



Geography
Bayreuth

Bayreuth SS 2011

Monitoring and Experiments



EVENT 3, May 2011



Carl Beierkuhnlein



Late Frost Event

Fagus sylvatica



Quercus robur

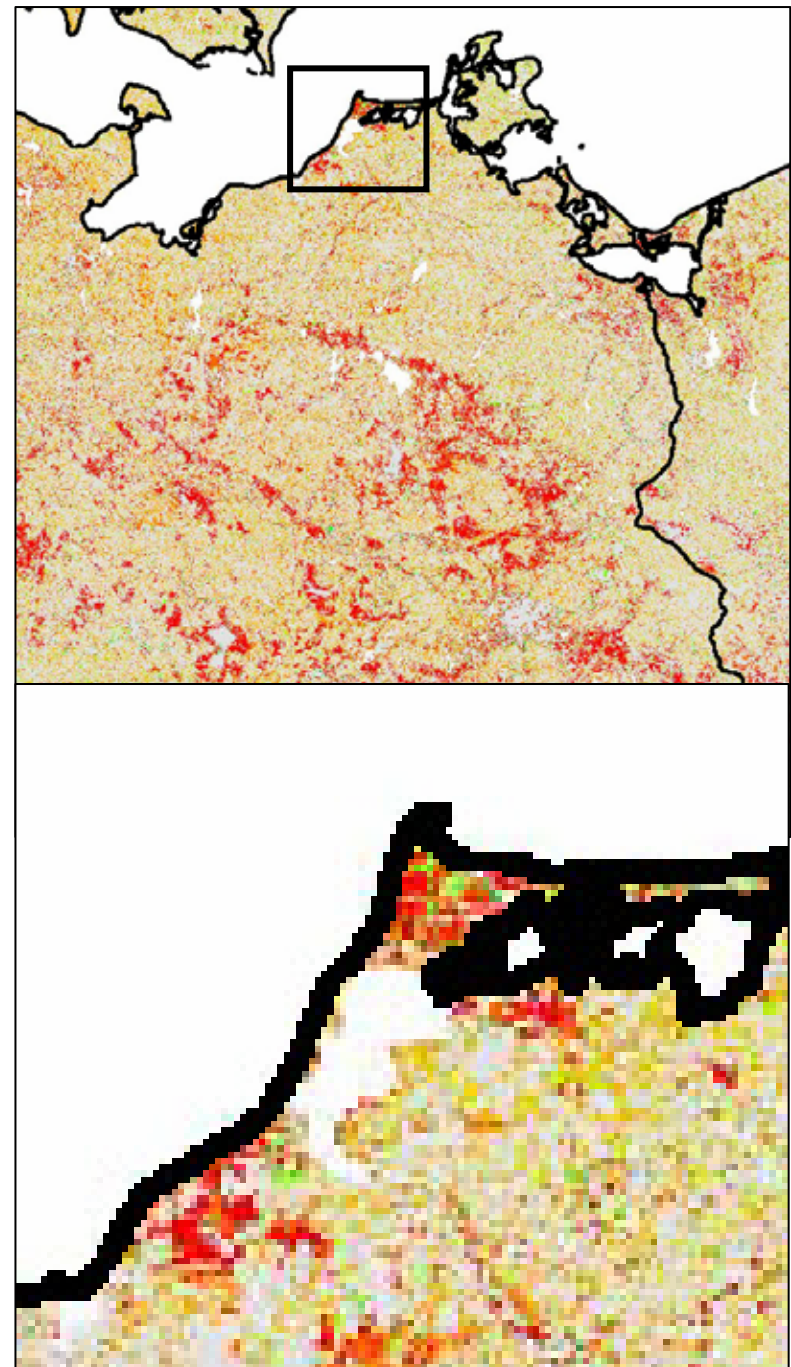
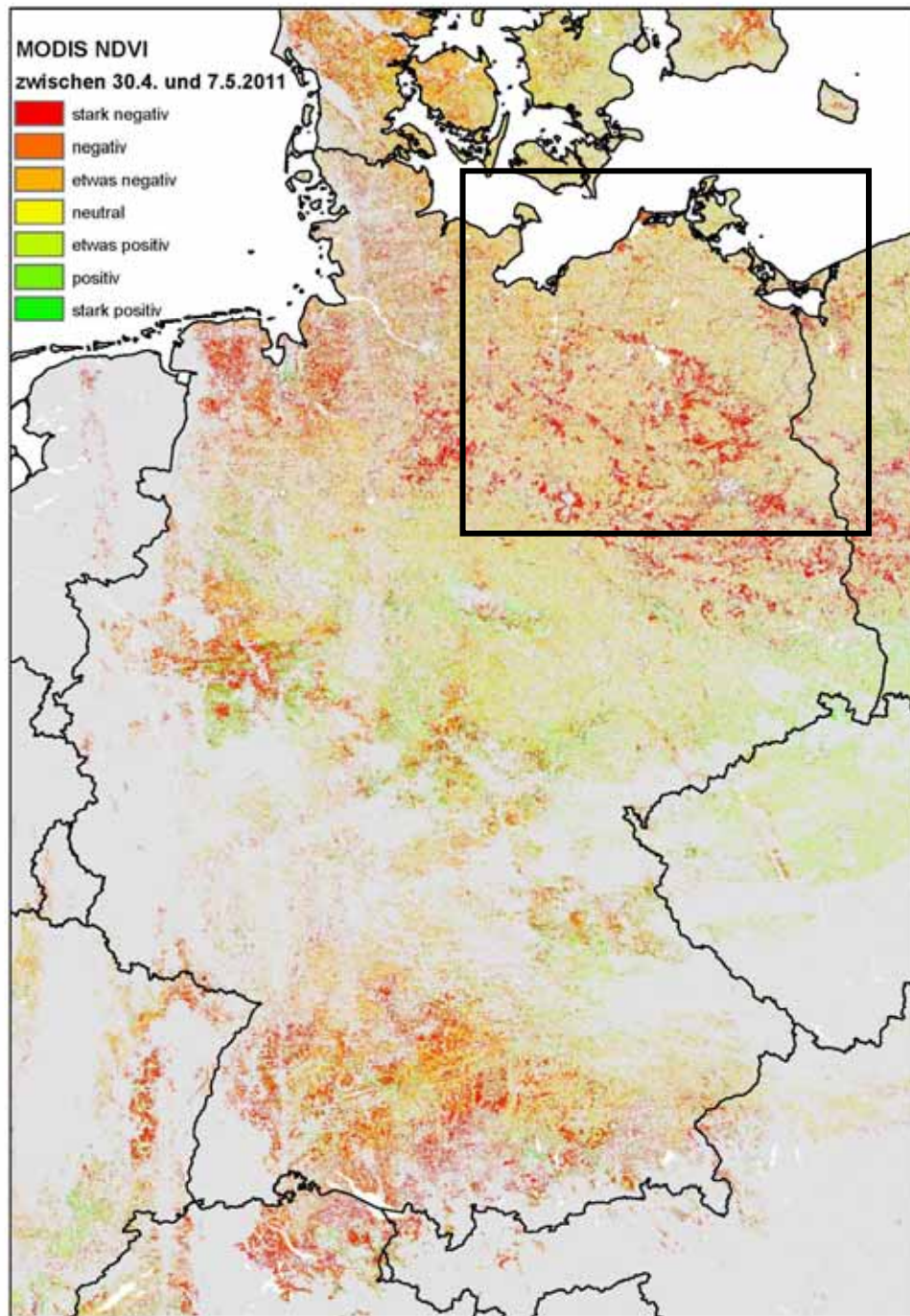


Prunus avium



Fraxinus excelsior







Monitoring

Monitoring has to be affected for the effects of major challenges in environmental change:

- Climate Change
- Landuse Change
- Change of Biogeochemical Cycles (e.g. C, N)
- Invasion



Monitoring

Monitoring may concentrate on various targets:

- Compounds (nutrients, toxic substances)
- Species Traits (e.g. phenology, biomass, genetic diversity, abundance)
- Species Functions (e.g. increment, water use efficiency, carbon sequestration, N-Fixation)
- Ecosystem Traits (e.g. biodiversity, biomass, cover, phenology)
- Ecosystem Functions (e.g. productivity, water retention capacity, carbon turnover)
- Ecosystem Services



Case Studies on Landuse Change

Ongoing and historical land use changes are still the most important contribution of humans to modifications in biodiversity and biogeochemical cycles.



Case Studies on Landuse Change

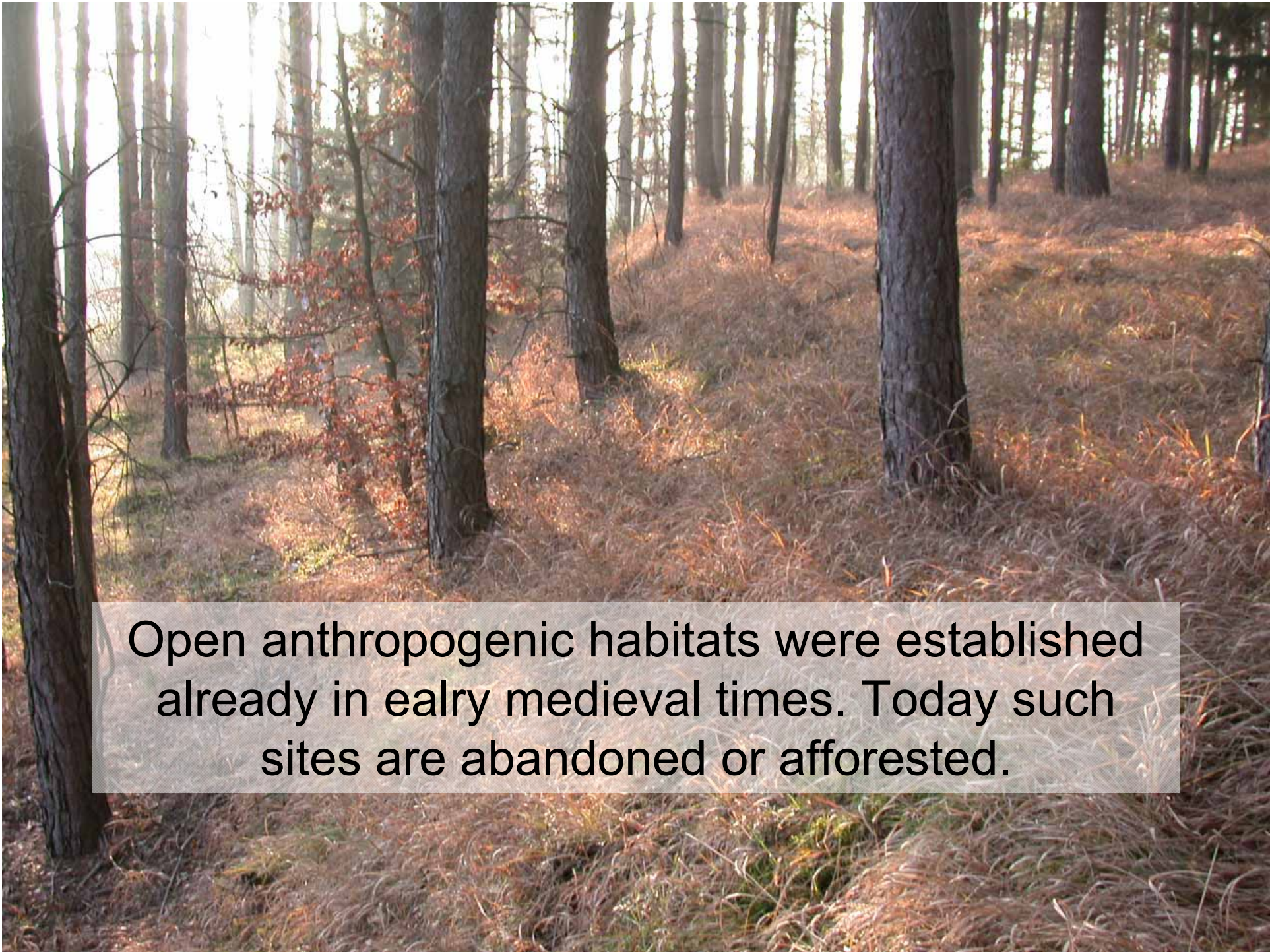


In Central Europe, the threat for species of open habitats that are adapted to low land use intensity is increasing.



Case Studies on Landuse Change

Open anthropogenic habitats were established already in early medieval times. Today such sites are abandoned or afforested.

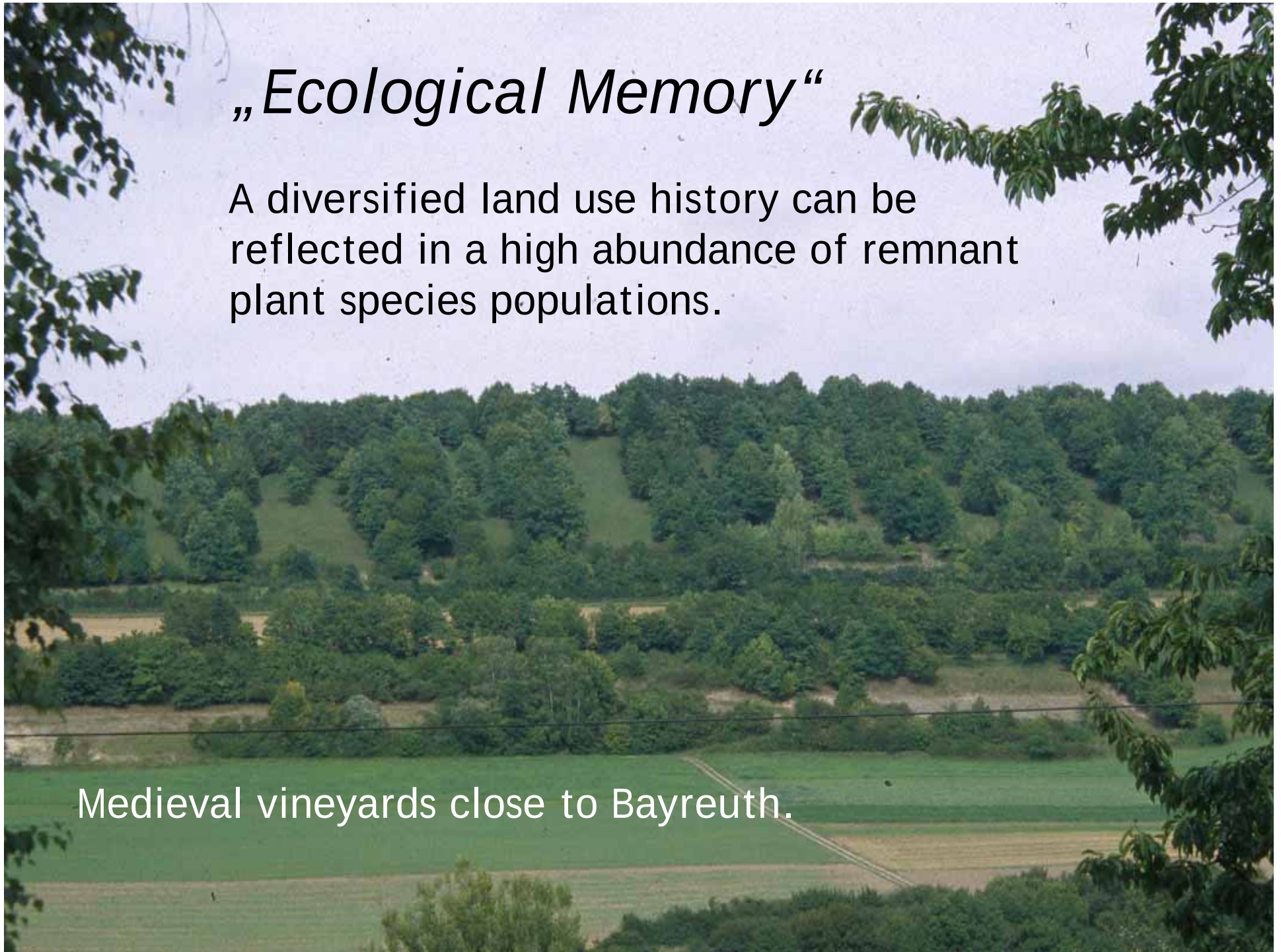


Open anthropogenic habitats were established already in early medieval times. Today such sites are abandoned or afforested.

„Ecological Memory“

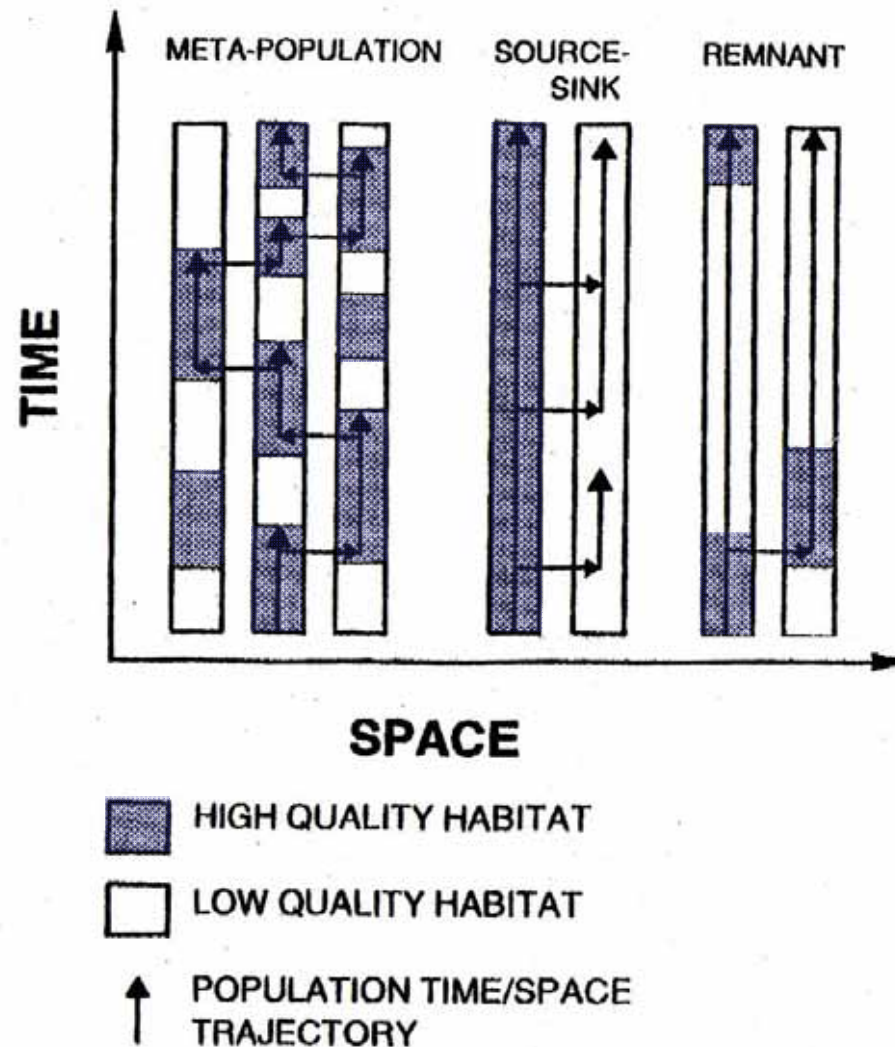
A diversified land use history can be reflected in a high abundance of remnant plant species populations.

Medieval vineyards close to Bayreuth.





Case Studies on Landuse Change



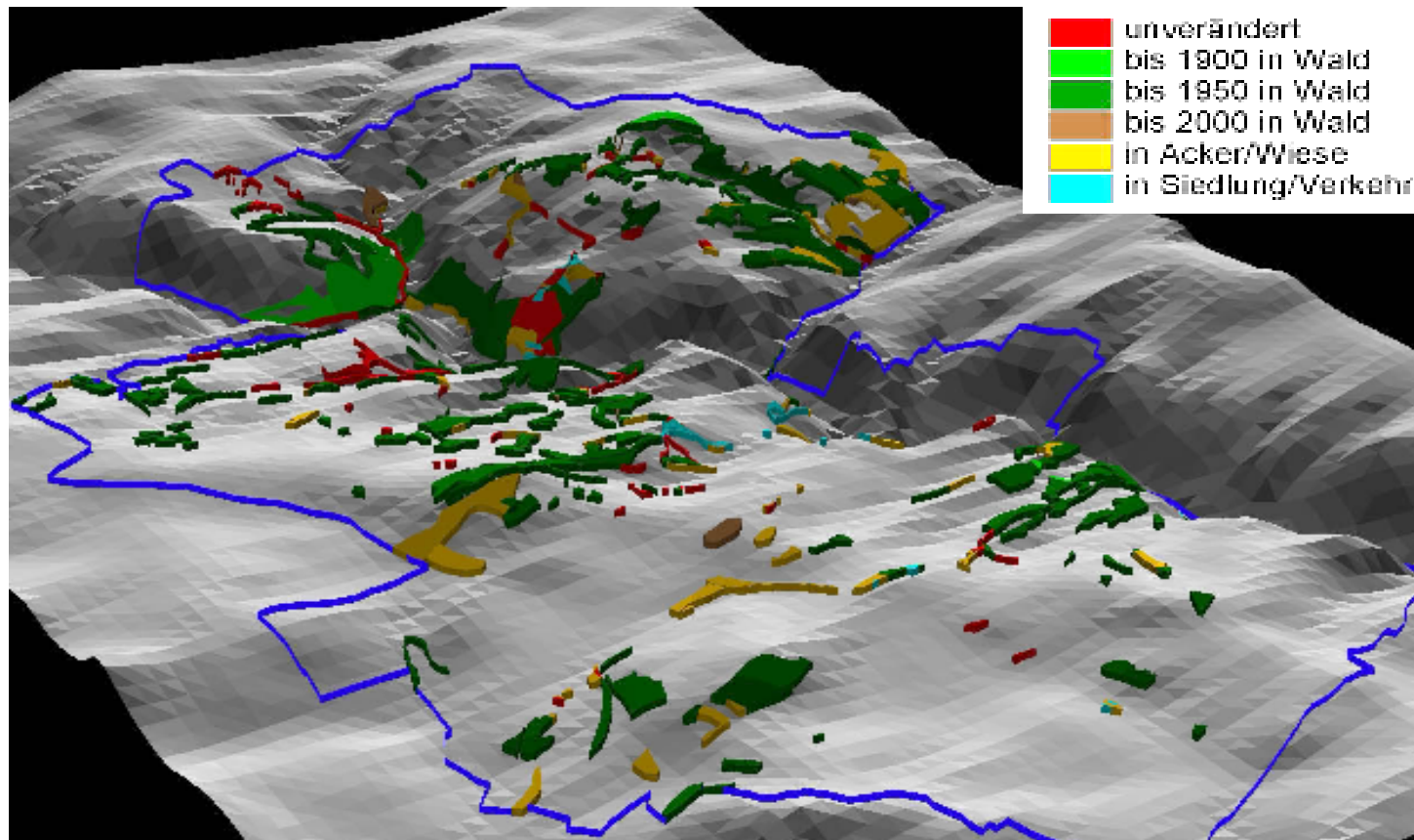
(Eriksson 1996)



Case Studies on Landuse Change

Veränderungstypen (1850 - 1900 - 1960 - 2000)

Hutung-Wald-Wald-Wald bzw. *Hutung-Hutung-Wald-Wald*
"Steppenheide-Kiefernwald" nach Gradmann / Gauckler



Veränderung der **Hutungen** und **Ödländereien**, Gmk. Wüstenstein



Case Studies on Landuse Change

Ziel: Rekonstruktion der
Landnutzung &
Landnutzungsänderung in
der Nördlichen Frankenalb

Datenquellen

1844–1847 cadastral maps 1:5000

1851–1854 land register

1877–1902 cadastral maps 1:5000

1896–1908 land register

1954–1961 cadastral maps 1:5000

1956–1962 land register

1963 aerial photos 1:23000

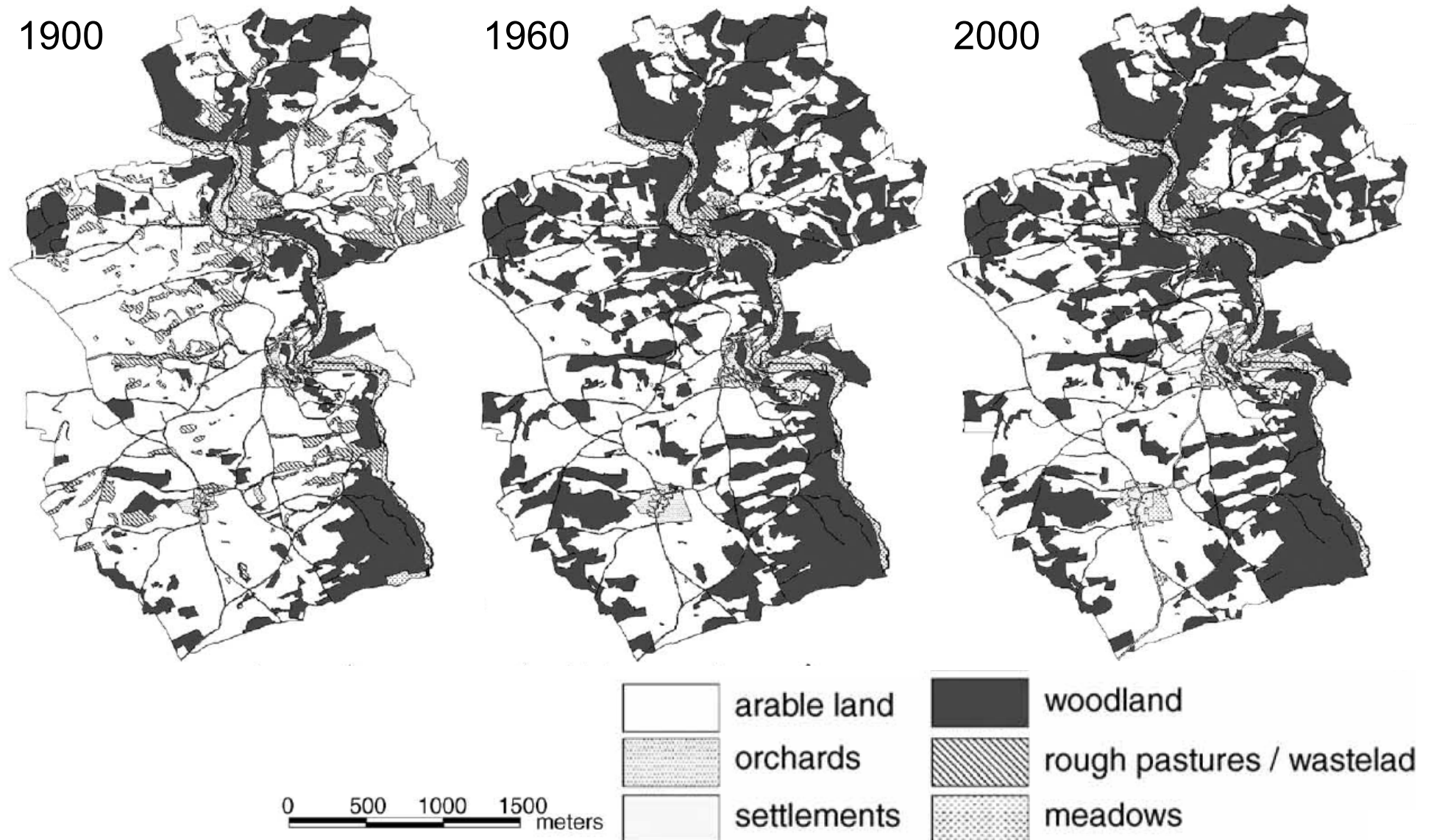
1997–2000 cadastral maps 1:5000

2000–2001 land register

1996 aerial photos 1:5000



Case Studies on Landuse Change



Bender O et al. 2005. Landscape Ecology 20 (2):149-163.

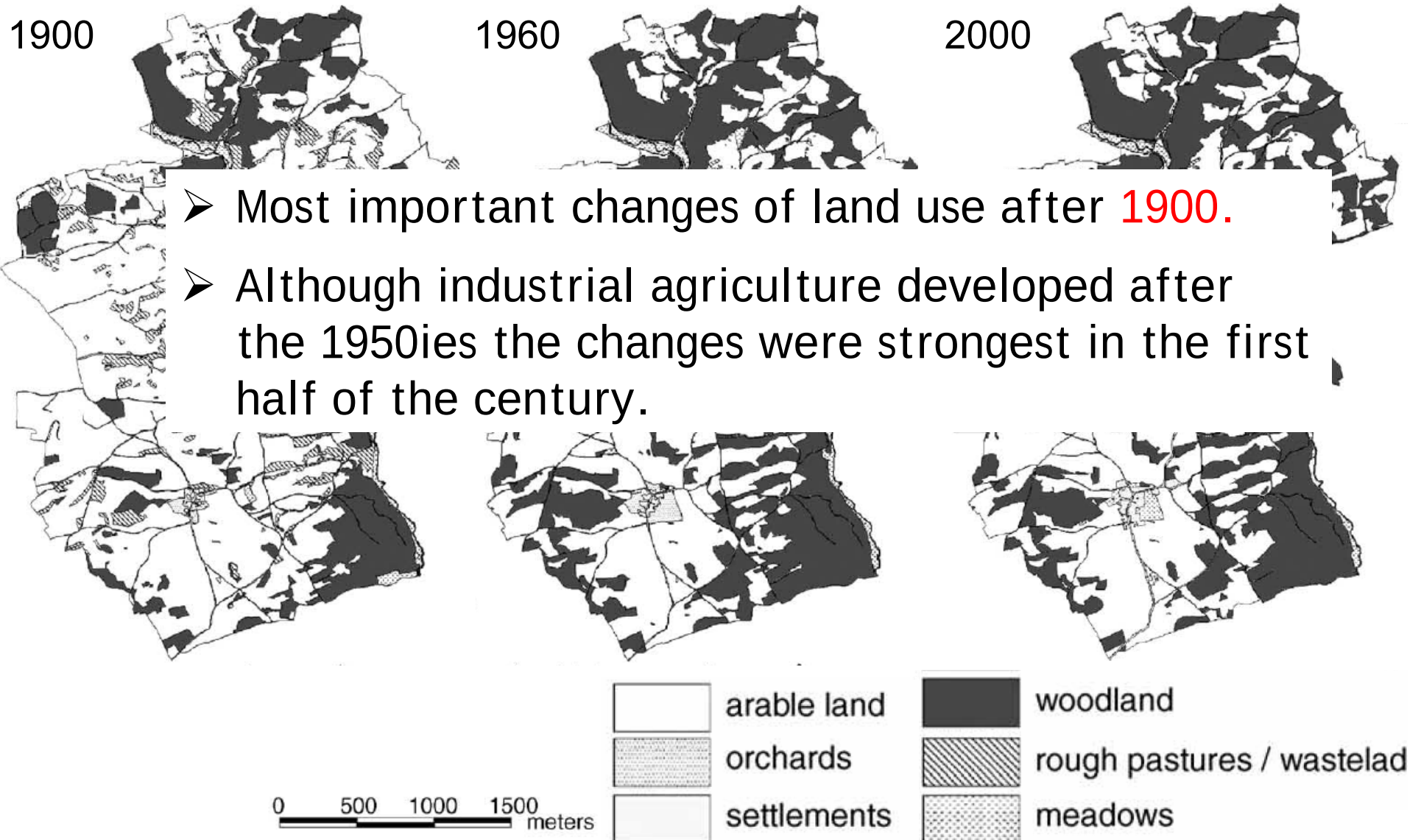


Case Studies on Landuse Change

	Cat. of change 1850–2000	Plots (%)	Area (ha)	Area (%)	Av_SQ	Av_SL
Äcker	arable land – arable land	28.59	982.79	47.23	5.71	3.87
	arable land – meadows	1.01	14.70	0.71	6.98	7.03
	arable land – pastures	0.40	2.40	0.12	5.13	6.40
	arable land – wasteland	0.61	2.34	0.11	4.87	5.96
	arable land – woodland	13.21	331.63	15.94	3.93	7.58
Grünland	pastures – arable land	0.47	9.38	0.45	2.72	5.52
	pastures – meadows	0.06	0.22	0.01	1.43	7.41
	pastures – pastures	0.33	7.31	0.35	3.46	7.32
	pastures – wasteland	0.11	0.71	0.03	4.00	5.24
	pastures – woodland	1.27	48.78	2.34	2.30	8.03
Wälder	woodland – arable land	0.89	20.20	0.97	3.74	5.70
	woodland – meadows	0.18	1.83	0.09	4.08	11.15
	woodland – pastures	0.02	0.47	0.02	2.50	4.53
	woodland – wasteland	0.01	0.05	0.00	3.50	10.39
	woodland – woodland	5.38	354.51	17.04	3.45	10.87



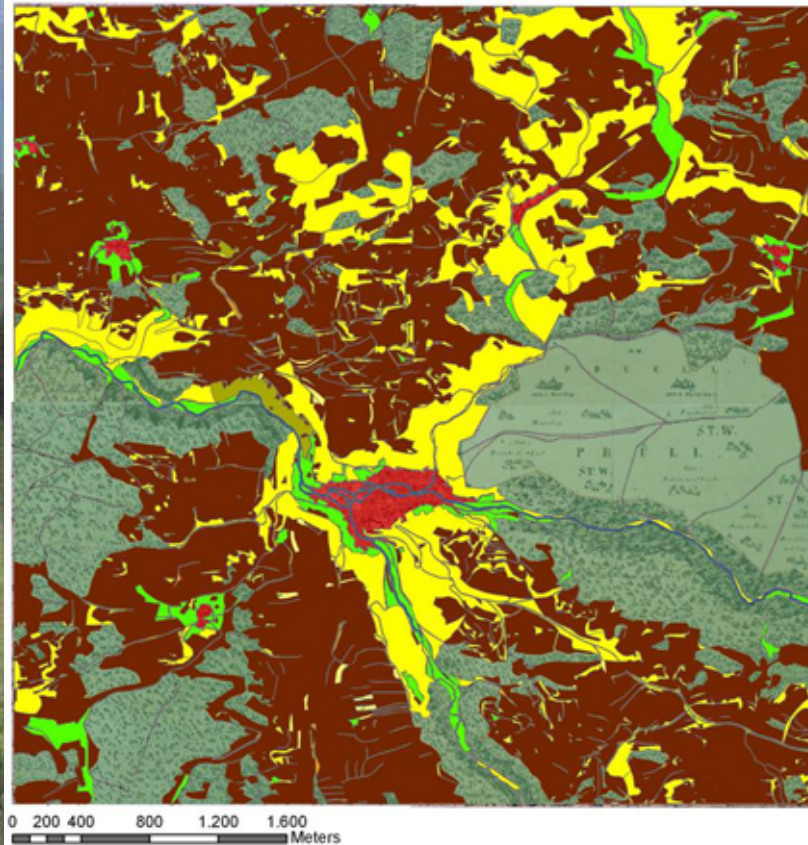
Case Studies on Landuse Change



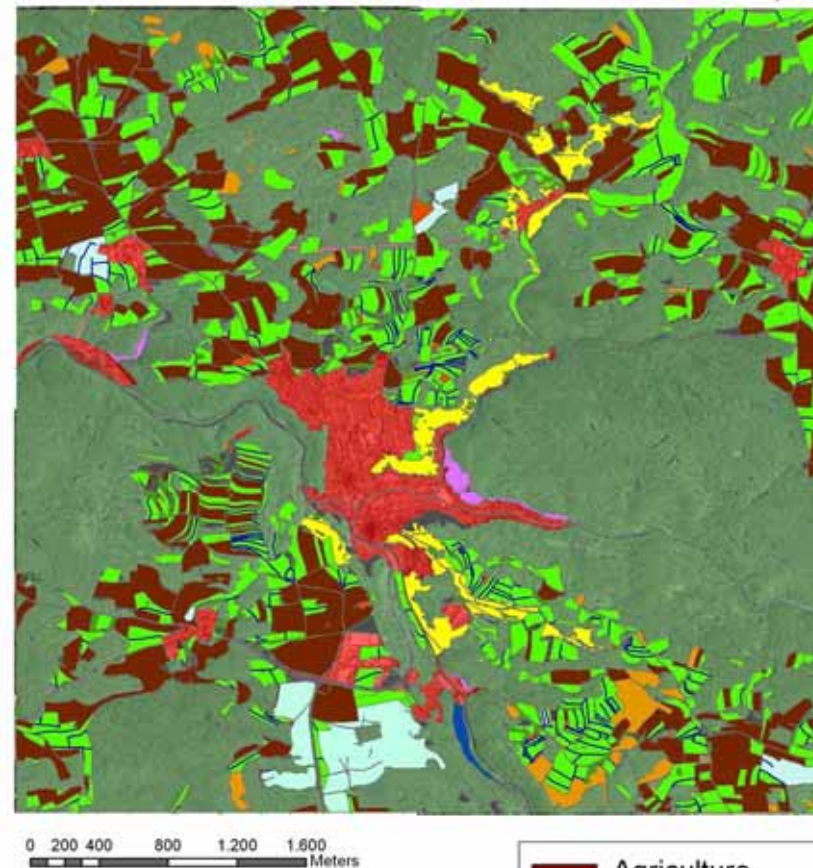


Case Studies on Landuse Change

Landuse: 1850



Landuse: 2006



Land use change in the vicinity of
Pottenstein, Nördliche Frankenalb

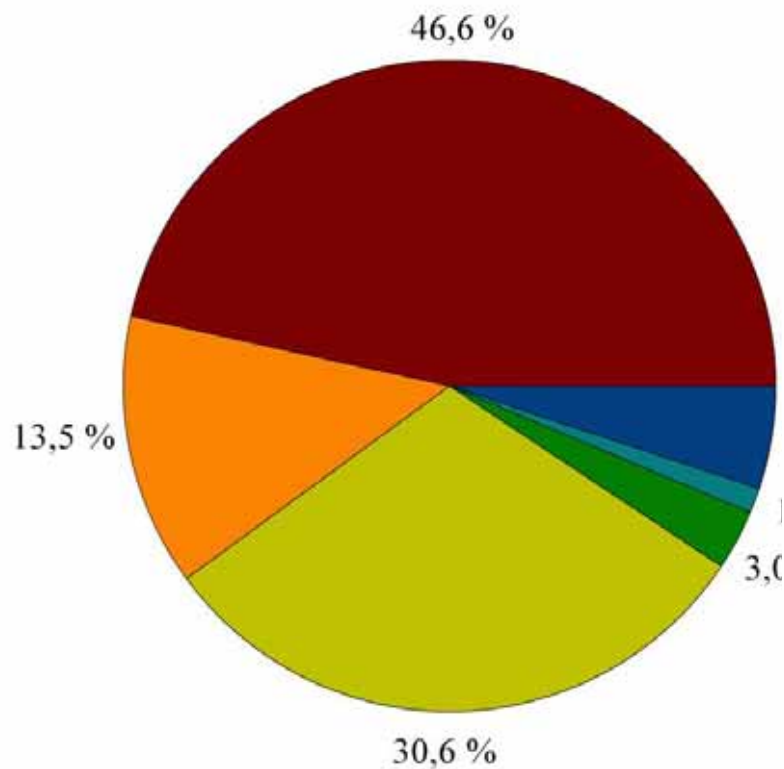


(Heubes, Retzer, Schmidtlein, Beierkuhnlein 2011)

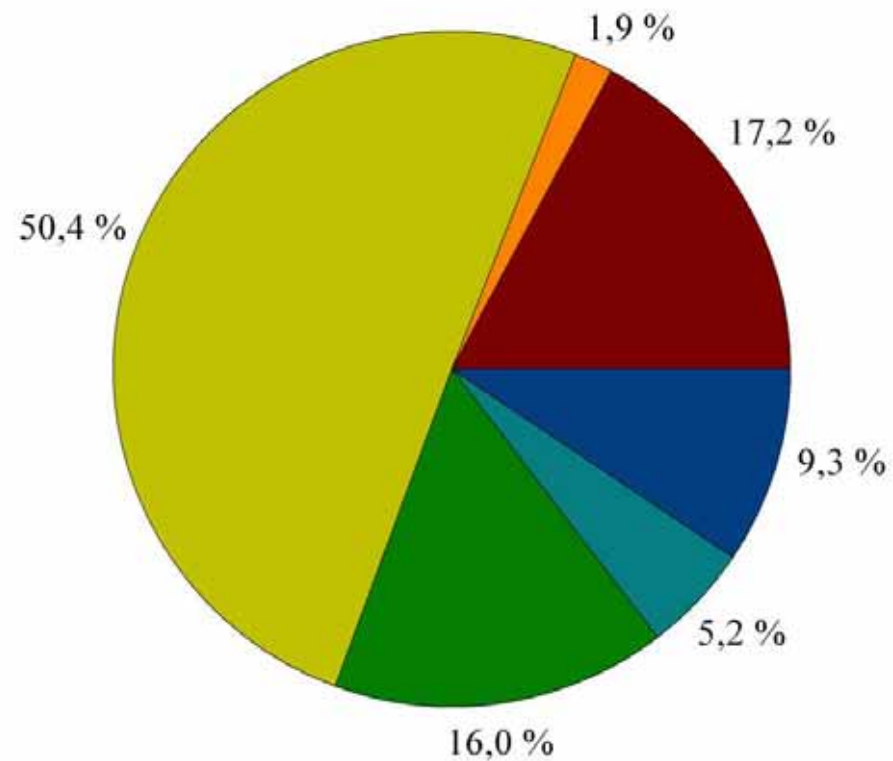


Case Studies on Landuse Change

Landuse: 1850



Landuse: 2006



Land use change in the vicinity of
Pottenstein, Nördliche Frankenalb

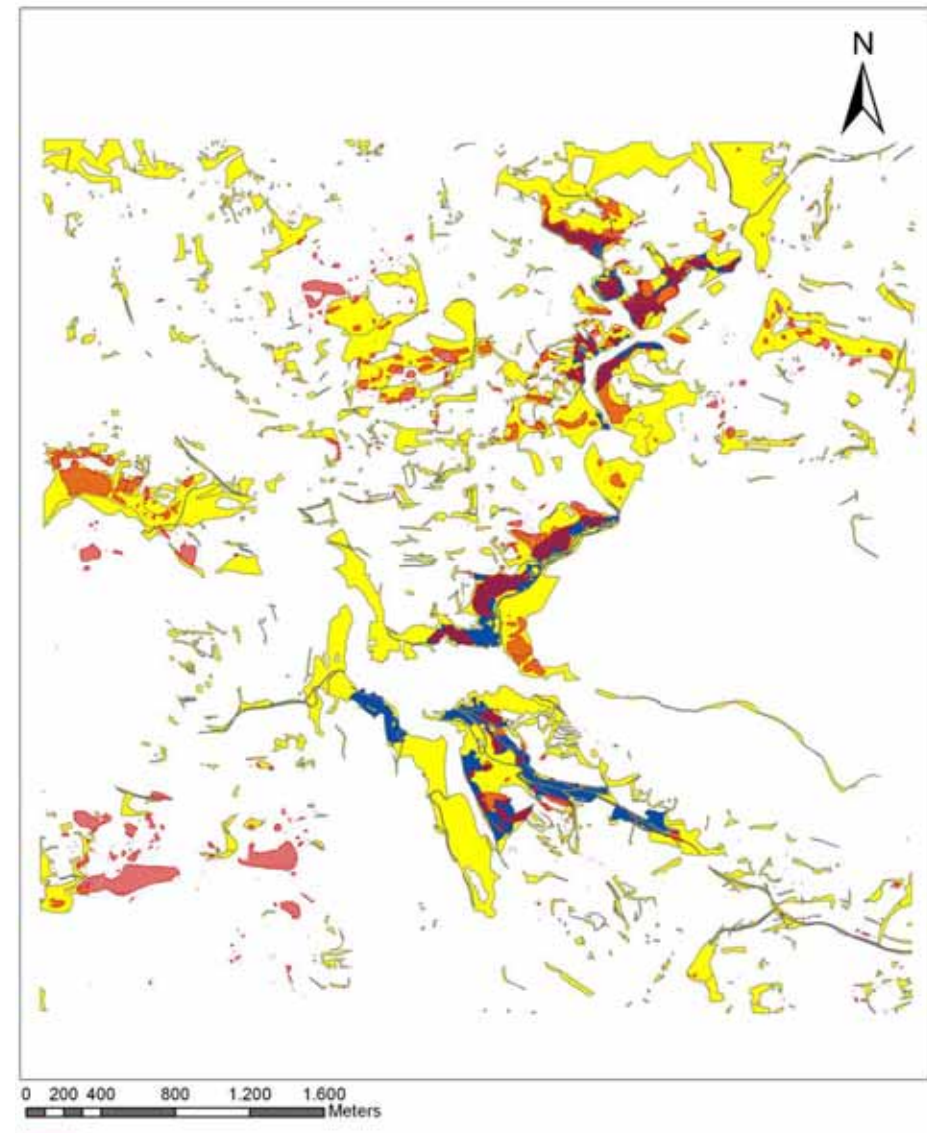
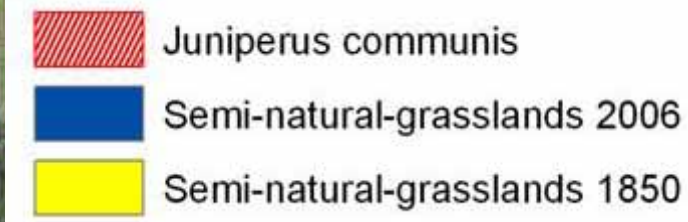


(Heubes, Retzer, Schmidtlein, Beierkuhnlein 2011)



Case Studies on Landuse Change

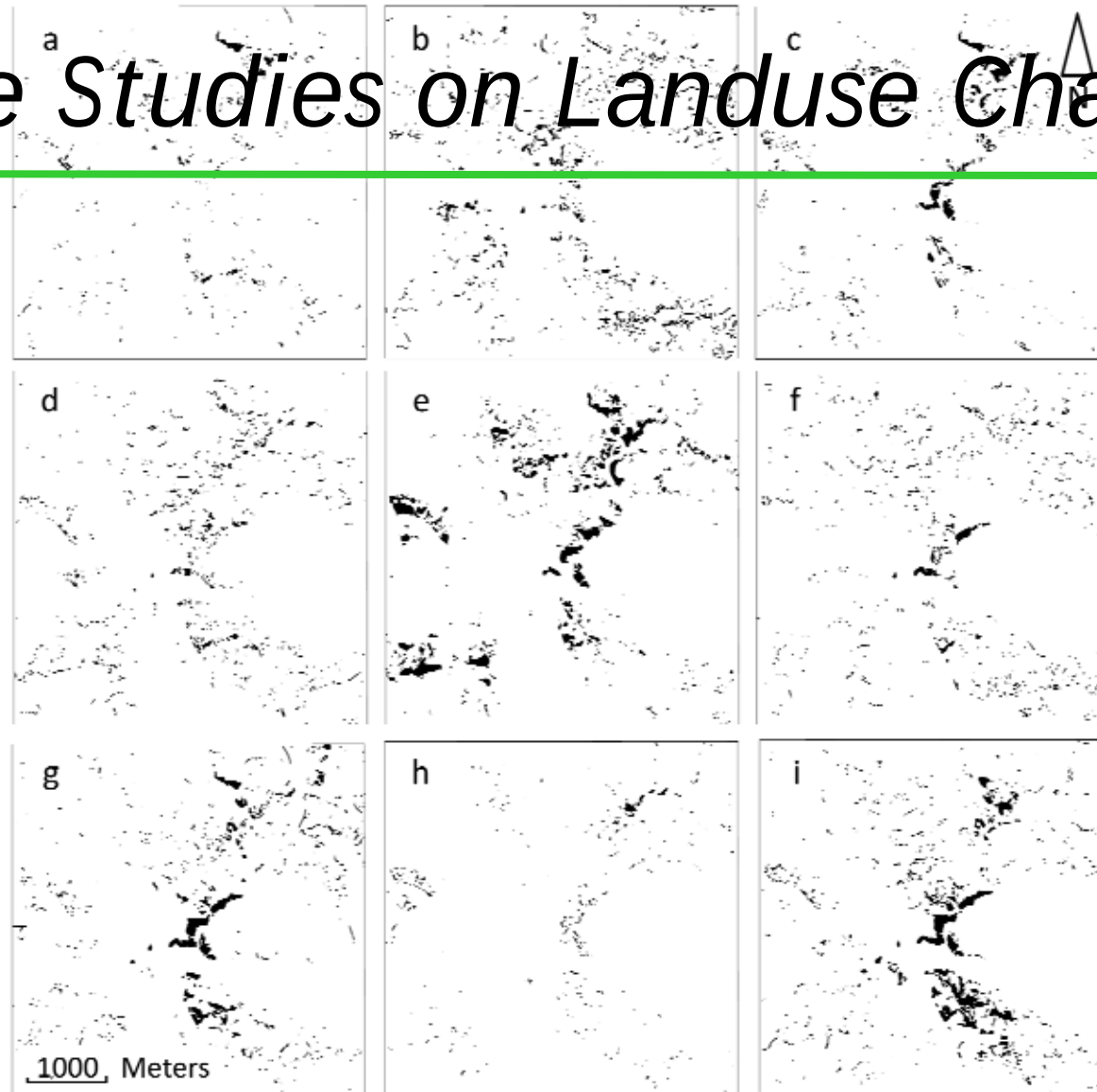
Distribution of Juniper
(*Juniperus communis*) and
former land use



(Heubes, Retzer, Schmidtlein, Beierkuhnlein 2011)



Case Studies on Landuse Change

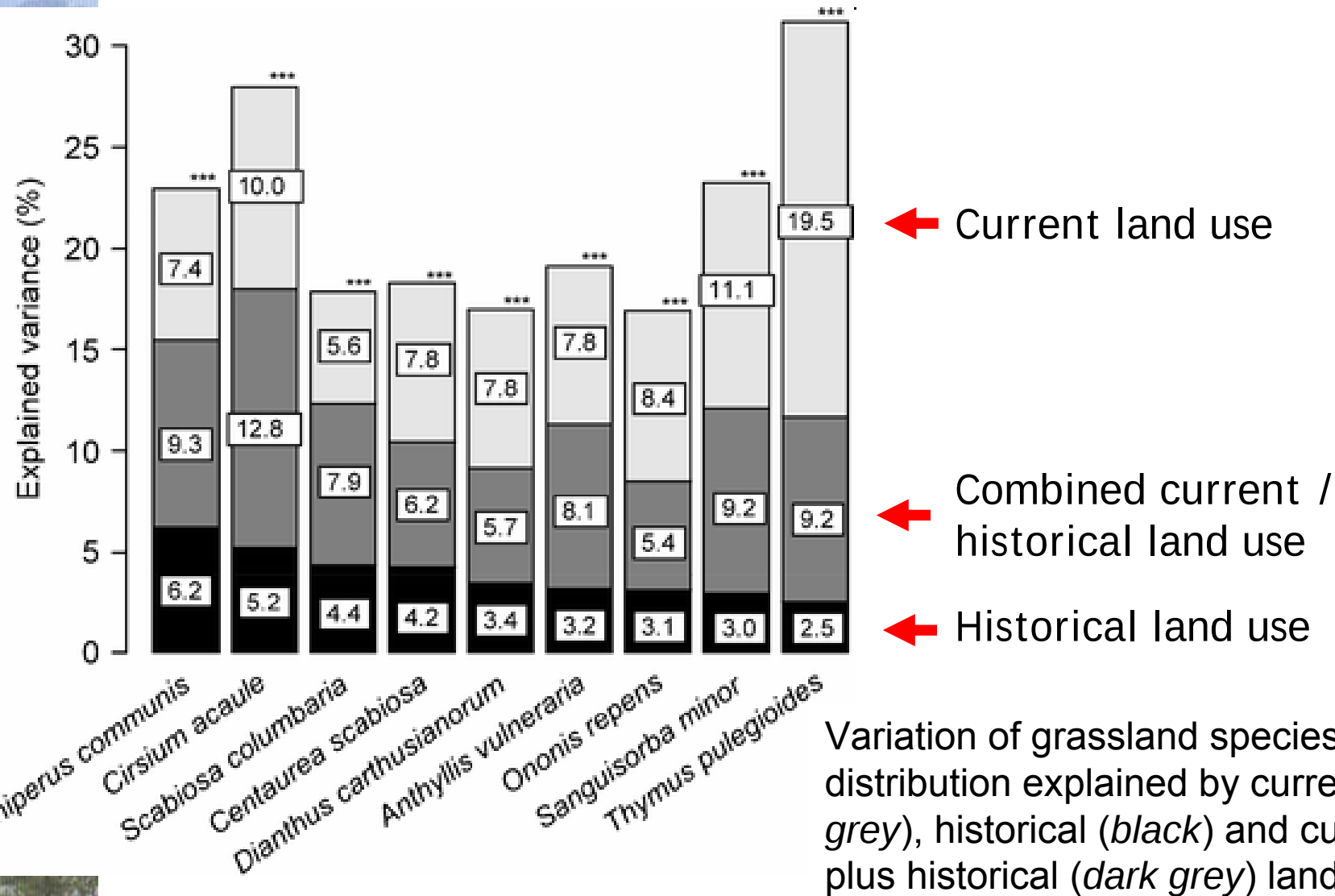


a – *Anthyllis vulneraria*, **b** – *Centaurea scabiosa*, **c** – *Cirsium acaule*,
d – *Dianthus carthusianorum*, **e** – *Juniperus communis*, **f** – *Ononis repens*,
g – *Sanguisorba minor*, **h** – *Scabiosa columbaria*, **i** – *Thymus pulegioides*

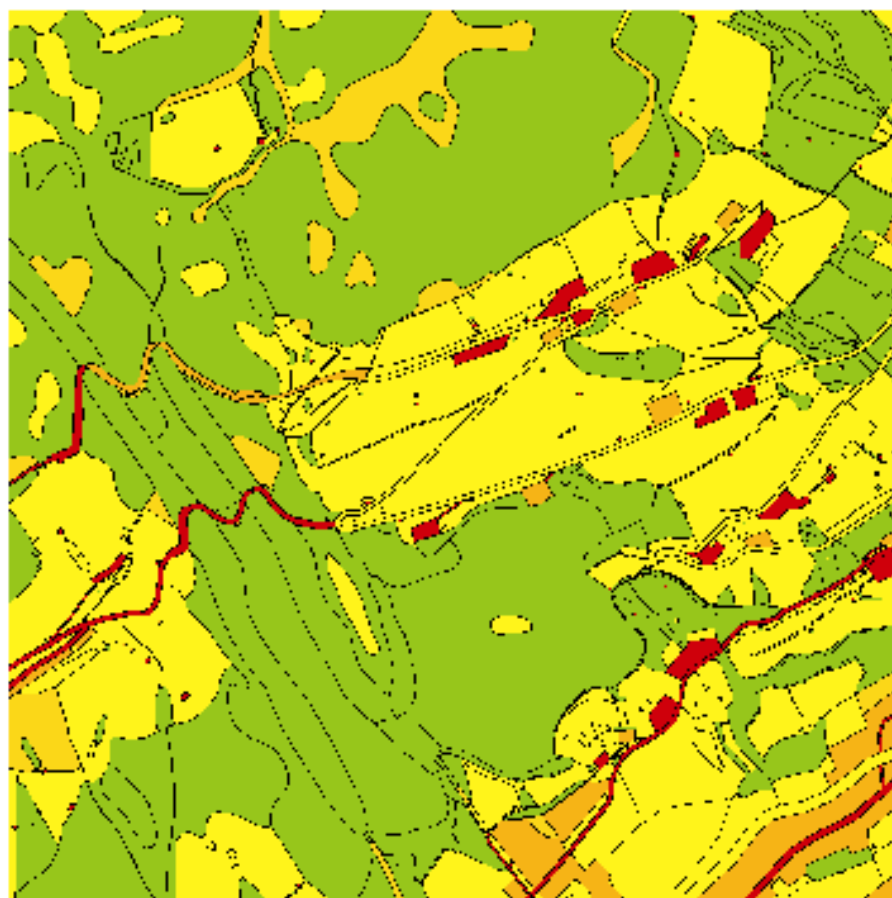
(Heubes, Retzer, Schmidtlein, Beierkuhnlein 2011)



Case Studies on Landuse Change



(Heubes, Retzer, Schmidtlein, Beierkuhnlein 2011)



4 m

1090 m

DEGREE OF ANTHROPOGENIC INFLUENCE

- | | |
|--|---|
|  megahemrob |  mesohemrob |
|  polyhemrob |  oligohemrob |
|  euhemrob |  ahemrob |
|  euhemrob | |

(nach Egger & Hattner 1998)



SINUS Research Program Austrian Cultural Landscapes **BMVV**

Theme: **HEMEROBY**

Quadrant: **Nennberg - Obergrafendorf I**

F Coord.: **686337**

Topog. Map Nr. **55**



DEGREE OF ANTHROPOGENIC INFLUENCE

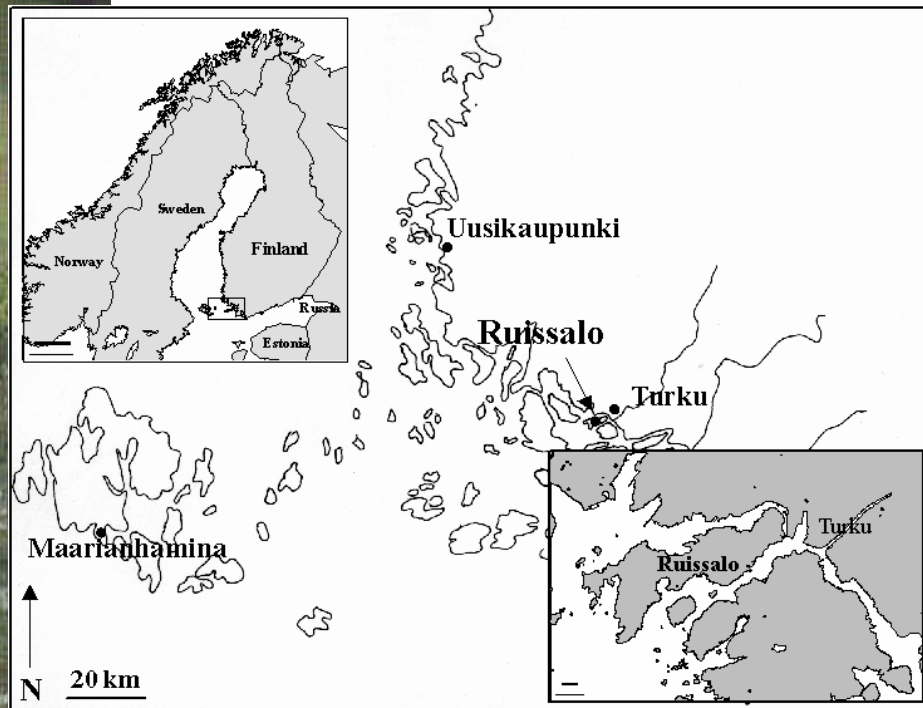
- | | |
|---|--|
|  metahemerob |  mesohemerob |
|  polyhemerob |  oligohemerob |
|  a-euhemerob |  ahemerob |
|  b-euhemerob | |

(nach Egger & Hattner 1998)



Case Studies on Landuse Change

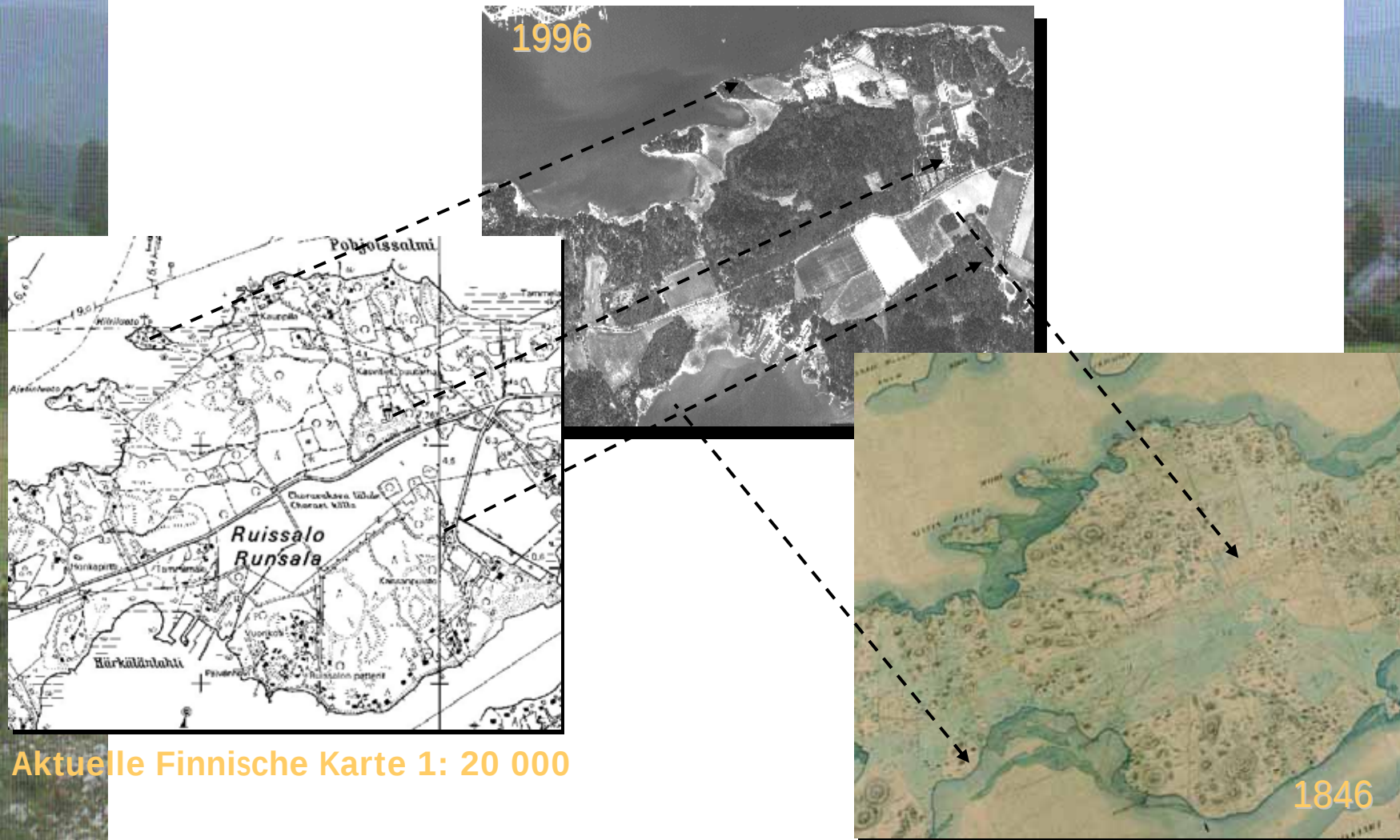
Ruissalo-Island in SW-Finland



(Vuorela 2001)



Case Studies on Landuse Change



Aktuelle Finnische Karte 1: 20 000

(Vuorela 2001)



Case Studies on Landuse Change

Nadelwald
(A)

Nadelwald
(B)

Gehölze

Offenland



Acker

Laubwald

Nadelwald

Naturschutz-
flächen

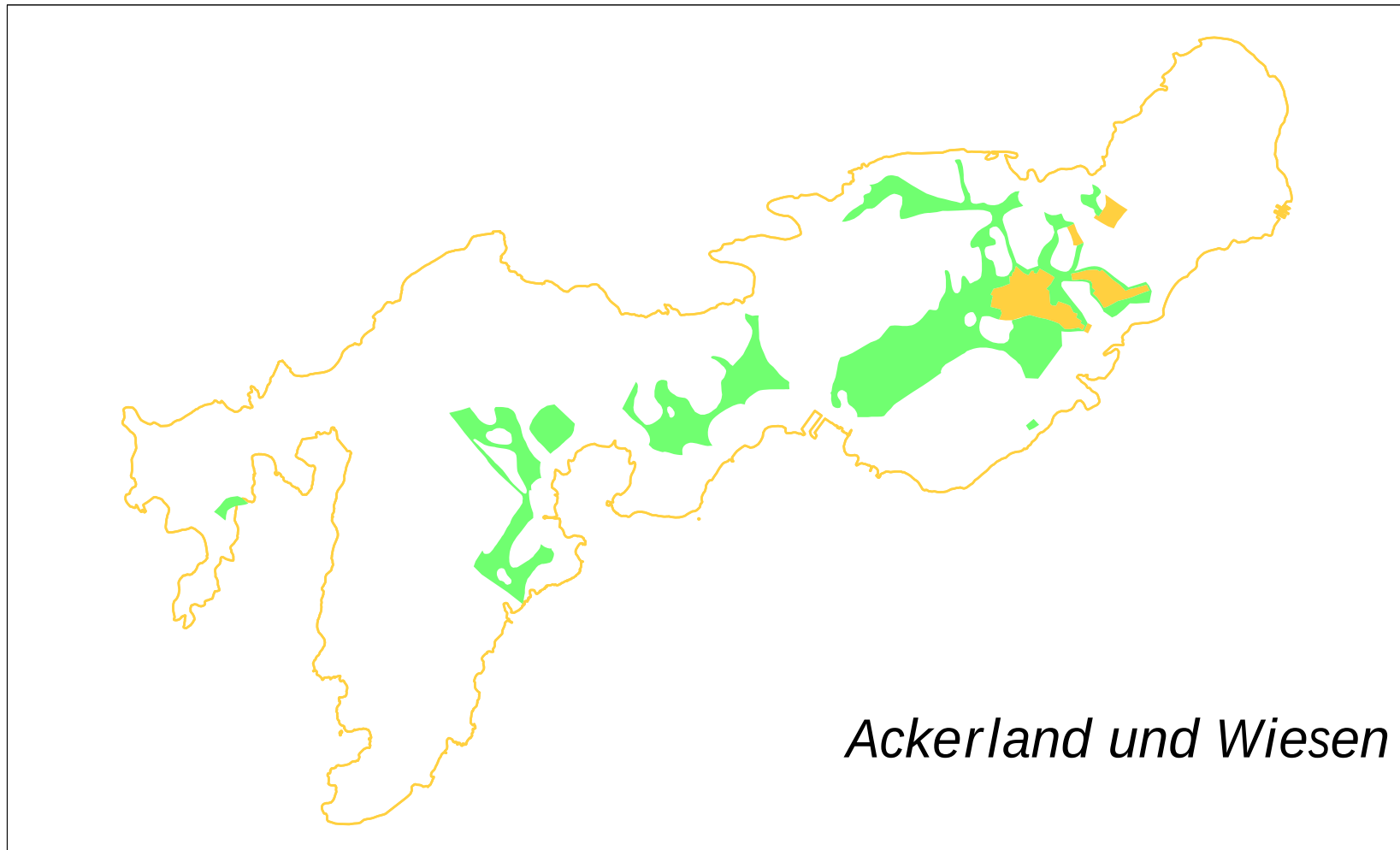
Wiese

(Vuorela 2001)



Case Studies on Landuse Change

1690

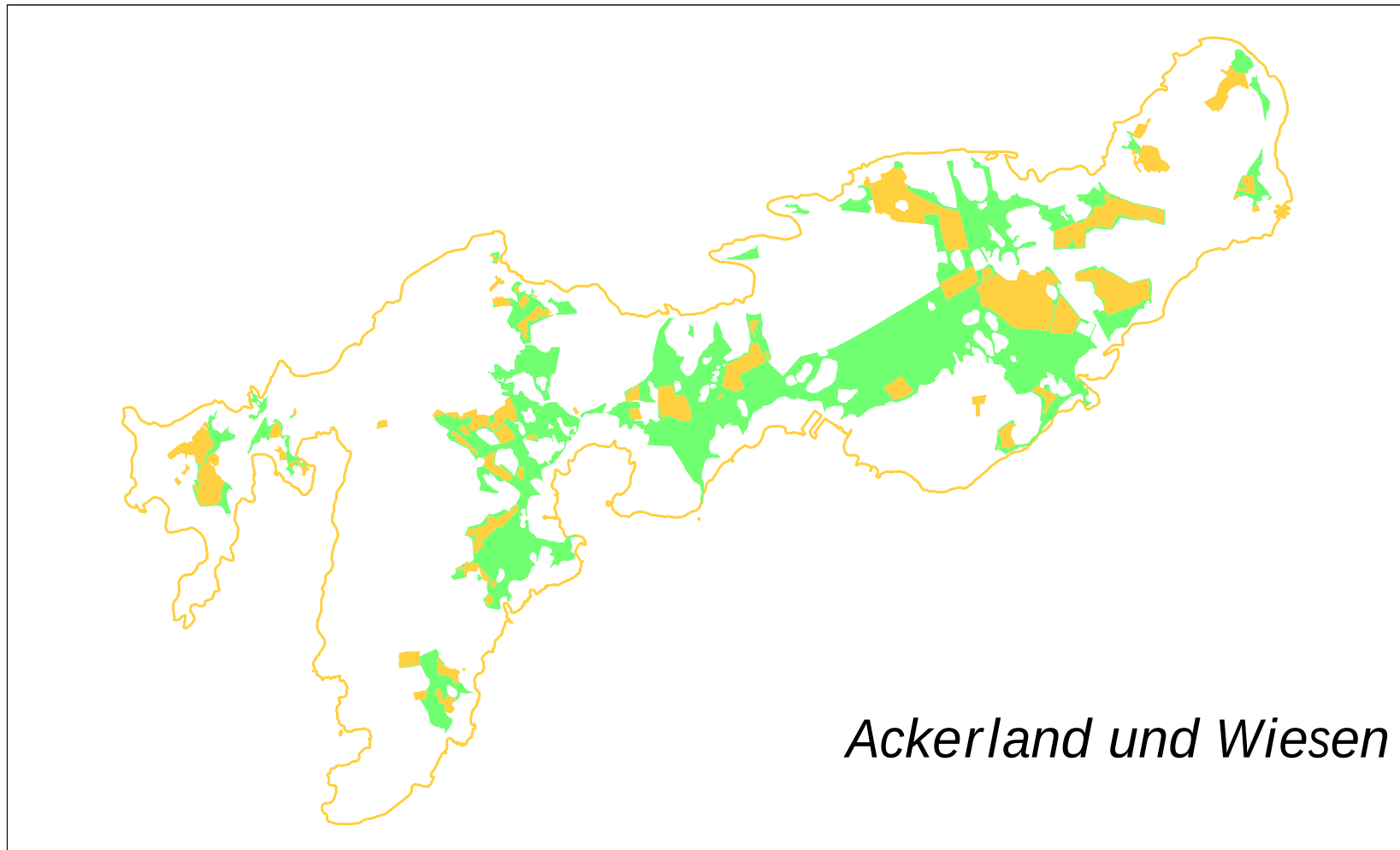


(Vuorela 2001)



Case Studies on Landuse Change

1846



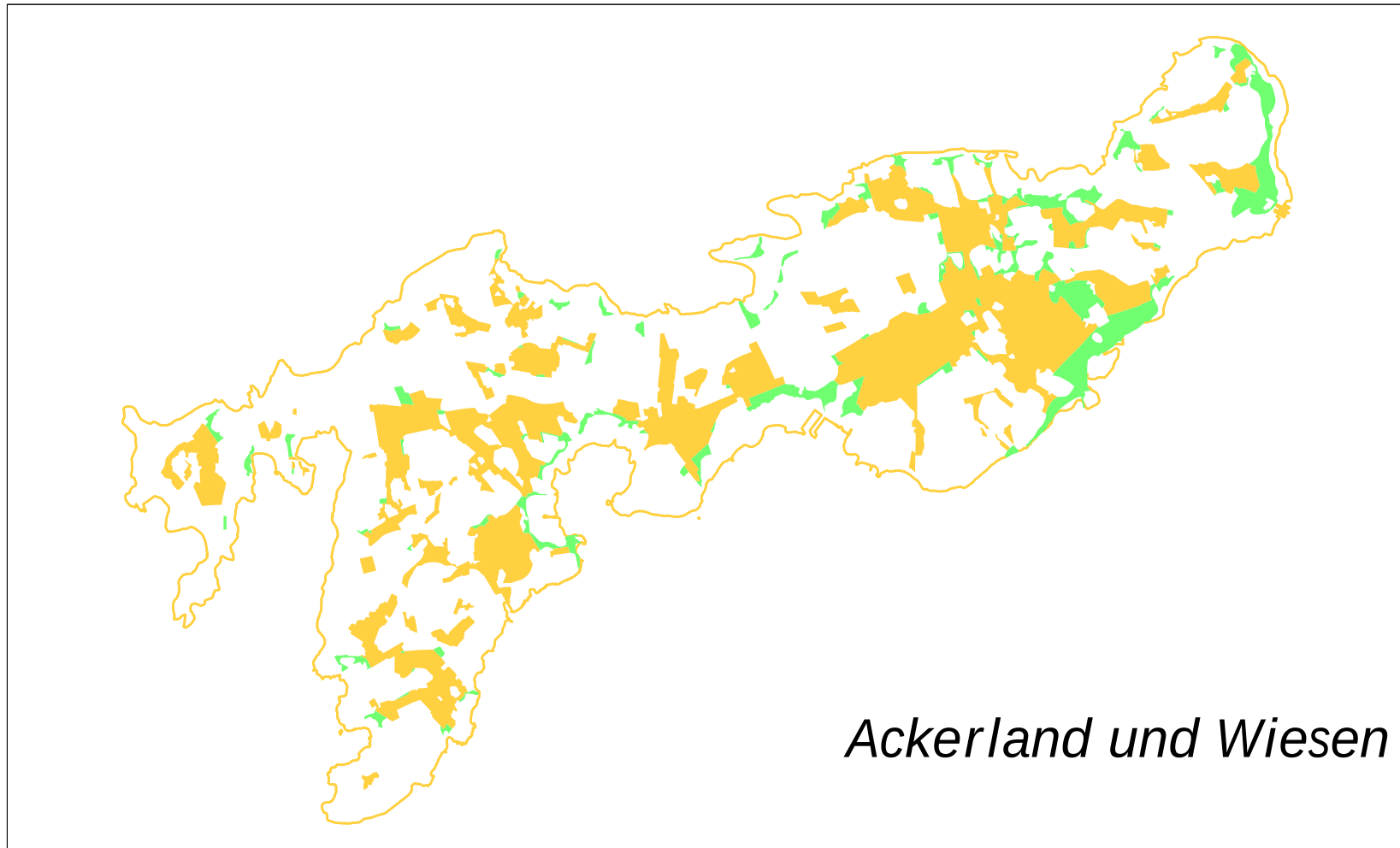
Ackerland und Wiesen

(Vuorela 2001)



Case Studies on Landuse Change

1892



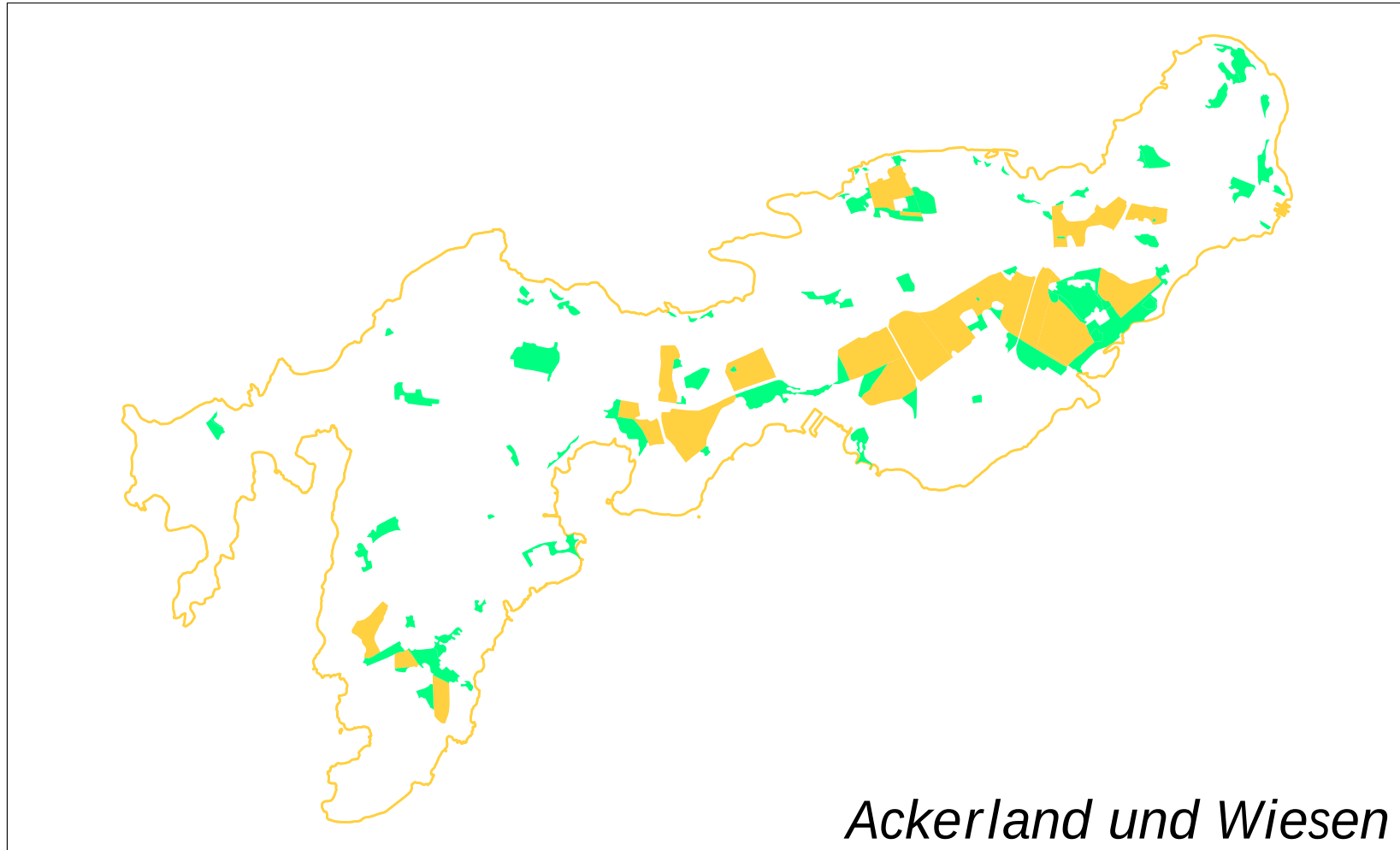
Ackerland und Wiesen

(Vuorela 2001)

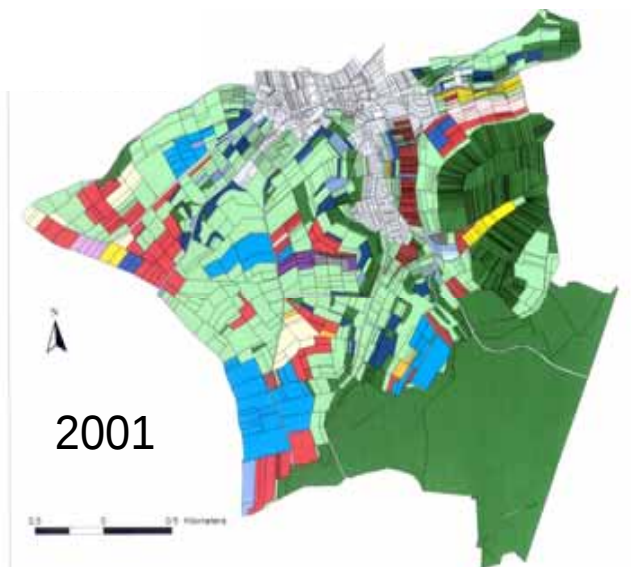
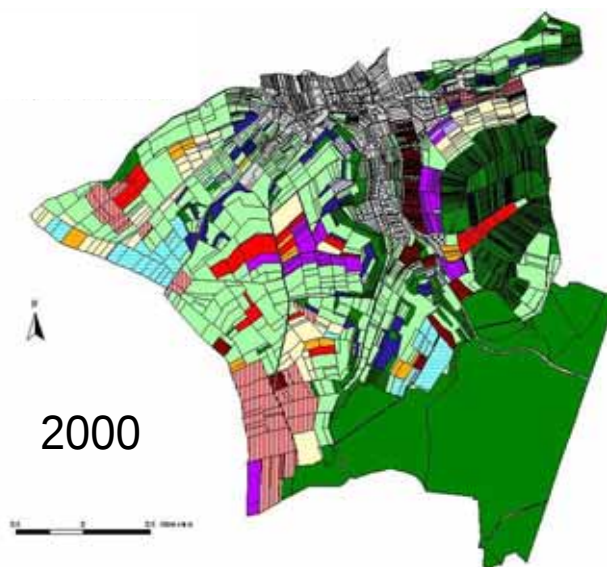
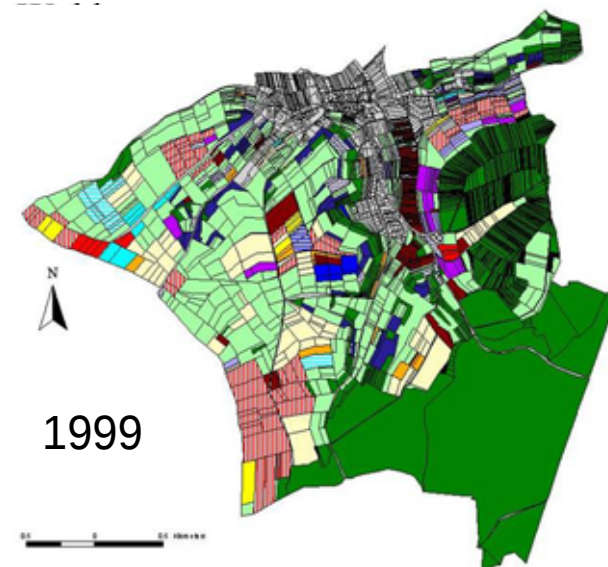
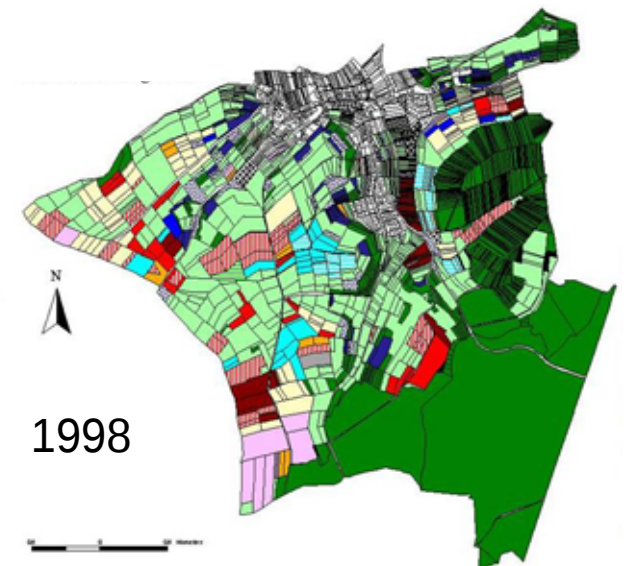
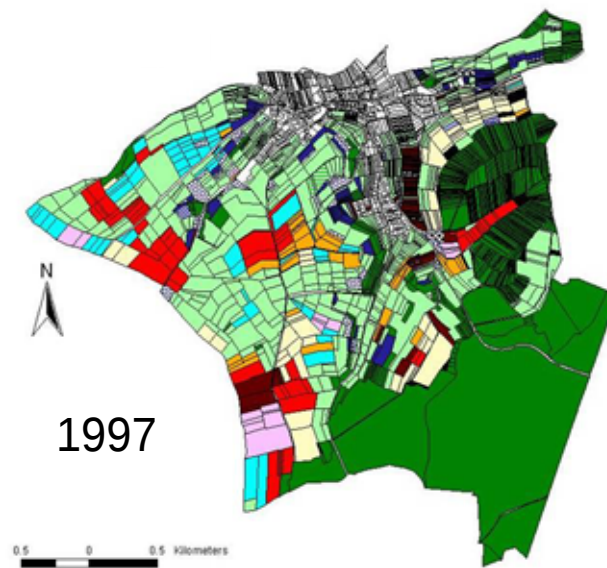
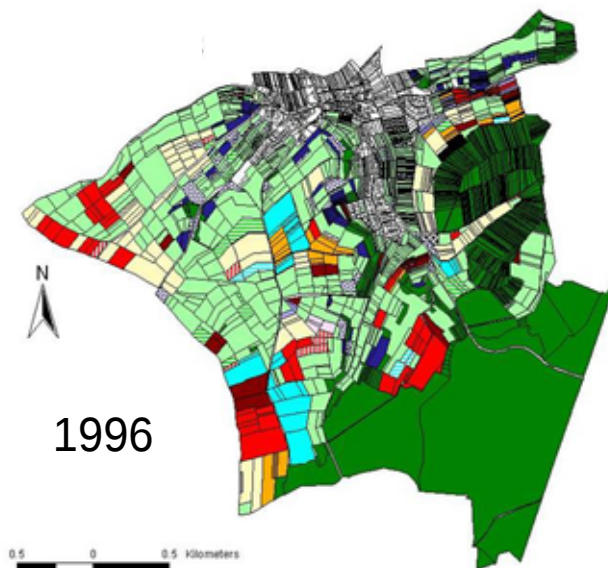


Case Studies on Landuse Change

1998



(Vuorela 2001)

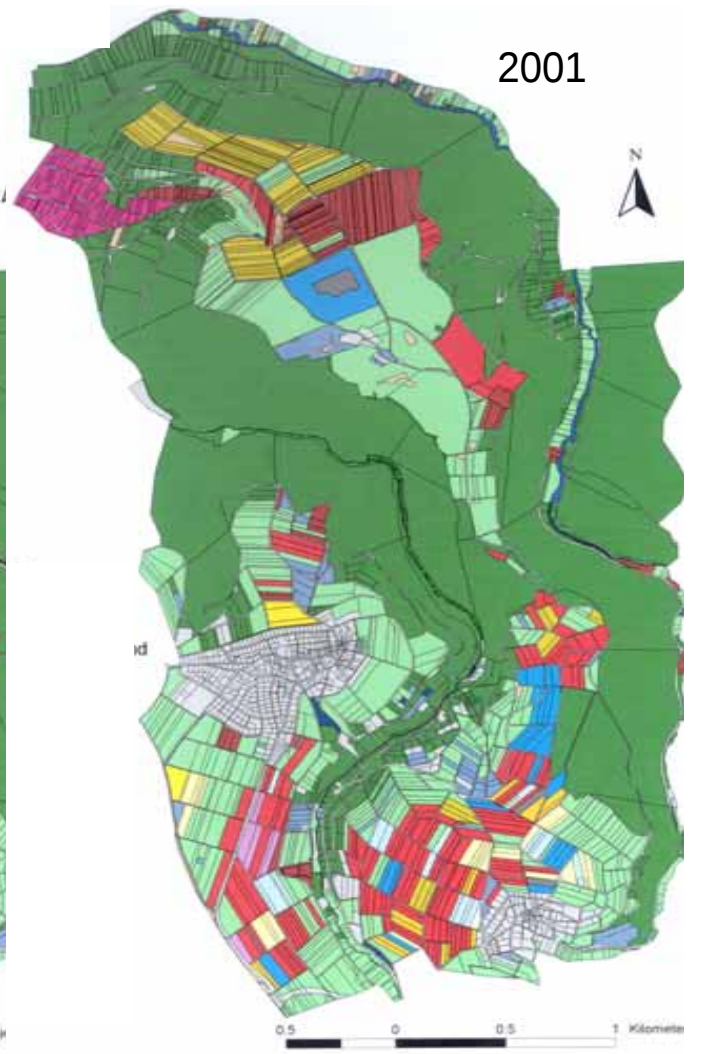
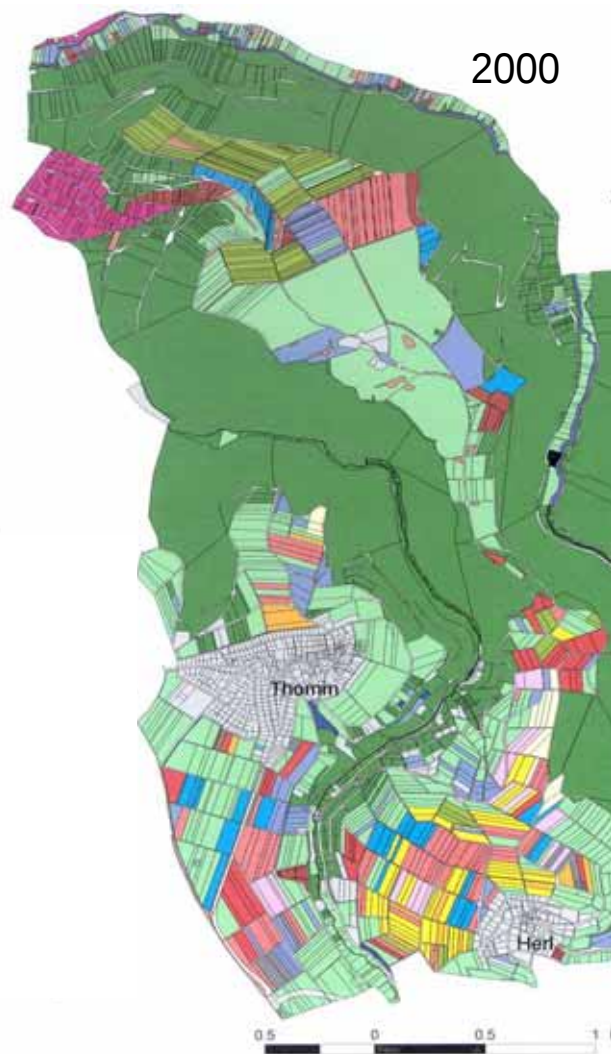
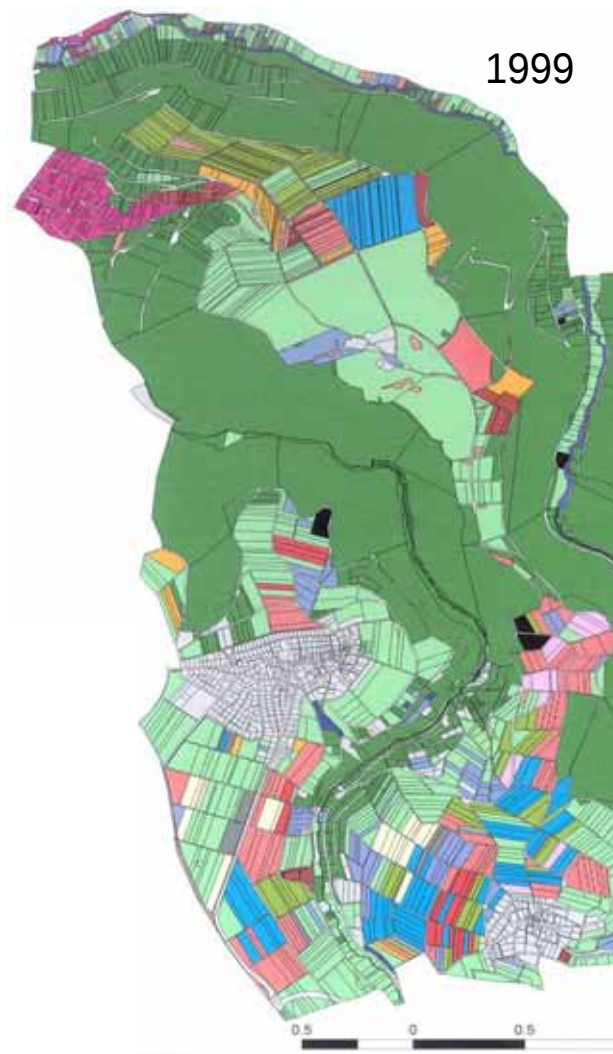


- Siedlung
- Wald / Feldgehölz
- Streuobst- gepflegt
- Streuobst- brachliegend
- Grünland
- Brache

- Weizen
- Gerste
- Roggen
- Hafer
- Triticale
- Dinkel

- Raps
- Mais
- Kartoffel
- Rüben
- Erbsen
- Topinambur

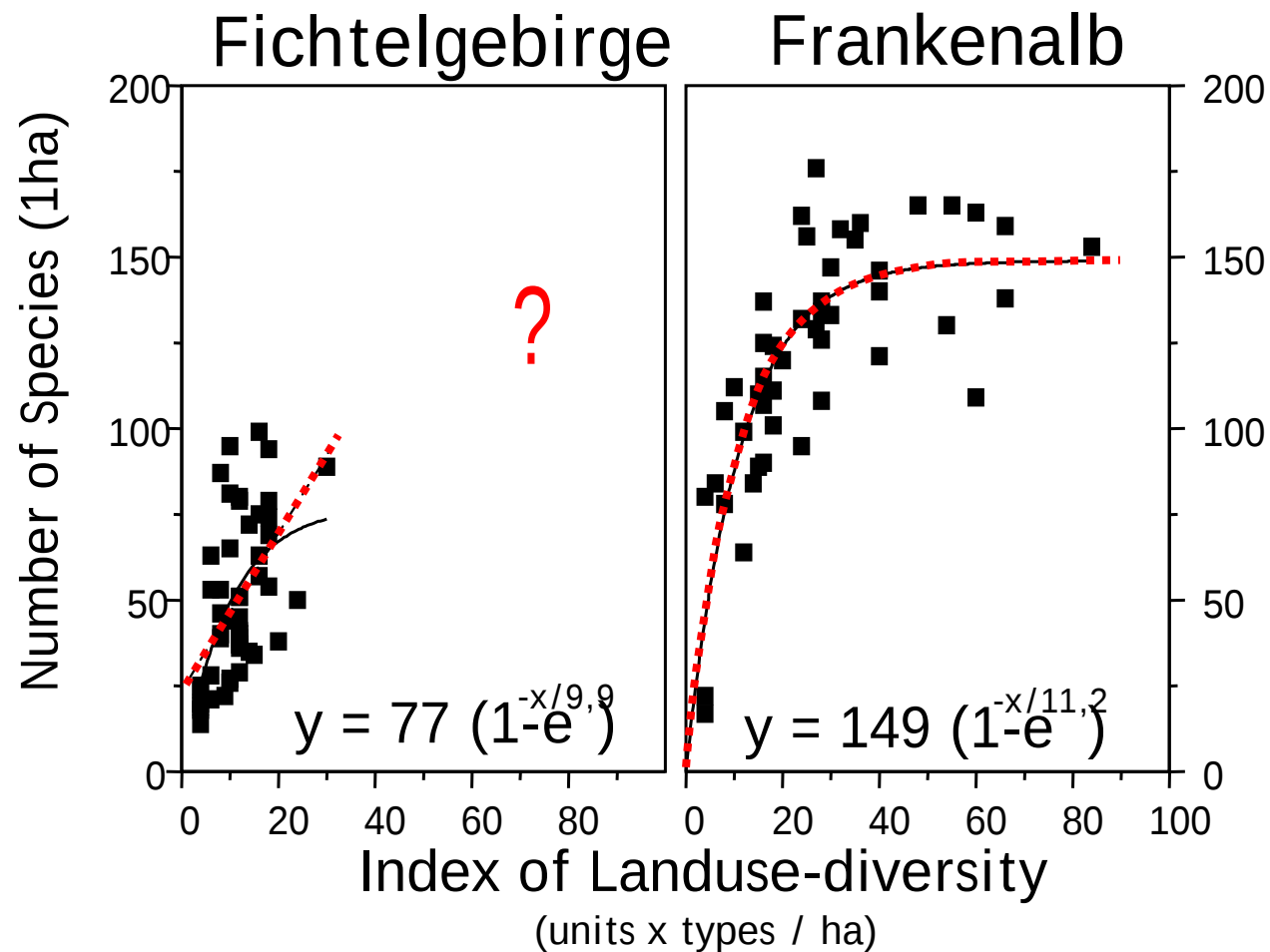
- Biobauer
- sonstige Nutzung



Gemeinde
Thomm-Herl,
Saarland



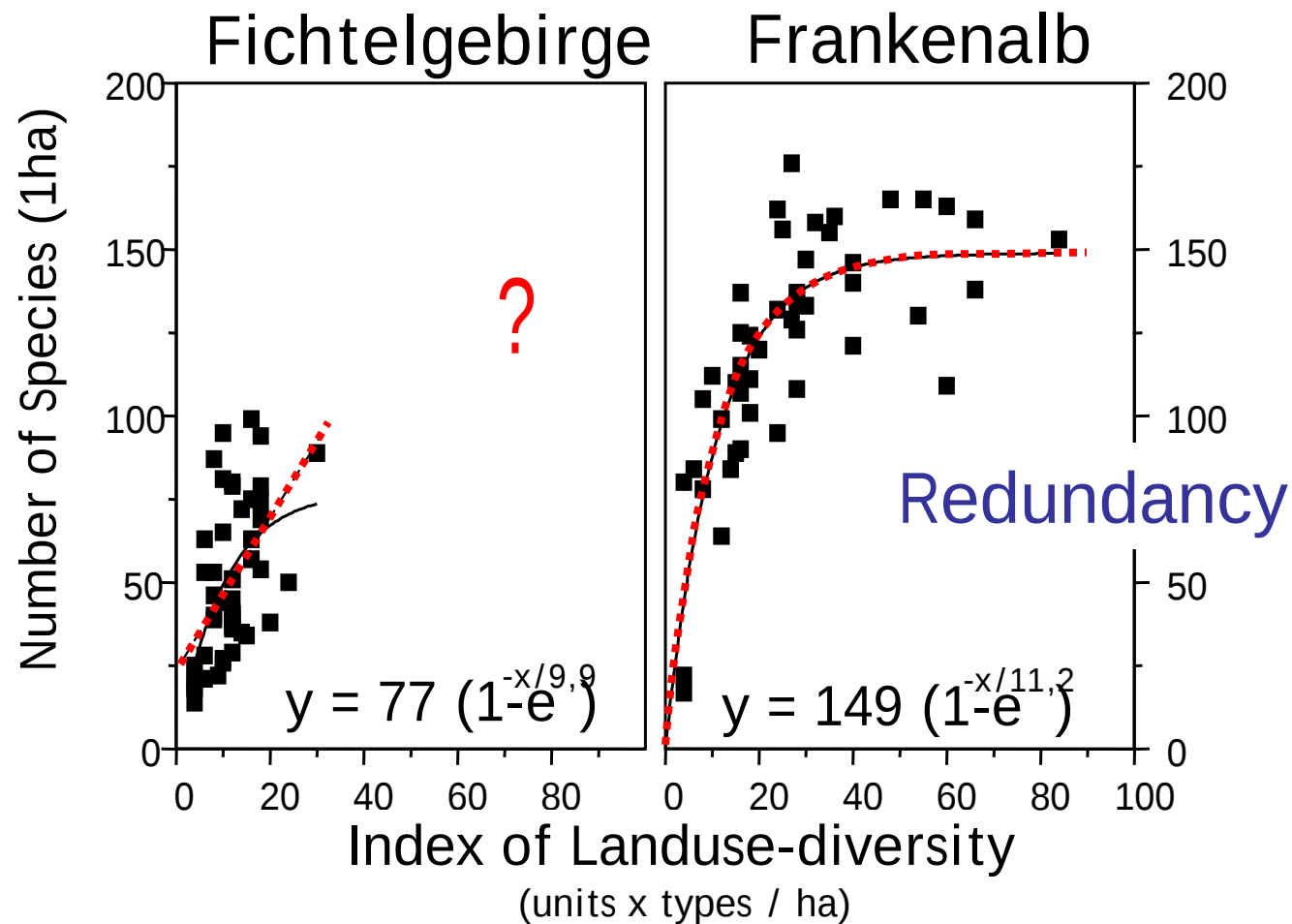
Case Studies on Landuse Change



(Retzer & Beierkuhnlein in prep.)



Case Studies on Landuse Change



(Retzer & Beierkuhnlein in prep.)



Vegetation Science

Vegetation science offers a broad spectrum of methods that can be applied for monitoring assessments.

However, not all methods are appropriate.

Surveys have to be based on standardised approaches, which have to refer to the local or regional conditions.

- And to the problem under investigation!



Vegetation Science

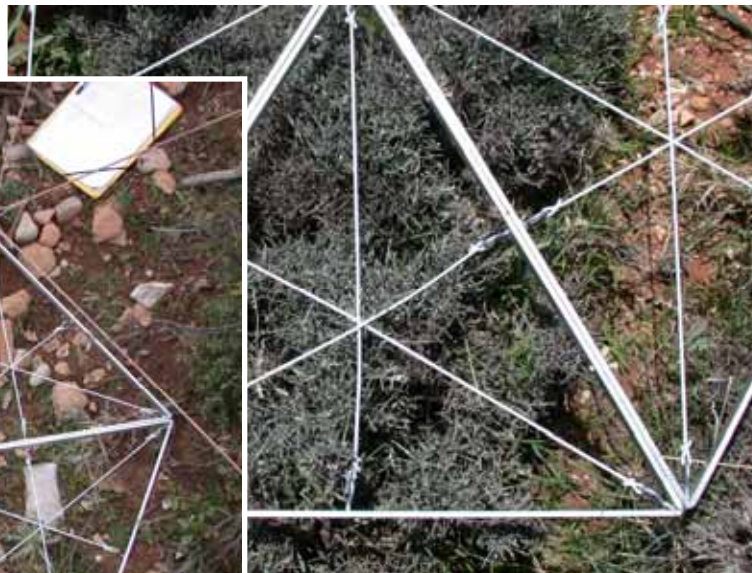
Spatially explicit approaches are based on defined areas (plots). Most common are frequency values for species.





Vegetation Science

Spatially explicit approaches are based on defined areas (plots). Most common are frequency values for species.





Vegetation Science

Complete Belt Transects





Vegetation Science

Complete Line Transects





Vegetation Science

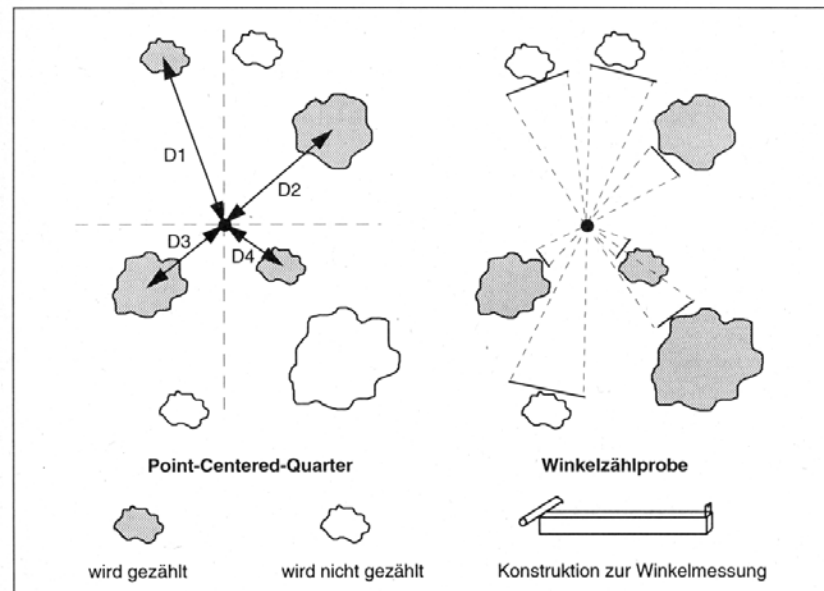
Open Belt Transects

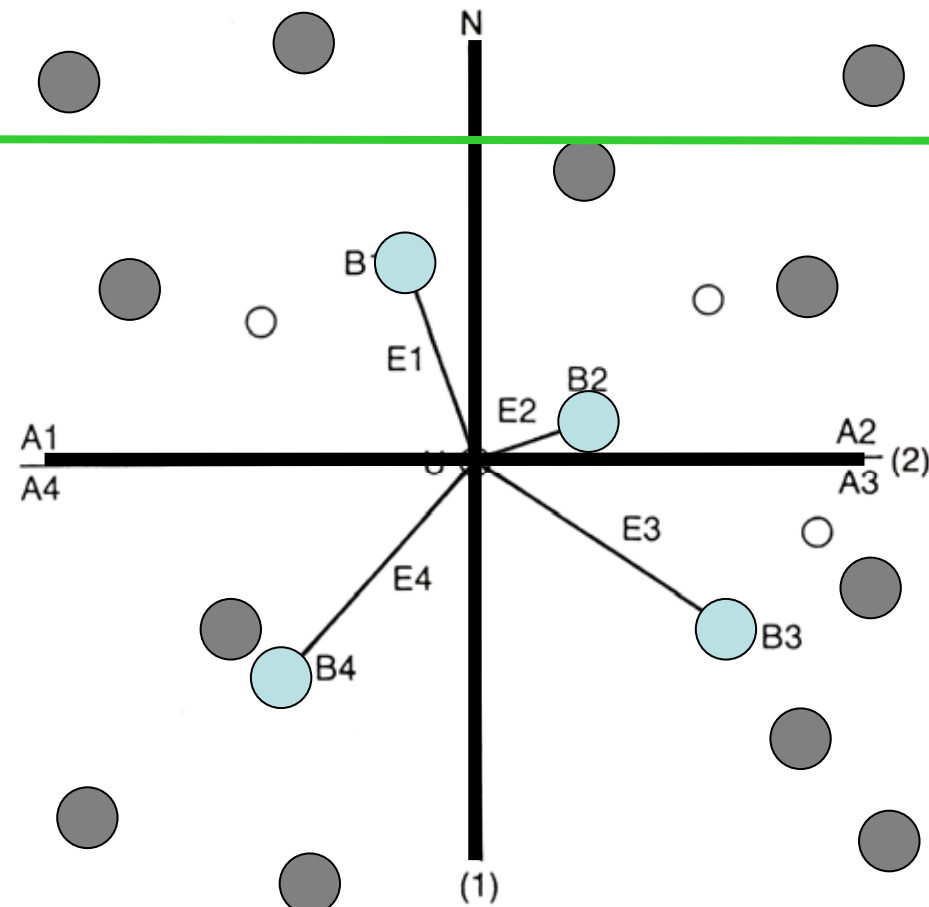




Vegetation Science

Plotless sampling approaches are based on point data and extrapolations in between.



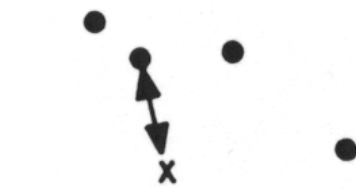


„Point - Centred Quarter“

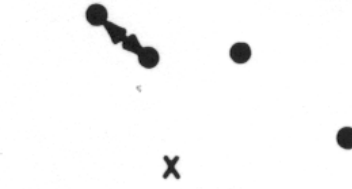
Distance in all quarters to the next tree, all others are ignored. Direction of quarters can be northfacing, but can also be chosen to be stochastic (and turned from the same point of reference).



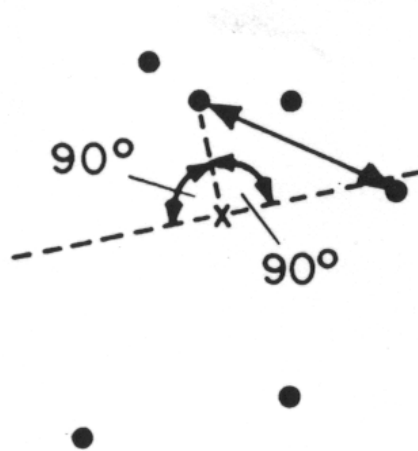
Vegetation Science



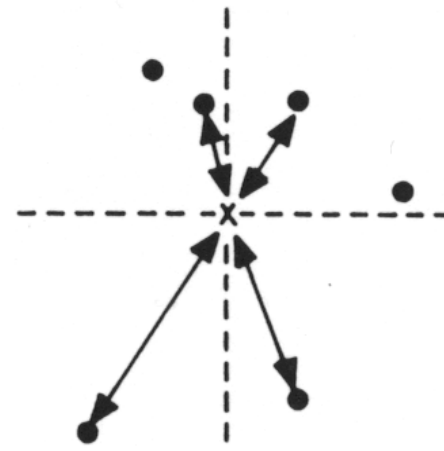
Closest Individual



Nearest Neighbour



Random Pairs



Point-Centred Quarter

(Greig-Smith 1983)



Vegetation Science

Basal area



Vegetation Science



DBH



Communities

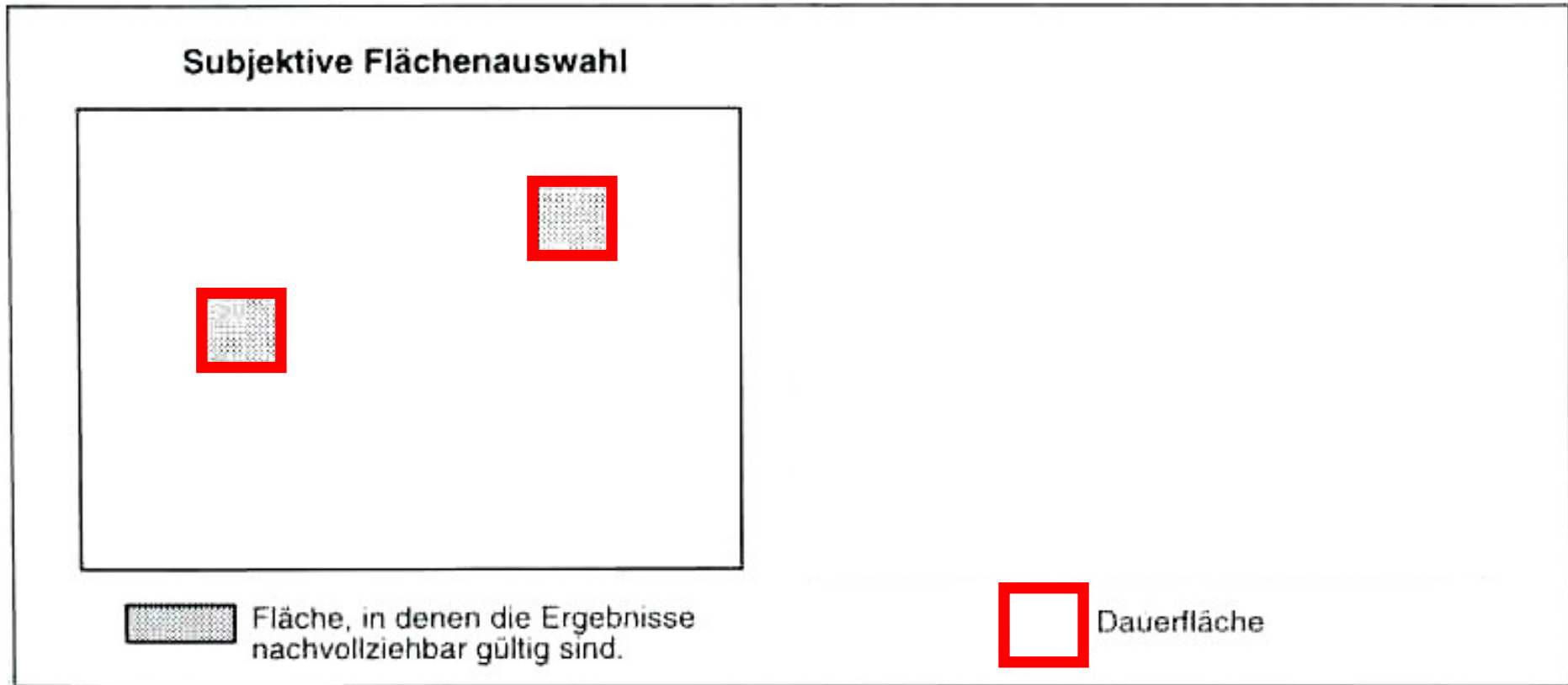
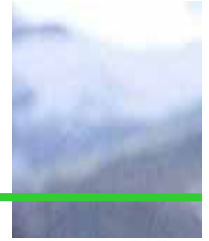


Abb. 15: Vergleich von subjektivem und statistisch abgesichertem Dauerflächendesign, hinsichtlich Reichweite der Aussagekraft.



(aus Traxler, 1997)





Communities

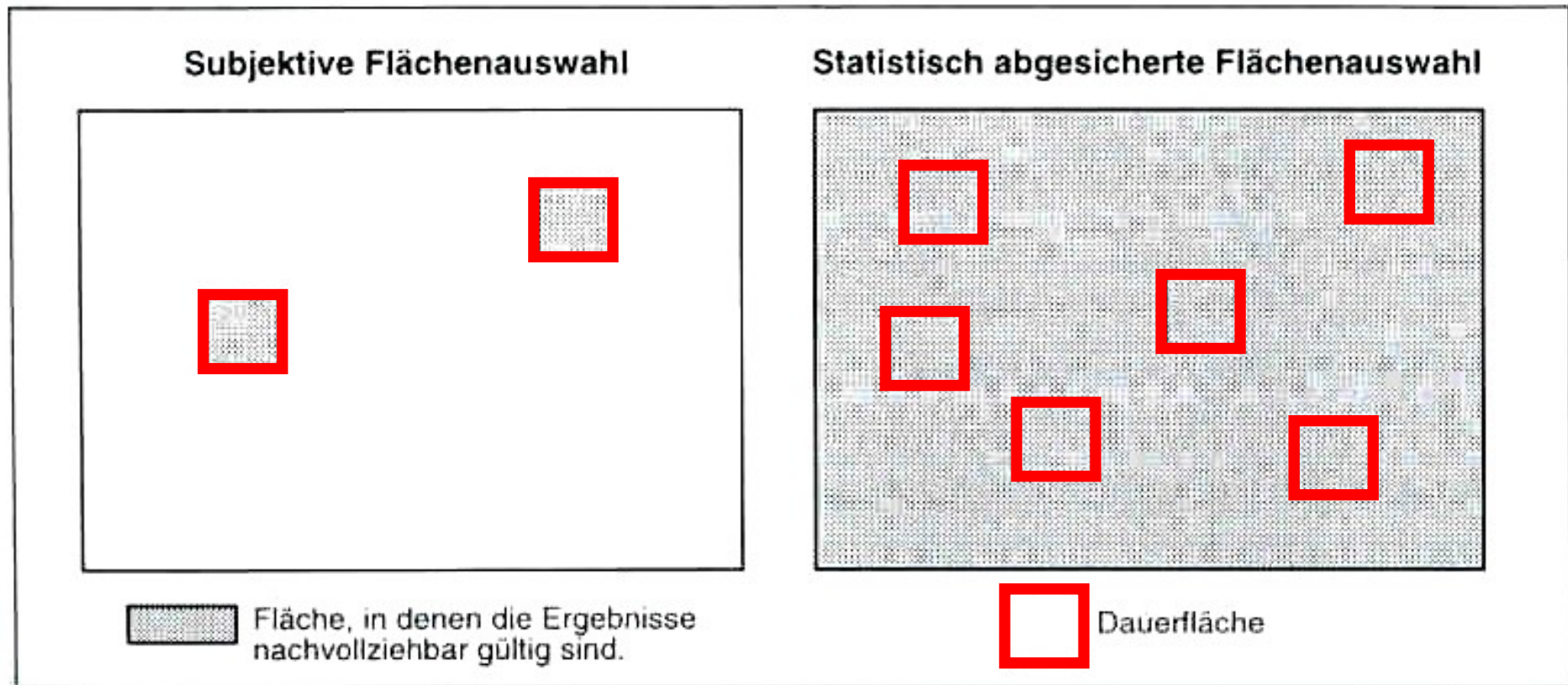


Abb. 15: Vergleich von subjektivem und statistisch abgesichertem Dauerflächendesign, hinsichtlich Reichweite der Aussagekraft.

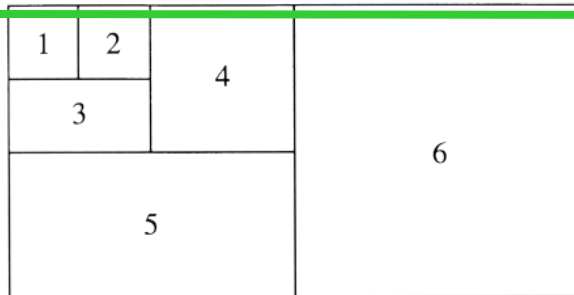


(aus Traxler, 1997)





Communities



Artenzahl auf der Weide
größer – aber erforderliche
Fläche geringer!

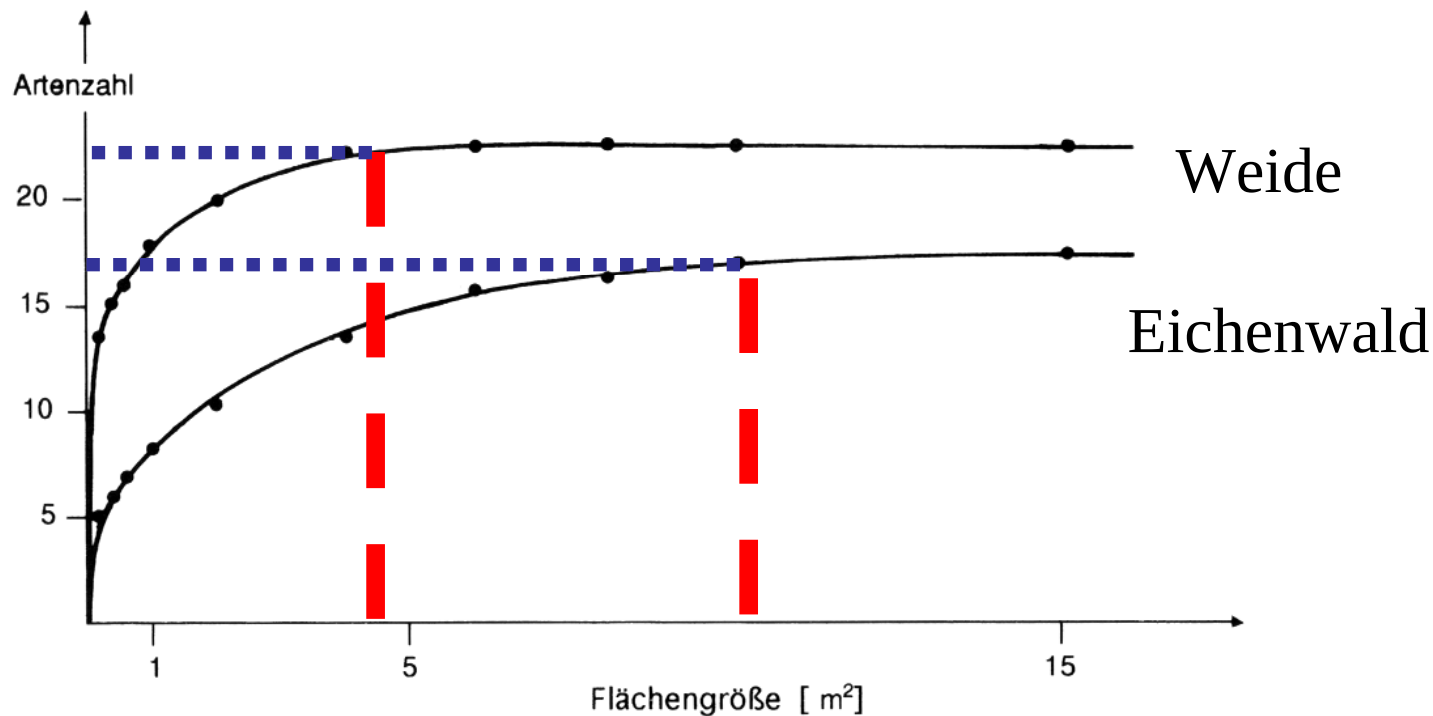
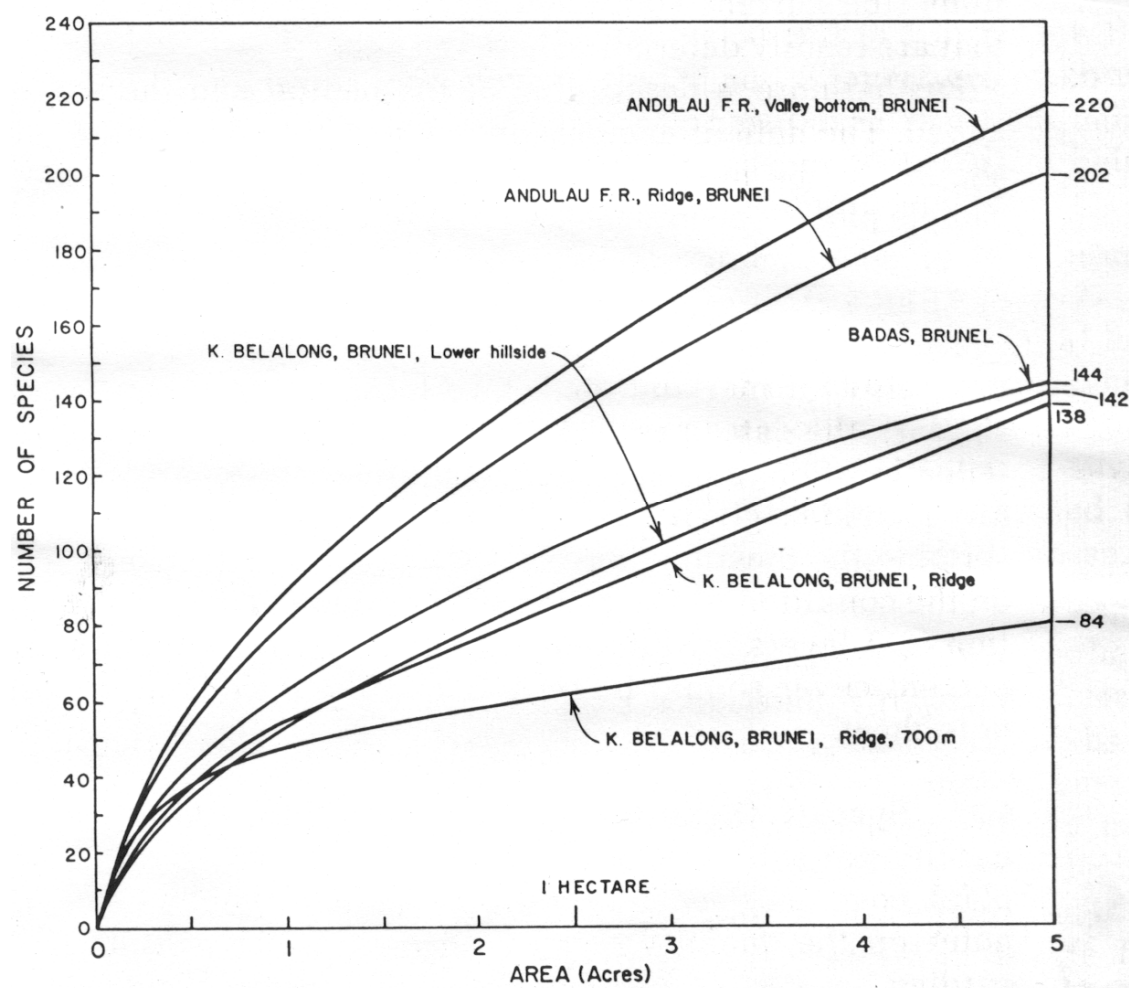


Abb. 4.4. Oben: Erweiterung der Untersuchungsfläche durch ihre sukzessive Verdoppelung. Jede numerierte Fläche enthält auch die Flächen der vorherigen;
Unten: Obere Artenzahl-Areal-Kurve: Lolio-Cynosuretum-Weide, untere: Eichenwald auf extrem saurem Boden (Quercion robori-petraeae) (nach KNAPP 1984)

(aus Glavac, 1996)

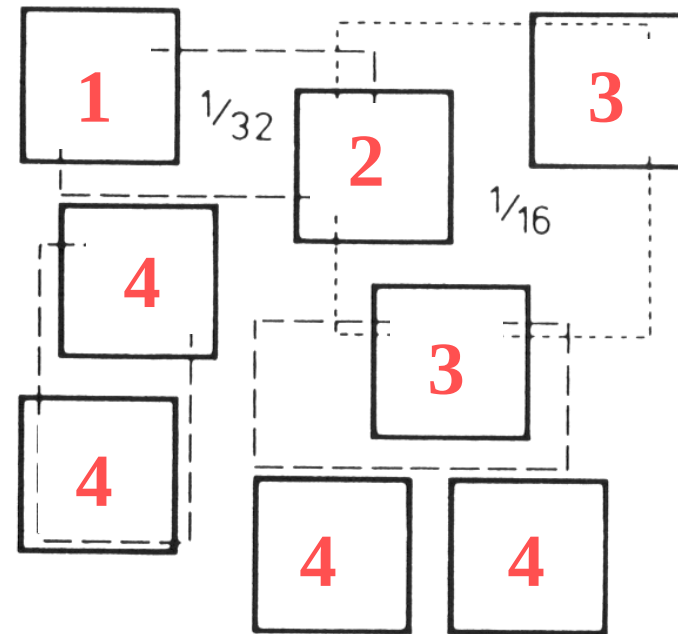
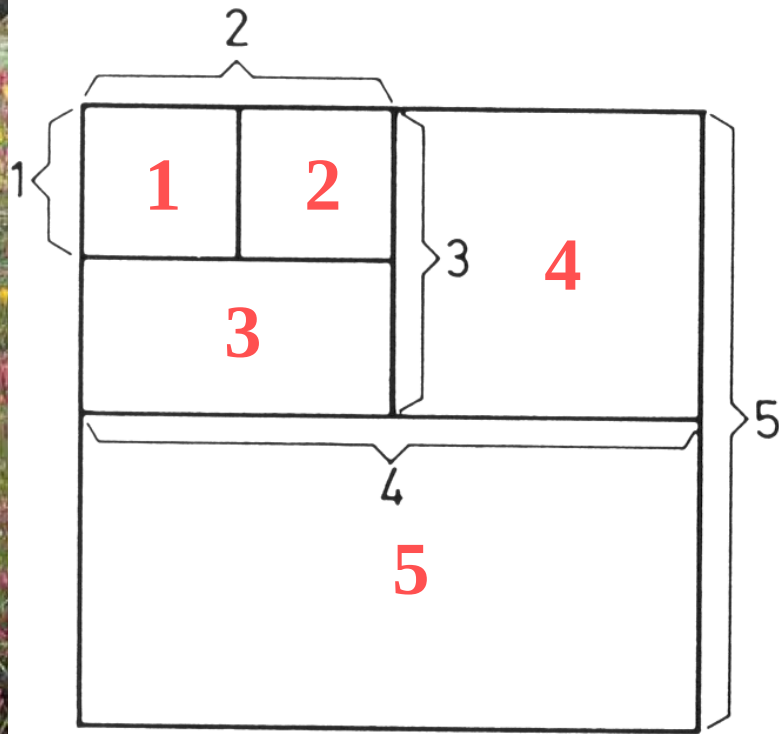
Communities



(Ashton, 1965)

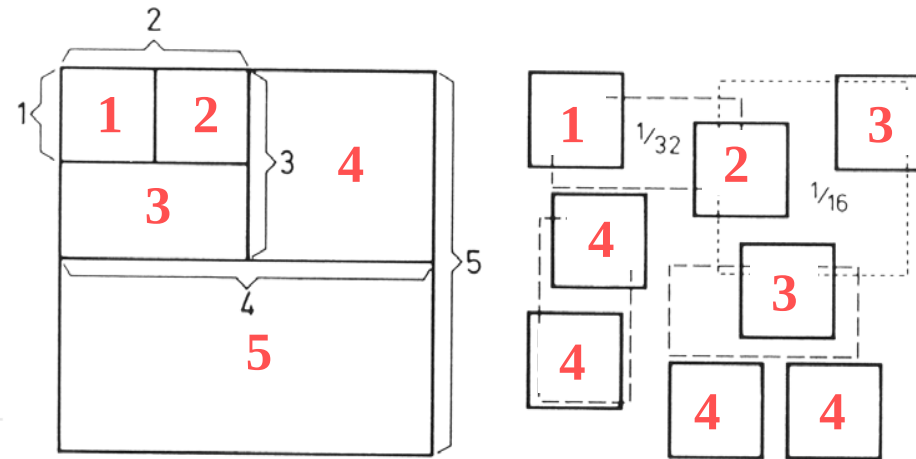


Communities





Communities



Advantage:
rapid and easy

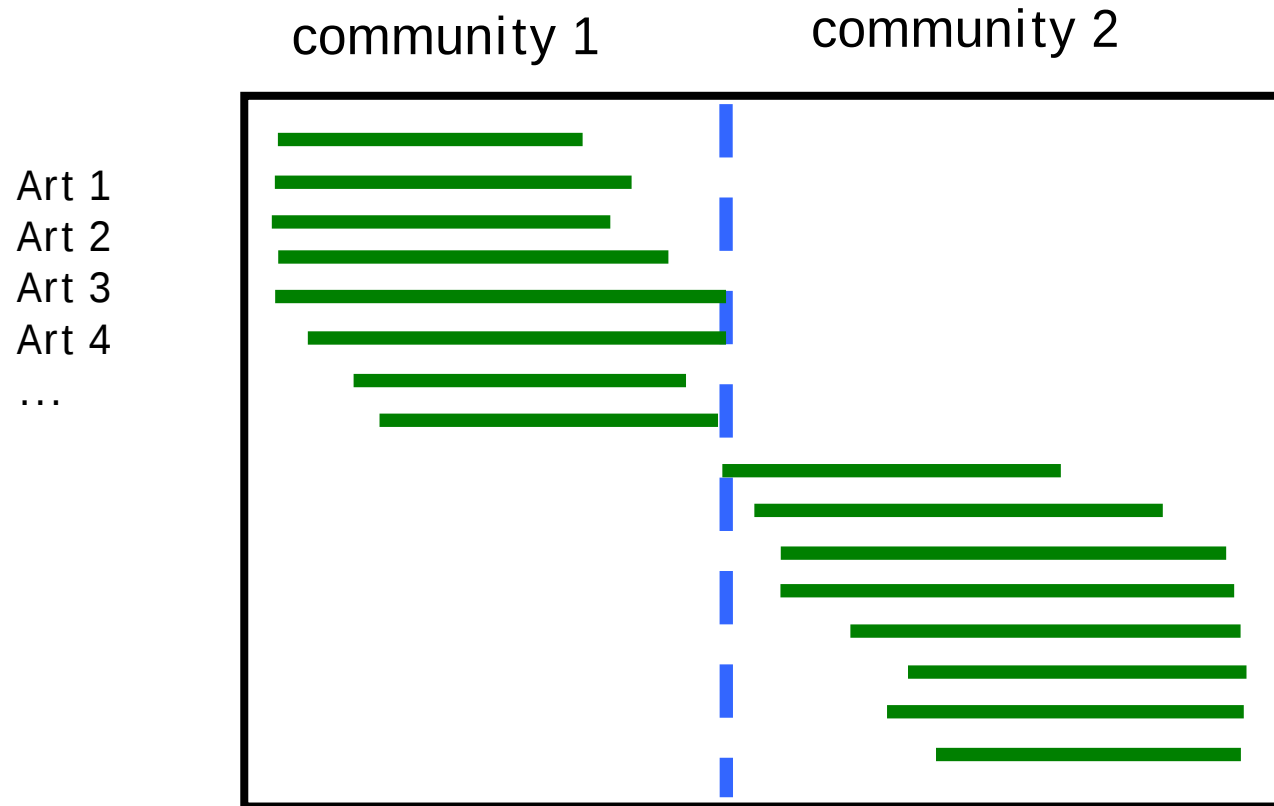
Disadvantage:
autocorrelation

Vorteil:
no autocorrelation

Nachteil:
larger area required



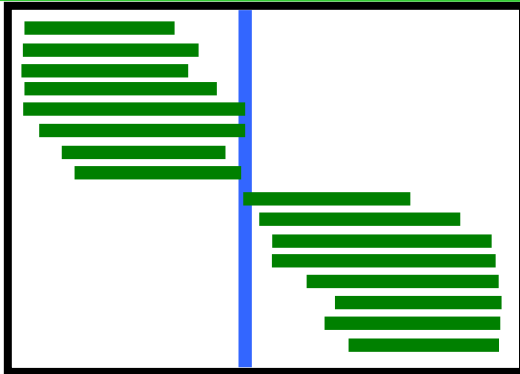
Communities



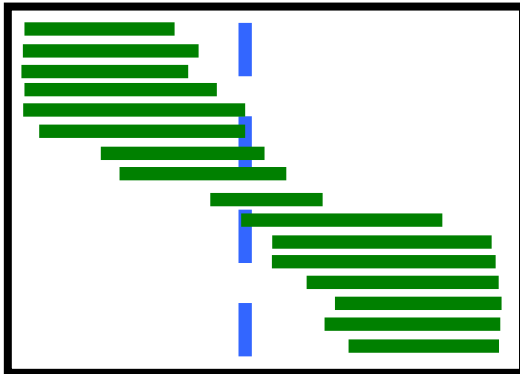
Theoretical or implicit assumption:
discrete boundaries



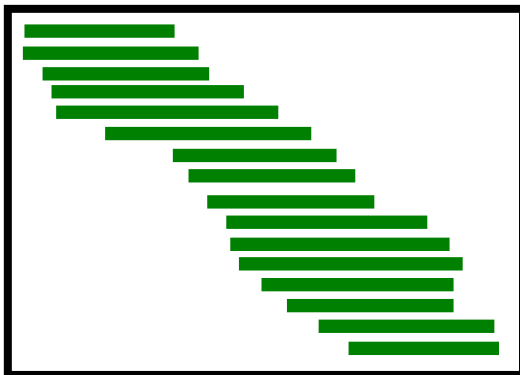
Communities



Clear types



Discontinuous
gradient



Continuum





Case Studies on Biodiversity

Forecasts predict severe and rapid changes of biodiversity.

Available data sets do **not allow for comparisons** between landscapes and in time. (focus on complete collection!)

- standardized for long term assessments at the national scale, but prone to bias / hazard at regional or local scale.

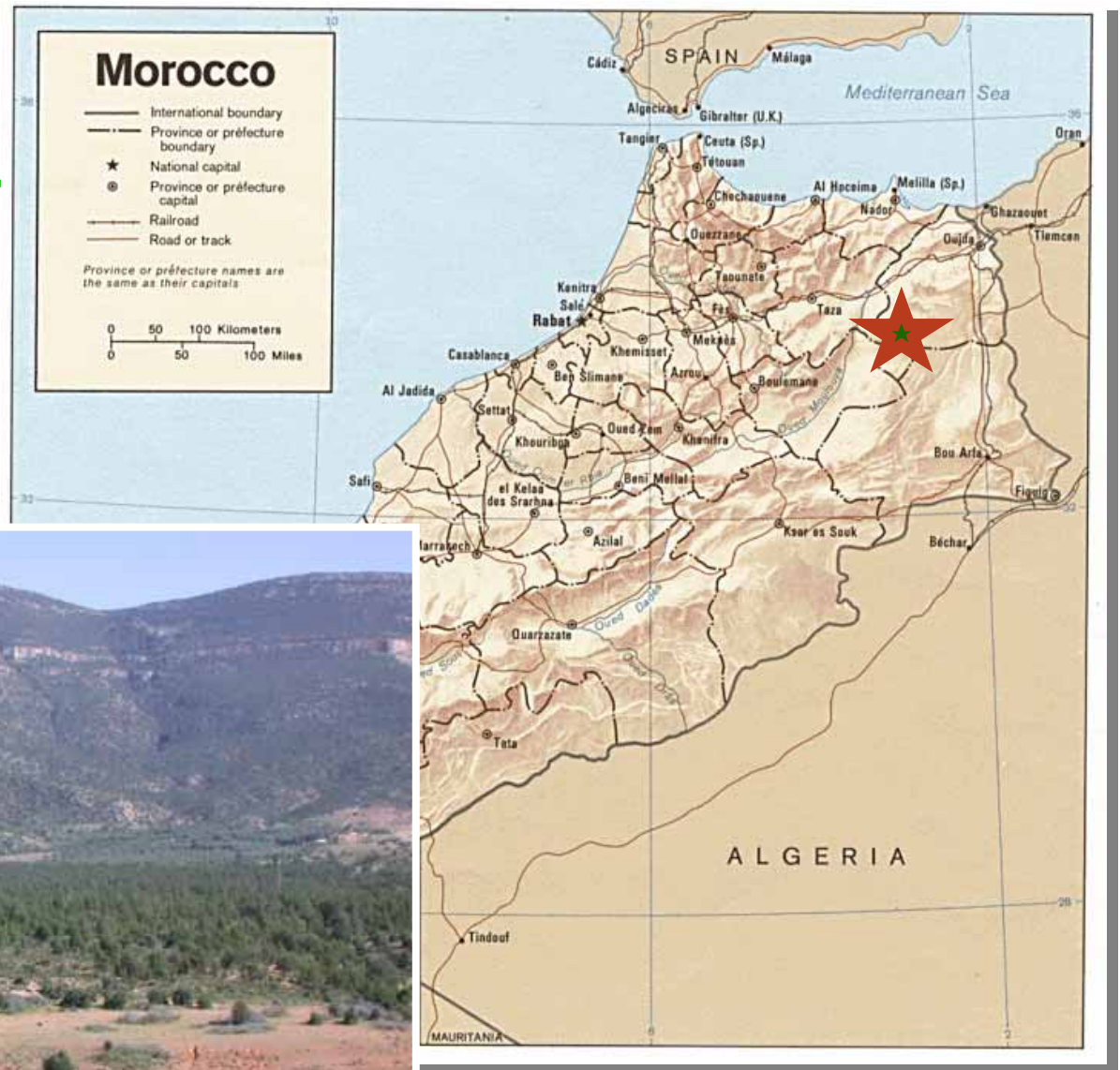
There is an urgent need for rapid, quantitative, un-biased, reproducible assessments at relevant scales.

- **no necessity to be complete!** (simply impossible)

Standardized results for future comparisons are needed.



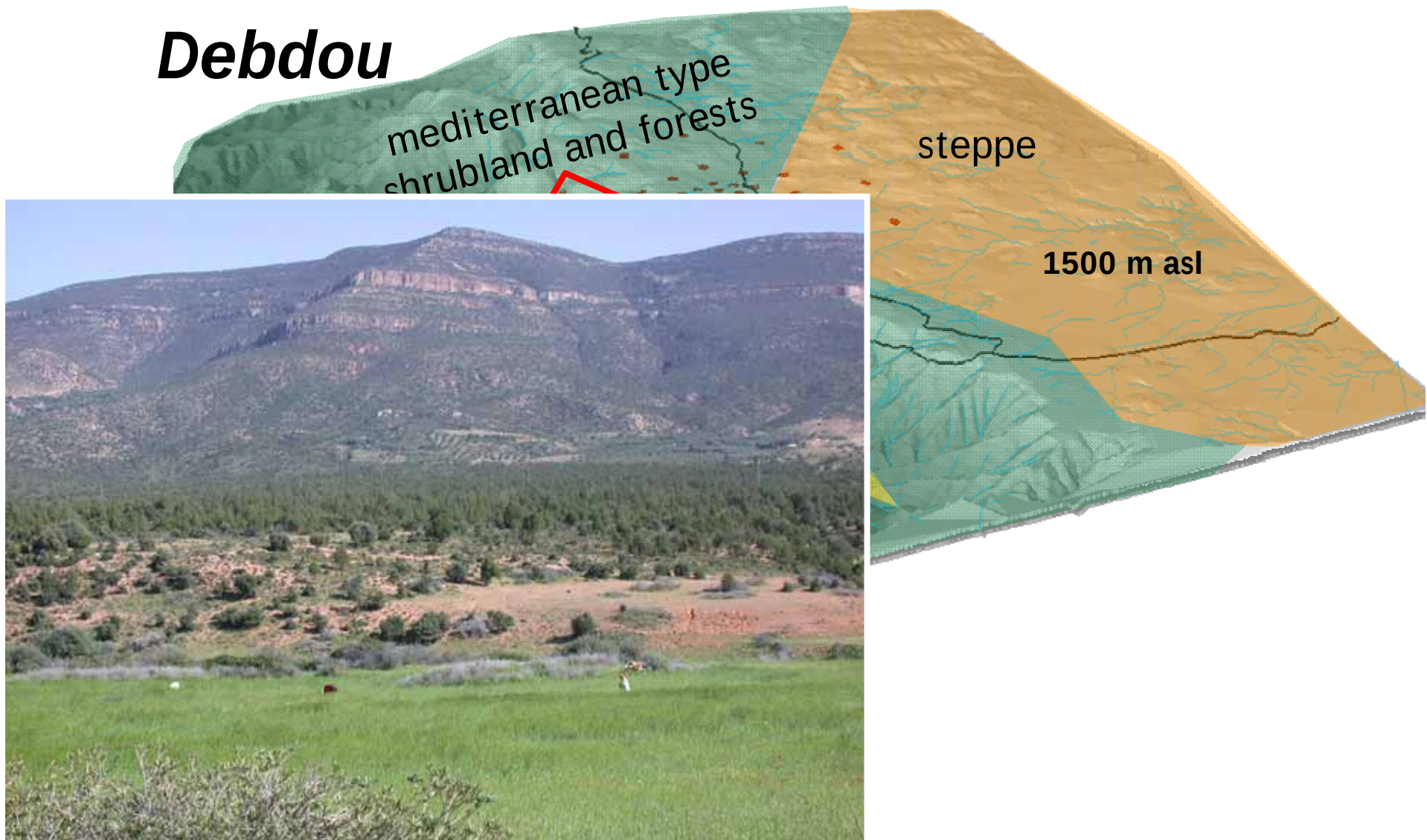
Gaada de Debdou





Case Studies

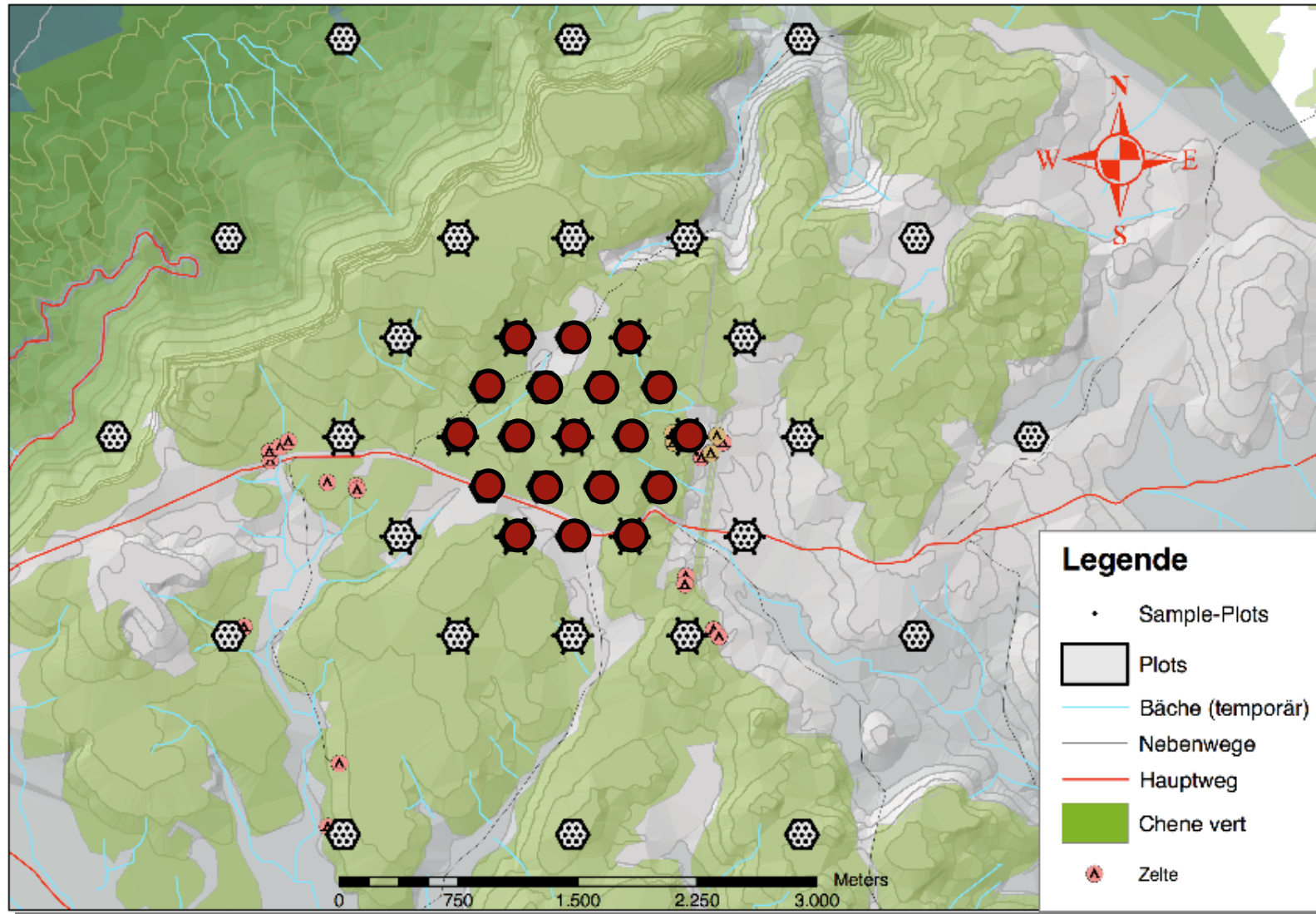
Gaada de Debdou





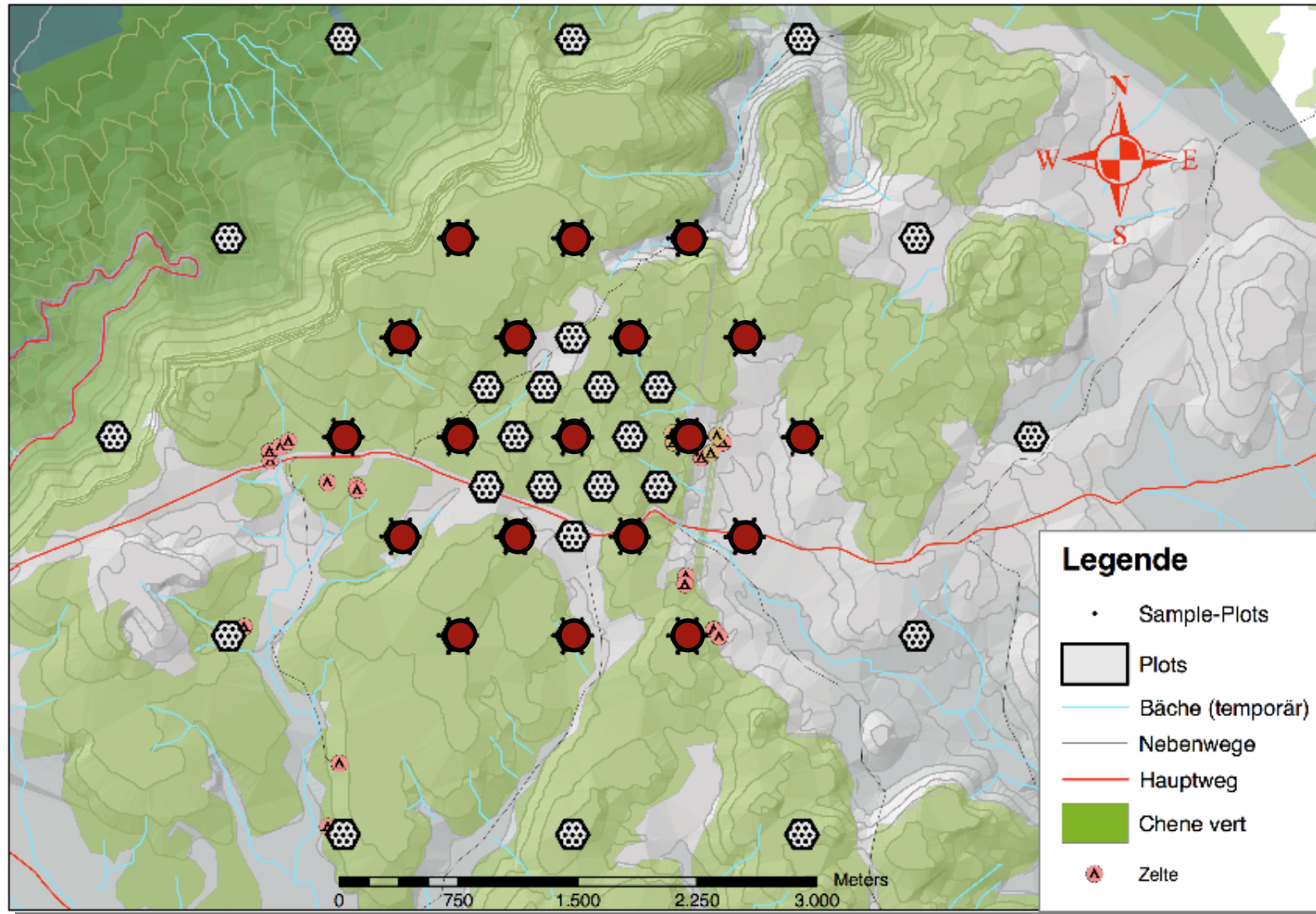
Case Studies

2-fold Nested Sampling Design



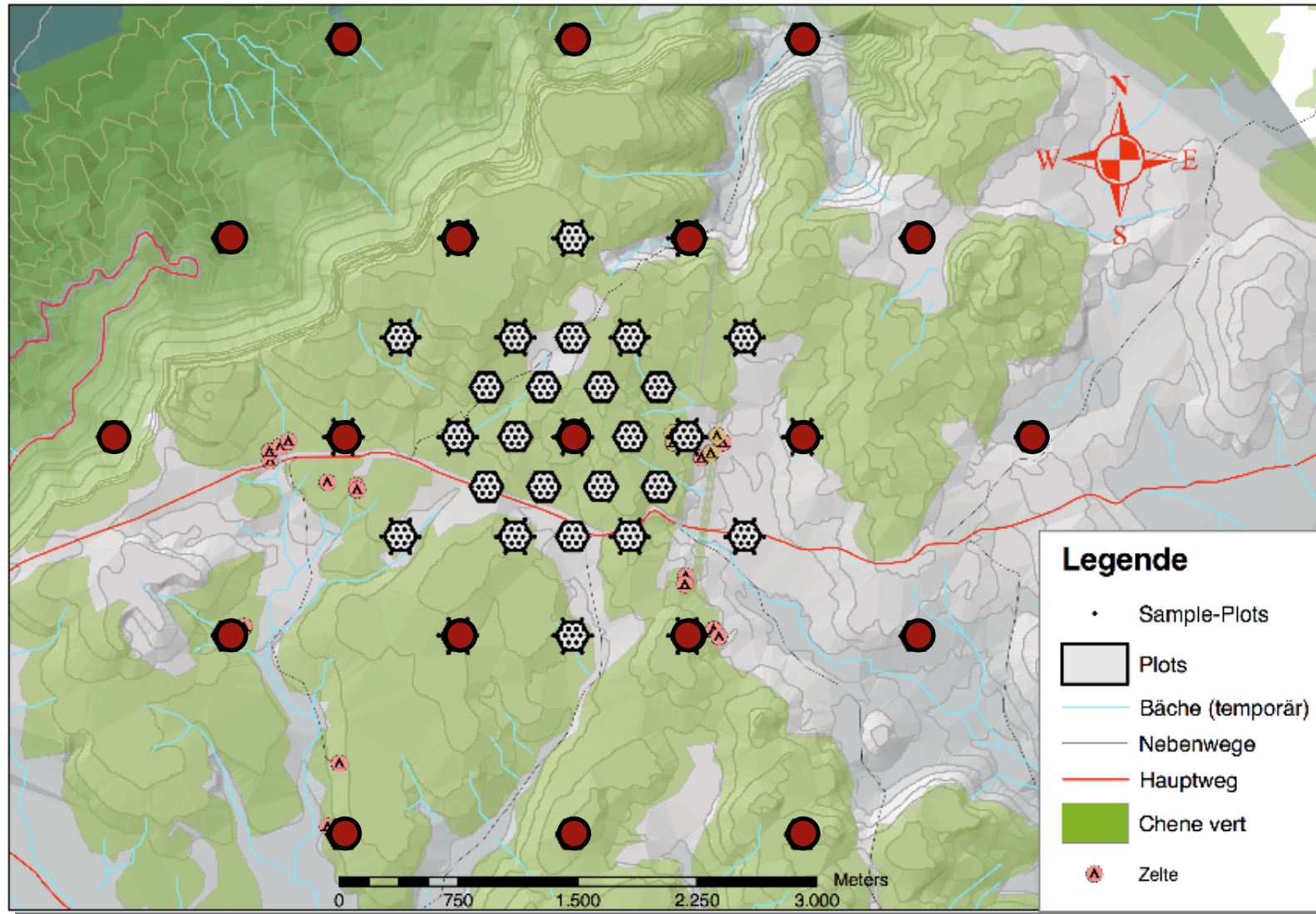


Distribution



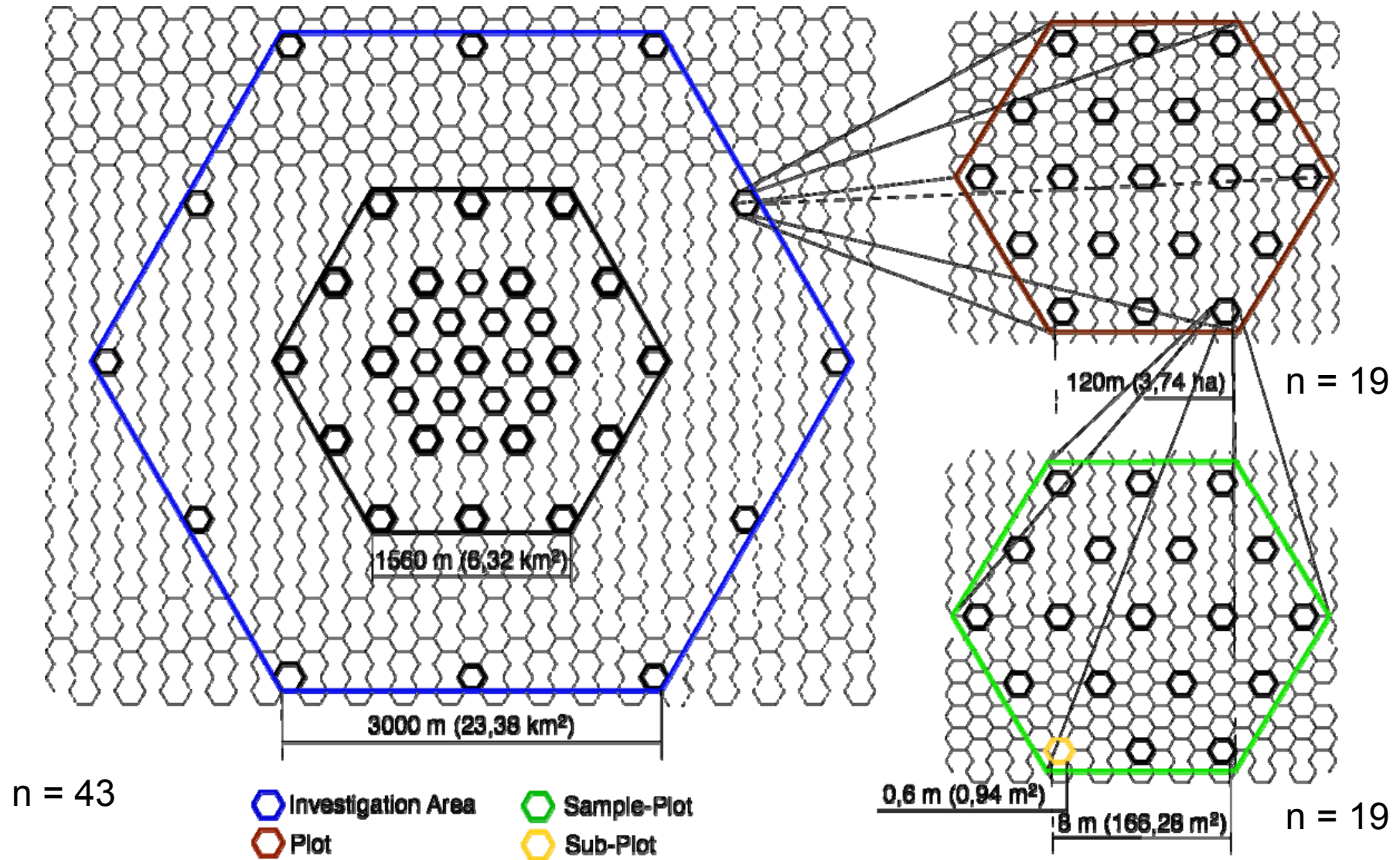


Distribution





Distribution





biogeography
uni bayreuth

Data Acquisition

*High Precision
GPS*

Magnetic Marking in Soil

Eastern-Morocco (Debdou)

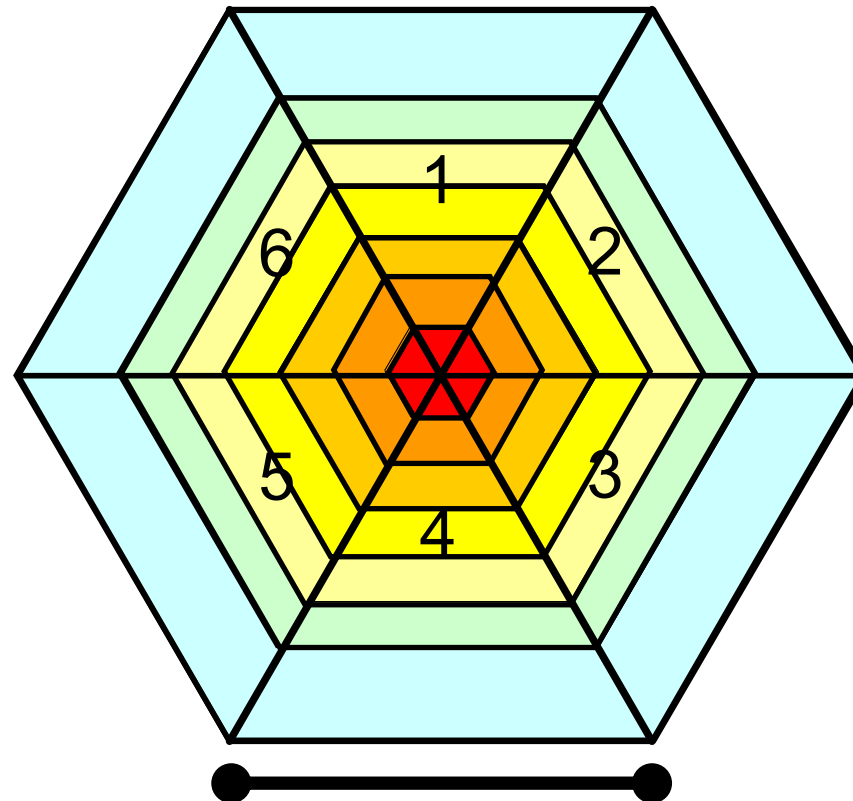




Field Surveys

Eastern-Morocco (Debdou)

Area
2,60
10,39
23,38
41,57
64,95
93,53
166,28



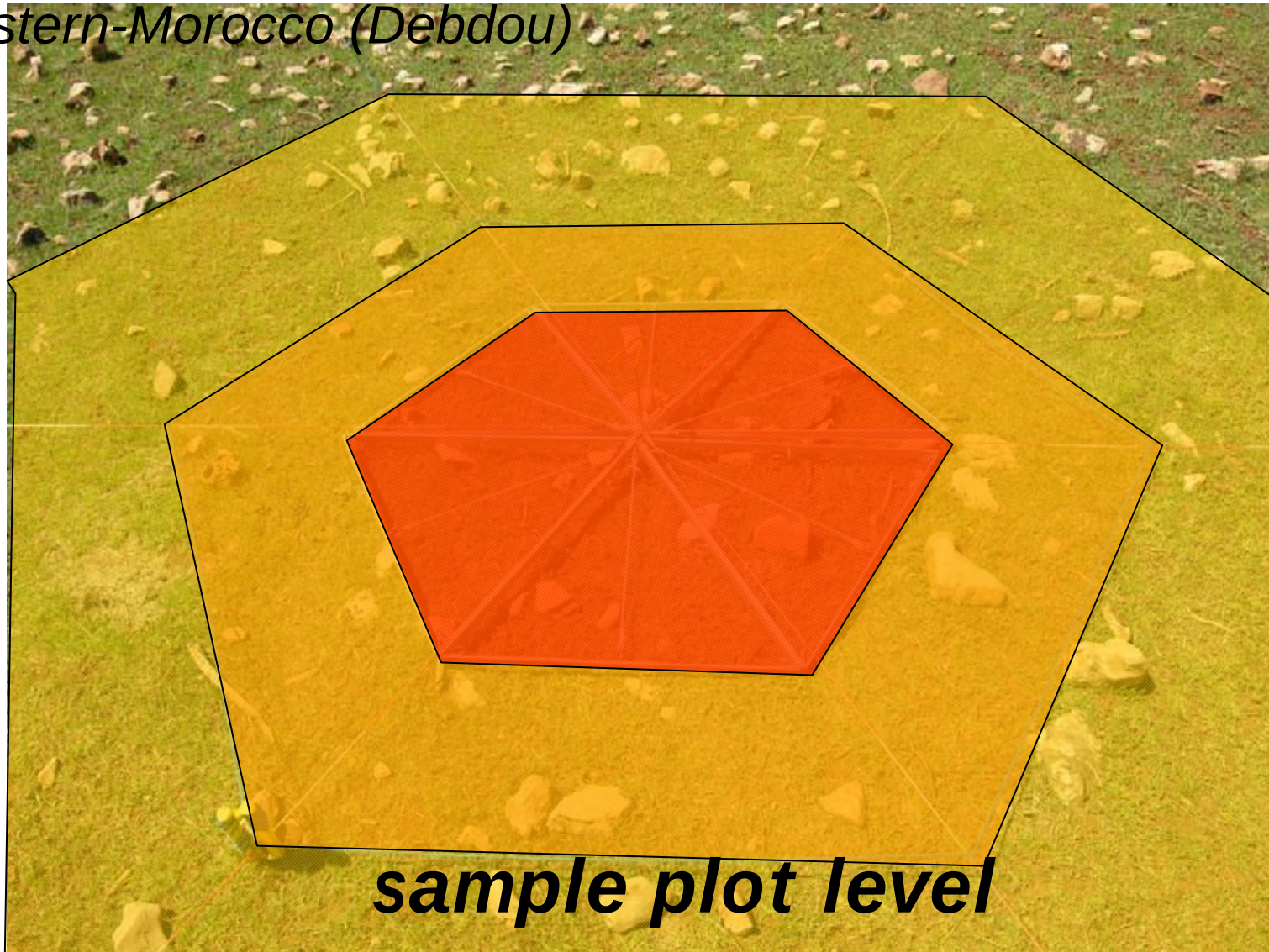
8 m

sample plot level



Field Surveys

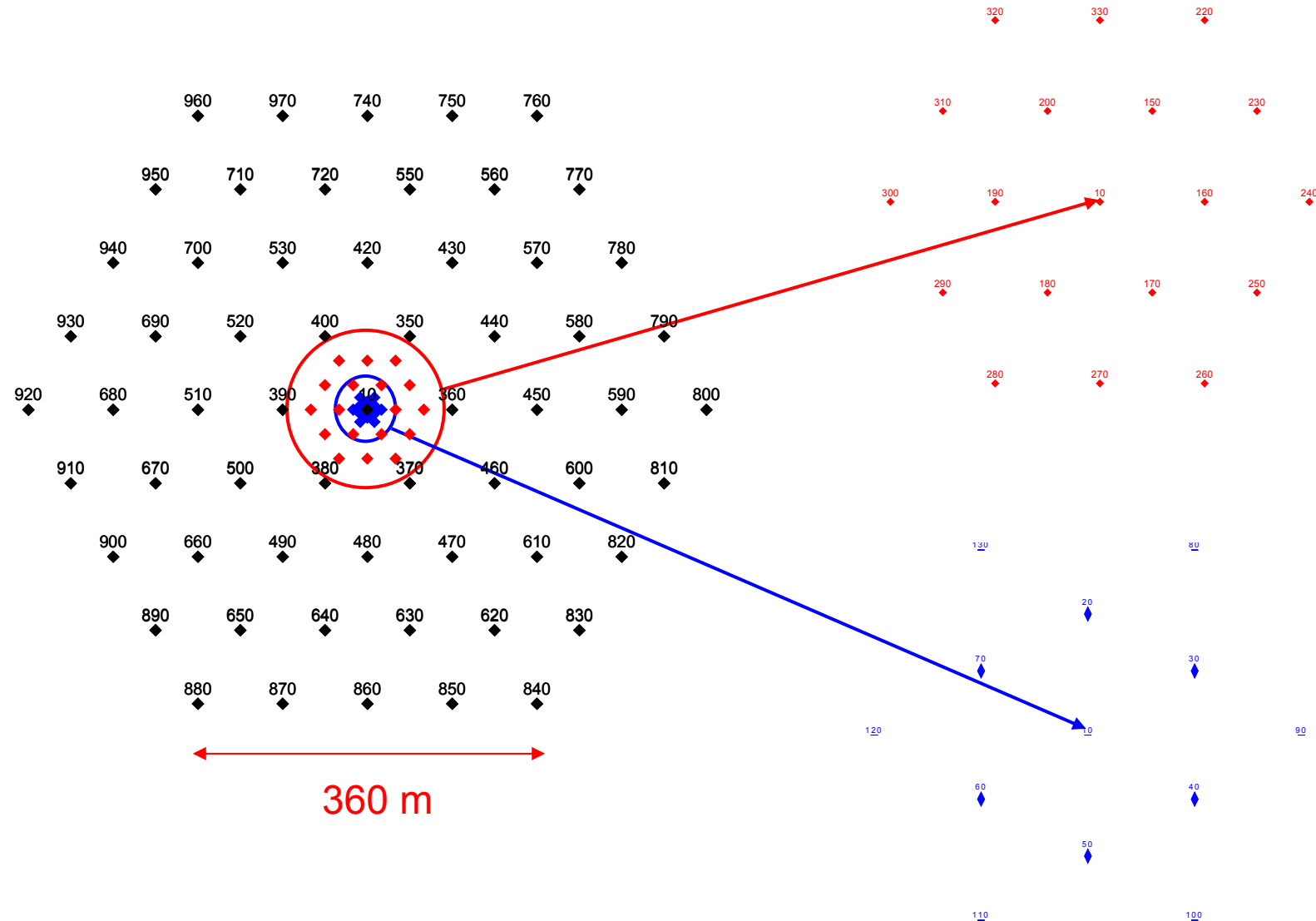
Eastern-Morocco (Debdou)





Hierarchical Sampling

Eastern-Morocco (Debdou)





Field Surveys

Northern-Sweden (Abisko)

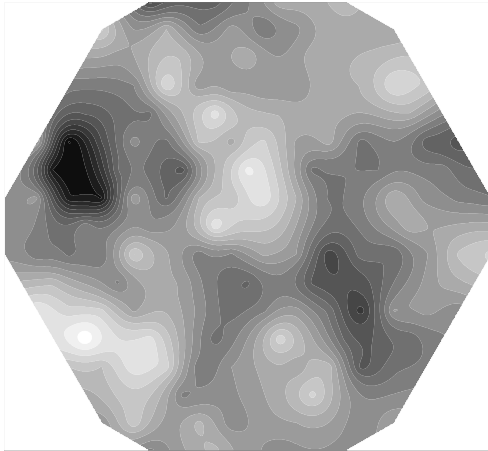




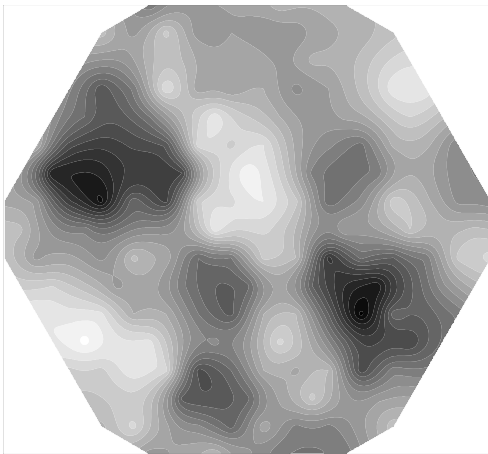
Field Surveys

Northern-Sweden (Abisko)

Sørensen

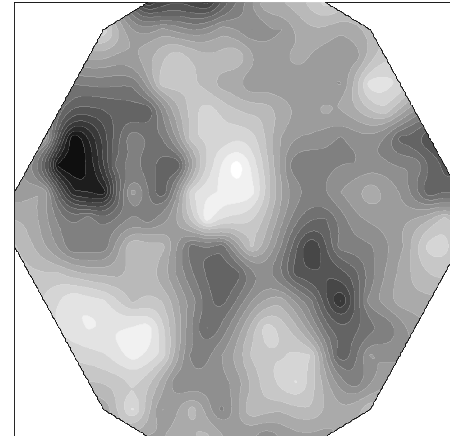


Simple Match.

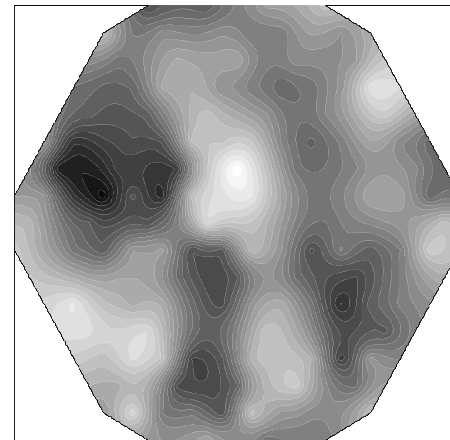


Ähnlichkeitsmaße

Bray-Curtis



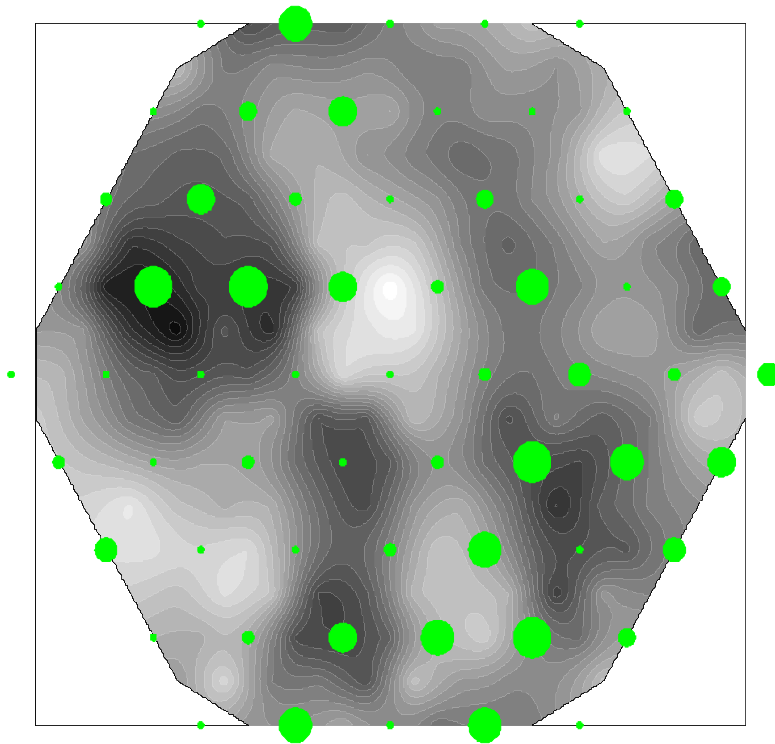
Euklid. Distanz



Distanzmaße



Field Surveys



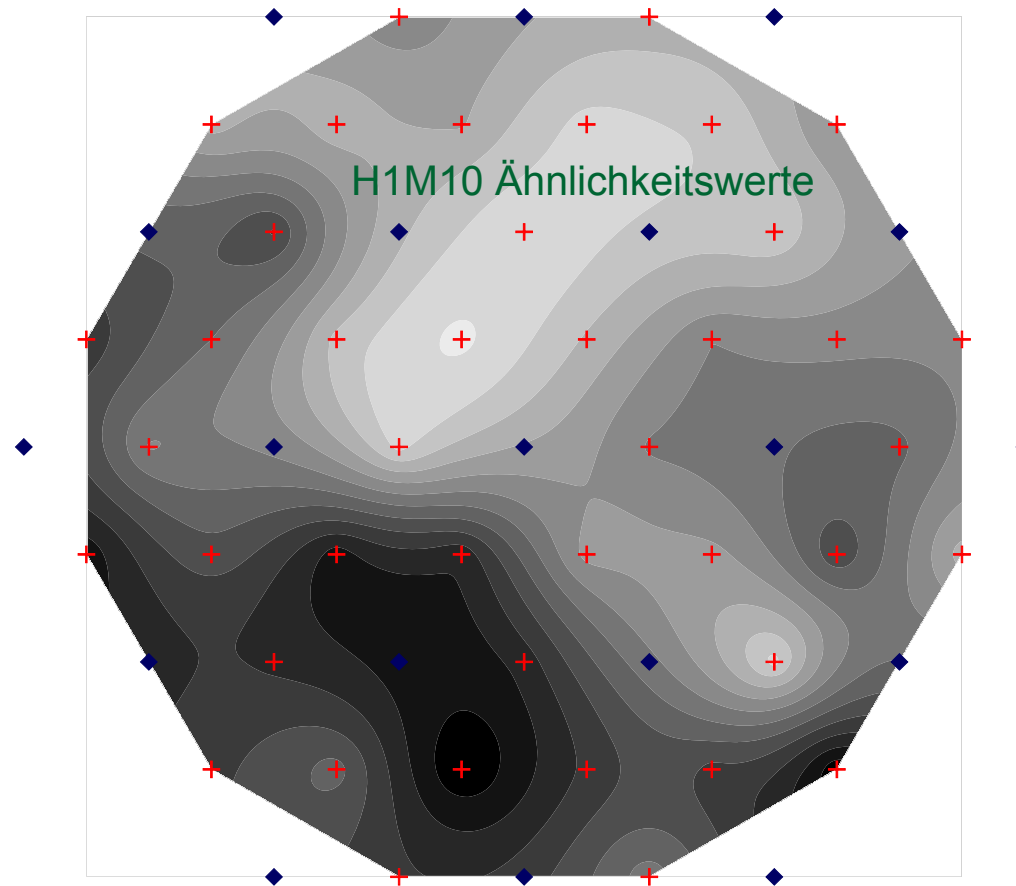
- Remnants of Fjell Birch Forest are correlated with similarity patterns.
- These are related to certain sites in the relief...

Betula pubescens
Northern-Sweden (Abisko)



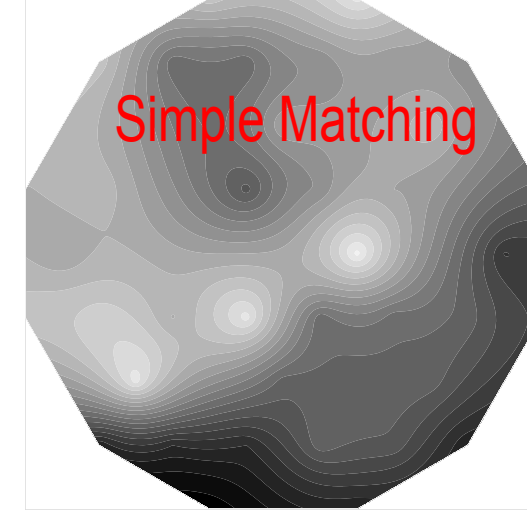
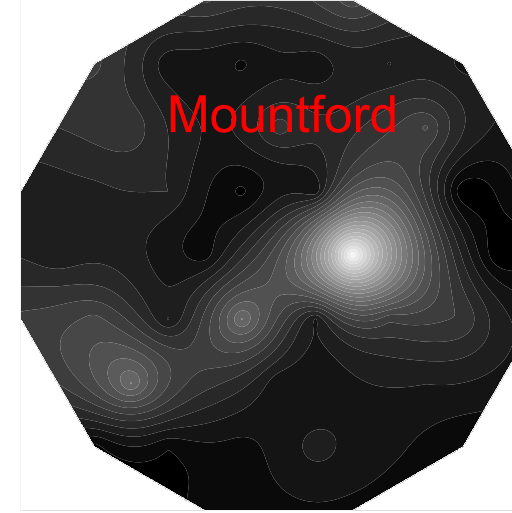
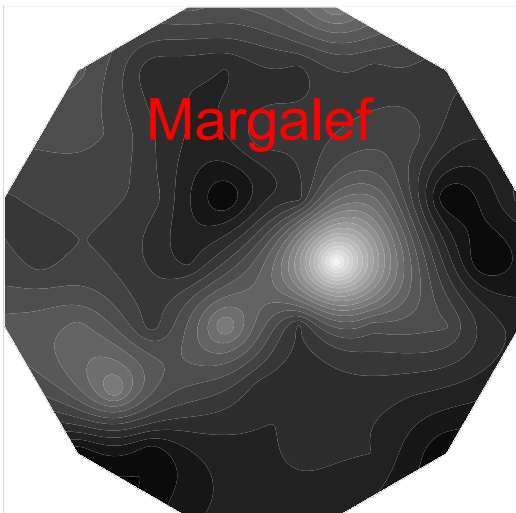
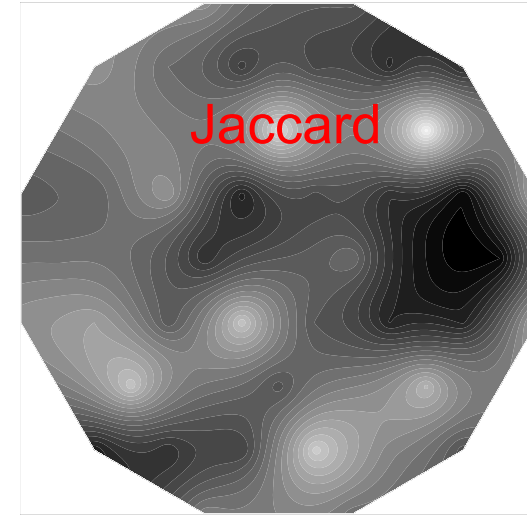
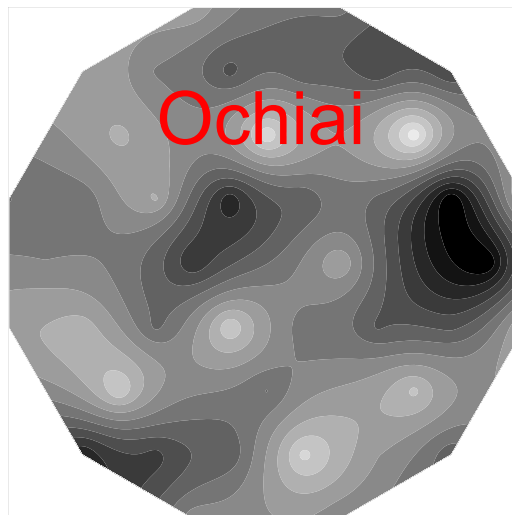
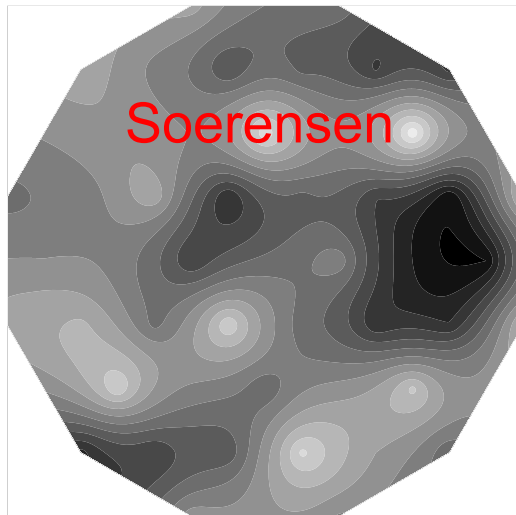
Similarity Patterns

Hexagon H1M10: Muster aus Grid der Ähnlichkeitswerte



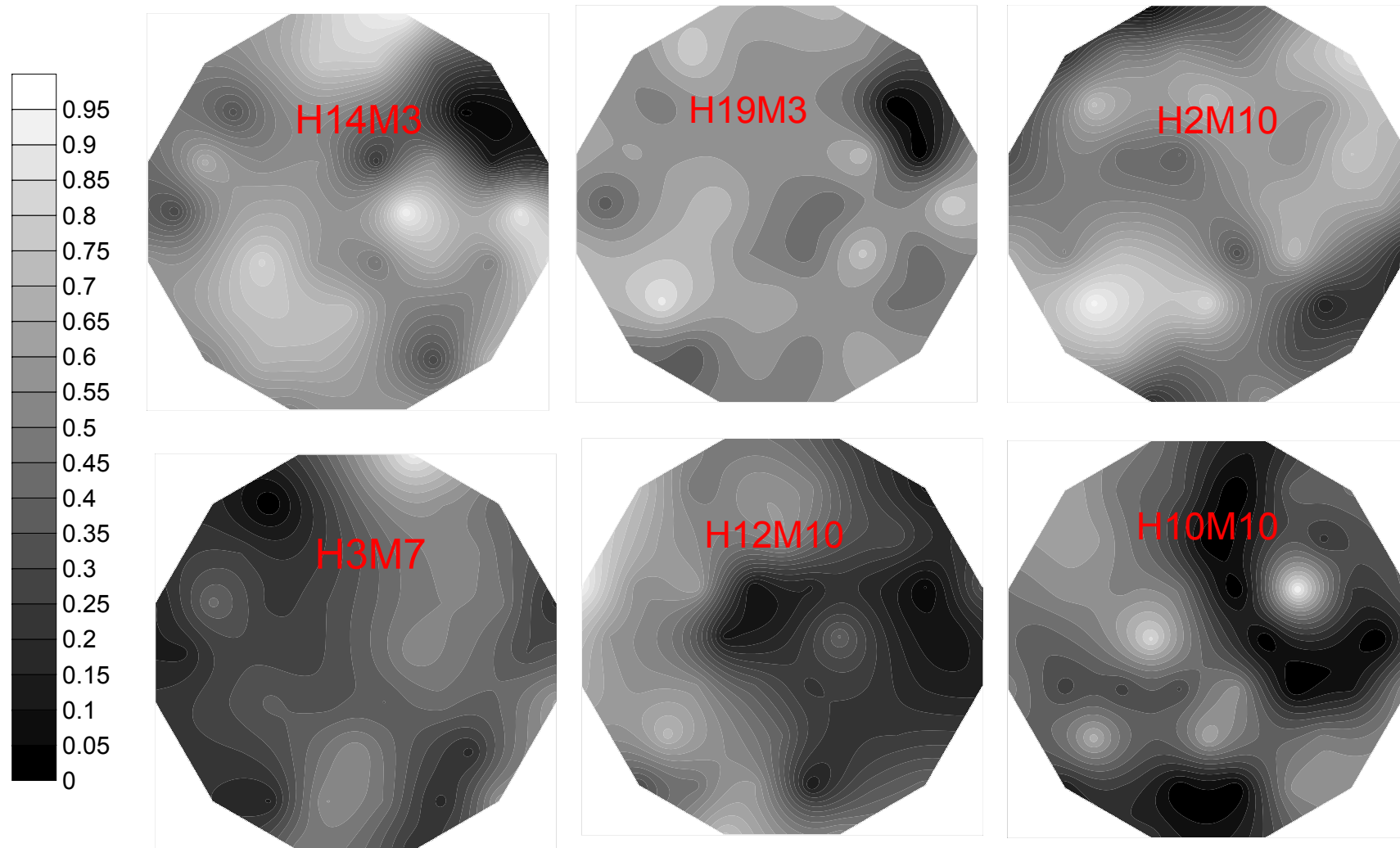


Similarity Patterns





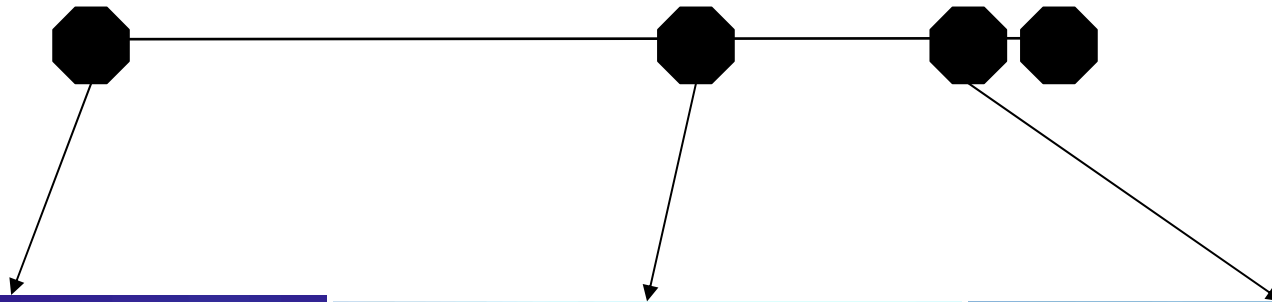
Field Surveys



Sørensen's Index for different hexagones



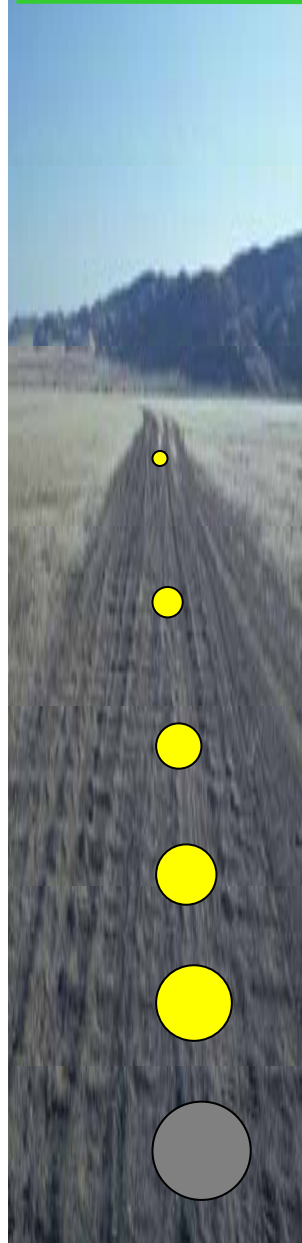
Field Surveys



Northern-Namibia (Kaokoveld)



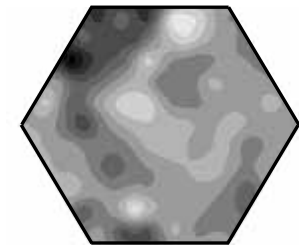
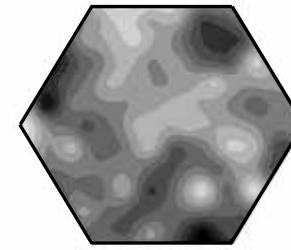
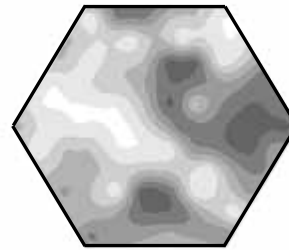
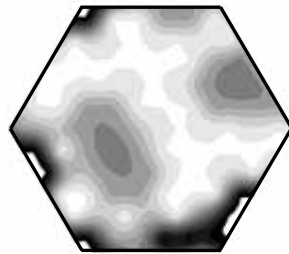
Field Surveys



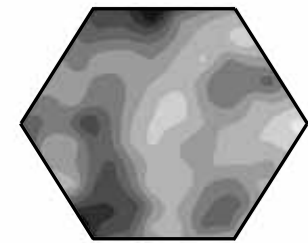
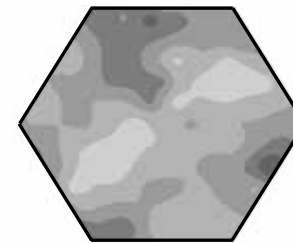
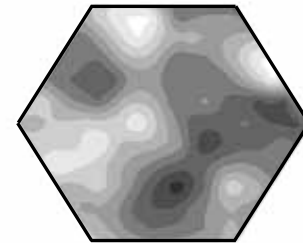
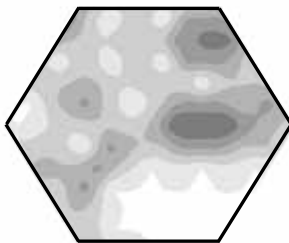
Dry season



Sørensen
values



Wet season



Purros

ZooDesert

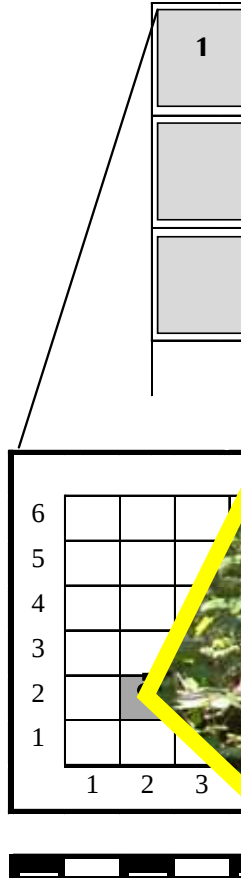
Warmquelle

Mbakondja

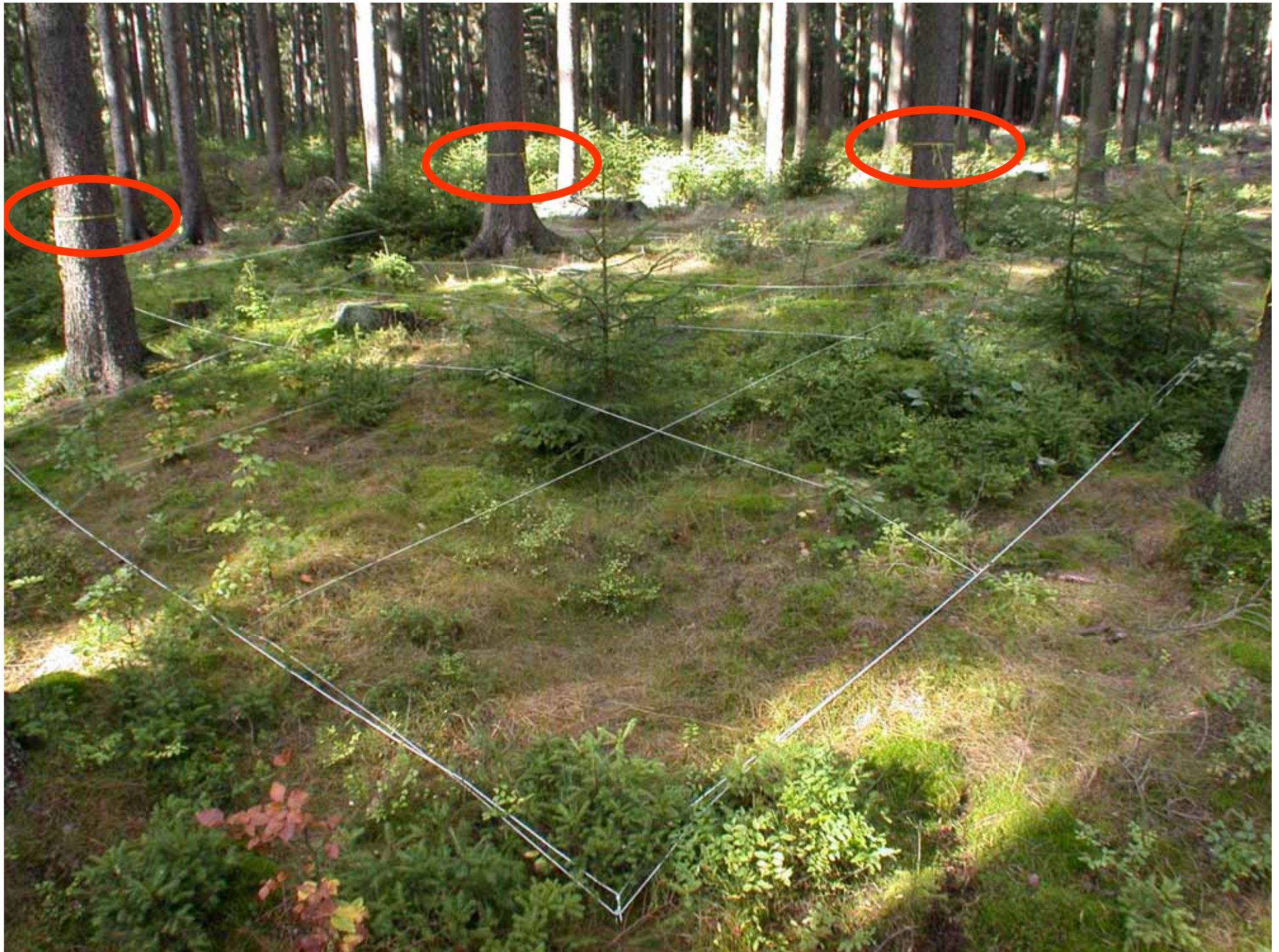


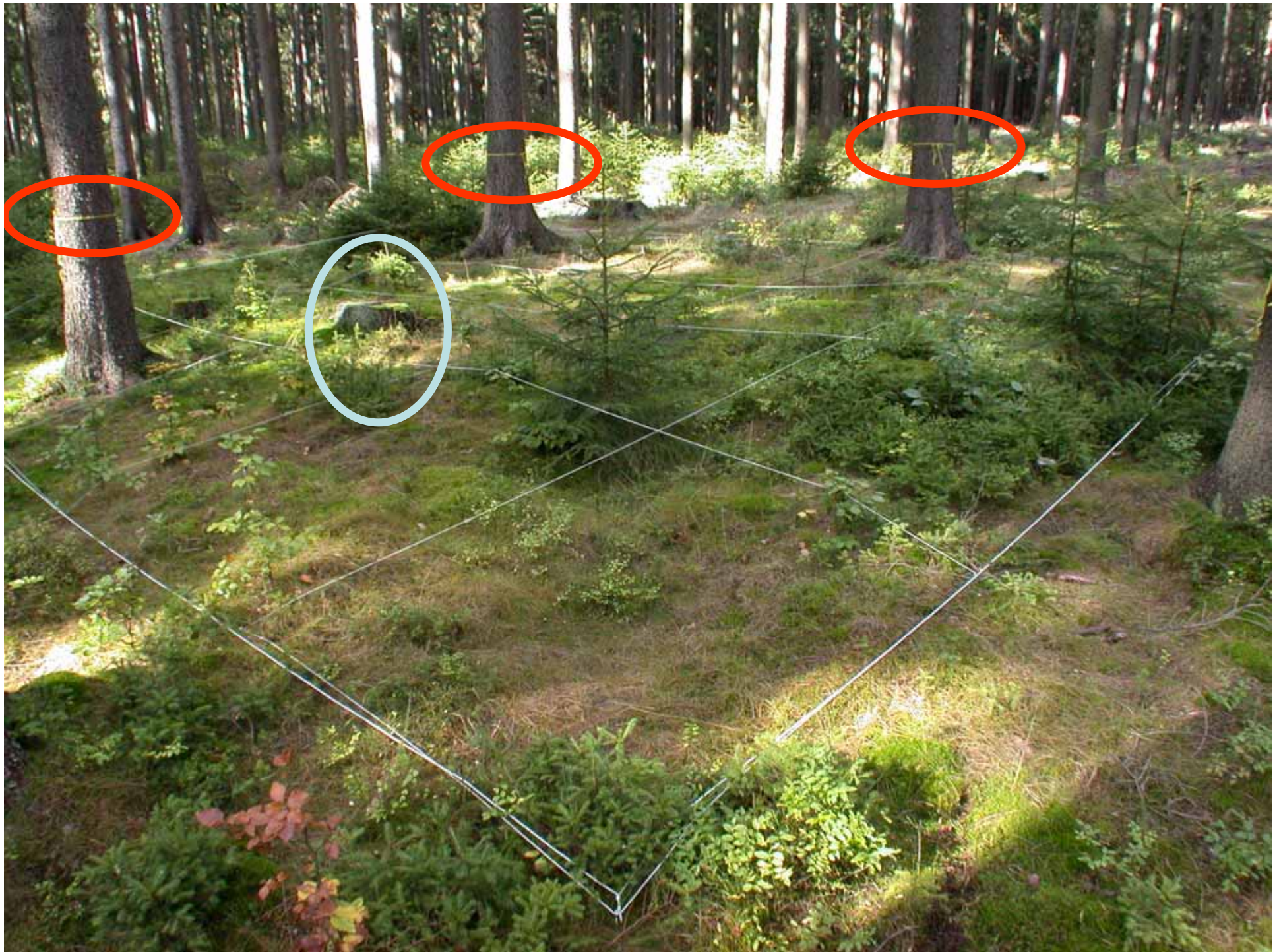
Field Surveys

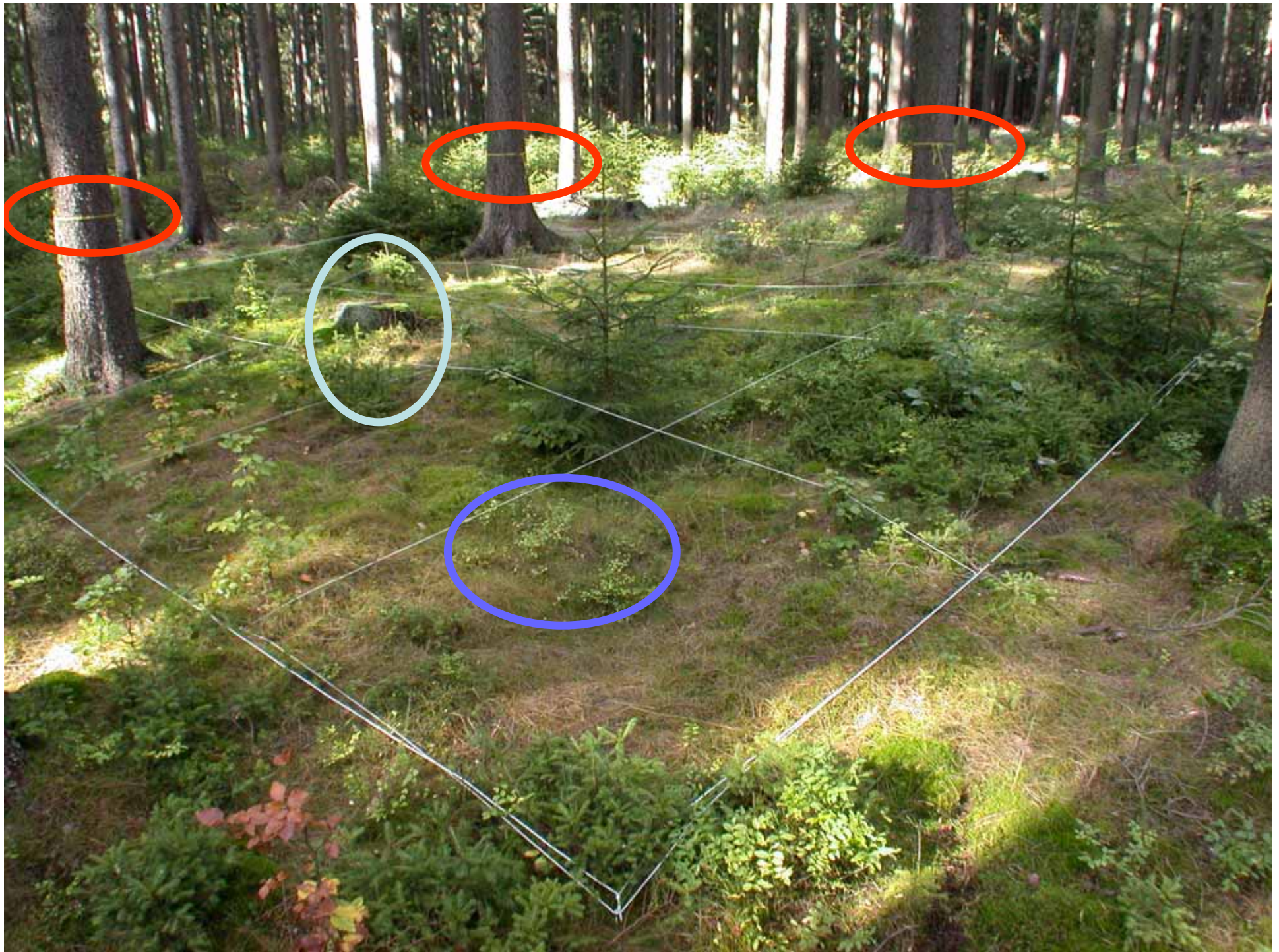
**Criteria must be fulfilled:
e.g. minimum distances to water bodies
and roads; forest cover; pest outbreaks**

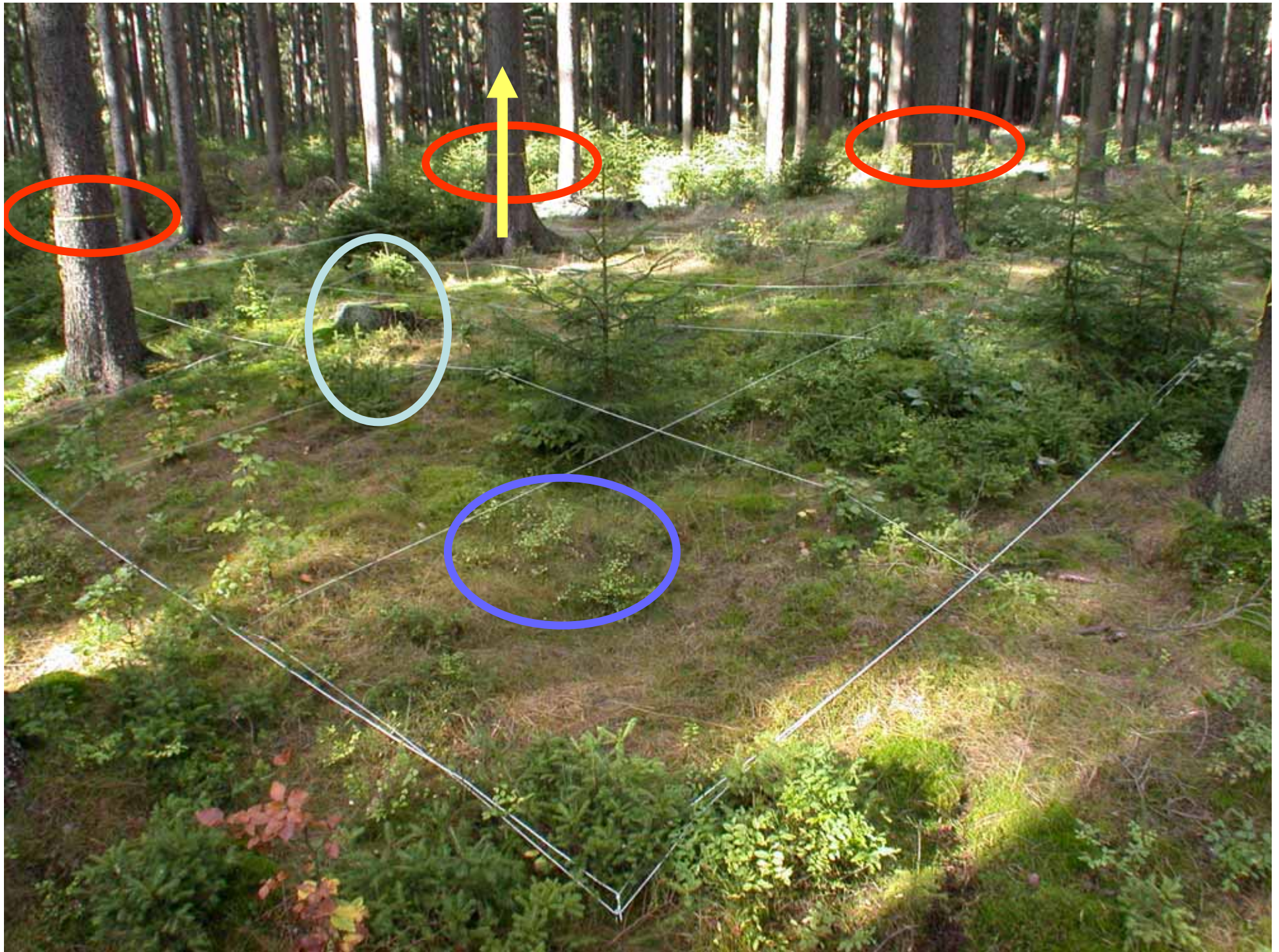


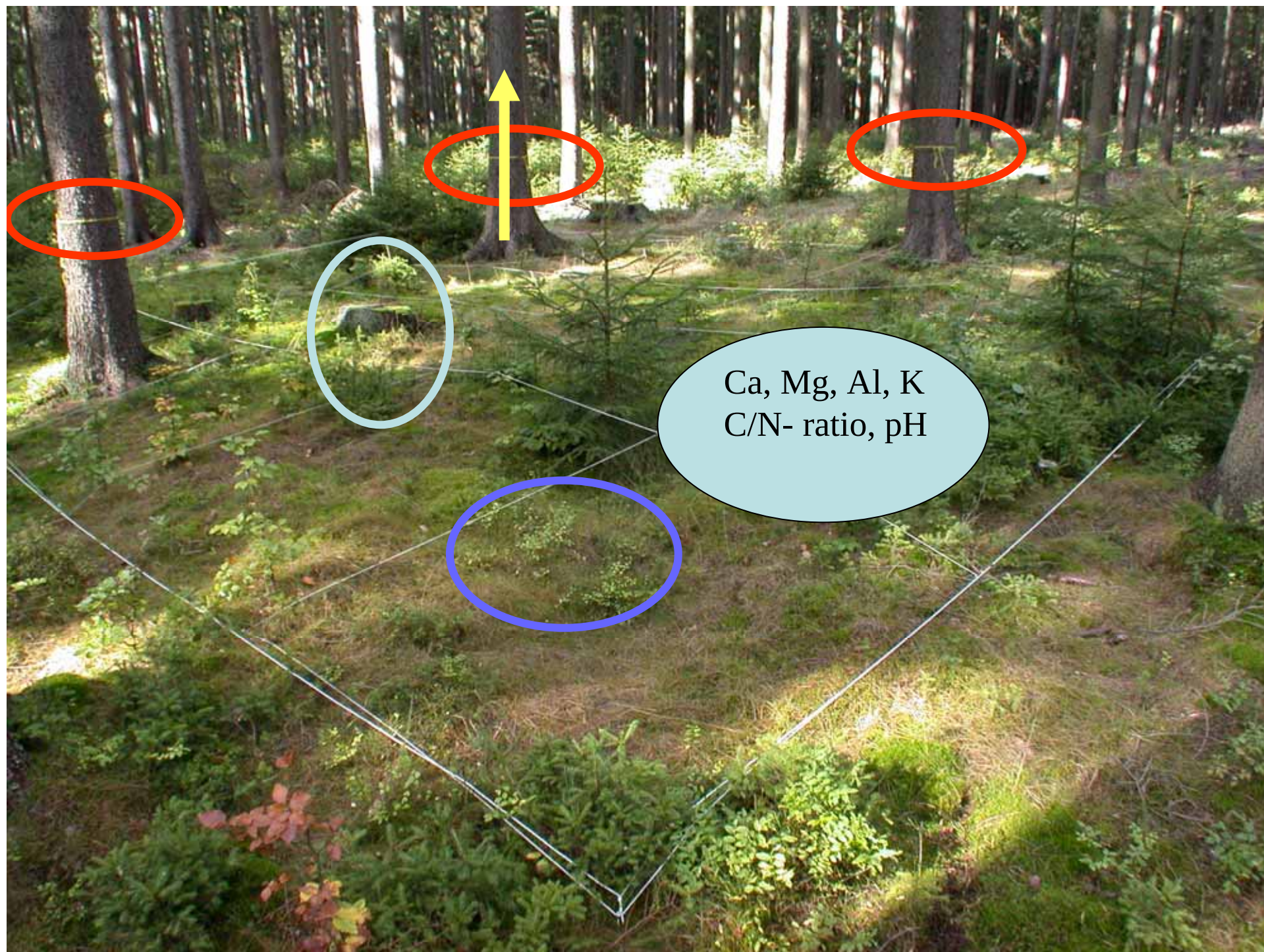








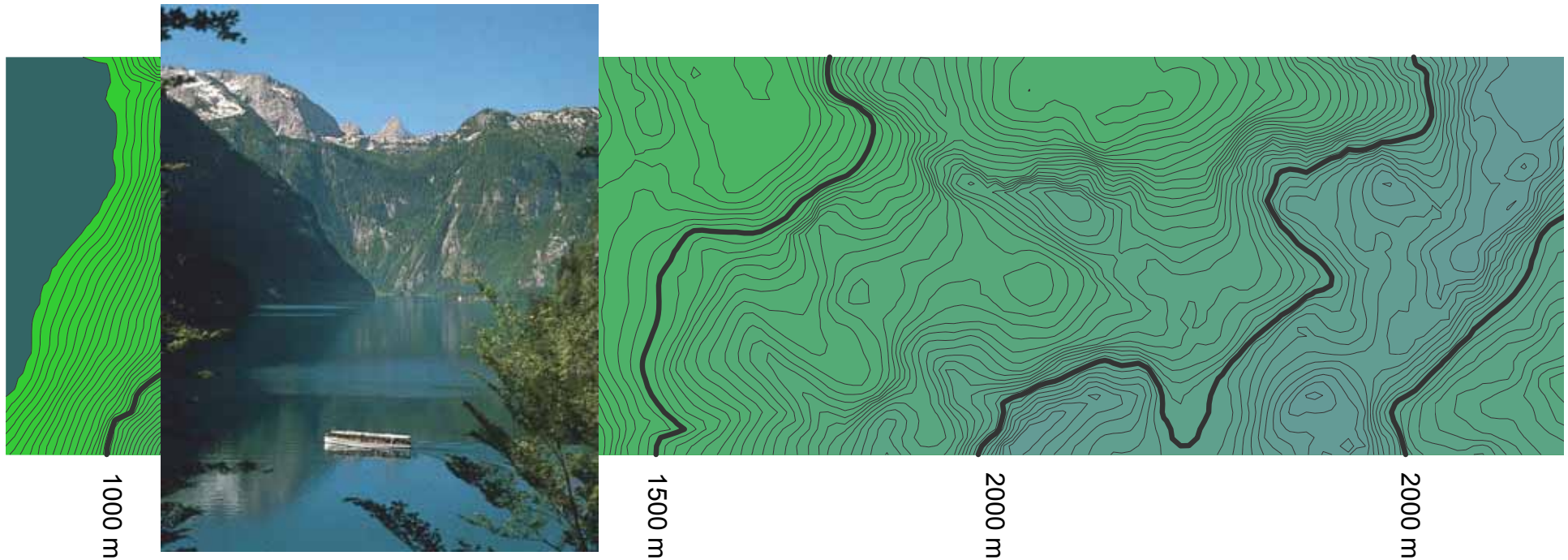






Field Surveys

The gradient starts at 603 m NN at
Königssee...

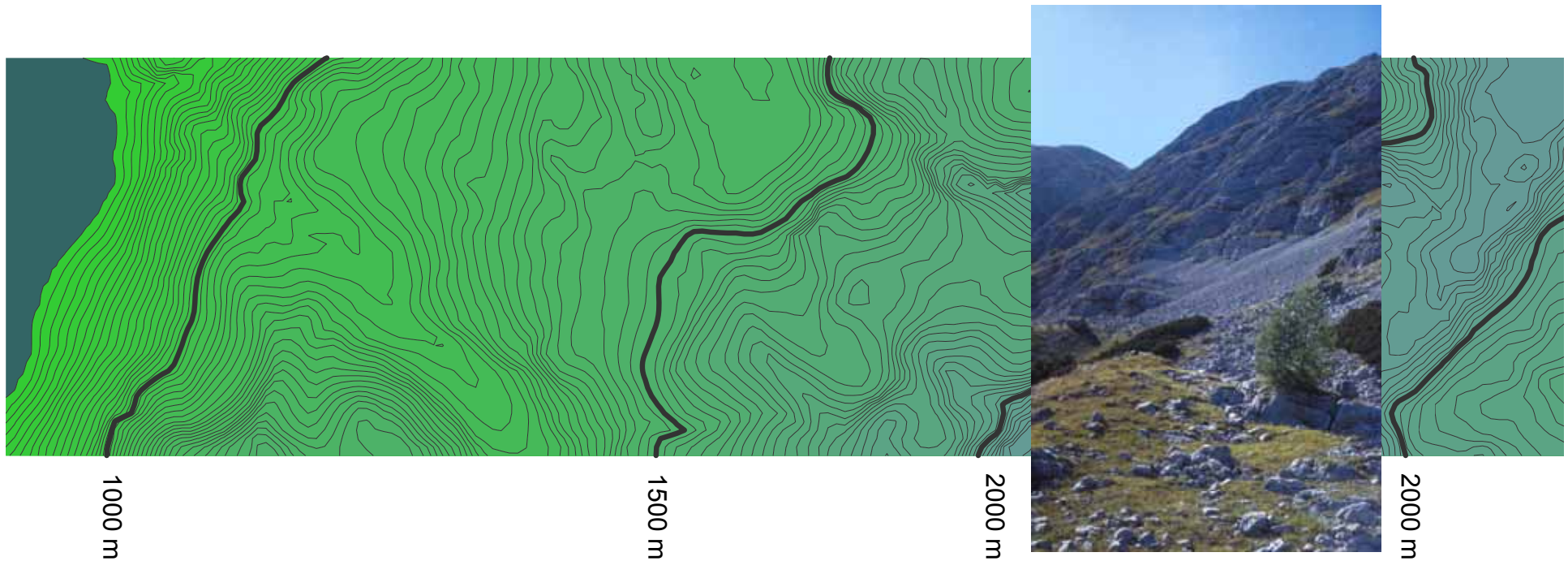


(Schmidtlein, 2001)



Field Surveys

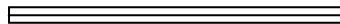
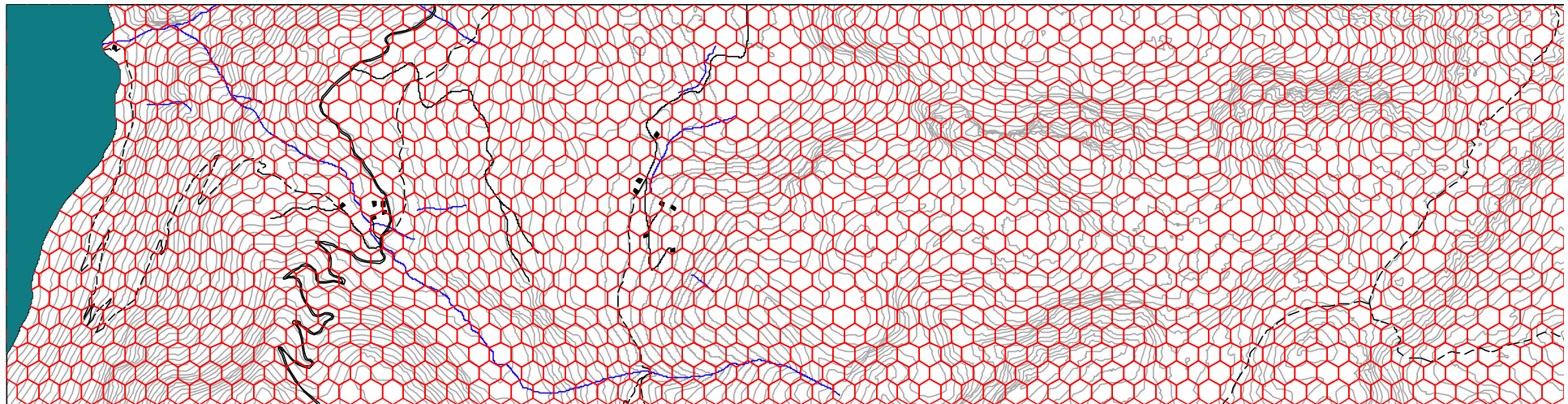
... and ends at 2200 m in the alpine zone of the Hagengebirge



(Schmidtlein, 2001)



Field Surveys



1 km

(Schmidtlein, 2001)



Field Surveys

68 Assoziationen aufgenommen

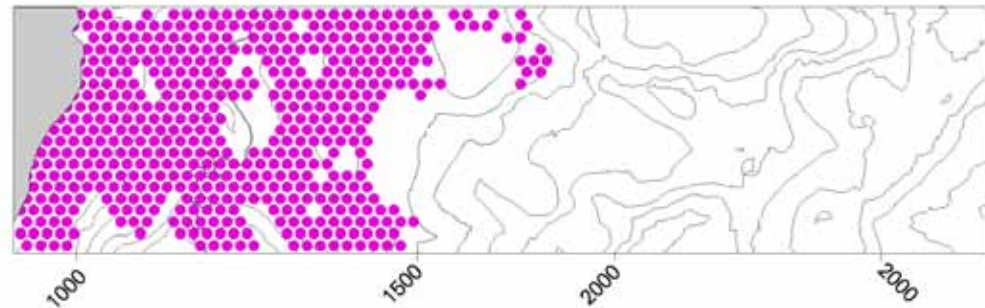
Frequenz in den Rasterflächen

Höhenverteilung

Nachbarschaften

Verbreitung

Aposerido-Fagetum

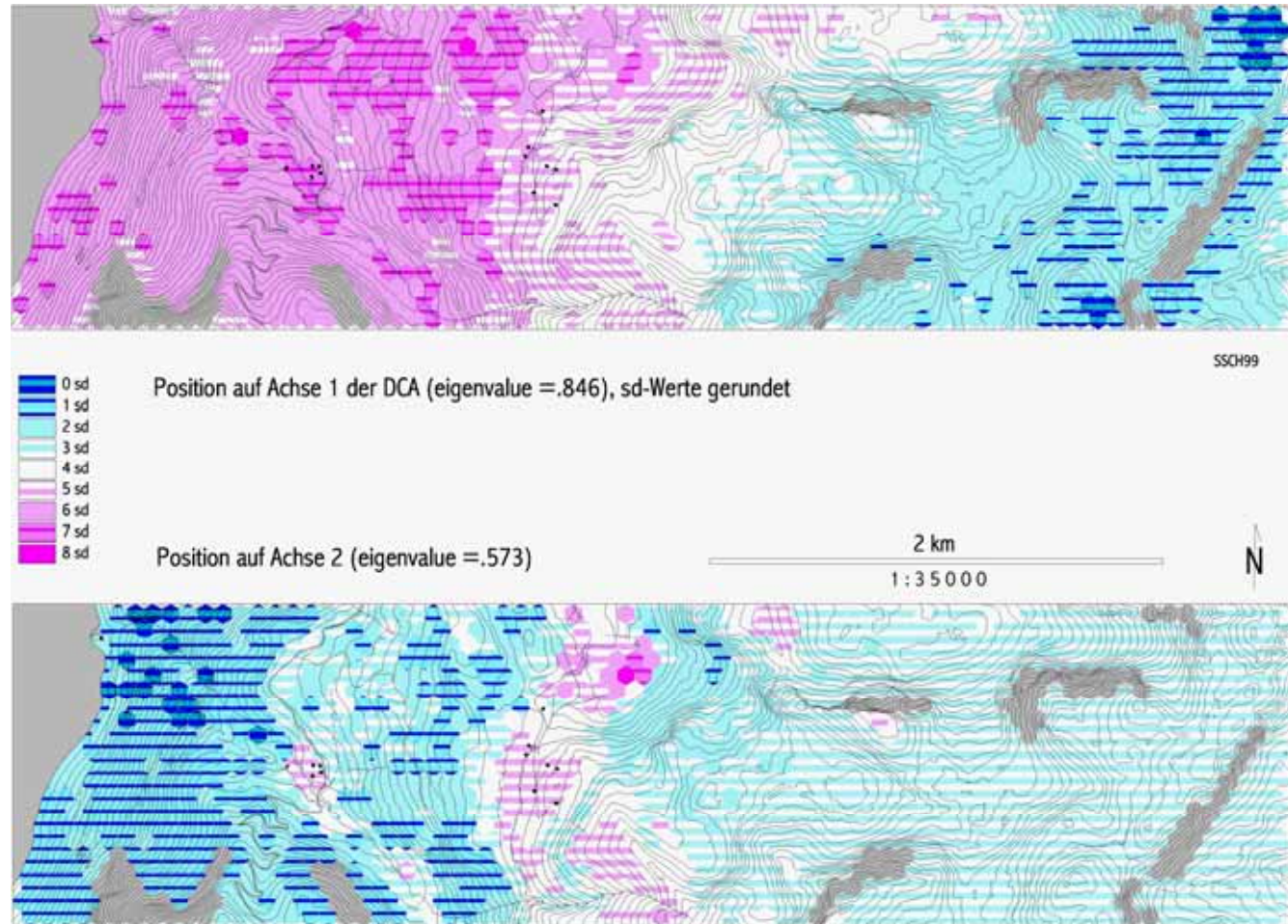
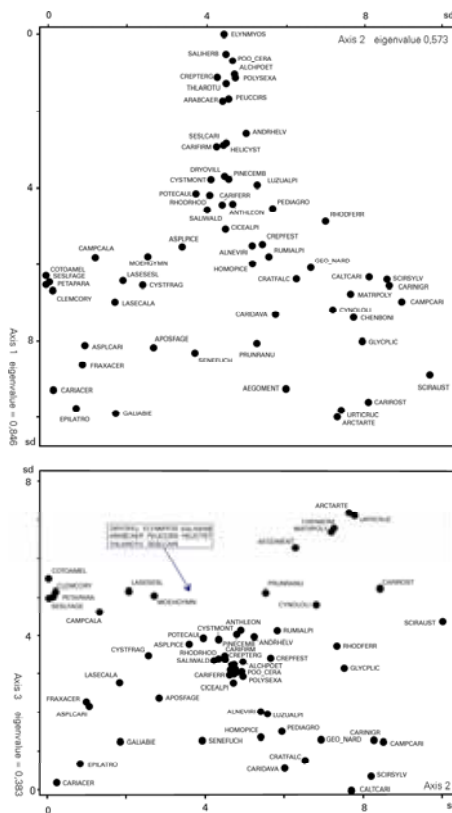


(Schmidtlein, 2001)



Field Surveys

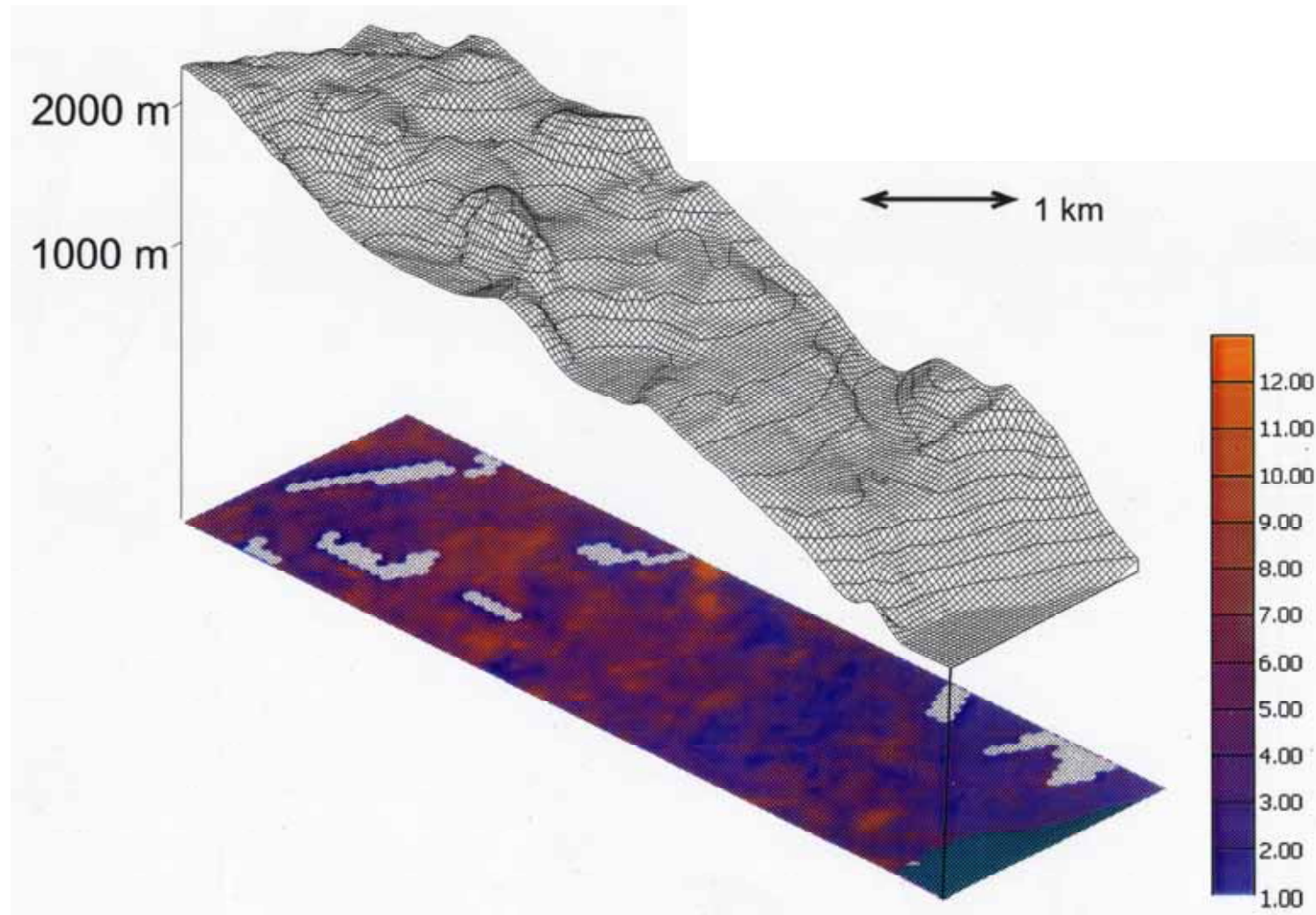
Ordination



(Schmidtlin, 2001)



Field Surveys

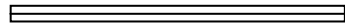
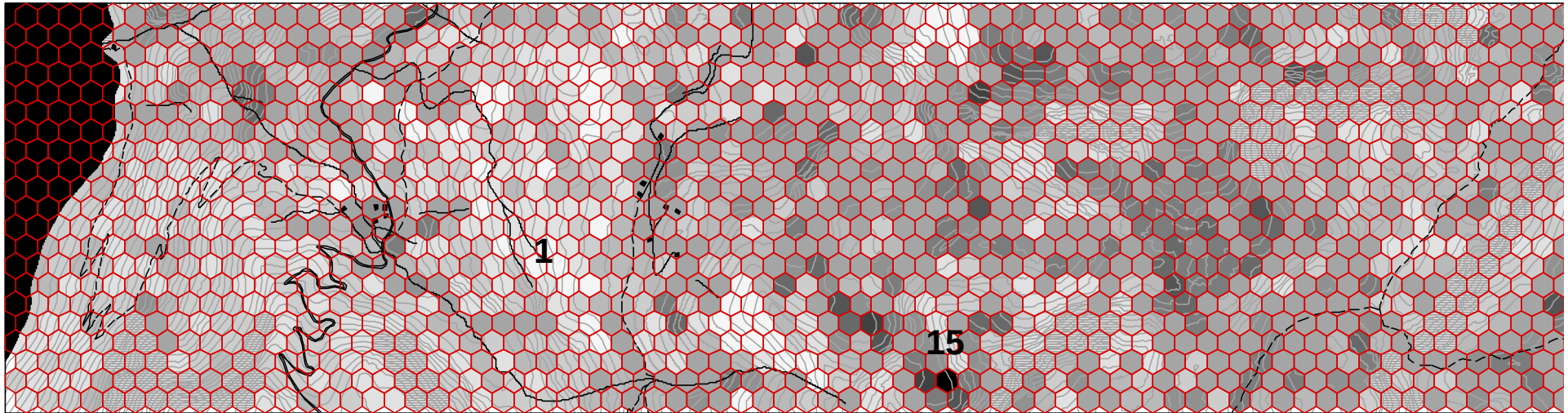


(Schmidtlein, 2001)



Field Surveys

scale:



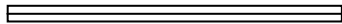
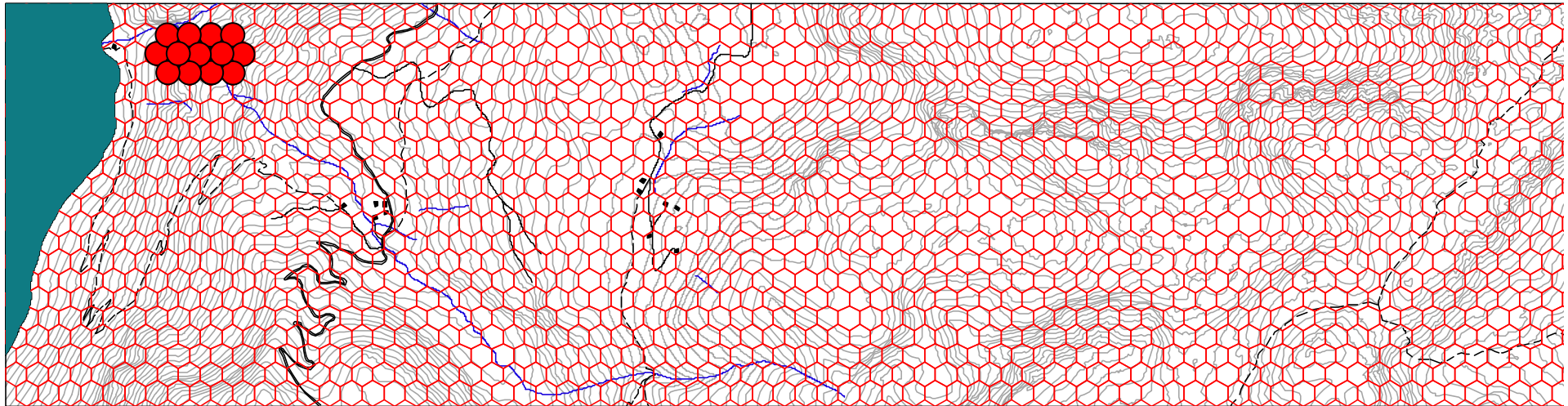
1 km

(Schmidtlein, 2001)



Field Surveys

7-Plot aggregates



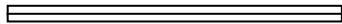
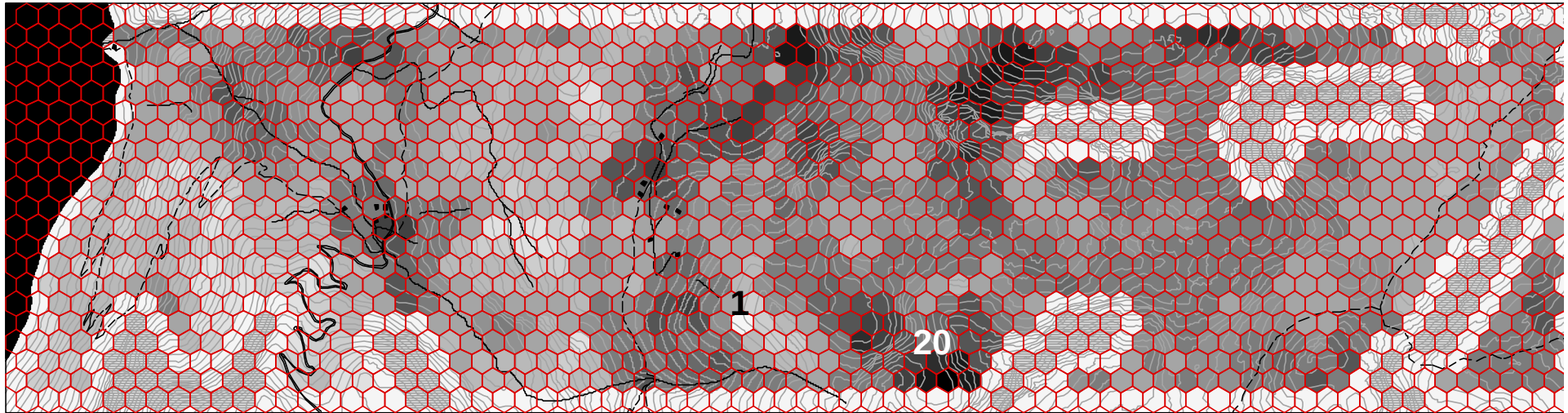
1 km

(Schmidtlein, 2001)



Field Surveys

scale:



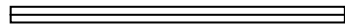
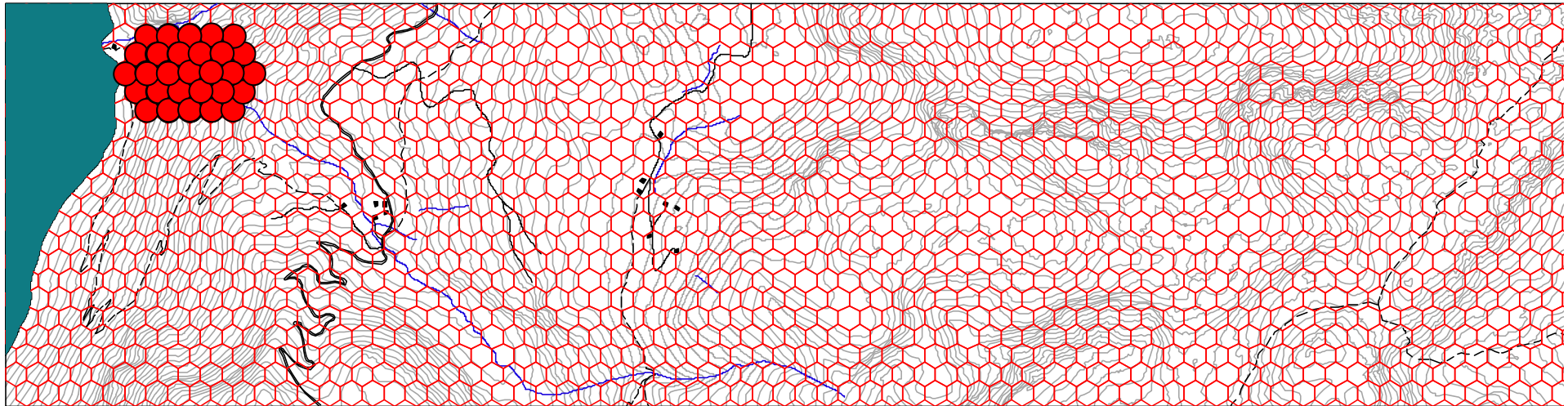
1 km

(Schmidtlein, 2001)



Field Surveys

19-Plot aggregates



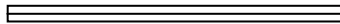
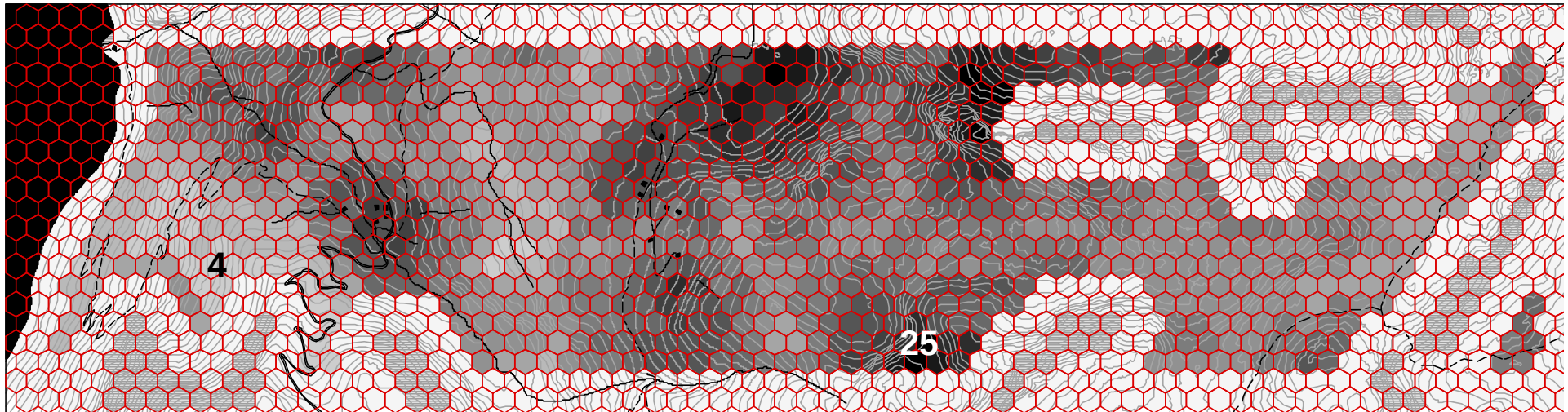
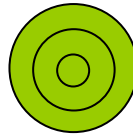
1 km

(Schmidtlein, 2001)



Field Surveys

scale:



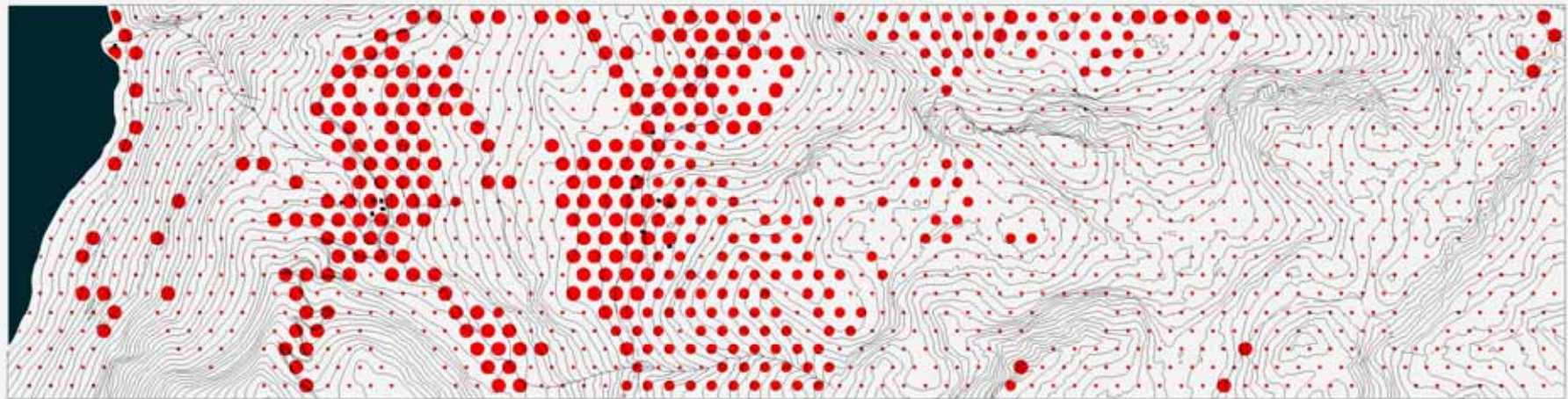
1 km

(Schmidtlein, 2001)



Field Surveys

Synanthropie



Maximaler von den Pflanzengesellschaften angezeigter Synanthropiegrad (Erläuterungen im Text)

- 1
- 2
- 3

(Schmidtlein, 2001)