

Attuning to the Biosphere: Considering Intimacy in Conservation

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On the Issue of Anthropocentrism
in the Creation of Conservation
Spaces by the Example of a
UNESCO Biosphere Park in the
Austrian Alpine Valley "Großes
Walsertal"

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And you may find yourself living
in an age of mass extinction.
(Morton, 2018a, p.38)

At five points in the history of life on earth major events wiped out the largest part of life on earth in a short time. Various "natural" causes, such as asteroids changed the conditions on earth in such a way that few lifeforms could survive. Timothy Morton (2018a, pp.39-67) argues that we are living in the sixth mass extinction caused by another catastrophic, fast paced, major event. The destructive power of industrialised, capitalist, anthropocentric human activity has already wiped out large parts of the biodiversity that existed before the industrial revolution (Bradshaw, 2021). The magnitude of this crisis is becoming clearer by the year. As an answer, conservation efforts create enclosures of biosphere preservation by attempting to shield and shut it off from these human influences but in their efforts are exclusive and themselves reproducing destructive patterns, which is posing a big obstacle to be overcome to effectively protect and restore biodiversity, life and vitality in the times ahead, anywhere.

This paper will examine such interiors of ecological action in the light of anthropocentrism induced environmental destruction and climate change.

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0.1/ The issue with anthropocentric conceptions of the Non-human

Anthropocentrism “ensure[s] that we only ever learn about the world from a safe and privileged transcendent distance.” (Common Worlds Research Collective, 2020, p.10) It roots in the idea of Cartesian dualism which has constructed an artificial boundary between humans and the natural world. Bruno Latour (1993) has argued, it assigns a superior subject-status to the human and an inferior object-status to the non-human. The result is a false differentiation in value between natural and cultural realms as well as moral distinctions between the two. Hence, human activity is seen as the intentional and actualising power and nature as an unintentional resource to be actualised - meaning unlocking its (presumed) full or predestined potential to humans. A lithium deposit and its mining company, fertile land and modern agriculture, a plot and its developer. A human, *actualising power* and a *raw resource or empty space* that is *waiting to be actualised*. This disparity in value has been used to justify the exploitation and domination of non-human existences. It helped to develop a Western “tradition of the appropriation of nature as resource for the productions of culture” which sees the natural world as the empty canvas on which human history and world-making unfolds. (Haraway, 1985, p.150)

This dualism is also visible in the way land is divided generally into cultural, human land or natural, non-human land. *Cultural* realms are places where we accept exploitation of such *resources, natural* realms, such as UNESCO world heritage sites, forbid it and protect a certain unique biotope in a state of wilderness and human absence. (Cronon, 1996). With the global scale of human activity and its resulting global effects it is becoming more difficult to uphold such separation, practically, as climate change ignores such zoning and calls for more inclusive approaches. Furthermore, such enclosures are blind to the fact that there is also non-human presence in lithium mines and human presence in wildlife sanctuaries and that these two spaces are not unrelated.

And while natural protection by exclusion from the realms of actualisation seems virtuous to some, it too perpetuates anthropocentric patterns. Consider e.g. David Attenborough’s “A Life on Earth” documentary (*A life on this planet*, 2020) in which he pledges humanity should preserve

“holocenic wilderness” which is its “Garden of Eden”, assuming a historical equilibrium in “wild” or untouched places.

Such forms of conservational thought are violent because they assume non-human existence as static. They too rob non-humans of their agency and self-actualising power which lies in constant adaptation, expansion, change, disturbance, rearrangement, emergence, death, rebirth. Furthermore, for such places to remain pure they need to dispel human presence. For humans, this renders the experience of the immersed-ness of their existence in its actual and intimate nature impossible. After all *life is intimacy*. “Embodied selves come to into being only through others: The biosphere critically depends on cooperation and ‘interbeing’”. (Weber, 2013, p.7)

Human life has always been possible only because of the existence of non-humans. *World is made* through interbeing, a complex web of entanglements, relationships, symbiosis, aversion eating, being eaten, synthesis and disintegration. “Interbeing” has always shaped human and non-human histories.

To leave anthropocentric frames is to understand human immersion and take serious the fact that non-human beings too are dynamic, self-actualising entities. To see this is crucial in conservation because it deals with a hugely important issue that is *giving adequate space to non-human life and rethinking our relationship with and place in it*.

0.2 / Considering change in conservation

In 1971 the UNESCO developed a “intergovernmental scientific programme” named Man & Biosphere (UNESCO, 2023) which is aimed at “enhancing the relationship between people and their environments” while promoting “sustainable development” in compliance with the UN 2030 sustainable development goals (UNESCO, 2017). Its vision is stated as “a world where people are conscious of their common future and interaction with the planet, and act collectively and responsibly to build thriving societies in harmony with the biosphere”. (UNESCO, 2023) Its aim is to find and preserve places in which humans live in “harmony” or symbiosis with their natural environment and to learn from it.



Depictions of Walser people, 1942. Sammlung Risch-Lau, Vorarlberger Landesbibliothek

Walser "Trachtengruppe" dressed in traditional costumes, 1953. Sammlung Dienger, Vorarlberger Landesbibliothek



Walser



Haymaking, 1940. Right: hay sledge. Sammlung Risch-Lau, Vorarlberger Landesbibliothek



Haymaking

Hay drying in Blons, 1965. Sammlung Risch-Lau, Vorarlberger Landesbibliothek

However, this model is not free of anthropocentrism and it too proceeds to recreate the same old anthropocentric patterns, as I will show later on. Consider the emergence of symbiotic interspecies relationships. Anna Tsing (2021, p.142) says "Interspecies relations [...] depend on the contingencies of encounter." Encounter allows for ecological intimacy, out of which symbiosis such as mushrooms and trees or even complete integration such as mitochondria into human cells (Gray, 2012) arises.

Timothy Morton calls this process collaborative becoming *attuning* (Morton 2018, pp.105-165). It involves all participants, although, not necessarily in the same scale of time.

A rock shapes stream water immediately. The attuning of the rock to stream water takes longer to become visible. And together with other participants they *become* a stream which might host crayfish, trouts and, later, hydroelectric plants. Human presence will shape an environment and the environment will shape human presence through its own agency. Over time the different aspects of this relationship such as land practices, deer migration routes, human and non-human habitats might become integrated with the result being the thriving of all participants. Until a disturbance arrives, reshuffles the conditions and asks once again for a process of integration.

Beings emerge through one another, attune through encounter and ecological intimacy. Therein lies the resilience of life.

0.3 / Reading guide to this paper

Following Anna Tsing's idea of the art of noticing (2021), I want to dive into the valley of the Großes Walsertal (I will refer to it in the less common but in English grammatically sounder way Großwalsertal) and look at its history and at how the biosphere and its participants responded to sudden and continuous changes such as the immigration of the Walser from 1289 on and later the influx of global technological, sociopolitical developments such as industrialisation of agriculture and tourism in the 20th century as well as early signs of global warming.

I will look at how these encounters swayed the livelihoods of humans that have lived, disturbed and

shaped the valley in embedded, attuned and somewhat symbiotic ways as well as how their local, traditional, non-per-se-exploitative practices - shaped by continuous ecological intimacy - changed when economic pressure emerged. I will arrive at exploring in which way the specific attunements the local human population historically developed influenced the path towards the designation of a UNESCO Biosphere Reserve (synonym with Biosphere Park) in the valley and how they were and are influenced by the park.

Lastly, I will discuss the following questions:

- In which ways does anthropocentric thinking apparent in the UNESCO Biosphere Park concept deprive human and non-human ecology of its agency and how does this limit ecological intimacy, thus impeding the developing of newly attuned human practices embedded in the valley's present and (possible future), especially in the light of the to be expected effects of global warming?
- How can preconditions for attunement be facilitated (again) for a situation to arise which is sensitive to the omni-present complexity, entanglements and interdependencies of life and thus able to better promote vitality in the valley's ecology as a whole? What are the political and spatial aspects of this?

1 / Attuned Land Practices, Geological Agency, and Issues of Livelihood in the Großwalsertal

The Großwalsertal is a Western Austrian alpine valley in the state of Vorarlberg, 50 minutes away by car from where I grew up. I know this place well. It is one of my favourite places to go for hikes and I have been on and around many of the valley's mountains and seen it in different times and seasons.

The valley is around 14km long, starting in the East with the lowest point at 1.400m and in the West, at 540m, opening into the wide valley of the densely populated Rheintal, an important economic region for both Austria and Switzerland. On the North side the *Walserkamm* mountain range separates it from the Bregenzerwald and the ski-resort Mellau-Damüls to which it is connected only through a pass at Faschina. East of the valley lays Warth-Schröcken



Alpenrose & Enzian in Vorarlberg, 1982. Helmut Klapper, Vorarlberger Landesbibliothek



Girl holding a roe fawn, 1940s. Sammlung Risch-Lau, Vorarlberger Landesbibliothek

Bergidylle

Edelweiss in Vorarlberg. Sammlung Risch-Lau, Vorarlberger Landesbibliothek



Postcard motive of Alpenrose, Enzian, Edelweiss. Holy trinity of the Alpine flowers. Origin unknown.

which is connected to the Arlberg region with St. Anton and Lech-Zürs, a major high-profile tourist destination.

The Großwalsertal covers around 200km², which is similar to the size of Amsterdam. It has steep faces that peak in mountains as high as 2.704m (Rote Wand). The North side of the valley consist of flysch stone that brittles easily and in places forms rather soft slopes, whereas the South side is predominantly limestone forming harsher and steeper slopes. At the bottom of the valley flows the river Lutz with many smaller streams from the side valleys feeding into it. It eventually flows out the valley into the Ill and into the Rhein. There are two side valleys branching off South that are generally steeper than the main valley. Characteristically, for a V-shaped valley, there is no flat bottom and so the villages emerged on the slopes. The North side, which is also the sunny side of the valley, is generally gentler and thus more densely populated and the South side being where most of the *Alpen* are.

There are 6 municipalities in the valley, *St. Gerold, Thüringerberg, Raggal-Marul, Sonntag, Blons and Fontanella-Faschina*, which are rather small conglomerations of houses around churches. Farms are scattered and distributed over most of the valley's gentler slopes. Towards the East the density decreases. The villages stop at around 800m. Today, around 3.400 people live in the valley (Berchtold, 2019, p.7)

For the last 700 years the Großwalsertal has been inhabited by the Walser¹, a people originating in Western Switzerland. They were likely brought in by Vorarlberg's feudal lords for their methods of transhumance on steep mountain faces closely attuned to the landscapes and their seasons (Kathrein, 2018), the *Dreistufenwirtschaft* (three-level-agriculture). The Walser rigorously cleared the forest that covered much of the valley to turn it into farmland, introducing alpine pastures. They built settlements, shielings and transhumance infrastructure, thus shaping the valley quite drastically since their arrival in the late 13th century posing a major disturbance. (Schmid-Mummert, 2018)

The *Dreistufenwirtschaft* consists of moving the cattle, such as cows, sheep or goats, through three levels of altitude throughout the year. To allow for haymaking in the valley as supply for the winter in spring the cattle are brought higher into the mountains to graze elsewhere and allow for the grass in lower altitudes to be cut multiple times and dried into hay. At the first stop, the *Maisäb*, the cattle graze until June, when the weather allows it, they move up to the *Alpe*, the highest settlement just above the treeline at 1.700m, to clear the pastures around the *Maisäb* too. For example, Sonntag lays on 900m, the *Maisäb* in Sonntag-Stein is on 1.300m and the *Alpe* Oberpartnum is on 1.650m. The upper pastures consist of some simple buildings, stables, living quarters and a *Senneri* (cheesery) which were traditionally shared by a community of families. Today there are still 23 *Alpen* in use in the valley.

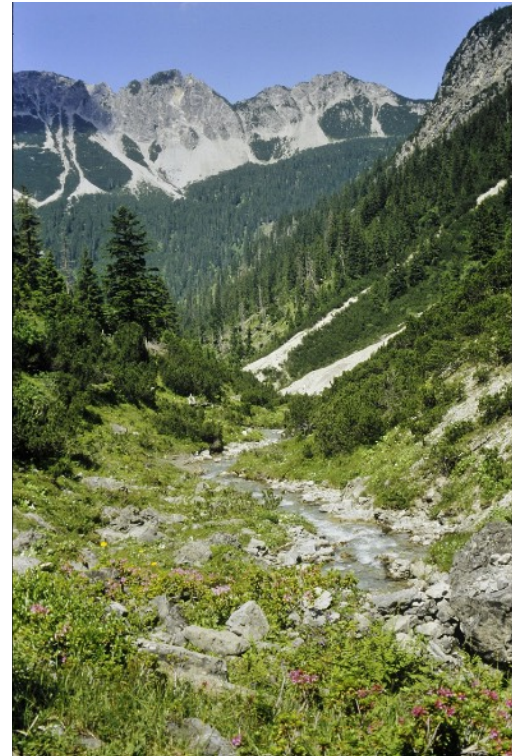
Since some people had to stay in the valley to make hay and only around 10-15 people are required to milk and pasture the cattle the families organised in groups and each sent a few members up to the pastures. The families also together elected a *Senn*, responsible for the dairy production and usually head of operations during the time on the *Alpe*. The resulting cheese was divided according to the amount of cattle and workforce each family had contributed. At the end of summer, the cattle were brought down to the *Maisäb* and after a short stay back to the village where during the harsh winters the people would largely live off the supplies they had stocked in summer and the cattle would live off the hay that had been produced. The *Dreistufenwirtschaft* is still practiced this way today. Another attuned land practice of the Walser is forestry. They were aware that certain parts of the forest had to be kept intact to prevent avalanches. On the steep, bare faces the snow can easily hive off and therefore it was crucial to keep certain *Schutzwald* (protective forest) in especially precarious places. Since wood was needed for heating and building they developed a method of taking only certain trees out of the *Schutzwald*, allowing it to keep its shape and protective stability². The cutting of the trees happened mainly in winter when the ground was frozen and the cut trees could be dragged out of the forest on the hard

¹ Hence the name Großes Walsertal, "large Walser valley".

² In the beginning of the 20th century the forestry became industrialised with motor saws and an increased demand in Swiss pine lead to the *Schutzwald* being cut back too much which likely was one of the reasons for the avalanche catastrophe in 1952 in Blons (Ganahl, 2014) which killed 50 people.



Rote Wand, 1961. Sammlung
Risch-Lau, Vorarlberger
Landesbibliothek



Faludriga-Nova. Helmut Tiefenthaler, Vorarlberger
Landesbibliothek



Pastures by Raggal, 1985.
Helmut Klapper, Vorarlberger
Landesbibliothek.

Protected Landscapes



Waterfall in Gadental, 2005. Helmut
Tiefenthaler, Vorarlberger Landesbibliothek



Magerwiese, unfertilised pasture with a variety of alpine flowers, in the background is a *Heustadl* where appliances for hay making were stored, around 1980. Vorarlberger Landesbibliothek.

forest soil. This extensive forestry also helps keep the forest young and resilient as well as preventing bush encroachment in the pastures.

The cleared areas of the meadows in combination with the traditionally maintained forests started to host an incredible amount of biodiversity providing a habitat for a vast array of insects and plants. Higher up in the rocky parts of the valley hosts *rare* species such as Edelweiß³, snow grouse and chamois as well as marmots and raptors.

1.1 / Geologically unsuited for Mass tourism

In end of the 19th century, in a romantic pursuit for *adventure and natural beauty*, travellers and scholars from Germany started discovering the Großwalsertal and documenting the local peculiarities. They were impressed by the *pureness* of the valley and they reported that it was still *“not being frequented much by the common tourist”* (Schmid-Mummert, 2018, p.23). Karl Blodig, a Viennese doctor wrote 1905 *“for days you can walk here without being harassed by objects of our (uber-culture)”* (pp.24-25).

He and others advertised the beauty of the Großwalsertal in a magazine issued by the German Alpine Club and in 1911 the first *Alpenvereinshütte* (alpine hut for leisure), the *Biberacher Hütte*, was opened. More followed soon, mostly financed by the German Alpine Club, and by the beginning of the 20th century the valley had started to become an off-the-grid tourist destination.

It was made increasingly accessible to the outside world by road and train. In 1932 a state-of-the-art hotel opened in Faschina (Schmid-Mummert, 2018, p.63) and in and around the valley skiing lifts started popping up.

The landscape and especially the scenery had started to become more and more of an asset to the livelihoods of the local people.

On the other hand, these connections linked the valley to global supply chains which brought a sudden influx of goods and produce which began to put pressure on the local farmers as their productivity levels were not competitive with the global markets. Many were forced to change trades

or move away and tourism came as a welcome alternative of livelihood.

Josef Türtscher, former chairman of the regional development association REGIO (see chapter 1.2), said that it was expected, as had been the case in other alpine valleys, that winter tourism would slowly supersede agriculture.

However, this development slowly came to a halt as the geological preconditions in the Großwalsertal were not like in other valleys such as the close by Bregenzerwald or Arlberg. Its faces are too steep and narrow for large scale skiing areas and in its relatively low altitudes the early effects of global warming already resulted in progressively fewer amounts of snow in as early as the late 1970s. The slump that all of the alpine regions felt in the 80s was also noticeable in the Großwalsertal and caused a trend of emigration in the local population, Josef Türtscher said. (Schmid-Mummert, 2018, p.67)

Local farmer Kurt Stark (2023) told me at that moment it was about *“do we find new ways of creating an income here or do we leave the valley”*. In response to these threats the local governments of the 6 villages started to work together more closely in tackling the situation and in 1972 founded the REGIO, a regional development department that should envision a new future for the valley and its people.

1.2 / “...It Was Decided 200 Million Years Ago That the Großwalsertal Would Become a Biosphere Park”

The REGIO held different committees involving the local population. An example is the Participatory Rural Appraisal for the *“survival of the famers”* (Tillmann, 1993). Over the course of 5 days, facilitators from the German *“Gesellschaft für technische Zusammenarbeit”*, a German NGO for (until 2011) international, sustainable development, together with 16 local farmers created ideas for the future of the agriculture in the valley. For the farmers it was out of question to deviate from their traditional practice of agriculture.

On the question of *“why”*, Kurt Stark (2023) said that many Walser hold a feeling of responsibility towards future generations to leave the valley *“the way that we found it, or better”* and this extensive agriculture ensures that.

³ The Edelweiß played a big role in early Alpine preservation projects and became a symbol of untouched mountain valleys. It is the logo of the Austrian Alpine Club which also has traditionally been very involved in keeping the mountains wild. (Tiefenthaler, 2016)



Hiking path to the Gadenalpe. Helmut Tiefenthaler, Vorarlberger Landesbibliothek



Biberacher Hütte (1.846m) in Front of the Hochkünzelspitze, 1960. Sammlung Risch-Lau, Vorarlberger Landesbibliothek



Street L 193 coming up from the Walgau/Rheintal, 1978. Sammlung Helmut Klapper, Vorarlberger Landesbibliothek



Faschina / Vorarlberg, Seesattelbahn Rote Wand - www.seesattelbahn.at

Skilift in Faschina, 1960. Sammlung Risch-Lau, Vorarlberger Landesbibliothek

Early Tourism



Hikers in the Rote Wand, 1979. Helmut Klapper, Vorarlberger Landesbibliothek

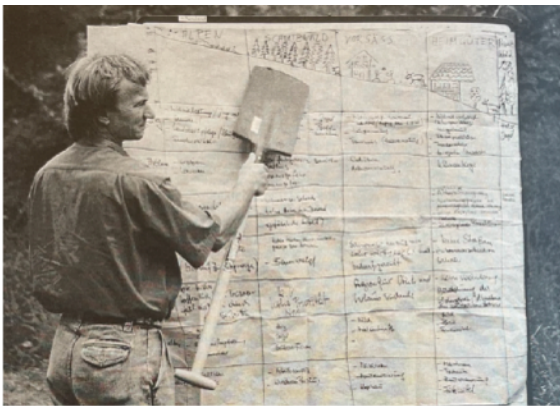


Hikers on the top of the Rote Wand, 1916. Norbert Bertolini, Vorarlberger Landesbibliothek

On the other hand, a 1986 commissioned study from the Institute for Transit and Tourism (Innsbruck) answered the economic problems with the proposition to implement a nature-near tourism concept in the valley. (Schmid-Mummert, 2018, pp. 69-70)

The results of the sum of these and other initiatives in 1997 was the citizen-backed application for the designation of the valley as a UNESCO Biosphere Reserve. The REGIO played a key role in developing the necessary concepts for the designation and acts as the legal entity.

In the conversations I had with various people in the valley I was told that the Biosphere Reserve was the only sensible solution to the situation. David Ganahl (2023) told me that with its topography and the resulting impossibility of industrial agriculture or mainstream tourism "...it was decided 200 million years⁴ ago that the Großwalsertal would become a Biosphere Park".



Participant of the Participatory Rural Appraisal workshop presents a model on how to use and treat different parts of the valley, starting with the peaks, to the forest, Vorsäß, village, river. Tillmann, 1993.

2 / Conservation as economic survival

The UNESCO Man & Biosphere program (UNESCO, 2023) is aimed at "enhancing the relationship between people and their environments" while promoting "sustainable development" in compliance with the UN sustainable development goals.

Biosphere Reserves are the spatial manifestation of the MAB program and counts 738 sites in 134 countries including famous examples such as the Rocky Mountains, the Hawaiian Islands, the Galapagos Islands and Ngorongoro in the Serengeti.

As opposed to more conventional national parks, human activity is not excluded from its borders. Instead, they are places "where humans and biosphere thrive alike".

[The] World Network of Biosphere Reserves is a dynamic and interactive network of sites of excellence that foster harmony between people and nature for sustainable development through participatory dialogue; knowledge sharing; poverty reduction and human well-being improvements; respect for cultural values and society's ability to cope with change. (UNESCO, 2023)

Biosphere Reserves, "sites of excellence" protecting biodiversity, are also meant to serve as an example and a learning ground for humanity to rethink its relationship with nature. Precisely this grand aspiration of *reconciling humans with nature* and finding examples of *best practices* that should be applied more globally and its application in large numbers make this concept worth looking at.

According to the UNESCO roadmap for Biosphere Reserves, the Lima declaration (UNESCO, 2017), their purposes are ensuring the conservation of biosphere and the sustainable use of its resources. Conserving local biotopes, sustainable practices and growing and sustainably using ecosystem services such as clean water and air or leisure with a focus on renewable energies (e.g. Bridgewater, 2016).

⁴ Approximately the time when the valley was shaped by glaciers.



Wood works in winter around 1920-1935. Horses helped drag the cut logs over the frozen ground, volare.



Wood works in Blons in 1993 supported by a helicopter to transport the logs because the ground is not frozen, volare.



"Upper Lutz", site of the planned dam, core zone, unobstructed river home to various species of fish. Sonntag, 2004, volare



Existing hydroelectric dam "Lower Lutz", Raggal, built 1956, volare 2004

Biosphere Reserves facilitate scientific research into their specific biotope and monitor populations. They also spread education and awareness among the local and general public about the importance of biodiversity and sustainable development. In a paper on the future of ecological education, from the UNESCO digital library, it is stated, that “[b]y 2050, we have fully acknowledged that humans are embedded within ecosystems and that we are ecological, not just social, beings.” (Common Worlds Research Collective, 2020, p.4)

They are supposed to promote sustainable livelihoods for communities inside the park - activities such as ecotourism, forestry, agriculture, and other forms of “sustainable” use - as well as regional and international cooperation and exchange of best practices in sustainable development and conservation through the global network of Biosphere Reserves.

2.1 / Creating a Biosphere Park

Biosphere Reserves consists of 3 mandatory zones (Dünser, 2002, pp.19-20):

(1) Core zones, protecting a unique biotope - Natural processes are generally allowed to occur *free* from human intervention. The shared area of these zones has to be at least 3% of the reserve’s area and should be protected by local law, in the case of the Großwalsertal through the EU’s Natura 2000 program and Austrian national park programs. In these zones only few human activities e.g. hiking/ tourist visits or research such as monitoring populations of wildlife are permitted.

(2) Buffer zones, surrounding the core zones - They define an area that is available for “sustainable” use such as ecotourism or agriculture/forestry which might constitute a protected cultural landscape that emerged through certain traditional land practices such as the Großwalsertal’s alpine pastures. It also shields the core zone further. These zones are usually the majority of the reserve’s area and at least 24% are mandated by the UNESCO.

(3) Development zones, around existing human settlements where sustainable economic activity is permitted. The focus here is on human livelihoods through “socially valuable production and marketing

of sustainable projects” (Dünser, 2002, p.20). These zones can even comprise cities.

In the Großwalsertal there are 6 individual core zones making up 17% of the valleys area around some of the highest peaks of the valley and the river Lutz, all of which had already been protected areas before the Biosphere Park. The buffer zones are where most of the traditional agriculture and transhumance happens and consist mostly of characteristic alpine pastures. The development zones are found around the existing settlements and around the ski lift *Sonntag-Stein*.

The park’s borders were established along the combined area of the 6 member municipalities. To determine the zoning, in 2000 the state Vorarlberg commissioned the Institute for Ecology and Conservation of the University of Vienna to classify and create a landscape inventory (Grabherr, 2001). A grid was laid over the map of the designated reserve comprising 3264 cells, 250x250 meters. 21 types of landscapes were identified and each cell was assigned a specific genome.

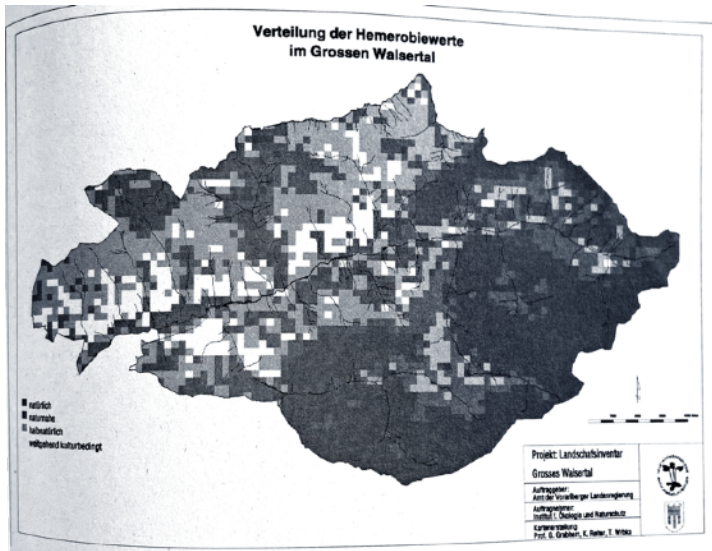
The researchers also assigned a degree of hemeroby (Degree of cultivatedness of land; Greek hemero- = “tame”, bios = “life”, therefore hemeroby = “tamed life”) to each cell and out of this analysis a zoning proposal was created.

The particularly “untamed” cells were the base for the core zones, the more “usage-oriented” parts became buffer and development zones. This proposal was then implemented almost identically in 2002 when the valley became a Biosphere Park. (Dünser, 2002, p. 73)

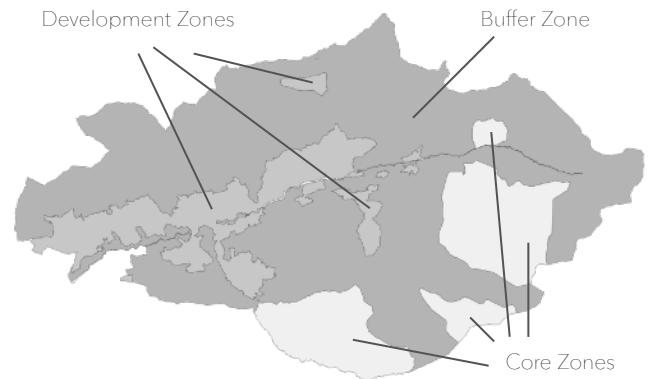
The national parks of the core zones already have such inventories of their biodiversity that were created as early as in the 1980s and there are multiple documents on their future development focused on the growth of the existing biodiversity and the limitation of outside influences. (e.g. Biosphärenparkmanagement Grosses Walsertal, 2004)

2.2 / Economic and Conservation Interests

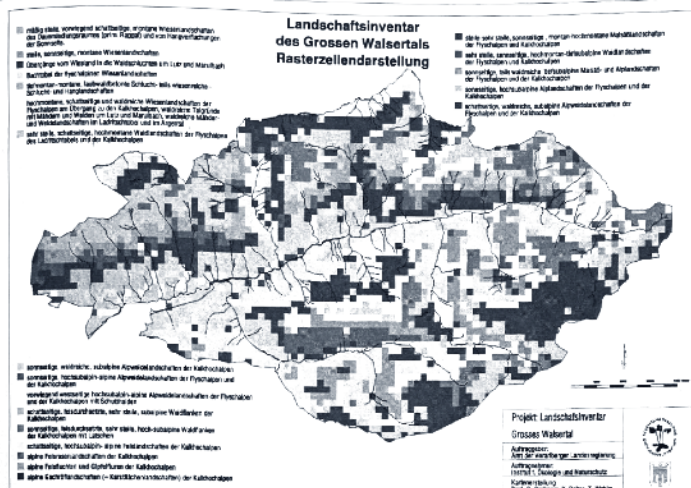
From a UNESCO (2023) point of view what made the Großwalsertal a possible contender to become such a “site of excellence” were its high degree of biodiversity in the now core and buffer zones but also in the cultural landscapes. Thus, the Dreistufenwirtschaft and the sustainable forestry and



"Distribution of degrees of hemeroby in the Großwalsertal". The darker, the more "natural" the cell was deemed. Grabherr, 2001



Zoning of the biosphere park. Data: vogis, 2023



The 3264 cells were all assigned one of 22 predominant landscape types. Grabherr, 2001

- 154d
- Carex ferruginea Scop.(3), Deschampsia cespitosa (L.)PB.(2), Festuca nigrescens Lax.(2), Ligusticum murellina (L.)Cr.(2), Peucedanum ostruthium (L.)Koch(2), Pulsatilla alpina agg.(1),
- Alchemilla glabra Meyenb.(1), Rhododendron hirsutum L.(1), Carex sempervirens Vill.(1),
- Paselago carfare L.(1), Geranium sylvaticum L.(1), Alchemilla nitida Buser(1),
- Cheerophyllum villosa: Koch(1), Viola biflora L.(1), Silene vulgaris (Monch)Garcke(1),
- Astragalus frigidus (L.)A.Gray(1), Solidago virginica L.(1), Hedysarum hedyotoides (L.)Schub. & Thell(1),
- Phleum hirtutum Honck.(1), Salix waldsteiniana Willd.(1), Hypericum maculatum Cr.(1), Galium anisophyllum Vill.(1), Bartelia alpina L.(1), Cystopteris fragilis (L.)Bernh.(1),
- Hieracium europaeum L.(1), Trollius europaeus L.(1), Anemone narcissiflora L.(1), Phytolacca orbiculata L.(1), Kneuzia hirsuta (Opiz)Orta.(1), Polystichum ionchitis (L.)Fock(1),
- Paricicaria vivipara (L.)Rosa Decr.Layer(1), Gentiana anolepiada L.(1), Campanula schoucherei Vill.(1),
- Leontodon hispidus L.(1), Sambucus lucida Vill.(1), Veronica album L.(1),
- Cystopteris montana (L.)DC.(1), Thalictrum molligolobatum L.(1), Aconitum napellus L.(1),
- Aster bellidiflorus (L.) Scop.(1), Hieracium villosum Jacq.(1), Valeriana montana L.(1), pratense L.(1),
- Trifolium badiu Schreb.(1), Trifolium majus L.(1), Trifolium pratense L.(1),
- Saxifraga paniculata Mill.(1), Achillea atrata L. s. str.(1), Hippocrepis comosa L.(1), Soldanella alpina L.(1),
- Scutellaria rotundifolia L.(1), Parnassia palustris L.(1), Ranunculus montanus Willd.(1),
- Leucanthemum scoulerianum DC.(1), Pinguicula vulgaris (L.)Radd.(1),
- Pringon unicoloris L.(1), Salix appendiculata Vill.(1), Anthyllus vulneraria L.(1),
- Salix retusa L.(1), Carduus defloratus L. s. str. Ranz(1).

Each landscape type has a register of typical/native plants. Grabherr, 2001

Biosphäre als Chance für die Zukunft

Großwalsertaler Regionalplanung legte Zeitplan für Umsetzung fest

Blons (hh) Mit hochgekrepelten Hemsärmeln will man im Großen Walsertal an die Umsetzung des „Biosphärenparks“ gehen. In den sechs Talgemeinden wurden Grundsatzbeschlüsse gefaßt. Der Hauptausschuß der Regionalplanung legte nun den Fahrplan fest.

„Der Biosphärenpark ist eine Chance, kein Wunderwuzzi“, warnte LR Erich Schwärzler vor übertriebenem Optimismus. Das Kapital „Landschaft“ müsse im Walsertal eingesetzt werden.

Kaum anderswo im Land gebe es bessere Voraussetzungen für den Einklang zwischen Landschaft und naturnaher Bewirtschaftung.

Die Unterstützung durch das Land wurde den Walsern zugesichert. Schwärzler will in Brüssel versuchen, mit dem „Biosphärenpark“ in ein EU-Leaderprogramm zu kommen.

Rasche Umsetzung

Weniger Papier und Leitbild-Kataloge, dafür rasches unbürokratisches Handeln wünscht sich Bezirkshauptmann Leo Walser. Verschiedene Ressourcen des Naturraums Großes Walsertal sind für ihn im Sommer- und im Wintertourismus derzeit nicht optimal genutzt. Bis zum 10. September werden Vorschläge für die zu bildenden Gremien vorgelegt. In Unterausschüssen für Tourismus, Landwirtschaft, Verkehr, Kultur sollen Themen konkretisiert werden.

Bereits bis zum Sommer des kommenden Jahres könnte die Verordnung „Biosphärenpark“ im Landtag perfekt sein. Einer Anerkennung durch die UNESCO steht dann nichts mehr im Wege.

(Foto: Hronek)

Article in the Vorarlberger Nachrichten. "Biosphere as an opportunity for the future". H, 1998

the way that the Walser live in "harmony" with the land are important features which are also stated in the policy paper of the park. (Berchtold, 2019, p. 25)

Among the different parties in the valley the motivations behind the designation of the park are heterogenous yet it is somewhat evident that, unsurprisingly - given the situation it arose from -, there is a strong economic interest. Elke Szalai (2004), landscape planner for regional development in alpine regions and feminist planning, faulted this prevalence of economic interests over the conservational aspects of the UNESCO MAB concept. An interviewee she quotes, says that "*many of the projects in the valley [happen with] too little involvement of nature and too much focus on profit*". And this coincides with how some of the people saw it who I spoke with, now in 2023 (Ganahl, 2023, Stark, 2023, Weber, 2023) as well as in literature and time documents.

State administrator (Landrat), Erich Schwärzler, 4 years prior to the designation of the park told a local newspaper "*the capital 'landscape' needs to be deployed*" in the Großwalsertal to ensure its economic survival. (H, 1998)

The Biosphere Park concept, he claimed, is an ideal way to do this, increasing the value creation of the economic activities in a wide array of branches. As Szalai (2004) mentions, by being added to the worldwide network of Biosphere Parks the popularity of the Großwalsertal increased significantly. Through becoming a Biosphere Reserve formerly uncompetitive products and services could be marketed as traditional, local, ecologically sound, yet progressive, unique and of high quality and thus could justify higher prices.

This had the effect that traditional land practices became profitable once again.

Bergholz, which markets forestry and carpentry products produced in the Walser's traditional way, has seen an increase in their value creation (Mathis, 2001). The farmers united in a collaboration to sell and market their cheese together under the brand *Walserstolz* (Walser's pride), which Kurt Stark (2023) was an initiator of. Rumour has it that this cheese even made it to a speciality shop in New York.

2.3 / Walser Practices Within the Biosphere Park

Through the change of the valley from a place of rather self-sufficient agricultural to a space of "ecological production and tourism" the land practices also underwent changes.

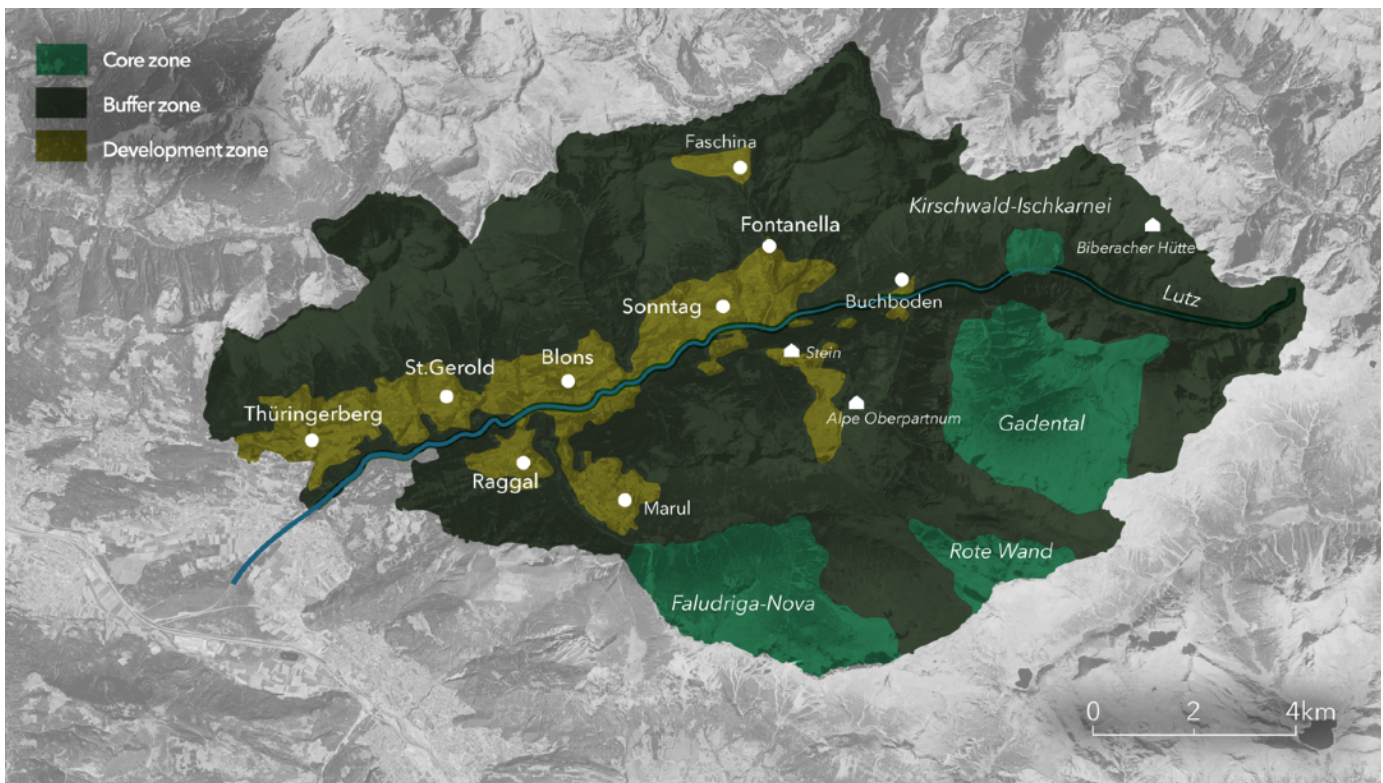
Traditional transhumance is still practiced in similar ways, the same routes are taken and the settlements, now modernised, are still in place. Its purpose, however, is much less food production for winter stocking than it is preserving the cultural landscapes of alpine pastures and image of the valley as stated in the policy paper of the Biosphere Park Großwalsertal. "*Agriculture is one of the main pillars of the economic and cultural life. It serves the structuring and preservation of the scenery.*" (Berchtold, 2019, pp.17-18), as well as preserving the practice itself.

Kurt Stark (2023), somewhat jokingly, called it landscaping with the benefit of creating cheese. The tourism also saw the *Alpen* adapt to new income streams such as providing traditional food to tourists and even accommodation. They also receive various subsidies from agricultural funds, such as the ÖPUL, a subsidy for especially biodiverse "*mowed steep areas with a slope of more than 50%*" (LKO, 2023).

The forestry also has a maintenance role as well as keeping the forest young and preserving the pastures from scrub overgrowth (Leissing, 2023). Taking single trees out of a forest in the traditional way, however, is becoming more difficult because this practice relies on frozen forest ground which is an increasingly rare phenomenon. If the trees are pulled over unfrozen forest ground they carve drenches and harm the scrub and mycelia as well as the roots of other trees. That and the fact that some local trees are already struggling in other places of the Alps poses a challenge for the future of this extensive kind of forestry.



Map of the valley showing the general context, 2 exemplary transhumance routes (red), ski-lifts (yellow dotted) and some Alpen.



Map of the zoning the biosphere park with core zone Kirschwald Ischkarnei including Unter/Überlut as well as the river Lutz being its own zone. Development zones are around the existing villages.

3 / Balancing Conservation and Change

The Biosphere Park Großwalsertal celebrated its 20th anniversary and 50th anniversary of the REGIO in 2022. From a regional, "sustainable" development point of view the implementation of the Biosphere Park is quite successful. It helped keep the traditional economic activities profitable while involving the local population directly, and the successful creation of a far-reaching Biosphere Park brand gives added value to almost all economic activity in the valley. It provided a new livelihood for the valley's people and, in a unique way, "deployed" the valley's "economic capital". It also once more enabled tourism, this time under the branding of "eco-tourism" and "de-celeration" (Leitbild des Biosphärenparks Großes Walsertal, 2019, p.16).

However, despite the MAB programme's aspirations to mend "the troubled relationship between humans and nature" the model reflects aspects of anthropocentrism in its fundamental principles. I want to discuss how this presence becomes visible in the Großwalsertals the zoning and spatial policies and their effects.

3.1 / Pure Nature and (Non-)Actualisation by Law

Firstly, in Biosphere parks aspirations to further improvement and development of human living conditions are often more prominent than ecological efforts. The MAB has also been criticised for its focus on conservation through purely human terms of wellbeing i.e. ecosystem services such as water, food, clean air but also leisure and tourism.

And although the zoning is "not supposed to be indicative of different value" (Dünser, 2002, p.21) the categorisation into areas of different hemeroby and creation of enclosures on this base forces a division between humans and nature. This practice also implies that human presence needs to be separated from the core area of the park to protect its wilderness from the hemerobic spheres of the development zones which the concept of the "buffer" zone further reinforces.

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The idea of *pure* nature this perpetuates appeared in different conversations such as the vegetable garden at the Propstei being transformed into an example of "real" nature as the one in the core zones⁵. (Ganahl, 2023)

Perpetuating such a view can lead to a focus on preserving idealised versions of nature and maintaining the concept that nature is where humans are not, rather than adequately responding and allowing non-human and human agency to interact and influence each other.

This separation also perpetuates the view of nature as an *unactualised* resource and whose preservation is mandated by the park according to a specific number (at least 3% of core zones). However, once a protected resource becomes economically relevant this position holds the possibility for *overperforming* parks to actualise that resource anyway.

There are plans to build a hydroelectric dam in the core zone of the Upper Lutz in addition to the existing one by Raggal (built 1956) to further renewable energies in Vorarlberg and reduce reliance on imported power. These plans are hugely discussed currently. It will have a devastating effect on the habitats of trouts and other fish and is currently not possible since the site lies in one of the park's core zones. What, however, even allows for this possibility is that much more area (17%) is zoned as "core" than is mandated by the MAB program. Thus some of it could be redesignated, sacrificed, *actualised*, without losing the predicate (Stark, 2023), theoretically 14%.

3.2 / At the Charge of the Mute Nature

The parks borders and zones are anthropocentric because non-humans cannot read them and will not adhere to them and they were created without their consideration. Former Austrian Alpine Club chairman Dr. Werner Brandtner (Tiefenthaler, 2016, p.90) called out the lack of non-human voice in "the always-same-ending weighing of interests - namely at the charge of the mute nature" concerning decisions about projects in natural areas in Vorarlberg.

In talking about the hydroelectric plant to Weber, Stark and Ganahl, they all said that, whatever the outcome, it is a success that it is discussed in such

⁵ The vegetable garden was turned into a garden of experience where a planting grid should not be applied. It should be more "wild". (Ganahl, 2023)



Skilift Raggal (own), Hotel in Faschina (unknown), Camping in Plazera, Sonntag both Böhringer Friedrich, CC2.5

Landscapes allowed to change



Industrial area at the Lutz in Sonntag with a saw mill and a logistics center.

detail and so many people are involved. If not for the political frame of the park, none of the locals would have had to be considered. However, non-humans such as the trout remain mute in these processes, represented merely by clubs of volunteers who demonstrate for the preservation of the Upper Lutz. They lack actual integration in political decisions that are as or more relevant to them than to the humans who currently make them.

3.3 / Ignoring inevitable change

The models and biotope inventories that the Biosphere Park and its preservation policies build on, propose definite biotopes, kinds and numbers of local species (e.g. Grabherr, 2001). This assumes the biotope's state of health as a *perfect*, countable equilibrium of certain number of individuals of specific species and falsely fixes it rather than recognising the constant dynamic, ongoing processes of attunement necessary for such health to develop.

Furthermore, there is a *Verschlechterungsverbot* (deterioration prohibition) in place in the Natura 2000 areas meaning species populations can grow or stagnate but not decline.

David Leissing (2023), manager of the Natura 2000 areas and core zones Gadental and Unter-Überlut, told me that if e.g. a certain kind of tree would not be able to cope it would have to be replaced with another tree which is part of the landscape's inventory but it cannot be replaced with a non-local tree even if such a tree might be organically settling there. Such exclusivity in the admission of species might harm the immune reaction of the valley's biosphere.

The landscape and species inventories are quite inert and over the years largely remain the same⁶. David Leissing (2003) said that shifts in these "natural" areas happens really slowly. Seeing that global warming is quite drastically influencing some of the Alpine regions' biotopes this might not be the case for much longer.

With increasing temperatures it is for example expected that tree lines in alpine areas will shift

upwards. Currently barren lands as high up as 2100m (Zou, 2022) might soon become populated by plant species found much lower presently. Such development is not *admitted* or accounted for the current models despite, in all likelihood, becoming a reality soon.

3.4 / Adapting Is a Human Privilege

In the Biosphere park model itself there is more room for change in parks and the policy of the Biosphere Park needs to be adapted every 5-7 years. However, in practice this mostly applies to the human realms. As such, *sustainable* development and new livelihoods are encouraged, tourist target orientations are adapted but changes in the more *nature-dominated* zones are less welcome and actively prevented.

Anna Weber (2023) mentioned for example that in thinking about the impact of climatic changes in the valley the focus lies on preserving alpine pastures and Schutzwald in their current form despite already looming droughts. The efforts go more towards ensuring water security in the higher altitudes than to re-evaluate. There are many political and financial reasons for this such as the ÖPUL funding and the fact that if the alpine pastures deteriorated the predicate of a biosphere park might be revoked by the UNESCO.

All this heavily limits the agency of humans and non-humans to attune to unavoidable changes in the ecosystems together and there is a big risk that these rigid models and definitions of the valley's biosphere will prove very harmful in the near future and contribute to the mass extinction rather than preserving biosphere. The alpine regions and this specific valley have already been experiencing the effects of global warming since the 1980s (Burger-Scheidlin, 2009) and will be amongst the most affected in Europe⁷ (EEA, 2023). The inconsiderate fixation on *stati quo* prevents attunements and action which might be required sooner than expected. It is for example worth asking the question if an undoubtedly historically extensive and symbiotic practice like Walser transhumance and forestry will remain so if continued without regards to the (global) changes in climate.

⁶ E.g. in a still relevant paper from 2004 on the landscape development and zoning in the park a main source is a landscape inventory from 1988, it is linked on the park's website. (Biosphärenparkmanagement Großes Walsertal, 2004)

⁷ Temperature increase is currently 2x faster in Alpine than in non-Alpine regions in Europe.

For that I suggest looking at the situation these practices have arisen from initially, one of ecological intimacy, time and shared agency and I want to ask how such preconditions for attunement can be facilitated (again) for a situation to arise that takes into account the entanglements and interdependencies of life and can actually help the valley's vitality in a future of global warming.

4 / Intimacy as Tool for Biodiversity Protection

What gave rise to the attuned practices of the Walser and the biodiversity in the valley was an inevitability of mutual agency. The interspecies relationship of transhumance was an answer to cold winters, the forestry a protection mechanism to avalanches. The biodiversity of insects and flowers was an answer to alpine pastures and chamois population a response to remote inaccessible mountains which are unsuitable for other species. The biosphere park itself was an answer to global influences driven by industrialisation and romantic adventurism and was itself enabled by the species that inhabit the park and the Walser's way of living. The valley's human and non-human inhabitants have always dynamically attuned to disruptions in their ecosystem. These are the processes that gave birth to traditional symbiotic land practices.

Without doubt the Biosphere Reserves' preservational policies carry the hugely important role of avoiding harm in the form of blunt and purely profit oriented human interventions that are a threat to many lifeforms who currently have no political voice. Eventually, however, the focus has to be on emancipating non-humans in the valley as well as in the programme itself into these processes, in the sense that, rather than just shielding them, their agency is respected and acknowledged and their voice is heard.

The valley's non-human voices, once as loud as avalanches, are quieter these days, have changed and it is important to get close to hear them.

Biosphere parks need to allow for ecological intimacy by removing inaccurately stable definitions of the biotopes and dissolving their anthropocentric

borders. For it to be a "site of excellence" where humans live in "harmony" with non-humans, human and non-human voices need to be heard in all areas of the parks. Biosphere parks should provide political processes in which non-human interests are represented adequately and honestly.

There should also be a reconsideration on what makes a healthy biosphere away from anthropocentric equilibrium thinking. It is impossible to isolate any one species as an indicator for a healthy ecosystem as well as labelling them local or non-local to any human defined realm and time. Historically, a host of non-local species have made a home in the valley like the rainbow trout or Walser people and through attunement they have always furthered the valley's resilience and biodiversity.

A more holistic approach to environmental health would be to focus on furthering, instead of specific species, aliveness or vitality more generally. This incorporates the ambiguity of place in ecological matters as well as the inevitable changing nature of ecosystems and their participants and the necessary specificity and uniqueness of actions. There needs to be fluidity in ideating possible ecological futures for all beings and how to act on them in the present.

For the MAB to actually create places that help that "[b]y 2050, we have fully acknowledged that humans are embedded within ecosystems and that we are ecological, not just social, beings." (Common Worlds Research Collective, 2020, p.4) it needs to leave behind the anthropocentrism causing ideological and practical rigidities and insensitivities negating the continuous complex interplays that give rise to biosphere. Enabling these should actually be the object of interest.



Sunrise Biberacher Hütte, 2007. Hanno Thurnher
Filmproduktion

References

- A Life on this Planet*. 2020. [Stream] Directed by Jonnie Hughes. United Kingdom: Altitude Film Entertainment, Netflix, Silverback Films
- Berchtold, M., 2019. Ziele und Maßnahmen (Teil 2) - Regionales Räumliches Entwicklungskonzept Biosphärenpark Großes Walsertal. URL <https://www.grosseswalsertal.at/system/web/GetDocument.ashx?fileid=982234&cts=1579542103>
- Biosphärenparkmanagement Grosses Walsertal, 2004. Landschaftsleitbild und Zonierung für den Biosphärenpark Großes Walsertal (1999) – aktualisierte Version 2004.
- Bridgewater, P., 2016. The Man and Biosphere programme of UNESCO: rambunctious child of the sixties, but was the promise fulfilled? *Current Opinion in Environmental Sustainability, Sustainability science* 19, 1-6. <https://doi.org/10.1016/j.cosust.2015.08.009>
- Burger-Scheidlin, H., Christanell, H., Vogl, C. R., 2009. Wetter - Wahrnehmung - Wissen. Bäuerliche Perspektiven auf Klima und Klimawandel. In: AgrarBündnis, Der kritische Agrarbericht. Schwerpunkt: Landwirtschaft im Klimawandel, 261-265; *ABL Bauernblatt Verlag*, Kassel / Hamm
- Common Worlds Research Collective., Silova, I., Taylor, A., Blaise, M., Pacini-Kechabow, V., 2020. Learning to become with the world: Education for future survival. <https://unesdoc.unesco.org/ark:/48223/pf0000374032>
- Cronon, W., 1996. The Trouble with Wilderness: Or, Getting Back to the Wrong Nature. *Environmental History* 1, 7-28. <https://doi.org/10.2307/3985059>
- Dünser, E. & Schoch, C., 2002: Biosphärenpark Großes Walsertal - Analyse eines regionalen Netzwerkes. *Diplomarbeit an der Wirtschaftsuniversität Wien*, Wien.
- EEA, 2023. Alps – The impacts of climate change in Europe today. *European Environment Agency*. <https://www.eea.europa.eu/signals/signals-2010/alps>
- Ganahl, D., 2014. 60 Jahre Lawinenkatastrophe im Großen Walsertal. *Walsert Heimat* 94. <https://www.vorarlberger-walservereinigung.at/wwwp/60-jahre-lawinenkatastrophe-im-grossen-walsertal/>
- Ganahl, D., 2023. Interview by Andreas Höfert [Video-Call], 6 March.
- Grabherr, G., Reiter, K., Wrбка, T., Hübner, K., 2001. Landschaftsinventar Großes Walsertal. Institut für Ökologie und Naturschutz, *Universität Wien*, Wien.
- Gray M. W., 2012. Mitochondrial evolution. *Cold Spring Harbor, perspectives in biology*, 4(9), a011403. <https://doi.org/10.1101/cshperspect.a011403>
- Haraway, D., 1985. A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century. In *Simians, Cyborgs and Women: The Reinvention of Nature* (pp. 149-181). *Routledge*.
- H, H., 1998. Biosphäre als Chance für die Zukunft Großwalsertaler Regionalplanung legte Zeitplan für Umsetzung fest. *Vorarlberger Nachrichten*, 24 July, p. 11.
- Kathrein, J.F., 2016. „Walliser off Gultüre“. Die Wanderungsbewegung der Walser und Galtür. *historia scribere* 08 (pp. 187-222). <https://doi.org/10.15203/historia.scribere.8.468>
- Latour, B., 1993. *We have never been modern*. *Harvard University Press*, Cambridge, Mass.
- Latour, B., 2017. *Facing Gaia: eight lectures on the new climatic regime*. *Polity*, Cambridge, UK; Malden, MA.
- Leissing, D. 2023. Interview by Andreas Höfert. [Video-Call], 14 March.
- Leitbild des Biosphärenparks Großes Walsertal, 2019. *Biosphärenpark Großes Walsertal*. URL <https://www.grosseswalsertal.at/system/web/GetDocument.ashx?fileid=961588&cts=1568891505>
- LKO, 2023. 1 A Umweltgerechte und biodiversitätsfördernde Bewirtschaftung (UBB) ÖPUL

2023. [ONLINE] <https://www.lko.at/öpul+2400++3563524>

Mathis, M.J.V., 2001. Biosphärenpark gibt Holz Marktvorteil Waldaufseher Hannes Küng kurbelt Wertschöpfung aus dem Forst kräftig an. *Vorarlberger Nachrichten*, 28 February, p.5

Mathis, T. 2021. Bevölkerung Stichtag 31. Dezember 2020. *Amt der Vorarlberger Landesregierung Landesstelle für Statistik*. Bregenz.

Morton, T., 2018a. Being ecological. *The MIT Press*, Cambridge, Massachusetts.

Pope Franciscus. 2015. ENCYCLICAL LETTER LAUDATO SI'. *Vatican Press*, Vatican.

Schmid-Mummert, I.V., 2018. Alpingeschichte kurz und bündig. Das Große Walsertal. *Österreichischer Alpenverein*. Innsbruck.

Stark, K., 2023. Interview by Andreas Höfert [Video-Call], 6 March.

Szalai, E., 2004. Die Errichtung von Großschutzgebieten als Strategie in der Regionalentwicklung - Beispiel Biosphärenpark Großes Walsertal. - *Vorarlberger Naturschau - Forschen und Entdecken* - 14. (p. 161-178).

Tiefenthaler, H., 2016. Naturschutz in der Geschichte des Alpenvereins. In *Montfort* - 68/1. (p. 71-95). *Studienverlag*. Innsbruck

Tillmann, H.J.M., 1993. Seminar Bäuerliches Überleben im Großen Walsertal 1.-6. Aug. 1993, Gasthof Traube, Sankt Gerold, Österreich. *Deutsche Gesellschaft für Technische Zusammenarbeit*.

Tsing, A.L., 2021. The mushroom at the end of the world: on the possibility of life in capitalist ruins, *New paperback printing*. ed. *Princeton University Press*, Princeton Oxford.

UNESCO, 2017. New Roadmap for the Man and the Biosphere (MAB) Programme and its World Network of Biosphere Reserves. *United Nations Educational, Scientific and Cultural Organization*, Paris, France.

UNESCO, 2023. Man and the Biosphere (MAB) Programme. *UNESCO*. <https://en.unesco.org/mab>

Weber, Andreas, 2019. Enlivenment: toward a poetics for the Anthropocene, Untimely meditations. *MIT Press*, Cambridge, Massachusetts.

Weber, Anna, 2023. Interview by Andreas Höfert [Video-Call], 8 March.

Zou, F., Tu, C., Liu, D., Yang, C., Wang, W., Zhang, Z., 2022. Alpine Treeline Dynamics and the Special Exposure Effect in the Hengduan Mountains. *Frontiers in Plant Science* 13.

Images

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Translations

Some direct quotes from German sources were translated by the author. These are indicated in italic font "This is an example of a translated quote." (Author, 2023).