Monitoring vegetal landscapes of the Gabna reindeer herders community (northern Sweden): links between current temperatures raises and ecosystems borealization

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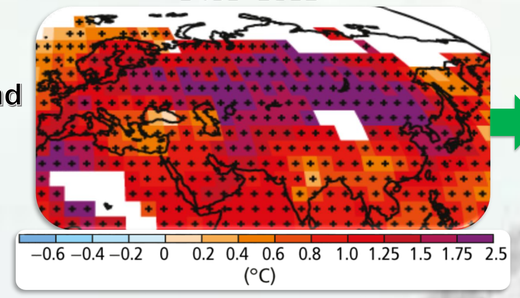
Introduction

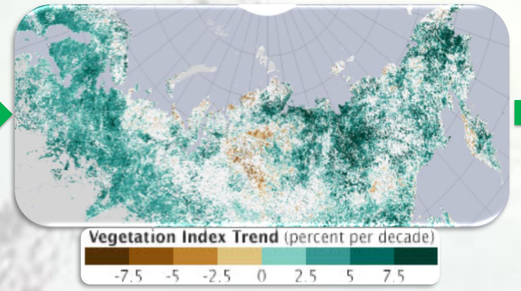
- Climate warming effects are stronger for arctic and subarctic regions (fig.1)
- This tends to borealize arctic and subarctic ecosystems (recent process of increase of woody and shruby biomass; fig. 2 and 3)
- The Gabna community is a saami reindeer herders traditional association in northern Sweden (fig.4)
- We want to know here how much reindeers seasonal pastures (and other pastoral units) are impacted by borealization

Observed change in Earth' surface temperature 1901-2012



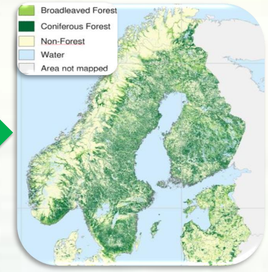
(source: IPCC, 2013)

Observed change in vegetation index 1982-2011 (Eurasia)



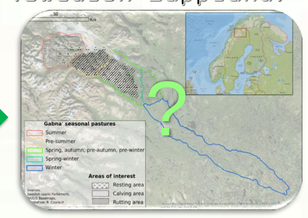
(source: NASA, Earth Observatory, 2013)

Forest cover in Nothern Europe (2006)



(source: http://forest.jrc.ec.europa.eu/activities/forest-mapping/)

Reindeer pastures of Gabna' community (Swedish Lappland)



(source: Swedish Saami Parliement, RenGIS 2.0; realization R. Courault 2018;)

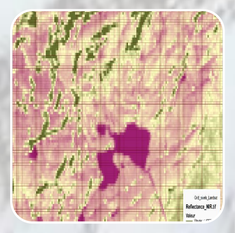
Material and methods

1- Imagery acquisition

- Making diachrony comparable...
- Landsat surface reflectance products
- End of July 1990 – 2006 – 2017 (same tile: WRS 2, path : 197, row : 012)

2- NDVI thresholds computation

- NDVI thresholds (intensity) as proxy for vegetation cover…
- NDVI > 0.8 (woody layer extent)
- NDVI > 0.5 (shruby layer extent)
- NDVI >0.15 (herbaceous layer)



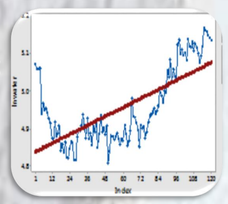
3- Multi-date extent quantification

- Is treeline advancing? Which seasonal pastures are the most impacted?
- GIS extent calculation (RasterToVector and Areas Attributes Fields creation)

NDVI >0,7 (km2)	1990	2017
Gabna unit	973,5	1631
Calving area	181,7	345,8

4- Linking vegetation dynamics with monthly temperatures

- For the same time period, are monthly T°C showing the same evolution?
- Monthly T°C 1988-2017 (Abisko)
- Mann-Kendall (MK) trend test
- Magnitudes of the linear models time-T°C



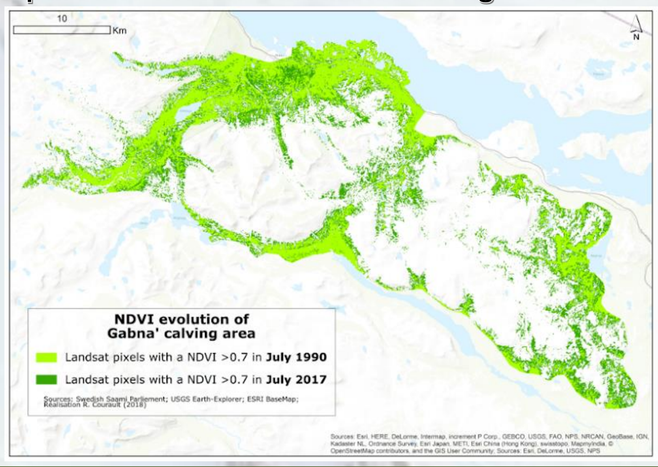
Results

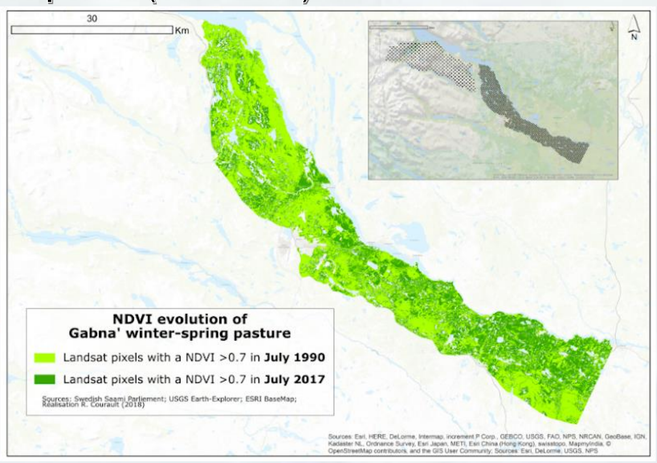
1- Pastoral units : strong evidence for borealization/shrubification (1988-2017)

- Across the time period (1990-2017), results show a general increase of surfaces with NDVI is >0.15; >0.5; 0.7 for each spatial unit
- For the threshold of NDVI >0.7, the rise is stronger for winter pastures (+81,1%) and shoulder seasons (spring-winter +69,7%) compared to summer pastures (pre-summer: +58,2%, summer +44,1%). Vegetal formations described by high woody species or low woody species are densificating and / or in extension

2- Regional temperatures : winters preceding the monitored years showing significant positive anomalies

- 9 months on 12 present an increasing trend, with a modelized trend going from +0,5 to 2,1°C (1990-2017). MK trend tests show that january, may and september are particularly significant (p-value <0,05)
- Winter temperatures (DJF) which precede the three phenological peaks present positive anomalies compared to means calculated using the reference period (1990-2017)





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IPCC, 2013)

https://www.sametinget.se/english

http://forest.jrc.ec.europa.eu/activities/forest-mapping

More informations

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