# Ecological connectivity in the Alps – a strategy to strengthen biodiversity for the whole Alpine space?
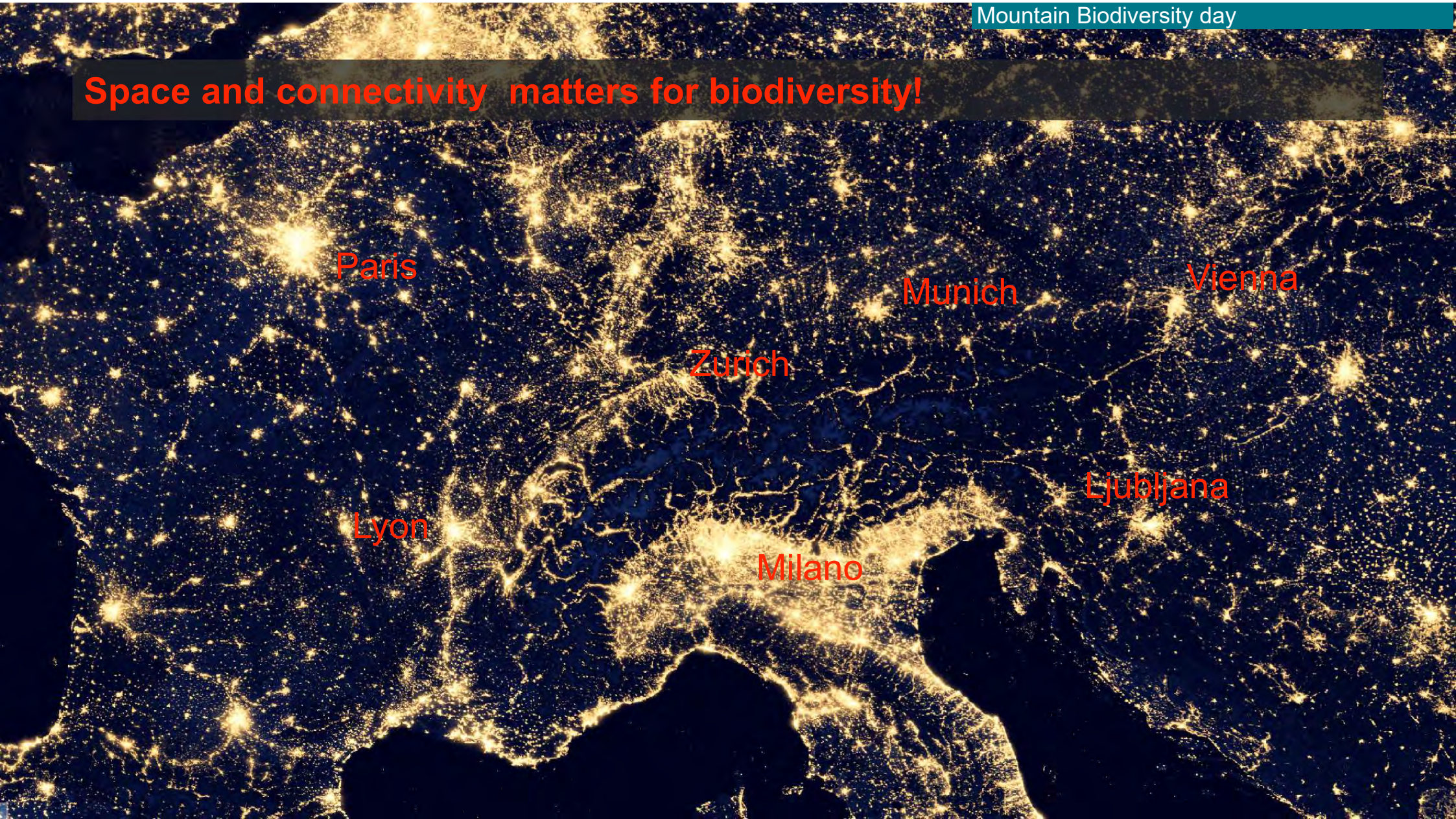
Ruedi Haller
Swiss National Park

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**Space and connectivity matters for biodiversity!**

Paris

Munich

Vienna

Zurich

Ljubljana

Lyon

Milano

# Species must migrate!
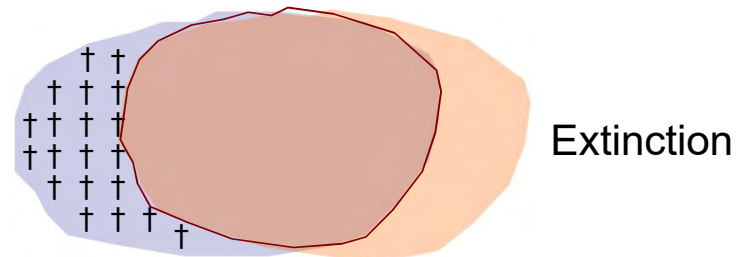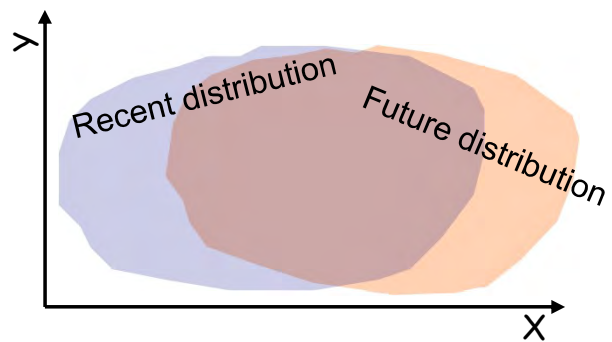




Temperatur

Winter (Dezember–Februar)

Sommer (Juni–August)
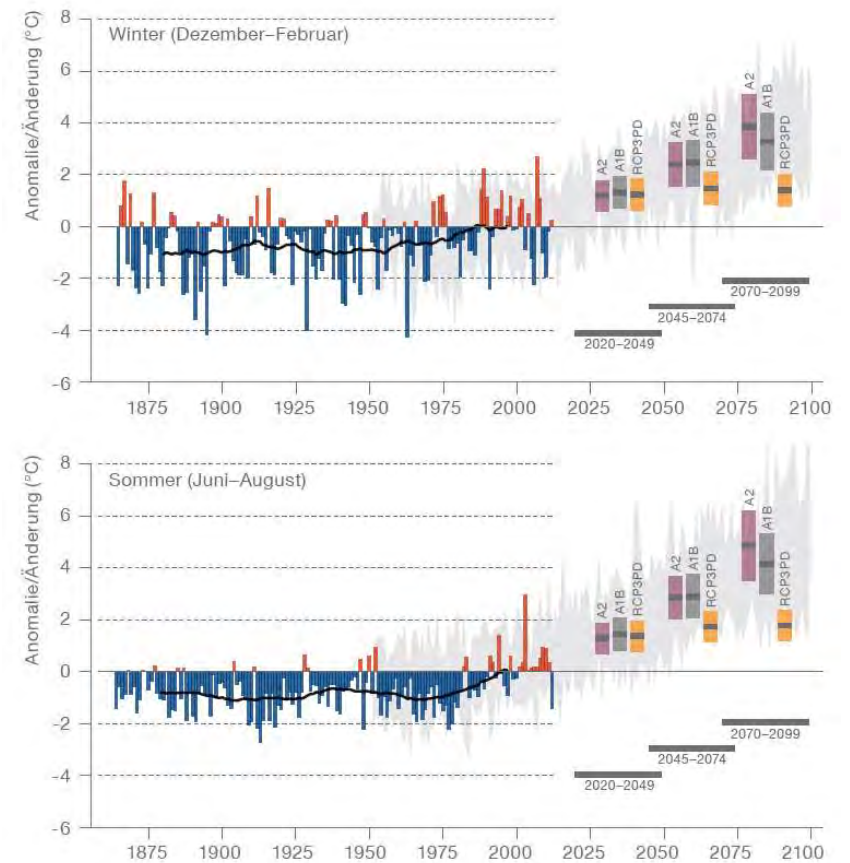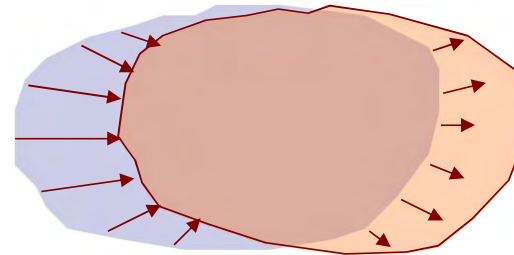
swisstopo 2011

Meteoschweiz 2012

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# Possible strategies for species
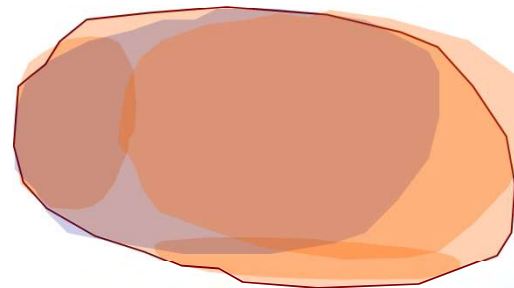
# Butterflies: Observations and modelled distribution 2008 of 3 species
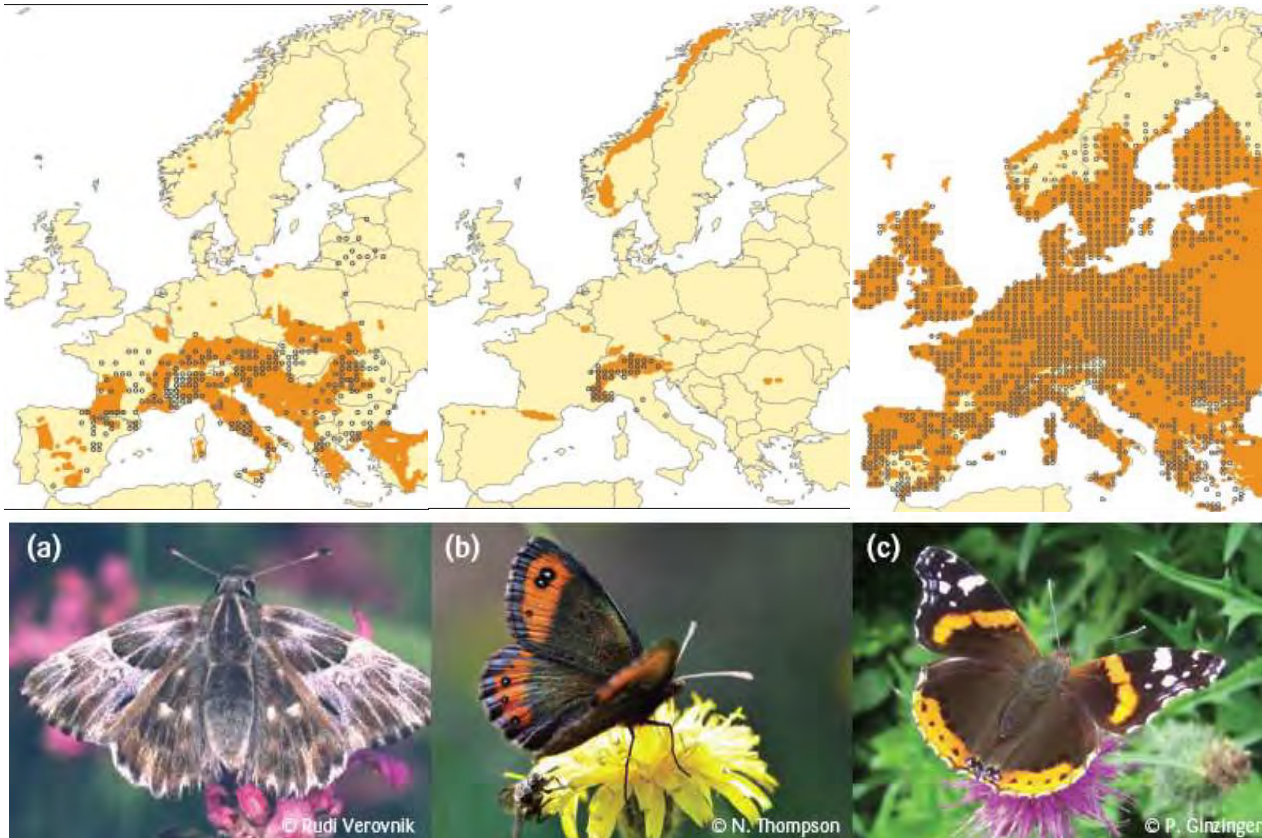


Heilziest-Dickkopf (*Carcharodus floccifera*)

Mohrenfalter (*Erebia montana*)

Admiral (*Vanessa atalanta*)

Settele et al. 2008

13.01.2020

# Butterflies: Modelled distribution 2080 of 3 species



Source Settele et al. 2008

Heilziest-Dickkopf (*Carcharodus floccifera*)

Mohrenfalter (*Erebia montana*)

Admiral (*Vanessa atalanta*)

Settele et al. 2008

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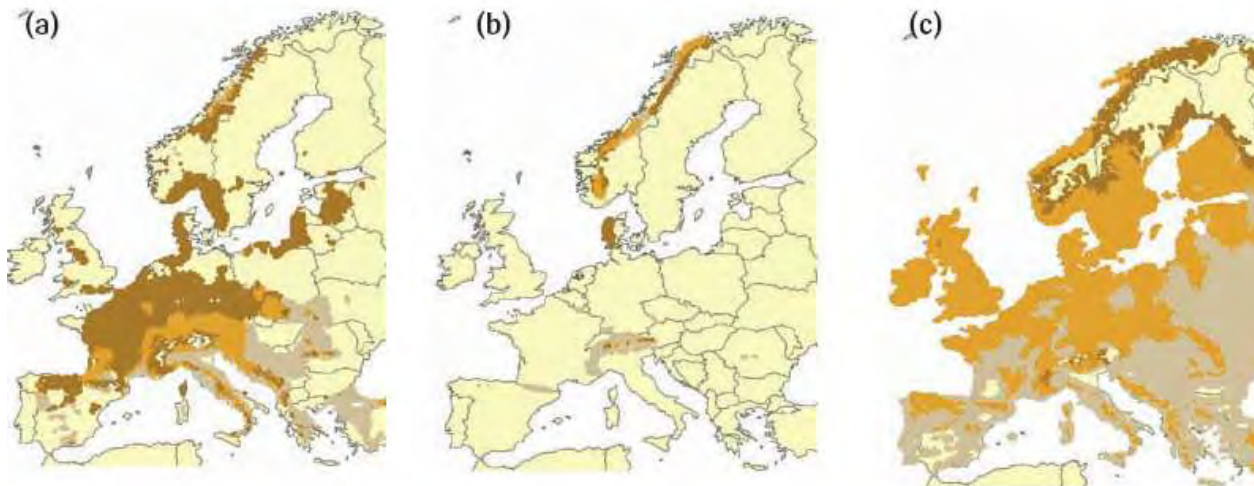# Reactions of single species to global change in mountainous regions



Körner 2009
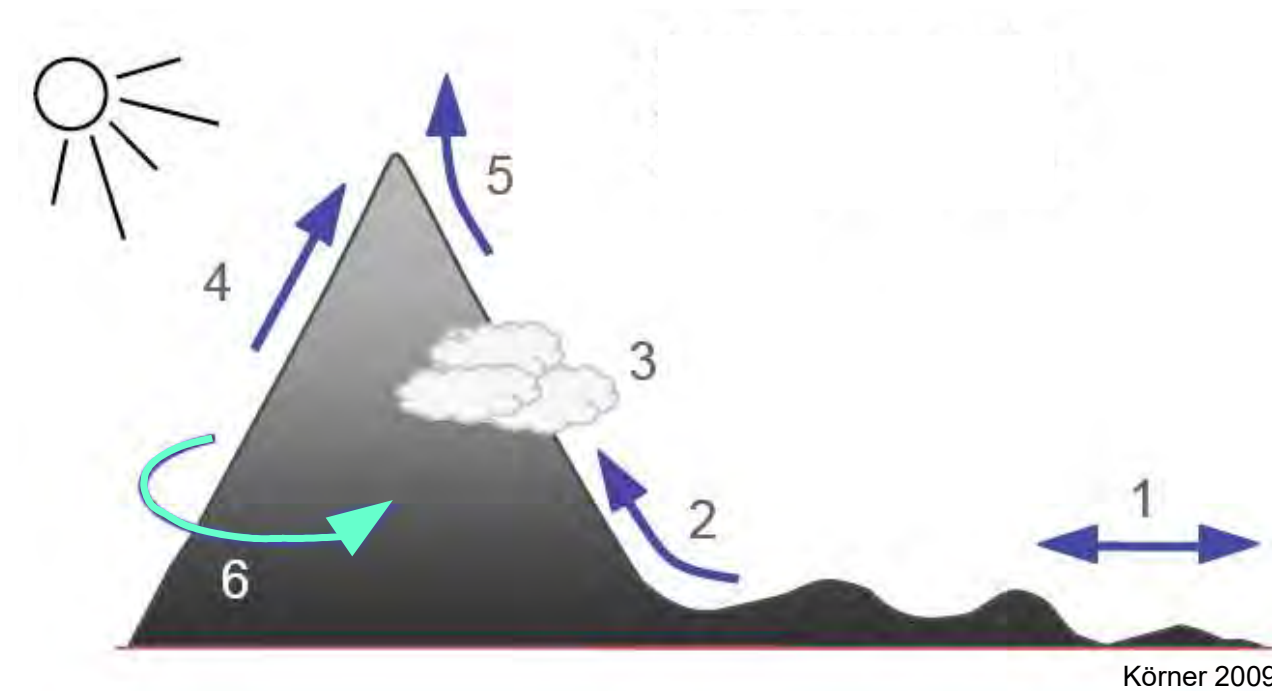
# It's far more than single measures, stochastically distributed in space!



Ecological corridor
Migration paths
Protected areas
Biotopes functioning as stepping stones along the ecological continuum
Ecological continuum

http://www.alpine-ecological-network.org
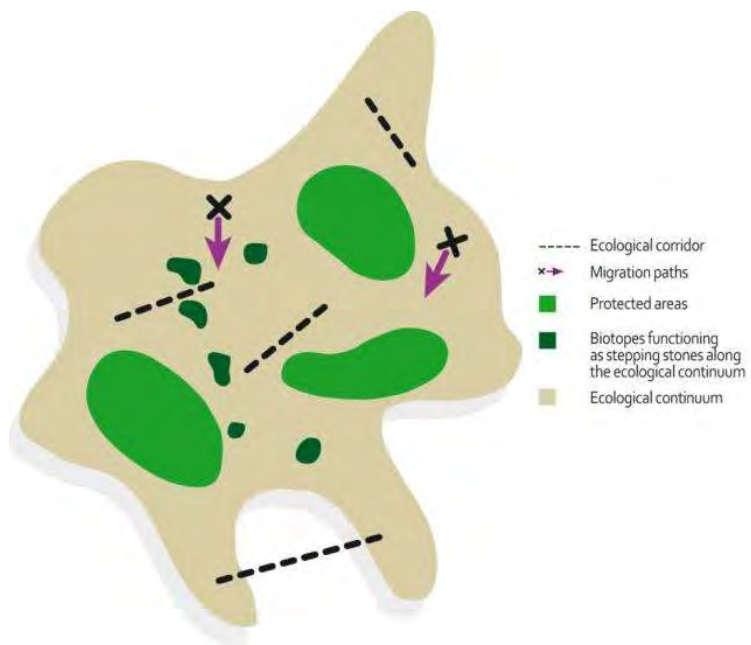
Photos
Yannik Andrea ©WF
Angelika Abderhalden © BSR
Engiadina Val Müstair

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# We need a spatial strategy for ecological connectivity!

- Mountain ranges such as the European Alps exhibit high species richness making them important for global biodiversity conservation (Körner and Spehn, 2002).

- No protected area is in itself large enough to fulfil essential conservation goals.

- Vast amounts of biodiversity exist in, and depend on landscapes outside the present-day protected area domain (Dinerstein et al., 2017).

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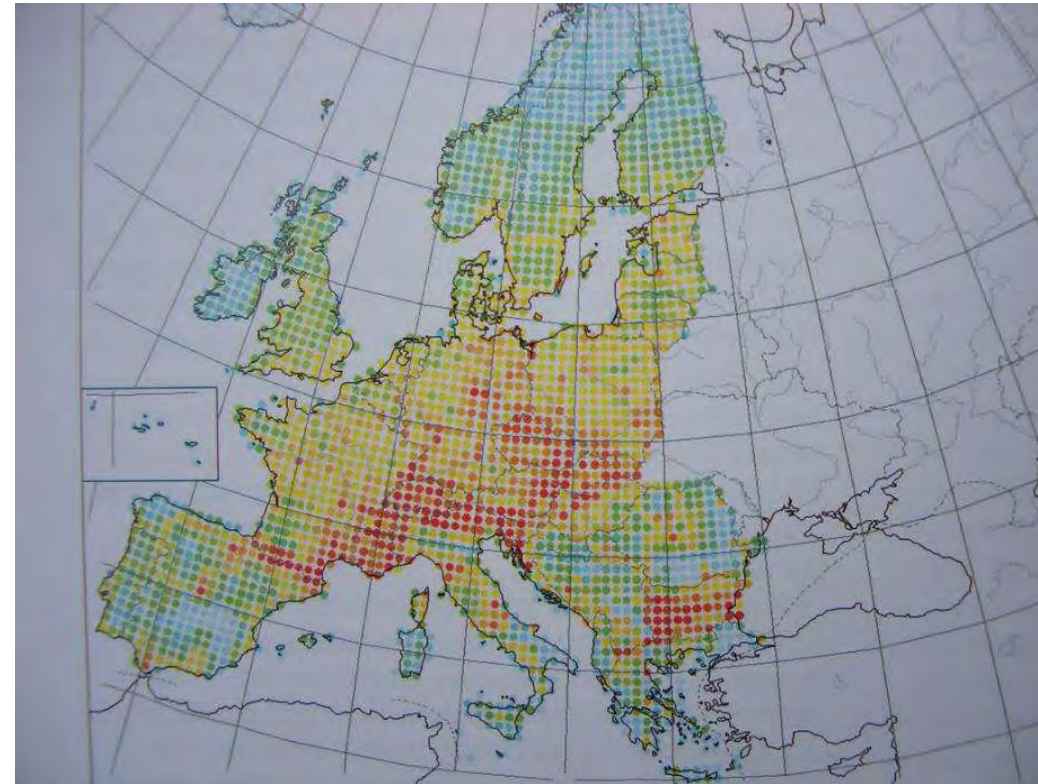
# We need a spatial strategy for ecological connectivity in the whole landscape matrix!
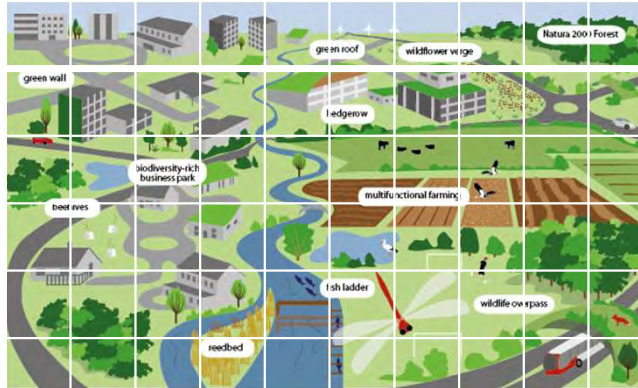


**Landscape**

**Species**

Ecological connectivity  (Lindenmayer and Fischer, 2007):

- Species specific connectivity of habitats
- Connectivity of land use and landscape metrics
- Connectivity of ecological processes

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# The evolution of a ecological connectivity / green infrastructure in the Alps
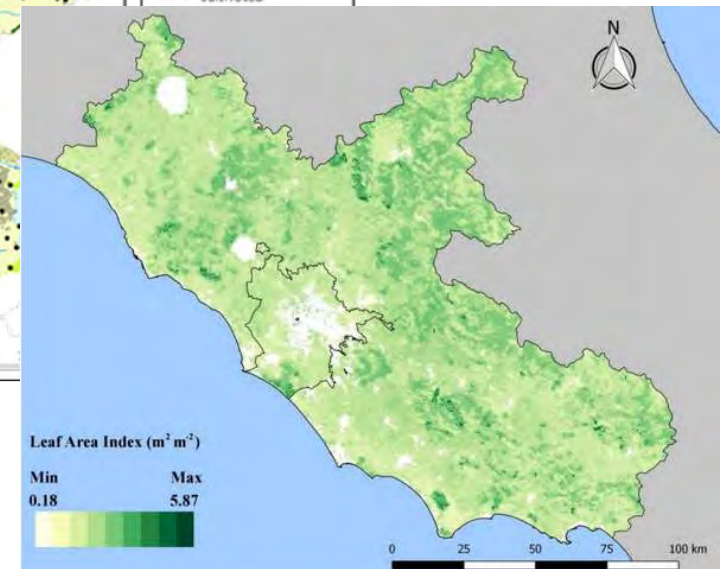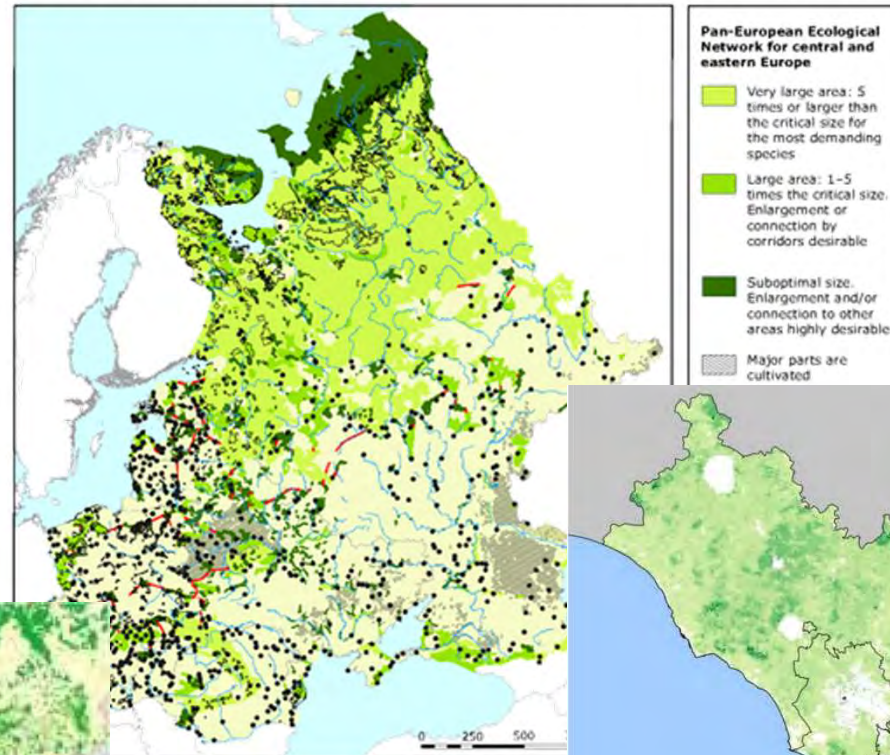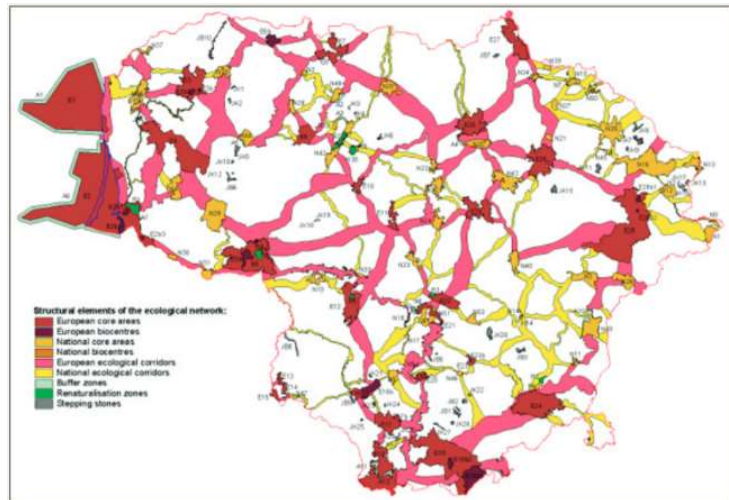
# Strategic (Alpine) Connectivity Areas (SACAs)

- **SACA 1**: Ecological conservation areas are areas where ecological connectivity already works quite well.
  → **conserve**

- **SACA 2**: Ecological Intervention areas. They represent important links between SACA1 areas (ecological conservation areas). Connectivity is currently working to some extent but would benefit from enhancements.
  → **develop** (e.g. restoration)

- **SACA 3**: Connectivity restoration areas. They represent important barriers between SACA1 areas (ecological conservation areas).
  → **mitigate negative impacts**





Source: ALPARC



Source: ALPARC

# SACAs – input data

- Based on the evaluation of spatial indicators consisting of five relevant factors for ecological connectivity:
  - LAN: land use
  - POP: population pressure
  - ENV: environmental protection
  - FRA: fragmentation
  - TOP: altitude and topography

  (Luethi et al., in prep.)



Indicator value

| | | |
|---|---|---|
| 10 | 6 | 2 |
| 9 | 5 | 1 |
| 8 | 4 | 0 |
| 7 | 3 | |

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# SACAs – definition and methods

- Definition an methods:
  - SACA 1:
    - weighted mean of 2*LAN + 2* POP + ENV + FRA + TOP ≥ 8
    - Area ≥ 100 hectares

  - SACA 2:
    - Modelling experiments based on electrical circuit theory (McRae et al., 2008)

  - SACA 3:
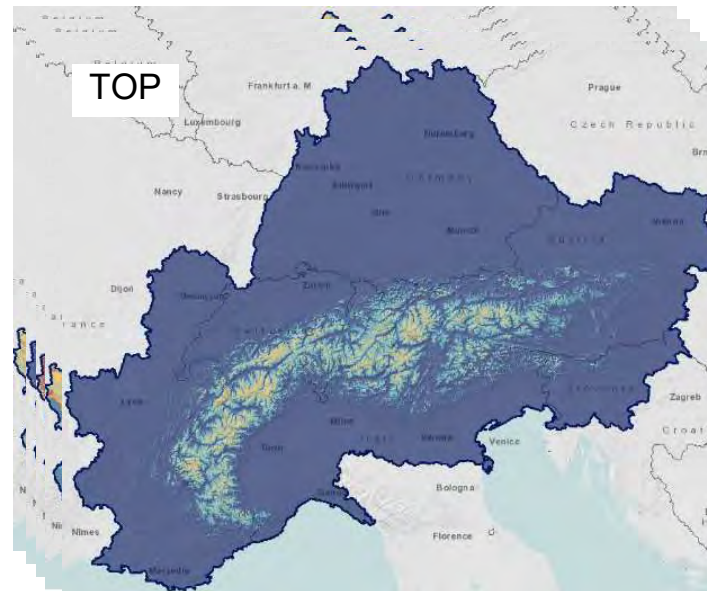    - weighted mean of 2*LAN + 2* POP + ENV + FRA + TOP < 5

# Strategic Alpine connectivity areas

**SACA 1**: Ecological conservation areas are areas where ecological connectivity already works quite well. – Inside and outside the current protected area domain.

→ **Strategy: conservation**



**In Alpine Convention :**

✓ 80% SACA 1 in protected areas

✓ 70% of protected areas



**Ecological conservation areas (SACA1) in the EUSALP macro-region**

**SACA1:** Ecological conservation areas are areas where ecological connectivity already works quite well (CSI ≥ 8) with an area ≥100 ha.

Alpine Convention

Data: Asters, SNP

200 km

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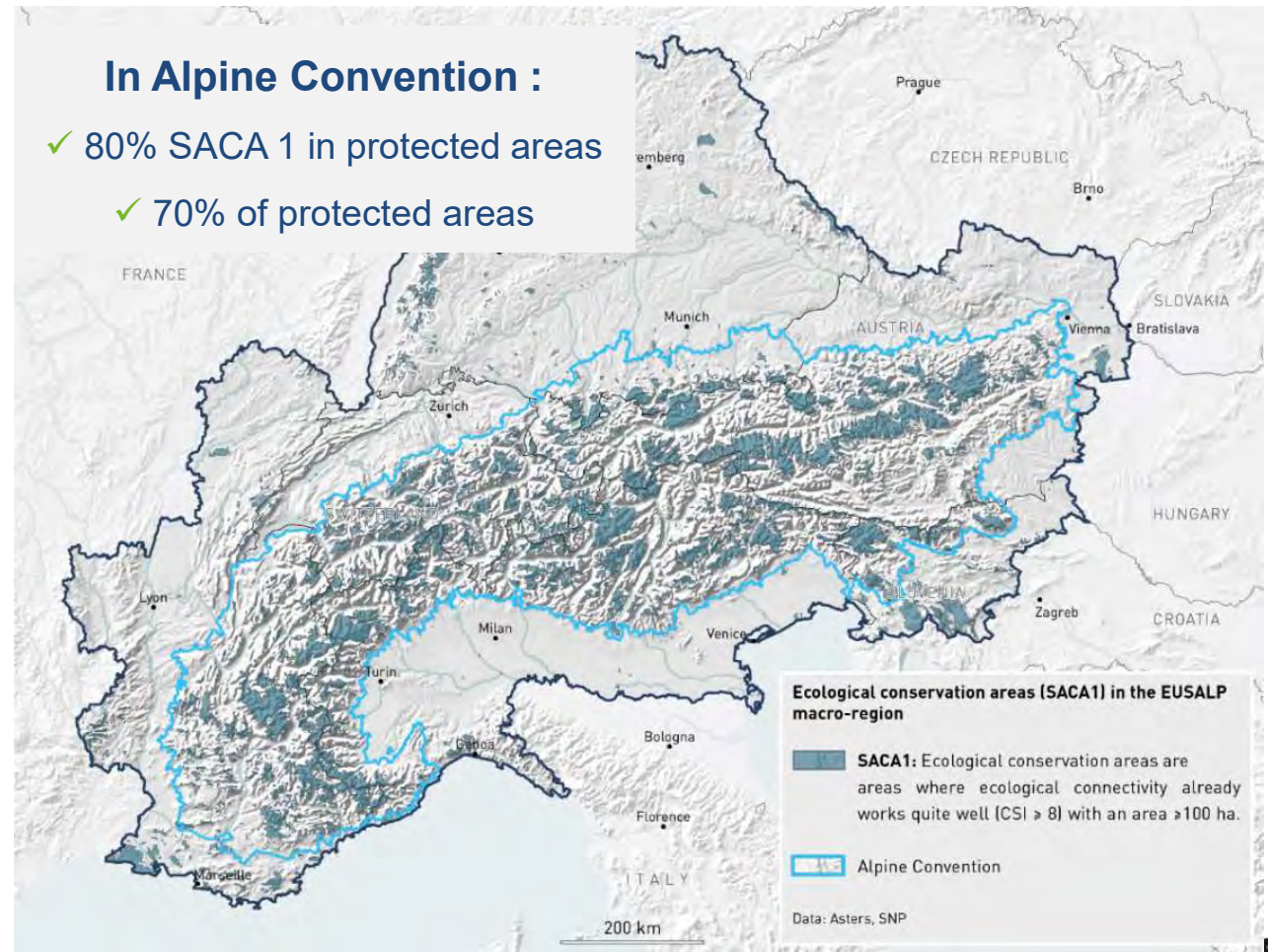
# Strategic Alpine connectivity area

**SACA 2**: Ecological Intervention areas. They represent important links between SACA1 areas (ecological conservation areas). Connectivity is currently working to some extent but would benefit from enhancements.

→ **strategy: development** (e.g. restoration)



**Ecological intervention areas (SACA2) in the EUSALP macro-region**

**SACA2:** Ecological intervention areas. They represent important links between SACA1. Connectivity is currently working to some extent but would benefit from enhancements. In these areas improvement / restoration measurements are needed.

Data: Asters, SNP

200 km

(Photo: Bernina, Wikimedia Commons)

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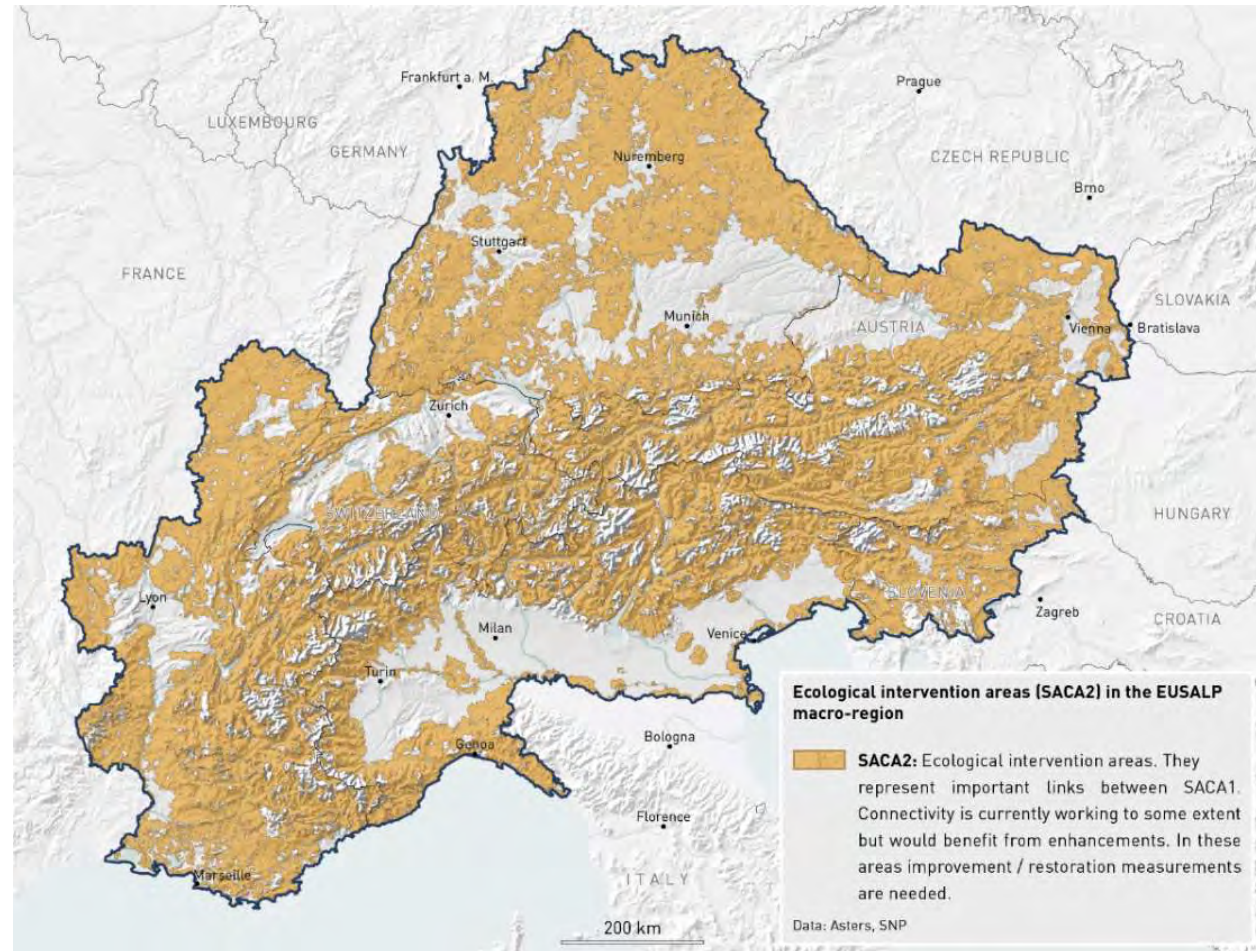
# Strategic Alpine connectivity area

**SACA 3**: Connectivity restoration areas. They represent important barriers between SACA1 areas (ecological conservation areas).

→ **strategy: mitigate negative impacts**





Connectivity restoration areas (SACA3) in the EUSALP macro-region

**SACA3**: Connectivity restoration areas (CSI ≤ 5). They represent important barriers between SACA1.

Alpine Convention

Data: Asters, SNP

200 km

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Strategic Alpine Connectivity Areas (SACA) in the EUSALP macro-region

SACA1: Ecological conservation areas
SACA2: Ecological intervention areas
SACA3: Connectivity restoration areas
No SACA areas: Areas with CSI > 5 and < 8 which are not SACA 2

Data: Asters, SNP

200 km

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# SACA 2: modelling method

Strategic Alpine Connectivity Areas (SACA) in the EUSALP macro-region

**SACA1:** Ecological conservation areas
**SACA2:** Ecological intervention areas
**SACA3:** Connectivity restoration areas
**No SACA areas:** Areas with CSI > 5 and < 8 which are not SACA 2

Data: Asters, SNP

200 km

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Map 38: Overcoming main barriers in the EUSALP macro-region

Super SACAs in the EUSALP macro-region

- Ecological macro corridors
- Main barriers
- Connectivity areas

SACA 1: Ecological conservation areas
SACA 2: Ecological intervention areas
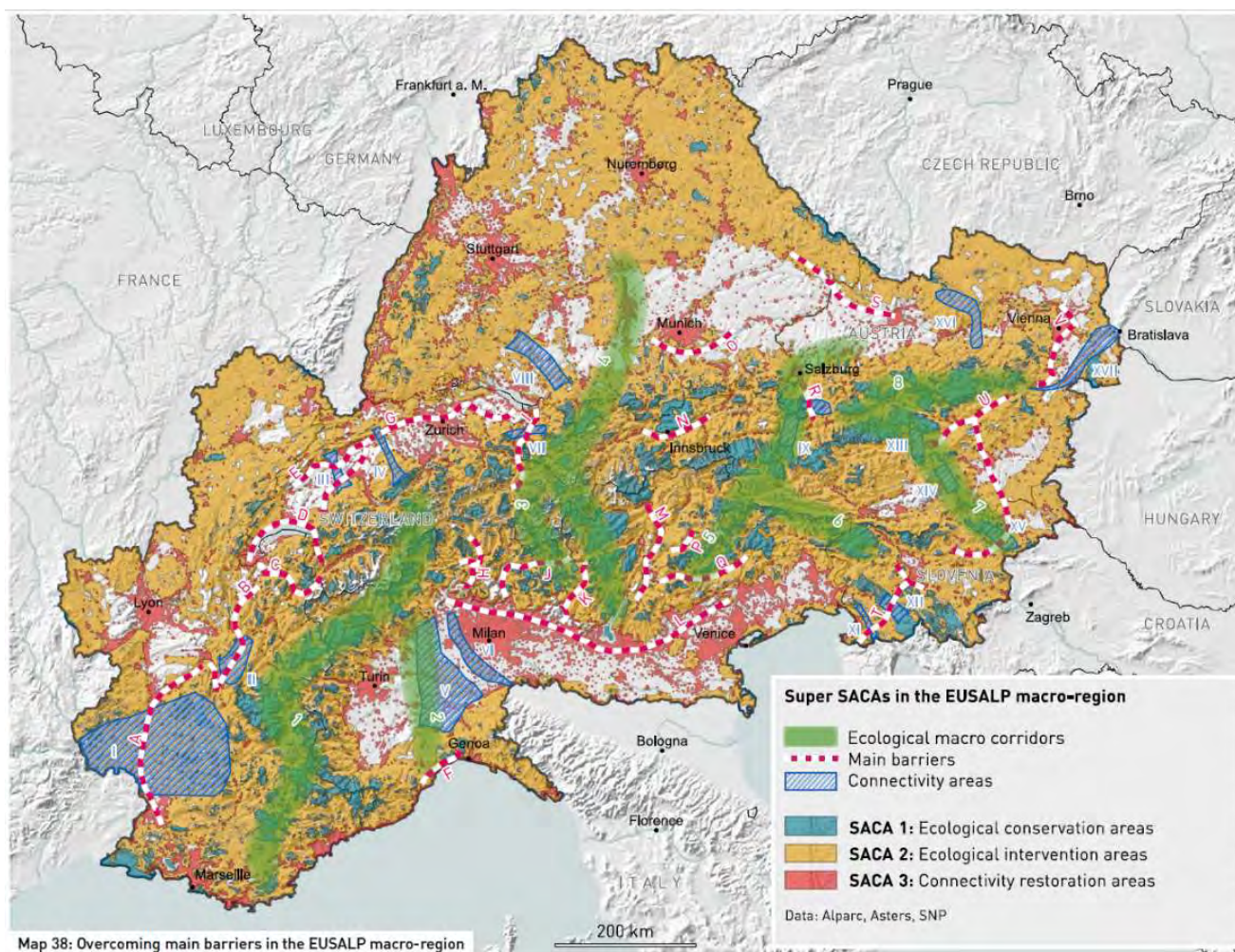SACA 3: Connectivity restoration areas

Data: Alparc, Asters, SNP

200 km

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Atlas ALPBIONET2030
Integrative Alpine wildlife and habitat management for the next generation
Spatial analysis and perspectives of [ecological] connectivity in the wider Alpine areas





https://www.alparc.org/alpine-resources/atlas-alpbionet2030

## Conclusion

- Reduce ecological fragmentation within the Alps, keep spaces open and allow species migration with the goal to strengthen biodiversity conservation and as adaptation strategy on climate change.

- Safeguard natural areas beyond protected areas both within and outside of the inner Alpine area and identify and secure green crossing spots (stepping-stones) between natural spaces.

- Reduce impacts in urban areas, invest in green infrastructure in construction areas

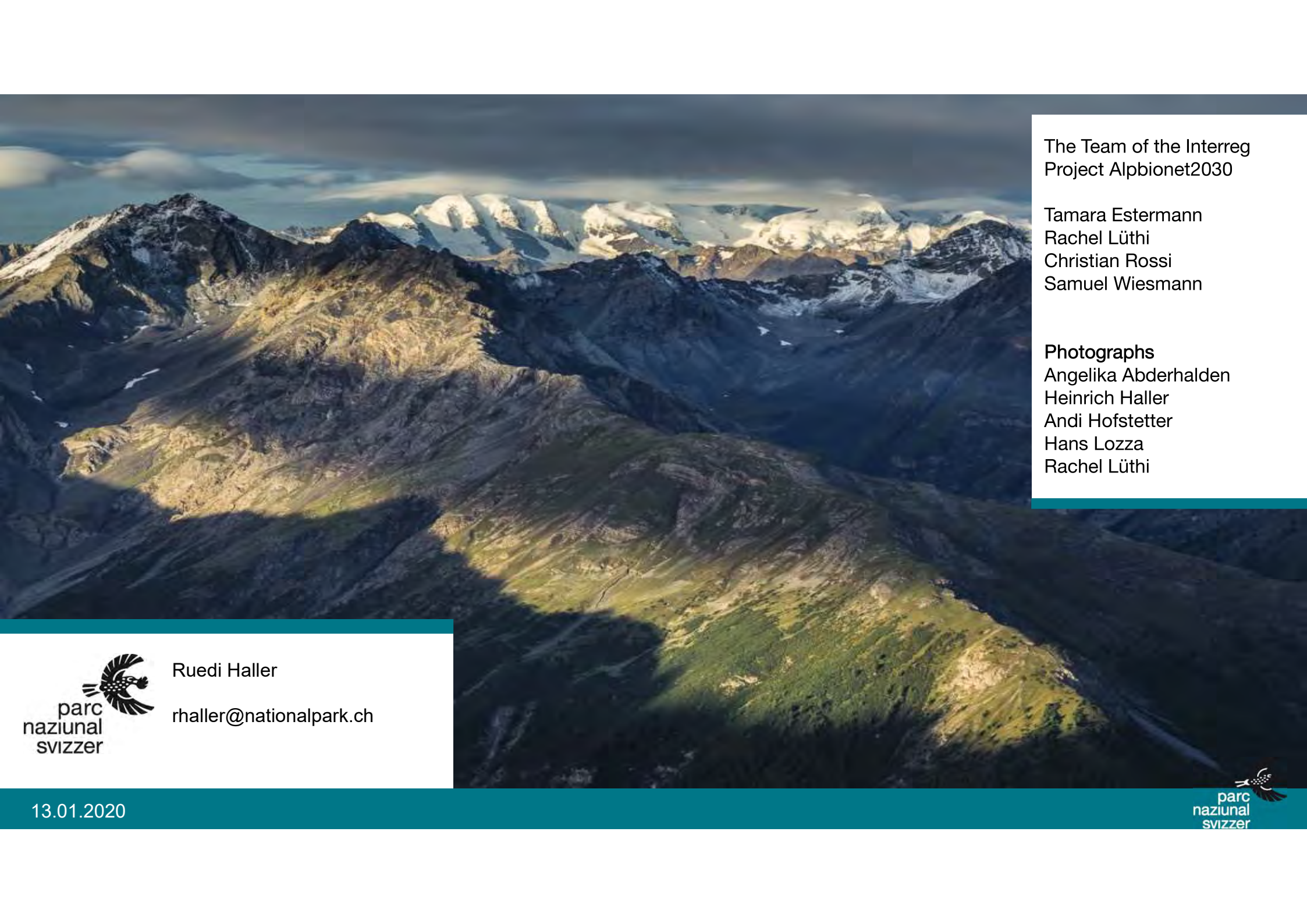- Reduce economic pressure on agricultural landscapes

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# What would be the outcome? – Modelled for the Swiss Canton Fribourg



SACA 1
SACA 2
SACA 3

Initial state



SACA 1
SACA 2
SACA 3
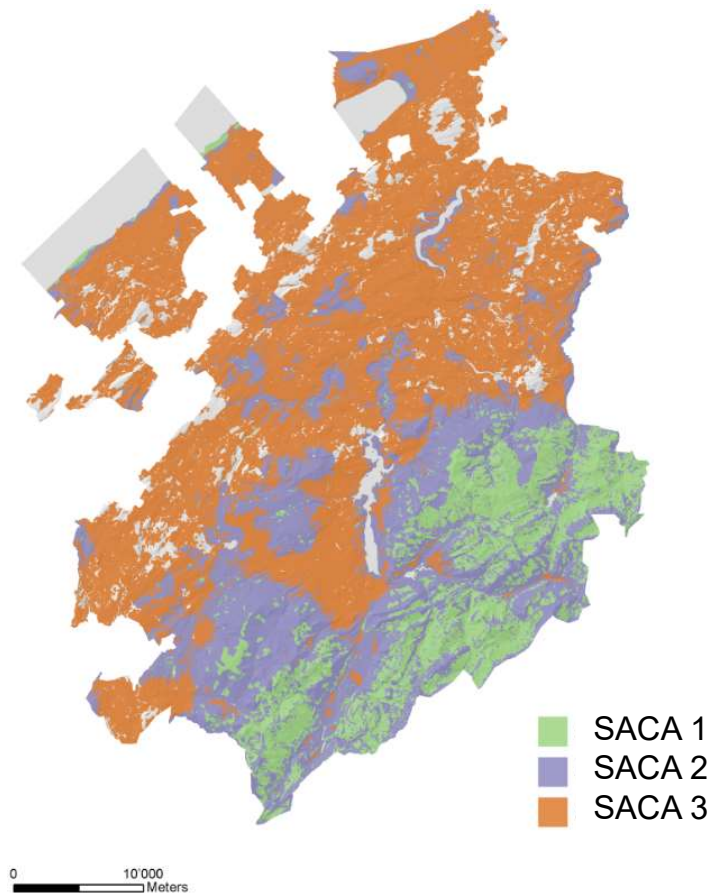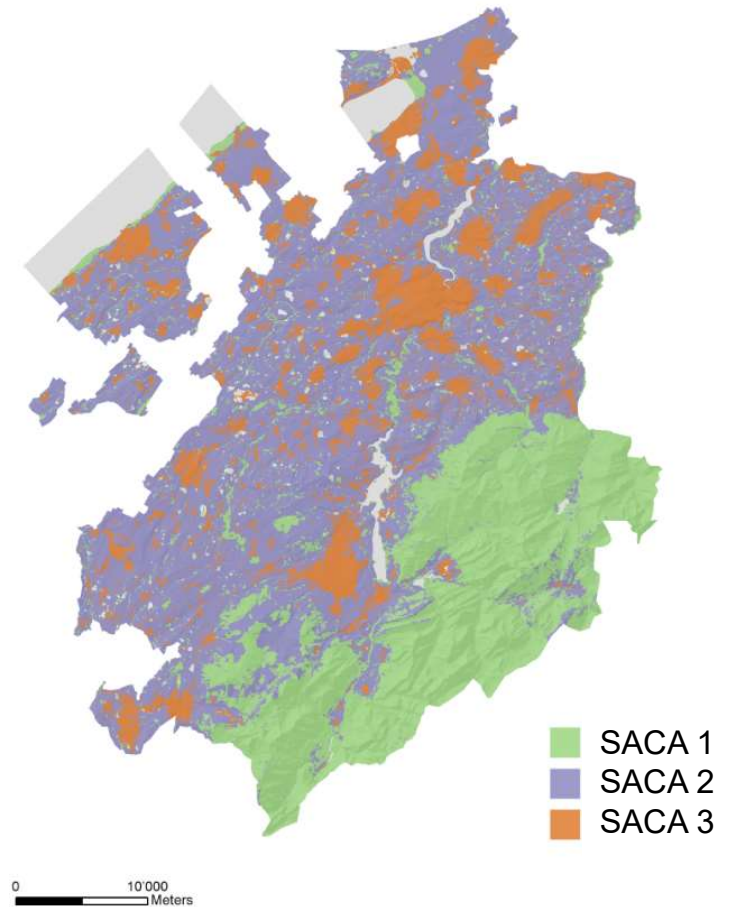
Result with increased permeability in
agriculture and creating stepping stones

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