

# The Glarus Alps Battery with Algae Cultivation

## Multifunctional use of existing infrastructure

The logbook 'Klausenpass: Between two distinct valleys' was created during the research phase on the topic 'Switzerland at a Crossroads' in the Klausenpass region. It focused on the similarities and differences between the Schächental and Glarnertal. With several interviews, we explored the infrastructure in the landscape, living systems and the migration to the centres.

The resulting project 'The Glarus Alps Battery with Algae Cultivation' deals with the question of how existing infrastructure systems, vacant buildings and agriculture can be used to create a post-fossil production and at the same time a qualitative place with added value for the local population with just a few tweaks.

The Linth-Limmern pumped storage power plant produces energy using hydropower. The power plant network makes it possible to collect turbid water and pump it back up when the energy price is low in order to generate energy again. In addition to the high-Alpine Muttsee and Limmernsee reservoirs, there are the Tierfehd and Linthal compensating reservoirs in the valley. These are monofunctional concrete reservoirs, which are fenced in and offer no added value.

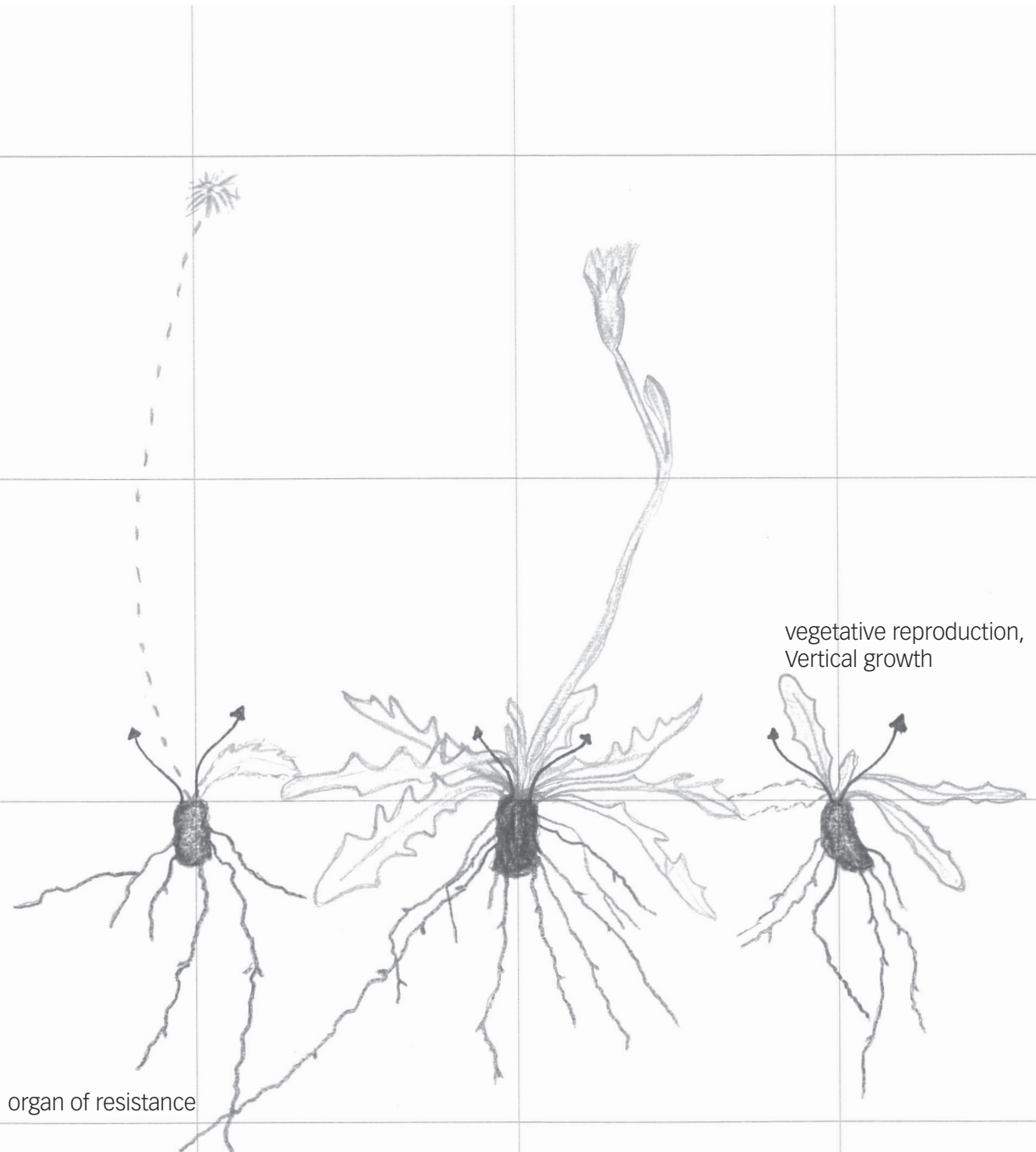
After the collapse of the textile industry, the valley is characterised by vacant industrial buildings, which are underused. Due to the vacancy and the location, there is little economic pressure on real estate compared to urban areas. This provides cost-effective space for projects and innovative ideas.

Besides the former industrial buildings, the valley is very agricultural. In Switzerland, 270,000 tonnes of animal feed are imported from soya every year. Agroscope is currently researching alternative sources of protein, such as algae. These can be produced on uncultivated land and have a higher protein content per kg. Growth occurs through photosynthesis and CO<sub>2</sub> in a closed system.

The project combines a floating algae production facility on the compensation basin built for energy generation with a public swimming pool as an additional function and added value for the local population. The algae will be processed in the nearby former Bebié wool spinning mill, which will be converted with minor interventions. Both the construction of the bath and the installations in the industrial building are made of unused hardwood.

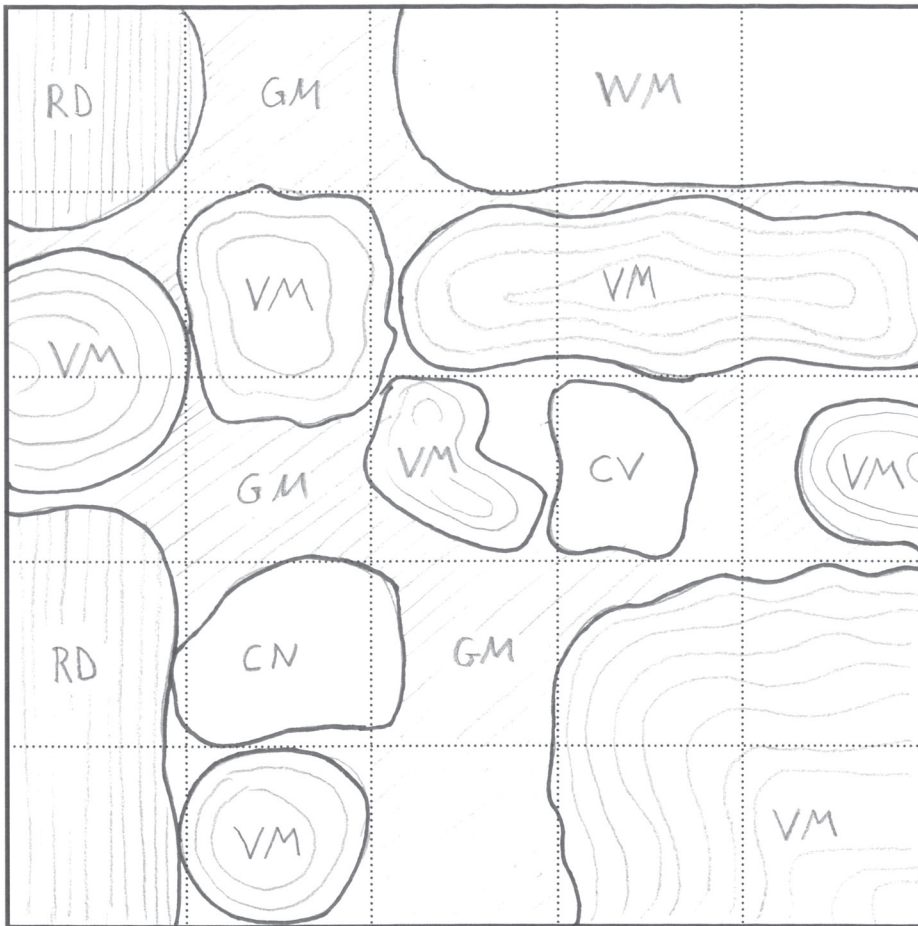
# Plant Species Klausenpass

*Leontodon autumnalis* L. 25.09.2024



# Plant Community Klausenpass

PC01 25.09.2024



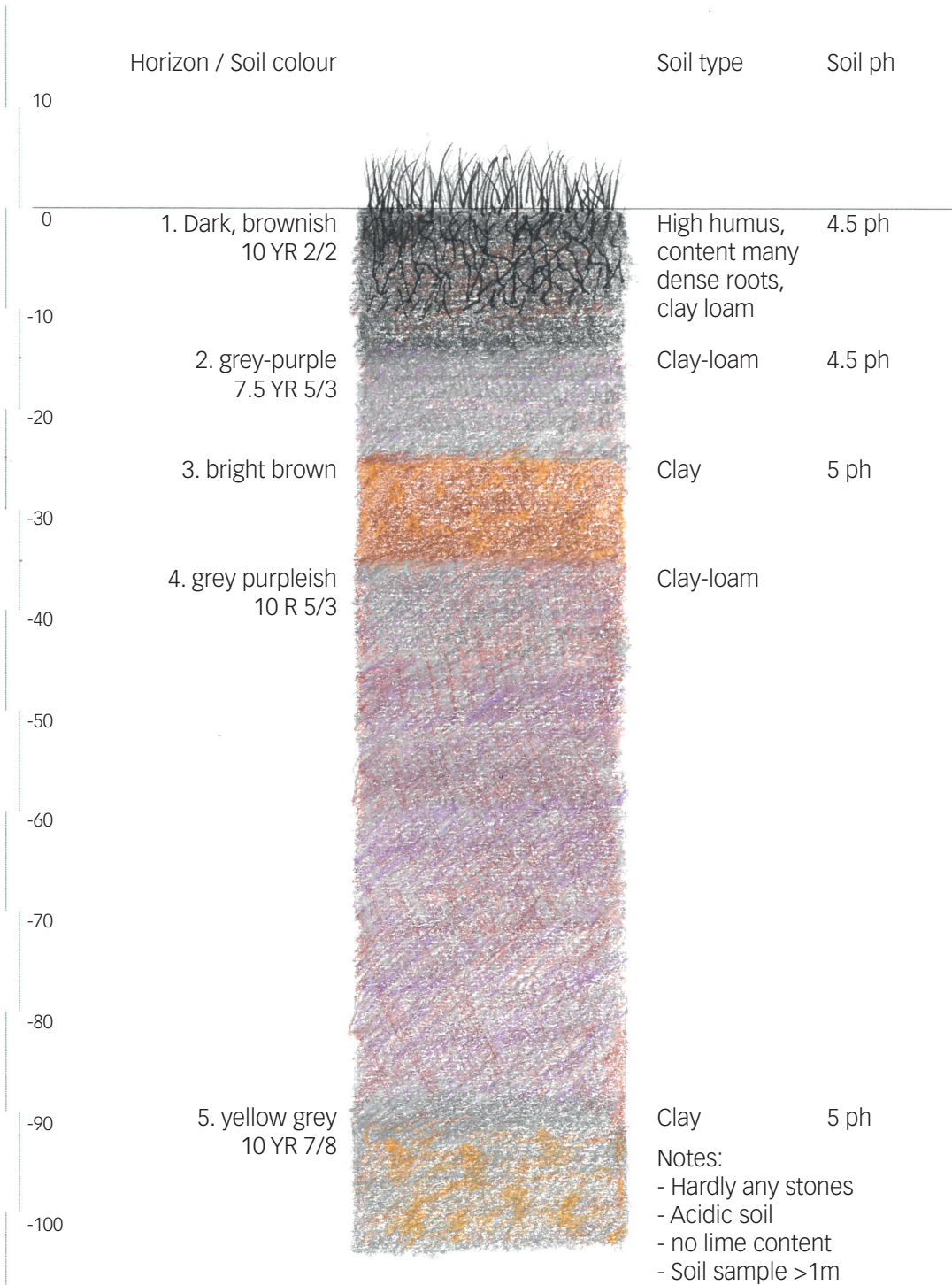
50cm

|    |                     |
|----|---------------------|
| VM | Vaccinium myrtillus |
| RD | Rhododendron        |
| CV | Calluna vulgaris    |
| CN | Carex nigra         |
| WM | White moss          |
| GM | Green moss          |

# Soil Sampling Klausenpass

Soil Sample #01 25.09.2024

Klausenpass 1948 m a.s.l (2'707'828 / 1'191'698)  
Land Use: Pasture, in between 2 ditches  
Ground Cover: Moss and grass

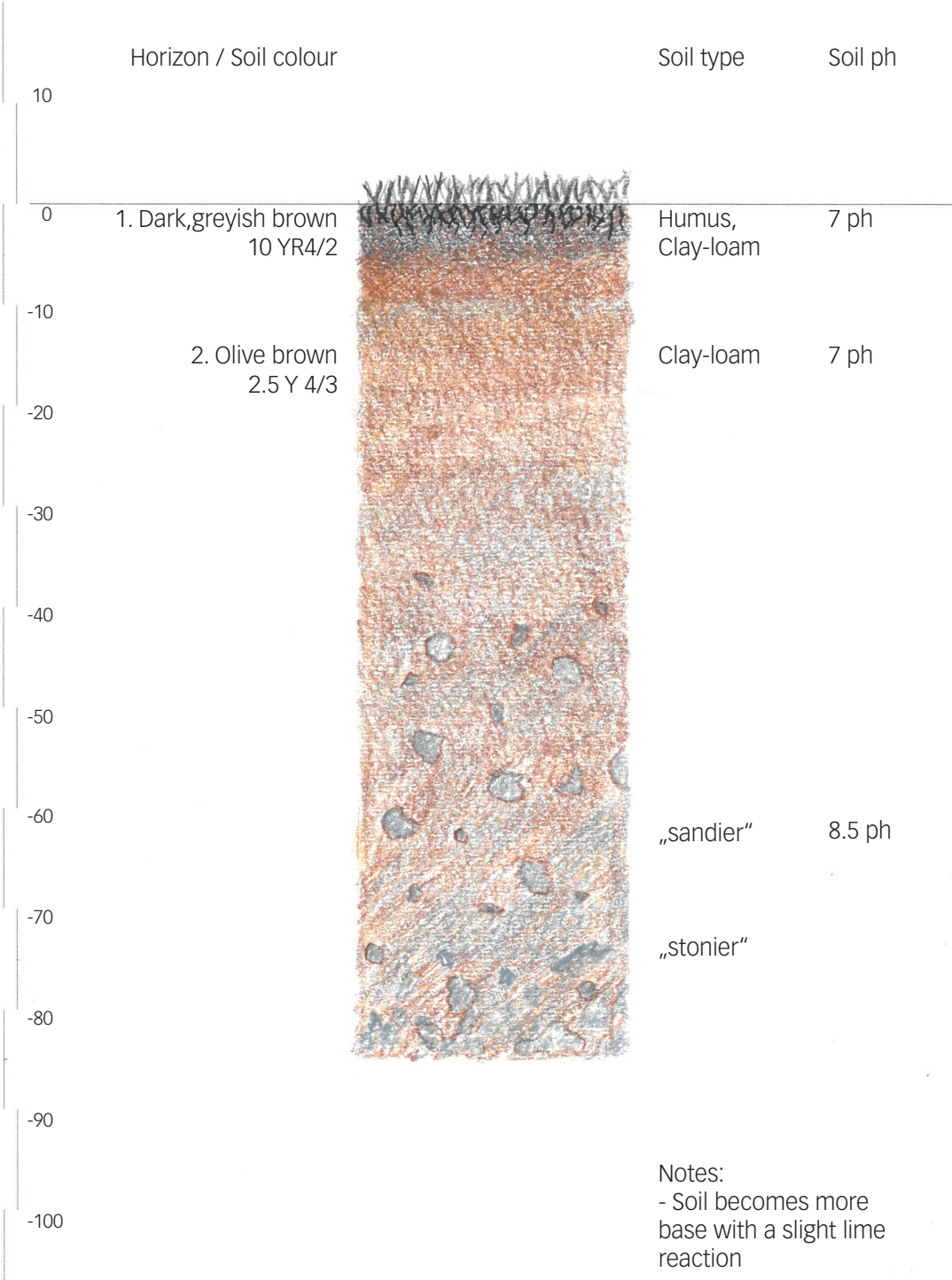




# Soil Sampling Klausenpass

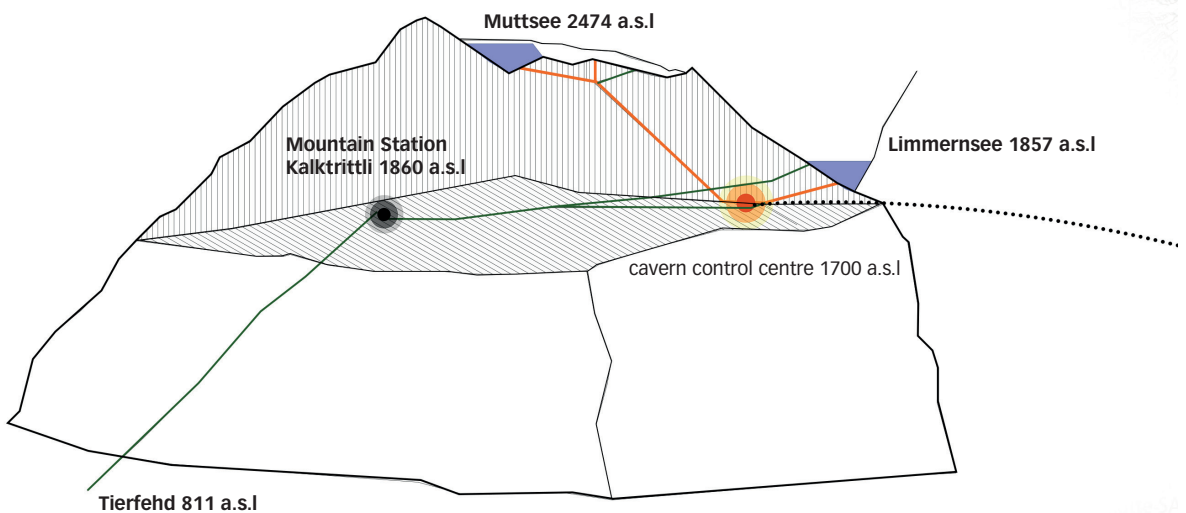
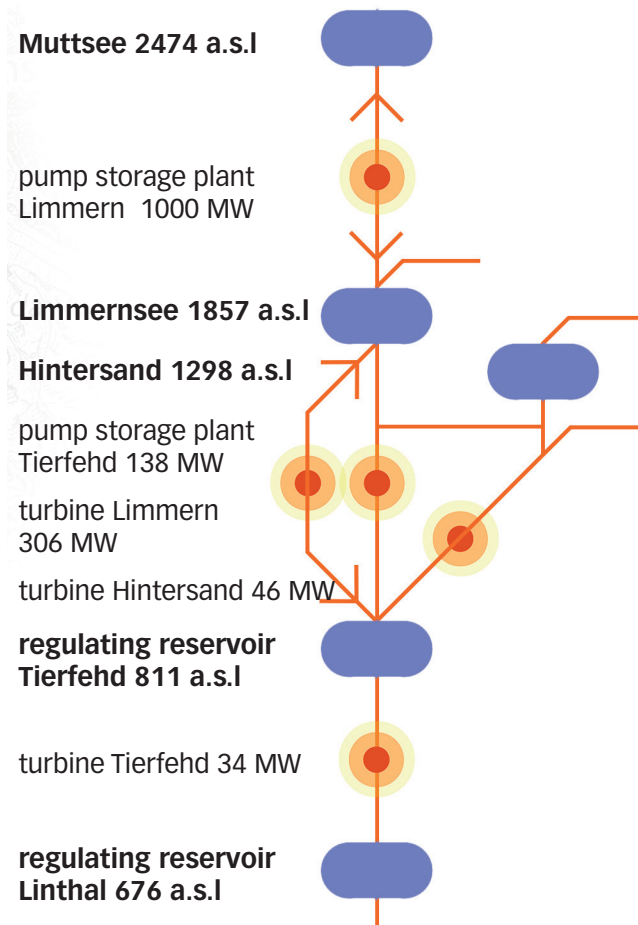
Soil Sample #02 25.09.2024

Klausenpass      1967 m a.s.l steep north facing (2°707'842 / 1°191'568)  
Land Use:        Pasture  
Ground Cover:   grass cover



# Pumped Storage Power Plant

## Linth-Limmern Power Plant



## Hydropower Plants on the Linth

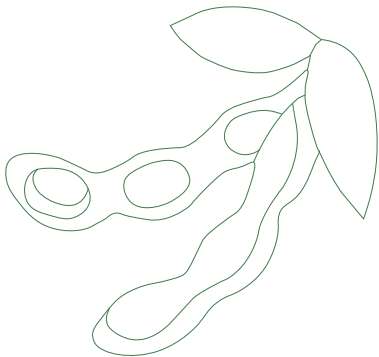
| Name                         | Location                  | Kt. | Operation | Power Turbine [MW] | Produktion [GWh] | Typ. EFH 4 P. 4000 kwh / yr |
|------------------------------|---------------------------|-----|-----------|--------------------|------------------|-----------------------------|
| Äsch                         | Unterschächen             | UR  | 1996      | 0.5                | 1.9              | 475                         |
| Unterschächen                | Unterschächen             | UR  | 1962      | 2.2                | 8.2              | 2038                        |
| Schächen, Schattdorf         | Schattdorf                | UR  | 2020      | 4.9                | 16.4             | 4100                        |
| Bürglen (Unterschächen)      | Bürglen                   | UR  | 1967      | 20.8               | 91.7             | 22925                       |
| Limmern                      | Linthal, Ochsenstafel     | GL  | 2016      | 1000               | 1333             | 333250                      |
| Tierfehd (Limmern)           | Linthal, Tierfehd         | GL  | 1964      | 306                | 322.6            | 80650                       |
| Tierfehd (Umwälzwerk)        | Linthal, Tierfehd         | GL  | 2010      | 137                | 150              | 37500                       |
| Tierfehd (Hintersand)        | Linthal, Tierfehd         | GL  | 1964      |                    |                  |                             |
| Linthal (Limmern)            | Linthal                   | GL  | 1964      | 34.4               | 63.8             | 15950                       |
| Fätschbach                   | Linthal                   | GL  | 1950      | 15                 | 30               | 7500                        |
| Linthkraft (Stiftung)        | Linthal                   | GL  | 1900      | 0.5                | 2.3              | 568                         |
| Linthal (Spinnerei Linthal)  | Linthal                   | GL  | 1877      | 1.6                | 8.1              | 2035                        |
| Brummbach, Linthal           | Linthal, Stachelberg      | GL  | 1921      | 3.9                | 12.6             | 3150                        |
| Brummbach, Braunwald         | Braunwald                 | GL  | 2014      | 0.9                | 3.2              | 800                         |
| Cotlan, Rüti                 | Rüti, Gmde Glarus Süd     | GL  | 2017      | 2.5                | 12.5             | 3125                        |
| Diesbach (Linth), Legler     | Diesbach                  | GL  | 1945      | 0.9                | 5.1              | 1275                        |
| Hätzingen                    | Hätzingen                 | GL  | 1850      | 1.1                | 6.7              | 1675                        |
| Luchsingen                   | Luchsingen                | GL  | 1940      | 3.5                | 13.5             | 3375                        |
| Leuggelbach                  | Leuggelbach               | GL  | 1930      | 1                  | 6.4              | 1600                        |
| Haslen Daniel Jenny & Co     | Haslen                    | GL  | 1848      | 0.9                | 6                | 1500                        |
| Schwanden (F.Blumer)         | Schwanden                 | GL  | 1828      | 0.9                | 4.3              | 1075                        |
| Schwanden (Sernf)            | Schwanden                 | GL  | 1931      |                    |                  |                             |
| Schwanden (Niederembach)     | Schwanden                 | GL  | 1931      | 28.2               | 40               | 10000                       |
| Schwanden (Gemeinde)         | Schwanden                 | GL  | 1899      | 1.8                | 10.5             | 2625                        |
| Schwanden (SNE)              | Schwanden                 | GL  | 1908      | 0.5                | 2.3              | 575                         |
| Mitlödi (Föhnen/Sool)        | Mitlödi                   | GL  | 2020      | 4                  | 21.8             | 5450                        |
| Mitlödi (Seidendruckerei)    | Mitlödi (Glarus Süd)      | GL  | 2016      | 0.9                | 5.7              | 1425                        |
| Mühlefuhr, Ennenda           | Ennenda                   | GL  | 1920      | 0.8                | 5.5              | 1375                        |
| Holenstein I Wehr. KW Glarus | Mitlödi, Gmde. Glarus Süd | GL  | 2016      | 0.6                | 2.2              | 550                         |
| Walzmühle 2                  | Ennenda, Alpenbruggli     | GL  | 2011      | 0.3                | 2.4              | 595                         |
| Elggiskraft, Netstal         | Netstal                   | GL  | 1912      | 0.8                | 4.4              | 1088                        |
| Am Löntsch                   | Netstal                   | GL  | 1908      | 89.1               | 119.1            | 29775                       |
| Linthkraft, Netstal          | Netstal                   | GL  | 1923      | 1.4                | 6.2              | 1550                        |
| Rütiberg (Obersee)           | Rütiberg / Näfels         | GL  | 1961      | 0.9                | 4.7              | 1175                        |
| Rütiberg (Brändbach)         | Rütiberg / Näfels         | GL  | 1977      |                    |                  |                             |
| Risi, Näfels                 | Näfels                    | GL  | 1925      | 4.5                | 18.7             | 4675                        |
| Bleiche                      | Niederurnen               | GL  | 1903      | 2.2                | 6.8              | 1700                        |
| Ziegelbrücke                 | Ziegelbrücke              | GL  | 1837      | 0.6                | 2.2              | 543                         |
| Rufi, Hätzingen              | Hätzingen                 | GL  | 2016      | 1.1                | 4.7              | 1175                        |
| KW Schmid / Gisler           | Bleicherei                | GL  | 2017      | 0.0518             | 0.3              | 65                          |

## Hydropower Plants on the Linth

|                            |               |    |      |       |      |      |
|----------------------------|---------------|----|------|-------|------|------|
| KW Tschudibergbach         | Braunwald     | GL | 2016 | 0.088 | 0.4  | 110  |
| KW Zentrale Elm Dorf       | Elm           | GL | 1978 | 0.1   | 0.8  | 225  |
| KW Zentrale Elm Empächli   | Elm           | GL | 1995 | 0.3   | 0.9  | 275  |
| KW Zentrale Elm Gütli      | Elm           | GL | 1978 | 0.2   | 1.3  | 300  |
| Mühlebach / Bergen         | Engi          | GL | 2002 | 0.2   | 0.6  | 160  |
| KW Mühlebach 1             | Engi          | GL | 2009 | 3.6   | 17   | 4250 |
| KW Mühlebach 2             | Engi          | GL | 2018 | 0.556 | 2.5  | 625  |
| KW Eberle                  | Ennenda       | GL | 1903 | 0.0   | 0.2  | 55   |
| KW Gmür + Braun Ennenda    | Ennenda       | GL | 2006 | 0.3   | 0.2  | 50   |
| KW Ronner                  | Ennenda       | GL | 2009 | 0.037 | 0.2  | 55   |
| Wehrkraftwerk Holenstein   | Ennenda       | GL | 2016 | 0.8   | 2.7  | 600  |
| KW Walzmühle               | Glarus        | GL | 2011 | 0.6   | 3    | 670  |
| TKW Auli Glarus            | Glarus        | GL | 2023 | 0.146 | 1    | 223  |
| TKW Bleiche Glarus         | Glarus        | GL | 1937 | 0.265 | 1.6  | 355  |
| Hefti Hätzingen AG         | Hätzingen     | GL | 2007 | 1.1   | 6.5  | 1625 |
| KW Ruffi Hätzingen         | Hätzingen     | GL |      | 1.4   | 4.8  | 1200 |
| KW Decoral Leuggelbach     | Leuggelbach   | GL | 1944 | 0.3   | 0.2  | 60   |
| KW Brummbach-Niederschwend | Linthal       | GL | 2012 | 2.3   | 14   | 3500 |
| KW Luchsingen              | Luchsingen    | GL | 1941 | 5.6   | 22.5 | 5000 |
| KW Krauchbach              | Matt          | GL | 1999 | 0.6   | 3.7  | 1000 |
| KW Weidmann Mitlödi        | Mitlödi       | GL | 1975 | 0.145 | 1    | 250  |
| KW Doppelpower             | Mitlödi Sernf | GL | 2020 | 4.2   | 18   | 4500 |
| KW Burg Näfels             | Näfels        | GL | 1830 | 0.030 | 0.1  |      |
| KW Dorfbach Netstal        | Netstal       | GL | 1991 | 0.080 | 0.2  | 45   |
| KW Spinnerei Oberurnen     | Oberurnen     | GL | 2012 | 0.1   | 0.6  | 140  |
| KW Cotlan                  | Rüti          | GL |      | 2.6   | 11.8 | 2600 |
| KW Rüti                    | Rüti          | GL | 1900 | 0.2   | 1.3  | 325  |
| KW Niederenbach            | Schwanden     | GL | 2003 | 2.2   | 2.2  | 2750 |

# Agroscope Research: A Sustainable Protein Alternative?

## Comparison of Algae and Soybean Cultivation

|                   | Soya Animal Feed                                                                  | Microalgae                                                                         |
|-------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|                   |  |  |
| Crude Protein     | 36%                                                                               | up to 60%                                                                          |
| Land              | Arable land                                                                       | Uncultivated land                                                                  |
| Proteins per acre | 1x                                                                                | 30x more than soya                                                                 |
| Water recycling   | -                                                                                 | Closed system / Recycling                                                          |
| Fertiliser        | Overfertilisation in the environment                                              | Closed system                                                                      |
| Methane           | Methane emission animals                                                          | Reduced methane emissions from ruminants                                           |

# Algae Cultivation

## Process and spatial programme

1

### Algae Growth

#### Algae Cultivation Area

Photobioreactors (PBR)

#### Room for Analysis

Simple laboratory installation

Office workstation

Sanitary facilities

#### Room for Processing Nutrients and Starter Culture

#### Space for Public Relations Work

Advertising and education

2

### Algae Production

#### Harvesting Space

Filter & Press



#### Clean Processing Space

Extrusion



#### Clean Packing Room

Mixing and Packing



#### Clean Processing Space

Vacuum Pump



#### Drying Chamber

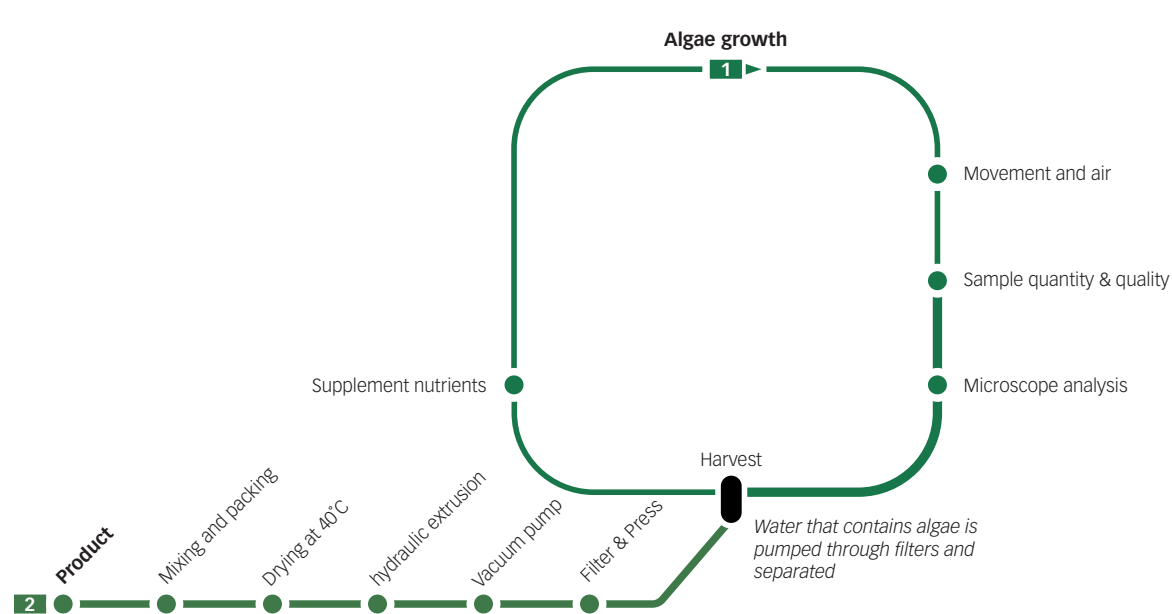
Drying at 40°C





# Algae Cultivation

## Process and spatial programme



# Tierfehd Regulating Basin

Guided hike with Glarus artist Patrick Rohner





# Linthal Regulating Basin

Lowest reservoir of the Linth-Limmern power plant network



# Monofunctional Infrastructure

Construction 1964





# Bebié & Co. wool spinning mill

Industrial history of the Canton of Glarus





# Funding from Hydropower Profits

Linthkraft Foundation



J. Zimmermann 12.11.2024



# Klöntal Triennale

Art installation: ‚A fabric in Turkey red‘, Romy Rüegger 2013 / 2020



J. Zimmermann 07.09.2024