

Monitoring of palsa mires in Sweden



"Mires and wetlands of the North Calotte", Vadsö 2019-10-03
Susanne Backe



Monitoring of palsa mires in Sweden



Working group for monitoring of palsa mires since 2007

Swedish Environmental Protection Agency SEPA - Johan Abenius

Brockmann Geomatics Sweden AB - Kjell Wester, Per Wramner, Niklas Hahn

County Administrative Board of Norrbotten - Susanne Backe

County Administrative Board of Dalarna - Urban Gunnarsson



County Administrative
Board of Norrbotten

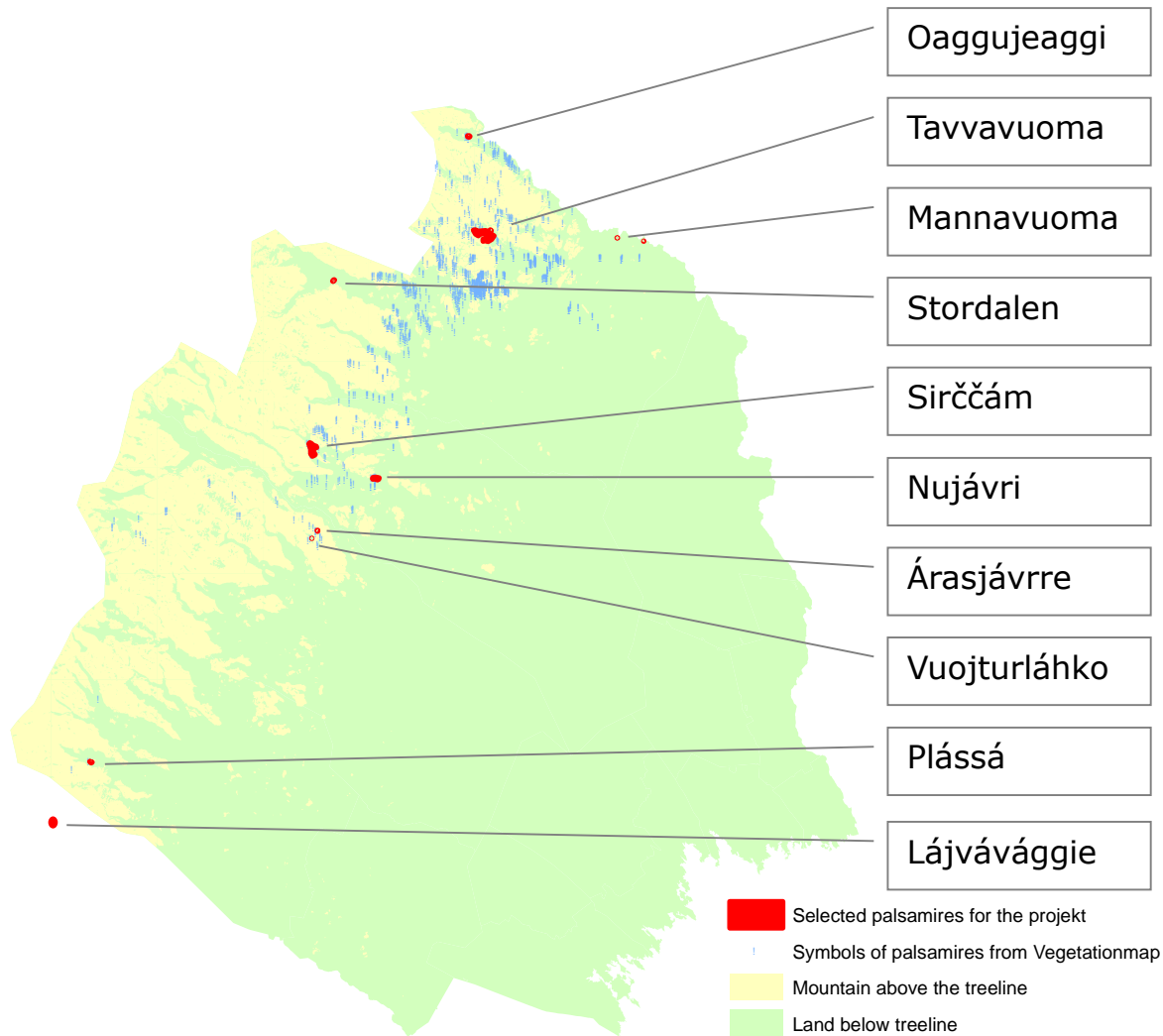
Monitoring of palsa mires in Sweden



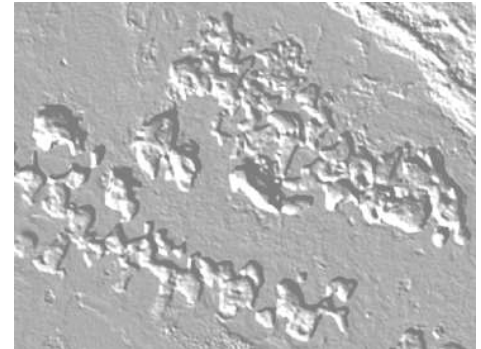
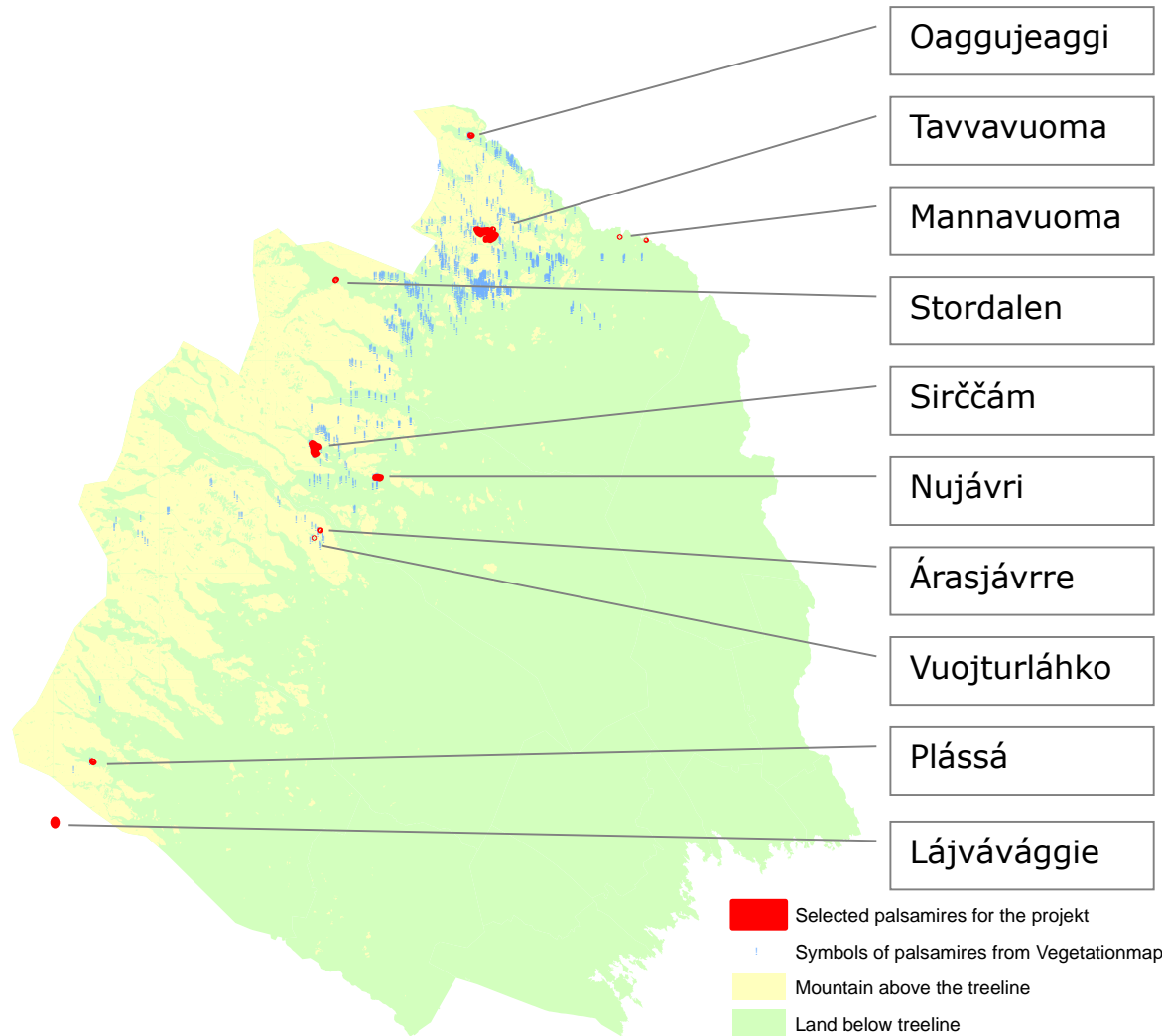
- Pilotstudie for monitoring of palsa mires 2009-2013
- Total mappning of all palsa mire in Sweden
- Monitoring program of palsa mires 2018



Pilotstudie for monitoring of palsa mires 2009-2013



Pilotstudie for monitoring of palsa mires 2009-2013



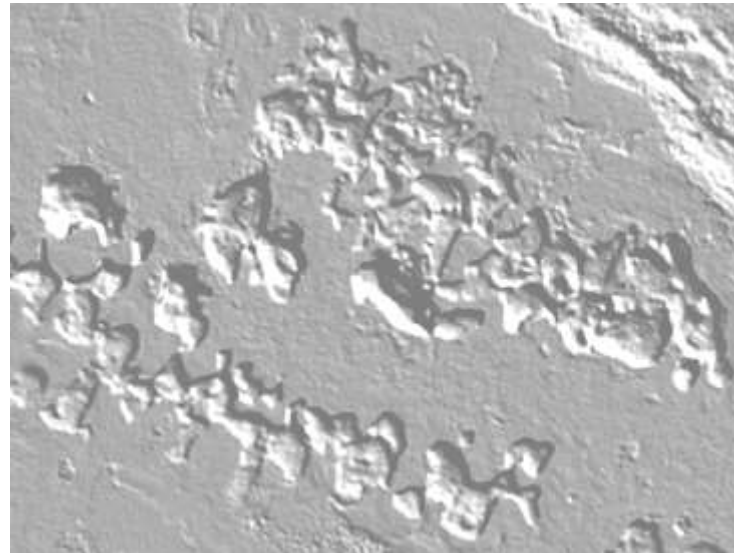
Laserscanning from 700 m
(5,5 pt/m² (+/- 0,1 m; 0,5 m grid))

Tavvavuoma 2007+2009
The other 9 palsa mires 2009

Pilotstudie for monitoring of palsa mires 2009-2013

Indata

- Laserscanning
- Satellite data
- Aerial orthophotos



High resolution satellite data 2003 –



Infrared orthophoto from 1970-80 and 2000's



Pankromatic orthophoto from 1950-60 and 2000's



Pilotstudie for monitoring of palsa mires 2009-2013

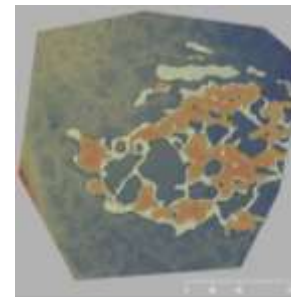


Comparing with historical data

Transects in field for palsastructurs, vegetationtyp, species and permafrostdepth

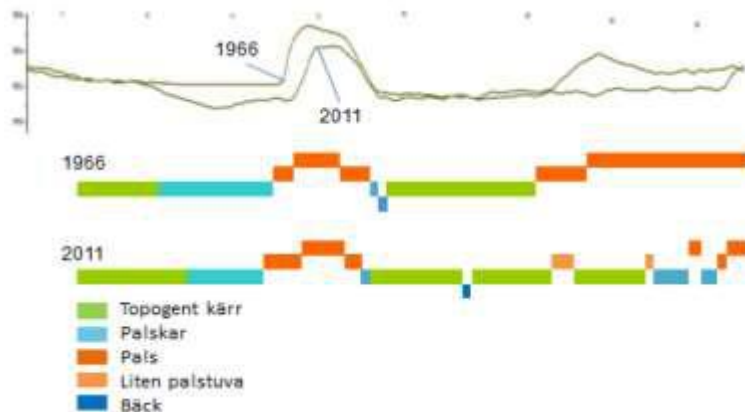
Transects in laserscanningsdata

Mapping of palsas

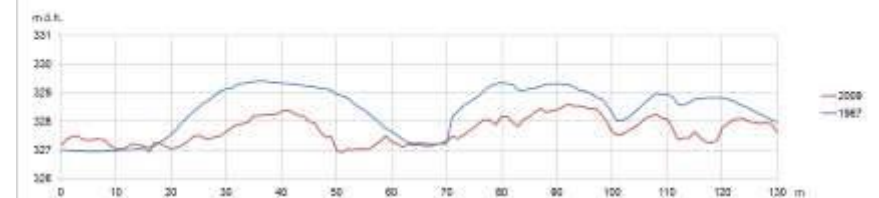


Mannavuoma
Mapping of palsas 1967 & 2009

Tavvavuoma 1967 & 2011



Mannavuoma Transect 1967 & 2009
Heigh of palsa (mean) 1,35 m & 0,85 m



Pilotstudie for monitoring of palsa mires 2009-2013

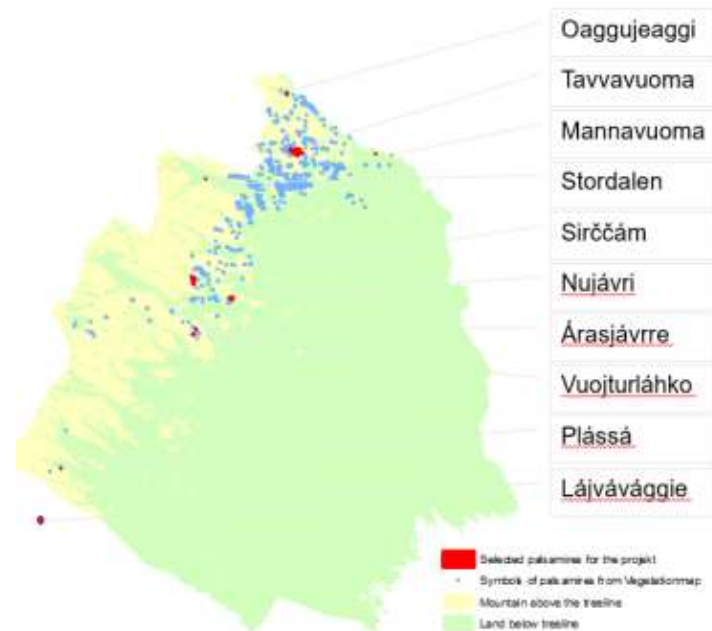


Förslag till övervakningsprogram
för Sveriges palsmyrar

Länstyrelsens rapportserie nr 16/2012



Program for monitoring of the palsa mires in Sweden

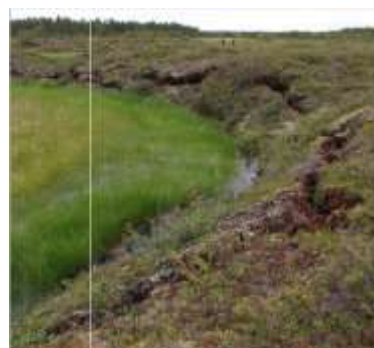


County Administrative
Board of Norrbotten

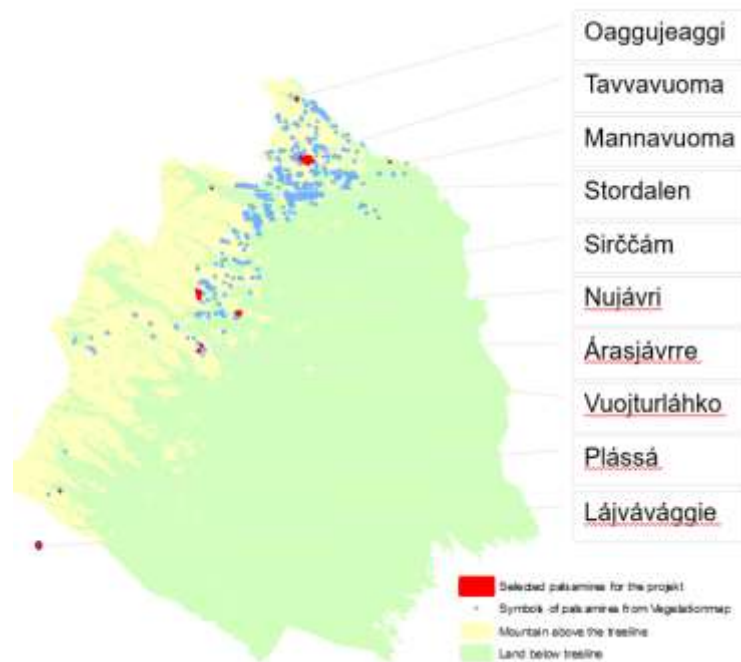
Monitoring of palsa mires 2013-2016



Tavvavuoma
 Inlands- dokumentation inom
 övervakningsprogram för Sveriges palarv
 Länsstyrelsen rapportnr nr 20/2013
 Länsstyrelsen
 Norrbotten



Mannavuoma
 Inlands- dokumentation inom
 övervakningsprogram för Sveriges palarv
 Länsstyrelsen rapportnr nr 21/2011
 Länsstyrelsen
 Norrbotten



Detailed documentation of 4 sites



Sirččám
 Inlands- dokumentation inom
 övervakningsprogram för Sveriges palarv
 Länsstyrelsen
 Norrbotten



Oaggujeaggi
 Inlands- dokumentation inom
 övervakningsprogram för Sveriges palarv
 Länsstyrelsen rapportnr nr 1/2016
 Länsstyrelsen
 Norrbotten

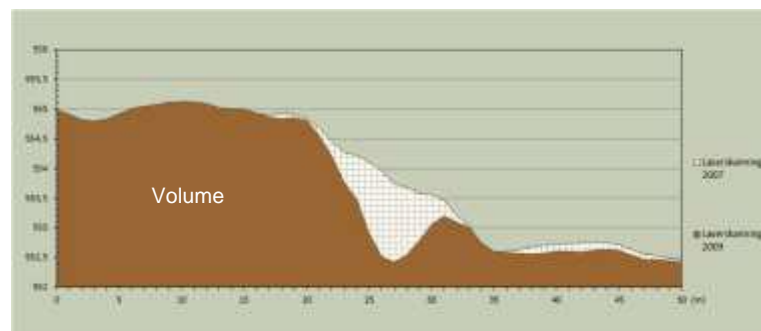
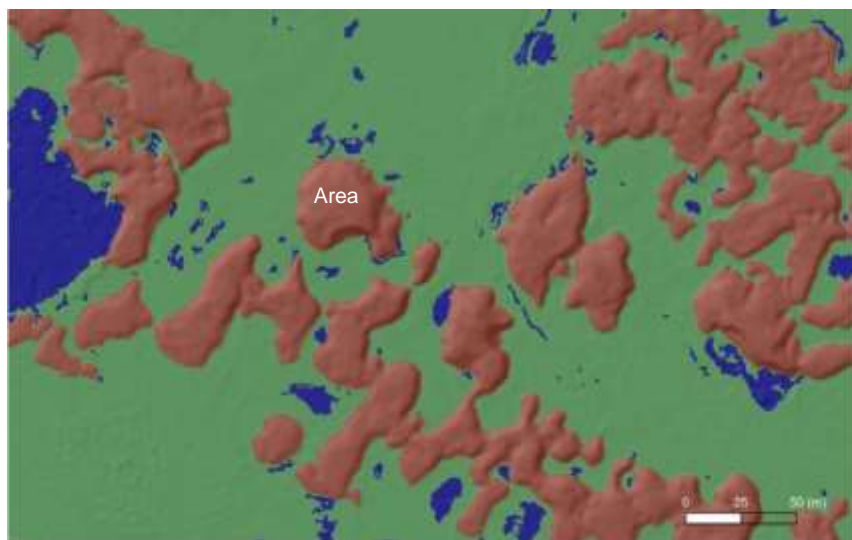
Monitoring of palsa mires 2013-2016

Area and volume of the palsas

- most useful parameters for describe the whole palsa mire population

The detailed documentation only describe the subjectiv selected palsa mires

...so we start a revision of the program



Mapping of all palsa mires in Sweden

For the report for Article 17 of Habitats Directive 2013
SEPA needed to update area of all palsa mires

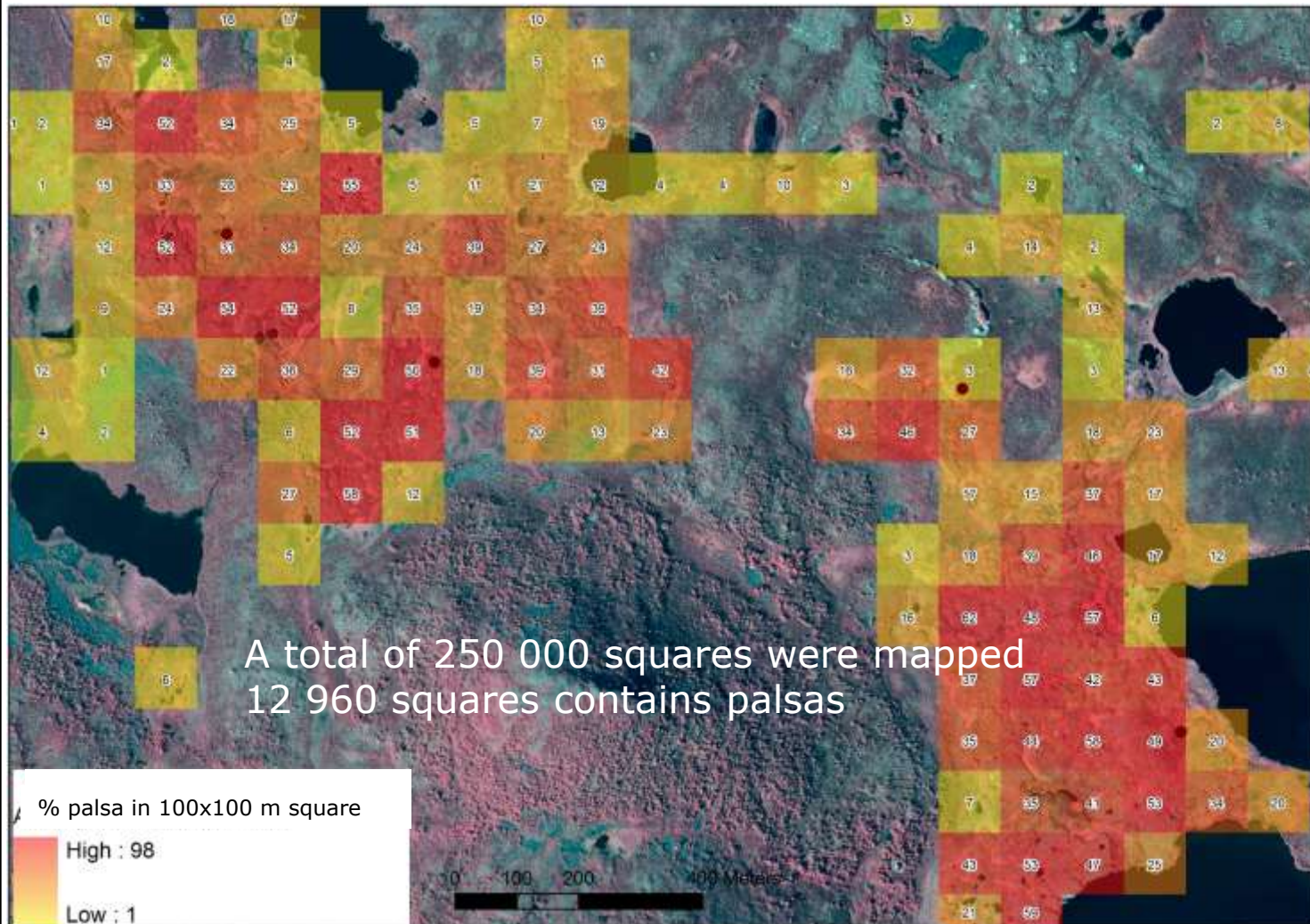
County Administrative Board of Norrbotten
get the assignment to develop a quick method



Mapping of all palsa mires in Sweden



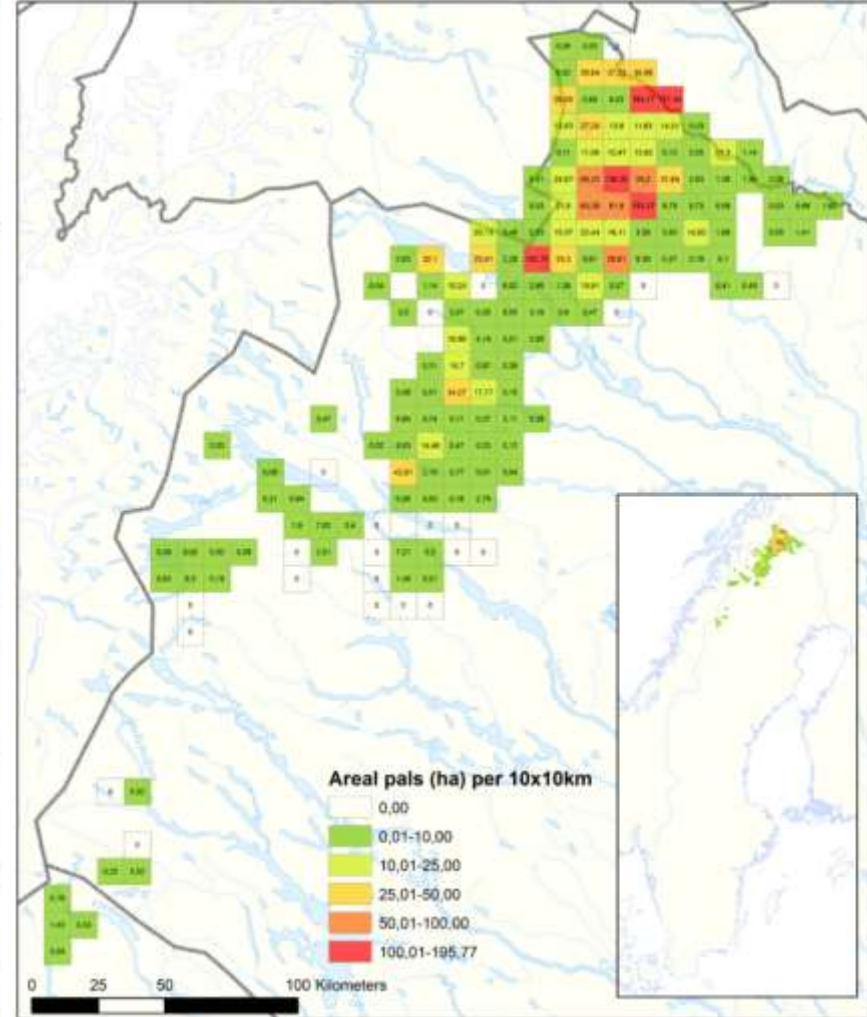
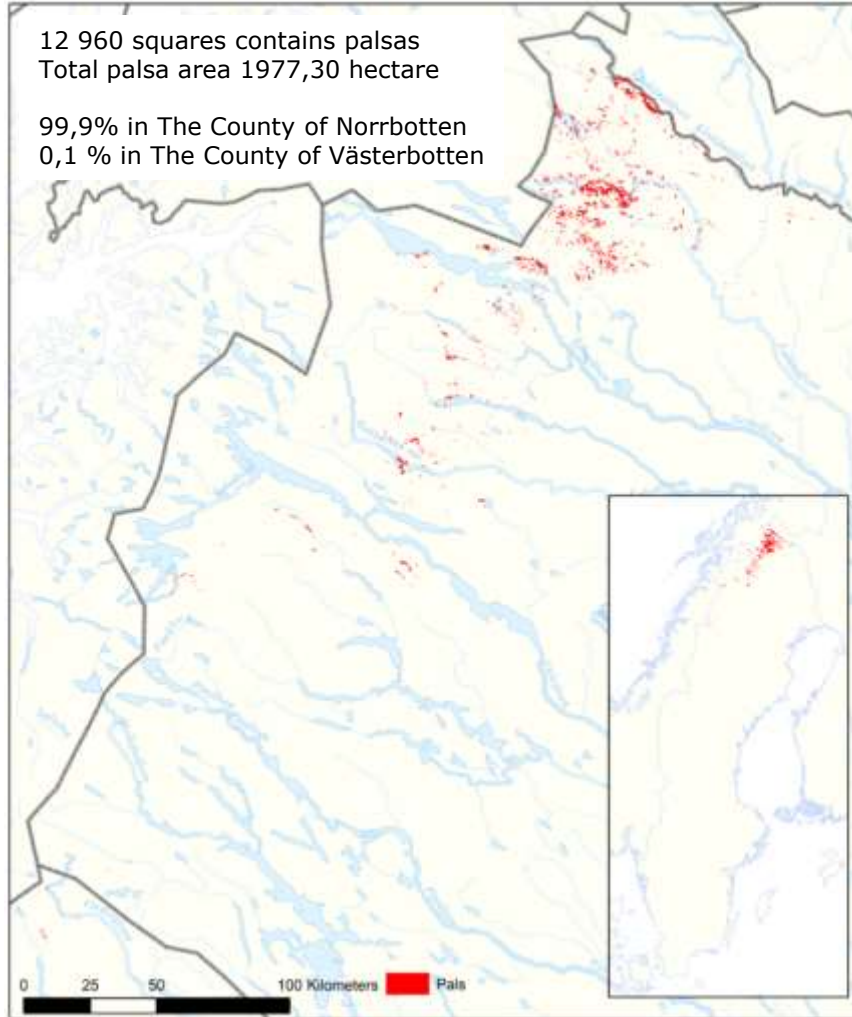
Mapping of all palsa mires in Sweden



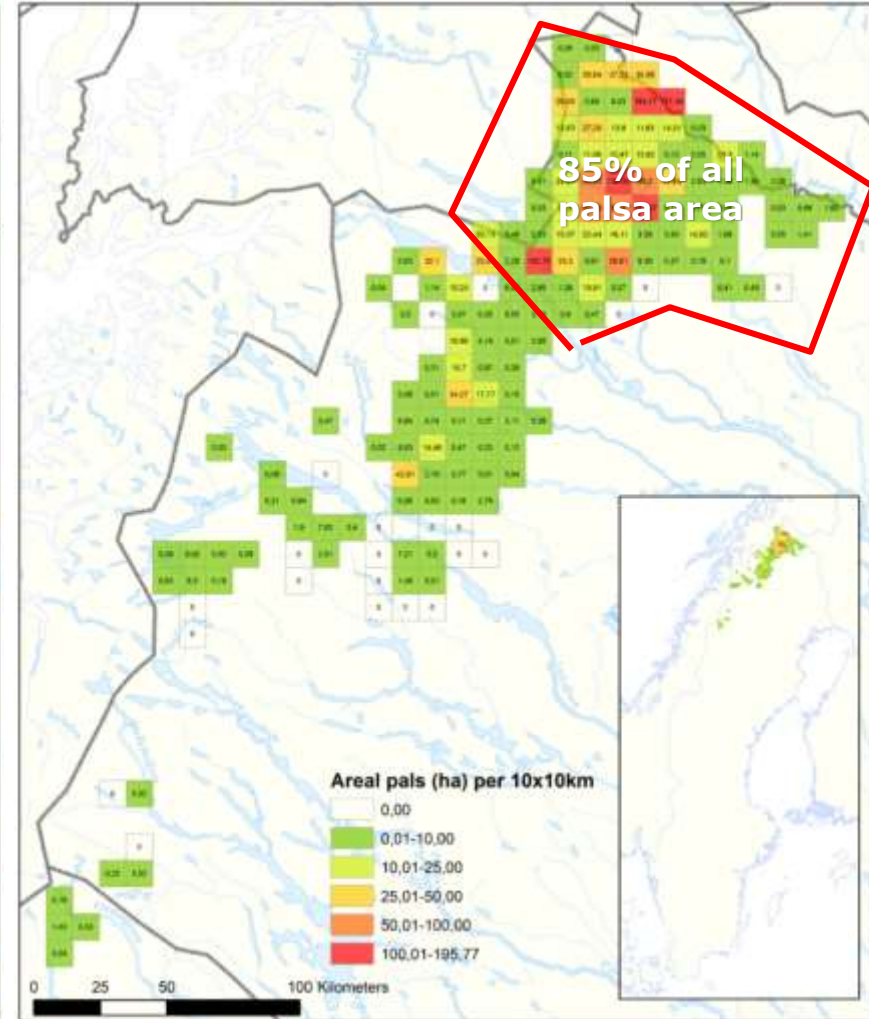
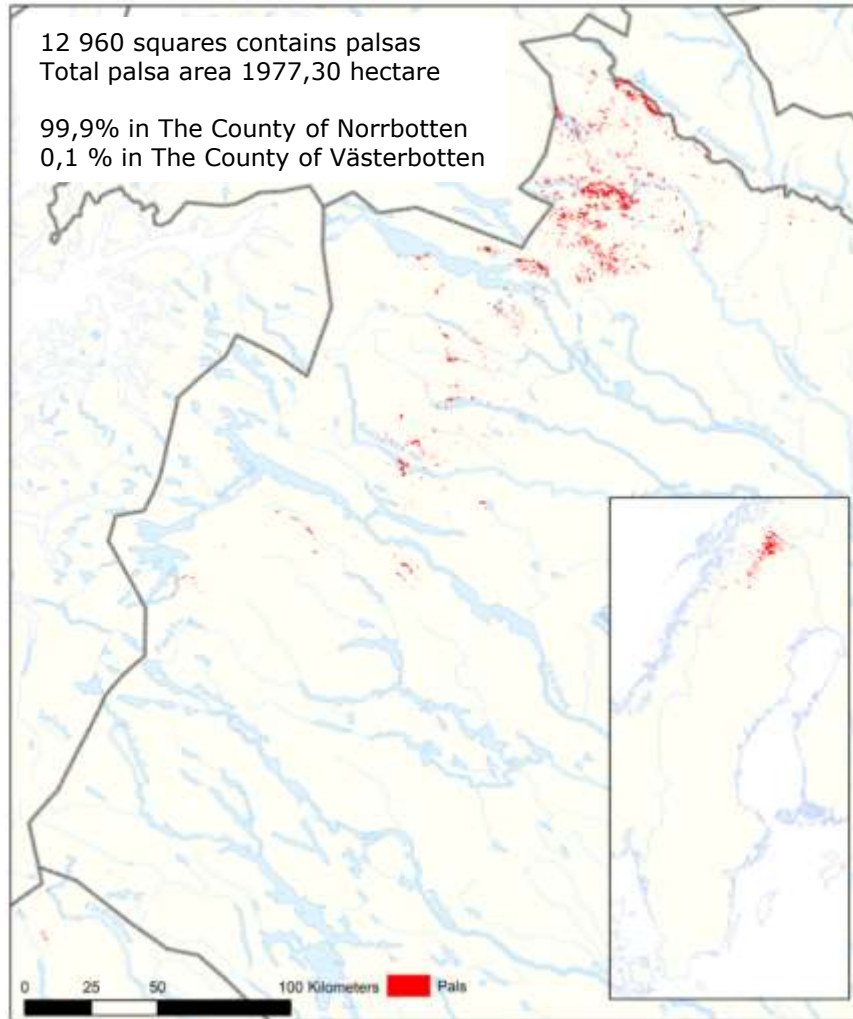
Mapping of all palsa mires in Sweden

12 960 squares contains palsas
Total palsa area 1977,30 hectare

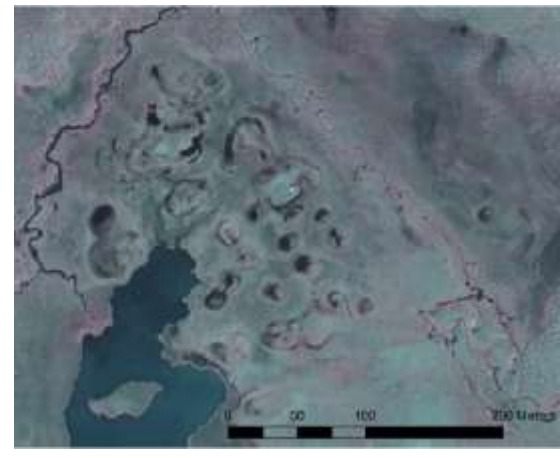
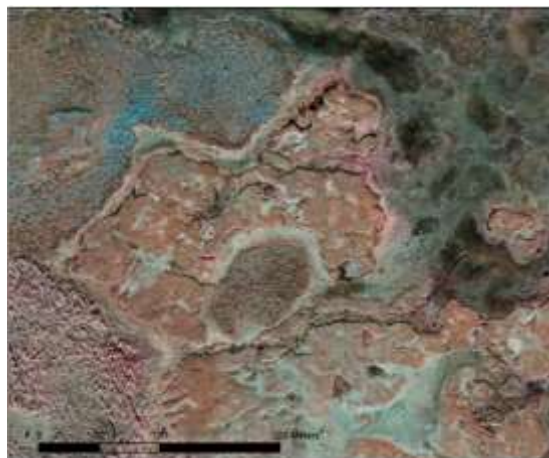
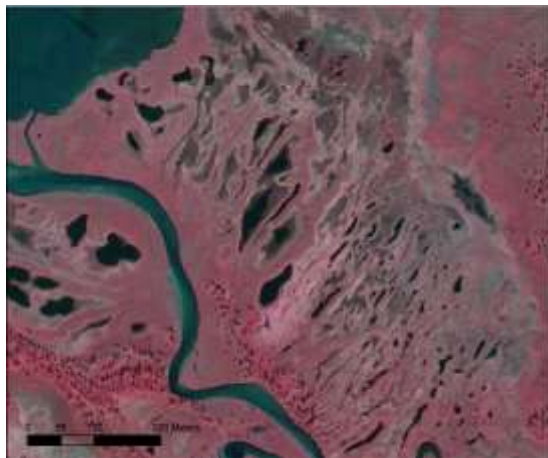
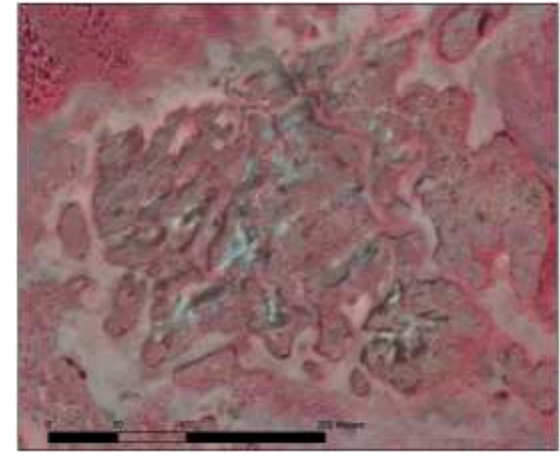
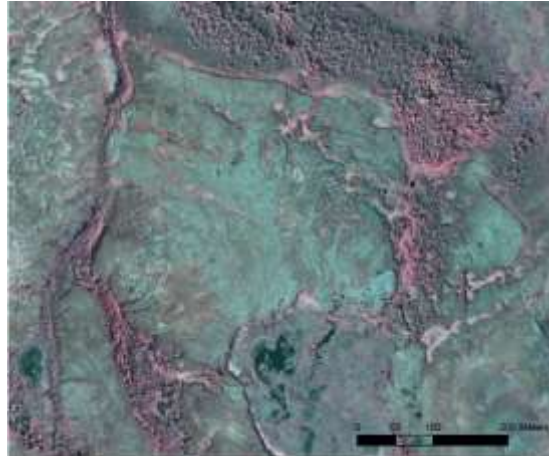
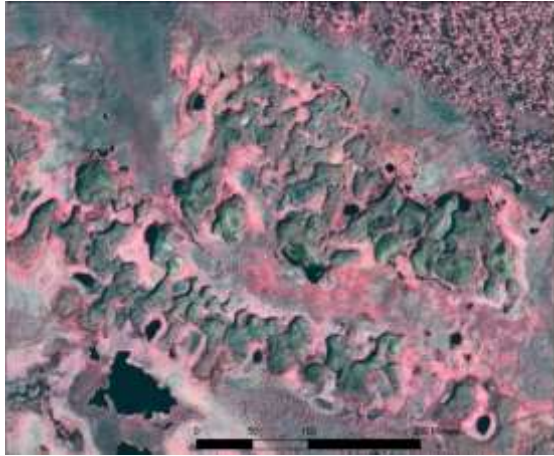
99,9% in The County of Norrbotten
0,1 % in The County of Västerbotten



Mapping of all palsa mires in Sweden



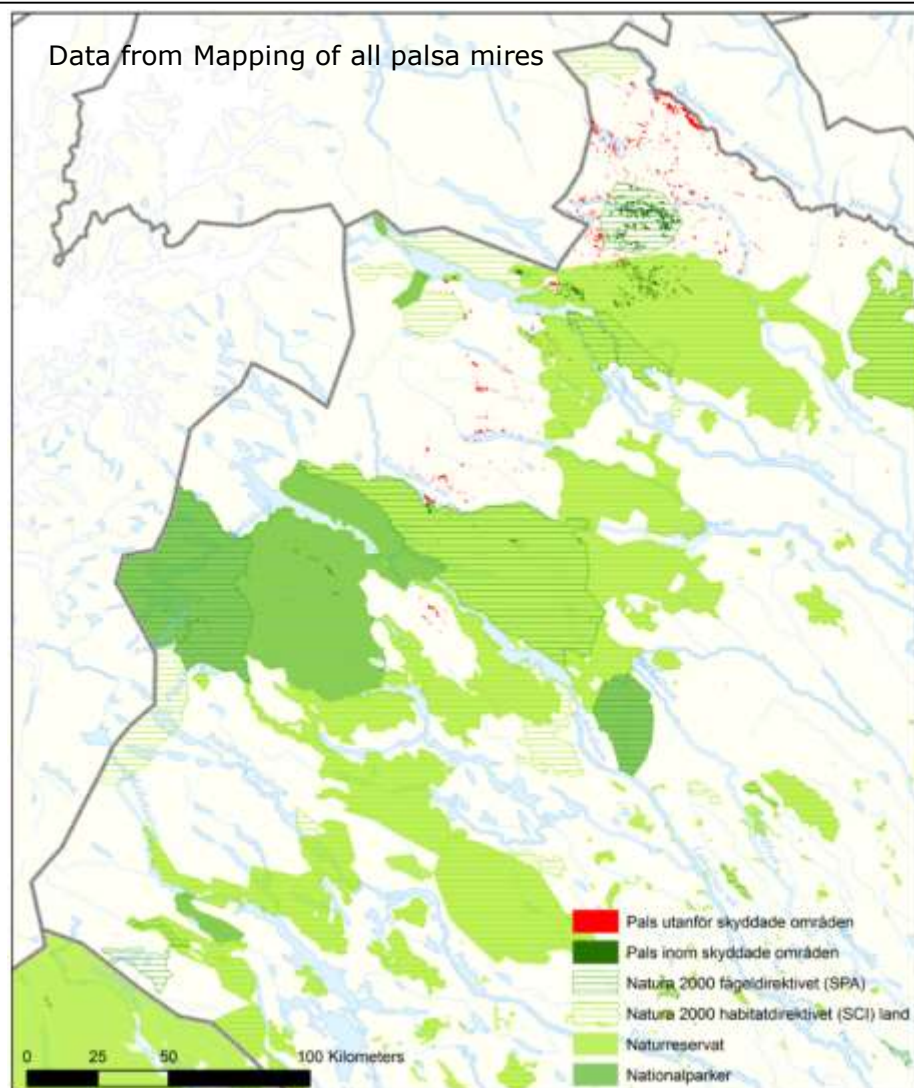
Mapping of all palsa mires in Sweden



Mapping of all palsa mires in Sweden



Protection of palsas in Sweden

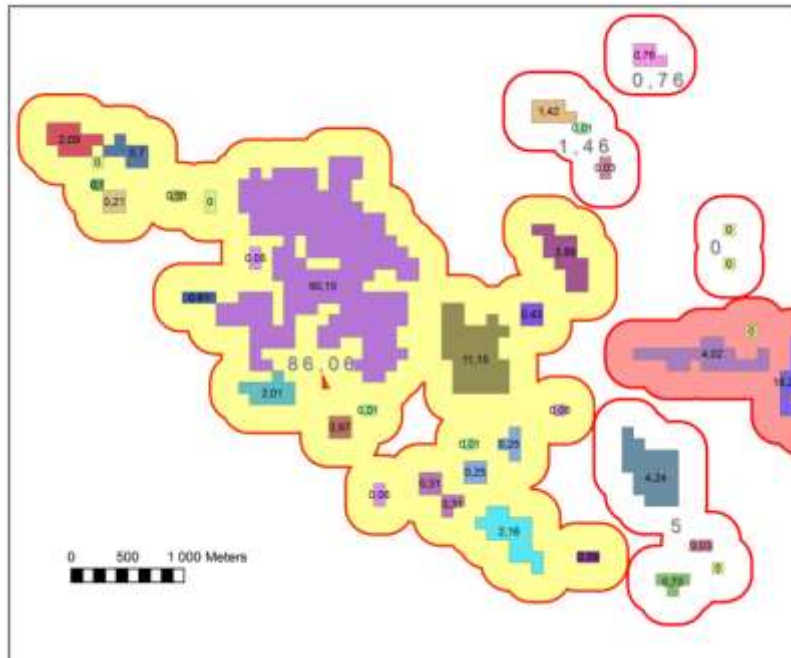


47 % of all the palsas are in protected areas
(National Parc, Nature Reserve, Natura 2000 SPA- or SCI-site)

Easy to summery area of palsas.
Exemple Natura 2000-sites:

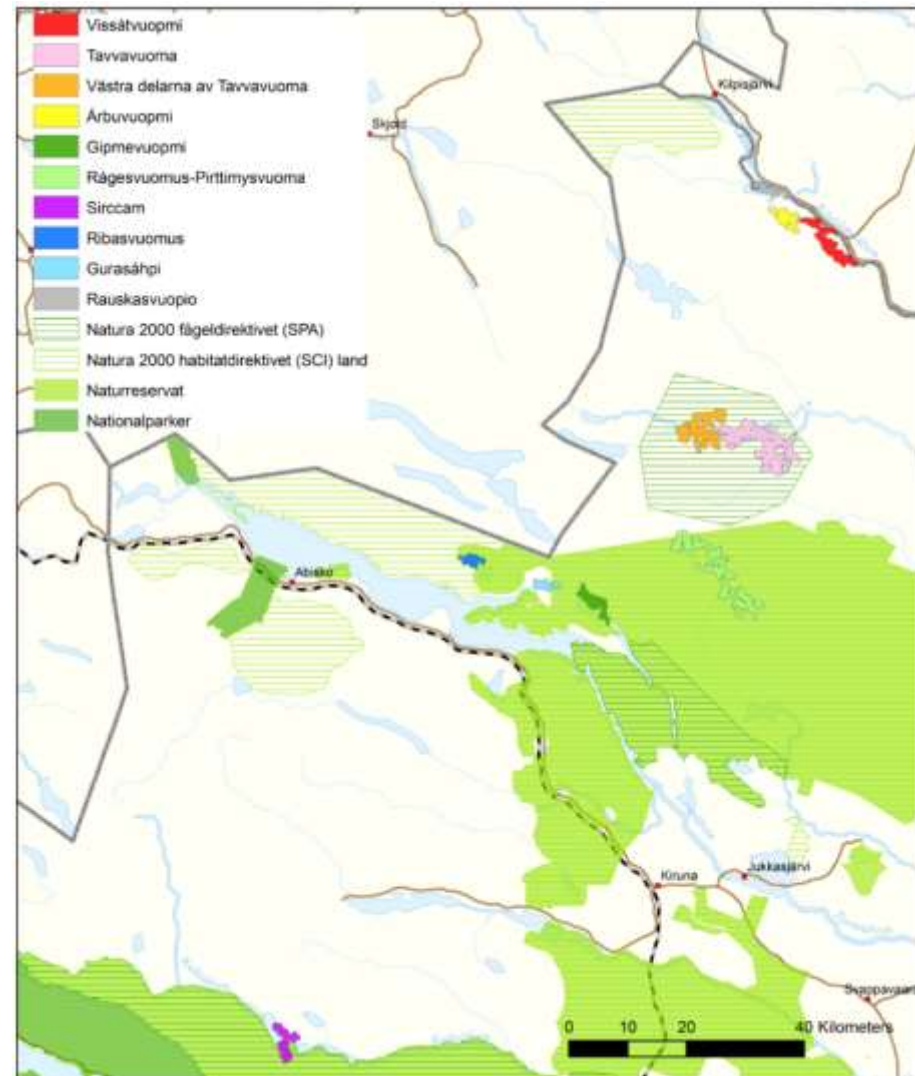
Name	Squares with palsa	Area palsa (hectare)
Tavvavuoma	3 731	563,76
Torneträsk-Soppero fjällurskog	2 159	279,29
Sjaunja	244	23,97
Rautas	174	14,71
Stordalen	54	11,81
Sarek	118	9,56
Padjelanta	85	7,44
Nissuntjärro	32	5,05
Alajaure	39	3,91
Stora Sjöfallet	32	3,70
Vindelfjällen naturreservat	61	1,99
Norra Torneträsk	19	0,92
Abisko	5	0,53
Laisdalens fjällurskog	8	0,52
Hornavan-Sädvajaure fjällurskog	5	0,52
Kaitum fjällurskog	5	0,37
Pältsa	7	0,29
Summa:	6 778	928,34

10-top – area of palsa mires

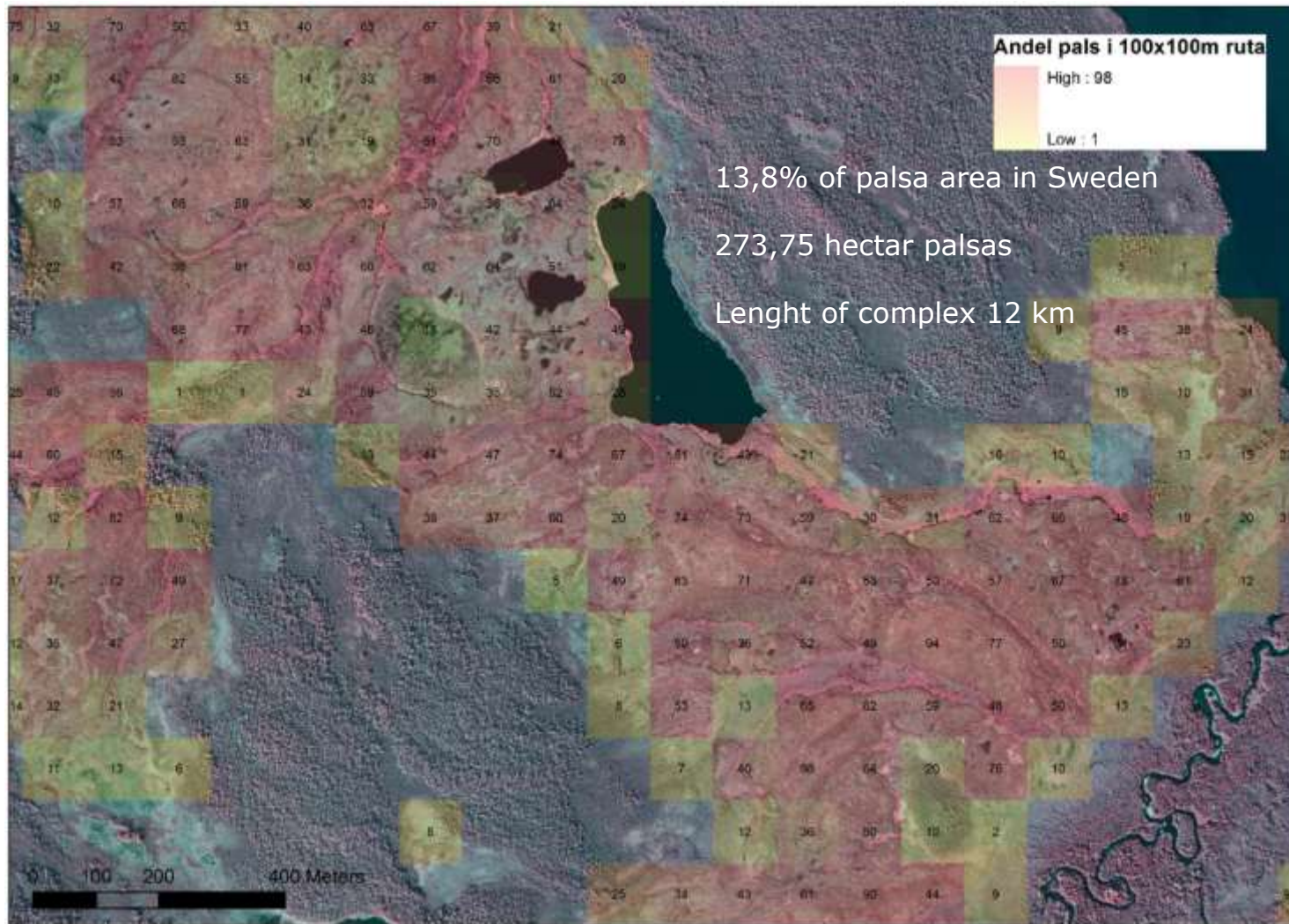


GIS-analysis to sum area of palsas for palsacomplex

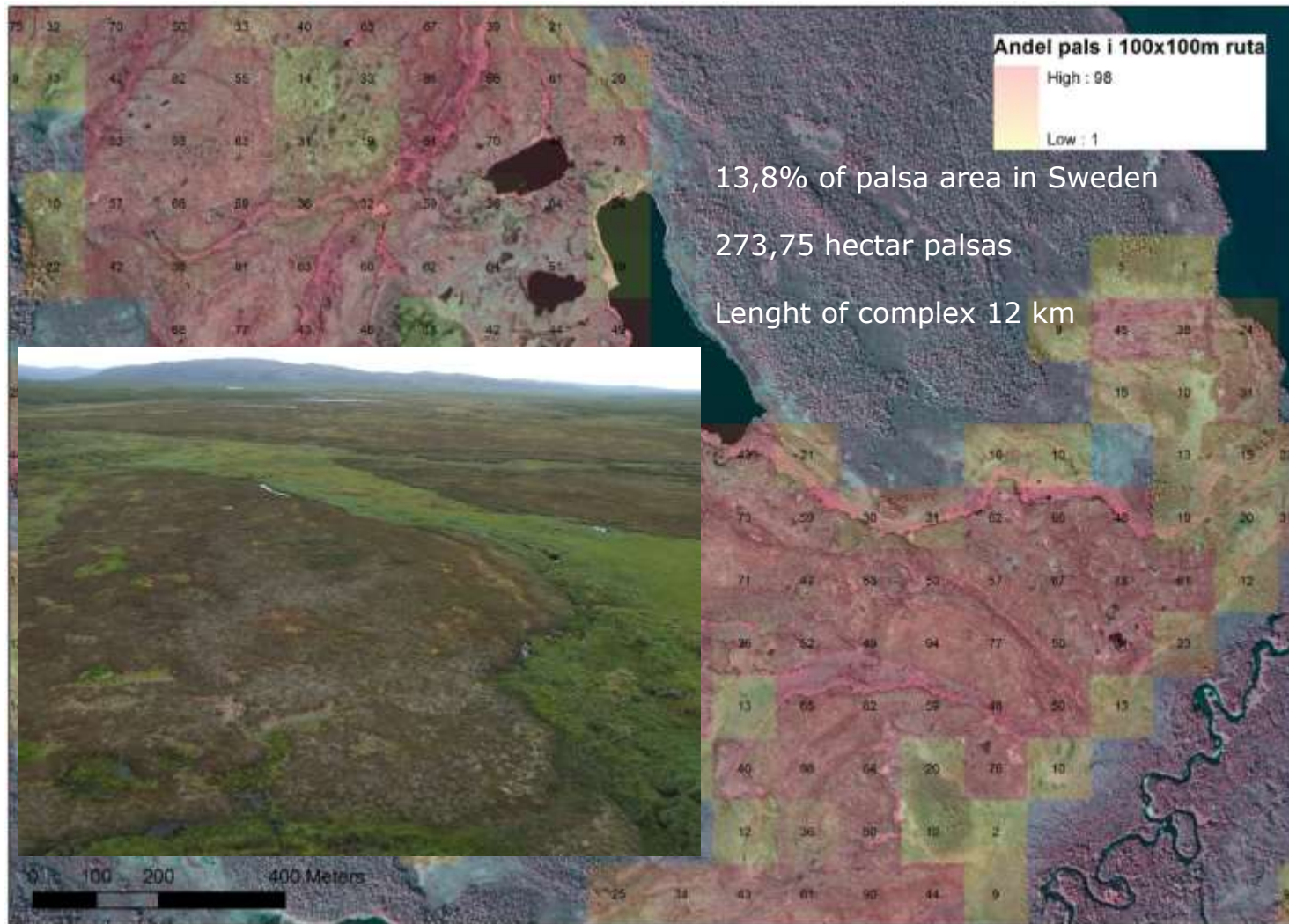
- Adjacent square with palsas or
- Buffer 250 m from square with palsas



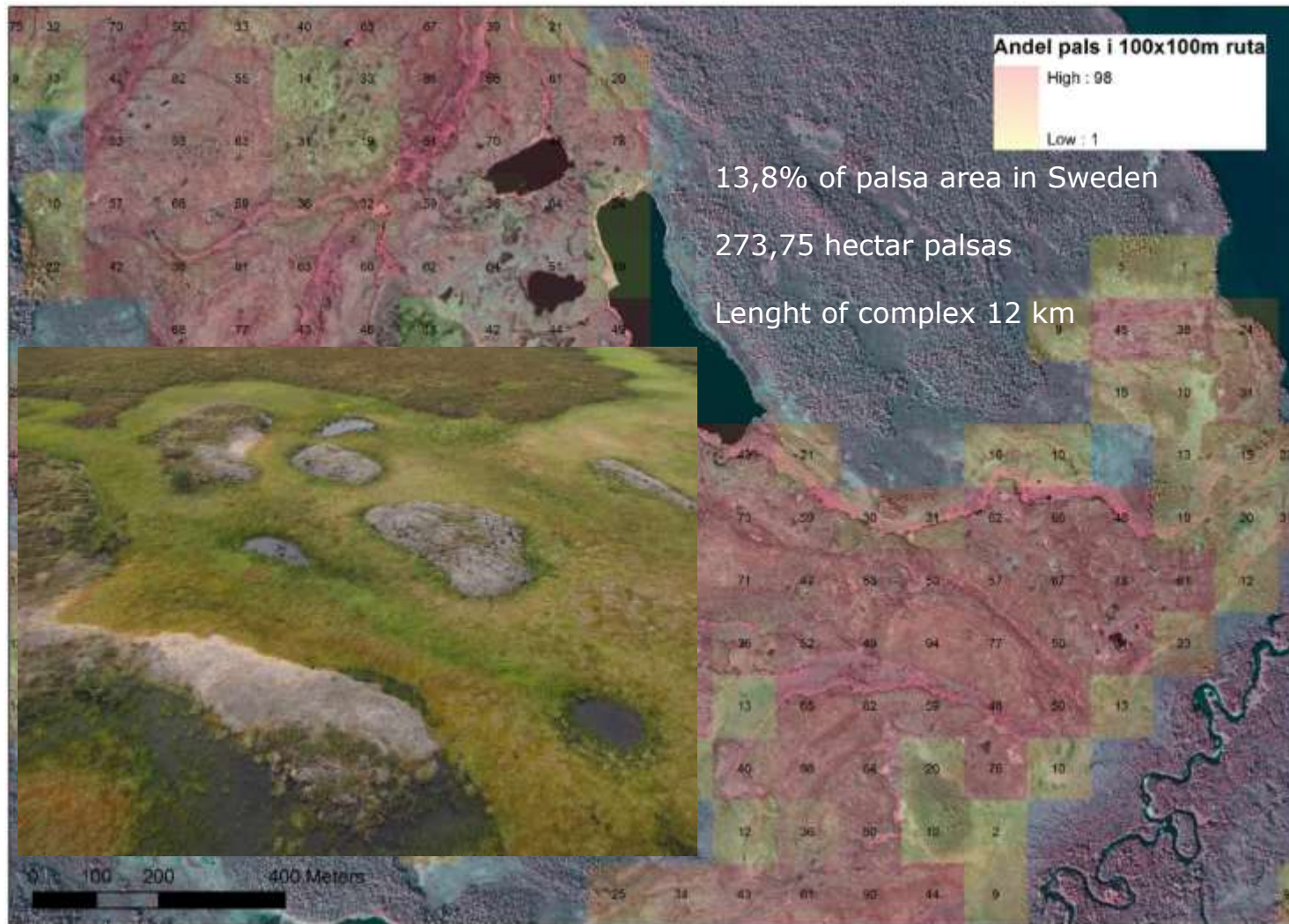
Number 1 - Vissátvuompi



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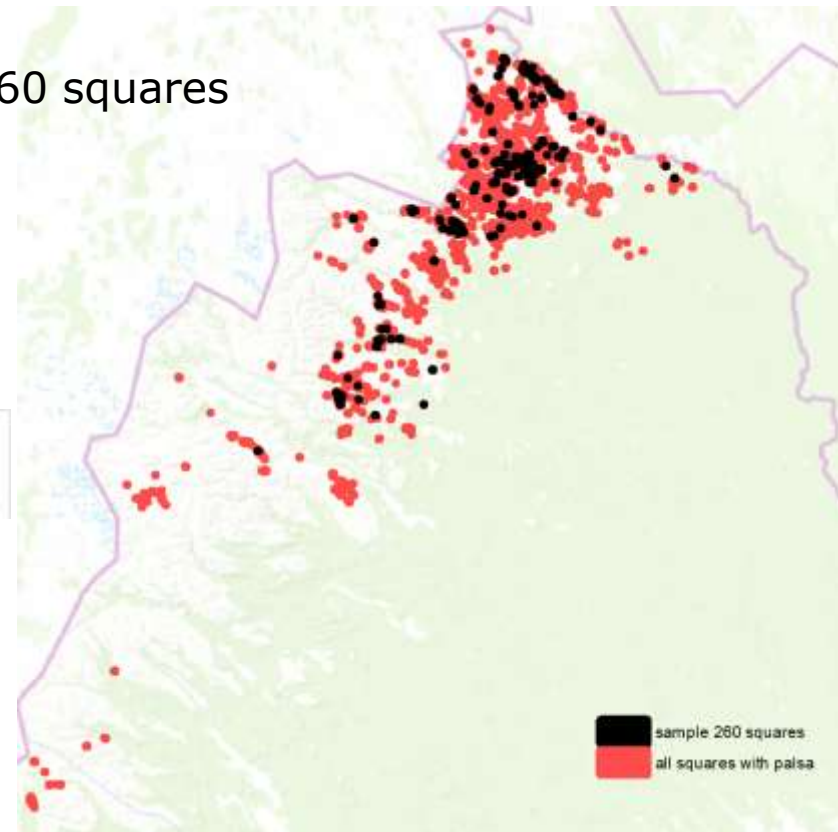
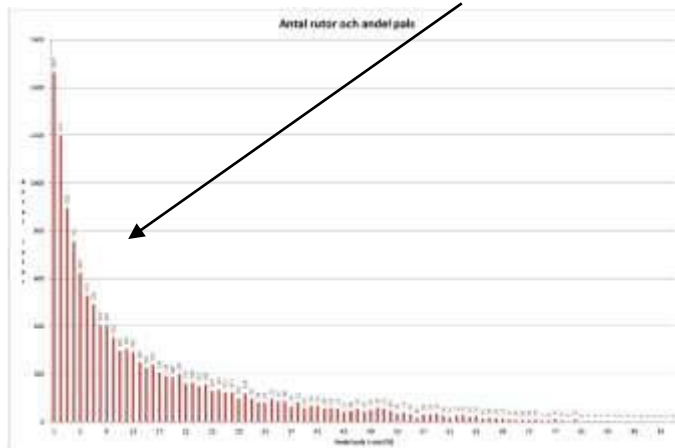
2019 Report for EU's Article 17

Total palsa mire population = The 12960 squares

260 squares random sampled
stratified from 20 groups
(depending on how much palsas 2013,
13 from each group)

1	1-4 %
2	5-7 %
3	8-10 %
4	11-13 %
5	14-16 %
6	17-19 %
7	20-22 %
8	23-25 %
9	26-28 %
10	29-31 %
11	32-34 %
12	35-37 %
13	38-41 %
14	42-45 %
15	46-49 %
16	50-53 %
17	54-58 %
18	59-63 %
19	65-73 %
20	74-87 %

Stratified because
the amount of squares with low % palsa is high

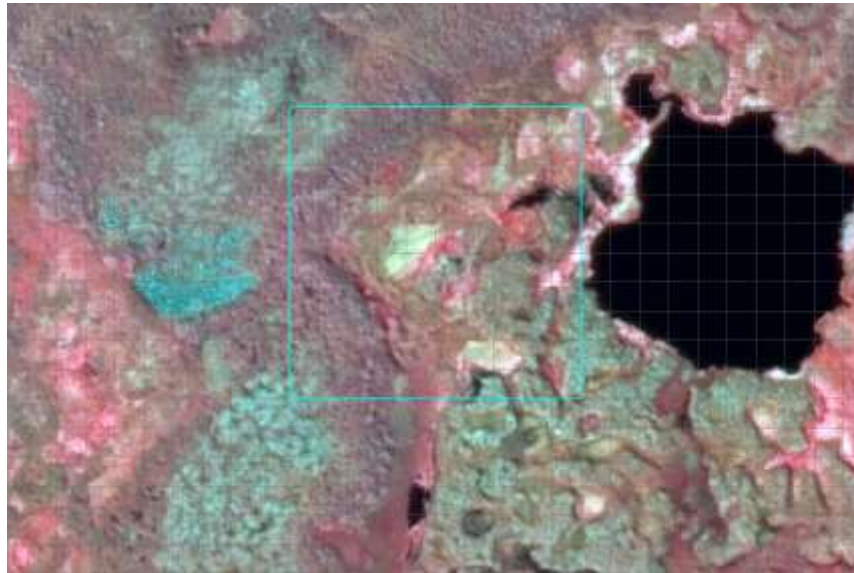


New aerial photos från 2016-2018
to compare with Total mapping 2008-2010

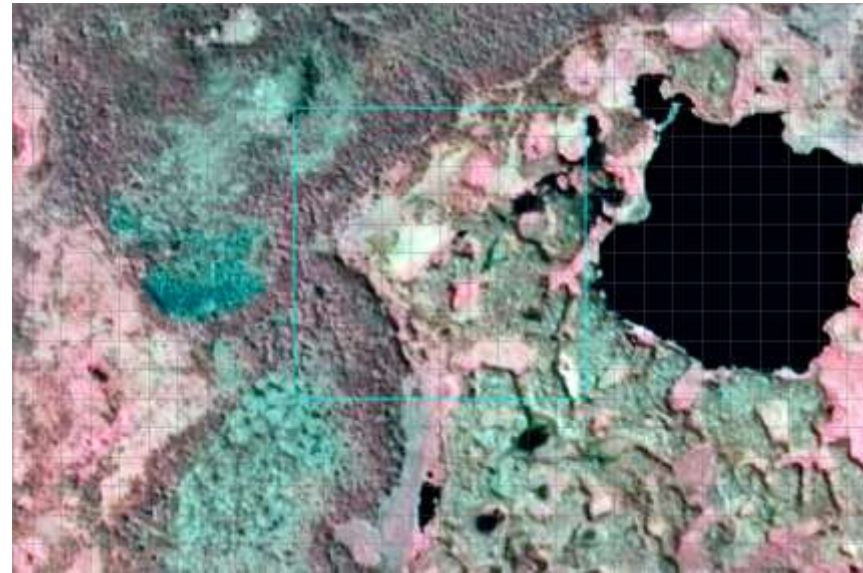


2019 Report for EU's Article 17

Exemple compair palsa area of a 100x100 m's square



2010 : 19%



2016 : 16%

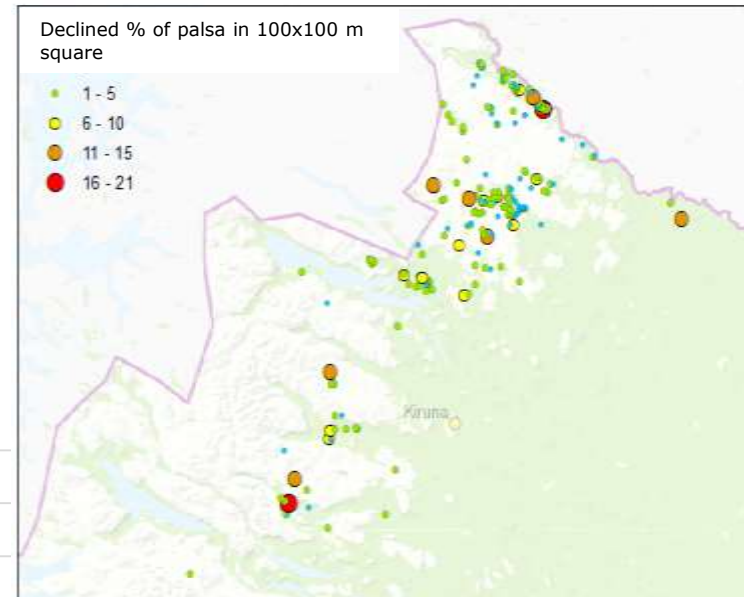
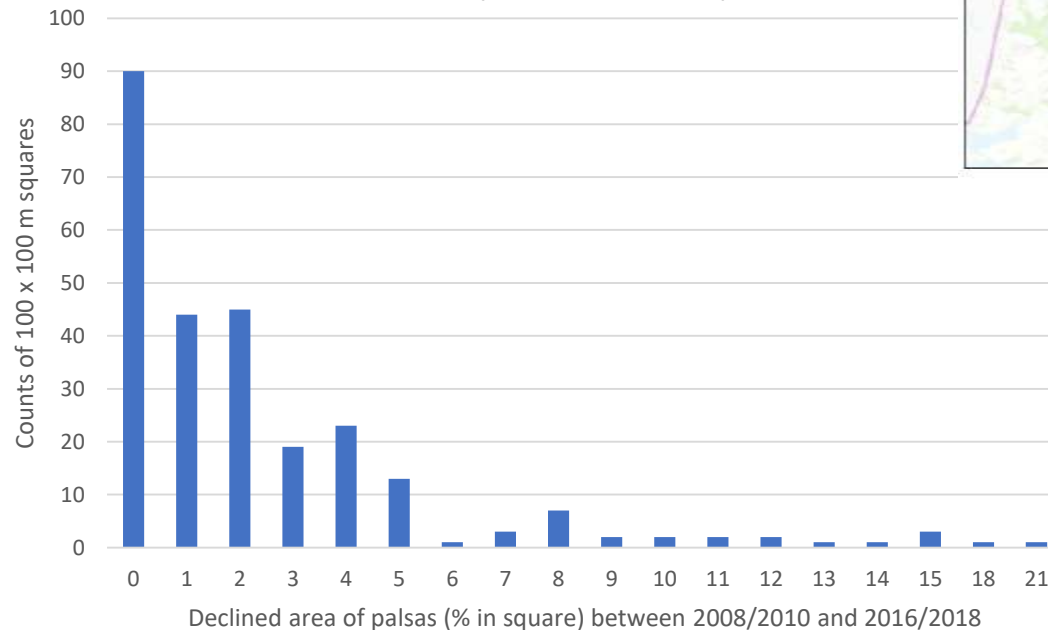


2019 Report for EU's Article 17

Differences 2013 and 2019

- 35 % intact
- 65 % decline palsarea 1-21% (mean 2,4%)

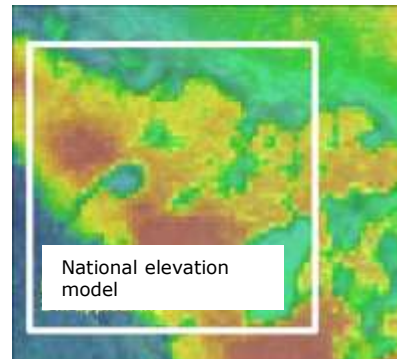
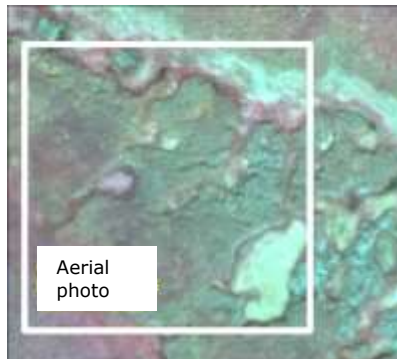
Counts of squares and declined area of palsa between 2008/2010 and 2016/2018



Program of monitoring program revision 2018



- Not continue with the 10 sites from pilotstudie (subjectiv selected)
- 260 randomly selected squares
 - Total mapping method 2D in 260 squares
 - Detailed **area** in 3D and **volume** in the same 260 squares
 - Aerial photos (Lantmäteriet, The Swedish mapping, cadastral and land registration authority)
 - National elevation model (2 m resolution)



Program of monitoring program revision 2018

1. Elevation model



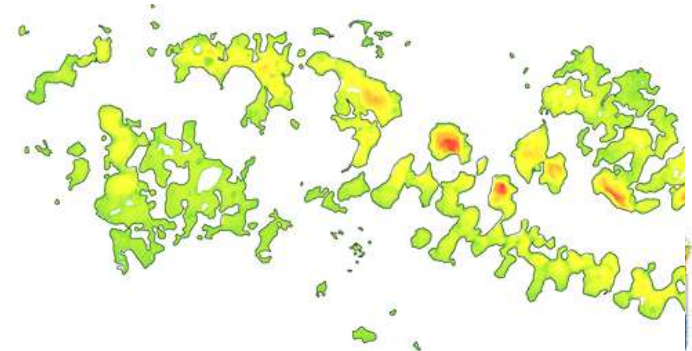
2. Detailed mapping of palsas = Palsa area



3. Delete data with no palsas from elevation model



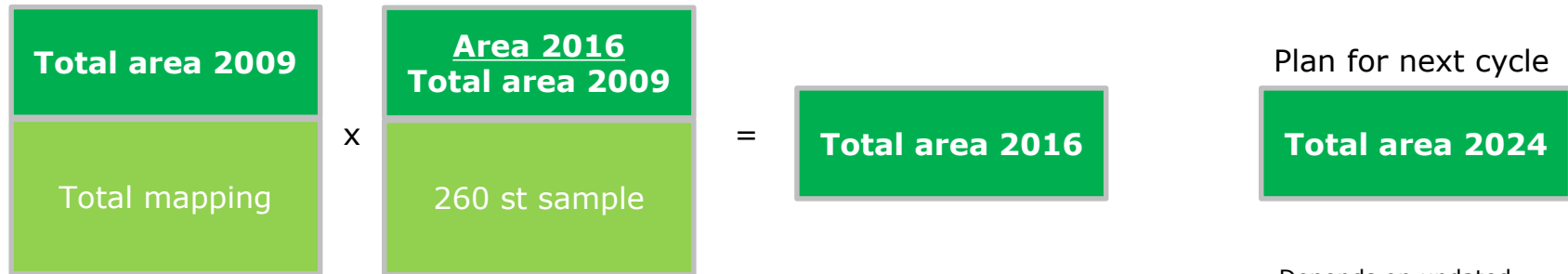
4. Calculate the mean height of palsas



5. Palsa volume = Palsa area x Palsa height (mean)

Program of monitoring program revision 2018

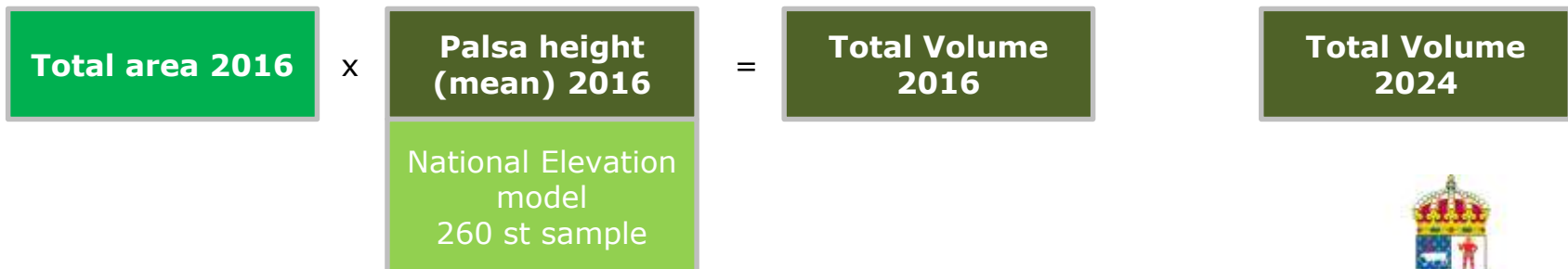
Monitoring parametres – “**National total palsa area**” and “**National total palsa volume**”



Plan for next cycle

Total area 2024

Depends on updated
aerial photos and
elevation models



Thank you!

At least we now have better knowledge of the palsa mires

