

Chapter 8

Are the Skiing Industry, Globalisation, and Urbanisation of Alpine Landscapes Threatening Human Health and Ecosystem Diversity?



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Abstract The Jamtal Environmental Education Centre is a joint effort of the local communities of Galtür and Ischgl and the Alpinarium museum, dedicated to high mountain livelihoods and landscapes. For this study, we compiled available scientific evidence and personal views in the two communities on the co-evolution of human health and the biodiversity of local ecosystems. Main sources are historical records and maps, chronosequencing in the glacier forefields, and an analysis of contemporary land cover and glacier changes. In both communities, a large part of the area has remained unused since the start of the records in 1857. While the glacier area has shrunk by 70% since then, the forest area has increased as a result of changing land use and climate. Chronosequencing reveals that the glacier forefields are refugia for cold-adapted species under pressure from climate warming. Although land cover has changed, no type of land use recorded in the historical data has disappeared completely. While health services and infrastructure are thought to be sufficient, interviewees saw the largest potential for improvement in today's lifestyle. Traditional practices involving usage of herbs or food culture, for example related to *Gentiana punctata*, are still alive and important for the communities.

Keywords European Alps · Tourism · Biodiversity · Health · Museum · Silvretta

1 Introduction

Both conservation and sustainable use of mountain biodiversity can ensure the health of humans and the ecosystem and increase the resilience of socio-ecological systems. In this sense, mountain municipalities are promoting their landscapes as

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M. Nishi et al. (eds.), *Biodiversity-Health-Sustainability Nexus in Socio-Ecological Production Landscapes and Seascapes (SEPLS)*, Satoyama Initiative Thematic Review, https://doi.org/10.1007/978-981-16-9893-4_8

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destinations for sports, wellness, and even health tourism. The upper Paznaun Valley in the Austrian Alps is one of the highest settlements in the Eastern Alps. With glaciers and badlands like steep rocky mountain faces occupying 69% of the area of the community of Galtür and 37% of the community of Ischgl, only 1% and 5% of the area, respectively, is inhabitable. Therefore, the majority of the land is not used directly, despite the evidence of human impact in pollen profiles for the last millennia.

The landscape we find there today is shaped by various geomorphological processes, ongoing agricultural use, and modern infrastructure such as traffic, energy production, and tourism. The community of Galtür and the Alpinarium Society founded a museum, the Alpinarium (<https://www.alpinarium.at>), which came into operation in 2003. This *Erlebnismuseum* (experiential museum) is dedicated to livelihoods in high mountain regions. In 2013, the Jamtal Environmental Education Centre was established as a joint venture between the Alpinarium, the community of Galtür, and the Institute for Interdisciplinary Mountain Research of the Austrian Academy of Sciences to improve the accessibility of scientific results and initiate a discourse with the public. The main target audience has been pupils, who can spend a week at a mountain hut and experience high mountain nature and climate as a first step to come to a deeper understanding of mountain landscapes based on their own experience. Now the Environmental Education Centre has gained more cooperation partners, like the local guides who help to extrapolate the Alpinarium museum from the building into the backyards and outdoors. But the major impulse towards transdisciplinarity arose from the extensive exchange between the cooperation partners, so that the needs expressed by the communities also shape the upcoming scientific studies.

Of the data compiled for the Environmental Education Centre, this chapter pulls together those scientific data related to biodiversity and health. It shows that a look back in time can help to understand current environmental changes and their consequences for local people. Located near the border between Austria, Switzerland, and Italy, a nodal point of cross-Alpine mobility, the upper Paznaun Valley has been inhabited and farmed for millennia. During industrialisation, with decreasing trade, the prosperity of the region fell, forcing families to send their children abroad for work. Tourism started in the late nineteenth century, changing (but not entirely replacing) agricultural land use and increasing the mobility and exchange of goods, people, and ideas. Consequently, poverty was alleviated, the provision of affordable (clean) energy improved, and transport infrastructure expanded throughout this high-alpine environment, with large investments in avalanche mitigation measures, all of it deeply altering the socio-ecological production landscape. Changes in agricultural land use led to decreasing biodiversity. From the mid-nineteenth century onwards, glaciers retreated, becoming one-third of their former size. The rapid succession of plants in the ice-free former glacier areas has created new ecological niches.

This study is focused on the co-evolution of agricultural and touristic land use, and related changes in social settings. We tackled the former through a detailed analysis of geodata and investigated the latter by interviews with stakeholders of the two communities of Ischgl and Galtür. The landscape is permanently changing as a

result of both natural processes and (changing) cultural practices. We analyse the use of agricultural areas in particular, as this has a high impact on biodiversity in the settlement area.

Within the larger framework of the UN 2030 Sustainable Development Goals (SDGs), this study illustrates that the communication of pathways of sustainable development in the past and present is a necessary endeavour to ensure the balanced development of healthy and biodiverse socio-ecological production landscapes.

1.1 Geographical Information

The communities of Ischgl (1377 m asl) and Galtür (1600 m asl) are the highest villages in the Paznaun Valley, right at the national border with Switzerland (Fig. 8.1 and Table 8.1), in the Austrian state of Tyrol. The highest point of the two communities is the Fluchthorn peak (3399 m asl).

Located right at the margin of permanently inhabitable areas, the villages have a rough climate with an annual mean temperature of 2.7 °C (Galtür 1957–2000) and high annual precipitation (1013 mm; Fischer et al. 2019). In recent years, monthly temperature means have exceeded past averages by up to about 4 °C. Average height of winter snow cover is among the highest in Austria, and the topography-induced precipitation in the case of north-westerly flows leads to high precipitation rates. Now the glaciers are receding extremely rapidly (Fischer et al. 2021), with a potential total deglaciation in a few decades. This could have major effects on inhabited areas due to glacier outburst floods during the rapid retreat and sediment erosion and rock falls after the loss of ice (Kääb et al. 2005). The high number of rock glaciers in the area (Krainer & Ribis 2012) holds additional potential for destabilisation during the current climate change.

The area has been inhabited for at least 6000 years (Dietre et al. 2014), with a history of migration and adaption of different ethnolinguistic groups from German-speaking Upper Valais, Rhaeto-Romance Switzerland, Tyrol, and Vorarlberg (cf. Bender & Haller 2017). The specific groups brought with them greatly differing agricultural practices, making the region a rich repository of diverse cultural practices (Gemeinde Galtür 1999).

The glaciers are located close to pastures, and the trails used for trading cattle and goods were reportedly unpassable due to the glacier advance during the Little Ice Age (Huhn 1997). This caused major problems, as until the sixteenth century, Galtür and Ischgl were part of the community of Ardez in the Engadine Valley in the Grisons (now part of Switzerland), and the area had been used as summer pasture as was common along the main Alpine ridge in the Eastern Alps.

Working migration has involved the outgoing seasonal working migration of poor alpine peasants' children, mostly 6–14 years old, to big farms in the German (Suebian) foreland (so-called *Schwabenkinder*) continuing from the fifteenth to the early twentieth century (Ulmer 1943), and currently includes the presence of incoming seasonal workers mainly from Eastern Europe (Bender 2015).

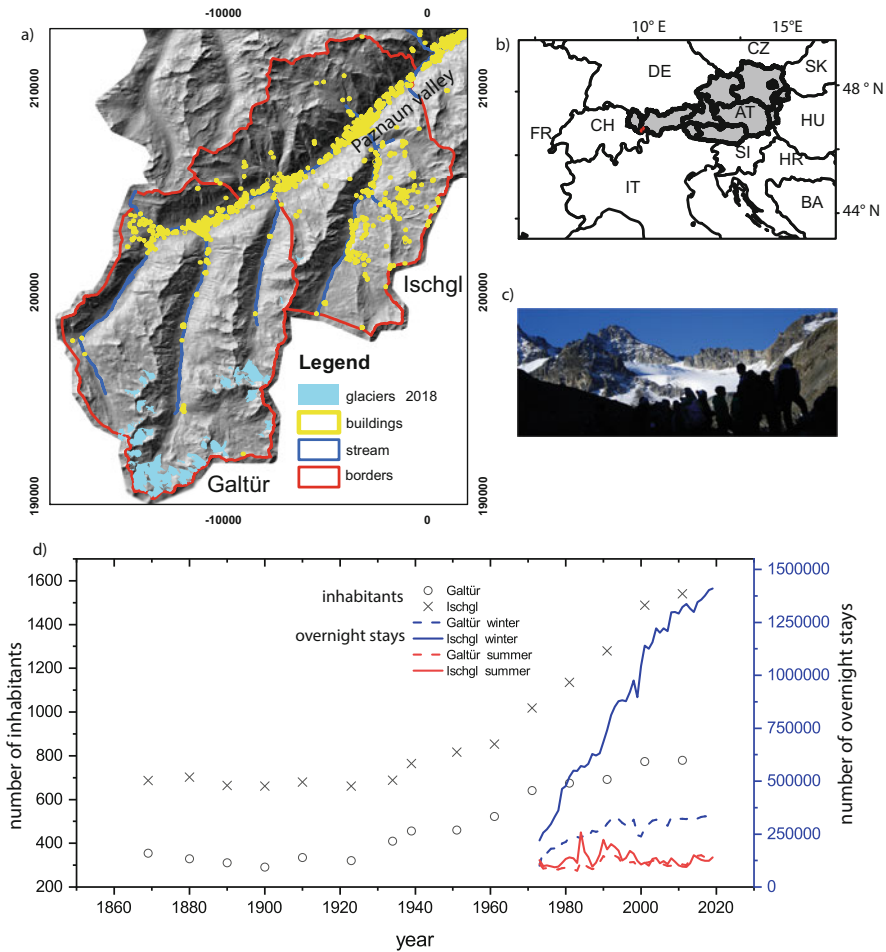


Fig. 8.1 Site map (a) and location of the communities (in red) in Austria (AT) (b) of the communities of Ischgl and Galtür in upper Paznaun, with (c) pupils in action with the Environmental Education Centre in Jamtal on Jamtalferner (photo by Andrea Fischer), and (d) total population and overnight stays (data source: Federal Administration of Tyrol)

From about 1870, the first touristic infrastructure began to be constructed, mainly mountain huts. Slowly, summer tourism also developed down in the valley, but it was not until the 1960s that cable cars were built—60 years after ski tourism reached the valley. In the 1970s, earnings from winter tourism exceeded those from summer tourism, and have been increasing since then, more strongly in Ischgl than in Galtür. In 2019 both municipalities together had ca. 441,000 tourist arrivals and over two million overnight stays (Land Tirol 2021).

In 2020, a population of 766 lived in Galtür on the 6 km² of inhabitable area of a total municipal area of 121 km². The community of Ischgl had 1604 inhabitants

Table 8.1 Basic information of the study area

Country	Austria
Province	Tirol
District	Landeck
Municipality	Ischgl, Galtür
Size of geographical area (hectare)	22,400
Number of direct beneficiaries (persons)	776 + 1604
Number of indirect beneficiaries (persons)	776 + 1604
Dominant ethnicity(ies), if appropriate	n.a.
Size of the case study/project area (hectare)	22,400
Geographic coordinates (latitude, longitude)	46°59'17.76"N, 10°14'55.65"E

(5.2 km² inhabitable area, 103 km² total area). The population in Ischgl and Galtür slightly decreased from 355 inhabitants in 1869 for five decades, with a strong reversal of the trend after the census of 1923; however, the resulting average increase for 1870–1940 amounted to only 0.25% a year, while after the Second World War population increased significantly by 1.25% a year (Statistik Austria 2021, Fig. 8.1d).

This population increase was due to a positive population change (birth surplus, e.g. 2001–2011: +144), which over both time periods, before and after the Second World War, exceeded the negative spatial population change (migration balance, e.g. 2001–2011: –87). During the last 50 years, demographic change has led to a significant ageing of the population. While the age group of 0–14 years halved, the 15–29 group stagnated, and all groups for 30+ years increased by around one-third. This trend is a result of a strong decrease in birth rate and the increasing outmigration of young people, mostly in search of faraway higher education opportunities and related workplaces. On the contrary, for the period 2001–2011, about 300 persons of the 50–74 age group in-migrated from more distant places (other political districts or abroad) (all data from GALPIS), making the upper Paznaun Valley a typical destination for amenity and retirement residences (Bender & Kanitscheider 2012; Bender 2015).

Livelihoods in the valley have also exhibited distinct change (Table 8.2, Figs. 8.1 and 8.2). While the number of workplaces in the agrarian sector became nearly insignificant, employment in the traffic and tourism sectors increased substantially, especially in Ischgl. Likewise, from 1971 to 2011, the proportion of commuters doubled (Fig. 8.2). In 2011, 24% of employed persons living in Ischgl and Galtür were commuting out to other municipalities, and 38% of the persons employed in the communities were commuting in. Especially for Ischgl, the number of persons commuting in was three times that of those commuting out (all data from GALPIS). Especially due to commuters, multilocal living (357 second residences in 2011 for both municipalities), and tourists, mobility has become very high, up to a degree which is typical for winter sport resorts in Tyrol in the uppermost locations of the tributary valleys (Bender & Borsdorf 2014).

Table 8.2 Change of workplaces by economic sectors in the municipalities of Galtür and Ischgl 1971–2011 (source: GALPIS with temporally harmonised data after the Austrian classification of economic activities ÖNACE)

	Galtür (1971)	Galtür (2011)	Ischgl (1971)	Ischgl (2011)
Workplaces (total number)	235	235	360	864
Agriculture (%)	23.4	5.1	30.6	1.2
Production of goods (%)	4.7	5.1	6.7	2.1
Supply of water and energy (%)	6.4	0.0	1.7	0.8
Construction (%)	5.1	11.5	5.3	0.2
Commerce and repair (%)	5.5	13.2	5.6	11.5
Traffic and communication (%)	6.8	10.6	13.9	28.0
Tourism (%)	28.9	31.9	18.3	37.4
Banking and insurance; housing and business-related services (%)	0.9	8.5	0.8	10.8
Other public and private services (%)	17.9	14.0	14.4	8.1
Unknown/not classified (%)	0.4	0.0	2.8	0.0

1.2 Human-Nature Interaction

Human-nature interaction in the communities over the long term is recorded in pedological and palynological records (Dietre et al. 2014) and shows the strong impact of human presence on biodiversity, e.g. by grazing cattle or managing forests, and wildfires over at least the last six millennia. Cultivation of land and land use reached up to the glaciers even as late as the 1870s, with the majority of Neolithic to Bronze Age activities taking place above today's tree line (Kutschera et al. 2014). The federal maps of the Habsburg Monarchy allow the first detailed insight into the spatial distribution of land cover at one point of time. The first land register, the *Franziszeischer Kataster* (e.g. Scharr 2018), was drawn up to assign the amount of taxes to be paid to reflect different types of land use/cover (for classes, see Fig. 8.2). In 1963 Böhm (1970) mapped land cover in the area again in a detailed study. Although glaciers are much smaller now, and climatic conditions much better, the area used for grazing cattle is much smaller today—partly the effect of switching from sheep and goats to cows. Today, irrigation of dry meadows is not as important as it was before 1950, and the forest is reconquering the area up to the actual glacier termini (Fischer et al. 2019). The now ice-free areas formerly covered by glacier tongues are discussed as refugia for species under pressure by thermophilisation, i.e. species adapted to warm conditions grow in areas where species adapted to cold conditions used to grow (Pauli et al. 2012).

Early tourism started up in the mountains, with the building of huts by Alpine Clubs (von Pfister 1911), not down in the valley. There, tourists were not very appreciated, as, in contrast to travellers and traders, they were thought of as being demanding and reluctant to pay for services. This view has definitely changed. In contrast to other regions, like neighbouring Silbertal in Montafon, where spas have

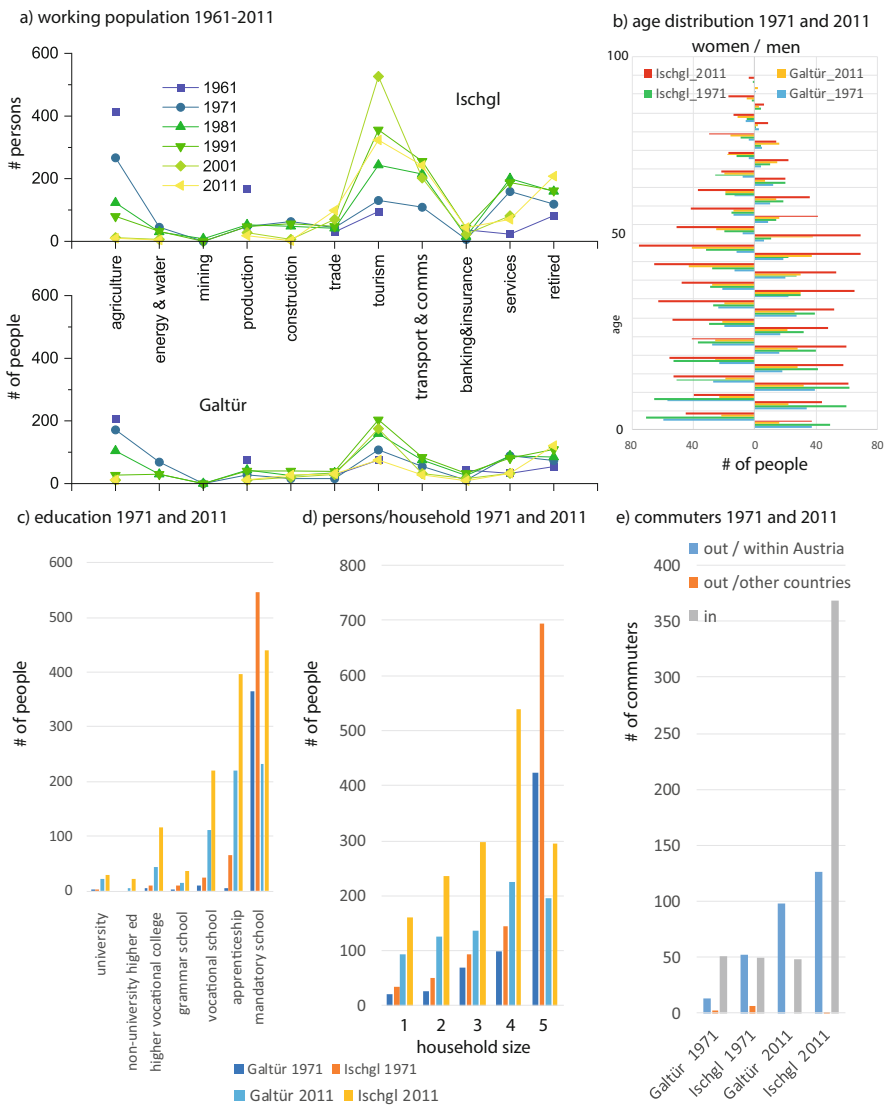


Fig. 8.2 Changes in working population by sector (a), age distribution (b), education (c), number of persons per household (d), and commuters (e) of the communities of Ischgl and Galtür in upper Paznaun (prepared by author, data source: Federal Administration of Tyrol)

been reported as early as 1616, neither early health tourism, such as visiting healing baths, nor pilgrimages took place in upper Paznaun.

Only 0.18% of the area of Galtür and 2.8% of the area of Ischgl are used for ski runs and cable cars (Table 8.3), but most of this area is also part of pastures. Over the years, the construction of cable cars has been discussed by the local community, as

Table 8.3 Proportion of area which could be used for ski resorts, area actually used for ski resorts and other sports, and inhabitable area in total numbers and percentages (data source: Federal Administration of Tyrol)

Municipality	Area reserved for skiing in spatial planning		Area used for ski runs		Area for other sports and recreation		Inhabitable area	
	km ²	%	km ²	%	km ²	%	km ²	%
Galtür	2.520	2.079	0.189	0.156	0.006	0.005	1.590	1.312
Ischgl	22.956	22.215	2.823	2.732	0.022	0.022	5.200	5.032

well as on a broader scale. Some projects, like the construction of the Piz Val Gronda cable car in Ischgl in 2013, were carried out despite protests by NGOs. Others were debated and rejected by the locals, like the proposal of a glacier ski resort on Jamtalferner glacier in 1976. Construction of skiing infrastructure is not only based on the decision-making of the locals. Federal and state laws stipulate a complex procedure of approval in terms of water resources, environmental protection, and various other aspects before cable cars can be built. Even so, the effects on nature are debated by a much wider and diverse community (Fig. 8.3).

1.3 Health-Related Issues of Livelihood

Out of many potential scientific approaches towards measuring sustainability, well-being, and health, indicators such as the Years of Good Life (YoGL; Lutz et al. 2021) or the SDG Indicators (United Nations Statistical Commission 2017) for Goal 3, “Ensure healthy lives and promote well-being for all at all ages”, try to capture the status quo and make improvements visible. A list of aims and the respective indicators in the framework of the SDGs can be found in Appendix 1. Austria, where the study area is located, is among the most developed countries. This results in high scoring on SDG health indicators related to good health infrastructure such as medical care and hospitals, as well as some low scoring on other health indicators, for example, for alcohol consumption (Fig. 8.4).

Changes in livelihoods in the study area since 1850 are diverse, with industrialisation and recently digitalisation affecting society. Böhm (1970) described various physical, cultural, ecological, and societal aspects of the site at the beginning of the period of rapid economic development (“*Deutsches Wirtschaftswunder*”) after the Second World War, which drastically changed livelihoods and the landscape even in the remotest parts of central Europe. Mountain farming was influenced by mechanisation of work, with increasing amounts of machinery and decreasing numbers of workers (Lichtenberger 1965). Figure 8.5 illustrates that the total working hours for a typical farmer were distributed more equally around the 2010s than in the 1960s, as holidays from the secondary occupation (in most cases in tourism) were used for farming work. Figures for the 1960s and the 2010s are based on a survey made by Böhm (1970) in the 1960s and the authors in 2021. In the

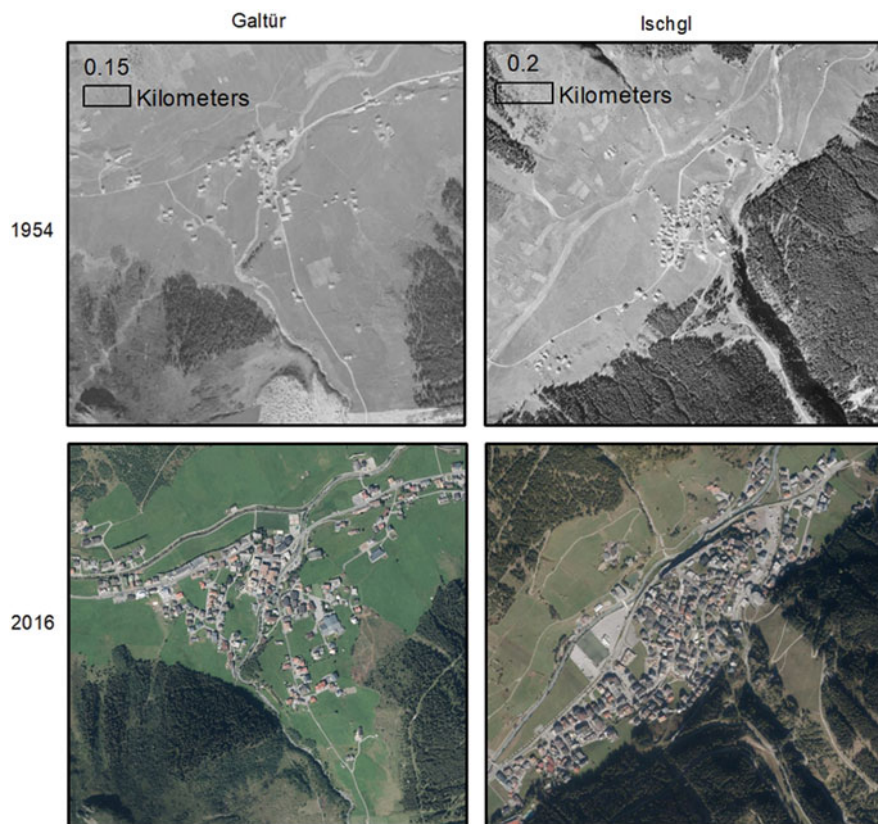


Fig. 8.3 Orthophotos of the communities of Galtür (left) and Ischgl (right) in 1954 and 2016 (data source: Federal Administration of Tyrol). The number of buildings and traffic areas have increased significantly. North of the communities, some of the former agricultural land is occupied by forest, and south of Ischgl, part of the forest has become a ski slope

2010s, 3 h per day were needed for farm work, with 2 weeks of holidays made possible by supportive manpower. The holidays at the end of the skiing season were used for preparatory work, and few days were spent for hay work in July and the second week of September. The cattle are grazed on the mountainside from June 15 to September 10 or 15, with 3 weeks of grazing outside the stable afterwards. Tree felling and other additional work have been excluded from this study. Böhm (1970) listed small bed and breakfast activities as typical businesses complementary to farming in the 1960s. Although this type of business was often run by female family members, empowering them by allowing them to earn their own money (Schmitt 2010), the summer season was part of a very busy farming time. In contrast, in more recent times the period where two occupations overlap is much shorter.

During intensive working periods, e.g. making hay, external workers or family members are needed as extra labour. While in the 1960s farming was the main part of

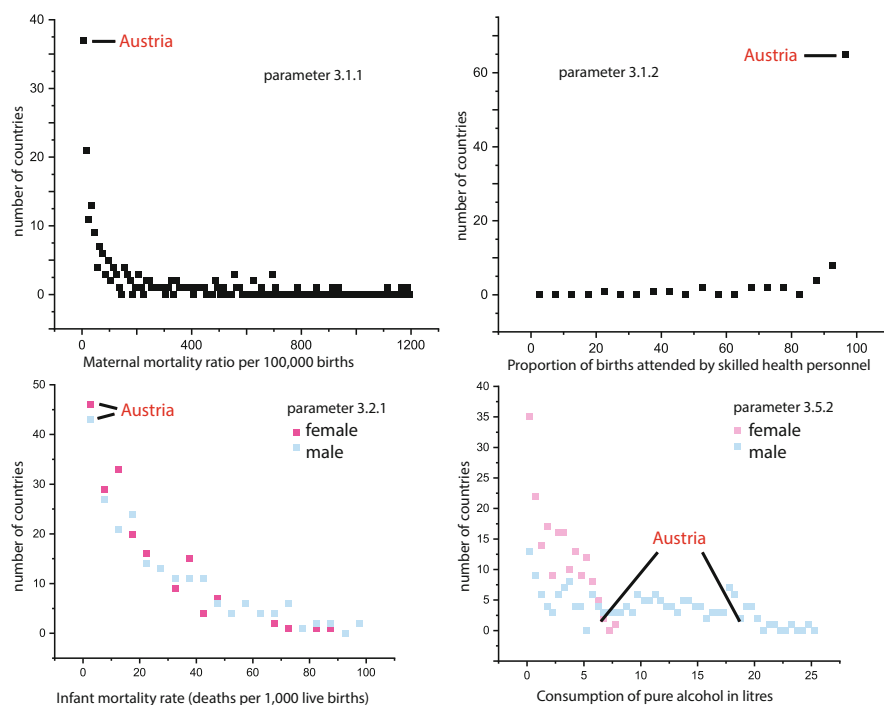


Fig. 8.4 The parameters of the study area, as part of Austria, with all other countries of the world for indicators 3.1.1, 3.1.2, 3.2.1, and 3.5.2 show that the supply of healthcare in Austria is above average, but lifestyle-related health issues such as alcohol consumption clearly have the potential for improvement (data source: United Nations Statistical Commission 2017)

working life, in the 2010s the “secondary” occupations (blue line) are the main and most continuous part of the working life of the farmer, due to the workload being reduced by the mechanisation of farming (data sources: Böhm 1970, author’s survey).

2 Description of Activities and Methods

2.1 The Environmental Education Centre

The Jamtal Environmental Education Centre at Jamtalhütte hut was founded in 2013 to foster the transfer of scientific knowledge, mainly on the effects on climate change, to the interested public directly on-site. The community of Galtür and the local Alpinarium museum supported this project. Based on more than 30 years of research on climate and glaciers in the area, the project has come to include more and more disciplines and opened a dialogue between local people and scientists. This

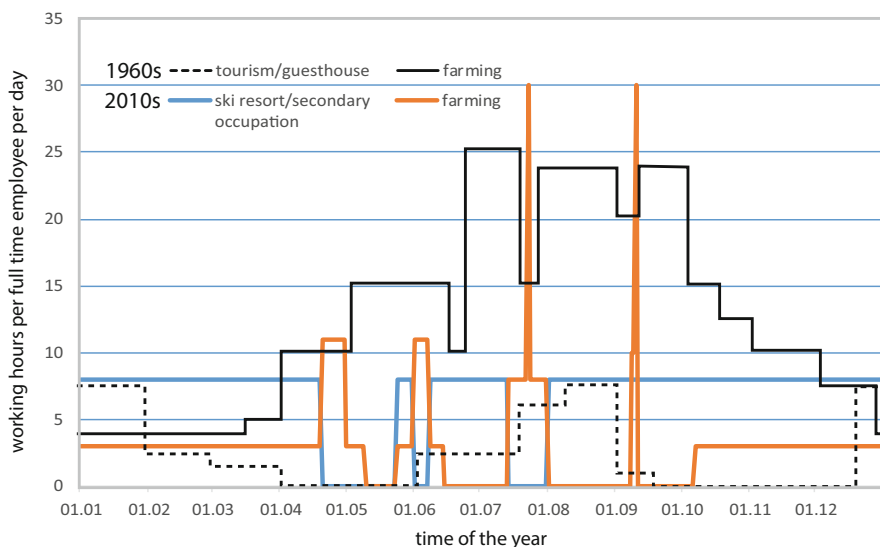


Fig. 8.5 Working time for a typical farmer in the 1960s (solid black line) with additional earnings from small guesthouses (dashed black line) and farming and paid work time in the 2010s (source: Böhm 1970, author's survey)

dialogue comes together in the Alpinarium, where the local community presents high-alpine livelihoods and environment, their changes over time, and their relation to global processes.

Local activities include usage of a flowering plant called a gentian (*Gentiana punctata*), designated as an intangible cultural heritage (UNESCO 2013). The roots of *Gentiana punctata* are collected in a strictly regulated way to produce schnapps used as medicine. Despite being forbidden for a short period after 1991, the practice of collecting roots has been allowed again. Likewise, the traditional and sustainable practice of collecting grassland plants and lichens as described by Zwitter and Rasran (2022) has long been part of the local identity and economy, with the numbers of gentian rising due to the intensification of land use during the Neolithic and later periods. Zwitter and Rasran (2022) show that the usage of medical plants led to an increase in the number of this species. Therefore, a modern restriction on plant usage has no guarantee of preserving the niche of a species in an ecosystem, which is the result of thousands of years of co-evolution of humans and the biosphere. The now joint efforts of locals and scientists aim to tackle past pathways in the co-evolution of nature and society to build a sustainable future. “Living in harmony with nature” implies dynamic action and response from both sides, humans and nature, to cope with pulse and pressure dynamics as societal response to environmental pressure and vice versa (e.g. Collins et al. 2007).

2.2 *Analysing Land-Use Change from Historical Maps and Land Cover Types*

Repeated data on biodiversity in the area are rare and restricted to single plots. For example, the chronosequencing of the periglacial area of Jamtalferner shows the rapid succession of vascular plants after glacier retreats (Fischer et al. 2019). One of the major drivers of changes in biodiversity is land use, as shown in numerous studies (e.g. Mayer et al. 2009, Brugger & Erschbamer 2012). To get an impression of the spatial distribution of land cover/land use and its changes, we analysed historical maps and modern data of the Federal Administration of Tyrol. The changing extent of glaciers (Fischer et al. 2021) and the area of rock glaciers complement the total picture of land cover/land use and badlands in the study area.

In addition, information on historical and present infrastructure related to human health was compiled, including local health infrastructure.

2.3 *Interviews*

To reach this study's aims, we carried out interviews with mayors and managers in the local authorities (*Gemeindeamtsleiter*) in February 2021. The interviews were structured and followed a set of open-ended questions (see Appendices A2 and A3).

3 *Results*

3.1 *Land-Use Change*

In both communities, the portion of agrarian land (agriculture, pastures) has decreased since 1857 (Figs. 8.6 and 8.7, Table 8.4). In 1857, alpine pastures reached up to the actual glacier areas, but these are not used for grazing cattle today. The largest part of the areas of both communities is badlands, forests, and alpine meadows. In Galtür, large-scale timber production for the salt mine located in Hall reduced the total amount of forest drastically in the nineteenth century. Today the proportion of forest in Galtür is small but on the increase again as a result of abandoning of alpine pastures and of the warming climate raising the treeline. In 1857 traffic routes (footpaths) led to the Swiss border. Today no road across the border exists. Recreational areas are not evident from the 1857 maps. In relative figures, the fraction of both recreational and inhabitable areas in both communities is small. Therefore, most areas in both communities can be considered to be unaffected by direct local human influence. Larger scale pressures like climate change,

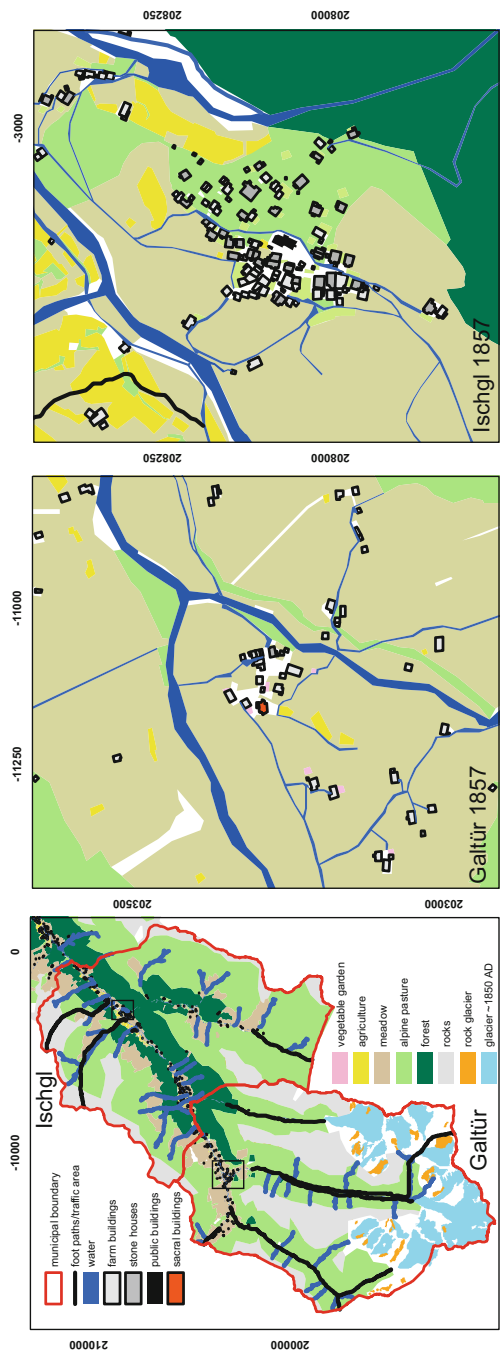


Fig. 8.6 Land use as displayed in the cadastral map *Urmappe/Franziszische Mappe* of 1857 (map created by the authors based on the cadastral map *Urmappe/Franziszische Mappe*)

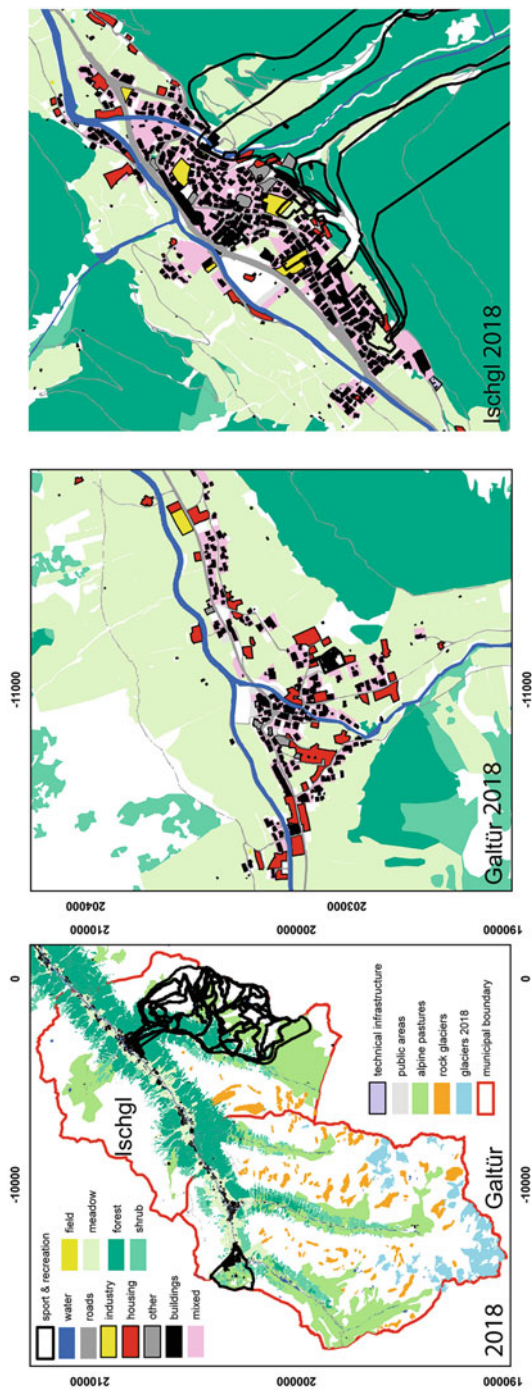


Fig. 8.7 Land use as displayed by the land-use plan (*Flächenwidmungsplan*) of the Federal Administration of Tyrol for 2018 (source: Land Tirol, data.tirol.gv.at 2021)

Table 8.4 Land use in the communities of Galtür and Ischgl in absolute figures. The year 1857 was extracted from the map of the land register of Francis I (*Urmappe of the Franziszeischer Kataster*), and other data were provided by the Federal Administration of Tyrol. Although the data sources have been compiled in very different legal frameworks and settings, they allow for interpretation of the general picture of changes, which can also be gleaned from changes in the classifications themselves. For example, the footpaths of the *Urmappe* have only limited economic or legal impact today, as most of the traffic is on roads. Traffic areas were not compiled for every year in the table

	Year	Buildings km ²	Agriculture km ²	Vegetable gardens km ²	Alpine pasture km ²	Forest km ²	Water km ²	Traffic area km ²	Other km ²
Galtür	1857	0.024	6.009	0.002	46.087	4.657	0.482	0.044	63.930
	1944	0.039	2.935	0.000	45.885	3.917	0.000		68.389
	1973	0.050	3.091	0.000	45.471	3.939	0.448		68.166
	1983	0.056	3.076	0.000	45.471	3.939	0.456		68.167
	1987	0.062	3.070	0.000	45.469	3.939	0.456		68.169
	1991	0.070	3.057	0.000	45.469	3.939	0.457	0.307	68.174
	1995	0.084	2.919	0.001	45.449	4.084	0.460	0.312	67.866
	1998	0.085	2.845	0.025	45.543	4.045	0.457	0.316	68.174
	2001	0.104	2.636	0.100	45.515	4.131	0.460	0.356	68.227
	2002	0.110	2.667	0.097	45.482	4.131	0.460	0.356	68.227
	2005	0.077	2.660	0.103	45.482	4.131	0.462	0.360	68.264
	2014	0.106	2.532	0.100	33.102	14.829	1.603	0.478	69.381
	2015	0.106	2.531	0.100	33.102	14.829	1.603	0.478	69.381
	2020	0.109	2.527	0.109	33.047	14.833	1.608		68.995
	1857	0.050	13.437	0.014	51.772	21.620	0.333	0.084	16.205
Ischgl	1944	0.068	3.847	0.000	61.851	19.659	0.000		18.002
	1973	0.075	4.292	0.000	61.829	19.285	0.318		17.628
	1983	0.120	4.240	0.002	61.826	19.248	0.325		17.629
	1987	0.139	4.184	0.002	61.819	19.238	0.326		17.681
	1991	0.149	4.170	0.002	61.819	19.238	0.328	0.362	17.682
	1995	0.130	4.199	0.016	61.803	19.224	0.328	0.368	17.260

(continued)

Table 8.4 (continued)

Year	Buildings km ²	Agriculture km ²	Vegetable gardens km ²	Alpine pasture km ²	Forest km ²	Water km ²	Traffic area km ²	Other km ²
1998	0.140	4.122	0.056	61.803	19.213	0.336	0.405	17.661
2001	0.250	3.504	0.216	61.793	19.497	0.338	0.442	17.731
2002	0.255	3.490	0.211	61.793	19.455	0.338	0.443	17.786
2005	0.132	3.482	0.221	61.790	19.449	0.342	0.452	17.924
2014	0.231	3.789	0.137	37.246	23.816	1.012	0.750	36.087
2015	0.231	3.790	0.138	37.246	23.816	1.012	0.750	36.086
2020	0.235	3.780	0.142	37.404	23.768	0.995		37.014

pesticides, and accumulation of microplastics by rain and snow, however, occur. Areas set free by the shrinking Alpine glaciers provide new refugia and niches for vascular plants (Fischer et al. 2019).

3.2 Interviews on Health Issues

All interview partners described the health infrastructure and medical provision as good and sufficient for both municipalities (see the complete interviews in Appendix 2). At the same time, the way of life clearly has potential for a change towards a healthier one—reducing the need for medical interventions. Traditional medicines, schnapps, and fresh and healthy foods and herbs are all getting increasing attention in the municipalities both for personal use and as a touristic attraction.

4 Discussion

The data presented in this study relate to Goal 3 of the UN Sustainable Development Goals, “Ensure healthy lives and promote well-being for all at all ages”, as well as SDG 15, “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”, but gaps in knowledge are evident. By combining data on changes in land cover and livelihoods in two Alpine villages, we try to relate sustainable development of the landscape to human health and well-being.

In Austria, one of the richest countries in the world, healthcare in the communities is very good, with low maternal mortality and an environment that sustains health. As evident from the interviews, lifestyle is considered a major criterion for health and well-being. Interviewees expected the most room for improvement at this individual level. To identify this potential, our land cover and demographic data need to be complemented by empirical social research. What is clear, however, is that only together are scientists and local people able to approach any problems in a broader and more effective way—and hopefully find answers.

Keeping in mind the historical background of the partial deforestation of Galtür in the course of timber production for the salt mines in Hall, present changes in land cover are less drastic and have minor effects. Even accounting for the increased area used for settlements and the skiing industry, every type of land use is still present. Changes in the landscape are found mainly in Ischgl during the summer, as the arable fields of the 1950s have been replaced by meadows—a general phenomenon in the Alps for the second half of the twentieth century. The forest is now regaining areas which had been used for grazing cattle, and warmer temperatures allow trees to

conquer areas occupied by glaciers 100 years ago. With ongoing debates about land use at all levels of society and politics, awareness of land-use changes and their implications may be greater than ever in history.

5 Conclusion

In the communities of Ischgl and Galtür, land use/land cover has changed, with an increasing portion of previously used land being abandoned. Changes in climate have led to glacial recession with biotic succession and a rise in the treeline. Both factors have impacted biodiversity. Human impact on the landscape since 1857 comprises an increase in the settlement areas, a decrease in arable fields, as well as the addition of traffic and tourism infrastructure. The areas used for ski tourism are also part of alpine pastures.

Traditional health-related activities are the ongoing use of *Gentiana punctata* as a medicinal drug and as a herb, although for a short period, use of the roots of this protected plant was forbidden. Now, strictly limited use is allowed again and protected in the United Nations' framework for cultural heritage.

The local people of the communities of Ischgl and Galtür see the landscape they live in as an intrinsic part of their livelihood, and one they benefit from for their own health and for health tourism. Living standards in the middle of the European Alps are already very high in terms of health infrastructure, food and water security, affordable and clean energy, and climate change mitigation and adaptation. SDG indicators for Austria confirm the statements in the interviews that future optimisation of health and well-being does not need additional resources and infrastructure, but a change in the way of life. In the light of the "One Health" approach and the aim of "living in harmony with nature", the most important piece of the puzzle to be improved now is the individual lifestyles to increase personal well-being and resonance with nature.

Acknowledgements We thank the communities of Ischgl and Galtür as well as the Alpinarium, the Jamtal Environmental Education Centre, and the Jamtal hut for their cooperation and support. The Federal Administration of Tyrol provided Open Government geodata and statistics. Last but not least we thank Brigitte Scott for improving the language!

Appendix 1

Table 8.5 Targets and indicators for SDG 3: Ensure healthy lives and promote well-being for all at all ages (Independent Group of Scientists appointed by the Secretary-General, 2019)

Aim	Indicator
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	3.1.1 Maternal mortality ratio 3.1.2 Proportion of births attended by skilled health personnel
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births	3.2.1 Under-5 mortality rate 3.2.2 Neonatal mortality rate
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, waterborne diseases, and other communicable diseases	3.3.1 Number of new HIV infections per 1000 uninfected population, by sex, age, and key populations 3.3.2 Tuberculosis incidence per 100,000 population 3.3.3 Malaria incidence per 1000 population 3.3.4 Hepatitis B incidence per 100,000 population 3.3.5 Number of people requiring interventions against neglected tropical diseases
3.4 By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes, or chronic respiratory disease 3.4.2 Suicide mortality rate
3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	3.5.1 Coverage of treatment interventions (pharmacological, psychosocial, and rehabilitation and aftercare services) for substance-use disorders 3.5.2 Alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	3.6.1 Death rate due to road traffic injuries
3.7 By 2030, ensure universal access to sexual and reproductive healthcare services, including for family planning, information and education, and integration of reproductive health into national strategies and programmes	3.7.1 Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods 3.7.2 Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1000 women in that age group
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all	3.8.1 Coverage of essential health services 3.8.2 Proportion of population with large household expenditures on health as a share of total household expenditure or income

(continued)

Table 8.5 (continued)

Aim	Indicator
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution
	3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene (exposure to unsafe water, sanitation, and hygiene for all (WASH) services)
	3.9.3 Mortality rate attributed to unintentional poisoning
3.a Strengthen the implementation of the World Health Organization framework convention on tobacco control in all countries, as appropriate	3.a.1 Age-standardised prevalence of current tobacco use among persons aged 15 years and older
3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all	3.b Support the research and development of vaccines and medicines for the communicable and non-communicable
3.c Substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in least developed countries and small island developing states	3.c.1 Health worker density and distribution
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction, and management of national and global health risks	3.d.1 International Health Regulations (IHR) capacity and health emergency preparedness

Appendix 2 Interview on Galtür and Health

Anton Mattle (AM), mayor of Galtür, and Helmut Pöll (HP), head of the municipal administration of Galtür, were interviewed in German on 2 February 2021, 10:10–10:30 a.m., by Andrea Fischer (AF). The transcript was translated into English.

AF: Question 1. Galtür and health: What is your assessment of the current healthcare provision?

HP: Healthcare provision is mainly covered by the local general practitioner. The nearest hospital is in Zams. It is well equipped and can be reached by car in about 40 min. Specialist doctors across the spectrum are available in Zams, Landeck, and Innsbruck. I would consider the medical provision very good.

Older people are being cared for either at home by members of their family or in the home for the elderly. There is support for care at home available from the local care services *Sozialsprengel*, for instance with looking after patients. The home for the elderly is run jointly with other municipalities and is located in the village of Grins at the start of the Paznaun Valley. Whether people are cared for at home or in the home for the elderly depends not just on their health status and the related medical and care needs, but also on the total circumstances of the family, for instance whether there is sufficient space available, whether all family members are working, or someone is at home.

AF: Question 2. Galtür and health: How is health in Galtür—how has the situation changed in recent decades?

HP: Health has declined. We no longer lead as healthy lives as the older people. For example, my father ate everything, including bacon with lots of fat, but then he did hours of physical labour. So he never had any problems with his weight, and he was never really ill and lived to over 90. So that fat never accumulated. Today we lack exercise. Of course, medicine has made great advances, and we can fix a lot. But our lifestyle is not as healthy as in the past.

AF: Question 3. What traditional substances and practices of healing exist in Galtür?

HP: Many people still use herbs in everyday life, for cooking and as tisanes. In our community we also have individuals who work with healing herbs as a sideline and produce oils and salves. We have also developed touristic options in this respect, for instance the learn-about-herbs path.

AM: In our village the spotted gentian [*Gentiana punctata*] is distilled into schnapps which is used as a traditional healing substance. Unlike the yellow gentian [*Gentiana lutea*], the spotted gentian cannot be cultivated. It is already mentioned way back in the herbarium of Admont monastery as a medical drug with a number of applications. Gentian of course also has a cult following. Marmot fat is another example, it is used against problems of the musculoskeletal system, but also in midwifery, for humans and animals.

AF: Question 4. What is your view of health tourism?

AM: We work with what nature offers us, our landscape. We want to preserve nature, our ancestors rejected plans to develop glacier skiing. Our village is part of the climate association and we participated in a climate change adaptation project. We are the only climatic spa in Tyrol and have been awarded the ECARF label of the European Centre for Allergy Research Foundation.

Appendix 3 Interview on Ischgl and Health

Christian Schmid (CS), Ischgl local authority manager, was interviewed on 4 February 2021, 13:00–13:30 by Andrea Fischer (AF)

AF: Question 1. What is the current health infrastructure like?

CS: General practitioner Dr. Walser employs four doctors. Then there is the Schenk sports injury surgery, equipped with a CT scanner; they also operate two rescue helicopters in the skiing area, but only in the winter season from late November to early May. We have two ambulances of the Red Cross stationed in the village, plus another rescue helicopter of the Austrian automobile club ÖAMTC stationed all year round in Finais/Zams. One dentist and two physiotherapists have their practices in the village. The home for the elderly is located in Grins, and the Ischgl care association supports the infrastructure for care at home.

AF: Question 2. In your view, has the health situation improved or declined in recent decades?

CS: In the past there was only one ambulance and one general practitioner in the village, so provision has improved. But the people practiced more exercise in the past, and possibly also more leisure time. It would be good to be free every day from about 4 p.m. and have the weekends free. There is a rethink among younger people; they roam our mountains again in summer and winter, getting exercise.

AF: Question 3. Is there traditional medicine in Ischgl?

CS: In Galtür there is the Enzner (schnapps) (laughs). In Ischgl we have good cuisine—ten gourmet restaurants and five-star chefs. Gathering gentian is not as popular here as in Galtür, but the restaurants in our village and up on Idalpe use local produce. There is a small slaughterhouse in Ischgl and a farm cheesemaker. A range of produce of the 60 farmers in our municipality is processed and consumed in our village.

AF: Question 4. Is there health tourism in Ischgl?

CS: In 1969 we created a forest swimming pool with tennis courts (pulled down and rebuilt in 1993). In summer you can walk, climb, cycle, and play tennis, and in winter you can ski, snowboard, go cross-country skiing, ice skate, and much more. In short, enjoy nature in its beauty to the full. The open-air swimming pool and the leisure centre, built in 1986, are beginning to show their age. A new spa is under construction.

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