Understanding Climate Change in Alpine Region Through Geo-Referenced Multi-factor Mapping of Ski Facilities and Over-Tourism

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Abstract. The exponential growth of winter tourism, which in the central-European Alpine Region is inseparable from the rise to mass practice of Alpine skiing, has fundamentally reshaped leisure practices and the Alpine landscape, transitioning from a recreational pursuit to a multi-billion dollar industry [1]. This evolution necessitated landscape modernisation efforts, with stakeholders including skiers, supply companies, local and foreign investors, regions and states collaborating to tailor the Alpine environment to skiing needs, fostering a predictable and profitable industry [2]. This transformation made a previously feared environment profitable and laid the foundations for the economic development of entire valleys [3]. However, it has not been without consequences. While intended to facilitate growth and profitability, interventions and technologies have paradoxically diminished skiing's appeal to specific segments of society due to the intense exploitation of natural resources, including landscape, which appears to be the most noticeable casualty [4]. This paper explores the ongoing changes in Italy's Alpine and Apennine regions, tracing the transition from landscape modifications for infrastructure development to contemporary challenges driven by structural abandonment, exacerbated by climate change and inadequate management practices [3]. Utilising a multi-practical approach, including visual aids such as maps and aerial photographs, this research aims to offer accessible insights into the phenomenon of mass skiing in Italy, shedding light on its historical trajectory, socio-economic impacts, and current challenges.

Keywords: Mass Ski Tourism · Climate Change · Alpine Regions · Georeferenced Data · Over Tourism · Rural Development

1 Mountain Mass Tourism and Anthropization

Extreme weather conditions, due to climate change, bring changes to environments and biodiversity together with inevitable transformations in social, economic, and political dynamics [5]. These conditions often manifest and are enhanced by power distribution problems, new forms of social inequality and a broad diversification of opportunities. In addition, changes in the technological landscape, new energy relations and the introduction of new technologies are being witnessed and experimented [3]. Within this

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framework of tension and restlessness contradictions, among many others, the issue of the economic, social and environmental sustainability of winter alpine tourism takes up ample space, also considered high mountain areas being the most affected by climate change [6].

The exponential growth of winter tourism, mainly through alpine skiing, has brought about significant changes in leisure practices and the alpine landscape since the 1930s, transforming this once widely popular recreational activity into a multi-billion dollar industry [3]. By the end of the 20th century, the Alps housed approximately 12 million residents but welcomed tourists at least ten times more annually [7]. Due to its magnificent landscape, steep and challenging terrain, high levels of snowfall, and proximity to European metropolitan areas, the Alpine region was particularly suitable first for health and healing trips for the urban upper middle class and then for downhill skiing, born and promoted as an expression of the futurist values of speed, impulse, a relationship with nature and a holiday from hectic urban life [2]. This process of adaptation to tourist skiing, however, has not been painless: European ski resorts, decade after decade, have become more and more products of human management and manipulation of the alpine landscape, mass-oriented architecture and leisure-led development, continuously promoting human interventions involving cutting, filling, excavating, building and finally reaching the point of artificial snow production [7].

Certain Alpine regions have gradually transformed into monocultural landscapes dedicated exclusively to winter tourism, resulting in expansion and overcrowding [7]. This shift has led to a gradual gentrification of these areas, manifested in the displacement of the local population, which has been replaced by temporary, seasonal tourists and profit [3]. Supported by an economic inducement in the hands of a few but closely linked to the ruling class of the various regions, it has reached the semblance of a veritable Alpine skiing lobby [7].

It is worth noting that the romanticised image of alpine skiing before mass tourism and the pre-intense skiing era overlooks the complex interplay between humans and nature. It presents a reality that appears increasingly distant from the mountain landscape and ecosystems and the actual socio-economic situation. Regardless of this and the actual climate situation, romanticised images of mountain landscapes and the promise of abundant snowfalls are still used as the main content for advertising and promoting winter holiday destinations [3].

As stated by Nardelli and Dematteis [7] in their book Inverno Liquido, for quite a long time, the mountains supplied the cities with minerals, building stones, timber, meat, milk, cheese, hydraulic and electric power, and labour functions that are still present today but with much less importance than in the past. The mountain and the city used to be much more explicitly interdependent, a feature that today has been blurring mainly in communication rather than reality. The mountains were and are a place of hard work, harsh rhythms, and climate, which have always forced the people living there to adapt. As Maya Ishizawa [8] states in her thesis, “Even though “life in the mountains is tough”, this way of life forms communal values, making mountain communities resilient. These essential principles of community are fundamental for sustainability and make mountain populations the most suitable to adaptation.”

In contrast to this context, from the 18th century onwards, the mountain became an object of the urban imagination. The needs it satisfies are no longer linked to local production but to the leisure time of citizens [3]. The communities living in the mountains adapted to these new demands, radically modifying their productive structure, welcoming holidaymakers, building health facilities such as sanatoria, places where they could offer relaxation, cures, and cosmetics, proposing mountaineering and hiking routes to reach the peaks, inventing professions to welcome, feed and guide guests that represented the prodromes of modern mountain tourism [9] (Fig. 1).



Fig. 1. The Dolomites, as illustrated in three advertisement manifestos from around 1935.

Following this path of shaping and constantly implementing the urban vision of the mountain environment in the construction of the tourism industry, the mountains become elective places for recreation and entertainment, where a semblance of an unspoilt natural landscape remains just for the citizens' eyes [9], and the agropastoral and rural production and economic system quickly fade into the background.

Analysing the topic of mountain mass tourism through the definition of "Monoculture of Skiing" therefore adds a layer of interpretation to the research, significantly expanding the scope of the satellite themes and highlighting the socioeconomic, anthropological, and political implications of such a transition [3]. In anthropology and ethnology, monoculture refers to the process of cultural homogenisation resulting from historical and social factors, wherein diverse traditions and ideologies converge towards a unified cultural model that diminishes the distinctions among their original components. This convergence often leads to the dominance of a simplified or standardised cultural framework. However, monoculture can also manifest inflexibly, disregarding the complexities and variations inherent in the original components [10].

Framing the ski industry as 'monocultural' is indispensable when seeking solutions for mitigation and adaptation to the climatic and economic future looming over mountain areas. A more moderate and less widespread type of practice would require less radical approaches while having such a developed, capillary, monocultural industry leads the problem actors to the near impossibility of imagining alternatives. For this reason, new technologies for adapting to climatic conditions and new infrastructural development plans conceived even decades ago continue to be implemented, testifying to a system that sees no future but only the present and the past.

By interpreting the ski industry as a monoculture, the research exposes the pervasive growth processes of a seemingly recreational activity that has come to dominate entire valleys, creating economic dependencies that are challenging to overcome (Fig. 2).



Fig. 2. Hotel Nevada is an abandoned accommodation facility for skiers near the slopes. Monte Bondone, Trento (TN) Italy, photographed June 2023.

The repercussions of the mass skiing industry on local communities and environments are continuously being discovered, particularly when scrutinised through an informed lens. For instance, the reliance on the monoculture of tourism has resulted in the gradual marginalisation of traditional sectors of the local economy. This is partly due to the challenges supply chains face integrating with the logic of hotel chains and algorithms that tend to homogenise offerings [3].

Consequently, there has been a gradual detachment from the local territory as a living space while the emphasis shifts towards sustaining the ski industry, which remains seasonal. The result is a flattening of economic incentives, the convergence of local businesses towards the sustenance of ski activities, the expansion of accommodation facilities, and the homogenisation of culinary and experiential offerings in favour of what is labelled as 'traditional' [7]. The fossilisation of most of the economic input on a single tourism practice developed on a weather event (snow) that is not seasonally predictable and, in recent years, subject to intense alterations and peaks, creates an extremely fragile socioeconomic structure [7]. As an example of some areas' risk of economic reliability and socio-economic sustainability, the dataset compiled by the Dislivelli association encompassed 563 municipalities in the Western Alps (Piedmont, Aosta Valley). The research findings indicated a pronounced disparity in financial outcomes between municipalities focusing solely on snow tourism and those embracing diversifying their offerings to tourists. Specifically, the analysis revealed an average loss of 89.8 million euros per municipality, characterised by a mono-functional approach, compared to an average loss of 47.8 million euros among municipalities that exhibited

a diversified range of services [11]. These findings underscore the significance of diversification as a strategic approach for enhancing economic resilience within mountain tourism. Ultimately, due to monocultural management, the connections to the specific localities erode. The narrative thread aligns season after season, country after country, culminating in large ski complexes such as Dolomiti Superski (Trentino-Alto Adige, Veneto, IT), La Via Lattea (Piedmont, IT), or Monterosa Ski (Aosta Valley, Piedmont, IT) (Fig. 3).



Fig. 3. The report from Legambiente, 'Neve Diversa' (Legambiente, 2023), shows the number of artificial reservoirs in each region of Italy, from 0 to 60.

To give an idea of state investments without which the Italian ski industry would be able to sustain itself due to the very high operating costs and the intricate network of profit distribution, it is interesting to report one of the latest governmental measures: the Italian Ministry of Tourism alone has allocated more than 200 million euro 'for the modernisation, safety and decommissioning of ski lifts and snowmaking facilities' for the two years 2024–2026 alone, the year in which, not coincidentally, the 2026 Winter Olympics Milan Cortina will take place in Italy [12]. This money do not comprehend annual and seasonal investments from regions alone and spot-investment from the central government.

Considering all the above, if we now shape the problem around balancing economic prosperity and environmental conservation, we will find another big issue in this industry, which is strictly linked with its economic profit-led system and interlinked with its social, economic, and political levels (Fig. 4).

The phenomenon of mass winter tourism in Italy and the proliferation of ski facilities and resorts from the boom years of the snow industry up to now have had a significant impact on the architecture and landscape of the Italian Alps, starting from the development of facilities dating back to the 1960s–70s–80s which led to the installation of numerous invasive ski resorts at very low altitudes, even at less than a thousand metres



Fig. 4. Via Gioia, next to Piazza Gae Aulenti, Milan, Italy, 2023.'Piles of Snow and 'Winter with a Bang' are in the Airbnb advertising winter campaign.

above sea level [2]. With the continuous rise in temperature and the general harmful redistribution of snowfall in recent decades, this factor, through the progressive rise of the snow reliability line, is causing more and more closed, disused or abandoned ski areas to emerge. Some of these areas, once alive with activity and the daughters of a playful spirit that is now anachronistic, now stand as silent witnesses to poor management practices and the climatic challenges faced by the ski industry [7]. If the lower ski areas are not being abandoned, it is because of public money given by provinces, regions and the central government to create adequate intensive infrastructure to provide artificial snow: the 2024 Nevediversa Report [13] from Legambiente states that that the number of snowmaking reservoirs in Italy is 158, 16 more than 2023. Artificial water storage lakes - from local rivers and streams - are indispensable for creating artificial snow, which in Italy is used to make snow on more than 90% of its ski slopes [13].

Based on this data, this research represents a geo-referenced mapping of Italian ski areas, divided into active and non-active ones. This geo-referenced snapshot of the current state of the ski industry in Italy was made possible by using qualitative and quantitative data from online blogs [15], official reports [13, 14], literature, and editorial texts. Through the analysis of these sources, an attempt was made to gain a deeper understanding of the current situation in the Alps, shedding light on this widespread phenomenon and its implications and, most of all trying to offer a way of portraying them through an easily accessible and understandable medium.

It is imperative to acknowledge that the following representation of reality is predicated upon an extensive array of sources, albeit with specific applicability limited to the Italian Alps and, to a certain extent, the Appenini mountain region.

While it is true that diverse values and characteristics characterise different Alpine regions and their touristic management [8], the aim of this study lies first in a punctual depiction of reality and, most of all, in developing a methodological framework that - given the lack of data on the subject - tries to combine all available resources drawing upon archival data, online citizen science platforms, and reports.

By leveraging these resources, one of the aims is to facilitate and augment mapping endeavours spanning the entirety of the Italian Alps and Appennini and extend this approach to encompass a more comprehensive understanding and analytical examination. With this tool being managed by single individuals, it could be a very interesting base to enhance citizen-based collaborative processes, filling the gap between scarce administration communication of monitoring and reality.

Citizen-based collaborative approaches, as advocated by Legambiente within their Nevediversa 2023 report [14], would entail active engagement with local communities, thus engendering a more nuanced and context-specific exploration of the subject matter at hand, hypothetically enhancing a first-step acknowledgement of reality and, further, decisionmaking (Fig. 5).



Fig. 5. Seiser Alm, access to the slopes covered in mud, photographed the week after the end of the ski season, meaning without continuous artificial snow. April 2023.

1.1 Geo-Referenced Mapping of Italian Mountain Ski Areas

Examining the geographical distribution of skiing facilities in Italy offers a comprehensive insight into the extensive prevalence of this recreational pursuit. Consequently, one can discern the extent of the socio-economic significance of the ski monoculture, underscoring its pivotal role in sustaining entire valleys as a primary economic driver. This analysis elucidates the inherent socio-economic risks associated with a potential cessation of skiing activities and the concomitant disappearance of the sport, a consequence of the ongoing climate change and the precipitous escalation in temperatures [13].

Such research also highlights the profound implications for environmental management and conservation policies. It is imperative to address the environmental and landscape-related implications of such a future-blind investment machine, which, is frequently applied even to protected areas [13], proving the extent of such a profit-led and competitive sector.

As part of the qualitative and quantitative research, it was decided to include a quantitative geographical and geo-referenced cloud of the distribution of ski facilities in Italy to provide a direct visualisation of the problem and, above all, to provide a monitoring basis for research. Aside from this, a qualitative analysis was conducted using satellite top-views of the areas considered. It is important to notice that this database must be updated frequently due to rapid environmental changes and the consequent impact on the opening and closure of ski plants related to snow reliability and available vital liquidity. To better explain and understand the method, the steps and sources that were used and went into creating the final result, three sections explain the process step by step (Fig. 6).

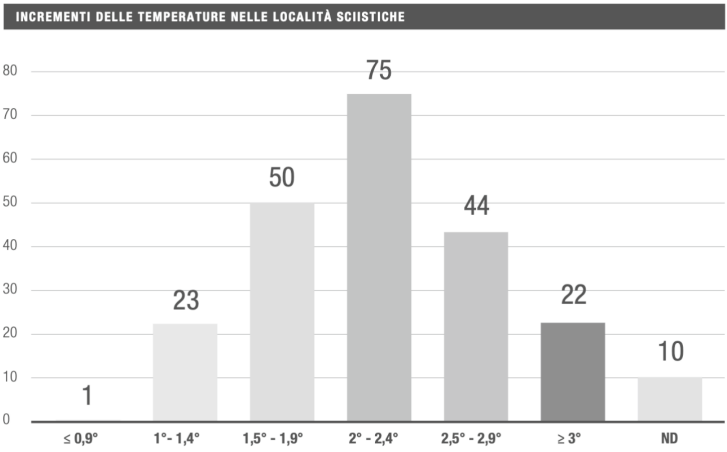


Fig. 6. Legambiente elaborates on temperature increases from 1961 to 2018 in Italian mountain municipalities in or near ski resorts, based on data https://climatechange.europeandatajournalism.eu/it/map. (Legambiente, 2023)

The software chosen map each location was Google Earth. Using Google Earth for mapping proved significant, enabling deep top-view analysis of the territorial transformations associated with ski area development and post-development phases. These alterations encompass deforestations taking on a corridor-shaped configuration, the emergence of commercial structures, the specific presence of artificial lakes next to ski plants, and the systemic reorganisation of the overall territory, including edification projects [7]. This visual evidence was important for research and delivery reasons since it has proven to be a strong visual tool to show the depth of the modification in these territories, making all the data more evident, reality-linked, and therefore graspable to a broader and more varied public.

Moreover, by looking at specific ski areas, both on pins and in visual top views, it is possible to identify patterns and factors that have either enhanced their current activity or contributed to their decline, providing a relative understanding of the challenges faced by the ski industry. In the eyes of those who want to see, this analysis provides a critical basis for anticipating pessimistic repetitive developments [13] and investments or assessing the potential for a disruptive, positive management shift in these areas.

1.1.1 Geo-Referenced Mapping Method and Criteria

The approach adopted to map the Italian ski areas in the northern, central, and southern regions, including the Alpine and the Appenini regions, has been multi-factor.

For example, the mapping includes data obtained through online archival research [13, 14], regional datasets [13], and spontaneous citizen science [15], as well as in-person research visits and research.

Regarding the technical distribution of the data in question, the map's pins were divided into sub-sections for communication and research reasons. Firstly, two large datasets were created: one corresponding to the existing and active ski areas and the other representing the existing but inactive or abandoned ones. Each of these two sets of geographical coordinates was, in turn, divided into 21 sub-areas, i.e. by regions of Italy. By doing this, considering the high degree of multilevel diversity between one Italian region and another [16], it was also possible to visualise the different distribution of ski facilities according to region.

Regarding the two-group classification, the mapping criteria must be specified to understand why a location is considered in one group, the other, or none. The limitations of the interpretation criteria may emerge when looking for a definition of 'open', 'abandoned', or 'closed'. In such a case, the interpretation may seem blurred when applied to a variable context, like seasonal openings.

In the case of open facilities, references are made to complex ski areas grouped under a general name, such as location and pin. Under one pin, there might be multiple chair lifts or cablecars, depending on the area's infrastructuralisation. The name refers to the generally called location (e.g. the ski area of Foppolo has multiple chair-lifts, but just one pin is shown).

On the other hand, in the case of abandoned or closed lifts, the pin represents only single or multiple lifts that are not affiliated with other lifts that are still active are included. Therefore, it is important to note that ski lifts or chairlifts that have been closed, perhaps due to lack of snow or limited altitude, are not included in the mapping of abandoned or closed lifts if they belong to a larger area that is still functioning, that therefore could be listed under a pin in the map of the still open ones.. This methodology may not accurately reflect the presence of lifts no longer in operation within active ski areas but it was the best that could have been done with the time and resources given. Moreover, fieldwork investigation, walkscapes and Photoscape experiences, together with satellite top-views and further blog research, confirm that several closed plants may be under the jurisdiction of other still operating districts or that could have been bought and implemented by bigger ski areas to enlarge their ski area [7]. All these considerations support the difficulty of finding specific and clear data within the Italian ski areas.

1.1.2 Geo-Referenced Mapping Sources

The data required for mapping ski facilities was gathered through various channels, constituting a mix of sources across multiple platforms. This diverse dataset includes information on both active and inactive plants. It is essential to distinguish between data related to active lifts, which are readily available due to the direct interest of ski resorts and tourism offices, and data concerning abandoned or temporary-closed ski plants, which is often less known, even among regional mobility and tourism offices. This separation is crucial for a comprehensive understanding of ski facility infrastructure, especially considering the limited awareness surrounding inactive lifts within regional authorities and little management and investments for their re-naturalization.

For this reason, forms of citizen activism, personal contributions, and partial censuses from people interested in the topic or participants in activist movements had to be used to map the inactive section of ski-plants.

This glaring lack of data in the regional archives concerning disused facilities highlighted an underlying problem in their management: the lack of transparency, attention and post-use protection, and, as said, the lack of attention to dismantling and natural regeneration of the areas affected by disuse. If something is not documented or discussed, it is difficult to affect future decision-making.

As said before, the data inherent to non-active plants came from various sources, including personal testimonies, forums and dedicated websites documenting the state of disused ski areas. The most consulted blog was a website called www.skiforum.it [15]. On this amatorial ski-fan-based online platform, users have been tracking several disused facilities in the Alps and Apennines for years through memories, historic photo sharing, and online discussion with data from all over Italy. These first-hand experiences and observations have provided valuable insights into these abandoned areas' locations, history, and status. Complementing the data from the online blogs, official reports such as Legambiente's 'Neve Diversa' [13, 14] and other reports from previous censuses by associations such as Mountain Wilderness [17] offered further authoritative help in mapping and raising awareness of the current state of the problem. Beyond the non-active areas, the reports provided extensive data also on the second layer of mapping, meaning those still in operation and others referred to as 'cases of therapeutic obstinacy' [13, 14], which means ski plants in which the money input overflows the seasonal income wisely.

1.1.3 Geo-Referenced Mapping Process

The project began by acknowledging the necessity of systematically incorporating numerous location points into a map. Following this, a strategic decision was made to divide active and abandoned ski facility layers into 21 distinct regional sub-divisions. This segmentation was essential to avoid logistical challenges and maintain organisational coherence when mapping the pins within a broader geographical context. The first layer of pins made was the one regarding the closed areas, followed, just later, by the one of the existing and active ones. The process started, therefore, with gathering data regarding abandoned and closed ski areas and triangulating data from citizen science approaches by one specific online blog and three papers by Legambiente and Mountain Wilderness [17]. The mapping started on Google Earth, which made it possible, together

with the pinning, to analyse the territory and relative modifications and peculiarities of different abandoned ski areas from a top-view visual perspective. Therefore, the abandoned and active ski plants have been mapped in Google Earth, region after region, and shaped into a KML File. upon generating the KML file in Google Earth, the objective was to render the project accessible and shareable to the public via an open-access, browser-searchable map. However, during the upload of the pins on Google Maps, a significant obstacle was encountered, stemming from the limitations of My Maps, a platform within the Google ecosystem. Importing the KML file from Google Earth into My Maps posed a challenge due to restrictions on the number of points allowed for importation. consequently, in light of the extensive point data in both maps, it became necessary to create two partial maps. Notably, these partial maps exhibited a notable dearth of points, particularly about Southern Italy. A hypothetical methodology involving the sequential selection of points based on their chronological order of insertion was adopted regarding the arrangement of points on My Maps. Consequently, points originating from northern regions, being inserted first, were prioritised, while pins corresponding to southern regions, inserted subsequently, were excluded from the final presentation. At the same time as fixing the points on the map, an analysis of the location was carried out in parallel, employing bird flights and screenshots. This was mainly made possible by using Google Earth, which is integrated into the software, among others, photography, terrain analysis, and measurement commands.

1.2 Results

The mapping offers an insightful overview of downhill skiing in Italy, highlighting its widespread presence across the Alpine and Apennine regions. Notably, the sport's diffusion extends even to areas typically associated with maritime and summery activities, such as Sardinia and Sicily. This geographically comprehensive perspective provided by the mapping serves as crucial support for a narrative that often relies on complex scientific data, facilitating comprehension for a diverse audience.

The comparison between the general mapping of skiing facilities and aerial photos from Google Earth reveals distinct patterns within each location, particularly in active areas. These patterns include corridors dedicated to slopes, water reservoirs, artificial snow structures, ropeways, and a dense array of public and private reception facilities such as Airbnb, hotels, holiday homes, bed and breakfasts, winter sports shops, rentals, and restaurants. These features are typical of ski areas [7], and if compared between high-season and low-season periods, they express with critical precision how these locations have evolved towards the expression of what Marc Augée defines as 'non-places' [18], further interpretable as transitional landscapes. One evidence of this is the label 'temporarily closed' showing in every third sector service based in this area for two months before and after winter, representing the low season (Fig. 7, 8, 9, and 10).

1.3 Evaluation

The mapping process constituted a segment of a broader research endeavour, limiting the time available for its execution and preventing a thorough exploration of the complexities involved. Therefore, the maps offer a previously lacking general overview, serving as a

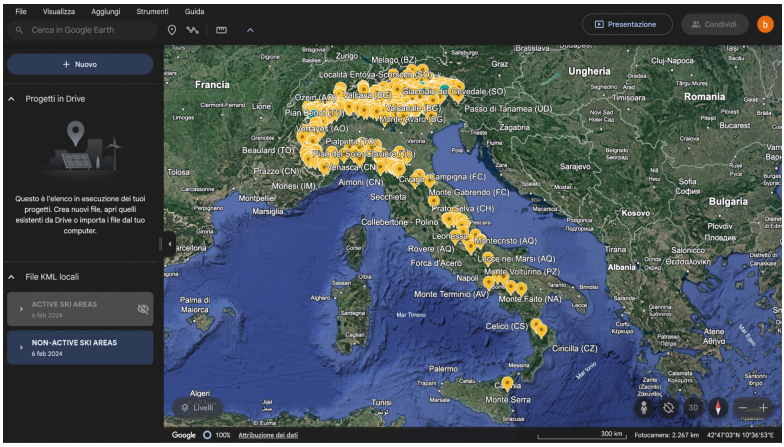


Fig. 7. Sneakpic of the mapped Abandoned Ski Areas in Italy on Google Earth (complete). Every pin is linked to the province to which it belongs. MyMaps version (incomplete due to the software's limited number of pins) is accessible here Non-Active Ski Areas, Italy (Mapped 2023).

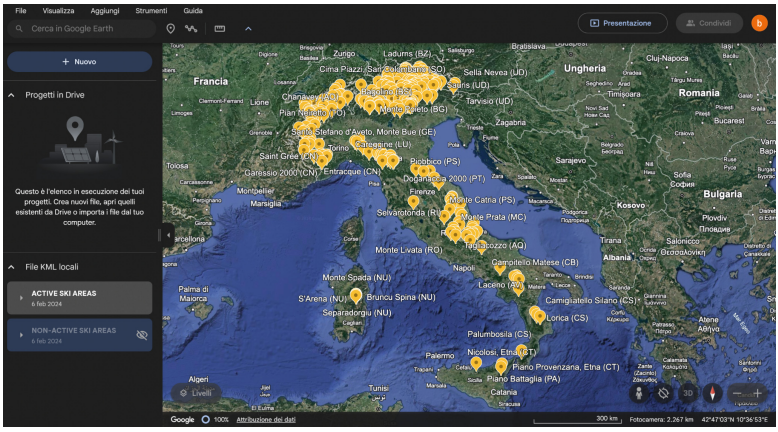


Fig. 8. Sneakpic of the mapped Active Ski Areas in Italy in Google Earth (complete). Every pin is linked to the province to which it belongs. The MyMaps version (incomplete due to the software's limited number of pins) is accessible here: Active Ski Areas, Italy (Mapped 2023).

foundation for interpreting a more intricate and non-visual dataset encompassed in the overall research.

Reading the results in this light, the primary objective - to make a more complex search visually comprehensible - has been achieved. Given the semi-collective nature inherent in the delineation of 'abandoned' sections within the mapping, it is underscored that the representation provided is not entirely exhaustive. This limitation arises from the dearth of comprehensive data sources, save for a handful of dated censuses with a degree of official vagueness.

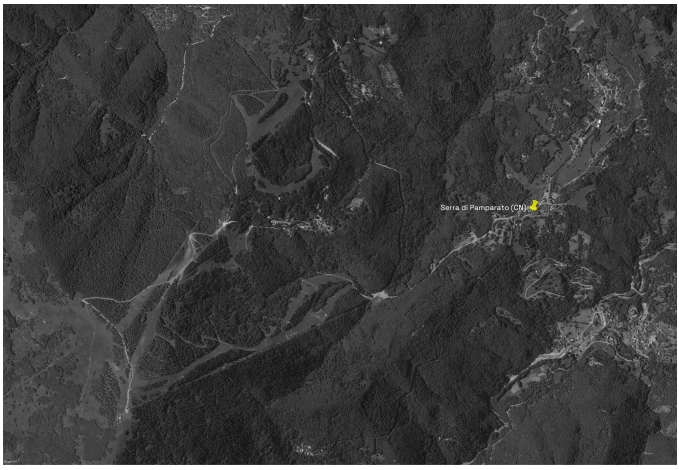


Fig. 9. Example of one of Google Earth's top views of the active ski areas representing Arabba's Ski Area (BL), Veneto, Italy. The intense use of artificial snow and the linked artificial reservoirs are highly visible.



Fig. 10. Example of one of Google Earth's top views of the non-active ski areas representing Serra di Pamparato (CN), Piedmont, Italy. The intense territorial modification the persistence of compacted snow on soil and artificial snow is still very visible even after the closure of the ski plant.

The dissemination and documentation of such locations are largely contingent upon voluntary and sporadic contributions, reliant upon the engagement of specific individuals within particular locales. For instance, anecdotal transmission and oral tradition play a significant role in identifying numerous disused areas that may not be represented on the map. Additionally, certain decommissioned installations exhibit ambiguous associations with adjacent operational facilities, rendering it challenging to ascertain their alignment

with the mapping criteria established by the community discourse. It is imperative to highlight that, concerning abandoned installations, the mapping criterion adheres to the guidelines delineated within the Skiforum [15] sharing blog, owing to the exigencies and practicalities of incorporating highlighted locations. Nonetheless, a supplementary mapping initiative encompassing all stationary installations, including those affiliated with parent facilities and consequently omitted from the current map, would prove beneficial and pivotal in advancing research.

A more detailed and accurate mapping exercise, particularly regarding abandoned plants, could have been conducted with additional time and resources. Moreover, increased resources and time facilitated the involvement of a larger research team, allowing for a more comprehensive and precise system of data mapping and interpretation.

Another point to emphasise is how, during the research, due to ignorance resulting from lack of experience in the field of mapping or due to limitations attributable to the software used, problems were encountered that made the reception of data from an external audience complex. About this, it must be mentioned that going from a dataset of coordinates from Google Earth and wanting to insert it into a publicly usable map on MyMaps, a service also offered by Google, limits were encountered in the number of points that could be imported: the map published on MyMaps is therefore deprived of part of it. This mapping process, both in its source form and ultimately in its outcome, however exhaustive for the research that was carried out, confirms how such an exercise carried out collectively and especially with a pool of multi-practice experts would achieve much more complex and comprehensive results.

1.4 Possible Developments and Implementations

Since the mapping process took place in a short period, and because of the fast-moving opening and closing situation as a result of the uncertain and pessimistic climatic situation, it is certainly possible to improve the project by implementing the mapping with an automatic update system that adds or subtracts locations in real-time. However, this is considered a complex and, above all, not a short-term step since, as it is also a data triangulation job, this update would require linking the mapping to a database in which someone would report the status of the ski resorts or in which each resort could declare its status.

Given the difficulties encountered in data retrieval, this implementation option is currently immature. Therefore, a more precise, independent and non-automated mapping of the resorts would be more appropriate and a possible next step. In light of this, opening the research as a shared database for the public and local inhabitants would be a strategic choice. Once more precise data has been obtained, after automating the data collection mechanism and localities' status, a further step would be to subdivide localities by extension to highlight their impact on the territory, the economy, and the infrastructural aspect. Finally, in addition to the two sections of 'open' and 'closed', we would like to implement a third section, called 'new investments' to shed light on all those resorts that benefit from current public or private investments and use the money to create new facilities, finance new ski services and/or feed their interests.

This, despite the extreme difficulty of finding much data on the subject, would complete an important research cycle and provide additional and indispensable foundations for understanding the phenomenon. Therefore, adding a third section to the map is considered the most important implementation to go further with.

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