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# PERCEPTIONS AND LOCAL KNOWLEDGE OF THE STATE, THE CHANGES AND THE PROTECTION MEASURES OF ALPINE BIODIVERSITY IN THE CONTEXT OF PASTORAL ALPINE FARMING IN SWITZERLAND: HOW DO LAY AND SCIENTIFIC DISCOURSES ABOUT BIODIVERSITY CONSERVATION DIFFER?

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# Preface

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At this point I would like to thank all the participants from the qualitative data collection in Switzerland, who voluntarily took their time to answer to my questions about alpine agriculture, giving me insights into a topic that is more intricate than was previously expected. Special gratitude I would like to express towards the alpine farmers who answered and tested the survey, resulting in a creation of a tool that could prove its value in a limited amount so far but showed great potential for further application.

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# Table of Contents

<b>List of abbreviations</b> .....	5
<b>List of 'indigenous' words and bureaucratic terms</b> .....	6
<b>Abstract</b> .....	8
<b>Introduction with literature review</b> .....	9
<b>Original Research Objectives, Hypothesis and Research Questions</b> .....	23
<b>Theoretical outline</b> .....	24
<b>Methods</b> .....	27
<i>Qualitative data collection</i> .....	34
Epistemological: <i>Quantitative data collection outline</i> .....	39
<b>Adapted methods</b> .....	43
<b>Results</b> .....	47
<i>Älplers' perception of the state of the environment, climate, socio-political circumstances and economy</i> .....	47
<i>Externals' perception of the state of the environment, climate, socio-political circumstances and economy</i> .....	54
<i>Älplers' perception of the changes of the environment, climate, socio-political circumstances and economy</i> .....	62
<i>Externals' perception of the changes of the environment, climate, socio-political circumstances and economy</i> .....	69
<i>Älplers' opinion, attitude, ideas and proposals for biodiversity conservation for pastoral alpine farming practices</i> .....	78
<i>Externals' opinion, attitude, ideas and proposals for biodiversity conservation for pastoral alpine farming practices</i> .....	86
<b>Discussion</b> .....	95
Terminology .....	95
Comparing opinions, attitudes, ideas and proposals on biodiversity conservation .....	96
<i>Perspectives: anthropogenic and environmental centric</i> .....	97
Management related developments and corresponding measures .....	99
Financial constraints and the market .....	100
Income diversification on the alp .....	100
State influences on pastoral alpine farming practices .....	104
Alp ownership and employment and corresponding training .....	105
Meliorations and encompassing use of technology .....	107
Biodiversity and farming practices .....	109
Direct payments and biodiversity conservation .....	113
Mechanisms of agri-environmental schemes .....	116
Trust in politics and science through communication .....	117

<i>Narratives: a rift in society and its implications for biodiversity conservation</i> .....	119
<i>Monitoring and impact monitoring</i> .....	122
<i>Socio-cultural aspects in recent developments and its potential impacts on future developments</i> .....	124
<i>Future trends, current attitudes and past perceptions</i> .....	127
<i>Traditional ecological knowledge with pastoral alpine farming practices discussed</i> .....	130
<i>Local ecological knowledge with pastoral alpine farming practices discussed</i> .....	131
<i>Socio-demographic factors discussed</i> .....	132
<i>Limitations of the study</i> .....	132
<i>Epistemological assessment</i> .....	134
<b>Conclusion</b> .....	136
<i>Future outlook for research</i> .....	137
<b>References</b> .....	139

## List of abbreviations

(used more than 3 times)

BD	Biodiversity
BFF2	Biodiversitätsförderflächen der Qualitätsstufe 2
Bio.	billion
ca.	circa
CC	Climate change
e.g.	exempli gratia
Etc.	et cetera
FGD	Focus group discussion
GVE	Großvieheinheit
LEK	Local ecological knowledge
m.a.s.l.	metres above sea level
Mio.	million
PAFP	Pastoral alpine farming practices
PP	Participative process
SFr	Swiss Francs
TEK	Traditional ecological knowledge

## List of 'indigenous' words and bureaucratic terms

(used more than 3 times)

It was chosen to use a range of indigenous and bureaucratic terms that are Swiss-specific as a fitting translation could not be obtained or created and a contextual explanation with the original words used can be considered more accurate and less cumbersome.

*The Alps* (always plural and with capital first letter and with article) - Geographic name for the alpine mountain range

*alp/s* (always with small first letter) - alpine farm with a stable usually integrated with housing area and surrounding pastures where the animals are managed from. Also a higher located stable connected to the main alp but without housing facilities.

*Äpler/s* - Anglicised version of the Swiss standard term for a pastoral, transhumant alpine farmer (see also *Discussion, Terminology*)

*Alpungsbeiträge* - The *Alpungsbeiträge* gives the year-round farmer an incentive to place his animals on an alpine pasture for *Sömmerung*. The animals must be pastured on a recognised alp or communal grazing farm in Switzerland. The height of the *Alpungsbeiträge* is 370 SFr per pastured *Normalstoß* on an alp in a year and is the same in all zones. Part of the direct payments.

*BFF2* - *Biodiversitätsförderflächen der Qualitätsstufe 2* - Quality level 2 biodiversity promotion areas – part of the direct payment scheme for agriculture in Switzerland. Area-based, result-oriented payment scheme that rewards the presence of structural elements considered beneficial for BD on agricultural land. Introduced in 2014 for the *Sömmerungsgebiet*.

*Bergzone* – Part of the agricultural zones as demarcated by the Bundesamt für Landwirtschaft (BLW). The agricultural production register records aggravating production and living conditions that are taken into account for the calculation of direct payments and regulations. Zoning forms the agricultural production cadastre. *Bergzone* is differentiated in four levels (I – IV) which are set according to altitude.

*Bestoßung* - Swiss term for pastorally pastured animals on an alp usually measured in *Normalstoß* which is: GVE/100 days (the usual length of *Sömmerung*), heavily regulated by the cantonal administration.

*Buvette/Besenbeiz* - small gastronomic operation with food and drinks on alps to cater to tourists.

*Flysch* - loanword from German, meaning soil consisting of sedimentary rock layers known to be very unstable when water is flowing through due to its water permeability properties.

*GVE* – *Großvieheinheit* - abbreviation for *Großvieheinheit* meaning a standardised measure for animals – one cow is 1 GVE while 1 pig only accounts to 0.6 GVE etc. GVE is the most common measurement for productive capacity for animal farmers in Switzerland, Austria and Germany and is used in Switzerland to determine the '*Normalstoß*'.

*Höhensteigen* – height climbing – term used to describe different species' behaviour to extend habitats to higher locations due to global warming from CC impacts.

*Landschaftsqualitätsbeiträge* – part of the direct payment scheme for agriculture in Switzerland. Introduced in 2014 for the Sömmerungsgebiet. Regionally managed through negotiated contracts with Älplers and farmers. Bottom-up as farmers can be involved in the creation of projects eligible for Landschaftsqualitätsbeiträge. Projects usually have a running time of several years. The scheme supports farmers in their work for the conservation, promotion and enhancement of cultural landscapes.

*Normalstoß* – is a regular measurement unit to determine stock density in the Sömmerungsgebiet. One Normalstoß = GVE for 100 days

*Normalbesatz* – is the animal stocking rate corresponding to sustainable use in the Sömmerungsgebiet; gets determined by each Canton for every alpine pasture; gets adapted to changes in management and appearance of ecological damages. Formal term used in government publications and is synonymous with 'Sömmerungszahlen'

*Rutschgebiete* - (plural of Rutschgebiet - direct translation: sliding areas) – areas prone to sliding slopes with often Flysch type of soil, differentiated in active and dormant

*Sennerei* - alpine dairy which is usually included in the alp. Long standing tradition in Switzerland and other alpine countries; used to be practised out of necessity to cure the milk and process it into different products.

*Sömmerung* - Pastoral alpine farming practice of herding different kinds of animals, usually dairy cows or cattle for meat production; roughly from the end of May until the end of September depending on the weather on alps.

*Sömmerungsgebiet* - Part of the agricultural zones as demarcated by the Bundesamt für Landwirtschaft (BLW). The agricultural production register records aggravating production and living conditions that are taken into account for the calculation of direct payments and regulations. Zoning forms the agricultural production cadastre. The area where Sömmerung is practiced in Switzerland as defined by the authorities.

*Sömmerungszahlen* – synonymous with 'Normalbesatz'; often used in scientific publications and informal language.

*Sömmerungsbeiträge* – part of direct payments aimed at the alp owner for 75 % to 110 % of the Normalbesatz. Normalbesatz is the baseline for calculating the Sömmerungsbeiträge. It is ranging between 120 to 440 SFr/Normalstoß depending on the animals, their production characteristics and pasture management. Rates raised in 2014.

*Strukturverbesserungsbeiträge* – formal term for 'Meliorations' (see also *Introduction with literature review*)

*Vernetzungsbeiträge* – part of the direct payment scheme for agriculture in Switzerland. Introduced in 2014 for the Sömmerungsgebiet. Regionally managed through negotiated contracts with Älplers and farmers. Bottom-up as farmers can be involved in the creation of projects eligible for Vernetzungsbeiträge; similar to Landschaftsqualitätsbeiträge but aimed specifically at creating corridors for wild animals and each project is temporally set at 8 years.

*Wildheu* - harvesting hay on very steep slopes mostly through manual labour or the use of specialised light machine mowers. Wildheu is mostly in use for avalanche prevention and subsidised by the state. The economic value of the hay harvested is in no relation to the amount of labour input.

## Abstract

The hotspot of biodiversity in alpine areas, shaped by centuries of pastoral agricultural practices is currently threatened by multiple developments in agriculture and economy. Pastoral alpine farmers characterised by a multifunctional role being both producers and landscape managers possess local ecological knowledge that is created through working experience and is exerting an effect on pastoral and conservation practices. To understand the relationships between management and ecosystems with a focus on biodiversity conservation of this lay knowledge an original plan of this study included both a qualitative and quantitative assessment of local- and traditional ecological knowledge of alpine farmers in a delimited alpine area in Canton Fribourg and parts of Canton Bern in Switzerland. Aspects of participatory methodology were included in the design of the data collection and analysis, to make the study relevant to local contexts and to achieve valid results that represent a close fit to reality. Qualitative semi-structured interviews with alpine farmers and external “experts” were conducted as a preliminary step to gain data used for an explorative analysis and the creation of a quantitative survey. Due to problems with the survey distribution it was decided to concentrate on the qualitative data and conduct a discourse analysis of information given and narratives used on the state and changes of the environment, climate, socio-political context and economy with identification and comparison of personal attitudes, opinions, ideas and proposals for biodiversity conservation. These results were then discussed and findings were compared with existing literature. The main findings include that currently trust is eroding in alpine farmers’ communities in political and scientific entities together with a lack of social awareness about pastoral alpine agriculture and conservation practices. Existing conservation schemes were critically assessed and put into perspective of perceived effectivity with benefits and drawbacks formulated. Local ecological knowledge was found out to show great potential which is currently not harnessed enough by conservation schemes.



## Introduction with literature review

Biodiversity (BD) worldwide is in decline and mountain areas are some of the hotspots as anthropogenic influence is limited due to natural limitations. Approximately two thirds of Switzerland is located in alpine areas, with a population of around 1.5 Mio. inhabiting those regions which are characterised by the traditional transhumant pastoral alpine farming practices (PAFP). The alpine landscapes as they are known worldwide today have been shaped actively by the use of PAFP and the grazing of farm animals. As ever decreasing amounts of animals are pasturing during summer on the alps the areas have changed and currently are changing (Lauber et al., 2013) with implications for the alpine environment and BD as well as social structures connected to these.<sup>1</sup>

### *Socio-cultural contexts for pastoral alpine farming practices*

PAFP and alpine dairy practices are considered a living tradition in Switzerland and serve as a point of cultural identification for the society (Bundesamt für Kultur – BAK, 2022, Fischer et al., 2014). Festivities around PAFP are celebrated annually and are dating back to the middle ages with especially the Alpabzug<sup>2</sup> being celebrated widely. This cultural heritage of Switzerland is marketed internationally and actively since the 19<sup>th</sup> century creating the stereotypes commonly associated today with Swiss agriculture. The most famous stories associated could be considered “Heidis Lehr- und Wanderjahre” as well as “Heidi kann brauchen was es gelernt hat”<sup>3</sup> by Johanna Spyri published in 1880 and 1881 which characterised the alpine landscape and PAFP in a romantic, idealised way which cemented the stereotype of PAFP today. The other famous widely adapted myth (much older and foremostly verbally transmitted) present in the whole Alps is the story of “Sennentuntschi”<sup>4</sup>, a story close to the Pygmalion myth about the exact opposite of the idealised picture displayed in Heidi but rather thematically picking up on loneliness, hardship and crimes by a seclusive male community. Both stories characterised by extreme transfiguration of the alpine world describe the current stereotypes present in society rather well: The idealised PAFP in a beautiful and healthy landscape contrasting with the harsh realities of seclusive, secretive, remote aspects of such a life. That those stereotypes hardly display the reality of working with PAFP in the Alps is obvious.

Today the traditional pastoral practice and its cultural reference was and still is in big parts located between the villages and the Alps with urban culture generally not being much involved. While the

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<sup>1</sup> Here, a recommendation can be made for the extraordinary work of “Zukunft der Schweizer Alpwirtschaft; Fakten, Analysen und Denkanstöße aus dem Forschungsprogramm AlpFUTUR” (Lauber et al., 2013) which is also available in French<sup>1</sup> and Italian<sup>1</sup> and can be considered one of the best introductions to everything related to current alpine agricultural topics in Switzerland.

- <https://www.wsl.ch/en/publications/avenir-de-leconomie-alpestre-suisse-faits-analyses-et-pistes-de-reflexion-du-programme-de-recherche-alfutur.html> - Date of last access: 06.01.2023

- <https://www.wsl.ch/de/publikationen/futuro-delleconomia-alpestre-svizzera-dati-analisi-e-spunti-di-riflessione-dal-programma-di-ricerca-alfutur.html> - Date of last access: 06.01.2023

<sup>2</sup> Alpabzug – annual event in alpine regions. Cattle is driven down the mountains, usually in late September or early October.

<sup>3</sup> *Heidi: Her Years of Wandering and Learning, Heidi: How She Used What She Learned*

<sup>4</sup> Translation of the summary of the German Wikipedia article about “Sennentuntschi” – “There are various versions of this legend, but the following points are usually central: The lonely alpine dairymen and shepherds on the high Alps create a female doll out of boredom - usually only men worked on the Alps. They feed her for fun, talk to her and take her to bed with them. Shortly before the departure, the doll comes to life and starts to talk. She takes revenge for the misdeeds and the ungodly deed that the alpine dairymen have done to her. In the legend, she forces one of the herdsmen to stay with her and removes his skin.”

<https://de.wikipedia.org/wiki/Sennentuntschi>, - Date of last access: 03.01.2023

stereotypes of the Alps and PAFP were shaped by urban discourses - the alp entering the city - the entry of urban cultural and sociological discussions to the alps happened mainly during the counterculture movements quite recently in the 1970s, having their roots in the hippie movement coming from the US. This clash of different cultural spheres with urbanity invading the alps is even today still noticeable and is characterising the alp communities (Schütz et al., 2010). This exposure to urbanity on the alps was described having a strong influence on the dynamics of local ecological knowledge (LEK) (Fontefrancesco & Pieroni, 2020), which will be introduced later on in more detail.

In Canton Fribourg, a predominantly agriculturally shaped Canton culturally rooted in Catholicism, in which this research was planned to be conducted, PAFP with Sennerei<sup>5</sup> practices play an important social and economic role exemplified by the Gruyère AOP and Vacherin Fribourgoise AOP cheese located in the region (Agridea, 2016) with Gruyère cheese historically first mentioned in 1762 in the 'Dictionnaire de l'Académie française' (Bundesamt für Kultur – BAK, 2022). Sennerei activities were common practice as the fresh milk had to be cured for transport and selling on the market. Leftovers from dairy activities were considered along with bread, potatoes, polenta as basic nutrition together with seasonally collected berries, mushrooms and herbs. Traditional Sennerei products include milk, butter, cheese, whey, Ziger<sup>6</sup> and cream (Bundesamt für Kultur – BAK, 2022). There exists an abundance of local traditions ranging from local festivities to music compositions like the 'Ranz des vaches' that have been adopted internationally in a multitude of music genres by different composers (Raboud-Schüle et al., 2020). During the 19<sup>th</sup> century with the introduction of valley dairy operations Sennerei became more uncommon on alps and has only risen again since the second quarter of the 20<sup>th</sup> century.

#### *Traditional pastoral alpine farming practices*

PAFP were originally used to expand the foraging area for farm animals during the summertime (normally from end of May till the beginning of October with adjustments to yearly weather conditions) to conserve the cut grass from the valley as hay or silage for wintertime use leading to higher useable animal stock counts. As such it was traditionally a necessity for food production in densely populated Switzerland. PAFP was and is defined as a vertical type of pastoral activity where Älplers with their animals are moving between areas in which fodder plants are growing at different times (Lauber et al., 2013). This could happen with intermediate steps (Maiensäß, Voralp, Staffel) before the animals arrive at the alp. This type of transhumance is not unique to the Alps but exists also in many other mountainous areas worldwide (e.g. Scandinavia, Pyrenees, Karpates, Himalaya, Andes etc.).

Traditionally alps were characterised by a certain self-sufficiency with a high degree of subsistence. The alp was usually a place, just like regular farms, where family members from different generations would live and work together. Their lives being characterised by resourcefulness due to the limitations of the alpine environment and scarceness of available resources. Policies in the context of PAFP were in the past focused on preserving homeostasis, protecting social mechanisms like heritage which allowed the closed communities to maintain a population living adapted to the limited resources of the local environment, while contrasting today policies are incentivising non-local actors, institutions and generally constraining Älplers' choices (Netting R., 1981).

The landscape which can be seen in the Swiss Alps today can be viewed as the living heritage of those traditional practices that shaped the mountain slopes: "The stability of culturally engineered

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<sup>5</sup> Sennerei – alpine dairy which is usually included in the alp hut. Long standing tradition in Switzerland and other alpine countries; used to be practiced out of necessity to cure the milk and process it into different products.

<sup>6</sup> Ziger – a product from leftovers of the cheese production process. It is pure curdled whey. Labour and energy intensive to produce and as such is today not much produced anymore in with Senneri practices.

landscapes must be maintained by their inhabitants, requiring ecological knowledge and careful ‘balancing’ choices about cultivation, depending on micro-ecological conditions.”(von Glasenapp & Thornton, 2011). The location of that knowledge was reported to be family or community based.

*Traditional ecological knowledge (TEK) and local ecological knowledge (LEK) in the context of pastoral alpine farming practices*

TEK and LEK [and ILK (indigenous local knowledge) etc.] are often in use as synonyms for the same phenomena described. In recent scientific publications a trend towards the use of LEK to describe this pool of knowledge can be observed and many older sources using the terms TEK or ILK are encompassing the definition of LEK as well. Coming from the unclear definitions it was decided to use only and differentiate between TEK and LEK in this thesis: TEK and LEK can be seen as two spheres of lay knowledge that draw on each other while TEK is characterised by the perceived traditional character of lay knowledge while LEK puts more emphasis, as the name says, on a wider range of lay knowledge that is highly localised on a spatial scale. Other important differences include that LEK is usually not passed down through generations and is very specifically delimited to individual perceptions and subjectivity which has been shaped through experience in a local environment and the work with and in this ecosystem (Gilchrist et al., 2005) while TEK with its strong emphasis on historic cultural references can be considered in some cases less localised than LEK. The term ILK (which is also in common use) was avoided here as the ‘indigenous’ connotation might cause confusion in the Swiss context but theoretically could be used equivalently to the other terms. If findings from research about indigenous livelihoods from other countries can be transferred to a Swiss context is to be doubted but systems of PAFP and indigenous communities worldwide show striking similarities, such as a strong value of traditions, extensive land-use practices and a certain seclusiveness.

In the last two decades TEK and LEK have been internationally established as a pillar in conservation science (see also *Theoretical outline*) with TEK being defined as an essential socio-cultural heritage of rural communities (Oteros-Rozas et al., 2013). TEK and more specifically BD-related knowledge transmission between generations has been reported to show a negative trend (Ianni et al., 2015) with loss of TEK and cultural practices about the use of forests, field and livestock management linked to loss of BD (Oteros-Rozas et al., 2013). The process of TEK protection or recovery is characterised not by static conservation but rather as an endogenous development in which communication can be seen as a group of actors exerting power in territorial, ecological, cultural, social, economic and political dimensions (Ianni et al., 2015) which characterise the community. The important issue of dynamics of TEK is not the loss of a specific content but was described as the ability of society to generate this knowledge and the role it assumes, implied herein is the autonomy of the community to control the process of production and regeneration (Gómez-Baggethun & Reyes-García, 2013). Another definition of TEK is that instead of it being seen as a static body of knowledge, it should rather be seen as a dynamic process in constant change and adaptation to socio-ecological conditions (Berkes F., 2017): “a cumulative body of knowledge, practice, and beliefs, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment”. The term traditional in this context is based on perceptions influenced by historical and cultural continuity while changing with the socio-cultural context and showing fluidity. TEK can be characterised by lay knowledge, experienced based, historically rooted, put into use and with adjustments can show high resilience (Reyes-García et al., 2014; Oteros-Rozas et al., 2013, Folke et al., 2010).

The collection and use of TEK or LEK can be considered part of “new ecology” commonly characterised by complex, non-linear, panarchic systems (Gunderson & Holling, 2022) or in the sphere of “post-normal” science (Funtowicz & Ravetz, 1994). In this context the collection of TEK and LEK can be seen

as implementing new sociological insights on scientific processes into practice. In this case, the theory on institutional memory can be used to understand dynamics in TEK development with the notion of a store of ideas and practices enabling local flexibility while keeping the delimited social and cultural norms forming a cultural capital with local languages (dialects) which is connected to ecological information in an everyday context (von Glasenapp & Thornton, 2011).

Much published research about TEK was located in areas with indigenous communities. Ianni et al. (2015) mention that, albeit the process of developing the abstract concept of TEK was rooted with ethnological research mostly outside of Europe, it does not imply that it is an 'exotic' concept, but rather applying to all contemporary rural communities and landscapes. As such a need was expressed to expand the use of the concept to modern rural populations. In the case of Älplers in the Swiss context, which represents a mix of modernity and lived traditions, the concept of applying TEK in research seems appropriate. In terms of TEK regarding PAFP, which is mostly verbally communicated and hard to collect, the literature states that TEK about nature and animals is supposed to be present in Swiss Älpler communities (Bundesamt für Kultur – BAK, 2022). Traditional PAFP such as "Wildheu"<sup>7</sup>, practiced only to a limited amount today in Switzerland (and not at all in Canton Fribourg), were generally assessed as having a positive influence on species diversity when reintroduced or protected as a subsidised practice (Jenny E., 2013). In the context of lay knowledge and generally experience, the trend for mechanisation was assessed critically, removing the farmers and Älplers further from nature and encompassing this process: the loss of knowledge because of over-reliance on technology (Liner M., 2022).

Scientific as well as popular published information about TEK is hardly existent for the Swiss context of PAFP. The knowledge was reported to be a development driven by demanding conditions exerted by the harsh environment and partly because of this reason is still in place today. A study by von Glasenapp & Thornton published in 2011 assessed TEK amongst Älplers still present today at different scales (community level to individual Älpler) but focused on the production of agricultural goods and hazard management implying that "TEK must also be responsive to these (environmental) constraints and the premise of biodiversity conservation and landscape and livelihood maintenance that underlie them." (von Glasenapp & Thornton, 2011). Looking at Älplers in the Swiss context who despite working in a capitalist environment have kept the living tradition of PAFP alive, the political discourse can be viewed as to how much it is constraining or enabling sufficient space for adaptations to the ongoing changes in the physical and socio-economic climate while harnessing this LEK and TEK - or not.

In a study by Fabian et al. (2019) amongst "conservation professionals" with participants drawn from practical backgrounds, excluding participants working in a purely abstract academic environment, it was shown that lay knowledge and experienced based information sources were regarded as more important for practical implementation purposes in conservation in comparison to theoretical, abstract, evidence-based sources. Älplers working in a very practical manner with PAFP, highly based on LEK, are with their production-oriented tasks also responsible for landscape conservation and thus habitat-conservation having a big influence on BD conservation efforts in the alpine area and can be seen as "conservation professionals", thus relying more on lay knowledge sources. The communication of the aforementioned knowledge can be considered in this case viable information that should be systematically collected and disseminated. In case of Älplers who marginally work as "conservation professionals" and rather in agricultural production with a busy schedule can be estimated to rely even

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<sup>7</sup> Wildheu – harvesting hay on very steep slopes mostly through manual labour or the use of specialised light machine mowers. Wildheu is mostly in use for avalanche prevention and subsidised by the state. The economic value of the hay harvested is in no relation to the amount of labour input.

heavier on lay knowledge as it is not their main source of income as was shown to be the main limiting factor in the study for evidence based knowledge acquisition (Fabian et al., 2019).

The people of the alpine areas have always been known for their ethno-botanical knowledge of medicinal plants, many of those endemic species are today protected due to altitude delimited habitats (Petelka et al., 2020). TEK in context of medicinal plants has been reported to have almost disappeared in a study from South Tyrol, Italy (Grabherr G., 2009) but the use of medicinal plants has seen a boom in recent years with new ethno-botanical literature appearing and was described as a growing market niche (Petelka et al., 2020). This trend was put into context of exerting positive effects on BD conservation through diversification of agricultural production, an establishment of local value chains, maintenance of rural economies, the preservation of traditional land-use types through extensive and ecologically oriented PAFP, the maintenance of habitat for insect species and the preservation and revitalisation of local identities and culture, while over exploitation is considered a threat (Petelka et al., 2020).

The use of LEK and TEK in resource management and ecosystem conservation science has been considered anecdotal but are widely in use in multiple conservation programs today (Abrar et al., 2021). LEK and TEK has been described as a reliable, rapid and low-cost information source and has been in use for environmental planning and management internationally (Bergmann et al., 2004; Gilchrist et al., 2005) apart from the economical perspective TEK and LEK have been proven to contribute conservation efforts (Gadgil et al., 1993; Turner & Berkes, 2006; Gomez-Baggethun et al., 2010) while providing benefits to holders of such knowledge (McDade et al., 2007) and partially encoding human cultural diversity (Maffi, 2005).

As was stated by Kugler (2011) TEK does not play an important role in PAFP today but rather LEK can be regarded as shaping and being shaped by current practices with their context embedded in modern societies. As such the term LEK will be used predominantly in this thesis with the term constituting of lay knowledge in local contexts about the environment and PAFP which is foremostly shaped by experience.

#### *Pastoral alpine farming practices today*

The basic pastoral animal movements have been kept today while intermediate steps are not used anymore with animals being usually brought directly to the alps from the valley, often with lorries and from further away located lowland farms. Sömmerung<sup>8</sup> of farm animals today are still of great importance as a supplement to the all-season agriculture located in the valleys and lowlands with an estimated possibility of 10 % more farm animals that can effectively be used compared to a scenario without alp-usage (Lauber et al., 2013). Unlike the traditional PAFP which were characterised by necessity and hardships exerted by the harsh environmental conditions in the Alps, today PAFP have changed drastically with encompassing rural life and culture while keeping some traditions alive for cultural purposes and others for practical reasons, as the alpine environment despite the use of modern technology and construction of modern infrastructure still can be considered putting its limitations to human and farm animals comfort compared to the flat areas in Switzerland (Grabherr G, 2009). Today, additionally to the forage provision, health benefits for the animals, labour division and maintenance of cultural ecosystem services play a role for PAFP (Herzog & Seidl, 2018). The divide between urbanity and Sömmerungsgebiet was described as a sort of time travel to the past in Switzerland (Lauber et al., 2013) exemplifying the existing and consolidated gap between urbanity and

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<sup>8</sup> Sömmerung - Pastoral alpine farming practice of herding different kinds of animals, usually dairy cows or cattle for meat production; roughly from the end of May until the end of September dependent on the weather on alps

alpine rurality. After the second world war PAFP have declined with large areas being abandoned, the loss of much of the extensive goat herding and the introduction of modern cattle breeds having lost their fitness for mountain grazing, while sheep herding has recovered and horse populations are rising (Grabherr G., 2009). Today around 17 000 Äplers are annually working during Sömmerungszeit on the alps in Switzerland using a wide variety of PAFP (Lauber et al., 2013). The Sömmerungsgebiet with its alpine pastures is spatially constituting 4655 km<sup>2</sup> ca. a third of the whole agricultural area and 11 % of the whole area of Switzerland but only accounting to 4 % of direct payments for agriculture by the federal state. An estimated 100 000 dairy cows, 35 000 mother cows, 180 000 cattle, 90 000 calves, 210 000 sheep and an unspecified number of horses, goats and llamas and other ruminants are driven every year up to alpine pastures (Lauber et al., 2013). Those animals are distributed over ca. 7000 alps which generate around 280 Mio SFr. (Swiss Francs) which constituted around 11 % of the total agricultural revenue in Switzerland in 2012.

The lifestyle on alps has changed dramatically compared to the past with 'commuter alps' being common putting much strain on the labour force as efficiency with manual labour has become very important, analogues to developments in the lowlands (mechanisation etc.). The mean workload per week in 2012 was stated to be 86 hours (!) during the Sömmerung (Lauber et al., 2013) with a mean gross wage of 11 843 SFr for the whole season (in comparison the gross minimum wage in Switzerland is currently ranging between 3200 and 4200 SFr per month). The human factor on alps today is highly dependent on the location, very heterogeneous and in many areas still traditionally characterised by family alp management. Employed seasonal staff is common practice with workers coming often from other European countries (Bundesamt für Kultur, 2022). Ownership of alps and pastures can be private, leased or owned by an alp cooperative, animals pastured are either owned by the alp manager or from another farmer. Machinery is in common use on alps, esp. on dairy alps the use of milking machines is common practice. Raw produce is in most cases processed in the valley and not on the alp anymore with Sennerei practices being in place in ca. a third of all alp huts. Depending on the regions different methods are used for cheese making from traditional practices with wood fired copper cauldrons to modern electric or gas-powered equipment. Hygiene standards required for entering the formal market are a factor for abandoning the Sennerei practice and are even a burden for small valley dairies. Traditional herding methods have largely been replaced by fenced pasturing with open or rotational systems. A major difference as described by one Äpler interviewed [Ä2] is in the timing of pasturing, while traditionally it was common to pasture the cows at night while they are located in the stable during daytime, common practice today is the opposite. Pasturing can be differentiated today between more intensive rotational pastures and more extensive open pasturing. Effects on the ecosystem have been described as only visible in the rotational pasturing system with diminished plant species diversity as an effect, while the open pasture did not show any influences by the presence of animals and influencing factors on the quality of pastures were rather assessed being by pasture management like e.g. weed management (Schneider et al., 2013) with mineral fertiliser and agrichemicals were in use also with PAFP, today it is prohibited with the exception of herbicide use.

Diversity of PAFP is still given due to historic developments characterised by not minimal interference of the state in the Sömmerungsgebiet. Alps today are shaped by the local environmental conditions, historic organising principles, regional culture and cantonal legislature. Currently the diversity of farm animal breeds are, after a long period of decreasing species variety, rising again as the federal state is incentivising since 1999 the breeds of a wider spectrum of farm animals (Koordinationsstelle Biodiversitäts-Monitoring Schweiz, 2009).

Usually alps are located between 1000 and 2900 m.a.s.l. (with 95 % of all alps being located between 1000 and 2500 m.a.s.l.) and are usually constructed of locally available materials such as wood, stone and lime for historic buildings and modern materials like concrete and steel for more recent

constructions (Lauber et al., 2013). Tourism has become in recent years an important source of income for Älplers catering to hikers during the summer and in cases where the alp is located in a skiing area serving winter tourists presents an economic opportunity as well. Around 1 % of the Swiss alps are used as ski slopes with the use of artificial snow making up around a third of those (Wipf et al., 2005). Skiing tourism and touristic activities off delimited tracks has been assessed rather negatively in literature having detrimental effects on the ecosystem and thus on BD levels (Rixen C. & Rolando A., 2013). Infrastructure for artificial snow making has been described as esp. harmful (Pathey et al., 2008; de Jong C., 2020).

The mean age of farmers and Älplers in Switzerland was in the year 2018 50 years and it was estimated that until 2030 ca. 30 % of Älplers will have reached the retirement age, pointing at a generational change to change in the near future (Zorn A., 2020).

#### *Global climate change (CC) impacts in the Swiss Alps*

PAFP being like regular agriculture in its nature very dependent on environmental and climatic factors are assessed to be heavily subjected to CC impacts in the future. CC impacts were assessed to have an influence on BD in Switzerland with rising temperatures and decreasing precipitation expected (Lachat et al., 2010). Global warming in Switzerland will, depending on scenarios, result in a rise of mean temperature of 1,0 – 3,1 °C by 2060. A stronger rise of temperatures was assessed for the alpine areas (BLW, 2011). Precipitation levels are reported to be uncertain apart from the summer months where precipitation is projected to fall 17 % by 2060 in western parts of Switzerland and 6 to 10 % in eastern parts. Vegetation periods in the alpine areas are expected to lengthen by 2 months because of impacts of global warming (Butterling et al., 2017; Frei et al., 2007). Apart from the already ongoing processes of melting glaciers that regularly make headlines in popular media outlets, dry summers, heavy precipitation, more heat days and less snow in winter were summarised as the main projected outlook for CC impact in Switzerland (Müller-Ferch et al., 2019). A trend of increasing populations of warmth loving species like butterfly-, firefly- and bird species of the Mediterranean area was identified in Switzerland and one impact specific for alpine (mountainous) regions assessed is the tendency of plant species to climb in heights (Koordinationsstelle Biodiversitäts-Monitoring Schweiz, 2009). Invasive species were described as an issue of high importance for BD conservation with 825 Neobiota<sup>9</sup> identified in Switzerland of which 107 are considered invasive (Lachat et al. 2010). This spread of foreign species expanding their former habitat can create problems for indigenous species diversity as the possibility of displacement in limited habitats is present. This was assessed as esp. critical as the species with Swiss responsibility are mostly limited to the alpine, high altitude areas (Gatteln et al., 2017). Identified effects are changes of development processes dependent on seasonal changes and the distribution of species with thermophilic species profiting from the impacts leading to climbing in heights presenting habitat problems for species currently limited to higher altitudes. More precisely invasive species e.g. like *Aedes albopictus* or *Ailanthus altissima* are assessed to spread further in Swiss alpine regions with detrimental effects on endemic species diversity (Butterling et al., 2017). An increase of *Tracheophyta* (e.g. ferns) in the alpine area was recorded esp. with species of a high nutrient uptake that was put into connection with the increasing homogenisation of alpine meadows and pastures in the whole area of Switzerland and esp. in the areas of the northern Alps and Jura (Walter et al., 2013). The most prominent example of a flagship plant species endangered by CC impacts is the iconic Edelweiß (*Leontopodium nivale* subsp. *alpinum*), which can be considered the

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<sup>9</sup> Neobiota - German classification which seems to be not existent in English language, meaning all non-endemic species' which got introduced with anthropogenic influences. Neophytes – plant species falling into the Neobiota category.

national plant of Switzerland and of alpine areas in general (Grabherr G., 2009). According to monitoring data measured between 2001/2002 and 2006/2007 an average climb of 13 m in height of plant species were measured (Koordinationsstelle Biodiversitäts-Monitoring Schweiz, 2009). Bird – and butterfly species was measured to climb 40 m (Gatteln et al., 2017). Declining precipitation levels were identified to effect esp. species with habitats connected to small water structures like amphibia. Fragmented landscapes were in this context described as esp. harmful as they might hinder the movement of species to other habitats and are generally hindering the exchange of individuals between isolated populations (Fischer et al., 2014). This fragmentation and decline of individuals of species populations is creating problems with genetic diversity making the population less resilient against all kinds of diseases (Gatteln et al., 2017). In terms of forest encroachment, CC impacts are projected to shift the treeline up in altitude leading to greater issues with this development in future on alpine pastures (Schwörer et al., 2014).

Other CC impacts include: the increase of sliding slopes due to more often occurring extreme precipitation events, effects on insect species diversity that have their habitat along cold water in the alpine area making them climate sensitive and bogs that were assessed sensitive to CC. Extreme weather events like extraordinary heat have reportedly in the northern alpine region already by 2007 (Frei et al.) increased by 70 %. In general, the increase of extreme weather events like heat, precipitation with following sliding slopes and floods, dry-spells and storms were assessed to likely increase until 2050.

With longer seasons and compared to the flat area less water availability problems the alpine areas were assessed to possibly profit economically from CC impacts, while those potentials for economic development have to be balanced with environmental- and BD conservation goals (Frei et al., 2007). For example, in 2005 the start of the alp season began in the middle 15 days earlier than in 1975 (Lachat et al., 2010), this trend can be expected to have continued and continue in the future (Herzog & Seidl, 2018).

#### *State programmes influencing pastoral alpine farming practices*

Direktzahlungen or direct payments are generally defined as state subsidies given to agricultural and alp operations to steer envisioned developments for agricultural production in Switzerland. For the alps and PAFP these make up a big amount of the income due to the extensivity and limited economic viability of PAFP today. Direct payments are measured since the 1990s by agricultural zones (Valley-, Hill-, Mountain zones, see also Map 4, p.29) and since 2014 they were also introduced for the Sömmerungsgebiet. Measurement of payments is normally the Normalstoß and every alp has as its benchmark the Normalbesatz/Sömmerungszahl while area-based payments were introduced recently to compensate for extensive PAFP.

Landschaftsqualitätsbeiträge<sup>10</sup> (see also *List of 'indigenous' words and bureaucratic terms*) are part of the direct payments and were introduced in 2014. An instrument of direct payments by the federal state for action taken by farmers and Äplers that can be considered beneficial for environmental- and BD conservation (Schnurrenberger M., 2022). Initiative projects get contracted by the cantonal administration with an annual payment towards Äplers. It displays a legal framework for potentially participative, bottom-up movements to incentivise action-oriented PAFP and farming practices in general.

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<sup>10</sup> Translation – landscape quality subsidies



Strukturverbesserungsbeiträge<sup>11</sup>(see also *List of 'indigenous' words and bureaucratic terms*), more commonly called meliorations are not part of the direct payments and are state subsidies aimed at infrastructure constructions. For the alpine areas these are of special importance as the areas are less densely populated in comparison to the central plateau for example and investments for necessary infrastructure in the mountains cannot be easily shouldered by the population commonly using them. Currently meliorations are discussed critically esp. in the case of road constructions in the alpine area making the use of heavy machinery on alps possible, as such meliorations today were assessed still destroying high value structures in the alpine area (Gatteln et al., 2017). The most infamous example of meliorations misused in the BD conservation context in the history of Switzerland was described as the loss of bog areas due to drainage constructions to make intensive agriculture possible or to create more building land (Fischer et al., 2014). In 2012 83 % of all alps were connected through road infrastructure (Lauber et al., 2013).

Sömmerungsbeiträge<sup>12</sup> and Alpungsbeiträge<sup>13</sup>(see also *List of 'indigenous' words and bureaucratic terms*), part of the direct payments are both financial instruments by the federal state to incentivise PAFP and part of the direct-payments for agriculture aimed to counter the development of pasture abandonment and generally the conservation of current animal numbers on alps (Mack & Flury, 2014). The important difference between those two measures is the aiming of payments: In case of Alpungsbeiträge, which are aimed at the farmer giving the animals to the alp, while Sömmerungsbeiträge are aimed at the Älpler, or rather the alp owner. The effectivity was assessed as positive while they reportedly cannot stop the negative trend of giving less animals to the alp, esp. with goats and sheep (Mack & Flury, 2014).

Subsidies in the frame of direct payments aimed directly at BD conservation will be introduced in the following section.

### *Biodiversity conservation in Switzerland*

Agriculture in Switzerland created until the end of the 19<sup>th</sup> century a multitude of new habitats for plants and animals beneficial for BD. This trend reversed during the 20<sup>th</sup> century esp. in the central plateau and valley areas but also in the mountainous regions (Lachat et al., 2010, Fischer et al., 2014). Main reasons for this development applying to agriculture in general, but also to PAFP were listed by Fischer et al. (2014): Intensification of land-use, insufficient amount of high quality BD support areas, removal of near-natural areas and structures, meliorations, drainage of organic soils and high value wet meadows, excessive use of fertiliser - mineral nitrogen fertiliser and slurry, excessive animal stocking numbers per area unit, irrigation of sensitive - species diverse types of meadows, preventive or overuse of pesticides and herbicides, Nitrogen input via the atmosphere or ammonia emissions, immediate packing of the mown grass (and small animals) in bale silage, use of mowing techniques that are harmful to small animals (e.g. mower conditioners, flail mowers), no staggering of cutting of meadows and too early cutting, too little and declining genetic diversity in crops and livestock, breeding of high-performance animals that require high-protein feed (clover grass, corn, cereals), abandonment of use of areas difficult to access, loss of cultivated land due to settlement expansion and too little dissemination of near-natural farming systems at farm level (organic, low-input and integrated farming).

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<sup>11</sup> Translation – structural improvement subsidies

<sup>12</sup> Translation – subsidies for Sömmerung

<sup>13</sup> Translation – subsidies for alping

Since the 1990s the goal has been to conserve and promote BD in and through agriculture as an explicit goal in agricultural politics. Switzerland as a signatory member of the Convention of Biological Diversity of Rio (UN, 1992) took official responsibility to conserve and protect BD. With the introduction of the ecological proof of performance and ecological compensation areas these goals were meant to be met in agricultural areas (Lachat et al., 2010). The development of agriculture in the alpine area in Switzerland was assessed as esp. critical as a two-fold development currently in progress with areas located closer to the valley with high potential for agricultural production getting intensified while remote areas with less economic potential get abandoned, both trends identified as being detrimental for BD conservation (Fischer et al., 2014). In 2008 a cooperation between the Bundesamt für Umwelt<sup>14</sup> (BAFU) and the Bundesamt für Landwirtschaft<sup>15</sup> (BLW) drafted common environmental goals for agriculture in Switzerland. Species of national priority<sup>16</sup> and target species were, as well as corresponding habitats, taken to create quality criteria which were called Umweltziele Landwirtschafts-Qualität<sup>17</sup> (UZL-Quality). The results showed that in the Sömmerungsgebiet and Bergzone III and IV UZL-Quality areas were sufficiently present while all other agricultural areas with UZL-Quality were lacking (Walter et al., 2013; Fischer et al., 2014).

Lachat et al. (2010) in a Swiss-wide study came to the conclusion that even though successes were attained in conservation of cultivated plants and farm animal breeds, conservation of species- and habitat diversity was falling short of aspired goals. The state of species diversity was described as very worrying as over a third of plant, animal and mushroom species in Switzerland was categorised as “threatened” with 255 endemic species are reported to be extinct in Switzerland and with many vertebrate species the last year of observation known (and quite recent) such as the woodchat shrike (*Lanius senator*) in 2006 (Fischer et al., 2014). The reason for the ongoing loss of species levels and diversity was identified being the loss of quantity and quality of habitats with esp. mechanisation of PAFP was pointed out being one of the main drivers (Guntern et al., 2020).

In 2010 within the framework of the Convention for Biological Diversity in Nagoya, Switzerland adopted new goals (UNEP, 2010) one of them being that 15 % of harmed ecosystems need to be restored and another that all economic sectors are required to act. In the whole BD conservation efforts were assessed as by far not sufficient to reach agreed goals (Fischer et al., 2014). The agricultural sector that uses roughly a third of the total area in Switzerland was assessed to be a crucial factor in reaching the goals for BD conservation. More concretely agricultures’ contribution to BD conservation efforts were seen threefold: 1. BD and diversity of habitats, 2. Genetic diversity of species and 3. Functional BD (Walter et al., 2013). The recommendations resulting from a Swiss-wide study by Lachat et al. (2010) were implemented during the new agricultural policy from 2013 and the creation of new BD monitoring programmes (Walter et al., 2013). Coupled to eligibility to receive direct payments the federal state made Biodiversitätsförderflächen<sup>18</sup> (BFF) mandatory for agricultural producers. This scheme was extended to the alpine areas with equal payments as in the flat areas in 2014, while only the second (higher) quality – BFF2 is available. This means that at least 7 % of pastures

<sup>14</sup> Bundesamt für Umwelt – Federal Office for the Environment

<sup>15</sup> Bundesamt für Landwirtschaft – Federal Office for Agriculture

<sup>16</sup> Species of national priority (BAFU, 2019) – The list contains 3665 species from 21 organism groups. 87 % of priority species are listed as endangered (red list) and for 10 % Switzerland is of high to very high responsibility globally (for Switzerland endemic and partly endemic species). 30 % of species are categorised of high to very high national priority. For 793 priority species a recommendation for protection measures was given. These are connected to habitats of national priority of which 85 % were assessed needing measures for protection.

<sup>17</sup> Umweltziele Landwirtschafts-Qualität – translation provided by Walter et al. (2013): Agriculture-related Environmental Objectives

<sup>18</sup> Biodiversitätsförderflächen – agricultural compensation area to promote BD, result-oriented payment scheme to determine eligibility for other direct payments.

in the Bergzone and Sömmerungsgebiet need to be marked as BFF2 area to receive the direct payments. The introduction of BFF2 areas for agricultural and pastureland were assessed as having a moderate success in reducing the loss of species diversity in cultured land, but the goal to stop BD loss through this conservation scheme cannot be guaranteed (Fischer et al., 2014). In the period from 2014-2017 2.8 Bio. SFr were spent on agricultural direct payments, of those ca. 14 % or 367 Mio. SFr was intended for BD promotion measures (Agroscope, 2015).

Switzerland currently has more than 45 000 proven species present with ca. 100 species that are located mostly or exclusively in the area of the Swiss state with 235 different habitat types categorised resulting from the mountainous landscapes with high variety in altitude differences, the geological diversity and the traditional cultural landscapes developed over a long period of time (Delarze et al., 2015, Fischer et al., 2014). 600 species of flowering plants, a fifth of all native plants, are located exclusively or have their distribution focus in the alpine areas.

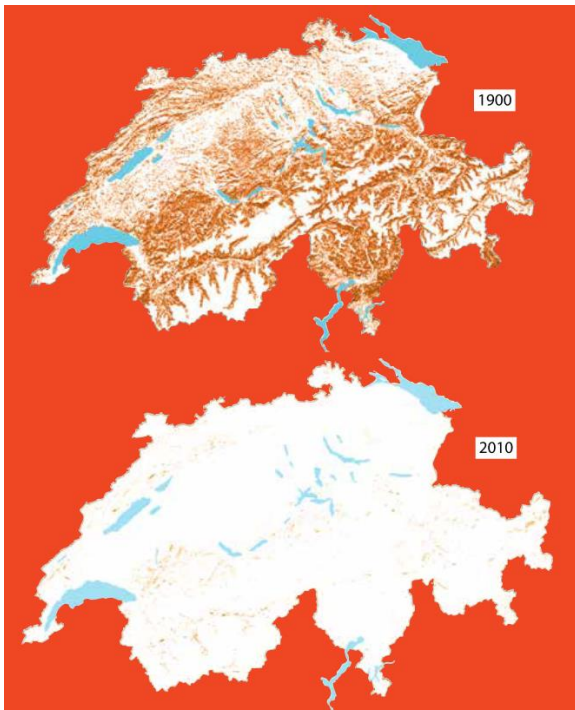
Vernetzungsprojekte were described with contractual agreements as very successful, both harnessing LEK and TEK and enriching cooperation and communication between Äplers and scientists with a long term perspective, while the spatial limitation to agricultural land with forest and adjacent riverine environments not being included were considered downsides (von Glasenapp & Thornton, 2011).

#### *Species of special responsibility and national priority in Switzerland*

The Alps with its specific occurrence of species limited to higher altitudes is seen as an area of special responsibility for Switzerland (Lachat et al., 2010). The Alps in Switzerland were described as being esp. diverse for vascular plant species and butterfly species (Koordinationsstelle Biodiversitäts-Monitoring Schweiz, 2009) and a trend for increasing presence of vascular plants that prefer nutrient rich soils was identified. The Sömmerungsgebiet in Switzerland is home to 75 % of nationally protected flat bogs, 76 % of nationally protected dry grassland with 8 of 12 endemic plant species and 250 of 389 plant species of national responsibility being located within (Lauber et al., 2013). Habitat types in the alpine region are diverse and many have been assessed as being to a high percentage endangered in the whole of Switzerland such as stagnant (100 %) and flowing waters (50 %), riparian and wetlands (85 %), glaciers, rocks, debris and moraine areas (29 %), meadows and pastures (43 %), forest area (41 %) and pioneering vegetation and agrarian flora (61 %)(Fischer et al., 2014). Alpine habitats are characterised by their extreme topography resulting in the only (esp. in higher altitudes) consistently large wild natural landscapes left in Switzerland (Koordinationsstelle Biodiversitäts-Monitoring Schweiz, 2009). The alpine area was identified to show a substantial decline in biodiverse meadows and pastures alongside a decline of protected species populations. Main factors identified for this development are intensification of agricultural practices including PAFP and abandonment of locations with marginal returns (Walter et al., 2013). It got pointed out that esp. a strong decrease in species diversity is located in the lower Alps, which are well connected by road networks and accessible and thus are subjected to stronger developments with agricultural intensification using more machinery (Fischer et al., 2014). Even though the total BD levels are higher below the treeline areas above were still assessed as a hotspot for BD compared to the flat parts of Switzerland. Abandonment of pastures was seen critically as usually shrub- and forest-encroachment is following and a further spread of forest in the alpine area was assessed as generally (with exceptions) not beneficial for BD levels in the Alps (Lachat et al., 2010). The trend of an increase of forest area in Switzerland, started in the second half of the 19<sup>th</sup> century, is still present with around a third of the whole area of Switzerland covered by forest compared to the scenario with an estimated potential of 74 % total natural forest cover with no anthropogenic influences (Ginzler et al., 2011). In the Sömmerungsgebiet shrub- and forest- encroachment accounts to the loss of ca. 2400 ha of pastures every year (Lauber et al., 2013, Gatteln et al., 2017) and is located 93 % in areas with species rich pastures and meadows (Bundesamt für Statistik - BFS, 2012). The

northern Alps region was assessed as having the lowest pressure from forest encroachment (+4.5 % between 1983 and 2007) while in general forest encroachment on pastures and meadows is expected to continue, if no strict policies targeting this issue are introduced (Price et al., 2016).

Switzerland showed a positive development with the creation of protected areas and those existent were assessed as vitally important to reach BD conservation goals with a strong notion of pre-emptive action for future developments (Lachat et al., 2010) as certain habitat types were assessed as difficult if not impossible to restore once destroyed such as bogs, natural forests and subalpine and alpine ecosystems in general (Fischer et al., 2014). Concrete quantified scientific findings like the case study by Stampfli A. & Zeiter M. (2010) showed that a restoration of a pasture after forest and shrub-encroachment even after 20 years showed significantly lower plant species diversity and around 45 % less fodder production.



Map 1: Development of dry grassland between 1900 and 2010 in Switzerland (Fischer et al., 2014).

Nevertheless, regarding the historic development of habitat loss exemplified here in the context of protected areas the decline of 95 % of dry grasslands, an esp. an important type of habitat in the alpine area, between 1900 and 2010 was pointed out to be a problem for BD conservation as those 21 000 ha in existence in 2010 showed an ongoing trend of declining quality (Fischer et al., 2014; Lachat et al., 2010)(see Map 1). In 2014 it was estimated that Switzerland needs to double the protected habitats to ensure BD conservation and keep ecosystem services intact (Fischer et al., 2014).

The development of green energy and esp. hydroelectric power projects were assessed as having potential negative effects on BD in Switzerland (Lachat et al., 2010; Fischer et al., 2014). The potential of solar power in the alpine area between 1500 and 2000 m was assessed as greater compared to the valley areas as sunlight is potentially available all year but effects on BD of

larger scale solar arrays placed in alpine landscapes has not been assessed yet and shows a considerable risk (Schlegel J., 2021).

BD conservation in connection to ecosystem services has been discussed excessively in scientific communities in the recent past and also for Switzerland a consensus was described as one of the most pressing current topics together with CC characterised by high levels of uncertainty and a necessity to act quickly describing it as a “Generationenvertrag”<sup>19</sup> (Fischer et al., 2014).

#### *Biodiversity monitoring programmes in Switzerland*

Monitoring of BD with cross-linking to other environmental monitoring is a part of the convention on biological diversity of Rio (1992). Switzerland as a signatory state has expanded their monitoring to a great extent since then with the OECD (2017) acknowledging success with monitoring in particular. Currently there are four complementary big BD monitoring programmes in place.

<sup>19</sup> Translation – Intergenerational-contract

The red lists consist of monitoring data of development trends of populations and size of the distribution area. Currently around a quarter of the ca. 46 000 known species are catalogued in Switzerland (BAFU, 2017).

The Biodiversitäts-Monitoring Schweiz (BDM) was introduced in 2001 having the goal of monitoring long-term effects of environmental changes on BD. A grid is used to monitor vascular plants, birds and butterflies in 450 areas (each 1 km<sup>2</sup> in size). Additionally, monitored on 1450 areas (each 10 m<sup>2</sup> in size) are the diversity of vascular plants, mosses and snails. Furthermore, there are 570 aquatic structures monitored where data on water insects is obtained (BAFU, 2014). The BDM is focused on recording data that represent changes in species diversity as this was before the introduction of this monitoring programme not possible, or only to a limited unsystematic amount possible (Koordinationsstelle Biodiversitäts-Monitoring Schweiz, 2009). For this goal a Swiss-wide long-term structured monitoring of 30 indicators was introduced, from which implications on a wide spectrum of BD in Switzerland can be harnessed.

The Arten und Lebensräume Landwirtschaft – Espèces et milieux agricoles (ALL-EMA) monitoring programme was introduced in 2015 and was supposed to close the monitoring gap of developments and diversity of plant species and habitats in agriculturally characterised areas (Agroscope, 2015). Data generated is directly aimed to be linked with the environmental goals for agriculture in Switzerland. It is based on the BDM grid from which 170 km<sup>2</sup>-sized areas in which habitats, habitat-structures and plant species are monitored. Monitoring intervals for the same area are every 5 years.

Biotopes of national importance were introduced during the 1990s and ca. 6800 objects were designated, accounting to 2,2 % of the total area of Switzerland, with conservation goals and development plans specified. In 2011 a monitoring programme WBS (Wirkungskontrolle Biotopschutz Schweiz)<sup>20</sup>, specifically aimed at those biotopes, was introduced (Boch et al., 2018). Biotopes are often located on alpine pastures making management with cooperation of Älplers necessary.

### *State of the art*

The development of PAFP in the alpine area was assessed showing a similar development comparable to the central plateau during the 1960s and 70s, resulting in an estimated loss of a quarter of all biodiverse areas in the Alps by 2021 (Fischer et al., 2014). This ongoing intensification of agricultural activities, as well as expansion of sporting facilities, urban areas are exerting a high pressure on alpine habitats with detrimental effects on BD (Gatteln et al., 2017). The development of nature conservation as a practice in the past can be characterised by the shift from experience-based towards evidence-based management (Sutherland et al., 2004). With the developing gap between scientific knowledge and implementation, this orthodoxy has been increasingly questioned during “new-ecology” and “post-normal” discourses, stressing a change back to incorporating experience based solutions such as harnessing LEK for conservation implementation strategies (Gunderson & Holling, 2022; Fabian et al., 2019; Funtowicz & Ravetz, 1994). In a study on perceptions in the scientific and (lowland) farmers communities in Switzerland by Maas et al. (2021) findings included significant differences for BD conservation measures, agri-environmental schemes and environmental conservation measures. Factors influencing “BD-positive” perceptions stated are female, organic and highly educated farmers with the conclusion of an urgent need to enhance communication efforts to incentivise cooperation between scientific- and farmer communities. Given the current lack of scientific publications in Switzerland about the collection and use of LEK in the context of BD conservation and taken the recent agreement of the COP15 (Convention on Biological Diversity - CBD, 2022) into consideration, a start of systematically collecting LEK for BD conservation seems to be a viable way of advancing conservation-

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<sup>20</sup> WBS - Impact monitoring biotope protection Switzerland

scientific process and BD conservation implementation schemes alike. The use of LEK in science has been described generally as challenging due to the inherent differences between the knowledge systems (Tengö et al., 2021): “[...], these systems are qualitatively different from scientific knowledge systems and are fine tuned to meet diverse knowledge needs specific to cultures, worldviews, truth claim-making traditions, and institutions.”; but LEK has historically been widely used internationally and shown its usefulness to obtain information on the presence or qualitative abundance of species (Leedy, 1949; Zimmerer, 1991; Vaughan et al. 2003; Moller et al., 2004) and on qualitative population trends (Ferguson et al. 1998; Mallory et al. 2003) while it has seldom been used to obtain quantitative estimates of abundance or population trends while comparing results to scientific data (Gilchrist et al. 2005; Lozano-Montes et al. 2008). This circumstance that LEK is rarely collected systematically in areas with abundant scientific data present has led to its validity rarely being assessed on quantitative grounds (Teixera et al., 2013). In a study quantifying shepherds LEK about turtle abundance in Almeria, Spain (Anadón et al., 2009) it was proven that LEK can be used not just as an initial exploratory method but also to quantify relative abundance with high correlation to evidence-based distance sampling data, making this method an economically viable and scientifically accurate option to monitor certain species. In another study LEK was recorded and compared to habitat suitability in a marine protected area in west Galicia, Spain which showed that LEK correctly identified local species habitats (Sánchez-Carnero et al., 2016). In a study located in the Bornean rainforest it was proven that the incorporation of LEK in systematic manner can prove as an effective and complementary tool to estimate wildlife densities (Abrar et al., 2021). Morales-Reyes et al. (2019) showed high consistencies between shepherds LEK and scientific findings about frequency of occurrence, esp. at species level of vultures in Spain coming to the conclusion that: “[...] shepherds and their ILK are often overlooked both in European and national policies. In this sense, it is necessary to highlight the relevant role of ILK and to integrate ILK (indigenous local knowledge) and SK (scientific knowledge) into management and conservation strategies.” In a review about power structures in participative environmental monitoring projects, harnessing LEK, it could be shown that PPs (participative process) are more than just scientific purpose and is empowering local communities effectively (in this case indigenous populations) with the local communities not just being shaped by the process but actively shaping the process themselves (Thompson et al., 2020). In general, the use of multiple knowledge systems was assessed as improving ecological policy, if the conviction of decision-makers can be reached that such inputs can be beneficial (McElwee et al., 2019).

Scientific interest in the context of (BD) conservation has shifted in Switzerland in the recent past more towards including anthropogenic components such as the introduction of the point system developed by Vogelwarte<sup>21</sup> and FiBL<sup>22</sup> (Birrer et al., 2014) and a development of a simplified BD assessment scheme for farmland (Tasser et al., 2019). In the frame of assessing BFF2 payments interviews with stakeholders were conducted in Switzerland with one result being (Bundesamt für Landwirtschaft - BLW, 2019): “Die befragten Bewirtschafter/innen bedauern zudem, dass ihr Erfahrungswissen von Behörden und Fachstellen zu wenig berücksichtigt werde.”<sup>23</sup> LEK has already been reported in a qualitative context showing its potential usefulness if harnessed systemically in Switzerland (von Glasenapp & Thornton, 2011): “Farmers’ ability to pinpoint certain species to exact locations in combination with intimate engagement with the microecological conditions of the cultivated land and sources of water allow for close monitoring of changing ecological conditions. For example, during the extremely dry summers of 2003–2004 the impact of drought was not only immediately registered, but

<sup>21</sup> Vogelwarte – the main institute for bird species’ monitoring in Switzerland

<sup>22</sup> FiBL – Forschungsinstitut für Biologischen Landbau - Research Institute for Organic Agriculture – the main research institute for organic agriculture in Switzerland, also very active in offering extension. Privately funded.

<sup>23</sup> Translation - The managers surveyed also regret that their experiential knowledge is not taken into account enough by authorities and specialized agencies.

so were the differing impacts for different areas of the valley according to their different ecological zones (e.g., northern facing slopes in better condition than those opposite).”Älplers usually working in the same environment for multiple years, if not a lifetime, present an opportunity for the collection and quantification of LEK in Switzerland while also a qualitative assessment on perceived species characteristics and opinions on protection measures can be harnessed during the process.

## Original Research Objectives, Hypothesis and Research Questions

Due to problems encountered during the data collection it was deemed necessary to include epistemological parts to understand decisions made during the research process and to assess biases ultimately present.

*Objectives:*

- 1. Eliciting farmer’s knowledge about biodiversity at local scale*
- 2. Exploring the relationship between farmer’s LEK and scientific knowledge*
- 3. Identifying farmer’s perceptions of changes in biodiversity*
- 4. Understanding the socio-demographic, including learning pathways and management factors or characteristics influencing farmer’s LEK and perceptions on biodiversity and its changes*

*H: Alpine farmers have heterogeneous but abundant LEK about bio-physical processes and know accurately about certain species diversity in their area, thus are capable of giving an intricate description of the dynamic processes on a local scale.*

*RQ 1. How much correlation exists between scientific reporting on certain species population presence and changes and farmers’ perceptions?*

*RQ 2. What factors are influencing the dynamic of LEK on BD of Älplers?*

*RQ 3. What LEK exists concerning attributes of examples of local plants, mammals, birds, reptiles, amphibia and insects?*

*RQ 4. What is Älplers’ perception of the impact of their actions on biodiversity?*

## Theoretical outline

Reyes-García & Benyei (2019) describe two emerging approaches to combine LEK and science for conservation with one of them being based on the IPBES concept which targets the maintenance of both biological as well as cultural diversity simultaneously. It was decided to take the IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services) integrative conceptual framework (Díaz et al., 2015) as a basic theoretical outline and inspiration (see Figure 1, p.25) in which methodology can be drawn from to address research objectives and answer RQs. Its universal ambition and wide acceptance in the scientific community were further reasons to take this source as a theoretical starting point. The IPBES framework seemed in its grounding theory esp. fitting as the topic of the thesis is inherently embedded and the planned methodology with characteristics of PP used, was considered as a satisfactory method for stated ambitions and pre-requisites: “Integrative conceptual frameworks are particularly useful tools in fields requiring interdisciplinary collaboration where they are used to make sense of complexity by clarifying and focusing thinking about relationships, supporting communication across disciplines and knowledge systems and between knowledge and policy.” In particular the application in the context of LEK (in this case equivalent to ILK (indigenous local knowledge) was seen sharing parts of the theoretical outline as it is stated that: “Each knowledge system has its own processes of validity. Communities will often recognize that valid knowledge comes from certain knowledge holders: person/s with the rights (e.g. gender, title-holding) and skills (e.g. language, farming). Valid knowledge in ILK systems is tested and retested through practice, for example, the application of medicinal plants, or the use of materials in fishing. The most important validity issue for ILK holders is often that of ensuring that the inclusion and interpretation of their knowledge and information in processes outside of their cultural context is robust in terms of their knowledge and belief systems.”

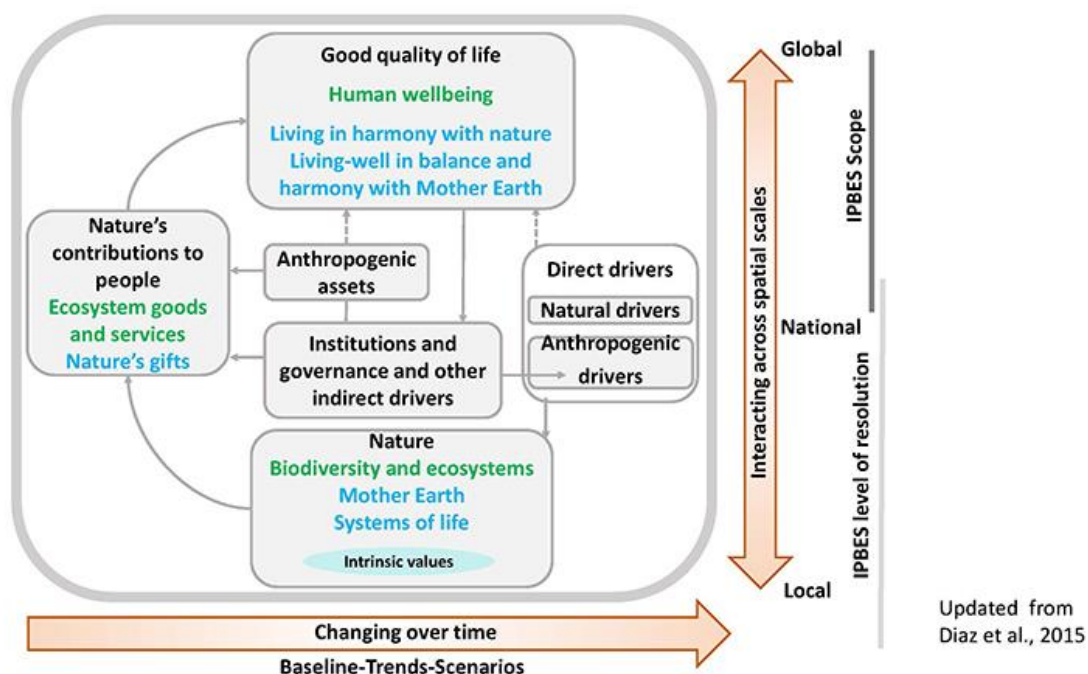


Figure 1: IPBES integrative conceptual framework. Source: Díaz et al., 2015

From this framework the dimension of time was integrated into the analytical methods for the qualitative data, while analysis was centred around BD with the other factors present included in a



looser manner adapted to the structure of the interviews and analysis. The dimension of spatial scales was dropped as the study was locally delimited (See in *Methods*, Map 2, p.27 & Map 5, p.29).

The task of legitimising LEK as originally envisioned is not trivial and Díaz et al. (2015) propose to use a multiple based evidence (MEB) [otherwise also known as “methodological bricolage”(Parlee et al., 2021)] approach: “The MEB approach highlights the complementarity, synergy and cross-fertilization of knowledge systems, rather than the integration of one system into another. It also stresses that relevant stakeholders should be involved at all stages in the processes of knowledge generation, assessment, design of policy support tools and capacity building. Such involvement should include the critical steps of definition of goals, scoping of problems and tasks, and examination and adaptation of findings.”

Collection of LEK shows many prerequisites, similarities and targets as PPs (participative process) as such it was considered most beneficial to use this methodological approach to address objectives and answer RQs. To address this task it was decided originally to have include methodology from participative processes such as outlined by Townsley P. (1996) and McCracken et al. (1988) with possibilities to triangulate qualitative and quantitative data as well as having enough flexibility during the process to make sure validation of LEK can be accomplished effectively. General principles for participation were drawn from Chambers (1981) description of rapid rural appraisal (RRA), with a focus on eliciting and extracting knowledge, as due to the constraints set by the temporal and monetary limits a complete PP with a strong notion of knowledge generated, owned and shared amongst local people as outlined by Cuéllar-Padilla & Calle-Collado (2011)<sup>24</sup>, Oteros-Rozas et al. (2015)<sup>25</sup> or Chambers (1994)<sup>26</sup> was thought to be too ambitious. More concretely inspiration was drawn from the methodology used by Reyes-García et al. (2021) for the LICCI (Local Indicators of Climate Change Impacts) research project: Semi-structured interviews, Survey and focus group discussion (FGD). A deliberative PP with the use of participation by consultation (Pretty, 1995) was chosen for the semi-structured interviews and the design of the survey to involve local stakeholders and rightholders in the process of research. It was hoped to gain new ideas, address uncertainties and surprises, decrease bias, value local peoples’ perception with a notion of empowerment by addressing the plurality of legitimate perspectives, create space for emerging events to be included and esp. make the research applicable to real life problems and ensure there is a practical value perceived by all participants. Reportedly farmers and Älplers alike reacted positively to PPs in former studies and implementation efforts conducted (von Glasenapp & Thornton, 2011).

Methodology of qualitative interviews and their analysis was designed along three principles for evaluation as stated by Baxter & Eyles (1996). For this emphasis was taken to ensure “scientific rigour” in the conventional sense of displaying validity, reliability and objectivity as well as scientific integrity including responsibility and honesty by adapting a fitting methodology addressing outlined goals of this thesis to come to a plausible research design and research findings were corroborated or refuted with fitting literature and existing theories to make accounts plausible and appeal to the interpretive community. To further ensure scientific rigour in methodology selection appropriateness of methodology was taken into account as well as the intended use of multiple methods as outlined in the section *Methods*. Triangulation of data was the aspired goal. This was conducted by using a qualitative part, to ensure information obtained from the literature research was correct and foremostly still relevant, while weighing importance of information and the inclusion of right and stakeholders in the process of designing a methodology around topics of interest as outlined in

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<sup>24</sup> PAR – participatory action research

<sup>25</sup> PSP – participatory scenario planning

<sup>26</sup> PRA – participatory rural appraisal

ambitions for PP: gaining new unthought-of ideas and insights not documented or focused on in existing literature and collecting qualitative data to answer parts of the RQs which could be compared to data obtained during the quantitative data collection. Comparability was an important factor in designing both parts. The qualitative part should in this case fulfil its ambition to identify causal mechanisms while the quantitative data was supposed to establish causal relationships and ranging validity (Gläse & Laudel, 2013). Information on respondent sampling and selection was provided and with the qualitative analysis verbatim quotations were used extensively and it was ensured that most participants are quoted in topics that were focused on during the interview. Otherwise quotations were chosen in terms of quality and representation of topics discussed, thus some participants were quoted more extensively as interviews significantly differed in length and quantity of information received. Focusing and adapting interview questions according to whatever emergent phenomena took place was made possible by using a semi-structured design with guideline question catalogues. Power relations were taken into account during the interviews and it was actively given attention to balancing those to ensure a relaxed atmosphere and unbiased responses. Misinterpretations of meanings expressed through interview conversations could not be adequately addressed, but through testing of the designed survey implicit misunderstandings could be identified and eliminated for qualitative data analysis thus qualitative validity was ensured to a smaller degree. The quantitative part, meant to be the main data collection in the form of a survey, was designed to address all research questions and the hypothesis. Survey design was relying heavily on the initial qualitative data collection to ensure relevance of data collected. The planned FGD was supposed to be a final review on data obtained during the qualitative and quantitative data collection with results shown to participants and discussed alongside to avoid bias and to include new ideas inspired by those findings with a strong focus on reflexivity of both the researcher and participants. The FGD would have also functioned in revisiting data collected in the initial qualitative interviews thus ensuring validity of the data and avoiding bias through misunderstandings.

In the whole the design of methods was conducted using inquiry audit through the graduate student-supervisor relationship (Baxter & Eyles, 1996) to ensure an appropriate methodology was set a priori resulting in (theoretically) more dependable results. The final thesis was designed around the eight checklist questions by Rose G. (1982) to ensure confirmability of the results. The planned thesis was meant to be a combination of exploratory and conclusive research with a focus on expanding theoretical concepts with empirical validation.

## Methods

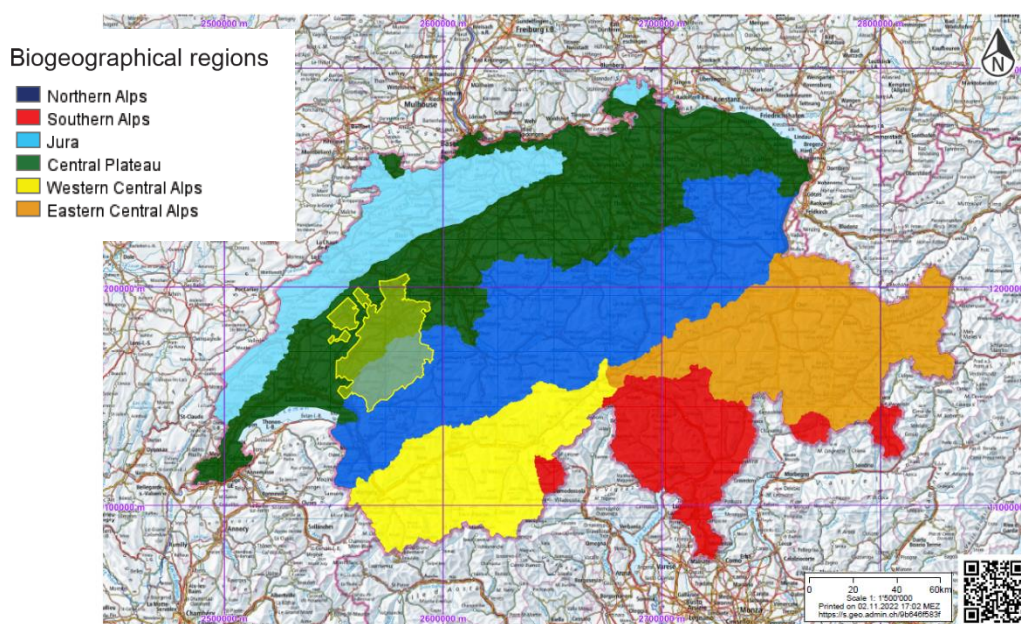
### *Literature review*

A comprehensive literature review, in German and English language, was conducted preliminary and during the research process. All literature was gathered from online libraries such as: “Web of Knowledge”, “Google Scholar”, “OECD”, and several government homepages such as “BAFU”, “BLW”, news networks and project homepages from Switzerland.

### *Study area description*

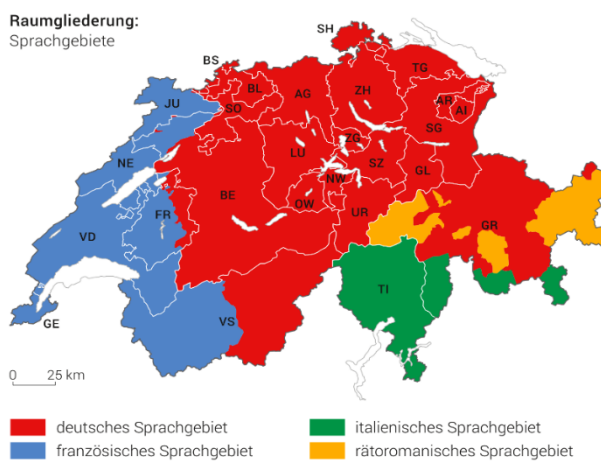
For reasons of convenience Canton Fribourg in Switzerland was chosen as the study site for both qualitative (only for the Älpler sample) and quantitative data collection. The quantitative data collection was supposed to be strictly limited to the Bergzone III, IV and the Sömmerungsgebiet in Kanton Fribourg (see Map 4, p.29) while qualitative data was collected foremostly in Canton Fribourg but not exclusively as knowledgeable interview partners were often living in other parts of Switzerland. After distribution of the main sample got organised it was decided to extend the area with Naturpark Gantrisch located in Canton Bern bordering on Canton Fribourg.

*Geographic location:* The planned area where the study should have been taking place is situated in the Canton Fribourg in western Switzerland (see Map 2). The area is known as ‘Voralpen’ or northern Alps, a lower part of the alpine mountain range characterised by the abundant traditional pastoral practices still in place today. Alps for Sömmerung in this area are usually situated between 800 and 1800 m.a.s.l.. The biggest cities in this area of the northern Alps are all located north of the study site in the central plateau: Fribourg, Lausanne and Bern. Canton Fribourg is characterised by the bordering area of the central plateau to the parts northern Alps with mountain peaks being relatively low with a height around 2000 m.a.s.l. of the highest peaks (highest mountain in Canton Fribourg: Vanil Noir with 2398 m.a.s.l.).



Map 2: Canton Fribourg displayed as the transparent yellow area located in Switzerland with biogeographical regions displayed; Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023

### Die vier Sprachgebiete der Schweiz



Map 3: The four language areas in Switzerland; red = German, blue = French, green = Italian, yellow = Romansh

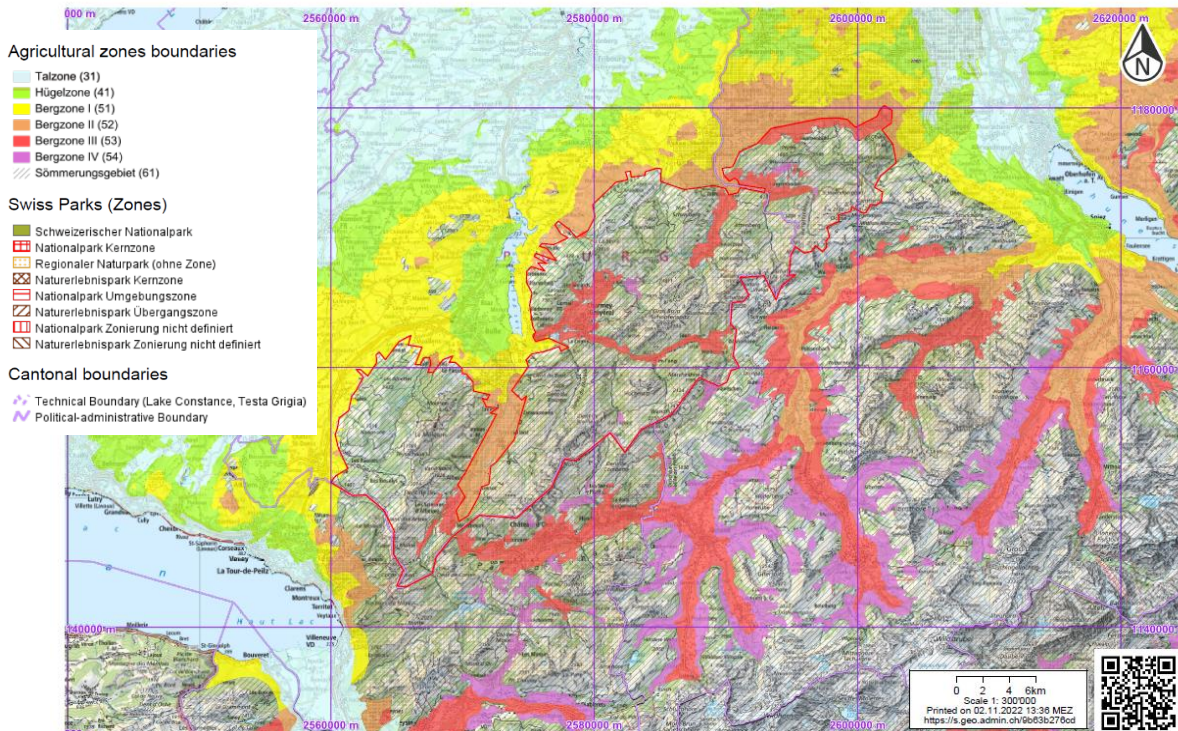
Source: BFS – Raumgliederung der Schweiz, Strukturhebung (SE); <https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/maps.assetdetail.23366958.html>, Date of last access: 02.11.2022

### *Social data and agricultural characteristics of Canton Fribourg*

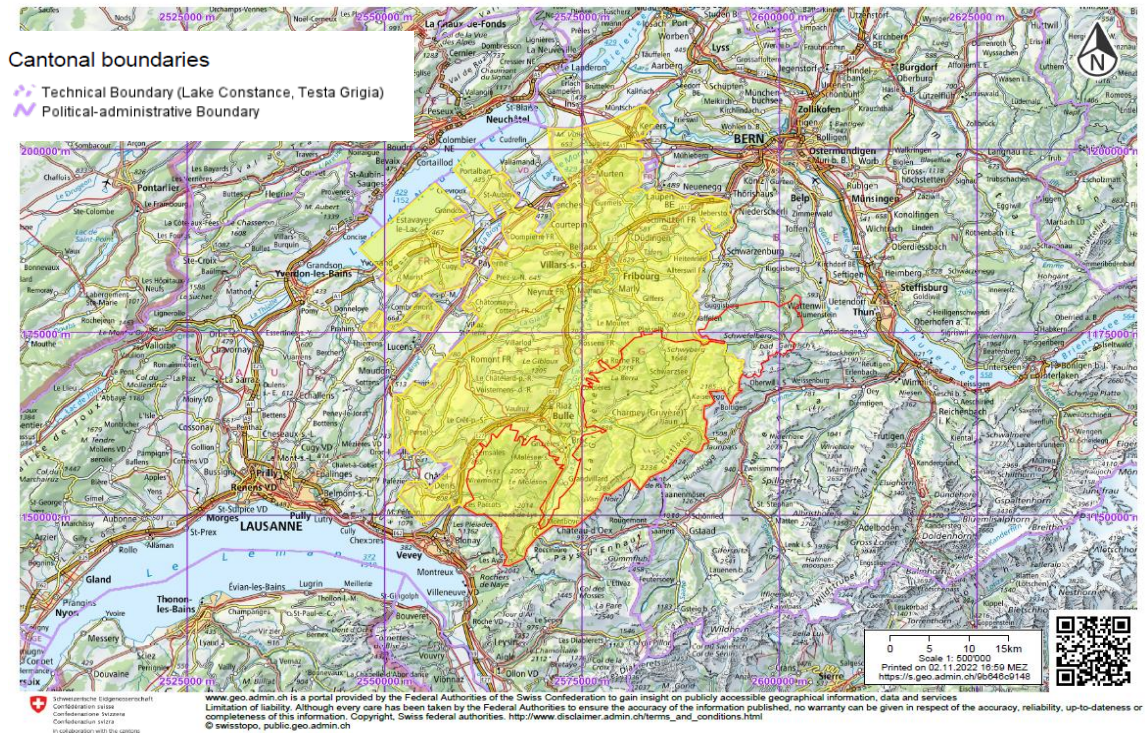
A Population of 321 783 was counted in 2019 (Bundesamt für Statistik - BFS) with 202 people per km<sup>2</sup> of population density, while it has to be noted that this is concentrated in the flat parts of the central plateau exemplified by 74.8 % of the population living in urban areas. Canton Fribourg's population is to 69 % speaking French and 26.1 % speaking German (Bundesamt für Statistik, 2019), albeit in the alpine regions the percentage of German speakers can be assumed higher as they are predominantly located in the German speaking part (see Map 3). In 2018 there were 8643 people in 2860 places [in 2014 2937; 5.4 % of agricultural operations in Canton Fribourg (Agridea, 2016)] employed in the primary sector of economic production. Primary mandatory without follow-up education accounts to 25.9 % of the population in Canton

Fribourg, 42.1 % have finished a secondary education (professional training etc.), 32.1 % the tertiary education (University and higher professional education) while 29.8 % have a degree (Diploma, Bachelor, Master and Doctor). Area in agricultural use was specified at 56.3 % (for comparison 35.9 % for Switzerland), of which 8.9 % are certified organic agriculture (16.5 % for Switzerland) and forest area was stated at 26.9 % of the total area. Organic production in terms of farms certified organic and floor space used for certified organic production is increasing at a relatively slow pace of ca 2 % in 10 years (Agridea, 2016) even though a trend for consumers demanding more organic produce and esp. more regionally produced foodstuffs was observed. The Canton was described as characterised by rurality and agricultural production even though the current trend sees towards urban areas with an increase of urban spaces of 34.6 % from 1979/85 to 2007/09 and a decrease of agricultural area of 4.3 % in the same timeframe (Agridea, 2016). The mean area per farm was stated in 2019 (Bundesamt für Statistik) with 27.5 ha, while the alpine farms should be a lot smaller compared to valley farming practices. In the time span from 2005 till 2014 the number of farms went back by 16 % while area managed per farm increased (Agridea, 2016). Milk production was described as the mainstay of agricultural production in Canton Fribourg with 32 % share of the total agricultural production value, while milk and dairy products stemming from alpine production is accounting solely to 2.5 % of the total production value in the dairy industry. In the accounting period from 2012 – 2013 from the 1711 milk producing farms with an output of 341 Mio. kg milk (accounting to roughly 10 % of milk production in Switzerland) 31 % or 101 Mio. Kg of milk were produced by 591 operations located in the alpine areas (Agridea, 2016). The amount of dairy farms is declining while production per farm is rising leading to a slight increase of milk production in the Canton in the time from 2009 till 2013. Milk prices on the market have been low, apart from milk sold to dairies producing Vacherin Fribourgeois AOP and Gruyère AOP. In the year 2021 the milk price was, after a period of low values, at the highest value since 2010 with a jump in prices esp. in the dairy milk sector for cheese production (Bundesamt für Landwirtschaft – BLW, 2022). Cheese production was assessed to trend towards enlargement of single industrial dairies while smaller dairies were assessed to struggle with economic viability issues

(Agridea, 2016). Marketing of milk and dairy products is predominantly in the hands of big distributors like Coop and Migros in Canton Fribourg as is the case in all Switzerland.



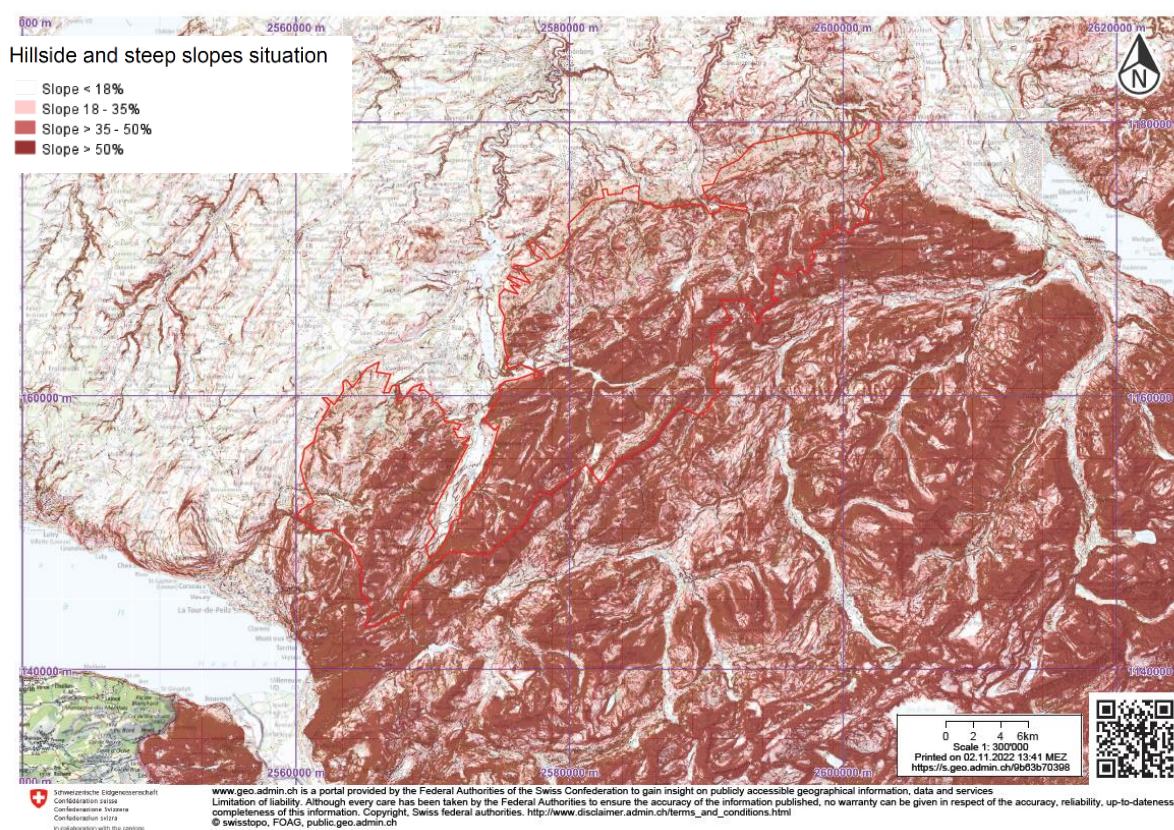
Map 4: Agricultural zones boundaries, Swiss parks and cantonal boundaries to determine the sampling area marked with the red line; Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023



Map 5: Canton Fribourg displayed as the yellow area with the sampling area encircled in red; Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023

The outlined sampling area for mainly the quantitative data collection but also Älpler sampling for the interviews was determined by the agricultural zone boundaries as outlined by the BLW and by the borders of Canton Fribourg (see Map 4, p.29). An extension to the sampling area was made to Naturpark Gantrisch limits encompassing some parts of Canton Bern (see Map 5, p.29 & Map 9, p.32) to reach a higher sample for the survey and create a redundancy for survey distribution (see also *Methods, Epistemological: Quantitative data collection outline*).

The landscape in the sampling area is classified through the landscape typology register (Schweizer Eidgenossenschaft, 2022) as “Limestone landscape in the lower areas of the Northern Alps”<sup>27</sup>, “Limestone landscape in the Alps”<sup>28</sup>, “Moor-shaped landscape”<sup>29</sup> and to a very small part “Hilly landscape of the central plateau”<sup>30</sup>. Slopes in the sampling area are of varying degree with predominantly flatter parts (18 – 35 %) in the northern part bordering to the central plateau transitioning with more slopes of more than 35 – 50 % to the southern part of the area with slopes predominantly over 50 % inclination (see Map 6). The very steep parts of the sampling area with their steep slopes defined by limestone karst mountains are of limited use for alpine agriculture with the majority of pastures located between 0 – 50 % steepness, the middle and northern part of the area.



Map 6: Slope inclinations in the sampling area encircled in red; Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023

Landscape use is dominated by the pastures for dairy cows and cattle, while other animals are herded on a smaller scale as well. Sheep have traditionally been herded in steeper higher areas with less fodder

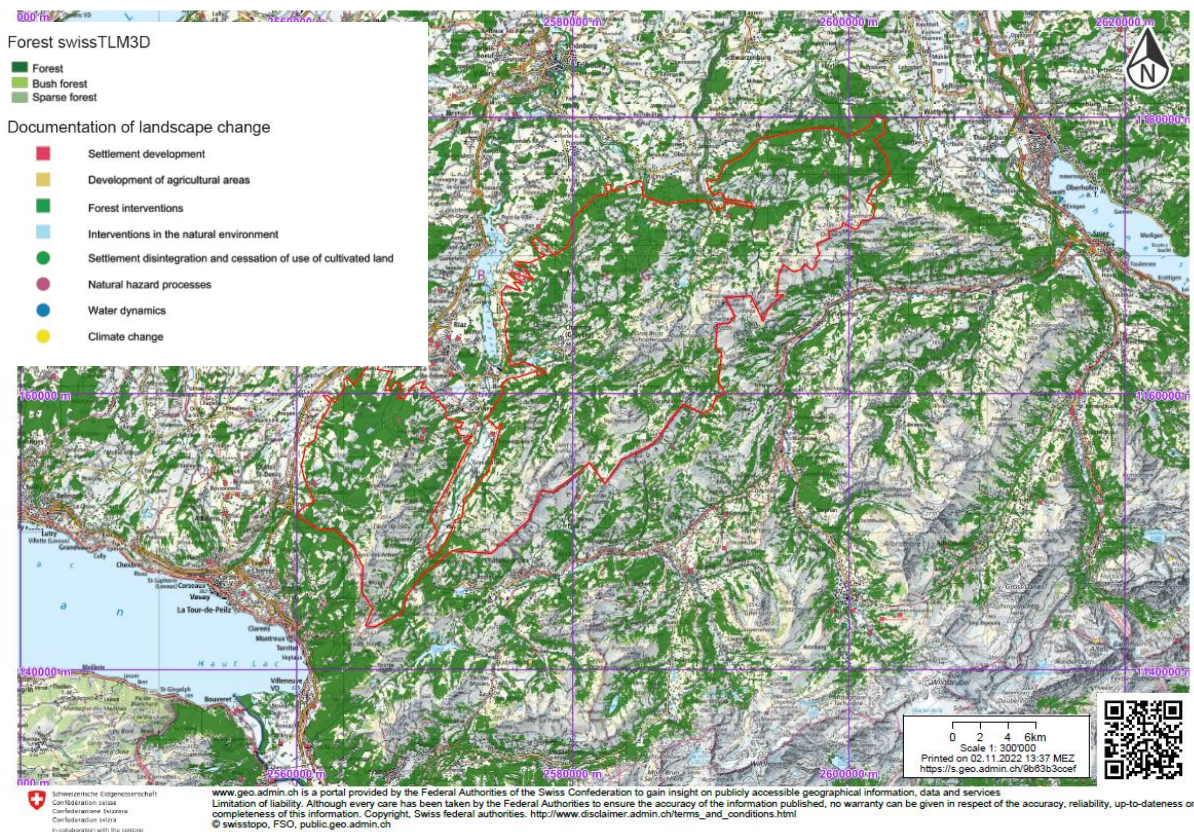
<sup>27</sup> Kalkberglanschaft der Nordalpen

<sup>28</sup> Kalkgebirgslandschaft der Alpen

<sup>29</sup> Moorgeprägte Landschaft

<sup>30</sup> Stark geformte Hügellandschaft des Mittellandes

available where the pastures would be too dangerous or impossible for cows to access. Other landscape uses include forestry as most of the area is located below the tree line and forest cover accounts to roughly 50 % of the area (see Map 7), while denser forests can be found in the lower parts located at the northern border of the sampling areas and generally less trees and forests is located in the southern part with steeper slopes and higher altitudes. Tourism plays an important role in the form of hiking and mountaineering trails located throughout the area and small skiing resorts located throughout the valleys with 3 areas each having 2 bigger lifts and 2 areas with each 1 bigger lift in operation. Other uses are rock mining and quarries with 7 of those located in the area.

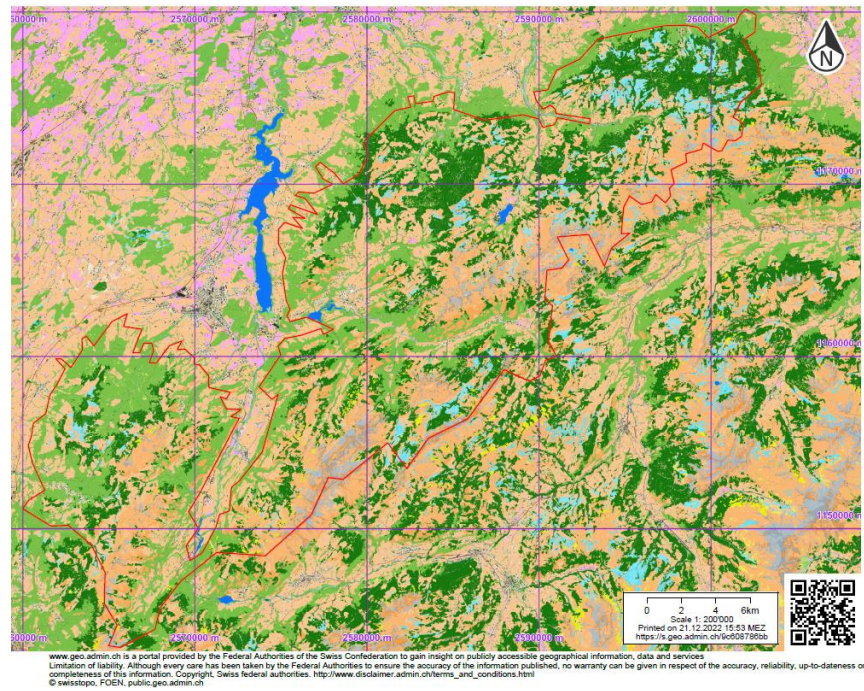


Map 7: Forest areas in the sampling region with documented landscape changes (see also Pictures 1, p .107, Picture 2, p. 108 and Picture 3, p.113). Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023

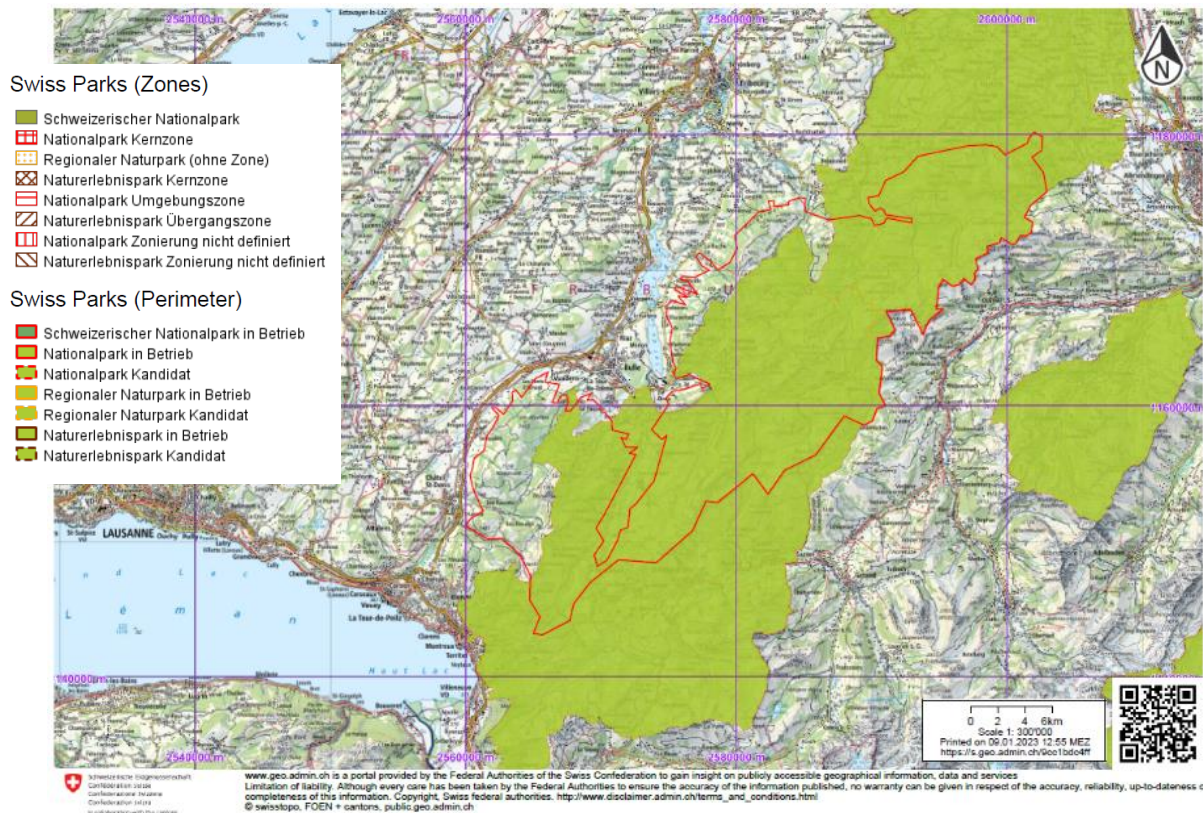
Landscape change is well documented in the area with forest/shrub encroachment, sliding slopes and landscape change through infrastructure construction being the main reason (see also Pictures 1, p .107, Picture 2, p. 108 and Picture 3, p.113), while there was also damage through extreme weather events (esp. storm 'Lothar' in 1999) and expansion of touristic infrastructure documented. Overall the documented landscape changes account to only 14 locations (Bundesamt für Statistik, 2020) and can be considered relatively minor. The alpine area of Canton Fribourg was assessed having relatively low potential areas for reforestation usually ranging between 1 to 10 % of the pastures in the Sömmerungsgebiet (Fischer et al., 2014). The delimited area is characterised by a very diverse landscape with multiple habitat types classified (see Map 8, p.32) consisting mostly of natural meadows and pastures and forest with subtypes identified for each. To a lesser extent there are also present: flowing and standing water, riparian and wetlands, rock, rubble and scree, turf and ruderal grassland, tall shrubs and grasslands, bushes and dwarf shrub heaths and to a very small amount also nurseries, orchards and field crops as well as human constructed infrastructure characterised by sealed soils.

Habitat Map

- 1.1. Stehende Gewässer
- 1.2. Fließgewässer
- 2. Ufer und Feuchtgebiete
- 2.1. Ufer mit Vegetation
- 2.2. Flachmoore
- 2.3. Feuchtwiesen
- 2.4. Hochmoore
- 3. Gletscher, Fels, Schutt und Geröll
- 3.1. Gletscher, Firn- und Schneefelder
- 3.2. Alluvionen und Moränen
- 3.3. Steinschutt- und Geröllfluren
- 3.4. Felsen
- 4. Grünland (Naturrasen, Wiesen und Weiden)
- 4.0. Kunstrasen
- 4.1. Pionierfluren auf Felsböden
- 4.2. Wärmelebende Trockenrasen
- 4.3. Gebirgs-Magerrasen
- 4.4. Schneeflächen
- 4.5. Fettwiesen und -weiden
- 5.2. Hochstauden- und Schlagfluren
- 5.3. Gebüsche
- 5.4. Zwergstrauchheiden
- 6. Wälder
- 6.0. Forstpflanzungen/Einzelbäume
- 6.1. Bruch- und Auenwälder
- 6.2. Buchenwälder
- 6.3. Andere Laubwälder
- 6.4. Wärmelebende Föhrenwälder
- 6.5. Hochmoorwälder
- 6.6. Gebirgs-Nadelwälder
- 7.1. Trittflächen und Ruderalfluren
- 8.1. Baumschulen, Obstgärten, Rebberge
- 8.2. Feldkulturen
- 9. Bauten, Anlagen
- 9.2. Bauten
- 9.3. Verkehrswege
- 9.4. Versiegelte Sportplatz, Parkplatz usw



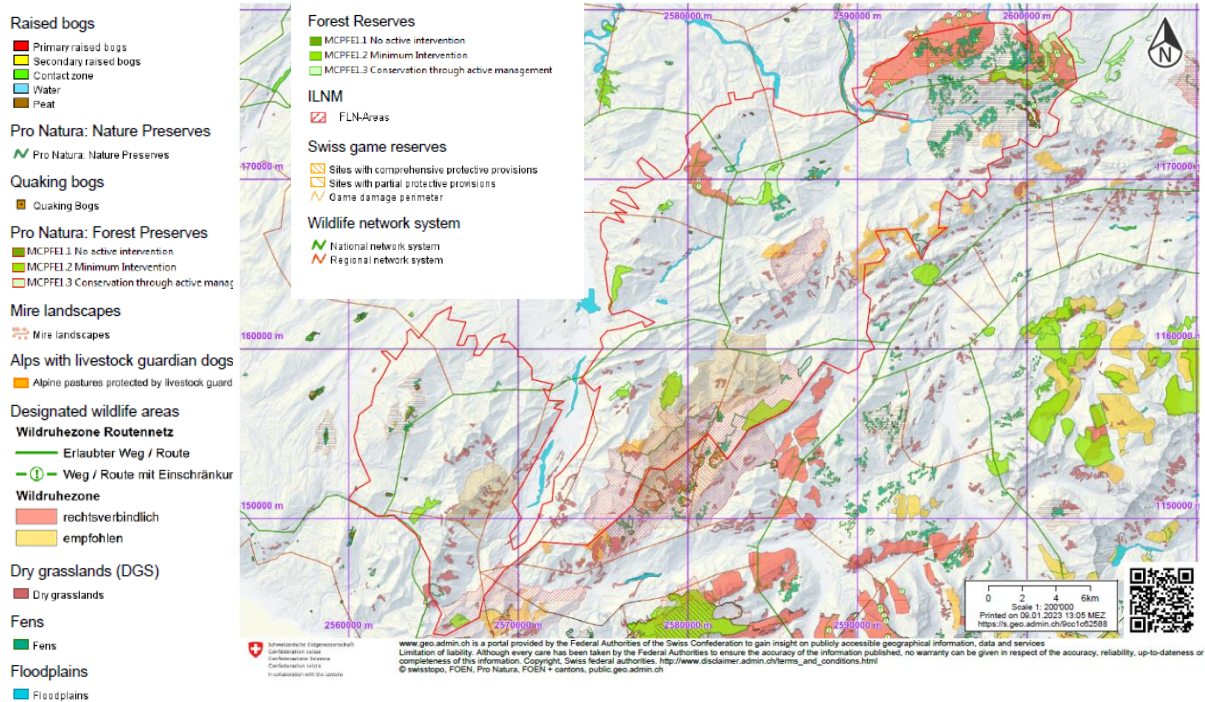
Map 8: Landscape classified according to habitat types in the sampling area. Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023



Map 9: Natural parks in the sampling area. The south-westerly park is the 'Parc naturel regional Gruyère Pays-d'Enhaut' and the north-easterly the 'Naturpark Gantersch'. The line marking the bordering parks is displayed in orange colour. Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023



The area is predominantly located within the vicinities of two national parks: Parc naturel régional Gruyère Pays-d’Enhaut and Naturpark Gantrisch (see Map 9, p.32) with multiple protected areas being located in the research area (see Map 10): Raised bogs, Quaking bogs, Pro Natura: Nature Preserves, Pro Natura: Forest Preserves, Forest reserves, protected dry grasslands, designated wildlife areas, fens, mire landscapes and wildlife reserves, Alps with livestock guarding dogs, floodplains, Swiss game reserves, wildlife network systems and parts of the Federal Inventory of Landscapes and Natural Monuments (ILNM – FOEN).



Map 10: Officially designated protected areas in the sampling area. Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 06.01.2023

As such it conveniently presents a fitting area for the collection of LEK of Älplers in the context of BD conservation as a high degree of environmental diversity, habitat diversity and protected areas are present together with a predominant land use system of Sömmerungsgebiet together with smaller areas of Bergzone III and IV.

*Original timetable*

	08.21*	09.21	10.21	11.21*	12.21*	01.22*	02.22*	03.22	04.22	05 – 09.22
Literature Review + Organising Interviews										
Conduct Interviews										
Develop + Test Survey										
Survey Distribution										
Initial Data Analysis										
FGD										
Final Data Analysis + Completion of Thesis										

Table 1: Original schedule for the research and master thesis completion, designed in 08.2021. \*= Reported months in which PAFs have more time and motivation to conduct interviews and surveys. In the top row the dates from 08.2021 until 09.2022 are displayed; in the columns the different steps for the research are listed.

*Qualitative data collection*

The main goals for the qualitative part was to verify information obtained in the literature review, collect comparable qualitative data for exploratory reasons and to triangulate with literature and quantitative data and esp. delimiting the possible topics influencing Älplers' LEK adown to a sensible amount to include in the survey. Following from the information obtained in the literature review and regarding the *Theoretical outline* it was decided to conduct semi-structured in-depth interviews with two groups of participants: Älplers and external "experts" involved with alpine farming. The purpose of the interviews was to complete the information obtained in the literature review for the purposes of gathering qualitative data to answer the RQ as well as get more information especially on a local scale in Canton Fribourg and bordering areas in the Canton Bern and to create a comprehensive well designed survey according to criteria mentioned by Groves et al., (2011). Question catalogues for the groups were developed, partly with the same questions or similar differently formulated questions to ensure comparability with these (see also Appendix 1. Surveys).

The time frame chosen for the qualitative interviews was not ideal for Älplers' schedules as it fell into busy months as reported by the Externals (compare to Table 1), but due to time constraints it was decided to conduct the interviews anyway. The rest of the timetable was organised around the distribution of the survey as the timeframe from November till February was the only window an unsupervised survey could be effectively conducted according to information obtained from several Externals. It was decided to conduct these (initial) qualitative interviews and not solely rely on data published in literature due to the ambitions of the PP (see also *Theoretical outline*) and to findings in literature that personal presence is of advantage in conservation science (Fabian et al., 2019).

*Question catalogues (see Appendix 4.)*

The Externals' interview questions were designed to focus more heavily on the theoretical, abstract side while Älplers' questions were developed to be more praxis-oriented. For instance both direct and indirect techniques were used for the farmers catalogue with a heavy reliance on probing for direct questions and the use of projective techniques to discover underlying attitudes and motivations mainly to overcome knowledge barriers that were assumed to exist to a varying extent. The Älplers' catalogue was relying more heavily on socio-demographic and management practice questions to address Objective 4 and RQ2 (see *Original Objectives, Hypothesis and Research Questions*). The Externals' questions only consisted of direct qualitative techniques and were mainly based on laddering with probing to uncover underlying motives and values of the participants.

*Externals sampling*

It was chosen to use the term 'Externals', that could also be described as non-farmer key informants, to describe the group of people interviewed that are working not on an alp but have considerable knowledge about alpine farming as they possess a heterogeneous background and activities while also the word 'experts' was avoided to not use any judgemental terminology. Due to the cumbersome length of 'non-farmer key informants' it was decided to stick to the term 'Externals'. Theoretical sampling was used with an online research amongst agricultural institutions (scientific, environmental and cultural), universities, farmers' associations, media, private companies, as well as agricultural and environmental authorities (both on local and federal scale) to find a fitting group of potential participants for the External interviews for the topic BD and alpine farming. A list of 65 people either involved with alpine agriculture and/or BD conservation from the aforementioned categories were contacted with 33 replies and 13 people expressing interest and potential availability in the time frame chosen. 9 interviews were scheduled pre-emptively according to the background and knowledge the interviewees possessed, to reach the goal of theoretical saturation (see Table 2, p.36). It was decided to not mention the names of either the institutions and neither the names of the people, as well as their backgrounds as one participant mentioned explicitly that the institution the interviewee was working for cannot be named nor should information be traceable. Of these 9 interviewees 5 people interviewed were working as scientists with federal agricultural institutions, an organic institution and a BD conservation institution. 2 participants were working with authorities both national and local, while one participant worked for an alpine farmers association, another for a natural park and one interviewee for a cultural institution concerned with alpine farming. In the case data was not considered sufficient the remaining four potential interview partners were kept on hold until a decision could be made. During the interview process it was decided to take one additional tenth interview, which resulted in no further new information reported and thus the remaining three were dropped.

	Science (BD background or current work)	Authorities (BD local and federal)	Consulting Älplers	Cultural sector connected to Älplers	Background alpine farming
External 1 [E1]		x	x		x
External 2 [E2]			x		x
External 3 [E3]			x	x	
External 4 [E4]	x	x			
External 5 [E5]	x		x		x
External 6 [E6]				x	
External 7 [E7]	x		x		x
External 8 [E8]	x		x		
External 9 [E9]	x				

Table 2: Externals' sample with backgrounds and professions typology.

### *Älpler sampling*

Interviews with farmers were originally planned to be limited to 5 interviewees, as data from Älplers should originally be mainly obtained through the quantitative survey. The qualitative data from Älplers was mainly intended to be compared to the Externals' data, also for testing the information obtained by the External information sources as they were scheduled in the beginning of October when Älplers were already down the huts to accommodate to their free time availability. It was chosen to only conduct German speaking Älplers as the fluency in French of the interviewer was considered too limited for semi-structured questions and to avoid the bias of misunderstandings following from that. A mix of snowball and convenience sampling methods were chosen for the Älpler interviews as it was considered unlikely to find a good sample from the distance, esp. considering the highly volatile nature of farmers' schedules depending on the weather and busy time frame chosen for the interviews (see Table 1, p.34). With the Älplers attention was put on organising a sample consisting of different backgrounds, management practices and gender. Älplers contacts were asked through stating characterisations of what was thought to be important for a sample (see also Oteros-Rozas et al., 2013; Morales-Reyes et al., 2019; Gomez-Baggethun et al., 2010), coming closer to theoretical saturation as the group of farmers interviewed can even with more participant interviewees count as representative due to the very heterogeneous managing practices and backgrounds. To reach theoretical saturation with farmers was considered impossible due to the strong heterogeneity of Älplers knowledge and management practices. The decision was made in order to try and find a diverse group to have most theoretical aspects covered considered important. This was conducted with the help of Externals giving the contacts fitting to the desired characteristics and asking Älplers already interviewed. Eventually a sample of 6 farmers was reached with the data obtained considered sufficient for continuation of the process (see Table 3, p. 37). The additional Älpler [Ä3] interviewed was the only one not living in Canton Fribourg but due to his activities and him getting mentioned by many Externals during their interviews, he was chosen as an important source for information.

	Äpler 1 [Ä1]	Äpler 2 [Ä2]	Äpler 3 [Ä3]	Äpler 4 [Ä4]	Äpler 5 [Ä5]	Äpler 6 [Ä6]
Sampling	Convenience	Convenience	Snowball	Snowball	Snowball	Snowball
Gender	Male	Male	Male	Male	Female	Female
Experience	~ 12 years	~ 50 years	~ 30 years	~ 60 years	~ 20 years	~ 25 years
Side-Job	No	Yes	Yes	Yes	Yes	Yes
Type of alp	Cattle and dairy cows	Cattle and goats	Cattle	Cattle and horses	Horses	Cattle and dairy cows
Family alp	Yes	No	No	Yes	No	Yes
Source of Education	Farmers' school and family	Auto- didactic /colleagues	Auto- didactic & Farmers school	Family	Family	Farmers' school and family
Tourism	Yes	No	No	No	No	No
Machinery	Light machinery	Light machinery	No machinery	Light machinery	No machinery	Light machinery
Living situation	Valley commuting to alp	On alp	On alp	On alp	Valley commuting to alp	Valley commuting to alp
Weed control	Mechanical and herbicides	Mechanical	Mechanical and herbicides	Mechanical and herbicides	Mechanical	Mechanical and herbicides
Self declared organic?	No	Yes	No	No	Yes	No
Subsistence or direct marketing	Yes	Yes	No	Yes	No	Yes

Table 3: Äplers sample with deliberately identified potential socio-demographic factors

Albeit a small sample size a big variety in management practices was visible amongst the interviewed Äplers. Thus half the sample were employed herders working only Sömmerung, while the other half were mountain farmers with huts owned by themselves and operation was year-long with a valley farm during wintertime. Four male and two female Äplers were interviewed for the qualitative data collection, while in general alpine farming is predominantly done by male Äplers with a relatively traditional family structure. Only one farmer had no other side-job for additional income while all others were working either a different job in winter or were working part time another job while also running an alp. One farmer was younger with less experience of autonomous alp management while all other farmers interviewed were 40 years and older with at least 20 years of experience running an alp. Animals pastured on the alps were, with one exception of horses, predominantly cattle for meat production and dairy cows. Only one farmer of the sample was currently catering for tourists in form of a “Buvette” or “Besenbeiz”<sup>31</sup> creating additional income during the Sömmerung. Half of the sample was actually living on the alp during summertime while the other half was commuting regularly from their home in the valley to the alp. Only two farmers utilised only mechanical weed control and the other four used a mix of mechanical and herbicides, while most of them stressed that there is a focus

<sup>31</sup> Buvette/Besenbeiz - small gastronomic operation with food and drinks on alps to cater to tourists.

on mechanical methods and chemical is only utilised if the situation demands it. Machinery was used by four farmers in types of light alpine tractors and motor mowers and two farmers stated no use of self-propelled machinery apart from cars for transportation. Two Farmers declared the usage of strictly organic methods but with no certification as the application process was considered too cumbersome. Most farmers practised subsistence food production with only two declared no food produced for own use on the alp. Bias present in the sample through snowball and convenience sampling techniques shall be discussed later on (see *Discussion, Limitations of the study*)

### *Conducting the interviews*

Because of the perceived impossibility to conduct sensible in-depth interviews with previously unknown farmers in any other way than on site and face-to-face it was decided to extend that technique to the External's interviews as well to reduce bias stemming from mixing interview methods. All Interviews were conducted in German language, as all participants could speak high German well enough.

It was tried to keep the interviewer's bias low during the actual interviews and try to not exert any ideas on to the interviewee by posing the questions as neutrally as possible and not use wording that implies any kind of judgement. For this purpose statements given by interviewees were usually not taken as facts but rather an understanding of connections of different statements was tried to be reached to test these views with probing techniques. For this a basic positive attitude was brought against the participants, no matter if content was personally believed to be true or not in the interviewers understanding of the thematic. Like this a multitude of, as coherent as possible, information could be obtained that should in theory represent each participants set of mind closely which then allows for a viable analysis by comparing not just contents and statements but also sentiments and underlying motives that exert influences on the narratives used during the interviews. This allowed for high reflexivity during the process and analysis while keeping the power relations between interviewer and interviewee balanced.

### *Transcription*

Interviews were recorded after consent of the participant on a smartphone with a standard sound recording application. Transcriptions were created as soon after the interviews as possible to keep a vivid memory of the interviewee alive to include personal observations of the interviewer in the data.

During transcribing the content of the German audio was manually directly translated into English with the occasional use of common online dictionaries like "deepl" and "linguee". Specific Swiss terms for alpine farming or bureaucratic words with no English equivalent were not translated and a contextual explanation was added as footnotes to ensure understanding and avoid bias.

Qualitative data analysis will be continued in the section *Adapted Methodology*.

## Epistemological: *Quantitative data collection outline*

### *Quantitative sampling*

Coming from the information obtained during the qualitative data collection, it was considered most sensible to stick with the original plan to conduct an unsupervised survey with the alpine farmers in the Bergzonen III - IV and the Sömmerungsgebiet as defined by Swiss authorities to get a relatively homogeneous sample (see Map 4, p.29), representative of the Älplers in Canton Fribourg and the Naturpark Gantrisch area, located in Canton Bern as an extension, with an estimated return rate between 10 and 20 %. While conducting the interviews the question arose how the survey could be most effectively distributed. The general conclusion was face-to-face being the most reliable method while the best formats for self-reported surveys were assessed to be on paper for older people and simultaneously do a version online for the younger Älplers. The decision for self-reported surveys was taken out of two main reasons: A lack of time and budget restraints. Two institutions volunteered for distribution in the two sample areas, Naturpark Gantrisch administration and the farmers' association Fribourg. Those two samples combined had a scope of ca. 500 Älplers to whom the survey would get distributed with an estimate of ca. 90 Älplers in the smaller sample from the Gantrisch area and an estimate of over 400 Älplers from the bigger sample in the whole of Canton Fribourg. Canton Fribourg as a whole was chosen because of the diverse nature of alpine farming presented between the German and the French speaking part of the Canton presenting an ideal opportunity to look into socio-cultural differences dependent on the German and the French part of Switzerland, also considering the location in the northern alps presenting a wide range of geological conditions and most alps with their pastures located between 1000 m.a.s.l. and 2000 m.a.s.l. where reportedly the highest pressure for changes are lying at the moment and with the highest BD levels reported from those regions. The location of the sample in different language areas of Switzerland is resulting in the possibility to compare cultural differences resulting from language (Hermanns F., 1999), if they are present and display a factor for LEK. The smaller sample of the Naturpark Gantrisch presented itself as a convenient extension to the main sample as the nature park is active in Canton Bern mainly but also comprises of some areas of Canton Fribourg bordering to Canton Bern regions. The final sample can be considered representative of Canton Fribourg and Naturpark Gantrisch area as most Älplers in the sampling area were supposed to get access to the survey. In the end it turned out that the farmers' association was unreliable, unfortunately consisting of the biggest sample with approx. 400 Älplers. After three promises given asking back in December and January no answers to emails and telephone inquiries were received resulting in the conclusion that no cooperation was to be expected from the farmers' association. The smaller sample from Naturpark Gantrisch was reportedly distributed with a return rate of under 2 % (2 answers from a sample of approx. 90). The return rate was doubted as three Älplers interviewed (and expressing interest in the survey) were located in that sample as well as in the farmers' association sample. After contacting the Älplers it was reported that no survey got distributed to them from neither the farmers' association nor the Naturpark Gantrisch leading to the conclusion that both voluntary offers for distribution proved to be (partly) unreliable. This double let down led to the decision to modify the whole thesis as shall be presented and discussed later on (see *Adapted Methods* and see *Discussion, Limitations of this study*)

*Design of the survey (see also complete survey in Appendix 1.)*

For the design of the survey existing examples of studies quantifying LEK about BD were used to draw inspiration (e.g. Anadón et al., 2009). The decision to design a self-reported survey on paper and online was mainly taken out of the necessity to save time and money as the whole study was individually financed. The survey was structured along with an introduction to the topic for the Äplers to get an overview of the aspired goals and background information to create an understanding of the study to sensitise the participants of the benefits and to raise motivation for participation. A short disclosure of data protection was added to the introduction. It was decided to create three distinct sections for questions starting with classification and socio-demographic data to address Objective 4 and RQ 2. The second section consisted of questions to frequency and changes of single species addressing all objectives, the hypothesis and RQ 1, 2, 3 and the third part consisted of question about structures and their effects on species diversity addressing Objectives 1,2,4 and RQs 1, 2 and 4 (see *Original Objectives, Hypothesis and Research Questions*). The whole survey was created as a draft in English for coordination with the supervisor, while the final clean versions were created in German and French to be then distributed (see *Appendix 1.2 'Survey German'* and *1.3 'Survey French'*). The French survey was created through a translation of the researcher with the help of deepl and corrections from a contact with French mother-tongue. The survey was designed to be semi-structured with the biggest part being structured close-ended questions while open-ended questions were mostly used for additional commentary sections and specific questions to TEK where not many answers were expected. The survey got tested with three Äplers, consisting of one Äpler who did not participate in the initial interviews, in two rounds adapting changes from the responses obtained in the first round and then shortened substantially with the help of 3 External testers to get to an estimated time of 15 to 20 minutes to answer all questions, which was considered by multiple Externals and Äplers the feasible maximum for a self-reported survey for Äplers. The online surveys (French and German version) were created copying the content of the paper versions into a google survey with the links supposed to be distributed through the two associations consisting of both sample areas.

Section 1: Socio-demographic questions

Questions to the individual Äpler were chosen according to the information obtained from the literature review (e.g. Oteros-Rozas et al., 2013, Zabel A., 2019) and qualitative data obtained. This part consisted of a mix of question types predominantly designed around metric ratio measurements with discrete and continuous variables and categorical non-metric with dummy, nominal and ordinal variables. To discover underlying motivations and to differentiate intensity of management practices, non-comparative rating scales as interval scales were used to a small extent. Both observed and latent variables were tried to be obtained through the socio-demographic questions.

Section 2: Frequency and changes of single species

This part was considered to be the main part of the survey as it addresses all objectives and was supposed to be integral to answer most RQs. Pictures were used to display the different species as bias through misunderstandings of names was tried to be avoided due to a wide range of vernacular words in existence. The process of species selection for the survey was inspired by Neupane et al. (2020). Specific species of interest were collected during the qualitative interviews and a comprehensive list was created from those to compare those species to lists of national priority, UZL-species and general characteristics like invasive species, medicinal plants, local species, weeds and indicator species, species of scientific interest (e.g. BAFU, 2020; Meier et al., 2021) and compared to the databases of



occurrence (e.g. info fauna CSCF<sup>32</sup>; info flora neophytes<sup>33</sup>; info flora atlas<sup>34</sup>, Vogelwarte<sup>35</sup>) in the sampling area. Easy identification by appearance was one of the main criteria (Anadón et al., 2009) of selection of species, which resulted mostly in a variety of species, esp. with fauna, that can be considered flagship species and are of limited scientific interest as conclusions about BD levels can only be made to a certain extent. This decision was taken because higher probability and next to no skills necessary for identification was deemed more important than scientific usability of data, as the main purpose of the survey was the initial systematic collection of LEK and lay knowledge in general with comparability to scientific results were to be assessed, as in the case of Switzerland there was no research data to extend from. Dummy variables were used for general occurrence and a non-comparative rating scale with categorical ordinal variables for frequencies. Categorical nominal scales were used for properties and characteristics and categorical ordinal scales for changes in the past. Plants, mammals and birds took the biggest part of this section as Älplers were reported to be most knowledgeable with these families of species. Reptiles, Amphibia and Insects took a smaller part in the survey due to the expectation of less answers for these families of species. Perception of existence of species was generally asked if it was seen or not and development of populations was generally asked about by stating more, less or no change.

Flora: Altogether 9 plant species were included in the final survey with a focus on creating pairs of similar looking plants with very different properties for example *Hypericum perforatum* defined as a beneficial, medicinal, local plant and *Jacobaea vulgaris* defined as a poisonous weed on alpine pastures. Frequency of plants was measured in perceived percentage of pastures where this plant occurred. Plant properties were taken from characteristics of interest and where scientific data was readily available and characteristics counting as LEK with non-scientific properties like “decorative” or “spiritual”.

Fauna: Questions for mammals, birds, reptiles, amphibia and insects had to be slightly adapted. Frequency was measured in how often Älplers saw the species and the properties and characteristics were adapted to a similar mix of scientific categories for comparison purposes and non-scientific categories like “pleasure to watch” or “dangerous”. Fauna was chosen esp. for having an unmistakable appearance in the sample area to reduce bias from wrong identifications as well as the aforementioned factors for selection. Altogether 3 birds, 3 mammals, 2 reptiles, 2 insects and one amphibia were included in the final version of the survey. An extra question for insects as a group was added as multiple Älplers interviewed noticed a change of insect population in the mountains in general albeit not species-specific.

### Section 3: Structures and their effect on species diversity

The smallest part of the survey consists of 10 questions with Likert scales to have maximum statistical power. Different statements were designed around management related measures affecting species diversity to be judged by the Älplers if they agree or disagree. 4-point Likert scales were chosen to make a neutral answer impossible always getting a judgemental answer and also from the experience that participants of surveys “like” to take the neutral answer if no knowledge is present, thus picking an equal-point scale reduces bias in this case, as knowledge is the variable in question.

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<sup>32</sup> <https://lepus.unine.ch/carto/> - Date of last access: 06.01.2023

<sup>33</sup> <https://neo.infoflora.ch/de/> - Date of last access: 06.01.2023

<sup>34</sup> <https://atlas.infoflora.ch/de/> - Date of last access: 06.01.2023

<sup>35</sup> <https://www.vogelwarte.ch/de/projekte/lebensraeume/leitarten/leitartenkarten> - Date of last access: 06.01.2023

An additional section for commentary and listing species known was added for Älplers who had abundant knowledge about a specific topic in the context of biodiversity and motivation for completion, but data obtained was considered not part of the study and was expected to be used for additional ideas concerning follow up research. This section was included due to the notion obtained during the qualitative study that knowledgeable Älplers like to comment excessively.

#### *Quantitative data analysis*

Socio-demographic data was intended to be analysed mainly qualitatively considering the heterogeneity of Älplers knowledge, backgrounds and management practices with the option if a high enough sample should be reached for certain categories of response groups to convert ordinal questions to dummies and use statistical testing and correlations as well as regressions on the obtained data to create connections to the other two sections of the survey.

The main part for analysis was considered Section 2 of the survey as it contained data of occurrence, frequency and changes of single species. It was planned to correlate the data, if the sample size should have been big enough with scientific data available for the selected species. Occurrence was planned to be mapped with a GIS program and compared to scientific data available. Otherwise no plans for analysis of the quantitative data were made as it was considered highly dependent on the return rate and on the amount of completion of the surveys returned. The categorisation of LEK about BD would have been accomplished through the creation of simple tables listing the results numerically and testing the variability for significance as well as a qualitative assessment. The quantitative analysis was not further developed as the remaining parts were considered highly dependent on the return rate and rate of completion of the questions and final methods were best to be decided after the survey got transferred digitally and the data cleaned.

The 2 % return rate from the smaller sample already produced interesting results with the beetle species *Rosalia alpina* and a bird species *Tetrao urugallus* being identified in an area where scientific monitoring did not locate them yet. This can be seen as a further test and resulting in the assessment that the survey works as it is supposed to, this thematic will be discussed later on (see *Discussion, Epistemological assessment*).

The FGD for final discussion amongst participants and Externals was decided to be dropped due to the complications with the survey distributions.

## Adapted methods

As argued by Bédard & Gendrom (2004) that “being tolerant of uncertainty is part of the fundamental skills of the qualitative researcher” and “specific objectives of the study are not always determined a priori, but often ‘emerge’ from fieldwork”. This theoretical concept will be stretched to unforeseen changes in research through events that the researcher had limited influencing power on. As a result of the quasi non-distribution of the surveys a change in RQs was seen necessary to viably analyse the qualitative data collected, which was effectively being promoted from a stapes holder for the quantitative data collection to royalty status of the single primary data source.

While objectives were decided to be kept albeit with an exploration at (much) lower explanatory power the hypothesis and the RQs had to be dropped due to the missing quantitative data. RQs were reformulated to fit the objectives using only the primary data collected during the qualitative data collection. This change of methodology will be discussed later on (see *Discussion, Limitations of this study*)

*Adapted RQs:*

*RQ1: What perception do Älplers and Externals have of the state, changes and protection measures of alpine biodiversity?*

*RQ2: In which way do Älplers’ and Externals’ opinions about state, changes and protection measures of alpine biodiversity differ?*

*RQ3: Which socio-demographic factors could possibly influence Älplers’ perceptions?*

*RQ4: In which ways could biodiversity conservation in the alpine area in Switzerland be improved?*

*Adapted Methods: Coding (see also Appendix 2. Code book/Coding tree)*

It was chosen to work with coded literature as compared to other qualitative analytic methods (e.g. qualitative content analysis) it shows strengths in exploring of meaning and the construction of narratives (Gläse & Laudel, 2013), both points considered crucial to answer the new RQs. Coding of transcribed interviews was used to systematically reduce the amount of data, complexity and to display the information in a structured manner making source triangulation easier (Mattimoe et al., 2021; Baxter & Eyles, 1996; Gläse & Laudel, 2013). While creating codes an emphasis was laid on the identification of communication themes. For code creation two guidelines were used in a liberal interpretation: The six phases of the thematic data analysis process as outlined by Braun & Clark (2006) and six steps as outlined by Ashorth & Lucas (2000) and Lucas (1998). It was pre-emptively decided to use a qualitative coding software to theoretically fasten the process while theoretically keeping the process structured. For this purpose Nvivo [Release 1.7 (1533) QSR International Pty Ltd.] was used as it presents one of the most commonly used qualitative data analysis software for coding currently used in scientific work (Mattimoe et al., 2021). Training to use the software was done via an online

manual published by the developing company (QSR International, 2014) and multiple Youtube video tutorials from Hull University Library (2022)<sup>36</sup>.

It was tried to determine inductively through the questions of the semi-structured interview catalogues deductive coding for the qualitative part, as the questions in the catalogues were derived out of the extensive literature review done before starting the data collection phase. The questions thus show a theoretical base that was constructed before and can be compared to deductive codes derived from the interview transcripts and the created survey, that did not get distributed eventually. The survey questions provide deductive coding implicitly to the qualitative methodology as for the survey the necessary steps of isolating relevant topics to the objectives from the interview data was necessary and can henceforth be extrapolated to the qualitative analysis. Like this the survey design can still be of use even though the original plans for distribution and analysis failed miserably. The interview catalogues, the interview transcripts and the survey provided a basis for a combined approach of using inductive and deductive coding, where discrepancies between information from literature and information gathered first hand at site can be made explicit with the potential of showing gaps between agricultural practices influencing BD and in scientific research in the Swiss Alps.

### *Process of Coding*

In the process of coding it was tried to capture participants assumptions, insights given and complex motivations explicitly or implicitly stated. After re-analysing the interview questions the inductive code was retrieved for further analysis of the interviews. Two codes for participants were created after the two different semi-structured interview catalogues: Interview catalogue Älplers and interview catalogue Externals. After scanning through the Externals' catalogue following codes were made to categorise the information that was thought to have an influence on perception and knowledge of farmers involved with alpine mountain farming practices: Cooperation farmers and Externals, Attitude of Externals towards farmers, Perception of changes, Politics, Scientific practices, Socio demographics, Perception of BD state. The same procedure was done with the question catalogue for farmers resulting in the additional codes: Attitude towards BD conservation, Knowledge on alpine farming, Practices of alpine farming and Thoughts of farmers on BD conservation; the codes: Perception changes, Politics, Scientific practices, Socio demographics, Perceived state of BD and additional info was used for this catalogue as well.

Following from the inductive codes derived from the survey which added: description of environment and Knowledge on structures influencing BD, while former codes Socio-demographics, Practices of alpine farming, Perception of state of BD and Perception of changes BD were used, it was decided to simplify the messy coding into main codes describing most basic differentiation into smaller sub-codes that were identified.

Further inductive coding was added alongside moving passages into code categories and sub-categories. Resulting from this mix of theoretical methods applied benefits of both types of coding could be theoretically harnessed; a theoretical foundation from deductive coding and incorporating new ideas and concepts emerging from analysing the transcripts as well as assumptions from literature to be tested (Mihás P., 2019). After the failure to determine a structured process for the creation of a

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<sup>36</sup> Hull University Library. (2022), New Nvivo (Release 1)  
[https://www.youtube.com/watch?v=tGVHbWisbfw&list=PLjCDy\\_BmhjHK1GE84\\_UE0se9hUaoSNvIV](https://www.youtube.com/watch?v=tGVHbWisbfw&list=PLjCDy_BmhjHK1GE84_UE0se9hUaoSNvIV), Date of last access: 01.01.2022

coding tree it was decided to proceed in a heuristic manner, which will be discussed later on (see *Discussion, Limitations of this study*).

#### *Adapted Qualitative Data Analysis*

During qualitative data analysis and discussing the results more attention was paid to the logical relationship of information received than representativeness of information for the sample to ensure validity of results (Baxter & Eyles, 1996). For this purpose the discussion focused on making underlying motivations and sentiments explicit to make the logical order of connected information clear. The four criteria for evaluating qualitative research as formulated by Baxter & Eyles (1996) were kept as a guideline for structuring and composing the discussion of results: Credibility, Transferability, Dependability and Confirmability. Source triangulation was one major objective to apply in the analysis with references to different respondents together with referential adequacy by a comparison to literature. Generally during data analysis the constant comparative analysis method was used by incorporating findings from other interviews for source triangulation until a coherently netted state was reached that findings could be taken into context throughout all participants information given.

The codes were used to create themes where codes and sub-codes would be grouped together to retrieve information relevant to answering RQs and discussing results (Mihás P., 2019). To view these themes a visualisation (see Figure 2, p. 46) was created where each arrow represents one perceptive theme where information from codes were systematically sorted into. A type of “compass” was designed alongside principles formulated by Baxter & Eyles (1996) that qualitative research can draw less on conventional procedures but rather employ resourcefulness to reach scientific rigour in the display of results. Clarification of results and their structure were the leading motif for the creation of this visualisation. It can be considered a functional “framework” which was designed out of a flawed data set to make it work in this particular situation and has limitations in comparison to a normal “guideline” framework. Instead of a frame it’s a functional component of the thesis or using coding vocabulary an inductive visualisation was created to bring more structure alongside themes identified to answer RQs. Each new theme introduced will include a cut out version of the framework to display at which stages the results are with white arrows pointing for Älplers’ data and blue arrows for Externals’. To take this step was considered necessary as the delimitations of themes, esp. between perceived state and changes, was blurry and without any visual structure the resulting data displayed could easily become confusing to the reader (and writer).

It was decided to exclude any quantifications of the transcripts as the interviews were semi-structured and two different question catalogues were used for the groups. A trial of applying cluster analysis on the Älplers’ sample resulted in some potential similarities concerning coding structure that could display correlations to socio-demographic data between participants but the sample size was considered too small resulting in too low statistical power, not even considering biases through unfit codes and methodology. In conclusion a qualitative analysis arguing through logic connections rather than quantifying transcribed data was regarded as a more viable way of analysing and discussing the data.

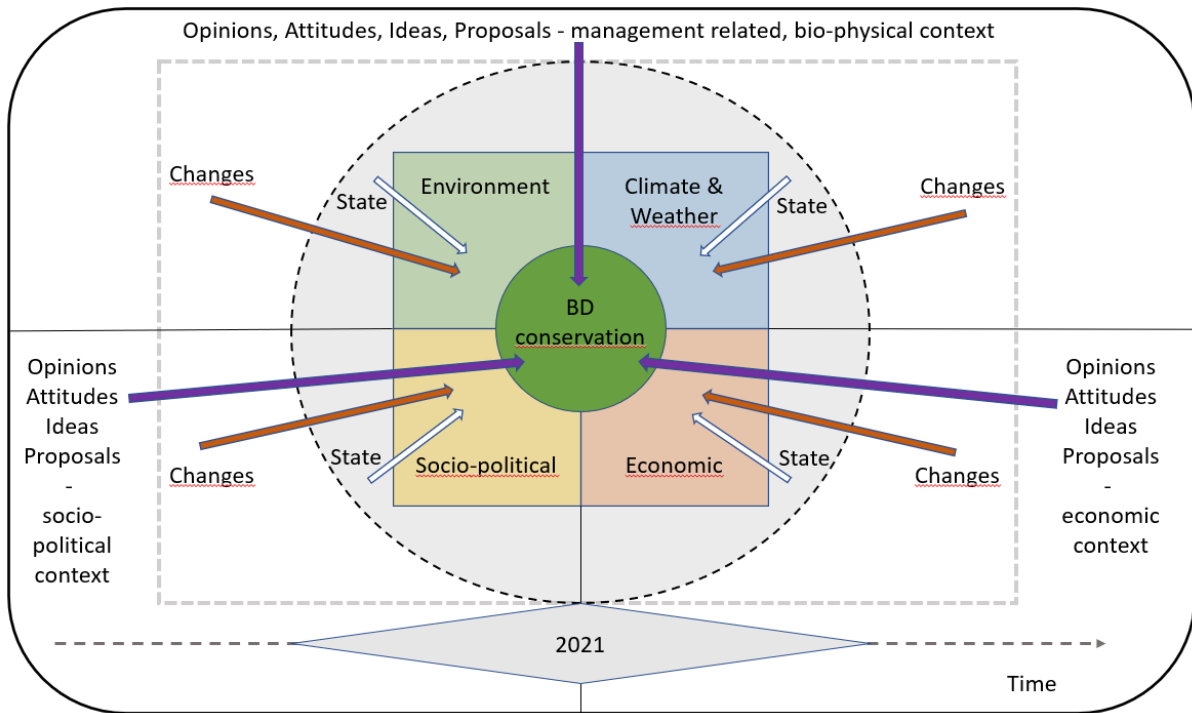


Figure 2: Overview of the visualisation of the analytical structure used for the qualitative data. White arrows: Perceived state of the Environment, Climate & Weather, Socio-political contexts and economic contexts; Orange arrows: Perceived changes of the Environment, Climate & Weather, Socio-political contexts and economic contexts; Purple arrows: Opinions, Attitudes, Ideas; Proposals on BD conservation in the management related, bio-physical context, the socio-political context and the economic context. Source: own elaboration

## Results

Altogether 1021 min and 11 sec of interviews were recorded accounting to 92 146 words transcribed. External's interviews consisted of the biggest share with 598 min and 11 sec accounting to 49 538 words transcribed, while Älplers' interviews consisted of 422 min and 43 sec accounting to 42 608 words transcribed (see full transcripts in Appendix 5.).

Displaying the results shall start from displaying the perceived states of different contexts followed by perceived changes and finishing with more concrete opinions, attitudes, ideas and proposals for BD conservation embedded in the aforementioned contextual information.

### *Älplers' perception of the state of the environment, climate, socio-political circumstances and economy*

“Yes, that comes from the sustainable management since many 100 years. I am doing everything in the same way as my great-grandfather. We are doing this since generations without sheets and books and the flowers are still sprouting. There he didn't do any mistakes in that direction. That is a gentle management with cows, with cows, not more cows, just the cattle that the Alp needs so that it is going, that is sustainable management.”[Ä1]

Information was taken from the Code categories “Environment”, “Perceptions on BD”, “Practices of alpine farming”, “Scientific practices BD” and “Socio-demographics” and put into four categories: Environment, Climate, Socio-political and Economy, creating the context in which measures and practices for BD conservation are embedded.

### *State of the (alpine) environment as reported by Älplers (see also Figure 3)*

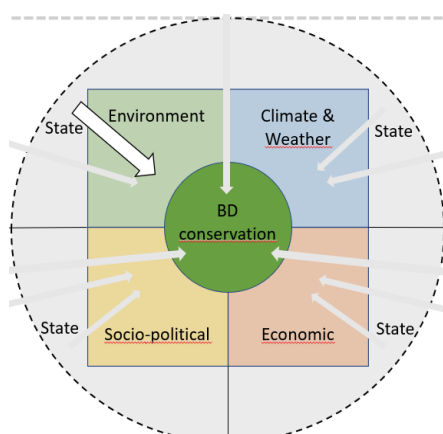


Figure 3: Cut-out visualisation: State of the (alpine) environment as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

Generally, an intact natural environment in the Alps with the current mix of management with pasturing, forestry and touristic activities with a spatially limited and isolated shrub and forest encroachment got reported by all Älplers interviewed [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]. Half of the interviewed Älplers described their management as extensive [Ä2, Ä3, Ä5], while the other half described their practices as “normal” or half-intensive, generally stating neither extensive nor intensive [Ä1, Ä4, Ä6]. Notably all Älplers perceived their practices sustainable not connecting extensivity necessarily with sustainable management. One farmer described the Alps and mountains in general as a habitat that is not inviting human presence due to the limitations and hardships resulting from a harsh and unforgiving environment [Ä2] and multiple Älplers stressed the potential dangers of working in the Alps resulting from the mountain environment [Ä1, Ä3, Ä4]. Two

Älplers mentioned detrimental effects of the present touristic infrastructure on the environmental quality, esp. ski areas were pointed out having the strongest impacts [Ä2, Ä4]. Infrastructure was assessed as being in good shape as most alp huts have access to electricity and are accessible with the car [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6] while one Älpler mentioned explicitly that he thought the current road infrastructure in the mountains as already over-developed [Ä2]. Other important infrastructure present in the Alps were described as water supply, machinery on the alps, esp. on dairy alps (i.e. milking machines), sewage of stables and kitchens in huts with two Älplers considered Internet connection as unimportant on alps in general even hinting at the lack of it as a benefit [Ä2, Ä4].

All Älplers mentioned the reason for this good state being the alpine management practices on pastures and forests in place, creating an ideal habitat for a diverse range of species while producing foodstuffs: “[...] it makes sense to let the animals eat on those pastures, to pasture those landscapes because you cannot produce tomatoes or wheat over there. Then out of these mountain flanks you get milk and meat and that is really awesome.”[Ä3] More precisely species diversity in the Alps got assessed as very much intact and functional compared to the central plateau and flat areas in general, coming from the highly diverse landscapes resulting from alp management and the active preservation and creation of small structures like: open trenches and open water in general, stone lumps and loose stone walls, dead wood and wooden constructions, tree and hedge structures with the presence of forest [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]. Location was mentioned by one Älpler as a further important factor for species diversity with higher altitude areas having less diverse species present and the notion that theoretically BD should be highest in the flat lands on the central plateau - but is not [Ä5]. The alpine landscape is defined by flowers, big mammals and big birds according to all Älplers, while the reintroduction of the wolf (*Canis lupus*) into the Alps of Canton Fribourg got reported usually negatively in connection with alp management albeit not negatively as a general trend [Ä1, Ä3, Ä4, Ä6]. Two Älplers [Ä2, Ä5] were relatively positive about the re-introduction of the wolf and one Älpler reasoned this with the lack of natural predators was linked to diseases in wild animal populations spreading further and quicker due to not enough predatory pressure [Ä2]. This interviewee mentioned a current disease: chamois blindness (Gämsenblindheit) as “rampant” due to the aforementioned reasoning [Ä2]. Insects were described universally as abundant in the alpine area.

A strong heterogeneity of pasture quality in the Alps dependent on the location with the most important factors being hydrological properties of the soil, exposition, nutrient content of the soil, steepness of the pastures and homogeneity or presence of small structures was reported by most Älplers [Ä1, Ä2, Ä4, Ä5]. Generally, pasture quality was equated with the potential for good fodder production by most Älplers [Ä1, Ä3, Ä4, Ä6]. Grazing practices with fenced off plots were described as having a positive effect on plant species diversity [Ä3, Ä4]. Three Älplers [Ä2, Ä4, Ä6] mentioned a human induced bad state of the soil on many alps connected to a low water absorption capacity and connected to water erosion present esp. in Flysch<sup>37</sup> areas, while all other Älplers connected the sliding slopes only to the presence of Flysch [Ä1, Ä3, Ä5].

Excessive presence of weeds on alpine pastures was stressed and mentioned extensively by all farmers with heterogeneous magnitudes dependent on the species [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6] with the presence of creeping thistles (*Cirsium arvense*) being currently considered the biggest problem in the area and bitter dock (*Rumex obtusifolius*), ferns (class Polypodiopsida) and green alders (*Alnus alnobetula*) got stressed as well. The presence of alders was assessed having the biggest detrimental effect on plant species diversity [Ä1, Ä3, Ä4]. Assessment of which plants can be considered weeds or how bad a weed has an effect on pasture quality and species diversity was very heterogeneous for example considered

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<sup>37</sup> Flysch – loanword from German, meaning soil consisting of sedimentary rock layers known to be very unstable when water is flowing through due to its water permeability properties.



one Älpler the ferns as “not too bad” as they create shade for lower plants during dry spells [Ä2], while another interviewee said problems arising from alders (*Alnus*) are locally limited and management has not so much influence on their population in the long run [Ä3]. All Älplers reported not having many issues, or no issues with invasive plant species on their pastures and thus having not much experience with identification and control.

The use of slurry for fertilisation was reported to have detrimental impacts on the soil quality by multiple Älplers [Ä2, Ä4, Ä5] while the others saw the effects as not that harmful or not harmful at all [Ä1, Ä3, Ä6]. Fertilisation even with mineral fertiliser in spatially limited spots was reported by one Älpler to be not detrimental for plant species diversity [Ä3].

#### State of climate and weather as reported by Älplers (see also Figure 4)

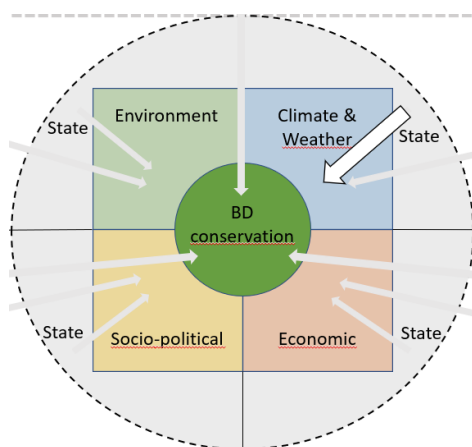


Figure 4: Cut-out visualisation: State of climate and weather as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

Weather was mentioned as one defining factor for alp management by all Älplers and esp. weather extremes being an important issue dependent on the precipitation, esp. longer dry spells leading to water shortages in areas where there are no glacier fed streams (so generally in the lower parts of the Alps) and excessive precipitation leading to slopes sliding in Flysch areas. As extreme events storm Lothar in 1999 got mentioned [Ä2, Ä3] as well as extreme droughts in 2013, 2018 and strong hail damaging pastures and infrastructure in 2021 [Ä1, Ä2, Ä4, Ä5, Ä6]. The reason for extreme weather events was stated being global CC impacts by multiple farmers [Ä4, Ä5, Ä6] while the other Älplers were sceptical arguing that extreme weather events are not new phenomena and that usually these equalise during the course of the summer [Ä1, Ä2, Ä3]. CC being responsible for generally higher temperatures was stated by all Älplers with the notion of warmer winters and no snow during summertime in higher altitudes. One Älpler mentioned the

extended vegetation periods resulting from warmer temperatures esp. affecting higher altitude pastures [Ä2]. Another participant stated an increase of temperature during night-time explicitly [Ä4]. Generally there was consensus that CC impacts [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6] are having a big impact on PAFP while the usage of machinery overcomes some of those limitations set by the climate and also lead to a disconnection of the Älplers to the climate and environment (i.e. use of helicopters to transport water to alps during extreme dry spells in 2013 and 2018) [Ä2].

*State of the socio-political context as reported by Älplers (see also Figure 5)*

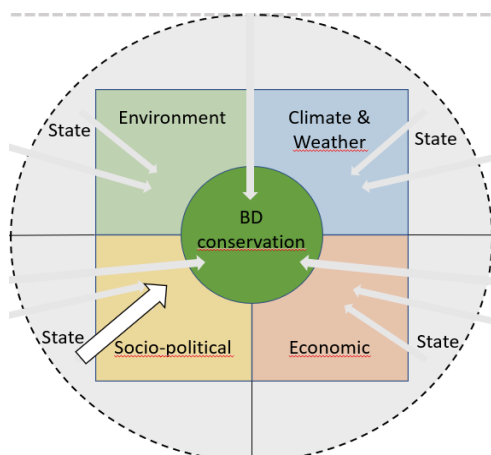


Figure 5: Cut-out visualisation: State of socio-political context as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

The most important topic in this category were the direct payments paid to Älplers, which was discussed in detail and excessively by all participants stressing the importance of those payments. The consensus was that without those payments by the state, PAFP would cease to exist entirely. Many Älplers were esp. positive about the BFF2 result-oriented direct payments, as they were described that without any additional management necessary the criteria is usually fulfilled in the Sömmerungsgebiet [Ä1, Ä4, Ä6], consequently all Älplers participating in the interviews received those payments. Opinions about directionality differed amongst Älplers considerably with some considering the status quo sufficient or extendable [Ä1, Ä4, Ä6] while others mentioned misalignments for goals and general lacking effectivity and directionality of direct payments [Ä2, Ä3, Ä5]. Esp. payments directed at the alp owner were heavily criticised by one Älpler as farm ownership does not imply any management relation [Ä2]. Generally, type of ownership was regarded as important and influential on the type of management practices used.

Melioration measures by the state were assessed as supporting PAFP well, with the exception of water infrastructure [Ä4] and meliorations in general got a heterogeneous reception from very positive [Ä1, Ä4, Ä6] to mixed [Ä3, Ä5] to downright bad [Ä2]. Meliorations were described [Ä2, Ä3] as being supportive to land consolidation efforts and generally overdoing the meliorations was described by him. One Älpler mentioned the projects for soil stabilisation through reforestation of critical areas as esp. positive [Ä5]. A participant described that there are not many public services available on alps giving great freedom and responsibility for management and being a reason why not many Älplers are actually living on the alp during the Sömmerung but rather prefer to commute. The possibility was created through the increased road network in the Alps financed through melioration measures by the state. "What did an old herder say? The street to the alp gives the possibility to be quickly on the alp but also quickly down again" [Ä2]. The presence of small structures on pastures was reported to be highly dependent on the municipality and melioration measures applied [Ä3].

In terms of political action most Älplers criticised the current incentivisation for the creation of bigger alps and the neglect of small often family run operations [Ä1, Ä2, Ä4, Ä5, Ä6], while it was reported that politics is currently concentrating heavily on conservation topics [Ä6]. Politics was described by two Älplers as currently not trustworthy [Ä2, Ä3], while the other Älplers interviewed did not mention trust in politics.

Generally information dissemination structures were regarded as well-established with the nature parks in the areas, the farming association, farmer schools, agricultural press, consulting and research institutions (e.g. FiBL, Agridea), multifunctional cooperations and municipalities involved with organising meetings amongst Älplers about current management related topics, albeit the quality of these extension meetings were assessed heterogeneously with a baseline positive view [Ä1, Ä3, Ä4, Ä5, Ä6], while a one-sided information dissemination being not focused on environmental protection or BD conservation was reported [Ä4, Ä5]. It was criticised that sometimes questionable information is given, clashing with experience [Ä3] while one farmer was downright negative about those meetings reporting that only unsustainable practices get discussed [Ä2]. One project: Digiplanalp

by Agridea was reported to be particularly successful, albeit the voluntary nature of these information dissemination offers was described as only partly successful because not many Äplers actually participate [Ä3]. Participation was reported being highly dependent on the topic and its perceived usefulness to increase productivity and it got stated that everything is boiling down to income generation [Ä3, Ä4, Ä6]. The consensus amongst all Äplers was that experience is the most important and thus exchange with colleagues was considered the most important information source. Learning about PAFP should start from an early age [Ä1, Ä2, Ä4, Ä6] with the notion of general benefits of alpine work as a worthy experience also for unaffiliated people from society [Ä1, Ä2]. Many Äplers thought scientific information and data were abundant and readily available in Switzerland [Ä1, Ä3, Ä6] while some stated a lack of scientific activity and conservation practices [Ä2, Ä4, Ä5] with esp. the scientific communication being targeted with written formats which were mostly criticised as being not understandable enough [Ä2, Ä3]: “I have studied the documents and I am theoretically not up to date and I would have to get it explained to me, to find the connection between theory and practice.” [Ä2]

A good image of PAFP in society was seen in general by many [Ä1, Ä3, Ä4] but misunderstandings with communication were also reported [Ä1, Ä2, Ä4, Ä6], while two participants [Ä2, Ä5] complained about miscommunication and bad images amongst Äplers: “Only an Äpler managing cattle and even better dairy cows is considered a proper Äpler” [Ä5]. One Äpler stressed the topic fertilisation esp. with slurry as a current conflicting point with the image in society [Ä1], the society reportedly having a strong stance against slurry-use, while others mentioned the Swiss sense for tidiness, also amongst Äplers, as “almost pathological” [Ä2] and clashing with conservation practices like leaving dead wood on the pastures, which is currently one of the mandatory measures for receiving direct payments [Ä2, Ä3, Ä4, Ä5, Ä6].

Predominantly the older Äplers mentioned the current fast-paced lifestyle in the society also affecting alp huts negatively [Ä2, Ä4], others mentioned difficulties to survive with PAFP as the only income source in the context of this circumstance [Ä1, Ä3, Ä5, Ä6]. Mentality was described as being of big importance for the uptake of PAFP [Ä4]: “We often say that has to be in your blood. Of course there are also people who had a different job, but quite often the grandfather was an alpine farmer already and like that...” while in this context it was noted that it is currently difficult to find good employees to work on an alp as requirements for this type of work are high: “If I would take the alpine farmer, who is up there, only 2 months but in that time she really lives up there. She doesn’t have water, no electricity, just a little solar energy, which is enough to charge the mobile and water, she has to walk to get potable water. So that readiness to live like that, or even to want to live like that. She for example wants that, finds it great to be in nature be offline and also be able to work physically.”

The topic of Äplers as a very heterogeneous community was generally assessed as a benefit, with the diversity of people being bound together by an ideological drive to work with PAFP [Ä3]: “[...]this is something that is characteristic for alpine farmers is that they are quite individual. Not everyone, but I would say around 75 % are rather individualists, so rather not in an association. Otherwise they are very different. All types exist: rich, poor, intelligent, dumb, higher class, lower class, left-wing, right-wing, all colours exist.” This can be exemplified by the description of values and requirements perceived important for PAFP are resourcefulness [Ä2]: “My side job is, you might have noticed that, is the art of living (living in an unusual way). Alp-restorer and that’s why, living cheaply. Somehow collecting blueberries. That was always my fortune here, that I could, when I was here in wintertime, that I needed that little money, that I could live here with one cow the whole winter.”, independence [Ä2]: “*So how you are doing the things here. - Minimalism! - That fits. - That has huge advantages, because it results in an immense freedom. If you are minimalist then you are not dependent, or very little dependent.*”, and some sort of wisdom to use calmness [Ä2]: “The knowledge when I am able to

keep it calm to save energy, for the time when the window is opening again. Instead of doing some things, there are situations when you better stay in your bed.”

Clashes with acceptance in society got reported [Ä2, Ä3], exemplified by the Covid pandemic and discussion about vaccinations that reportedly split the community as well as Älplers with society [Ä2, Ä3, Ä4, Ä5]. Two failed initiatives<sup>38</sup> on agricultural topics in the year 2021 were mentioned, reasoning that lobbying groups of agricultural industry with the (agricultural) press presenting high power over the public opinion [Ä2, Ä5]. Generally it was stated that PAFP are increasingly in public debate particularly the use of herbicides and the use of slurry on alpine pastures, considered a controversial topic today [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]. In dealing with external influences like politics and science power imbalances are mentioned, resulting from a one-sided responsibility lying with the people actually implementing ideas through their PAFP [Ä3].

### *State of the economic influences on BD conservation as reported by Älplers (see also Figure 6)*

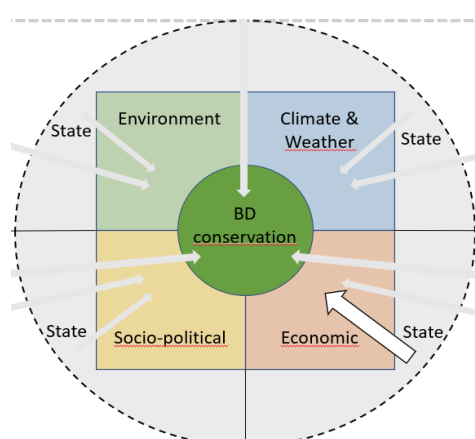


Figure 6: Cut-out visualisation: State of the economic influences as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

Economic interests with productivity being in focus were reported by most [Ä1, Ä3, Ä4, Ä6], while some went as far as saying they do not want to be seen as landscapers and that PAFP in the core is about production [Ä1, Ä6], stating that income from selling products should be sufficient for a living and not having to take multiple jobs. Nevertheless, it was said that today most Älplers have a side income or that PAFP are a side income, or even a hobby [Ä1, Ä2, Ä4, Ä6]. Most participants stated that pure profits are not their main interest but rather the life and work with PAFP and that this is influencing management practices heavily dependent on the individual and personal preferences [Ä1, Ä2, Ä3, Ä4, Ä5]. Due to economic pressures there are very few employees existent on alps today [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6].

Often valley farms and alps are managed simultaneously by the same mountain farmer leading to severe time constraints for doing all but the most necessary management [Ä1, Ä2, Ä4, Ä6]. Generally, the Sömmerung was described universally as characterised by no free time at all and stress keeping busy [Ä1, Ä3, Ä4, Ä6]. Without family labour this was often considered impossible [Ä1, Ä4, Ä5, Ä6]. All respondents explicitly emphasised that their own alps are currently managed sustainably in terms of environmental protection and general extensivity, despite economic pressures, which underlines the value of PAFP, while other alps were assessed more critically. One Älpler mentioned for example that there are not many organically run alps in Canton Fribourg, describing it as “backwards” [Ä5].

The dependency on direct payments by the state was reported coming from the distorted market situation where foodstuffs are undervalued [Ä1, Ä2, Ä4, Ä6], resulting from import of cheap produce [Ä2] while the administrative effort that is connected to direct payments was generally described as excessive and too high [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]: “Someone said to me every time he takes a pencil in

<sup>38</sup> Initiatives – public votes on proposed policies in Switzerland. One public vote tried to ban the use of pesticides in Swiss agriculture as well as the import of foodstuffs that were treated with pesticides. The second vote was on the suspension of direct payments to all farms that do not have an ecological certificate with criteria of pesticide free production, no non-farm produced fodder and a largely renouncement of antibiotics use.

his hands he gets headaches and they have to file rather a lot. “[Ä3] This economic push for rationality together with political decisions made are incentivising specialised and professionalised alps [Ä1, Ä2, Ä4, Ä5, Ä6], while there was a lack of available pastures reported that would enable growth limiting currently this development [Ä1, Ä6] - a development not wanted by all participants [e.g. Ä2]: “What is important today? Today it’s important that the supermarkets are dictating a style of living for us. That is a total consume dictatorship, which is going on today.” and [Ä5]: “Well that’s capitalism. The richer are getting richer and we the middle class have to do as well.” Subsistence and direct marketing practices got mentioned as an important economic factor [Ä1, Ä2, Ä4, Ä6]. One Älpler stated he was actively pushing against that economic rationality and for him time was of less importance for instance as nature was “dictating the timetable” [Ä2], him also being the only one stating explicitly economic difficulties and problems with sufficient income.

A lack of interest by young people to take up PAFP was described by one Älpler [Ä1] stemming from the limited economic outlook of taking up this profession and generally more tempting alternatives in the valley and big cities: “This is not just a job it is a vocation it is a life, a style of life. Sometimes I see that the young decreasingly want to be tied down.” Others reported a migration happening in both directions and young people having a growing interest in rurality and PAFP in general [Ä4, Ä5, Ä6]. Despite a push for efficiency the possibilities for mechanisation in the alpine area was assessed as limited [Ä1, Ä2, Ä4, Ä6]: “But well here in the hilly area here are the borders set, you cannot work with big machines and fortunately a bit.” [Ä1] albeit it was reported that mulching with connected landscape homogenisation is present in singular cases in Canton Fribourg [Ä2, Ä4]. Usual practices done with machinery, even on remote alps with no road access are digging drainages and trenches, milking, mowing, forestry, spraying of herbicides and transportation. Despite the use of some machinery on most alps, PAFP were described as relying heavily on manual labour [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]. On the contrary forestry work was described as completely mechanised and traditional forest management practices with horses are currently not practised any more [Ä4]. The common use of slurry was described as also being influenced by efficiency concerns, as slurry saves labour hours [Ä1, Ä4, Ä6]. Animals present on the Alps were generally assessed as diverse esp. if subsistence is practised [Ä1, Ä2, Ä4, Ä6] while it was stated that cows held are heavily leaning towards high-yield breeds [Ä2] and one interviewee reported that there is in general too much homogeneity present in farm animals on alps [Ä5].

Additional income through market based instruments such as labels got assessed as of great importance, for example the IPSuisse<sup>39</sup> label for valley farm operations [Ä1] and the AOP Gruyère and AOP Vacherin designation for local cheese specialities [Ä6] with tourism on the alps and in the Alps in general being a very important source of extra income for Älplers [Ä1, Ä4].

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<sup>39</sup> IPSuisse – Schweizerische Vereinigung integriert produzierender Bauern und Bäuerinnen - Swiss Association of Integrated Producing Farmers – private labelling association for the sustainable production of foodstuffs. Cooperation with FiBL and Vogelwarte with the development of a point system for assessment of BD in 2008. The system has proven to show high correlation with scientifically collected data (Birrer et al., 2014)

*Externals' perception of the state of the environment, climate, socio-political circumstances and economy*

“So for Switzerland, very, very clear. This is where our priority species are. Switzerland, a big part of the Alps are in here, the alpine species are with us and we are responsible on a European level. Also that's where the diversity is high, because we destroyed everything in the Mittelland (the central plateau). Normally there should be more species here (central plateau) than in the Alps, but that's not the case.”[E4]

Information was taken from the Code categories “Environment”, “Perceptions on BD”, “Practices of alpine farming”, “Scientific practices BD” and “Socio-demographics” and put into four categories: Environment, Climate, Socio-political and Economy, creating the context in which measures and practices for BD conservation are embedded.

*State of the (alpine) Environment as reported by Externals (see also Figure 7)*

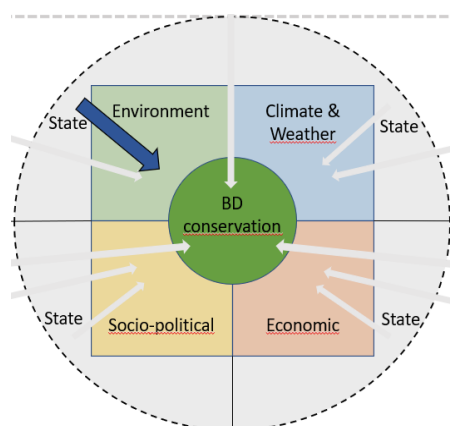


Figure 7: Cut-out visualisation: State of the (alpine) Environment as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

In general good values for BD levels were connected by all externals to the presence of extensive PAFP with the biggest threat to environmental conservation currently being shrub and forest encroachment on pastures, esp. where pastures are abandoned: “We need these animals in the mountains, without these animals there are no meadows with flowers.”[E4]; albeit it was mentioned that depending on the location reforestation must not be negative [E3, E4]. One scientist [E4] stated that BD levels are directly connected to the PAFP in the Alps and Älplers are vice-versa dependent on the high BD levels present for production.

Local Externals in the Canton Fribourg assessed the alpine area being in a resiliently good shape because of the environmental limitations of the pastures limiting economic possibilities [E1, E3]. The pastures in Canton Fribourg were assessed as 60 % of pastures having not much problems with BD levels and in the remaining 40 % nothing could be done as it is a Flysch area and generally the state of BD conservation was described more dependent on environmental factors like geology than human interference [E3]. Problems with sliding slopes in Flysch areas were mentioned as a circumstance which human activity does not have much influence on [E1, E3]. Pasture abandonment in Canton Fribourg was supposedly due to bad road infrastructure and limited accessibility to water sources [E3]. All scientists shared the opinion that areas in the Alps where current technological and environmental circumstances allow it are being intensified heavily [E4, E5, E7, E8, E9] as such an expansion of the road infrastructure was assessed more critical as it leads to further mechanisation with landscape homogenisation following in line [E2, E4, E5, E7, E9]. Landscape homogenisation was mentioned explicitly by most Externals as very bad for conservation efforts as small structures, being the habitat of many species, are getting removed [E1, E2, E4, E5, E6, E7, E8, E9], reasoning for main drivers of landscape homogenisation was assessed being predominantly rooted in economic and political influences.

Many Externals stressed the problem of tourism and esp. skiing areas for habitat loss and corresponding detrimental effects on species diversity [E1, E4, E5, E7], while some relativized this by stating that even ski tourism is comparably extensive in Switzerland and in Canton Fribourg in

particular [E1, E3, E5]. The responsibility of Switzerland in Europe and globally, to less extent, to protect the species of national priority was reported [E4, E7]. One scientist stressed the importance further by comparing the alpine area as comparably intact to the central plateau stating that the alpine area is the current place of conflicts happening between economic and environmental interests. The only External not mentioning this was stressing that the biggest danger for BD conservation is shrub and forest encroachment on abandoned pastures with too extensive management, not enough infrastructure and pressure from big predators (wolf) exerting too much financial pressure on alps as main reasons [E3], albeit the other local External [E1] stated that currently there are not many wolves in the Canton, thus being currently not an issue. The thematic for possible solutions to fight shrub encroachment was differently assessed, most stating human management as being the biggest impact factor while one External reported that the use of sheep has proven to be very effective [E2]. Current problems with shrub encroachment were connected by one scientist to commuting practices to the alps stating that pastures on inhabited alps are in better shape than ‘commuter-alps’ [E2].

Generally issues with weeds, invasive species and shrub and forest encroachment were localised by most Externals to pastures below the treeline (900 – 1400 m.a.s.l. range is most pressured and generally below 1600 m.a.s.l.), stressing importance for sustainable management esp. in these areas [E1, E2, E3, E5, E7]. In higher located pastures above the tree line juniper (*Juniperus L.*) was identified as the only problematic plant having a potential negative impact on plant species diversity levels [E5]. Pasture management in these areas were assessed as crucial as many biotopes of national importance<sup>40</sup> are located below the treeline while these national biotopes are managed through contracted agreements, that are being applied strictly top-down (regulated through NHG)<sup>41</sup>, by Älplers while other areas of high value are not contractually regulated leading to problems with improper management [E4].

Alp management practices in general were reported by one External [E3] to be dependent very much on environmental factors and to a lesser degree on the attitudes and idealism of the individual farmers, as the environment imposes its limitations strictly on the working day, this circumstance was also described as a dependency and described as still present and influential [E5]: “[...] you live in that harmony with nature and the observation of nature, because you are completely dependent on it.”

Current problems with plant species diversity were described as coming from a high pressure of weeds growing on nutrient rich soils. While the specification of what a weed or a problematic plant is was assessed with variety as for example one External explained that bitter dock is usually growing in Lägeplätze<sup>42</sup> where the soil is rich in nutrients and that does not affect pasture quality much as in these spaces cows would not be grazing anyway, coming to the conclusion that many management practices regarding weed management are ineffective and quite useless [E2]. Otherwise fertilisation with slurry is reportedly leading to enriched soils with more potential to grow weeds, thus implying that current management practices supposed to save time create new problems, making the time and labour saving ineffective [E2]. One External mentioned the impossibility of doing intensive PAFP due to environmental limitations and relativized the detrimental effects of slurry completely while also stating that mineral fertiliser is hardly in use and if it is used it is limited to phosphorus [E3], even though the use of mineral fertiliser in the Sömmerungsgebiet is completely prohibited. Concentrated-feed-use, allowed if dairy cows get pastured, on the alps are dependent on the production intensity and on the cow breed [E3], but have a detrimental effect on the soil nutrient balance [E2, E4, E5, E7]. These topics

<sup>40</sup> Biotopes of national importance – Swiss classification by the state regarding protected habitats of species of national importance (see also *Introduction, Species of special responsibility and nation priority in Switzerland*)

<sup>41</sup> NHG – Bundesgesetz über den Natur- und Heimatschutz – Federal law on nature and homeland security

<sup>42</sup> Lägeplätze – usually flat areas of alpine pastures where cows like to lie down and are thus fertilising the soil heavily on these spots.

got very heterogeneously assessed as one scientist stressed huge detrimental effects on plant species composition because of slurry fertilisation on lean pastures: “It is very extreme on a mountain meadow, if you put slurry on it only once, where there was never slurry before, that’s glaring. With only one fertilisation you are destroying many, many plants.”[E5] In the context of weed management the high workload of Äplers was described having a detrimental effect on PAFP, as Äplers have no capacity to pay much attention to anything but the most necessary tasks and everything that is not directly production related gets neglected [E6]. Invasive species were assessed by multiple Externals [E4, E5, E7] as a greater threat esp. fleabane (from the family of *Asteraceae*), ferns and spearmint (*Mentha spicata*) were mentioned by one scientist as currently displacing endemic species on alpine pastures [E5]. Not everyone saw invasive species as a problem of national priority as one local External claimed not many issues with invasive species in the alpine pastures of Canton Fribourg: “I don’t have the feeling that our Alps are invaded by certain plants.”[E3]

Current levels of noise and light pollution, esp. affecting bird populations were mentioned by two scientists [E4, E5]. And a deteriorated quality of groundwater through the use of agrichemicals like herbicides was mentioned by one External [E2].

#### *State of climate and weather as reported by Externals (see also Figure 8)*

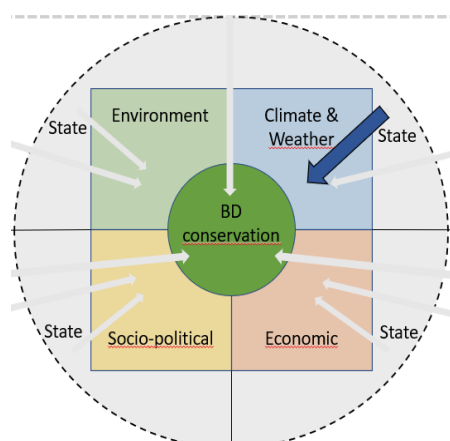


Figure 8: Cut-out visualisation: State of climate and weather as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

In general, not much information on CC impacts were given as conservation issues were not directly connected to global changes and CC impacts were seen tangibly and unavoidably touching the topic. Only one External stressed weather conditions in a wider manner but doubting that CC impacts are the reason [E3].

CC impacts were generally identified as being connected with hotter temperatures and melting of the glaciers and reduced snowfall in the Alps. Pasture management was described as currently being out of balance due to increasing heat and dry spells with management needing adapting to weather extremes and warmer conditions to become sustainable again [E4]. Most scientists were cautious naming CC impacts as reasons for weather extremes occurring in the mountains in recent years with the cumulation of those, like very dry or very wet summers being carefully being called “suspicious” [E5].

These weather extremes esp. heat and drought were assessed by one local External [E3] as having a great effect on management as animals need exponentially more water the hotter it gets: “That is the issue, that the whole management is changing because of 10 days, 10 hot days. So water, the number of animals and the location was usually in an equilibrium.” A local External described the lack of water in 2013 and 2018 as due to the reason that the northern Alps in Canton Fribourg are not high enough to have glaciers and thus are totally dependent on precipitation [E3]. Current adaptation strategies in place were reported to rather put pressure on the valley as in extreme weather events cattle and cows are driven down the mountains with the possibility of resource shortages resulting from too high animal stocking densities [E3]. Multiple scientists reported that organic Äplers had less trouble adapting to weather extremes, as they were reported to pay more attention to environmental factors [E2, E5]. This circumstance was put into context with the presence of LEK being in use, describing organic farmers as more attentive to natural circumstances and events [E5, E6]: „But also things like weather, when do you have to do something in which way? When is the best time to start certain



things? Many of those things that are not clearly nameable. Also when they make cheese, the nose plays an important role, the view and experience, what you can pass along. I believe there's no exact science on the alp." [E6]

*State of the socio-political context as reported by Externals (see also Figure 9)*

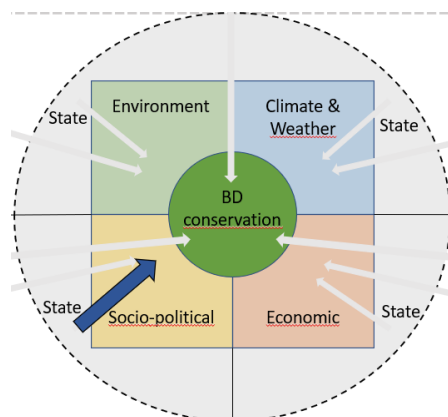


Figure 9: Cut-out visualisation: State of socio-political context as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

One political goal was identified by multiple Externals [E1, E4, E7] to conserve extensive alp management for the future. The alpine area and alpine pastures particularly were described as subjected to heavy regulations in particular with Bestoßung<sup>43</sup>, fertiliser- and concentrated feed-use [E1, E5, E7].

In a socio-cultural context alp management was described despite modernisations as still very traditional due to the nature of PAFP in Switzerland being a living tradition [E6]: Language was reported to play a crucial role for identification amongst Älplers [E6]: "At this interface between modernisation and tradition, verbal communication, or local language is playing a big role." and the practice of being an Älpler was described as the wish to take oneself out of the world<sup>44</sup> [...] something exclusive and something exclusionary. I think it's both" [E6]. The work of Älplers was characterised by

as being centred around the animal needs: "in Berner Oberland they were saying to me: 'First come the animals and then it's the people's turn' if the animals are doing badly you have to act.'" [E6].

A general lack of interest with BD issues by Älplers was reported by multiple scientists, relativizing the statement of great heterogeneity in terms of LEK of Älplers [E2, E5, E6, E7, E8, E9]. The most important factors for their state of knowledge was assessed as dependent on interest, training and family background [E1, E2, E3, E4, E5, E6, E7, E8, E9] while one External stated gaps in controlling Älplers training stemming from a disinterest in BD and environmental topics amongst people affiliated with agricultural [E2]. Tourism on alps was described by one External as a boon to Älplers' sensitisation and the generation of knowledge about environmental values. When not much tourism exists Älplers tend to be more production-oriented, implying not valuing the environment as much. Knowledge was assessed as being mostly connected to geographic locations rather than e.g. plant species' [E5]. Älplers perceptions on state, changes and conservation measures on BD were regarded as an unknown [E1, E3, E4, E5, E7, E8, E9] and there were currently no programs reported aimed specifically at incentivising knowledge generation or gathering knowledge about farmers LEK [E1, E2, E3, E4, E5, E7, E8, E9], albeit one External mentioned in this context that the introduction of the BFF2 result-oriented direct payments implicitly raised the interest (with LEK generation implied) of Älplers for BD and environmental conservation [E1]. It was mentioned that perception and cognition for agriculture benefitting from a good BD state is currently lacking [E2], another stated that Älplers' knowledge about BD, if present, was very selective and the part lacking is about the scope of the diversity [E4]. Älplers were reported to associate the topic BD very negatively mainly due to state interference with their PAFP and perceived freedom [E2, E3, E4, E5, E7, E8]. Several Externals talked about the current

<sup>43</sup> Bestoßung – Swiss term for count of animals on an alp usually measured in Normalstoß which is: GVE/100 days (the usual length of Sömmerung), heavily regulated by the cantonal administration. See also *List of 'indigenous' words and bureaucratic terms*

<sup>44</sup> Also compare with 'The magic mountain' by Thomas Mann

problems with cooperative led alps and Älplers changing too often (ca. all 3 years), leading to problems with inexperienced staff as management is highly location specific and leading potentially to unsustainable management practices necessitating in good supervision [E5]. Privately owned alps had problems with alp owners, who are responsible to take the decisions, ultimately not knowing enough about the alp as they are not working often enough on their own pastures [E2, E5]. The majority of alps in Canton Fribourg and adjacent Naturpark Gantrisch area in Canton Bern are reported to be privately owned family run alps [E1, E3, E8] with many Älplers not living on the alp but rather commuting [E3, E5, E7].

Älplers were described as afraid of the public and media about certain practices, like the use of slurry and herbicides as there is a relatively wide consensus amongst society reported being opposed to the use of such practices in alpine areas [E2]. In the context of herbicide-use, it was mentioned that Älplers often do not understand agrichemicals leading to wrong and excessive use impacting plant species diversity negatively [E2]. The incremental picture of landscape beauty in society was criticised as structures like dead wood and stone piles were reported to not be considered as a beauty standard for pastures [E2, E4, E5, E7]: “In Switzerland we want that the landscape to be very beautiful and for biodiversity this is sometimes not a good solution.”[E4] Mechanisation and landscape homogenisation was seen by one External [E5] as a result of a lack of awareness of small structures and plant diversity on pastures: “They don’t see the beauty or the diversity of all those different structures, they see only things that you have to dispose of with the tractor.” PAFP still have a generally good reputation in Switzerland [E1, E3, E5, E6, E7, E8, E9] compared to farming in the lowlands having a rather bad reputation through the association of animal mistreatments and asocial behaviour of farmers. Traditions play a crucial role in this discussion exemplified by the taboo of questioning the purpose of cow-bells: “Why do those cows have to (wear those bells) with the eyes of the cows wide open and loudly mooing, but criticising the bells, you cannot do that. At most the size of the bells you can criticise.”[E2].

A conflict-saturated environment got mentioned between organic and non-organic Älplers and described as gridlocked and difficult to solve, as the narrative is led by non-organic farmers in a “hypocritical way” using terminology like traditional and modern in an opportunistic manner [E2] and thus are setting the agenda for debate showing stronger lobbying power. This circumstance was exemplified by communication patterns and provocations: “Yea the tendency is simply... A farmer from down there is sending me a photo, with Whatsapp. ‘Meadow of a real farmer and meadow of an organic farmer’.”[E2] The organic community was described being in conflict within because of BioSuisse<sup>45</sup> accepting the use of herbicides on alp pastures. Today most bigger agricultural research institutions are against the use of herbicides on alpine pastures [E2, E7, E9] while politicians and associations were described as committed to the use of agrichemicals on alps [E2].

Generally direct payments were universally assessed as the most important and most effective lever on PAFP and judged in its current state and in the context of BD conservation very heterogeneously and in detail. Direct payments are designed to be as equal as possible to the labour that has to be put in, thus they got differentiated between direct payments for animal management dependent on the Sömmerungszahlen, to be adequate to the labour demand in all terrains in the Alps and opposed to that direct payments for environmental conservation being based on area size, to be adequate to the labour demand independent on the Sömmerungszahlen [E5]. Generally this duality of systems was assessed very positively as many aspects for remunerations are covered, while critic and praise in details were numerous and with great variety: One External thought it positive that they are

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<sup>45</sup> BioSuisse – the most important organic label for foodstuffs in Switzerland.

dependent on the GVE<sup>46</sup>, another External was extremely critical because of weed management allowing the use of herbicides on alp pastures [E2], one said they are too high compared to the flat land farming [E5], it was thought that direct payments in their current state should be extended [E3] or in extreme cases the necessity for a complete redesign of the system was seen by one External [E2]. One External viewed the system implemented as mostly negative, albeit not questioning the system in itself [E4], while others were mostly positive albeit seeing a necessity for reform [E5, E7, E9]. Given the dependency of Älplers on direct payments all political decisions concerning those are regarded as highly sensitive [E2]. Currently the measuring system for BD for direct payments is set by Agridea with measurements of plant species diversity for the BFF2 result oriented payments are conducted through either contracted biologists or trained Älplers [E1, E3].

Result-oriented schemes were mostly seen as the way future direct payment systems will evolve, albeit some mentioned reservations of applicability by stating its administrative difficulties with formulating precise and effective goals and the effort of measuring those [E2, E4, E5, E7, E9]. Soil nutrients were identified as a problem with the federal BD monitoring program ALL-EMA as it does not include this factor and it was described as a mostly static value [E7], while generally ALL-EMA was described by many Externals with its 5-year measurement intervals and covering the whole of Switzerland as a good compromise between measuring faster and slower changes and fit for monitoring BD levels on agricultural land [E4, E5, E7, E8, E9], even noting that the monitoring system in Switzerland is the most advanced in Europe and assumes a pioneering role [E5, E9]. Room for improvements was seen as BD measures applied were reported to be partly misaligned as practices mandatory for a certain type of pasture gets used on wrongly assessed types of pastures with ALL-EMA: “We saw that as a big problem, that many of these ... so it doesn’t work out if the soil is too rich in nutrients and then you can’t have a dry meadow there, it’s not possible. Nevertheless, there are many people who try that and they get a lot of money for that, but for the biodiversity at the end it’s not very useful. So it’s not really about knowledge, it’s about how this whole system functions.” [E7]. Monitoring has been described as lacking only with certain species esp. insects [E2, E4, E5, E7]. Current BD monitoring programmes were described as one-sided not representing actual species diversities, what exactly in detail was not enclosed [E2]. Monitoring of temporal limited projects was identified as lacking with consequences for communication and follow-up research [E4]: “There are projects with a lot of money to do something. It is assumed it functions. No one goes to the field afterwards to see if it worked or not and I would recommend doing that.”

Several Externals stated an issue with BD monitoring: A perceived potential of fear of Älplers towards new restrictions being exerted on them when endangered species and species of national priority should be found on their pastures, even though that would not be the case [E4, E5, E7] resulting in data from monitoring and the monitoring process itself being considered sensitive and making it a political issue. In this case communication between science and the public was described as problematic in the current state, as many people don’t know what the data is actually used for and how it is assessed [E4] and one External stated trust as the most important value for effective cooperation between Älplers and scientists [E8]: “[...] if you have projects located there and you are dependent on them. It’s about building trust [...]”.

Melioration measures in form of road infrastructure expansion thus being connected to detrimental effects on BD were assessed as a trade-off where the right balance needs to be found [E2, E4, E5, E7, E8, E9], albeit the assessment to which extent exactly was considered controversial and the current

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<sup>46</sup> GVE – abbreviation for Großvieheinheit meaning a standardised measure for animals – one cow is 1 GVE while 1 pig only accounts to 0.6 GVE etc. GVE is the most common measurement for productive capacity for animal farmers in Switzerland, Austria and Germany.

meliorations applied were assessed as very heterogeneous ranging from currently still beneficial [E5, E7] to completely detrimental for conservation efforts [E2, E4]. Only one External had a thoroughly positive view on the melioration measures by the Swiss state [E3]. Meliorations for water infrastructure were seen as positive: “[...] so water supply, this is one of the really essential contributions, also to biodiversity, because without water no pasture.”[E7], while meliorations for road construction in alpine areas were widely criticised [E4, E5, E7, E9] and one mentioning that road infrastructure should not be seen as a reason for intensification just because the possibility is there [E5]. It was noted that infrastructure development and human activity in the mountains in Switzerland was rather given the approach of intensifying small areas while leaving the biggest part extensive and the question of land sharing vs. land sparing was assessed, the latter being the preferable option in a densely populated country [E5]. Following that argumentation Switzerland was described as relatively corruption free in terms of development projects in mountain areas: “On the one hand that circus with St. Après-ski, but also in Austria, they build like crazy, still at the moment. They use explosives and build so much, you can forget it, you don’t even have to try it, you will never get through. In Austria they simply say: ‘the valley descent is too narrow’, then there is corruption, I can’t say it otherwise, money is being pushed everywhere and in the end they do it. It’s intense, there are movies about that. With us, only with money you can’t do it.”[E5]. It was also noted that Älplers, dependent on the Canton and area mostly abiding by the laws and regulations and Canton Fribourg was assessed to be one of the areas where compliance is rather high [E1, E3].

Switzerland as a federal state has big cantonal differences in legislating PAFP, resulting in very different management practices by Älplers dependent on the financial situation and the legislation in the Canton, as well as isolated traditions [E1, E2, E3, E6, E7, E8], one External stated that differences even between valleys in the same Canton can be big, dependent on heritage [E7]. In Canton Fribourg an alp inspection is conducted by the farmers’ association every 8 years assessing quality of pastures and state of alp infrastructure and every 3 years BD values get assessed for BFF2 direct payments [E3]. The BFF2 areas were one factor identified ensuring the stability of BD levels in the Alps [E1, E7] while another External more generally described it being due to a “clear legislation with not many margins” [E5]. On top of financial contributions from state funds the alp and farmers associations have a self-declared financial role: “So what comes around: water, rocks, direct payments, new constructions, so we give little subsidies for constructions, sometimes social problems, neighbourhood problems. Everything goes through us. Every year we have something of everything, from what I just said.”[E3] Vernetzungsbeiträge<sup>47</sup> on a cantonal level were stated as being beneficial for BD conservation as well as Älplers income and compliance as they receive direct payments to create wild-life corridors for example [E1].

Älplers’ training with conservation topics was described as an important factor for sustainable management on the alps beneficial for BD levels. Meetings between extension services, nature parks and Älplers were described as important [E1, E2, E3, E5, E7, E8] with one External mentioning communally organised events to coordinate control of invasive plants as an example [E1]. Several Externals stressed the importance of communal action as information dissemination efforts are tailored to the local situations while programs from federal and even from cantonal level were described as less effective due to mistrust from the Älplers [E4, E5]. Their interest in voluntary

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<sup>47</sup> Vernetzungsbeiträge – part of the direct payment scheme for agriculture in Switzerland. Introduced in 2014 for the Sömmerungsgebiet. Regionally managed through negotiated contracts with Älplers and farmers. Bottom-up as farmers can be involved in the creation of projects eligible for Vernetzungsbeiträge - similar to Landschaftsqualitätsbeiträge but aimed specifically at creating corridors for wild animals and each project is temporally set at 8 years. See also [Introduction](#).

programs for education were described as a mixed success [E1]: “[...] they conduct consultation events, but all of this is voluntary and the participation, depending on the topic... if it’s about the wolf, that concerns the most, compared to a rare plant out of my experience“. An exception of the mostly voluntary nature of most programs are the alp controls conducted by the alp associations in Canton Fribourg being strictly mandatory [E1, E3]. The quality of extensions and training was not undisputed as the state of education about BD and its conservation for Älplers was described by one External as non-existent [E2]. Institutions responsible for researching agricultural and environmental topics and multifunctional cooperatives were reported to organise and fund projects with financing help by the federal state in the alpine area with Älplers [E1, E2, E3, E5, E7]. Institutions doing consulting for Älplers were assessed critically as potentially biased dependent on who is financing them [E2]. For weed management catalogues are created on cantonal level to list weeds considered problematic and management practices how to deal with them [E2], while it was noted that according to federal politics it is allowed to use herbicides up to ¾ of the pastures and some plants that are questionably weeds are included. Those guidelines and training were assessed as important and influential on PAFP, Kolas-Z guidelines by the Canton Zentralschweiz were showcased as a positive example [E2]. Other guidelines were criticised with the example of the stinging nettle (*Urtica dioica*) being included as a weed while one External [E2] described the plant as beneficial.

Cooperation by scientists or environmental institutions with Älplers in conservation projects where they get subjected to economic losses with no or low remuneration were described as very difficult but sometimes necessary to create effective conservation projects. Problems with cooperation in such situations can be overcome with good communication and explanation creating trust [E8], albeit a current general lack of state capacities for answering to Älplers’ questions regarding state programs was noted [E5]. Communication and cooperation between Älplers and society was described as lacking, emphasising a lack in communicative competence by state and scientific actors [E4, E5, E7].

#### State of the economic influences as reported by Externals (see also Figure 10)

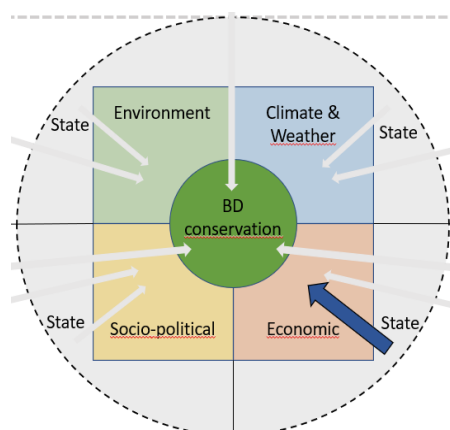


Figure 10: Cut-out visualisation: State of economic influences as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

Economic feasibility issues were stated as one of the main problems with PAFP by all Externals and one of the main reasons why pastures are being abandoned and the reason for direct payments in place [E3, E4, E5, E7] as well as the current development towards bigger alps as the smaller and more difficult the terrain is the more labour is necessary (relatively) to take care of the animals [E3]. Generally, for pastures to be abandoned, one single factor was described as not being sufficient to make PAFP infeasible, but a combination of factors must be present: “Water at the moment is not the limiting factor. With one factor alone, in most cases it’s not enough. It’s not only water, not only road, not only wolf. There have to be multiple causes. So it’s steep, no road, no water and the wolf on top.”[E3]. All of the aforementioned factors are environmental in nature but the reason for giving up management in these areas was described being due to purely

economic reason as the current workload is already very high, which was mentioned by all Externals and time management issues between taking care of the valley farm and the alp were noted for Älplers who are also running a farm in the valley [E3] leading to the conclusion that too high extensivity with

not enough Normalstöße<sup>48</sup> is not good for the alps as well, while Canton Fribourg does not have that problem as much as Canton Zentralschweiz or Graubünden [E3]. Mechanisation is a result of this strife for economic and labour rationalisation and demand for high efficiency to stay economically feasible with very slim margins for the alp resulting in a lack of employees on alps [E3]. Alpine work thus was described as being currently undervalued by the market economy [E3] with wages being low leading to income problems of alp employees [E7]. There are not many local alpine cheese dairies in existence due to economic pressure and heightened hygienic standards enforced [E1]. Economic development in the alpine area was described by multiple External as endangering BD conservation efforts not just implicitly by putting pressure on PAFP but also directly esp. through development of winter tourism with the construction of new lift operations having direct and indirect detrimental effects on habitats [E4, E5, E7].

### *Älplers' perception of the changes of the environment, climate, socio-political circumstances and economy*

“So you almost have to say the Älplers today are forced to give up the old knowledge, because they are ever more rational and how should I call this? They have to plan with the machine or something, you go to the telephone and get whoever, who is managing the land because you are going to work and you pay for that. That has become so perverted.”[Ä2]

Information was taken from the Code categories “Environment”, “Perceptions on BD”, “Practices of alpine farming”, “Scientific practices BD” and “Socio-demographics” and put into four categories: Environment, Climate, Socio-political and Economy, creating the context in which measures and practices for BD conservation are embedded.

### *Changes of the (alpine) Environment as reported by Älplers (see also Figure 11)*

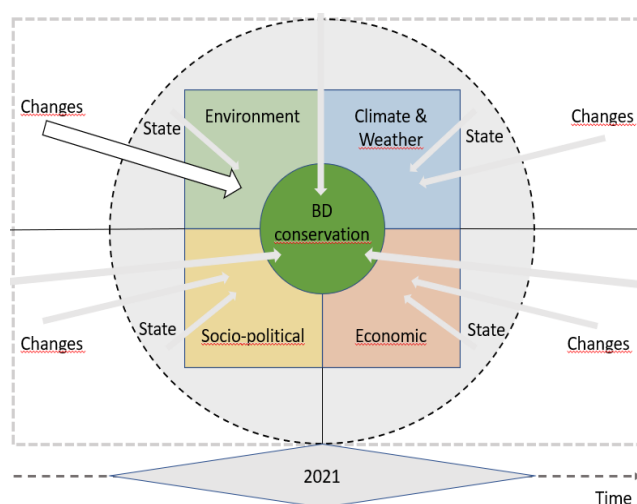


Figure 11: Cut-out visualisation: Changes of the (alpine) environment as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

Compared to changes in lowland agriculture, changes for PAFP were generally described as marginal. All Älplers mentioned pastures overgrowing as an ongoing trend for approx. the last 20 years, albeit mostly relativizing the statement as locally limited and not all regions subjected to it, esp. the alpine region in Canton Fribourg has not seen many issues with overgrowth [Ä1, Ä2, Ä4, Ä5, Ä6]. All Älplers assessed these changes have taken place in areas with difficult terrain with factors mentioned: wet soils, rocky ground, low quality vegetation (in context of fodder for animals), high altitude, remote locations and no access roads. Generally environmental conditions with geological conditions stressed in this case were described as being not able

<sup>48</sup> Normalstoß – measurements of Stoß/100 days the usual length of Sömmerung used by the Swiss administration to determine animal stocking counts on alps. 1 dairy cow = 1 Stoß, 1 meat cattle = 2/3 Stoß, 1 calve = ¼ Stoß etc. see also *List of 'indigenous' words and bureaucratic terms*

to change in the mountains [Ä1, Ä2, Ä3, Ä6]. Some Älplers having alps in active “Rutschgebiete”<sup>49</sup> reported an increase in sliding slopes in Flysch areas compared to the past [Ä4, Ä5] stating many dormant Rutschgebiete became active again, while others dismissed this reporting that it was always the same [Ä1, Ä2, Ä6], noting their alps had no issues with activating Rutschgebiete even though located in Flysch areas. One Älpler [Ä4] reported this was due to past neglect of water infrastructure like trenches and drainages resulting in water erosion. Water shortages were mentioned as the most notable change creating the most problems in the recent past [Ä1, Ä2, Ä4, Ä5]. Structural elements are reportedly increasingly removed creating more homogenous landscapes together with an increase in mechanisation of tasks and increase in farm-size going alongside this development [Ä2, Ä3, Ä5], while simultaneously it was stated that former pasture delimitations like stone walls and hedges get currently refurbished due to the increased use of plot grazing for farm animals and Strukturverbesserungsbeiträge<sup>50</sup> [Ä3, Ä4]. Pasture fertilisation with slurry instead of manure was stated by all Älplers to be a big change from past practices, while currently the trend was reported to be moving away from this development more towards the use of manure again [Ä2, Ä3, Ä4, Ä6]. The introduction of direct payments for single trees on pastures which got introduced recently were mentioned [Ä1, Ä2, Ä4, Ä5, Ä6]. Most important changes included commodities on alps now being commonplace like electricity, water supply, road access, milking machinery, sewage systems and modern kitchens making alp management easier and more comfortable, which was not commonplace in the past [Ä2, Ä4] with general maintenance of the huts improved compared to them formerly being mostly in bad shape [Ä4].

It was stated that in the context of BD global changes were perceived more important, like the destruction of rainforests around the world [E3], than what is currently happening on the alps in Switzerland [Ä1, Ä2, Ä3, Ä5]. One Älpler reported a trend for deforestation esp. around settlements and urban areas [Ä4]. Generally changes in single animal species populations, such as marmots (*Marmota marmota*), golden eagles (*Aquila chrysaetos*), chamois (*Rupicapra rupicapra*), lynx (*Lynx lynx*), deer (*Capreolus capreolus*), etc. were reported to be the reason from natural predator-prey cycles, availability of food and diseases. One Älpler observed a decline in marmot population that he explained with the re-occurrence of the golden eagle in the valley [Ä1]. Another mentioned a strong decline with deer and chamois populations and a recovering European hare (*Lepus europaeus*) and marmot population [Ä4]. One Älpler mentioned a general decrease of wild animals in the alps in Canton Fribourg [Ä5]. In terms of changes of a single species the return of the wolf was most notably stressed by all Älplers, albeit almost none of them having actually encountered a wolf [Ä1, Ä2, Ä3, Ä5, Ä6]. The wolf was described as being dangerous to young farm animals and small farm animals, while grown cows and cattle were considered not prey for the wolf being too big in size [Ä1]. Some Älplers mentioned an increase of the lynx population in Canton Fribourg as a comparison to the wolf being resettling since a longer time, reason for this was given as the lynx is less interfering with PAFP and generally creating less issues with killed farm animals compared to the wolf [Ä1, Ä4]. Multiple Älplers reported having either seen a lynx [Ä1] or a wolf [Ä4] on their pastures, one Älpler found traces of the lynx (a killed deer) on his pastures [Ä2]. There were fewer changes observed with single plant species populations and diversity, only weeds were reported to be increasing as a trend [Ä1, Ä2, Ä4, Ä5, Ä6] corresponding to more labour necessary for weed control on pastures [Ä1, Ä2, Ä4, Ä6]. In that context

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<sup>49</sup> Rutschgebiete (plural of Rutschgebiet direct translation: sliding areas) – areas prone to sliding slopes with Flysch type of soil, differentiated in active and dormant areas. See also *Discussion, Meliorations and encompassing use of technology*

<sup>50</sup> Strukturverbesserungsbeiträge – see *Introduction, State programmes influencing pastoral alpine farming practices*

an increase in Höhensteigen<sup>51</sup> of plant species was observed by multiple Älplers [Ä1, Ä2, Ä4, Ä5, Ä6], one Älpler observed also a similar trend for stinging insects [Ä5] and she noted also the disappearance of the Turk's cap lily (*Lilium martagon*) from her pastures [Ä5]. In particular the climbing of weeds to higher altitudes that were formerly only located in the valley (i.e. the creeping thistle) got assessed by multiple farmers being connected with warmer temperatures in the Alps [Ä1, Ä2, Ä4]. Plant diseases got identified by only one Älpler mentioning sick ash trees (genus *Fraxinus*) being the case in the whole of Europe [E6] and certain ash trees being resistant comparing it to a passed plant epidemic with elm trees [genus *Ulmus* - field elm (*Ulmus minor*) and witch elm (*Ulmus glabra*)]. Another Älpler thought the increase of weeds was caused by the excessive use of herbicides on alps [Ä4]. An increasing upward movement of the snowline was observed universally. A decrease of insects in the flat parts were reported by most Älplers stating at the same time that more insects are present in the alpine area [Ä2, Ä3, Ä4, Ä5, Ä6]. Blueberries got reportedly infected by a vinegar fly which was reported as a new phenomenon [Ä2]. Behavioural changes of wild animals were observed by not many Älplers and those observed were connected to an increase or decrease of shyness, credited to the presence of big predators [Ä1, Ä4] or getting more accustomed to human presence [Ä6]. One Älpler reported an increasing irritability of his cattle after a wolf was spotted on his pastures [Ä4]. Generally plant species-diversity changes were described being more dependent on the locality with geological and soil properties being most important [Ä1, Ä3], the diversity and changes was seen in this context rather on a spatial rather than a temporal level.

#### Changes of climate and weather as reported by Älplers (see also Figure 12)

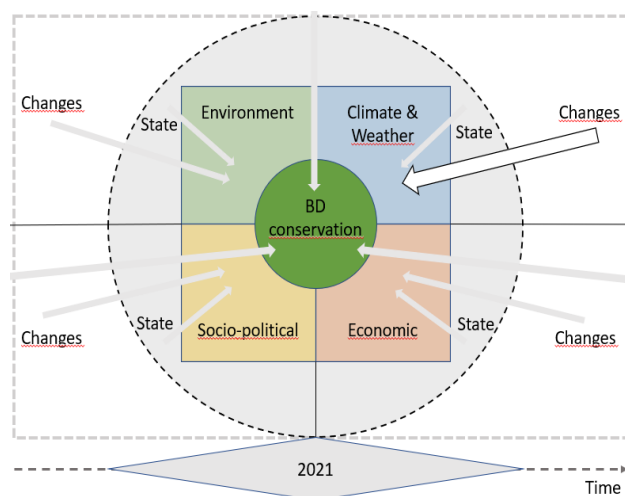


Figure 12: Cut-out visualisation: Changes of climate and weather as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

Changes with climate and weather conditions were mostly broken down to an increase of extreme weather events [Ä1, Ä4, Ä5, Ä6], longer dry spells, more intense rainfall and generally the point stressed by all Älplers the most was warmer weather both in summer and winter [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6], though some of the participants noted that perceptions of long-term changes of the climate have issues with the human subjectivity creating bias and not being accurate enough in the long run (more than 30 years) [Ä2, Ä3]. The most obvious global CC impact was reportedly the melting of glaciers and the increase in altitude of the snow line with rising temperatures. One Älpler mentioned that the length of summers has gotten less predictable than in the past with

bigger variations between years [Ä4]. Most notably were the extreme water shortages in Canton Fribourg discussed, when water was flown to alps with helicopters which had never happened before [Ä1, Ä2, Ä4, Ä5, Ä6]. One Älpler noted he thought it was rather too late to take measures against CC and society should focus on CC impact mitigation [Ä3].

<sup>51</sup> Höhensteigen (direct translation – altitude climbing) – cc impact that species formerly located to the low/valley areas are now occurring in the mountains as well with rising mean temperatures



*Changes of the socio-political context as reported by Älplers (see also Figure 13)*

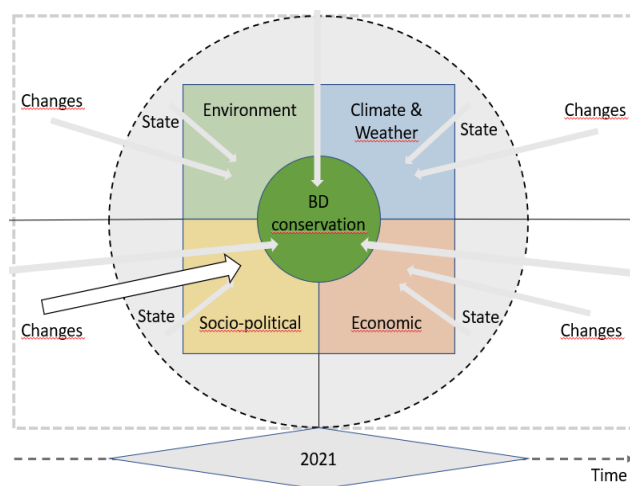


Figure 13: Cut-out visualisation: Changes of the socio-political context as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

Generally, changes for PAFP were characterised as very slow, as incentives applied take time to be noticeable [Ä4], while a trend for continued support for PAFP by the society was reported with adaptations how this support is constituted. Despite that some Älplers expressed a feeling of increasingly being used as scapegoats for pre-existing environmental problems [Ä1, Ä3].

Financial incentives were universally regarded as currently the most powerful lever to change management practices [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]. A trend of politics introducing increasingly restrictive laws limiting choice in PAFP was reported and assessed negatively [Ä1, Ä3, Ä4, Ä6]. A level of insecurity regarding politics was mentioned as the perception was that of

volatility with topics and streams picked up by politicians being unforeseeable [Ä1, Ä3, Ä4, Ä6]. Most notably two Älplers [Ä2, Ä4] stating managing their pastures voluntarily very extensively and differently to the alp norm did not mention any feelings of uncertainty regarding politics. All Älplers reported the introduction of the result-oriented BFF2 payments and mandatory coupling of direct payments to management practices to receive financial contributions at all as a big change for PAFP even though all interviewees from this group stated that it did not change their management practices much [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6], many of them even stating that they did not have to change anything [Ä1, Ä4, Ä6] which was assessed positively.

Rising amounts of direct payments towards PAFP was described by all as necessary to sustain alpine pasturing. Meliorations were criticised by some Älplers as a symptom of not changing political support for intensification and no trend for change visible [Ä2, Ä3, Ä4, Ä5] with one Älpler mentioning a trend in society and politics following a technocratic mindset that is only focused on commerce and efficiency as an ongoing and increasing trend [Ä2], other Älplers did not mention it explicitly as a problem but rather as a matter of fact [Ä1, Ä3, Ä5, Ä6]. Changes brought by melioration measures were assessed very critically by one Älpler [Ä3] stating a clear difference visible and resulting in 'cleaned out landscapes' [Ä3]. An increase in the mountain road infrastructure was described leading to an increase of mechanisation on adjacent alps [Ä2, Ä3, Ä5]. Support for water infrastructure was reportedly [Ä4] neglected in the past though it was mentioned that financing for this issue is improving, albeit slowly, but the trend is seen positively. Generally, the agricultural reforms starting from 2012 were assessed very positively. All Älplers for example saw the demand for leaving organic matter on the pasture as positive, stating that it reduced the practice of burning organic residues. Älplers reported that since the introduction of the new agricultural and policies focusing heavier on conservation more data on BD from pastures were recorded [Ä1, Ä3, Ä4, Ä6]. One important change was reported being the introduction of the Sömmerungszahlen<sup>52</sup> which helped balance the extensivity of management practices [Ä4]. The introduction of area based payments in the alps increased the problem as speculators start to show interest in buying pastures [Ä2], while it was assessed as positive that payments are dependent rather on area as on animal count as the latter is regulated by the

<sup>52</sup> Sömmerungszahlen – Number of Normalstoß that are allowed on pastures as set by the administrations

Sömmerungszahlen to not incentivise Älplers to squeeze the maximum amount of animals on the pastures [Ä1, Ä2, Ä3, Ä4]. Prohibition to remove dead wood and dead organic material got introduced in forestry resulting in a change that more organic material is actually left to rot, which was described universally as a positive change, although conflicts were mentioned with colleagues and other people as them complaining that the land is not looking not tidy enough [Ä1, Ä2, Ä4, Ä6]. The introduction of a CO<sup>2</sup>-tax was mentioned by one Älpler and got assessed as a positive development as it does not affect PAFP but is focused on the energy intensive economy [Ä2]. Alps getting rationalised and pastures generally getting bigger with fewer Älplers on the alps was stated by all Älplers as a problem in the recent past and as an ongoing trend putting unequally more stress on smaller alps than on bigger operations, while politics and economic pressure was reported to be the reason for these changes [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6]. The administrative effort being already very high was seen by all Älplers as still rising as a trend.

Alp management in its basic characteristics was described by some Älplers as unchanged compared to a 100 years ago in perspective of number of farm animals and pasture management [Ä1, Ä4] and it was stated more generally that while the anthropogenic component was transformed to a considerable amount, the environmental components remained relatively static. A trend mentioned by multiple Älplers was that PAFP were driven in the past by necessities while today it was characterised more as a lifestyle choice for some people to become Älplers or as an esoteric force that children growing up with PAFP are intrinsically driven to take up this life [Ä1, Ä2, Ä3, Ä4]. One Älpler described only sheep and cattle herding as the two practices being the closest to traditional PAFP with less changes than for other farm animals induced through mechanisation [Ä3].

All Älplers reported that fewer people are living and working on the alps compared to the distant past (~100 years ago), while this was described as an ongoing trend [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6] with the notion that the mindset in society changed and fewer people's demand for lifestyle being compatible with working on an alp [Ä1, Ä2] more specifically a general laziness in society was reported together with the trend of non-commitment to manual labour and hesitancy to settle down in a place [Ä2]. The shortage of labour was regarded as connected to mismanagement and neglect [Ä6]: "I think it is going to be more difficult if ever fewer farmers have ever more land and do not have the time to do certain things. To fight against shrub encroachment or so. That is going to be difficult." The younger generation was described by most Älplers being more sensitive to environmental and BD conservation topics than older generations [Ä1, Ä3, Ä4, Ä5, Ä6] with a certain hope expressed for future changes in that context [Ä3, Ä5, Ä6]. One Älpler mentioned in the context of the trend in the 70ies and 80ies to manage an alp, where people grew up in cities connected to the counterculture movement, that currently there is a trend amongst young environmentalists from the cities to move to the alp [Ä2]. Some mentioned, despite the stated lack of current public services available working on an alp, that the situation with medical service has increased greatly compared to the past making traditional medicine obsolete [Ä1, Ä3, Ä4, Ä5], albeit a returning lifestyle trend for herbal medicine was stated by one Älpler [Ä5]. One employed Älpler described the decision of doing the Sömmerung as hard as there are many trade-offs such as: very limited career opportunities, limited possibilities to take part in communal activities as theatre or bands and in general limiting choices for employment due to its seasonal and remote characteristics [Ä3].

All Älplers stated the necessity for constant further education and the need coming from a quickly changing society [Ä1, Ä2, Ä3, Ä4, Ä5, Ä6], one Älpler stated further that it is necessary to change with society and not unhitch from other developments happening [Ä1]. Agricultural training and esp. agricultural schools got reported to have updated their curriculum towards conservation topics, while reportedly in 2006 this was not yet the case and training and extension was focused on productivity and even pesticide use was still promoted [Ä1, Ä6] while it was stated that training longer in the past

around 1970s and 80s was even heavier focused on productivity and agrichemical use [Ä4]. Reasons given for this change of curriculum were of political nature with the introduction of new regulations heavier focused on conservation than productivity [Ä1, Ä4, Ä6]. Two Älplers mentioned that it is common practice to try new practices every season and the community was described as creative with testing of improved management practices [Ä1, Ä3]. It was stated that constant evaluation and self-criticism is a necessary trait for PAFP [Ä1]: “[...] you try to develop further, you have to do that constantly”. Only one Älpler mentioned technological innovations being a big change for PAFP, he stated that mobile phone connection on the alp made the work a lot easier, by being able to call a veterinarian or the alp boss if something is wrong [Ä3].

Future perspectives were described as positive by most Älplers [Ä1, Ä3, Ä4, Ä5, Ä6] as PAFP have always been and are still seen positively from society and politics. Only one Älpler explicitly mentioned worries about the future development of PAFP in the context of abandonment of traditional practices and increasing mechanisation [Ä2]. One Älpler described a trend of reduction of social interactions amongst the community due to higher workloads and less free time due to economic pressures [Ä4].

#### *Changes of the economic influences as reported by Älplers (see also Figure 14)*

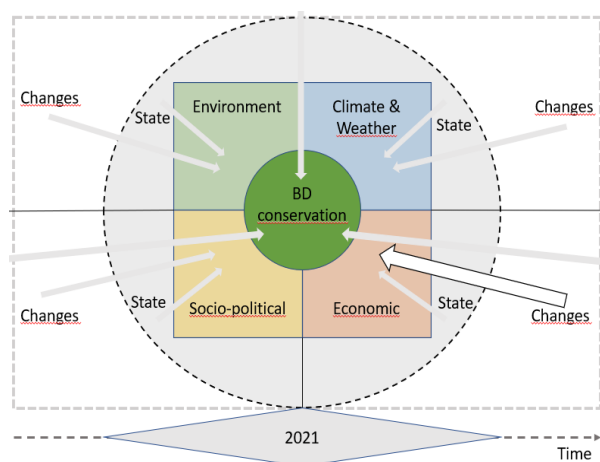


Figure 14: Cut-out visualisation: Changes of the economic influences as reported by Älplers;  
Source: own elaboration (see also Figure 2, p.46)

Despite economic pressure for alp labour rationalisation and increase of use of machinery this trend was assessed as limited by most Älplers as the environmental limitations set in the Alps do not allow the use of big and heavy machinery on most pastures [Ä1, Ä3, Ä4, Ä6], while all tasks formerly done manually or with animal traction and that can be mechanised with small and light machinery have been mostly so [Ä4]. Esp. the introduction of mulching machines on alp pastures was assessed as specifically harmful to BD as they homogenise the landscape and “everything gets destroyed” [Ä2, Ä3, Ä4, Ä5]. The ongoing mechanisation was seen by most Älplers negatively describing this development as removing the human from the environment

stating milking-robots as an example where no human contact to the animals exists anymore [Ä1, Ä2, Ä4]. In terms of management rationalisation it got reported that practices demanding a lot of manual labour with limited efficiency and output work are increasingly being neglected or given up completely and following from that not all resources available are used anymore as it was normal in the past [Ä2, Ä3, Ä4, Ä5]. Esp. weed management was pointed out as being one of those labour-intensive tasks currently being neglected [Ä2, Ä3, Ä4].

The reason that fewer employees are working today on the alps was assessed due to wages having risen in the past by a big margin [Ä1, Ä3, Ä4]. One Älpler [Ä3] stated: “So I get 140 Franks a day and then I pay 70 to the helper, or maybe 60, it depends, sometimes if he has no idea what he is doing. But I am paying for the food, so he has as much as I have, because I think everyone is working and responsibility, you don’t necessarily have to pay that. Responsibility is something some people like to take, so I like to take it and I don’t need to get money for that. But 70 Franks is not much money, so I almost have a bad conscience, but I can’t pay him more than I get, that is also not possible, that would be strange.”

The ongoing trend to replace old cow breeds with modern high-yield breeds was assessed as problematic for weed control as the high-yield cows were described as picky in fodder selection, while traditional cows ate some non-poisonous (and supposedly poisonous) weeds on the pastures [Ä2]. Another Äpler reported a trend in breeding again more robust cow breeds purely out of economic reasons as those cows demand less management activities and thus costs, which was seen as beneficial with a low milk price as in 2021 [Ä1]. In general, the traditionally higher diversity of farm animals present on the alps compared to lowland farms was reported [Ä2, Ä3, Ä4, Ä5]. The market situation for low producer prices for raw products like milk and meat was seen by all farmers as not going to change in the near future.

Most Äplers interviewed stated that they do not want to intensify or extend their alp in scale if they are not economically forced to do so [Ä1, Ä4, Ä6] with one farmer mentioning that profitability is of decreasing importance for motivation for PAFP as the margins are very low [Ä1]. The need for expansion and intensification was explained by one Äpler being present because of rising production prices, while prices for produce are stagnating [Ä6]. Several Äplers stated the necessity to earn more than in the past due to rising living costs and the economic development in general [Ä1, Ä5, Ä6] forcing Äplers into taking side-jobs or to cater to tourists [Ä1, Ä3, Ä4, Ä5, Ä6]. Only one participant stated intentions of expansion and only due to economic reasons [Ä6].

Due to economic stress pasture grazing was described as the standard today, while the traditional stable management of animals is still present in isolated cases, while separating the pastures into plots using fences is common practice apart from sheep herding, which is hardly practised anymore due to economic feasibility issues [Ä2, Ä3, Ä4]. The Abandonment of sheep pasturing, traditionally practised in higher altitudes and steeper terrain, is having an effect as pastures are not getting used differently as generally economic possibilities are limited in those locations [Ä2, Ä3, Ä4].

Multiple Äplers mentioned that an extending variety of land-use gets established in the Alps, with an interviewee (living in close proximity to a quarry) describing a negative example of quarries expanding business. One Äpler mentioned a positive development of increasing awareness for the use of forestry in certain locations instead of pastureland in the Alps [Ä4]. It was stated that tourism got expanded in the recent past which was seen positive if it was an “soft tourism” like hiking and negative if it got intensified through big hotels or holiday house settlements [Ä1, Ä2, Ä3, Ä4, Ä5], the latter was described as a decreasing trend also due to basic democracy where construction projects are up for vote in the community. Several Äplers stated this soft tourism as an important source for future income [Ä1, Ä4]. The Covid pandemic connected to local tourism was seen as a boon as the Swiss were vacationing often in the local Alps with tourism profiting heavily from that [Ä1, Ä4].

The resilience of PAFP was assessed being driven by different factors, on the one hand negatively because of strong dependencies on direct payments and on the other hand positively because of the positive attitude in society. While holding dairy cows and cattle was considered of high resilience the traditional method of stable managed animals esp. with herding instead of fencing was reported to be almost non-existent today due to economic pressure [Ä2]. The least productive PAFP like sheep herding were seen by all Äplers as being the most sensitive to any contextual changes. Alp dairies have reportedly almost vanished from the alpine area in Canton Fribourg [Ä1, Ä2, Ä4, Ä6], while the management of dairy cows has increased since 2001 dependent on the region and milk prices [Ä3, Ä5].

### *Externals' perception of the changes of the environment, climate, socio-political circumstances and economy*

“We surmise that the condition in the Sömmerungsgebiet is not bad, concerning biodiversity. There are singular examples, that are catastrophic, where alps get cleared out, get over fertilized, terrible, often in connection with street building. At first there is a big street, then there is slurry, then the rocks get put on the side and then they are working with machines, levelling the soil.”[E5]

Information was taken from the Code categories “Environment”, “Perceptions on BD”, “Practices of alpine farming”, “Scientific practices BD” and “Socio-demographics” and put into four categories: Environment, Climate, Socio-political and Economy, creating the context in which measures and practices for BD conservation are embedded.

### *Changes of the (alpine) Environment as reported by Externals (see also Figure 15)*

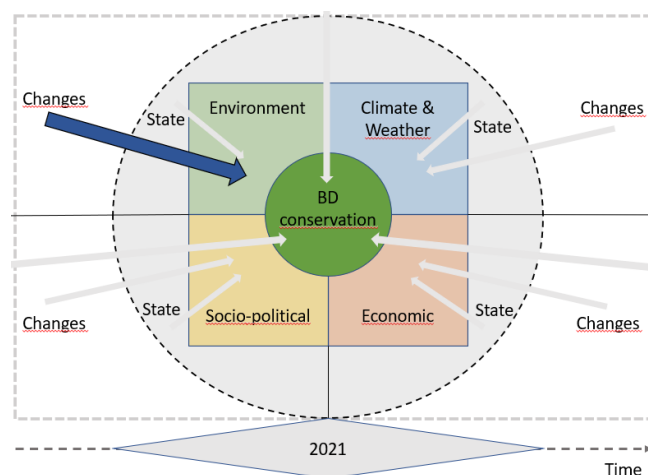


Figure 15: Cut-out visualisation: Changes of the (alpine) environment as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

The alpine environment currently undergoing huge changes through the CC impacts as melting of the glaciers was mentioned by one External giving as an example the creation of new lakes in the Alps [E5]. Adding to these global changes affecting Switzerland, the transformation of society and economy exert further pressures on the alpine environment. All Externals stated the environmental limitations being set by the harsh alpine geology and climate as one of the main factors that PAFP are not getting as heavily intensified as the development in flat areas in Switzerland, albeit the development was described as an increasing trend. Surface sealing was specified to be not extensively present in the Alps, while in the flats it was

mentioned as one of the main reasons for BD decreasing [E7]. Good environmental and habitat quality was reported to be present for a long time and not likely to change in the future with the current development happening [E3] with one External noting a positive trend for conservation since 2011 and wished for this trend to continue with the current structure of measures applied [E7]. Dependent on the location a recent trend for reforestation efforts in difficult terrain was seen positively [E5], while shrub-encroachment generally and the intensification of alp pastures on “easy” terrain was assessed negatively [E1, E2, E4, E5, E7].

The current ongoing trend of losing small structures on alpine pastures was reported to be the reason for mechanisation and wrong application of melioration measures [E5]. One External perceived a negative trend for BD conservation in context of PAFP [E2] the reason being currently a widespread use of herbicides on alpine pastures and the trend for intensification with connected landscape homogenisation esp. in lower parts of the Alps. This development was compared to agricultural development in the central plateau [E2]: “Very strong is the intensification in between 1000 and 2000

metres, so there is something happening, that already happened in the Mittelland<sup>53</sup> for 50 years.“ Homogenisation was reported by all External as problematic, while the occurrence due to PAFP was assessed with great variety. One External reported the development with landscape homogenisation as “huge” [E2]. The development was described in general starting from meliorations with road constructions by one External [E5] which was connected to landscape homogenisation foremostly with the use of machinery on alps [E7]: “Yes, in my opinion especially the use of machinery always leads to a homogenisation, and that is a bit of a pity, if you have pure pasture, only the animals create heterogeneity and the machines create homogeneity.“ Another External stressed the importance of the alpine area in the Swiss context [E4]: “I think for us, what happens in the mountains is very important as for us in Switzerland that’s where the higher quality and the higher diversity exist and that’s where the changes happen at the moment.“, describing BD in the Alps as esp. sensitive to changes and future developments. An External with cultural background emphasised the impact of human action in that context [E6]: “[...] when we think about man from Anthropocene and we are conscious about, how big the influence is, that we people leave behind. We are responsible for these changes.“

Adding nutrients to lean soils in the Alps was described as changing the soil properties rapidly while not being irreversible but the transition from rich soils to lean soils taking a much longer time [E5]. Soil stability is reportedly changing in regions with main influencing factors being water flows and the type of vegetation cover with karst regions being esp. subjected to changes in water flow [E5]. Reasons leading to soil degradation were summed up by an External [E7] starting with more intensive PAFP, leading to more irrigated areas and then more fertilised areas with slurry. Shrub encroachment was summed up in a similar process of holding more animals in an intensive manner meaning an abandonment of pastures and of practices like mowing pastures, leading finally to shrub encroachment. Increasingly, effects of water and soil contamination with agrichemicals are becoming visible, even in the alpine areas, as was reported by one External [E2], necessitating the changing of some water extraction sites. The areas where there are currently low BD levels recorded on agricultural land (alpine and flat areas) suffer reportedly due to the (excessive) usage of agrichemicals [E2]. An ongoing trend to use less herbicides in agricultural practices in the lowlands was mentioned while at the alps herbicide use is increasing [E2]. One negative factor for soil quality was reported to be the change from traditionally using manure for fertilisation to the currently predominant use of slurry [E2].

The spread and population growth of big predators was assessed as being a critical factor amongst others for future developments of PAFP [E3, E5, E7]. “If you ask the question: ‘what kind of risk do you see for your Alp?’, so not only water or predator, so I don’t have a negative attitude against the wolf. It’s a fact, it is a huge effort and a huge amount of stress, it’s like that.“ [E3]. The development of the re-introduction of the wolf was seen partly very critical [E3]: “If the goal is to remove the human from the alp areas, also the tourists, then they can continue like that.“, stating the wolf being one of the main factors for drastic change of the landscape picture as it entailed an introduction of new types of pasture management or and abandonment of those.

The occurrence of invasive plants on alp pastures was regarded by multiple External as a matter of time and was assessed as a growing problem with more issues in the future [E2, E4, E5, E7], one External described the encroachment of invasive plants as a national problem that needs to be taken care of urgently [E2]. Höhensteigen, the climbing of plant species was reported by External [E2, E4, E5, E7] esp. in the context of weed control [E2] with fleabane and alders pointed out being esp. problematic. Species with their normal habitat in the valleys were reported “fleeing” to the Alps as

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<sup>53</sup> Mittelland – the central plateau, see also Map 2, p.27

environmental stress is too high in the lowlands and seeking an alternative habitat in the mountains [E4].

An increase in noise pollution was identified as one problem that got assessed as developing negatively [E4, E5]. Light pollution was mentioned [E4, E5] as a big issue increasing in trend which has not gained much attention by science and the society yet [E4].

Development of tourism infrastructure in particular for winter sports was described directly and indirectly having a detrimental effect on BD levels in the Alps. Multiple Externals regarded this as one of the main threats currently threatening the alpine areas [E4, E5, E7] as the environmental impact of the construction of sporting facilities (esp. artificial snow making for skiing) in the alps was assessed as one of the biggest drivers of BD loss, as it entails a long list of intensification possibilities through higher accessibilities of alpine pastures with heavy machinery which are resulting in great landscape homogenisation and stating that the “truly coarse” [E7] interventions in the landscape are stemming from ski infrastructure constructions.

#### *Changes of climate and weather as reported by Externals (see also Figure 16)*

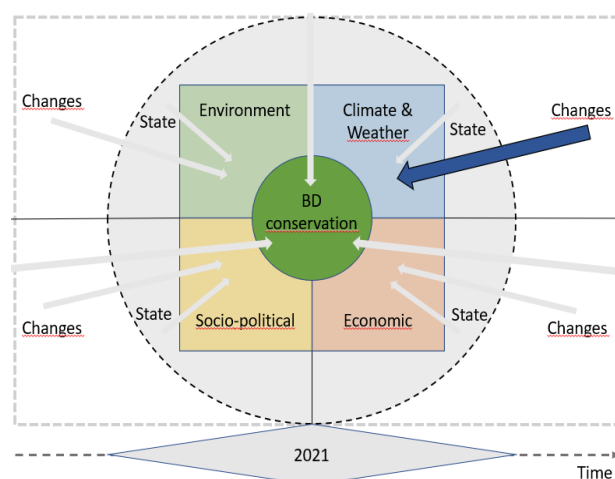


Figure 16: Cut-out visualisation: Changes of climate and weather as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

CC impact global warming was identified to result in spreading plant species non-native to the alpine area in Switzerland. The death of glaciers and reduced snowfall both in winter and summer time was connected to the same reason, thus the biggest impacts of CC were identified on winter tourism activities as snow is lacking and the season is shortening [E7]. Warmer temperatures were reported to lead to a change of the water flow regime, creating lakes and changing the soil stability in certain areas, particularly in areas with Geröllgeschiebe<sup>54</sup>, creating problems [E5]. CC was described as having a big influence on PAFP and its alpine pastures due to erosion and permafrost soil reduction leading to impacts, like slopes collapsing and sliding. Economic

implications are reportedly positive for PAFP with earlier snow melting and later snow falling leading to a prolonged season making the alp more meaningful for Älplers [E7]. Esp. considering a development towards drier summers the alpine region is getting potentially more meaningful with generally higher precipitation rates compared to the flat areas [E7]. Water scarcity due to dry spills, as happened in 2013 and 2018, when water had to be flown to alps the first time in history in Canton Fribourg, was identified as one factor leading to pasture abandonment [E3] with the equilibrium which was reportedly in place in the past between natural resources and animals pastured is disrupted through extreme climatic events like droughts and heat waves. Strategies to handle CC impacts in the alps were described as mostly adapting to the conditions sensibly, which was described as successful

<sup>54</sup> Geröllgeschiebe – all coarse sedimentary components worked and moved by the ice (glacier or ice sheet), which underwent a characteristic surface treatment during ice transport. Fluvial characteristics of this sediment allows for water flow.

so far as long as climate extremes are not occurring too regularly to exceed adaptation capacities currently present [E3].

In this context knowledge was described as being a major influencing factor in CC adaptation strategies of Älplers [E2]: “He produces organically and he said: For all those who were working organically, this year was not so bad. They were very attentive and they always made everything just in time. And the people who have big troubles this year are the people who used the chemicals as prescribed.” The danger of using CC impacts as an excuse for inactivity by Älplers was stressed by one scientist [E5].

#### *Changes of the socio-political context as reported by Externals (see also Figure 17)*

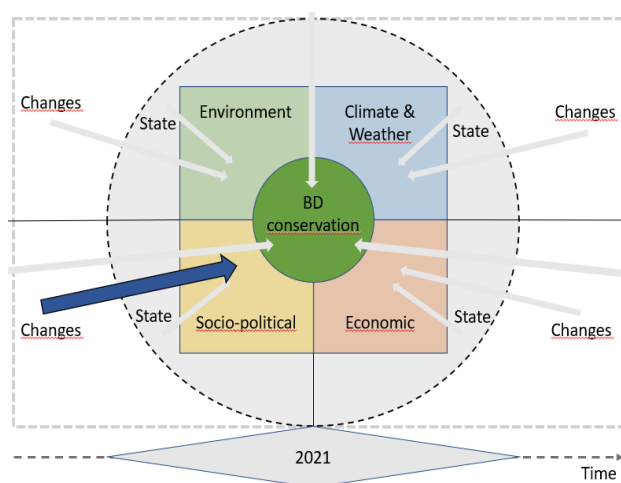


Figure 17: Cut-out visualisation: Changes of the socio-political context as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

A main trend identified for rural areas in Switzerland is centralisation of institutions and a rural exodus following from that [E7] albeit different Cantons were reported to follow that development to a varying degree [E1, E2, E3, E5, E8].

Alps being managed or abandoned was described more as a socio-cultural issue than a socio-economic one as only a small percentage of the Swiss population work in the mountains as Älplers and thus making the conservation of PAFP more of a social question relating to Swiss cultural patrimony than one that is driven by necessities [E3], as such the re-introduction of the wolf was also considered a socio-political decision also assessing that the society has a

bigger influence on PAFP future development than the Älplers themselves. Traditional PAFP that are currently increasingly being abandoned were described being sometimes important for landscape management, as an example the practice of “Wildheu”<sup>55</sup> which is abandoned due to economic feasibility issues and the danger of the work involved [E5]. Wildheu is not practised in Canton Fribourg and where it is practised cantonal authorities are contracting Älplers and volunteers. Rotational pastures and permanent pastures got promoted for better resource use and conservation of biodiversity replacing traditional herding practices [E3].

The dependency on environmental conditions was reported to be currently decreasing with mechanisation [E5], stating difficulties of mechanised farming practices with weather extremes. A trend for the reduction of agrichemicals was mentioned albeit relativizing this development partly by stating that the use in the past was “insensibly high” [E2]. In a socio-political context, meliorations were regarded as partly necessary but should be “self-restricted” as the excessive use of those with improved infrastructure has adverse effects on BD in the alps [E7], while another External [E3] pointed out explicitly that he regards ongoing meliorations (with road constructions) as a necessity for the future viability of PAFP.

<sup>55</sup> Wildheu – traditional practice of manually cutting hay on very steep slopes, which are difficult or impossible to reach with animals for fodder production also reducing the risk of avalanches during winter; predominantly still practised in Cantons Uri and Canton Nidwalden.



Raising awareness for conservation topics was described as an important factor for steering changes in farming and PAFP in particular [E1, E2, E3, E4, E5, E7, E8, E9]. Past communication efforts by administration and scientific consulting were considered to be partly successful mentioning the example of shrub-encroachment which is considered a well-known issue amongst Älplers [E1, E3, E4, E5, E7, E8, E9]. Neobiota<sup>56</sup>, neophytes, non-resident species and invasive species are currently getting more focus in Älpler training through schools and extension services compared to the past, although it was reported that there still is a lack of training about BD in general with farmers [E2], notwithstanding the already mentioned trend of sensitising Älplers for BD conservation [E7]. One External scientist was particularly critical about scientific communication in Switzerland being sluggish and effectively hindering the implementation of scientific knowledge [E4]. For future cooperation between Älplers and science the definition of a common goal was assessed as a necessity to avoid alienating Älplers [E3]. Intrinsic motivation and sense seeking was reported as important for pro-active engagement of Älplers in conservation practices [E5, E8]. If trust can be generated in Älplers several Externals [E3, E7, E8] described them generally as being open to new ideas and projects.

Agricultural policy was mentioned by one External [E5] as one of the most important factors for changes together with CC impacts and new employment opportunities in the mountains. Political authorities funding schools and agricultural institutions reportedly have power over setting the agenda for the curriculum and what content of information is included in guidelines [E2]. One reason for the successful acceptance of the direct payments coupled to BD levels given by two Externals [E1, E3] was that Älplers didn't have to change their management or adapt it just slightly [E1]: "They were very well received, many participated in that, over 80% I think and when there is money coming in, without changing anything, then it's possible." One scientist [E4] mentioned though that the thresholds for result-based payments for BD-rich areas might get stricter as he judged the current thresholds for qualification for payments as not sufficient. The perceived success of the BFF2 areas led to the current testing of more result-oriented schemes by the BAFU and BLW [E7]. Though many scientists mentioned that with result-oriented payments, citizen science and participation in general was that it needs to be monitored and verified, which was described as a very resource-intensive (human and financial) activity [E4, E5, E7, E9]. Esp. the negotiated alp-control measures were pointed out as being of significance for steering developments [E7]: "With the alp-control measures are negotiated with the farmers, they are mandatory, and if he doesn't comply with it, there is a check in the next 3 to 4 years, the contributions are being cut. This is the lever administration has got: cutting contributions."

A current trend of improving directionality of direct payments for PAFP was seen by one Externals as positive but still not enough to effectively conserve BD through alpine agriculture [E4]. One scientist [E5] reported a shift of agricultural direct payments by a big margin towards PAFP to an excessive extent: "There relatively a lot is going up. In the last agricultural reforms, if someone was winning, then always the mountain- and the Sömmerung-farms." [E5] Misalignment of state investments into the infrastructure in the alpine area are stemming from a connection of financial contributions which are connected to the building costs, making higher cost productions more sensible as more money from the state can be attained [E5]. Due to the strong lever of direct payments to Älplers present this policy mechanism was seen as a valid and effective tool to promote and push agendas [E3], as such the currently set into stone Normalbesatz on the alps are blocking intensification [E3].

An External [E6] mentioned that the most sustainable solution is the complete abandonment of alpine agriculture, albeit depending on the definition of the word sustainable: "Of course this is a double

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<sup>56</sup> German classification which seems to be not existent in English language, meaning all non-endemic species' which got introduced with anthropogenic influences. Neophytes – plant species falling into the Neobiota category.

edged sword, if we want to have agricultural production, when we look at milk production, at meat production, at animal products in that way, if we consume it in that way, the alpine management must be one of the most sustainable versions. But of course it would be more sustainable to say we abandon that – comprehensively. [...] But of course things are happening, which are very important for the ecosystem in the landscape. That you would have to replace, if you say, we abolish every kind of production with animals. I think this is that two-edged character, when you talk about sustainability.” Changes in societies perception of PAFP was reported currently moving to a more negative assessment of alpine agriculture [E2]: “But now it is common knowledge that biodiversity is being destroyed even on the alps.” The allegory of the double edged sword was used by a scientist to describe the changes induced by melioration measures serving a compromise [E7]: “Well this helps on the one hand saving the management, on the other hand you also get changes, [...] this management stemming from need, this is vanishing and you lose BD and certain infrastructure saves the management and I believe there would be an outcry if you would give the people some outhouses for example, or if there would be the street infrastructure from long ago.”

In the past alp management was described as family business while today the alp is run by one generation alone resulting in a higher workload for the individual Älpler [E7]. This higher workload is reportedly [E5] leading to Älplers socialising less amongst colleagues, whilst it was described that the stereotype of the solitary Älpler is changing towards Älplers accepting the necessity for assistance and listen to others needs as was identified by one External [E7], pointing into a positive development for communication about BD conservation in the Alps.

The development in society perceiving agriculture differently was assessed as “partly good and partly bad” [E7], with the good part being described as society is more aware of environment protection and the bad part was described as a greater divide between urban and rural population with a trend for increasingly conflictive argumentation for financial contributions to agriculture, as the biggest part of society in Switzerland reportedly loses its understanding for farming and rural contexts [E7]: “But it is increasingly a balancing act, as more people in the cities are foreign to agriculture and want wilderness, if they realise the coherences, that might be doubted [...]”. Another External described the development as an increase of the need for economic justification [E6]: “I believe the need for explanation will rise. I believe there will be a time, when society, the democracy will ask: What exactly are you doing up there? What does it cost? And do we still want that? [...] A question of profitability, of synergies, of process optimisation, so all these great McKenzie-terms will in my opinion not stop in front of the Alps.” One External noted an increasing pressure from society for spotless produce and landscapes, while management measures to accommodate the market were described as misaligned [E2]. In the context of conservation measures financed by the Swiss government this trend was seen critically as the financial situation for environmental protection was described as being “luxurious” [E4] in the last 30 years but the trend assessed for the future goes towards higher necessities to explaining tax funded schemes to the urban population. A certain lack of financing BD monitoring was reported and it was stated that the current quality is only as good because it was introduced over 20 years ago. Today an introduction of a similar scheme was assessed as impossible [E4].

One External stated that weed control is intensified due to stricter alp-control measures leading to issues with increased herbicide use [E7]. Future regulations regarding herbicide use in the alpine area will most probably be subjected to heavier restrictions [E7] due to rising environmental pressure from society and politics with media paying attention to the topic to reduce agrichemicals in general and for the creation of alternative structures. This was put into context reporting that recent policy changes prohibiting mineral fertiliser use and limiting use of concentrate feed in the Sömmerungsgebiet were described as feared by Älplers but ultimately the resulting management adaptations arising from that were not as severe as expected [E7]. In summary those restrictions passed were universally seen as

very positive for the environment in the Alps and got assessed as very well-designed policies by not putting not too much strain on Älplers. Those recent changes in legislation were seen universally as a positive development by all Externals with the current trend, which reportedly started in 2011 with the new agricultural policy focusing heavier on conservation topics, was believed to continue by all Externals.

Externals reported that socio-economic changes in alpine agriculture in the past developing more towards bigger professionalised alps was pushed by politics, also the trend towards more short-term contracted alps was criticised by some Externals [E5, E7] as it hinders the generation of experience-based knowledge, that is considered very important in the context of sustainable PAFP. Älplers experience knowledge got assessed being foremostly passed on through the family to the next generations [E5], while it was described that this is a predominantly oral process and the importance of this way of knowledge dissemination was stressed as it includes senses (olfactorial etc.) and lay knowledge [E6]: “I believe it’s rather the traditional farmers’ shrewdness that is being passed along.” Knowledge about the alpine environment was described as lacking compared to the past [E4]: “I think generally we lost much knowledge, because we don’t need this knowledge any more.” Mechanisation was described as the main driver for this loss [E4]: “The farmers they don’t need this knowledge anymore, it’s a little bit like the tech made all those knowledge obsolete.” The psychology of passing an alp on to your children was mentioned as setting different management practices, resulting that ownership and management contracts play a significant role in the type of alp management and knowledge generation [E5]. The current practice of commuting to the alp was seen by multiple Externals as a factor reducing Älplers’ knowledge [E2, E4, E5, E7], while tourism with people visiting huts was reported to have a positive influence on Älplers’ LEK as exchange between different societal spheres is facilitated [E7].

Two Externals [E2, E3] stated that despite the currently ongoing trend of intensification and use of heavier machinery on the alps most Älplers are generally resistant to using machinery and only do so out of economic necessities: “As much as possible is then done mechanically, it’s not because they enjoy the machines, but often the problem lies with the Tagwerk<sup>57</sup>”. Following from that it was assessed that implementation of innovations (also with following homogenisation) and improving efficiency were described as coming exogenously and not intrinsically [E2, E6].

Abandonment of alp pastures was also reportedly driven by the generational change [E3]. One External stated that Älplers children are not interested in PAFP anymore presumably due to kids not actually living on the alp nowadays [E7]. Another External viewed the future generation as a chance for a positive development as the young farmers and Älplers have reportedly more affinity towards digitalisation and as such are more open for future (less intrusive) technological implementations [E7].

The concentration of BD conservation efforts on the alpine area was seen by one External [E4] resulting from the economic pressure being exerted on the less developed alpine areas: “In the mountains, you could destroy very much and there are many interests, not to kill the BD, but to create ski slopes and so on. I think at the moment, that’s where we have the big challenge for the future.”

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<sup>57</sup> Tagwerk – The amount of labour a person can do in one day

*Changes of the economic influences as reported by Externals (see also Figure 18)*

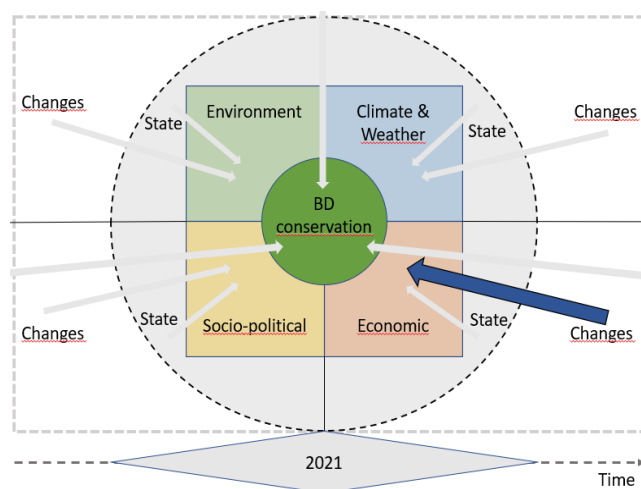


Figure 18: Cut-out visualisation: Changes of the economic influences as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

Current developments are stemming from the change of PAFP in the past being a necessity, to a choice of landscape management as it is regarded by multiple Externals today because feed from alpine pastures could theoretically be replaced with concentrated fodder through imports from other countries [E5, E7]. All Externals agreed that the economic trend for rationalisation and efficiency-increase is also present for PAFP albeit at a slower pace compared to lowland agriculture; e.g. intensification with connected BD loss was described by one External happening usually in flatter, “easier” areas where it becomes an economic feasible option [E5]. One External stated that most thorough changes for PAFP happened in the

last 10 to 15 years from 2006 on [E7]. Market mechanisms were described as crucial for future developments of PAFP with multiple Externals stressing the low income of Älplers [E1, E3, E4, E5, E6, E7, E8, E9]: “If the work is keeping to be undervalued ..., if it’s not being valued anymore and not seen as a necessity, then it’s going to be difficult and they (the Älplers) are going to give that up.” [E3] As such economic pressure on PAFP was identified one of the main current and future factors for pasture abandonment esp. in areas with difficult terrain and pasturing of animals that create not much revenue like sheep and goats [E1, E3, E4, E5, E7, E8, E9]. Several Externals also described economic pressure as a main driver for environmental “insensible” behaviour from Älplers and farmers in general [E5, E7]. An adoption of agricultural techniques common in the lowlands was reported to be introduced in alpine farming, partly leading to higher workloads for Älplers with the use of highly efficient farming methods such as Eingrasen<sup>58</sup>[E7].

Alp size was identified as a major factor in economic feasibility, esp. in the context of having employees. The size of a farm in the valley, if an Älpler manages both, can have an influence on PAFP as a bigger valley farms mean usually more work, leading possibly to a neglect of alp management as it is the lesser profitable operation resulting in shrub-encroachment and BD loss [E5]. One External pointed out the current necessity of external voluntary work on alps, which is seen as a new development in comparison to the family labour usually supplied [E2]. A segregation of areas was reported according to “good areas” where intensive farming is possible which are partly managed like common agricultural fields and a neglect of “bad areas” through the reduced foraging by the animals on the pasture [E5]. Some alps being currently underdeveloped in terms of herd size and thus productivity was mentioned by multiple Externals [E3, E5, E6], resulting in a development-potential for intensity instead of expanding on a spatial level [E3, E6]. Also the potential economic gains of longer seasons due to global warming could be used by Älplers to increase revenue from PAFP [E7].

Faster changes in the alpine region are driven by tourism according to multiple Externals, while change induced through PAFP is happening at a slower pace [E4, E5, E7]. The development of soft tourism was regarded as a major boon to a sustainable development of PAFP as it releases some of the economic pressure for intensification or expansion [E1, E5, E7]. The Covid pandemic accelerated extending

<sup>58</sup> Eingrasen – Freshly cut grass is fed to the animals in the stable, very labour intensive

touristic activity in the Alps and Älplers were reported to follow that trend opening more gastronomic operations (Buvette/Besenbeiz) on alps [E7].

The traditional practice of distributing manure on the pastures for fertilisation got mostly abandoned due to spraying slurry resulting from stable management where urine and manure is not separated anymore [E1, E3, E5, E7]. Slurry management was reported to be a controversial topic currently amongst Älplers as the system is currently at the tipping point of changing back to using manure [E2]. The tradition of drudgery for alp owners was basically forgotten leading to the potential of wrong investments or to the supply of insufficient funds regarding the alp [E2, E5]. A trend of taking more diverse farm animals to the alp presents a chance for income diversification and contributing to BD in the alpine region [E7]. Potential innovative technologies like the use of remote sensing cameras, GPS neck straps and drones are currently not getting implemented in PAFP as there is considerable resistance from Älplers and not enough incentives and training opportunities by the state [E2].

Green energy development was identified as one driver for BD loss, as alpine areas have a big potential for energy production through hydroelectric dams and wind turbines and the accommodation of both interests, economic and environmental, were assessed as difficult or even impossible to consolidate [E7].

Future problems with potential total abandonment of PAFP are not seen by any Externals: “I believe the craft there will pretty much stay. For that (to happen) we do that thing (PAFP) for a too long time. For this, for certain processes I believe that certain hermeneutics already slipped in too far, or are too well established that this could change in a short amount of time.”[E6]

*Äplers' opinion, attitude, ideas and proposals for biodiversity conservation for pastoral alpine farming practices*

“First they (the scientists) come to the successful farmer and they collect the data, pay attention, convert that somehow and are creating regulations for everyone. Then they come again with a check list if you are doing it in that way. So all their ideas they get from that experience knowledge from the farmer and later they are coming back and do the regulations.” [Ä3]

Information was taken from the code categories “BD conservation”, “Personality” and “Knowledge in context of BD” and put into three categories: Socio-political, Economic and Management related (bio-physical)

All farmers considered BD conservation equal with the continuation of their management practices of pastoral farming activities. Conservation measures were mostly focused on conservation of structural diversity in the alps. Generally, all farmers had the opinion that the highest amount of structural diversity together with diverse management practices adapted to the local conditions are the main beneficial points for BD conservation in the alps.

First things associated with BD:

- “The many flowers, many types of grass as well, [...] The plant community makes the milk and that is species diversity.” [Ä1]
- “Of course to rescue certain species threatened by extinction. But of course also, I don't have to say that, the corresponding habitat.” [Ä2]
- “I don't know, much of everything.” [Ä3]
- “Certainly, the financial contributions!” [Ä4]
- “Protection..., like I am doing that. This is always very difficult.” [Ä5]
- “Not so much slurry must be put out.” [Ä6]

Älplers' opinion, attitude, ideas and proposals for biodiversity conservation in the socio-political context (see also Figure 19)

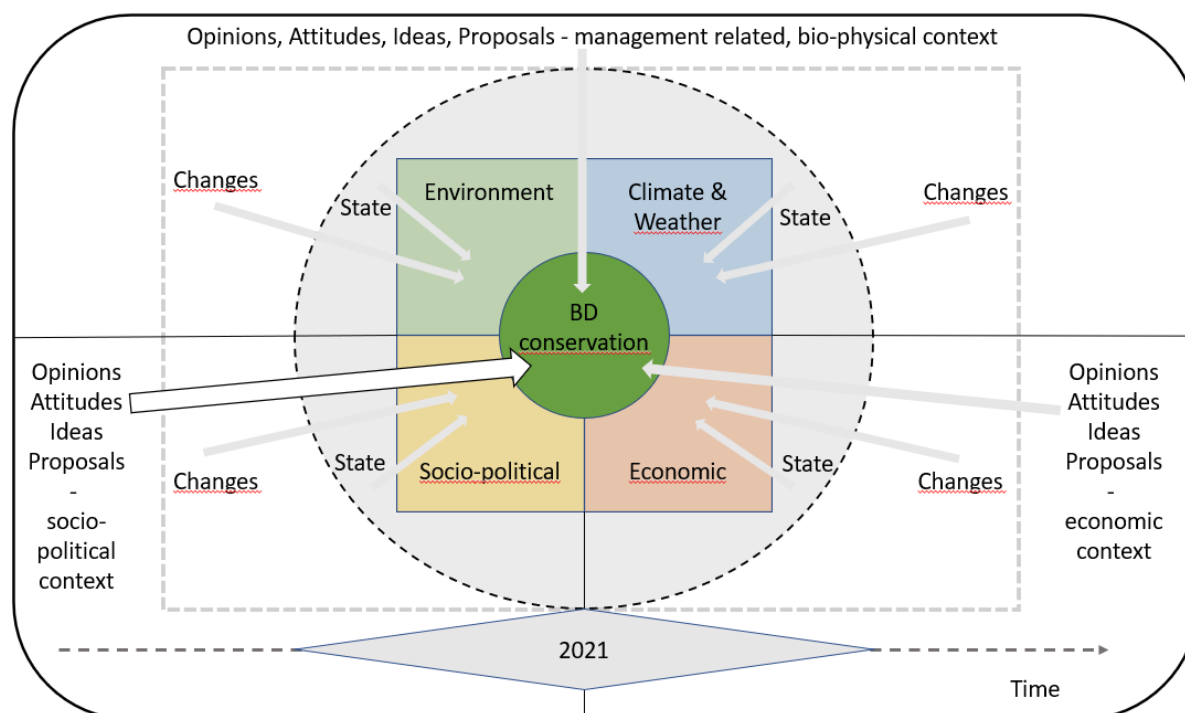


Figure 19: Visualisation: Opinions, Attitudes, Ideas, Proposals on BD conservation in the socio-political context as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

BD conservation in the Alps was described by most farmers as not the most pressing issue compared to the lowlands in Switzerland and generally in a global perspective, nevertheless in the more narrowed spatial context of Switzerland and the European Alps it was perceived as very important [Ä2, Ä3, Ä5, Ä6].

All Älplers stated that connectedness to nature is essential to their work and was assessed of high importance. Most expressed explicitly the joy of living in a beautiful and diverse environment during the interviews [Ä1, Ä2, Ä3, Ä5, Ä6]. One Älpler stressed the joy of nature as a point that should get more attention as the awareness of a persons' pleasure is leading to a more respectful relationship to the environment [Ä3]: "And when, you can ask yourself that: do I enjoy that diversity and if you have that, it would be great doing something for it, that you feel joy. And if through that the whole earth gets rescued, it would of course be a nice side-effect." All Älplers described BD conservation and environmental protection in general of high importance for them: "How important is environmental protection for yourself? - That is the future for sustaining alpine farming. Also for the population." [Ä1] Only two Älplers [Ä2, Ä5] described the re-introduction of the wolf as beneficial to BD in Switzerland, while all others were more critical of wolves being present in their areas [Ä1]: "I was lucky that never anything happened until now, but you have to keep an eye on that, that the wolf is not reproducing otherwise alpine farming is endangered."

A purposeful use of resources in general was mentioned by multiple Älplers [Ä1, Ä2, Ä5] which was usually used in the context of energy consumption, often stating a resourceful lifestyle with humble expectations like not wanting to fly long distance for destinations as a holiday or in general travelling excessively in contrast to a stated wastefulness of resources in society described as an addiction by one interviewee [Ä2]. The conservation of soft tourism and at the same time prohibiting intensive tourism like holiday home settlements and other bigger infrastructure projects catering to tourism to

protect the environment was mentioned by multiple Älplers as a crucial factor for conservation of alps and thus BD conservation [Ä1, Ä2, Ä4, Ä5].

Agricultural and environmental politics were assessed by many Älplers as an important factor for BD conservation through PAFP [Ä1, Ä4, Ä5, Ä6]: „Also from the viewpoint of agricultural politics, we have sympathies. It is also important, otherwise nobody will do it anymore.“[Ä1]; and the change from production-orientation to more focus on conservation topics was regarded as a generally beneficial trend [Ä6]: “Yea after the old idea of the agricultural politics, where you had to nourish the population and now the politics, well maybe that will change again, I don’t know, but it’s much more on BD and so on. I think maybe a little bit of both is necessary.” The introduction of Sömmerungszahlen and the prohibition of mineral fertiliser in the Sömmerungsgebiet was assessed by all Älplers as a step in the right direction. Long-term planning from politics was mentioned as an essential factor, as effects on BD conservation through PAFP can take a long time to show effectiveness [Ä3]. The currently stated lack of trust in politics should be tried to be restored and more specifically politicians and scientists should take more responsibility for their recommendations and show more humility in respect of past decisions (mistakes) with regulations and publications. In general, more self-reflexivity with decisions should be shown to Farmers and Älplers who have to comply with the decisions made by politicians [Ä3]: “The government, the agricultural offices, they are never responsible and that is a huge issue. The best example is BSE<sup>59</sup>,[...] I mean a farmer would never have gotten the idea to feed his cow meat, but the scientists found out that if I give so and so much protein to the front, then I get more at the back, so I am feeding things where protein is included and take some fish flour. So a farmer would never have thought of feeding a fish to a cow and then you have a scandal, but no one is responsible from them.” Political support was described as one-sided and unbalanced towards agri-businesses by several Älplers [Ä1, Ä2, Ä6]. “[...] not always bigger, bigger, bigger, what was happening in the past.”[Ä1] In the context of environmental conservation the wish towards politics to end support for the creation of big alpine farming operations was expressed by all Älplers interviewed: “The landscape is being cleaned out when the same farmer has bigger areas, connected bigger areas, when he owns them, or when he can lease them.”[Ä3] In this context a focus on small-scale farming in general as family farms was requested [Ä1, Ä4, Ä6].

The continued flow of finances from the society towards PAFP was described as essential for future alpine agriculture and thus BD conservation by all farmers. “Many small farmers stop, because it is not profitable anymore. We are lucky here with the dairy milk, that we have Gruyère AOP (see also *Introduction, Socio-cultural contexts for pastoral alpine farming practices*) and get a good price for the milk, but yea well, the milk price is... or better said, the costs that you have with this size like ours and selling the milk, that is balanced. The revenues are the direct payments.”[Ä6] The coupling of the direct payments to BD conservation was described favourably by most farmers [Ä1, Ä4, Ä5, Ä6]. Some noted though that the payments are sometimes misaligned or entirely useless [Ä2, Ä3]: “When those biodiversity contributions were coming, there I also thought now they have gone crazy! I mean they have been managed for hundreds of years and the biodiversity is there and it will probably be similar in a hundred years, I would say, through the contributions that is not being changed greatly. [...] There are people, for example the Bündner<sup>60</sup> farmers president was saying: ‘Finally we get paid for something, that we always have done’.”[Ä3] Thus redirecting the direct payments more towards effective BD conservation was an idea proposed by several Älplers [Ä2, Ä3 Ä5], while almost everyone was generally open towards more direct payments [Ä1, Ä2, Ä4, Ä5, Ä6]. It was reported that through the coupling the awareness for BD issues was raised greatly in the alpine farming community [Ä4]: “What we already talked about the consultations, with clarification for the people. Before these

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<sup>59</sup> BSE – mad cows disease

<sup>60</sup> “Bündner“ – adjective used for the people of Canton Graubünden



biodiversity contributions were introduced, well the species diversity was present and you didn't occupy yourself with it. That is only since that." Flexibility of the Sömmerungsbeitrag should be raised as current rules are too stringent to adapt PAFP enough to accommodate the weather in some years and the expected increase in weather extremes through CC impacts [Ä6]. A reduction of bureaucratic effort was proposed by one Äpler regarding BD conservation practices and corresponding direct payments [Ä3].

Meliorations were seen partly critical and for BD conservation redirecting those was seen as a necessity: "The municipality where I have my Alp, they don't have those meliorations and that is extreme how many hedges and, how do you say it, obstacles basically, stone piles, little walls are around there. And if I think of [...] where I was in the past, there were meliorations and this is pretty much cleaned out, everywhere streets, cleaned out landscape. So for biodiversity this is certainly very bad." [Ä3] The current measures against the spread of invasive plants were described as sufficient and successful by the two Äplers who had some issues with them [Ä1, Ä4].

Education and extended training for environmental and BD conservation topics for Äplers were proposed by all farmers, esp. the farmer schools were characterised having a high responsibility as it is a mandatory school for most Äplers [Ä1, Ä4, Ä5, Ä6], but also extension services and nature parks should practise more information dissemination about conservation topics [Ä4, Ä5]. The annual meetings currently organised by the extension services and the nature park were described as a good measure to raise awareness [Ä1, Ä4, Ä5, Ä6], even though consultation events about BD were described as not too popular with farmers, apart from the topic wolf leading to them dependent on the topic not having high participation rates. Generally perceived personal (economic) benefit was described as the main factor for participation in voluntary extension. E.g. alp-excursions conducted every year and organised by Agridea were described as being not well visited by Äplers. Currently the Naturpark Gantrisch is having a competition for the most BD pastures, which was assessed as a viable method to incentivise sustainable PAFP by one Äpler (who won the competition) [Ä5]. One idea mentioned [Ä2] that would extend that scheme was a prize for sustainable farming by the Swiss state. Scientific publications were described of limited usability for implementing conservation practices because of over-saturated contents and generally being too complicated to understand [Ä2, Ä3], while communication efforts to simplify information on BD or environmental conservation in general were described by several Äplers as lacking [Ä2, Ä3, Ä4, Ä5].

Äplers mentioned some conflicts with society regarding conservation measures, where it was seen necessary to not only educate Äplers but members of society in general to promote BD conservation practices [Ä2, Ä4, Ä6]: "That dry pile there, you could leave it like that, so that someone said Niederwild<sup>61</sup> can hide in there, like a hedgehog or so, hide underneath there and Switzerland is extremely tidy. That doesn't come easy for the people." [Ä2] Mentality of Äplers and people in general was assessed as very heterogeneous dependent on the Canton in Switzerland. That mentality can be a hindering factor implementing BD conservation measures, esp. if legislation and regulations come from the federal government [Ä3]. "[...] but the farmers, they have a mentality or something and this is sometimes pointing the other way. Especially here in this area people are skeptical about scientists or the state or so and yes, as a farmer - you get a certain defensive position as a farmer. I experience that very differently in Canton Graubünden, there they are more loyal to the government. If they are saying something, then they are cooperating and here in central Switzerland people are skeptical. If someone says something, then you most certainly do not do that. So you yourself (the Äpler) know better. That has to do with mentality and this is hindering certain new things, or progressive things, so mostly those are like new things, that they now should also look out for BD, that is standing in

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<sup>61</sup> small game, small wild mammals

opposition.“; with this argument leading to the recommendation of communal or cantonal action, rather than a centralised approach [Ä3]. Bottom-up approaches were seen as viable as Äplers were described to be creative with the introduction of adapted PAFP through economic pressure [Ä3]. Many farmers complained about the unwillingness in the society to pay higher prices for foodstuffs [Ä1, Ä2, Ä4, Ä6] and one Äpler [Ä2] complained about the unwillingness in politics and society to exert more pressure on big distributors. The two failed initiatives (see *Äplers’ perception of the state of the environment, climate, socio-political circumstances and economy*) should be repeated with more media presence given to the conservationist point of view [Ä5]. This critique of narratives was extended by another Äpler criticising the terminology of for landscape changes esp. critical: „that is such a perverted word: Flurbereinigung<sup>62</sup>, as if there was dirt there before, clean everything.“

*Äplers’ opinion, attitude, ideas and proposals for biodiversity conservation in the economic context (see also Figure 20)*

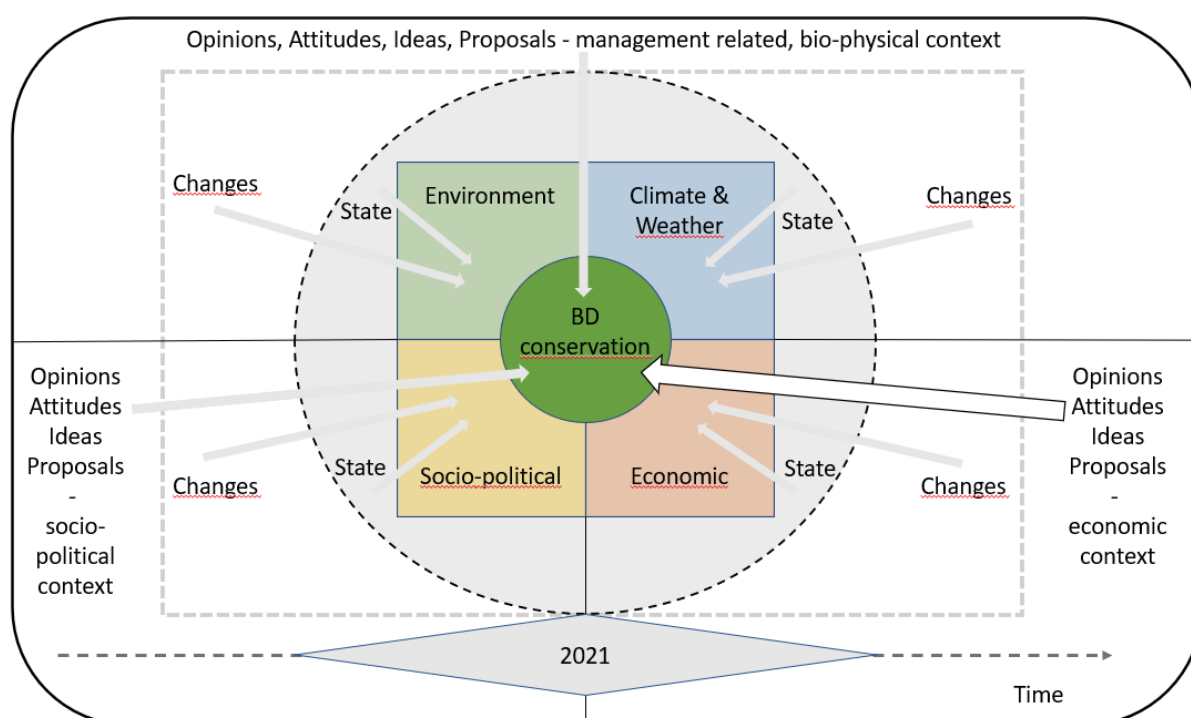


Figure 20: Visualisation: Opinions, Attitudes, Ideas, Proposals on BD conservation in the economically related context as reported by Äplers; Source: own elaboration (see also Figure 2, p.46)

Generally, BD issues with its bio-physical implications were rather seen by all Äplers as an economic question in terms of labour division and rentability problems. The re-introduction of the wolf was seen by Äplers more of a threat to rentability as the application of measures to protect herds from big predators were described as expensive and labour intensive [Ä1, Ä3, Ä4, Ä6]. The monetary value of BD was hinted by one Äpler [Ä2] and put into context of other values perceived in society: “What is all the BD good for if we don’t have time to use it? Over the internet we get information much faster. Nature is a little slower and a bit more boring.”

One Äpler [Ä2] mentioned that prices for carbon-based energy sources are too low and should be raised by a big margin to protect the climate and the environment. The dependence of the current economy on energy consumption was mentioned as a threat to adapt to CC impacts [Ä2]: “Of course,

<sup>62</sup> Flurbereinigung – land consolidation; directly translated – land cleansing

they are talking about climate change, but I believe formerly there were climate changes too. I believe the much bigger problem is, not just climate change, but that we cannot get off that kick, that we made ourselves so dependent on (carbon-based) energy.“ He also raised the issue of noise pollution connected to the use of carbon-based energy sources in the Alps: “But on every machine that is driven with energy (fossil that is) and is also making noise, I would introduce a noise tax, that it has some kind of counter, a noise counter and the noise producing, the CO<sup>2</sup> problem would be included in that.“

Alpine agricultural production was described as an important factor for BD conservation as the produce gets marketed as coming from the alp and can generate higher income labelled as such, compared to produce from the lowlands. The geographic protection of cheese making was seen in Canton Fribourg as a major economic boost for the local PAFP. As such the positive image of PAFP in Switzerland was described as essential for a continuation of alpine agriculture. Power imbalances being present in the market were described as leaning heavily towards big distributors dictating low prices for foodstuffs and esp. the milk price. If Älplers' and farmers' interests could be balanced leading to higher prices for raw produce, intensification of PAFP could be avoided [Ä1, Ä2, Ä4, Ä6]: “I am always saying the war today is being fought at the shop counter.“[Ä2] In this context consumer awareness was mentioned by one Älpler as a powerful lever to support sustainable PAFP with the current perceived wastefulness with foodstuffs in society being an example of lacking awareness for sustainability and values in food production.

Älplers currently low income rate was widely criticised [Ä1, Ä2, Ä4, Ä5, Ä6] in the context of BD conservation as the valuation of PAFP is hindering Älplers focusing more on conservation practices or practices considered beneficial for conservation: “[...] and I can understand the person who says: first I need to have some food before some butterfly gets some food, [...]” In that context conservation measures applied by Älplers were stated coming not from an intrinsic idealistic motivation but are solely out of monetary reasons to get the direct-payments connected to conservation measures [Ä4, Ä6]: “[...] I mean you get money for that. Much is done because you get money for that. On the other side (of the valley) we have some land in the Vernetzungsprojekte and we didn't mow right up to the hedge, because you have to leave some part standing to get the money. Otherwise I believe my father and my son would have mowed everything, so it looks clean and that there is no chance of shrub encroachment and through the incentive there, you do it like that.“[Ä6] Only one Älpler stated explicitly using PAFP that are economically not viable but better for conservation even though not getting paid for it [Ä2], albeit other Älplers mentioned that common PAFP can be considered as BD conservation measures due to their inherent extensivity [Ä1, Ä3, Ä4].

*Älplers opinion, attitude, ideas and proposals for biodiversity conservation for the management related, bio-physical context (see also Figure 21)*

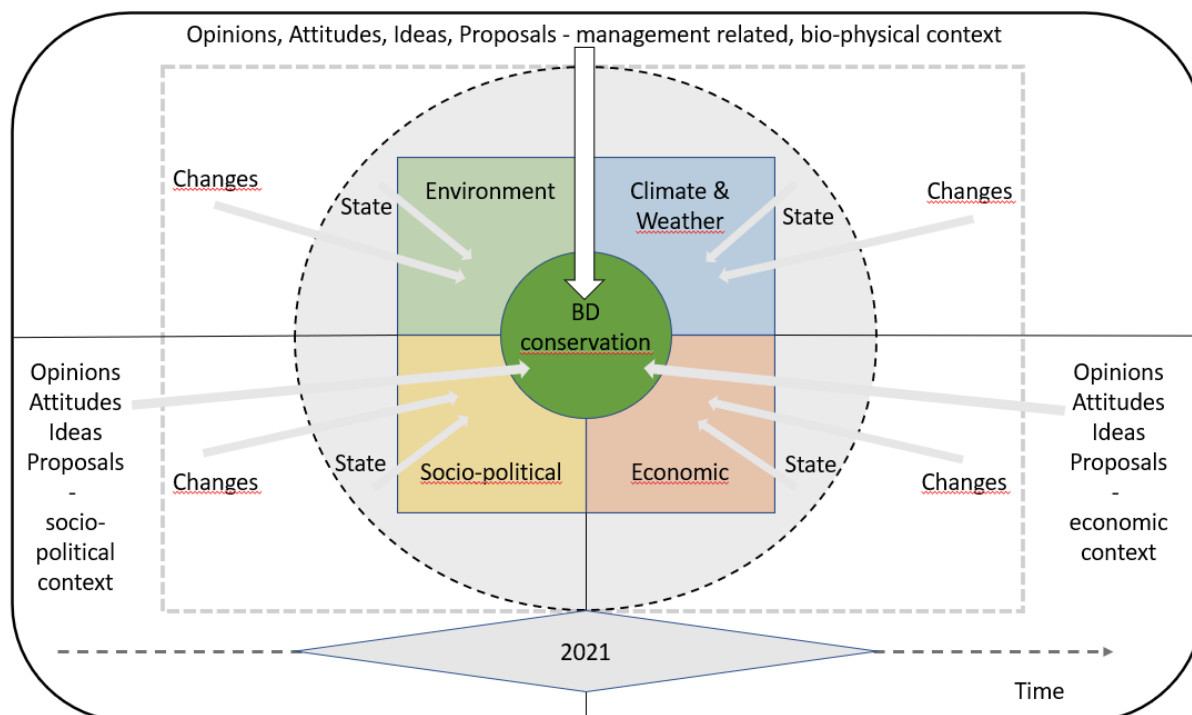


Figure 21: Visualisation: Opinions, Attitudes, Ideas, Proposals on BD conservation in the management related bio-physical context as reported by Älplers; Source: own elaboration (see also Figure 2, p.46)

A concrete measure all Älplers regarded as beneficial was a later mowing time, to give plants the chance to flower and spread their seeds, while the timing needed to be early enough so weeds cannot seed. For that a reduction of the Sömmerungszahlen was proposed [Ä3] to delay mowing times and no silage production and esp. no springtime-silage production for agriculture in general was mentioned as a beneficial adaptation of production practices leading to higher BD levels. Shrub encroachment and the spread of weeds and invasive plants throughout alpine pastures stemming from neglect of pasture management was seen universally as detrimental to BD conservation. Several Älplers proposed to improve fertiliser management regulations and even a complete prohibition of using slurry on alpine pastures, rather going back to using manure as was tradition [Ä2, Ä3, Ä4]. The conservation of small structures on pastures was regarded by all Älplers as beneficial for BD and further protection of those was demanded by the authorities not financing landscape homogenisation through meliorations. The use of herbicides in PAFP was opposed by three Älplers [Ä2, Ä3, Ä5], while the other three described it as a necessary evil [Ä1, Ä4, Ä6]. The three Älplers opposed to the use were also supporting a complete prohibition of herbicide-use in the Sömmerungsgebiet: “Well of course on the Alp, I have also sprayed herbicides already, [...]. Yea I did that too, but I really think it should be forbidden on the alps, because it is not necessary.” [Ä3] One Älpler thought it important to not eradicate all plants considered weeds as they give habitat for certain insect, bird and mammal species and weed control in general was described as a rather abstract topic [Ä3]: „But with the problematic plants I think, you can approach that philosophically, what is or should be done.“ The increased planting of fruit trees was proposed by one Älpler [Ä1] to accommodate bee populations in the alpine area.

One Älpler mentioned differences of PAFP dependent on altitude and that above the treeline practices have less influence on BD levels below, pointing to the direction that current legislation for the Sömmerungsgebiet is not differentiating enough between different heights [Ä3]. Too aggressive prohibitions and laws passed by the state should not be formulated as it was perceived being too

intrusive taking out traditional practices and homogenising PAFP [Ä1]: “When they come with prohibitions and we do it since generations exactly the same and suddenly someone from the office is coming and is saying: this is prohibited now. With that I have my issues.”

The term sustainability was understood differently by Älplers focusing on different aspects of PAFP which encompass sustainability. One Älpler described it being foremostly an independence of PAFP from most external inputs and a circular management of resources through higher input of manual labour, describing himself as a volunteer working for the benefit of society by the sustainable PAFP he is using [Ä2]: “[...] that I am putting more effort with manual labour here. Working at the right moment. I reach less profitability but instead at the end its not only profit I get out of, but that I can manage it in a sustainable way.“, while another stated that a locally optimised - “tailor-cut management” of alps as the most sustainable PAFP describing it as not necessarily extensive but rather the best compromise between production and conservation [Ä1]: “There must be a compensation between profitability, so that the farmer is not only a landscaper and that’s the difficult part to keep the balance. It should nevertheless be, it should stay a business - the farming, not just landscaping.“ One Älpler [Ä5] suggested optimising pasturing times for the animals dependent on development states of plants growing on the pastures, albeit another Älpler stated that getting the timing for pastures right was extremely difficult and rather a diverse pasturing should be practiced to minimise detrimental effects of potential “mistakes” made [Ä3].

It was generally stressed that high experience levels in a certain location are of greatest importance for sustainable PAFP and at the same time theoretical knowledge was described being of limited practical use [Ä1, Ä2, Ä3, Ä4]: „We are doing this since generations without sheets and books and the flowers are still sprouting.“[Ä1] Multiple Älplers proposed using a wider variety of farm animals and more locally adapted farm animal breeds, which should be in general of lighter weight, robust and with less exalted eating habits [Ä2, Ä3, Ä4, Ä5]. Esp. high-yielding dairy cow breeds, like Holsteins<sup>63</sup> were criticised as they were described as heavy, damaging the soil and making the use of concentrated fodder necessary, which would not or to a lesser extent be the case with lower yielding breeds [Ä2, Ä3, Ä5]. The use of multiple types of farm animals and breeds was stressed by two Älplers as important in reducing necessary weed control as different animals have different eating habits [Ä2, Ä5].

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<sup>63</sup> Holstein cows – high yielding dairy cow breed, originated in the flat parts of northern Germany

*Externals' opinion, attitude, ideas and proposals for biodiversity conservation for pastoral alpine farming practices*

“We are discussing in the house recently above all. Much helps much. We mean it in the sense that there is no benefit if all farmers would start to farm organically, but we have to have a lot of diverse farmers who are doing things in a diverse way, different crops, different sizes, different cutting dates. [...] Simply many, different technics, types of management, types of crop and this is very important for the state of biodiversity. So that there is no homogenous thing, so that there are more possibilities.”[E5]

Information was taken from the code categories “BD conservation”, “Personality” and “Knowledge in context of BD” and put into three categories: Socio-political, Economic and Management related (bio-physical)

*Externals opinions, attitudes, ideas and proposals for biodiversity conservation in the socio-political context (see also Figure 22)*

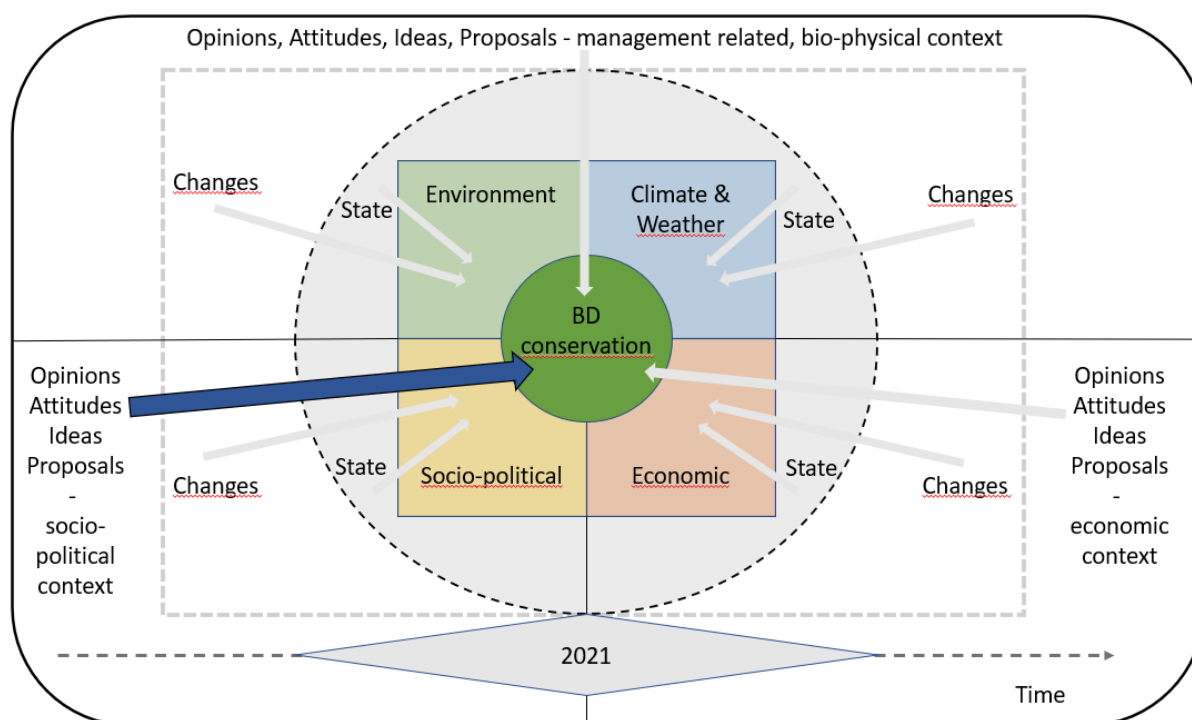


Figure 22: Visualisation: Opinions, Attitudes, Ideas, Proposals on BD conservation in the socio-political context as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

The main reason for the good state of BD in the Swiss Alps was identified by almost all Externals as the protective measures in place since a long time while a necessity to re-enforce BD conservation was seen by multiple Externals [E2, E4, E5, E7, E9] as the trend for BD levels in the alpine area was reported to be [E4] “a bit worse every year”. All externals stressed that state support is absolutely necessary for conservation of PAFP and accordingly BD [E4]: “The diversity is always vanishing. But this could change. We are lucky that we still have so much diversity there ... and Älplers.” One of the local Externals [E1] judged that the political tendency is going into the right direction with the introduction of whole year

projects (Vernetzungsbeiträge) that cover the whole district Sensebezirk<sup>64</sup>. Financial measures were universally and with great emphasis assessed as having the most leverage for conservation measures, as such to alter the direct payments and adapt directionality was regarded as the biggest potential to steer PAFP towards conservation goals [E2, E4]: “Yes, but in the end it is going through the wallet, except for some rare exceptions.” [E2] Current direct payments for conservation actions taken by Älplers were mostly described as effective and benefitting the Älplers economically leading also to the conservation of alps universally regarded as beneficial for BD [E1, E3, E5, E7, E8, E9]. The introduction of the BFF2 payments lead to more engagement of farmers with the topic BD and a sensitisation happening, due to financial incentives. The creation of small structures is incentivised by the state with Landschaftsqualitätsbeiträge<sup>65</sup>. One External [E3] thought the current political measures for conservation are fine as they are and no change is necessary to protect the environment in the alps, with the notion that for conservation purposes it would even be possible to intensify PAFP a little esp. with increasing the Sömmerungszahlen in some cases. Other Externals stated that the current Sömmerungszahlen are sufficient and well measured [E1, E5, E7, E8, E9] while some noted them being too high [E4] and still existing loopholes esp. with alpine pig farming [E2]. One External [E4] noted that financing for BD measures are currently well established and have been so for 20 years even though other state programs not aimed specifically at BD conservation were described as often insufficiently aligned with BD conservation goals. This misalignment of finances was seen as currently the main problem regarding BD conservation [E4] stating that policies in the context of BD conservation are not “100 % logic” and not oriented towards a common goal [E4]: “[...] if we really want to do something for BD, what’s important is all the rest. That means for example with financing, there are so many millions in misaligned incentives, so 40 times more misaligned incentives than for BD.” As such BD conservation was described as a holistic concept [E4] and a wholesome diversity was proclaimed by one External to be the right way for the future [E5].

Meliorations were considered by all Externals to be important for the continuation of PAFP and thus BD conservation in the context of societal changes albeit controversial to what is supported in infrastructure construction. Misuse of meliorations was mentioned by multiple Externals being an issue. Focusing meliorations more on water supply structures as it serves the farmer as well as the wild animals was proposed by several scientists [E5, E7]. Contracts with Älplers for biotopes of national importance were stressed by one External [E4] as one of the most important measures to conserve BD on alpine pastures. In general focusing conservation efforts on the alpine area was regarded as most sensible as the potential for destruction was assessed [E4] much higher compared to the central plateau and generally flat parts of Switzerland.

Education and training was believed by all Externals to have a crucial role for future BD conservation efforts in the Alps. According to one External [E2] the BLW, Agridea<sup>66</sup> and Agroscope<sup>67</sup> need to update their guidelines for weed management to only mechanical standards in the Sömmerungsgebiet. One External [E7] mentioned that chemical weed management in the alps will most probably be subjected to heavier restrictions in future and following from this predicted development Älplers’ training should focus on mechanical weed management as a preparatory measure. Alp and farmer associations were

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<sup>64</sup> Municipal district in the alpine area of Canton Fribourg

<sup>65</sup> Landschaftsqualitätsbeiträge – part of the direct payment scheme for agriculture in Switzerland. Introduced in 2014 for the Sömmerungsgebiet. Regionally managed through negotiated contracts with Älplers and farmers. Bottom-up as farmers can be involved in the creation of projects eligible for Landschaftsqualitätsbeiträge. Projects usually have a running time of several years. The scheme supports farmers in their work for the conservation, promotion and enhancement of cultural landscapes. See also *List of ‘indigenous’ words and bureaucratic terms*

<sup>66</sup> Agridea – publicly funded swiss agricultural extension centre for cantonal extension services

<sup>67</sup> Agroscope – publicly funded agricultural research institute in Switzerland, active on a federal level.

regarded as an important source for information concerning BD conservation as well, for example the SAV<sup>68</sup> was described as very dedicated also on the topic BD. A regulatory gap that alp owners don't need alp training to manage their alp needs to be closed and training needs to be improved with more focus on conservation topics to sensitise Älplers with the education being monitored to ensure better alp management [E2].

All Externals thought that the current push for landscape homogenisation needs to be addressed as the reason has been described as being exogenously rooted and not intrinsically. In the context of mechanisation, which was reportedly not popular with all Älplers, a return to non-engine powered traditional mechanical PAFP should be promoted to incentivise Älplers who want to do it as a lifestyle choice [E2], encompassing conserving LEK and local cultures as well as being beneficial for BD conservation, while in the other direction Älplers should get trained on modern information technology to enable them to use GPS and drones in the future to reduce Älplers' workload through non-intrusive practices in the context of BD conservation through PAFP. Many Externals mentioned that generally Älplers' and farmers' schools should focus more on conservation topics and esp. BD conservation [E2, E4, E5, E7] as this part of the curriculum was assessed currently still lacking.

Only one External focused on potential organic production in the alpine area in Switzerland comparing possibilities to the Austrian system[E2]. He noted that organic PAFP should get more promoted for a sustainable development in future than is currently the case, alongside that, BioSuisse<sup>69</sup> should prohibit the use of herbicides in the Sömmerungsgebiet completely to be eligible for the label [E2]. More specifically it was proposed that BioSuisse copies the requirements of the EU organic label resulting in easier trade relationships as well. It was noted that preferably a total prohibition of all pesticides and herbicides by the Swiss federal government would be passed [E2]. Furthermore, the BioSuisse label should allow farmers to create compartments in bigger stables with organic and non-organic standards to diversify their production while keeping risk management in a sensible scope [E2]. Positive experience with state monitoring for weed management from Canada was mentioned [E2] and could be implemented in Switzerland to have contracted companies that cut weeds before seeding if the Älplers or farmers are not doing it themselves. For weed control another External [E3] proposed to raise the Sömmerungszahlen on alps as he identified the reason for weed encroachment being not enough pressure from animals on the pastures. Non-compliance to the rules was mentioned as a problem that has to be calculated in with laws and regulations [E5].

Society's opinion on rurality was reportedly trending towards a more environment conscious view thus pushing politics into more conservation measures, regarding the agricultural policies in general [E1, E7]. The beauty standards by society for alpine pastures were criticised by many Externals [E2, E4, E5, E7, E8, E9] as detrimental to BD conservation. The conflictive relationship between organic and non-organic farmers should get resolved, albeit it was stated as a difficult case [E2]. One solution proposed was to change the bad image of organic Älplers (and farmers) resulting from not having "clean" pastures in the Alps which needs to get consolidated through communicating increasingly about biased beauty standards reportedly the society and non-organic Älplers and farmers possess [E2]. To accomplish this goal, the narrative dominance of non-organic farmers in society and media according to the External should be broken by displaying the perceived inherent hypocrisy and opportunism [E2]: "It cannot be that the conventional farmers are ordering what is possible and are reasoning with tradition and when they cannot come further with traditions then they push forward the modern methods." Another topic raised by multiple Externals is that the image of BD conservation needs to be

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<sup>68</sup> SAV – Schweizer Alpwirtschaftlicher Verein – Swiss society for alpine farming, federally organised association for Älplers

<sup>69</sup> The main organic food label in Switzerland



better communicated to Älplers and to society in general. Specifically, the circumstance that the state of the environment is that good in the Alps because - and not despite PAFP [E1, E3, E4, E5, E7, E8, E9]. Älplers image of BD conservation topics need to be changed [E4, E5, E7, E8] so that they lose their negative attitude and fear of scientists working in the alps - a change of perspectives on BD conservation [E4]: “[...] so you are a farmer in Wallis and I tell you, that you’ve got 15 national priority species on your area and then you think: ‘pity!, I have to do something special, this is complicated and then I have a so and so much...’. The other direction would be that you are proud, that you take it as: ‘this is a beautiful meadow, I am so happy, it’s so beautiful because I have done something right for this meadow and that shows what a good Älpler I am’. Until now, I think, we are in the first situation, if the people... I realise that with the monitoring, the people are very afraid of the people who are monitoring, [...]”; and esp. the monitoring purposes were reported to be generally misunderstood [E4]: “[...] people don’t understand that well. They think, if you measure something here then you write a report: ‘Point 21: bad!’ We don’t do that. You have to explain it well.” The same scientist also mentioned that the dependency of PAFP on good BD levels and particularly high plant species diversity in the Alps need to be communicated as this point is reportedly widely underestimated [E4] as well as the scope of diversity present that needs to be communicated better to create awareness of less obvious species and their values. Other points stressed by several scientists [E3, E4, E5, E7, E9] about the bad image of BD conservation with Älplers is that the topic is mainly associated with the re-introduction of the wolf and the probability of new regulations that are action-oriented, limiting their freedom of choosing management practices for the alp [E5]: “You also take away the fun from the Älplers, or the instrument. It’s decreed and you aren’t allowed anything else.” Result-oriented payments for farmers were proposed to put more “fun” into farming.

With alp control the negotiated management contracts for landscaping measures were mentioned having a positive effect on BD conservation through PAFP. Extending the use of result-oriented payments for BD conservation with alpine farmers, to give them a more proactive role and more liberties with management was seen by many Externals as a potential future development with BD conservation schemes [E4, E5, E7, E9], albeit high costs of consulting for those type of payments were stressed and the difficulty of defining appropriate goals and proper delimitation of influencing factors was mentioned. As such result-oriented payments were described by one scientist as “a big step towards future” [E9]. The current programme that utilises result-oriented payments, the coupling of direct payments to BFF2 areas in the Sömmerungsgebiet, was assessed with great heterogeneity with most Externals judging these as purposeful [E1, E3, E5, E7, E9], even though some had reservations [E2, E4] regarding their effectivity. With the ALL-EMA monitoring program and corresponding action-oriented measures one scientist [E7] had a proposal to correct misalignment in BD-related direct payments where the wrong ineffective actions got applied to meadow and pasture management: “That means a farmer does something in particular with a plot, so that it is a medium-fat meadow or a rich-fat meadow and he gets money for it, because he does everything correctly, but then when the people from the monitoring are coming, it’s not a biodiverse-fat meadow, it’s a biodiverse-poor meadow, because the soil is so full with nitrogen, there is no possibility to have some lean-fat there, because it’s simply not possible, or it would take 150 years to get it lean. We saw that as a big problem, [...]. Nevertheless, there are many people who try that and they get a lot of money for that, but for the BD at the end it’s not very useful.” In principle the monitoring programmes in Switzerland have been described as very good and even favourably in comparison to the surrounding countries, but some Externals mentioned parts that could be extended. Several scientists [E2, E4, E5, E7, E9] proposed to extend insect monitoring as this was neglected in the past. There is no monitoring programme for stagnant waters in the Sömmerungsgebiet yet, esp. fireflies were reported [E4] to be interesting as they can be used as an indicator for BD levels unlike amphibians which were described as being of limited use for BD assessment. In general, it was noted that monitoring should be extended esp. to

wet areas in Switzerland as these are hotspots for BD. One scientist [E4] proposed a monitoring programme for moths, again being statistically interesting. To Allocate more money into result- and long-term success-monitoring rather than only conducting a project and assume its effectiveness was mentioned by multiple Externals [E4, E7]. Most Externals [E1, E3, E4, E5, E7, E9] stressed the continuation of current monitoring programs to be crucial for BD conservation [E5]: “So preferably here better quality and a little bit less small scale and instead a continuous and always consistent for good results.” Citizen science was only considered a way for monitoring BD if detailed protocols are created and it is supervised by scientists, generally it was seen as rather difficult as it does not create accurate data and more suitable for introduction of a topic or for the creation of big (but inaccurate) datasets [E4, E5, E7, E9], as such it was described as especially suited for non-scientific use and for collection of knowledge and innovations [E5]. Remote sensing should be developed to use on alpine pastures, which currently is in use with forestry already, with the possibility of using photographs across valleys giving potentially higher picture resolution with extended scientific usability [E5, E9]. To adapt monitoring to valley specific contexts, as Switzerland was described as very heterogeneous between those, was proposed by one scientist [E7].

The issue that Älplers and farmers were perceiving themselves as scapegoats was implicitly taken up by one scientist [E4] proposing to take on light pollution, that is a reportedly a pressing problem not researched enough in the context of BD conservation with the notion of shifting the focus to urban areas: “But for what reason: for the light pollution. We don’t have anything about it and we know it’s a big issue. And if I come back to your project. The problem we always have with agriculture is that the farmers always say: ‘It’s always agriculture’. And with light pollution, then we could include the settlement into the picture and for me strategically this is an interesting idea, because it’s not only agriculture, also residential area and development and we know that it has a very big influence.” One External emphasised that Älplers are afraid of the public opinions of their PAFP and media attention because of this issue [E2].

Most Externals assessed Älplers’ interest in BD and environment conservation in general as low and saw a necessity for improved communication by science to Älplers and society with the topic of BD in Switzerland. The communication between scientists and local farmers needs to be extended as the current state was considered by all Externals more or less insufficient. Communication efforts of projects involving Älplers are currently lacking specific goals that are explained to the participants, one scientist stressed that communication needs to improve by starting to formulate common goals for all participants in those projects [E4]. The most complicated part considered by multiple Externals [E2, E4, E5, E7, E8, E9] was to explain to farmers why it also makes economic sense to have less intensive production in the long run, esp. flowers and insects were pointed out as possessing a hard to communicate value. In the big picture it was considered universally by all Externals to communicate to society that PAFP and agriculture can be beneficial for environmental conservation and BD in particular, if and only if the right practices are used. As to what the right practices were defined was up to the individual External to determine and a very heterogeneous array of answers were given (see the results mentioned before). Most Externals stressed that an effective cooperation between farmers and scientists need to function on an equal level and not with a hierarchy implied. For better understanding the term sustainability needs to be defined or one definition should be chosen for concrete development goals [E7]. Top-down regulatory frameworks to implement measures were seen by all Externals as ineffective arguing for more bottom-up approaches, they stressed in that context that measures for conservation need to be applied to a local context by the local authorities and not the federal state. For good cooperation between science and Älplers it was considered that a personal contact with accompaniment of conservation projects is most important: “I think it would be more sensible to have people in a region, who do things very personally with accompaniment. Le conseil.”;

which is reportedly already the case with soil scientists in Switzerland [E4]. Showing farmers rare species in their area created a sense of pride and happiness that can be harnessed for more volunteer management engagement [E5]. The creation of trust through physical presence and reliability was another component stressed by multiple Externals [E2, E3, E4, E5] an example was given in the context of interactions between state actors and Älplers which were criticised as the stated intangibility of the state was described not being acceptable. Several Externals noted the excessive bureaucracy for Älplers regarding projects and direct payments, consequently a reduction of the bureaucratic effort for Älplers to participate in BD conservation projects would raise the acceptance of these.

The controversial topic wolf was reported needing to be discussed inclusively in future and political decisions have to be made to determine which direction development should take as the current state was deemed unsustainable, be it more BD conservation-centric with stricter protection or more centred on conservation of PAFP. A compromise was described as very difficult due to economic reasons resulting from a co-existence, albeit not impossible [E1, E3, E4, E5, E7, E8, E9]. The reappearance of the wolf in the Alps was seen by no External as undoubtedly positive for BD conservation as it was considered a big factor for changes in PAFP practices with can in the worst case leading to the abandonment of pastures.

The recording of LEK about BD was mostly considered interesting by Externals, even though multiple of them questioned the sensibility of doing that [E5, E9] doubting the usefulness of information obtained.

*Externals opinion, attitude, ideas and proposals for biodiversity conservation in the economic context (see also Figure 23)*

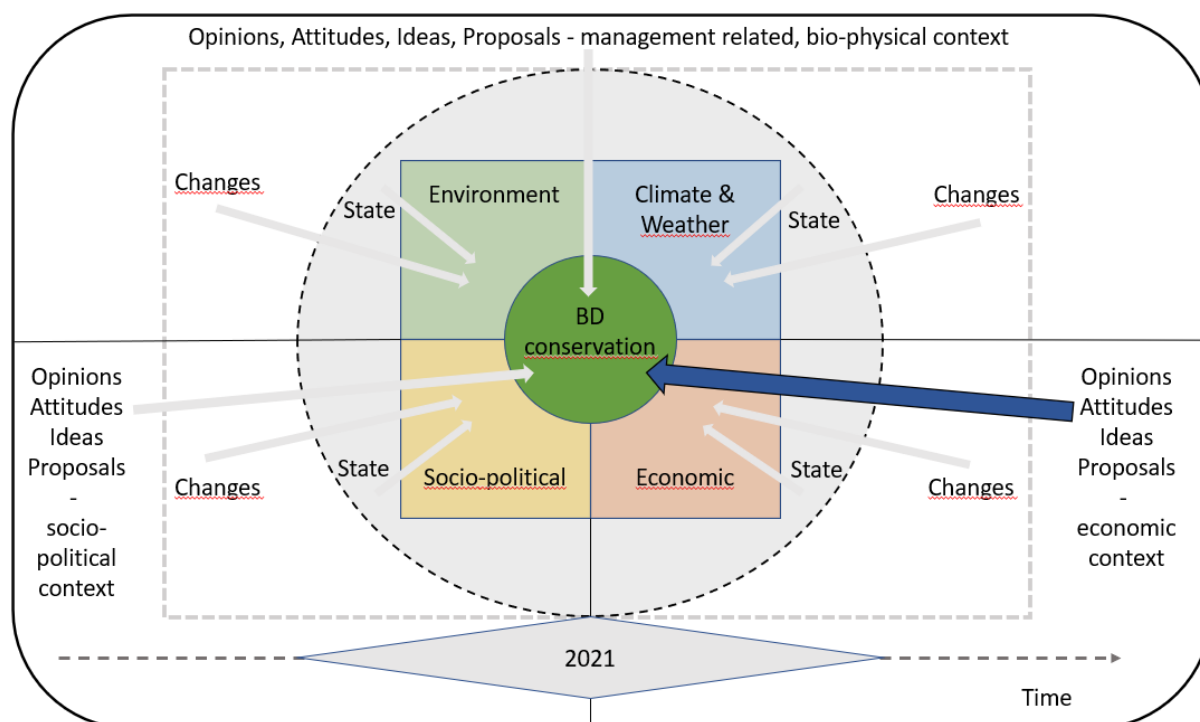


Figure 23: Visualisation: Opinions, Attitudes, Ideas, Proposals on BD conservation in the economic context as reported by Externals; Source: own elaboration (see also Figure 2, p.46)

No External mentioned much about BD conservation in the context of economic developments. The only points raised were tourism, marketing labels, economic pressure on Äplers and green energy developments.

Soft tourism is reportedly supplying an important additional income opportunity to Äplers, protecting BD in the long run by alps and pastures, which would without touristic activities become infeasible to run, not getting abandoned and at the same time not putting too much stress on habitats of different alpine species. Intensive tourism in the alps should be limited, esp. artificial snowmaking and expansion of skiing slopes, which is leading to major changes in alpine landscapes and was reported to actually destroy habitats [E4, E5, E7]. One External thought it possible to introduce an alpine IPSuisse label for PAFP as it would not change much with managing practices in Canton Fribourg while generating higher producer prices for raw products for Äplers [E3]. Another External reported having worked on a similar project, conducting initial interviews with Äplers about the feasibility of such a label resulting in the conclusion that LEK is mostly very low with Äplers around the topic BD, making the implementation of a label very difficult [E5]. The main reason for PAFP beneficial for conservation goals being currently neglected was described to be economic feasibility issues as alpine farming in its current state is not efficient enough to survive without support, while market oriented developments increasing efficiency were discarded as being very harmful to environmental protection goals. Green energy development in the mountains was seen as critical, as it is usually not conform with BD conservation and should be strictly delimited to areas where it is not too intrusive for the alpine ecosystem [E7].

*Externals' opinion, attitude, ideas and proposals for biodiversity conservation for the management related, bio-physical context (see also Figure 24)*

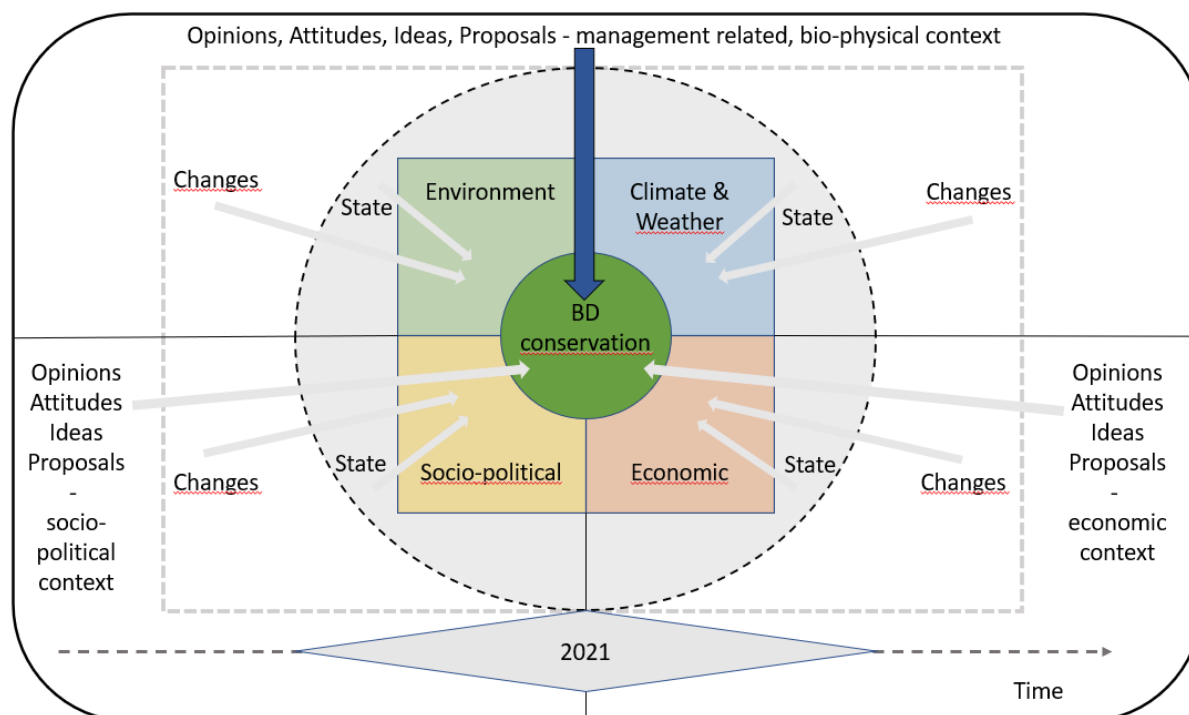


Figure 24: Visualisation: Opinions, Attitudes, Ideas, Proposals on BD conservation in the the management related, bio-physical context as reported by Externals; Source: own elaboration ( see also Figure 2, p.46)

Älplers were assessed having the biggest influence on BD conservation through their PAFP and LEK was considered one of the most important factors by all Externals for sustainable management practices and thus also to BD conservation in the Alps. Effectively changing PAFP was considered difficult by all Externals, while the necessity to change current practices and developments for BD conservation was assessed very heterogeneously. Nevertheless, in general adapting grazing and management practices to extreme weather events and CC impacts was considered necessary.

All Externals had the opinion that the extensive PAFP still in place today need to be protected and further incentivised for BD conservation purpose, Esp. in the context of perceived future developments the protection of traditional and diverse PAFP was seen as essential to halt the transition to more intensive, homogenised PAFP that is currently taking place. One major step mentioned by all Externals was that PAFP have to be (re-)adapted to the locally given environmental circumstances, esp. soil types for effective BD conservation. Stricter regulations regarding the use of heavy machinery in the Sömmerungsgebiet were proposed [E2, E4, E5, E7, E8, E9] together with a reorientation of melioration measures where compromises, deemed necessary, should be reached. One External [E2] recommending explicitly the prohibition of the use of mulchers in PAFP. Creating a frame for meliorations was assessed being important, so funds can get used more effectively, e.g. rather building water infrastructure than creating wider tarmacked roads in the alpine area and generally creating a legislative frame for better evaluation of infrastructure projects which take beneficial or detrimental factors for BD conservation and PAFP into consideration was reported to be required in the future for sustainable PAFP developments and future BD conservation in the alpine areas [E2, E4, E5, E7].

The correct management of weeds was assessed by all Externals as essential for BD conservation, esp. the management of alders is essential to have a high BD in the alps together with fighting perennial plants like rosehip was pointed out as important. For one External [E2] BD conservation was almost

equal to weed management. For weed and invasive plant control Älplers ought to be trained further to cut weeds thoroughly before they start seeding [E2] as well as focusing more on invasive plant species as they were seen as a future problem of high order [E4]. Focus of weed control should be differentiated and the guidelines for weed management updated to concentrate on the quickly seeding plants like ferns and the fleabane [E2], while other not quick seeding weeds like spearmint, bitter dock and stinging nettle should be taken out of the focus as they only create spatially isolated problems or in case of the stinging nettle can be considered a beneficial plant. Structures for disseminating more sensible weed management practices are reported to be present, as updating guidelines could be conducted together with the mandatory alp-control programme already in place [E2]. One External proposed and introduction of a regulation that bringing out slurry during the weekend is prohibited to improve the image of Älplers and farmers in society and increase communication between the two groups. Prohibiting cow-bells in general or at least the size of cow bells to ease stress for the animals and reduce noise pollution in the mountains was proposed in combination with extending communication efforts to display detrimental effects of traditional cow-bells to the society to slowly break the perceived necessity seen because of heritage reasoning [E2]. In that context replacing bells with GPS collars and using drones for herd monitoring and pasture monitoring was proposed as a good measure for the future reducing Älplers' workload and freeing up time for conservation measures.

In general, there should be more political support to research feasible alternatives for agrichemicals [E2, E4, E5 E7]. The current support in conserving and creating small structures beneficial for BD should be extended with subventions. For example the direct payments for creation and maintenance of wooden structures was considered only partly beneficial for BD conservation goals with some ridiculous aspects being present [E2]: "For example my brother is the manager of this alp. He gets money for this hut, he gets money for a wooden spring tub, he gets money for a cross. That is traditional, that is home, for every cross he puts up he gets money. - *The bigger the cross, the more subventions payed?* - No, ... it should have a regulated size. [...] It is partly absurd..., for wooden fences..., but I mean that with the crosses ..." The introduction of new farm animals and new farm animal breeds was mentioned as a positive factor for BD together with the use of mixed pastures and locally adjusted farm animals to the environmental conditions [E2, E7].

## Discussion

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“Yes, Switzerland is small even though the Alps are big.”[Ä5]

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### *Terminology*

The correct use of descriptions for people working with PAFP was not a trivial task as it quickly showed that esp. in the scientific sphere a differentiation between different types of people working with PAFP was made while no definitive definition is provided with a mix of terms in use. During the interviews the biggest consensus reached was to use the term “alp manager” to describe a person working on an alp with PAFP, taking care of the farm animals and pastures. Alpine farmers interviewed described themselves foremostly as ‘Äpler’ or ‘Äplerin’ but being by the External’s consensus alp managers. It is arguable if an indigenous term like ‘Äpler’ needs a strict definition or if it can be left with the wide meaning making it without further narrowing in scientific literature too inexact to use. It was nevertheless decided to use the word ‘Äpler’, as it represents a self-description (Baxter & Eyles, 1996) and in this case is used as an equivalent to the definition of the alp manager. The use of ‘Äpler’ was anglicised in not differentiating with genders and just with the plural -s at the end thus ‘Äplers’ describes multiple alp managers of possibly all genders. This shall not represent an effort to create a universal definition but was rather a decision made resulting from the information given during the interviews and is debatable as the word ‘Äpler’ is used most commonly with different meanings in the German speaking part of Switzerland. While differentiating alpine farmers further regarding their socio-demographic backgrounds, as it presents without doubt an influence on PAFP and knowledge, both from experience and theory, it was decided to not use it in this thesis as the sample of alpine farmers interviewed was too small to effectively applying and differentiating between such categories. For the planned survey such a differentiation was created and included (see Appendix 1. Surveys).

Sustainability, currently a term in high fashion which is used excessively in scientific, political and popular discourses has become an almost dangerous word to use due to its universality and many different definitions as well as misunderstandings being commonplace today (Janker et al., 2019). In the case of the interviews this could be observed as well esp. with the Äpler group participants showed interesting underlying thoughts when the word was used. Mostly in the context of PAFP and BD conservation every Äpler perceived their own practices sustainable (also compare to Aerni P., 2009) with different argumentation often pointing in a historic dimension and stating experience or lay knowledge in general LEK as the most important factor to apply sustainable practices with the theoretical component of knowledge playing a rather small role dismissing scientific definitions partly that are arguably more focused on future impacts extrapolated from conservation science research. Many participants from both groups of interviewees included a component of economic sustainability hinting at the nesting of BD conservation in economic and social matters in general. One scientist pointed out the danger of the word by stating that practices with detrimental effects on the environment and BD can still be considered sustainable in a sense that the industrial agricultural system is, with good practices used, resiliently sustaining itself over a longer amount of time, while the environment is suffering arguably albeit not to an extent comparable to the situation in the flat areas. This statement points into the direction of balancing conservation with economic and society interests in case of PAFP and that a too narrow definition of sustainability can lead to problems of these nested

problems, creating a grey area of the term used. As such in this thesis the term “sustainable” shall be understood as an adjective describing situations which can be considered resiliently sustaining themselves in all dimensions BD conservation is embedded, while still reaching the goals defined by the BAFU (2017b, 2016).

### *Comparing opinions, attitudes, ideas and proposals on biodiversity conservation*

Conservation ideas and proposals put forth by interviewees from the two groups were in large parts on common ground. All participants in the qualitative study identified the continuation of PAFP, keeping the living tradition alive, in future as the most important factor for BD conservation in the Alps. All interviewees also agreed that financial contributions by the state are the most important measure to conserve the tradition of PAFP in Switzerland because the market is not paying sufficiently for alpine products due to PAFP not being a necessity to supply the Swiss society with foodstuffs anymore. Proposals for this conservation were varying to a considerable degree between the groups and within the groups although information received from both groups concentrated mostly on the socio-political context as expected due to current PAFP having a high dependency on direct payments and financing schemes surrounding alpine agriculture (Bundesamt für Kultur – BAK, 2022). A consensus amongst all participants that alp abandonment has detrimental effects on BD conservation is discussed in some literature differently, stating it as a goal for species conservation of alp pastures above the treeline (Baur & Flückinger, 2018) and showing heterogeneity in the scientific analysis and assessments of the current situation.

More concrete management related ideas in the bio-physical context were advocated by both groups to a significant extent as well, while a greater difference is visible in the economic context that was more stressed by the group of Äplers interviewed than the group of Externals. However, several scientists stressed explicitly that the trend for intensification is driven by economic reasons and was assessed as a development that is hindered by environmental limitations; but as soon as technology becomes economically feasible on the alp it gets applied. The reason for this could be that no External was working directly in the private economic sector, but all were employed by institutions receiving their finances not directly through market activities, thus implying them having less exposure to market issues. Äplers in contrast to most Externals viewed BD issues with implications on PAFP more in economic terms, which displays the focus on production with BD beneficial properties as a side effect in opposition to the BD conservation centric viewpoint of many Externals seeing the situation the other way round. In the socio-political context both groups agreed that BD levels in the flat areas of Switzerland are much worse compared to the alpine area but came to different conclusions. Äplers stated that BD conservation efforts should focus more on the valleys and flat area as the biggest challenges were seen there, possibly because they want to enjoy more freedom from state regulations. Interestingly, many Externals had a rather fatalist view on this issue arguing that conservation efforts must be concentrated on the alpine area as this environment is still comparably intact, dismissing the flat part as lost for conservation efforts and rather being a subject for restoration, also displaying the generally more negative point of view of many Externals regarding BD conservation in Switzerland. This view can be explained, albeit Switzerland being one of the richest countries in Europe, by the limited financial frame of state supported schemes, where a compromise has to be made and focus has to be put on an area where finances can most effectively be used. The focus on alpine areas makes sense regarding literature describing the subalpine and alpine ecosystems as especially difficult and even impossible for restoration, making a focused BD conservation in this area of greatest importance (Fischer et al., 2014). Putting this in the context of the literature describing the often slow and



sometimes erratic changes in biodiversity and the potential for underestimating the need for conservation measures (Fischer et al., 2014), it is reasonable to assume that this explanation fits very well with this difference in perception and highlights the need to communicate this specificity of changes in species populations and BD more strongly to both Älplers and society. Effectivity of state financed measures was evaluated very heterogeneously throughout the interviews, which can be down to the lack of specifically measurable goals for conservation efforts. Goals are set in quite opaque terms (BAFU, 2017; BAFU, 2016), leaving enough space for interpretation dependent on the actors' agendas and leading to the conclusion that assessment of effectivity could be seen as more a subjective view. In this case, this subjectivity would provide a suitable lens to determine more specifically measurable goals as was proposed by multiple Externals.

Change of PAFP was seen by all participants as inevitable in the context of a changing society, technological progress and CC impacts. CC impacts were discussed not extensively but very heterogeneously, while there is a general consensus about global warming and the resulting impacts, already well discussed, well known and generally accepted. More controversially assessed was the occurrence of extreme weather events, which were partly credited to CC impacts and partly reported to have always been present in the Alps, fitting well with other observations made (von Glasenapp & Thornton, 2011). Insights by climate scientists state clearly that those events are predicted to increase globally and in the area of the Swiss Alps as well (Frei et al., 2007). Following those models, capacities should be created in Swiss agriculture to allow more flexibility in PAFP, so that adapted animal movements dependent on weather events can be made possible. The impacts from decreasing levels of precipitation could be countered to a limited amount by an increase of investments through melioration measures for water infrastructure in the Alps. Meliorations shifting focus more towards water infrastructure was assessed by many Externals as feasible and beneficial also for BD conservation, while an Äpler stated that current plans going in this direction have not shown any changes yet. Those hindrances could be analysed and removed in near future, presenting one of the rare opportunities where all actors profit while it can be considered beneficial for BD conservation, if planned and implemented well.

#### *Perspectives: anthropogenic and environmental centric*

Interestingly, the question of monetary values of BD levels was only tangibly discussed by a few participants from both groups, while a future issue was perceived to be the trend of society increasingly questioning what tax money is used for. In this context literature points most prominently into the direction of BD's role within ecosystem services, displaying a hard to quantify but very high value for economy (Fischer et al., 2014) and the well discussed matter of BD conservation from an ethical point of view, where monetary values cannot be assigned (Maler D.S., 2012). Scientific findings that biodiverse pastures are quantifiably possessing higher fodder values for farm animals (Stampfli A., & Zeiter M., 2010) should be better disseminated amongst Äpler communities. With PAFP and BD conservation being highly subsidised and incentivised with tax funds, the question of valuation both in monetary and subjective terms needs to be evaluated and communicated in future. The only Äpler stressing this point contrasted its presence with increasing time constraints in society, hinting at the problem of increasing alienation of the society towards the environment. One External stated that the vast scope of the value of BD for the economy is largely unknown in concrete quantifiable terms to society and Älplers alike, resulting in a lack of awareness of the perceived importance of BD conservation in general terms for the whole society. This lack was requested by the scientist to be better communicated, while the Äpler had a radically different view on this. Stating it rather being a

nested problem that cannot easily be solved, he put it in almost Marxist terms of understanding materialism as a trend that is bound to increase if the system around is not adapted. In the whole, there were only two participants asking for grander changes in the system of PAFP for BD conservation with the important difference that the Äplers viewed BD conservation being nested in society and economy, so generally anthropogenic systems, while the External viewed the anthropogenic components mainly nested in an environmental system with a healthy BD. In the end, they viewed similar problems and reported similar solutions, even though coming from completely different theoretical viewpoints of BD conservation in the Swiss Alps. Apart from the aforementioned two interviewees it was noticeable that Äplers viewed BD conservation very much as a nested issue with wicked problems and their potential solutions, while in comparison most Externals had a more focused view, seeing it in a singular manner and a smaller context of PAFP and agriculture in general. Thus, Äplers views were more holistic and generally going into a wider range of topics, while most Externals went deeper into single contexts of individual interest, such as herbicides, the topic of wolves, landscape homogenisation or traditional management practices. Most Äplers, albeit viewing the problems with BD in general more nested into the bigger topic of Swiss society and economy, did not perceive the problems as bad enough to actually warrant changes in that bigger system, rather arguing for adapting, just like most Externals viewed the system as a given, advocating smaller changes about specific topics. Regarding the often stated technocracy and arrogance of scientific communities (nicely exemplified by Guha R. 2003, 'The Authoritarian Biologist and the Arrogance of Anti-humanism [...]', and Stanley Jr, T. R. 1995, *Ecosystem Management and the arrogance of Humanism*), as was here the case as well, the difference between two perspectives could explain why scientists concerned with natural sciences mostly think of environmental factors as the frame for anthropogenic concepts, while members of the society, in this case the Äplers, think the other way round in a more anthropogenic fashion with solutions closer to the perceived social communities. The use of absolute language was not common during the interviews with either group, but it can serve as an example for the described discrepancy of perceptions. When absolute language was used, it was always in the context of politics and society. Two groups could be isolated among the participants. On the one hand, mostly Äplers [Ä1, Ä2, Ä3, E3] criticising policies and politics or developments in society that are being seen insensible or unjust; on the other hand, mostly scientists [E2, E4, E5, E7, Ä2] criticising policies, infrastructure developments and developments of Äplers' PAFP that were considered having a heavily detrimental effect on environmental- and BD conservation. While the first group was mostly mentioning production-focused problems, the second focused exclusively on conservation-centred topics. This use of absolute language pertaining to the context of policies shows the importance of the socio-political sphere for conservation practices and PAFP, while it also exemplifies the problems being currently perceived as most pressing. This dichotomy of perceptions can also be described by using Backhaus' (2007) findings of "inside" ("in the mountains", "rural") and "outside" ("flat area", "urban") landscape description discourses. The collection of LEK, being located between natural and social (socio-ecological) sciences, thus creates an opportunity to consolidate these two modes of perception in an interdisciplinary manner, in this case making it possible for both sides to facilitate greater mutual understanding (see also *Introduction, Traditional ecological knowledge (TEK) and local ecological knowledge (LEK) in the context of pastoral alpine farming practices*)

*Management related developments and corresponding measures*

One matter both Älplers and External discussed critically and extensively during the interviews was the political incentivisation of bigger professionalised alps, leading to more use of machinery ensuing landscape homogenisation. This trend can be confirmed by looking at the numbers for milk production and dairy farms (see also *Methods, Social data and agricultural characteristics of Canton Fribourg*). This strife for increasing efficiency of PAFP was evaluated almost universally negatively and as one of the reasons why sustainable traditional practices are neglected with following negative effects on BD conservation, which were seen as a necessity to shift goals for agricultural development policies both from a BD conservation and traditional alp conservation perspective. In a case-study by Ianni et al. (2015) the loss of LEK was theorised to be a symptom of increased disconnection from the environment, and it was argued that negative trends in conservation practices in agriculture can be viewed as following this loss of connection: “The loss of ecological knowledge [...] is thus an indicator of a wider phenomenon of loss of ecological control over the territory.” Put into context with machinery use that was stated to remove the connection to nature and environmental surroundings, this trend must be assessed as detrimental for BD conservation in the Swiss Alps. A shift of environmental-dependent livelihoods to market-dependent livelihoods was reported in this context (Ianni et al., 2015). In literature it was mentioned that associations, farmers and Älplers see this structural change of bigger operations more positively as more direct payments can be obtained (Liner M., 2022). This mindset could not be observed neither among participants working for associations nor among Älplers interviewed. In this context proposals of changing agricultural policies towards smaller scale alps and farms can be regarded as a way forward together with prohibiting the use of heavy machinery like mulchers in the Sömmerungsgebiet and with incentivising the use of manure instead of slurry. This matter undoubtedly discussed in literature and agreed on by participants from both groups can be seen as a more pressing issue, as restoration of alpine pastures were shown to be a lengthy process with reduced fodder production (Stampfli A. & Zeiter M., 2010). The proposal to completely ban the use of slurry or the use of it at specific times can be discussed further, while undoubtedly this would be beneficial for a better relationship of farming and society. The proposed measure of prohibiting this practice cannot be seen as the most ideal solution as any restrictions and prohibitions will be received badly by farmer and Älpler communities. Politics would lose a significant amount of trust, as slurry use on alps was propagated widely as a more efficient solution for animal residue management. The reversing trend to manure use should be incentivised, as it presents a practice beneficial for soil conservation and resulting BD levels. A complete u-turn in the shape of policies could result in fortifying Älplers and farmers resentments towards politics, which should be avoided if viable alternatives exist. Alternatives to prohibitions like raising awareness about such issues and potentially organising community meetings to discuss problems might prove to be more popular with both the farmers and Älplers as well as the affected persons and in the end more effective, resulting in less conflicts between interest groups if facilitated well. The stated asocial behaviour reported by one External regarding one farmer can probably be seen as an exceptional case that does not justify more restrictions passed but nevertheless shows that action is necessary on the issue of slurry use.

### *Financial constraints and the market*

Apart from politics, the insufficient income of many Älplers, especially those employed, a topic often mentioned by all participants, can be regarded as a further driver of the fore-mentioned development of professionalisation. The current system of harnessing flexible labour is heavily based on community levels to recruit local friends, family and village youth (von Glasenapp & Thornton, 2011). This issue can be regarded as crucial for the current professionalisation trend and political incentivising, as the supply of voluntary labour is keeping production costs lower compared to a professionalised environment. Unlike political goals, this market-oriented factor cannot be changed easily, as high food prices are considered a controversial topic in Switzerland already (Rudolph et al., 2020). Many Älplers wished for politics to exert higher pressure on the bottlenecks in the food value chain identified, meaning the big distributing companies, pushing for higher producer prices. The dependency on fluctuating market prices can mean higher vulnerabilities, especially for less diverse alp products, if the reliance on market generated income is extended (von Glasenapp & Thornton, 2011). This problem is not isolated in Switzerland but is a world-wide phenomenon (Hyland et al., 2019), and while it can be recommended that those bottlenecks be opened with more competition possible, it seems highly unlikely that anything like this will happen in the near future. The only market-oriented proposal made was the introduction of further labels for alpine products valuing sustainable practices. It is questionable if such labels can be implemented effectively asking for higher prices: the market for food product labels is already considered saturated (Temple & Fraser, 2014; Jordan K-P., 2019), and only if the label gets marketed effectively and awareness can be created, it could then be considered as a viable instrument to increase Älplers' income. Chances of successful implementation could be raised by looking at examples from other countries like the Italian slow food movement and markets for local products (Dunlap R., 2012), which was also recommended explicitly for conservation of traditional PAFP in literature (Bundesamt für Kultur - BAK, 2022; Steinauer et al., 2022). Other ways of raising income and alleviating the financial situation of Älplers were (not surprisingly) suggested to come through state funded direct payments. Raising consumer awareness about sustainably produced foodstuffs, especially dairy and meat products in the case of PAFP, can nevertheless be seen as a potential to incentivise such practices through potentially more selective consumer choices. Practices beneficial for BD conservation could be promoted through this lever as was stated by participants from both groups. The necessity that awareness of foodstuffs' value should be raised was exemplified by a reported wastefulness in society. The problem of food waste is a well discussed topic worldwide (and Switzerland is no exception), and the potential to increase awareness in Swiss society can be considered present taking into account the already existing pre-disposition of preferably buying foodstuffs produced in Switzerland as well as reportedly increasing consciousness towards environmental conservation topics (Rudolph et al., 2020).

### *Income diversification on the alp*

Income diversification within PAFP was a topic foremostly mentioned by Externals in the context of sheep herding being less viable with a negative trend for the future stated. An increased diversity of farm animals kept on alps was considered a viable method to increase species diversity in the alpine area together with conserving traditions and was assessed by participants from both groups to improve pasture management and diminishing the need for weed control due to varied grazing habits of the farm animals (see also Schneider et al., 2013). The ongoing trend of increasingly using older, more robust and generally better locally adapted breeds in the mountain environments (Bundesamt

für Kultur – BAK, 2022) was seen – especially by External – as a practice that should be incentivised in future. Economic viability can be considered in this case as the main hindering factor, as prices for sheep and goat milk and cheese are comparably lower than revenue gained from cow and cattle herding. One External mentioned a loophole for intensive alpine pig farming that obviously should be closed by either raising the Normalstoß value for pigs or passing an additional regulation of PAFP regarding pigs, so that this practice is not gaining more popularity (see also Bissig et al., 2005). The increasing trend for professionalisation and specialisation on one certain product can be considered a hindering factor as well. Keeping farm animals for subsistence or small-scale production was reported as a negative trend, exemplified by the fact that only half of the Äplers' sample stated producing foodstuffs for subsistence use. The recently increased hygiene standards leading to the slow death of Sennerei practices (Bundesamt für Kultur – BAK, 2022) can be seen as an obstacle difficult to overcome with the current legislation favouring bigger industrial style food processing methods, while smaller cooperatives are struggling to finance infrastructure that complies to the standards enabling them to sell on the formal market – a trend that was in this context negatively assessed in literature (e.g. Fischer et al., 2014; Liner M., 2022; Danby G. A., 2015). A further problem displays the stated social norm amongst Äplers that only those herding dairy cows are considered “real” Äplers with cattle alps being considered acceptable as well, as such exerting a social pressure to have a dairy alp (Bundesamt für Kultur – BAK, 2022).

The role of the informal market within PAFP needs to be discussed as well, as with raised hygienic standards, alp dairies' only outlet for their produce is often on the informal market or directly through an alp shop. This has an effect on management practices, as keeping different farm animals and the small-scale production of goat or sheep milk products produced in a traditional way can be considered dependent on the feasibility of such sales channels. These informal channels have been described in literature as one of the “key value adding strategies” for pastoralists in the Swiss Alps (Schulz et al., 2018). In the context of professionalisation a trend towards complying to formal market standards encompasses a homogenisation of PAFP which as was discussed can have detrimental effects on conservation practices in use. Also viewed in terms of community cohesion, the existence of an informal market in the alpine area can prove beneficial as smaller craft trades like carpentry can profit from such non-regulations strengthening the economy and empowering small tradesmen and producers in remote areas. Basically, it could be seen as a worthwhile incentive for maintenance works on alps and additional income that can be generated leading to less abandonment of alpine pastures. Arguably direct marketing channels and uncomplicated contracting for maintenance can be considered well received in the Äpler community, as it provides a certain unregulated freedom to earn additional income in ways Äplers and tradesmen see fit. The decision of control of such outlet channels ultimately lies with Swiss politics and the financial administrative offices accepting losses in tax revenue – or not. The loss of tax income through those practices can be considered minor (Bundesamt für Kultur – BAK, 2022; Agridea, 2016) in comparison to the Swiss household and benefits resulting from a small grey area in the market, for BD conservation practices can be seen outweighing the potential losses of income for the state. This can only be estimated heuristically as there are obviously no certain numbers that could be calculated to come to a conclusion on this subject. The discussion presented here is based on private communications conducted on the side while collecting the interview data with members of the communities. It was stressed during those talks that the importance of this informal market is considered very high. As there was no data, scientific or non-scientific, available on the topic it presents a good opportunity for further research.

The conservation of soft tourism was a topic recommended by multiple participants from both groups as it provides additional income while having minor effects on the environment and social structures. Literature emphasises the conservation and expansion of soft tourism for incentivising traditional PAFP

as well (Bundesamt für Kultur – BKA, 2022). This can be a viable way of creating a system in Switzerland contrasting surrounding nations and providing a chance to pioneer in ecological tourism offers in the Alps (Widmann E., 2005). A development that should thoroughly be avoided according to many interviewees from both groups is the construction of more skiing infrastructure and especially facilities for artificial snow-making, which were assessed in literature as having a dramatic impact on the ecosystem with very detrimental effects on BD conservation (de Jong C., 2020), even though Switzerland has less intensive snow-making facilities than Austria, Italy and France with ski resorts generally being smaller in size (de Jong C., 2020). With rising temperatures through global warming ski areas will be more incentivised to invest in artificial snow-making, this development should at best be avoided or at least limited for environmental conservation reasons. But as ski tourism is creating a big income, strong interests to keep this sector alive can be considered. This dilemma should be anticipated and avoided as much as possible by creating other income sources for the winter season through offering and incentivising other touristic winter activities that are less intrusive than skiing on artificial snow. This part of the tourism industry was singled out creating the most issues and the biggest problems for BD conservation in the Alps. In this case one External favoured a land sparing development tactic (will be discussed in more detail later, see *Discussion, Direct payments and biodiversity conservation*) instead of less intensive but broader developments. In literature this topic is discussed with great heterogeneity (e.g. Sachot et al., 2003; Bouyer et al., 2014, Lécuyer et al., 2022). Another point raised in literature is the stricter delimitation of protected areas for touristic activities using the parks of national priority and a general goal setting of BD conservation in the tourism industry: “Die Tourismusbranche täte gut daran, ihr Engagement im Bereich Biodiversität deutlich zu verstärken.”<sup>70</sup>(Lachat et al., 2010).

Green energy development was assessed very critically in the alpine area as the potential for having a detrimental effect on BD levels was evaluated as significant. This development can be seen as especially controversial balancing interests between BD conservation and interests for the reduction of greenhouse gases, as the topic of green energy development is already emotionally charged; in that case, finding a middle ground can be considered difficult. The alps providing a viable location for wind/solar energy and potentially hydroelectric constructions presents a great potential for unintended unecological developments in the name of environmental protection which was already pointed out over ten years ago (Lachat et al., 2010), leading to the assumption that more action in these developments is necessary to ensure BD conservation goals in the Alps can be met. These unintended consequences present an argument for making BD conservation goals universal for all development programmes as proposed by a scientist and are discussed at another point in detail (see *Discussion, Direct payments and biodiversity conservation*), making potential site selection for construction more complex.

Interestingly, certificated organic PAFP were reported by all participants to be of minor importance in Switzerland, which at first seems to be odd as “conventional” PAFP are already very close to organic practices and as such certification would present an easy step to increase income. Looking at the context a few hindrances can be isolated with the most important being that usually farm animals on alps are neither belonging to the Älpler nor the alp owner, and an organic certified standard in that case would prove a hindrance to get enough farm animals, as with the current legislation animals coming from a certified organic valley farm are allowed to pasture on non-organic alp pastures without losing certification, with the certified organic alp essentially be economically disadvantaged. Secondly, certification is costly, and considering the alp sector’s low revenue rates and in general small sizes in terms of Sömmerungszahlen, the certification process itself would have questionable feasibility even

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<sup>70</sup> Translation - The tourism industry would do well to significantly strengthen its commitment to the area of biodiversity.

if the first issue did not exist. A possible solution was proposed by an External in, firstly, changing certificate standards to Sömmerung only on pastures where weed control is mechanical and no herbicides are in use and, secondly, generally changing organic standards and adapt the EU organic label requirement easing trade of organic products between Switzerland and EU countries, which has been requested for a while by other publications (Kilcher et al., 2004). This on the first glance looks like an obvious decision to make, as it would provide Äplers not using herbicides with additional income while also increasing trade with neighbouring EU countries. Again, looking at the context there are reasons to not take those steps as the (slightly stricter) BioSuisse standard displays protectionist characteristics without being officially labelled as such, which would create a target for complaints. The slightly higher standards guarantee an effective barrier against cheaper EU organic imports, while exports are still a viable option. Generally opening the market for agricultural produce was calculated to be detrimental for Swiss farmers (Mack et al., 2017). The use of labels for such purposes would not be surprising as it is common practice in the EU and other countries as well (Trienekens & Zuurbierm 2008). From a conservationist point of view, the BioSuisse standard displays an advantage, as specific measures aimed at BD conservation are included in the standard, which is not the case with the EU regulation (Kilcher et al., 2004). The second reason is that lowland livestock farms would be disadvantaged by being severely limited in their choice of where to send animals for Sömmerung, which would lead to higher production prices, while it is questionable whether the wholesalers, who have already been described as a bottleneck, would increase purchase prices accordingly to compensate for the losses. Taking these interests into account, it is questionable whether changes to the Swiss organic standards will happen in the near future, unless more pressure is exerted on politics and the labelling organisation. The second proposal to incentivise organic farming and organic alps in Switzerland was to introduce the possibility to give farmers and Äplers the opportunity to simultaneously use the same animal stable for organic and non-organic certified animals, presenting an opportunity for income diversification and making the transition to organic farming less costly and in general reducing risk. In this context, the conflicts between organic Äplers and non-organic Äplers present another hindering factor for taking up organic practices if it encompasses potentially being ridiculed by the bigger group of the Äpler community. Resolving this conflict was described as a difficult task, which obviously means it should be systematically undertaken as soon as possible. Systematic communication efforts will be needed to pacify both parties in this situation. As the reported sensitive points were the perceived “messiness” of organic Äplers’ pastures, the Swiss beauty standards, which will be more widely discussed at another point (see *Discussion, Socio-cultural aspects in recent developments and its potential impacts on future developments*), seem to be the crucial aspect, and the perceived arrogance and know-it-all attitude of organic Äplers should be communicated by not doing things better but differently, maybe with the notion of the concept of BD conservation benefiting from a diversity of PAFP more than from homogeneous PAFP, giving validation to both groups in that case. Due to the nature of alp animals in most cases not belonging to the Äpler or alp owner, incentivising organic animal farming in the flat area would indirectly give a mandate to Äplers changing to organic management practices, too, if the legislation is changed so that the same standards apply to the Sömmerungsgebiet as in the flat area. The organic labelling institution should provide lower prices for certification to alps or a funding scheme to incentivise transition and communication support to connect organic farmers to organic Äplers. The most important factors for a successful uptake of organic certification will obviously be that Äplers can profit from such a cooperation and bureaucratic effort is limited. To sum up, the stated factors favouring and disfavouring implementing organic labelling in the Sömmerungsgebiet is a surprisingly difficult task that should nevertheless be pursued for BD conservation goals, as with a successful implementation it presents a market-based instrument not straining state finances. Other examples with EU regulation have proven successful with PAFP in surrounding countries (Mazzocchi & Sali, 2021; Bonadonna et al., 2017).

*State influences on pastoral alpine farming practices*

All interviewees shared the notion of locally adapted management regarding sustainable PAFP and BD conservation. LEK plays a major role in this context as it enables and prepares Älplers to respond to CC impacts, socio-ecological shifts by observing changes and adapting PAFP which requires an intimate understanding of this agriculturally characterised ecosystem (von Glasenapp & Thornton, 2011). Everyone from the sample agreed that adapting PAFP to the very specific environmental contexts is the pivotal point for future sustainability. Especially soil types were pointed out by multiple participants from both groups to be one of the most important factors for pasture management. This circumstance would provide – with the stated recent advances made by soil scientists in cooperation with Älplers – an ideal opportunity to expand this cooperation to BD conservation. In the context of locally adapted solutions and PAFP, current legislation with too rigid frames was criticised by both groups, especially with action-oriented schemes, not allowing Älplers enough space for adapting practices to environmental circumstances. More specifically, concerning the topic of Sömmerungsbeiträge more flexibility was proposed by one Älpler; and, viewed in the context of expected increasing extreme weather events and longer seasons, this would make sense and probably taken up well by Älplers as it provides more flexibility with PAFP also supplying a legal frame for more adaptability to local geographic conditions making PAFP economically more viable. In the whole, the coupling of direct payments to conservation measures or PAFP beneficial for conservation goals can be currently considered as one of the most promising levers to steer PAFP towards BD conservation goals. One aspect worth looking further into is the aiming of coupled direct payments at alp managers or alp owners. Employed Älplers and Externals described a discrepancy of rewarding PAFP actually implemented dependent on the ownership status of alps. Many direct payments were reported to go in the wrong direction of the alp owner instead of the alp manager who is responsible for eligibility and reported problems that those revenues generated are not getting passed along towards the alp manager or the alp in general making those payments ultimately ineffective. Another idea mentioned in literature on this topic was the coupling of direct payments to mandatory participation of specific training on conservation practices (Liner M., 2022). The introduction of mandatory training programs would arguably be not taken up well, as time on the alp is already scarce and the introduction of a forced coupling with payments where it was not necessary so far and where management is in big parts unnecessary (see *Discussion, Biodiversity and farming practices*) would pose the danger of eroding trust in agricultural policies and information dissemination.

The introduction of area-based payments in the recent past got assessed very positively by Externals interviewed, as former payments solely based on GVE or Sömmerungszahlen did not factor extensivity of alp pastures into account which lead to biased equality of Älplers. These area-based payments took care of the aforementioned issue and equalised payments between different systems of PAFP, but at the same time created a new problem mentioned by Älplers: the appearance of land speculation for alpine pastures, which reportedly existed to a lesser extent in the past. This problem arising from the payments being aimed at owners and not managers shows the necessity to differentiate payments better in future between those groups and that area based payments should arguably be aimed at the managers rather than owners, as extensive pastures with low animal counts display more of a strain on the Älpler than the alp owner.

Sömmerungszahlen were assessed mostly positively in Canton Fribourg, while some Externals stated too low numbers leading to not enough pressure on weeds, shrubs and trees. Von Glasenapp & Thornton (2011) described similar concerns of Älplers with the notion of their perceived peak of alp productivity in the 1950s and 1960s. Whether modern high yield breeds with fancy eating habits and high feeding requirements with encompassing high nitrogen pollution of the soil can really accomplish



better weed control through higher intensities is to be doubted, while shrub and forest encroachment is clearly linked to lacking pasture management, as no farm animals apart from goats eat small trees and shrubs. With goats and other animals with diverse eating habits being less common as a trend, more pasture management will be necessary in future.

The lack of income stated by all employed Äplers and to a lesser degree by Äplers also owning the alp makes sense in this context, as payments can be seen well aimed if the alp owner is also the active alp manager. One scientist noted the political favouring of alpine agriculture compared to agriculture in the flat area, stating a much higher amount of payments received in this area from the state with the recommendation to not favour alpine agriculture further. Since only a small amount of direct payments (4 %, see *Introduction*) for agriculture by the state gets used in the Sömmerungsgebiet, the production levels are low. As can be seen, only 2.5 % of the total milk-production in Canton Fribourg (see *Methods*) is generated on alps and stands in no comparison to the area used, exemplifying the extent of the extensivity of PAFP in this Canton at least. The question arises if alpine agriculture gets a wide extent of financial contributions and where does the money go, as employed Äplers with famously low incomes seem to not profit from that development. This implies that employed Äplers are overlooked by state policies and a re-arrangement of aiming of existing payments could possibly take financial strain off Äplers, resulting in a more just financial distribution between alp owners and employed Äplers. Also considering the abolished traditional practice of mandatory drudgery days required from alp owners, additional income by Äplers could be used to employ temporary help for tasks that would otherwise be neglected.

#### *Alp ownership and employment and corresponding training*

Ownership status presents arguably one of the bigger influencing factors regarding PAFP, as an employed Äpler will in general put less effort into maintenance work than alp owners. The most common ownership types described were private and cooperative owned alps while a predominance of types of ownerships are strongly dependent on Cantons and regions, with Canton Fribourg leaning much heavier towards privately owned alps. During the interviews both positive and negative characteristics were reported by participants from both groups. In terms of PAFP beneficial for BD conservation, the private owned alps were assessed to be more heterogeneous, as positive examples exist with the Äpler taking good care of pastures and infrastructure with extensive practices, while also the opposite exists with unfit management practices leading to environmental problems or complete abandonment of pastures. In general, the larger liberties encompassed with a privately owned alp empowers Äplers to use PAFP with a greater variety and with greater insecurities regarding finances. Cooperative owned alps were described as more restricted as the cooperative has a more stringent set of rules that has to be complied with, which usually leads to more standardised practices with the Äplers who are members of the cooperative having a more secure, but very limited, financial situation. Chances can be seen in cooperatives to combine more and less profitable alps, as income can be distributed equally and if the goal is not maximum profitability but also conservation. As such, this system shows theoretically greater resilience against pasture abandonment. The literature on conservation of traditional PAFP is coming to similar conclusions as this analysis (Bundesamt für Kultur – BKA, 2022). One critical aspect in the context of LEK and experience is the very limited time Äplers in a cooperative usually spend on one alp, leading to less knowledge about local environmental conditions and possibly to poorly adapted PAFP. This can be considered less the case with private owned alps where the owner or an employed Äpler manage the pastures for a much longer time. This issue can be regarded problematic, as it was stated that Äplers' acquired LEK is not easily transferable

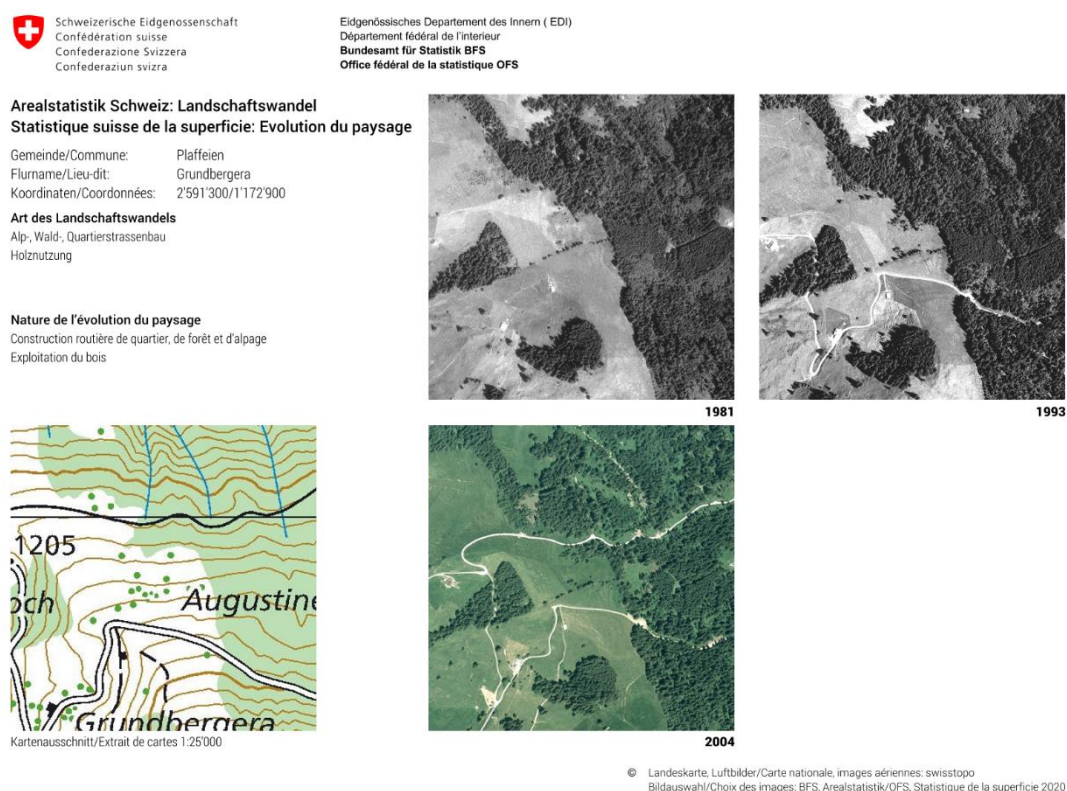
to other locations. A general lack of experienced and well trained workforce for Sömmerung was mentioned in literature, stressing long term experience in alpine agriculture as particularly important (Liner M., 2022). Interestingly, this seemed to be less the case in the areas the participant Älplers were working in, as all of them mentioned few worries about future Älplers working with PAFP. This detrimental factor is a difficult problem to solve; but putting this information into the context of the necessity of BD conservation dependent on the location a recommendation can be made to concentrate cooperative Älplers with less experience in more remote, higher altitude and generally less profitable alps and pastures, as not adapted management practices can do less harm to conservation efforts, while in lower located alps, described as more sensitive to PAFP, more experienced Älplers would be beneficial. Whether change of ownership statuses is a topic at all is highly debateable, as the regional specific traditions play a big role and should be preserved for the sake of cultural, alp and PAFP diversity. High levels of BD from a high diversity of alp ownership statuses can be a way in the future as it was in the past to save PAFP in remote and less favourable areas as well as in critical locations for BD conservation purposes (e.g. in areas with biotopes of national importance). The conflictive potential of alp ownership is, as in every employer-employee relationship, obviously present and mainly concerns topics such as wages paid and management practices used. Albeit better communication and cooperation between Älpler and alp owner could be beneficial for conservation practices, this everyday but nontrivial matter shall not be discussed further.

Another problem concerning ownership status was reported to be a loophole for alp owners' mandatory training and education as a prerequisite for eligibility for direct payments in the first place. This legal loophole needs to be closed so that both alp owners and employed alp managers will be required to prove qualification either through experience or professional training. Education and training in general was described by all interviewees and literature (e.g. Lachat et al., 2010; Pfiffner & Schader, 2008) as a very important factor for sustainable PAFP; an extension of courses and improvements in basic professional agricultural training in regards of BD conservation and environmental protection in general was proposed by many participants – a point also discussed in literature (Liner M., 2022). This soft measure could relatively easily be implemented, as structures and schools are present and an updated curriculum could create more awareness and disseminate newer insights in BD conservation within the younger generations of Älplers and farmers. Some Externals and Älplers stated a general lack of focus on conservation topics with extension services and additional training for Älplers. This circumstance needs to be evaluated and courses adapted accordingly. One specific idea mentioned was the expansion of competitions for the most sustainable PAFP in the alps to raise awareness and motivation for adoption of sustainable management. Such competitions could be held relatively easily by existing institutions as is already done leading to the recommendation to expand on this concept. In the context of agricultural extension, multiple Externals mentioned a specific program by Agridea called "Digiplanalp", an online extension programme using videos to show and explain issues in the context of PAFP. This programme was assessed very positively, Externals reporting it being successful and taken up well by Älplers. Interestingly, only one of the Älplers interviewed mentioned this extension project, but all others were rather talking about the local agricultural schools and the local nature park. One Älpler mentioned the guidelines and videos by FibL, an ecological agricultural extension service, being partly flawed, in his opinion, as he experienced the actions recommended did not have the effects promised, resulting in a slightly negative assessment of such online or "remote" extension services and ultimately undermining trust in such institutions. A further problem is present that alps being remote in the mountains are not necessarily connected to the internet through cable or mobile network and especially that the older generation of Älplers is lacking skills to use the digital infrastructure. Offering online extension services can be assessed as being a good addition to extension in presence but not as a replacement. Nevertheless, the future

viability of such measures will increase as digital proficiency and demand for digital services will most likely rise with coming generations.

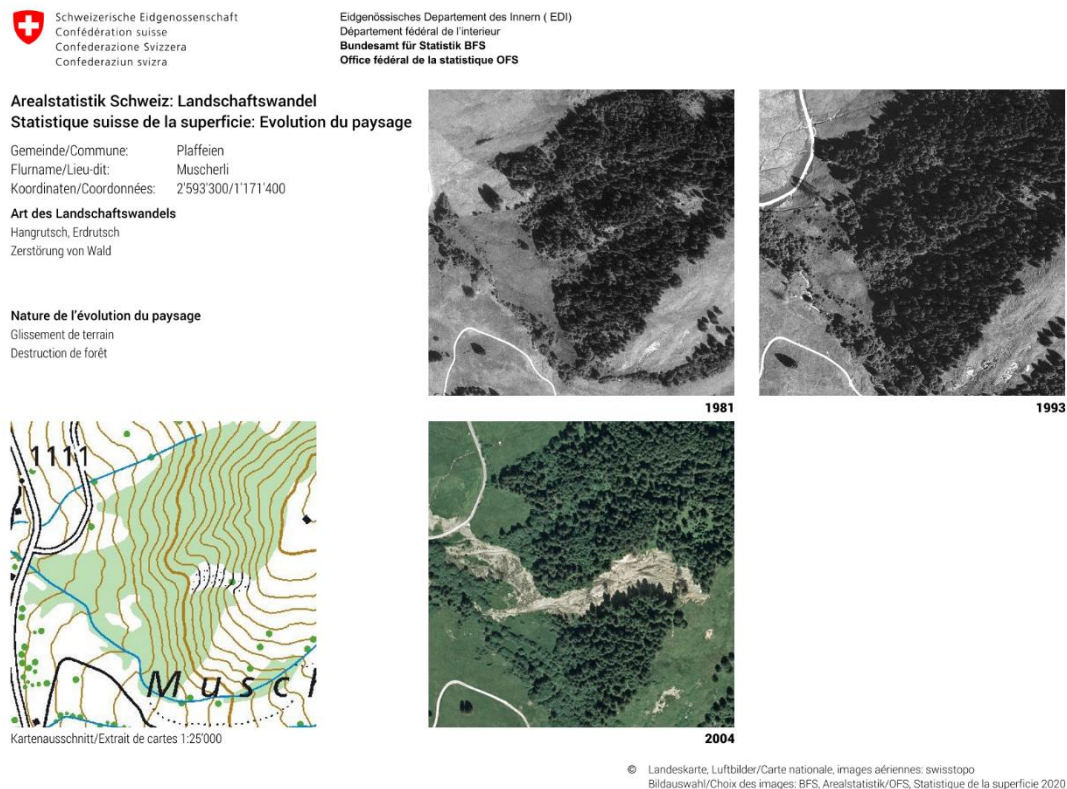
### *Meliorations and encompassing use of technology*

Another aspect regarding BD conservation goals that was addressed by many interviewees is connected to the use of machinery and landscape homogenisations, such as the use and direction of finances for meliorations (see Picture 1) needing to be re-evaluated by the Swiss state. Literature assessed the effect of meliorations on sustainable agricultural practices driving landscape homogenisation generally negatively for BD conservation (Guntern et al., 2020; Fischer et al., 2014), which falls in line with the narrative observed during the interviews. Generally, it was stated by many participants from both groups that meliorations get used ineffectively and a stricter evaluation of the necessity of these payments could be relatively easily conducted if clear goals are set regarding alpine infrastructure use and conservation goals. Especially the introduction of Landschaftsqualitätsbeiträge for PAFP exemplifies the shortcomings of the current use of meliorations, showing the misalignment of state funding schemes regarding BD conservation goals, rendering both schemes somewhat with reduced efficacy. Meliorations were assessed critically in literature; it also pointed to the necessity of including BD conservation goals in infrastructure plans to limit damages to habitats (Lachat et al., 2010). The complete abandonment of all meliorations in the alpine area was seen by no participant as a viable method, as they were describing it as an important factor for supplying commodities to Älplers, and following from that conserving alpine agriculture for the future.



Picture 1: Effects of meliorations exemplified with road constructions. Source: Data:swisstopo, public.geo.admin.ch, Date of last access: 07.01.2023

The reported re-activation of Rutschgebiet in Flysch areas (see Picture 2) through periods of excessive precipitation, which might increase in the future with CC impacts (Butterling et al., 2017), could be a more prominent future point for implementing melioration measures. This problem, differently assessed by participants in both groups, might be tackled effectively as strategic measures are already developed (Krättli W. & Schwarz M., 2015). Rather than concentrating efforts on reconstruction, a possibility could lie in investing in precautionary measures in areas prone to sliding with, for example, tree roots or trenches stabilising the slope wherever this is assessed possible. These practices should be discussed locally as landslides can generate habitat for important pioneer vegetation (Wohlgemut et al., 2019).



Picture 2: Flysch area and sliding slopes in a reactivated Rutschgebiet; Source: Data:swisstopo, public.geo.admin.ch, Date of last access: 07.01.2023

Further concrete proposals include an incentivisation and training on new information technologies to use drones and GPS for herd management. This can be seen as a very viable method to increase efficiency while still using traditional extensive practices without heavy machinery involved, as the use of new digital technologies enables to rationalise traditional practices while not being intrusive for the soil and the species community on alp pastures or even could create a possibility to improve pasture management having beneficial effects on BD levels. The proposal of replacing cow bells with GPS necklaces, as sensible as this would be in every way, can be considered of limited feasibility in Switzerland coming from the high valuation of bell-tradition with PAFP. This curiosity, which undoubtedly constitutes cruelty towards animals, can to a lesser extend be compared to bullfighting traditions in the Mediterranean area showing the sensitivity of the topic. Changing this tradition can be considered if the goal is explicitly formulated to abandon this practice, while undoubtedly it would encompass a slow process in a systematic and consistent manner over a longer duration, thus good planning and preparation would be necessary. As with all new technologies, adoption strategies have

to be formulated and training provided as Äplers were usually described as having a technology adverse attitude resulting in a usually lengthy process of introducing technologic innovations. In the context of LEK being lost due to the use of technologies (von Glasenapp & Thornton, 2011), increasing the gap between Äplers and their environment, developments of digital non-intrusive techniques should be discussed critically in the future.

### *Biodiversity and farming practices*

One of the most controversial topics discussed during the interviews was the re-introduction of the wolf to areas where PAFP is practised. While the general opinion of Äplers can be described – with exceptions – as more negative towards the development, opinions of Externals varied to a great extent. Information obtained from literature is ranging similarly, seeing big predators like wolf, bear and even the lynx, which was described unproblematic by all Äplers, as a threat to traditional PAFP (e.g. Bundesamt für Kultur – BAK, 2022, Lavorel et al., 2019, Hinojosa et al., 2018). Äplers' opinion could fittingly be described with a not-in-my-backyard attitude, while no Äpler experienced that his house animals were attacked, even though a wolf was spotted by one interviewed Äpler. The fear of wolves attacking calves or smaller house animals in that case can be described as mostly abstract at least in Canton Fribourg, while animals killed by wolves are widely reported in Switzerland with the economic damage being on a minor level. The most pressing issue with the wolf would be in this situation not the actual danger but rather the unclear political legislation. A basic tenor complaining about a lack of clarity of the agenda of wolves could be identified with most interviewees being more irritated by a lack of a concrete plan or scenario in which way the development should advance than the opposite standpoints on the topic itself, be it stricter protection of the wolf or stricter delimitation of habitats. This circumstance shows a high fatigue in Äpler communities of the topic and that action is necessary. Notably, in a study by Behr et al. (2017) it was pointed out that there still are gaps in research that are hindering conclusive scientific assessments: "We could not find any systematic information at the desired spatial scale about small livestock husbandry practises and we could therefore not investigate the topic in further detail." In that situation conservation policies should create realistic scenarios with economic calculations which can be discussed inclusively, coming to a decision that clarifies the currently perceived messiness of measures; especially the financial compensations for losses induced by wolves were criticised as not being sufficient enough and too complicated in application as well as a lack of support for pre-emptive protection measures like herd guarding dogs, leading to the conclusion of Äplers that environmental and agricultural politics are incapable to find a sustainable compromise and formulate functional policies. In the literature it was stressed that co-existence of wolves and farm animals result necessarily in a more intensive animal management activities by Äplers (Liner M., 2022), leading to a connection of this topic to Äpler income and workload. This discussion shall not dive further into this heavily debated topic as literature on feasibility of proposed solutions and information about the topic in general is abundant (e.g. Wallner & Hunziker, 2001; Hunziker et al., 2001). It was pre-emptively decided to generally try to avoid the issue and limit data collection to a minimum about this topic, as it was considered to be beyond the scope of this thesis with the potential of exerting bias on other results.

Generally, BD conservation topics were assessed by Äplers not coming from intrinsic motivations in most cases and considering the high workload of Äplers with no trend identified of a reduction in the near future. Additional income was identified as one of the main drivers for potential adoption of more PAFP beneficial for BD conservation, as it enables Äplers and alp owners to employ additional employees taking care of the "luxury" task of better pasture management. In this context the coupling

of direct payments towards BD conservation practices was generally judged favourably by Älplers and most Externals alike. Further improvements were proposed, realigning payments to create further incentives for conservation especially with traditional practices in use. Higher standards proposed by one scientist would arguably be not well received by Älplers, albeit necessary if the result orientation shall be taken seriously. This point will be discussed later on in more detail (see *Discussion, Mechanisms of agri-environmental schemes*). The payments were assessed as raising awareness with the managers, thus implying that more coupling to specific topics can steer knowledge generation and can be harnessed to apply an effective lever on BD conservation practices. As such, this measure could and probably should be used to a greater extent than is currently the case. Incentivising PAFP beneficial for BD conservation thus stays an expensive task, since the main factor for the use of generally considered unsustainable practices was identified as the lack of income, resulting in necessity for rationalisation with practices detrimental for BD levels in the Alps and in the worst case in complete abandonment of alpine pastures.

Concerning concrete bio-physical measures to increase plant species diversity on alpine pastures proposed was to optimise mowing times, generally stated later mowing times being beneficial for BD levels; while in the context of weed control, mowing times should be early enough to prevent problematic plants from seeding. This combination of factors requires for specific timeframes for mowing which presents a difficult problem for Älplers, as the correct timing is dependent on the weather and can change significantly. Influences of pasturing and pasture management have been measured and shown to be of importance for plant species diversity (Schneider et al., 2013), especially on lower located alps with more intensive production, making it a positive factor for BD conservation. Further complicating the matter, pasturing times and mowing times were considered by multiple Älplers as one of the more difficult tasks of PAFP using plots for grazing. The trend for professionalisation could prove beneficial in this case if adequate training and consultation can be provided. In general, professionalisation was equalised by most participants with rationalisation and increased economic output, while another sort of professionalisation could be conceived where sustainable practices and PAFP beneficial for BD are promoted actively through schools, training, extension services etc. if the economic levers in form of direct payments were supplied, compensating potential losses through more extensive practices used. In that case, professionalisation of PAFP can be a curse or a chance for BD conservation, which makes it ultimately a political decision about which direction the trend should develop. An idea to address this issue would be the creation of an online platform displaying growth stages of different plants together with guidelines for mowing dependent on altitudes in Switzerland. A decrease of Sömmerungszahlen and prohibition of silage production in the alpine areas was proposed by an Älpler, while this affects foremostly alpine farmers in valley areas considered Bergzone with not many effects on the Sömmerungsgebiet as Silage production is not practised on alps. This might prove difficult to be implemented as extensivity in the Sömmerungsgebiet was already considered an issue by multiple Externals. Interestingly, no Älpler in the sample stated such problems, rather describing the Sömmerungszahlen on their alps as being rather reasonably set and not expressing wishes to increase intensity of pasturing or only minimally so. However, most Älplers interviewed were from a region where local Externals assessed Sömmerungszahlen as suitable. This circumstance, as reported, is not everywhere the case, so such re-assessments of Sömmerungszahlen in either direction should be an integral part of future development of PAFP.

Control of invasive plant species was assessed very differently between the two groups, with Älplers stating – at least in Canton Fribourg – not many issues with such plants, while Externals stated a far greater concern for the future also in the context of CC impacts and global warming affecting higher altitude pastures. Literature also focuses on the topic of genetic diversity that is threatened through invasive species and Neobiota (Gatteln et al., 2017). This difference in perceived problems fits

beautifully into the description of the typical time delayed development from occurrence to explosive reproduction of invasive plant populations (Lachat et al., 2010), exemplifying that more measures and especially better communication to Älplers and farmers are necessary to limit the danger that invasive plant species exert on BD conservation and PAFP. Extending the monitoring and control measures enforced by the state could prove an effective measure against developments similar to Canton Tessin in the whole of Switzerland (Amacher et al., 2022; Wittenberg et al., 2006; Schwarz et al., 2016), albeit increased costs of creating more capacities with the local administrations. This point needs to be elaborated further and an economic calculation should determine in which areas more measures are necessary. The federal state could contribute by providing specific funds for tackling this issue if single Cantons or regions are slacking in the task. Priorities for funding and goals need to be formulated very specifically in that case, while still being delimited wide enough that allows adaptation for local contexts.

The increased spread of weeds on alpine pastures and encompassing problems with plant species diversity was thematised by all participants from both groups and is in line with scientific literature on the topic (Walter et al., 2013). New guidelines and improved weed management training were proposed mainly by participants from the group of Externals, stating a necessity to increase efficiency and effectiveness of weed management by more selective control measures and especially locally adapted solutions. The perception of species where weed control was differing between both groups and between participants inside the groups points to the strong notion of locality with weed control. One of the few consents that could be identified was that green-alders (*Alnus alnobetula*) were universally regarded having detrimental effects on BD conservation and pasture quality alike (Bühlmann et al., 2013). This concept is not new, as it was mentioned by Walter et al. in 2013 already, showing that implementation efforts were only partly successful, and revision of measures taken are necessary. Weed control and management was a topic widely discussed by participants from both groups interviewed, since it is currently a hot topic emerging from a recent focus of popular media reporting abundantly about agrichemicals (Struchen J. M., 2020; Alföldi T., 2009) and in this case herbicide use on alpine pastures. Literature also points to the connection of herbicide use and the depletion of seed supplies in the soil leading to a species-poor, nitrophilous, grass-dominated weed communities (Gabriel et al., 2006). The society was reported to take generally a strong negative stance on this topic, with one External even describing Älplers being afraid of media attention because of a perceived risk of being displayed negatively for the use of herbicides. Why is herbicide use on alpine pastures such a big issue for Swiss society, while its use in the lowlands is arguably less controversial? This can be explained by the common heritage properties of alps with the stereotype of them being sustainably managed in a pristine landscape (see *Introduction*). The sensitivity of this common symbol for identification leads, together with the perceived character of agrichemical use as unsustainable, to a strong rejection of such practices. Also, according to scientific literature, a ban of herbicides in the Alps would contribute to minimising dangers of contaminating water bodies in the context of the alps being the “Wasserschloss Europas”<sup>71</sup> (Fischer et al., 2014). Remarkably, most participants perceived herbicide use on alpine pastures as unnecessary, even though a majority of Älplers reported to use them occasionally or regularly. This does probably not represent common Älplers’ opinion but shows that a potential ban on herbicides can be considered a feasible political solution consolidating PAFP with society’s expectations and improving conservation in the Alps. At the same time, this regulation would not strain Älplers too much. However, a prohibition will most probably not be taken lightly, as many Älplers mentioned a negative stance on potential new restrictions concerning PAFP. These reservations can be seen as mostly abstract, as past restrictions issued were received relatively lightly in the case of prohibiting mineral fertiliser use, the limited use of concentrated feed in the

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<sup>71</sup> Translation – water castle of Europe

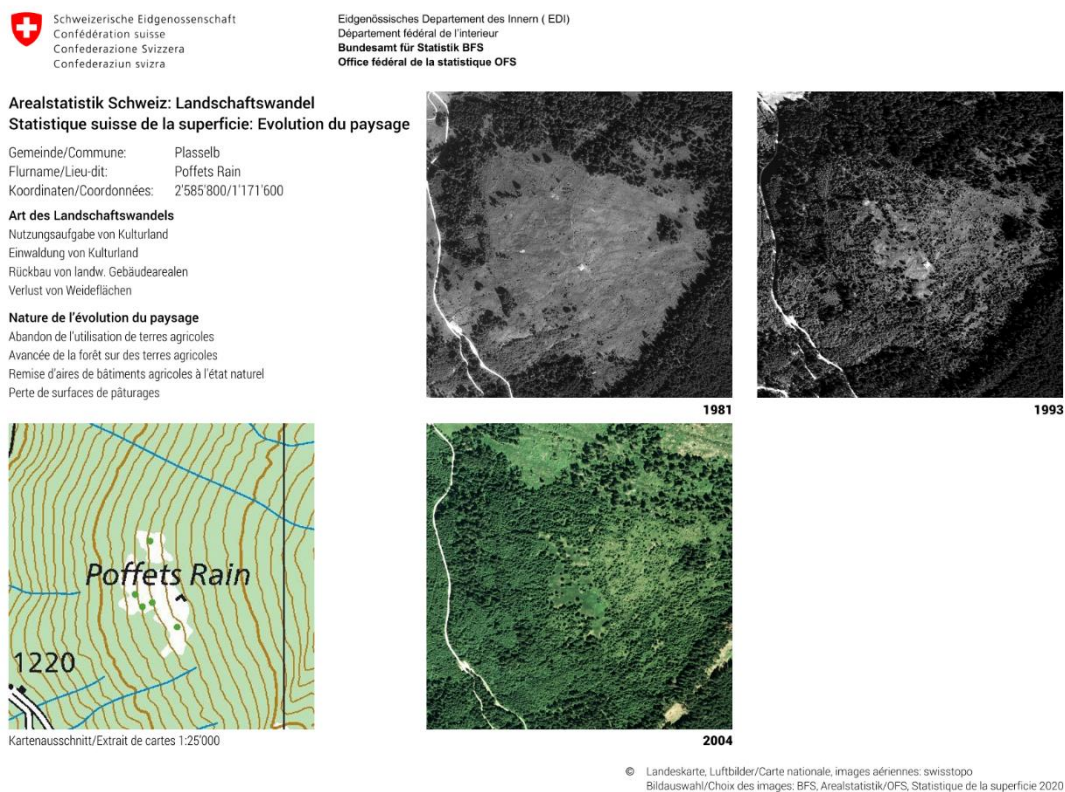
Sömmerungsgebiet and restricted Sömmerungszahlen on alps. Nevertheless, this circumstance albeit abstract shows the eroding trust in policymakers and the system encompassing scientific research by the Älpler community. A prohibition of herbicide use could be effectively implemented with slower processes and could be considered feasible since herbicide use is limited on most alps, making the transition to mechanical weed control relatively easy. New policies issued should aim at incentivising certain PAFP instead of others and, if care is taken to address potential future problems adequately, prohibitions can be considered unnecessary in many areas where unsustainable developments have not yet advanced to be considered essential or “conventional” in the Sömmerungsgebiet. Many Älplers were especially cynical about regulations introduced on the basis of scientific evidence, describing them as being known to Älplers for a long time and regarded common knowledge by alp managers. This circumstance was already thematised in other scientific research: “[...] so dass ich fürchte, hier nicht viel mehr als eine Fußnote zu ‚Zalp‘ liefern zu können und Hösli einen weiteren Beleg dafür zu liefern, dass Alp-Forscher im Wesentlichen Dinge ‚herausfinden, die andere Wissenschaftler bereits herausgefunden haben und Nichtwissenschaftler schon lange wussten“<sup>72</sup>(Schütz et al., 2010). In this context, concepts developed or adopted in the scientific community as “conservation science” and “agroecology” were seen by several Älplers as “urban” concepts or concepts that are removed from the reality. In their view, such concepts describe certain practices and ways of thinking that have been in place with PAFP for a long time and present nothing crucially new, rather displaying the gap between the social spheres and showing effectively the hypocrisy, arrogance and impracticality of theoretical discourses about practical topics as PAFP, which exemplifies the lack of communication between those social spheres. This danger of politics and scientific advice being perceived as lacking competence with its own policies and recommendations could be leading to decreasing trust amongst Älpler communities towards politicians’ and scientists’ competence regarding PAFP. In this context, policymakers and scientific advisory services need first to compare potential “new” insights or regulations with Älplers’ and farmers’ LEK to avoid eroding trust further.

Shrub encroachment heavily thematised by Externals was treated rather in a more relaxed manner by the sample of Älplers, all stating that they currently do not experience many problems with managed pastures concerning this issue. It takes a considerable amount of time to take care of such problems as shrub encroachment if small structures and field margins are conserved. The coupled direct payments were considered sufficient to pay for lost opportunity costs for conservation. Overall, Älplers stated that the problems arising from shrub encroachment have been well communicated and effectively taken care of in most cases, showing a successful problem-oriented implementation of management practices and giving an example of a success story of politics and science cooperating with the Älpler community in Canton Fribourg. Ongoing shrub encroachment was reported to be locally limited to abandoned pastures located below the tree line while those, at least in Canton Fribourg, are not numerous, thus not constituting a pressing issue. Future monitoring of results can provide a stable basis for controlling development and for a potential limitation of this issue. For example, remote sensing is already in use to map these developments (see Picture 3, p. 113), the extension of this practice showing great promise to fulfil aforementioned goals, as was also assessed by many scientists interviewed.

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<sup>72</sup> Translation – I am afraid in this case that I cannot add much more than a footnote to ‘ZALP’ and that I provide Hösli with another evidence that alp-researcher essentially ‘discover things that have already been discovered by other scientists and non-scientists knew since a long time’.





Picture 3: Landscape change – shrub and forest encroachment after pastures were abandoned; Source: Data:swisstopo, public.geo.admin.ch, Date of last access: 07.01.2023

### *Direct payments and biodiversity conservation*

Recent and current environmental policies' tendency was assessed by the External working for local administration to be developing into the right direction, exemplified by the Vernetzungsbeiträge (will be discussed further on in more detail, see *Discussion, direct payments and biodiversity conservation*). They are distinguished by a on-going funding throughout the year and covering the whole of Switzerland, thus displaying a constant and trans-boundary scheme, even though it not being applicable to the Sömmerungsgebiet but to the valley areas classified as different Bergzone areas. No External explicitly stated a lack of long-term schemes in Switzerland or complained about a short life of projects concerning BD conservation in the alpine area. While this circumstance is currently not perceived as important, it can in the future present a viable method of evolving BD conservation strategies of implementing successful projects on a bigger scale, although generally implementing conservation schemes is criticised for their ephemerality (Adams et al., 2019). The lack of result monitoring of shorter projects that will be discussed further (see *Discussion, Monitoring and impact monitoring*) can create a hindrance to this development.

Regarding conservation areas protection schemes, the contractual management in cooperation with Älplers was pointed out as a success. In cases when biotopes or more generally protected areas are located within the vicinity of alp areas the alp manager is required to take care of protection measures. Literature contrarily states a loss of quality of national biotopes, and with focus on the alpine area, a problem of shrub encroachment was identified to be a main factor (Gatteln et al., 2017). In this context

more and better management of alpine biotopes seems to be necessary. The individually negotiated contracts between the environmental institution formally responsible and the Älpler implementing protection measures were pointed out as a viable tool for successful protection, stressing that the negotiated agreements are the key to success, as both parties can profit from such an arrangement. With the contracts being arguably complicated in development, the individual assessment of location and input from Älplers' viewpoint ensure highly adapted conservation practices in place. Such negotiated contracts for measures in the context of landscaping (Vernetzungsbeiträge) exist already and were considered effective. As such, this concept of adapting measures to local contexts could be extended to other management practices, be it for conservation or for general PAFP. Due to the complicated process of assessing individual situations, a wider application is of questionable economic viability. But generally providing a legal framework that allows for locally adapted management practices being implemented could be taken up well with Älplers – especially if Älplers are given the opportunity for proactive action. The current legislative frame was partly described as too stringent. If precedents can show that Älplers can profit from such arrangement, it could be assumed that others follow suit. The power of such a concept would lie in its high flexibility regarding potential PAFP resulting in possible highly adapted solutions with inclusion of Älplers' LEK in the process and potentially its greater effectiveness. In the context of Vernetzungsprojekte, von Glasenapp & Thornton (2011) described these processes as “walking negotiation” and assessed their usefulness in particular for BD conservation as especially positive since LEK can be harnessed while scientific knowledge is disseminated, which also could be understood as ongoing supervised experimentation by Älplers using unique LEK. Vernetzungsprojekte were not only praised, but also assessed as having mixed effectiveness, while successful implementation with high quality measures was reported to be led always in cooperation of experts, a process described as very time-consuming (Jenny et al., 2018).

Generally, a reduction of bureaucratic efforts for Älplers would be met with a positive response if new regulations would be introduced, since the current bureaucratic workload is already considered too high (see also El Benni et al., 2022). In this case digitalisation of administrative processes and further consulting opportunities could be an effective measure to reduce this stressor on Älplers, albeit only if appropriate training is provided. One idea would be the coupling of those consultation events with further consultation about BD conservation and sustainable management practices in general, since the voluntary nature of such events and lacking participation were described as a reason for limited effectivity. With the notion of multiple Externalities that participation is increasing if Älplers perceive a monetary benefit from a voluntary consultation event, this effect could be harnessed by mixing topics in a manner that monetary benefits could function like an incentive (a bait). Whether such practices can be considered ethical lies outside the scope of this master thesis and should be discussed further and in doubt be decided depending on the given situation.

One main problem with BD conservation described by one scientist was that all other policies not directly aimed at BD conservation are potential sources for misaligned funding, creating high inefficiencies, which should be readapted. They were assessed as creating more damage than policies and funding aimed at BD conservation can repair. A study by Gubler et al. (2020) reported a total sum of 40 Bio. SFr/year of misaligned subventions and direct payments that harm BD directly and indirectly, while 1.1 Bio. SFr/year are invested into BD conservation programmes. This proposal for aligning other policies at BD conservation goals present a potentially enormous task as the changes implied could mean a complete rethinking of policy making as a whole, even though it would show arguably immense effectiveness – a change of paradigms. This proposal would be in line with the goals for BD conservation set in Switzerland, where one specific aim was to include all economic sectors (UNEP, 2010) (see also *Introduction, Biodiversity conservation in Switzerland*), as well as with scientific publications about BD (Bender & Haller, 2015; Lachat et al., 2010) and with the most recent agreement

reached in the COP15 conference (CBD, 2022). Before dismissing this thought too quickly as a daydream and too ambitious, a notion from another scientist should be taken into account who mentioned the trend in his organisation to reconceptualise good BD conservation away from a strictly conservationist point of view towards expanding the concept of diversity also to the anthropogenic context. From much comes much, as a motto [E5]. Taking this into consideration the proposal to include BD conservation into all policy goals would be a much smaller and more feasible step, as the creation of diverse activity can be considered beneficial. The real question would be where exactly to find the balance also in terms of spatial distribution issues, leading again to the almost philosophical question of land sharing vs. land sparing. This question, still unresolved in scientific literature (e.g. Sachot et al., 2003; Bouyer et al., 2014, Lécuyer et al., 2022), would be resolved – as is so often the case in that context – by a mix of both ideas, while the composition theoretically could be determined by the formerly specified goals. Generally, it has to be noted that the trend seems to develop in direction of land sparing with strictly delimited protected areas and new ambitious goals to extend protected land areas to 30 % of the total area by 2030 (Convention on Biological Diversity, 2022). In contrast, conservation of BD in the Alps which can be seen in big parts of a cultured landscape would technically be considered land sharing and conservation through extensive agricultural practices. Critically viewed, this concept would also enable the possibility of the status-quo being declared sustainable, if goals are not set clear enough, while the current state was considered by most Externals unsustainable with change necessary. Also the historical irony shall be noted that the current diversity of PAFP in the Swiss Alps is a product of a long period of limited state involvement due to the remoteness of the locations, whereas today this laissez-faire attitude can be considered insensible due to technological possibilities that drive environmental deterioration. This would result in the necessity of a state controlled and incentivised diversity – a monumental task, albeit Switzerland’s decentralised and highly democratic governance system, which is curiously regarded as a living tradition (Camp & Washington, 2018), must be regarded as one of the best suited for this task. Regarding the clear quantifiable goals set (Walter et al., 2013) and new developments for ever increasing attention on BD conservation the step of making it a common policy seems overdue. Nevertheless, it can be seen as a change of paradigms in policy, which do not come easy (Hall P., 1993), making it theoretically a very elegant and viable way for BD conservation, but at the same time an improbable development for the near future – especially considering the predominantly conservative political landscape in Switzerland (Aerni P., 2009). In this context the proposed conservation of the “traditional Älpler” [Ä2] can be seen as a way to ensure diversity through PAFP, since with limited professionalisation and relying mainly on LEK, PAFP used would be a lot more heterogeneous in comparison to PAFP based on theoretical, book or school knowledge. This diversity is currently still present to a wide degree as was reported by Externals and literature (Bundesamt für Kultur – BAK, 2022). But considering the trend of professionalisation and ever more limiting regulations, it can be expected that PAFP will become more uniform in future. Results from a study conducted by Marini et al. (2011) in the Italian Alps showed that traditional farming systems are more environmentally friendly than modern, larger systems and pointed at a possible irreversibility of the trend of traditional farming declining as this was “closely linked to a broader process of social transformation”. Interestingly, the notion of von Glasenapp & Thornton (2011) that more traditional PAFP could be observed rather in connection to “part-time farmers”, is present in this sample as well. Putting it into context with professionalisation of PAFP, it can be stated that this ongoing trend most likely will result in further losses of TEK, whereas LEK will be reshaped by discourses driven by economic rationality.

*Mechanisms of agri-environmental schemes*

Action-oriented schemes widely in place are assessed as of limited viability, because ever further refinement of those would lead to an enormously increased bureaucratic effort which was seen already as over-developed by both groups. Externals assessed Älplers' readiness to deal with more restrictive measures as low due to even less freedom in management choices regarding PAFP, leading to a potential dissatisfaction with state policies and increasing the level of non-compliance, making control more necessary in the future. Generally, action-oriented schemes are measured having lower cost-effectiveness compared to result-oriented programmes (Mack et al., 2020). Concretely, the estimated return on investments for result-based schemes was proven to be higher than action-based equivalents in Switzerland (Wuepper & Huber, 2022). It was pointed out explicitly that a further drawback with all payment schemes is adverse selection by extensive farmers usually selecting schemes that lead to little changes in farming practices (e.g. free money) (Jenny et al., 2018; Mack et al., 2020). This observation fits well with the stated acceptance of BFF2 payments where little to no changes in PAFP were necessary to be eligible. Despite this drawback, the effectivity of BFF2 payments were proven for Canton Tessin (Ravetto Enri et al., 2020). Generally, the development of result-oriented payments, which heavily rely on harnessing LEK, was evaluated as positive by both groups: Älplers, because they have more freedom in reaching those goals; and Externals, stating that with well-defined goals a higher effectivity of this payments scheme compared to action-oriented payments. The development towards this type of payments was seen by most Externals as a step towards future improvements for BD conservation efforts, but not without problems, as specific goals need to be clearly defined and monitoring capacity of those goals need to be extended creating a burden on Swiss finances and thus the tax payer. Furthermore, result-based payments' effectiveness was found out to heavily rely on farmers' knowledge and competences (Mack et al., 2020). In this context the possible introduction and extension of this type of payment scheme would encompass a thorough assessment of existing knowledge and incentivising the extension of it to come to efficiently designed and well received programmes. The most important financial aspect for BD conservation on alps acknowledged by both groups was the extension of direct payments introduced in 2013 for PAFP. The programme can be considered a success, proving the recommendations made by Lachat et al. in 2010 to be ultimately correct. Älplers stated explicitly that becoming eligible for those payments required no or only minor changes in management. This assessment was repeated by multiple Externals, making those result-oriented BFF2 direct payments essentially a covered subvention for PAFP by the Swiss state. This can be viewed as a good trick to conserve the current PAFP in place, while at the same time not getting into trouble with international trade organisations like the WTO that view market distorting subventions unfavourably (WTO, 2022). Apart from that, the distorting effects can be regarded as negligible compared to other economic sectors and probably not having big impacts regarding the whole economy of Switzerland and of its trading partners. Following the described circumstance, this scheme can however hardly be called result-based if results were mostly present before the introduction. More specifically, one proposal was to introduce higher standards to the existing result-oriented payments, making more adaptations of PAFP necessary, which must be balanced carefully as PAFP are reportedly changing slowly and a stepwise introduction of stricter goals over a longer time frame seems to be the most suitable course of action to not alienate Älplers. At the same time this offers a good testbed for management practices as Älplers can experiment. Dependent on the outcomes, more effective guidelines for PAFP drawing on LEK can be established, saving capacities in the scientific community to implement theoretical knowledge, as well as skirting problems associated with regulations and restrictions. This current stated lack of implementing scientific knowledge into practice was considered being mostly a result of lacking communication between the social spheres of science, politics, society and agriculture. One improvement of result-oriented payments could be

mandatory training sessions for Älplers or farmers eligibility. This measure would increase participation in agricultural extension and at the same time provide a social platform for information exchange regarding PAFP. As discussed before, mandatory training would probably not be well received, but maybe outweighed by the perceived financial benefit that can be gained implicitly. A similar concept was recommended in the frame of AP22+<sup>73</sup> (Zurbrügg C., 2020).

### *Trust in politics and science through communication*

Agricultural policy was requested to be reliable and trustworthy by all Älplers, developing long term plans to give both Älplers and farmers a specific perspective preparing for slow and long-term developments instead of the uncertainty currently perceived. This slow change was seen universally as essential for PAFP and farming practices in general due to the inherently high resilience of farming and especially forestry – thus making trust one of the most crucial factors for sustainable development policies. Science here was explicitly mentioned as a non-trustworthy partner for PAFP and farming in general too, stemming from the perceived imbalance of responsibilities between theoretical knowledge generation and dissemination and actual implementation. Here, it was proposed by interviewees from both groups that the hierarchy should be reduced and a more horizontal level of cooperation between agriculture, politics and science be introduced. The necessity for introducing this change can be seen coming from the political and scientific spheres, as they were often described as taking an arrogant stance towards Älplers and farmers in general and as the more powerful parties. The physical presence of representatives of politics, agricultural extension and scientists was also stressed in literature (Fabian et al., 2019) as a crucial trust generating factor. Ever more efforts for digitalisation in a process driven by rationalisation can be seen as critical in this case, if trust generating actions are replaced by remote offers, which have been proven to be perceived as a less effective source of information concerning practical implementation efforts (Fabian et al., 2019). This trend for more remote working and less physical presence should be actively steered against in this case, even though it would mean higher costs. Especially the stated inviolability of political representatives in the context of agricultural policies should be addressed, as trust in politics can be considered already low and further erosion should at all costs be avoided, considering that agricultural policies were judged by all participants as the most important factor for changes in PAFP. The case of loss of trust during the Covid-19 pandemic serves as a fitting instance thereof (e.g. Büssing et al., 2022; Broadbent J., 2020). Physical presence could also effectively raise interest in BD conservation topics, as one scientist reported how an Älpler got motivated after being shown a rare birds' nest on his pastures. Birrer S. (2018) and Chevillat et al. (2017) mention that with personal engagement by scientists and extension workers giving explanations and sharing experiences, implementation efforts generally exceeded set goals. This hands-on approach can be considered as a very viable method in general with Älplers and farmers alike, since abstract knowledge is connotated with uselessness in these very practical and experience-oriented professions. Guntern et al. (2020) mention that the seven most important motivations with farmers for the implementation of ecological compensation areas are (in importance descending order): sensibility, integrability, joy, environmental balance, direct payments, improved products sales and improved image.

As discussed before, the wider introduction and acknowledgment of the concept of LEK alongside scientific knowledge could provide a viable measure to improve those perceived hierarchies and power

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<sup>73</sup> Agrarpolitik 2022+ Agricultural policies 2022+ in this case a feasibility analysis of future BD conservation schemes for agriculture that was conducted by Agridea in the frame of AP22+.

imbalances, while generally a wider application of PP has the potential of consolidating power imbalances as was shown in many cases (e.g. Cuéllar-Padilla & Calle-Collado, 2011; Oteros-Rozas et al., 2015). This change towards more horizontal inclusion of agriculture in political and scientific discourses can be regarded as very difficult as it would demand members of the currently perceived higher hierarchies to distribute power towards Älplers and farmers. In a study from the French Alps it was concluded that building capacities to empower local stakeholders is crucial for future adaptation strategies (Lavorel et al., 2019). Many Externals both with scientific and political background perceived Älplers' LEK as lacking and in some perspectives showed great dissatisfaction with experienced cooperation. In this context many Externals stated a perceived disinterest of Älplers towards the topic BD conservation on a broader basis, though admitting that interest and great knowledge in isolated cases is present. During the interviews, all Älplers stated an interest in the topic and assessed it as very important for future development of PAFP, albeit with a varying amount of LEK. This discrepancy between many Externals' perceptions and Älplers stating the opposite could be explained by a potential bias resulting from sampling techniques used for the Älplers, which will be discussed later (see *Discussion, Limitations of this study*). It could also be an effect of miscommunication, resulting in unsuccessful cooperation and implementation attempts through flawed scientific and political communication efforts. The assessment of that case is not a trivial topic and cannot be conducted to a satisfying degree with the data collected. Nevertheless, through the stated lack of communication, information dissemination and consultation provided by political and scientific actors – in combination with the stated lack of monitoring results – it can be assumed that the latter case is present to a varying degree dependent on the situation and as such should be addressed to a wider extent in future cooperation efforts.

This problem can be seen as structural, as scientific and LEK does not fit well in the current system. Experienced based LEK of Älplers and specific frames for a consolidation of these two types of knowledge should be created starting with a structured assessment of LEK and TEK amongst Älplers in a broader context of PAFP. During the interviews, many scientists showed a misunderstanding of the term LEK and also of the suggested use of experience knowledge, leading to the proposal of a more widespread introduction of this concept towards current scientific and political circles. This lack of awareness towards LEK can possibly be explained by the historic evolution of rural development in Europe and environmental protection in agricultural areas in particular. The concept of rural development and conservation science started as a concept in non-industrialised nations and found its way as a mainstream topic discussed publicly only after the shift towards multifunctional roles of agriculture and rural areas (Elands & Wiersum, 2001). As such, rural development was equal with agricultural development, and most aspects apart from production related ones were neglected. Effects of this circumstance can be seen today in most European nations, where institutions such as schools, hospitals, public transport etc. have been eroded and are still eroding in rural areas. Even with the development of rurality exceeding its limits formerly set by agricultural production, the central European states having an effective and sufficiently financed state apparatus was not necessary dependent on inputs from LEK, as it had sufficient inputs from scientific sources. A lack of scientific viability for sustainable rural development began to get scientifically publicised since the late 1990s in the case of agriculture with the mad cows' disease crisis being a trigger point (e.g. Keown-McMullan C., 1997) to shift attention. While scientific progress is nowadays often associated with a stronger focus on conservation science, Älplers' view on scientific and resulting technological progress in this case would argue that science made conservation necessary in the first place, as problems seen today are a result of past implementation efforts of scientific knowledge and the Älplers were the originally sustainable managers 100 years ago. To what extent this is really the case is debateable, as it is an intertwined system in constant development where any clear single responsibilities can hardly be isolated. Nevertheless, in this case Swiss politics and sciences regarding agriculture and PAFP

specifically could get new inspiration from harnessing LEK systematically in Switzerland and apply concepts already developed in other regions like Latin America and Africa for example (e.g. Anadón et al., 2009; Sánchez-Carnero et al., 2016; Abrar et al., 2021).

One specific limiting factor identified by many Älplers was the language used in scientific publication being not understandable to “regular” people as well as over-saturation of scientific publications concerning PAFP with not enough focus on pressing issues. During the interviews with Älpler participants, this circumstance became apparent, as interviewees often would not understand scientific terms even though they were knowledgeable about the topic, e.g. in the case of the German words “Diversität” which could easily be replaced with the synonym “Vielfalt”<sup>74</sup> and the latter always being understood. This notion by Älplers shows a discrepancy of not just communication efforts in itself but also differing goals of scientific work on PAFP and Älplers interest, which would be mainly management related and economic topics. As such, it shows a necessity for scientific communication to focus dissemination efforts on research with practical applicability and concentration on easy language with concrete recommendations and goals. By the style of writing requested in scientific publications a certain irony can be identified with topics aimed at very practical, implementation-oriented topics such as conservation science and agronomy. The question whether a marginal gain in accuracy is worth sacrificing a potential readership amongst the non-scientific community in practical subjects should be discussed more extensively in future, as a simplified style could serve goals of scientific communication well while still being accurate enough for scientific purposes (Sundin et al., 2018). Especially in conservation sciences the question about where scientific work is aimed at is recently in hotter debate: public efforts to enable science or science aimed for public use? If the definition of purposes in conservation sciences are drawn from a view through a post-normal lens (Grove, 1996), a recommendation with a clear aim for the latter can be made, pointing towards the use of simpler language. But the scientific sphere being shaped by strange and sometimes cynical streams [e.g. publications about PP methodology hidden behind paywalls on the internet (e.g. Chambers, 1994)] cannot be expected to change anytime soon, meaning more effort has to be focused on popular scientific outlets in media channels.

#### *Narratives: a rift in society and its implications for biodiversity conservation*

Several Externals stressed the lack of common goals explicitly hindering effective cooperation. Such goals could be determined through inclusive processes taking a step towards Älplers perspective, reducing mistrust and potentially harnessing LEK during the process. During the interviews it became obvious while comparing the two groups of participants that misunderstandings on both sides exist in a wide range which has already led to irrational grudges being held in some cases and which should get resolved by increased efforts and self-reflexivity mainly in the scientific community. One hindering factor noticed was the partly very strong heterogeneity of opinions on conservation topics between the scientific individuals and what gets actually communicated through media channels leading to unclear messages delivered. A greater cooperation between science, institutions and politics could lead to more coordination of information dissemination efforts and less confusion amongst Älplers. Agricultural media outlets were interestingly not discussed much by Externals, but it was noted that they hold a strong conservative stance (Péclat & Puddu, 2017; Alföldi & Tutkun-Tikir, 2007; Aerni P., 2009), to a point that it sets the frame for the narrative and has a reportedly negative influence on

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<sup>74</sup> Both words mean diversity with “Diversität” being the scientific term and “Vielfalt” the term with more colloquial connotation that could also be translated as “variety” or “range”.

adoption of sustainable PAFP. Media in this case at the same time representing mainstream perceptions in farmers and Äplers communities as well as exerting reinforcing effects on such opinions display a dynamic recently being discussed in the context of social-media algorithms (Kaakinen et al., 2020; Vastermann P. L., 2005). Such effects should heavily be considered in future communication efforts to reduce the danger of creating division in social groups in this case “conventional” Äplers and to alleviate potentially more conflicting relations between social spheres. The described hermeneutics present in Swiss society making PAFP more resilient towards more abrupt changes can be seen shifting in this case, as using agrichemicals, slurry and heavy machinery to a limited extent is considered conventional PAFP. With these cases, actors should pay attention that those hermeneutics are not fortified in future, as it represents practices neither explicitly wanted in society nor by scientists or by Äplers interviewed, as those practices were rather seen as a necessary evil to accommodate to lower production costs and increase yields – in short, to market demands (the infamous “invisible hand” taking control). This process of shifting perceptions regarding PAFP seemed to be especially present with some Äplers stating “[...] we do it (PAFP) since generations exactly the same [...]”[Ä1]. At the same time they reported major changes in management practices, living situation, infrastructure, value chains etc. The Alps as a type of time-capsule with traditions being kept alive and the archetype of a scruffy but plucky Äpler enduring all changes where the harsh environment puts its strict limitations to developments exerted from Swiss society is obviously a stereotype. This is a picture that was historically created by romanticising discourses about the Alps by urban elites outside of the region (Stremlow M., 1998; see also *Introduction, Socio-cultural contexts for pastoral alpine farming practices*). This contradiction seems to be stemming from narratives used and nurtured in agricultural media for identity finding (Bendix R., 1989) as well as from the myth of the never changing Alps in popular media (Wolff E., 2010); it should be clearly pointed out that generally most PAFP have changed quite drastically, less so than agriculture in the lowlands of Switzerland, but still to an amount that current alp management in most cases does not show many similarities, apart from the transhumant pastoral character of the animal movements and the infamous cow-bells, to its traditions it is stemming from – the stereotype which is extensively used mainly for marketing purposes. Rather than actually living and showing tradition, in many cases it can be considered a show of tradition, be it to show to foreigners or for identity finding purposes. The principal stance against new restrictive policies has to be evaluated with the perceived historic dimension that sustainable PAFP were created without much interference of politics (Netting R., 1981), that development without political constraints was always limited by socio-economic constraints and that those and the encompassing possibilities for development have changed completely, which is in this case gladly forgotten by many Äplers interviewed. If discussed in the context of the theory of institutional memory (von Glasenapp & Thornton, 2011, and Niederer 1996), a dominant position can be seen in the role of “conventional” agricultural groups and stakeholders lobbying and using media to exert control over future changes of PAFP and farming in general (also compare to Mach et al., 2021). This perception of the alpine area can be considered potentially harmful, as necessity for active protection and conservation can be denied, in that context not recognising past efforts and the role of conservation science and practices in place: “Die bisher ergriffenen Massnahmen zur Erhaltung und Förderung der Biodiversität in der Schweiz haben dazu beigetragen, dass die Lage der biologischen Vielfalt nicht noch viel schlechter ist.”<sup>75</sup>(Fischer et al., 2014) Between Sennentuntschi and Heidi (see also *Introduction, Socio-cultural contexts for pastoral alpine farming practices*), PAFP in the Swiss alps have rarely been portrayed differently in popular media with science having the arguably difficult task of creating a third narrative, certainly more boring and neither black nor white in its content between striking stories and myths Äplers and the Alps are associated with in broader society. Even during the data collection those

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<sup>75</sup> Translation - The measures taken so far to conserve and promote biodiversity in Switzerland have helped to ensure that the biodiversity situation is not much worse.



stereotypes were present while interviewing some participants from both groups. The common impression of the arrogant and irresponsible scientist only possessing theoretical knowledge being derived from Älplers' LEK was certainly as much present as the typical description of an ignorant and shrewd Älpler who is generally hostile to everything unknown. While all participants relativized those descriptions as a cliché, they were nevertheless considered important enough to be mentioned in the first place showing a certain underlying bias from both sides.

As such, popular agricultural media outlets should be taken more into account and could possibly be harnessed by BD conservationists, albeit this might prove to be a difficult task. In this context, interviewees from both groups expressed the wish that the two failed initiatives on farming practices in Switzerland be repeated with a stronger conservationist viewpoint displayed by the media, as for the initial vote media was perceived strongly influenced by big industrial interests such as an article in "agrarheute" (Lehmann N., 2021). These initiatives would be revolutionary for BD conservation regarding farming practices in Switzerland, and while the one initiative requesting direct payments only being given to basically organic farming practices is in the range of feasible solutions incentivising organic farming and making organic products cheaper, non-organic products would rise in price. The second initiative trying to prohibit agrichemical use and import of foodstuffs treated with agrichemicals seems illusionary in the current situation. If initiatives are repeated, success is less than likely, given the strong lobbying power expressing industry interests as well as a negative sentiment in society towards higher food prices (Rudolph et al., 2020). Initiatives could reduce goals and try to work in smaller steps, which seems in view of the status-quo to be a more resilient solution in the long term, as changes in farming practices usually cannot be forced quickly. It has to be noted that even if both initiatives should be successful, the resulting food prices could easily be skirted by the Swiss society in simply going shopping in the surrounding EU countries, thus possibly harming the Swiss retail economy. Overall, a slower step-by-step process of introducing stricter legislation on agrichemicals seems the more viable way, as is usually recommended in political sciences (Daugbjerg & Swinbank, 2016), leaving time to adapt and adjust other policies if necessary and reducing the danger of a shock to agriculture and society while simultaneously ensuring farming practices beneficial for BD conservation with high acceptance in society and farmers alike in Switzerland.

Scientists stated that destruction of habitats and ecosystem is a relatively fast process not necessarily stemming from bad intentions but rather carelessness and unawareness of impacts anthropogenic actions can have, while restoration takes time and is considered generally more complicated (and more expensive) than pre-emptive conservation, showing the necessity of firstly acting carefully, secondly acting fast if necessary and thirdly the necessity to increase understanding and awareness of actions which are potentially implicitly impacting BD in the alpine area. While a return to past PAFP is arguably not wanted by most Älplers and members of society alike and wouldn't display a sustainable future for PAFP, it dismisses the argument that meddling from the state or scientific community is unnecessary for environmental and BD protection as was perceived by multiple Älplers. While it is undoubtedly true that past PAFP have conserved the environment in the current state for a long time, the creeping changes towards unsustainable industrial agricultural practices is also currently undeniable in the alpine area (Gatteln et al., 2017; Fischer et al., 2014; ), presenting potential problems arising that should rather be avoided – a lesson learned from the intensive agriculture in the lowlands of Switzerland. In this context most scientists noted that they perceived the situation currently as good, as it is due to protective measures in place for a long time. Interestingly, the consensus in literature is rather negative, and especially lower located alps were described displaying a similar development as the central plateau (Fischer et al., 2014). The exact same narrative was used by two External scientists interviewed [E2, E4] and can be put into context of the notion by another scientist [E5] stating intensification is usually happening as soon as it becomes economically viable. This discrepancy in

perception of where responsibilities for the current state lie displays a problem for future conservation efforts, as it provides a basis for misunderstandings to continue. A thorough assessment of past impacting factors and communication of those can potentially provide a more solid foundation for BD conservation efforts in future. The aim for acknowledgment of the importance for BD conservation through the combination of sustainable PAFP, scientific conservation research and policy implementations could provide a good consolidation strategy between those social spheres. The past successful cooperation efforts most precisely lead to the perceived (partial) success of protecting BD in alpine agriculture, while future efforts for conservation were assessed to likely intensify to counter the intensification of PAFP happening at the moment.

The fact that Älplers perceive themselves as scapegoats for environmental problems was acknowledged by multiple Externalists too, leading to a perceived necessity to shift more attention of environmental conservation towards urban populations. The stated general wastefulness of society with carbon-based energy sources would suit this perspective well, as especially Älplers with less intensive production methods are to a much lesser extent responsible for those. The reduction of CO<sup>2</sup> emissions was also proposed in literature as a measure against global CC and implicitly for BD conservation suffering from CC impacts, albeit with a negative assessment of meeting goals for reduction of greenhouse gases (Lachat et al., 2010). This frustration can be exemplified by the fact that not a single Externalist and not many Älplers mentioned a necessity for CO<sup>2</sup> reduction at all, displaying a certain resignation of this topic and rather concentrating efforts on CC adaptation strategies. Shifting focus on light and noise pollution issues could also help this cause while broadening the range of BD conservation, creating more awareness in the urban population for their own responsibilities. That necessity for action with these topics is present and is discussed in literature (Gatteln et al., 2017). Developing this perspective further, an awareness of positive effects on BD conservation through extensive agriculture, could be promoted creating a more differentiated view in urban society on rural topics and vice versa, while shifting the perceived blame and responsibility more towards the urban population.

### *Monitoring and impact monitoring*

Monitoring impacts<sup>76</sup> on projects and schemes for implementing scientific research into practice in the context of PAFP was reported to be lacking in Switzerland, as funding is foremostly used in implementation and no or not enough specified funding is reserved for monitoring purposes. This issue is hardly an isolated case but rather a wide-spread problem perceived in the whole area of environmental protection and rural development (Kleijn & Sutherland, 2003; Lindenmayer et al., 2011), presenting a problem in communication efforts as presumed successful results cannot effectively be communicated to affiliated social spheres, thus creating a lack of understanding resulting in unawareness of responsibilities of certain successes achieved. As was discussed before, this can lead to uneven baselines for following implementation strategies and thus can be considered a further reaching problem rather than being an issue isolated to the scientific or political dimension. In terms of long term planning, this circumstance presents even more issues, as the continuous process of developing effective implementation strategies, learning from past mistakes and building on past successes can be eroded leading to the potential danger of repeating mistakes or letting successful strategies be potentially forgotten or undervalued. The BD monitoring programmes in place were generally assessed very positively but could naturally be extended – especially in regards of insect

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<sup>76</sup> For the Swiss readers: in this case the term monitoring would be translated to “Wirkungskontrolle”

monitoring that has become a hot-topic (Homburg et al., 2019) in central Europe since the release of the study by Hallmann et al. (2017) and the stated advantage of usability of insect diversity for extrapolations on BD. In this case, the creation of a more focused programme for insect monitoring seems to be an obvious development for the near future, as Swiss literature states clearly a lack of focus on this class of species (Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation – UVEK, 2019). Moths and fireflies were mentioned as a particularly interesting group for monitoring, while generally the continuation of current monitoring was assessed as the most important point. This consistency generates naturally the most interesting and representable data with species diversity monitoring, as population number changes happen usually slowly. The stated lack of monitoring for stagnant waters in the alpine area comes as surprising as 100 % of this habitat type was assessed in the past as endangered (Fischer et al., 2014), and action regarding this habitat seems to be a most pressing issue. In this case, an extension or change of existing monitoring schemes was not seen as necessary by any scientist but would be taken well if additional funds exist and those funds are not deducted anywhere where they are esteemed more important for BD conservation efforts. Swiss BD monitoring programmes were described by participants and literature as very advanced and pioneering in some respects (Fischer et al., 2014), but improvements are always possible as it was shown.

An extension of citizen science was interestingly dismissed by many Externalists partly or completely, since reported drawbacks were described as hard to overcome. Examples of successful application with species monitoring do exist, as was already mentioned, with the long-term insect monitoring by “hobby scientists” (Hallmann et al., 2017). The methodology got criticised as being not consistent enough, but the data recorded in the course of 30 years was of such strong significance that it outweighed the bias, also providing a good argument for implementing long-term monitoring projects. This shows clearly that citizen science can effectively be used for BD conservation purposes with projects where methodology for data collection can be highly simplified, an extensive data collection is necessary and where a long time-span is of importance, both characteristics in which “classic” science is, with the increased rationalisation of the academic environment, decreasing in capabilities. As such, it can be seen as a chance to get additional valuable data sets that would otherwise be unobtainable rather than replacing existing scientific monitoring practices. But also with classic evidence based scientific methods biased samples have proven their usefulness. In a study conducted in the French Alps modelling maximum entropy to predicting spatial distribution of two owl species performed well despite biased sampling (heterogeneity of reliability of bird located based on visual and eared contacts), which can be useful for decision making in habitat protection (Redon & Luque, 2011). As well as the aforementioned (see also *Introduction, State of the art*) study about turtle habitat suitability using LEK as sampling has proven its scientific usability (Sánchez-Carnero et al., 2015). In a South-African study citizen science was assessed as a useful factor in early warning systems in the context of BD conservation in close cooperation with scientific and conservation management (Barnard et al., 2017). Citizen science has proven its value worldwide (Chandler et al., 2017) with benefits and drawbacks being well known and discussed, also in Switzerland in case of the bird watchers (Vogelwarte), leaving only one question: why not expand on it?

*Socio-cultural aspects in recent developments and its potential impacts on future developments*

Communication in society about agricultural and conservation topics was identified by all groups as one major factor that has to be improved for future effective conservation efforts of PAFP and BD in general, with tax money being the main factor to conserve the tradition of alpine farming [E6]: “[...] but also something like subsidies, we are totally dependent on the state, if you want, on tax money. I think both jobs (Äpler and artists) wouldn’t exist if there wouldn’t be a society that says: ‘ok we are ready to subsidies you with our money’ [...]”. The currently mostly positive image of PAFP in Swiss society was considered by participants from both groups as an important factor for the continuation of those, so that this positive image has to be conserved for the future development of alpine agriculture and the view of society has to be taken into account when deciding in which way development should continue. A key point that needs to be better communicated to society mentioned by multiple Externals is that PAFP and farming in general can be very positive for environmental conservation and especially BD conservation if locally adapted sustainable practices are used. A limitation to this was reported to be the taxpayers’ (in this case the urban society) expectation for tidy landscapes (von Glasenapp & Thornton, 2011). As to defining the right practices, no consensus could be seen in any group interviewed – apart from extensivity, a waiver of agrichemicals and desist from the use of heavy machinery like mulchers. If one consensus could be isolated, it would be the diversity of different practices often mentioned by participants from both groups as being beneficial for high BD levels. In this context the trend for professionalisation and specialisation can be seen as very critical, as it shows a reduction of diverse practices, which would include inefficiency and also unsuitable management on a smaller scale. Along this line, if the state wants to incentivise diverse PAFP, then a concentration on result-oriented schemes and negotiated contracts in the context of BD conservation should be taken, as these schemes allow for wider liberties of PAFP in contrast to action-oriented schemes and mandatory measures. Feasibility and advantages and disadvantages were already discussed (see *Discussion, Mechanisms of agri-environmental schemes*).

Aesthetic preferences of members of the Swiss society living in the lowlands were stated in literature favouring diverse landscapes with many structural elements, so generally landscapes are considered beneficial for BD (Lindemann-Matthies et al., 2010). Contrary to that, most interviewees stated that this circumstance of beauty standards, that were reported clashing with landscapes created through extensive PAFP, needs to be explained better to the part of Swiss society that is unaffiliated with agriculture, generally the urban population. This disparity in perception might stem from different aesthetic preferences being present in members of the Swiss society from the lowlands and those from the alpine areas – a topic that should be further researched. This was seen as critical as the Alps and PAFP are considered to be one of the most important topic for identification in Swiss society (Bundesamt für Kultur – BAK, 2022; Beyeler et al., 2022), and a current trend was stated that, with increasing awareness of environmental conservation, a more critical view is developing towards current PAFP with a simultaneous disengagement of the urban population, with nature leading to increased misunderstandings between the groups of stake or rightholders. This identification of the Swiss society (Bundesamt für Kultur – BAK, 2022) with the Alps, the alps and PAFP leads to them all being rightholders subjectively, as the mountains and the practices are considered a cultural heritage (see also *Introduction, Socio-cultural contexts for pastoral alpine farming practices*), displaying a common good accessible and inherently possessed by everyone, making ultimately everyone in Swiss society a rightholder. The alps as a place of work and living were described in literature as well as a place of longing for the Swiss population explicitly: “Das Interesse an Alp, meine ich, ist in der

Bevölkerung da, weil es doch so eine Ursehnsucht nach der Südseeinsel ist.”<sup>77</sup> (Hösli G., as cited in Schütz M., 2010). This situation can be described as a potential base for future conflicts, as Älplers generally mentioned a very high connectedness to the surrounding nature, while conservation topics were mostly seen in a management related manner leading to potentially two different views in society of BD conservation and how it should look like. But the common interest could also serve as a future base of understanding if different views can be communicated and consolidated, creating a very strong coalition for implementing BD conservation measures. Precisely this line of reasoning was recommended by Pachoud et al. (2019) in a study about perceptions of ecosystem service provision in the eastern Italian Alps.

This development of Älplers losing control over their own management practices was connected to feeling less joy in this occupation, potentially leading to issues with abandonments of alps, as income is very low and Älplers reportedly do not want to take up more side incomes through tourism or a second or third job. The perceived undervaluation of Älplers’ work, as was stated, can be put into context that society does not take only the alpine environment as granted (as was discussed before, see *Discussion, Narratives: a rift in society and its implications for biodiversity conservation*) but also the work of Älplers and PAFP, as well as farmers in the lowlands, resulting in a potentially conflictive relationship between those spheres in society. The stated joy of working in this environment was proposed by one Älpler as a point that communication to society should focus on more, as a broader awareness in society of nature supplying people with joyous feelings can lead to a more respectful behaviour and generally more sustainable decisions concerning environmental protection. While the joy of being in nature is felt by a broad majority, the conscious awareness of the individual behaviours influencing this surrounding might be lacking, as the Alps can be seen as a standard that was always and will always be present in the current way, which is clearly not the case. This rather subjective matter could be communicated relatively easily and connected to BD conservation practices and efforts to raise acceptance in society in general and Älplers/farmers alike. In this context, future policies for professionalisation of Älplers can be seen critically as it goes against the background of the perceived sensual character of PAFP. Multiple Externalists stated that the question of what kind of Alps and alps the Swiss society wishes for the future is a political decision, be it the professionalised, more rational development similar to farming in the flat areas or a more traditional style, arguably better for BD conservation and less efficient making more investments in PAFP necessary or a compromise in between. The joy of living and working in the Alps was seen by all Älplers as one of the main motivations to take up PAFP, be it keeping the alp in the family or coming from another background. Often while talking about motivations to work as an Älpler an almost mystical sense of being driven by an intrinsic force was described as the reason; connecting PAFP to sensuality where rationality is of limited influence. Especially Älplers with a family background of family members doing PAFP were very clear about this feeling up to seclusive statements displaying a notion of an active rejection of developments in society. An Älpler stated a pride stemming from discerning manual production methods [Ä3]: “You have the feeling that you are individualistic, you are one who is still able to work, that is also very important.” It was both described by Älplers and one Externalist with a cultural background as a necessity to do this type of work and was compared to the intrinsic urge of being an artist [E6]: “I believe especially that I see a lot of similarities. I always find it interesting to think about similarities and I believe that both jobs, be it that of the alpine farmer, but also that of an artist are both very precarious types of professions. No one does that, who says: ‘alright, I just need to do something, so I’m up here on the Alp, or now I’m here in this art thingy’, but I think they both are professions and also passions, where you dive into completely and you say: ‘I see a necessity here and

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<sup>77</sup> Translation – “The interest, I think, in society is there because it (the alp) is such a primeval yearning for the south sea island.”

I need to do this, this is what I absolutely want to do!”’. This interviewee described himself as part of the urban society in Switzerland and as a cultural professional having (presumably) a more conscious (self-)awareness of social trends, views and streams, and this can be seen as a good perspective of this social sphere exemplifying the discrepancy between Älplers inwards view of themselves and their work and how society is regarding it: “The reason why we assume something that we supply cultural labour, they (the Älplers) do landscape nursery, they look for the fields and that the mountains aren’t running wild, they look for a certain tidiness, they look for biodiversity, [...]”[E6]. This statement is contrasting to Älplers self-perception for their role in society, them pointing out that they want to be seen as farmers producing foodstuffs and not landscapers fulfilling other roles outside of the market economy, taking a bigger role in the former position. This discrepancy in perceptions between the spheres was thematised in literature with similar results (Fischer et al., 2014, von Glasenapp & Thornton, 2011). The perspective of environmental work was nevertheless greeted by all Älplers interviewed, as it showed, in their opinion, what actually happens as a result from the food production with PAFP, but stressing that the hierarchy of tasks should stay that way, stating a compromise with heavier focus on production being the perceived optimum.

One matter complicating this situation further are the stated power imbalances regarding conservation practices and PAFP. The Älplers were described by all External as the less powerful group in the context of setting agendas, policy creation and implementation, resulting that changes in PAFP were generally assessed being exerted exogenically on the alp managers by the society through agricultural politics, which was seen as a negative development by all Älplers and External alike and a stated ongoing trend. Admitting Älplers as the current managers, albeit implicitly, for BD conservation in the Alps could then be harnessed to create more bottom-up processes and generally an empowerment of Älpler grassroots movements having a bigger voice in future political decision concerning PAFP. The afore discussed issue of Vernetzungsbeiträge (see *Discussion, Direct payments and biodiversity conservation*) would serve as a prime example of such processes necessary for future implementations of conservation management. Von Glasenapp & Thornton (2011) stated that alpine smallholder farmers generally prefer bottom-up “autonomous adaptations” rather than top-down planned solutions. Älplers should be included with higher responsibilities in agricultural policy making through higher participation in such process, while these need to be facilitated actively by policy makers as voluntary engagement can be considered low as long as their voice is not strengthened in comparison to the Swiss urban societies. The Swiss legislation is almost perfectly suited – with its basic democratic values anchored in society and the law – to include a development in this direction in the context of BD conservation and PAFP (Lachat et al., 2010), as was discussed in a different context before (see *Discussion, Direct payments and biodiversity conservation*). Also, the described differences of mentality by participants of both groups would favour this factor, leading to the creation of locally adapted solutions and avoiding non-compliance with regulations. Problematic for BD conservation efforts in this case could be current farmers’ and Älplers’ associations taking an arguably productivist (Coleman and Grant, 1998) standpoint with not many regards to environmental conservation and generally multifunctional aspects (Bardsley & Bardsley, 2014; Howley et al., 2014). Nevertheless, a more inclusive process can be seen as necessary, as there is currently already a rift going through the society between the urban and the rural population as well as in between these groups. To halt this trend of further alienation a more participative decision making with future rural policies can be regarded as pivotal to consolidate different rightholders in the alpine context, as was shown in recent success stories for the creation of high-quality habitats (Fischer et al., 2014). As such, more resources should be put in communication efforts at all levels to enhance understanding and discourse between different interest groups, while state actors on a federal level should set the agenda and provide means for incentivising measures, with local actors concentrating on concrete implementation efforts.

Other Externalists viewed Älplers in this context arguably in a more multifunctional role than Älplers themselves, fitting well with recent developments of agricultural policy paradigms shifting from a productivist paradigm (Daugbjerg & Feindt, 2017; Coleman and Grant, 1998), which was predominant until the 1990s, to a more multifunctional paradigm (Feindt P., 2018), established due to pressure from international trade institutions in the whole of Europe, with Swiss agricultural politics displaying a similar development to the CAP on EU level (or vice-versa) (Hofer & Eggenschwiler, 2004) – easily explained by the tight trade relationship between Switzerland and surrounding EU countries. Some of the direct payments for PAFP can be regarded as productivist policies in the disguise of multifunctionalism, as some financing can be considered in reality potentially trade distorting subsidies. Thus, Switzerland is an interesting example of agricultural policies regarding conserving living traditions like PAFP which are also present in the surrounding nations of France, Italy, Germany and Austria (not considering Liechtenstein being a very small city state in the Alps). Some Externalists compared Swiss policies regarding BD conservation in the context of PAFP favourably to measures taken in the surrounding countries; especially Austria and Italy were pointed out still applying unsustainable practices to a larger amount in the alpine area. Kleijn et al. came in 2006 to a quite devastating conclusion by comparing agri-environmental schemes in 5 countries in Europe (Switzerland, Germany, UK, the Netherlands and Spain), generally crediting ineffectiveness to taken measures apart from Switzerland and another country where statistically significant improvements (albeit minor) through agri-environmental scheme implementation could be observed. This study was not delimited to the alpine area and it is questionable if results can be compared in mountainous areas. Nevertheless, it shows general effectiveness with schemes implemented in Switzerland. As the source is older and the Swiss government has implemented many new schemes, effectiveness can most probably be considered favourable compared to other alpine countries. Zingg et al. (2019) proved the effectiveness of Swiss agri-environmental schemes in the lowlands for birds and butterflies. Otherwise there is not much information on comparing effectiveness of different schemes between countries, which displays a lack in scientific literature.

#### *Future trends, current attitudes and past perceptions*

The common issues with the rural exodus, as is present in many rural areas in Europe, was discussed to a small extent during the interviews with both groups. Interestingly, all Älplers interviewed stated it was no problem or some locally isolated problems, even acknowledging that they see a positive trend towards more rurality, and describing especially PAFP as currently popular with young motivated generations taking over alps as well as conservation topics as being increasingly in favour with younger generations. The consensus in literature is quite the opposite (Bundesamt für Kultur – BAK, 2020; Lachat et al., 2010; Walter et al, 2013), stating the rural exodus as one of the main threats for PAFP and as such for BD conservation in the culture landscapes of the Alps, as well as that the younger generation is supposedly even less caring about the land (von Glasenapp & Thornton, 2011). Externalists interviewed were more negative in assessment than participants from the group of Älplers stating that the problems arising from abandonment of alps and their pastures are rather economic feasibility questions than a generational change or mismanagement. This current trend and motivation with the next generation of Älplers can be harnessed to focus more on BD positive - nature positive<sup>78</sup> - practices, which was described as a chance in literature as well (Liner M., 2022).

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<sup>78</sup>Zu Ermgassen et al. (2022) – “ [...] four key elements for ‘nature-positive’ strategies: 1) demonstrating positive biodiversity outcomes across the entire value chain (“scope”); 2) buy-in throughout the entire organization (“mainstreaming”); 3) integrated consideration of different components of nature (e.g. both biodiversity and

Motivation for BD conservation amongst farmers and Älplers was described in literature as one important factor for future successes (Lachat et al., 2010). Unfortunately, many participants from both groups stated that BD conservation is a topic that has a negative connotation with many Älplers, even though no interviewed Älpler was regarding it in that way, with sampling bias (see *Discussion, Limitations of this study*) being the most likely reason, making future action to address this attitude necessary. This reported predisposition was also reported in scientific literature about framing issues of agri-environmental schemes (Villamyor-Tomas et al., 2019): “According to our results, framing tree planting as a water conservation measure would be less appealing for farmers than if framed as a biodiversity or soil conservation measure.” On the contrary, Wezel et al. (2021) came to a different statement about Älplers motivation in a study with a much bigger sample located in the Alps: “In general, the interview results demonstrate that many farmers were well aware of questions around biodiversity management and reveal how farmers thought they could or were already contributing to biodiversity conservation.” Maybe this proclaimed negative attitude is not present to an extend as currently perceived. Reasons for a negative attitude reported were the re-introduction of the wolf with strict protection, new legislations relying on prohibitions and restrictions, generally limiting Älplers’ perceived freedom in alp management and the anticipated fear of both for future developments. This negative attitude towards BD conservation can be considered, if overcome, a pivotal point for improving PAFP for conservation practices. Overcoming those problems might prove very difficult though, and a significant amount of resources might have to be taken to correct the distorted image of BD conservation in Älpler circles. The controversial wolf was already discussed (see *Discussion, Biodiversity and farming practices*), while the fear of BD conservation being connected to limiting the freedom in PAFP practices further should be addressed most diligently. This question draws on the already discussed scapegoat issue (see *Discussion, Narratives: a rift in society and its implications for biodiversity conservation*), the lacking communication with society (see *Discussion, Trust in politics and science through communication*) and the eroding trust in authorities and science (see *Discussion, Biodiversity and farming practices*). The positive contribution of PAFP to BD in the Alps should be communicated more aggressively to urban societies and Älplers alike, so that the trend of decreasing positive image can be stopped with scientific research and monitoring better explained. The stated sensitivity of BD monitoring can be viewed critically in this case, as it has an arguably negative influence on disseminating an understanding. This confidentiality of data collecting activities (not the geo-data as results) about BD monitoring presents, at least compared to the surrounding countries, a curiosity and does not contribute to communication purposes between science and Älplers and the whole society, so measures taken to at least explain to Älplers and society on a broader basis why the necessity for secrecy is seen. Interestingly, no sources on reasoning for confidentiality could be found apart from a publication of IUCN on behalf of Holcim Ltd. (a private multinational company, also operating in Switzerland), stating the necessity for confidentiality during monitoring activities in BD conservation schemes being rooted in the necessity for corporate security (Imboden et al., 2010). This topic shall not be further discussed as sources are lacking. A further point that can be raised is the presumed perception of Älplers to have nothing to gain by new legislations and measures for BD conservation – but much to lose. The wider introduction of result-oriented schemes could prove useful in changing this perception, but only if the necessary trust can be established. Interestingly, Älplers thought BD conservation often in a global context, connecting this issue with CC impacts and unsustainable practices worldwide, resulting in stating an insignificance of Switzerland. Contributions to BD conservation through PAFP were estimated rather low in this context, resulting in the assumption that raising awareness of Älplers’ achievements also in a global context, e.g. the species of

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climate; “integration”); and 4) measurable outcomes against a fixed baseline aligned with overall societal goals (e.g. post-2020 Global Biodiversity Framework; “ambition”).” A currently emerging term in popular media and scientific publications in the context of (private) BD conservation schemes.



national priority (see *Introduction, Species of special responsibility and national priority in Switzerland*), could ameliorate Älplers' perception of BD conservation as a topic while also raise interest. In the context of dairy alps, which are allowed to use concentrated fodder as supplement, although it was clearly stated during the interviews with participants from both groups that those rules can and commonly are used to a greater extent than necessary, Swiss awareness of responsibility could be raised for buying ingredients for this fodder internationally. Thus, it could raise awareness also of having an indirect responsibility for detrimental effects on BD conservation in other places, e.g. in the case of imported soy beans from Brazil (Frischknecht et al., 2014). In general, to resolve this issue a culmination of all the points already discussed plays a role directly or indirectly, and a more positive image can be reached by addressing those.

The universally proclaimed heterogeneity (see also Wezel et al., 2021) of experienced based LEK and theoretical based knowledge about BD by Externals can be seen clearly in the sample of Älplers interviewed, even if it is present to a smaller amount than expected. Interestingly, the Älplers showed a more homogeneous picture in terms of proposed solutions and desired developments of PAFP in the context of BD conservation with a broader consensus between all participants present than the interviewed Externals, who were differing in situation assessment and proposed solutions to a greater extent even if only the participants from the sphere of science are regarded. Basic consensus was present in the Älplers' and Externals' sample that the conservation of small scale locally adapted PAFP was wanted contrary to the ongoing trend of bigger farms in the mountain areas. Education in combination with LEK was regarded as being of high importance and a lack of communication efforts were stated. The wish for conservation of tradition on these small alps with enough liberties to adapt management to local contexts while keeping regulations low with direct-payments high shows that PAFP are currently in a phase of upheaval with multiple future scenarios possible. Political decisions with direct payment schemes were assessed universally as the single most influential lever in this case to steer development, be it towards rationalisation or towards conservation, encompassing implicit effects on BD conservation. Switzerland as a rich country with sufficient state funding can actually afford the luxury to have a political decision in this case, thus actively steering development for alpine agriculture. Externals interviewed showed a more heterogeneous assessment of the situation. Two groups could be identified within the participants that are interestingly close to political streams: conservationists [E2, E4] and conservatives [E1, E3], with most of interviewees with a scientific background holding the middle position between the two distinct groups, meaning also that political change in terms of PAFP in the context of BD conservation was generally seen as necessary. But on which scale? Opinions ranged from paradigm changes to minor adjustments of the current system. Comparing the two groups of participants with a relatively uniform consensus amongst Älplers, it can be viewed critically that this group does not have much political leverage, as it seems to be affected by the political streams while having a basic vision for the future but not much voice in agenda setting or implementation of policies. As was written before: means, knowledge and methods to address the outspoken problems are at hand with implementation lacking. Generally, a common vision for future developments can be seen lacking in the group of Externals – arguably the more powerful group hindering implementation efforts. A process of PSP (participatory scenario planning) could help in this case, setting some common goals to work towards (see also Oteros-Rozas et al., 2015): For what kind of alpine agriculture can a consensus be reached for the future in Switzerland?, and the explicit dissemination of such scenarios with specified measures to be taken.

*Traditional ecological knowledge with pastoral alpine farming practices discussed*

In a study by Kugler W. (2011) a lack of projects collecting TEK systematically was identified for Switzerland, while it was stated that the main objective presently is to collect and disseminate lay knowledge, traditions and customs. Resulting from this study was a homepage “Fundus Agri-Cultura Alpina”<sup>79</sup> that collects a limited amount of TEK concerning predominantly production oriented agricultural practices from the alpine areas. With the website of “Lebendige Traditionen”<sup>80</sup> meaning living traditions there exists a platform to collect traditional knowledge still practised with a focus on cultural activities. For Canton Fribourg specific living traditions that can be considered TEK according to the list is only the tavillonage<sup>81</sup> which was assessed as not economically feasible currently and future perspectives were described as endangered (Sandoz et al., 2018). A tradition located in the whole Alps amongst Äplers was stated to be the “Wetterbüchli”<sup>82</sup> (Risi M., 2018) but none of the interviewees stated any living traditions or TEK that was listed in one of those internet collections. In general information on TEK given by both groups of participants was scarce. Äplers stated apart from a recipe for marinated fox meat, a traditional pasturing method and two proverbs [Ä1]: “The dung is the gold of the farmer.”, “The street to the alp gives the possibility to be quickly on the alp but also quickly down again.”; nothing else specific was mentioned. The state of TEK was described as almost non-existent today, while older Äplers and farmers might still possess some TEK. The reason for this state was given to be the lacking utility of TEK in today’s PAFP, nevertheless TEK was assessed as important for environment conservation and BD conservation as [Ä1]: “You would see if our ancestors wouldn’t have managed as they did, we wouldn’t have such an area, that’s why we have to make sure that this can be continued.” The process of losing TEK through implicit force exerted by rationalisations of PAFP was described by one Äpler as “perverted” [Ä2] with resourcefulness as a basic character being “totally forgotten”. An example was supplied about gardening practices by a Ukrainian women living in the village [Ä2]: “(...) she is saying she could make a garden in the desert and I am always so moved when I go half an hour through that garden, what kinds of possibilities are there!” Specific TEK being lost or already lost was described being herding knowledge, because of predominant uses of fences with rotational pastures, TEK about milk refinement due to less dairy activities on the alps and more specifically Ziger production was stated to be completely abandoned in Canton Fribourg and the knowledge how to handle residue plant material on the pastures which mostly gets left behind today while back in the day it was removed to give more light for the plants to grow. Hunting practices were described as unsustainable today as most hunters do not observe animals long enough anymore to take out only the weak and sick ones leading to spread of diseases in wild animal populations [Ä2]. The knowledge how to use animal traction and managing forests as well as trench making was stated to be lost due to mechanisation. In the context of mechanisation the ability to “listen to nature signs” [Ä2] is reduced with political, scientific and technological progress being partly to blame for this development TEK and use of medicinal plants was reported to have a returning trend with multiple Äplers stating acquiring knowledge.

Externals’ perceptions of TEK did not differ much from Äplers’ assessments describing that through the obsolescence of TEK the current use is more of recreational character. While no systematic collection of TEK for PAFP is presently in place a hostile discourse was reported to exist between Äpler groups to consider what is traditional (see also *Discussion, Narratives: a rift in society and its implications for biodiversity conservation*). Further points raised was the loss of knowledge about

<sup>79</sup> <https://fundus-agricultura.wiki/> - Date of last access: 06.01.2023

<sup>80</sup> <https://www.lebendige-traditionen.ch/tradition/de/home.html> - Date of last access: 06.01.2023

<sup>81</sup> Shingle making to weather proof roofs and walls of alpine houses.

<sup>82</sup> Weather book: collection of weather data through Äplers for private use.

management of manure on pastures, management of weeds and the reduction of single traditional PAFP like Wildheu. Management related participants from both groups stated that the traditional drudgery system for alp owners is forgotten and not practised anymore.

In the whole this assessment of state and changes of TEK with PAFP paints a grim picture for future developments as much knowledge is already lost with not enough ambitions to recreate or revive those traditions while there is a conflict present over the narrative dominance of the term 'traditional'.

### *Local ecological knowledge with pastoral alpine farming practices discussed*

Unlike TEK, information which can be considered LEK was abundantly reported by the interviewed Älplers. The knowledge did not only specify many species noticed regularly with most of them being easy to identify or of personal interest, but also phenological and behavioural connections being made. Generally, the knowledge recorded can be considered very heterogeneous, as was expected by Externals interviewed, but unlike Externals' prediction a great interest, without exception, in environmental and BD related topics was found in the sample of Älplers. Most of the LEK considered important to answer the RQs was already stated in the part Results and shall not be repeated while a complete list of information obtained and categorised as LEK provided by Älplers can be viewed in the Appendix 3. 'LEK as reported by Älplers'. The knowledge was regarded universally as most important for PAFP as theoretical knowledge is not always applicable to all localities, meaning LEK is crucial for locally adapted solutions if it can be fostered and harnessed. LEK was considered sometimes lacking regarding beneficial practices for BD conservation and thus is of no importance for BD conservation. Instead of using this point to argue for incentivising this knowledge this argument was used to defend action-oriented schemes in place. Most participants stated that also LEK is lost (or not generated) because it has outlived its usability in the modern society and with PAFP changing while "modern" LEK about machinery use was considered unimportant or detrimental to conservation efforts and thus LEK creation was assessed being partly guided into the wrong direction. This commonly referred process is underlined by scientific findings that describe similar processes worldwide (Reyes-García et al., 2013) and should not come as surprising. Raising LEK was considered most effective if conducted through personal contacts with on-hand experiences rather than documents and information material.

The future outlook for LEK generation in the context of PAFP and BD conservation look much more amiable than TEK with several beneficial trends stated. It shall be mentioned that there still is no systematic scheme in place to record the state of LEK with Älplers or farmers.

In summary while LEK about the environment and species diversity was present to a great but varying amount with interviewed Älplers. Knowledge that could be considered TEK was hardly reported and most interviewees from both groups stated that they perceived that the knowledge got lost or is in the process of getting lost because it is not in use anymore in PAFP. This seems to be a consensus also amongst literature (Liner M., 2022; von Glasenapp & Thornton, 2011) where use of technology was said to be a factor for loss of TEK as well as LEK.

### *Socio-demographic factors discussed*

Looking at socio-demographic influences in the Älpler sample only the influence of family background seemed to provide some explanatory power of PAFP used to a limited extent. Striking was the greater variety of PAFP used by Älplers without alpine agricultural family background and a stronger focus on environmental conservation topics in this group. The other group consisting of Älplers who managed their “family-alp” generally had very similar PAFP and showed generally a higher focus on productivity related topics during the interviews, not meaning their practices are actually worse for BD conservation, which could not be assessed through the interviews. To discern further socio-political influencing factors the sample of Älplers was too small, nevertheless a list was created with information gathered during the interviews of both groups and the literature review and was included into the survey with presumed socio-demographic influences (see also Appendix 1. Surveys): Age, Gender, mother language, experience in farming, experience in PAFP, experience on current alp, family background, self-perceived name of profession, commuter-alp or not, % of income from PAFP, interest in environmental protection, perception of unusualness of BD in the Alps, source and significance of source of Älplers’ knowledge on PAFP, regularity of participating with extension services, location of alp and its pastures, tourism on alp, ownership of alp, ownership of farm animals, proximity of protected areas, ecosystem types on pastures, seasonal or full year farmer, animals managed on alp, use of concentrated fodder if dairy cows are present, production on alp, machinery use, fertiliser use, use of any perceived traditional methods, introduction of innovations, partake in Landschaftsqualitätsprojekten, % of BFF2 areas on pastures, organic management, description of PAFP and type of weed management. The research on and quantification of such factors, not just for LEK but with participation in agri-environmental schemes can be considered of high importance as was stated by Brown et al. (2021) in an EU study concerning the CAP, that the uptake of agri-environmental schemes was not well designed nor understood by lawmakers and corresponding consultants, leading to ineffective implementation. Regarding similarities between Swiss agricultural politics and the CAP (see also *Discussion, Socio-cultural aspects in recent developments and its potential impacts on future developments*) this case is most probably also present in Switzerland.

### *Limitations of the study*

Taken the content of the recent agreement of the COP15 conference (CBD, 2022) into account it can be said that most topics that appeared as future challenges for PAFP in the context of BD conservation appeared also in the official agreement released on 19.12.2022, more than one year after the data collection. Thus it can be said that the study probably covered the most important issues perceived by a wide range of participants and theoretical saturation has been reached to a satisfying degree and credibility and transferability is given. Nevertheless, looking at dependability of results there are many shortcomings that shall be discussed:

On the one hand the biggest bias in the context of the adapted methodology was without doubt the design of the semi-structured interview catalogues, as they were not meant to be the sole primary data source and are as such thematically too widely placed leading to a certain superficiality of content discussed leading to a high possibility of premature closure present (Baxter & Eyles, 1996). On the other hand it can be seen as a trade-off that an interdisciplinary topic like this requires. Even though the dataset was not planned to be used as it was, the original plan consisted of it as a back-up plan if the survey should not have a high enough return rate. One scientist predicted unforeseeable issues

with data collection in this case which turned out to be absolutely correct [E5]: *“And always my last request: some good advice that you could pass along?”* - Well with the presence. You have to see that you can have a plan in time, how you want to proceed and then that you have a plan b, if it's not working out. And if it's not going as you imagined, you can do something else. I think it's extremely unfortunate, if you make an effort and then the result is 'it didn't work out'. This is not an easy task. It's possible.” This advice was followed and the measures taken can be considered in this case a success as enough data was collected to finish the research be it in a heavily altered version. That the return rate would be below 0.5% could not be foreseen and the distribution was not in the responsibility of the researcher, which can be considered the main fault. This decision taken due to financial and temporal constraints could not be avoided realistically as the ambition of the study was large in its original plan and probably looking at it in retrospect too ambitious for a master thesis as it relied heavily on the case that everything works out with not many margins for errors.

These unforeseen developments resulted in a thematic basis much wider than aspired and arguably excessive in the scope for a master thesis. This circumstance created a certain bias in the literature review as much information was drawn from reviews due to time pressure and up-to-date information could not be included in all thematic areas while these were tried to be delimited to contextual information considered less important for addressing the objectives and RQs outlined.

In the aforementioned context a bias between the two sampling groups is present as Externals were sampled Switzerland-wide whereas Älplers were foremostly sampled in the originally planned spatially limited area in the Sömmerungsgebiet in Canton Fribourg. Thus, comparability of collected data can be considered biased as spatial comparability is not given.

During the analysis the code categories and subcategories were not used to their full potential owing to time constraints. This part could have possibly been extended substantially albeit it would have to be discussed how powerful the resulting data would be considering the limited sample size in the context of semi-structured interviews as data collection method but it can be considered that bias through poorly defined analytical constructs and premises is present to a debateable amount (Baxter & Eyles, 1996). Coding and the use of Nvivo was biased through the lack of experience of the researcher building only on theoretical knowledge using this methodology. In the context of the subject of this thesis, this circumstance can prove as another example that experienced-based knowledge and its dissemination proves more effective for actual implementation of (coding) research methodology than solely relying on abstract, theoretical guidelines.

Self-selection bias through sampling methods of Älplers could not be avoided as any other techniques than snowball- and convenience sampling were considered infeasible. Due to the snowball sampling the Älpler sample can definitely be considered biased towards a more positive attitude towards BD conservation efforts and a greater interest in such topics as is the standard and as such is not entirely representing the heterogeneity of the community. If such heterogeneity can be at all represented using qualitative semi-structured interviews is a matter for discussion, in this case with severe time and financial constraints it was deemed not possible and in the original plan also not necessary, as a representative sample would have been reached through the survey.

Bias in the sample for Externals can also be considered present due to the wider range of topics used and discussed in this thesis than was originally planned. As such no stakeholders from the private economy, e.g. from the alpine foodstuffs value chain, and no representatives of media were interviewed as they were considered unnecessary in the original plan for the thesis.

In the context of a participative process as described in the *Theoretical outline* the esteemed participatory nature of this research could not be fully implemented due to the limited time and

finances for this research project. Considering the limiting frame of a master thesis the originally pursued plan was assessed as sufficiently participative enough to harness traits of such methods used. Due to the hardly existing distribution of the survey this PP was considered infeasible in the timeframe and was dropped completely to use the plan b and the PP was converted into a completely exploratory qualitative research.

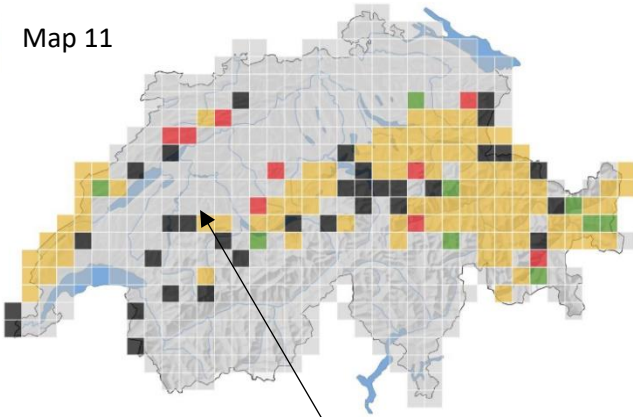
Bias from using in-depth interview methods with semi-structured interviews can be considered present to a minor extent, as the researcher paid meticulous attention to these points. Resulting interviewer bias can be considered present as all interviews were conducted by the same individual but only to a limited extent.

While much of the information gathered during the interviews could also have been obtained through a literature review it shall be noted that considering the planned PP a creation of a survey only through secondary data was deemed not sufficient enough to avoid misunderstandings which might have resulted in a flawed data collection through the survey. Even though the interviews were conducted in the German speaking part of Switzerland the author of this thesis is not entirely accustomed to the local cultures as Switzerland which, as reported, display a huge variety in local traditions and different customs that cannot be explained effectively through theoretical literature. Secondary data on a local scale such as the planned research area is additionally hard to obtain through a literature review as many results and information would have had to be extended from other regions or even other alpine countries and could have been considered flawed in this context where locality plays a great role.

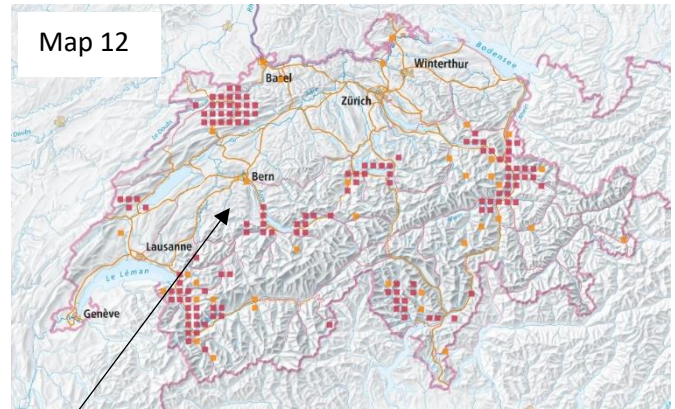
### *Epistemological assessment*

Changing the context of the qualitative data collection as compared to the original plans, biases are heavily reduced: In terms of the outlined PP the data collected during the qualitative part of the study did exactly what it was supposed to, namely the collection of comparable data from a wider range of topics where information can be isolated as influential for the creation of the survey. The survey that got tested in two rounds and then under “real” conditions with a return rate of two can be considered fit for the purpose it was intended for, namely collecting LEK about BD and BD conservation with socio-demographic information that was assessed as a possible influencing factor. The main flaw of the survey was in its way of distribution and its ambition to be unsupervised. Physical presence can be considered in this case much more promising to heighten return rates and improve quality of results. That already both returned surveys (from the same area) displayed results of scientific interest, precisely the location of a rare beetle species (*Rosalia alpina*) in one of the surveys and the location of a rare bird species (*Tetrao urugallus*) in both surveys in an area that previous scientific monitoring has not documented yet (see Map 11, p.136; Map 12, p.136 and Map 13, p.136), indicates that the survey can be very much of viable scientific interest as well as proof of a currently reported trend that the beetle species is recovering (Lachat et al., 2013). As there is no other systematic collection of LEK about BD in the alpine area in Switzerland conducted yet the survey presents a good opportunity to expand on the knowledge already harnessed systematically in many countries worldwide and has proven its value in many cases (e.g. von Glasenapp & Thornton, 2011; Anadón et al., 2009; Sánchez-Carnero et al., 2016; Abrar et al., 2021).

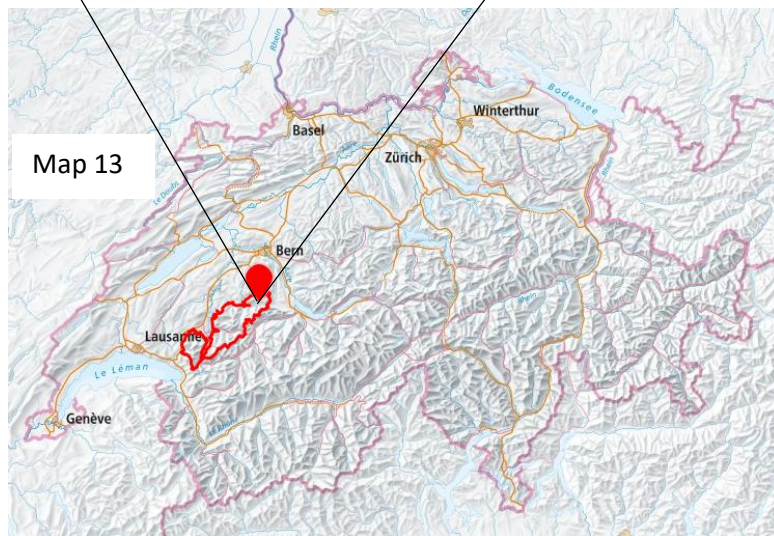
Map 11



Map 12



Map 13



Map 11: Shows the scientific monitoring data on *Tetrao urugallus*, colours mark years when birds were spotted. Grey: not spotted and identified; Black: 1993/96; Red: 1993/96 & 2005/08; Yellow: 2005/08 & 2013/16; Green: 2013/16. Source: Mollet et al. (2019)

Map 12: Shows the scientific monitoring data on *Rosalia alpina*, colours mark monitoring timeframes. Yellow: before the year 2000; Red: after the year 2000. Source: infofauna <https://lepus.unine.ch/carto/22897> Date of last access: 18.01.2023

Map 13: Shows data obtained from LEK of Älplers of the year 2021. The red market shows the area (in Naturpark Gantrisch area: Gemeinde Rüscheegg and Guggisberg) where both species were spotted. Source: own elaboration with use of an online GIS: <https://map.geo.admin.ch> Date of last access: 18.01.2023

## Conclusion

Perceptions of Äplers and Externals showed many similarities concerning the state, changes and protection measures for BD in the Swiss Alps with favouring small alps and diverse and locally adapted PAFP while incentivising education, training and awareness raising not just amongst Äpler communities but society as a whole. As is often the case: the devil is in the details. Comparing the discourses used to describe currently perceived problems and proposed solutions two main themes quickly emerged differing substantially between the two groups interviewed: eroding trust of Äplers in political and scientific discourses in connection to lacking communications between perceived rightholders of alpine landscapes and a nested critically viewed trend of professionalisation in the context of implementing sustainable management practices in connection to political influences exerted on Äplers. These themes need to be addressed urgently as a further deterioration of trust, communication as well as encompassing divergence of goals for development cannot be consolidated easily, should this gap widen further. Urgency of protection measures for BD conservation was perceived universally, albeit to a varying extent, with measures well known and well assessed concerning viability for implementation and effectivity. The sustainable solution for BD conservation, keeping the living tradition of PAFP and economic interests presents undoubtably a balancing act or literally a ridge-walk in the alpine context. The multidimensionality of the problems lead to the assessment that proposed solutions need to be bigger than the concentration on single topics in the current system but rather a more drastic change on a larger scope encompassing the Swiss society as a whole. In this situation the ongoing polarisation between urban and rural populations and within those groups need to be carefully avoided, more specifically with communication efforts expanding the horizon of current sphere-specific media outlets, actively pursued by all perceived rightholders to come to more mutual understandings leading hopefully to a closure between the currently already advanced rift between spheres in society showing interest in the alpine environment. As is so often the case the main factor lacking to advance BD conservation can be considered implementation strategies as goals are abstract but clearly set and measures are potentially at hand with an abundant base of knowledge that can be drawn from. A focus on hard measures on soft topics can be recommended at this point as the abstract goals seem to be an insufficient fixpoint in a complicated world with wicked problems for science, society, politics and Äplers alike. Novel research findings in this case are arguably limited to the importance of communication efforts, trust building activities and in general the viable possibility for recognition of LEK for future BD conservation in the Swiss Alps to address aforementioned issues as other parts of this conclusion compared to literature (Fabian et al., 2019; Zimmermann & Keel, 2010) is hardly new but proves the validity of other research as it was in almost the exact same sense already formulated in 2014 showing the urgency of these issues (Fischer et al.): “The need for action has been identified, and the effective measures are known. Politicians and society now have it in their hands to make the right decisions and thus ensure the well-being of future generations.”<sup>83</sup> On the upside the current state of BD in the Alps and diversity and sustainability of PAFP in Switzerland were assessed as still present and mostly in a good shape, even with the negative trends currently at work, meaning if measures are taken in near future and successfully implemented, the tradition of pastoral alpine farming practices with the encompassing beautiful and iconic landscapes enabling the unique biological diversity and also diversity of its managers and local cultures that Switzerland is famous for worldwide can be conserved for future generations to live and enjoy.

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<sup>83</sup> Original Quote - “Der Handlungsbedarf ist ausgewiesen, die wirkungsvollen Massnahmen sind bekannt. Politik und Gesellschaft haben es nun in der Hand, die richtigen Entscheidungen zu treffen und damit das Wohlergehen auch für die nächsten Generationen zu sichern.” (Fischer et al., 2014)



\*

*“What would you personally judge as very important? – Yes, that the species of sustainably living Älplers is not becoming extinct. Male and female.” [Ä2]*

\*

### *Future outlook for research*

Regarding the recent agreement reached of the COP15 (CBD, 2022) conference with Switzerland being one of the signatory states, 6 of the agreed 23 targets could be isolated needing to be addressed in Switzerland according to the results and discussion of BD conservation in the Alps in Switzerland with PAFP.

- Target 1: further incentivising participatory integrated planning and management.
- Target 9: protecting and encouraging customary sustainable use by local communities.
- Target 10: addressing the trend of intensification with PAFP to reach an alpine agriculture that is conserving and restoring BD, ecosystem functions and services.
- Target 14: “Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning and development processes, poverty eradication strategies, strategic assessments, environmental impact assessments and, as appropriate, national accounting, within all levels of government and across all sectors, [...]”
- Target 18: Misalignments of direct payments and tax money use in general need to be re-oriented towards BD conservation goals
- Target 21: “[...] strengthen communication, awareness-raising, education, monitoring, research and knowledge management and, also in this context, traditional knowledge, innovations, practices and technologies of indigenous peoples and local communities [...]”

In the context of these targets the collection of LEK could provide a basis for its usage and a way to directly address Targets 1, 9, 10 and 21. The most obvious recommendation for future research would be to take the survey developed (see Appendix 1. Surveys) for the original methodology of this thesis and expand its use to the whole of Switzerland with adaptations to the questions, taking into consideration the larger scale and in the best case conducting the survey in a supervised manner as the lesson learned from the failure of survey distribution during this study is that presence with the collection of LEK with Älplers ensures a (higher) return rate with most probably higher quality results and less bias. Other structured ways for the collection of LEK of Älplers should be taken into consideration as well as the state of the knowledge arguably needs to be evaluated as a first step before it can be put to use for BD and cultural conservation purposes. The collection of LEK in this context might be debated as data usability cannot be seen as a given with scientific knowledge but rather new systems how to work with systematically collected lay knowledge have to be created. This can be considered possible as interest was expressed by most Externals and Älplers alike as this lay knowledge is currently an unknown factor and all participants stated the possibilities lying in this largely undocumented knowledge dimension. Maybe more important than the usability of the knowledge itself it can be considered that the implicit effects of such future collections of LEK encompasses improving communication channels between the scientific and the agricultural sphere, incentivising more cooperation and mutual understanding and thus taking a step into the direction of closing the gap between knowledge generation and actual implementation, which was identified as the most pressing problem in the past and today with BD conservation (Lachat et al., 2010). The possibility of LEK co-evolving with scientific discourses with deliberative, open and linked governance

institutions empowering lay knowledge in Älpler communities resulting in more horizontal power structures seeing the Älplers rather as rightholders than stakeholders (Berkes 2007). Future research on LEK of Älplers could furthermore provide interesting insights about the process of losing this knowledge as many characteristics of changes that were happening in Switzerland in the last 100 years are very similar to changes happening in other (indigenous) communities worldwide since roughly the 1970s (García-Reyes et al., 2013). Recording LEK together with factors influencing speed and selectivity of losses could then be used for predicting comparable developments internationally. Urgency with incentivising, conservation and restoration of TEK can be considered high amongst Älpler communities in Switzerland as Reyes-García et al. (2013) stated that under rapidly changing socio-economic, political and environmental conditions - to which degree these are present in the Swiss Alps is up to debate - cultural heritage and encompassing knowledge can be lost within a single generation, especially considering the (non-) reported TEK during the in-depth interviews. Looking at the current evidence recorded which shows the usefulness of LEK and TEK, the question of systematic application of these concepts in Switzerland amongst Älpler communities but also farmers can, rather than being characterised by an “if or if not?”, be regarded as a “when?”, “how?” and “on which scale?”

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