REGENERATE | Interreg Italia–Österreich | Co-funded by the European Union

Environmental impact of tourism in the project area

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Interreg Project "Regenerate: regenerative paths to go beyond sustainability"

Work Package 2: MONITORING THE IMPACTS OF TOURISM POLICIES

Task 2.1: Environmental impact of tourism in the project area

Deliverable: Report on the environmental impact analysis of the four tourism destinations taking part in the project

Report prepared by Etifor | Valuing Nature

January 2026

Project partners

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1. Introduction

1.1. Regenerative approaches to tourism for a prosperous future

Given the continuous challenges tourism faces, stakeholders must rethink their operating models. Regenerative approaches offer a future-oriented vision that goes beyond traditional sustainability, requiring a fundamental shift in mindset to put nature, communities, and places at the center of development. This approach views tourism as a complex system capable of creating multiple values and driving positive change. Key focus areas include:

- **Nature as a stakeholder**: Nature is an active subject, not just a backdrop; it must be included in decision-making and supported in its regeneration.
- **New ways of thinking**: encouraging creative, system-wide thinking that challenges the status quo and seeks local solutions to global problems.
- **Places as dynamic ecosystems**: Destinations are first and foremost homes for communities; tourism must serve the well-being of these territories.
- **Community-led development**: Communities become the protagonists of balanced and lasting tourism development, taking responsibility for territory care.

1.2. The Interreg Regenerate project

To achieve its objective, the Regenerate project aims to **raise awareness in the territories, activate the social fabric, and create a tourism offer** that responds to the needs of the community and the natural environment.

In addition to the main project **partners**, the Consorzio di Promozione Turistica del Tarvisiano, di Sella Nevea e di Passo Pramollo, NLW Tourismus Marketing GmbH, Cooperativa Turistica Alta Badia, and Etifor | Valuing Nature, there are others who participate intensely in the project, namely PromoTurismoFVG and Fondazione DMO Dolomiti Bellunesi. They all work together to **find a new balance between economy and nature, tourist flows, and sustainability for residents**.

The project focuses on:

- **Analysis and monitoring of the environmental, socio-economic, and cultural impacts** of the tourism policies implemented so far, with a specific reflection on the changes related to obtaining sustainability certification according to the GSTC standard.

- **Exchange of good practices**, planning of a **shared communication strategy**, and development of a **"sustainability toolkit"** for stakeholders. Within the project, the effects of tourism on the respective regions are analyzed. Cross-border cooperation allows for the exchange of good practices and promotes innovations that are environmentally respectful, economically sustainable, and community-centric.
- **A co-creation tourism laboratory for local young people**. Finally, the four destinations will try to go beyond sustainability and experiment with an innovative way of co-designing the tourism offer, with local communities, particularly young people, as the absolute protagonists.

The Interreg Regenerate project therefore offers project partners the opportunity to develop a forward-looking tourism concept that is ecologically and socially sustainable through the exchange of experiences and skills. The Interreg project is a step in the right direction to address the challenges of tourism in the Alpine regions, preserving the beauty and value of nature and culture for future generations.

2. Context of the analyses

2.1. General and specific objectives

The Regenerate project includes a work package, or **Work Package** (WP2) **dedicated to monitoring the impacts of tourism policies** in the project destinations. WP2 includes two analyses for each territory: one dedicated to the **study of environmental impact** (*Task 2.1*) and one relating to the **social, economic, and cultural impact of tourism** (*Task 2.2*). The motivation for the creation of WP2 was the lack of detailed research and data on the impact of tourism in Alpine mountain destinations.

Task 2.1, in particular, is the focus of this report. The objective was to measure a specific type of environmental impact that tourism can have in each of the four destinations involved. Each of the destinations, based on its own needs, specificities, and history (i.e., which environmental analyses it has already carried out and which it would like to focus on instead) has decided to investigate the following aspects:

- Alta Badia: **vehicular traffic and noise pollution**
- Arabba & Colle Santa Lucia: **carbon footprint of tourism activities**
- Tarvisiano: **carbon footprint of tourism activities**
- NLW: **waste and its management**

Each partner therefore used a different methodology for its analysis, conducting the investigation and data collection with internal staff or delegating to external professionals.

The evidence collected from the individual destinations converged in four detailed reports, one for each destination, which this report synthesizes (Chapter 4). Since the focus of the analyses is different and comparative analyses cannot therefore be conducted, this document aims to:

- Serve as a future basis for an **exchange of good practices** between destinations that may face common challenges and the eventual **emergence of solutions** to address these challenges;
- Provide considerations and food for thought for **sustainable and regenerative local tourism**.

2.2. Tourism contexts

2.2.1. Alta Badia

Alta Badia is a mountain destination located in the Dolomites, characterized by a landscape of extraordinary value. The area extends over 160 km² and includes two UNESCO World Heritage protected areas: the Fanes-Sennes-Braies Nature Park and the Puez-Odle Nature Park. Tourism plays a central role in the local economy, with almost 500,000 arrivals and over 2.4 million overnight stays per year. Seasonality is marked, with peaks in tourist influx during the winter months (December, January, and February) and summer months (July and August).

2.2.2. Arabba and Colle Santa Lucia

The Arabba (Municipality of Livinallongo del Col di Lana) and Colle Santa Lucia tourist destination, an Alpine area of the UNESCO World Heritage Dolomites, is deeply rooted in Ladin culture. In 2024, it recorded 98,671 arrivals and 419,539 overnight stays, demonstrating a growing international presence. The accommodation offer includes 48 hotel facilities and 267 non-hotel facilities, mainly private accommodations, agritourism, and mountain refuges. Seasonality is bimodal with peaks in summer and winter, reflecting its Alpine vocation and tourism products such as Alpine skiing, snowboarding, hiking, and cycling. Local tourism governance is managed by the Arabba Fodom Turismo Consortium and the Colle Santa Lucia Tourist Association, with the support of the Fondazione DMO Dolomiti Bellunesi and the Dolomiti UNESCO Foundation.

2.2.3. Tarvisiano

The Tarvisiano tourist area, located in Friuli Venezia Giulia, includes the municipalities of Tarvisio, Pontebba, Malborghetto-Valbruna, and Chiusaforte,

coordinated by the local Tourism Promotion Consortium. The territory extends over a vast Alpine area characterized by a rich natural and cultural heritage, located at the crossroads between Italy, Austria, and Slovenia. The destination is closely linked to protected mountain environments and cross-border ecosystems, which make it a key area for sustainable tourism. Tourist flows are highly seasonal, with peaks in both winter and summer related to skiing (Sella Nevea and Passo Pramollo area), hiking, and nature activities, while spring and autumn generally record lower numbers.

2.2.4. Nassfeld-Pressegger See/ Lesachtal/ Weissensee

This Austrian destination covers an area of approximately 1,006 km² in Carinthia and includes important protected natural areas. Natura 2000 sites are found both in the mountains and around the Gail River, along with protected landscape areas such as the one surrounding Lake Weissensee. The region also hosts the Carnic Alps Geopark, which adds significant ecological and cultural value. Tourism is strongly linked to the mountains and lakes, with over 449,000 arrivals and more than 2.2 million overnight stays recorded annually. The area has a high percentage of international visitors, with foreign tourists accounting for about 70% of overnight stays. Seasonality is characterized by peaks in both summer and winter, while April, May, October, and November are the months with the fewest visitors.

2.3. The importance of data for *smart tourism destinations*

Why engage in measurements like those carried out by the four partner destinations? The evolution of the tourism landscape today requires moving beyond models based solely on arrivals and presences to embrace a vision of **stewardship**, where management organizations become directly responsible for the care of the territory. Tourism is in fact a complex phenomenon that not only suffers the consequences of environmental degradation but is also an active part of it through emissions, (excessive) consumption of resources, and pressure on ecosystems. Integrating analyses such as those of the project partner destinations allows for the recognition of this impact and for **moving from a purely marketing perspective to a regenerative management one**, essential for preserving the balance between economic activity and the health of local ecosystems.

To guide this transformation, it is essential to adopt a **data-driven approach** inspired by the European model of *Smart Tourism Destinations*, replacing planning based on feelings with decisions based on objective evidence. Developing a data culture - which includes constant monitoring and compliance with international standards such as the **Global Sustainable Tourism Council (GSTC)** - is not just an act of responsibility, but a factor of strategic competitiveness. A destination capable of measuring and communicating its environmental and social impacts is in fact more

resilient and attractive, transforming measurement into a concrete strategy for continuous improvement to ensure truly sustainable tourism development in the long term.

3. Environmental sustainability initiatives in the destinations

Below are the sustainability initiatives already underway for each destination.

3.1. Alta Badia

The GSTC certification obtained in 2022 kicked off a strategic re-evaluation of sustainability, accompanied by intense stakeholder awareness, aimed at promoting awareness among guests and local stakeholders. In parallel, there was significant involvement of tourism businesses, with many accommodation facilities and ski lifts obtaining certifications such as GSTC and ISO 14001. Another key point was the full integration of sustainability into local strategies and inter-municipal synergies. At the planning level, provincial and local plans such as the Alto Adige Climate Plan 2040 and local climate plans were adopted, supported by the establishment of a joint task force between Municipalities for collaboration on climate policies. Alta Badia already published a report in 2022 that measured its Carbon Footprint according to the international GHG Protocol standard.

The activities implemented include the promotion of the Südtirol Alto Adige Guest Pass for the use of public transport, the establishment of shuttle services for airports and train stations, the Dolomites Ranger program for environmental awareness, initiatives such as EcoHiker and EGA for waste collection and conscious water use, and the involvement of local farmers in sustainable agricultural practices.

3.2. Arabba and Colle Santa Lucia

Arabba Fodom Turismo has demonstrated commitment to sustainability and the promotion of local heritage. The main initiatives include the partnership with Smartway, an e-bike brand, which led to the donation of two e-MTBs to the Carabinieri for patrolling the trails, thus reducing CO_2 emissions and improving environmental monitoring. Furthermore, Arabba is crossed by the HERO Dolomites, a mountain bike marathon that obtained the "Carbon Neutral" certification thanks to emission reduction actions, including a reforestation project to compensate for the carbon footprint. The Fodom Valley, of which Arabba is a part, is also committed to the preservation and promotion of Ladin culture and traditions, contributing to the unique identity of the region.

The Colle Santa Lucia Tourist Association focuses on slow tourism, culture, and heritage conservation. Among the prominent initiatives is the Alta Via dell'Orso, a cultural trekking route that connects the Fedare Refuge to Colle Santa Lucia, emphasizing literature, nature, and environmental awareness. The association plays a crucial role in maintaining cultural identity through the Istitut Cultural Ladin "Cesa de Jan", dedicated to the preservation of the Ladin language and culture of the Dolomites. Furthermore, projects such as the restoration of Malga Castello and the extension of the Strada de la Vena aim to enhance the eastern part of the municipality, actively promoting slow tourism.

3.3. Tarvisiano

The Tarvisiano Tourist Consortium, which includes Sella Nevea and Passo Pramollo, has demonstrated a strong commitment to sustainability and climate action, as evidenced by obtaining international GSTC certification for sustainable tourism and Travelife certification within the European project ETGG2030 (European Tourism Going Green), co-financed by the EU COSME program. The region promotes sustainable mobility through the enhancement of the cycle path and the Alpe Adria Trail, encouraging the use of ecological means of transport. Furthermore, it supports the local economy and sustainable agricultural practices with the MADE project, which promotes the products of local mountain farms, contributing to the local economy and promoting sustainable agricultural practices. Finally, environmental sustainability and social responsibility are also integrated into local events, such as the No Borders Music Festival, which combines live music with cultural and natural aspects. The Festival itself is subjected to an incidence study to evaluate its possible impacts on habitats and animal species, given that it takes place in a Natura 2000 area (Conca di Fusine).

3.4. Nassfeld-Pressegger See/ Lesachtal/ Weissensee

Initiatives include certification according to the Austrian eco-label, designation as a Model Climate and Energy Region with a focus on tourism, and the establishment of a Green Team for sustainable regional development. The expansion of public transport was also planned, with the introduction of digital displays at bus stops, increased frequency, and the provision of specific buses for hikers and skiers, also offering free use of public transport for tourists. Finally, the presence of Renewable Energy Communities, such as the EEG Nassfeld, should be noted.

4. Environmental analyses

As already mentioned in Chapter 2, each destination has decided to focus its analysis on a specific aspect of environmental impact deriving from tourism in the territory. Below is a synthetic report of the methodologies used and the evidence emerged for each of the four analyses.

4.1. Alta Badia: vehicular traffic and noise pollution

Methodology: the study focused on monitoring the acoustic impact and vehicular traffic flows in strategic points of the destination (La Villa, Funtanacia, Passo Gardena). Punctual measurements were carried out using certified sound level meters to detect sound pressure levels (dB) and traffic counts (manual and automatic) to record vehicle volume and type. The surveys took place over four operational days between September 2024 and January 2025, covering both high and low season periods, in compliance with provincial and national regulations on noise pollution.

Key Results:

- The results highlighted systematic exceedances of regulatory noise limits (70 dB) in inhabited areas such as La Villa, even during the winter season. High acoustic peaks (up to 73.6 dB) were recorded at Funtanacia and Passo Gardena, directly correlated with the transit of over 2,000 vehicles during peak hours. A constant presence of motorcycles emerged, even in the autumn months, which contribute significantly to the acoustic load.
- The analysis confirms that the current tourism model, heavily based on individual transport, generates critical environmental impacts both in the residential valley floors and on the Dolomite passes. Leisure-related traffic and high-displacement vehicles are identified as the main cause of the acoustic discomfort perceived by residents and the environmental pressure on high-altitude areas.

Recommendations: the report suggests experimenting with limitations on vehicular access to the Dolomite passes during certain periods and enhancing local public transport (incentivizing the use of the *Guest Pass*). It is also recommended to launch awareness campaigns for tourists (visual feedback on noise and *CO2*) and to establish working tables with stakeholders to co-design a "Mobility Master Plan" for the valley that integrates infrastructure and regulations for more sustainable mobility.

4.2. Arabba and Colle Santa Lucia: carbon footprint of tourism activities

Methodology: the analysis calculated the carbon footprint for the municipalities of Livinallongo del Col di Lana and Colle Santa Lucia, following the *GHG Protocol* and ISO 14064 standards. The study focused on tourist flows considering four main emission categories: tourist travel (round trip), accommodation, meals, and, specifically for the Arabba area, ski lifts. Activity data (km traveled, overnight stays, meals) was converted into emissions using factors from international databases (Ecoinvent, ADEME, Defra) and ISTAT statistics. The reference year for the data is 2024.

Key Results:

- For the municipality of Colle Santa Lucia, total emissions were approximately 6,895 tCO2eq, with transport accounting for 96% of the total impact, while accommodation and meals contributed only 2% each. For the municipality of Livinallongo, total emissions amount to 43,682 tCO2eq. Transport is the dominant source (88%), followed by accommodation facilities (6%), meals (4%), and ski lifts (3%). It should be noted that Arabba and Colle S. Lucia have very different data because their tourism systems are very different: while Arabba concentrates on hotels and ski lifts, Colle S. Lucia relies on widespread non-hotel accommodation.
- The results unequivocally confirm that transport is the main emission hotspot for the destination. The calculation took into account the different origins of tourists, assuming the use of a car for Italian and nearby European travelers, and a plane-car combination for more distant origins, highlighting how distance and the chosen means of transport are decisive for the final impact.

Recommendations: any emission reduction strategy must primarily focus on the transport sector. The difficulty in finding specific local data (besides statistical ones) is also noted, recommending for the future the implementation of more punctual monitoring systems of emission hotspots directly in the territory to refine the analyses.

4.3. Tarvisiano: carbon footprint of tourism activities

Methodology: the analysis adopts a bottom-up approach to calculate the carbon footprint of the Tarvisiano tourist destination, covering 17 municipalities for the year 2023. The methodology follows international standards such as the GHG Protocol and the ISO 14064-1 standard, analyzing six specific modules: Accommodation, Transport, Tourist Consortium, Recreational activities, Public services, and the No

Borders Music Festival event. Both primary data (collected through questionnaires and invoices) and secondary data (ISTAT statistics, databases such as Ecoinvent, and sector studies) were used for the calculation, applying specific emission factors to convert activity data into tonnes of CO2 equivalent (tCO2eq).

Key Results:

- The analysis detected a total of 67,229 tonnes of *CO*2 equivalent generated in 2023. The transport sector overwhelmingly dominates, representing 73% of total emissions, followed by recreational activities (21%). Accommodation facilities and public services have a much smaller impact (2% and 3% respectively). Analyzing the detail of transport, a strong disparity emerges related to the means used: European and international tourists, who use the plane or travel long distances by car, contribute more than local tourists.
- Excluding transport to reach the destination, the greatest impact comes from spending on clothing (31% of residual emissions) and agri-food products (21%), highlighting how the indirect consumption of tourists has a significant weight. The average footprint per tourist was calculated at 116.32 kg of *CO2eq*, with a significant difference between Italian residents (94 kg) and non-residents (126 kg), mainly due to the greater travel distance.
- Seasonal tourism trends are highly relevant: the ecological footprint is strongly influenced by the peaks of summer and winter tourism.

Recommendations: the document recommends prioritizing intervention on mobility, incentivizing public transport, train-bus intermodality, and soft mobility. It also suggests promoting low-impact activities, the consumption of local short supply chain products, and the purchase of eco-sustainable goods. Finally, the need to improve data collection through the involvement of stakeholders and the use of open data platforms to monitor the effectiveness of mitigation actions over time is underlined.

4.4. Nassfeld-Pressegger See/ Lesachtal/ Weissensee: waste production and management

Methodology: the analysis focused on waste production related to tourism, using the municipality of Weissensee as a model because, unlike others, it registers all commercial waste in the public system. Historical quantitative data (2013-2024) provided by the Umweltservice Hermagor entity were analyzed and interviews were conducted with local experts. The methodology involved comparing waste production in low-season months (April/November) with high-season months to isolate and calculate the share of waste attributable specifically to tourists. Furthermore, an annual survey among tourists and residents on the cleanliness of the region was conducted.

Key Results:

- Waste production is strongly seasonal, with low-season months (April, November) recording approximately 8,850 kg of urban waste (~0.39 kg per capita per day) and peak months (July/August) reaching 45,660 kg and 43,750 kg respectively. On average, each tourist produces about 0.34 kg of waste per day, slightly less than the resident population, perhaps due to larger packaging in the food sector. The total volume of regional tourist waste is approximately 765 tonnes per year, with evident fluctuations related to tourism seasonality.
- The perception of cleanliness is positive: surveys conducted among the local population and guests confirm that the destination is generally perceived as clean.
- Regarding disposal, approximately 770 tonnes/year are managed mainly by regional waste disposal service providers (Seppele in the Drau Valley, Rossbacher in East Tyrol) who ensure high recycling rates. The rest is disposed of in landfills or incinerated for energy production.
- The challenges to be addressed are waste reduction and increased recycling through awareness campaigns. The lack of data on waste in open areas (e.g., microplastics in natural areas) remains a critical gap.

Recommendations: the interviewed experts indicate that the margins for improving downstream waste treatment are limited by current regulations. Therefore, the main recommendation is to focus on awareness to make the 770 tonnes of tourist waste as recyclable as possible or to reduce its production at the source. It is also suggested to investigate the problem of waste dispersed in the natural environment (which causes microplastics) in the future, an aspect currently lacking data but crucial for ecological sustainability.

5. Final considerations: towards regenerative tourism?

There is a **common thread** that unites these analyses with the four pillars of regenerative tourism mentioned in the introduction of this document (nature at the center, new paradigms, role of communities, places as dynamic systems), which is that acting on environmental impacts means **making the destination a good place for residents to live all year round, even before it is a good place to visit**. Issues such as the reduction of emissions, noise, traffic, and the waste load primarily improve the quality of life for those who inhabit those places all year round, in addition to those who only visit for a short period.

A clear indication also emerges from the analyses carried out: the transition to regenerative tourism is not only a technical issue, but one of **political *governance***,

social justice, and **new ecological sensitivity**. Destinations are often still in a phase of "measuring the damage" (classic sustainability/mitigation) rather than a phase of "active regeneration" (net improvement of the ecosystem and the community). This is not wrong; on the contrary, it is a first step to guide action. The analyses provide valuable data that, when read through the lens of regenerative tourism, highlight structural discrepancies between the current tourism model and a future where tourism "gives back" to the territory more than it takes. The ultimate goal should be to **use data for care** (of the territory), not just for counting.

5.1. An extractive tourism model

The concept of regenerative tourism is based on the assumption that the presence of the visitor should bring a benefit to the territory. However, the *carbon footprint* and acoustic impact analyses present a critical picture: the environmental "cost" of tourism concretely risks **exceeding the benefit generated at the local level**.

The evidence is clear: in the analyzed territories, **transport** has a preponderant impact on total emissions, reaching 73% in Tarvisiano and touching as high as 96% in Colle Santa Lucia. Not only emissions: in Alta Badia, vehicular traffic causes **noise levels exceeding legal limits** (over 70 dB) in inhabited areas, effectively eroding the peace and the **natural and social capital** that are the basis of tourist attractiveness.

Currently, the tourism model is configured as "extractive": **the tourist imports global emissions (air or car travel) to consume a local resource (landscape and community)**, leaving behind noise and atmospheric pollution as a legacy. A truly regenerative approach cannot be limited to incremental measures like the simple adoption of electric cars, which reduce CO2 but do not solve the problems of traffic, noise, and land consumption. A **paradigm shift is necessary** that includes measures such as de-marketing towards markets of origin too distant for short stays, or the introduction of a prolonged minimum stay to amortize the "carbon debt" of the journey. The Alto Adige data on motor vehicles and "leisure" traffic suggests that **the freedom of individual movement is compromising the fundamental tourist resource**.

Given the severity and systematic nature of the violation of legal limits, the response must be institutional, requiring a **higher governance level** (provincial or regional) capable of imposing radical actions such as traffic blocks or access limitations to the passes. Such measures must not be passively imposed but integrated into a **communication with a clear regenerative narrative**: "We stopped traffic because nature (and the community) need silence." Interviews with residents and operators confirm that there is already broad consensus for the adoption of these limitations.

Finally, the goal cannot be only the efficiency of current flows, but a true reversal of priority in mobility: it is essential to **reduce the volumes of private traffic or**

incentivize its collectivization. In fragile mountain territories, the private car proves incompatible with achieving climate goals and maintaining local well-being.

5.2. Nature as a stakeholder and ecological integrity

The acoustic and traffic analysis in Alta Badia reveals criticalities that go beyond the mere decibel threshold, imposing a regenerative approach. It is fundamental to consider Nature as a "stakeholder": noise data should not be read solely based on human annoyance, but above all in relation to the **impact on fauna**. For example, it would be crucial to cross-reference acoustic data with wildlife monitoring (e.g., displacement of ungulates via GPS collars) to understand how anthropogenic noise fragments habitat and alters animal behavior.

A conflict also emerges between "passing through" and "staying" visitors, highlighting a governance criticality. The DMO can monitor, and somehow manage, those who stay overnight, but has no jurisdiction over traffic crossing the passes (day hikers, motorcyclists). This **"hit-and-run" traffic** does not generate significant positive economic benefits but only discharges damage (noise and pollution) onto the territory.

Moving on to the waste analysis (based on the Nassfeld/Weissensee report), it is noted that, despite the effectiveness of the current management system (separate collection, incineration with energy recovery), the model remains linear or, at most, one of recycling, but not circular/regenerative. The evidence shows the production of 770 tons of tourist waste per year. Although the tourist produces slightly less per-capita waste than the resident (0.34 kg vs 0.39 kg), the seasonal peak is massive. Furthermore, the admission of a "**blind spot**" is alarming: the **lack of data on waste dispersed in the environment (*littering*) and on microplastics at high altitudes**. Investigating these seemingly invisible aspects is crucial, even in the absence of historical data, due to their pervasive and lasting impact on aquatic and terrestrial ecosystems. This makes one reflect on how perceived "cleanliness" (cited in the surveys) does not always equate to ecological health. A regenerative approach is not limited to emptying bins but aims to **eliminate the source of the waste** (e.g., through a ban on single-use items at high altitudes, suggesting the need for source reduction). It should also be noted that, in the Austrian case, the margins for improvement in downstream waste treatment are saturated due to regulatory and technological limits, so the only regenerative path is source reduction (less packaging, less single-use) and strong awareness-raising, transforming the waste problem into an educational opportunity for the tourist.

5.3. Leading the change: leadership and trust

The Carbon Footprint analysis clearly shows that technology alone is not sufficient to guarantee sustainability; the implementation of a solid political strategy is

indispensable. This requires clear leadership and responsibility: calculating emissions is not enough; a **governance that takes political responsibility for implementing effective reduction strategies is necessary**. It should also be added that, to guide action, complex data must be transformed into understandable and usable information to direct decisions, often moving beyond the status of mere technical graphs in a report.

To **make the impact of emissions more tangible**, immediate comparisons can be used, such as car equivalence (one of the many images possibly usable). Considering a medium-sized gasoline car that emits about 150g of CO2 per km, a trip around the world is equivalent to about 6 tons of CO2. On this basis, the 6,895 t of CO2 from Colle Santa Lucia are equivalent to traveling around the world 1,150 times, while the 43,682 t from Arabba correspond to 7,280 trips around the world. From an Italian per-capita consumption perspective (7 t of CO2 per year), the emissions of Colle Santa Lucia are equivalent to the annual lifestyle of almost 1,000 citizens, while those of Arabba are about 6,240. This data helps administrators understand that tourist activity, while a crucial resource, imposes a "weight" in terms of emissions comparable to that of an increase of thousands of stable residents.

One of the issues that has often emerged from the analyses is that of transport impact. The identification of **transport** (air and car) as the absolute hotspot for emissions requires a **systemic intermodal strategy**. This must include shuttles from airports and, above all, a network of local transport that connects attractions and neighboring valleys, with timetables based on the real mapping of tourist itineraries. Furthermore, the success of these measures is linked to the openness and sharing of the information pool. Effective monitoring presupposes **data sharing** (open data) and the **active involvement of stakeholders**. This process simultaneously generates and strengthens a **climate of trust and a shared tourism culture** among residents and operators. Without this diffused "**social capital**," mitigation strategies are destined to fail. Finally, it is fundamental to recognize that DMOs cannot solve complex infrastructural problems (such as the Dolomite passes) alone; the intervention of a higher political level is necessary to regulate flows according to the acoustic and physical carrying capacity of the territories. In contexts characterized by a strong climate of collaboration, such as Alta Badia, it is possible to implement a management strategy based on an integrated and multilevel approach, thanks to the collaboration already in place between local authorities and stakeholders.

5.4. The potential of the local supply chain

The Tarvisiano analysis highlights a critical tourist spending dynamic: excluding transport, the purchase of clothing (31%) is the most impactful item in terms of emissions, even surpassing food expenditure (21%). This spending suggests that the destination is being used as a "**decontextualized shopping center**." The purchase of clothing, often coming from *fast fashion* with a high-impact global supply chain,

generates significant emissions (scope 3) without leaving ecological or economic value on the territory.

A regenerative tourism approach mandates **re-directing the tourist's wallet**: shifting that 31% of residual emissions from the purchase of global goods to that of local ecosystem services and durable artisanal products or food with zero food miles. Such a conversion would activate economic and agricultural regeneration, valuing investments in the local agricultural supply chain which, we want to recall, often contributes to maintaining the landscape in good health. The analysis therefore reveals the destination's difficulty in **connecting the tourist with virtuous local production**. Substituting global goods with local products not only reduces emissions but also enhances local culture and craftsmanship. It is essential to develop low-impact activities on-site that transcend mere recreation, serving as moments of awareness-raising and sustainability education for the visitor.

5.5. Resident communities at the center

The acoustic analysis conducted in Alta Badia highlights with greater clarity the need to adopt a regenerative approach for the social protection of the territory. Indeed, a significant social conflict emerges: residents find themselves acting as environmental "shock absorbers" for the tourist impact.

Acoustic limits are systematically exceeded in residential areas such as La Villa and Funtanacia. Vehicular traffic is identified as the main source of disturbance and the most felt problem by the local community. This scenario suggests that the **current tourism model is eroding the quality of life of those who "host"**. Social regeneration, on the contrary, demands that tourism be a factor of improvement for residents' lives, not a cause that forces them to suffer illegal noise pollution. The recommendation to "limit vehicular access" and the establishment of a "Mobility Master Plan" are configured as the only true regenerative measures proposed in the documents. These actions, in fact, restore space and silence to the local community, even at the cost of placing a limit on the tourist's freedom of movement, which, if it occurs, must be adequately communicated, see ¶ 5.1.

6. Glossary of technical terms

Carbon footprint

The total volume of greenhouse gas emissions (expressed in CO2e) caused directly and indirectly by an individual, an organization, an event, or a product. In this report, it was primarily calculated through transport, accommodation, and meals.

Tonnes of CO2 equivalent (tCO2eq)

The reference unit of measurement in carbon footprint calculation: it allows for quantifying the emissive contribution of each greenhouse gas based on its respective Global Warming Potential (GWP). By converting the different greenhouse gases into the equivalent amount of carbon dioxide (which has a GWP of 1), the report can provide a single, consolidated figure for the total impact of a destination.

GHG Protocol (Greenhouse Gas Protocol)

The most widely used international accounting standard for government and business leaders to understand, quantify, and manage greenhouse gas emissions. It ensures that data collection across different regions follows a coherent and transparent logic.

ISO 14064 / ISO 14001

These are reference parameters of the International Organization for Standardization (ISO). The ISO 14064 standard specifies the principles for the quantification and reporting of greenhouse gas emissions, while the ISO 14001 standard establishes the criteria for an effective environmental management system.

Decibel (dB) and acoustic impact

A logarithmic unit used to measure sound intensity. The report uses it to quantify noise pollution, noting that systematic exceedances of the regulatory limit of 70 dB in residential areas can erode the quality of life for residents and disturb local fauna.

Scope 3 / indirect emissions

Emissions resulting from the destination's activities but coming from sources not owned or controlled by it. Scope 3 includes emissions generated upstream and downstream of the activity itself (e.g., transport, purchase of goods, waste disposal, etc.). A significant example in the report is the carbon impact of tourists' "fast fashion" clothing purchases.

Linear vs. circular models

- **Linear model:** a traditional "extractive" process where resources are turned into products, used, and then disposed of as waste.
- **Circular/regenerative model:** an advanced system focused on "source reduction," where waste is minimized or eliminated at the start of the cycle through reusable materials and awareness, rather than merely managing its disposal at the end.

Carrying capacity

The maximum level of visitor use that an area can support without a high degree of environmental degradation or an unacceptable decline in the quality of experience for residents. The report makes specific reference to acoustic and physical carrying capacity in relation to vehicular traffic on Alpine passes.


il Tarvisiano


MOUNTAINS
& LAKES
NASSFELD-PRESSEGGER SEE
LESACHTAL | WEISSENSEE


ALTA
BADIA
Dolomites · Italy


E T I F O R
valuing nature