Swiss Mire Monitoring

Combining Remotely Sensed Spectral Data and Digital Surface Models for Fine-Scale Modelling of Mire Ecosystems

Dr. Meinrad Küchler
Advisory Service for Mire Conservation
Swiss Federal Research Institute, WSL

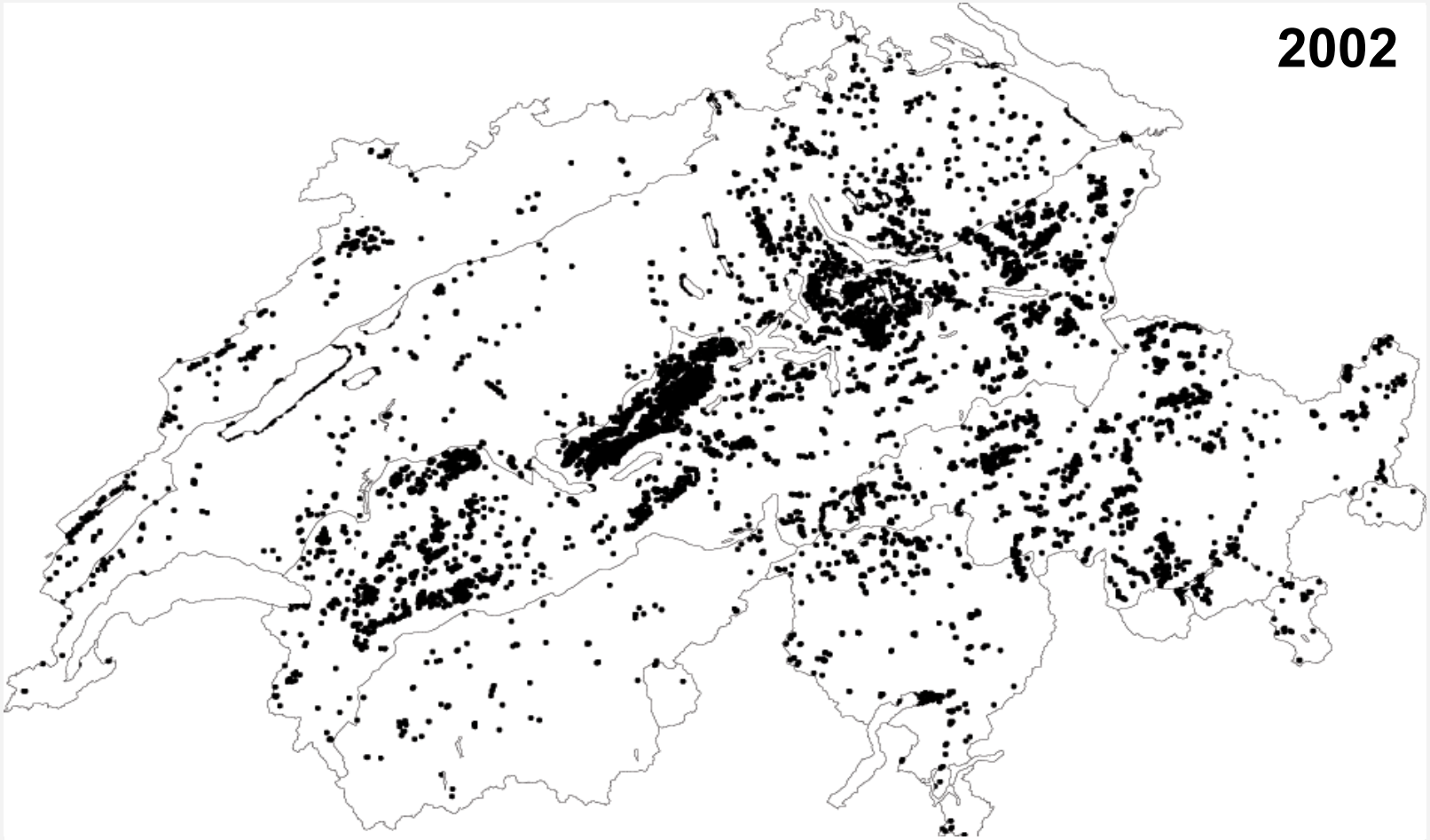
Contents

- The Swiss mire monitoring program
- Site description with modelling
  - Response variables
  - Predictor variables
  - Composite model
- Change detection

Contents

- The Swiss mire monitoring program
- Site description with modelling
  - Response variables
  - Predictor variables
  - Composite model
- Change detection

The Swiss mire monitoring program



Data from the Federal inventories of raised and transitional bogs and fenlands of national importance.

Federal Constitution

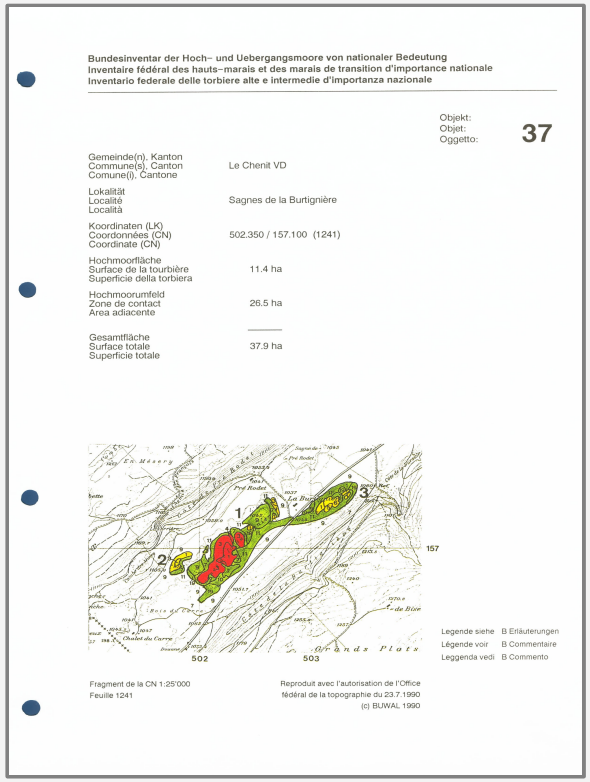
Article 78 - Paragraph 5

Mires and mire landscapes of particular beauty and national importance are protected areas.

The construction of any kind of building or installation and any operations changing the soil structure are strictly prohibited. Excepted are operations and installations necessary for the maintenance and sustainable agricultural use of the mires and mire landscapes.

The Swiss mire monitoring program

Inventory of the raised and transitional bogs



Bundesinventar der Hoch– und Uebergangsmoore von nationaler Bedeutung
Inventaire fédéral des hauts–marais et des marais de transition d'importance nationale
Inventario federale delle torbiere alte e intermedie d'importanza nazionale

Objekt: 37
Objet:
Oggetto:

Gemeinde(n), Kanton: Le Chenit VD
Commune(s), Canton:
Comune(i), Cantone:

Lokalität: Sagnes de la Burtignière
Localité:
Località:

Koordinaten (LK): 502.350 / 157.100 (1241)
Coordonnées (CN):
Coordinate (CN):

Hochmoorfläche: 11.4 ha
Surface de la tourbière:
Superficie della torbiera:

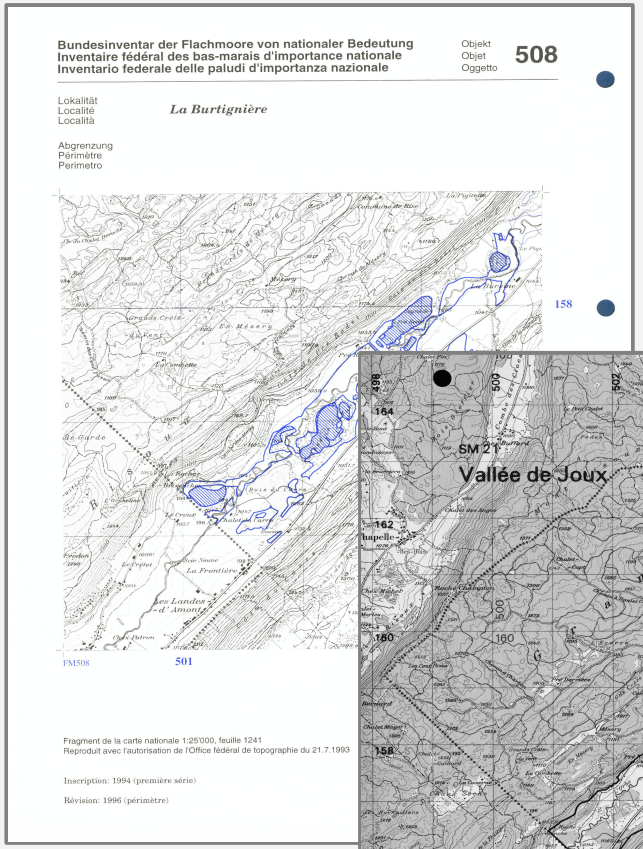
Hochmoorumfeld: 26.5 ha
Zone de contact:
Area adiacente:

Gesamtfläche: 37.9 ha
Surface totale:
Superficie totale:

Fragment de la CN 1:25'000
Feuille 1241

Reproduit avec l'autorisation de l'Office fédéral de la topographie du 23.7.1990
(c) BUWAL 1990

Inventory of the fenlands



Bundesinventar der Flachmoore von nationaler Bedeutung
Inventaire fédéral des bas-marais d'importance nationale
Inventario federale delle paludi d'importanza nazionale

Objekt 508
Objet
Oggetto

Lokalität: *La Burtignière*
Localité
Località

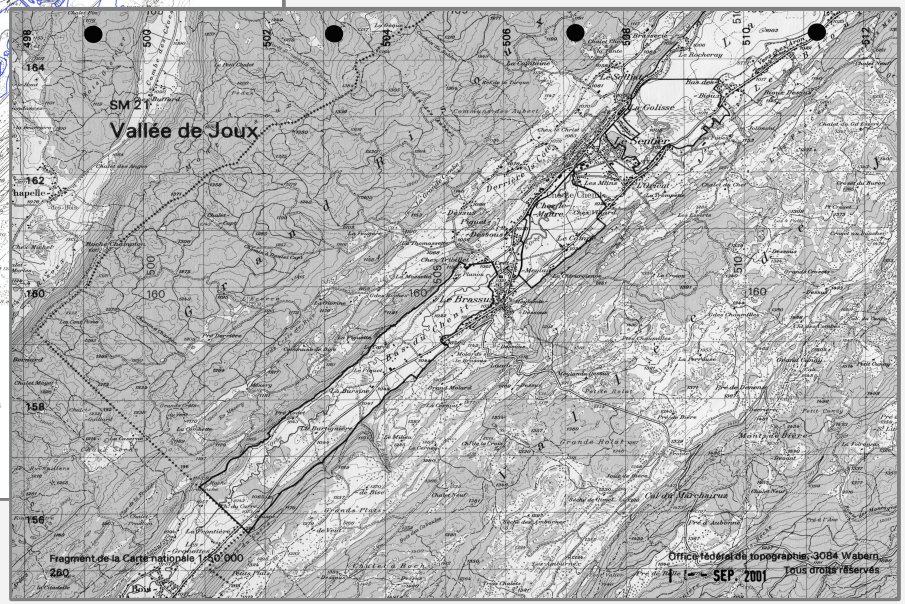
Abgrenzung
Périmètre
Perimetro

Fragment de la carte nationale 1:25'000, feuille 1241
Reproduit avec l'autorisation de l'Office fédéral de topographie du 21.7.1993

Inscription: 1994 (première série)

Révision: 1996 (périmètre)

Inventory of the mire landscapes

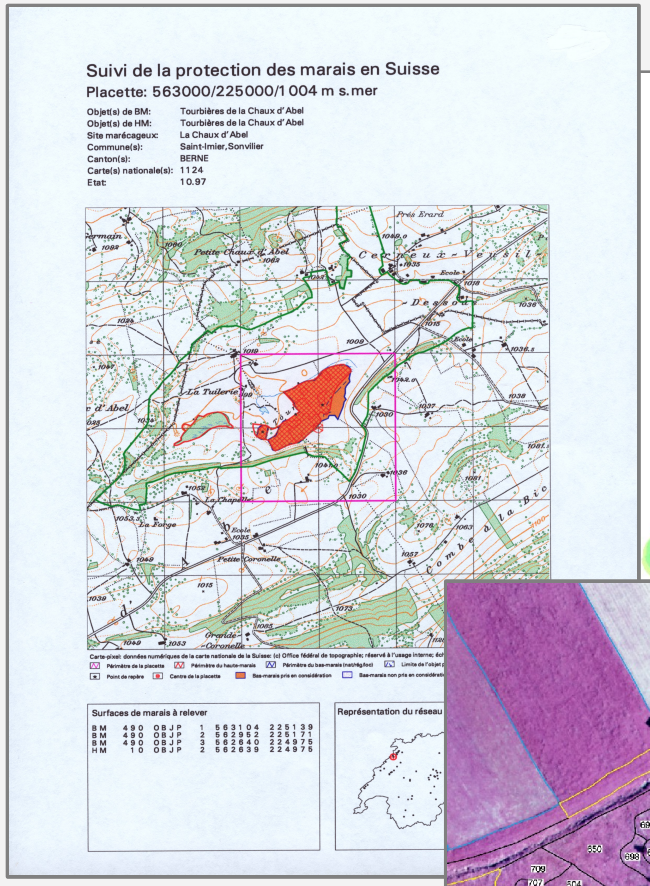


The Swiss mire monitoring program

The protected mires are to be maintained in their present state, i.e. their quantity (= area) and their quality (= features typical for mires) must not diminish.

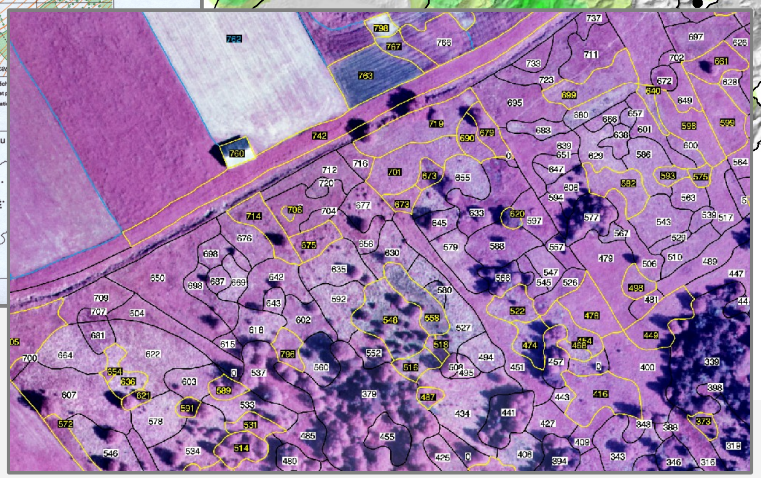
The Swiss mire monitoring program

Sampling design



Sampling unit

Sample distribution



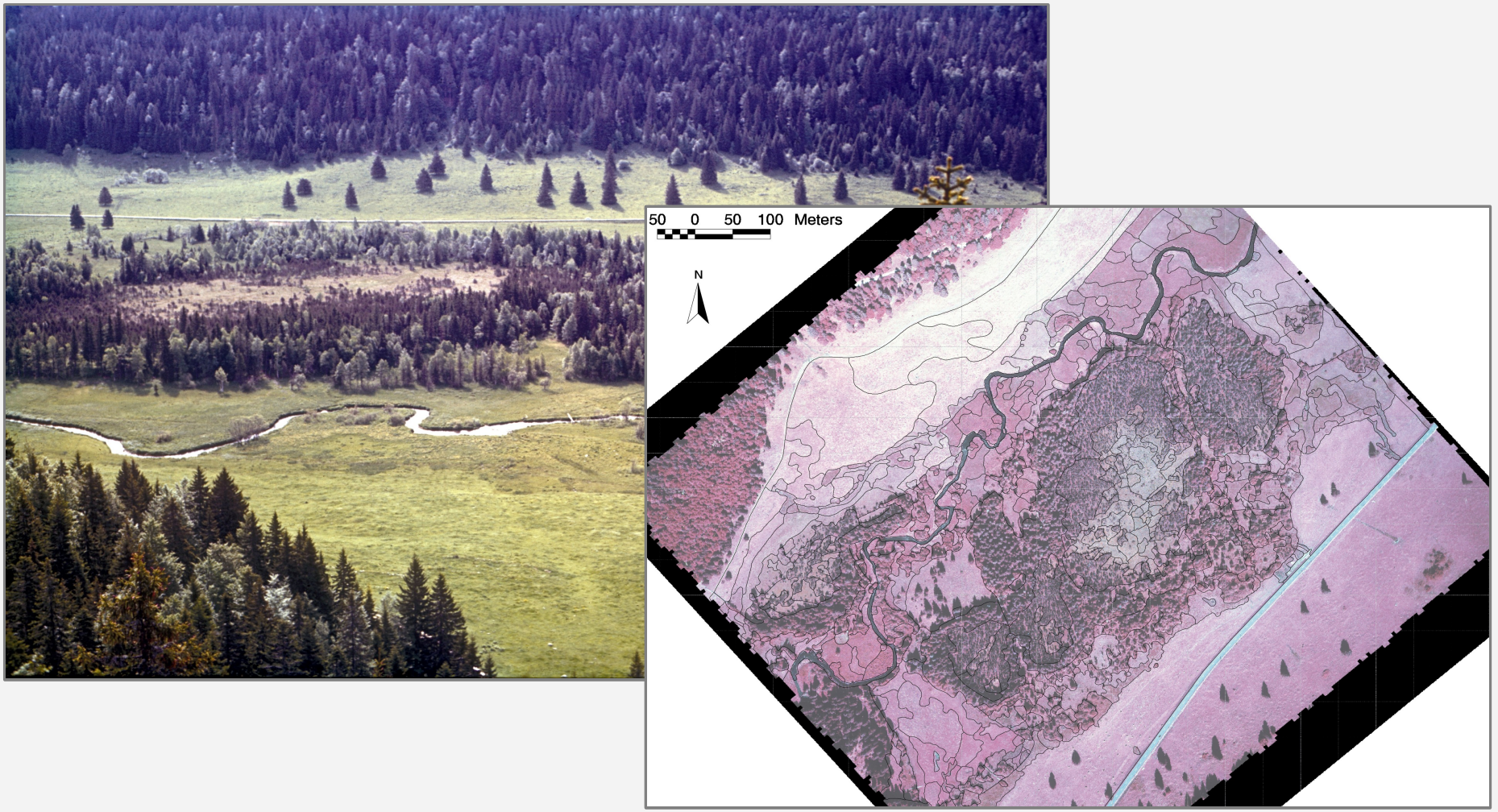
Plots within a sampling unit

Contents

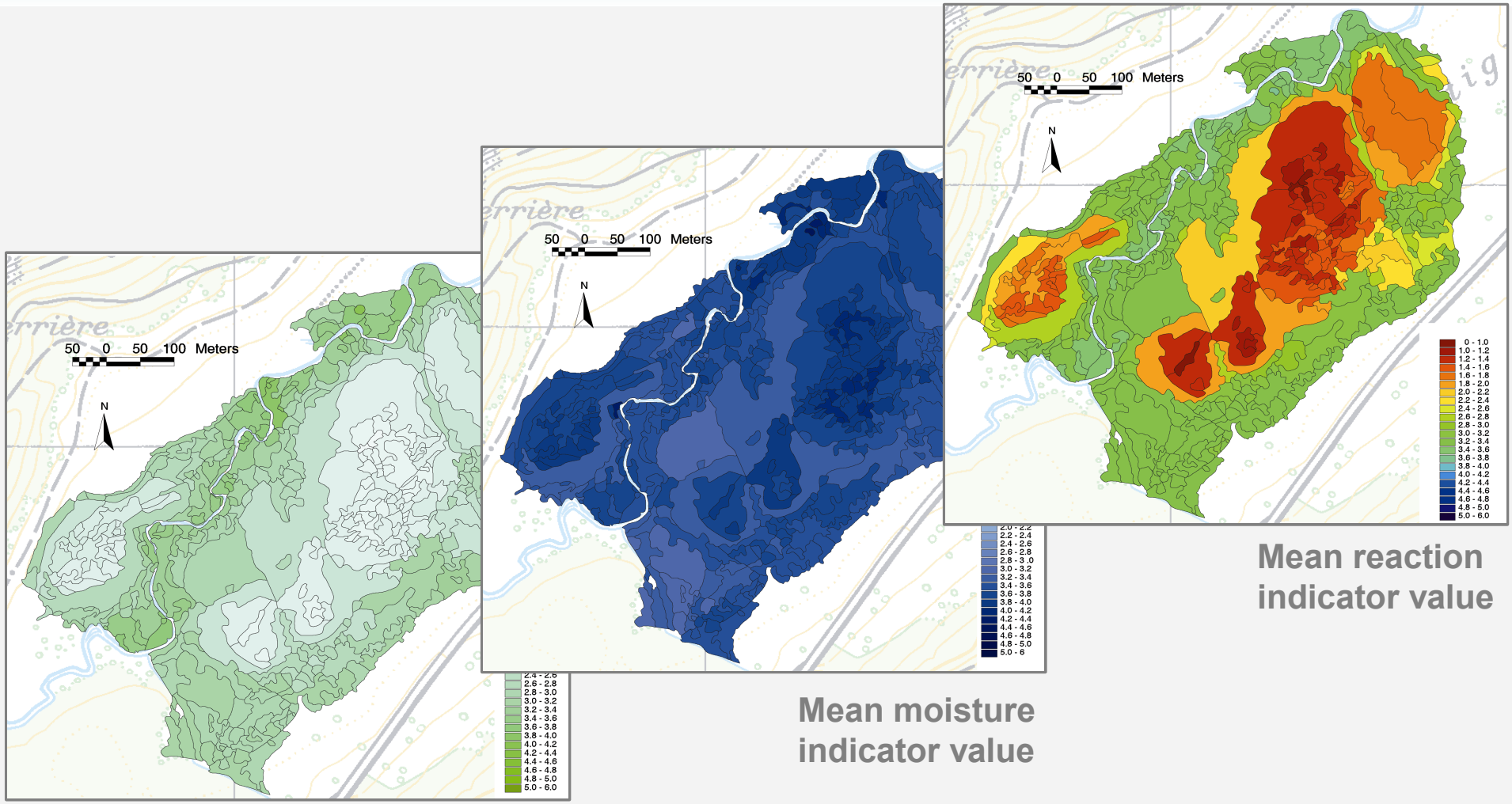
- The Swiss mire monitoring program
- Site description with modelling
  - Response variables
  - Predictor variables
  - Composite model
- Change detection

Site description with modelling

Les Sagnes de la Burtignière, canton Vaud



Site description: response variables

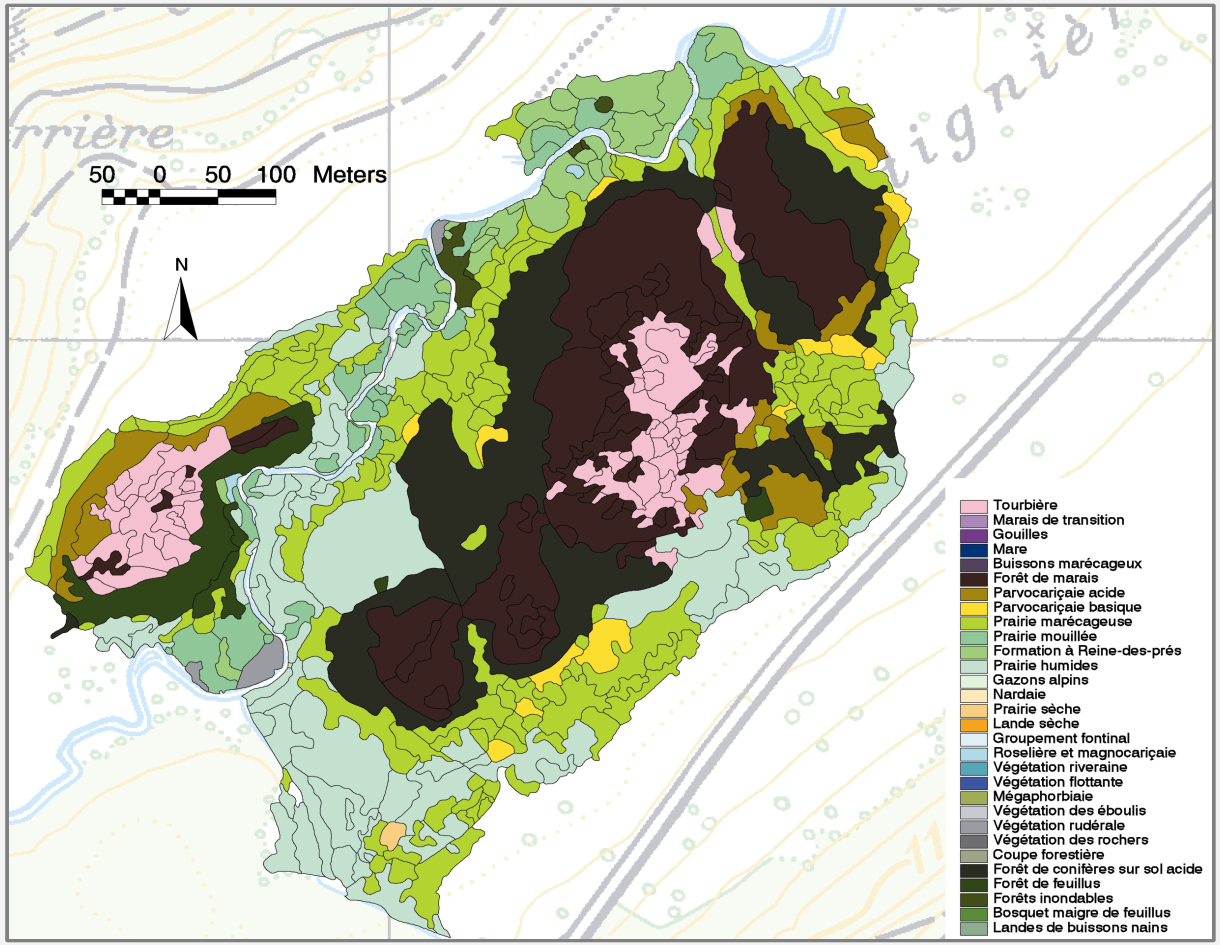


Mean reaction indicator value

Mean moisture indicator value

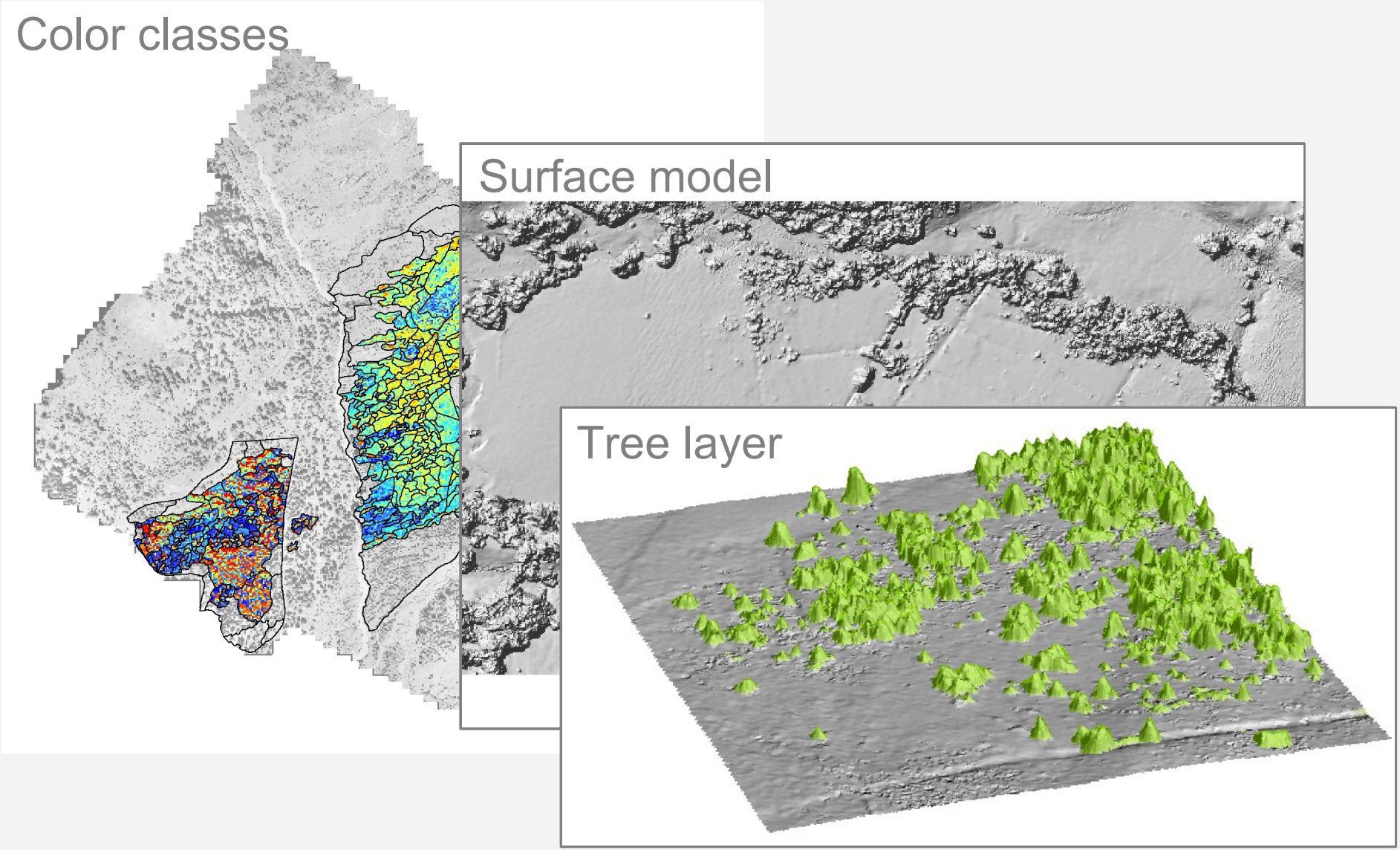
Mean nutrient indicator value

Site description: response variables



Vegetation units derived from mean indicator values

Site description: predictor variables

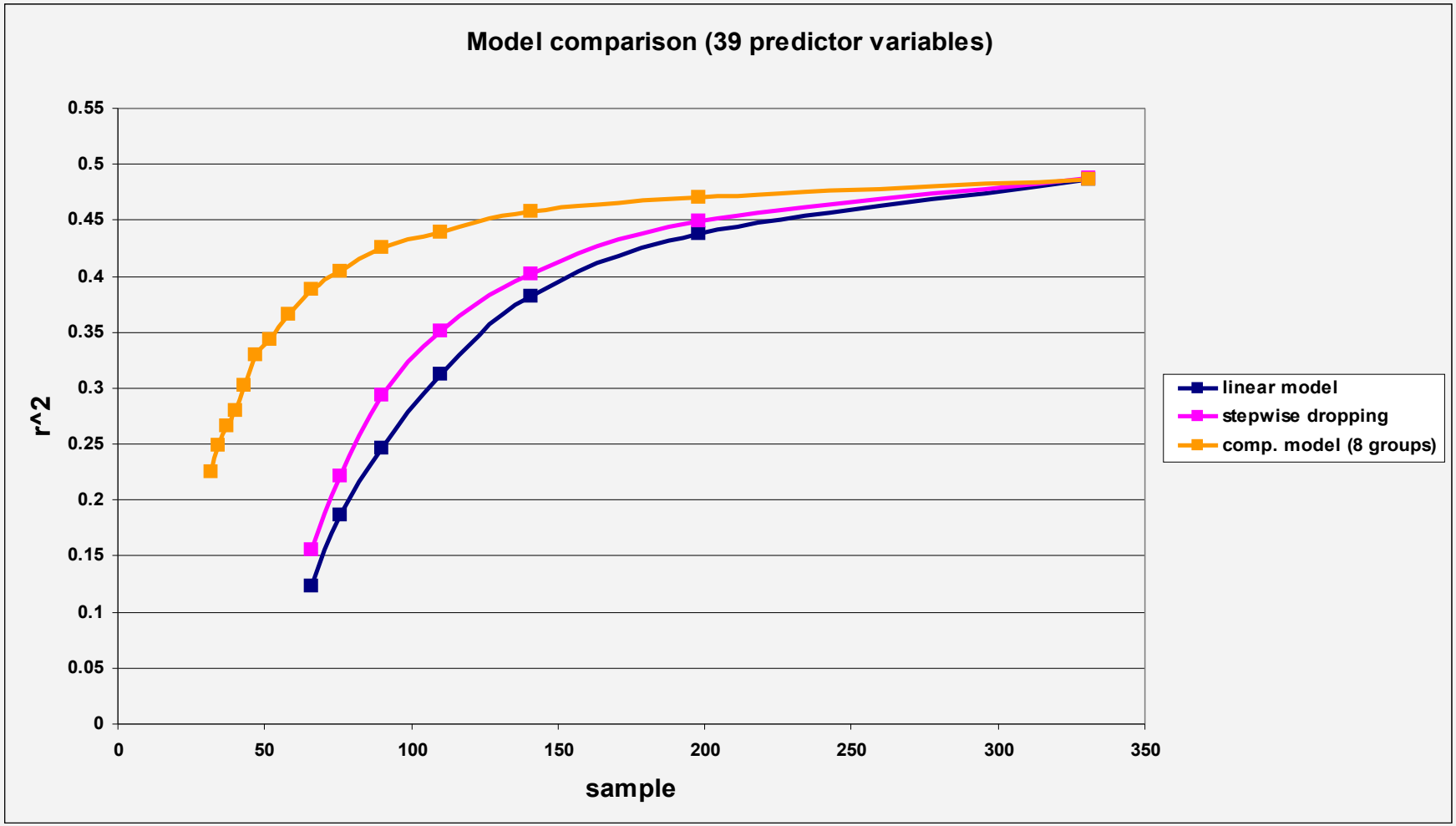


Site description: predictor variables, composite model

Predictor variable group	No	Environmental relevance
Spectral variables		
Colour bands	9	Spectral reflectance, absorption and transmission of the vegetation cover
Colour band ratios	6	Calibrated spectral reflectance, absorption and transmission of the vegetation cover
Normalised Difference Vegetation Index (NDVI)	3	LAI, chloprophyl content, above-ground phytomasse, net primary production
Spectral-textural variables		
Colour class proportion	24	Proportions of spectrally similar vegetation units
Colour class agglomeration	24	Spatial distribution of spectrally similar vegetation units
Colour class homogeneity	24	Spatial distribution of spectrally similar vegetation units
Topographical variables		
Exposure	3	Broad-scale surface energy budget, evaporation and water flow conditions
Curvature25	3	Broad-scale soil properties and water flow conditions, topographic features like ridge, slope, slope bottom and sink
Curvature05	3	Fine-scale soil properties and soil water conditions, topographic features like drainage ditch, hummock, hollow
Slope05	3	Fine-scale water flow conditions, surface roughness
Topographical-textural variables		
Slope class proportion	8	Surface composition
Slope class agglomeration	8	Surface roughness
Slope class homogeneity	8	Surface roughness
Spatial dependency of residuals		

WSL

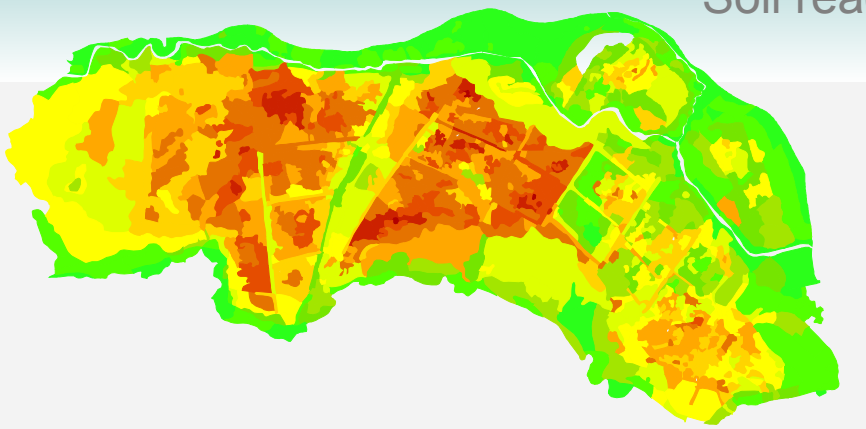
Site description: composite model



Site description

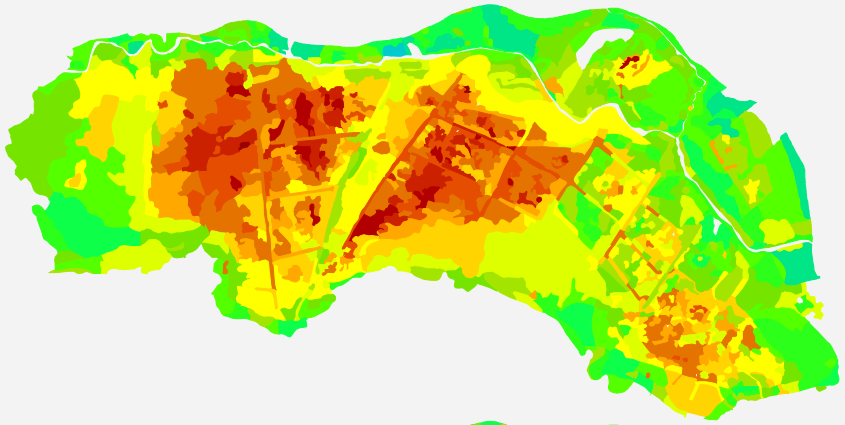
Soil reaction

Recorded
field data



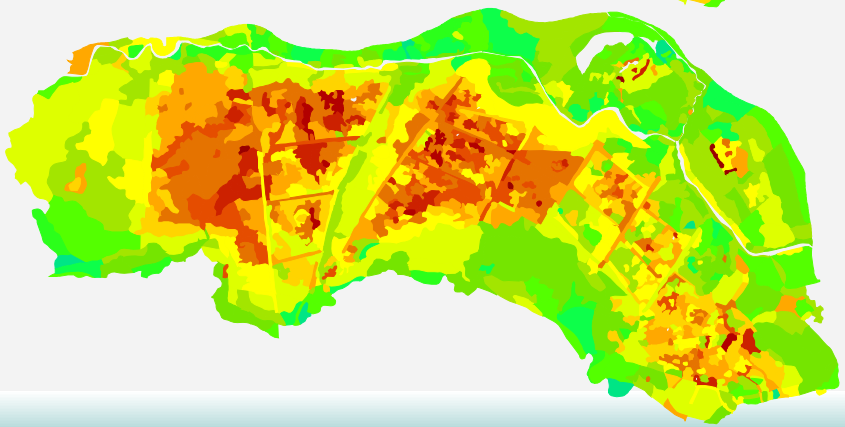
Model with
200 relevés

r = 0.81
med = 0.22
Q95 = 0.73



Model with **70**
relevés

r = 0.73
med = 0.28
Q95 = 0.88



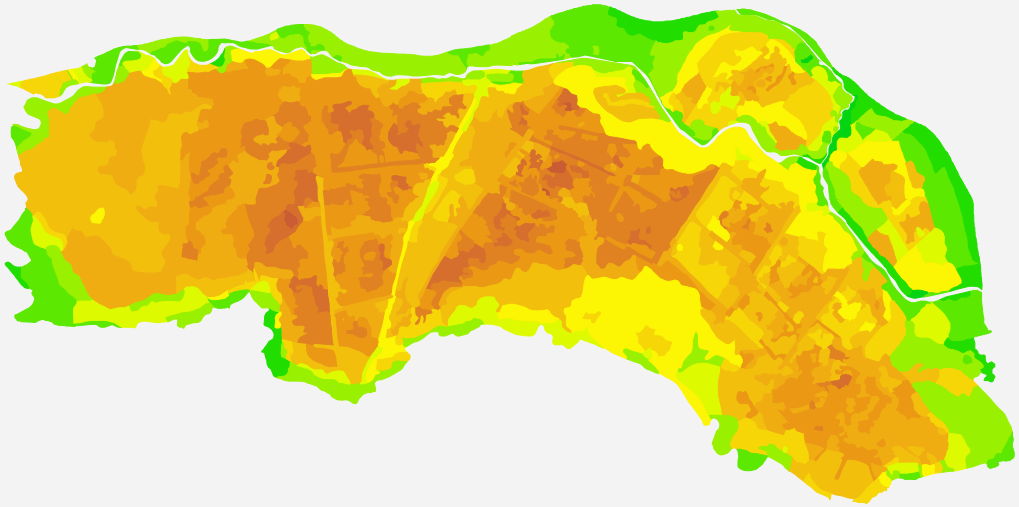
Contents

- The Swiss mire monitoring program
- Site description with modelling
  - Response variables
  - Predictor variables
  - Composite model
- Change detection

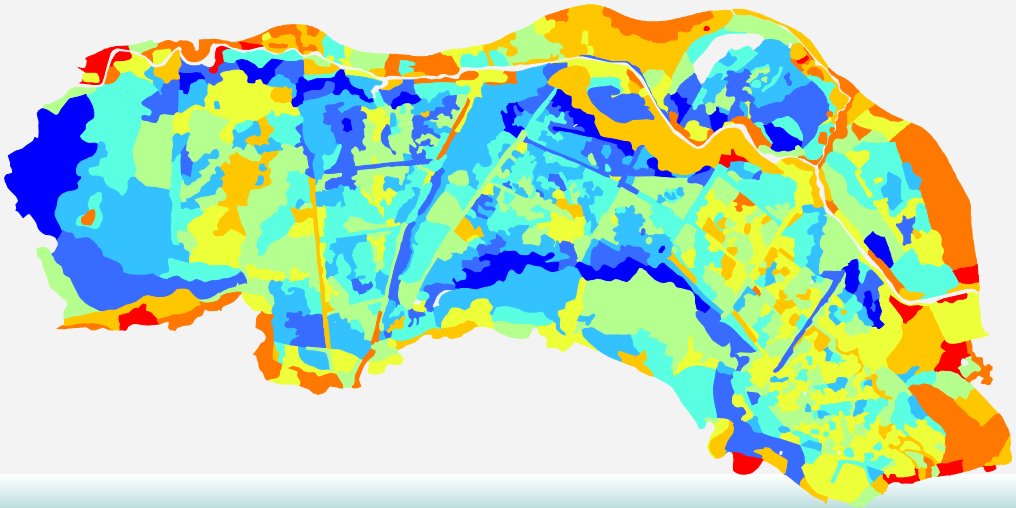
Change detection

Problem: Statistical models depend on data quality

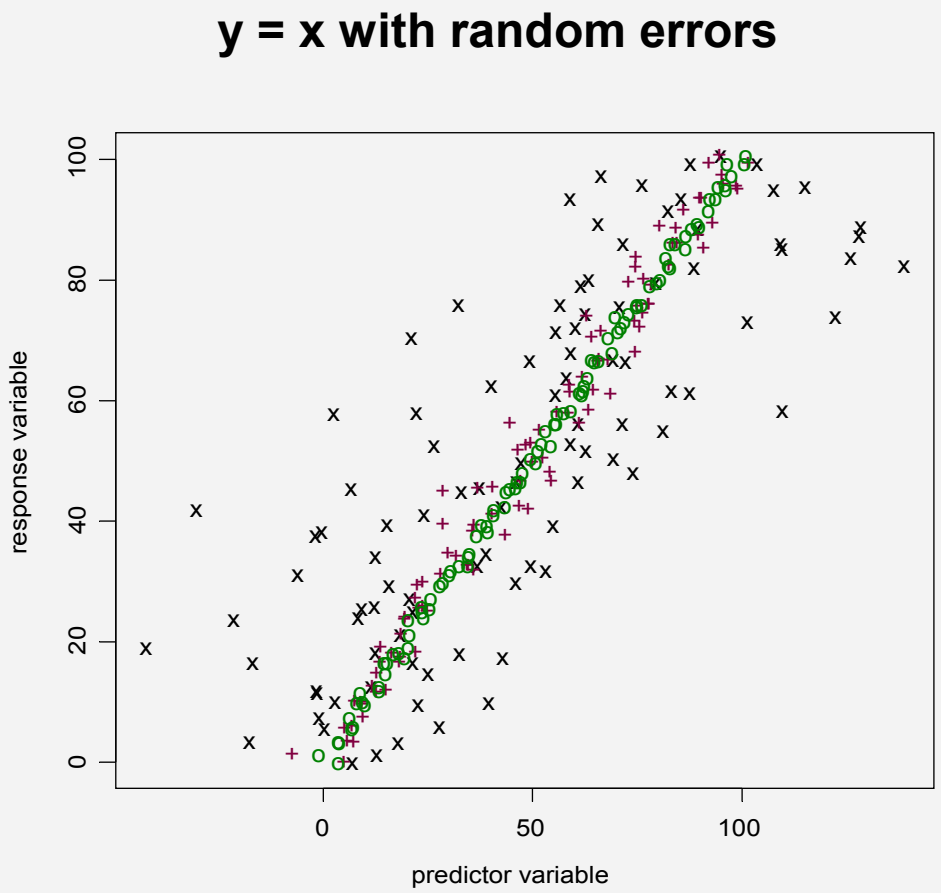
Nutrient value (observed)



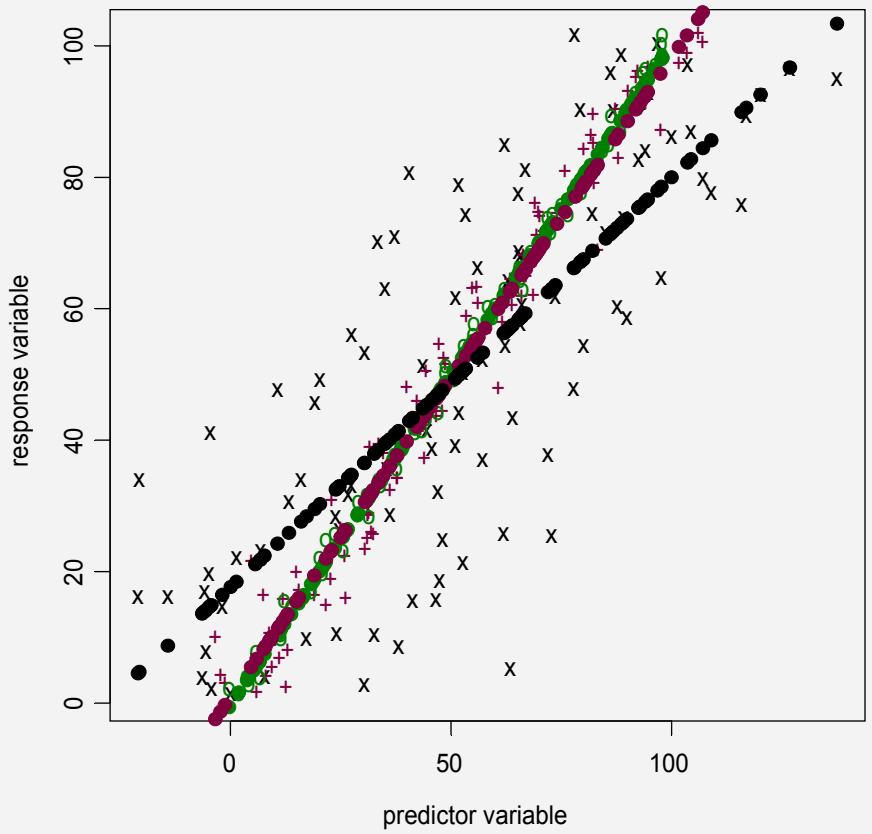
Nutrient value (residuals)



Change detection



Change detection

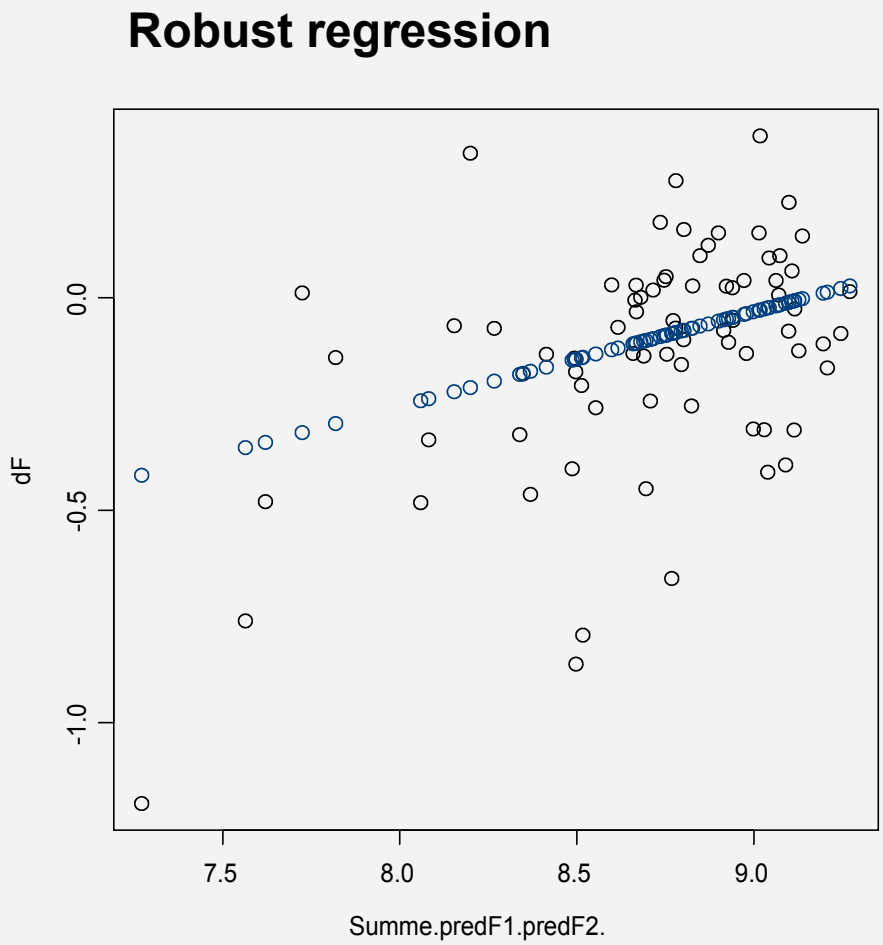


Change detection

Google:

"Regression attenuation effect"	**137.000 entries**
"Dilution bias"	**196.000 entries (mainly medicine)**
"Remote sensing"	**no entries found**

Change detection



The study was funded by the
Swiss Agency for the Environment, Forests
and Landscape, Berne, Switzerland

Swiss mire monitoring program

Project manager:
Dr. Meinrad Küchler

Project team:
Dr. Klaus Ecker
Dr. Elizabeth Feldmeyer-Christe
Dr. Ulrich Graf
Dipl. nat. Helen Küchler

Swiss Federal Research Institute WSL

Birmensdorf, Switzerland

Thank you for your attention