system, in what soil conservation is concerned, as it reduces the effect of erosion, of losses from superficial runoff and risk of landslides, allowing for greater water infiltration and the replenishment of the watercourses. Observe the careful introduction of smaller rocks in between the larger ones to provide higher robustness to the whole set [8].

### **Totem 11: Hedges**

Hedges are rows or groups of trees, shrubs and herbs growing or planted along unfarmed areas, such as crop block limits, roads, fences or other. Hedges perform multiple ecological functions: they serve as habitat for auxiliary fauna, promoting natural pest control and shelter for wild fauna; they provide protection against the effect of rain and erosion, wind or heat; they control unwanted floristic species (weeds); they stabilize and - filter watercourses, increasing water infiltration into the soil; they serve as a buffer zone, reducing plant protection drift; they function as a landscape element beautifying leisure areas, or hiding dissonant elements. Hedges also function as ecological corridors, allowing the passage of many species among cultivated areas and connecting wild areas that are thus not isolated. Observe the natural biodiversity of species in this hedge. They complement

each other for ecosystem functions.

### **Totem 12: Mating disruption against the European grapevine moth**

The European grapevine moth, *Lobesia Botrana* (Lepidoptera: Tortricidae), is a small moth whose larvae inflict damage to flower buds and grape berries. Bacteria and fungi develop rapidly on damaged berries, causing bunch rot that substantially degrades wine quality. Pheromone-mediated mating disruption (natural aromatic substances that insects use to find the opposite sex) is among the most environmentally friendly treatments used to manage and control insect pest populations. Its goal is to interfere with pheromone communication and mate finding between males and females. If female moths do not mate, they cannot lay fertile eggs, thus reducing the number of damaging larvae within vineyards [9].

### **Totem 13: Historical vineyard**

The historical vineyard of Quinta do Seixo is a centenary vineyard, with a plantation in traditional terraces, a high planting density and a mixture of a high number of grape varieties. The blending of grape varieties in the vineyard, a traditional method, originates greater heterogeneity resulting in greater complexity for the wine produced from this vineyard. This way, each variety contributes with its characteristics, complementing each other. With several varieties, a longer period of flowering is also achieved in the whole vineyard, which promotes greater success in the fruit set ensuring stable yields. Old vineyards also show less sensitivity to climate change, with a gain in resilience and consequent sustainability.

### **Totem 14: Grape varieties**

In the Douro Wine Region, there are more than 100 white and red grape varieties identified and authorized to produce Port and Douro DOC wines. At Quinta do Seixo, we find a mixed plantation including high quality, traditional Douro varieties, such as Touriga Nacional, Tinta Roriz, Touriga Franca, Tinto Cão and Tinta Barroca. Among these, we highlight Touriga Nacional, which is a variety excelling in colour, aromas of black fruit and orange blossom and structure in the mouth. We also find varieties with smaller areas of planting, but also traditional of the Douro, such as Sousão, Tinta Francisca, Touriga Fêmea, Donzelinho Tinto, etc.

## **4 Discussion**

Several authors have highlighted the role of wine tourism as a form of sustainable tourism [10]. By asserting wine as a cultural asset integrated in a wider space that includes traditions, know-how, landscape and communities, wine tourism is viewed favourably by local citizens and perceived as a driving force for the economy, besides being a sustainable model for development [11].

Linking a space and its landscape with wine confers upon the latter a sustainable image in the minds of visitors, a strong point of brand differentiation, especially for remote, rural areas like the Douro Valley [12]. Conversely, sustainable tourism seems to be indispensable to economic growth [13] generating a symbiotic relationship between wine as a product and local/regional socioeconomic development mediated by the use and communication of sustainable production practices.

A wine tourism product, integrated in the regional landscape, while maintaining the complexity of that same landscape through the conservation of biodiversity in non-productive areas, (e.g., hedges, groves or walls), blends environmental, social and economic benefits, promoting resilience of local networks and, inherently, the sustainability of local wine businesses [14]. But, more importantly, it has been proposed that higher biodiversity makes people happier [15], translating as a shared higher quality of life for both locals and visitors.

In the biodiversity pathway of this work, the chosen itinerary, the self-guidance, the subjects highlighted in the information stations, the design of the totems and chosen images, all combined to propose visitors a fun, educational and enriching experience meant to engage as much of their senses as possible, a demonstrated way of creating lasting memories [16].

After the pathway, visitors were proposed to taste the wines of this sustainable environment in a setting that promoted and educated about responsible consumption, while gazing at the surrounding landscape. Serving local food from biodiversity elements present in the visited landscape (olives, fruits and preserves, herbs, etc.), proposed the consumption of wine with food, securing its rightful place in the Mediterranean diet [17]. The happy experience, thus, became a bond between visitors and producers, contributing to achieve the UN's SDG12<sup>4</sup>.

Furthermore, raising awareness of the elements of biodiversity, conserved and managed in the scope of sustainable farming, means a decisive step towards achieving the much-needed reversal of biodiversity loss by 2030 and becoming a nature-positive world by 2050, an agreement reached by the governments of 152 countries that should be the basis for the post-2020 global biodiversity framework [18]. Recognizing the urgency for more ambition, namely because of the importance biodiversity conservation holds to achieve global climate mitigation and adaptation objectives [19], visitors to the biodiversity pathway were given first-hand insights into how conservation ambition can be feasible by sustainably farming commercial vineyards underpinning a successful wine business. The memories left from the experience, including the tasting of wine, became an on-site verification of nature-positive actions, trumping over any traceability system for credibility and trust [20]. It is thus expectable that visitors will be nudged in future purchasing decisions towards preference of wines they have tasted and had direct confirmation of biodiversity conserving production practices [21].

<sup>4</sup> <https://sdgs.un.org/goals/goal12>

## 5 Conclusions

Our work proved possible and desirable to present wine consumers, while visiting the production area, scientific information on nature, biodiversity, ecosystems and sustainable production. Framing that scientific information as a wine tourism product, taking care to use attractive contents in supports and formats suitable for open-air displays, in safe and comfortable conditions, was essential to capture their interest.

Nature-positive approaches are based on bottom-up and territorial processes. Translating science into action requires sensible judgement and correct choices on which scientific findings and data resonate with the common citizen. In return, a successful result paves the way for fruitful cooperation between the public and private sectors in achieving reversal of biodiversity loss, by replicating the product and extending its reach. Through word-of-mouth, the biodiversity pathway may become not just a product for visiting wine consumers but also a tool for farmers and vocational education systems helping close the large gap between the scientific and practical knowledge in the grape and wine industry where co-learning with consumers is invaluable [22].

In its short existence (3 months at the time of writing), the biodiversity pathway has proved attractive for a significant number of visitors (270), demonstrating the interest wine consumers have for this type of experiences involving contact with nature in the setting where wines are produced. The demographics most interested were young adults and small families demonstrating prior interest for nature tourism. Besides the expectable Portuguese visitors (because of proximity), the countries of origin of most visitors were France, the Netherlands and Germany. Capitalizing that interest will be critical to engage visitors as stewards of biodiversity conservation and active actors of an essential social-wide awareness of the need to recover a nature-positive world.

Further research will be able to gain insights on the aspects most valued by visitors, the impact the pathway had on their education, understanding of the value of biodiversity and perspectives for their behavioral change in terms of wine choice and consumption. The role of word-of-mouth and social media for sharing the experience will also be a point of interest for future studies. The pathway is planned to be updated and improved as more scientific data about the local biodiversity becomes available. In shaping these new additions, insights from visitors will be a rich source of precious information.

The immersion provided by the biodiversity pathway to visitors in the landscape and biodiversity of the Douro Valley region may become a major drive towards engaging wine consumers for advocating and promoting nature-positive actions from responsible, sustainable consumption in tandem with sustainable wine production practices.

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