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Stock-taking report of conditions and Alps-wide trends of nature-based activities (NBA)

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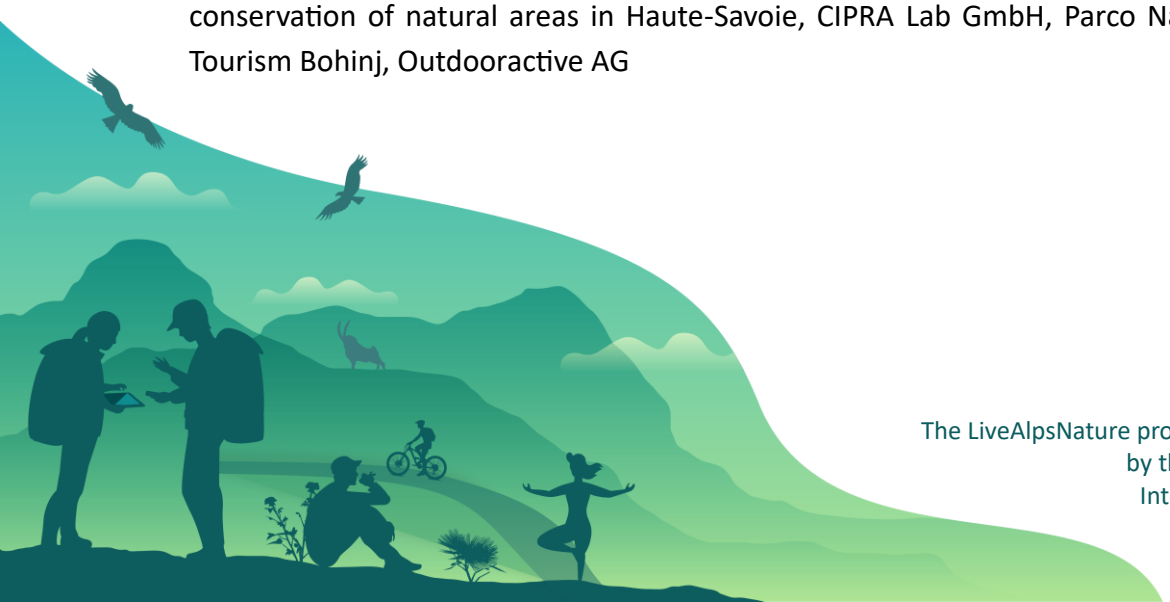

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Section I. Preliminary analysis on main trends in outdoor tourism and nature-based activities

The Alps represent one of Europe's most valuable mountain ecosystems, characterized by extraordinary biodiversity and landscapes of inestimable natural and cultural value. Alpine Protected Areas (APAs), which cover nearly 30% of the Alpine territory, play a crucial role in conserving these natural heritage sites, serving as refuges for numerous threatened species and habitats. However, the growing anthropogenic pressure linked to outdoor tourism and nature-based activities (NBAs) poses increasingly complex challenges for the sustainable management of these fragile territories.

Visitor monitoring within Alpine Protected Areas emerges as a fundamental tool for understanding, managing, and mitigating the impacts of human activities on biodiversity. This document, developed within the framework of the Interreg Alpine Space LiveAlpsNature project, provides an in-depth analysis of current trends in Alpine outdoor tourism and the dynamics governing visitor flows in protected areas. The objective is to provide protected area managers and Alpine tourism destination managers with the knowledge tools necessary to develop innovative and sustainable management strategies.

The Alpine tourism sector finds itself today at a crucial crossroads. On one hand, it represents the backbone of the Alpine rural economy, with an estimated annual turnover of approximately 50 billion euros and an employment impact supporting millions of jobs. On the other hand, the intensification of outdoor activities – accelerated by the spread of new technologies such as e-bikes and the growing post-pandemic demand for nature experiences – is generating unprecedented pressures on already fragile ecosystems. The document analyzes in detail this complex dynamic, providing economic data, market trends, and assessments of the ecological impacts of different types of recreational activities.

A central aspect of the analysis concerns the ongoing transition from an "extraction" economic model – based on intensive consumption of landscape resources – to a "stewardship" model, in which economic value derives increasingly from the preservation and non-consumptive enjoyment of natural capital. This transition is particularly evident in the renaissance of Alpine

summer tourism, which in many regions has reached and sometimes surpassed the volumes of traditional winter tourism. Systematic monitoring of visitor flows, their motivations, territorial use patterns, and generated impacts therefore becomes essential to guide this transition toward more sustainable and biodiversity-respectful forms of tourism.

The LiveAlpsNature project fits into this context with an innovative approach based on the "One Health" concept, which recognizes the profound interconnection between ecosystem health and human well-being. Visitor monitoring is therefore conceived not only as a control and limitation tool, but as a key element for developing tourism offerings that enhance the health benefits derived from contact with nature, while promoting more conscious and respectful behaviors toward biodiversity. The analysis of NBA trends and impacts presented in this document constitutes the foundation upon which to build visitor management strategies that are both effective in nature protection and attractive to users. A complementary stakeholder mapping, structured to support the implementation of the project's guiding principles by identifying the diverse actors influencing or affected by NBAs in the Alpine region, is provided as an annex to this document (Annex 1).

Focusing on Section I, the first Chapter examines the macroeconomic architecture of Alpine tourism, analyzing country-by-country dynamics and highlighting how the sector represents a unique economic paradox. Detailed data are presented on tourist flows, revenues generated, and employment sustained, with particular attention to the differences between the "industrial complex" of winter tourism – characterized by high capital intensity and high revenues per visitor – and the diversified and volumetric model of summer tourism.

The following Chapters of Section I explore Alpine outdoor activities in the context of conflicting priorities between tourist demand, utilization conflicts, and ecological impacts. Particular attention is devoted to the "revolution" of electric mountain biking, a phenomenon that is radically redefining patterns of access and enjoyment of mountain territory. The electrification of bicycles has effectively decoupled vertical mobility from the prerequisite of elite cardiovascular fitness, democratizing access to steep and remote terrain previously reserved for mountaineers and endurance athletes. This democratization, while positive in terms of accessibility, generates new management challenges related to soil erosion, wildlife disturbance, and social conflicts between different types of users.

In conclusion, this document provides a solid and articulated knowledge base for understanding the complex dynamics characterizing outdoor tourism in the Alps and for developing visitor monitoring and management strategies that are evidence-based, sustainable, and capable of balancing the needs of biodiversity protection with those of

economic and social development of Alpine communities. Visitor monitoring emerges not as a mere technical exercise, but as a fundamental strategic element to ensure that Alpine Protected Areas can continue to fulfil their dual role as guardians of biodiversity and engines of sustainable development for mountain territories.

Yet, whilst Protected Areas have gained valuable experience in monitoring and measuring natural assets (e.g. fauna, flora, biodiversity), tourism and recreational activities remain of secondary importance in terms of data collecting, monitoring and modelling throughout APAs.

In this document, the aim is to open the door to extensive monitoring and surveying techniques applied to large scale areas and territories: the questionnaires by which the data displayed in Section II are analysed rely on a background of similar activities carried out throughout Europe, mainly in the frame of various EU funded projects.

A very important feature relies on the fact that the questionnaires used for the surveys (aimed at visitors and operators) are based on the needs and findings of the project partners themselves: the whole partnership has contributed to build and spread the surveys, in order to focus on the themes APAs managers consider priorities and trend setters.

Thus, this report is aimed to put a focus on the actual phenomenon of NBAs in protected areas, from the point of view of protected areas themselves.

1 Current relevance and trends in the Alpine outdoor tourism market in terms of visitor's flows and revenues

The European Alps function as a unique economic paradox. While geologically representing a formidable barrier, economically they act as a porous membrane through which millions of consumers and billions of euros flow annually. Tourism in this region is not merely a sector; it is the structural spine of the rural economy, supporting a population of roughly 14 million people in areas that would otherwise face severe demographic contraction.[1]

[1] Federal Environment Agency (Umweltbundesamt). *Green Economy in the Alpine Region*. June 2016, www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/hg_alpenraum_en_bf_low_final.pdf . Accessed 14 Nov. 2025.

Historically, the Alpine economy operated on an "extraction model," consuming landscapes through activities like skiing and hydroelectric power generation. However, the region is currently navigating a profound transition toward a "stewardship model," where economic value is increasingly derived from the preservation and non-consumptive enjoyment of natural heritage. Residents who perceive direct economic benefits from this transition are significantly more likely to support conservation policies, creating a virtuous cycle where economic utility drives environmental stewardship.[2]

1.1.1 The Macro-Economic Architecture of the Alpine Leisure Economy

The scale of the Alpine tourism ecosystem is immense, rivaling major coastal destinations in total economic output. Aggregating data across the Alpine arc reveals a sector characterized by approximately 600 ski resorts and 10,000 ski installations, generating an annual turnover estimated near €50 billion when including indirect effects.[3]

In many Alpine regions, tourism serves as the primary driver of regional domestic product:

- **Austria:** Tourism satellite accounts indicate that direct and indirect value added amounts to approximately €29.5 billion annually.[4] While contributing roughly 6.2% to the national GDP, its impact in federal states like Tyrol is significantly higher, often exceeding 15% of the gross regional product when induced effects are considered.[5]
- **Switzerland:** In mountain cantons such as Valais and Graubünden, tourism creates roughly a quarter of aggregate income. Specific studies in regions like Davos suggest that winter tourism alone contributes 26% to aggregate income, with mountain railways generating 5%.[6]

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[2] Strzelecka, Marianna, B. Bynum Boley, and Arash Akhshik. "Beyond Economics: The Role of Empowerment in Shaping Conservation Justice Through Rural Nature-Based Tourism." *Journal of Ecotourism*, 2025, https://www.tandfonline.com/doi/full/10.1080/14724049.2025.2502621. Accessed 14 Nov. 2025.

[3] "Tourism - France." *ClimateChangePost*, www.climatechangepost.com/countries/france/tourism/. Accessed 14 Nov. 2025.

[4] "The Austrian Tourism and Leisure Industry in 2023." *WIFO, Austrian Institute of Economic Research*, 28 June 2024, www.wifo.ac.at/en/news/die-oesterreichische-tourismus-und-freizeitwirtschaft-im-jahr-2023/. Accessed 14 Nov. 2025.

[5] "National Data." *Federal Ministry of Labour and Economy (BMAW)*, www.bmwet.gv.at/en/Topics/tourism/tourism-statistics/national-data.html. Accessed 14 Nov. 2025.

[6] Pütz, Marco, et al. "Winter Tourism, Climate Change, and Snowmaking in the Swiss Alps: Tourists' Attitudes and Regional Economic Impacts." *Mountain Research and Development*, vol. 31, no. 4, 2011, pp. 357-362, https://doi.org/10.1659/MRD-JOURNAL-D-11-00039.1. Accessed 14 Nov. 2025.

- **France:** The French Alps host more than 80% of total annual French skier visits, a critical component for the world's second-largest ski destination. The tourism expenditure related to ski resorts alone amounts to approximately €6.5 billion, supporting nearly 120,000 jobs in the region.[3]

Despite external shocks such as the 2008 financial crisis, the COVID-19 pandemic, and the energy crisis of 2022, the demand for outdoor recreation has demonstrated remarkable stability. The post-pandemic period witnessed a "nature renaissance," where the intrinsic value of open spaces drove record visitation numbers in summer seasons.[7] This resilience is evident in Italy, where the Trentino-Alto Adige region recorded over 56 million presences in 2023, signaling that the appetite for the Alpine product remains robust even as disposable incomes contract.[8]

1.1.2 The Winter Industrial Complex: Hegemony and Adaptation

Winter tourism remains the financial heavyweight of the Alps, operating as an industrial complex characterized by high capital intensity and high revenue per visitor per day. A significant portion of Alpine tourism turnover is generated in a scant four-month window; the French ski lift sector, for example, generates €1.6 billion in turnover annually.[9] In Austria, the average nominal tourism export per capita was over €2,300 in 2019, reflecting the high-value capture of the winter consumer.[5]

The economic viability of this sector is now inextricably linked to the cost of adaptation, specifically snowmaking. In Austria, 90% of technical snowmaking now utilizes renewable energy.[10] This investment is viewed through the metric of "prevented loss"; research in the

[7] "Swiss Camping and Parahotel Industry Report a Strong Summer, Forecasts Bright Winter for Tourists." *Travel And Tour World*, 16 Sept. 2024, www.travelandtourworld.com/news/article/swiss-camping-and-parahotel-industry-report-a-strong-summer-forecasts-bright-winter-for-tourists/. Accessed 14 Nov. 2025.

[8] "In Italy Never So Many Tourists as in 2023, a Record Year." *Finestre sull'Arte*, 6 June 2024, www.finestresullarte.info/en/tourism/in-italy-never-so-many-tourists-as-in-2023-a-record-year. Accessed 14 Nov. 2025.

[9] Cour des comptes. *Mountain Resorts and Climate Change*. Summary, Feb. 2024, https://program-evaluation.ccomptes.fr/sites/default/files/2024-03/20240206-Summary-Mountain-resorts-and-climate-change.pdf. Accessed 14 Nov. 2025.

[10] "Sustainability in Austria." *Austrian National Tourist Office*, www.austriatourism.com/fileadmin/user_upload/Media_Library/NETA/Nachhaltigkeit/Sustainia_Publikation/Nachhaltiges-Oesterreich_Web_ENG-21MB.pdf. Accessed 14 Nov. 2025.

Swiss community of Davos calculated that technical snowmaking prevents losses of up to 10% of the regional factor income (approximately US$ 67 million) during snow-poor winters.[6]

However, this capital-intensive model has created a dual-speed economy. Large, high-altitude resorts maintain profitability due to economies of scale, while smaller, low-altitude operators face solvency crises. Studies confirm that size and elevation are the primary determinants of economic survival, as smaller operators cannot amortize the cost of adaptation over a shrinking visitor base.[11] Furthermore, the sector contends with the "cold bed" phenomenon—real estate that remains empty for 40 weeks a year—prompting regulatory responses like Switzerland's Weber Law to ensure real estate serves the tourism economy rather than cannibalizing it.[12]

1.1.3 The Summer Renaissance and the Green Economy

If winter is the story of capital and consolidation, the Alpine summer is defined by diversification and volume. The "Green Season" has shifted from a secondary supplement to a primary strategic pillar.

- **Volume Growth:** In Switzerland, summer overnight stays reached a record 23.7 million in 2024, distinctively rivaling winter figures in absolute volume. Similarly, summer tourism now accounts for over 50% of annual tourism revenue in many Austrian regions.[13]
- **Closing the Yield Gap:** The historical "value gap" between high-yield winter tourists and low-yield summer hikers is closing due to the professionalization of summer products. The introduction of the e-bike has been a game-changer. A study in the Swiss

[11] Moreno-Gené, Jordi, et al. "The Economic Sustainability of Snow Tourism: The Case of Ski Resorts in Austria, France, and Italy." *Sustainability*, vol. 10, no. 9, 2018, p. 3012, https://www.mdpi.com/2071-1050/10/9/3012. Accessed 14 Nov. 2025.

[12] "Alpine Convention." *Umweltbundesamt*, Federal Environment Agency, 13 Mar. 2024, www.umweltbundesamt.de/en/topics/sustainability-strategies-international/international-cooperation/alpine-convention. Accessed 14 Nov. 2025.

[13] "Record Breaking Summer Tourism Numbers Sparks A New Era For The Alps According To Alpine Property Finders' Summer Report." *Snow Industry News*, 13 Sept. 2023, www.snowindustrynews.com/articles/record-breaking-summer-tourism-numbers-sparks-a-new-era-for-the-alps-according-to-alpine-property-finders-summer-report. Accessed 14 Nov. 2025.

Alps found that mountain bikers spend an average of 159 CHF per day, significantly higher than the 128-140 CHF spent by general summer visitors.[14]

- **Infrastructure Utilization:** In Chamonix, summer visitor numbers exceeded winter numbers for the first time in 2024, indicating a historic pivot where ski lifts are becoming year-round transport utilities rather than just ski tows.[13]

The region is also successfully rebranding as a "Health Factory." Wellness tourism in France is projected to double to $149.7 billion by 2030, and the sector is growing at 12.2% annually in Switzerland.[13] Destinations like the Krimml Waterfalls in Austria utilize clinical studies to market natural assets as therapy, decoupling revenue from weather conditions.[15]

1.1.4 Country-Level Economic Dynamics

To fully grasp the relevance of nature-based activities, one must examine the specific structural dynamics of key Alpine nations.

Austria and the Integrated Model

Austria represents a highly integrated model where tourism is a massive contributor to the national current account surplus. Following a drop in tourism exports per capita from €2,308 in 2019 to €801 in 2021 due to COVID-19, the swift recovery to near-2019 levels by 2024 demonstrates the structural robustness of the sector.[5] Austria is also aggressive in modernizing summer offerings, creating massive outdoor playgrounds like Area 47 that capture the youth market.[13]

Germany (Bavaria) and Biosphere Economics

The German Alps are characterized by high-volume day trips. In Oberbayern alone, tourism turnover reached €13.6 billion in 2014, supporting nearly 200,000 income equivalents.[16] Furthermore, Germany's Biosphere Reserves generate €1.97 billion in value added annually from 71.6 million visitor days. Notably, visitors with a "high affinity" for these reserves—those

[14] "Economic Impacts of Mountain Biking Tourism." *Pinkbike*, 28 June 2014, www.pinkbike.com/news/economic-impacts-of-mountain-biking-tourism-2014.html. Accessed 14 Nov. 2025.
[15] "How Much Is Nature Worth?" *CIPRA*, International Commission for the Protection of the Alps, 24 Feb. 2022, www.cipra.org/en/news/how-much-is-nature-worth. Accessed 14 Nov. 2025.
[16] DEHOGA Bayern. *Wirtschaftsfaktor Tourismus in Oberbayern*. dwif-Consulting GmbH, Apr. 2024, www.dehoga-bayern.de/uploads/media/Wirtschaftsfaktor-Tourismus-in-Oberbayern_FINAL.pdf. Accessed 14 Nov. 2025

who come specifically because it is protected—generate €85 million in value added, proving that conservation status is a marketable asset.[17]

Slovenia and the Boutique Strategy

Slovenia has positioned itself as the "Green Heart of Europe," avoiding the mass-industrial model. Tourism contributes roughly 5-8% to GDP directly, with total consumption estimated at €6.6 billion in 2023.[18] The country's strategy targets "higher value added" rather than volume,[19] a successful approach evidenced by a 7.5% increase in international arrivals in 2024.[20]

Italy and Domestic Strength

The Italian Alps rely on a mix of international prestige and domestic volume. In 2019, foreign tourist expenditure for mountain vacations reached nearly €2 billion.[21] While the Dolomites operate on a high-quality model similar to Austria, the Western Alps rely more on wilderness tourism. Seasonality is also shifting; in Lombardy, summer seasonality is growing, driven by lakes and hiking, while winter flows in lower areas decline.[22]

France and the Industrial-Territorial Hybrid

The French Alps are structured around a highly industrialized tourism model rooted in the postwar Plan Neige, which created large, purpose-built, high-altitude resorts such as La Plagne, Les Arcs, and Val Thorens.[23] This system prioritizes volume, capacity, and centralized

[17] Majewski, Lisa, et al. "Evaluating the Economic Impact of Tourism in Germany's Biosphere Reserves." *Tourism Geographies*, 2025, https://www.tandfonline.com/doi/full/10.1080/14616688.2025.2536120. Accessed 14 Nov. 2025.

[18] Statistical Office of the Republic of Slovenia (SURS). "Economic Accounts for Tourism, 2022 and 2023." *SURS*, 19 Dec. 2023, www.stat.si/statweb/en/News/Index/13559. Accessed 14 Nov. 2025.

[19] Ministry of Economic Development and Technology. *Slovenian Tourism Strategy 2022–2028*. Government of Slovenia, May 2022, www.gov.si/assets/ministrstva/MGTS/Dokumenti/DTUR/Strategija-slovenskega-turizma-20222028-/SLOVENIAN-TOURISM-STRATEGY-2022-2028-v2.pdf. Accessed 14 Nov. 2025.

[20] "2024: A Landmark Year for Tourism with Bright Prospects Beyond." *Slovenian Tourist Board*, 16 Feb. 2024, www.slovenia.info/en/press-centre/press-releases/31502-2024-a-landmark-year-for-tourism-with-bright-prospects-beyond. Accessed 14 Nov. 2025.

[21] Mariani, Gioia Maria, and Diego Scalise. "Climate Change and Winter Tourism: Evidence from Italy." *Questioni di Economia e Finanza (Occasional Papers)*, no. 743, Bank of Italy, Dec. 2022, https://www.bancaditalia.it/pubblicazioni/qef/2022-0743/QEF_743_22.pdf. Accessed 14 Nov. 2025.

[22] Caprino, Gianpaolo, and Antonio Dal Bianco. "Evolution and Change of Winter Tourism: How Seasonality Affects the Economy of Lombardy's Mountain Communities on the Olympic Road." *Rivista Italiana di Economia Demografia e Statistica*, vol. 78, no. 3, 2024, https://www.rieds-journal.org/rieds/article/download/291/291/1838. Accessed 15 Nov. 2025.

[23] Cour des comptes. *Mountain Resorts and Climate Change*. Cour des comptes, 2024.

management, making France structurally distinct from Austria's integrated village model. Historically winter-dominated, the French Alps have been slower to diversify into summer nature-based activities, though recent investments in hiking, cycling, and four-season resort conversion signal a gradual transition.[24] A key structural tension lies between highly specialized resort enclaves and more diversified mid- and low-altitude Alpine territories, a dualism increasingly stressed by climate change and declining snow reliability.

Switzerland and the High-Value Fortress

Operating on a low-volume, high-yield model, Switzerland has revolutionized its revenue model with innovations like the "Magic Pass," a season pass valid for over 80 resorts in both summer and winter.[13] The camping and "parahotel" sector is also seeing record demand, indicating a shift toward immersive nature experiences.[7]

1.1.5 The Economics of Ecosystem Services and Employment

Traditional financial analysis often misses the value of non-market ecosystem services, yet these are foundational to the Alpine economy. Economists use the Travel Cost Method (TCM) to estimate the economic value of non-market sites. For example, research on ice climbing estimates consumer surplus per trip at $76-$135,[25] while studies in Alpine valleys demonstrate that visitors derive immense value from mixed forests and pristine landscapes.[26] Tourists also demonstrate a positive Willingness-to-Pay (WTP) for biodiversity and conservation, [27] supporting the implementation of "visitor payback schemes".[17]

[24] Tuppen, John, and Marc Langenbach. "Diversification of Tourism and Outdoor Sports Activities: New Challenges for Mid-Mountain Stations (France, Switzerland)?" *Journal of Alpine Research*, vol. 110, no. 2, 2022, https://doi.org/10.3917/rsss.020.0061. Accessed 04 Mar. 2026.

[25] Anderson, David M. "Estimating the Economic Value of Ice Climbing in Hyalite Canyon: An Application of Travel Cost Count Data Models that Account for Excess Zeros." *Journal of Environmental Management*, vol. 91, no. 4, 2010, pp. 1012-1020, https://pmc.ncbi.nlm.nih.gov/articles/PMC2819565/. Accessed 15 Nov. 2025.

[26] Grilli, Gianluca, Alessandro Paletto, and Isabella De Meo. "Economic Valuation of Forest Recreation in an Alpine Valley." *Baltic Forestry*, vol. 20, no. 1, 2014, pp. 167-175, https://www.researchgate.net/publication/265139855_Economic_Valuation_of_Forest_Recreation_in_an_Alpine_Valley. Accessed 17 Nov. 2025.

[27] Shen, Hanli, et al. "Tourists' Willingness to Pay for the Non-Use Values of Ecotourism Resources in a National Forest Park." *Journal of Resources and Ecology*, vol. 14, no. 2, 2023, pp. 331-343, https://doi.org/10.5814/j.issn.1674-764x.2023.02.011. Accessed 16 Nov. 2025.

Beyond direct revenue, the sector is a critical demographic anchor. Tourism is labor-intensive and supports millions of jobs across the EU.[28] In Bavaria alone, the tourism income equivalent supports nearly 200,000 people.[16] However, the Health Economy is also a rising frontier; physical activity undertaken by tourists generates public health savings. Programs like "Green Prescriptions," where doctors prescribe mountain hikes, are beginning to monetize this link.[15]

In conclusion, while the winter ski industry remains the financial "cash cow" in terms of direct turnover, the future growth engine is the summer "green" economy. The data confirms that the Alpine economy is transitioning toward a diversified year-round portfolio, driven by technological innovation and a structural shift in consumer values toward sustainable, authentic experiences.

[28] Eurostat. "Tourism Industries - Employment." *Statistics Explained*, European Commission, 2024, https://ec.europa.eu/eurostat/statistics-explained/index.php/Tourism_industries_-_employment. Accessed 14 Nov. 2025.

2 Alpine outdoor activities between the conflicting priorities of tourist demand, utilisation conflicts and ecological impacts

2.1 Mountainbiking and the electrification of cycling in the Alps

The Alpine region is currently navigating one of the most profound transformations in the history of mountain recreation: the mass adoption of the electric mountain bike (e-MTB). This shift represents a fundamental alteration in the kinetics of human travel within high-altitude environments. The integration of electric propulsion—specifically Class 1 pedal-assist systems—has effectively decoupled vertical mobility from the prerequisite of elite cardiovascular fitness, democratizing access to steep, remote terrain that was previously the exclusive domain of mountaineers and hardened endurance athletes.[29]

Current market data underscores the scale of this transition. The e-bike sector has emerged as the primary growth driver for the global bicycle industry, responsible for a staggering 63% of the growth in dollar sales between 2019 and 2023. In the Globally, the market is projected to expand at a compound annual growth rate (CAGR) of 14.5% through 2030, driven by a synergy between technological proliferation and a post-pandemic surge in outdoor recreation.[30]

2.1.1 The Democratization of Ascent and Altered Kinetics

The defining characteristic of the e-MTB phenomenon is the democratization of ascent. While traditional physical effort acted as a natural filter, limiting visitors to high-alpine plateaus, e-MTBs allow riders of varying physical abilities—often in the 55+ age bracket—to access wilderness areas previously beyond their reach.[29]

[29] "Forest-Friendly Cycling: The Impact of Electric Mountain Bikes on Ecosystems." *Movcan*, 17 Jan. 2024, https://movcan-bike.com/blogs/blog/forest-friendly-cycling-the-impact-of-electric-mountain-bikes-on-ecosystems. Accessed 18 Nov. 2025.

[30] Wattinne, Touissant. "Upway Trend Report 2025", *Upway*, 2025, https://upway.co/pages/trend-report-2025. Accessed 18 Nov. 2025.

This shift presents significant management challenges. A phenomenon known as "blocking" has emerged, where riders ascend technically easy gravel roads using electric assistance only to become stranded in high-altitude zones where the only descent options are technical singletracks exceeding their ability, often necessitating rescue.[31] Furthermore, the introduction of the motor has altered the "flow" of mountain biking. While traditional kinetics involve slow, low-impact ascents, e-MTBs allow for high-speed travel on climbs. This introduces high-torque drive forces to uphill sections, which can induce wheel spin and soil displacement—a mechanism of "power erosion" rarely seen with traditional bicycles or hikers.[32] Additionally, high-capacity batteries allow for "multi-valley" linkups, enabling riders to traverse multiple ridge lines in a single day and effectively expanding the "human zone of influence" into core wilderness areas.[29]

2.1.2 Biophysical Impacts on Ecosystems

The ecological footprint of this transition is a subject of intense scrutiny, particularly regarding soil mechanics and wildlife disturbance.

Soil Erosion and Vegetation

Scientific consensus on erosion is nuanced. Controlled studies, including those by the International Mountain Bicycling Association (IMBA), indicate that under normal riding conditions, the soil displacement caused by Class 1 e-MTBs is not statistically significantly different from traditional mountain bikes, as weight is distributed over similar contact patches. Trail design and maintenance remain the critical determinants of erosion; trails lacking proper water management degrade rapidly regardless of user type.[29] However, "power erosion" on steep, loose ascents remains a distinct e-MTB mechanism.[32] Vegetation impacts are primarily associated with the widening of trail corridors and the potential for seed dispersal, where tires transport lowland invasive species into high-altitude ecosystems.[33]

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[31] Bigdon, Simon Frederick, et al. "Injuries in Alpine Summer Sports Types, Frequency and Prevention: A Systematic Review." *International Journal of Environmental Research and Public Health*, vol. 17, no. 2, 2020, https://d-nb.info/1262235510/34. Accessed 18 Nov. 2025.

[32] Kuwaczka, Lukas F., et al. "Ecological Impacts of (Electrically Assisted) Mountain Biking." Global Ecology and Conservation, vol. 46, Oct. 2023, e02549, https://epub.uni-bayreuth.de/id/eprint/7574/1/1-s2.0-S2351989423001105-main.pdf. Accessed 18 Nov. 2025

[33] *Impacts of Mountain Biking on Biodiversity and the Environment*. IMBA Europe, May 2025, https://www.imba.com/sites/default/files/2025-05/Impacts%20of%20mountain%20biking%20on%20biodiversity%20and%20the%20environment.pdf. Accessed 18 Nov. 2025.

Wildlife Disturbance

A critical concern is the creation of a "Landscape of Fear" for Alpine fauna. Unlike hikers, who are often vocal and slow, e-MTBs approach wildlife quietly and rapidly, triggering acute "startle responses" that are metabolically costly.[34]

- **Alpine Chamois:** These ungulates experience heightened physiological stress (measured via fecal cortisol metabolites) when human presence is unpredictable. The rise of "Fat Biking" threatens to extend disturbance into critical winter periods when fat reserves are essential for survival.[35]
- **Black Grouse:** As a ground-nesting bird, the grouse is exceptionally vulnerable to flushing at considerable distances.[36] Habitat fragmentation by new trails effectively removes large areas from the species' usable range, and disturbance at leks can lead to nest abandonment.[37]
- **Alpine Marmot:** The speed of e-MTBs reduces the warning time available for marmots to retreat to burrows, increasing the risk of direct collision and disrupting foraging efficiency.[38]

2.1.3 Social Conflict and Safety Dynamics

The proliferation of e-MTBs has exacerbated "hiker-biker asymmetry," where hikers frequently object to the presence of bikers due to perceived safety threats and crowding,

[34] "Study Examines Recreational Impacts On Wildlife." *National Parks Traveler*, 21 Sept. 2020, https://www.nationalparkstraveler.org/2020/09/study-examines-recreational-impacts-wildlife. Accessed 18 Nov. 2025.

[35] Anderwald, Pia, et al. "Reflections of Ecological Differences? Stress Responses of Sympatric Alpine Chamois and Red Deer to Weather, Forage Quality, and Human Disturbance." *Ecology and Evolution*, vol. 10, no. 12, 2020, pp. 1-14, https://pmc.ncbi.nlm.nih.gov/articles/PMC8601901/. Accessed 18 Nov. 2025.

[36] Steven, Rochelle, et al. "A Quantitative Analysis of Recreation Ecology Research on the Impacts of Non-Motorised Nature-Based Tourism on Birds." *Journal of Environmental Management*, vol. 92, no. 10, 2011, pp. 2287-2294, https://concordma.gov/DocumentCenter/View/9141. Accessed 18 Nov. 2025.

[37] Tost, Daniel, et al. "Impact of Tourism on Habitat Use of Black Grouse (Tetrao tetrix) in an Isolated Population in Northern Germany." *PLOS ONE*, vol. 15, no. 9, 2020, e0238660, https://pmc.ncbi.nlm.nih.gov/articles/PMC7473583/. Accessed 18 Nov. 2025.

[38] Simma, Miriam, et al. "Shifting Heights? A 40-Year Resurvey of Alpine Marmot Distribution in Response to Climate Change." *Ecology and Evolution*, vol. 14, no. 6, 2024, https://pmc.ncbi.nlm.nih.gov/articles/PMC12277047/. Accessed 18 Nov. 2025.

while bikers are generally indifferent to hikers.[39] This friction is compounded by a values conflict regarding "fair means," where traditionalists view e-assisted ascent as a violation of the meritocratic ethos of alpinism, stigmatizing e-bikers as consumers rather than true recreationists.[40] In extreme cases, this has led to the discovery of traps, such as nail boards buried in trails in regions like Haute-Savoie.[41]

Safety statistics reflect these demographic and technical shifts. The Swiss Alpine Club (SAC) reported a 20% increase in mountain emergencies, with mountain biking accidents being a significant contributor.[31] Even expert riders are at risk in high-alpine terrain, as evidenced by fatal accidents in the Dolomites.[42] Furthermore, a new hazard has emerged regarding lithium-ion batteries. Following fire incidents, the German Alpine Club (DAV) has banned battery charging in its huts due to the lack of fire suppression systems capable of handling thermal runaway.[43] Insurance providers are consequently becoming wary of covering properties that allow unsupervised charging.[44]

2.1.4 The Regulatory Mosaic and Economic Imperatives

The management of e-MTBs across the Alpine arc is a fragmented patchwork of permissive and restrictive regimes.

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[39] *Literature Review of Bicycle and E-bike Research, Policies & Management*. Boulder County Parks & Open Space, 2019, https://assets.bouldercounty.gov/wp-content/uploads/2024/07/e-bike-literature-review.pdf. Accessed 18 Nov. 2025.

[40] Moesch, Christian, et al. "It's Getting Tight in the Alps - Challenges and Implications of the E-Mountain Bike Boom for Sustainable Tourism Management." *International Journal of Sport Management and Marketing*, vol. 22, no. 1/2, 2022, pp. 56-74, https://www.researchgate.net/publication/358999246_It's_getting_tight_in_the_Alps_-_challenges_and_implications_of_the_e-mountain_bike_boom_for_sustainable_tourism_management. Accessed 18 Nov. 2025.

[41] "Multiplication des pièges à clou visant les VTT et randonneurs sur les sentiers autour d'Annecy." *Outside.fr*, 28 Aug. 2023, https://www.outside.fr/multiplication-des-pieges-a-clou-visant-les-vtt-et-randonneurs-sur-les-sentiers-autour-dannecy/. Accessed 18 Nov. 2025.

[42] "Extreme Mountain Biker Andreas Tonelli Dies in Dolomites Fall." *Explorersweb*, 25 Oct. 2024, https://explorersweb.com/extreme-mountain-biker-andreas-tonelli-dies-in-dolomites-fall/. Accessed 18 Nov. 2025.

[43] "Hütten unter Strom." *Die Neue Südtiroler Tageszeitung*, 1 July 2018, https://www.tageszeitung.it/2018/07/01/huetten-unter-strom/. Accessed 18 Nov. 2025.

[44] "Home Insurers Could Ban Ebikes Due to Fire Risk, but There Is a Potential Solution." *BikeRadar*, 31 July 2024, https://www.bikeradar.com/news/home-insurers-worried-about-ebike-fire-risk. Accessed 18 Nov. 2025.

- **Austria:** Adopts a restrictive model where the *Forstgesetz* (Forestry Act) generally prohibits cycling on forest roads unless explicitly permitted. High landowner liability disincentivizes opening trails, forcing traffic onto limited networks.[45]
- **France:** Utilizes a zoning approach. While generally permissive, strict bans are enforced in the core zones of National Parks like Vanoise and Ecrins.[46] Additionally, France imposes fines of up to €30,000 for "tuning" e-bikes to exceed speed limits.[47]
- **Italy:** Characterized by regional fragmentation. While a 2021 decree theoretically restricts access on trails narrower than 2.5 meters, regions dependent on tourism like Trentino adopt permissive interpretations, contrasting with the restrictive stance of the Club Alpino Italiano (CAI).[48]
- **Slovenia:** Illustrates the tension between conservation and promotion. Triglav National Park enforces strict prohibitions on singletrack riding,[49] yet the country faces "greenhushing" criticisms for downplaying the environmental costs of cycling tourism in its marketing.[50]

Despite these conflicts, e-MTB tourism is aggressively promoted as an economic pillar. In Austria, cycling tourism generates approximately €580.6 million annually in Tyrol alone.[51] e-MTB tourists are high-yield consumers, spending more on rentals and accommodation than hikers.[40] Consequently, major ski conglomerates like Portes du Soleil are investing in

[45] Proöbstl-Haider, Ulrike, et al. "Mountain Bike Tourism in Austria and the Alpine Region – Towards a Sustainable Model for Multi-Stakeholder Product Development." *Journal of Sustainable Tourism*, vol. 13, no. 1, 2005, https://www.researchgate.net/publication/319946816_Mountain_bike_tourism_in_Austria_and_the_Alpine_region_-_towards_a_sustainable_model_for_multi-stakeholder_product_development. Accessed 18 Nov. 2025.

[46] "Ecrins National Park." *Parc national des Écrins*, https://destination.ecrins-parcnational.fr/en/information/21-Ecrins-national-Park. Accessed 18 Nov. 2025.

[47] "E-Bike Rules in Europe: Your Ultimate 2025 Legal Guide." *Fafrees Ebike*, 12 Jan. 2024, https://www.fafreesebike.com/blogs/knowledge/european-ebike-laws-guide. Accessed 18 Nov. 2025.

[48] Schwede, Julian. "New Italian Trails Law - What Does Italy's New 2.5 Metre Rule Mean for Mountain Bikers?" *E-MOUNTAINBIKE Magazine*, 19 Dec. 2021, https://ebike-mtb.com/en/new-italian-trails-law/. Accessed 18 Nov. 2025.

[49] "Code of Conduct." *Triglav National Park*, https://www.tnp.si/en/visiting-park/information-for-visitors/code-of-conduct/. Accessed 18 Nov. 2025.

[50] Gričar, Sergej, et al. "Domestic Cycling Tourism: Double Pollution, Greenhushing, and Slovenian Sustainable Travel." *Sustainability*, vol. 17, no. 1, 2025, p. 295, https://www.mdpi.com/2071-1050/17/1/295. Accessed 18 Nov. 2025.

[51] "Economic Factors of Cycling: 46,000 Jobs in Austria." *Radkompetenz Österreich*, https://radkompetenz.at/en/9098/economic-factors-of-cycling-46000-jobs-in-austria/. Accessed 18 Nov. 2025.

"summerizing" infrastructure to mitigate the economic unreliability of winter seasons.[52] Future management strategies may rely on technology, such as geofencing to automatically reduce power in sensitive wildlife zones,[29] and the harmonization of cross-border regulations to address the current legal confusion.[53]

[52] "A Preserved Domain." *Portes du Soleil*, https://en.portesdusoleil.com/les-portes-du-soleil/a-preserved-domain/. Accessed 18 Nov. 2025.
[53] "eMTB Information." *IMBA*, International Mountain Biking Association, https://www.imba.com/emtb. Accessed 18 Nov. 2025.

2.2 Trail running and the popularity of ultrarunning sports events in the Alps

The European Alps, historically the epicenter of the global ski industry, are undergoing a profound functional transformation. As climate change erodes the reliability of the winter season, trail running has emerged from a fringe activity to a dominant cultural and economic force. This shift represents a specific sociological phenomenon: the "sportification" of the wilderness. Unlike the contemplative walkers of the Romantic era, modern trail runners engage with the landscape through the lens of quantification—measuring vertical gain, heart rate variability, and split times—often utilizing high-tech infrastructure and generating distinct anthropogenic pressures.

2.2.1 Quantitative Dynamics: The "Ultra" Shift

The trajectory of running in the Alps represents a distinct divergence from the global jogging boom. Longitudinal data from Switzerland illustrates a significant decoupling between road and trail participation; while traditional road marathon participation has stabilized or declined since 2000, interest in trail running has surged, with a global annual growth rate of approximately 12% over the last decade.[54] The supply-side response has been explosive: the number of races accredited by the International Trail Running Association (ITRA) rose from 1,651 in 2015 to over 8,300 just a year later.[55]

A defining characteristic of this scene is the normalization of "ultra" distances (exceeding 42.195 km). Survey data indicates that 38% of male trail runners and 31% of female runners have completed a race of 100 kilometers or longer.[56] This fixation on extreme distance expands the "recreational sphere" deep into zones previously reserved for technical

[54] Rosenkrantz, Leah, et al. "Environmental Preferences and Concerns of Recreational Trail Runners." *International Journal of Environmental Research and Public Health*, vol. 21, no. 1, 2024, p. 87, https://pmc.ncbi.nlm.nih.gov/articles/PMC10815876/. Accessed 20 Nov. 2025.

[55] Duglio, Stefano, and Riccardo Beltramo. "Estimating the Economic Impacts of a Small-Scale Sport Tourism Event: The Case of the Italo-Swiss Mountain Trail CollonTrek." *Sustainability*, vol. 9, no. 3, 2017, p. 343, https://www.mdpi.com/2071-1050/9/3/343. Accessed 20 Nov. 2025.

[56] Metzler, Brian. "State of the (Trail Running) Union: Eight Takeaways From a New International Survey." *Outside Online*, 17 Oct. 2023, https://run.outsideonline.com/road/road-culture/survey-on-trail-runnning-2023/. Accessed 20 Nov. 2025.

mountaineers, as ultra-runners traverse multiple valleys and remote ridges in single sessions.[57]

Despite marketing imagery depicting runners scaling vertical cliffs, actual terrain preferences are nuanced. Research into "runnability" indicates that 57.2% of participants prefer "undulating" trails, while only 22.6% specifically seek out steep vertical gradients.[54] This suggests that mid-mountain balcony trails and rolling alpine pastures—zones heavily utilized by pastoral agriculture—are the primary assets for this tourism segment.

2.2.2 The Sociology of the Ascent

The demographic profile of the Alpine trail runner represents a specific socio-economic stratum, leading sociologists to describe the phenomenon as a form of "gentrification" of the outdoors. The barrier to entry involves significant time and economic capital.

- **Education and Status:** The community is exceptionally well-educated, with 82% holding a university degree and 51% possessing five or more years of higher education.[56] In the French Alps, 53% of trail runners occupy managerial or professional roles, compared to just 9% of the general population.[58]
- **Income and Equipment:** Approximately 35% of runner households report an annual income exceeding $100,000.[56] This fuels a robust "gear economy," where 40% of participants are willing to pay between $150 and $250+ for a single piece of equipment, such as carbon fiber poles.[59]
- **Age Dynamics:** The sport is dominated by middle-aged participants, with 64.4% of the community aged between 35 and 54.[60] Physiological data suggests that 'peak age' in

[57] Genitrini, Matteo, et al. "Downhill Sections Are Crucial for Performance in Trail Running Ultramarathons—A Pacing Strategy Analysis." *Journal of Functional Morphology and Kinesiology*, vol. 7, no. 4, 2022, p. 106, https://pmc.ncbi.nlm.nih.gov/articles/PMC9680470/. Accessed 20 Nov. 2025.

[58] Savre, Camille, and Marie Eveillard-Buchoux. "Sportspeople Tracking in the Mountains: A Methodological Proposal for the Spatial Analysis of GPS Data Produced by Trail Runners." *Journal of Alpine Research | Revue de géographie alpine*, no. 107-4, 2019, https://doi.org/10.4000/rga.12420. Accessed 20 Nov. 2025.

[59] "ATRA's Inaugural Trail Running Pole Survey Results." *American Trail Running Association*, 13 Apr. 2021, https://trailrunner.com/trail-news/atras-inaugural-trail-running-pole-survey-results/. Accessed 20 Nov. 2025.

[60] Ronto, Paul. "Ultimate Trail Running Stats." *RunRepeat*, 26 June 2024, https://runrepeat.com/ultimate-trail-running-stats. Accessed 20 Nov. 2025.

ultra-distances is shifting upwards, as experience and pain tolerance offset the natural decline in maximum physical potential.[61]

2.2.3 Ecological Impact: The Landscape of Fear

While runners often adhere to a "leave no trace" ethos regarding litter, the biological impact of their speed and timing is profound. Scientific assessment using Fecal Cortisol Metabolites (FCM) in species like the Black Grouse reveals that human recreation is a primary driver of physiological stress.[62] Unlike hikers, trail runners move rapidly and silently, mimicking the attack vector of a predator and triggering acute neuroendocrine responses in wildlife.[63; 64]

A distinct development driven by ultra-endurance racing is the "colonization of the night." Training for events like the Ultra-Trail du Mont-Blanc (UTMB) requires running with high-lumen headlamps, eroding the "temporal refuge" of nocturnal and crepuscular wildlife. This creates a "landscape of fear," forcing diurnal species to become nocturnal and compressing activity windows, which can disrupt biodiversity cascades.[65] Furthermore, while runners generally prefer established paths, the desire to bypass crowds or "seek vert" leads to the creation of "social trails," where the braking forces of running shoes on descents accelerate soil displacement.[54]

2.2.4 Economic Relevance and Usage Conflicts

Trail running has been seized upon as a vital diversification strategy for Alpine resorts. The "Station de Trail" concept, originating in the French Alps, replicates the ski resort model by

[61] Thuany, Mabliny, et al. "Road and Trail Running From 5 km to an Ultra-Marathon – Trends in Switzerland From 1999 to 2019." *Human Movement*, vol. 24, no. 4, 2023, pp. 27-35, https://hummov.awf.wroc.pl/Road-and-trail-running-from-5-km-to-an-ultra-marathon-trends-in-Switzerland-from,193799,0,2.html. Accessed 20 Nov. 2025.

[62] Baltic, Marjana, et al. "A Noninvasive Technique to Evaluate Human-Generated Stress in the Black Grouse." *Annals of the New York Academy of Sciences*, vol. 1046, no. 1, 2005, pp. 81-95, https://www.researchgate.net/publication/7689981_A_Noninvasive_Technique_to_Evaluate_Human-Generated_Stress_in_the_Black_Grouse. Accessed 20 Nov. 2025.

[63] Marzano, Mariella. *Recreational Use of Forests and Disturbance of Wildlife*. Forest Research, July 2012, https://cdn.forestresearch.gov.uk/2022/02/fcrp020.pdf. Accessed 20 Nov. 2025.

[64] Marchand, Pascal, et al. "Disturbance by Massive Sporting Events in Mountain Areas: When and Where Matters for the Protected Alpine Ibex Capra ibex." People and Nature, vol. 7, no. 11, Oct. 2025, pp. 3002-16. Wiley Online Library, https://doi.org/10.1002/pan3.70151. Accessed 2 Feb. 2026.

[65] Liu, Xueyou, et al. "Human Disturbance Increases Spatiotemporal Associations Among Mountain Forest Terrestrial Mammal Species." *eLife*, 26 Oct. 2023, https://elifesciences.org/reviewed-preprints/92457. Reviewed Preprint. Accessed 20 Nov. 2025.

providing marked routes and base camps with relatively low public investment.[66] Major events act as massive economic injections; for every euro of public money invested in events like the CollonTrek, the direct economic return is estimated between €5.64 and €6.90.[55]

However, the densification of mountain users has led to friction, particularly with pastoral agriculture. The most acute conflict involves Livestock Guardian Dogs (Patous), which protect flocks from wolves. To a Patou, a fast-moving, silent runner represents a high-threat profile, triggering chase-and-defense drives.[67] Similarly, conflicts arise on shared-use trails where hikers, who constitute the majority of summer visitors, perceive the rapid approach of runners as an intrusion into their "bubble of tranquility".[68]

To ensure sustainability, management strategies are shifting toward zoning and temporal regulation. Some Alpine nations are implementing "Quiet Zones" (Wildruhezonen) to restrict access during critical breeding periods, while event organizers are exploring caps on participation to address over-tourism.[67] Future integration efforts aim to connect trail routes with local agricultural producers, transforming runners from a pastoral nuisance into customers for local dairy products.[69]

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[66] "Isère." *Invest in Auvergne-Rhône-Alpes*, https://invest-in-auvergnerhonealpes.com/en/our-territories/isere/. Accessed 20 Nov. 2025.

[67] *Press File Summer 2023*. Chamonix-Mont-Blanc Tourist Office, 2023, https://www.chamonix.com/sites/default/files/media/brochures/ENG%20DP%20ETE%20.23%20BD.pdf. Accessed 20 Nov. 2025.

[68] "Comparing Relative Impacts of Various Trail User Groups." *American Trails*, https://www.americantrails.org/resources/comparing-relative-impacts-of-various-trail-user-groups. Accessed 20 Nov. 2025.

[69] Saha, Sudeb, et al. "Effects of Summer Transhumance of Dairy Cows to Alpine Pastures on Body Condition, Milk Yield and Composition, and Cheese Making Efficiency." *Animals*, vol. 9, no. 5, 2019, p. 248, https://pmc.ncbi.nlm.nih.gov/articles/PMC6523363/. Accessed 20 Nov. 2025.

2.3 Bivouacking and wild camping in Alpine areas

Historically, the concept of the bivouac was intrinsically linked to the practice of alpinism—a logistical necessity born of the austere conditions of high-altitude climbing. It was a temporary suspension of movement necessitated by darkness or exhaustion, typically executed with minimal equipment on rock ledges or snowfields.[70]

However, the last decade has witnessed a paradigm shift in which the alpine night has been commodified and re-imagined as a recreational product. This phenomenon, widely termed "wild camping," represents a departure from the alpinist tradition towards a consumer-driven pursuit of "wilderness," facilitated by ultralight technology and amplified by digital media.[71] The "thousand-star hotel" ideal now competes directly with the biological realities of sensitive alpine ecosystems.[72]

2.3.1 Terminological Distinctions and Drivers of Change

A critical impediment to coherent management is the ambiguity between "bivouacking" and "wild camping." While often used interchangeably in lay discourse, the distinction is legally and ecologically significant.

- **Bivouacking (*Biwakieren*):** In traditional terms, this refers to spending the night in the open without a tent, strictly from sunset to sunrise. It is largely tolerated in high-alpine environments but still prohibited in some highly protected areas. In the case of an unplanned emergency overnight, necessitated by extreme or unforeseen

[70] "Alpine Nights: Minimalism, Freedom, and Responsibility in a Bivouac." *Blackyak*, https://global.blackyak.com/en/blogs/news/alpine-nights-minimalism-freedom-and-responsibility-in-a-bivouac. Accessed 19 Nov. 2025.
[71] "Rise in Wild Camping Adventures." *SportsCover Direct*, 10 Mar. 2021, https://www.sportscoverdirect.com/scd-blog/rise-in-wild-camping-adventures/. Accessed 19 Nov. 2025.
[72] "The Thousand Star Hotel I - Wild Camping and Bivouacking in Germany, Austria, Switzerland." *VAUDE*, https://www.vaude.com/nl/en/blog/post/the-thousand-star-hotel-i-wild-camping-and-bivouacking-in-germany-austria-switzerland.html. Accessed 19 Nov. 2025.

circumstances, it is commonly recognized as a measure to protect life, which usually supersedes local conservation bans.[73]

- **Wild Camping (*Sauvage*):** This practice involves the establishment of a camp using a tent, often associated with multi-day stays and cooking infrastructure.[74] Regulators view this not as survival necessity but as a recreational appropriation of land.[75]

The blurring of these lines, where hikers use ultralight tents for planned "bivouacs" in non-emergency situations, has forced authorities to revise enforcement protocols.[76] This surge is driven by specific socio-cultural shifts:

- **The "Instagram Effect":** Digital platforms have altered visitor flows, with the visual allure of "waking up with a view" concentrating pressure on photogenic hotspots. Even though bivouac practices have existed for a long time, recent research indicates that geotagging drives inexperienced campers to remote locations without adequate knowledge of regulations.[77]
- **Ultralight Technology:** Advancements in gear, where complete sleep systems weigh less than 1.5 kg, have lowered the physical barrier to entry.[70]
- **Economic Factors:** Rising costs of traditional hut accommodation have incentivized younger demographics to bypass the hut system, even if bivouac equipment is often expensive in itself. Searches for "wild camping" in the DACH region have shown year-on-year increases since 2020.[71]

[73] CIPRA International. *Responsible Bivouacking: A Handbook for Environmentally Friendly Behaviour along the Via Alpina*. CIPRA, 24 Sept. 2025, https://www.cipra.org/media/files/vay_bivouac_whitepaper.pdf. Accessed 2 Feb. 2026.

[74] "Wild Camping In Europe: Where To Sleep Outside Legally." *Hanwag Stories*, https://stories.hanwag.com/en/wild-camping-europe/. Accessed 19 Nov. 2025.

[75] "Code of Conduct." *Triglav National Park*, https://www.tnp.si/en/visiting-park/information-for-visitors/code-of-conduct/. Accessed 19 Nov. 2025.

[76] "Wild Camping and Bivouacking in Austria - What Is Legal?" *Lacrux Climbing Magazine*, 13 June 2023, https://www.lacrux.com/en/klettern/wild-camping-and-bivouacking-on-the-mountain-what-is-legal/. Accessed 19 Nov. 2025.

[77] *A Report into Broader Sustainability Issues for Outdoor Sports*. Sustainability and Environmental Education (SEE) Project, https://www.see-project.eu/storage/app/uploads/public/62b/48f/bea/62b48fbea3ab6565638160.pdf. Accessed 19 Nov. 2025.

2.3.2 Ecological Impacts: Vegetation and Wildlife

The transformation of the alpine night from a period of quietude to one of human activity exerts profound pressure on ecosystems.

Vegetation Damage Alpine flora exhibits low resilience to trampling. Research demonstrates that the impact of camping on vegetation is non-linear and rapid; significant reductions in vegetation cover can occur after a single night of camping or approximately 20 trampling passes.[78] Chronic degradation prevents recovery, particularly in dwarf-shrub heathlands, while unregulated camping leads to the proliferation of "satellite" sites—secondary cleared areas around a central spot—that exponentially increase the degradation footprint.[79]

Faunal Disturbance

The most critical impact is the disturbance of wildlife during crepuscular and nocturnal periods.

- **Black Grouse:** As a bio-indicator for timberline ecosystems, the Black Grouse suffers from a "funneling effect" of stress. Analysis of corticosterone metabolites reveals that frequent disturbance pushes birds into "allostatic overload," compromising immune function. In winter, flushing a grouse from its snow burrow increases daily energy expenditure by over 10%, a potentially lethal cost.[80] Consistent disturbance leads to the abandonment of traditional lekking (mating) sites.[81]
- **Ungulates:** Chamois perceive humans as high-level threats; heart-rate telemetry shows their heart rates rise significantly upon detection, often before a behavioral flight response is visible.[82] The presence of campers removes the "nocturnal refuge"

[78] Eagleston, Holly, and Jeffrey L. Marion. *Sustainable Campsite Management in Protected Areas*. Appalachian Trail Conservancy, Jan. 2020, https://appalachiantrail.org/wp-content/uploads/2020/04/eagleston-marion-bwca-sustainable-camping-2017.pdf. Accessed 19 Nov. 2025.

[79] Cole, David N., and Christopher A. Monz. "Impacts of Camping on Vegetation: Response and Recovery Following Acute and Chronic Disturbance." *Environmental Management*, vol. 34, no. 2, 2004, pp. 231-240, https://pubmed.ncbi.nlm.nih.gov/15160895/. Accessed 19 Nov. 2025.

[80] Arlettaz, Raphaël, et al. "Disturbance of Wildlife by Outdoor Winter Recreation: Allostatic Stress Response and Altered Activity-Energy Budgets." *Ecological Applications*, vol. 25, no. 5, 2015, pp. 1197-1212, https://pubmed.ncbi.nlm.nih.gov/26485949/. Accessed 19 Nov. 2025.

[81] Zeitler, Alfred. "Human Disturbance, Behaviour and Spatial Distribution of Black Grouse in Skiing Areas in the Bavarian Alps." *Cahiers d'Ethologie*, vol. 20, no. 2, 2000, pp. 381-402, http://labos.ulg.ac.be/etho/wp-content/uploads/sites/34/2018/08/tetras_2000_zeitler.pdf. Accessed 19 Nov. 2025.

[82] Schnidrig-Petrig, R., and P. Ingold. "Effects of Paragliding on Alpine Chamois Rupicapra Rupicapra." *Wildlife Biology*, vol. 7, no. 4, 2001, pp. 285-294, https://bioone.org/journals/wildlife-biology/volume-7/issue-4/wlb.2001.033/Effects-of-paragliding-on-alpine-chamois-Rupicapra-rupicapra-rupicapra/10.2981/wlb.2001.033.pdf. Accessed 19 Nov. 2025.

for species like Chamois and Ibex, forcing them into constant vigilance or displacing them to suboptimal habitats.[83] For male Alpine Ibex, disturbance near thermal refuges can lead to overheating and potential impacts on reproductive success.[84]

Pollution

The influx of inexperienced campers has led to sanitary issues. The accumulation of waste and sunscreen in high-altitude oligotrophic lakes alters water chemistry and threatens aquatic life, a factor that drove restrictions in the Aiguilles Rouges.[85]

2.3.3 Legal Geographies: A Fragmented Alpine Landscape

The legal framework governing sleeping in the Alps is characterized by extreme fragmentation, ranging from strict prohibition to ambiguous tolerance.

Slovenia: The Strict Conservation Model

Slovenia represents the most restrictive regime, driven by the *Zakon o ohranjanju narave* (Nature Conservation Act). In Triglav National Park, specific regulations explicitly forbid camping and bivouacking outside designated places.[86] Culturally and legally, a "Bivak" in Slovenia refers to a specific physical shelter, not the right to sleep on the ground.[87] Enforcement is rigorous, with fines reaching up to €1,000.[88]

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[83] Thel, Lucie, et al. "Too Hot or Too Disturbed? Temperatures More Than Hikers Affect Circadian Activity of Females in Northern Chamois." *Animal Behaviour*, vol. 209, 2024, pp. 53-65, https://www.researchgate.net/publication/378623757_Too_hot_or_too_disturbed_Temperatures_more_than_hikers_affect_circadian_activity_of_females_in_northern_chamois. Accessed 19 Nov. 2025.

[84] Grignolio, Stefano, et al. "Predation Risk as a Factor Affecting Sexual Segregation in Alpine Ibex." *Journal of Mammalogy*, vol. 88, no. 6, 2007, pp. 1488-1497, https://academic.oup.com/jmammal/article/88/6/1488/861921. Accessed 19 Nov. 2025.

[85] *Je reste sur les sentiers, Je déclare mon bivouac, Je ne me baigne pas dans les lacs*. Communauté de Communes de la Vallée de Chamonix-Mont-Blanc, May 2024, https://www.chamonix.com/sites/default/files/media/brochures/CCVCMB%20DRAPEAU-AILE-70x170%202024-05.pdf. Accessed 19 Nov. 2025.

[86] "Zakon o Triglavskem narodnem parku (ZTNP) [Law on Triglav National Park]." *PISRS*, Legal Information System of the Republic of Slovenia, 2010, https://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO128. Accessed 19 Nov. 2025.

[87] "Safely into the Slovenian Mountains: A Complete Guide." *Slovenian Tourist Board*, https://www.slovenia.info/en/stories/stay-safe-in-the-mountains. Accessed 19 Nov. 2025.

[88] "Triglav National Park Camping: Rules, Best Campsites & Info." *Lifetrek.eu*, https://lifetrek.eu/triglav-national-park-camping-rules-best-campsites-what-you-need-to-know/. Accessed 19 Nov. 2025.

Austria: The Federal Patchwork

Austria presents a contradictory legal mosaic across its federal states:[89]

- **Strict Prohibitions:** Tyrol, Carinthia, and Lower Austria explicitly ban camping outside designated sites, with significant penalties.
- **Conditional Tolerance:** Upper Austria and Styria generally permit camping above the forest line, provided it is not on pasture land.
- **Forest Law:** The Austrian Forest Act (*Forstgesetz*) guarantees access but explicitly excludes "camping in the dark" from this right.[76]

France: From Toleration to Zoning

France generally operates under a regime of toleration for bivouac (sunset to sunrise) outside of protected areas. However, national parks and municipalities may enforce specific rules: Vanoise applies conservation-driven zoning rules with selected authorized camping areas during the summer period,[73] while Écrins allows it under strict conditions (small tent, 7 PM to 9 AM, additional zoning rules apply).[90]

Germany: Strictly prohibited

In the Bavarian Alps, wild camping is strictly prohibited in National Parks (e.g., Berchtesgaden) and nature reserves, with violators facing fines and evacuation costs.[77]

Switzerland: A Patchwork of regulations

In Switzerland, there is no uniform federal ban; authority lies with Cantons and Municipalities. Generally, a single night above the treeline is tolerated outside protected zones, though local enforcement varies.[91]

2.3.4 Emerging Management Paradigms

The era of unregulated wild camping is closing, replaced by proactive management models.

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[89] "The Romance of Sleeping in the Open - The Rules of Bivouacking in Austria." *Natreku.cz*, https://www.natreku.cz/en/rules-bivouacking-austria/. Accessed 19 Nov. 2025.

[90] *Gestion Bivouac: Note Technique*. Parc national des Écrins / Asters-CEN74, 2024, https://www.ecrins-parcnational.fr/sites/ecrins-parcnational.com/files/article/24450/gestion-bivouac-note-technique2024-asterscen74.pdf. Accessed 19 Nov. 2025.

[91] *Camping and Bivouacking in the Swiss Mountains*. Swiss Alpine Club (SAC), https://www.ticino.ch/dam/jcr:65ec8a47-1717-4db5-ae56-6012f22fc663/SAC_Camping_Bivouacking_e.pdf. Accessed 19 Nov. 2025.

Case Study: The Aiguilles Rouges Model (France)

Faced with sustainable visitor pressure (thousands of tents per season), the Aiguilles Rouges Nature Reserve implemented a pioneering hybrid model in 2024. This system combines zoning (banning camping at sensitive sites like Lac Blanc), a mandatory free digital reservation system, and educational gatekeeping via a "ludic quiz" regarding regulations.[92] Data from the pilot season showed high compliance, with 58% of users being itinerant trekkers, suggesting the hiking community is willing to accept regulation that provides legal certainty.[93]

The "Trekkingplatz" Solution

To mitigate conflict, Germany and Austria are expanding networks of *Trekkingplätze*—designated, primitive sites booked for a nominal fee. These sites channel trekkers away from core protection zones while providing legal certainty.[94]

In conclusion, the romantic notion of the solitary, unregulated bivouac is becoming incompatible with the biological fragility of the Anthropocene Alps. The future lies in a bifurcated approach: strict exclusion in high-value conservation areas, and managed access through zoning and digital reservation systems in broader landscapes.

[92] Asters – Conservatoire d'espaces naturels de Haute-Savoie. *Bivouac dans les réserves naturelles de Haute-Savoie*, 2023, reserve-bivouac74.fr. Accessed 29 Jan. 2026.

[93] *Régulation du bivouac en espace naturel protégé*. Asters Conservatoire d'espaces naturels Haute-Savoie, Mar. 2025, https://www.biodiversite-auvergne-rhone-alpes.fr/wp-content/uploads/2025/04/8_2025-03-20-Presentation-AstersCEN74.pdf. Accessed 19 Nov. 2025.

[94] "Trekkingplätze in Bayern: Wild campen ganz legal." *Bayern Tourismus*, https://erlebe.bayern/storys/trekkingplaetze-bayern/. Accessed 19 Nov. 2025.

2.4 Swimming and bathing in high-altitude Alpine lakes

High-altitude lakes in the European Alps represent some of the most pristine, yet ecologically fragile, freshwater environments on Earth. Traditionally, their physical remoteness allowed them to function as "sentinels of global change," providing baseline data on atmospheric deposition and climatic shifts.[95] However, a contemporary paradigm shift is occurring: the isolation that once protected these waters is eroding due to the rapid growth of "wild swimming." This transition from passive observation to direct immersion transforms these lakes into arenas of anthropogenic disturbance, creating a tension between the cultural commodification of "blue spaces" and the biological limitations of ultra-oligotrophic ecosystems.[96]

It is critical to distinguish between "Montane Valley Lakes" and true "Alpine Lakes." While lower lakes often possess higher biodiversity, enabling some resilience, true alpine ecosystems contain inherently fewer species to compensate for loss. Consequently, the introduction of a novel stressor—such as chemical contaminants or pathogens—can lead to rapid functional collapse without the possibility of "rescue" by tolerant taxa from the regional pool.[96] However, Analyses conducted as part of the PLOUF project, show that the impacts cannot be identified with certainty. Certain molecules linked to human presence have been detected, some of which may have a significant toxic effect, but in extremely low concentrations.[97] Additionally to the context of swimming and bathing, the use of paddleboards, canoes, or other recreational water vessels may pose additional risks, as they can introduce new, potentially invasive species and disrupt food webs.

2.4.1 The Limnological Context and Chemical Contamination

Alpine lakes are defined by a "Transparency-UV Paradox." Due to low concentrations of Dissolved Organic Carbon (DOC)—the primary natural filter for radiation—these waters are

[95] Rose, Kevin C., et al. "Differences in UV Transparency and Thermal Structure between Alpine and Subalpine Lakes: Implications for Organisms." *Photochemical & Photobiological Sciences*, vol. 8, no. 9, 2009, pp. 1244-1256, https://pmc.ncbi.nlm.nih.gov/articles/PMC2859601/.

[96] "Alpine Lakes But Not Montane Valley Lakes Require Rescue from the Ecological Impacts of Introduced Sportfish." *Biogeoscience Institute*, University of Calgary, https://research.ucalgary.ca/biogeoscience-institute/research/research-highlights/alpine-lakes-not-montane-valley-lakes-require. Accessed 21 Nov. 2025.

[97] "PLOUF 2 – Pollution of High-Altitude Lakes and Observation of Recreational Uses." Labex ITTEM, 2024, https://labexittem.fr/en/projets/plouf-2-pollution-of-high-altitude-lakes-and-observation-of-recreational-uses/. Accessed 2 Feb. 2025.

exceptionally clear, allowing high-energy UV radiation to penetrate deeply.[98] Swimmers may disrupt this optical balance by physically resuspending benthic sediments (turbidity generation) and introducing photo-reactive chemicals that degrade into toxic byproducts under intense solar radiation,[95] although research findings in this respect are not always conclusive.

The Sunscreen Vector

One of the most significant impacts is the introduction of Personal Care Products (PCPs), specifically organic UV filters. Estimates suggest up to 25% of applied sunscreen releases into the water during a 20-minute swim.[99] In closed-basin alpine lakes with slow hydraulic retention, compounds like Octocrylene and Benzophenone-3 accumulate as "pseudo-persistent" pollutants, often spiking during bathing weekends.[100] Preliminary modeling proposed by Tomy Doda suggests that these vulnerable lakes act as sinks where chemicals concentrate within the water, sediments, and food webs.[101] These lipophilic compounds bioaccumulate in the lipid reserves of zooplankton—critical for winter survival—and biomagnify up the food chain, causing reproductive failure and endocrine disruption. Furthermore, these chemicals can adsorb onto microplastics, creating a "co-pollution" scenario that concentrates toxins and facilitates their ingestion by aquatic life.[102]

Eutrophication ("Human Fertilization")

Swimmers also introduce nutrients through direct excretion (sweat and urine rich in nitrogen/phosphorus) and the disturbance of "legacy nutrients" trapped in sediments.[103] This "fertilization" triggers algal proliferation and macrophyte invasion; research in the Tatra National Park linked water access trails to the colonization of the lakebed by invasive

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98 "Research Brief: Threats to High-Mountain Lakes in the Alps." *Lake Scientist*, 23 July 2013, https://www.lakescientist.com/research-brief-threats-to-high-mountain-lakes-in-the-alps/. Accessed 21 Nov. 2025.

99 "The Truth About Corals and Sunscreen." *Smithsonian Ocean*, Smithsonian Institution, https://ocean.si.edu/ecosystems/coral-reefs/truth-about-corals-and-sunscreen. Accessed 21 Nov. 2025.

100 Balmer, Marianne, et al. "Occurrence of Some Organic UV Filters in Wastewater, in Surface Waters, and in Fish from Swiss Lakes." *Environmental Science & Technology*, vol. 40, no. 5, 2006, pp. 1427-1431, https://pubmed.ncbi.nlm.nih.gov/15773466/. Accessed 21 Nov. 2025.

101 Doda, Tomy, et al. Modélisation de la Fréquentation et de l'Impact des Polluants. Rencontres du Réseau Lacs Sentinelles, 2025, www.lacs-sentinelles.org/sites/default/files/ressources/rencontres_du_reseau/rencontres_2025/modele_frequentation_tomy_doda_ok.pdf. Accessed 2 Feb. 2026.

102 Mowbray, Sean. "Sunscreens Protect Us But Also Pose Real Planetary Health Concerns." *Mongabay*, 14 Aug. 2025, https://news.mongabay.com/2025/08/sunscreens-protect-us-but-also-pose-real-planetary-health-concerns/. Accessed 21 Nov. 2025.

103 "Alpine Lakes in Triglav National Park." *Triglavska Zakladnica*, https://www.triglavskazakladnica.si/en/content/content-details/47/. Accessed 21 Nov. 2025.

pondweed (*Potamogeton friesii*), although the same species of great importance for other mountain ecosystems, particularly in France, where it is strictly protected.[104] The subsequent decomposition of these blooms depletes dissolved oxygen, threatening sensitive cold-water species that are already under pressure due to rising temperatures.[105]

2.4.2 Biological Pollution and Pathogen Dispersal

A critical, often invisible impact is the translocation of pathogens. High-altitude lakes act as ecological islands, but swimmers and their water sport equipment function as biological vectors bridging these gaps.

- **Amphibian Decline:** The global decline of amphibians is linked to Chytridiomycosis (*Batrachochytrium dendrobatidis* or Bd). Humans and recreational water vessels transport Bd spores on skin and swimwear from lowland waters to pristine alpine sites.[106] The combination of UV stress and pathogen introduction creates a lethal synergy for species like the midwife toad (*Alytes obstetricans*).[107]
- **Impact on Mammals:** The disturbance extends to semi-aquatic mammals like the Pyrenean desman. Additionally, domestic dogs swimming in these lakes can release toxic insecticides from anti-parasitic collars (e.g., fipronil) into the water, decimating the aquatic insect populations that bats and small mammals rely on and which are already under pressure from introduced fish species and other harmful factors.[105]

[104] Dynowski, Piotr., et al. "The Impact of Recreational Activities on Aquatic Vegetation in Alpine Lakes." *Water*, Jan. 2005, https://www.researchgate.net/publication/330490528_The_Impact_of_Recreational_Activities_on_Aquatic_Vegetation_in_Alpine_Lakes. Accessed 21 Nov. 2025.

[105] "Impacts of Swimming in High Mountain Lakes." *CEAB-CSIC*, Centre d'Estudis Avançats de Blanes, https://www.ceab.csic.es/en/impactes-del-bany-en-els-estanys-dalta-muntanya/. Accessed 21 Nov. 2025.

[106] Kolby, Jonathan E., et al. "Presence of Amphibian Chytrid Fungus (Batrachochytrium Dendrobatidis) in Rainwater Suggests Aerial Dispersal Is Possible." *Aerobiologia*, vol. 31, 2015, pp. 411-419, https://doi.org/10.1007/s10453-015-9374-6. Accessed 21 Nov. 2025.

[107] "Impacts of Swimming in High Mountain Lakes." *Life Resque AlPyr*, https://liferesquealpyr.eu/blog/impacts-of-swimming-in-high-mountain-lakes/. Accessed 21 Nov. 2025.

2.4.3 Socio-Cultural Trends and the "Instagram Effect"

The ecological pressures are compounded by the "wild swimming" boom, influenced by wellness trends and the desire for "reconnection" with nature.[108] This commoditization is amplified by social media, which creates "viral" destinations.

- **Overtourism:** Lago di Braies in the Dolomites serves as the archetype. With hashtags like #lagodibraies attracting thousands of visitors, the shoreline suffers from concentrated trampling as visitors wade into the water for photos.[109] Similarly, Lago di Sorapis has seen influencers fined for unauthorized access and bathing, highlighting the conflict between digital fame and conservation.[110]
- **Visitor Divergence:** A dichotomy exists between "nature-oriented" visitors who value pristine conditions and "leisure-oriented" visitors who prioritize accessibility and amenities. Infrastructure improvements designed to accommodate leisure users often increase the ecological load, degrading the experience for nature-oriented groups.[111]

2.4.4 Regional Regulatory Frameworks

The regulatory response across the Alps is a patchwork of protection levels.

- **Slovenia:** Triglav National Park enforces a strict ban on swimming in high-mountain lakes (e.g., Seven Lakes Valley), explicitly linking the prohibition to the prevention of eutrophication and microbiome disruption.[103]
- **France:** Authorities utilize prefectoral decrees for enforcement. As of 2023, swimming is strictly banned during the summer season in the natural reserve of Aiguilles Rouge

[108] "The Hidden Cost of Wild Swimming: How Our Cold Water Craze Is Harming the Planet." *The European*, https://the-european.eu/story-46615/the-hidden-cost-of-wild-swimming-how-our-cold-water-craze-is-harming-the-planet.html. Accessed 21 Nov. 2025.

[109] "Overtourism in South Tyrol, Italy, Is Sparking Drastic Consequences." *SnowBrains*, 28 Apr. 2023, https://snowbrains.com/overtourism-in-south-tyrol-italy-is-sparking-drastic-consequences/. Accessed 21 Nov. 2025.

[110] "Influencer ignorieren See-Verbot: Cortinas Bürgermeister plant Maßnahmen." *T-Online*, 20 Aug. 2023, https://www.t-online.de/leben/reisen/europa/italien/id_100883344/influencer-ignorieren-see-verbot-cortinas-buergermeister-plant-massnahmen.html. Accessed 21 Nov. 2025.

[111] Schirpke, Uta, et al. "Recreational Ecosystem Services of Mountain Lakes in the European Alps: Preferences, Visitor Groups and Management Implications." *Journal of Outdoor Recreation and Tourism*, vol. 35, 2021, p. 100421, https://doi.org/10.1016/j.jort.2021.100421. Accessed 21 Nov. 2025.

in Chamonix to prevent chemical pollution and bank erosion.[112] Ecrins National Park currently works with the scientific interest group 'Lacs sentinelles' to study the effects of swimming through sociological surveys and physical and biological measurements to ensure that future regulations will reflect objective and legally sound arguments.

- **Italy:** Gran Paradiso National Park explicitly prohibits swimming to protect amphibians. In the Dolomites, while swimming is allowed in lower valley lakes, high-altitude sites like Lago di Braies enforce bans and traffic restrictions to manage volume.[113]
- **Germany:** Management often relies on zoning. In Berchtesgaden National Park (Germany), swimming is technically allowed but the ban on flotation devices effectively limits access to sensitive shorelines.[114]
- **Austria:** In Austria, National Parks like Gesäuse impose specific bans on sensitive water bodies like the Sulzkarsee.[115]
- **Switzerland:** The Swiss National Park maintains an absolute ban on bathing to ensure zero human interference.[116]

2.4.5 Synergies with Climate Change and Future Outlook

Swimming acts synergistically with climate change to destabilize these ecosystems. The warming of the Alps has led to an "extended summer," with ice-free periods increasing by approximately 24 days in some catchments.[117] This widens the window for recreational access, significantly increasing the cumulative annual load of pollutants and nutrients.[118]

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[112] "Swimming Prohibited at Lac des Chéserys and Lac Blanc." *Chamonix.net*, 25 July 2023, https://www.chamonix.net/english/news/swimming-prohibited-lac-cheserys-lac-blanc. Accessed 21 Nov. 2025.

[113] "Lake Braies." *South Tyrol Information*, https://www.suedtirolerland.it/en/highlights/nature-and-landscape/lakes/lake-braies/. Accessed 21 Nov. 2025.

[114] "Important Information and Frequent Questions About the Shipping on Lake Königssee." *Bayerische Seenschifffahrt*, https://www.seenschifffahrt.de/en/koenigssee/important-information/. Accessed 21 Nov. 2025.

[115] "Water Experiences." *Nationalpark Gesäuse*, https://nationalpark-gesaeuse.at/en/discover-national-park/activities/water-experience/. Accessed 21 Nov. 2025.

[116] "Protection Regulations." *Swiss National Park*, https://nationalpark.ch/en/protection-regulations/. Accessed 21 Nov. 2025.

[117] "A Not So Solid Season: Alpine Lake Ice Cover Responds to a Changing Climate." *LTER Network*, 20 Apr. 2023, https://lternet.edu/stories/a-not-so-solid-season-alpine-lake-ice-cover-responds-to-a-changing-climate/. Accessed 21 Nov. 2025.

[118] Woolway, R. Iestyn. "The Pace of Shifting Seasons in Lakes." *Nature Communications*, vol. 14, no. 1, 2023, p. 2101, https://pmc.ncbi.nlm.nih.gov/articles/PMC10102225/. Accessed 21 Nov. 2025.

Furthermore, organisms already facing metabolic stress from rising temperatures have less energy to detoxify pollutants, while toxin exposure lowers their thermal tolerance.[119]

Future management strategies are shifting from passive tolerance to active intervention. "Rescue" projects aimed at restoring native amphibians by removing invasive fish are increasingly paired with strict "no-entry" policies for swimmers to prevent re-contamination.[107] A de facto zoning strategy is emerging, distinguishing between "sacrifice sites" (accessible, lower-altitude lakes absorbing mass tourism) and "sanctuary sites" (remote, high-altitude lakes with strict no-touch policies). Agencies are also moving toward educational reframing, defining alpine lakes not as "natural swimming pools" but as fragile drinking water reservoirs for wildlife.

[119] Häder, Donat-P., et al. "Effects of UV Radiation on Aquatic Ecosystems and Interactions with Other Environmental Factors." *Photochemical & Photobiological Sciences*, vol. 14, no. 1, 2015, pp. 108-126, https://doi.org/10.1039/C4PP90035A. Accessed 21 Nov. 2025.

2.5 Ski touring and snowshoeing as new mass sports

The Alpine winter tourism model, historically predicated on the industrial infrastructure of downhill skiing, is currently undergoing a structural transformation. The 21st century has ushered in a "Post-Fordist" era, marked by a fragmentation of consumer demand and a transition from "hard," infrastructure-dependent tourism to "soft," nature-based experiences. This shift is driven by a complex interplay of demographic evolution, technological innovation, and the existential pressures of climate change, which is raising the snowline and rendering low-altitude downhill resorts economically precarious.[120] Within this landscape, ski touring and snowshoeing have transcended their niche origins to become central pillars of the modern winter experience.[121]

2.5.1 The Bifurcation of Ski Touring

Ski touring has splintered from a monolithic mountaineering discipline into distinct sub-cultures. The most significant development is the explosion of "Slope Ski Touring" (SST) or *Pistentouren*. This activity involves ascending groomed ski slopes and descending the same prepared runs. SST has effectively rebranded ski touring from a mountaineering pursuit to a fitness activity comparable to jogging, driven by risk aversion. It provides a controlled environment where the "objective dangers" of the Alps (avalanche risk, navigation) are managed by resort operators, opening the sport to a vast demographic of "resort skiers".[122]

Parallel to this, traditional backcountry touring is experiencing robust growth, driven by a desire for solitude and "unspoiled" landscapes, particularly in regions like the Dolomites and Julian Alps.[123] This expansion is supported by the "weight revolution" in equipment (carbon

[120] Ausserladscheider, Valentina. "Decoupling Climate Change: Winter Tourism and the Maintenance of Regional Growth." *New Political Economy*, vol. 29, no. 5, 2024, pp. 693-708, https://doi.org/10.1080/13563467.2024.2330486. Accessed 25 Nov. 2025.

[121] Perrin-Malterre, Clémence, and Laine Chanteloup. "Ski Touring and Snowshoeing in the Hautes-Bauges (Savoie, France): A Study of Various Sports Practices and Ways of Experiencing Nature." *Journal of Alpine Research | Revue de géographie alpine*, no. 106-1, 2018, https://doi.org/10.4000/rga.3934. Accessed 25 Nov. 2025.

[122] Happ, Elisabeth, Martin Schnitzer, and Ursula Scholl-Grissemann. "Ski Touring on Groomed Slopes—Exploring an Alpine Winter Sports Trend and Potential Tourism Product." *Tourism Management Perspectives*, vol. 48, Oct. 2023, p. 101155, https://doi.org/10.1016/j.tmp.2023.101155. Accessed 25 Nov. 2025.

[123] "Italian Ski Resorts Measures Against Overtourism." *Seilbahnen International*, https://www.simagazin.com/en/si-alpin/topics/management-tourism/italian-ski-resorts-measures-against-overtourism/. Accessed 25 Nov. 2025.

fiber, pin bindings) and the ubiquity of GPS-enabled smartphone apps, which have democratized route planning.[124]

2.5.2 The Mainstreaming of Snowshoeing

Snowshoeing has shed its utilitarian image to become the primary vehicle for "soft" winter mobility. Functioning as the winter equivalent of summer hiking, it possesses almost no technical barrier to entry.[121] In regions like Slovenia's Soča Valley, it is marketed as a "slow tourism" product, often bundled with gastronomy and wellness to appeal to the "experience economy" consumer.[125] Research indicates that for many, snowshoeing is a complementary activity; "hybrid" tourists may ski for two days and snowshoe for one, utilizing the activity as an insurance policy against poor snow conditions.[126]

2.5.3 Socio-Demographic Transformation

The shift to human-powered sports is mirrored by a profound transformation in the profile of the mountain user.

- **The Fitness-Oriented Urbanite:** Younger to middle-aged urban residents treat the mountain as an outdoor gymnasium. They are data-driven, using smartwatches to track vertical gain, and view the tour as a time-efficient "workout" rather than an adventure.[127]
- **Feminization:** Snowshoeing exhibits strong female participation, representing 51% of practitioners in France.[128] In ski touring, the gender gap is closing, particularly in the lower-risk Pistentouren segment.[129]

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[124] "Europe Ski Gear and Equipment Market Size & Share Analysis." *Mordor Intelligence*, 2024, https://www.mordorintelligence.com/industry-reports/europe-ski-gear-and-equipment-market. Accessed 25 Nov. 2025.

[125] "Snowshoeing." *Soča Valley*, https://www.soca-valley.com/en/in-search-of-adventure/activities/2021020211513989/snowshoe-hiking/. Accessed 25 Nov. 2025.

[126] Abegg, Bruno, et al. "Alternative Outdoor Activities in Alpine Winter Tourism." *Winter Tourism: Trends and Challenges*, edited by Ulrike Pröbstl-Haider et al., CABI, 2019, pp. 236-45, https://www.cabidigitallibrary.org/doi/pdf/10.1079/9781786395207.0236. Accessed 25 Nov. 2025.

[127] Schlemmer, Philipp, and Martin Schnitzer. "Research Note: Ski Touring on Groomed Slopes and the COVID-19 Pandemic as a Potential Trigger for Motivational Changes." *Journal of Outdoor Recreation and Tourism*, vol. 33, Mar. 2021, p. 100353, https://pmc.ncbi.nlm.nih.gov/articles/PMC9765413/. Accessed 25 Nov. 2025.

[128] "La raquette à neige et les Français." *Pôle ressources national sports de nature*, https://www.sportsdenature.gouv.fr/raquette-a-neige/observation/pratiquants. Accessed 25 Nov. 2025.

[129] Lohr, Roger. "An Overview of Snowshoe Statistics." *Snowshoe Magazine*, 10 Oct. 2011, https://www.snowshoemag.com/an-overview-of-snowshoe-statistics/. Accessed 25 Nov. 2025.

- **The "Silver" Economy:** As the baby boomer generation ages, they are transitioning from high-impact alpine skiing to lower-impact activities like snowshoeing, maintaining strong participation into the 50-70 age bracket.[129]
- **The Hybrid Digital Native:** Younger demographics display "omnivore" behaviors, engaging in multiple sports depending on conditions, with destination choices heavily mediated by the "Instagrammability" of the location.[130]

2.5.4 The Catalyst Effect of COVID-19

The COVID-19 pandemic acted as a massive accelerant. The 2020/2021 "zero lift" season, where mechanical lifts were shuttered across much of the Alps, resulted in an unprecedented surge in participation. Retailers reported stock-outs of touring gear, and estimates suggest that over 50% of current slope ski tourers began the activity within the last five years.[127] Crucially, retention remains high; the "forced trial" successfully converted many skiers into hybrid users who continue to value the crowd avoidance and safety of backcountry activities post-pandemic.[131]

2.5.5 Economic Effects: A New Value Chain

While human-powered sports do not generate the high-density revenue of lift ticket sales, they catalyze a distributed form of economic activity.

- **Retail Boom:** The global ski touring equipment market is experiencing robust growth, projected to reach USD 11.4 billion by 2033.[132] In the 2021/2022 season alone, Austria recorded a 30% increase in touring ski sales.[122]
- **Decentralized Expenditure:** Spending is distributed across a wider network of SMEs, including rental shops, guides, and valley guesthouses, rather than being captured by a single lift operator. High-alpine huts, such as those managed by the Swiss Alpine Club,

[130] "WGSN Social Data: Snowsports Trends." *WGSN*, 28 Nov. 2024, https://www.wgsn.com/en/blogs/wgsn-social-data-snowsports-trends. Accessed 25 Nov. 2025

[131] Kogler, Anna-Maria, and Stefanie Elisabeth Schöttl. "Sports-Related Leisure Behavior in Alpine Regions During the COVID-19 Pandemic—A Cross-Sectional Study in Austria, Germany and Italy." *Frontiers in Public Health*, vol. 11, 2023, p. 1136191, https://pmc.ncbi.nlm.nih.gov/articles/PMC10033945/. Accessed 25 Nov. 2025.

[132] "Ski Touring Equipment and Apparel Market Size." *Market.us*, https://market.us/report/ski-touring-equipment-and-apparel-market/. Accessed 25 Nov. 2025.

rely on touring for year-round viability, recording over 360,000 overnight stays in 2024.[133]

- **Alternative Models:** Villages like Val Maira in Piedmont have dismantled defunct lifts to brand themselves exclusively as destinations for sustainable touring, attracting a high-spending international clientele.[134] Conversely, traditional resorts are monetizing the trend through "Touring Tickets" and parking fees, effectively turning the ski slope into a paid fitness facility.[127]

2.5.6 Ecological Constraints and Management

The dispersal of humans into wild winter landscapes creates significant ecological friction. The core issue is the spatial overlap between recreationists and the winter habitats of fauna during a period of extreme energetic constraint. Unpredictable movement—unlike the predictable corridor of a ski piste—is perceived by wildlife as a "predation risk".[135]

Snowshoeing poses a specific paradox: despite its gentle image, practitioners often traverse dense forests and shrublands critical for species like the Capercaillie and Black Grouse.[136] Research measuring stress hormones confirms that Black Grouse in areas frequented by tourers exhibit significantly higher stress levels, leading to immune suppression.[137] To mitigate this, management strategies are shifting toward "Spatial Steering" (*Lenkung*). Studies confirm that channeling tourers onto designated ascent routes significantly reduces stress on wildlife compared to free-roaming usage.[138] Digital apps and platforms can also contribute to a more

[133] "Medien." *Schweizer Alpen-Club SAC*, https://www.sac-cas.ch/de/meta/medien/. Accessed 25 Nov. 2025.
[134] "A Sustainable Vacation." *Valle Maira*, https://www.vallemaira.org/en/a-sustainable-vacation/. Accessed 25 Nov. 2025.
[135] Walter, Anna-Maria, Joonas Plaan, and Jonathan Carruthers-Jones. "Nature-Based Winter Sports and Their Ephemeral Tracks: Interspecies (Non-)Encounters in Snow." *Landscape Research*, vol. 49, no. 7, 2024, pp. 946-59, https://doi.org/10.1080/01426397.2024.2386003. Accessed 25 Nov. 2025.
[136] Braunisch, Veronika, et al. "Spatially Explicit Modeling of Conflict Zones Between Wildlife and Snow Sports: Prioritizing Areas for Winter Refuges." *Ecological Applications*, vol. 21, no. 4, June 2011, pp. 1291-303, https://pubmed.ncbi.nlm.nih.gov/21639058/. Accessed 25 Nov. 2025.
[137] Arlettaz, Raphaël, Patrick Patthey, and Veronika Braunisch. "Impacts of Outdoor Winter Recreation on Alpine Wildlife and Mitigation Approaches: A Case Study of the Black Grouse." *The Impacts of Skiing on Mountain Environments*, edited by Christian Rixen and Antonio Rolando, Bentham Science Publishers, 2013, pp. 137-54, https://www.cb.iee.unibe.ch/e58879/e337551/e478038/e478048/Arlettaz_BS2013_eng.pdf. Acc. 25 Nov. 2025.
[138] Patthey, Patrick, et al. "Impact of Outdoor Winter Sports on the Abundance of a Key Indicator Species of Alpine Ecosystems." *Journal of Applied Ecology*, vol. 45, no. 6, Dec. 2008, pp. 1704-11, https://doi.org/10.1111/j.1365-2664.2008.01547.x. Accessed 25 Nov. 2025.

responsible behaviour of skiers and snow shoers when communicating rules and recommendations effectively.[139]

[139] Schwietering, Arne, et al. "Digitale Outdoorplattformen: Potenziale und Herausforderungen für Naturschutz und Aktivitätsmanagement." *Natur und Landschaft*, vol. 99, no. 8, 2024, pp. 384-96, https://doi.org/10.19217/NuL2024-08-03.Accessed 25 Nov. 2025.

3 Outdoor tourism framework conditions in the Alps and recent developments

3.1 Recreational and tourism mobility in the context of the climate crisis

The Alpine region, historically defined by the economic dominance of winter sports, is undergoing a profound transformation driven by the dual pressures of climate change and evolving visitor preferences. As nature-based tourism—encompassing hiking, climbing, mountaineering, and biking—emerges as a critical component of regional resilience, the role of sustainable mobility has shifted from a peripheral amenity to a central pillar of destination management.

This shift is necessitated by the environmental reality that transport remains the single largest source of greenhouse gas (GHG) emissions in tourism, with the journey to the destination and local mobility accounting for the vast majority of the sector's carbon footprint.[140] In 2024 and 2025, the strategic focus has moved toward mandatory, integrated mobility systems financed by tourism levies, marking a paradigmatic shift from voluntary offers to structural decarbonization.[141]

3.1.1 Strategic Policy Frameworks and Transnational Cooperation

The governance of sustainable mobility is dictated by a complex interplay of transnational agreements and national master plans. The Alpine Convention serves as the binding basis, with its Transport Protocol mandating a shift from road to rail.[142]

- **The Climate Action Plan 2.0:** Adopted by the Alpine Conference, this framework explicitly targets the decarbonization of tourism flows. It promotes "soft mobility"

[140] "Mobility and Sustainable Tourism: How POMA Is Reinventing the Mountain Experience." *I Love Ski*, 24 Oct. 2024, https://www.iloveski.org/en/2024/10/24/mobility-poma/. Accessed 19 Nov. 2025.
[141] "Symposium on 'Sustainable Tourism Mobility'." *Federal Ministry of Labour and Economy (BMAW)*, https://www.bmimi.gv.at/en/topics/mobility/mgmt/tourism/pep/symposium.html. Accessed 19 Nov. 2025.
[142] *Climate Neutral Alpine Mobility*. Alpine Convention, https://www.alpconv.org/fileadmin/user_upload/Organisation/TWB/Transport/2-Report_policies_FIN.pdf. Accessed 19 Nov. 2025.

(*Sanfte Mobilität*)—a concept championed by the Alpine Pearls network—to decouple tourism revenue growth from traffic volume growth. The mandate for 2025 emphasizes aligning financing streams to support climate-neutral tourism offers exclusively, moving away from strategies that paradoxically subsidize private vehicle access.[143]

- **The Austrian Mobility Master Plan 2030:** Austria exemplifies state-level intervention, utilizing a backcasting model to outline steps for a carbon-neutral transport system by 2040. This top-down approach provides legislative backing for regional initiatives, such as the standardization of guest mobility tickets.[141]
- **The Alpine Pearls Network:** Founded in 2006, this network of 19 municipalities across the Alpine arc promotes car-free holidays by guaranteeing comprehensive shuttle services and E-mobility options. While successful in "islands" like Werfenweng, the challenge remains to expand these into interconnected corridors to solve the "last mile" problem.[144]

3.1.2 Structural Changes in Access: The Rail Renaissance

The "first mile/last mile" problem—getting tourists from home to trailhead without a car—is being addressed through significant rail infrastructure developments.

Cross-Border Tunnel Projects

The engineering landscape is being reshaped to facilitate high-speed, cross-border flows. The Brenner Base Tunnel, stretching 64 km from Fortezza (Italy) to Innsbruck (Austria), is a critical development. Milestones achieved in late 2024 and 2025 signal a future reduction in travel

[143] *Transport and Mobility in the Alps*. CIPRA International, 2025, https://www.cipra.org/media/files/2025-cipra-position-transport-and-mobility-in-the-alps-long-version-en.pdf/@@download/file/2025%20CIPRA%20Position%20-%20Transport%20and%20mobility%20in%20the%20Alps%20-%20long%20version%20%28en%29.pdf. Accessed 19 Nov. 2025.

[144] Lund-Durlacher, Dagmar, Anja Hergesell, and Karmen Mentil. "Alpine Pearls: A Network Promoting Environmentally Friendly Holidays." *International Cases in Sustainable Travel & Tourism*, https://www.researchgate.net/publication/391119262_Alpine_Pearls_A_Network_Promoting_Environmentally_Friendly_Holidays. Accessed Mar. 04 2026.

times that will revolutionize the catchment area for day-trip hikers, facilitating a modal shift from the congested Brenner motorway to rail.[145]

Regional Reconnection and Night Trains

The reopening of the Tauern railway in July 2025, following extensive modernization, restored the connection between Salzburg and the Adriatic. This re-enabled "sleeping access" to the Southern Alps via international connections like the Nightjet.[146] Simultaneously, ÖBB's Nightjet service has expanded to position itself as an enabler of "sleeping while travelling," connecting urban hubs like Hamburg and Amsterdam to Alpine gateways. This allows climbers to arrive in the early morning, maximizing daylight hours for activity.[147] Private operators like the *Alpen-Sylt Nachtexpress* supplement this by connecting the North Sea coast to Salzburg, targeting the leisure market specifically.[148]

3.1.3 Mobility as a Service (MaaS) and the Revolution of Guest Cards

A radical restructuring of "Guest Cards" represents a systemic move toward Mobility as a Service (MaaS), funded by tourism levies.

- **The Austrian Paradigm (SalzburgerLand):** In May 2025, SalzburgerLand introduced a Guest Mobility Ticket that is issued automatically upon check-in and covers all public transport (bus and train) throughout the entire province. Financed by a mandatory mobility fee added to the overnight tax, this model removes "valley-centric" limitations, allowing hikers to explore neighboring regions without financial friction.[149]
- **The Swiss Model (Ticino vs. Valais):** Switzerland offers a fragmented landscape. The *Ticino Ticket* mirrors the Austrian model by offering free cantonal travel and discounts

[145] "Brenner Base Tunnel: Austria and Italy's New Rail Link to Boost Tourism Across the Alps in 2026." *Travel And Tour World*, 15 Oct. 2024, https://www.travelandtourworld.com/news/article/brenner-base-tunnel-austria-and-italys-new-rail-link-to-boost-tourism-across-the-alps-in-2026/. Accessed 19 Nov. 2025.

[146] Gardner, Nicky. "Light at the End of the Tunnels: Classic Rail Routes Through the Alps Reopen." *The Guardian*, 10 July 2025, https://www.theguardian.com/travel/2025/jul/10/classic-rail-routes-through-alps-reopen-austria-switzerland-italy. Accessed 19 Nov. 2025.

[147] "Where Do You Want to Travel on the Night Train?" *ÖBB Nightjet*, https://www.nightjet.com/en/. Accessed 19 Nov. 2025.

[148] Buechting, Florian. "Alpen-Sylt Nachtexpress - A New Night Train Crossing Germany." *Flyctory.com*, 23 Sept. 2020, https://flyctory.com/2020/09/23/alpen-sylt-nachtexpress-a-new-night-train-crossing-germany/. Accessed 19 Nov. 2025.

[149] "Guest Mobility Ticket – Free Travel Throughout Salzburger Land." *Alps Resorts*, https://alps-resorts.com/blog-en-details/guest-mobility-ticket-free-travel-salzburg. Accessed 19 Nov. 2025.

on mountain railways.[150] Conversely, regions like Valais rely on valley-specific cards (e.g., SaastalCard) that offer immense local value but do not facilitate inter-valley travel as seamlessly.[151]

- **Germany (Bavaria):** The *KönigsCard* bundles free regional transit with leisure experiences, notably offering cross-border functionality into the Tyrolean Außerfern region, effectively erasing the national border for the tourist.[152]
- **Slovenia (Julijske Alpe)**: The Julian Alps Card focuses on "soft mobility" within a UNESCO Biosphere Reserve. Issued to guests staying at least two nights, it emphasizes solving "last-mile" connectivity by providing free hikers' buses and shuttles. Unlike broader regional tickets, this model is specifically designed to divert private vehicle traffic away from sensitive high-altitude trailheads and glacial lakes, framing transport as a direct conservation tool.[153]

3.1.4 Last-Mile Logistics and Specialized Transport

The efficacy of sustainable mobility depends on the "last mile" connection to the trailhead.

- **Hiking Shuttles:** Regions like the Julian Alps (Slovenia) have implemented high-frequency shuttle networks to mitigate traffic chaos in sensitive valleys. The "intercept and transfer" model forces private vehicles to park at the periphery, with visitors transferring to subsidized buses included in the *Julian Alps Card*.[154] In Werfenweng (Austria), the "SAM" system offers on-demand E-shuttles to bridge the gap between train stations and accommodations.[155]
- **Luggage Transfer:** To support car-free multi-day trekking, services that move heavy gear between huts have become essential. Providers in Switzerland and France

[150] "In-depth Ticino Ticket Must-Knows, Downloads and Insider Tips." *MySwissAlps*, https://www.myswissalps.com/travel-ticket/ticino-ticket/. Accessed 19 Nov. 2025.
[151] "Guest Card." *Valais/Wallis Promotion*, https://www.valais.ch/en/explore/inspiration/guest-card. Accessed 19 Nov. 2025.
[152] "KönigsCard." *Füssen Tourismus*, https://www.fuessen.de/en/koenigscard/. Accessed 19 Nov. 2025.
[153] "Mobility in the Julian Alps." *Julian Alps*, 2026, https://julian-alps.com/en/p/mobility-in-the-julian-alps/36128892/. Accessed 2 Feb. 2026.
[154] "Julian Alps Card: Soča Valley." *Soča Valley*, https://www.soca-valley.com/en/be-inspired/julian-alps-card:-soca-valley/. Accessed 19 Nov. 2025.
[155] Transport Working Group. *Sustainable Mobility Solutions in Remote Alpine Territories*. Alpine Convention, https://www.alpconv.org/fileadmin/user_upload/Fotos/Banner/Organisation/thematic_working_bodies/Part_02/transport_working_group/Executive_Summary_1.pdf. Accessed 19 Nov. 2025.

facilitate linear travel (e.g., Chamonix to Zermatt), breaking the circular dependency of returning to a parked car.[156]

- **Bike Transport Constraints:** The surge in E-biking has created capacity challenges. For the summer of 2025, PostBus Switzerland introduced a mandatory reservation system for bicycles on over 130 tourist routes. While ensuring reliability, this introduces a "spontaneity penalty," requiring cyclists to pre-commit to specific transport slots.[157]

3.1.5 Challenges and Future Implications

Despite progress, significant challenges remain. The increasing requirement for digital reservations creates a barrier for spontaneous travel. Furthermore, a "shoulder season gap" persists; public transport schedules are often drastically reduced outside peak windows, forcing hikers visiting in June or October back into private cars despite favorable conditions. Finally, while local mobility is decarbonizing, the "arrival" leg remains carbon-intensive, as 75% of holiday trips to Austria are still made by private car.[158]

The landscape is increasingly bifurcated between fully integrated hubs like SalzburgerLand, where the guest card acts as a universal key, and fragmented zones where administrative friction persists. The future standard for nature-based tourism appears to be the "Salzburg Model"—mandatory, region-wide mobility fees funding free, comprehensive transit—which successfully socializes the cost of public transport to decarbonize the Alpine experience.

[156] "Luggage Transfers on Haute Route and Tour du Mont Blanc." *Alpenwild*, https://www.alpenwild.com/staticpage/haute-route-luggage-transfers/. Accessed 19 Nov. 2025.
[157] "Postbus Reservation Obligation for Bicycles." *Biosfera Val Müstair*, https://www.val-muestair.ch/en/biosfera-val-mustair-1/postbus-reservation-obligation-for-bicycles. Accessed 19 Nov. 2025.
[158] "Carbon Footprint of Tourism." *Sustainable Travel International*, https://sustainabletravel.org/issues/carbon-footprint-tourism/. Accessed 19 Nov. 2025.

3.2 The effects of social media and influencers on visitor flows in the Alps

No longer merely a physical geography of granite and ice, the region of the Alps has in the twenty-first century been remediated into a digital commodity, consumed as much through smartphone displays as through direct sensory experience. The "tourist gaze," historically defined as collective and historical, has been superseded by the "digital gaze"—a performative, algorithmic, and hyper-accelerated mode of consumption. This shift has democratized access to the high alpine environment while simultaneously eroding the requisite skills to navigate it safely, subjecting "viral" hotspots to ecological pressures that often exceed their carrying capacity.

3.2.1 The Sociological Remediation of the Alpine Experience

The motivation for Alpine travel has shifted from a desire for "wilderness" to a desire for "verified presence," mediated by the feedback loops of social media. Research into the "Instagrammability" of mountain destinations reveals that landscapes are increasingly viewed as static backdrops for self-presentation rather than dynamic ecosystems. This "consumerist attitude" prioritizes visual capture over ecological awareness.[159]

This phenomenon is underpinned by the collapse of "liminality." Traditionally, wilderness travel offered a space separate from daily life. However, ubiquitous connectivity creates a "digital ambivalence" among hikers, who feel torn between immersion in nature and the social compulsion to share experiences in real-time.[160] The smartphone acts as a tether to the "front stage" of social life, transforming the hike into a performance for an invisible audience.

This creates friction between the "Authorized Heritage Discourse" (AHD) promoted by tourist boards—focusing on culture and healing—and the User-Generated Content (UGC) of

[159] Cholakova, Siya, et al. "Social Media and Mountain Visits – Is This 'Friendship' Sustainable?" *Turyzm/Tourism*, vol. 33, no. 2, 2023, pp. 7-18, https://czasopisma.uni.lodz.pl/tourism/article/view/23493. Accessed 19 Nov. 2025.

[160] Syvertsen, Trine. "Offline Tourism: Digital and Screen Ambivalence in Norwegian Mountain Huts with No Internet Access." *Scandinavian Journal of Hospitality and Tourism*, vol. 22, no. 4-5, 2022, pp. 362-376, https://www.tandfonline.com/doi/full/10.1080/15022250.2022.2070540. Accessed 19 Nov. 2025.

influencers, which often emphasizes "hero shots" and risk-taking.[161] Consequently, Destination Management Organizations (DMOs) lose narrative control; the image of the Alps is crowdsourced, stripping away context regarding danger and cultural etiquette.[162] The engine driving this is "social proof," where geotagged images trigger "Fear of Missing Out" (FOMO) and funnel tourist flows into narrow spatial corridors, ignoring equally scenic but digitally "unverified" locations.[163]

3.2.2 The Mechanics of Viral Overtourism

The transition from "mass tourism" to "viral tourism" is characterized by exponential growth targeting micro-locations lacking adequate infrastructure.

The Hallstatt Simulacrum

Hallstatt, Austria, serves as the archetype. A village of approximately 780 residents, it has seen visitor numbers swell to between 10,000 and 30,000 per day.[164] This influx is driven by global digital trends, including the construction of a replica village in China which paradoxically drove tourists to the "original" to validate the copy.[165] The socio-economic impacts include extreme traffic loads (>21,000 buses in 2019), high economic leakage from "dollar-a-day" tourists, and the distortion of the housing market by short-term rentals.[166] Residents report a

[161] Mele, Emanuele, and Linde Egberts. "Exploring Travel Blogs on Tourism and Landscape Heritage: Representations of the Swiss Alps." *Journal of Heritage Tourism*, vol. 19, no. 1, 2024, https://doi.org/10.1080/1743873X.2023.2237617. Accessed 19 Nov. 2025.

[162] Wegerer, P, and Serena Volo. "Visual Content Analysis of Instagram Posts: The Case of an Alpine Destination." *Information and Communication Technologies in Tourism 2022*, edited by Jason L. Stienmetz et al., Springer, 2022, pp. 433-438, https://bia.unibz.it/esploro/outputs/conferenceProceeding/Visual-Content-Analysis-of-Instagram-posts/991006567897701241. Accessed 19 Nov. 2025.

[163] Seibel, Gleice. "The Impact of Influencer Marketing on Destination Choice - A Quantitative Study Among Brazilian and German Millennials." *ResearchGate*, Apr. 2024, https://doi.org/10.51473/rcmos.v1i1.2021.44.Accessed 19 Nov. 2025.

[164] Ahlberg, Bailey J. "Overtourism in Hallstatt, Austria." *Bailey J. Ahlberg*, 26 Oct. 2023, https://www.baileyjahlberg.com/blog/overtourism-in-hallstatt-austria. Accessed 19 Nov. 2025.

[165] Frey, Bruno S, and Andre Briviba. "Revived Originals – A Proposal to Deal with Cultural Overtourism." *Tourism Economics*, vol. 27, no. 5, 2021, https://www.bsfrey.ch/wp-content/uploads/2021/08/Publizierte-Version_C_639_Revived-Originals-A-proposal-to-deal-with-cultural-overtourism.pdf. Accessed 19 Nov. 2025.

[166] van der Borg, Jan. "Destinations During and After the Lockdown." *From Overtourism to Sustainability Governance*, June 2024, DOI: 10.4324/9781003365815-4.

"Disneyfication" of their home, leading to the erection of view-blocking barriers and protests.[167]

The Dolomite Effect

Similarly, Lago di Braies (Pragser Wildsee) in South Tyrol illustrates the "cinematic effect." Following its feature in a TV series and subsequent Instagram fame, the valley faced traffic collapse. Authorities were forced to implement timed road closures and parking reservations to mitigate gridlock.[168] However, this has commodified access, with visitors often congregating solely for the "rowboat photo" opportunity rather than utilizing perimeter trails.[169]

The South Tyrol Capacity Crisis

In 2024, South Tyrol recorded 37.1 million overnight stays, a 2.6% increase concentrated in "viral" valleys like Val Gardena.[170] This saturation has led to debates regarding capping bed numbers, as the region reaches its "social carrying capacity".[171]

3.2.3 The Safety Crisis: The "Sneaker Alpinist"

A critical consequence of social media's influence is the degradation of safety standards. The visual nature of social media often strips mountains of their danger, leading to the rise of the "Sneaker Alpinist"—visitors attempting high-alpine routes with inadequate fitness and equipment.

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[167] "Austria Hallstatt's Fairytale Charm Faces Over-Tourism as Locals Push for New Sustainable Solutions to Preserve Their UNESCO Village and Peaceful Lifestyle." *Travel And Tour World*, 17 Aug. 2024, https://www.travelandtourworld.com/news/article/austria-hallstatts-fairytale-charm-faces-over-tourism-as-locals-push-for-new-sustainable-solutions-to-preserve-their-unesco-village-and-peaceful-lifestyle/. Accessed 19 Nov. 2025.

[168] "Lago di Braies (Without the Crowds): 2025 Hiking Guide." *Throne & Vine*, https://throneandvine.com/exploring-lago-di-braies/. Accessed 19 Nov. 2025.

[169] "Lake Braies: A Sustainable Solution Against Overtourism." *Ecobnb*, 4 Dec. 2019, https://ecobnb.com/blog/2019/12/lake-braies-against-overtourism/. Accessed 19 Nov. 2025.

[170] "Overtourism in South Tyrol, Italy, Is Sparking Drastic Consequences." *SnowBrains*, 28 Apr. 2023, https://snowbrains.com/overtourism-in-south-tyrol-italy-is-sparking-drastic-consequences/. Accessed 19 Nov. 2025.

[171] "How Mass Tourism Is Endangering the Dolomites." *YouTube*, uploaded by DW Documentary, 23 Aug. 2023, https://www.youtube.com/watch?v=zBgCCuJ68-g. Accessed 19 Nov. 2025.

Statistical Reality

Data from the Swiss Alpine Club, the Austrian Alpine Safety Board and the Slovenian Mountain Rescue Association (GRZS) reveals shifting accident profiles:

- **Falls:** Account for approximately 45% of accidents and are the leading cause of death, often linked to distraction (selfies) or improper footwear.[172]
- **Blockages:** Represent 13-20% of emergencies, a rising category where hikers become stuck due to exhaustion or fear after underestimating route difficulty based on curated photos.[172]
- **Getting Lost:** Account for roughly 13% of emergencies, often linked to reliance on smartphone apps (e.g., Google Maps) that prioritize "fastest" routes over "safest" trails.[172]
- **Gender Disparity:** Men account for 72% of fatal falls, showing higher risk-taking behavior exacerbated by the performative nature of social media.[173]
- **The "Foreign Factor":** In 2022, 55% of rescues in Slovenia involved foreign nationals, many of whom underestimated the technicality of lower-altitude peaks. GRZS identifies inappropriate equipment as the primary driver for these interventions.[174]
- **Terrain Unfamiliarity:** In 2024, nearly 24% of accidents recorded in Slovenia were attributed to a lack of familiarity with the terrain—a figure closely linked to visitors following digital maps or social media pins rather than local trail markers.[174]
- **The "Uninjured" Emergency:** Approximately 41% of Slovenian rescues in 2024 involved uninjured individuals—hikers who became "blocked" or "stranded" because they lacked the physical or technical preparation required for the descent.[174]

Heuristic Traps

Accidents are often driven by the "social proof" heuristic. When hikers see viral images of

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[172] Gasser, B. "Half of Emergency Calls in Hikers Are Injuries from Falls in 50-70 Year-Olds." *Deutsche Zeitschrift für Sportmedizin*, vol. 70, no. 9, 2019, pp. 206-212, https://www.germanjournalsportsmedicine.com/archive/archive-2019/issue-9/half-of-emergency-calls-in-hikers-are-injuries-from-falls-in-50-70-year-olds/. Accessed 19 Nov. 2025.

[173] Faulhaber, Martin, et al. "Fall-Related Accidents Among Hikers in the Austrian Alps: A 9-Year Retrospective Study." *PLOS ONE*, vol. 12, no. 12, 2017, e0189339, https://pmc.ncbi.nlm.nih.gov/articles/PMC5728251/. Accessed 19 Nov. 2025.

[174] "Encouraging Trends: 2024 Sees a Decline in Mountain Rescues, but Challenges Remain." *GRZS - Mountain Rescue Association of Slovenia*, 31 Jan. 2025, https://www.grzs.si/en/current-news/encouraging-trends-2024-sees-a-decline-in-mountain-rescues-but-challenges-remain/. Accessed 2 Feb. 2025.

locations like the Aescher hut, they assume safety because "everyone else is doing it".[175] Following a 33% increase in hiking accidents in 2022, the Swiss Alpine Club launched a #nogeotag campaign to break this link.[176] Furthermore, "selfie deaths" constitute a specific morbidity, with 43.2% of global selfie accidents occurring in nature.[177] This places a staggering burden on rescue services; in Italy, a single summer month in 2025 saw 83 fatalities, causing volunteer burnout and leading to aggressive cost-recovery policies for negligence.[178]

3.2.4 Environmental Degradation and Economic Paradoxes

Social media-driven damage is often surgical, destroying specific photogenic micro-habitats.

- **Physical Impact:** The surge in off-trail photography leads to soil compaction and the widening of "social trails".[179] In the Dolomites, cigarette butts constitute 37% of trail litter, posing chemical threats to headwaters.[180]
- **Wildlife Disturbance:** The proliferation of drones for aerial videography, generally prohibited in most protected areas, provokes aggression in raptors (wasting critical energy) and alters the flocking behavior of Alpine Choughs.[181] "Animal selfies"

[175] "The Fallacy of Instagram & Alpine Accidents." *FemiGnarly*, 3 Jan. 2020, https://femignarly.com/2020/01/03/the-fallacy-of-instagram-alpine-accidents/. Accessed 19 Nov. 2025.
[176] "Swiss Alpine Club Attempts to Kerb Geotagging to Reduce Accidents and Death." *SnowBrains*, 6 Apr. 2021, https://snowbrains.com/swiss-alpine-club-attempts-to-kerb-geotagging-to-reduce-accidents-and-death/. Accessed 19 Nov. 2025.
[177] "Could Social Media Be Landing Hikers in Danger? This Study Suggests So." *Backpacker*, 15 Dec. 2023, https://www.backpacker.com/survival/could-social-media-be-landing-hikers-in-danger-this-study-suggests-so/. Accessed 19 Nov. 2025.
[178] Benavides, Angela. "The Deadly Italian Alps: Almost 90 Fatalities So Far This Summer." *Explorersweb*, 28 Aug. 2024, https://explorersweb.com/the-deadly-italian-alps-almost-90-fatalities-so-far-this-summer/. Accessed 19 Nov. 2025.
[179] Dragovich, Deirdre, and Sunil Bajpai. "Managing Tourism and Environment—Trail Erosion, Thresholds of Potential Concern and Limits of Acceptable Change." *ResearchGate*, Apr. 2022, https://www.researchgate.net/publication/359739093_Managing_Tourism_and_Environment-Trail_Erosion_Thresholds_of_Potential_Concern_and_Limits_of_Acceptable_Change. Accessed 19 Nov. 2025.
[180] Kephart, Kimberly. "Cadini di Misurina Hike: Stunning Views & the Dark Side of Dolomites Overtourism." *Kimberly Kephart Travels*, https://kimberlykepharttravels.com/cadini-di-misurina-hike/. Accessed 19 Nov. 2025.
[181] Rossi, Christian, and Samuel Wiesmann. "Flying High for Conservation: Opportunities and Challenges of Operating Drones Within the Oldest National Park in the Alps." *Ecological Solutions and Evidence*, June 2024, https://www.researchgate.net/publication/381470434_Flying_high_for_conservation_Opportunities_and_challenges_of_operating_drones_within_the_oldest_National_Park_in_the_Alps. Accessed 19 Nov. 2025.

normalize the harassment of wildlife, while winter content creation pushes ungulates out of refuges, leading to exhaustion.[182]

- **Climate Interaction:** "Last Chance Tourism" sees influencers flocking to melting glaciers, paradoxically increasing the carbon footprint.[183]

Economic Paradoxes

While influencers offer low-cost marketing, the Return on Investment (ROI) is often skewed. High engagement does not necessarily translate to high yield; viral posts often attract low-spending day-trippers who create maximum congestion.[184] This results in a "Tourism-Traffic Paradox," where tourists acknowledge traffic destroys their experience but are unwilling to accept restrictions on their own mobility.[185]

3.2.5 Governance: The Post-Digital Strategy

Facing these crises, Alpine regions are moving from marketing to management.

- **Demarketing and Guidance:** Strategies include the #NoGeotag campaign and digital visitor management systems that use real-time data to "nudge" tourists away from overcrowded hotspots.[186]
- **Hard Caps and Zoning:** "Soft" nudges are increasingly replaced by hard restrictions, such as the traffic bans at Lago di Braies[168] and tolls at the Three Peaks.[180]

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[182] Nageotte, Nichole L. et al. „Dynamics of human-ungulate interactions in a high-visitation alpine area", *Human-Animal Interactions*, 2025, https://www.cabidigitallibrary.org/doi/10.1079/hai.2025.0014. Accessed 19 Nov. 2025.

[183] Girardet, Edward. "Part II - Adapting to a Melting World: Reinventing Life and Tourism in the Alps." *Global Geneva*, 12 July 2023, https://www.global-geneva.com/climate/environment/part-ii-adapting-to-a-melting-world-reinventing-life-and-tourism-in-the-alps. Accessed 19 Nov. 2025.

[184] Bednar-Friedl, Birgit, et al. "Socioeconomics of Conservation in the Alps." *ResearchGate*, Dec. 2012, https://www.researchgate.net/publication/233971920_Socioeconomics_of_conservation_in_the_ALPS. Accessed 19 Nov. 2025.

[185] Scuttari, Anna, et al. "Assessing the Tourism-Traffic Paradox in Mountain Destinations: A Stated Preference Survey on the Dolomites' Passes (Italy)." *Journal of Sustainable Tourism*, Jan. 2018, https://www.researchgate.net/publication/322538892_Assessing_the_Tourism-Traffic_Paradox_in_Mountain_Destinations_A_Stated_Preference_Survey_on_the_Dolomites'_Passes_Italy. Accessed 19 Nov. 2025.

[186] *Good… in Practice: Alpine Destinations for Sustainable Tourism*. Permanent Secretariat of the Alpine Convention, https://www.alpconv.org/fileadmin/user_upload/Fotos/Banner/Topics/tourism/V_Brochure_Destinations_FINAL.pdf. Accessed 19 Nov. 2025.

Berchtesgaden National Park utilized social media monitoring to identify and subsequently close illegal "infinity pools," effectively ceding physical space to save it from the digital one.[187]

- **Digital Detox:** Paradoxically, the region is capitalizing on the backlash against connectivity. The "Digital Detox" tourism market is projected to grow significantly, with hotels marketing "dead zones" as luxury products.[188]

Future resilience lies in "Slow Tourism," replacing the "check-list" mentality of the influencer with a deeper connection to place, fostering stewardship rather than extraction.[189]

[187] Moczek, Nicola, et al. "What Is the Impact of Visitor Guidance Systems?" *ResearchGate*, Nov. 2024, https://www.researchgate.net/publication/385576520_What_is_the_impact_of_visitor_guidance_systems. Accessed 19 Nov. 2025.

[188] *Digital Detox Tourism Services Market Overview Report 2034*. Polaris Market Research, 2024, https://www.polarismarketresearch.com/industry-analysis/digital-detox-tourism-services-market. Accessed 19 Nov. 2025.

[189] *Alpine Nature 2030: Creating [Ecological] Connectivity for Generations to Come*. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUV), https://www.bmuv.de/fileadmin/Daten_BMU/Pools/Broschueren/alpine_nature_2030_broschuere_en_bf.pdf. Accessed 19 Nov. 2025.

4 The role and effects of digital outdoor platforms and apps in Alpine outdoor recreation

The use of the Alps for recreation has undergone a fundamental restructuring. For nearly two centuries, alpine navigation was governed by a stable analogue regime consisting of paper topographic maps, printed guidebooks, and physical signage. These tools functioned as spatial filters; the friction inherent in acquiring and interpreting complex maps ensured a baseline level of competency. This analogue consensus has collapsed with the advent of the smartphone and Global Navigation Satellite Systems (GNSS) and has effectively opened alpine recreation to new and less experienced target groups.[190]

This digital turn has overlaid the physical territory of the Alps with a dynamic "digital twin." This layer – composed of digital maps, GPX tracks, geolocated photos, and heatmaps—is now the primary interface through which millions of visitors perceive the mountains. Recent empirical studies in the Bavarian and Austrian Alps indicate that 86% of outdoor enthusiasts use digital tools for planning, and 73% rely on them for active navigation. Critically, the locus of trust has shifted: whereas the local ranger or hut warden was once the ultimate authority, a significant demographic—particularly younger users and high-velocity athletes—now places higher trust in information aggregated from peers than in official sources.[190] This "peer-to-peer" epistemological shift creates a decentralized consensus that often bypasses traditional gatekeepers of alpine safety and conservation.

4.1 The Ecology of Digital Attention

A critical review of outdoor apps suggests that platforms like Komoot and Strava are not merely navigational aids, they are niche social media.[191] They facilitate the "planning" and "experiencing" phases of a trip, translating digital intent into kinetic action. These apps

[190] Schwietering, Arne, et al. "Digitalization of Planning and Navigating Recreational Outdoor Activities." *Journal of Outdoor Recreation and Tourism*, vol. 44, Dec. 2023, p. 100704, https://doi.org/10.1007/s12662-023-00927-1. Accessed Mar. 4, 2026.

[191] Mangold, Max, et al. " The digitalization of outdoor recreation: Global perspectives on the opportunities and challenges for protected area management" *Journal of Environmental Management*, vol. 353, Mar. 2024, p. 120108, https://doi.org/10.1016/j.jenvman.2024.120108. Accessed 8 Jan. 2026.

operate through the "Quantified Self" and the "Performative Landscape," where digital activity—such as a track line or an elevation profile—becomes a form of subcultural capital.[192]

Planning phase interventions

Effective visitor management must now occur during the planning phase, effectively on a user's smartphone screen where the route is conceived. Survey data reveals a trust deficit: official sources are often viewed as static or overly restrictive, while community-generated content (UGC) is seen as dynamic, honest, and reflective of current conditions. This allows a single user comment – for example suggesting that closures may be ignored – to override state conservation mandates.[193]

The Feedback Loop and "Social Trails"

The relationship between digital platforms and physical terrain is recursive. A user may take a shortcut across a meadow, which the app records. A platform algorithm then aggregates this track into a heatmap or a route suggestion. Future users see this line in the virtual route guidebook or even on the Open Street Map (OSM), assume it is a valid trail, and follow it. This "OSM feedback loop" leads to the physicalization of "social trails," where vegetation is destroyed and soil is compacted based on an algorithmic suggestion.[194] These self-reinforcing routes remove individual agency, placing it in the hands of the aggregate past – the accumulated history of all previous users.

[192] Couture, J. "Reflections from the 'Strava-sphere': Kudos, Community, and (Self-) Surveillance on a Social Network for Athletes." *Qualitative Research in Sport, Exercise and Health*, vol. 13, no. 1, 2021, pp. 184–200, https://doi.org/10.1080/2159676X.2020.1836514. Accessed 8 Jan. 2026.

[193] Schwietering, Arne, et al. "Digitale Outdoorplattformen: Potenziale und Herausforderungen für Naturschutz und Aktivitätsmanagement." *Natur und Landschaft*, vol. 99, no. 8, 2024, pp. 384–396, https://doi.org/10.19217/NuL2024-08-03. Accessed 8 Jan. 2026.

[194] Mangold, Max, Arne Schwietering, and Manuel J. Steinbauer. "Towards a Digital Ranger: Using Data from Outdoor Platforms to Detect Rule Violations in Protected Areas and Improve Visitor Management." *MMV12 Conference Proceedings*, 12th International Conference on Monitoring and Management of Visitors in Recreational and Protected Areas, 2024.

4.2 Profiles and impacts of leading platforms

4.2.1 Komoot

Komoot, a platform founded in Germany and recently sold to an Italian technology conglomerate, has achieved significant market penetration in the DACH region by focusing on a broad target group outside traditional mountain recreation groups.[195] Its routing engine prioritizes scenic value, points of interest and surface types over trail safety and holistic management aspects. The central currency of Komoot is the "Highlight" (red dots on the map). As users upvote highlights, the algorithm actively suggests connecting these points when planning a tour, creating a "funnel effect" that channels users toward photogenic hotspots. This risks over-exposing sensitive locations previously protected by their obscurity. Komoot incentivizes the discovery of new routes through its "Pioneer" badge system, awarded to those whose highlights receive the most upvotes in a region. This taps into a human desire for territorial status, driving a digital colonization of space where users are motivated to map “secret trails" or off-grid locations to earn social capital, often directly conflicting with conservation zoning.[196]

4.2.2 Strava

The US-based sports app Strava operates on the register of athletes. For this demographic, the natural landscape is not scenery but primarily a sports facility. The platform is built around "segments"—specific trail sections where users compete for leaderboards (KOM/QOM). This encourages high-velocity travel, which introduces risk in alpine environments and invites conflict on shared-use trails.[197] The panopticon effect of a public leaderboard can create peer pressure and deter users from turning back in bad weather, as an incomplete activity remains visible to their network.[198] Strava’s aggregate heatmap is frequently used by recreationists to

[195] "Bending Spoons Acquires Komoot." *Business Wire*, 20 Mar. 2025, https://www.businesswire.com/news/home/20250320568940/en/Bending-Spoons-Acquires-komoot. Accessed 8 Jan. 2026.

[196] Zink, Julia, and Max Mangold. "Following the Digital Tracks: Visitor Monitoring Using Outdoor Platform Data." *7th International Symposium for Research in Protected Areas*, 7–9 September 2022, Vienna, 2023.

[197] "Inside the Cyclist's Mind – The Dopamine Trap of Chasing Strava Segments." *We Love Cycling*, 18 Nov. 2025, https://www.welovecycling.com/wide/2025/11/18/inside-the-cyclists-mind-the-dopamine-trap-of-chasing-strava-segments/. Accessed 8 Jan. 2026.

[198] "Strava Fuels Community and Anxiety for Runners." *Mashable*, 2024, https://mashable.com/article/strava-anxiety-joy-self-surveillance. Accessed 8 Jan. 2026.

verify if a route is "doable." If a line appears on the heatmap, users assume it is validated by the crowd. This is particularly damaging in winter, as it creates "phantom infrastructure" through sensitive wildlife habitats, such as capercaillie wintering grounds, which subsequent users follow without official oversight.

4.2.3 Bergfex

The Austrian mountain tourism platform Bergfex serves as a kind of virtual travel guide and remains an important utility for a solid segment of the Alpine market. It is deeply integrated with the tourism industry and DMO content, giving it a veneer of authority. While Bergfex provides official maps (such as the ÖK50), its massive database of UGC is less curated. User comments in forums often include "conditions reports" that may downplay risks (e.g., avalanche danger), potentially misleading less experienced hikers.[199] While the platform's terms of use disclaim liability for user data, its design implies a level of safety and curation that can lead to misplaced trust in unvetted user reports.[200]

4.2.4 Outdooractive

Outdooractive, a German-based digital ecosystem and app by the same name, remains a favourite among many mountaineers and other more traditional mountain recreation target groups in the Alps. With its complex B2B2C architecture, the platform connects official content from destinations and other sources with the community. As a B2B software-as-a-service provider, Outdooractive provides websites and white-label-app for a multitude of destinations in the Alps. Unlike purely social platforms, Outdooractive allows protected area managers and other local stakeholders to hold "My Business" accounts. This enables them to author official content, issue digital trail closures, and push warnings directly to the users.[201] Outdooractive's algorithm prioritizes "official" content over UGC and has thus earned a reputation as being a

[199] Winkler, Kurt, Günter Schmudlach, and Frank Techel. "Digitale Tourenplanung und Risikokommunikation im Bergsport." *Sicherheit im Bergland 2021*, Österreichisches Kuratorium für Alpine Sicherheit, 2021, pp. 142–156. Accessed 8 Jan. 2026.

[200] "General Terms and Conditions." *Bergfex*, https://www.bergfex.com/c/agb/. Accessed 8 Jan. 2026.

[201] "Digitize the Rules on How to Behave in Nature." *Outdooractive Business*, https://business.outdooractive.com/digitizing-conservation-laws. Accessed 8 Jan. 2026.

very “manageable” platform from a government and destination management perspective.[202] However, the complex usability and variety of features, some of which are clearly designed for niche “power users”, tend to let non-traditional mountain recreation target groups shy away from using the app, limiting the impact of visitor management opportunities.[203]

4.2.5 Alpenvereinaktiv

The web and mobile app Alpenvereinaktiv presents a special case: as a joint initiative of the DAV, ÖAV, and AVS Alpine clubs, the application is provided by Outdooractive and for the most part a white-label version of its own products. A paradigmatic case of digital sovereignty, Alpenvereinaktiv is operated under the alpine club brand to retain institutional control over the digital narrative of the Alps. While it allows UGC, public search results prioritize official content from destinations, certified guides, and trusted volunteers, in particular from the Alpine clubs themselves. It serves an educational mission, integrating live avalanche warning service data directly into the tour planner, forcing users to confront risk levels during the planning phase and promotes the official infrastructure provided by or in cooperation with the Alpine clubs. Like Outdooractive, the platform has operationalized digital visitor management concepts by including map layers for wildlife protection zones. The planning algorithm is programmed to route around these areas where possible, and authors of route descriptions are encouraged to include specific behavioral nudges regarding cattle or ground-nesting birds.[204]

4.3 Ecological consequences of digital guidance

The digital shift has profound footprints on the physical Alps:

- **Habitat fragmentation**
  The "OSM feedback loop" accelerates the formation of social trails, which fragment continuous habitats.

[202] Schwietering, Arne, et al. *Referenz-Guide zur digitalen Aktivitätenlenkung aus dem Projekt Digital Ranger*. Technical Report, 2024, https://doi.org/10.13140/RG.2.2.29085.63201. Accessed 8 Jan. 2026.
[203] "Outdooractive Review: How Does It Stack Up?" *Rogonneur*, https://www.rogonneur.com/outdooractive-review-how-does-it-stack-up/. Accessed 8 Jan. 2026.
[204] Heirler, Christoph. "Digitale Souveränität am Berg: Warum der Alpenverein auf eine eigene Plattform setzt." *DAV Panorama*, vol. 74, no. 4, 2022, pp. 12–15. Accessed 8 Jan. 2026.

- **An app-induced "landscape of fear"**
  Apps increase the predictability of human presence, causing sensitive species like red deer and lynx to avoid areas with high Strava activity density.[205] The "Heatmap" effectively becomes a map of habitat loss.
- **Concentration vs. dispersion**
  Algorithms currently have the power to do both in the worst way: they may overcrowd photogenic hotspots (social strain) while simultaneously leaking “pioneer” visitors into previously quiet refuges (ecological strain).

4.4 New demands for governance: the rise of the “Digital Rangers”

If the problem is digital, the solution must be digital. Management of Alpine destinations, Alpine protected areas, and trails is increasingly shifting toward Digital Visitor Management (DVM).[191]

4.4.1 The Digital Ranger

In several Alpine Protected Areas (APAs), so-called “Digital Rangers” are now tackling incorrect, harmful, or potentially damaging information in the digital sphere. This involves monitoring platforms for problematic content (e.g., unmarked trails or illegal camp sites), engaging in "friendly nudges" to ask users to remove or edit tracks, and correcting OSM attributes to ensure digital maps reflect legal realities.[202]

4.4.2 The need for machine-readable conservation standards

A major barrier to DVM in APAs was the lack of machine-readable conservation laws. The NGO *Digitize the Planet* has created a technical data standard that allows park authorities to digitize their regulations as polygons. This data is stored in an open database that platforms can pull via API to trigger automatic warnings when a user plans a route through a protected area.[206]

[205] "Combining Camera Trap and Fitness App Data Demonstrates that Mammals Change Behavior Near High-Use Bike Trails on Mount Tamalpais, CA." *SJSU ScholarWorks*, San Jose State University, 2023, https://doi.org/10.31979/etd.pvae-42n8. Accessed 8 Jan. 2026.
[206] *Digitize the Planet*. Digitize the Planet e.V., https://digitizetheplanet.org/. Accessed 8 Jan. 2026.

Among the bigger apps, currently only Outdooractive and Alpenvereinaktiv engage in this practice.

4.5 Conclusion

The era of analog-only visitor management is over. Digital outdoor platforms act as powerful agents that restructure social and spatial relations in the mountains. While some apps take only limited responsibility for their harmful impacts and can thus drive ecological and safety risks through their gamified and algorithmic incentives, others have proven that digital tools can also be instruments of effective visitor management and destination stewardship. The digitisation of nature conservation laws and safety-related information, as well as their dissemination to Alpine recreationists in real time, can significantly increase the protection of sensitive natural landscapes and the safety of visitors in the terrain. Cases like Alpenvereinaktiv or Digitize the Planet underline the big potential of institutional involvement of important stakeholders and show ways in which digitally supported harmonious coexistence between nature conservation, mountain tourism, and destination stewardship can be achieved.

Section II. Data Analysis of Questionnaires

1 Methodology

As part of the activities planned by the Interreg Alpine Space LiveAlpsNature project, a data collection and analysis phase targeting visitors and tourism operators of protected areas was included, conducted through the administration of online questionnaires. This survey specifically falls within Activity 1.1 (Analysing alps-wide factors accelerating the development of NBAs), as defined in the project plan.

The survey administered to visitors was structured with 17 questions (see Annex 2), some of which allowed for multiple or open-ended responses. The questions were designed to reconstruct an informative profile including: the modalities and motivations for visiting the protected area, the perception of the impacts of NBAs, as well as considerations related to well-being and health associated with the visit experience. Furthermore, the survey investigated the propensity and interest towards health-focused tourism proposals. In the final section, personal data such as age and gender of the participants were collected.

The survey administered to operators was structured with 19 questions (see Annex 3), with some multiple or open-ended responses. The questions explore aspects such as: activities and services proposed in or in relation to the protected area, the perception of the impacts of NBAs, as well as health and wellbeing considerations associated with the proposed activities.

Visitor questionnaires were administered via online platforms (social media pages and official websites) and through the placement of dedicated posters featuring QR codes within the protected areas, aiming to capture a broad and diverse user base. In contrast, questionnaires intended for operators were sent directly to the relevant parties. In both instances, participation was voluntary and anonymous.

In the Swiss National Park and the Mont Avic Natural Park, data collection was supplemented by on-site interviews conducted with visitors.

The distribution method adopted, primarily relying on spontaneous participation, introduces a self-selection bias, resulting in limited control over the randomness of the sample. For instance, it is not possible to determine the proportion of visitor questionnaires completed during the actual visit, nor to verify whether all online respondents had effectively visited the

protected areas. Consequently, the sample cannot be defined on a probabilistic basis, and the results are not statistically generalizable.
Therefore, the obtained sample cannot be considered statistically representative of the total population of visitors and operators frequenting the different protected areas.
Nonetheless, the scale of the dataset gathered through the survey activity is sufficient to provide valuable insights into the profiles of protected area users and their perceptions of the investigated themes, enabling this preliminary analysis. In terms of sample size, to analyse a population of approximately 1 million visitors, a sample of over 1,000 units is required (Population = 1,000,000; Confidence Level = 95%; Confidence Interval = 3%; Sample Size = 1,067). Although the data collection phase is ongoing, this initial monitoring stage has yielded a sufficiently large sample (1,223 visitor questionnaires and 136 operator questionnaires) to provide a robust preliminary assessment.

1.1 Data analysis

The data were organized in a tabular format to enable analysis using Microsoft Excel software. To optimize the analytical process, artificial intelligence software *Claude*[207] was employed. Initially, *Claude* was used to facilitate the translation of open-ended responses into English. Subsequently, the AI was utilized to facilitate the standardization and uniformization of structured data (e.g., country of origin), in order to render them analysable in a coherent tabular format. The *Claude* software was also used for aggregating data into more easily interpretable thematic categories. This approach was applied, for example, to the analysis of response No. 4 (approximate distance and travel time, type of transportation) and to the "*Other (please specify)*" sections. Specifically, the program was asked to identify and group responses by recurring themes.
A review of the data processing was subsequently performed manually to verify the reliability of the categorizations proposed by the AI and to make any modifications deemed necessary. Finally, the data thus processed and validated were integrated into the main database and analysed using pivot tables, enabling the generation of initial outputs in tabular and graphical format.

[207] https://claude.ai/

2 General visitors' *survey* data

The data presented in this report refers to the sampling period between late May and early September 2025. Data collection through questionnaires is still ongoing in some protected areas and will continue in order to acquire information related to the winter period.
During the initial survey phase, a total of 1223 questionnaires were collected from the 7 protected areas participating in the project[208] (Table 2.1).

1. For which of the following protected areas are you completing the questionnaire?		
	Response Percent	Response Count
Parc National des Écrins	17,33%	212
Swiss National Park	5,97%	73
Triglav National Park	23,47%	287
Mont Avic Natural Park	8,99%	110
Alpe Veglia e Alpe Devero Natural Park	8,99%	110
Alta Valle Antrona Natural Park	1,06%	13
Nature Reserves of Haute Savoie	10,79%	132
Berchtesgaden National Park	23,39%	286

Table 2. 1 - Visitors' survey |Answers to question No. 1

[208] The Alpe Veglia e Alpe Devero Natural Park and the Alta Valle Antrona Natural Park are both managed by the project partner Aree Protette dell'Ossola.

3 Preliminary analysis of visitors' *survey* responses

3.1 Are you local or are/were you visiting the region of the protected area?

Over 70% of visitors to natural areas declared coming from regions different from that to which the Park belongs. This trend is particularly evident in certain protected areas, such as Swiss National Park, Berchtesgaden National Park, and Triglav National Park, where about 8 or 9 out of 10 visitors in the analysed sample are non-residents (Fig. 1).

The Nature Reserves of Haute Savoie represents the only exception to this trend, recording approximately 64% of local visitors.

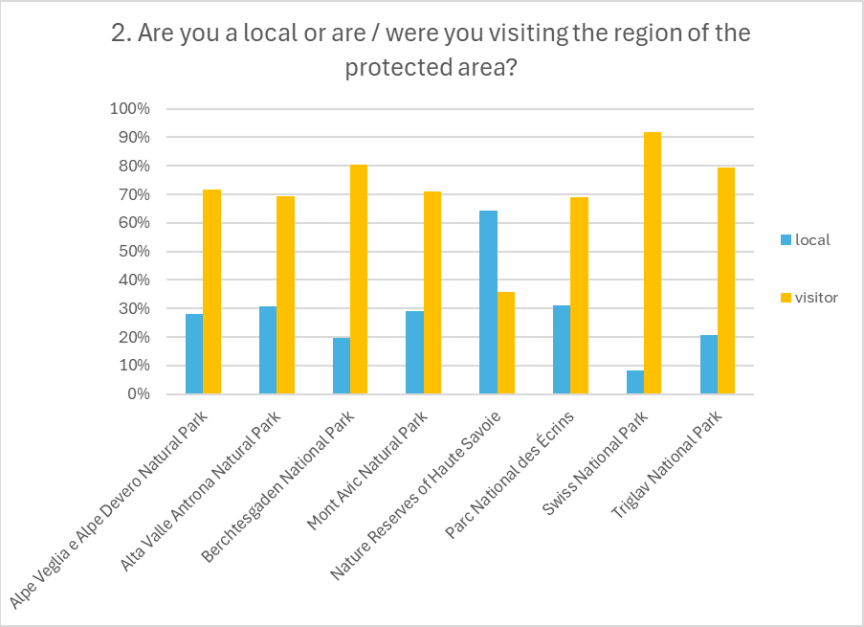


Figure 3. 1 - Visitors' survey |Answers to question No. 2

3.2 Do you live in a more urban or more rural area?

The responses to question No. 3 show an overall balanced distribution, with approximately 50.2% of users declaring coming from more urbanized areas.

A more detailed analysis by individual study areas reveals that in certain Parks, such as Alpe Veglia e Alpe Devero Natural Park, Alta Valle Antrona Natural Park, and Parc National des Écrins, the percentage of visitors from urbanized contexts exceeds 60%.

Conversely, for the Nature Reserves of Haute Savoie Park, the data indicate that up to 65% of visitors come from rural areas. This finding is consistent with the responses to question No. 2, which indicated a high percentage of local users.

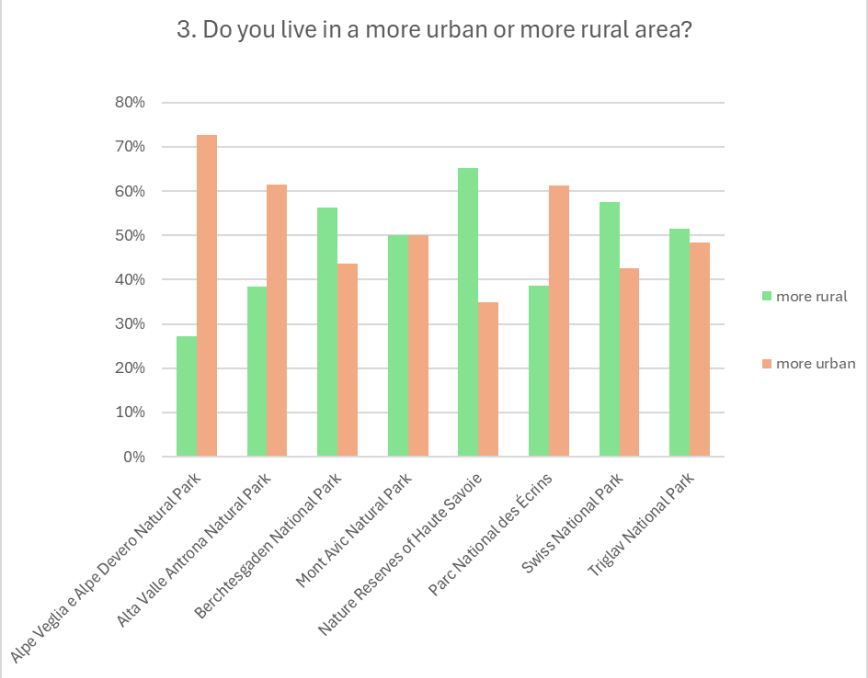


Figure 3. 2 - Visitors' survey |Answers to question No. 3

3.3 Where do you live exactly, how far is it from the protected area and how long does it take to travel to the protected area?

The objective of this question is to outline an overview of the user catchment area of visitors to the different Parks, through the analysis of the Country and province of origin, as well as the distance from the protected area. Specifically, quantification of kilometres traveled, and an estimate of travel times (in hours) used to reach the protected area are requested. Finally, respondents are asked to specify the method of transportation used.

Table 3.1 illustrates the Country of origin of visitors for each protected area. Countries with minimal representation in the dataset have been aggregated into two macro-categories: "European Countries" and "Extra-European Countries".

The "European Countries" category includes visitors from the following States: Austria, United Kingdom, Denmark, Belgium, Croatia, Czech Republic, Hungary, Ireland, Latvia, Norway, Spain, Netherlands, and Liechtenstein. Among the extra-European countries represented in the survey are: Australia, Canada, and the United States of America.

Country of Origin							
	France	**Germany**	**Italy**	**Slovenia**	**Switzerland**	**EU country**	**Extra-EU country**
Alpe Veglia e Alpe Devero Natural Park	1,8%	1,8%	**94,5%**	0,9%	0,9%	0,0%	0,0%
Alta Valle Antrona Natural Park	0,0%	0,0%	**92,3%**	7,7%	0,0%	0,0%	0,0%
Berchtesgaden National Park	0,0%	**92,6%**	0,0%	1,1%	0,4%	5,6%	0,4%
Mont Avic Natural Park	6,4%	0,0%	**90,9%**	0,0%	0,9%	1,8%	0,0%
Nature Reserves of Haute Savoie	**93,9%**	0,8%	1,5%	0,0%	0,8%	3,0%	0,0%
Parc National des Écrins	**93,4%**	0,5%	0,0%	0,9%	0,5%	4,7%	0,0%
Swiss National Park	1,4%	**11,1%**	1,4%	0,0%	**77,8%**	8,3%	0,0%
Triglav National Park	1,0%	5,2%	1,0%	**80,5%**	0,0%	**9,8%**	**2,4%**

Table 3. 1 - Visitors' survey |Answers to question No. 4

As can be seen from the data in tabular format, more than 90% of visitors declare that they did not travel outside their country of origin for the visit.

Only Swiss National Park and Triglav National Park show a significantly higher percentage of international visitors compared to other protected areas. Specifically, for Swiss National Park, 78% of users come from Switzerland, followed by 11% of German visitors and 8% of visitors from other European States.

Similarly, Triglav National Park records almost 10% of visitors coming from other European States and also attracts, overall, a considerable share of extra-European visitors.
As a preliminary analysis of question No. 4, data relating to the distance in kilometres travelled by visitors to reach the protected area (Fig. 3) and the means of transportation used (Fig. 4) were processed.

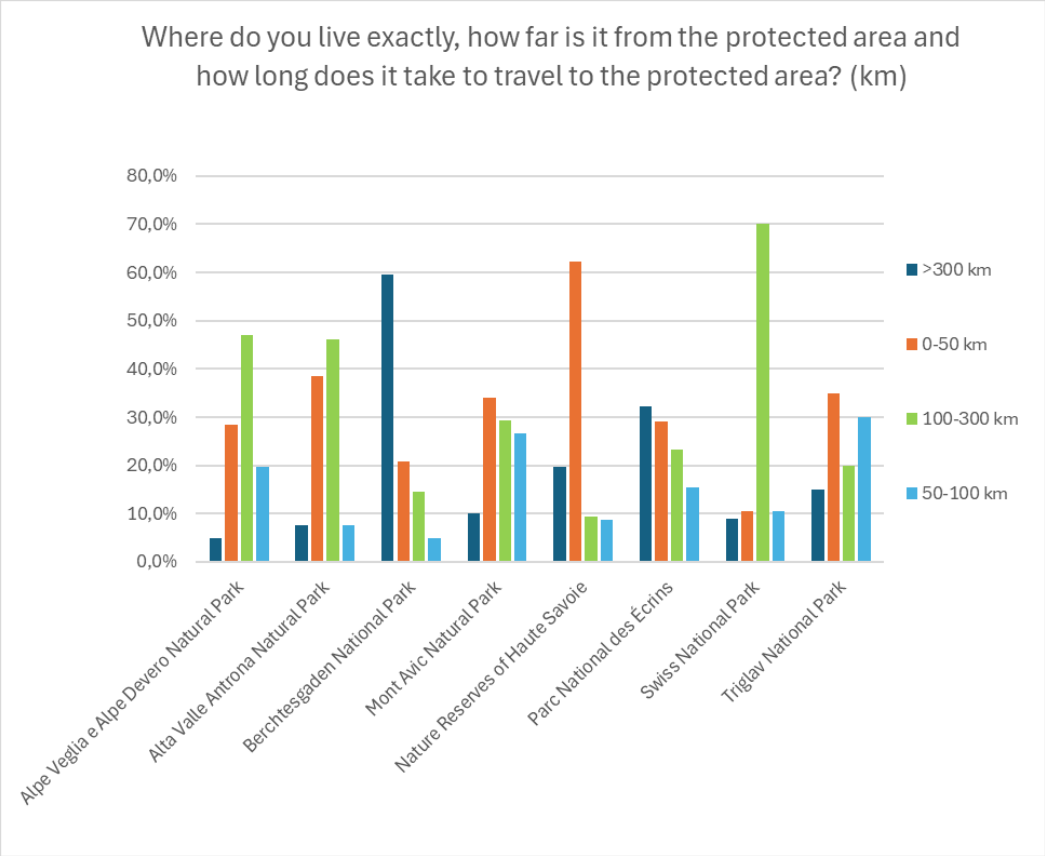


Figure 3. 3 - Visitors' survey |Answers to question No. 4

From the graph (Fig. 3) it emerges that in Italian parks the majority of visitors came from neighbouring areas. However, considering that in all three parks approximately 70% of visitors do not reside in the municipality where the protected area is located, it is evident how these destinations mainly attract visitors from the same region or from adjacent ones.

To reach parks such as Berchtesgaden National Park and Parc National des Écrins, users show a greater propensity to cover considerable distances, often exceeding 300 km. This data reflects the tendency of national visitors to undertake long-distance journeys to visit these areas.

In the case of Nature Reserves of Haute Savoie, approximately 62% of travel does not exceed 50 km, confirming the strong local attendance that characterizes this protected area, as already emerged in previous analyses.

For Swiss National Park, travel between 100 and 300 km prevails. This can be explained by the composition of the user base, which includes both more distant national regions from the Park, and a significant percentage of German tourists.

Data relating to means of transportation are presented in Fig. 4. The "Multiple modes" section aggregates responses that indicate the combined use of multiple transportation modes (e.g., car, public transport, on foot, airplane and bicycle). In the "Other" section, responses such as: motorcycle, camper, airplane and horseback were included.

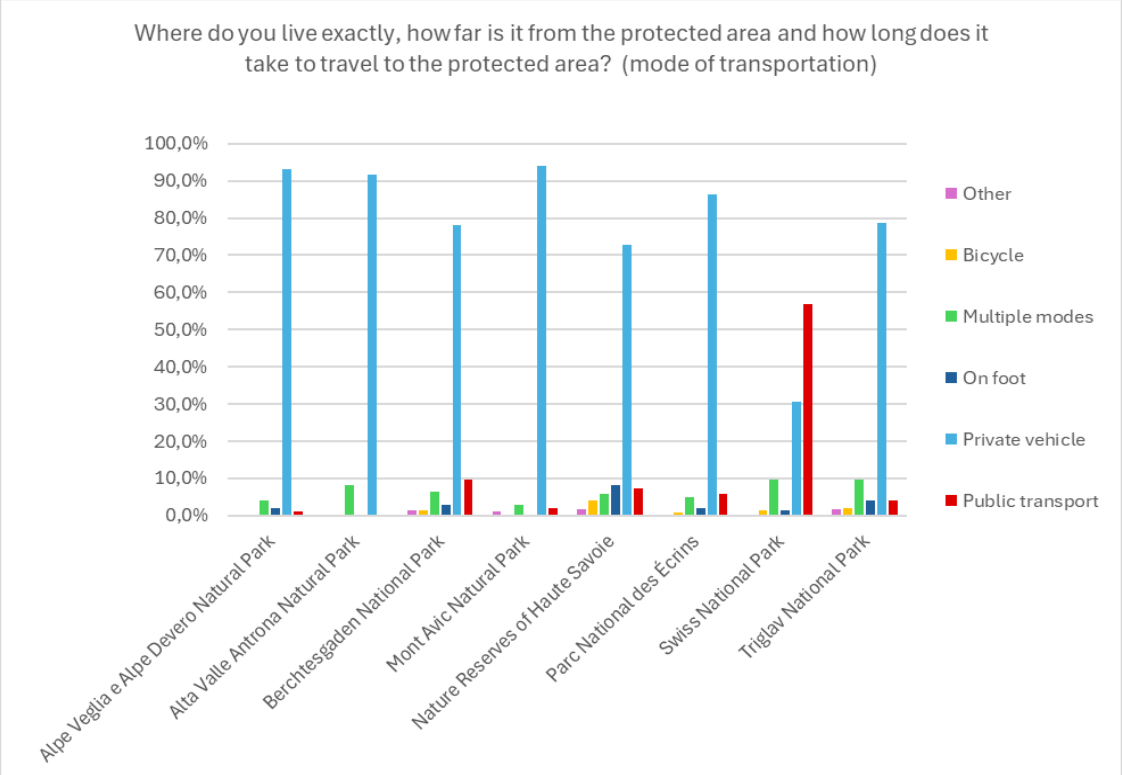


Figure 3. 4 - Visitors' survey |Answers to question No. 4

In almost all the analysed protected areas, private vehicles represent the prevailing mode of transportation (used by over 70% of users). Swiss National Park constitutes an exception, where the percentage of users who opt for cars is lower than those who prefer the use of public transport (approximately 57% of the total).

The Nature Reserves of Haute Savoie further distinguishes itself from other protected areas for a significant percentage of users who choose to reach it on foot or by bicycle, recording frequencies much higher than the overall average of the entire Alpine arc.

3.4 How long is / was your visit to the region of the protected area?

In general, a tendency to prefer extended stays is observed, with a stay exceeding 5 days (40.95% of respondents), followed by day visits (24%).

For Parks such as Berchtesgaden National Park, Parc National des Écrins and Nature Reserves of Haute Savoie, stays with a duration exceeding 5 days represent the choice of over 50% of users.

Italian parks, on the contrary, tend to be selected by visitors who prefer day visits.

Only in Swiss National Park does the predominant stay option (56.7%) turn out to be between 3 and 5 days.

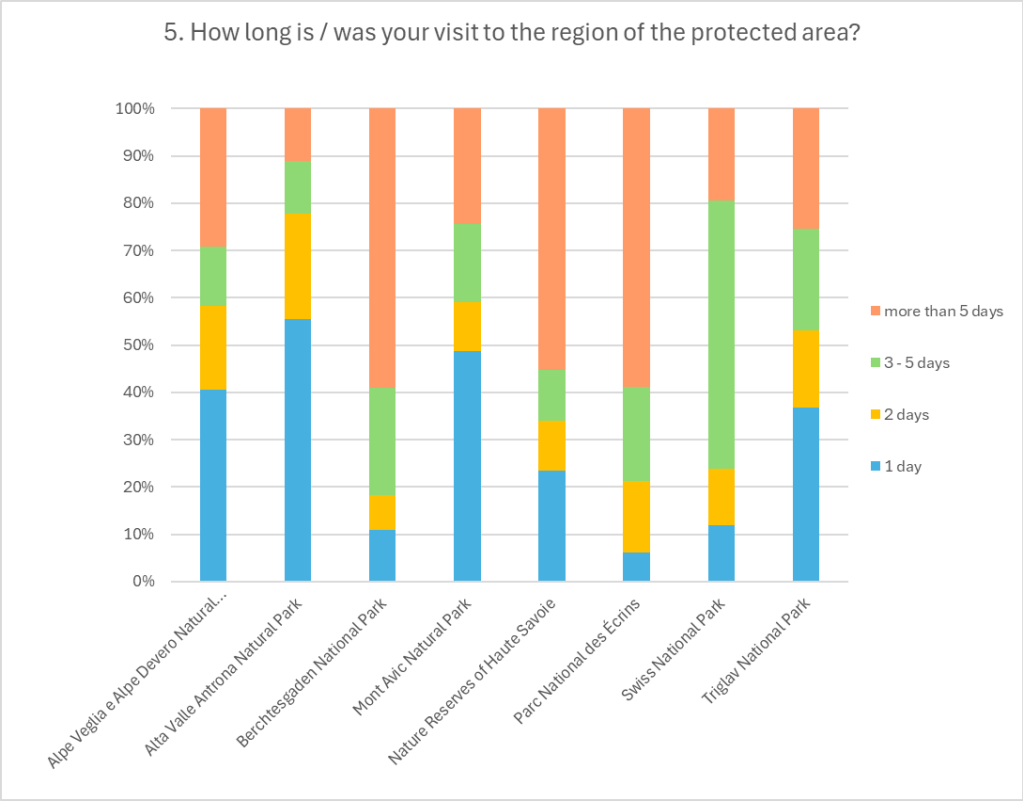


Figure 3. 5 - Visitors' survey |Answers to question No. 5

3.5 In general, how often do you visit the protected area?

From the analysis of question No.6 it emerges that, overall, users tend to visit protected areas several times during the year (33.52%).

In second place is the "Yearly" frequency, with approximately 15% of responses, followed by 12% of users who declare visiting the Park for the first time.

Therefore, a high percentage of "return" or repeated visits is evident, flanked by an overall positive percentage of new visitors.

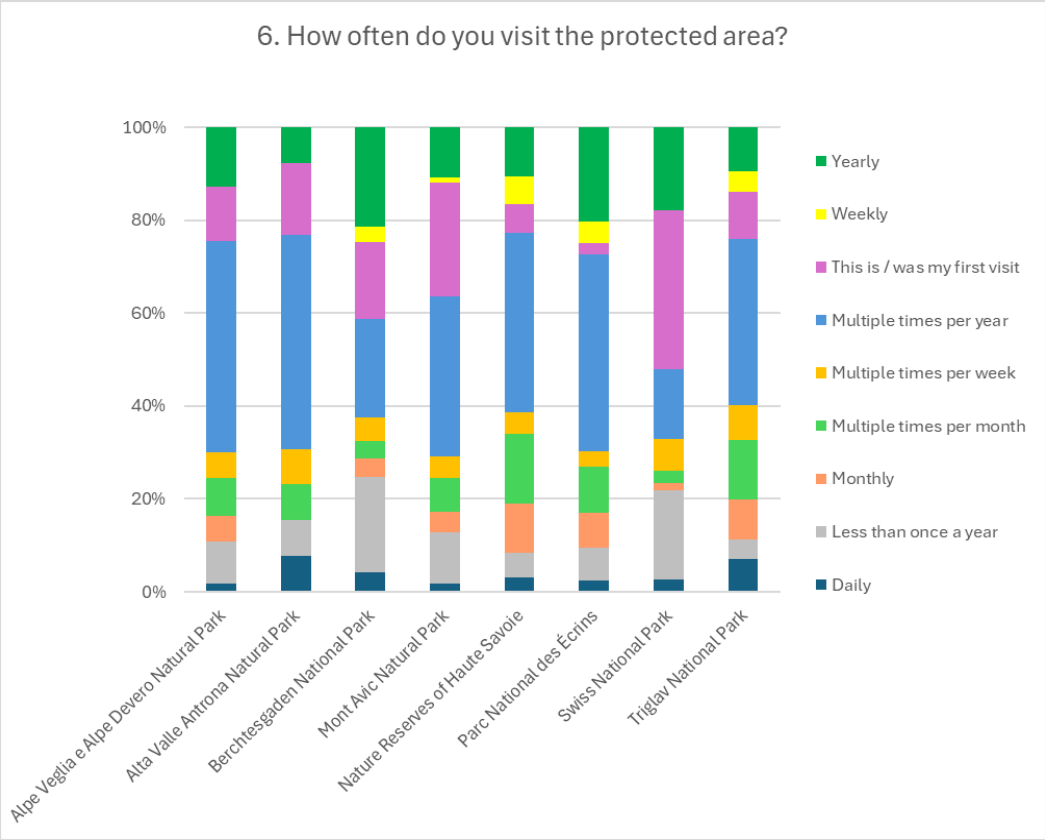


Figure 3. 6 - Visitors' survey |Answers to question No. 6

As illustrated in the graph (Fig. 6), Swiss National Park deviates from common data, recording only 15% of users who declare frequenting the protected area several times a year. This data is correlated to the higher value of new visitors (34%) recorded in the entire Alpine arc, followed by Mont Avic Natural Park.

In Berchtesgaden National Park and Swiss National Park parks, a rather high percentage (around 20%) of users who declare a return frequency of less than once a year is observed.

3.6 What is your favourite time of the year to visit the protected area?

In response to this question, over 42% of visitors indicated they prefer the summer period, followed by 40.7% of users who declare they visit the Park throughout the year. It is essential to emphasize that the period covered by this survey coincides precisely with the summer season; therefore, the data may not reflect visitors' actual seasonal preferences. An integrated analysis with data collected through winter questionnaires will be necessary to have a complete picture.

The preferences recorded for each park are represented in detail in the following graph (Fig. *7*).

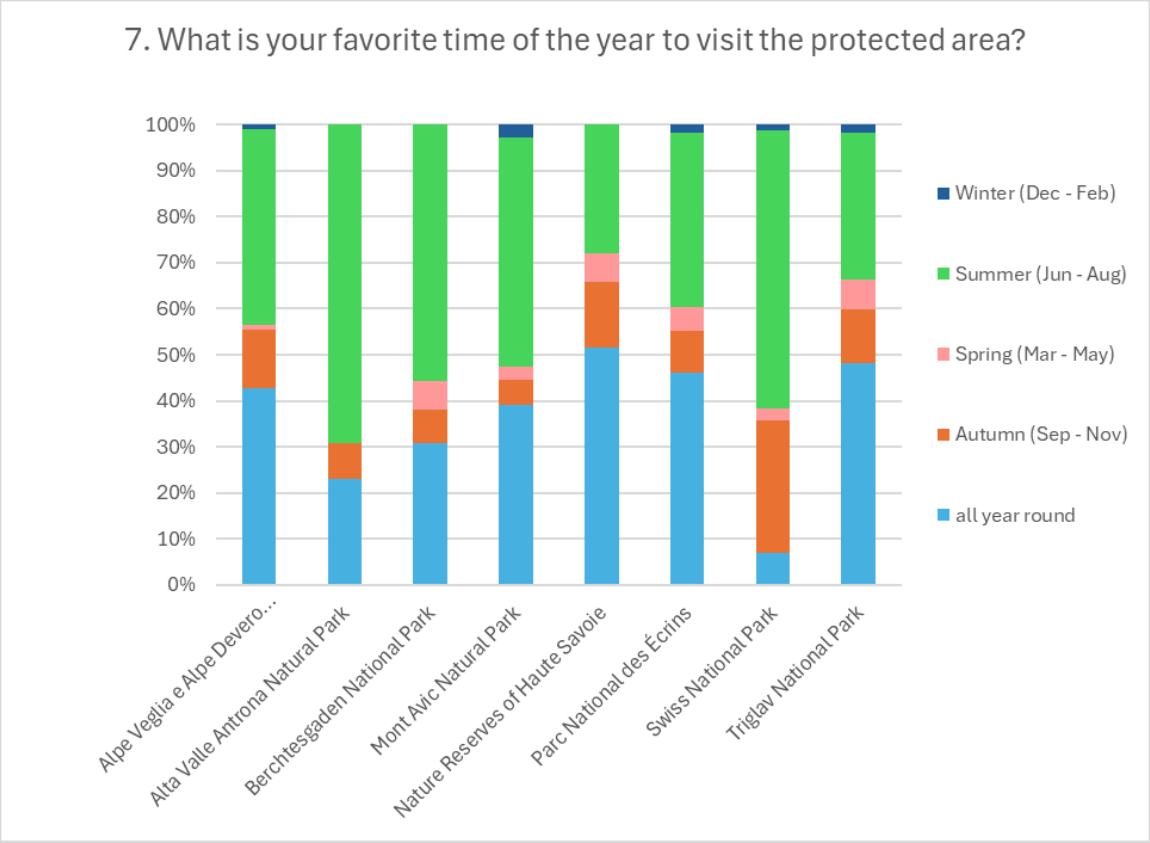


Figure 3. 7 - Visitors' survey |Answers to question No. 7

The Nature Reserves of Haute Savoie Park shows the highest percentage of visitation preference distributed throughout the year, a figure attributable to high local attendance.

The Alta Valle Antrona Natural Park and the Swiss National Park record the peak of visitation in the summer period, preferred by over 60% of survey participants.

Overall, the winter and spring seasons show the lowest preference levels, while the autumn season shows a relative increase in interest, particularly in the Swiss National Park, where it was indicated as the preferred option by approximately 29% of the sample. It should be noted that the Swiss National Park is closed to visitors during the winter season.

3.7 Before starting this survey, were you aware that you are visiting / have visited a protected area?

In response to this question, over 95% of visitors provided an affirmative answer, suggesting that knowledge of the protected area is widespread among visitors.

Out of a total of 1223 responses received during the sampling campaign, only 24 visitors declared they were not aware of being within a protected area, compared to 1199 affirmative responses.

This data can be seen as encouraging for the managing authorities and operators involved in park conservation and promotion activities. However, this result appears to contrast with the direct experience of many park rangers. During the focus groups conducted under Activity 1.2 and the field visits organized as part of the partner meetings, rangers frequently reported a lack of awareness among visitors regarding the very existence of the protected area. This discrepancy may reflect the selection bias in the survey sample or response bias, whereby respondents are reluctant to acknowledge a lack of prior awareness.

The percentage responses for each individual area are represented in the graph below (*Fig. 8*).

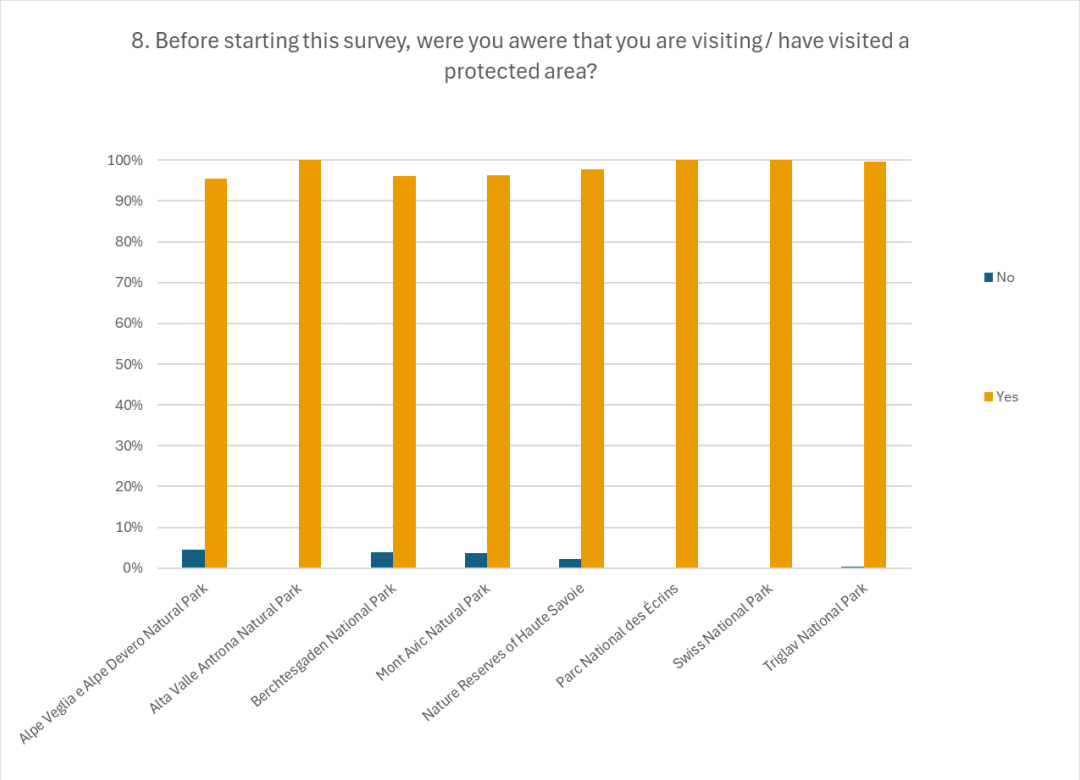


Figure 3. 8 - Visitors' survey |Answers to question No. 8

3.8 Your reason for visiting the protected area

Question No. 9 investigates the motivations for the respondents' visit to the protected area, offering the possibility to enter up to three responses in order of decreasing importance.

The question includes 7 predefined categories, plus an "Other" option that allows for the insertion of an additional motivation.

Open-ended responses were translated and, where possible, attributed to a pre-existing category. For example, responses relating to the search for a peaceful environment for relaxation, landscape contemplation, peace and solitude were attributed to the "Health" category.

Where deemed necessary, new specific categories were added, such as "Work", "Home / Accommodation", "Educational / Cultural event", etc.

As this is a preliminary analysis, further refinement of the categories is suggested, including motivations such as the search for a peaceful environment, landscape observation, educational purposes, and the specific choice to visit a protected area.

	Reason n° 1	Reason n° 2	Reason n ° 3
Alpe Veglia e Alpe Devero Natural Park	Nature (81%)	Sport and outdoor activities	Health
Alta Valle Antrona Natural Park	Nature (77%)	Sport and outdoor activities	Culture
Berchtesgaden National Park	Nature (75%)	Sport and outdoor activities	Health
Mont Avic Natural Park	Nature (69%)	Sport and outdoor activities	Health
Nature Reserves of Haute Savoie	Nature (81%)	Sport and outdoor activities	Health
Parc National des Écrins	Nature (69%)	Sport and outdoor activities	Photography
Swiss National Park	Nature (82%)	Sport and outdoor activities	Photography
Triglav National Park	Nature (70%)	Sport and outdoor activities	Health

Table 3. 2 - Visitors' survey |Answers to question No. 9

The following table summarizes the responses received for individual Parks (Table 3.2), while the complete tables are included in the appendix (App.1).

Users selected the "Nature" category as the main motivation for their visit, followed by "Sport and outdoor activities". The "Health" category was indicated as the third motivation. However, some specificities are observed by area: the "Photography" motivation emerges as the third choice for Parc National des Écrins and Swiss National Park, while for Alta Valle Antrona Park the "Culture" option is also present.

3.9 Your favourite activity in the protected area

The question aims to investigate users' preferred activities in mountain environments. For this preliminary draft, all five response categories provided were analysed. In the appendix (App.1), the results reported in tabular format for each available rank can be consulted.

In analysing the open-ended responses entered in the "Other, please specify" category, it was decided, for practical and classification reasons, to integrate activities such as mountaineering, trail running and paragliding into the "Other adventure sports" section. The "Other" category also includes activities such as fishing, swimming, foraging and gathering forest products, photography, meeting with friends, flora observation, and visits related to local gastronomic culture. A subsequent more in-depth analysis of these categories is recommended. Below is the summary table of the main activities reported for each study area (Table 3.3).

In cases where a response was repeated within multiple trends, the second choice was also considered, maintaining consistency with the percentages reported in previous responses.

A more in-depth analysis can be developed based on the tables in the appendix (App.1). In general, a comprehensive synthesis of user preferences is complex due to the high level of redundancy in the responses provided.

The preferred activity by visitors across the entire Alpine arc is "Hiking" with percentages exceeding 60% in almost all parks. In the second ranking by choice is the "Nature contemplation" category.

In general, preferred activities are closely related to hiking and observation of the natural environment. Activities related to physical and mental health, together with cultural activities, rank in the 4th and 5th categories respectively.

	Activity n° 1	Activity n° 2	Activity n° 3	Activity n° 4	Activity n° 5
Alpe Veglia e Alpe Devero Natural Park	Hiking	Nature contemplation	Relaxation / Wellness	Health	Wildlife observation
Alta Valle Antrona Natural Park	Hiking	Relaxation / Wellness	Educational activities related to nature	Nature contemplation	Wildlife observation

	Activity n° 1	Activity n° 2	Activity n° 3	Activity n° 4	Activity n° 5
Berchtesgaden National Park	Hiking	Nature contemplation	Wildlife observation	Relaxation / Wellness	Health
Mont Avic Natural Park	Hiking	Nature contemplation	Wildlife observation	Relaxation / Wellness	Educational activities related to cultural heritage
Nature Reserves of Haute Savoie	Hiking	Nature contemplation	Wildlife observation	Relaxation / Wellness	Other adventure sports
Parc National des Écrins	Hiking	Nature contemplation	Wildlife observation	Relaxation / Wellness	Educational activities related to cultural heritage
Swiss National Park	Hiking	Wildlife observation	Nature contemplation	Educational activities related to nature	Educational activities related to cultural heritage
Triglav National Park	Hiking	Wildlife observation	Nature contemplation	Health	Educational activities related to cultural heritage

Table 3. 3 - Visitors' survey |Answers to question No. 10

3.10 Your main sources of information

This question investigates the three main information sources relating to protected areas used by visitors, classified in order of relevance.

The results highlighted a significant user preference for institutional channels/official websites of Park Authorities for acquiring information (30%). The second source consists of guides and printed material, followed, as the third preference, by word of mouth.

Graph No.9 illustrates the distribution of different information sources for each individual park, with exclusive reference to the first choice expressed by respondents. The remaining graphical representations are included in the Appendix (App.1).

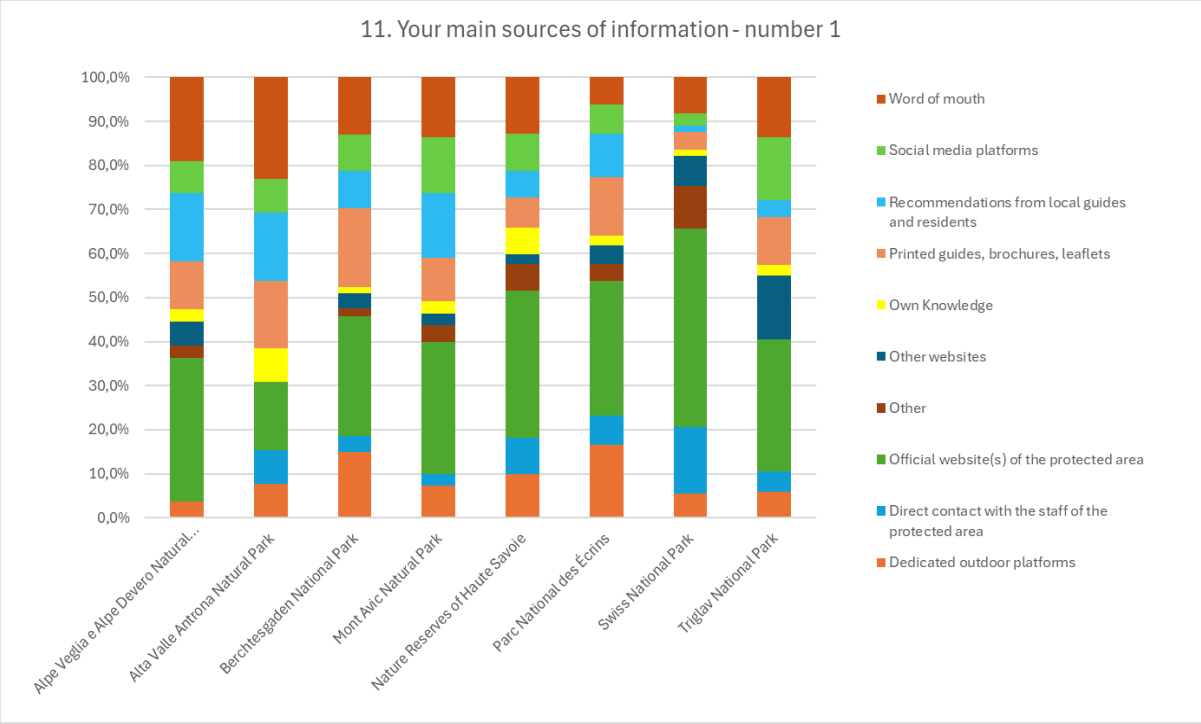


Figure 3. 9 - Visitors' survey |Answers to question No. 11

The "Other" category includes various items, such as specialized magazines, television programs, thematic cartography and knowledge acquired in professional settings.

The "Own knowledge" category was also introduced, which includes subjects with intrinsic knowledge of the area. This group includes residents, long-standing regular visitors and individuals whose familiarity with the area derives from family contexts.

Given the complexity of open-ended responses concerning the use of alternative websites, social media platforms and applications dedicated to outdoor activities, it was decided to exclude such data from this preliminary version of the report.

3.11 How would you rate the impact of outdoor activities on the protected area regarding the following aspects?

In question No. 12, visitors were asked to assess the environmental impact of 8 specific categories generated by outdoor activities. The assessment was entered on a three-level scale, where the value "1" corresponds to low environmental impact and the value "3" to high

impact. The option "I can't say / I don't know what that is" was also included among the responses.

Participants were provided with the possibility to enter a ninth environmental impact category at their discretion. For this section, an analysis of open-ended responses was conducted, excluding fields marked as "don't know/none" from processing. Overall, out of a total of 1184 responses recorded for this question, 965 were blank, indicating that approximately 81% of respondents did not answer this specific section.

The analysis of individual environmental impact categories produced the following results:

Disturbance to wildlife: approximately 47% of responses indicated a perceived impact as "medium", 31% as "high" and 21% as "low". The Nature Reserves of Haute Savoie shows the highest percentage of users (52%) classifying the impact of activities within the park as "high". Conversely, Mont Avic Natural Park records only 14% of visitors who consider it highly impactful, while 43% perceive it as having low impact.

Disturbance to natural ecosystem: Approximately 48% of users assessed the overall impact for this item as "medium". Only for the Nature Reserves of Haute Savoie was the impact considered "high" by almost half of respondents (48.5%). In the areas of Alta Valle Antrona Natural Park and Mont Avic Natural Park, visitors perceive the impact of their activities as "low" (over 40% of responses in both cases).

Soil erosion due to vehicle use: In this category, approximately 38% of visitors indicated a "high" impact. In general, responses were well balanced among the three impact levels and substantially equivalent across different study areas. About 4% of users stated they were unable to respond ("I can't say"), with over 9% of Swiss National Park visitors opting for this option.

Soil erosion due to foot traffic: the impact of people's activity on soil is generally perceived as "low", with more than 40% of users choosing this option. In contrast, we find the two French Parks (Nature Reserves of Haute Savoie, Parc National des Écrins), where the impact is predominantly classified as "medium", followed by the "high" category.

Vegetation damages: for 45% of users, the impact on vegetation was "medium". In parks such as Alpe Veglia e Alpe Devero Natural Park, Mont Avic Natural Park and Swiss National Park, the most selected category was "low impact".

Habitat fragmentation: This category recorded the highest percentage of "I can't say / I don't know what that is" responses (approximately 16%), indicating widespread difficulty in

classifying the degree of disturbance from outdoor activities in relation to habitat fragmentation or a limited understanding of the phenomenon itself. The impact is perceived as "low" in areas such as Alpe Veglia e Alpe Devero Natural Park, Mont Avic Natural Park, Parc National des Écrins and Swiss National Park. The percentage of responses classifying the impact as "medium" is instead predominant in Alta Valle Antrona Natural Park (61%), Triglav National Park (39%), Berchtesgaden National Park (38%) and Nature Reserves of Haute Savoie (37%).

Increase in waste/litter: this category is perceived throughout the Alpine arc as "high impact", with an average of 47% of responses. Analysing individual parks, it can be noted that responses for Alpe Veglia e Alpe Devero Natural Park are equally balanced among the three categories. The only park showing a different trend is Swiss National Park, where 31% declared the impact as "medium" and almost 47% of users stated that the impact is "low".

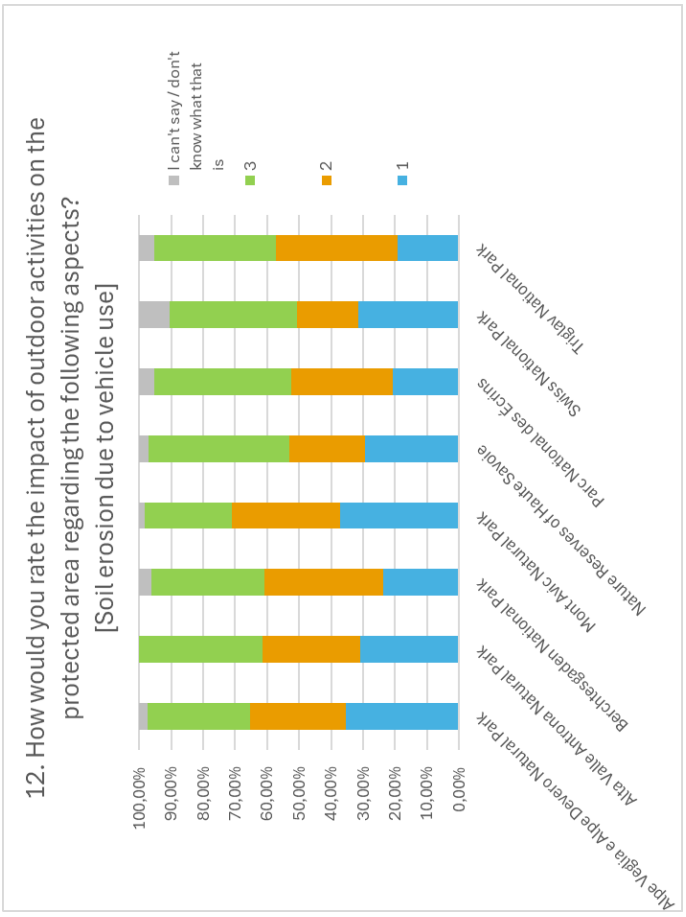
Risk of overtourism/overcrowding: 64% of survey participants indicated that this category falls within high impact, with only 24% of users considering it "medium" impact and 8% as "low". This data highlights how the threat of overcrowding in natural areas is clearly perceived by visitors. In particular, the high impact of overtourism is perceived in Nature Reserves of Haute Savoie (82%), followed by Triglav National Park (73%) and Parc National des Écrins (70%).

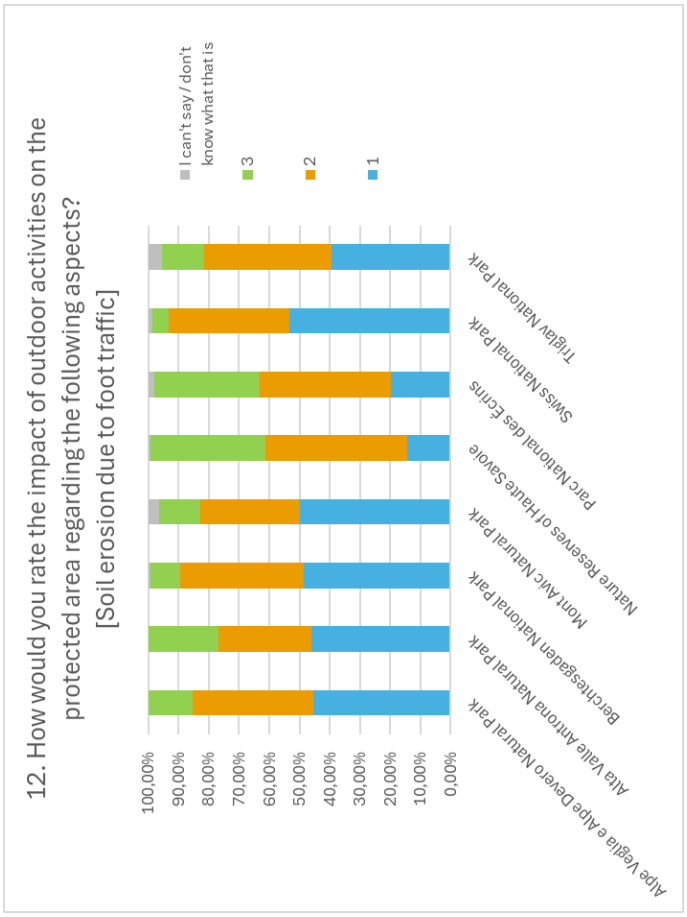
For the open-ended response category, a thematic categorization was performed, with the identification of 20 new items. Many of the emerging categories proved redundant compared to those already included in the questionnaire or attributable to causes of disturbance rather than direct environmental impacts, as required by the question.

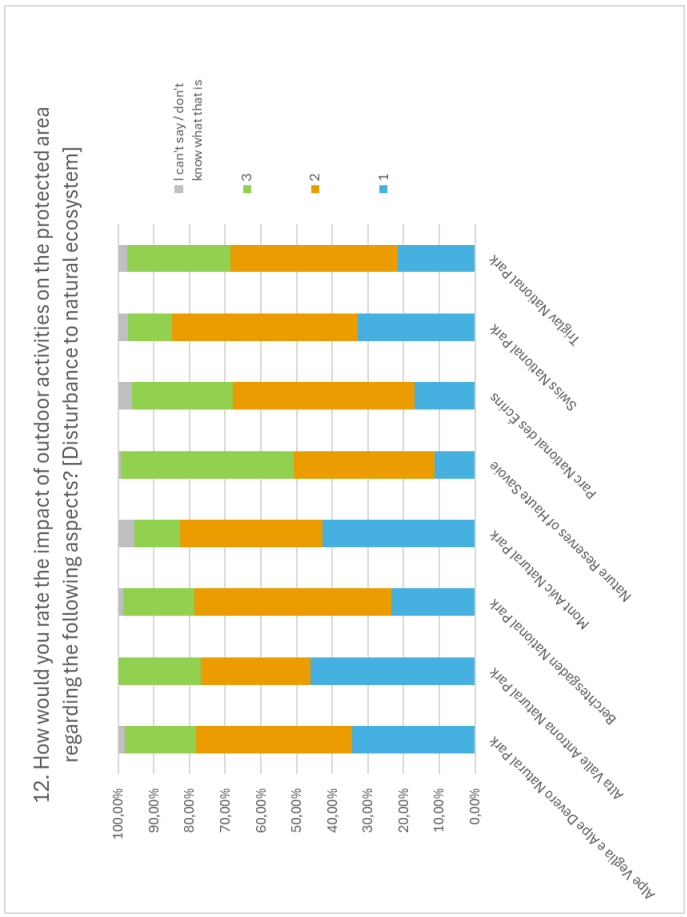
From an initial qualitative analysis, the additional impacts most perceived by users concern environmental pollution, primarily understood as noise pollution (11%) and contamination of water resources and air (7%).

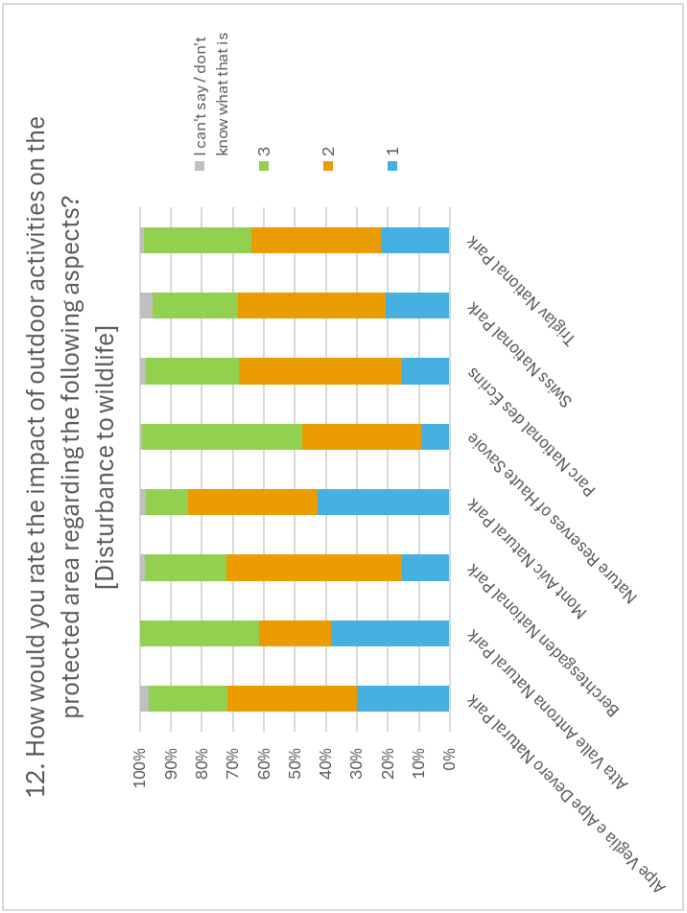
The results are shown below in graphical format, divided by individual impact.

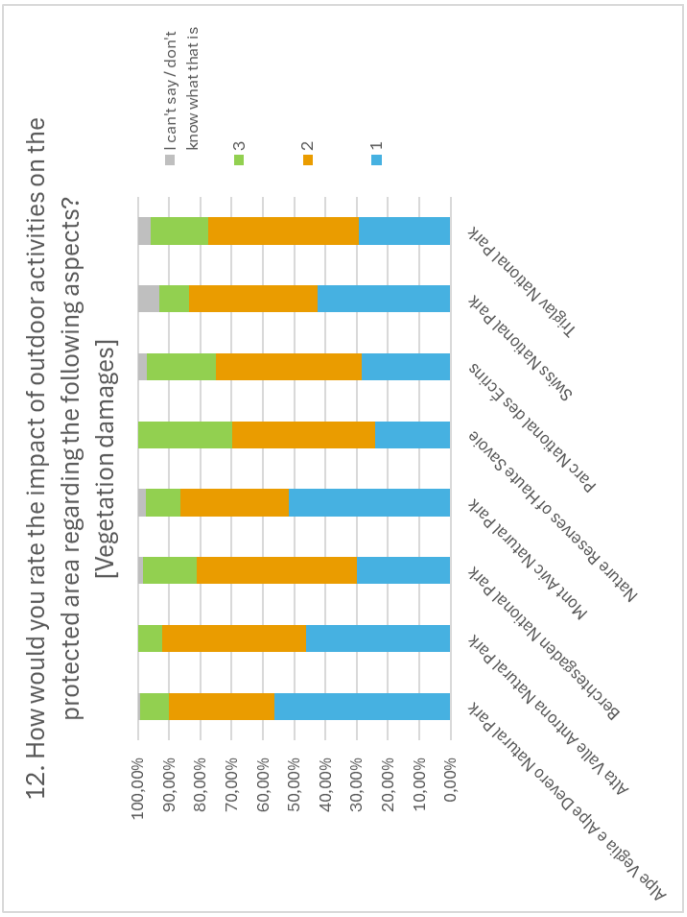
Figure 3. 10 - Visitors' survey |Answers to question No. 12

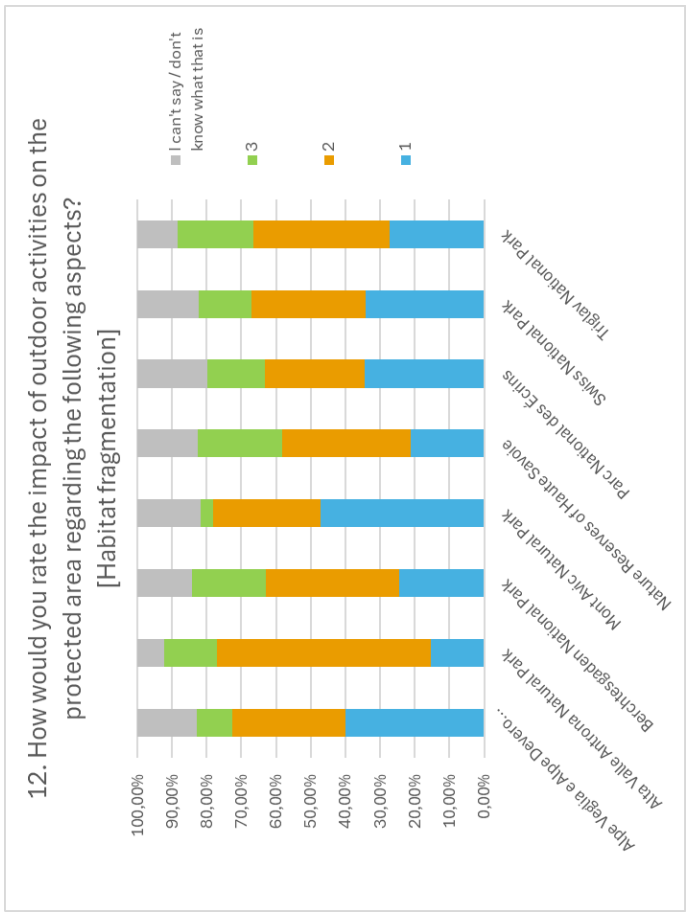


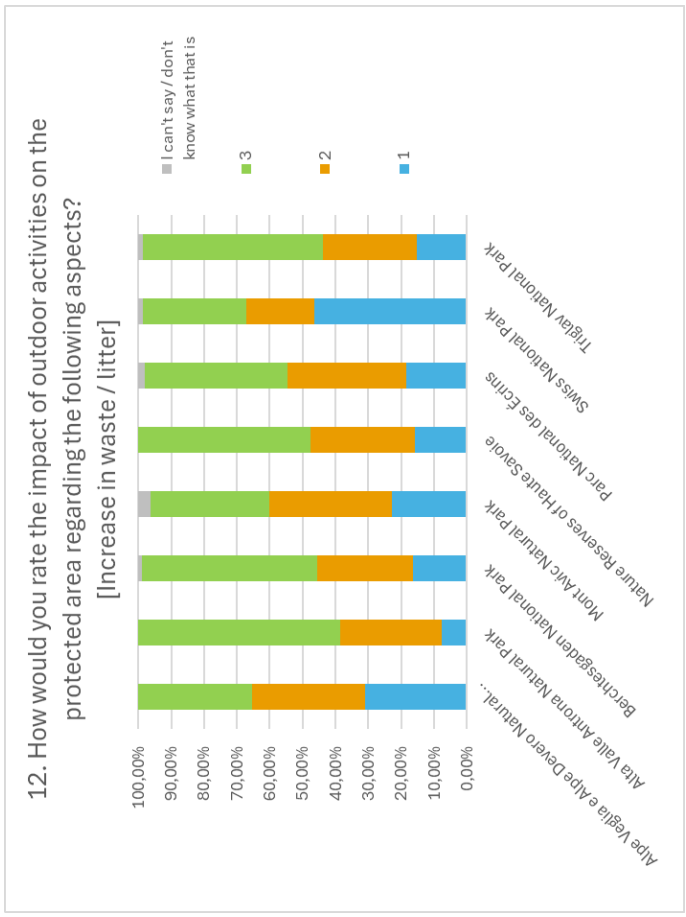


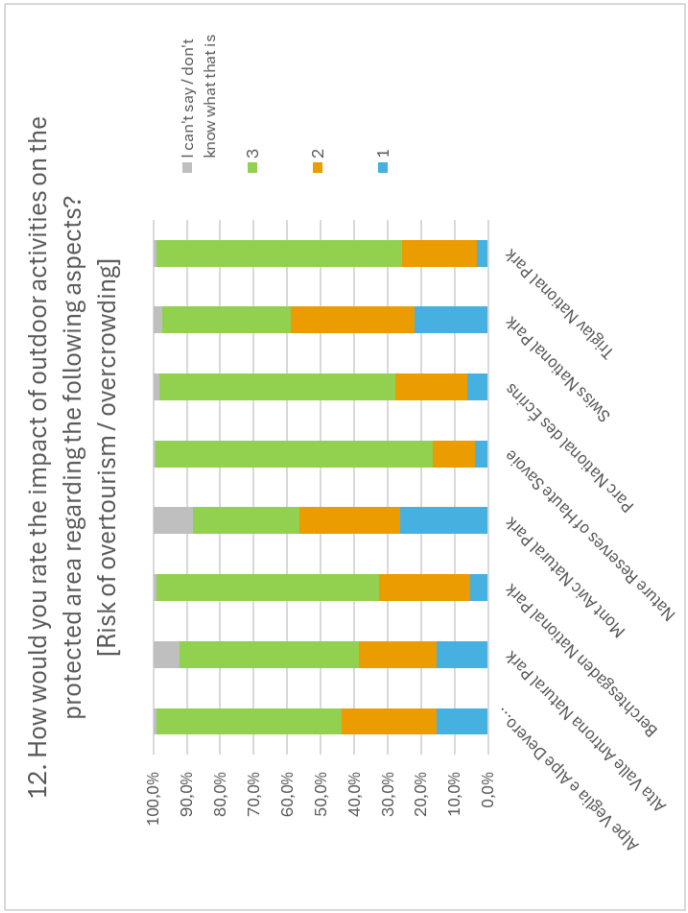





12. How would you rate the impact of outdoor activities on the protected area regarding the following aspects? [Vegetation damages]
I can't say / don't know what that is
3
2
1
100,00%
90,00%
80,00%
70,00%
60,00%
50,00%
40,00%
30,00%
20,00%
10,00%
0,00%
Triglav National Park
Swiss National Park
Parc National des Ecrins
Nature Reserves of Haute Savoie
Mont Avic Natural Park
Berchtesgaden National Park
Alta Valle Antrona Natural Park
Alpe Veglia e Alpe Devero Natural Park


12. How would you rate the impact of outdoor activities on the protected area regarding the following aspects? [Habitat fragmentation]
I can't say / don't know what that is
3
2
1
100,00%
90,00%
80,00%
70,00%
60,00%
50,00%
40,00%
30,00%
20,00%
10,00%
0,00%
Triglav National Park
Swiss National Park
Parc National des Ecrins
Nature Reserves of Haute Savoie
Mont Avic Natural Park
Berchtesgaden National Park
Alta Valle Antrona Natural Park
Alpe Veglia e Alpe Devero...


12. How would you rate the impact of outdoor activities on the protected area regarding the following aspects? [Increase in waste / litter]
I can't say / don't know what that is
3
2
1
100,00%
90,00%
80,00%
70,00%
60,00%
50,00%
40,00%
30,00%
20,00%
10,00%
0,00%
Triglav National Park
Swiss National Park
Parc National des Ecrins
Nature Reserves of Haute Savoie
Mont Avic Natural Park
Berchtesgaden National Park
Alta Valle Antrona Natural Park
Alpe Veglia e Alpe Devero Natural...


12. How would you rate the impact of outdoor activities on the protected area regarding the following aspects? [Risk of overtourism / overcrowding]
I can't say / don't know what that is
3
2
1
100,0%
90,0%
80,0%
70,0%
60,0%
50,0%
40,0%
30,0%
20,0%
10,0%
0,0%
Triglav National Park
Swiss National Park
Parc National des Ecrins
Nature Reserves of Haute Savoie
Mont Avic Natural Park
Berchtesgaden National Park
Alta Valle Antrona Natural Park
Alpe Veglia e Alpe Devero...

3.12 How important are the following health aspects to you when visiting the protected area?

Question 13 was designed to investigate how survey participants perceived the influence of visiting protected areas on their health status. Each participant was asked to express an assessment of the level of perceived importance, using a 5-point scale. The scale points were defined as follows: the value "1" corresponds to "not important aspect", while the value "5" identifies a "very important element" in relation to health effects.

Overall, the "very important" choice represents the category with the highest frequency across different items.

The detailed results for each response category are illustrated in the graphical representations that follow."

The detailed results for each response category are illustrated in the graphical representation that follows.

From the graphical reading of the data from the first six categories investigated (Fig. 11-16), it is evident that health-related aspects are perceived as "very important" by visitors. Specifically, these categories mainly refer to the beneficial effects derived from outdoor physical activity on psychological well-being and the maintenance of general physical health.

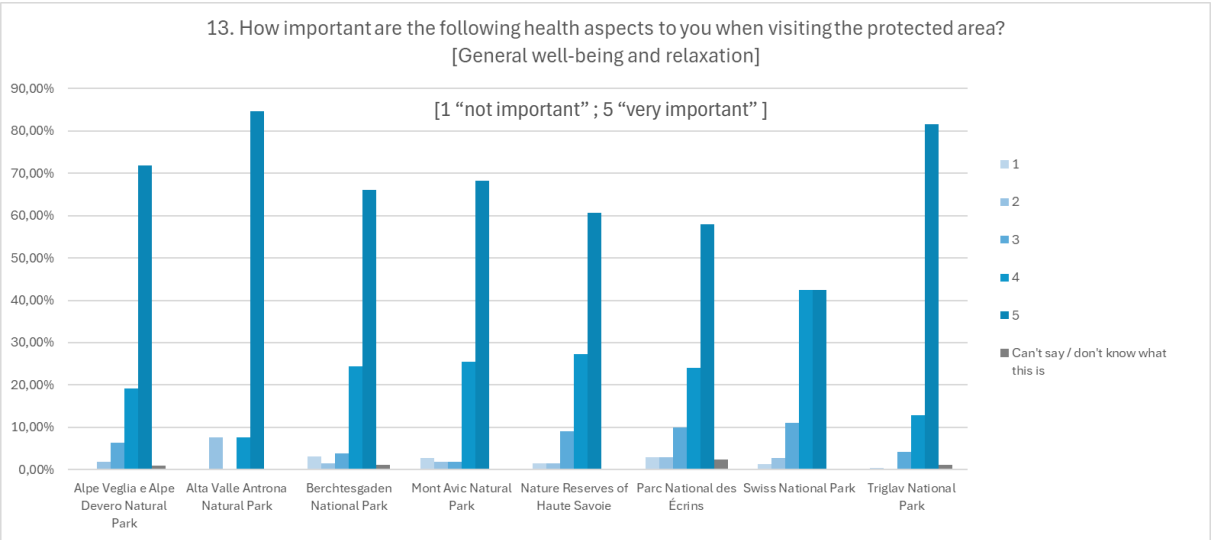


Figure 3. 11 - Visitors' survey |Answers to question No. 13

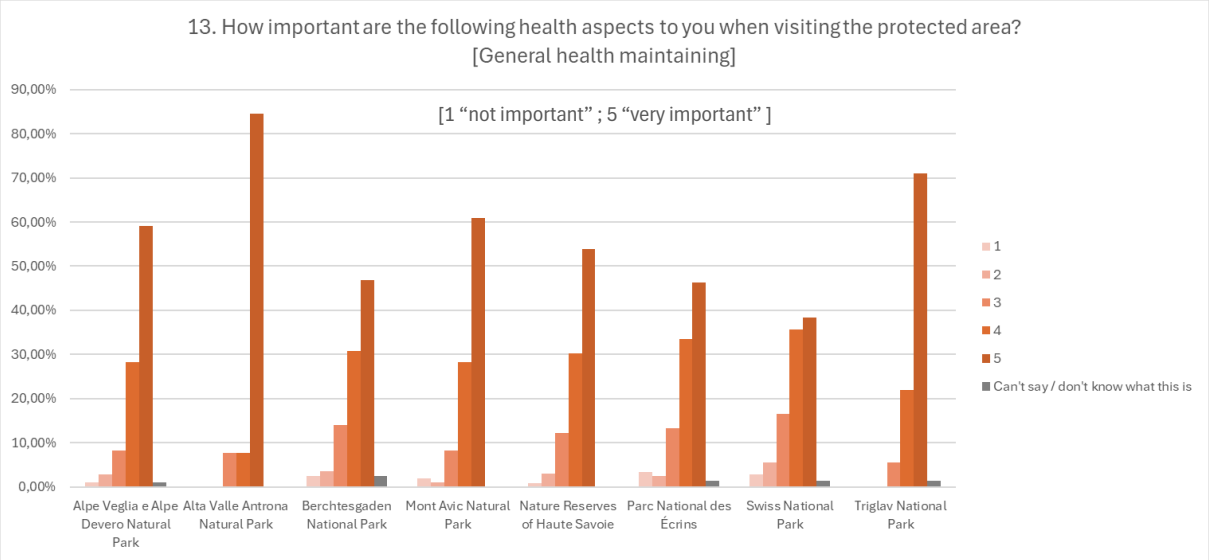


Figure 3. 12 - Visitors' survey |Answers to question No. 13

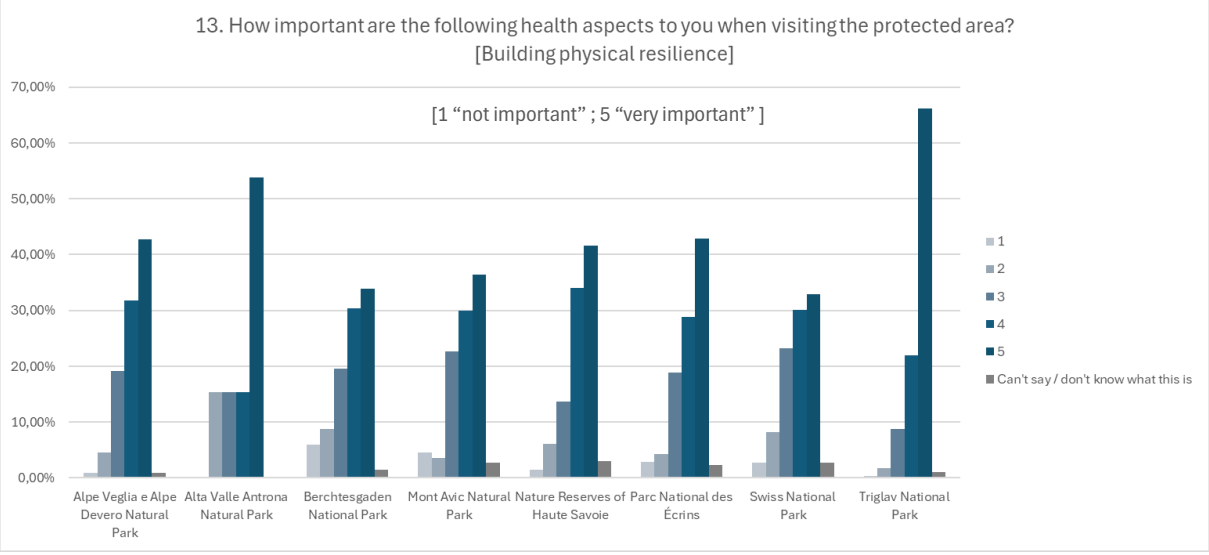


Figure 3. 13 - Visitors' survey |Answers to question No. 13

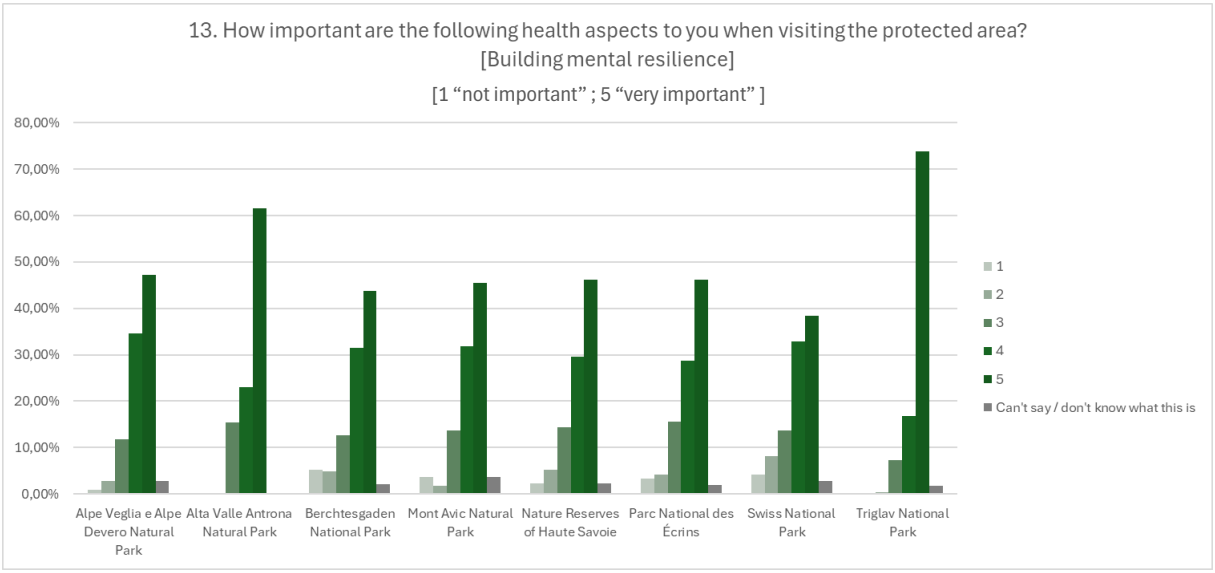


Figure 3. 14 - Visitors' survey |Answers to question No. 13

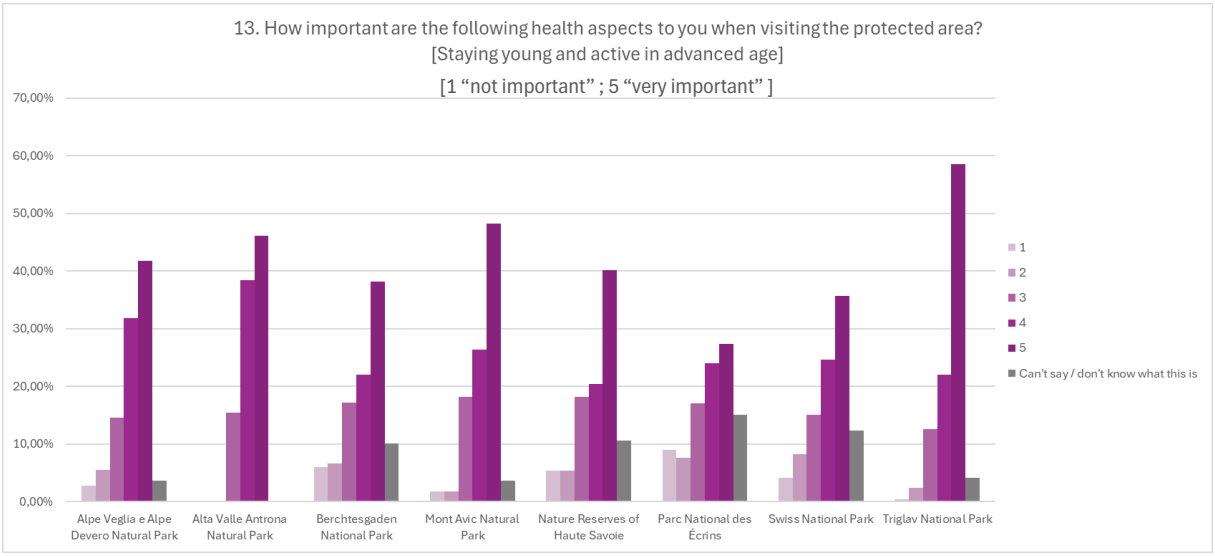


Figure 3. 15 - Visitors' survey |Answers to question No. 13

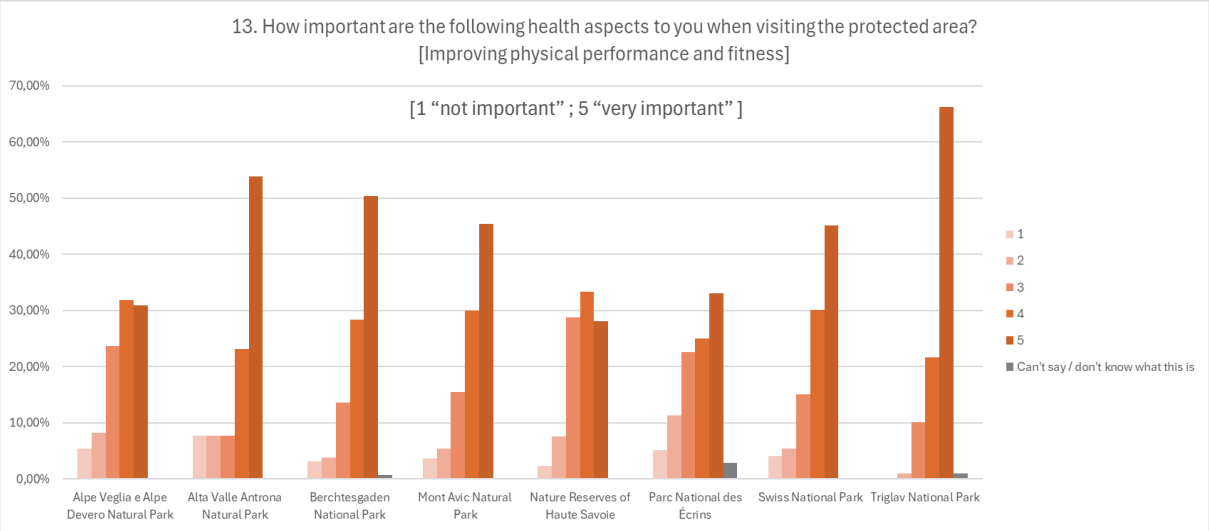


Figure 3. 16 - Visitors' survey |Answers to question No. 13

The following three items investigated the perception of the importance of visiting the protected area in relation to specific pre-existing pathologies and health problems, such as: respiratory disorders related to urban air pollution, cardiovascular system problems, and orthopaedic disorders. For these categories, it emerged that users, in specific geographical contexts, do not attribute significant importance to the visit as an improvement factor, or declare they are unable to answer the question.

This trend is particularly pronounced in the French National Parks, where approximately 20% of respondents chose the "Can't say / I don't know" option. Specifically, in Fig. 18-19, which concern the improvement of cardiovascular and orthopaedic conditions respectively, a high incidence of users who do not consider these aspects a priority for the visit is observed. Responses aligned with those of the French parks were also observed for Swiss National Park and Berchtesgaden National Park.

The remaining graphs are shown below.

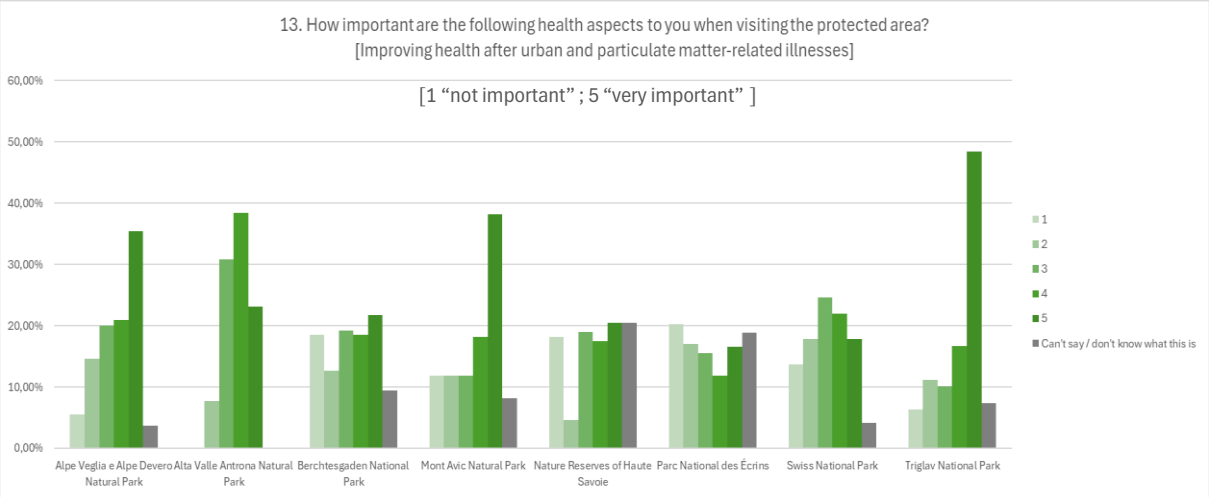


Figure 3. 17 - Visitors' survey |Answers to question No. 13

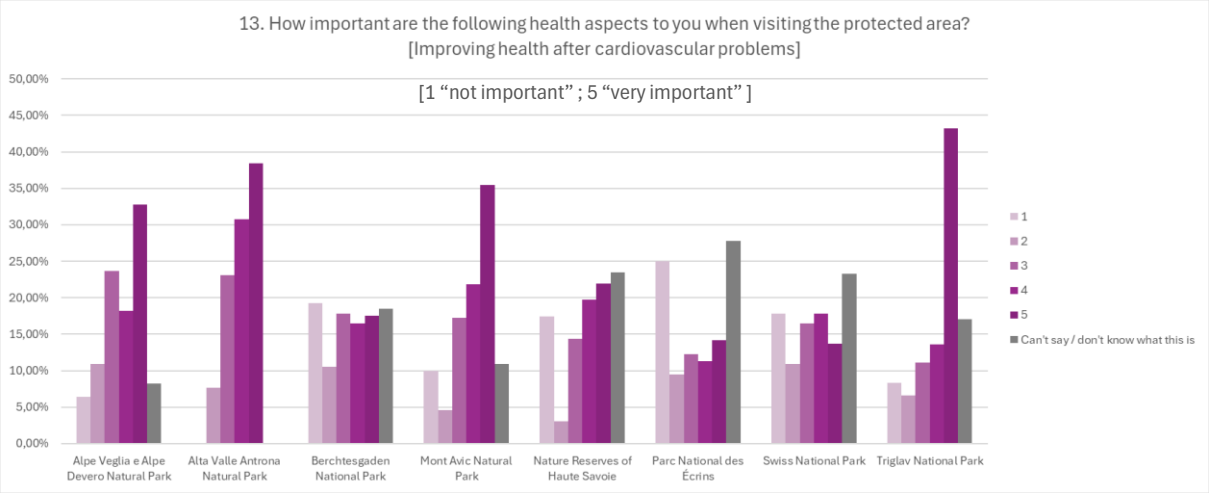


Figure 3. 18 - Visitors' survey |Answers to question No. 13

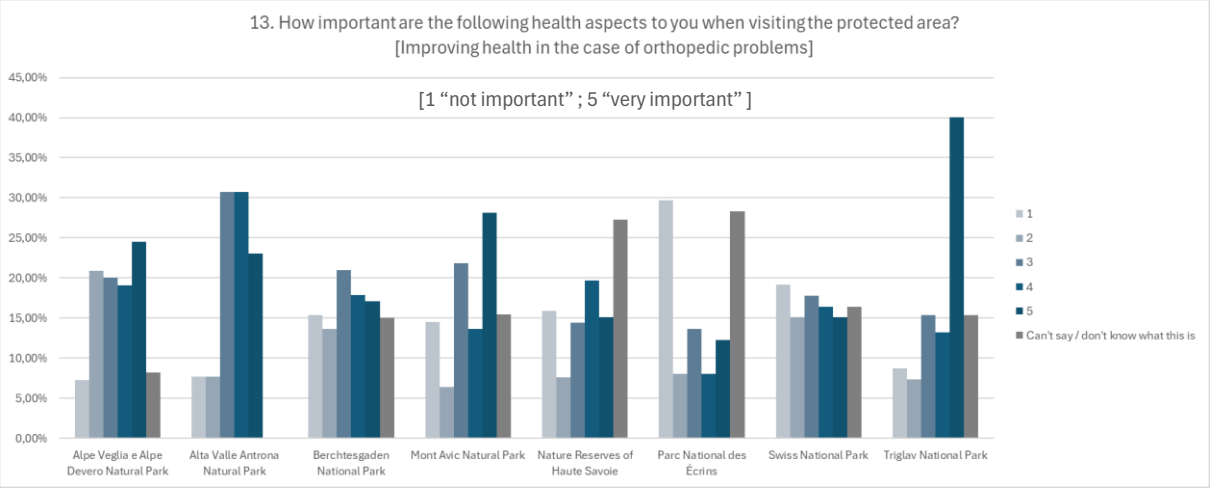


Figure 3. 19 - Visitors' survey |Answers to question No. 13

Finally, all users agree in recognizing the importance of the protected area in improving health conditions related to stress (Fig. 20).

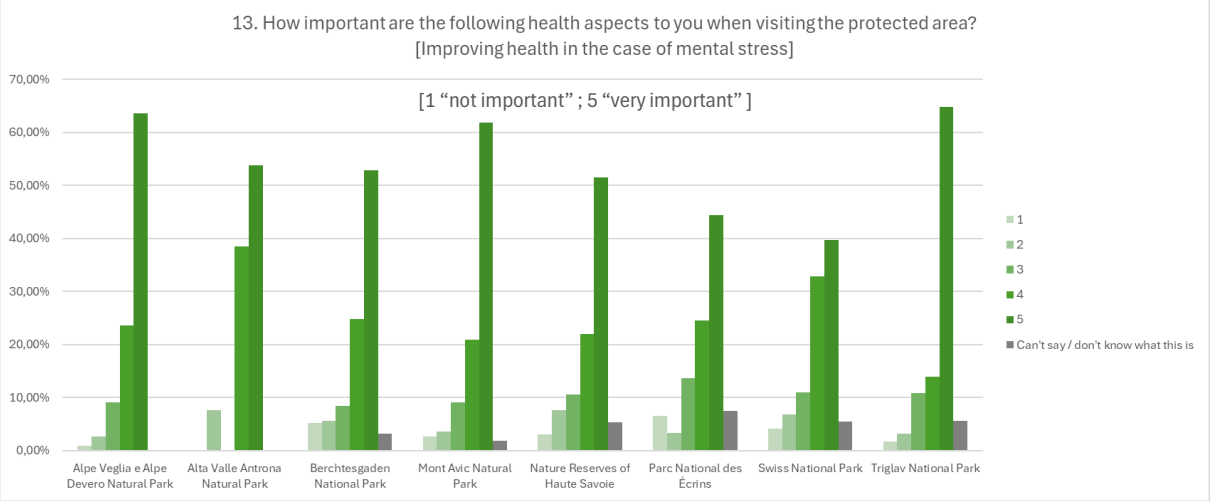


Figure 3. 20 - Visitors' survey |Answers to question No. 13

visiting the protected area, both regarding general and specific benefits, on health and well-being. This trend remained constant even in questions relating to more specific health topics, where a high degree of importance was uniformly recognized.

Similarly, in the Italian Parks as well, responses relating to health topics, both general and specific, consistently remained at high levels of perceived relevance by visitors.

3.13 Would you be interested in offers for specific health promotion activities in the protected area?

This question aims to investigate visitors' interest in potential activity proposals aimed at promoting user well-being in different areas. The responses show a balanced distribution among the five proposed categories. In particular, the activities that received the greatest preferences were those related to knowledge and interaction with local nature, wildlife, local traditions and wellness-related aspects.

It was found that over 30% of participants from Swiss National Park, Parc National des Écrins and Nature Reserves of Haute Savoie expressed a negative assessment regarding interest in new wellness-related initiatives within protected areas.

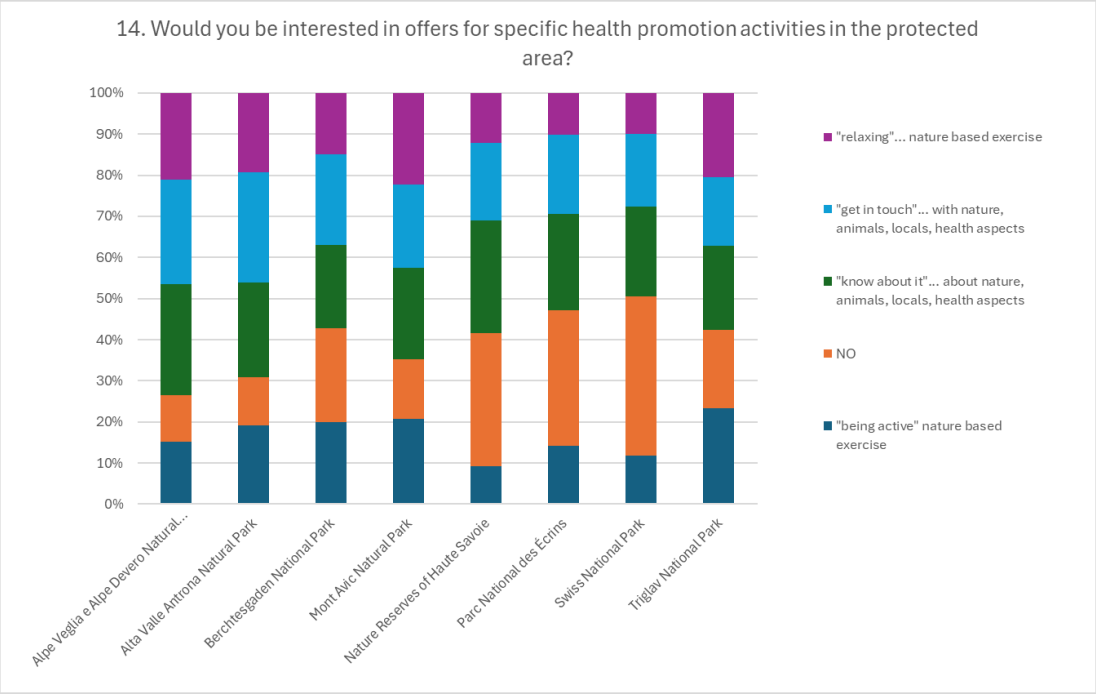


Figure 3. 21 - Visitors' survey |Answers to question No. 14

3.14 How much do you agree with the following statements?

Question No. 15 investigates public interest in relation to eight key topics concerning protected areas. The assessment was expressed on a scale from 1 to 5, where the value "1" indicates "strongly disagree" and "5" for "strongly agree" with the proposed statement.

Unanimous consensus emerged among visitors of all Parks, who agree in attributing high importance to the theme of natural environment protection (Fig. 22).

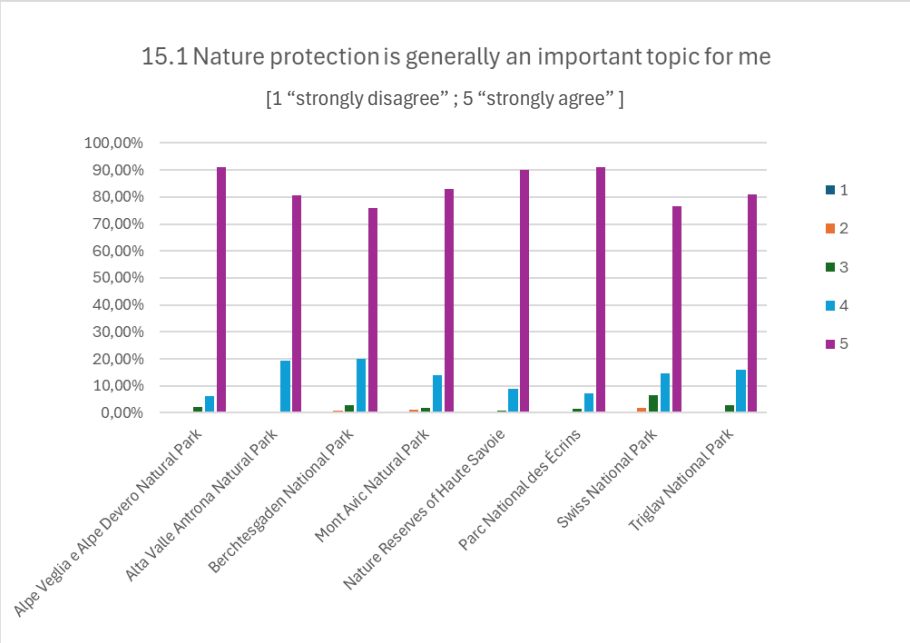


Figure 3. 22 - Visitors' survey |Answers to question No. 15

The following 4 topics investigate the importance of health in relation to protected areas, visitor interest in potential wellness-related activities, and the relevance attributed to the existence of scientific and concrete evidence about the beneficial effects of visiting the Park (Fig. 23-26).

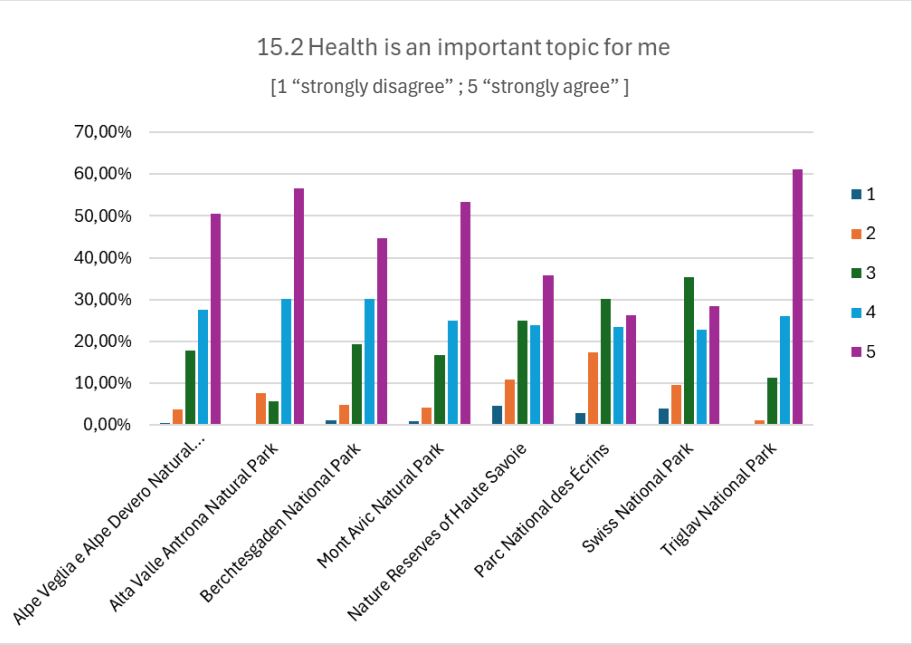


Figure 3. 23 - Visitors' survey |Answers to question No. 15

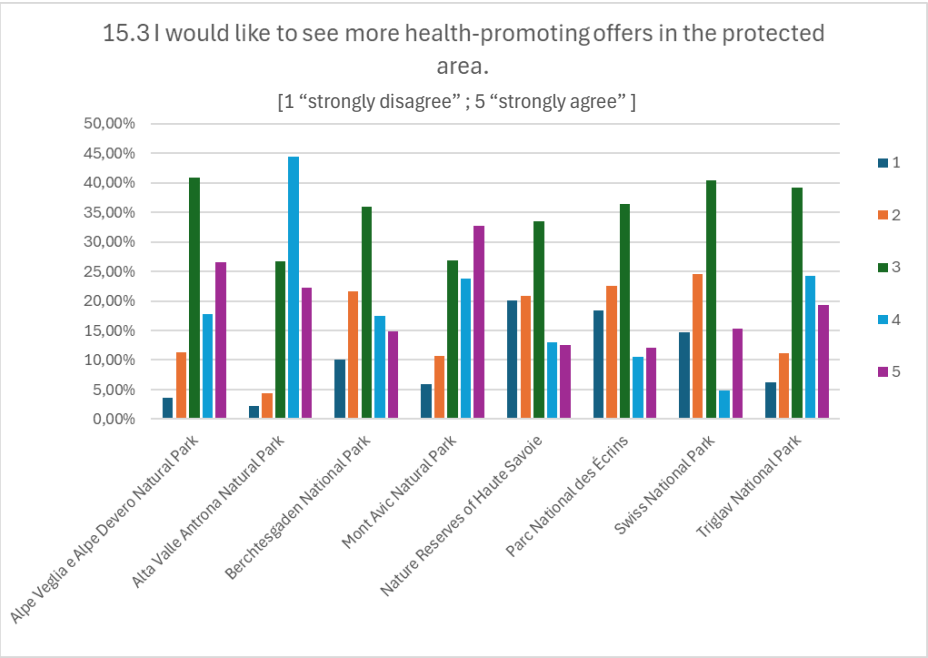


Figure 3. 24 - Visitors' survey |Answers to question No. 15

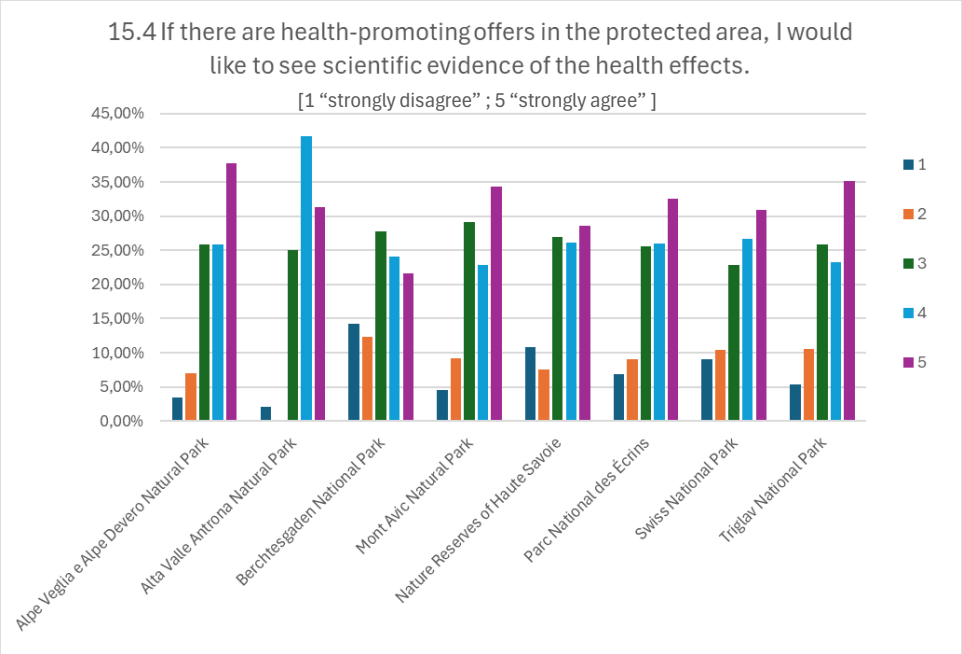


Figure 3. 25 - Visitors' survey |Answers to question No. 15

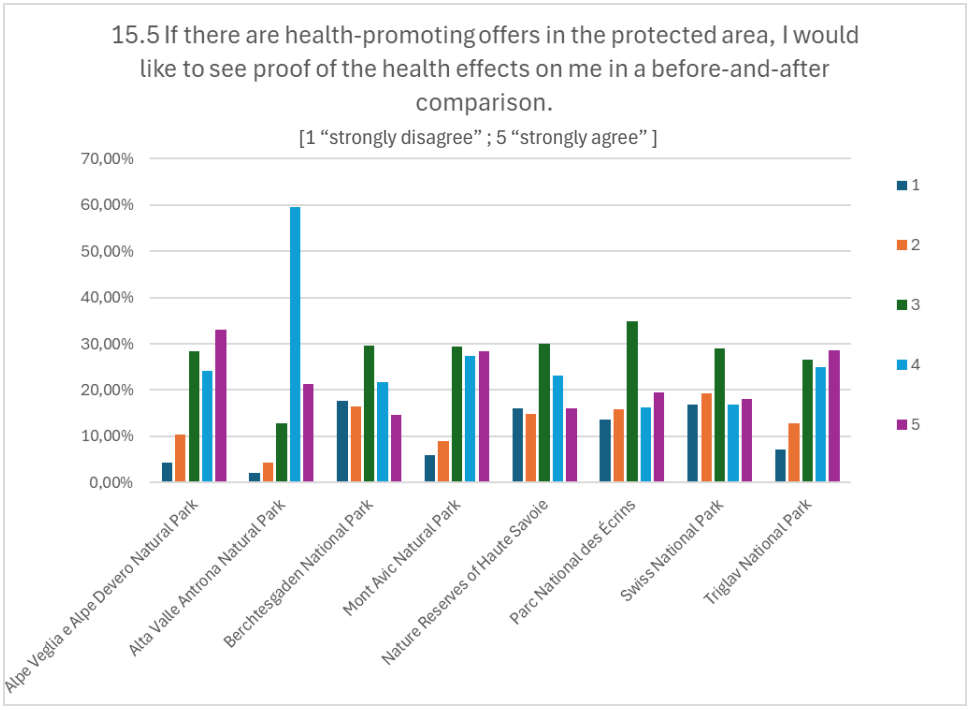


Figure 3. 26 - Visitors' survey |Answers to question No. 15

As previously highlighted by the responses to question No. 13, visitors to Triglav National Park and the Italian Parks agree on the high importance of the wellness theme compared to other Parks. Nevertheless, the average perceived relevance for this theme remains high across the entire sample.

From the analysis of the following topic, it emerges that visitors do not show a marked interest in the possibility of benefiting from a greater number of activities oriented toward user well-being (Fig. 24).

The possibility of implementing additional wellness promotion offerings was considered substantially neutral (central value of the scale). User responses indicate neither complete disagreement nor explicit agreement with the need for greater availability of such offerings. In some cases, such as for the French Parks, a more negative trend was observed, with almost 20% of respondents declaring themselves "strongly disagree" with this proposal.

In the context of activities promoted for well-being, visitors agree on the interest in having scientific evidence that attests to health benefits (Fig. 25). Less pronounced is the need for a clear effect on health that is visible and quantifiable, before and after the visit (Fig. 26).

Regarding the propensity to participate in guided tours within protected areas, visitor responses show a greater willingness to participate in Mont Avic Natural Park and Alta Valle Antrona Natural Park, followed by visitors to Alpe Veglia e Alpe Devero Natural Park and Swiss National Park (Fig. 27).

In contrast, in Parks such as Nature Reserves of Haute Savoie, Berchtesgaden National Park, Triglav National Park and Swiss National Park, the predominant percentage is represented by visitors who declare they are not interested in a guided tour service.

Across the entire study area, visitors agree on the willingness to pay more for activities offered within protected areas, if these would lead to greater protection of nature in the protected area (Fig. 28).

On average, visitors' willingness to pay more for health and wellness-related services was lower. However, visitors to Alta Valle Antrona Natural Park and Mont Avic Natural Park expressed a greater positive propensity toward such payment. A positive result, although to a lesser extent, was also recorded for Swiss National Park (Fig. 29).

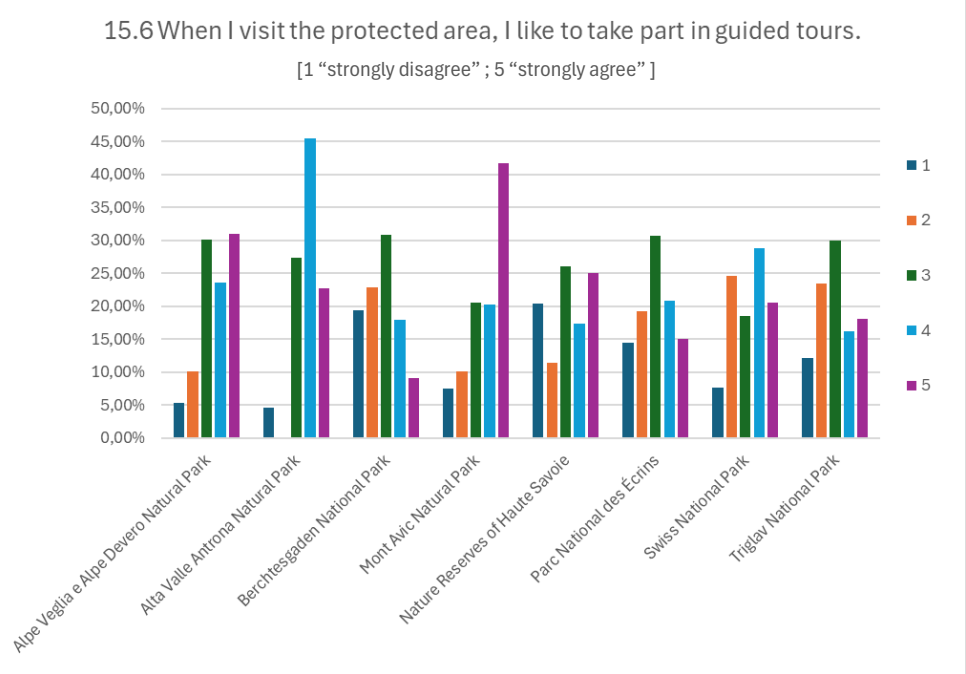


Figure 3. 27 - Visitors' survey |Answers to question No. 15

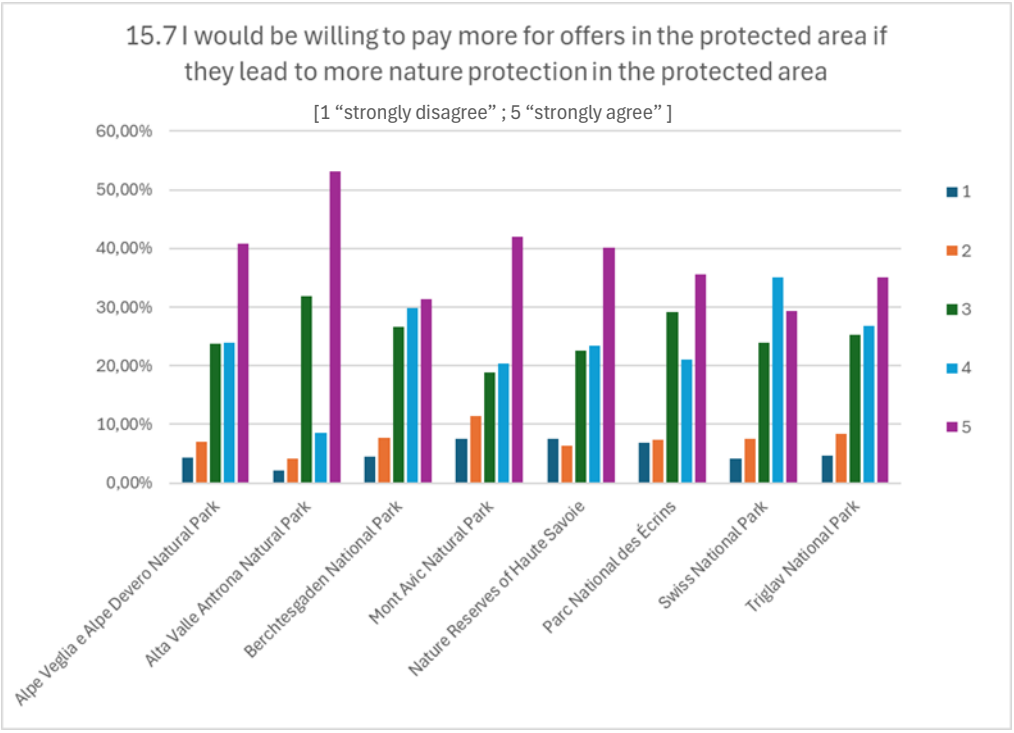


Figure 3. 28 - Visitors' survey |Answers to question No. 15

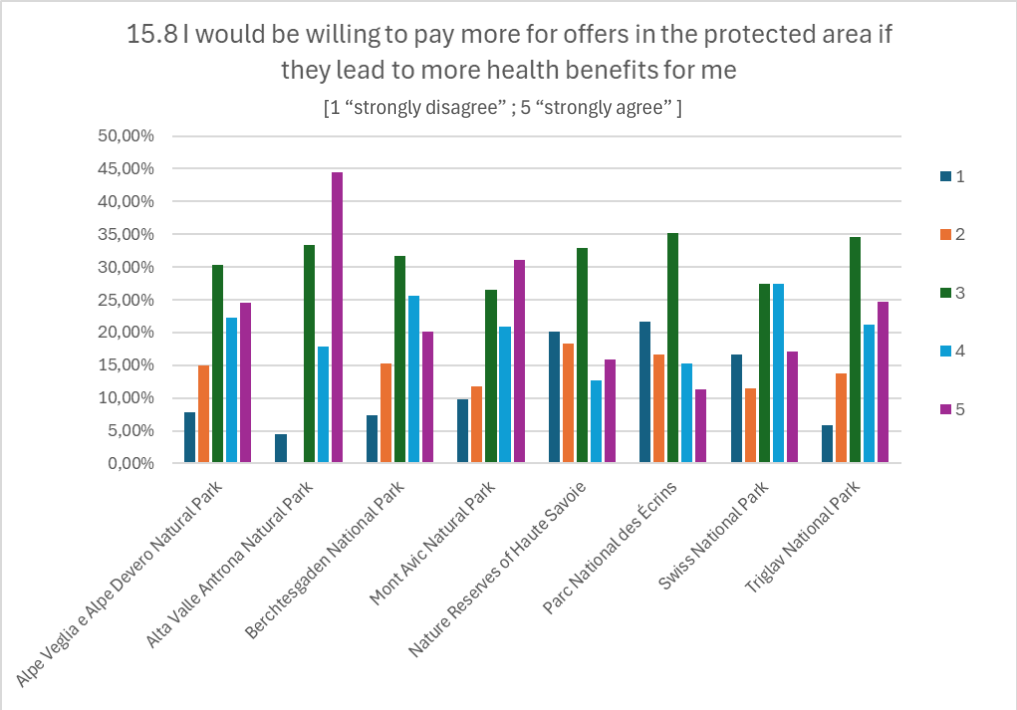


Figure 3. 29 - Visitors' survey |Answers to question No. 15

3.15 General information on the respondents

Questions No. 16 and No. 17 were used to collect basic socio-demographic data of the interviewed sample, namely age and gender. To proceed with the analysis and visualization of the sample's age distribution, the data were categorized and divided into 8 age classes. The complete data are reported in the Appendix 1. The results of this question are shown in the following graph (Fig.30). To facilitate interpretation, the groups were further classified into four broad categories.

The age class between 40-49 years represents the predominant bracket of the survey, followed by the 50-59 years class. Regarding Swiss National Park, the highest percentage of responses from the youngest visitor bracket is observed. This data requires careful consideration, as it emerged from previous responses that several users were present at the Park to participate in an organized event.

The analysis of responses to question No. 17 shows that, overall, 57% of questionnaires were completed by women. The only Park that deviates significantly from this pattern is Alta Valle Antrona Natural Park; this deviation, however, could be related to the reduced sample size of survey participants in that specific area.

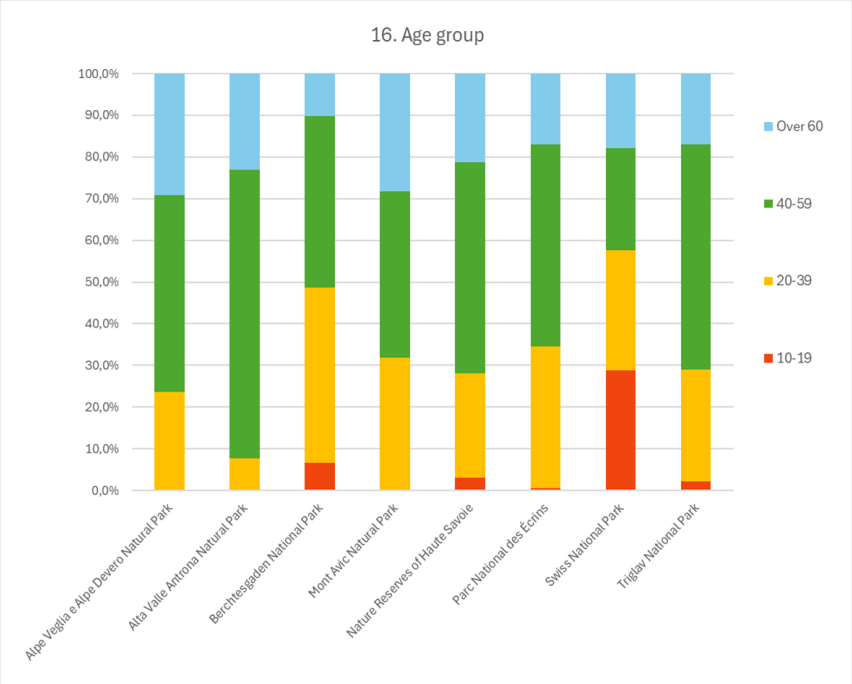


Figure 3. 30 - Visitors' survey |Answers to question No. 16

The complete results are displayed in the following graph (Fig. 31).

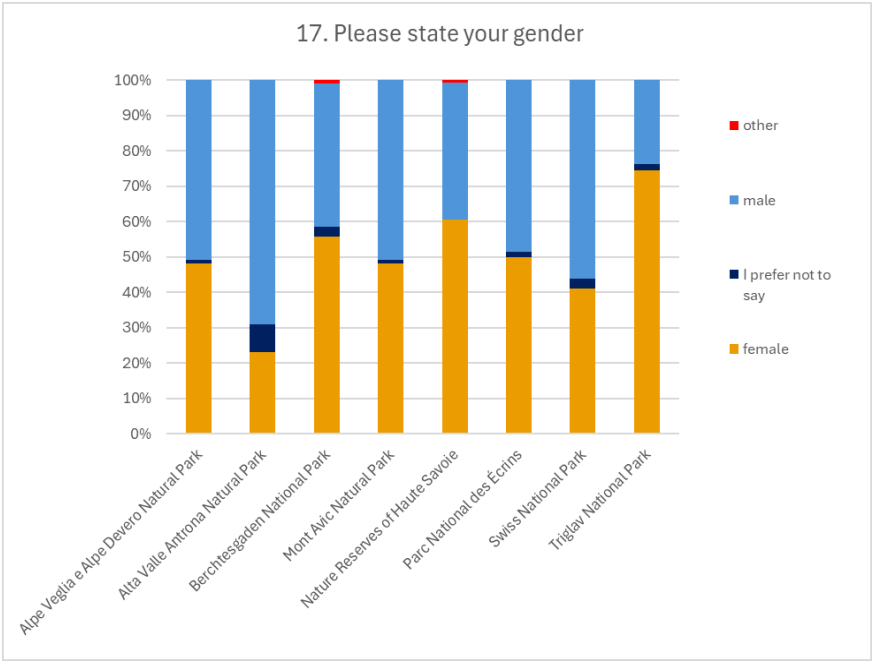


Figure 3. 31 - Visitors' survey |Answers to question No. 17

4 Summary profile of the visitors' sample for individual protected areas

The following section presents a generalized profile of the "typical" respondent for each protected area, based on the most common responses obtained.

This profile constitutes an initial interpretative tool aimed at facilitating the understanding of the results and the preliminary analyses reported so far.

Given the wide variability of responses obtained, the validity of this synthesis is to be considered purely summary and qualitative, offering an overview of the most prominent profiles that emerged from the analysed sample.

It should be emphasised that the summary profiles presented here do not serve as an accurate representation of the main protected area users.

Alpe Veglia e Alpe Devero Natural Park

The typical visitor is Italian, a man between 50 and 59 years old, residing in an urban area. He reaches the Park by car traveling 100–300 km, prefers day visits and returns several times a year during summer. He is aware of being in a protected area. The visit is motivated by nature, outdoor activities and personal well-being; he practices hiking and gets information mainly through the official website. He considers the impact of outdoor activities medium, while considering overtourism highly impactful on the environment. He believes visiting protected areas is very beneficial for health and mental well-being. He is interested in activities oriented towards knowledge of nature, wildlife, local communities and health-related aspects, considering nature protection and health topics of great importance. If wellness-related activities were proposed, he would want scientific evidence of their effectiveness. He is willing to pay a premium if activities contribute to environmental protection.

Alta Valle Antrona Natural Park

The typical visitor is Italian, a man between 50 and 59 years old, residing in an urban area and located between 100 and 300 km away. He reaches the Park by car, visits for the day and returns several times a year during summer. He is attracted by nature, outdoor activities and the cultural dimension of the place; he practices hiking and gets information mainly through word of mouth. He considers overtourism and waste management as the main problems

associated with outdoor activities. He attributes great importance to the Park's contribution to psychophysical well-being and could be interested in health promotion activities focused on interaction with nature, wildlife and local populations. He considers both nature protection and health as priorities. He would want scientific evidence on the effectiveness of any health promotion initiatives and to directly experience their effects. He is interested in guided tours and is willing to pay more if this brings benefits to conservation and well-being.

Berchtesgaden National Park:

The typical visitor is German, a woman between 40 and 49 years old, residing in a rural area. She travels over 300 km by car to reach the Park, where she stays for more than five days and returns at least once a year, in summer. She visits the Park for nature, outdoor activities and personal well-being; she practices hiking and consults the official website for information. She considers overtourism and waste among the most relevant impacts of recreational activities. She shows no interest in specific health promotion activities in protected areas. Nevertheless, she considers nature protection and health very important topics and is willing to pay a higher price if the proposed activities promote better environmental protection.

Mont Avic Natural Park:

The typical visitor is Italian, a man between 60 and 69 years old, coming from an area within 50 km of the protected area. He reaches the Park by car, visits for the day and returns several times a year during summer. He is motivated by nature, outdoor activities and health benefits; he practices hiking and gets information through the official website. He is interested in health promotion activities oriented toward relaxation and physical exercise in nature. He considers nature protection and health very relevant topics and wants any wellness-based offerings to be supported by scientific evidence. He is interested in guided tours and willing to pay a premium if activities contribute to environmental protection and personal health improvement.

Nature Reserves of Haute Savoie:

The typical visitor is French, a woman between 50 and 59 years old, residing in a rural area and coming from a distance within 50 km. She reaches the Park by car and prefers longer stays distributed throughout the year. She visits for nature, outdoor activities and well-being; she practices hiking and gets information through the official website. In general, she perceives the environmental impacts of outdoor activities as high. She is not interested in specific health promotion activities in protected areas, while considering nature protection and health

relevant. In case of wellness-oriented offerings, she would still want scientific evidence of the effects. She is willing to pay more for activities that contribute to environmental conservation.

Parc National des Écrins:

The typical visitor is French, a woman between 40 and 49 years old, residing in an urban area and coming from over 300 km away. She reaches the area by car, stays long several times a year and in all seasons. The visit is motivated by nature, outdoor activities and photography; she practices hiking and gets information through the official website. She considers outdoor activities very impactful on the environment and wildlife and judges overtourism highly critical. She is not interested in specific health promotion activities in protected areas but considers nature protection a central topic. If health-related activities were proposed, she would want scientific evidence of the effects. She is willing to pay a premium if this promotes greater environmental protection.

Swiss National Park:

The typical visitor is Swiss, male under 30 years old, residing in a rural area. He travels 100–300 km to reach the Park, mainly using public transport. He stays between 3 and 5 days and visits the area for the first time. He visits the Park in summer, driven by interest in nature, outdoor activities and photography; he practices hiking and gets information through the official website. He recognizes the negative impacts of tourism on habitat and environment. He is not interested in specific health promotion activities but considers nature protection a priority topic. If wellness-related activities were proposed, he would want scientific evidence of the related effects. He is interested in guided tours and is willing to pay more if they contribute to greater environmental conservation.

Triglav National Park:

The typical respondent is Slovenian, a woman between 40 and 49 years old, residing in a rural area and coming from a distance within 50 km. She reaches the Park by car, visits for the day and returns several times a year in all seasons. She is motivated by nature, outdoor activities and personal well-being; she practices hiking and gets information through the official website. She considers overtourism and waste production as very relevant environmental impacts. She is not interested in specific health promotion activities, while considering both nature and health important. If wellness-oriented initiatives were offered, she would want scientific evidence of the effects and the possibility to personally experience them. She is willing to pay a higher price for activities that result in better environmental protection.

5 General operators' *survey* data

During the initial survey phase, between late May and early September, a total of 136 questionnaires were collected from tourism operators connected to the 7 protected areas participating in the project[209] (Table 5.1).

1. For which of the following protected areas are you completing the questionnaire?		
	Response Percent	Response Count
Parc National des Écrins	16,18%	22
Swiss National Park	11,03%	15
Triglav National Park	26,47%	36
Mont Avic Natural Park	7,35%	10
Alpe Veglia e Alpe Devero Natural Park	2,94%	4
Alta Valle Antrona Natural Park	2,21%	3
Nature Reserves of Haute Savoie	15,44%	21
Berchtesgaden National Park	18,38%	25

Table 5. 1 - Operators' survey |Answers to question No. 1

[209] The Alpe Veglia e Alpe Devero Natural Park and the Alta Valle Antrona Natural Park are both managed by the project partner Aree Protette dell'Ossola.

6 Preliminary analysis of operators' *survey* responses

6.1 Do you offer any form of information, activities or other services related to the protected area?

It should be noted that almost all operators offer this type of service, regardless of the protected area in which they operate. The range of percentages of operators that offer information or activities related to the protected area is between 88% and 100%.

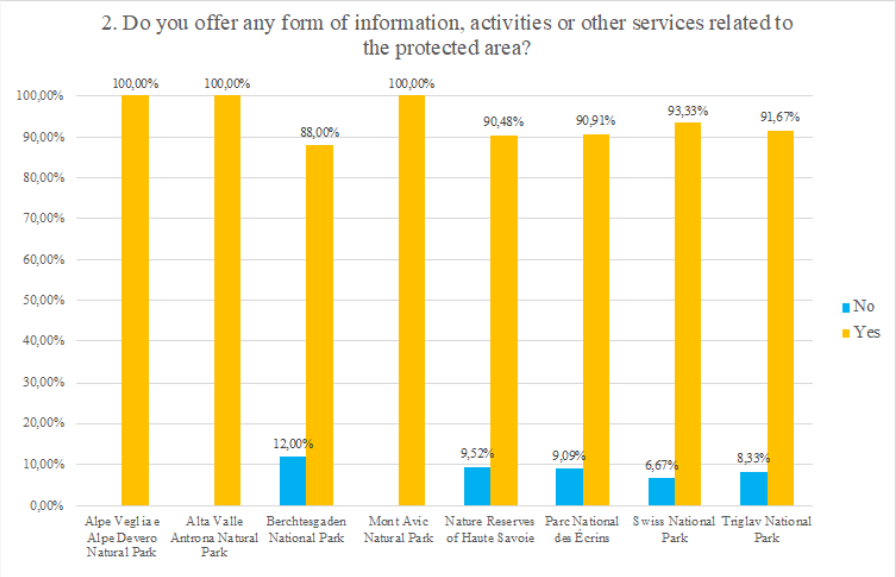


Figure 6. 1 - Operators' survey |Answers to question No. 2

The third question asked operators mainly what type of service they offer to tourists, such as information, activities or other (which had to be specified); with reference to the second question.

What emerges from the answers to the question is that in Alpe Veglia and Alpe Devero, Alta Valle Antrona, Berchtesgaden, Mont Avic and Haute Savoie protected areas are mainly offered activities; unlike Triglav and Les Écrins Parks where information services are primarily offered.

The only special case is Swiss National Park, where the provision of activities and information are almost equal.

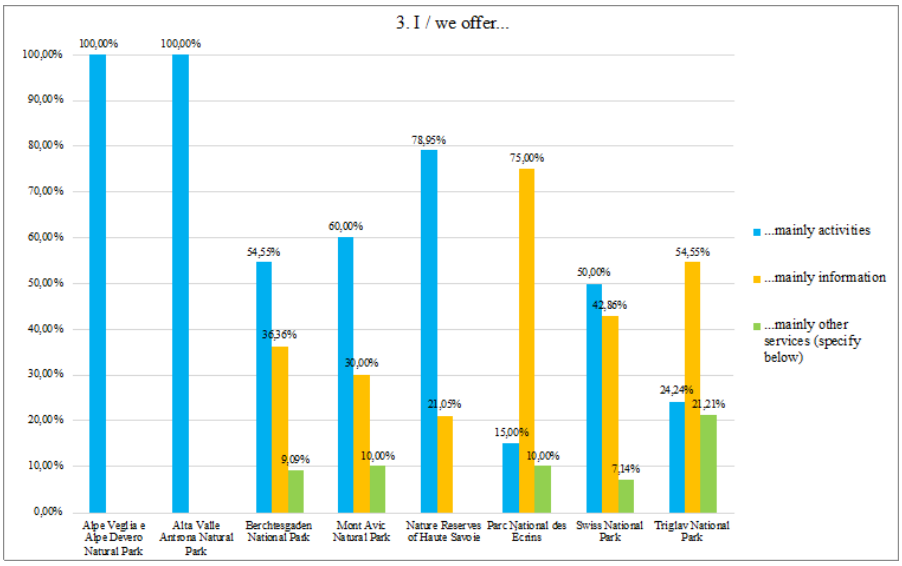


Figure 6. 2 - Operators' survey |Answers to question No. 3

6.2 What is your main field of work?

Based on the answers to this question (Fig. 3), the operators offering the most varied services are those in the Berchtesgaden area.

The services offered in almost all areas are those of retail and occasional guide/trainer. Operators could also answer this question with 'other', specifying their field of work. However, most simply specified their job, which in any case fell within the categories selectable in the question (e.g. refuge and mountain hut, which fall within the accommodation category).

The works that have been specified and do not fall within the categories are teacher in Mont Avic Natural Park, citizen science in Parc National des Écrins, herbal activities and supplementary farm activity in Triglav National Park.

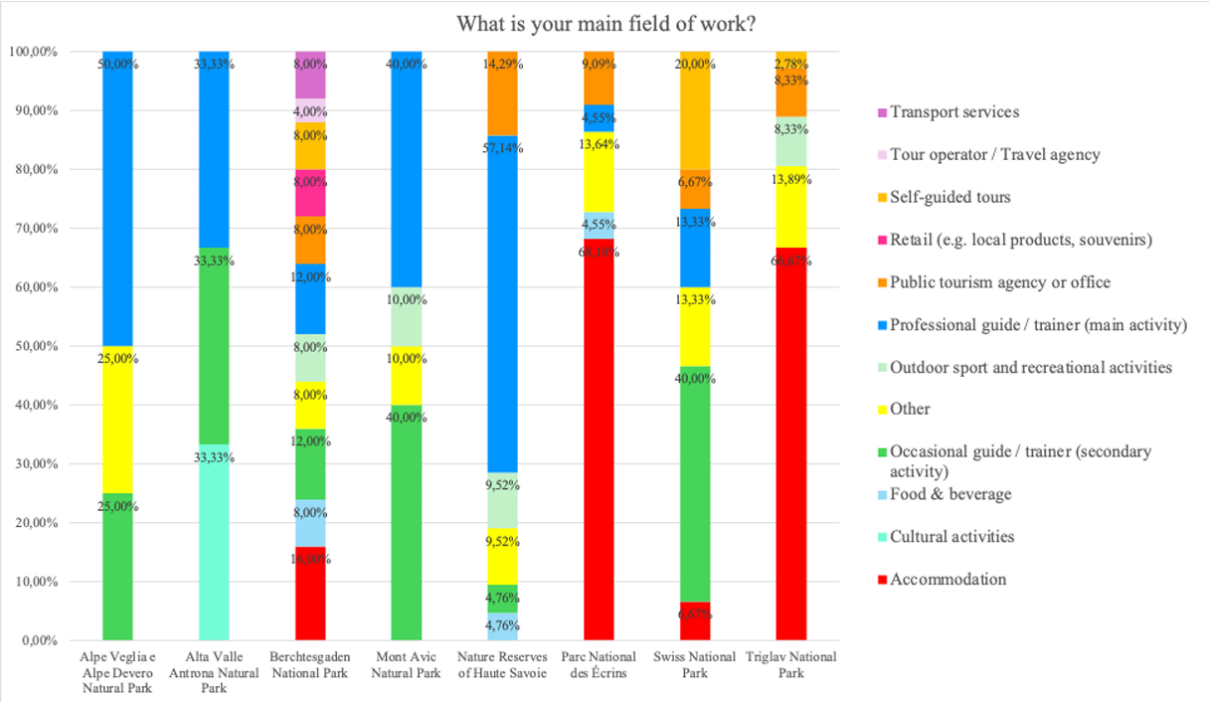


Figure 6. 3 - Operators' survey |Answers to question No. 4

The table shows the responses provided by those who specified their field of work (Table 6.1).

Protected Area	Field of work
Mont Avic Natural Park	Teacher
Triglav National Park	Herbal activities
Triglav National Park	More that mentioned: transport/guiding/outdoor sports and recreational activities
Triglav National Park	Food and beverage service and accommodation in mountain huts
Nature Reserves of Haute Savoie	Refuge/mountain hut
Parc National des Écrins	Citizen science
Parc National des Écrins	Refuge and catering
Berchtesgaden National Park	Mountain rescue

Alpe Veglia e Alpe Devero Natural Park	Hospitality - Professional guide
Parc National des Écrins	Accommodation and catering
Swiss National Park	None of these, personal use
Triglav National Park	Accommodation rental, hospitality and retail
Berchtesgaden National Park	Sky & Bike rental
Triglav National Park	Supplementary farm activity
Swiss National Park	Communication and public relations

Table 6. 1 - Operators' survey |Answers to question No. 4

6.3 How far from the protected area is your operational / legal seat?

Most operators responding to this question have their operational/legal headquarters within 50 km of the protected area's boundaries.

The operators who indicated greater distances are those in Berchtesgaden National Park where 8% responded that their operational/legal seats are located between 50 and 100 km from the park boundaries and another 8% responded that the distance is over 100 km from the park boundaries, and in Mont Avic National Park where 40% responded that their operational/legal seat are located between 50 and 100 km from the park boundaries and 30% responded that the distance is over 100 km from the park boundaries.

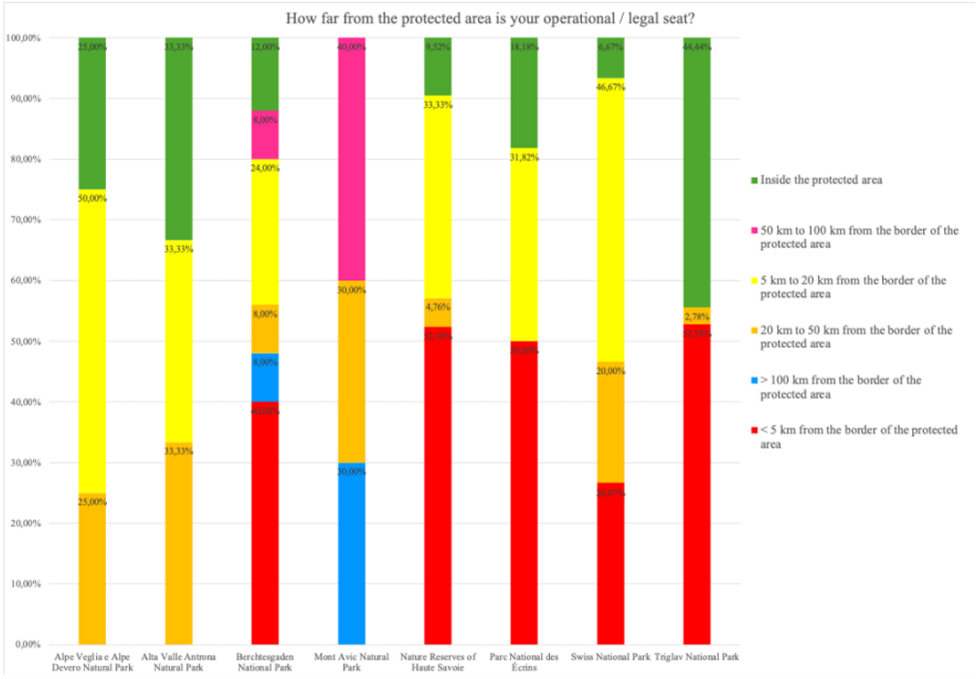


Figure 6. 4 - Operators' survey |Answers to question No. 5

6.4 How often is the protected area a destination included in your offers, information, or services?

For the majority of operators who responded to this question, the protected area is always or often included in their offers (Fig. 5). The only exception is operators in Mont Avic: 40% responded "it is rarely a destination", while 60% responded "it is sometimes a destination".

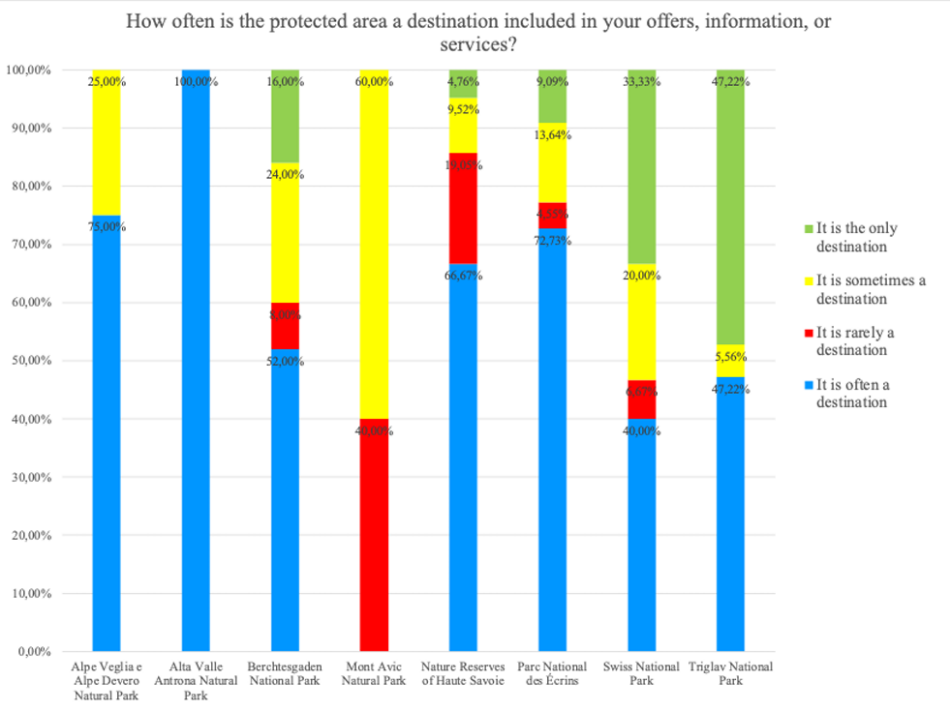


Figure 6. 5 - Operators' survey |Answers to question No. 6

6.5 During which season(s) do you primarily offer services within or related to the protected area?

In all protected areas, except for the Swiss National Park, whose operators offer services distributed differently across the seasons, operators offer services that are either equally distributed throughout the year or distributed differently depending on the season.

Analysis of the responses shows that the greatest number of activities are offered during the summer, while in other seasons the operators who participated in the survey offer fewer services.

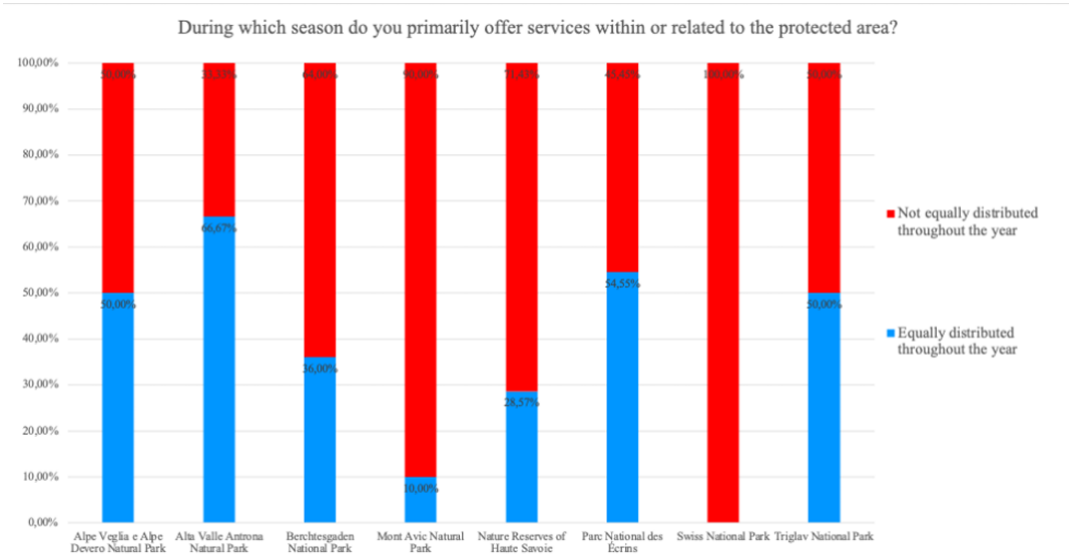


Figure 6. 6 - Operators' survey |Answers to question No. 7

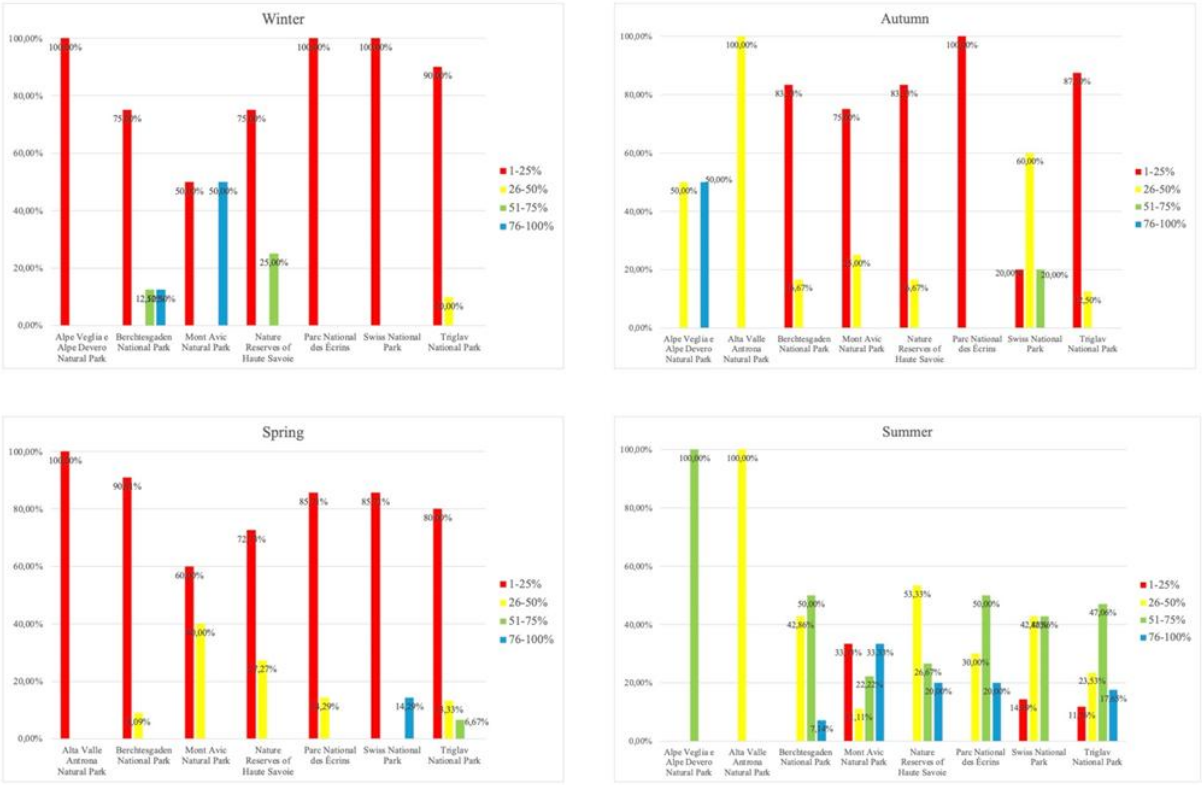


Figure 6. 7 - Operators' survey |Answers to question No. 7

6.6 Please list 3 main trends that you observed in the last 10 years concerning tourism in or in relation to the protected area. Please, start with the most relevant trend.

The open-ended responses to this question were categorized into macro-topics with the help of AI Claude software.

First most relevant trend: over tourism/overcrowding emerges as the critical issue (mentioned by 32,35% of respondents), particularly severe in Haute Savoie (71,43%) and Triglav (50%). Hiking/outdoor activities dominate across parks (mentioned by 17,65% of respondents). Nature and wildlife interest remain consistently high across all protected areas (mentioned by 12,50% of respondents).

Second most relevant trend: many respondents highlight the negative consequences of tourism growth. Visitor behaviour violations and rule infractions appear across most parks. Winter sports/ski touring intensifies seasonal pressure. Social media impact emerges as a new pressure factor driving visitor numbers. Dogs in protected areas and over tourism remain persistent concerns, while decreased visitation/services appears in some areas.

Third most relevant trend: cycling/e-bikes emerges as a strong trend, signalling activity diversification. Information/education gains prominence, reflecting growing awareness of sustainable management needs. Over tourism persists but with reduced intensity compared to earlier tables.

For a more detailed analysis, consult the tables in the Appendix 2. In the tables, the entry “Nothing” corresponds to a blank answer.

6.7 Thinking about tourism in or in relation to the protected area, how do you expect the situation to be in 10 years? Please, list 3 main aspects and start with the most relevant one.

The open-ended responses to this question were categorized into macro-topics.

In general, it emerges that the main trends expected in the next 10 years are: “overcrowding/overtourism” (chosen by almost 35% of all respondents in the study area), followed by “nature protection/conservation” (12% of responses), and “general/other”.

It's important to underline that the category "Nothing", which corresponds to a blank answer, is a common choice among respondents and reaches more than 40% as the third choice by importance.

The following table summarizes the main expected trends divided by protected area (Table 6.2).

Protected Area	Trend 1	Trend 2	Trend 3
Alpe Veglia e Alpe Devero Natural Park	Nature protection / Conservation, Overtourism / Overcrowding, Quality / Experience, Regulation / Restriction	Education / Awareness	Culture & Authenticity
Alta Valle Antrona Natural Park	Outdoor Activities, Overtourism / Overcrowding, Sustainable Development	Visitor Management, General / Other, Nothing	Nothing
Berchtesgaden National Park	Overtourism / Overcrowding	Nothing	Nothing
Mont Avic Natural Park	Nature Protection / Conservation	Nothing	Nothing
Nature Reserves of Haute Savoie	Overtourism / Overcrowding	Environmental Impact	Nothing
Parc National des Écrins	Overtourism / Overcrowding	General / Other	Nothing
Swiss National Park	Overtourism / Overcrowding	General / Other	Education & Awareness, Infrastructure, Nothing
Triglav National Park	Overtourism / Overcrowding	General / Other	Nothing

Table 6. 2 - Operators' survey |Answers to question No. 8

For a better overview of the expected future trends, it's appropriate to analyse in detail the different choices made by the participants:

- **First most relevant aspect** - Over tourism/overcrowding dominates future concerns across all parks, with Triglav National Park, Parc National des Écrins, and Swiss National Park showing particularly high values (respectively 33,33%, 40,91% and 40%). Nature protection/conservation emerges as a priority response, especially in Berchtesgaden National Park (24%) and Mont Avic Natural Park (40%). Regulation/restrictions and sustainable development are mentioned as management tools and were indicated respectively by 8,09% and 6,62% of operators who responded to this question. Transportation & access remains a persistent challenge for multiple parks. It is important to emphasize that over tourism is often cited as a direct consequence of climate change, for example, the increase in visitors is attributed to the fact that rising temperatures in cities are leading more people to seek cooler climates in the mountains.
- **Second most relevant aspect** - Visitor management gains prominence as a strategic focus (9,56%). Environmental impact and climate change become more explicit concerns (respectively 6,62% and 5,15%), particularly in Haute Savoie and Parc National des Écrins. Education/awareness appears consistently across parks, suggesting a shift toward preventive management strategies. Regulation & restrictions remain relevant, especially for Triglav and Haute Savoie. The general/other category indicates diverse emerging trends not yet fully categorized.
- **Third most relevant aspect** - Culture & authenticity emerges as a distinctive future focus, particularly for Triglav, suggesting efforts to differentiate tourism offerings. Visitor management and education/awareness consolidate as strategic priorities. Environmental impact concerns persist. Infrastructure development becomes more prominent, while local community involvement gains recognition. Transportation & access continues as a management challenge.

For a more view the complete data, consult the tables in the "Appendix 2" file. In the tables, the entry "Nothing" corresponds to a blank answer.

6.8 Main sources of information

In this question, the operators could indicate the three main sources they refer to, in order to obtain information about the natural area. Respondents could choose from nine categories, such as official websites, social media platforms, dedicated outdoor platforms, printed materials, direct contact with the staff of the protected area, information given by local guides and residents, word of mouth, "Other".

The following paragraphs summarize their responses, highlighting the most relevant choices.

Main Sources of Information (First choice): Official websites dominate as the primary information source (42,65%), particularly for Triglav, Swiss National Park and Berchtesgaden; when specified, tourism websites are the most cited. Direct contact with protected area staff represents an important alternative channel (18,38%), especially in Berchtesgaden and Haute Savoie. Printed guides maintain relevance in Parc National des Écrins and Triglav, suggesting traditional media still plays a role. Social media remains relatively underutilized as a first-choice source across most parks (2,94%).

Main Sources of Information (Second choice): Official websites continue as a strong secondary (25,19%). Direct contact with staff gains importance as a backup source, notably in Haute Savoie and Swiss National Park. Social media platforms emerge more prominently as a second choice (15,27%), indicating their growing role in the information ecosystem. The most cited social media are Facebook and Instagram. Printed guides remain significant for Triglav (20,595).

Main Sources of Information (Third choice): Word of mouth emerges as a substantial tertiary source (18,18%), particularly for Triglav and Swiss National Park. Printed guides consolidate their position (19,83%), while recommendations from local guides and residents gain traction (17,36%). Dedicated outdoor platforms show growing relevance for Triglav (17,65%). In this case, there is no platform that can be identified as the most widely used, every country and operator use a different platform. The diversification of tertiary sources suggests visitors use multiple information channels before their visit.

For a more detailed analysis, consult the tables in the Appendix 2.

6.9 What activities do you primarily offer in or in relation to the protected area?

In this question, operators were asked to indicate the five main activities offered within or in relation to the protected area. Respondents could choose from a list of fifteen widely offered activities. The list includes options for all seasons.

The data reveals that hiking remains the cornerstone activity across Alpine protected areas, with some locations where hiking opportunities are mentioned three times more than each other activity. Educational programs and nature-based activities form important complementary offerings, while winter sports activities maintain a consistent but more specialized presence.

For a more detailed analysis, consult the tables in the “Appendix 2” file.

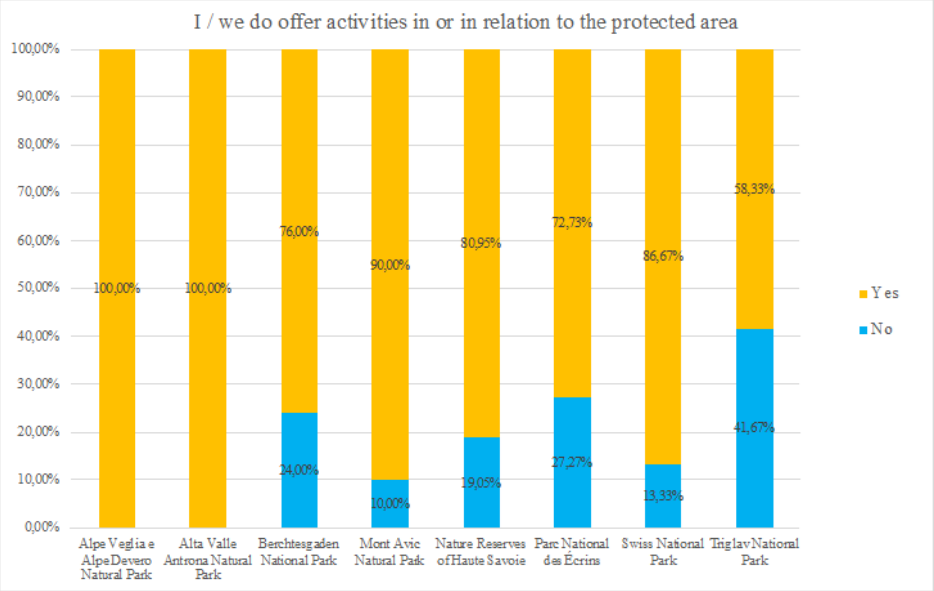


Figure 6. 8 - Operators’ survey | Answers to question No. 11

6.10 What activities in or in relation to the protected area are your offers linked to?

Within this question, respondents were asked to identify the five activities for which customers most frequently requested information and offers.

In general, more that 60% of the information and services are offered inside the protected areas. Alpe Veglia e Alpe Devero Park, Triglav National Park and Parc National des Écrins feature the highest percentage of activities offered within the natural park (*Fig 6.9*).

Analysis of the responses shows that the information and services are mainly related to hiking, followed by cycling tourism and nature contemplation and wildlife observation. Information and services related to educational activities related to the nature or culture of the area; multi-day treks and winter sports are also listed.

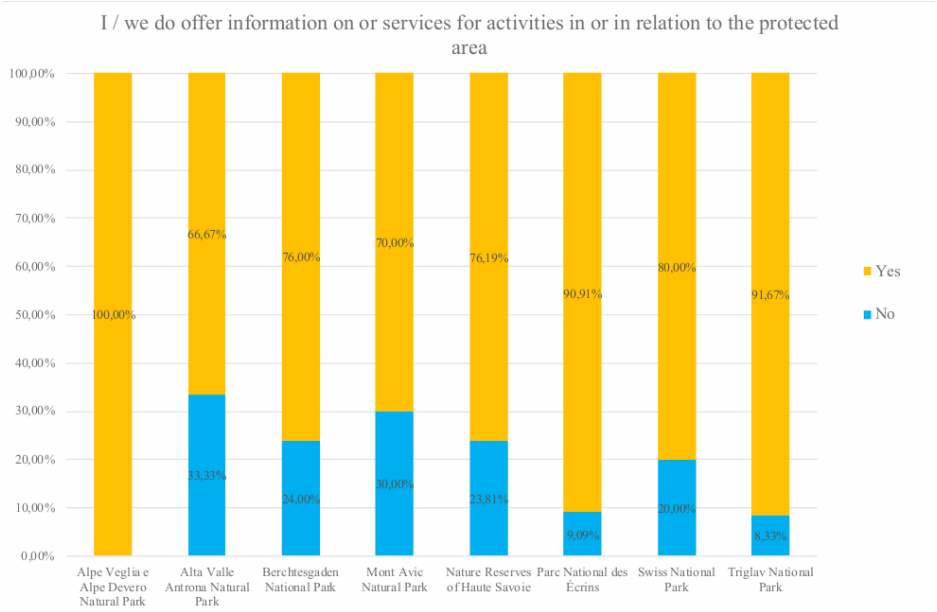


Figure 6. 9 - Operators' survey | Answers to question No. 12

For a more detailed analysis, consult the tables in the "Appendix 2" file.

6.11 Do you expect climate change to have an impact on your offers in the next 10 years?

Most of the operators who responded to the questionnaire expect climate change to have an impact on their activities.

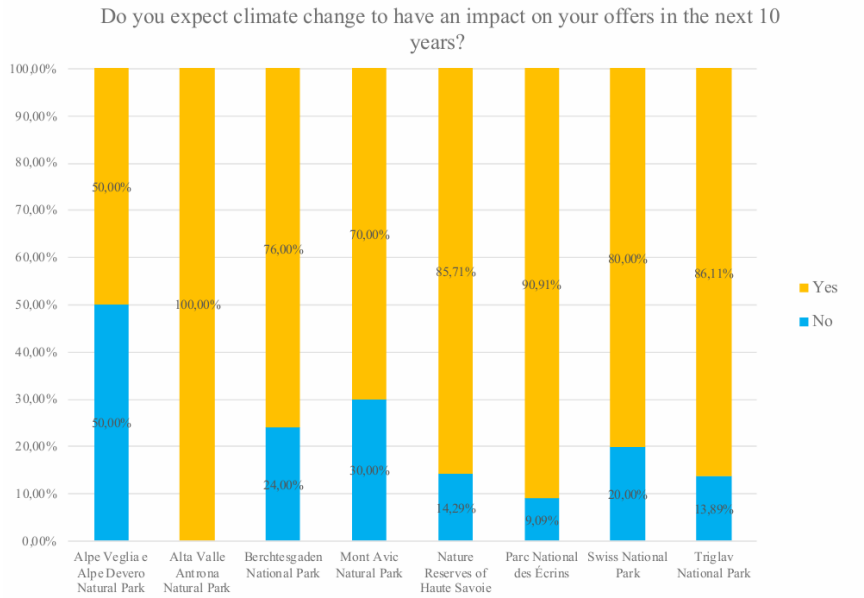


Figure 6. 10 - Operators' survey |Answers to question No. 13

Furthermore, operators were asked to indicate three expected impacts on their offers. The most frequently cited impact concerns the decrease in snowfall (23,53%) and the consequences this will have on winter sports and accommodation facilities during the winter months. It is also reported that extreme weather events are likely to increase (14,71%) and temperatures are set to rise (11,03%), making it more difficult to organize outdoor activities safely. Furthermore, there is also growing awareness of the repercussions that climate change will have on biodiversity and the environment in general.

For a more detailed analysis, consult the tables in the "Appendix 2".

When asked if the activities offered are being adapted to the impacts of climate change, the majority of operators respond positively (*Fig. 11*).

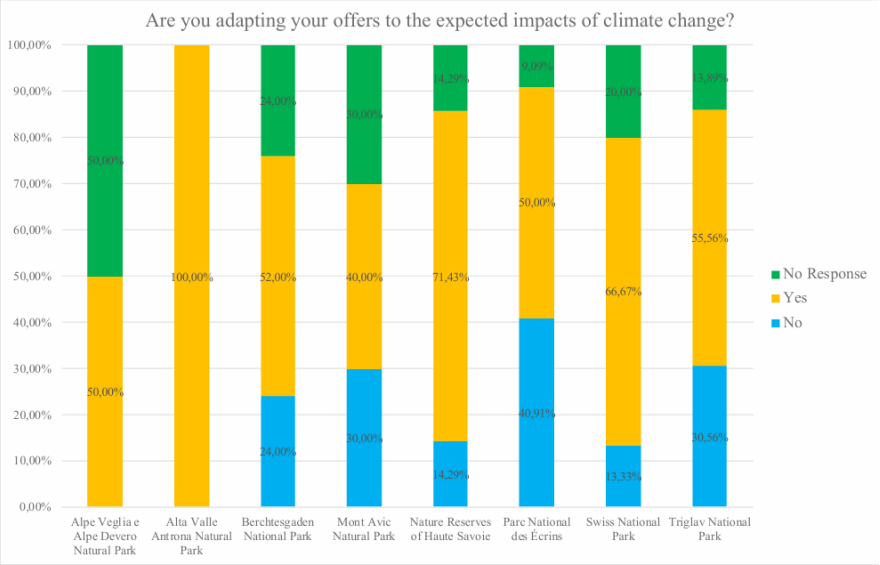


Figure 6. 11 - Operators' survey |Answers to question No. 13

The strategies adopted to adapt offerings to climate change mostly involve educational activities, with the aim of raising awareness among tourists and making them more conscious of the issues. 'Practical' solutions include extending the season and rescheduling activities to the cooler hours of the day or to cooler locations. The importance of paying greater attention to monitoring weather conditions is also highlighted.

For a more detailed analysis, consult the tables in the "Appendix 2".

6.12 How would you rate the impact of outdoor activities on the protected area regarding the following aspects?

In question No. 14, operators were asked to assess the environmental impact of 8 specific categories generated by outdoor activities. The assessment was entered on a three-level scale, where the value "1" corresponds to low environmental impact and the value "3" to high impact. The option "I can't say / I don't know what that is" was also included among the responses. The ninth impact proposed to operators was an unspecified impact labelled "Other", where operators had the option to specify an impact not included among the eight proposed in the questionnaire. None of the operators specified a new impact, and it should be noted that 66% responded with the option "I can't say/don't know what that is".

The analysis of individual environmental impact categories produced the following results:

Disturbance to wildlife: approximately 44% of responses indicated a perceived impact as "medium", 34% as "high" and 20% as "low". The Triglav National Park shows the highest percentage of operators (52%) classifying the impact of activities within the park as "high". Conversely, Swiss National Park records only 6% of visitors who consider it highly impactful, while 26% perceive it as having low impact.

Disturbance to natural ecosystem: Approximately 48% of users assessed the overall impact for this item as "medium". In Triglav National Park and Mont Avic Natural Park the impact was considered "high" by almost half of respondents (40%). In the area of the Swiss National Park, operators perceived the impact of activities as "low" (over 53% of responses).

Soil erosion due to vehicle use: In this category, approximately 34% of operators indicated a "high" impact. In general, responses were well balanced among the three impact levels and substantially equivalent across different study areas. About 5% of operators stated they were unable to respond ("I can't say"), with over 13% of Swiss National Park operators opting for this option.

Soil erosion due to foot traffic: for 46% of operators, the impact on vegetation was "medium". In parks such as Alpe Veglia e Alpe Devero Natural Park, Mont Avic Natural Park and Berchtesgaden National Park the most selected category was "low impact". In the Swiss national Park the responses are perfectly divided in the “low” and “medium” impact categories.

Vegetation damages: the impact is perceived as "low" in areas such as Mont Avic Natural Park, Nature Reserves of Haute Savoie, and Swiss National Park. The percentage of responses classifying the impact as "medium" is instead predominant in Triglav National Park (52%) and Berchtesgaden National Park (64%).

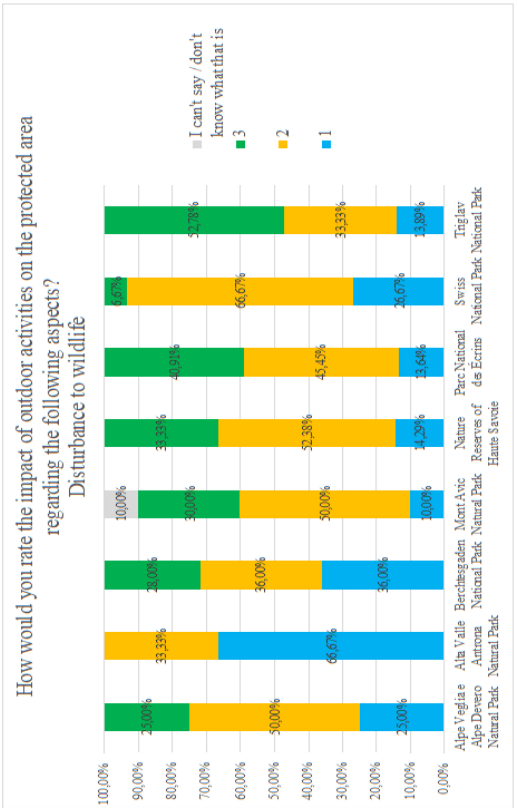
Habitat fragmentation: the impact is perceived as "low" in areas such as Mont Avic Natural Park and Swiss National Park. The percentage of responses classifying the impact as "medium" is instead predominant in Triglav National Park (41%) and Mont Avic Natural Park (50%). In the Berchtesgaden National Park the responses are perfectly divided in the “low” and “medium” impact categories.

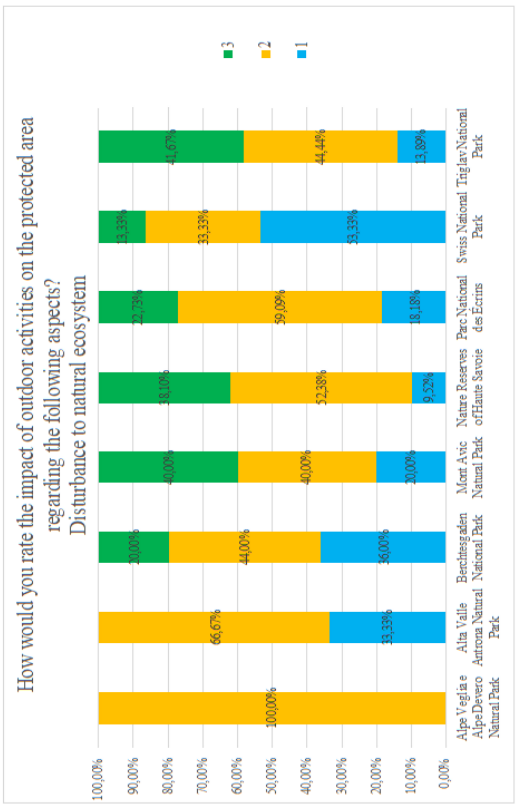
Increase in waste/litter: this category is perceived throughout the Alpine arc as "high impact", with an average of 45% of responses. In Triglav National Park 80% of the operators consider this specific impact as “high”. In the Swiss National Park and in Mont Avic Natural Park 40% of the responses are “low impact” and considering the Swiss National Park 40% of the operators

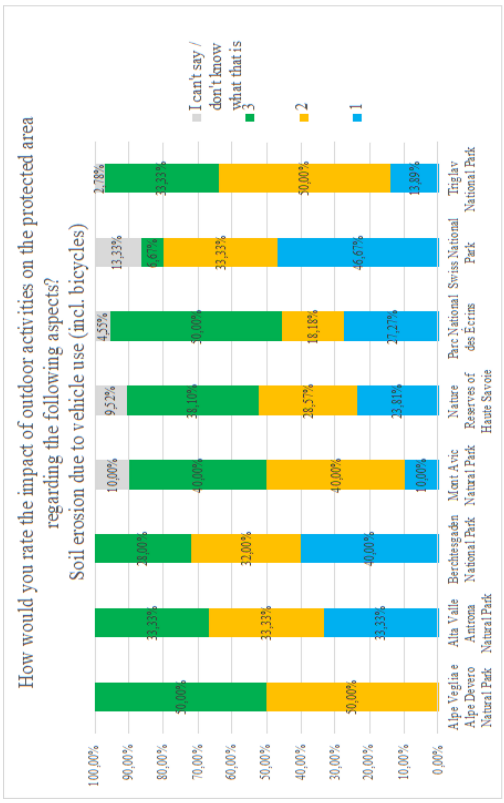
consider this impact as “medium”. In the Nature Reserves of Haute Savoie the majority of the responses consider this impact as “medium”.

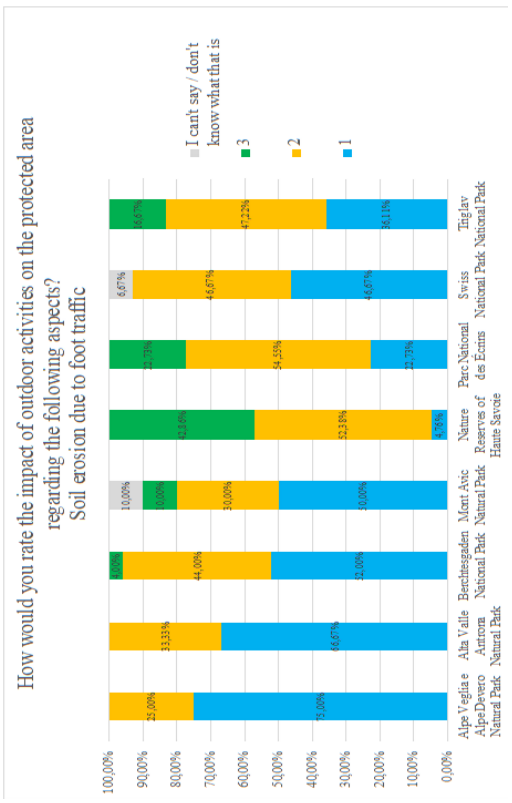
Risk of over tourism/overcrowding: 66% of survey participants indicated that this category falls within high impact, with only 25% of users considering it "medium" impact and 8% as "low". This data highlights how the threat of overcrowding in natural areas is clearly perceived by operators. In particular, the high impact of over tourism is perceived in Nature Reserves of Haute Savoie (85%), followed by Triglav National Park (80%) and Parc National des Écrins (63%).

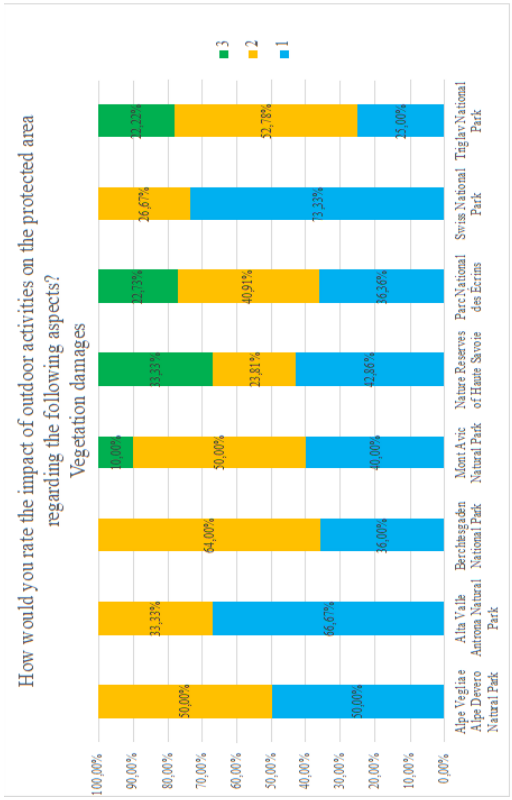
Figure 6. 12 - Operators' survey |Answers to question No. 14

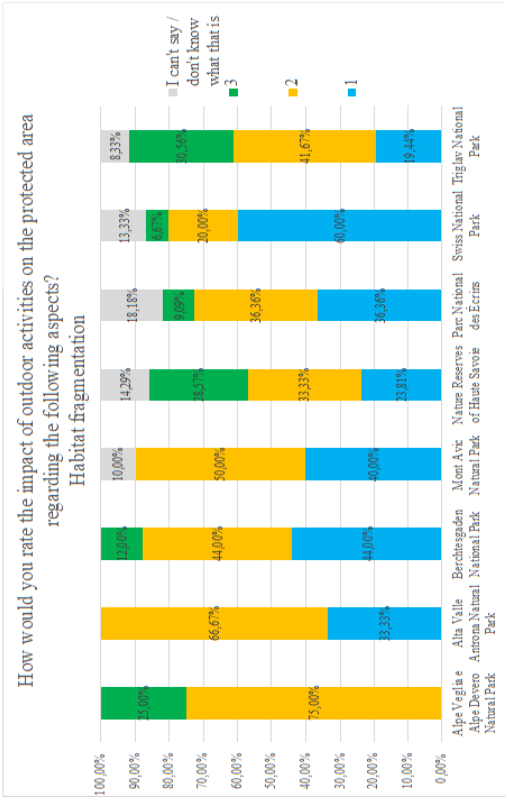


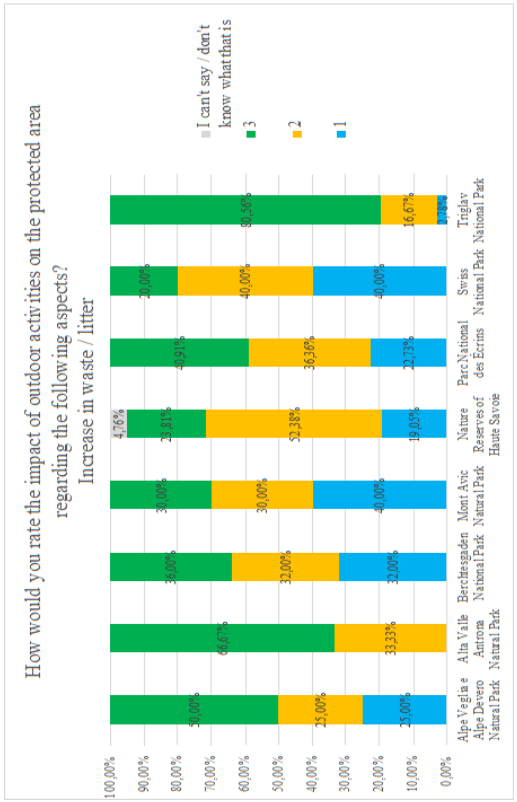


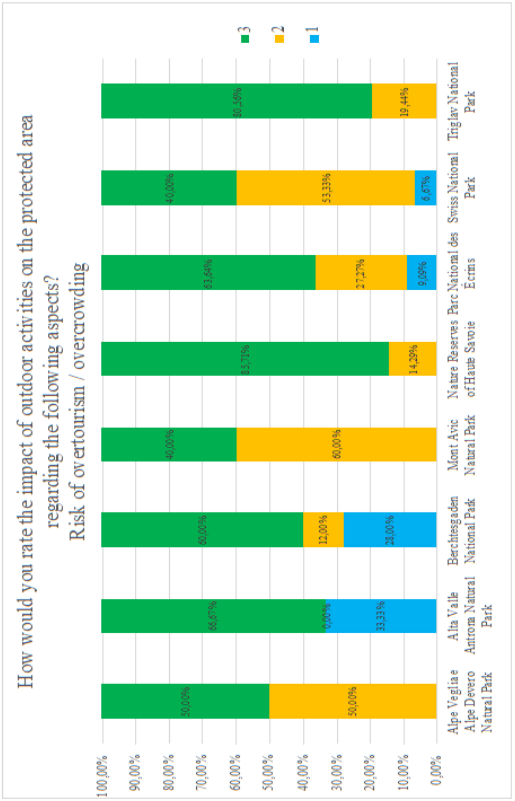





How would you rate the impact of outdoor activities on the protected area regarding the following aspects?
Vegetation damages
3
2
1
Alpe Veglia e Alpe Devero Natural Park
Alta Valle Antrona Natural Park
Berchtesgaden National Park
Mont Avic Natural Park
Nature Reserves of Haute Savoie
Parc National des Ecrins
Swiss National Park
Triglav National Park


How would you rate the impact of outdoor activities on the protected area regarding the following aspects?
Habitat fragmentation
I can't say / don't know what that is
3
2
1
Alpe Veglia e Alpe Devero Natural Park
Alta Valle Antrona Natural Park
Berchtesgaden National Park
Mont Avic Natural Park
Nature Reserves of Haute Savoie
Parc National des Ecrins
Swiss National Park
Triglav National Park


How would you rate the impact of outdoor activities on the protected area regarding the following aspects?
Increase in waste / litter
I can't say / don't know what that is
3
2
1
Alpe Veglia e Alpe Devero Natural Park
Alta Valle Antrona Natural Park
Berchtesgaden National Park
Mont Avic Natural Park
Nature Reserves of Haute Savoie
Parc National des Ecrins
Swiss National Park
Triglav National Park


How would you rate the impact of outdoor activities on the protected area regarding the following aspects?
Risk of overtourism / overcrowding
3
2
1
Alpe Veglia e Alpe Devero Natural Park
Alta Valle Antrona Natural Park
Berchtesgaden National Park
Mont Avic Natural Park
Nature Reserves of Haute Savoie
Parc National des Ecrins
Swiss National Park
Triglav National Park

6.13 How important are the following health aspects in your offers, information or services in or in relation to the protected area today?

Question 15 was designed to investigate the importance of the health aspects in the offers, information or services proposed to the survey participants. Each participant was asked to express an assessment of the level of perceived importance, using a 5-point scale. The scale points were defined as follows: the value "1" corresponds to "not important aspect", while the value "5" identifies a "very important element" in relation to health effects.

- **General well-being and relaxation**: 50% of operators consider this health aspect to be very important, while only 6% consider it a “not important aspect”.
- **General health maintaining**: 41% of operators consider this health aspect to be very important and 27% consider the aspect as “important”, while only 4% consider it a “not important aspect”.
- **Building physical resilience**: for this health aspect, responses are equally distributed between very important, important, and moderately important (respectively 25ì8%, 26% and 21%). 7% consider it a “not important aspect”.
- **Building mental resilience**: 35% of operators consider this health aspect to be very important and 24% consider the aspect as “important”, while only 6% consider it a “not important aspect”.
- **Staying young and active in advanced age**: 34% of operators consider this health aspect to be very important and 28% consider the aspect as “important”, while 8% consider it a “not important aspect”.
- **Improving physical performance and fitness**: for this health aspect, responses are equally distributed between very important, important, and moderately important (respectively 25%, 27% and 21%). 6% consider it a “not important aspect”.
- **Improving health after urban and particulate matter-related illnesses**: for this health aspect the responses are heterogeneously distributed, 25% of operators consider this health aspect to be very important, 21% consider the aspect as “important”, 16% voted “not very important”, 13% consider this health aspect as not important and 12% consider it as moderately important.
- **Improving health after cardiovascular problems**: for this health aspect, responses are equally distributed (about 19%) between very important, important, and moderately important. 15% consider this aspect as “not very important” and 13% consider it a “not

important aspect". It can be noted that in this case almost 14% of the operators responded "can't say".

- **Improving health in the case of orthopedic problems**: for this health aspect the responses are almost equally distributed, there is a slight preference for not important (19%) and not very important (18%). 17% of the operators responded "can't say"
- **Improving health in the case of mental stress**: 33% of operators consider this health aspect to be very important and 29% consider the aspect as "important", while only 5% consider the aspect as "not very important" and 8% consider it a "not important aspect".

The detailed results for each response category are illustrated in the graphical representation that follows.

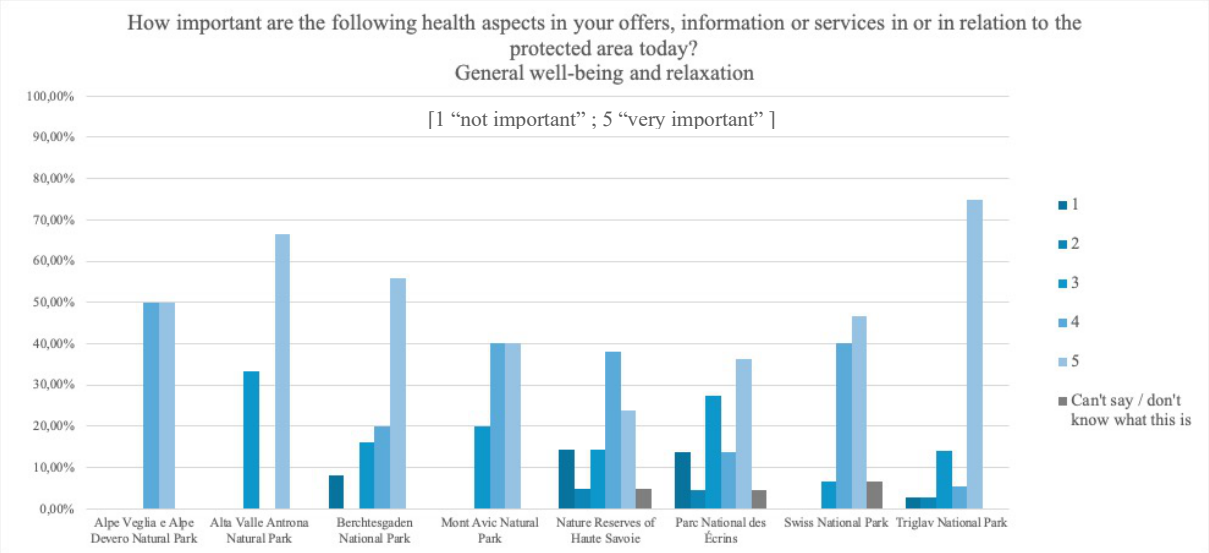


Figure 6. 13 - Operators' survey |Answers to question No. 15

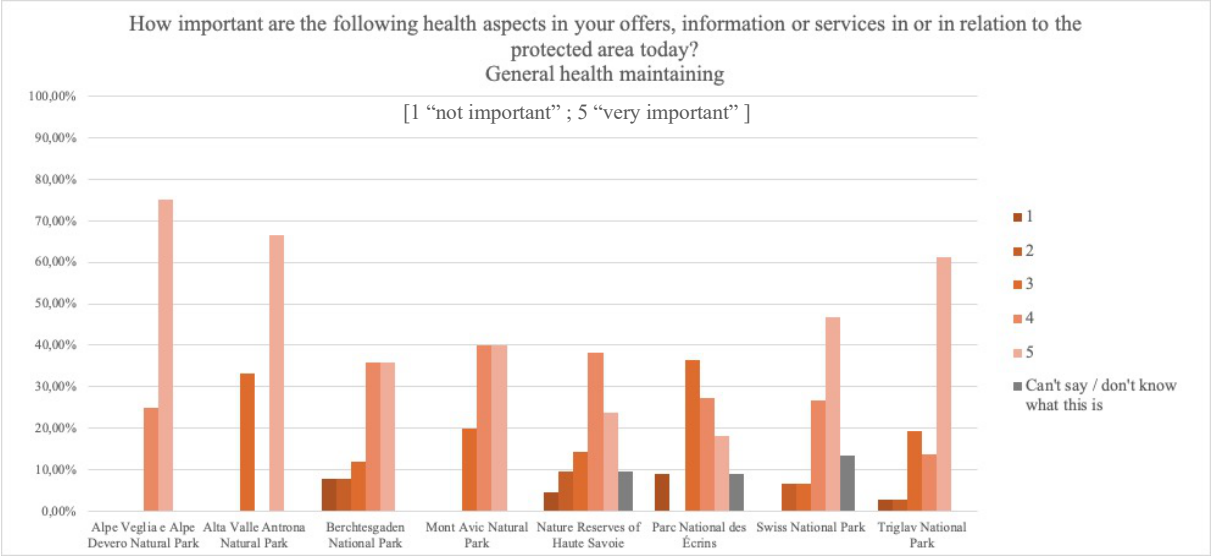


Figure 6. 14 - Operators' survey |Answers to question No. 15

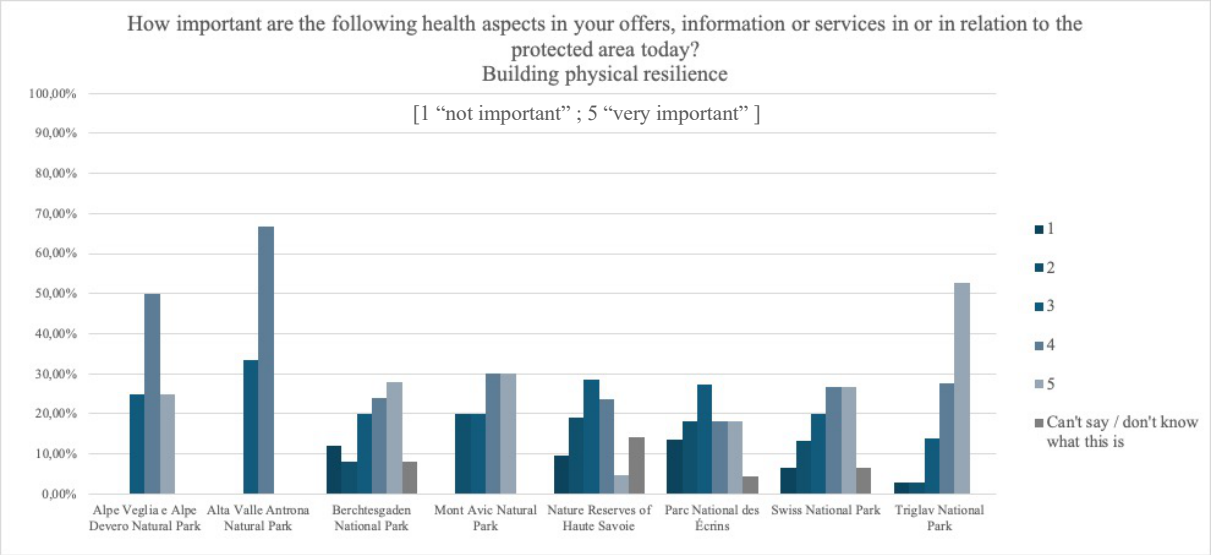


Figure 6. 15 - Operators' survey |Answers to question No. 15

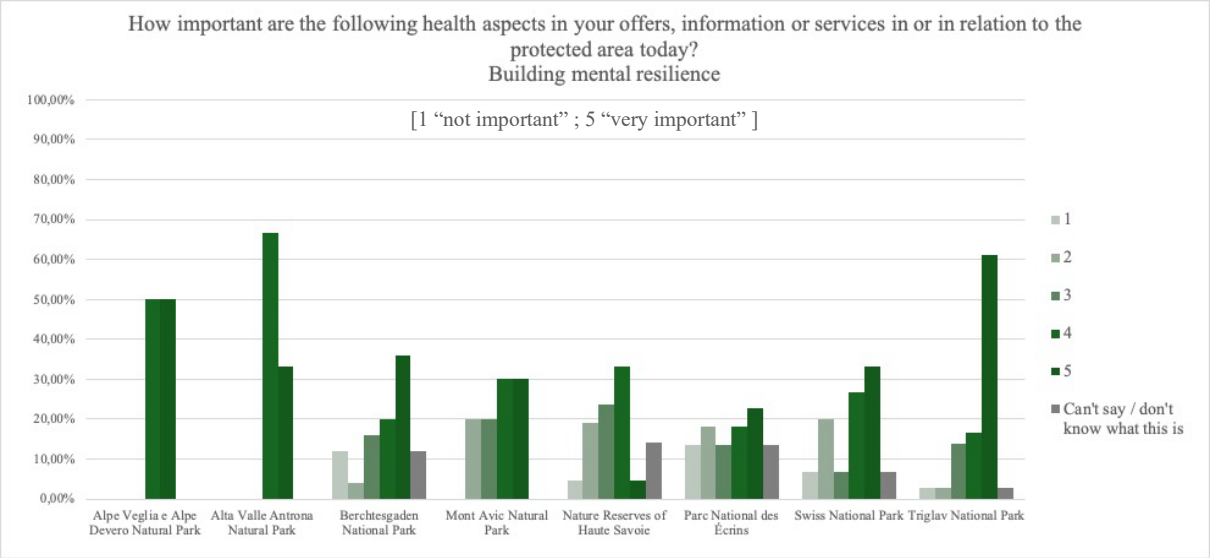


Figure 6. 16 - Operators' survey |Answers to question No. 15

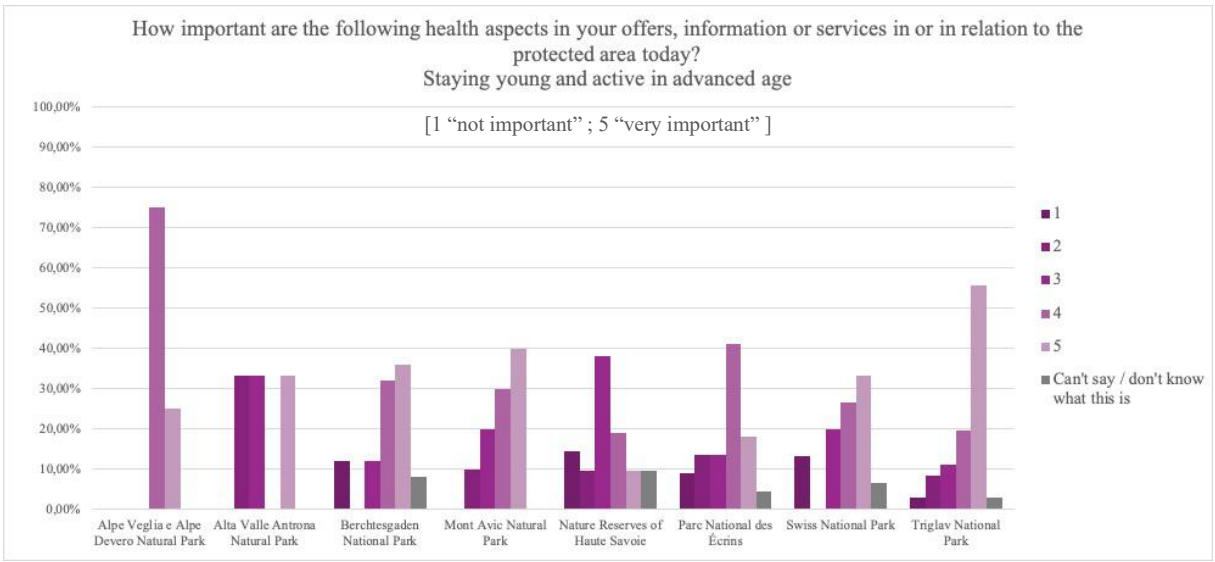


Figure 6. 17 - Operators' survey |Answers to question No. 15

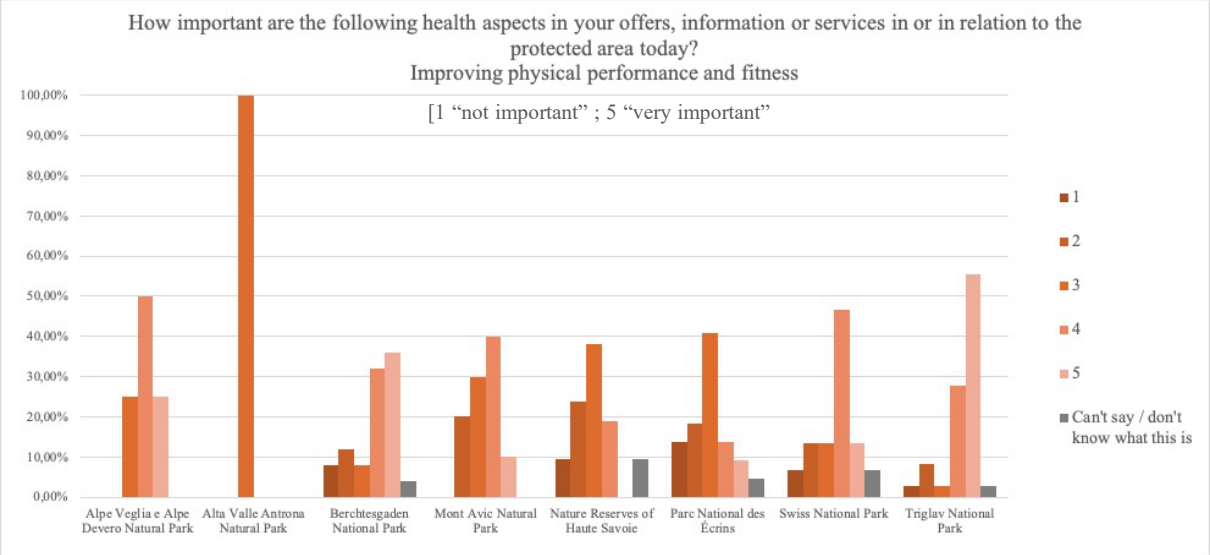


Figure 6. 18 - Operators' survey |Answers to question No. 15

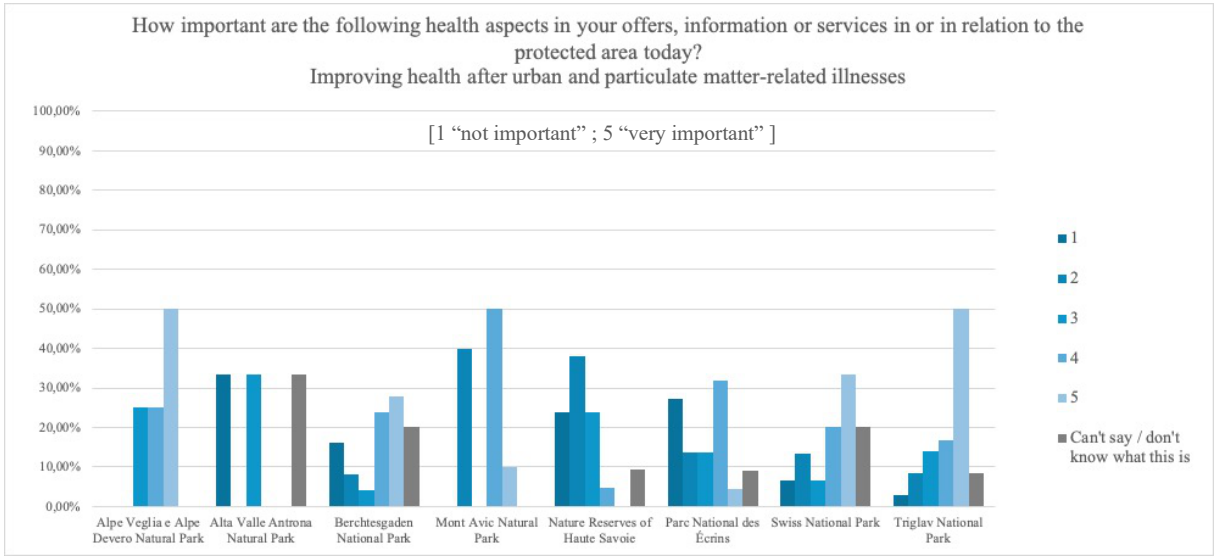


Figure 6. 19 - Operators' survey |Answers to question No. 15

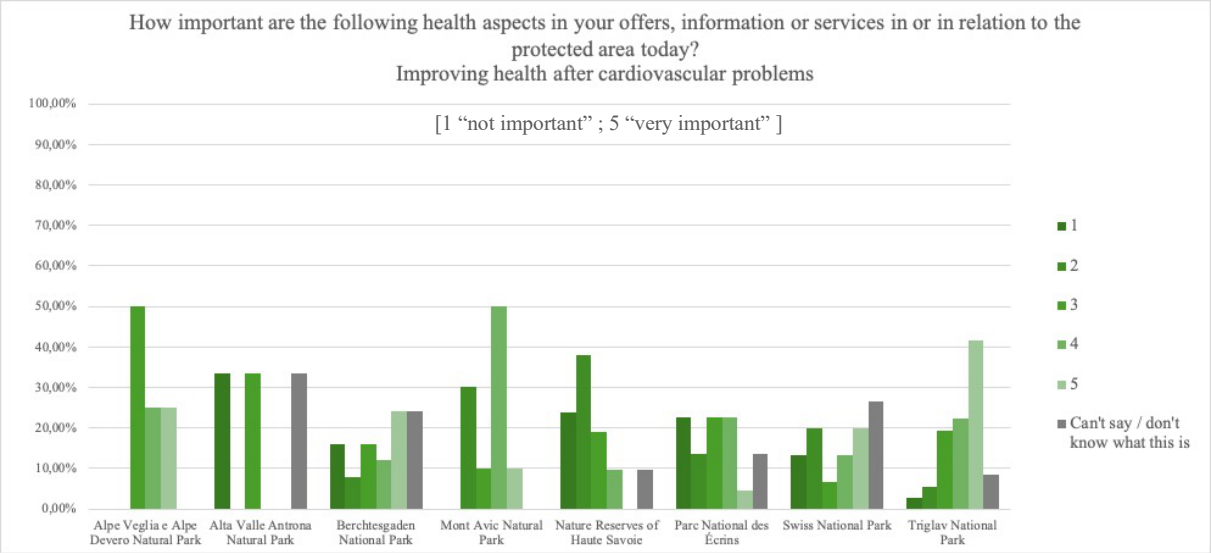


Figure 6. 20 - Operators' survey |Answers to question No. 15

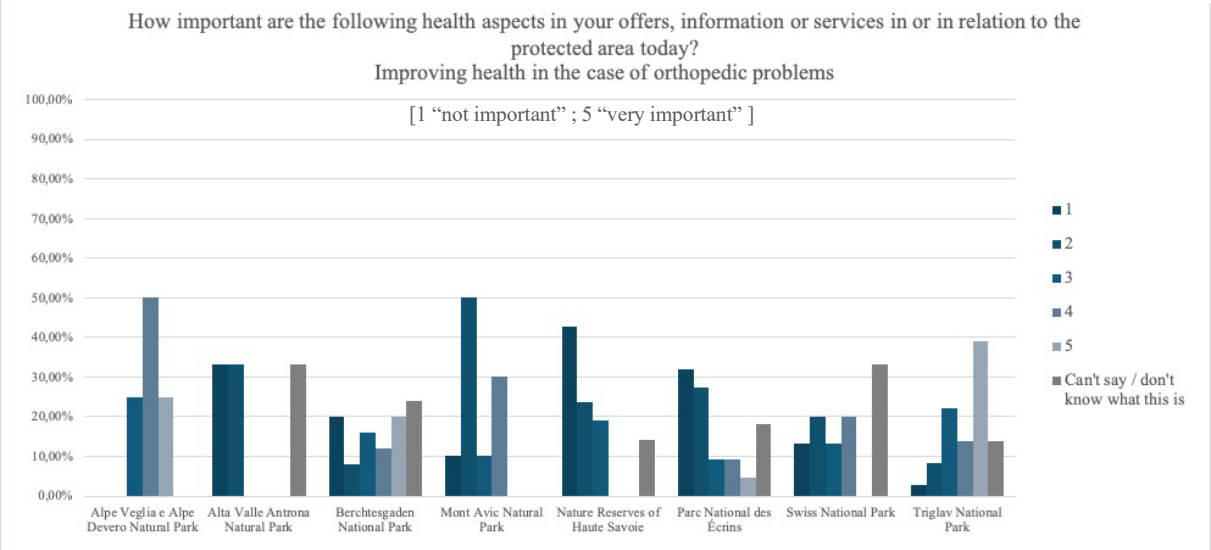


Figure 6. 21 - Operators' survey |Answers to question No. 15

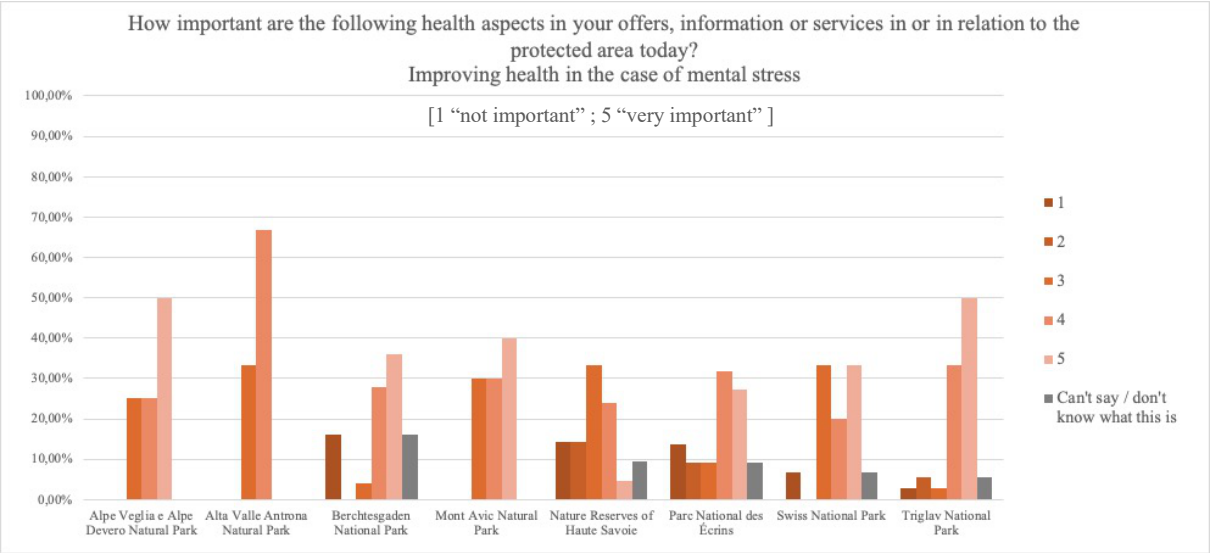


Figure 6. 22 - Operators' survey |Answers to question No. 15

6.14 How important are the following health aspects in your offers, information or services in or in relation to the protected area in ten years?

Question 16 was designed to investigate the importance of the health aspects in the offers, information or services in ten years. Each participant was asked to express an assessment of the level of perceived importance, using a 5-point scale. The scale points were defined as follows: the value "1" corresponds to "not important aspect", while the value "5" identifies a "very important element" in relation to health effects.

- **General well-being and relaxation**: 54% of operators consider this health aspect to be very important, while only 3% consider it a “not important aspect”.
- **General health maintaining**: 45% of operators consider this health aspect to be very important and 27% consider the aspect as “important”, while only 3% consider it a “not important aspect”.
- **Building physical resilience**: 37% of operators consider this health aspect to be very important and 27% consider the aspect as “important”. Almost 4% consider it a “not important aspect”.
- **Building mental resilience**: 42% of operators consider this health aspect to be very important and 21% consider the aspect as “important”, while only 3% consider it a “not important aspect”.
- **Staying young and active in advanced age**: 39% of operators consider this health aspect to be very important. In the meantime, 21% consider the aspect as “important” and 21% consider it “moderately” important, while 6% consider it a “not important aspect”.
- **Improving physical performance and fitness**: 31% of operators consider this health aspect to be very important. In the meantime, 24% consider the aspect as “important” and 21% consider it “moderately” important, while 4% consider it a “not important aspect”.
- **Improving health after urban and particulate matter-related illnesses**: for this health aspect 32% of operators consider this health aspect to be very important, 23% consider the aspect as “important”, 6% voted “not important” and “not very important”, 15% consider it as “moderately important”.

- **Improving health after cardiovascular problems**: for this health aspect, responses are equally distributed (about 24%) between very important and moderately important and (about 7%) between “not important” and “not very important” aspect. It can be noted that in this case almost 18% of the operators responded “can’t say”.
- **Improving health in the case of orthopaedic problems**: 24% of the operators consider this health aspect “very important”. Almost 20% of the operators responded “can’t say”
- **Improving health in the case of mental stress**: 44% of operators consider this health aspect to be very important and 21% consider the aspect as “important”, while only 2% consider the aspect as “not very important” and 4% consider it a “not important” aspect.

The detailed results for each response category are illustrated in the graphical representation that follows.

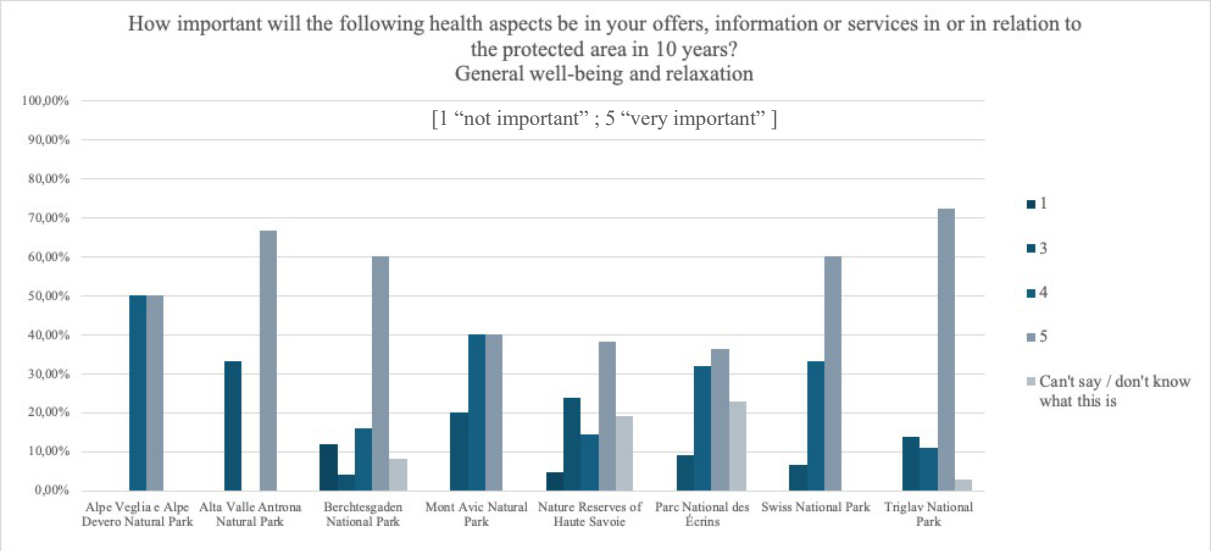


Figure 6. 23 - Operators’ survey |Answers to question No. 16

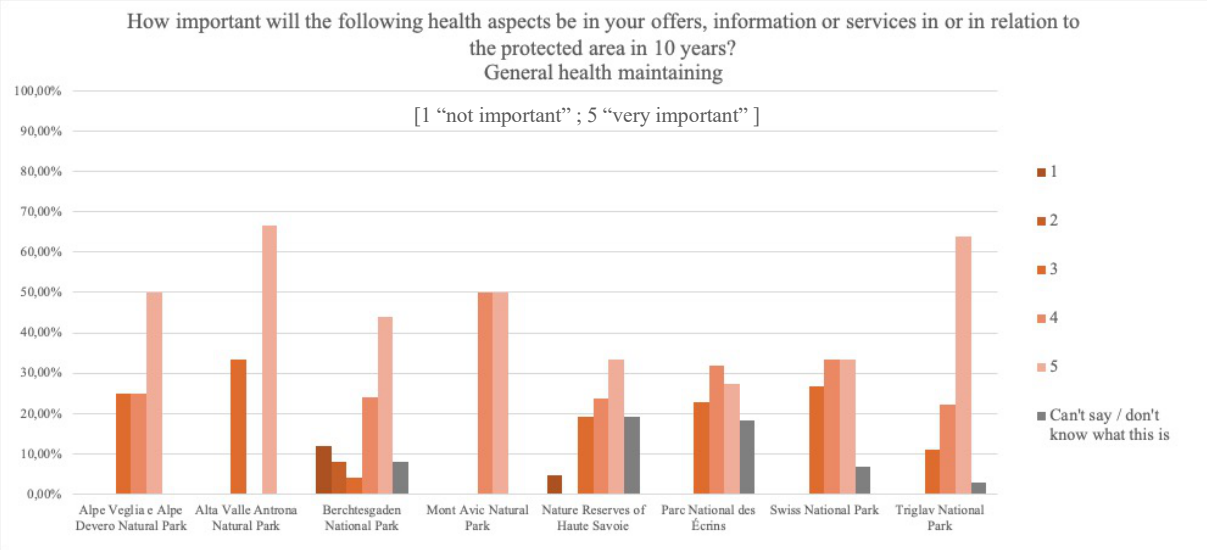


Figure 6. 24 - Operators' survey |Answers to question No. 16

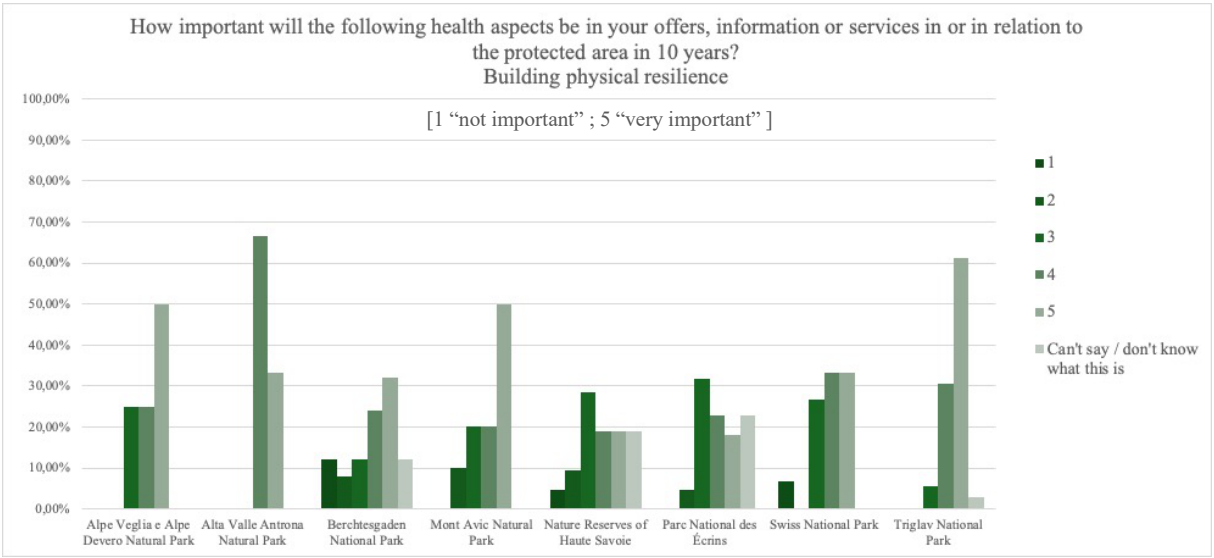


Figure 6. 25 - Operators' survey |Answers to question No. 16

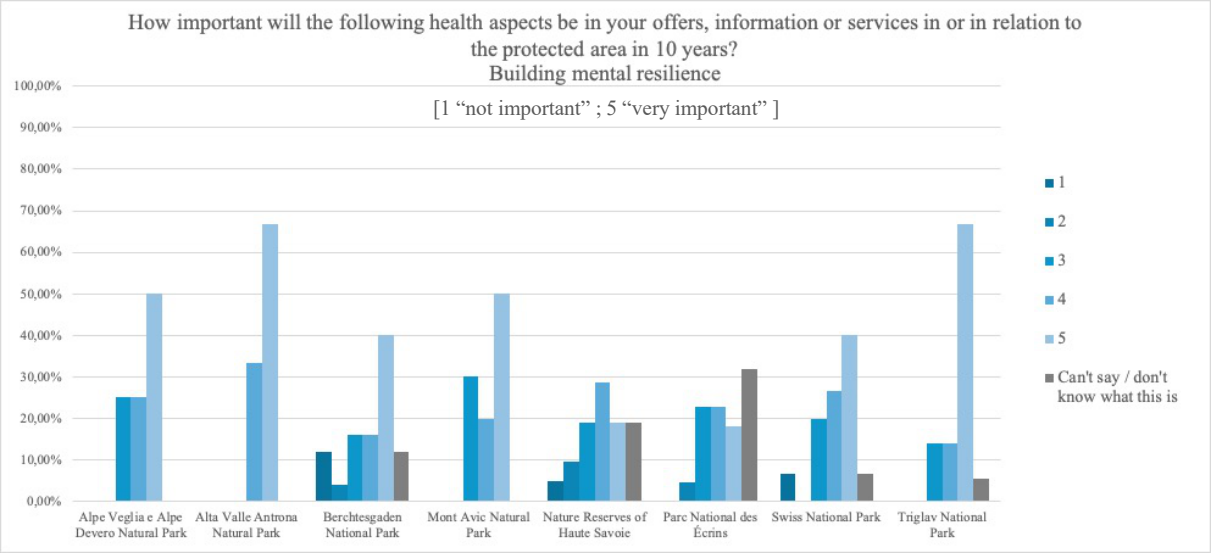


Figure 6. 26 - Operators' survey |Answers to question No. 16

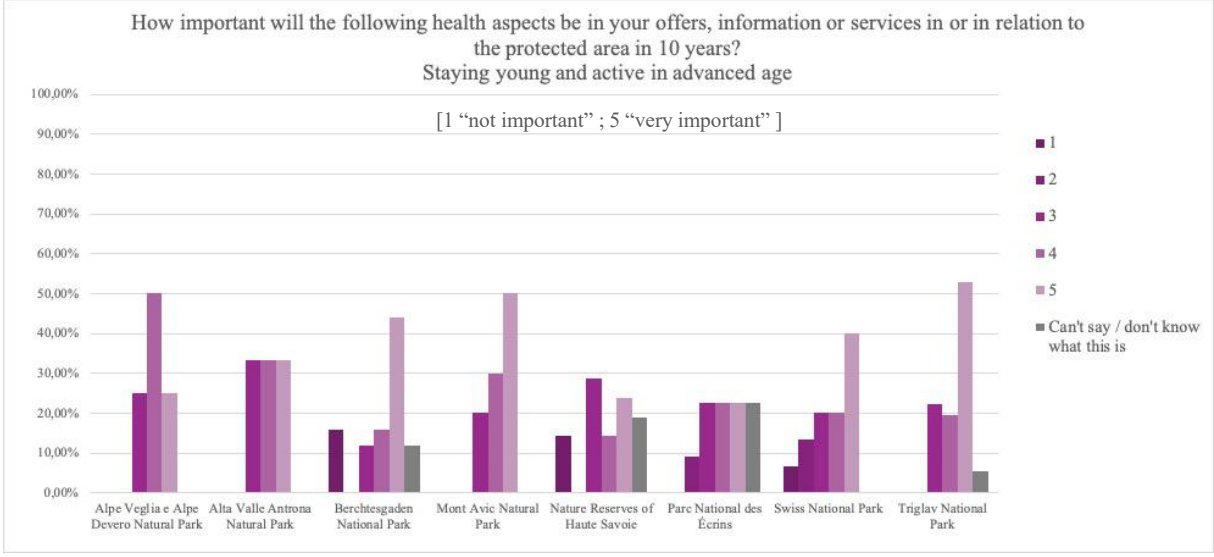


Figure 6. 27 - Operators' survey |Answers to question No. 16

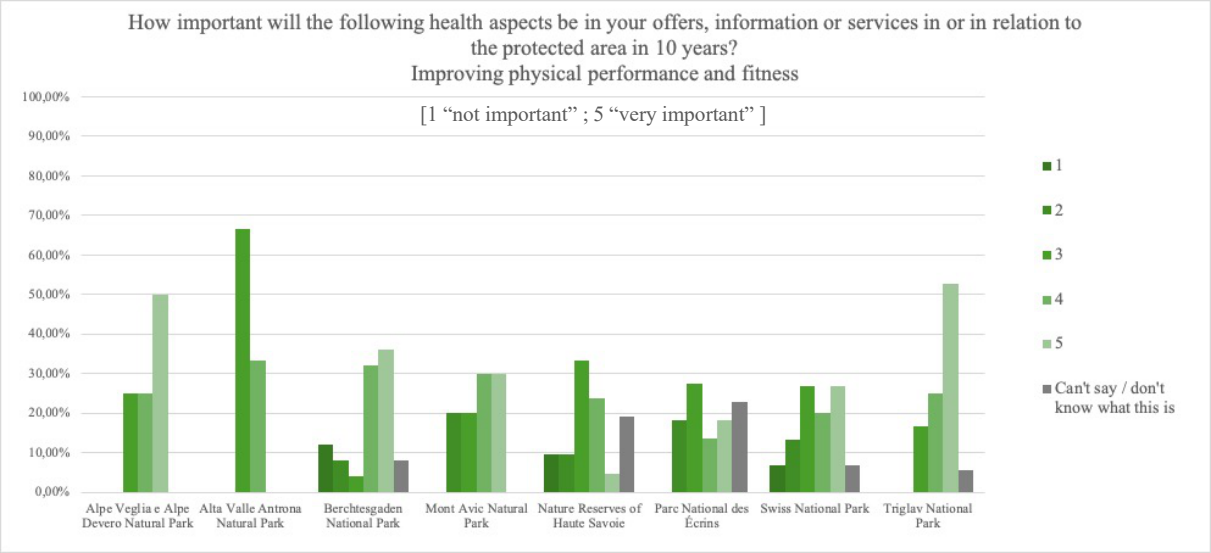


Figure 6. 28 - Operators' survey |Answers to question No. 16

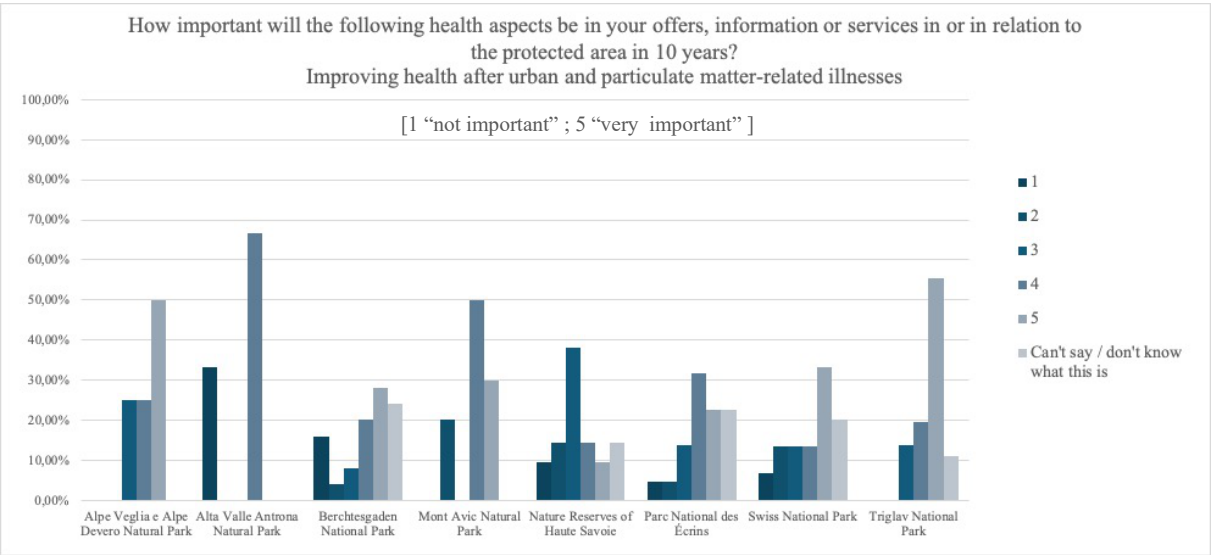


Figure 6. 29 - Operators' survey |Answers to question No. 16

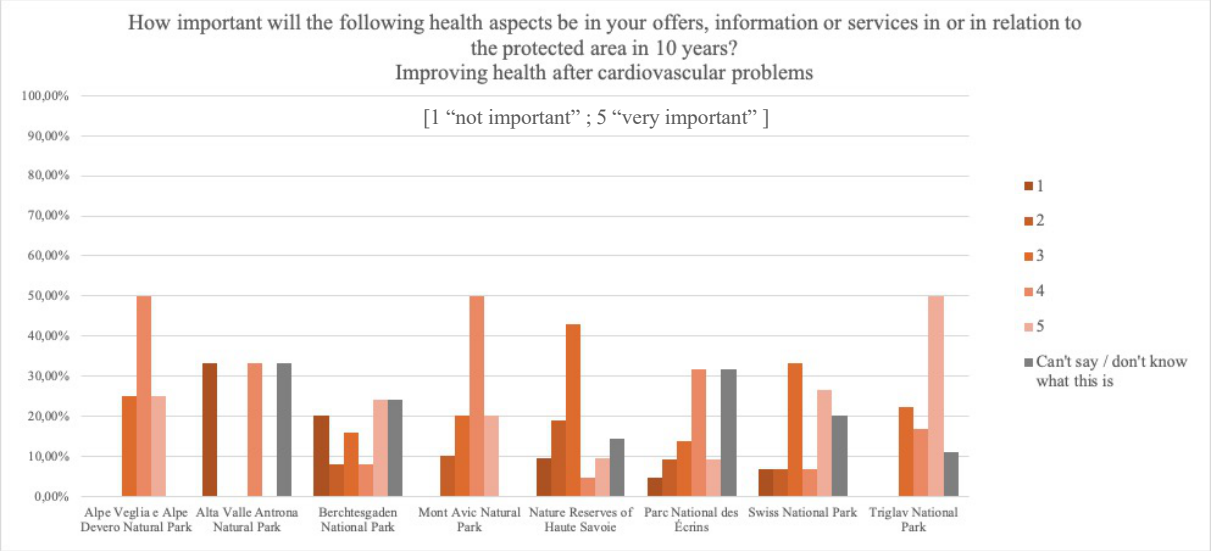


Figure 6. 30 - Operators' survey |Answers to question No. 16

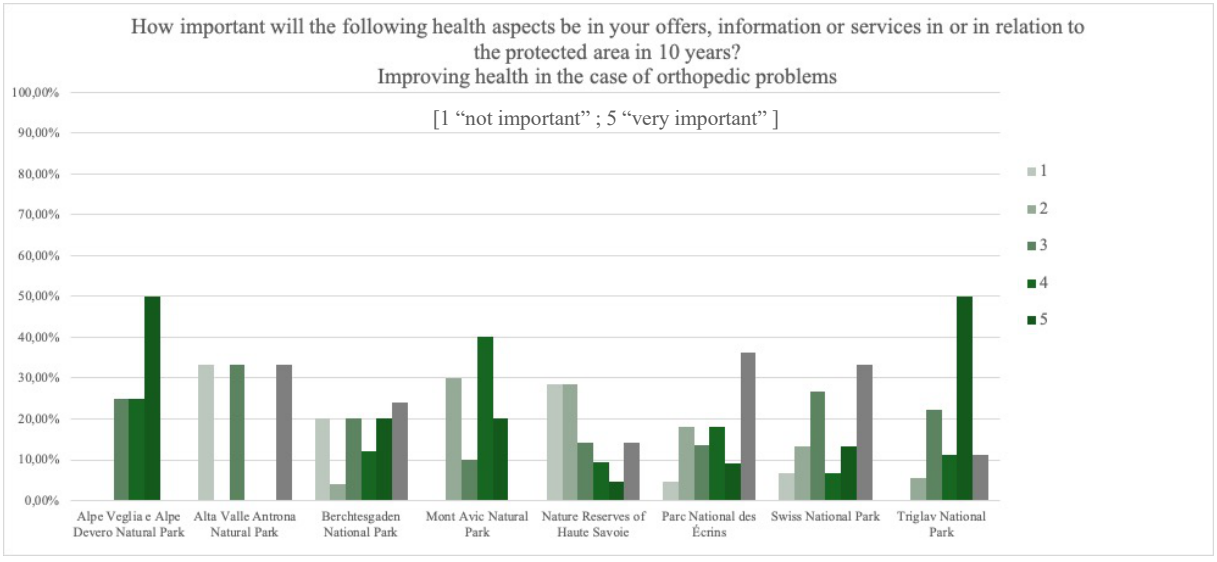


Figure 6. 31 - Operators' survey |Answers to question No. 16

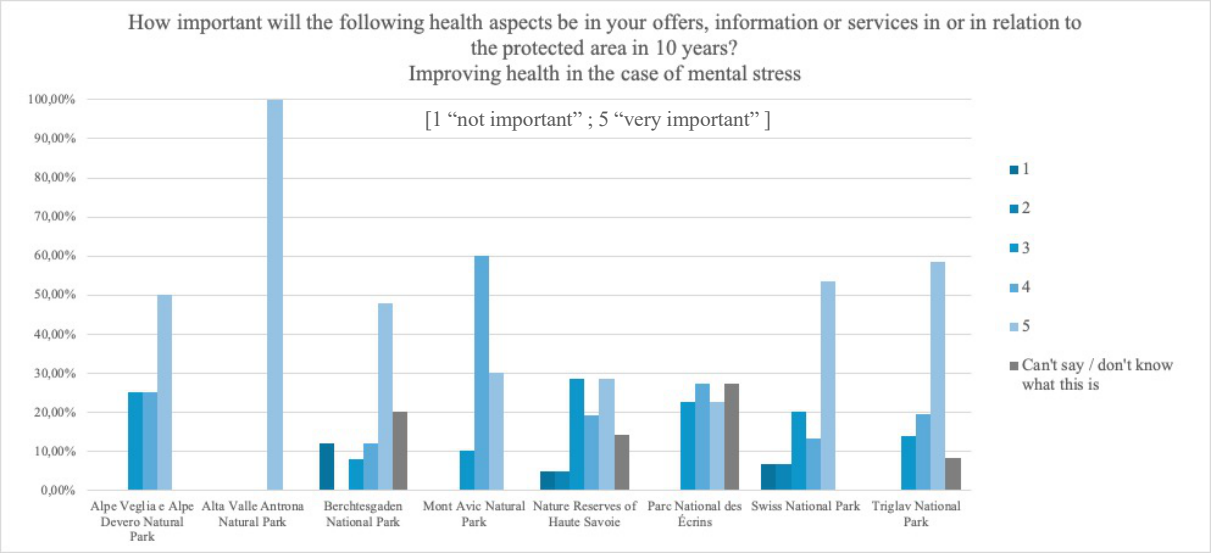


Figure 6. 32 - Operators' survey |Answers to question No. 16

6.15 Do you consider nature protection when offering / promoting activities in or in relation to the protected area?

77% of the operators consider nature protection when offering activities in relation to the protected area and they say that is a central aspect for them. Collectively only 1% of the operators responded "No, not at all", only in Berchtesgaden National Park.

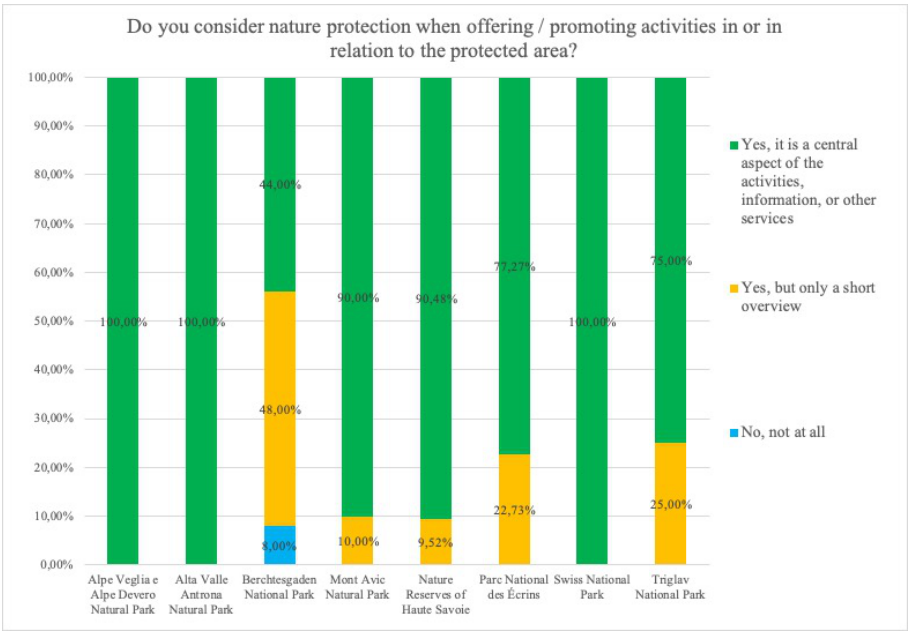


Figure 6. 33 - Operators' survey |Answers to question No. 17

6.16 Is the balance of human, animal, and ecosystem health (one health approach) part of your offers, information, or services in or in relation to the protected area?

Almost 54% of the operators consider the balance of human, animal, and ecosystem health (One Health Approach) when offering activities in relation to the protected area and they say that is a central aspect for them. In this case the percentage of operators that responded “No, not at all” is 12,50%.

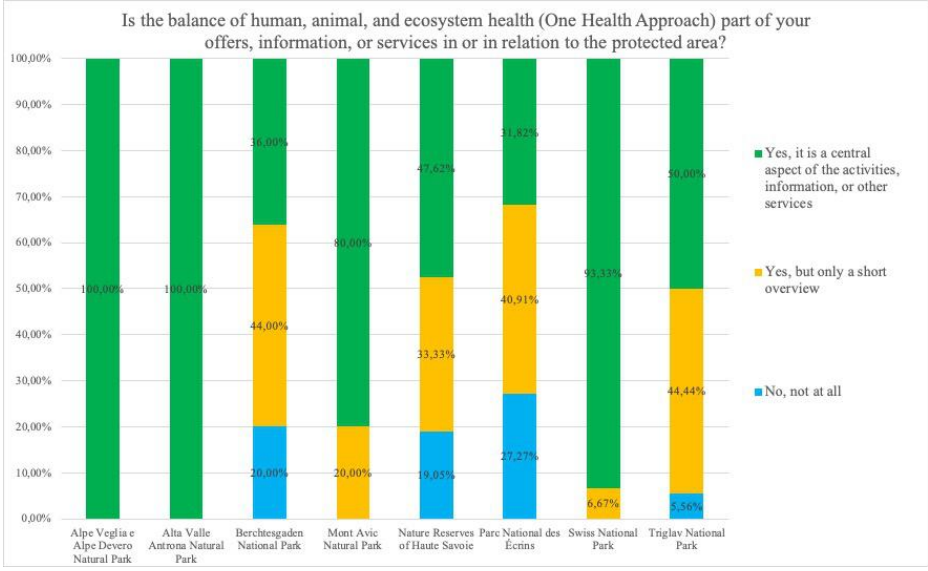


Figure 6. 34 - Operators’ survey |Answers to question No. 18

6.17 How much do you agree with the following statements?

Question 19 was designed to investigate how operators agree or disagree with some statements. Each participant was asked to express an assessment of the level of perceived importance, using a 5-point scale. The scale points were defined as follows: the value "1" corresponds to "strongly disagree", while the value "5" identifies a "strongly agree".

- **Nature protection is an important topic for visitors to the protected area**: in this case 57% of the operators “strongly agree” with the statement, while only 2% “strongly disagree”.

- **The demand for guided tours in and or around the protected area has increased significantly in the last 5 years**: the majority of the responses (35%) are "neutral" while 17% "strongly agree" and only 6% "strongly disagree".
- **The use of digital platforms for booking outdoor activities in or around the protected area has increased significantly in the last 5 years**: 65% of the operators "agree" (25%) or "strongly agree" (40%) with this statement, while "neutral" counts for another 20%
- **The demand for health-oriented outdoor activities in or around the protected area has increased significantly in the last 5 years**: the majority of the responses (32%) are "neutral" while 20% "strongly agree" and only 6% "strongly disagree".
- **Today, health is an important topic for visitors to the protected area**: for this statement almost 50% "agree" (29%) or "strongly agree" (20%), while 27% are "neutral".
- **In the future, health will be an important topic for visitors to the protected area**: again, in this case 85% of the operators are "neutral" (18%), "agree" (36%) and "strongly agree" (30%).
- **Activities in the protected area should be carried out under professional guidance**: in this case is important to underline the fact that over 20% of the operators "strongly disagree", in particular the higher percentage is found in the Parc National des Écrins, while at the same time over 25% "strongly agree".
- **Infrastructure in the protected area supports sustainable tourism**: the responses are almost the same (about 20%) with the exception of "strongly disagree" (10%) and "agree" (27%).
- **Providers of sustainable tourism offers have a competitive disadvantage**: 44% of the operators "disagree" and "strongly disagree" (both 22%); the majority is "neutral" to the statement (27%) and only few agree.
- **There are not enough funds or resources for sustainable initiatives**: more than 75% of the responses are almost equally distributed between "neutral" (24%), "agree" (24%) and "strongly agree" (28%).

The detailed results for each response category are illustrated in the graphical representation that follows.

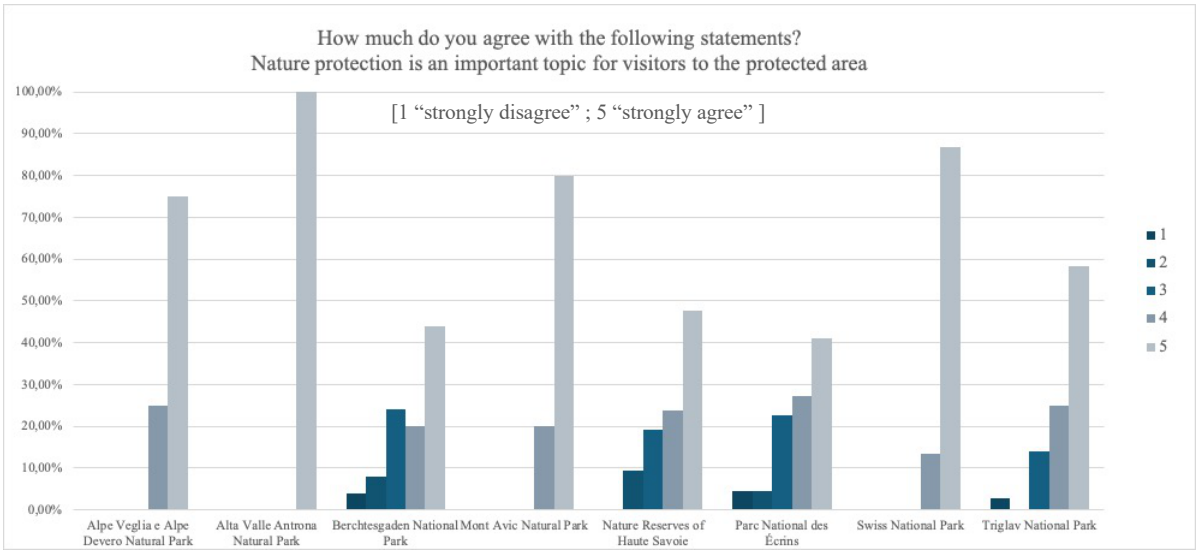


Figure 6. 35 - Operators' survey |Answers to question No. 19

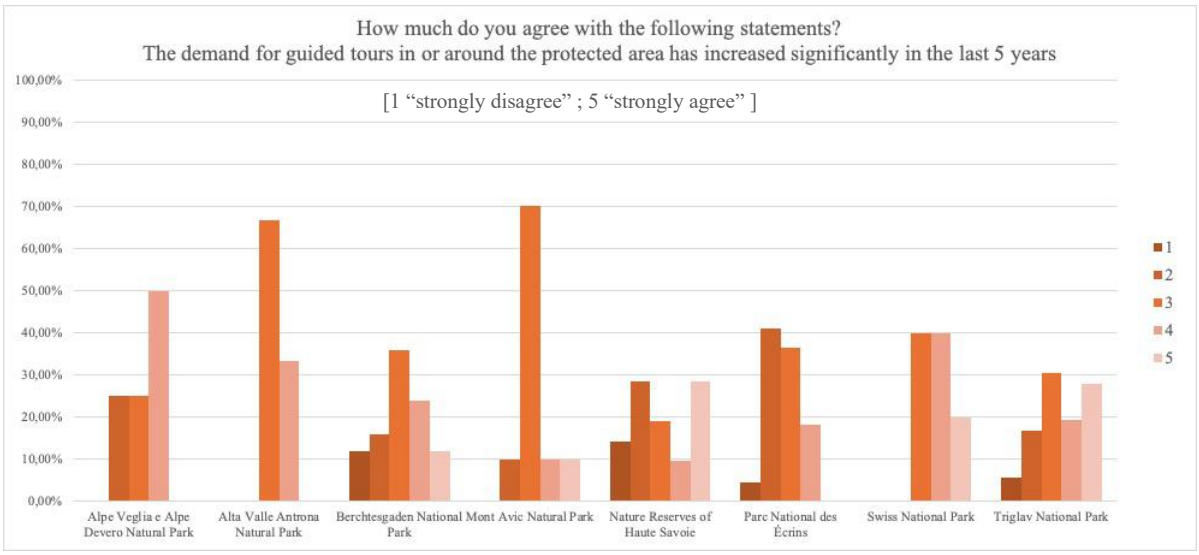


Figure 6. 36 - Operators' survey |Answers to question No. 19

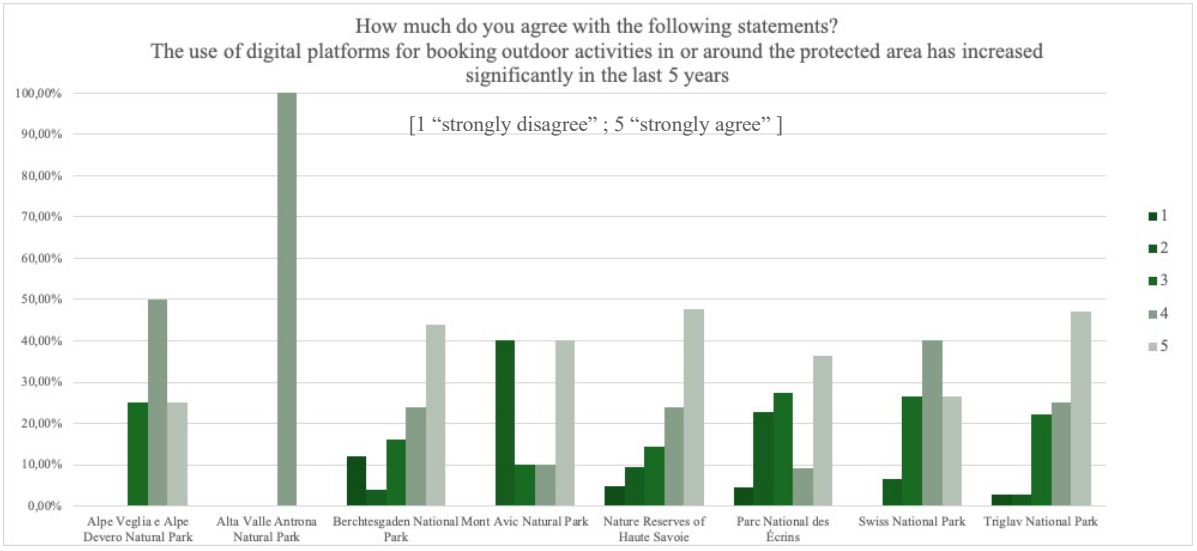


Figure 6. 37 - Operators' survey |Answers to question No. 19

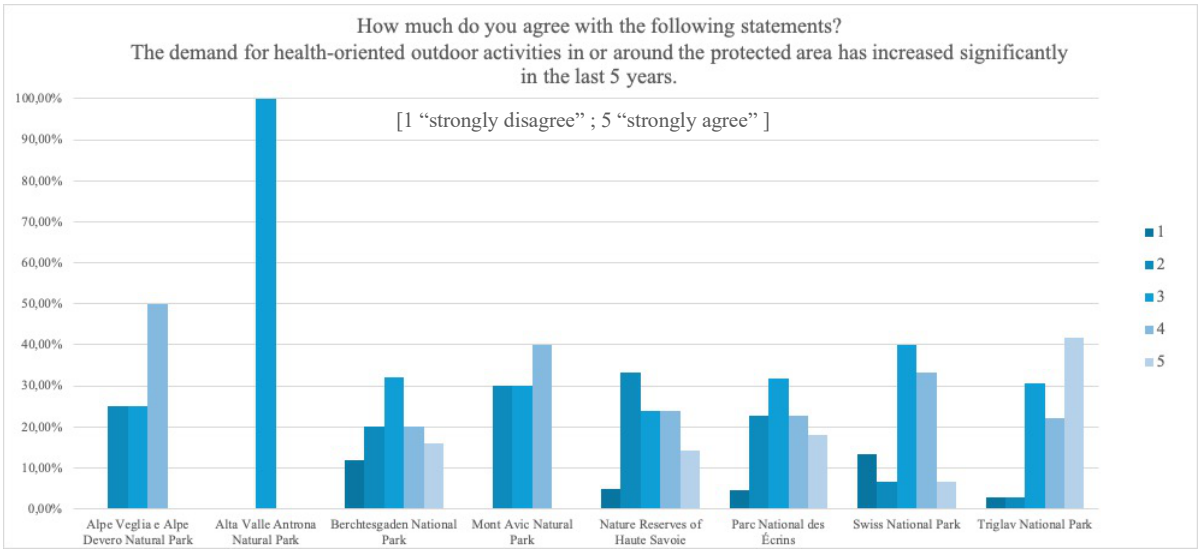


Figure 6. 38 - Operators' survey |Answers to question No. 19

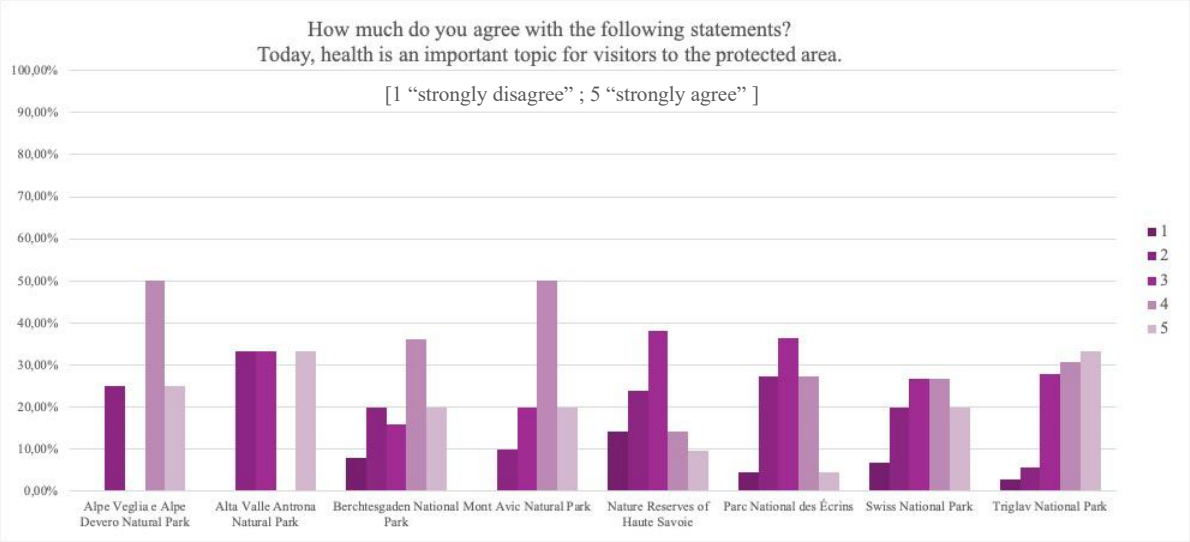


Figure 6. 39 - Operators' survey |Answers to question No. 19

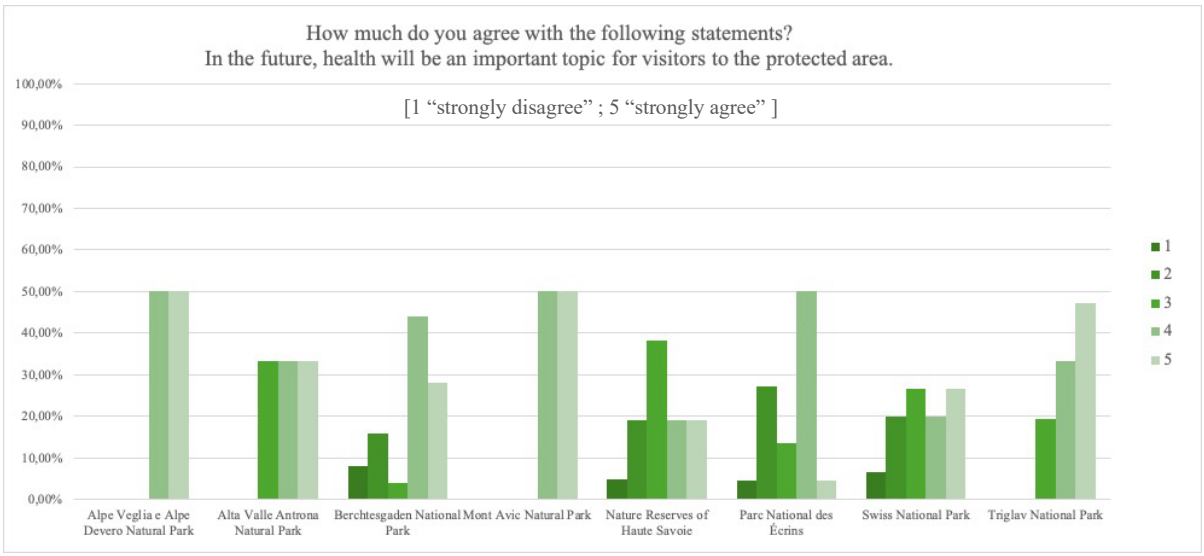


Figure 6. 40 - Operators' survey |Answers to question No. 19

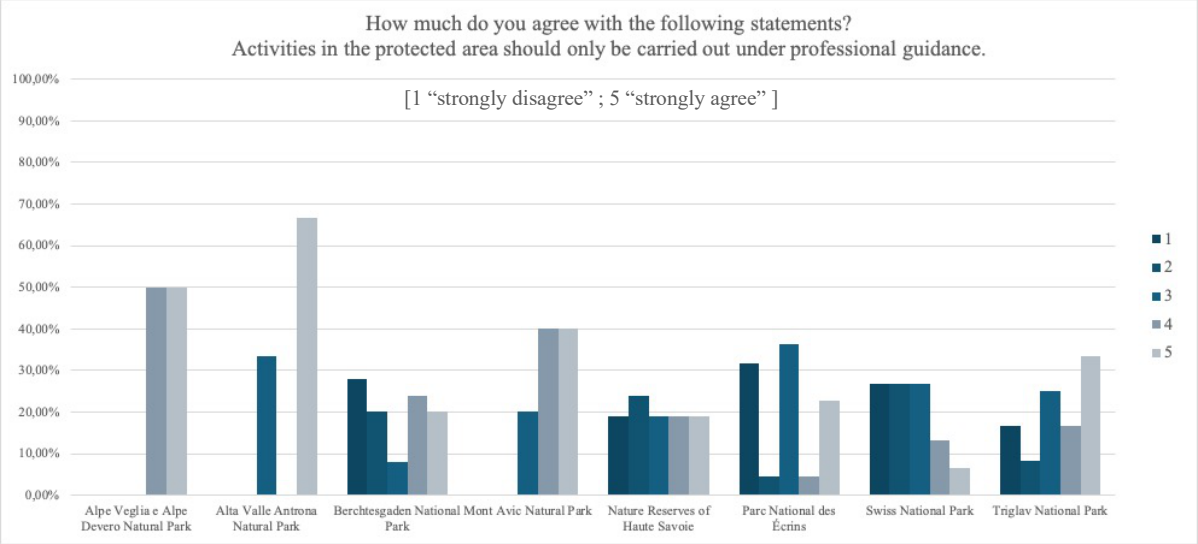


Figure 6. 41 - Operators' survey |Answers to question No. 19

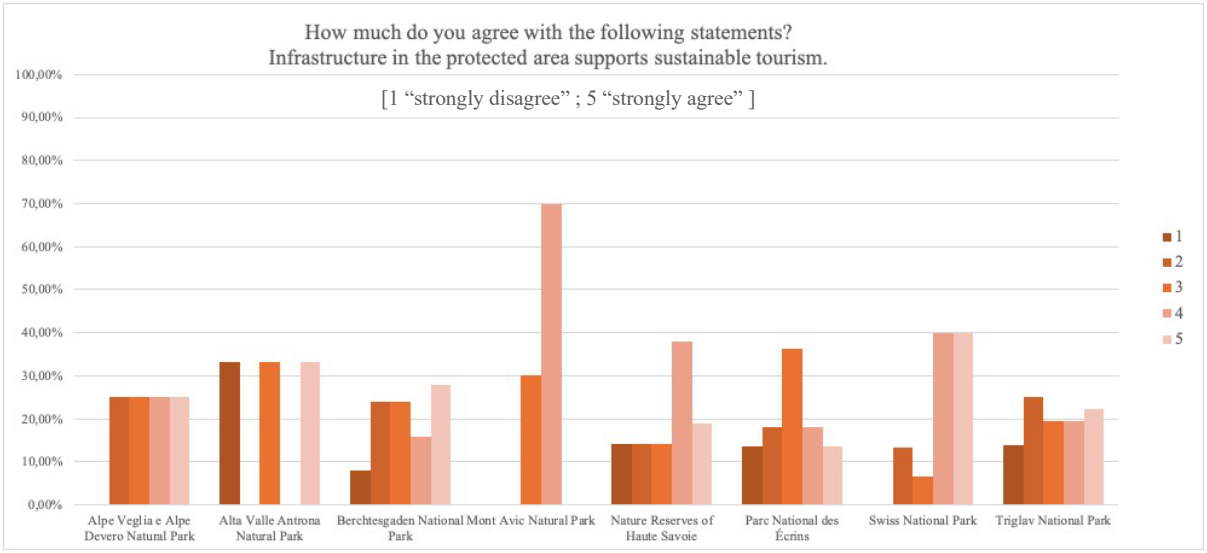


Figure 6. 42 - Operators' survey |Answers to question No. 19

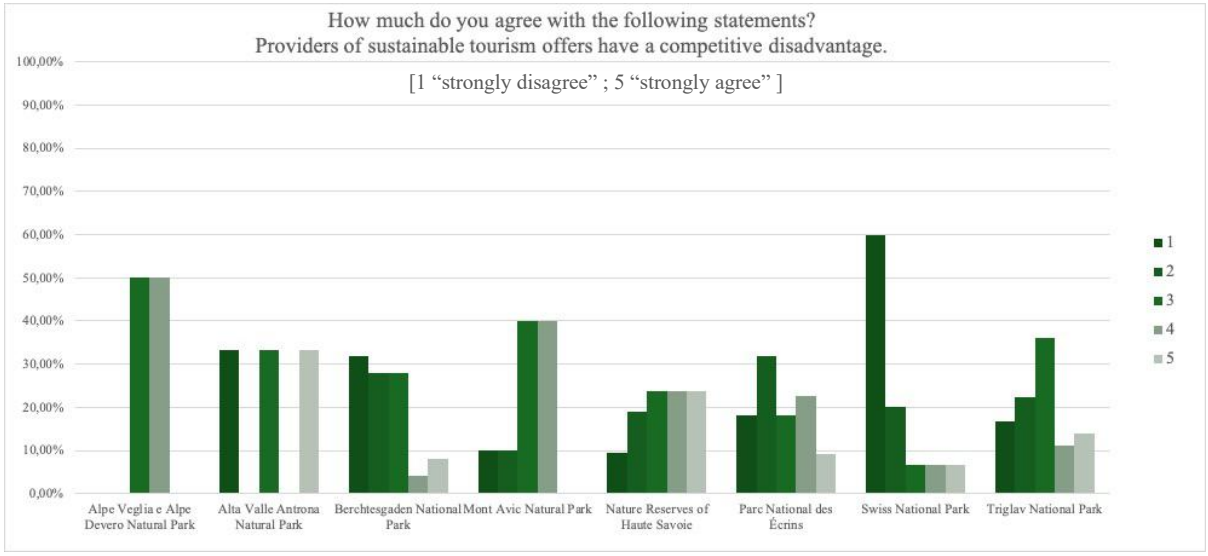


Figure 6. 43 - Operators' survey |Answers to question No. 19

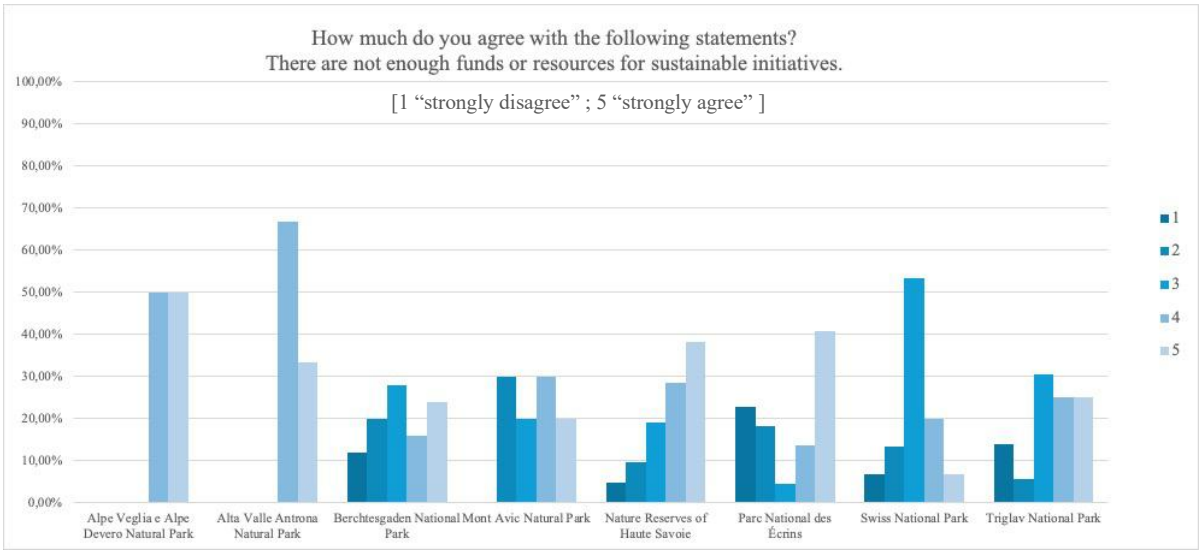


Figure 6. 44 - Operators' survey |Answers to question No. 19

7 Summary profile of the operators' sample for individual protected areas

As with the visitor survey, this section also presents a profile of a "typical operator" for each natural area, based on the most common responses.

The validity of this synthesis is to be considered purely summary and qualitative, offering an initial overview of the different profiles. It's important to underline the limitation of this kind of summary due to the small number of responses obtained.

Alpe Veglia e Alpe Devero Natural Park

They are a professional guide who mainly offers activities in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are offered throughout the year, particularly in summer and autumn. The main sources of information about the protected area are direct contacts with the staff of the protected area and the official website of the protected area. The most offered activity in relation to the protected area is hiking and, likewise, most of the information and services linked to the protected area concern hiking. They do not expect impacts on their offers in the next 10 years in relation to climate change, consequently are not particularly interested in adapting them to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: soil erosion caused by vehicle passage, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is the maintenance of general health; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Alta Valle Antrona Natural Park

They are an operator in the tourism sector who mainly offers activities in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are offered equally throughout the year, particularly in summer and autumn. The main sources of information about the protected area are dedicated outdoor platforms and direct contacts with the staff of the protected area. The most offered activity in relation to the protected area is hiking, while most of the information and services linked to the protected area concern educational activities related to nature. They expect significant impacts on their offers in the next 10 years, particularly related to snow reduction

and winter sports, and are actively interested in adapting activities to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: soil erosion caused by vehicle passage, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is the maintenance of general health; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Berchtesgaden National Park

They are an operator in the tourism and outdoor sector who mainly offers activities in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are not offered equally throughout the year, the most active season is summer. The main sources of information about the protected area are the official website of the protected area and direct contacts with the staff of the protected area. The most offered activity in relation to the protected area is hiking and, likewise, most of the information and services linked to the protected area concern hiking. They expect some impacts on their offers in the next 10 years in relation to climate change and are interested in adapting them considering the impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: soil erosion caused by vehicle passage, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is general well-being and relaxation; in ten years it will still be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Mont Avic Natural Park

They are a guide who mainly offers activities in relation to the protected area. Lives approximately 50km from the protected area, which is rarely the goal/destination of the activities offered. The activities are not offered equally throughout the year, but particularly in summer. The main source of information about the protected area is the official website of the protected area. The most offered activity in relation to the protected area is hiking and, likewise, most of the information and services linked to the protected area concern hiking. They expect some impacts on their offers in the next 10 years in relation to climate change and are moderately interested in adapting them to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: soil erosion caused by vehicle passage, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is the maintenance of

general health together with general well-being and relaxation; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Nature Reserves of Haute Savoie

They are a professional guide who mainly offers activities in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are not offered equally throughout the year, in particular the most active season is summer. The main sources of information about the protected area are the official website of the protected area and direct contacts with the staff of the protected area. The most offered activity in relation to the protected area is hiking and, likewise, most of the information and services linked to the protected area concern hiking. They expect impacts on their offers in the next 10 years, particularly related to biodiversity and environmental changes, and are interested in adapting activities to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: soil erosion caused by people passage, disturbance to wildlife, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is general well-being and relaxation; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Parc National des Écrins

They are an operator offering hospitality services who mainly offers information in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are offered throughout the year, particularly in summer. The main sources of information about the protected area are printed guides, brochures and leaflets and the official website of the protected area. The most offered activity in relation to the protected area is hiking and, likewise, most of the information and services linked to the protected area concern hiking. They expect significant impacts on their offers in the next 10 years, particularly related to snow reduction and winter sports, and are moderately interested in adapting activities to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: soil erosion caused by vehicle passage, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is general well-being and relaxation; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Swiss National Park

They are an occasional guide who offers activities and information in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are not offered throughout the year, particularly the most active seasons are summer and autumn. The main sources of information about the protected area are the official website of the protected area and direct contacts with the staff of the protected area. The most offered activity in relation of health aspect is for general well-being and relaxation. They expect impacts on their offers in the next 10 years, particularly related to safety and risk management, and are actively interested in adapting activities to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: disturbance to wildlife, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is the maintenance of general health; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

Triglav National Park

They are an operator offering hospitality services who mainly offers information in relation to the protected area. Lives near the protected area, which is often the goal/destination of the activities offered. The activities are offered throughout the year, particularly in summer and spring. The main source of information about the protected area is the official website of the protected area. The most offered activity in relation to the protected area is hiking and, likewise, most of the information and services linked to the protected area concern hiking. They expect significant impacts on their offers in the next 10 years, particularly related to snow reduction and winter sports, and are interested in adapting activities to these impacts. According to their judgment, the most relevant impacts caused by outdoor activities are: disturbance to wildlife, the increase in waste and litter, the risk of over tourism/overcrowding. Today, the most important health aspect in relation to the activities offered is general well-being and relaxation; in ten years it will be general well-being and relaxation. They consider both nature protection and the One Health Approach central to the activities proposed in relation to the protected area.

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