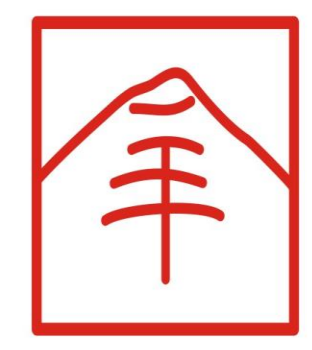


Impact of the ecological footprint on the loss of ice and glaciers



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THE GLOBE PROGRAM

Global Learning and Observations to Benefit the Environment

Abstract

The loss of snow due to snowmelt is a serious problem worldwide that progresses year after year and is attributed to the global warming generated by the pollution caused by climate change. In our area, it directly affects the availability of water in ecosystems and productive systems, increasing the risk of fires. The warming causes the melting affect the poles and in the mountains causes the loss of the thickness and extension of glaciers. Excess water generates floods due to sea level rise; shortage of fresh water and droughts and fires in areas dependent on melting in summer. To analyze the loss of glaciers in the Patagonia region, Argentina, two sites were compared using Landsat 5 and 8 images corresponding to the years 2005 and 2017. The Landsat 8 images were validated with samplings in the terrain using the GLOBE Protocols. The NDVI, NDWI and NDSI indices were calculated using the QGIS software. Ice loss was detected in both sites, which can produce an increase in drought, due to lower availability of water, particularly in the summer (which is the dry season and the melting of the available water resource).

Research Question

- What is the impact of the ecological footprint on the loss of ice and glaciers?
- How is this impact in our region compared to other places in the world?
- Can satellite images be used to observe this impact?

Introduction

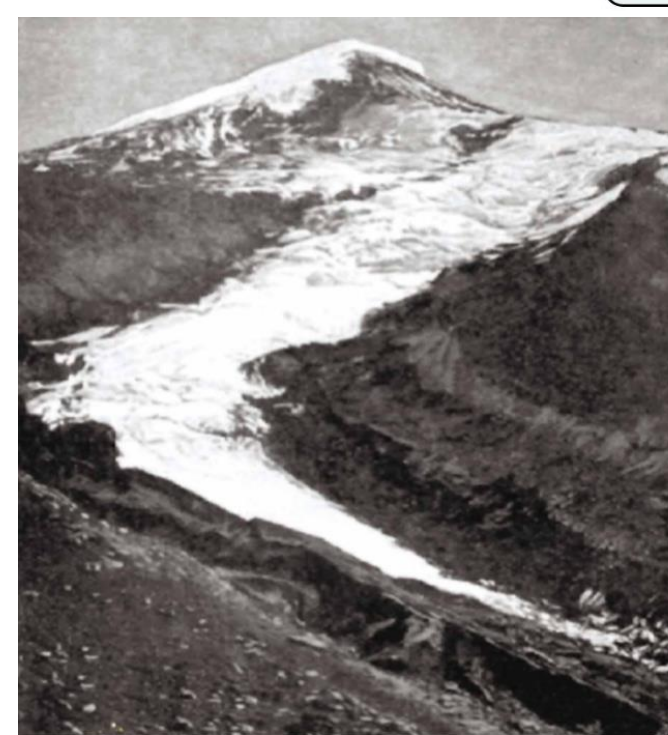
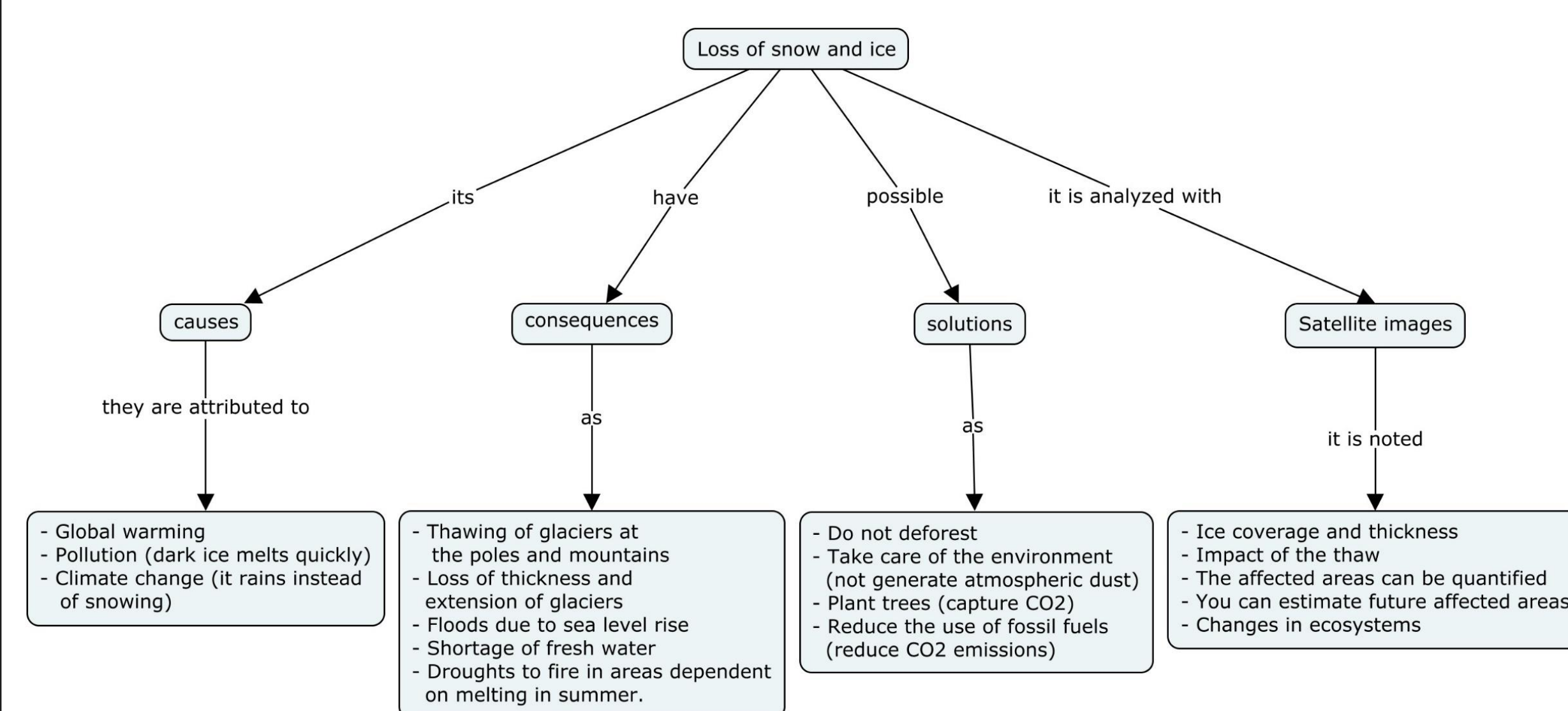


Foto: Francisco P. Moreno en 1896



Foto: Delgado, et.al., 2001



Glaciar Upsala



Fuente: "La verdad incómoda". Documental.

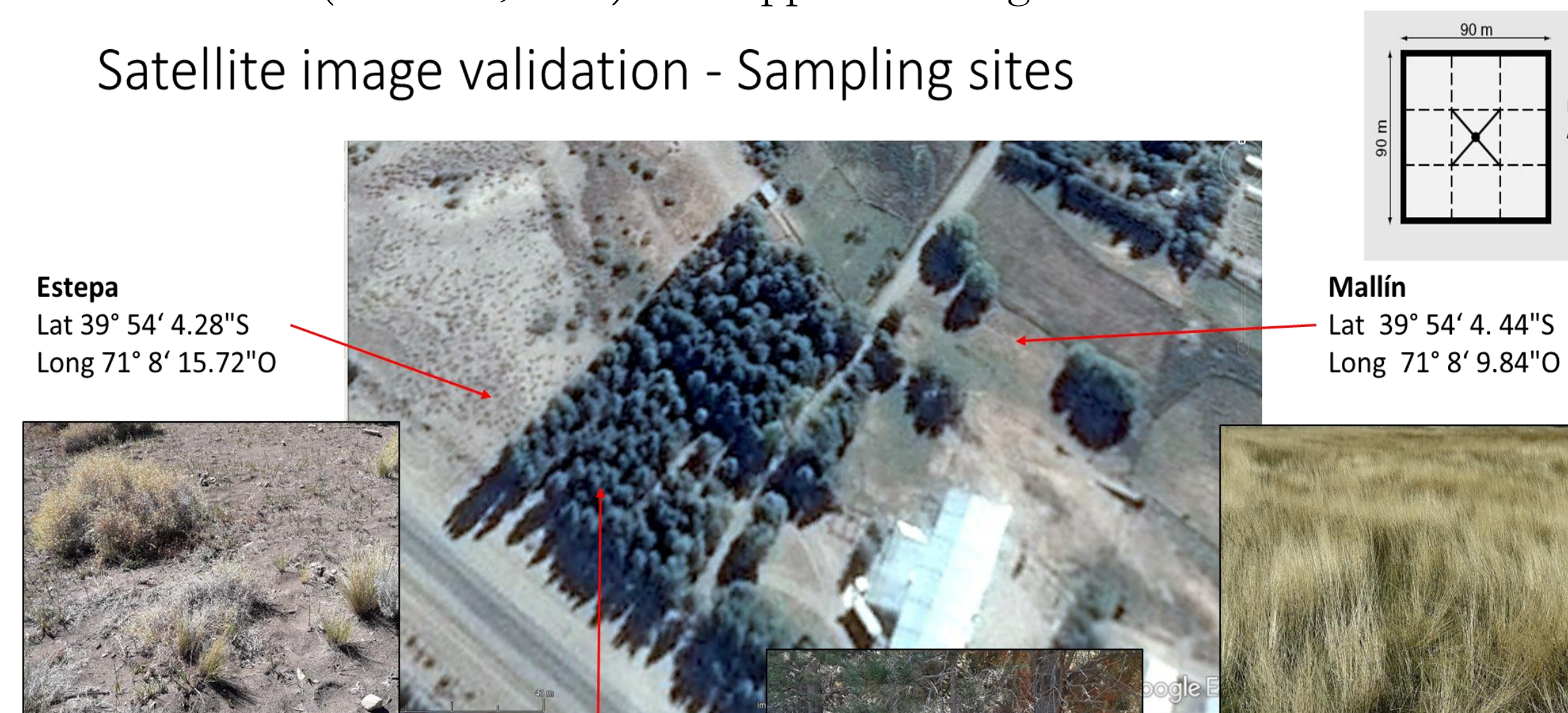
Research Methods

- Landsat 5 and 8 images were used to compare changes over a period of time.
- Landsat 8 images were validated with samplings in the field, using GLOBE Protocols.
- The green index, the water index and the snow index were calculated.
- The following software was used:
 - QGIS and Multispec (to analyze Landsat images)
 - Google Earth to locate environmental problems
 - CmapTools to map concepts
 - Office to process information and present the investigation

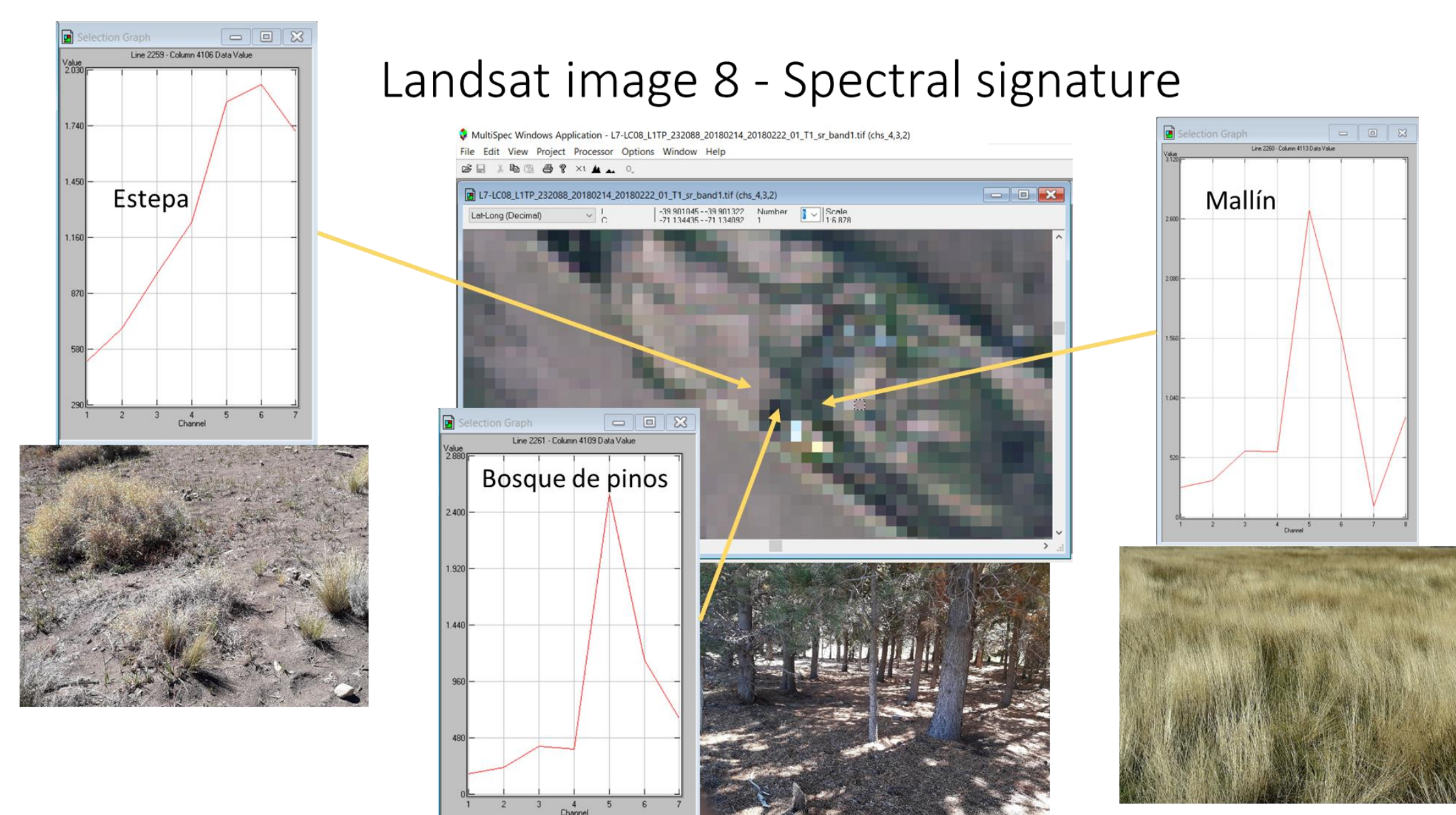
Carrying Out Investigations

- Two sites were taken to compare:
- Upsala Glacier (Province of Santa Cruz, Argentina), with a Landsat 5 satellite image of the year 2005 compared to a Landsat 8 image of the year 2017.
- Lanín Volcano (Province of Neuquén, Argentina) with a Landsat 5 satellite image of the year 2010 compared to a Landsat 8 image of the year 2017.
- The validation of the Landsat 8 images was done with field samplings, using GLOBE Protocols in three different sites within the San Ignacio CEI, with three different types of vegetation cover (Bosque, Estepa and Mallín).
- GPS GLOBE protocols, manual mapping, computerized mapping and Biometrics (GLOBE, 2005) were applied to assign MUC codes.

Satellite image validation - Sampling sites



Bosque de pinos
Lat 39° 54' 5.05"S
Long 71° 8' 14.27"O



GLOBE Badges

Be a Data Scientist

The report includes in-depth analysis of students' own data as well as other data sources. Students discuss limitations of these data, make inferences about past, present, or future events, or use data to answer questions or solve problems in the represented system. Consider data from other schools or data available from other databases.

Make an Impact

The report clearly describes how a local issue led to the research questions or makes connections between local and global impacts. The students need to clearly describe or show how the research contributed to a positive impact on their community through making recommendations or taking action based on findings.

Be a STEM Professional

The report clearly describes collaboration with a STEM professional that enhanced the research methods, contributed to improved precision, and supported more sophisticated analyses and interpretations of results.

Results

Analyzing Data

- Addresses the research question(s)
- Describes the procedures for data analysis including the mathematical calculations used
- Includes a detailed analysis of the data
- Tables and graphics show patterns or trends in the data
- Print screen of GLOBE visualization page

Figure #1

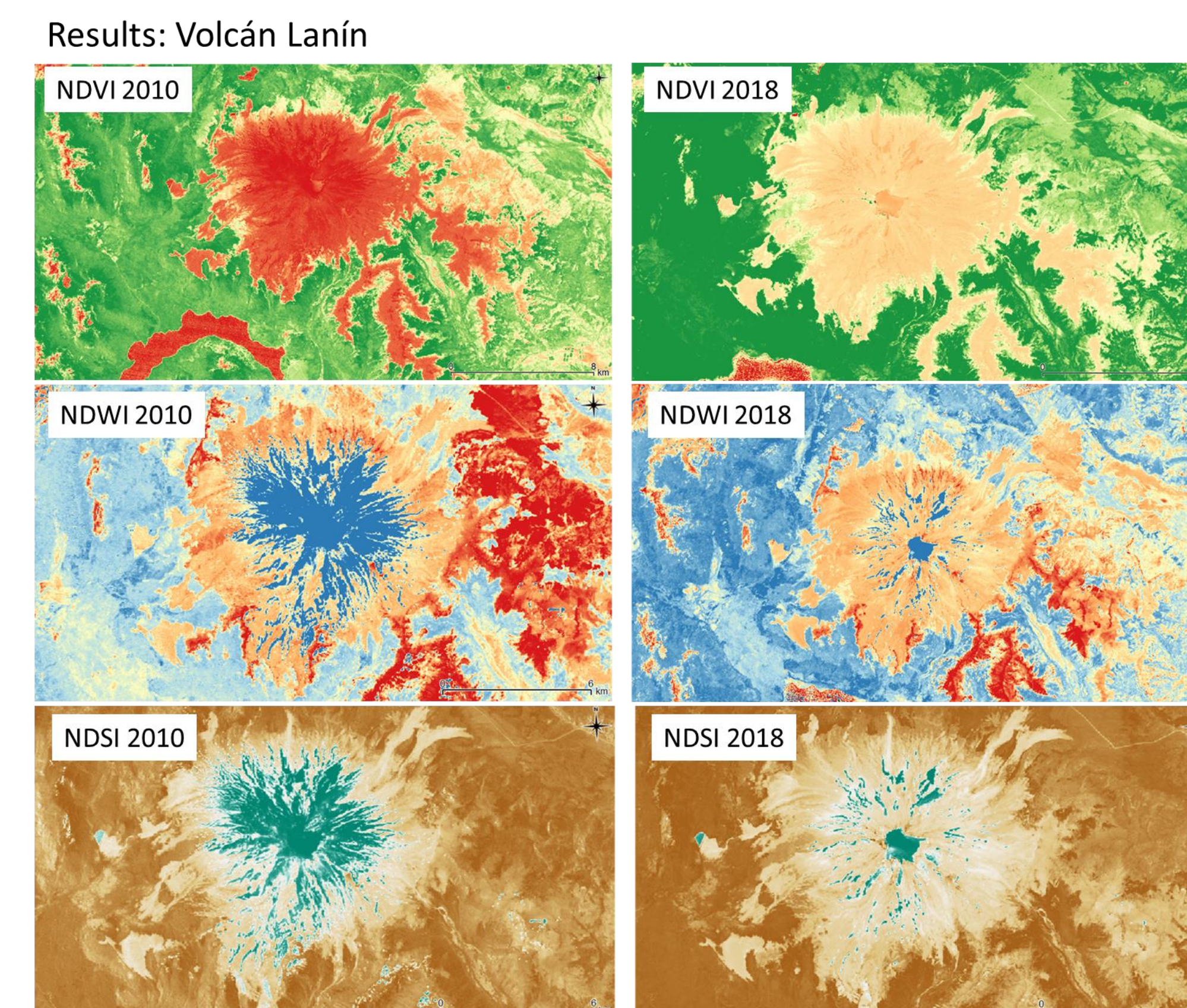
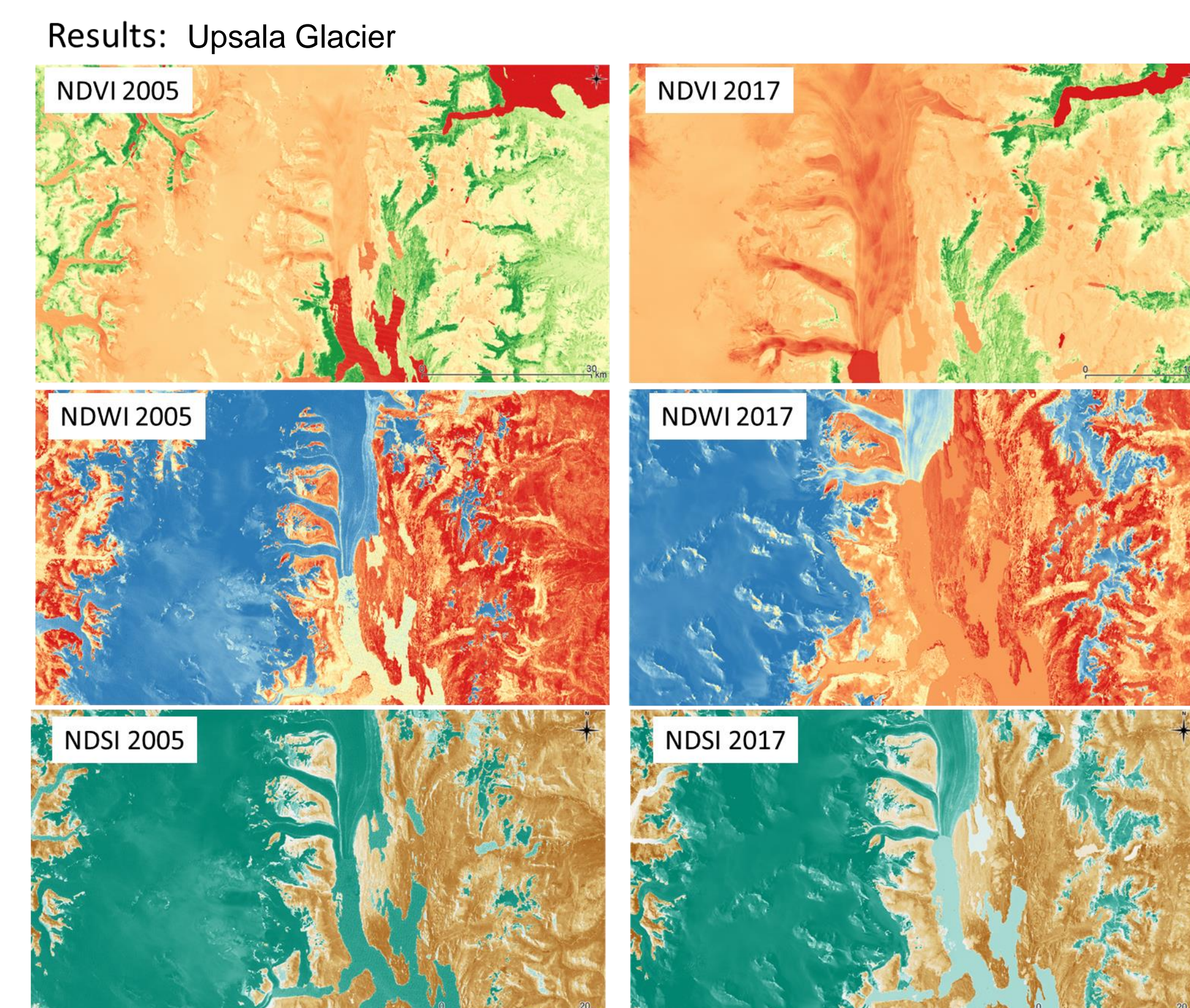


Figure #2



Discussion

- The satellite images show the decrease of ice over time. They could be used to monitor some periods of the year since the satellite passes every 14 days. Although it is not possible to see the origin of the loss of ice in the satellite images, the tendency of ice loss can be monitored.
- Some recommendations to try to maintain the ice are: Do not deforest, since the forests capture CO₂ and help to reduce the greenhouse effect. Recycle. Reduce the use of fossil fuels (reduce CO₂ emissions). Decrease the emission of dust particles that are deposited in the ice and accelerates the thaw.

Conclusions

- In both sites an important loss of ice is detected, which can have as consequence an increase of the drought, a smaller availability of water, in particular in the summer (because it does not rain and both regions depend on the thaw as a source of water resource),
- Negative impacts on ecosystems and loss of moisture can affect vegetation and increase the risk of fires.

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