

DRIVE FOR COMMERCIAL DESERTIFICATION IN MOUNTAIN AREAS: EVIDENCE FROM THE PROVINCE OF SONDRIO (ITALY), 2010–2022

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ABSTRACT: The availability of an adequate network of services of general interest (SGI) is a major issue for the vitality of rural areas, which is very much on the political agendas of different governmental levels. This is also true for the narrow field of food retailing, which is the subject of this paper. Here we focus on the provision of commercial services in the province of Sondrio, a small stretch of land in the Alps on the border between Italy and Switzerland. This paper investigates the rearrangement of the provincial distribution system between 2010 and 2022, focusing on the dynamics of food retail density in terms of shops and available floor area with respect to the resident population. What emerges is a progressive commercial rarefaction that plays a role in reshaping the relationship between the populations of built-up areas at different altitudes and leads to a sharp increase in instances of under-provision and commercial desertification in the strict sense. The way these critical situations affect the different municipalities depends on their individual position within their settlement networks, with residential municipalities being the most affected, even though they are not necessarily isolated or in remote locations. Retail dynamics in disadvantaged rural mountain areas must not be underestimated, as it also contributes to territorial cohesion.

KEYWORDS: services of general interest, food retail, commercial desertification, settlement networks, Alps

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Introduction

Compared to other developed economies, Italy is generally characterised by a more fragmented retail sector; however, this feature has decreased significantly since the 2000s. The advancement of high-volume retailers and e-commerce has pushed many small – and often independent – retailers out of the market, as they have been unable to cope with increased competition or intercept new consumer demand. Thus,

between 2000 and 2022, the density of the commercial selection decreased in terms of both the number of enterprises per 1000 inhabitants (from 10.2 to 7.5) and the number of shops per 1000 inhabitants (from 15.3 to 12.1) (ISTAT data, Annual Report). The victims of the increasing concentration of the distribution system are mainly small shops scattered in peripheral urban neighbourhoods and low-density settlements, which constitute an important service for less mobile segments of the population (Crowley, Stainback

2019). The more concentration grows, the more a few polarities impose themselves in retail landscapes, with city-centre high streets and large retail shops located in suburban areas playing a leading role (Gibbs 2012, Cirelli et al. 2021). With the outbreak of the COVID-19 pandemic, which required long lockdown periods and restricted individual freedoms, the importance of 'down-home' shops was rediscovered as one of the ingredients in the '15-minute city', which many experts believe to be a more sustainable model (Moreno et al. 2021, Zaheer et al. 2023). However, with the end of the health emergency, the erosion of commercial proximity continued apace. Confcommercio (2023) – the largest trade association in Italy – emphasises that commercial desertification is increasing, which is a major problem not only for businesses, but also for society as a whole, as it means fewer services for local communities along with less liveability and security. This is just the opposite of what was foreshadowed by Italian Legislative Decree 114/1998 which, while liberalising the distribution sector, aimed to protect small neighbourhood retailers, especially in fragile situations, through multi-purpose shops offering a mix of various services.

Commercial rarefaction is a major problem, not only in urban areas, but also in rural ones. In rural areas, the disappearance of shops is part of a broader process of downsizing services of general interest (SGI) that affects the vitality of local communities and fuels territorial gaps. Just like many other small things of everyday life, the value of shops is not only economic; they are places for socialising – 'third spaces' – and their presence influences individuals' decision to migrate or not (Karlsson 2012, Fertner et al. 2015, Cabras, Lau 2019).

Starting with this premise, this paper investigates the process of commercial retail rarefaction in the province of Sondrio, a small stretch of land in the Alps on the border between Italy and Switzerland. According to the OECD classification, it is a predominantly rural region covering an area of 3196 km², with approximately 179,000 inhabitants in 77 municipalities. This case study is interesting because it is located in Lombardy, a region where the distribution system is highly concentrated: in 2022 there were 8.3 sales points/1000 inhabitants, the lowest

ratio among Italian regions (ISTAT data, Annual Report). Another interesting element is that in the province of Sondrio, the spread of large-scale distribution – which is quite intense – began with endogenous initiatives, which is a peculiar situation, as rural areas are generally 'lands of conquest' for operators with non-local roots (Twardzik, Heffner 2019). In addition, Livigno, a well-known high-mountain tourism resort (1816 m a.s.l.), is a customs-free area, which affects the structure of commerce and relationships among towns at various distances.

We assess the development of trade density in relation to the resident population between 2010 and 2022. This is important for two reasons. First, in the food sector, a low density or a density that decreases significantly over time is a sign of a 'potential' food desert (Fulfrust, Howard 2006, Bilková et al. 2018), which should be investigated in more detail while considering individual perceptions (Shaw 2006). On the other hand, changes in the density of shops reflect the rearrangement of relations between the valley floor and high-mountain towns, as well as between the mountains and plains (Perlik et al. 2001, Dematteis, Corrado 2021). Large sales outlets on the valley floor provide consumption opportunities similar to those found in more urbanised areas. At the same time, however, they erode the supply system in high-mountain settlements. The problem is exacerbated in the food retail trade, which is an essential service for people to live in a place.

The objective of this research is twofold: (1) to identify situations where commercial provisions are rarefied and assess their dynamics in the 2010–2022 period and (2) to outline the profile of municipalities without commercial activities and with a low selection density – 'potential' food deserts (Fulfrust, Howard 2006) – considering a few indicators related to social and economic aspects and integration in settlement networks.

This paper is structured as follows. First, we reflect on the need for rural and mountain areas to retain a minimal fabric of SGI – including those related to retail – as a measure of sustainability and territorial cohesion. We then focus on the province of Sondrio. After recalling the methodological aspects of the research and the main features of this area, we analyse the evolution of the commercial network in the 2010–2022 period

and changing relationships between municipalities located at different altitudes. We also assess changes in the density of food retail options in relation to the population, looking for where the selection is rarefied or there is even commercial desertification in the strict sense. Finally, we analyse the profiles of municipalities in these critical situations.

Rural areas: Retail and other essential services

Supporting the vitality and viability of rural communities is one of the principles listed in the Cork 2.0 Declaration (2016) for inspiring an innovative, integrated and inclusive European rural policy. Priority actions in this regard include improving access to SGI, i.e. a wide range of public services or services provided by private entities that are of public interest and are essential for daily life and social inclusion (EC 2011). The retail sale of staple goods (foodstuffs, medicines, etc.) is an integral part of these services. The long-term strategy for rural areas, approved by the European Commission in 2021, also emphasises the importance of SGI: “retail, doctors, pharmacies, banks, post offices, public transport, childcare facilities and schools are essential to rural life and jobs, as well as to ensure no-one and no place is left behind” (EC 2021: 6).

Poor accessibility to these services is one of the factors exposing territories to the risk of becoming inner peripheries (ESPON 2017). Despite policy makers’ efforts, rural areas remain disadvantaged compared to urbanised areas in terms of the provision of SGI, with an often considerable gap that grows over time (Kompil et al. 2019). Low population density, scattered settlements and the shrinking of small local catchment areas due to depopulation are all factors that hinder the efficient provision of SGI in rural areas, thus limiting the quality of life of local communities (OECD 2010). In Italy, the problem lies at the heart of the National Strategy for Inner Areas (SNAI, *Strategia Nazionale per le Aree Interne*), which was launched in 2014 and financed again for the 2021–2027 period. The aim is to focus on remote areas and restore an adequate provision of public services (health, education and mobility) that underlie citizenship rights and which are seen as a prerequisite for curbing depopulation

and nurturing new place-based development (Cotella, Vitale Brovarone 2020, Lucatelli et al. 2022).

Even in the narrow field of retailing, it is clear that the rural environment has peculiar aspects that make it difficult for businesses to survive (Paddison, Calderwood 2007). The European Commission itself, in its decisive action to support the competitiveness of the retail sector, notes that the greatest challenges in rural areas are not fierce competition, lack of space or high immovable property revenues (EESC 2019), which all apply to urban contexts. Rather, the limited size of local markets – with a small and often shrinking consumer population – and complex, expensive logistics weigh heavily. This squeezes profitability margins for retailers. Tourist flows might boost turnover, but they are often concentrated seasonally in a few resorts.

As with other SGI, the disappearance of shops is detrimental to small rural communities. The desire to do things, to create income, employment and revenue for local governments is lost. Places that serve as valuable community hubs and vehicles for local culture, crafts and local products are also lost. However, the progressive erosion of commercial services is not experienced in the same way by the whole local population. It is a greater problem for elderly and less mobile people who are more dependent on the local supply system (Marshall et al. 2018, Verma, Taegen 2019). Highly mobile people, on the other hand, react by increasing outshopping practices during their daily commutes (Shannon 2016). This, however, compresses the turnover of businesses where they live, and contributes to further depleting commerce to the detriment of weaker populations.

In mountain areas, problems with accessing SGI tend to be exacerbated, as the complex orography leads to many scattered settlements and considerably larger distances to essential services (ESPON 2019). There is great concern about the impact of climate change in mountain areas, but ensuring a good provision of SGI continues to be one of the biggest issues for the future of these areas (Sikorski et al. 2023). This is, therefore, an essential factor in determining an ability to retain the native population as well as the ability to attract ‘new mountain dwellers by choice’, i.e. people from various social backgrounds who choose

to leave the chaotic metropolises in search of more sustainable lifestyles (Corrado et al. 2014).

Small mountain communities, however, generally rely on a lower service-to-population ratio than in the lowlands, especially for higher-ranking services (NORDREGIO 2004, ESPON 2018). Furthermore, there are major geographical imbalances, as services are concentrated in a few small and medium-sized towns mostly located in the valley floor and along the foothills (with respect to the Alps, see Di Gioia 2012, Bole et al. 2016, RSA 2022).

Rural and mountain areas are very much exposed to the risk of becoming food deserts owing to their structural features, especially when they fall within the radius of attraction of large commercial facilities (McEntee, Agyeman 2010, Twardzik, Heffner 2019, Neumeier, Kokorsch 2021, Trembošová et al. 2023). However, we should not generalise as rural areas are very diverse (OECD 2020) and paths of trade development depend on many factors, such as their remoteness in settlement networks, accessibility to large supply hubs and ability to attract various types of flows (labour, tourism), and these factors can be exploited by local retailers (Fertner et al. 2015, Szumilas, Pach 2021, Nilsson 2023).

New technologies may facilitate access to SGI in rural areas. In the past decade, there has been broad mobilisation in Europe and many developing countries in support of smart villages (Visvizi et al. 2019, Lakshmanan et al. 2021). This approach is important for keeping small mountain communities attractive and alive and creating mountain/plain exchange networks (SVP 2021). However, the persistent gap in digital infrastructure, use of new technologies and individual skills between rural and urban areas must be overcome.

Materials and methods

In contrast to the extensive literature on food deserts, which is based on assessing the accessibility of food outlets using different methods (Jaskiewicz et al. 2016), we consider the density of commercial supplies – in terms of shops and sales areas – in relation to the resident population. As Fulfroost and Howard (2006) point out, the use of density indices is useful in identifying areas with reduced food retail options. Such

areas are far more exposed to the risk of becoming food deserts, with important social and health implications.

To identify the sales activities in the province of Sondrio, we used data from the Lombardy Regional Trade Observatory referring to three types of commercial structures with size limits related to the demographic size of the municipalities:

- neighbourhood shops, with a surface area of up to 150 m² in municipalities with <10,000 inhabitants and up to 250 m² in municipalities with >10,000 inhabitants;
- medium-sized sales facilities, with a surface area between 150 m² and 1500 m² in municipalities with <10,000 inhabitants and between 250 m² and 2500 m² in municipalities with >10,000 inhabitants;
- large sales facilities, with a surface area >1500 m² in municipalities with <10,000 inhabitants and >2500 m² in municipalities with >10,000 inhabitants.

This classification is provided for by current commercial legislation (Italian Legislative Decree 114/1998), which also distinguishes just two product sectors: food and non-food. After selecting the data for the first sector, we calculated two indices of retail density for each municipality in the province of Sondrio at the end of the periods under examination (2010–2022):

Density index 1 (DI1) = shops / 1000 inhabitants

Density index 2 (DI2) = sales area in square metres / 1000 inhabitants

By comparing these data with data from the Lombardy Region, we identified municipalities with an over- and under-density of commercial activities. In particular, two groups of problem municipalities can be found: those with no commercial activities and those with low values for both density indices considered. As we will see, these are two particular situations within a broader case study.

We could have considered only the density of shops (DI1) similar to Bilková et al. (2018), for example, but in doing so, we would not have considered the different service capacities of the shops, which are related to their surface area, a fact captured by DI2.

The next step of the research concerned the profile of problem municipalities, which we outlined by analysing their insertion in settlement networks, their residential nature and the degree of mobility of the resident population. In addition, we considered the presence of certain local hardships – a large proportion of elderly people and scattered houses, a low density of cars and the absence of street markets. These are often considered priorities in Italian national and

regional calls for tenders in favour of mountain municipalities with a dearth of commercial activities (UNCCEM 2022).

Case study: General aspects

The province of Sondrio, on the border between Italy and Switzerland, consists of two main valleys with a different orographic pattern that has conditioned landscapes, activities

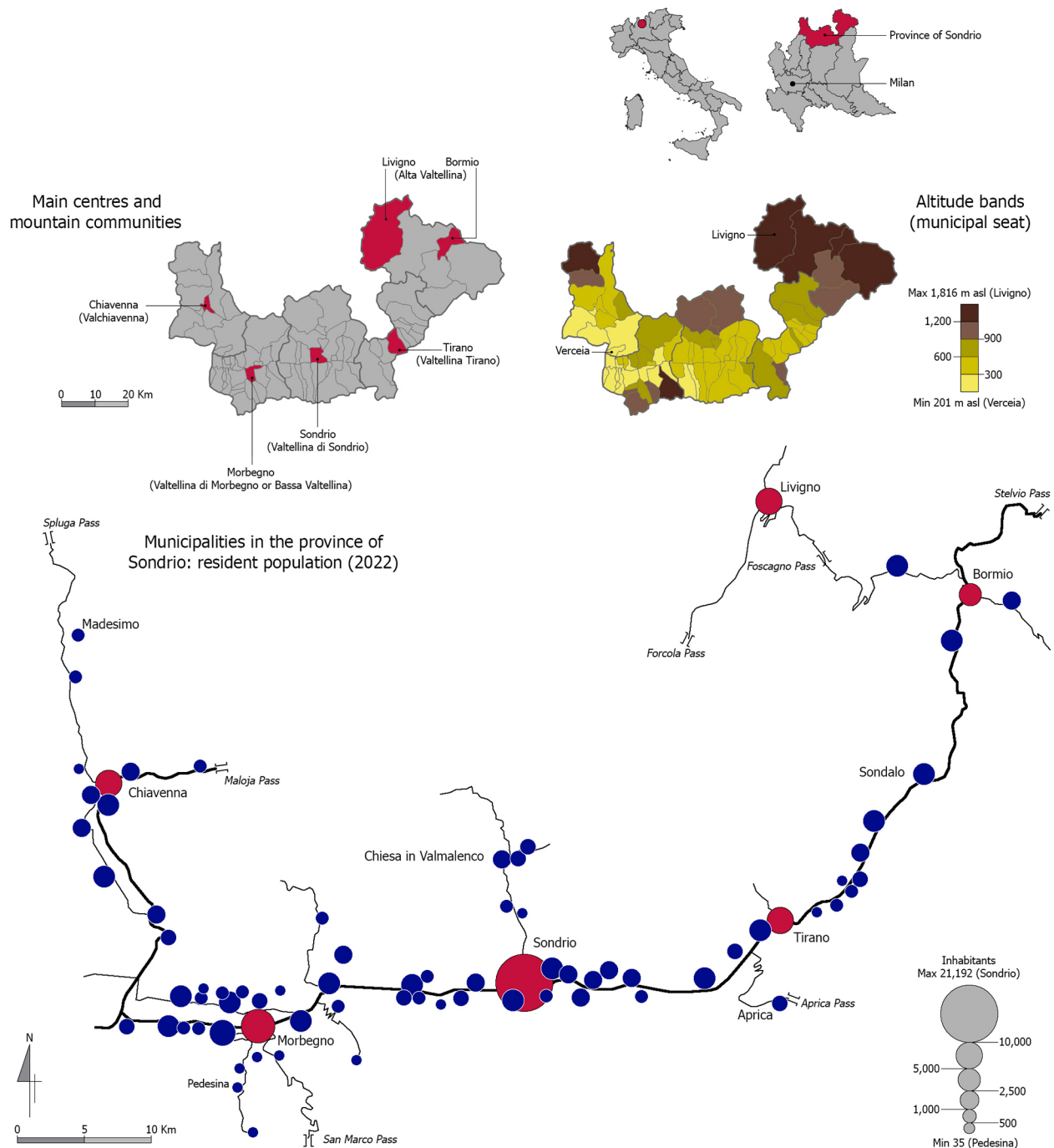


Fig. 1. Study area based on ISTAT data (population and households database).

and development (Fig. 1): Valtellina, with a primarily west-east orientation, and Valchiavenna, with a north-south orientation. As a whole, the province is enclosed by a ring of mountains separating it from neighbouring areas; it is a mountain among mountains, with no direct outlet to the plains. Despite this settlement pattern, it is not a marginal, isolated area. It actually forms part of a polycentric urban region tied to Milan (Dematteis 2009) and its fortune is owed to its privileged position along the trade routes that historically connected the Lombardy plain to Europe.

The province consists of 77 municipalities located between 201 m and 1816 m a.s.l.. These are mostly small towns, down to the limiting case of Pedesina, which, with only 35 inhabitants in 2022, was one of the smallest municipalities in Italy. Sondrio – the provincial capital – is the largest city (21,192 inhabitants in 2022), followed by Morbegno (12,227 inhabitants) and four other municipalities with 5000–10,000 inhabitants (Chiavenna, Cosio Valtellino, Livigno and Tirano).

The province of Sondrio is divided into five mountain communities with their respective main centres identified in the current Territorial Plan of the Lombardy Region: Valchiavenna (Chiavenna), Valtellina di Morbegno or Bassa Valtellina (Morbegno), Valtellina di Sondrio (Sondrio), Valtellina di Tirano (Tirano) and Alta Valtellina (Bormio and Livigno). The mountain community perimeter largely coincides with

that of the local labour systems, which identify the *de facto* cities generated by daily home-work commutes.

The massive urbanisation of the valley floor is an important issue in the area. A rather high-density linear city has now formed in Valtellina between Morbegno and Sondrio along the ‘Stelvio route’ (state road no 38). There are also areas with isolation issues: Valchiavenna and Alta Valtellina are included among the target areas of SNAI for 2014–2020 and 2021–2027.

The province of Sondrio has a strong tradition of tourism, but with flows concentrated in just a few resorts, particularly Livigno and Bormio (Alta Valtellina)¹.

Results

Redistribution of the population and economic activities

Between 2010 and 2022, the province of Sondrio lost 2836 inhabitants (–1.6%), a trend opposite to that of Lombardy as a whole (+2.8%: Table 1), opening a new phase. There has never been a shortage of municipalities experiencing depopulation, but since the post-war period, the

¹ Between 2010 and 2019, the province of Sondrio recorded an average annual value of 2,571,858 tourist stays in hotel and non-hotel facilities; 76.8% of the tourists were concentrated in Alta Valtellina (ISTAT data, tourism database).

Table 1. Resident population dynamics in the province of Sondrio, 2010–2022, based on ISTAT data (population and households database).

	No. of municipalities	Resident population				No. of growing municipalities 2010–2022
		No. 2022	Total (%)	Balance 2010–2022	Δ% 2010–2022	
Mountain communities						
Valchiavenna	12	24,440	13.7	–169	–0.7	4
Valtellina di Morbegno	25	47,112	26.4	840	1.8	12
Valtellina di Sondrio	22	54,323	30.4	–2780	–4.9	3
Valtellina di Tirano	12	27,952	15.6	–1226	–4.2	2
Alta Valtellina	6	24,957	13.9	499	2.0	3
Altitude bands						
Up to 300 m a.s.l.	19	50,137	28.0	1248	2.6	11
301–600 m a.s.l.	29	78,512	43.9	–2408	–3.0	7
601–900 m a.s.l.	13	16,594	9.3	–1156	–6.5	2
901–1200 m a.s.l.	10	15,382	8.6	–1244	–7.5	2
Over 1200 m a.s.l.	6	18,159	10.2	724	4.2	2
Total	77	178,784	100.0	–2836	–1.6	24

Table 2. Local units and employees in the province of Sondrio by altitude bands, 2011 and 2020, based on ISTAT data (statistical archive of active enterprises).

Altitude bands	Total economic activities (%)		Retail trade sector (%)	
	2011	2020	2011	2020
Local units				
Up to 300 m a.s.l.	25.8	25.9	23.9	25.0
301–600 m a.s.l.	44.3	43.2	42.8	41.0
601–900 m a.s.l.	6.8	6.5	6.7	6.3
901–1200 m a.s.l.	8.7	8.2	7.5	7.7
Over 1200 m a.s.l.	14.3	16.2	19.1	20.0
Employees				
Up to 300 m a.s.l.	28.8	30.4	26.0	29.7
301–600 m a.s.l.	40.6	42.2	39.7	39.6
601–900 m a.s.l.	5.9	5.7	5.0	4.4
901–1200 m a.s.l.	8.0	7.0	6.7	6.2
Over 1200 m a.s.l.	16.7	14.7	22.6	20.4
Total	100.0	100.0	100.0	100.0

province has consistently experienced population growth, albeit subdued compared to the lowland and foothill areas. In 2010, however, the picture began to change. Only Bassa Valtellina and Alta Valtellina gained inhabitants, maintaining the previous growth trend. The populations of the other three mountain communities decreased, most significantly in Valtellina di Sondrio (−4.9%) and Valtellina di Tirano (−4.2%). Of 77 municipalities, 53 have lost inhabitants and this process involves all main centres except Morbegno and Livigno (the latter holds the record for the highest population growth rate: +16.2%). Drives for re-centralisation have been imposed in each individual mountain community, as all the main centres have performed better than their surroundings (even where they lose inhabitants).

The strengthening of the valley floor – a long-term process with many negative consequences – has not stopped in recent years. Between 2010 and 2022, most municipalities in the 201–300 m a.s.l. range gained inhabitants, with a good increase overall (+2.6%). It is rare to find growth at higher altitudes. The picture grows increasingly problematic with altitude, and only >1200 m a.s.l. does the demographic dynamics become positive, although this is due to the presence of a few tourism resorts, with Livigno playing a leading role.

As with the population, the geographical re-distribution of jobs in the last decade has also developed in favour of further strengthening

low-lying municipalities (Table 2)². In 2011, municipalities <600 m a.s.l. accounted for 69.4% of total employment; nine years later, the figure had risen to 72.6% despite the difficult economic situation. This trend is also evident in retail trade³. In reality, the push is even more decisive in this sector, with significant strengthening of municipalities at lower altitudes to the detriment of the rest of the territory. The picture appears mixed when considering the dynamics of local units. The ‘lowlands’ have become stronger, especially in business activities, but so did areas >1200 m a.s.l. (900 m for commerce), which were helped by isolation and tourism.

The distribution network

Table 3 shows the structure of the commercial network in the province of Sondrio, distinguishing the three types of supply locations defined above: neighbourhood shops, medium-sized sales facilities and large sales facilities. Although neighbourhood shops are struggling, they are the backbone of the distribution system in the

² The strengthening of municipalities up to 300 m a.s.l. clearly stands out when looking at long-term data. In 1971, they contained 22.8% of local units, 25.2% of employees and 23.0% of the total population in the province of Sondrio (ISTAT data, historical series database).

³ In 2020, this sector accounted for 13.2% of local units and 12.4% of total employees (ISTAT data, statistical archive of active enterprises).

Table 3. Structure of retail in the province of Sondrio, 2010 and 2022, based on Lombardy Regional Trade Observatory data and ISTAT data (population and households database).

Variables / Years	Neighbourhood shops	Medium-sized sales facilities	Large sales facilities	Total	Neighbourhood shops in total (%)
No. of shops					
2010	3123	292	8	3423	91.2
2022	2850	303	9	3162	90.1
Balance	-273	11	1	-261	-1.1
Food sqm					
2010	49,622	27,987	13,022	90,631	54.8
2022	46,717	31,207	13,091	91,015	51.3
Balance	-2905	3220	69	384	-3.5
Non-food sqm					
2010	137,980	93,277	32,382	263,639	52.3
2022	127,429	106,494	41,373	275,296	46.3
Balance	-10,551	13,217	8991	11,657	-6.0
Total sqm					
2010	187,602	121,264	45,404	354,270	53.0
2022	174,146	137,701	54,464	366,311	47.5
Balance	-13,456	16,437	9060	12,041	-5.5

province of Sondrio. In 2022, they still controlled nearly half of all sales areas. In many municipalities (33 out of 77), only these small shops exist; for local communities – and isolated ones especially – they are also important places for socialisation.

The province of Sondrio has not been immune to the revolution unleashed by the spread of large sales facilities, which often consist of shopping centres located on the valley floor, close to major cities or at crucial points for mobility. There are not many facilities of this type – nine located in seven municipalities, covering a total of 54,464 m² – but there are enough to replicate the landscape of introverted consumption citadels and teeming market-streets typical of densely urbanised lowland areas. The largest facility, which belongs to the Iperal chain, opened in Piantedo in 1996, in an enviable location between Alto Lario, Valchiavenna and Valtellina di Morbegno. For people coming up from the plains, this is the first window onto the mountain; the impact is considerable.

In contrast to large sales facilities located in the floor of the valley of a few towns, medium-sized sales facilities are present in 44 municipalities at different altitudes above sea level and also extend into Alta Valtellina. These types of facilities account for approximately one-third of all sales areas. They have fewer orographic constraints and are favoured by regional regulations, which allowed them to play a key role in transforming the provincial distribution system. Between 2010 and 2022, large sales facilities

expanded (+9060 m²), but medium-sized sales facilities grew the most (+16,437 m²), offsetting the decline in neighbourhood shops. However, this only concerns the overall balance in terms of an available sales area, since the actual number of shops decreased.

Food retail density

Focusing on food retail, we calculated the density of supply for each municipality in terms of shops/1000 inhabitants (DI1) and sales areas in square metres/1000 inhabitants (DI2) at the beginning and end of the period in question (2010–2022). An assessment of the deviation from regional values⁴ for each of the two indices highlights three cases (Fig. 2):

1. municipalities with an over-provision of food supplies;
2. municipalities with an under-provision of food supplies;
3. municipalities with no food supplies.

Two maps are generated, one for shops and the other for sales areas. These do not necessarily coincide with each other because the

⁴ Density indices of the Lombardy Region in 2010: 3.2 shops / 1000 inhabitants and 364.7 sales area in square metres / 1000 inhabitants. Density indices of the Lombardy Region in 2022: 3.5 shops / 1000 inhabitants and 410.7 sales area in square metres / 1000 inhabitants (Lombardy Regional Trade Observatory data).

distribution system is locally different in terms of the number and size of food shops.

With respect to the DI1 index, a significant deterioration was recorded in the 2010–2022 period, as both the number of municipalities affected by commercial desertification (case 3: from 3 to 6) and those with a supply deficit (case 2: from 18 to 27) increased. Overall, the population in these two situations almost doubled during the period under review (from 17.6% to 32.3%), with a strong increase even before the COVID-19 pandemic. The criticalities are more frequent if one considers the DI2 index: cases of absence and deficits of food retail have increased to the point

that 44 municipalities and 46.2% of the total population are affected.

With respect to both density indices, the picture has worsened in all mountain communities, but in Valchiavenna and Alta Valtellina the criticalities are most evident in terms of the number of municipalities and/or population affected (Table 4). There are some particular situations, however. As far as DI2 is concerned, Valtellina di Sondrio and Bassa Valtellina are stories in themselves: they have an overwhelming presence of large retailers and most of the population enjoys a surplus of supplies. Valtellina di Tirano, on the other hand, has a dense network of small shops,

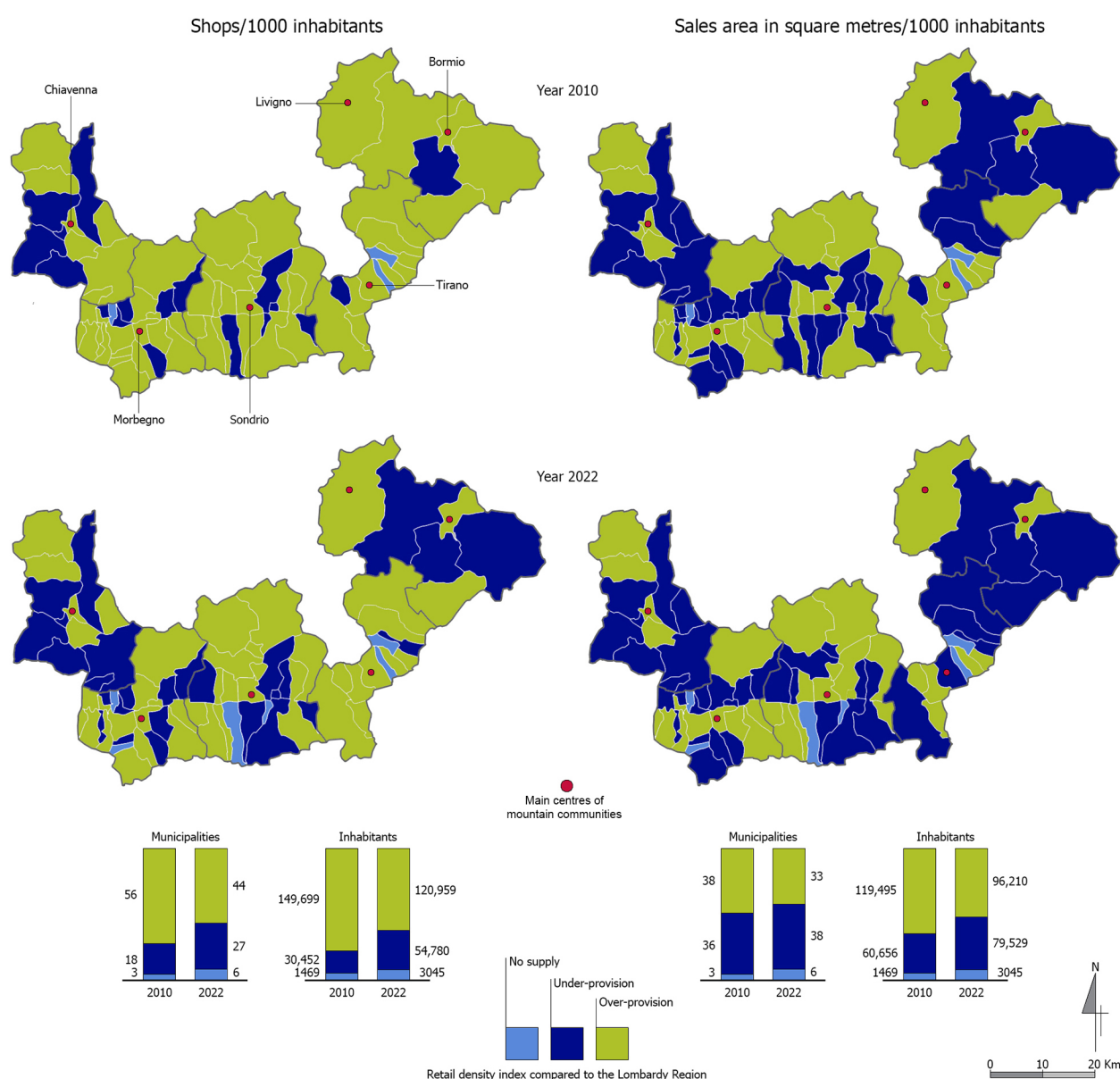


Fig. 2. Food retail density indices in the province of Sondrio, 2010 and 2022 based on Lombardy Regional Trade Observatory data and ISTAT data (population and households database).

Table 4. Cases of under-provision and absence of food retail in the province of Sondrio, 2022, based on Lombardy Regional Trade Observatory data and ISTAT data (population and households database).

	Total no. of municipalities	Compared to: shops			Compared to: sales area		
		No. of municipalities	Resident population	Resident population (%)	No. of municipalities	Resident population	Resident population (%)
Mountain communities							
Valchiavenna	12	7	11,862	48.5	8	12,829	52.5
Valtellina di Morbegno	25	11	15,911	33.8	15	16,918	35.9
Valtellina di Sondrio	22	9	18,121	33.4	10	17,725	32.6
Valtellina di Tirano	12	3	1705	6.1	7	20,946	74.9
Alta Valtellina	6	3	10,226	41.0	4	14,156	56.7
Altitude bands							
Up to 300 m a.s.l.	19	9	20,876	41.6	9	20,005	39.9
301–600 m a.s.l.	29	15	24,088	30.7	17	31,525	40.2
601–900 m a.s.l.	13	4	2309	13.9	10	15,059	90.7
901–1200 m a.s.l.	10	3	3920	25.5	6	9353	60.8
Oltre 1200 m a.s.l.	6	2	6632	36.5	2	6632	36.5
Total	77	33	57,825	32.3	44	82,574	46.2

which generates a mismatch between the density indices (many cases of surplus for the DI1 index and few cases of surplus for the DI2 index).

Orographical constraints hinder the establishment of large sales outlets in municipalities located at high altitudes. When one looks at the DI2 index, therefore, it is easy to find deficit situations (especially in the 600–900 m altitude range). However, if the density of shops (DI1) is considered, the problems are more frequent in the valley floor, where competition from large-scale retailers is strong and mobility is higher.

The two density indices considered here combine differently on the municipal scale, generating five situations (Fig. 3):

- A. no food retail;
- B. over-provision for both indices;
- C. under-provision for both indices;
- D. over-provision for the DI2 index only;
- E. over-provision for the DI1 index only.

Case B, the most common one in 2022, concerns 29 municipalities containing nearly half of the population in the province of Sondrio. These consist of the main centres, except Tirano, and their neighbouring or more peripheral municipalities with large commercial centres and many tourism resorts. Another 15 municipalities with a large population load (19.4%), fall under case E, i.e. with a high density of small shops. This situation is seen in different parts of the province and at different altitudes, but it is especially concentrated in Valtellina di Tirano. Case D is the rarest:

only four municipalities in the valley floor near Morbegno and Sondrio, have a distribution network consisting of a few large shops.

Not all localities have a good provision of food shops, according to at least one of the indices considered. Several situations of true commercial desertification (case A: 6 municipalities) or excessive rarefaction of supplies (case C: 23 municipalities) are scattered around the province. In 2022, these two critical situations involved as many as 47,805 inhabitants (26.7% of the total). The incidence is very high in Valchiavenna (7 out of 12 municipalities), Alta Valtellina (3 out of 6) and Bassa Valtellina (10 out of 25). In the first two areas, a significant proportion of the population is also involved (40%–50%), while the figure is lower in the third area (24%) as small municipalities are mostly affected. Around Tirano, the frequency of cases A and C is minimal: only 3 out of 12 municipalities, all bordering on municipalities with a good supply.

With respect to the second research objective, we analysed the characteristics of the 29 municipalities affected by food retail desertification and rarefaction (cases A and C). In demographic terms, the smallest town is Pedesina (35 inhabitants in 2022), while the largest ones have around 4000 inhabitants (Berbenno di Valtellina, Valdidentro). These are often towns on the mountain slopes that are well connected to the valley floor and more easily ‘captured’ by the large-scale retailers operating there. The

nearest large food sales facility is highly accessible by car. In most municipalities (18 out of 29), it is <15 min away, in eight municipalities it is between 15 min and 30 min, and only in three municipalities – all in Alta Valtellina – does it exceed 30 min⁵.

⁵ These data refer to the distance between the main settlement in the municipality – where most of the population resides – and the nearest large sales facility.

Three municipalities form part of the ‘restricted’ conurbations of the main cities identified in the current Provincial Territorial Plan. This is a particular position, in which both the influence of the main city and that of the shopping centres located in the conurbation are felt, which ‘drains’ the local supply. Only a few municipalities are located >1000 m a.s.l.: three in Alta Valtellina – in the area of Livigno and Bormio – and Pedesina,

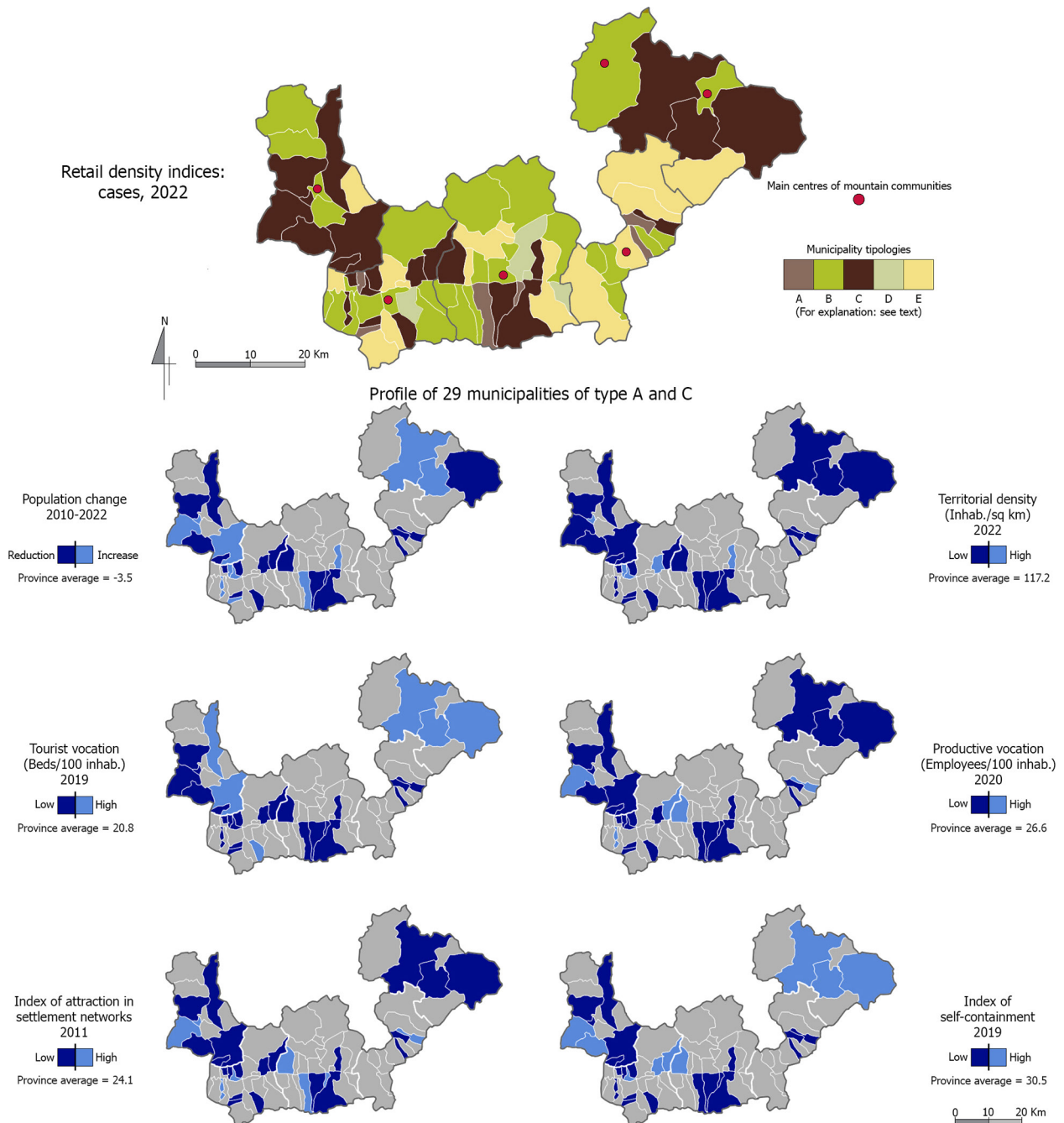


Fig. 3. Classification of municipalities according to food retail density and profile of municipalities A and C based on ISTAT data, various databases (population and households, tourism, general population census, statistical archive of active enterprises).

which, together with the other municipalities in Valgerola, revolve around Morbegno (with its many medium-sized sales and large sales facilities). Overall, it is rare to find critical situations in secondary valleys. Here, the greater isolation and fair tourist flows favour an over-provision of food retail (many B and E municipalities), even though the population is often decreasing, as in the emblematic case of Valmalenco (Sondrio area).

To better outline the profile of A type and C type municipalities, we considered indicators related to the local catchment area and insertion in settlement networks (Table 5 and Fig. 3).

Although varied, compared to the average values for the province of Sondrio, the picture mainly shows a low population density, strong residential character (low index of employees per 100 inhabitants) and a low capacity to attract labour flows (low index of attraction in settlement networks⁶). As seen above, the population increased between 2010 and 2022 in only 24 municipalities, 11 of which are types A and C. Despite population growth, however, food retail remains under-developed or completely absent. Municipalities of types A and C often also have moderate tourist flows (low bed ratio/100 inhabitants). In many cases, however, this feature is strong but still insufficient to support the local commercial network, at least in the food sector. Significantly, the rarefaction of commerce affects three municipalities in Alta Valtellina, which is the provincial area with the highest tourist

pressure. Here the flows are seasonal and there is competition from the centres of Bormio and Livigno (non-customs area). In other cases, such as Valgerola (Bassa Valtellina), there is a good connectivity to the valley floor and tourist flows are too small to have a positive effect on local commerce.

Municipalities of types A and C are not isolated, which is confirmed by their low self-containment index (especially type A municipalities)⁷. Therefore, these are municipalities that are open to the outside world for day-to-day business relations, which encourages outshopping, in line with the studies referred to above. Some municipalities mainly have production activities and are highly attractive within the settlement network, which could generate additional flows for local retailers. Particularly noteworthy are Gordona (Valchiavenna) and Andalo Valtellino (Bassa Valtellina), which are also central in a larger area (the balance between incoming and outgoing commuter flows is positive). However, the main cities and shopping centres can be easily accessed from these two municipalities, a situation that is detrimental to the local commercial supply, as also documented by Nilsson (2023).

The problems resulting from a lack or rarefaction of food retail could be amplified by certain local hardships. In particular, we considered four aspects:

- the presence of an elderly population (>65 years), with the hypothesis that elderly

⁶ This index measures the share of daily work-related trips entering a municipality in relation to the total number of trips in the municipality (see Table 3 for the formula).

⁷ This index measures the share of daily work-related trips that occur within the municipality compared to the total number of trips in the municipality (see Table 3 for the formula).

Table 5. Profile of the 29 municipalities of types A and C, average values based on ISTAT data, various databases (population and households, tourism, general population census, statistical archive of active enterprises).

Variables	Municipalities profile A (6)	Municipalities profile C (23)	Total municipalities province of Sondrio (77)
Change in resident population, 2010–2022 (%)	–1.8	–2.6	–3.5
Inhabitants / sq km, 2022	57.6	94.8	117.2
Beds in hotel and non-hotel facilities / 100 inhabitants, 2019	6.2	13.6	20.8
Employees / 100 inhabitants, 2020	9.6	22.5	26.6
Index of attraction in settlement networks, 2011	18.7	19.6	24.1
Index of self-containment, 2019	12.1	24.2	30.5

Index of attraction in settlement networks = $[De / (De + Du + Di)] \times 100$,

Index of self-containment = $[Di / (Di + Du)] \times 100$,

where: De – labour displacements entering the municipality; Du – labour displacements out of the municipality; Di – movements for work within the municipality.

people are more sensitive to neighbourhood services;

- the presence of scattered houses, with the assumption that this situation affects travel necessary to have access to essential services;
- the provision of cars, assuming that this conditions individual freedom of movement;
- the presence of street markets with food stalls, assuming that they can make up for the lack in local commerce (albeit for short periods).

Figure 4 shows the hardship factors characterising the 29 municipalities of types A and C due to the over-concentration (compared to the average for the province of Sondrio) of inhabitants over 65 and scattered houses, a low motorisation rate (cars/100 inhabitants) and the absence of street markets. The overall picture shows local

differences. In most municipalities of types A and C, there are no street markets (20 cases) and the settlement structure is scattered (18 cases). A high incidence of elderly people (13 cases) and low motorisation rate (12 cases) are also quite common. At least two hardship factors are often combined.

This map of problems could be used to gather perceptions from local communities and identify adaptation strategies in the face of desertification or an excessive scarcity of food retail.

Discussion and conclusions

This research highlights two relevant pictures. The first result is the strengthening of many valley floor municipalities, especially in the

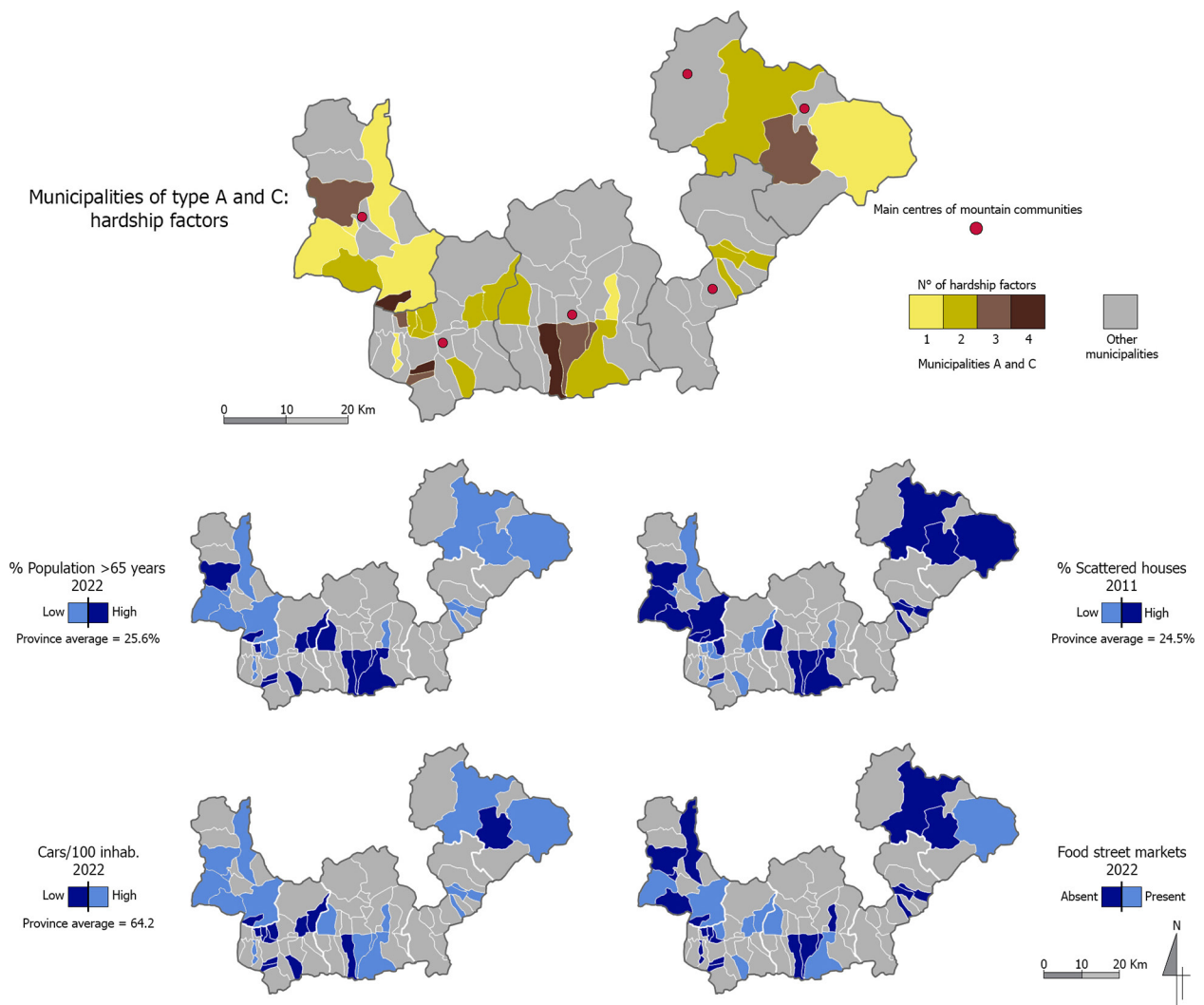


Fig. 4. Local hardship factors in the 29 municipalities A and C based on Lombardy Regional Trade Observatory data and ISTAT data, various databases (population and households, general population census, vehicle-public registers).

Morbegno area, which was also helped by transformations in the retail sector. This is a long-term process that has, in recent years and unlike in the past, taken the form of an overall demographic contraction in the entire province. Looking specifically at the redistribution of local units and jobs in commerce, a twofold movement can be observed: movement towards the valley floor and decentralisation away from the main urban poles. This second driver is less clear in population dynamics and other economic activities. In addition to the lowlands (up to 300 m a.s.l.), several highland tourism resorts stand out, including Livigno. This generates a tripartition in which the intermediate mountains suffer the greatest difficulties, similar to the picture drawn in other work relating to the Alps (Bartaletti 2011, RSA 2022).

The second relevant picture concerns the food retail density map, which, like other SGI, is an essential service for the 'good life'. As in more densely urbanised areas, the distribution system in the peripheral province of Sondrio is undergoing concentration. Between 2010 and 2022, larger sales outlets (large and medium-sized sales facilities) gained a lot of space, while small trade lost out. In terms of food supply density, progressive deterioration can be observed. Six municipalities currently have no food shops, while another 23 have fewer shops and sales areas in relation to the population compared to regional figures (low DI1 and DI2). Many local features could exacerbate the problems, such as a dispersed settlement arrangement and a high proportion of elderly people. Commercial rarefaction and desertification are found in areas that have long been considered problematic – such as Valchiavenna and Alta Valtellina, which are included in the SNAI – but they are also found in 'strong' areas – around Morbegno. This shows that the commercial dynamics follows specific paths that do not entirely overlap with those of other SGI.

The profile of municipalities affected by rarefaction and commercial desertification is interesting. It is often thought that the problems are greater in isolated areas (Karlsson 2012, Marshall et al. 2018), but in the province of Sondrio, they mainly affect residential municipalities open to external relations (low self-containment index) and close to the valley floor, where outshopping practices are easier, as Shannon (2016) also pointed out.

High tourist flows do not always 'support' commerce, favouring an over-provision of the local supply. The non-central municipalities in Alta Valtellina – an area that attracts nearly 80% of tourists in the province of Sondrio – are emblematic. The importance of relations in settlement networks has emerged, in line with evidence from other studies (Fertner et al. 2015, Szumilas, Pach 2021, Nilsson 2023). In particular, proximity to the main mountain community centres and large commercial settlements leads to a decrease in the local supply and favours outshopping.

It would be useful to extend this research to other mountain areas to assess the dynamics of commercial rarefaction and desertification and understand whether those municipalities are similar to the municipalities in the province of Sondrio, since the mountains are a varied world that can host different or particular dynamics. Furthermore, our mapping could serve as the starting point for assessing whether the limited density of commercial food supplies or its complete absence is an actual problem for people, in relation to their varied mobility and socio-economic status (Shaw 2006). Municipalities of type A and type C increased in the 2010–2022 period, but the results of our research only allow us to state that these are 'potential' food deserts (Fulfrust, Howard 2006).

The target areas of the SNAI include many mountain municipalities. This policy aims to rebuild a minimum fabric of useful public services to improve the quality of life in remote areas, reversing or at least limiting depopulation. Further investments in this direction are planned in the National Recovery and Resilience Plan. Commercial services, however, remain neglected. This should not be so, since commercial services are also important for the habitability of places, the production of relational goods and social and territorial cohesion. E-commerce may be believed to reduce the problems of limited supplies in rural areas, but this view is too optimistic. Its penetration in the food sector is still low – especially in Italy – and persisting problems related to the digital infrastructure and last-mile organisation are not easy to solve. It is good, therefore, to continue dealing with 'physical' commerce. Since the Italian regulatory revolution of 1998, there has been no lack of national and regional measures to support proximity trade in peripheral areas,

but more systematic action is needed in this regard, both due to sustainability and territorial cohesion and in anticipation of adverse events that, as with the COVID-19 pandemic, may limit people's mobility and force them to rely on local service networks.

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