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Industrial Brownfield Sites in the Alps. A first Quantitative Overview and Potential Implications for Regional Development

Marcello Modica

AUTHOR'S NOTE

This article is part of an ongoing doctoral dissertation in landscape architecture and planning which investigates the concept of *Alpine Industrial Landscape* as both an analytical device for the codification of large brownfield sites in mountain settings and a strategic/operative framework for their future transformation. A core part of the research is the in-depth analysis of four case studies of transnational relevance in Italy (Lombardia), France (Isère), Switzerland (Valais/Wallis) and Austria (Tirol).

Introduction

The misleading perception of the Alps as a predominantly rural and recreational region often leads to consider the phenomenon of land abandonment only in relation to agriculture and tourism, although the same also affects, to a greater extent, the urbanized landscape of main valleys and foothills. In this context, little relevance seems to be given, in particular, to industrial brownfield sites as result of large-scale deindustrialization processes (Smets, 1990; Grimski and Ferber, 2001; Berger, 2006). According to the European Concerted Action on Brownfields and Economic Regeneration Network¹ (CABERNET), brownfield sites can be defined as “derelict or underused [...] sites that have been affected by the former [industrial] uses of the site and surrounding land; may have real or perceived contamination problems; are mainly [found] in developed

urban areas; and require intervention to bring them back to beneficial use” (Oliver *et al.*, 2005). Major economic structural changes such as the end of mass production and its replacement with flexible specialization (Piore and Sabel, 1984), the rapid labour productivity growth in manufacturing due to technological progress (Rowthorn and Ramaswamy, 1997) and the globalization of markets and trade (van Neuss, 2016) have provided, starting from the late 1970s and further by the end of the century, the framework conditions for the rise and diffusion of industrial brownfields in developed urban areas.

Whether perceived and interpreted as *terrain vague*², *drosscape*³ or *tiers paysage*⁴, industrial fallow land has become since then a major issue in urban restructuring programs and, accordingly, the test-bed for several architectural and planning strategies aiming to sustainable urban and regional development (Hauser, 2001; Franz *et al.*, 2006). The functional reconversion of vacant built structures inherited from the industrial past, also known as adaptive reuse, has become through the time a common and rather successful way to deal with several former industrial sites in old manufacturing cities and regions (Baum and Christiaanse, 2012). Driven by environmental consciousness and strong ecological thinking, the transformation of heavy industrial sites and polluted wastelands in post-industrial landscape parks has also been adopted in several contexts, especially in ambitious, large scale restructuring programs of former industrial regions (Latz, 2001; Braae, 2015). In recent times of economic crisis, noticeable bottom-up, flexible and low-cost solutions for the cultural re-appropriation of derelict industrial spaces have also emerged under the concept of “temporary reuse” (Oswalt *et al.*, 2013).

Similarly to other traditionally peripheral regions in Europe, the Alps have been only marginally touched by such developments.⁵ A possible explanation of that can be related to the fact that industrial decline has manifested here with less evidence and most of all with considerable delay in comparison to the surrounding lowlands. Between 1975 and 2000 the employment rate in the secondary sector has shifted from 50% to 36% in Alpine regions⁶ and from 41% to 20% in Alpine countries entirely considered, i.e. France, Italy, Switzerland, Austria, Germany and Slovenia (sources: Alpine Convention, OECD, FSO-Federal Statistics Office). Alpine regions experienced in this phase a more restrained decrease of manufacturing jobs (-14) compared to national averages (-21), revealing therefore a still stronger presence of industry in the regional economy – although with significant local variations. In the following period 2001-2016, however, while at the national level the decrease of employment in industry has almost flattened, reaching an average of 18% (-2), in Alpine regions it has proceeded at the same intensity of the previous phase, reaching 23% (-13) (sources: European Commission, OECD, FSO-Federal Statistics Office). The economic crisis of 2008 has certainly contributed to this late speedup of Alpine deindustrialization, as suggested by the fact that the still strongly industrial sub-regions – the Alpine borders and the southeastern rim – are those which have recorded the worst post-crisis performances (Brozzi *et al.*, 2015).

Given this scenario, the sustainable management of industrial brownfield sites is expected to become increasingly relevant in the future development of the Alpine region, especially in connection to land use optimization and socio-economic well-being. A deeper understanding of former industrial sites in mountain contexts is therefore needed to be developed, starting from a realistic and updated quantification and then through the identification of potential context-related strategies for their transformation and recycling. This article intends to contribute to such a wide research objective by

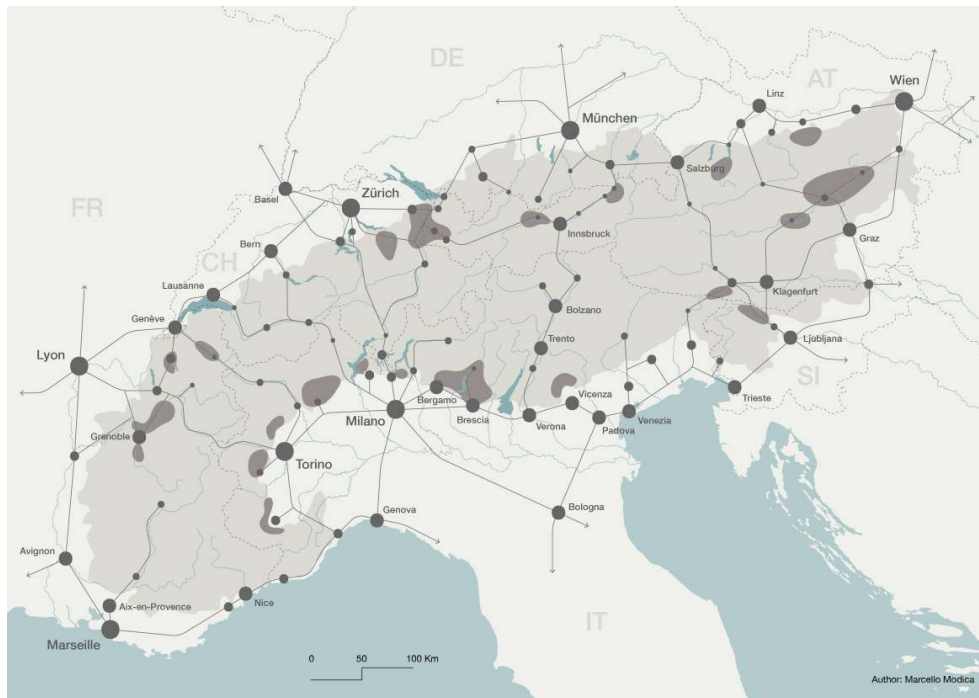
presenting the first results of a macro-regional survey of Alpine industrial brownfield sites, and discussing them in the light of past Alpine industrialization and, especially, in relation to future perspectives on regional development in mountain areas.

The origin of brownfields: a brief evolutionary overview of Alpine industry

Although the process of industrialization of the Alps has been largely influenced in space and time by national and regional context-specific socioeconomic dynamics, a common trajectory can be identified according to four main cycles of industrial development between roughly the half of XIX century and the beginning of the XXI century. In such a time frame, the establishment, growth and decline of Alpine industry have usually assumed the typical traits of exogenous development, that is, determined by external or extra-Alpine economic conditions – the source of capitals, technologies and production paradigms, as well as the location of decision-making centers and end-markets (Raffestin and Crivelli, 1988; Gebhardt, 1990a). This has not prevented, however, a certain self-adaptation of industrial activities to the specificity of the mountain environment. In some cases, the latter has even fostered the establishment of strong cultural and territorial relationships able to survive long after the end of industrial activities (Lorenzetti and Valsangiacomo, 2016).

In the first phase of industrialization (1850-1880), an increasing spatial concentration of modern industrial activities takes place according to the joint action of two main processes. On the one hand, the gradual introduction in the Alps of new technical and manufacturing systems deeply transforms the existing production activities, while ensuring their survival only in those locations characterized by relevant production advantages (Crivelli, 1998). This is the case of ferrous metallurgy – which is forced to concentrate nearby the largest ore deposits to compensate the transition from charcoal to coke as fuel – and textile production – which evolves from household activity to industry, thus moving from the hillside to lower areas richer of easily usable water sources. At the same time, the rapid expansion of the railway and the resulting new Alpine geography of trades and transports cause a significant spatial reorganization of all manufacturing activities. The need to link production sites to the railway network foster a sort of “inner delocalization” of industry, in which the birthplaces in side valleys or remote areas are abandoned in favor of main transit corridors and large valleys. In this way, the first industrial regions of the Alps are gradually set up (Fig. 1) in Austria (Eisenerz and Mur-Mürz valley in Upper Styria), Switzerland (Glarus and the Rhine valley between St. Gallen and Vorarlberg), France (the Grésivaudan and side valleys) and Italy (Turin, Biella, Bergamo and Brescia valleys).

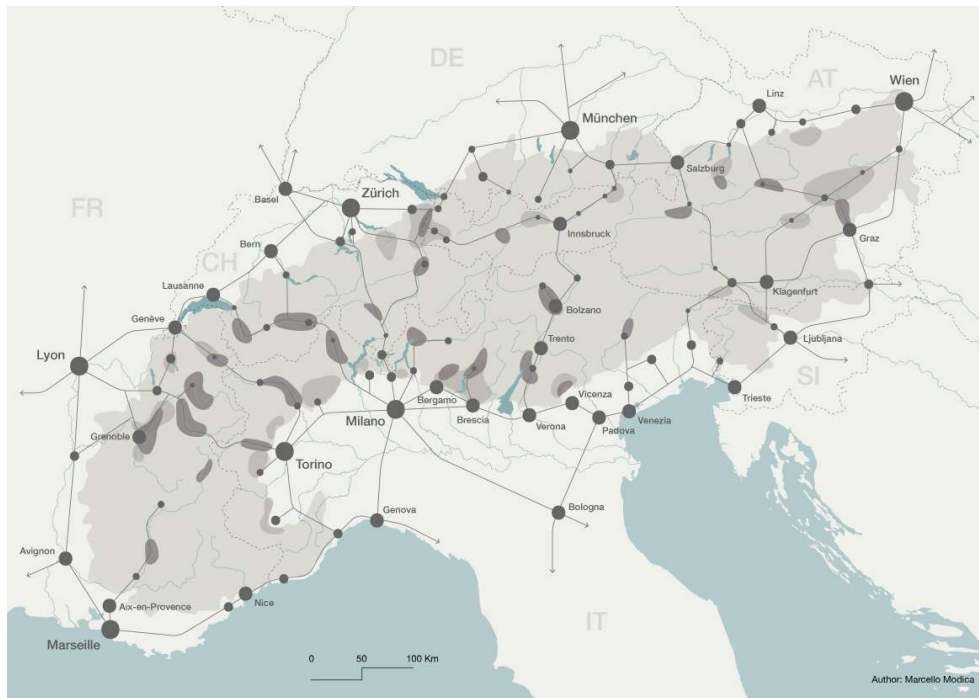
Figure 1. Alpine industrialization in 1850-1880



Author: Marcello Modica.

The second phase (1880-1960) coincides with the large-scale exploitation of the Alpine hydroelectric potential. Although locally-produced hydropower is largely drained by extra-Alpine cities and their industries, it also fosters the development, in the Alps, of new heavy industries in growing sectors such as electrometallurgy and electrochemistry (Veyret and Veyret, 1970; Bonoldi and Leonardi, 2004). Through a process of highly selective localization, which favors the proximity to hydropower generation sites, traditionally rural areas are also and for the first time involved in larger industrialization process (Fig. 2). This is the case of several inner valleys in the Western Alps, often acting as transnational transit corridors, such as the Rhone valley (Valais), the Maurienne and Tarentaise (Savoie), the Durance valley (Haute-Provence), the Aosta and Ossola valleys (Piedmont). More traditional industries such as textile and paper industry also profit from hydropower sources, but are indeed the energy-intensive industries of metal smelting and bulk chemistry that register a major growth – especially in the interwar period, due to the national strategic relevance of related productions. In the 1960s Alpine hydropower begins to suffer from the increasingly competition of fossil fuels (oil, gas) and nuclear power. The natural variability of water supply, the improvement of long-distance energy transport and the nationalization of the energy market (occurred in most of the Alpine countries at that time) contribute to make most of the hydropower-based heavy industries soon obsolete and unprofitable (Veyret and Veyret, 1970). The increasing independence from raw materials – now mobilized on long distances – and the downfall of railway transport due to mass motorization push this process even further.

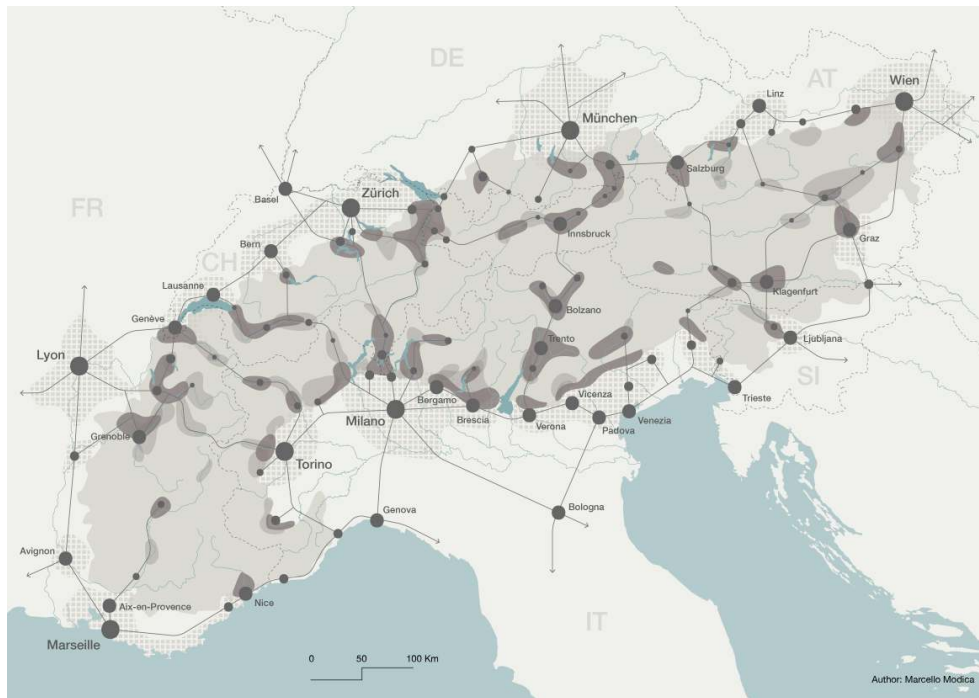
Figure 2. Alpine industrialization in 1880-1960



Author: Marcello Modica.

The third phase (1960-1980) is characterized by the rapid and widespread development of light industry in low added value sectors (mechanics, electric appliances, apparels and food), a process which mainly occurs in form of branch-plant industrialization and industrial districts. In the first case, the opening of branch plants (i.e. secondary production sites without management and R&D departments) by foreign (or national but extra-Alpine) companies is promoted and encouraged in low-cost labour areas and border regions, such as South Tyrol, Ticino and Valais (Gebhardt, 1990b). In the case of industrial districts, it is instead the private initiative of local entrepreneurs that allows the creation, in traditionally manufacturing regions, of functional networks of highly specialized small and medium-sized enterprises (Fortis, 1999; Becattini *et al.*, 2009). Significant clustering processes occur starting from the early 1970s along the southern Alpine rim in Italy (Lombardia, Veneto, Friuli, Trentino) and Switzerland (Ticino), but also in Vorarlberg and North Tyrol. A common feature of both branch-plant and district-based light industry is the strong functional link to road networks rather than railways, due to a smaller production scale and more flexible processing times. This new type of industry tends therefore to locate in most accessible areas such as the prealpine fringe or along the main transalpine motorway corridors (Fig. 3), thus avoiding the inner areas of previous industrialization.

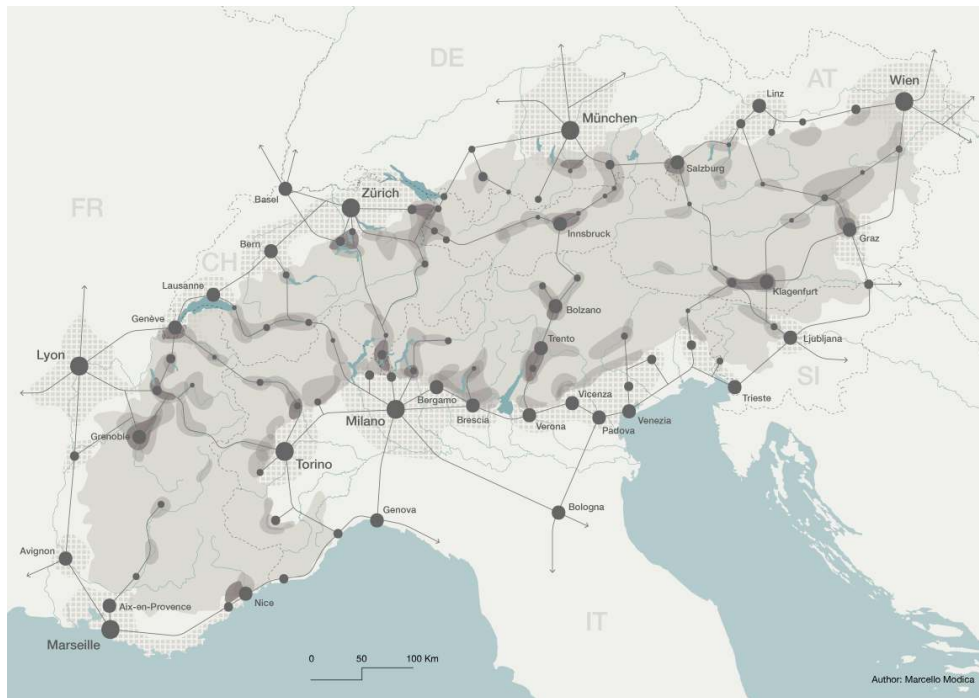
Figure 3. Alpine industrialization in 1960-1980



Author: Marcello Modica.

The fourth and current phase (post 1980) is strongly characterized by a marked shift from industry to the service sector, as a consequence of the increasing economic and functional integration of the Alps with the surrounding metropolitan areas and the global networks. In this context, Alpine cities and urban agglomerations gain a new centrality in the regional development process as catalysts of high added value activities (Perlik and Messerli, 2004; Perlik, 2007). Among these there are advanced industries in sectors such as nanotech, mechatronics, ICT, biotech and greentech, which mainly develop within innovative milieus proper of the cognitive-cultural economy. Basic preconditions for the latter are the functional symbiosis and spatial proximity of knowledge-generation (universities, research centers) and knowledge-transfer (business incubator, science and technology parks) institutions, which can only be found in the largest Alpine urban agglomerations (Bartaletti, 2011). Not by chance, these "Alpine Silicon Valleys" are located in and around Nice, Grenoble-Chambéry, Lucerne, St. Gallen-Bregenz, Lugano, Trento-Rovereto, Bolzano/Bozen, Innsbruck and Klagenfurt-Villach (Fig. 4).

Figure 4. Alpine industrialization post-1980



Author: Marcello Modica.

In the meantime, in the industrial districts of the previous phase the number of small supplier companies decreases in favor of the growth of a few leading enterprises, to which technological progress and district internationalization are entrusted (De Marchi and Grandinetti, 2012). In the case of branch-industry plants, structural decline is prevented only in those contexts where the establishment of a good education and training system allows the functional reconversion of small-scale and low-added value manufacturing activities. Differently, labour and energy-intensive industry developed between the first and the second wave of industrialization undergoes a progressive downsizing due to the fade-out of previous competitive advantages (raw materials, energy, location) and the change in the global pattern of accessibility, making useless and even counter-productive to be located in inner Alpine areas (Kopp, 1968/1969; Bätzing *et al.*, 2005). The survival of traditional heavy and manufacturing industry largely relies, in this last phase, on the capacity of developing an increasing specialization in high added-value sub-sectors, thus compensating the high production and transportation cost of Alpine locations.⁷ In general it can be seen however that, from the 1960s onwards, industry tends to leave the Alps and to concentrate, given a few exceptions (e.g. Brenner corridor), along the borders, within the area of influence of peri-Alpine metropolises (Gebhardt, 1990a).

The size of brownfields: Alpine industrial fallow land, identification and quantification

Currently, a realistic and comprehensive quantification of former industrial sites in the Alps does not exist yet. A few territorial surveys on brownfield sites are available at the

regional and national scale⁸, but their high heterogeneity in terms of geographic coverage, classification criteria and thematic focus (e.g. from polluted sites to vacant buildings) makes any comparison and synthesis hard to achieve, if not useless. In addition, since most of the surveys have been completed before 2010, the impact of the recent economic crisis in terms of site closures and decommissioning is inevitably ignored. Based on the diachronic analysis of Alpine industrialization, a first quantitative overview of Alpine industrial brownfield sites has been therefore developed in the framework of the present research. The survey has been focused on traditional labour and energy -intensive industry currently affected by deep structural changes, and specifically it has been conducted according to the following criteria:

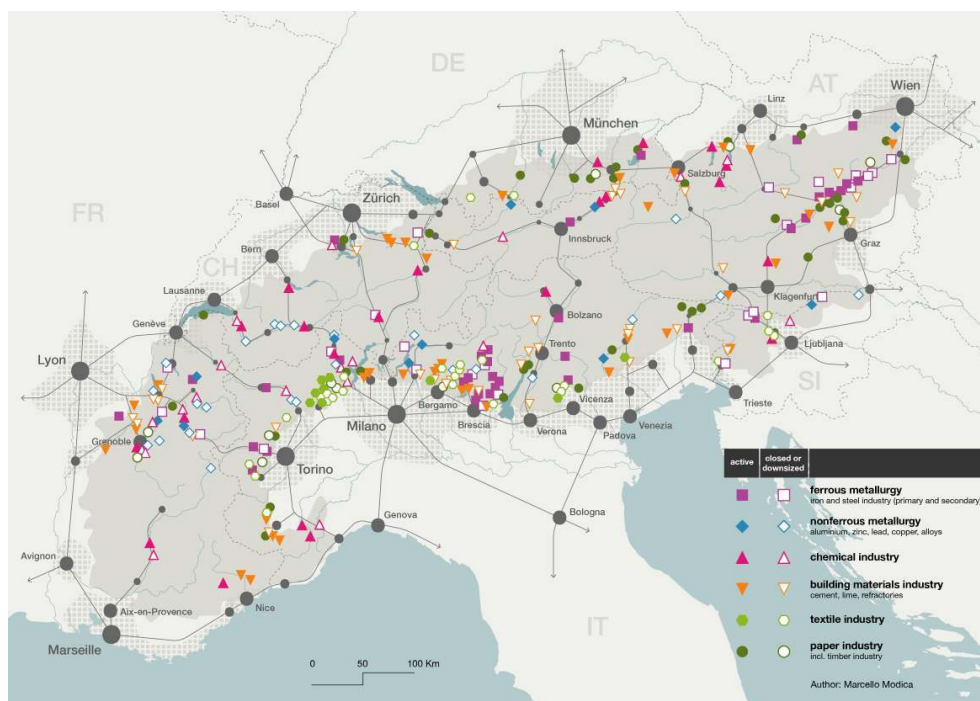
- **geographical coverage:** the area covered by the Alpine Convention, which roughly corresponds to the orographic boundaries of the Alps. In some cases, also part of the forelands have been included, especially where the origin of industrial sites is strongly related to the nearby mountains (e.g. Bavarian plateau south of Munich, Lombardian foothills between Varese and Brescia, Traunviertel south of Linz, etc.);
- **site typology:** heavy and manufacturing industry belonging to the earlier two phases of industrialization, i.e. established roughly between 1850 and 1960. In particular, the following industrial sectors (typologies) have been identified as key sub-categories: ferrous metallurgy (primary and secondary iron and steel industry), nonferrous metallurgy (aluminium, zinc, lead, copper and other metals smelting, including alloys), chemical industry (including to some extent petrochemical industry and pharmaceutical industry), building material industry (cement, lime and refractories), textile industry (primary processing only, no clothing/apparel), paper industry (including large-scale timber industry);
- **site size:** large industrial sites, covering a surface equal or above 50.000 m². Such a high threshold – especially for the Alpine context – allows to identify only those sites with a relevant spatial, environmental and socioeconomic impact in terms of decline, that is, with a significant transformation potential on the local and regional scale and thus with a greater influence on regional development;
- **site current status:** either active or closed/downsized sites. The grouping of closed sites (no more active) and downsized sites (partially still active, but highly reduced in size and function compared to the past) in a single category is motivated by the fact that industrial brownfield sites are generated in both cases – although in the second case these are usually limited in size and impact, at least until the definitive stop of existing activities. At the same time, the inclusion in the survey of still active sites with the same features allows to outline the potential extent of deindustrialization in the near future (anticipation and replication logic).

These criteria, and specifically the site size and the site typology, tend to exclude small-sized sites and those recently developed (post-1960). The firsts, which are very diffused in the Alps especially in relation to early forms of industrial activities (e.g. textile mills in Glarus and Biella), are usually subject to different reuse/recycling processes, which are in turn largely influenced by a stronger heritage-led perception and a higher economic feasibility of transformation (e.g. adaptive reuse of existing buildings). If we add the fact that in the Alps the average size of industrial sites is characterized by a huge gap between small/very small sites and large/medium-to-large sites⁹, it comes clear how reasonable is to focus on the second category if the spatial impact of deindustrialization is the issue under investigation. Industrial sites established after 1960 are also excluded from the survey, mainly because they belong to “newer” light industry sectors which differentiate

themselves from traditional heavy and manufacturing industry in terms of size, spatial and landscape impact and, most of all, decline/recycle dynamics (Lanzani *et al.*, 2013).

On the basis of the aforementioned criteria, the search, identification and classification of industrial sites have been developed by integrating information and data collected from different sources – such as existing literature on Alpine industry (see previous section), sectoral studies at the national and regional level, secondary sector statistics and company profiles/websites – with a virtual land survey on Google Earth. The latter has been chosen due to the high level of update of aerial photos covering the whole Alpine space (in some cases, national and regional data have been used too), the possibility to compare images from different years/decades and the option to easily add colored placemarks for immediate classification. In this way, a georeferenced database has been created, including the typology, name, size, status and municipality of each site.

Figure 5. Large industrial sites in the Alps



Author: Marcello Modica.

In total, 289 industrial sites with those characteristics have been identified across the whole Alpine arc (Fig. 5), of which 142 closed or downsized. Concerning the industrial sector, building material industry holds the largest share with 71 sites (of which 35 closed/downsized), followed by ferrous metallurgy with 60 sites (of which 26 closed/downsized), paper industry with 47 sites (of which 12 closed/downsized), chemical industry with 41 sites (of which 19 closed/downsized), nonferrous metallurgy with 35 sites (of which 24 closed/downsized) and textile industry with also 35 sites (of which 26 closed/downsized). The location in mountain areas seems to be still highly favorable for paper industry (including large-scale timber industry), which has indeed the lowest rate of closed/downsized sites. On the contrary, nonferrous metallurgy and textile industry are rapidly declining, having less than 1/3 of their respective sites still active. However, while most of the sites in nonferrous metallurgy are indeed downsized as result of sectoral restructuring (e.g. alloys and aluminum factories), in the case of textile

industry the majority of them are already definitively closed. In the remaining sectors, i.e. ferrous metallurgy, chemical industry and building material industry, the rate of closed/downsized sites is around 50%, in line with the Alpine average.

At country level, the distribution is rather unequal: Italy alone has 130 sites, followed at considerable distance by Austria with 69 and France with 43; in the back end, Switzerland with 21 and Germany and Slovenia with 13 sites each. The ratio between active and closed/downsized sites also varies from country to country. In Italy there are 63 closed/downsized sites (48% of the country's total), distributed throughout all the sectors with significant peaks in early established ones such as textile industry (Biella, Bergamo and Vicenza valleys) and cement industry (Lombardia, Veneto and Trentino). In France, the existing 29 closed/downsized sites (67%) are mostly belonging to former hydropower-based heavy industries such as chemical industry and electrometallurgy (ferrous and non ferrous), with a notable concentration in Isère and Savoie. In Austria the closed/downsized sites are 27 (39%), with a prevalence in ferrous metallurgy (Styria) and building material industry (cement industry in Tyrol and refractories in Styria). Switzerland has 10 closed/downsized sites (48%), with high shares of nonferrous metallurgy (aluminium industry in Valais) and some significant "spots" in other sectors (e.g. TAMOIL oil refinery in Collombey, Monteforno steelworks in Bodio, etc.). With only 3 closed/downsized sites on a total of 13, Germany shows the lowest rate of rundown sites – probably because the majority of them are located on the Bavarian Plateau, and thus benefiting from a better accessibility and proximity to well-developed urban centers. In Slovenia, 9 closed/downsized sites out of 13 have been identified in traditional industrial sectors strongly supported by the previous socialist state, i.e. steel industry and textile industry.

The future of brownfields: potential linkages between industrial site recycling and regional development

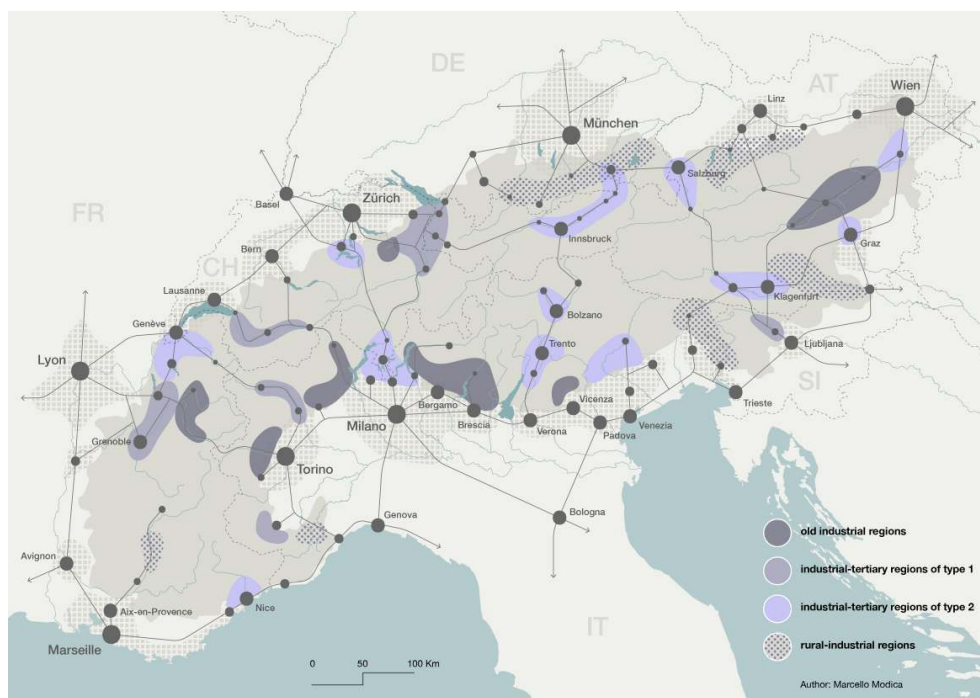
A step ahead of the identification and classification of large industrial sites is to understand, following a spatial aggregation logic, how the density of certain typologies of sites might be interpreted in terms of regional development potential. For this purpose, a contemporary industrial geography of the Alps has been outlined (Fig. 6) by comparing the spatial distribution of previously identified industrial sites with that of light industrial districts and innovation clusters (already described in the first section). Accordingly, four types of industrial regions can be identified:

- **old industrial regions**, characterized by a high density of industrial sites in traditionally mature and declining sectors (textile industry, former branches of electrometallurgy and electrochemistry, cement industry, etc.) and a substantial lack of more advanced industrial activities in leading sectors. The polycentric, scattered urban network of clear industrial matrix, i.e. developed in continuity with production sites and along water and railway infrastructures, resembles that of other European regions of early industrialization. Alpine old industrial regions can be found in inner Savoie (lower Tarentaise and Maurienne valleys), Piedmont (Turin valleys, Biella foothills and Ossola), Lombardy (Alto Lario and Bergamo-Brescia prealpine valleys) and Upper Styria (Mur-Mürz valley and Eisenerz Alps);
- **industrial-tertiary regions of type 1**, characterized by a significant presence of old industrial sites in traditional sectors (in sharp decline) as well as a high density of recently developed light industry clusters related to tertiary (tourism, services, logistics) and

quaternary (research and development) -based production cycles. Mostly found in Western Alps, these updated or “restructured” old industrial regions are the southern Sillon Alpin (Grenoble-Chambéry agglomeration), the Rhone valley from Visp to Lake Geneva, the Rhine valley between Chur and Bregenz and, on the Italian side, the mid-lower Aosta valley and the Cuneo region; to some extent, also the middle Sava valley in Slovenia might be included in this category;

- **industrial-tertiary regions of type 2**, characterized by a rather young and dynamic structure mostly developed after the 1960s-1970s (often as side-effect of peri-Alpine metropolisation processes), in which light industrial districts strongly connected to knowledge and innovation hubs largely exceed, by size and regional relevance, the few existing old industrial sites – usually with a good activity ratio. Advanced or new industrial regions of this kind are generally found in proximity or around major Alpine and peri-Alpine urban centers and agglomerations, such as those of Nice-Cannes, Annecy-Genève (and the Arve valley), Lucerne, Lugano-Bellinzona towards Varese-Como-Lecco (Insubria), Innsbruck (and the lower Inn valley), Bolzano-Merano, Trento-Rovereto, Belluno, Salzburg, Klagenfurt-Villach and Graz;
- **rural-industrial regions**, characterized by a limited presence of old, heavy industrial sites in predominantly rural contexts. Among rural-industrial regions of this type, which are mostly diffused in Eastern Alps, there are the Bavarian plateau between Munich agglomeration and the Bavarian Alps, the Salzkammergut-Traunviertel region between Salzburg and Linz, the Drava-Lavant valley between Klagenfurt and Maribor and the Friulian foothills. In the Western Alps, similar areas with lower territorial extension are the Moyenne-Durance and part of the Ligurian Alps between Cuneo and Savona.

Figure 6. Typologies of industrial regions in the Alps



Author: Marcello Modica.

In each of these regions, the role of large industrial sites in terms of transformation and recycling assumes a different dimension and weight, especially in relation to regional

development perspectives. Due to their weak economic monostructure based on declining industrial sectors, old industrial regions are expectably those where brownfields regeneration is assumed as a key priority. However, the impressive density of large and complex sites to deal with, a rather high administrative fragmentation (lack of major cities) and a generally low pressure for site reuse (due to out-migration and population decline too) make quite difficult to start and develop here an effective regeneration process. A potentially helpful approach might be to read and interpret the existing large industrial sites in a specific region (or valley) as one single territorial system, sharing therefore the same infrastructures (blue, green and grey), spatial structures (e.g. industry-driven urbanization) and of course socio-economic challenges and expectations. In this case, a strategic coordination at the regional level is an essential prerequisite to a successful large-scale transformation program, leading to a real and long-lasting economic restructuring and diversification.¹⁰ The strong attachment of local communities to industry (in terms of identity, employment and skills) makes the perspective of reindustrialization (or industrial renaissance¹¹) a desirable one, although the proper conditions for its realization (investors, knowledge generation and transfer institutions, etc.) are usually lacking in these contexts. At the same time, alternative pathways such as the touristic and cultural -oriented reuse of disused industrial sites, which might prove to be successful in mountain contexts due to potential linkages to unique landscape and environmental assets, are rarely explored. Positive experiences in this way are nevertheless being developed, for example, in the old textile district of Biella (Fondazione Sella¹² and Cittadellarte/Fondazione Pistoletto¹³) and in the former mining and steelmaking district of Eisenerz (Steirische Eisenstrasse¹⁴).

The situation is somewhat different in industrial-tertiary regions, where industrial decline is not perceived as such a problematic issue and thus brownfield regeneration is tackled in a more pragmatic, business-oriented way. This is the case, for example, of industry-tertiary regions of type 1, which are also faced with a significant amount of large disused industrial sites but, at the same time, can boast a developed and dynamic economic system as well as a significant population growth. In reason of their size, location and accessibility, large brownfield sites are usually perceived in these contexts as key land reserves for the regional industrial and productive system. This means that concrete strategies towards their redevelopment as future business and technology parks are prioritized, such as in the Canton Valais – where 7 key industrial sites, among which 3 former aluminium smelters, are identified as Pôles de développement économique (PDE) – and in the Communauté de communes du Grésivaudan – where relevant brownfield sites are converted in Zones d'activités intercommunales (ZA). In industrial-tertiary regions of type 2, the transformation of the few existing large industrial sites is strongly influenced by the location of the sites and, specifically, by their proximity to urban key services and regional transport-hubs. The sites located in major cities (e.g. Italcementi in Trento, Alumix in Bolzano) and relative agglomerations (e.g. Solvay in Hallein/Salzburg, Viscose Suisse in Emmen/Lucerne) are appealing for mixed-use inner urban development (e.g. former Michelin in Trento and Vetrotex in Chambéry), though the latter is not always easy to achieve. Those others who are located in peripheral areas (e.g. Zementwerk Eiberg in Schwoich/Kufstein, Faesite in Longarone/Belluno, etc.) are instead scarcely considered due to the impracticability/unprofitability of the aforementioned urban development – contributing therefore to the gradual transformation of the surroundings in *bedroom communities* of nearby Alpine urban agglomerations.

While the regional context provides, on the one hand, the framework conditions for the redevelopment of existing and future brownfield sites, their typological specificity allows, on the other hand, to define concrete strategies for the physical transformation. Extensive industrial sites connected or linked to railway lines and characterized by large-scale and flexible built structures such as steelworks and chemical plants (e.g. Monteforno/Bodio, Ascometal/Le Cheylas, etc.) usually offer the best conditions to implement a transport-oriented reuse (logistic platforms, intermodal hubs, etc.). Old water-based industries such as textile and paper mills, often characterized by notable architecture and relevant networks of blue infrastructures, can instead provide resources to an alternative touristic development strongly connected to industrial cultural landscapes (e.g. Biella and Glarus textile heritage trails, but also less prominent cases in Bergamo valleys or Gorenjska). Again, mining-related industries such as cement factories (e.g. Italcementi/Borgo San Dalmazzo, Ciment Vicat/Voreppe, etc.) have their potential in the related extensive landscape transformation (quarries, open-cast mines), which might be easily turned, through renaturalization, into new and valuable ecosystem services. In general, industrial brownfield sites can be positively and constructively interpreted, in the Alpine context, as territorial infrastructures rather than simply vacant land. In this perspective, it seems reasonable and useful to test and further develop the integration between typology-based criteria (spatial and landscape structure) and regional development framework conditions (economic, social and ecologic pressure on site transformation).

Conclusions

Since a few decades the Alpine region is undergoing a process of economic restructuring which involves the decline of traditional heavy and manufacturing industry. This process is occurring however with less evidence and most of all with considerable delay in comparison to the surrounding lowlands. Despite a significant, widespread and growing presence of large disused industrial sites, industrial fallow land is scarcely perceived, in this specific context, as a major issue in economic, sociologic and environmental terms. Extremely diverse by historical background, productive typology and spatial structure, these sites are however united by the fact that their future transformation is able, to a varying extent, to influence and even determine local and regional development perspectives.

The concentration of large industrial sites in “sensible” areas of the Alpine space such as the borders (mountain-lowland interface) and the main valleys (transit corridors) suggests to consider their recycling and redevelopment in a broader perspective, that is, to relate them to macro-regional development tendencies and their spatial manifestations (YEAN, 2005; Borsdorf, 2010; Perlik, 2010; Diamantini, 2014). Further research questions should be therefore addressed to deepening the link between mountain brownfield site typologies (forms, features, territorial impact) and regional development framework conditions and, accordingly, to identify and test potential context-based transformation strategies.

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NOTES

1. Expert multidisciplinary European Network (2002 - 2005) funded under the European Commission 5th Research Framework Programme.
2. (Solà-Morales Rubió, 1995)
3. (Berger, 2006)
4. (Clément, 2004)
5. A few significant brownfield redevelopment experiences, mostly focused on the cultural-led reuse of small-sized industrial sites, can be however also spotted here: Centrale Fies, Dro/IT (<http://www.centralefies.it>); La Fabbrica del Cioccolato, Blenio/CH (<https://www.lafabbricadelcioccolato.ch>); Sass Muss, Sospirolo/IT (<http://www.dolomiticontemporanee.net>); PIR-Centro 3T, Sellero/IT (<http://www.postindustriale.it>); Percorso del Cemento/ex SACEBA, Morbio Inferiore/CH (<http://www.percorsodelcemento.ch>).
6. NUTS 2 and NUTS 3 within (or, in a few cases, along) the perimeter of the Alpine Convention.
7. This is the case, for example, of chemical industry, which almost everywhere in the Alps shifts with success from bulk chemicals to intermediates, pharmaceuticals and biochemistry.
8. MTES/F 1998, Umweltbundesamt/A 2004/2008, USI/CH 2007, Regione Lombardia/I 2008-2010, ARE/CH 2008, Kanton Glarus/CH 2013.
9. This because the constraints of the Alpine environment (space, resources, accessibility, etc.) have driven industry to pursue a high spatial concentration of activities to reach a good level of efficiency and productivity – essential for most of the traditional heavy and manufacturing industries here developed.
10. A good conceptual reference for that might be the piloting experience of the IBA Emscher Park (1989-99), in the former heavy industry region of the Ruhrgebiet, Germany.
11. Cf. European Commission, Communication “*For a European Industrial Renaissance*” (2014), available at: https://ec.europa.eu/growth/industry/policy/renaissance_en
12. <http://www.fondazioneella.org>
13. <http://www.cittadellarte.it>
14. <http://www.steirische-eisenstrasse.at>

ABSTRACTS

Since a few decades the Alpine region is undergoing a process of economic restructuring which involves the decline of traditional heavy and manufacturing industry. This process is occurring however with less evidence and most of all with considerable delay in comparison to the surrounding lowlands. Accordingly, the management of industrial brownfield sites is expected to become increasingly relevant in the future development of the Alpine region, especially in connection to land use optimization and socio-economic well-being. This contribution intends to

raise the attention on the issue of industrial fallow land in mountain areas by presenting and discussing the first results of a macro-regional quantitative survey of industrial brownfields in the Alps.

INDEX

Keywords: Alpine industry, industrial brownfield sites, mountain regional development

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