University of Southampton

Research and outreach using Remote Sensing

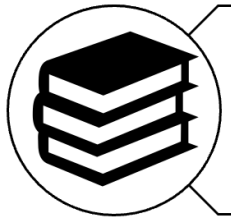
Daniela Rivera-Marin, M.Sc
University of Southampton

University of Southampton

Research

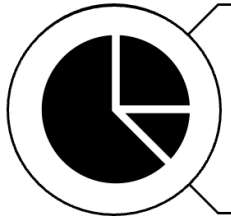
Country-scale assessment of desertification and its impacts on society

Objectives

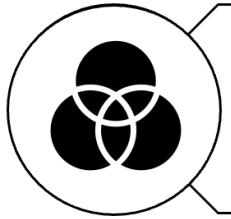


Analysis of the use of remote sensing in the study of desertification

Understand trends and dynamics over the last four decades of vegetation dynamics in Chile.

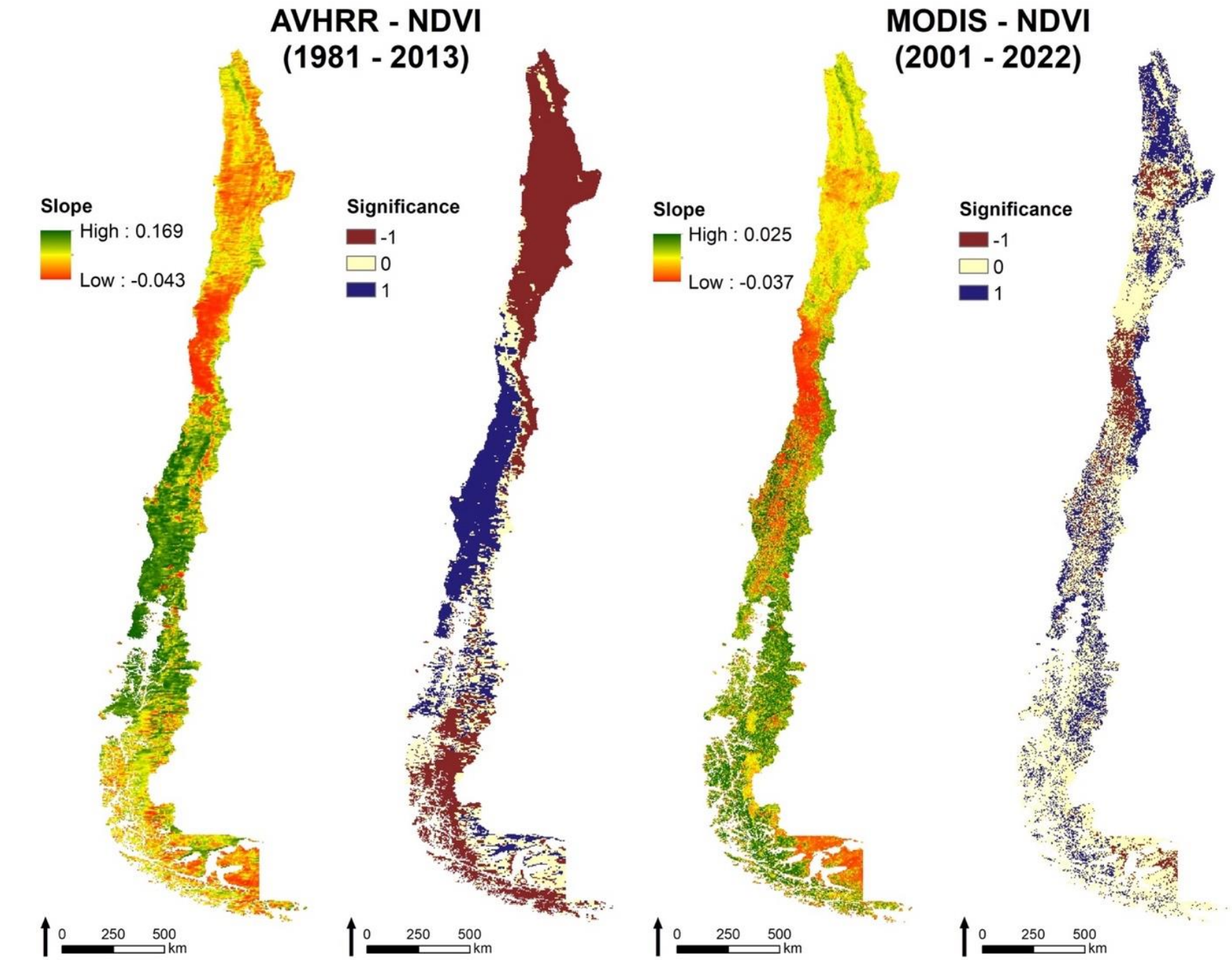


Evaluate climatic and anthropogenic factors as drivers of vegetation dynamics.

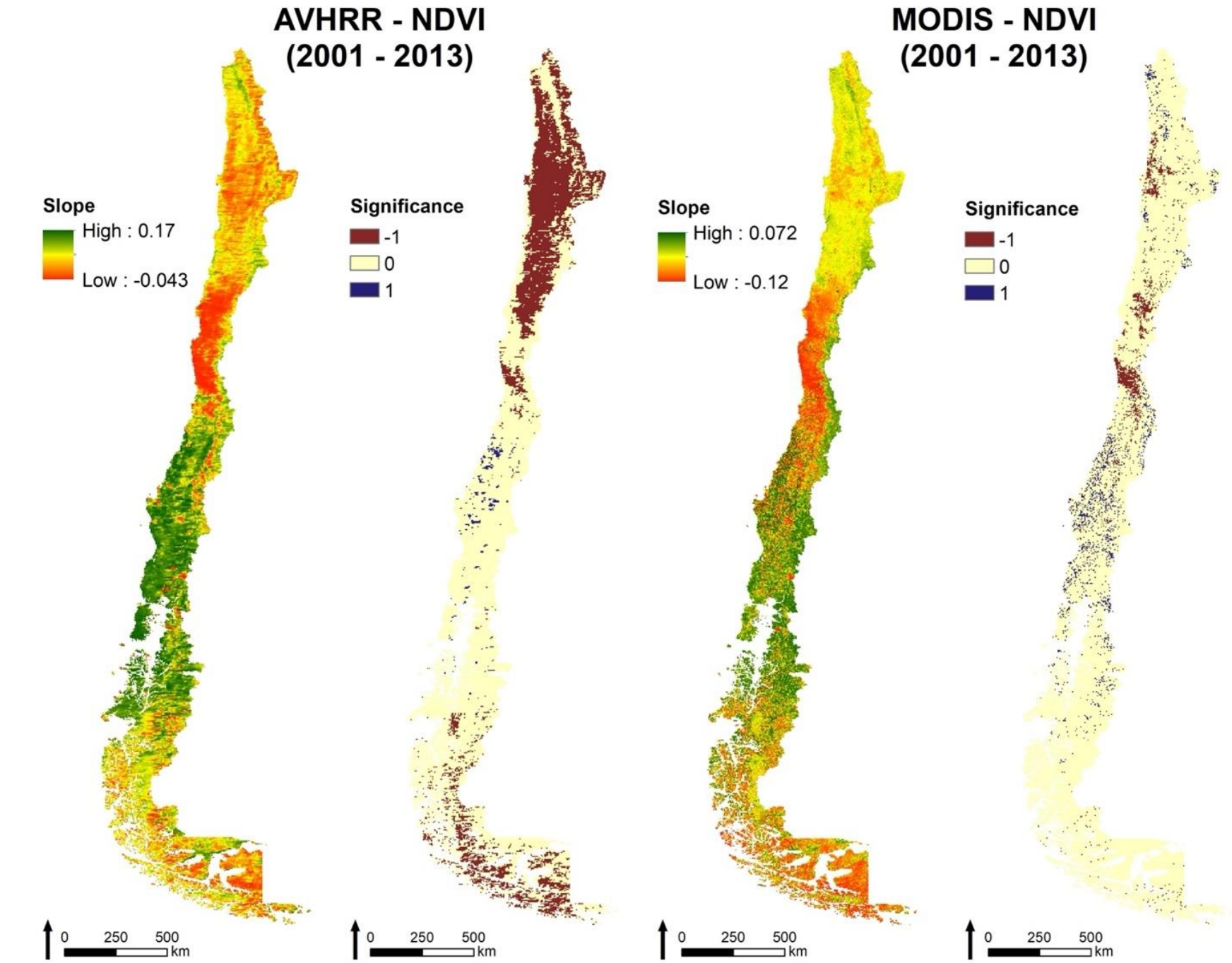


Validation of prediction model on vegetation dynamics.

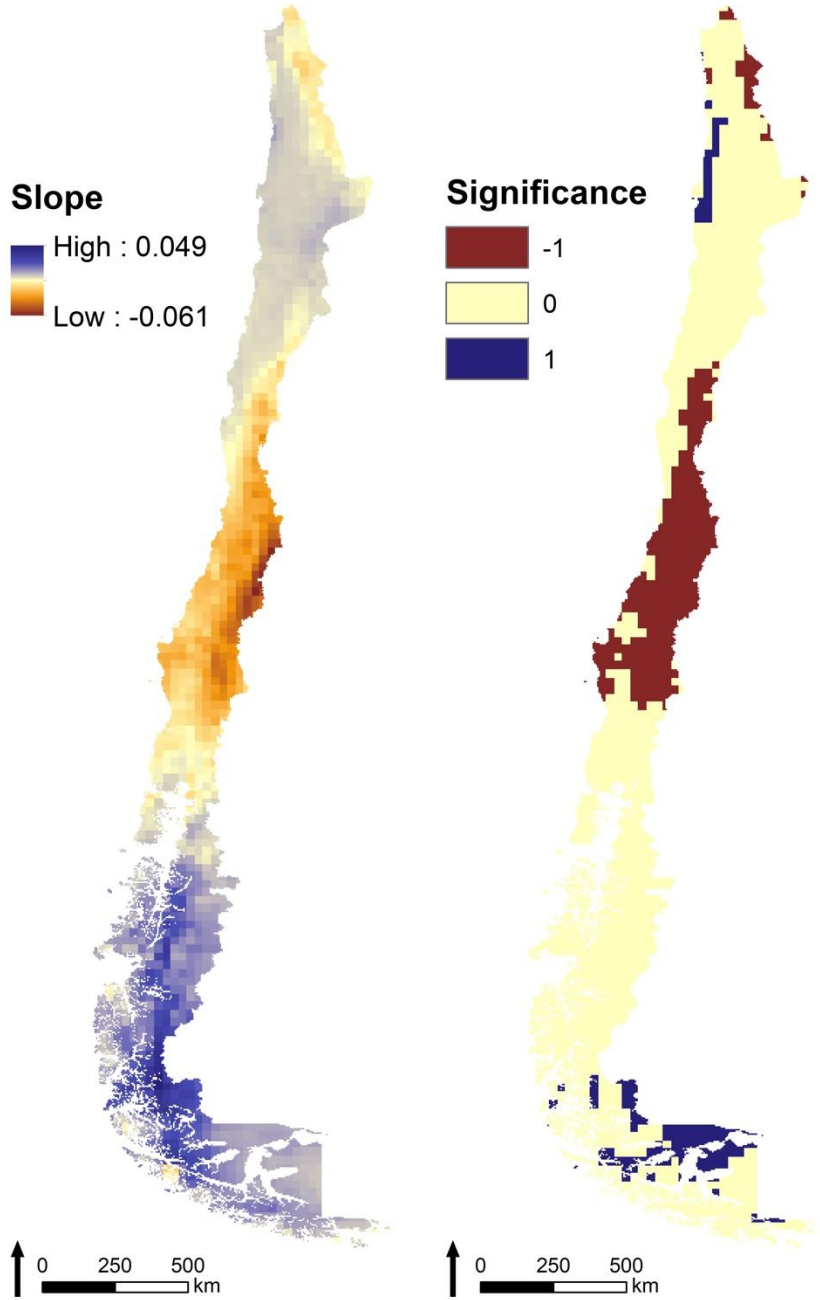
Vegetation


AVHRR - NDVI
(1981 - 2013)
Slope
High : 0.169
Low : -0.043
Significance
-1
0
1
0 250 500 km
MODIS - NDVI
(2001 - 2022)
Slope
High : 0.025
Low : -0.037
Significance
-1
0
1
0 250 500 km

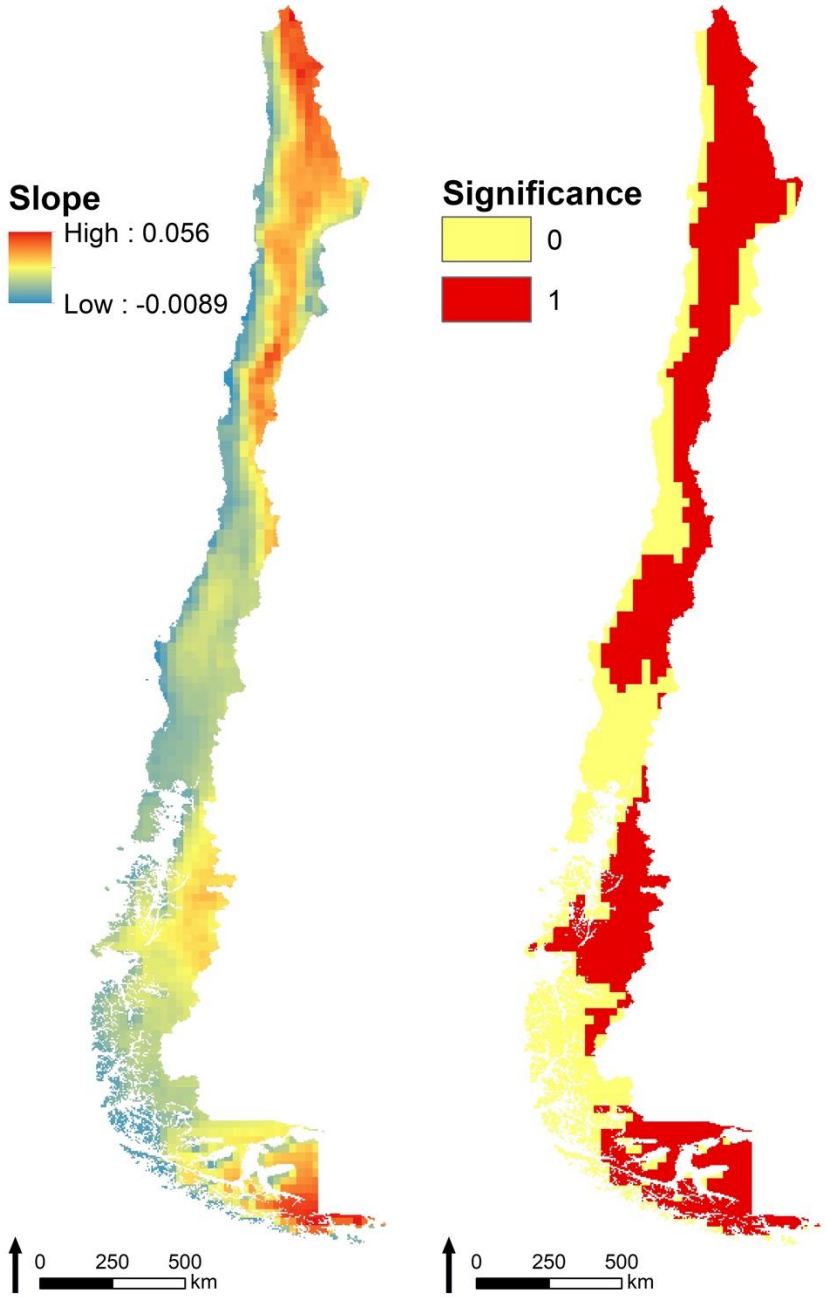
Vegetation test period (2001-2013)



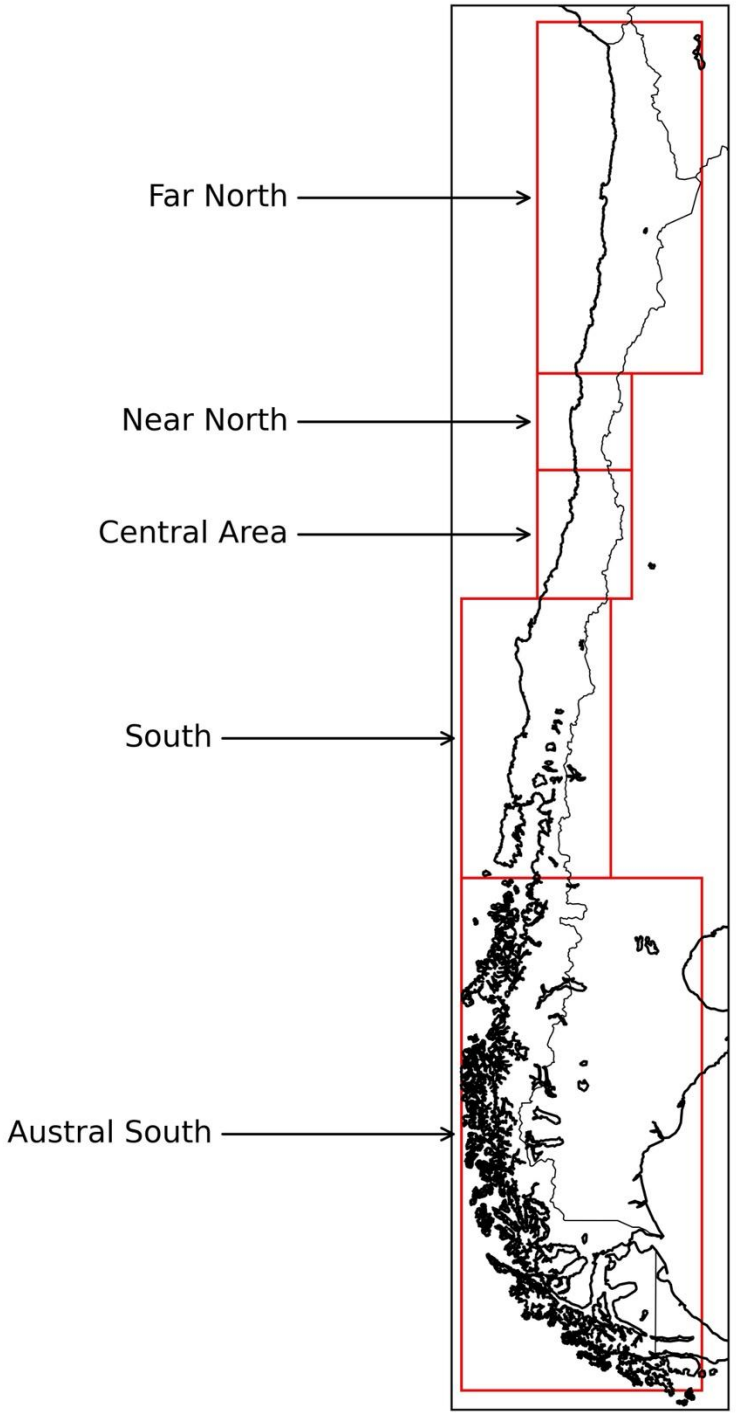
Precipitation

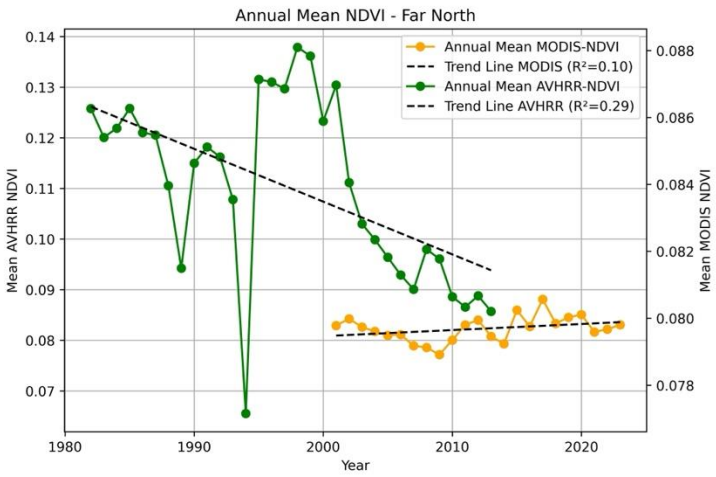


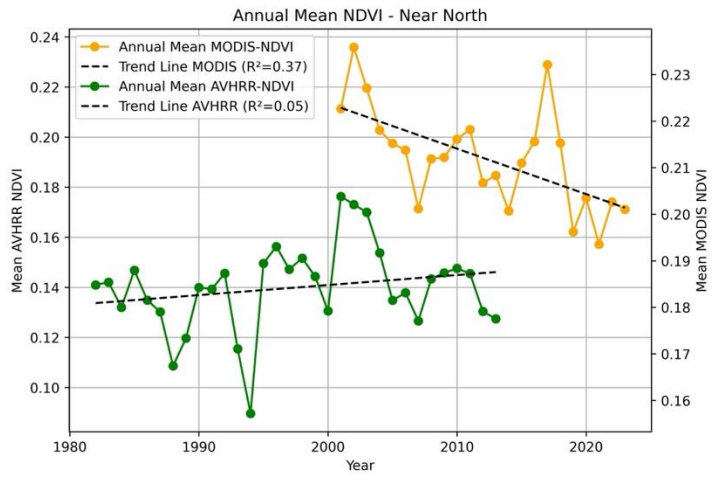
Temperature

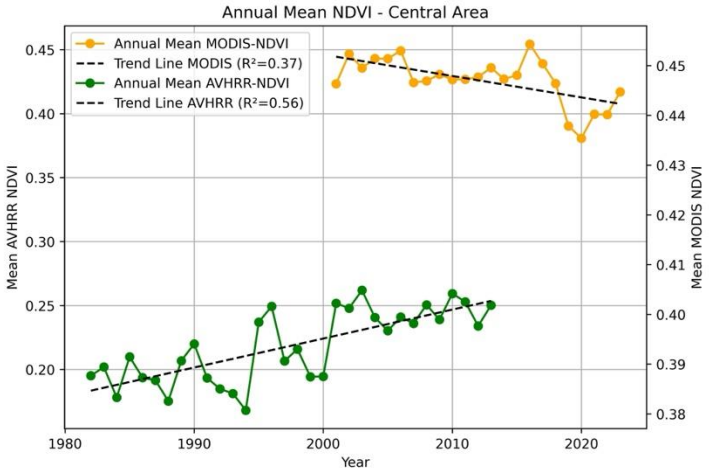


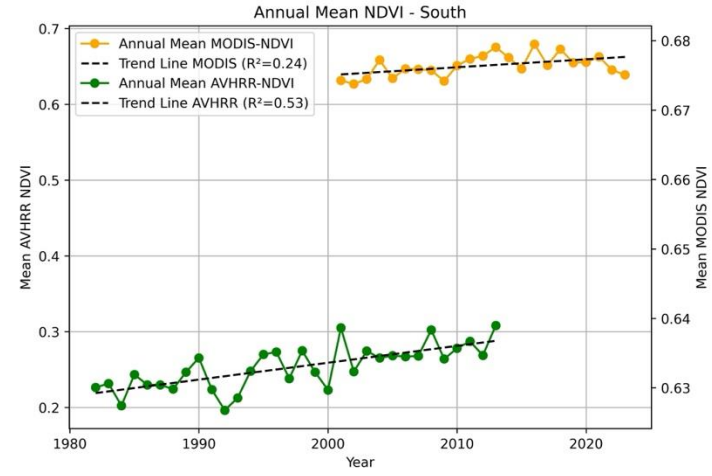
Vegetation

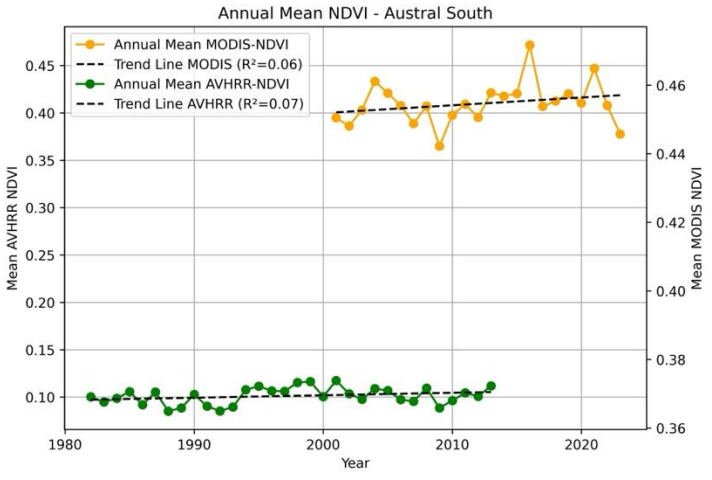

Far North
Near North
Central Area
South
Austral South


Annual Mean NDVI - Far North
Annual Mean MODIS-NDVI
Trend Line MODIS (R²=0.10)
Annual Mean AVHRR-NDVI
Trend Line AVHRR (R²=0.29)
Mean AVHRR NDVI
Mean MODIS NDVI
Year

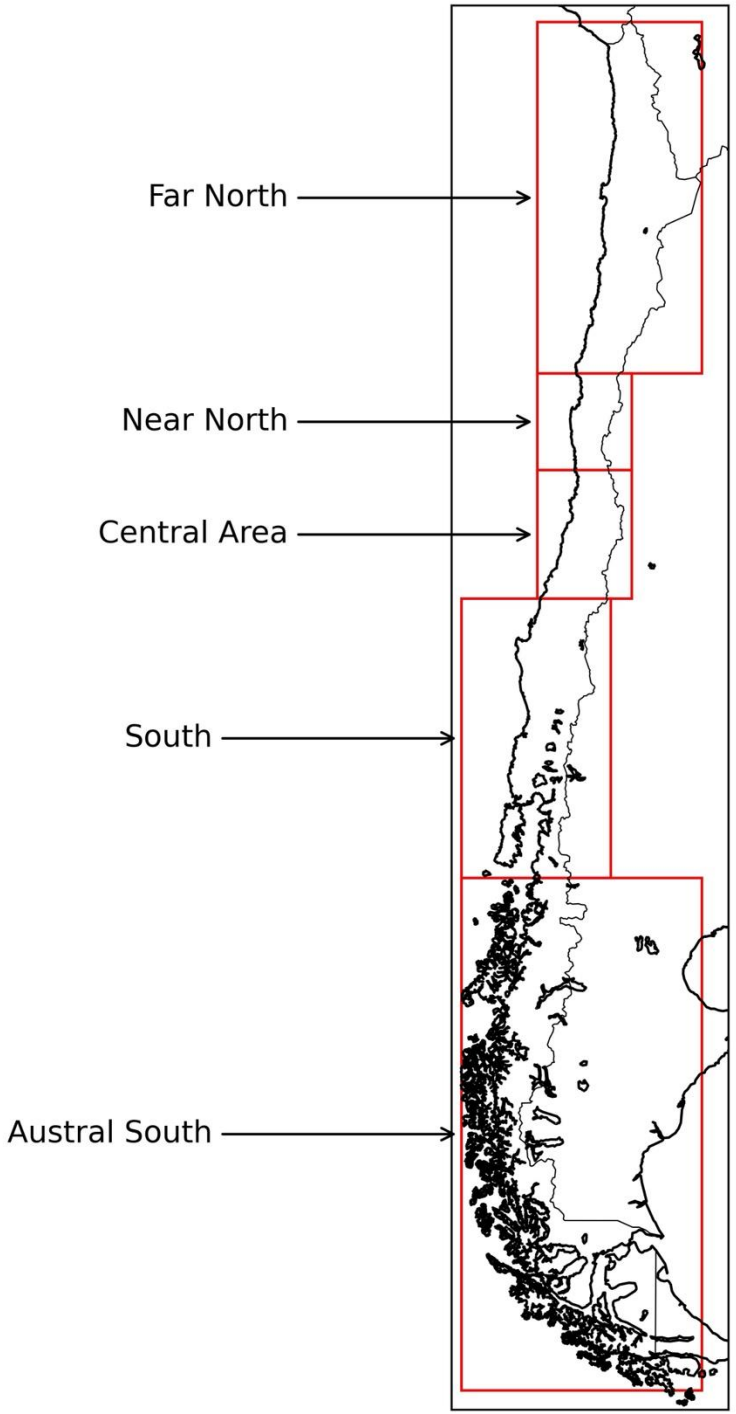

Annual Mean NDVI - Near North
Annual Mean MODIS-NDVI
Trend Line MODIS (R²=0.37)
Annual Mean AVHRR-NDVI
Trend Line AVHRR (R²=0.05)
Mean AVHRR NDVI
Mean MODIS NDVI
Year

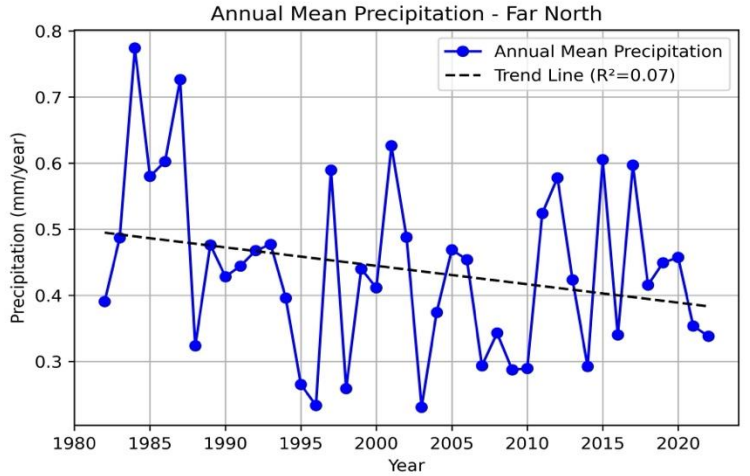

Annual Mean NDVI - Central Area
Annual Mean MODIS-NDVI
Trend Line MODIS (R²=0.37)
Annual Mean AVHRR-NDVI
Trend Line AVHRR (R²=0.56)
Mean AVHRR NDVI
Mean MODIS NDVI
Year

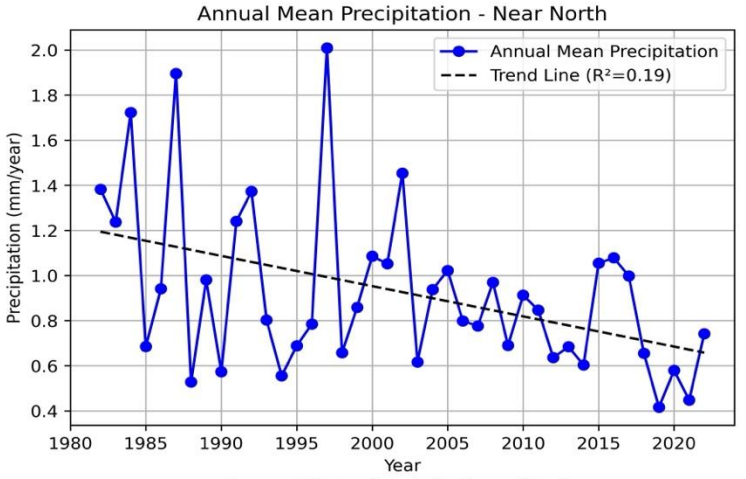

Annual Mean NDVI - South
Annual Mean MODIS-NDVI
Trend Line MODIS (R²=0.24)
Annual Mean AVHRR-NDVI
Trend Line AVHRR (R²=0.53)
Mean AVHRR NDVI
Mean MODIS NDVI
Year

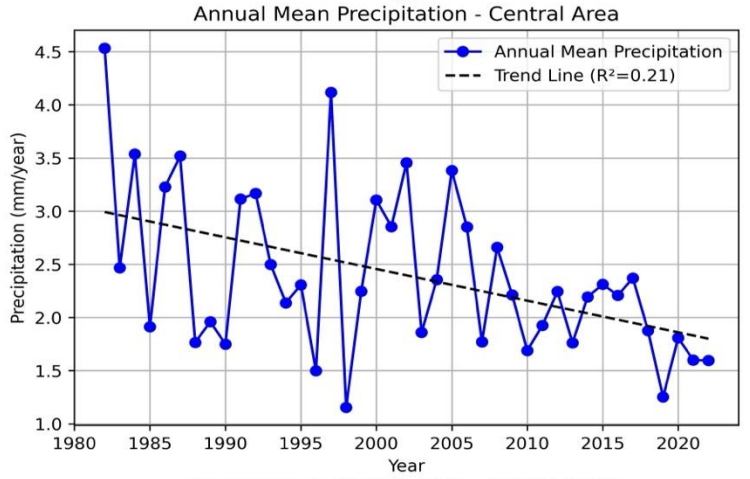

Annual Mean NDVI - Austral South
Annual Mean MODIS-NDVI
Trend Line MODIS (R²=0.06)
Annual Mean AVHRR-NDVI
Trend Line AVHRR (R²=0.07)
Mean AVHRR NDVI
Mean MODIS NDVI
Year

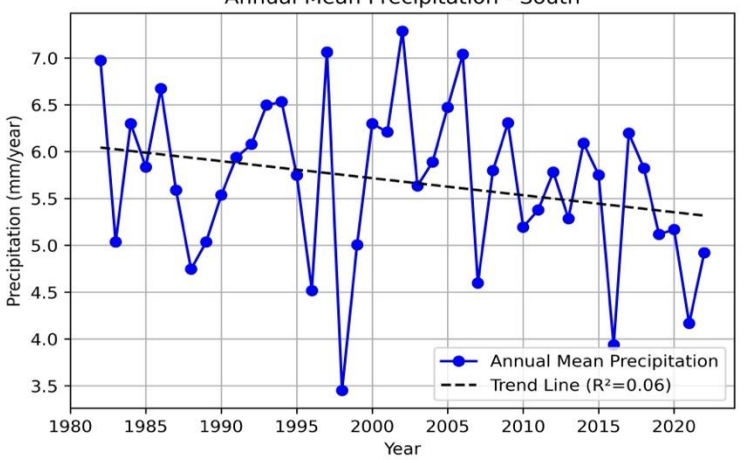
Precipitation

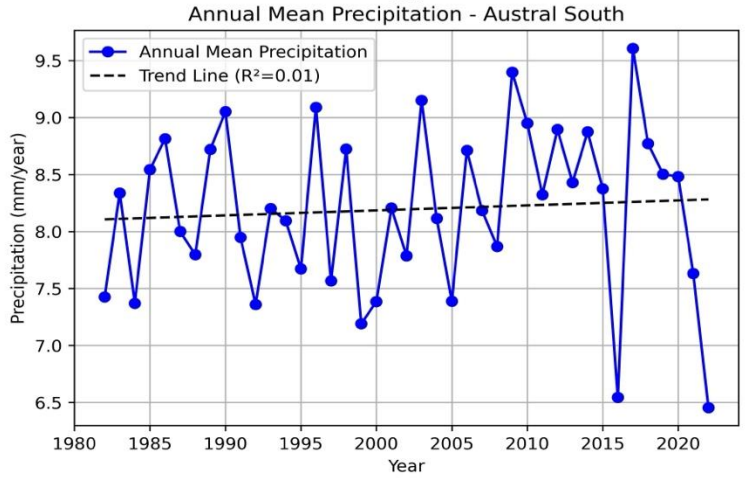




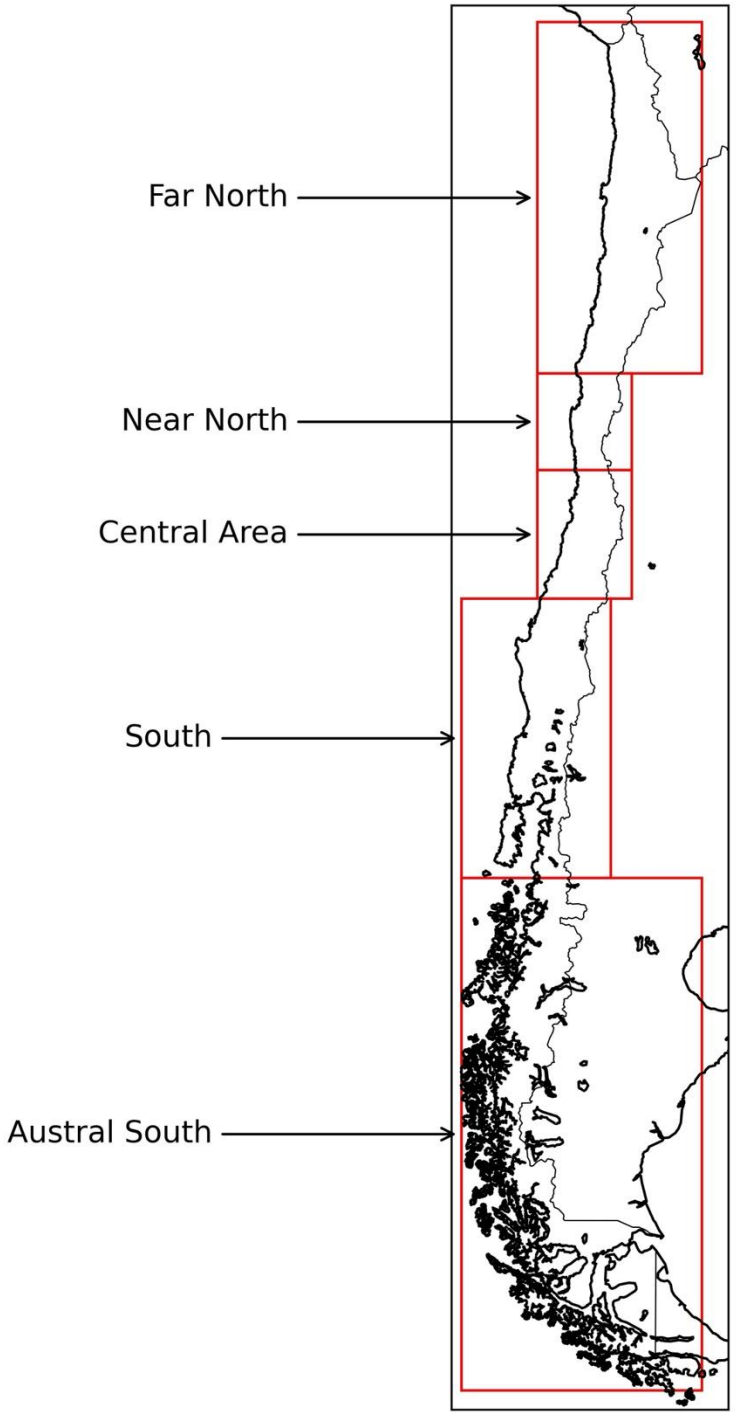


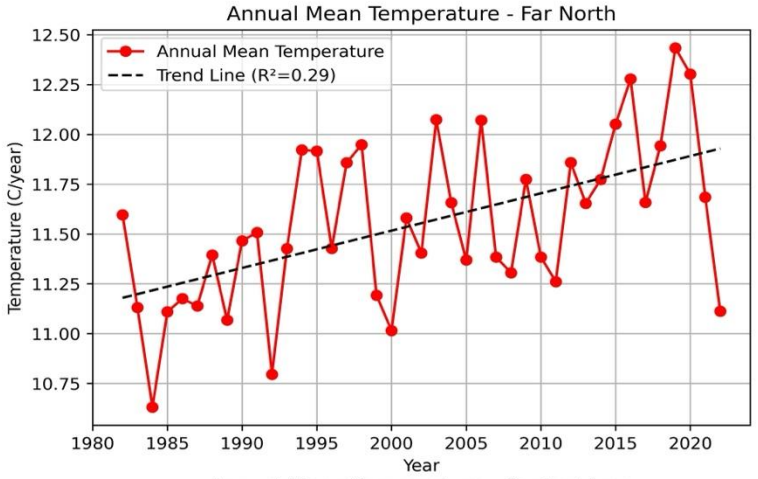


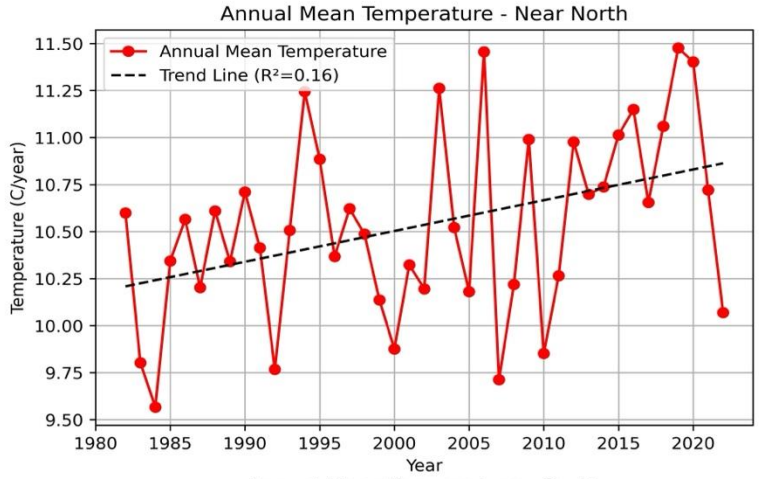


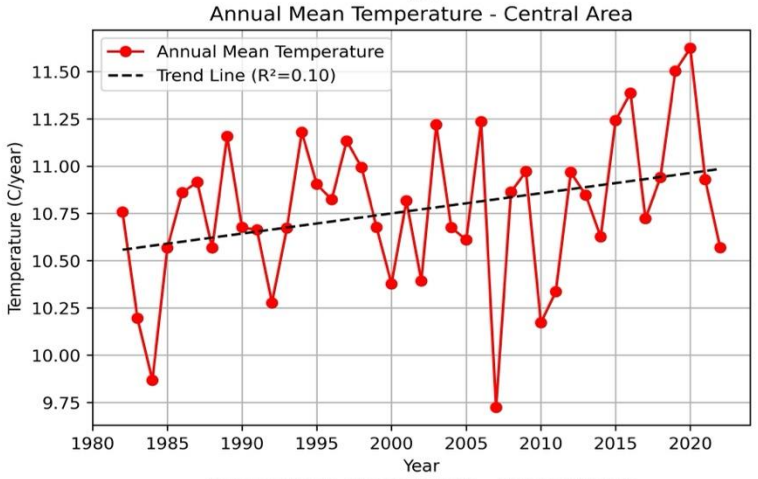


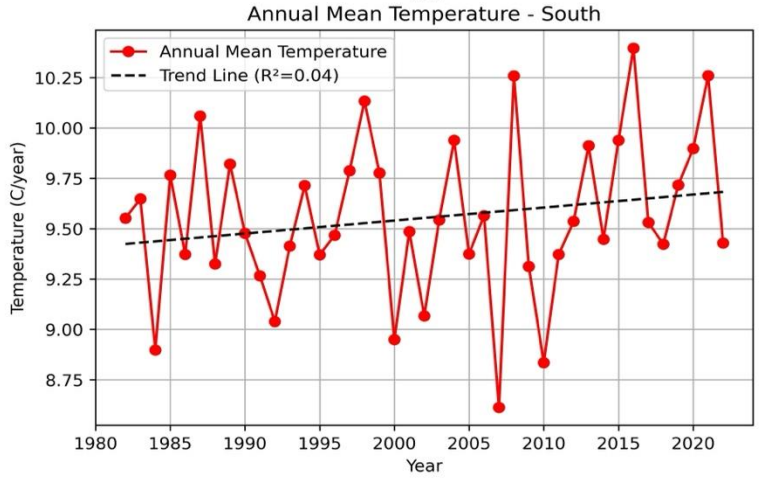
Temperature

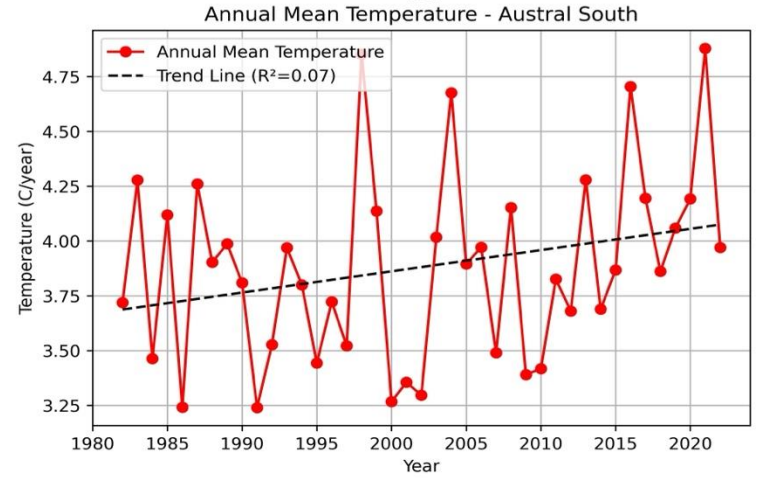




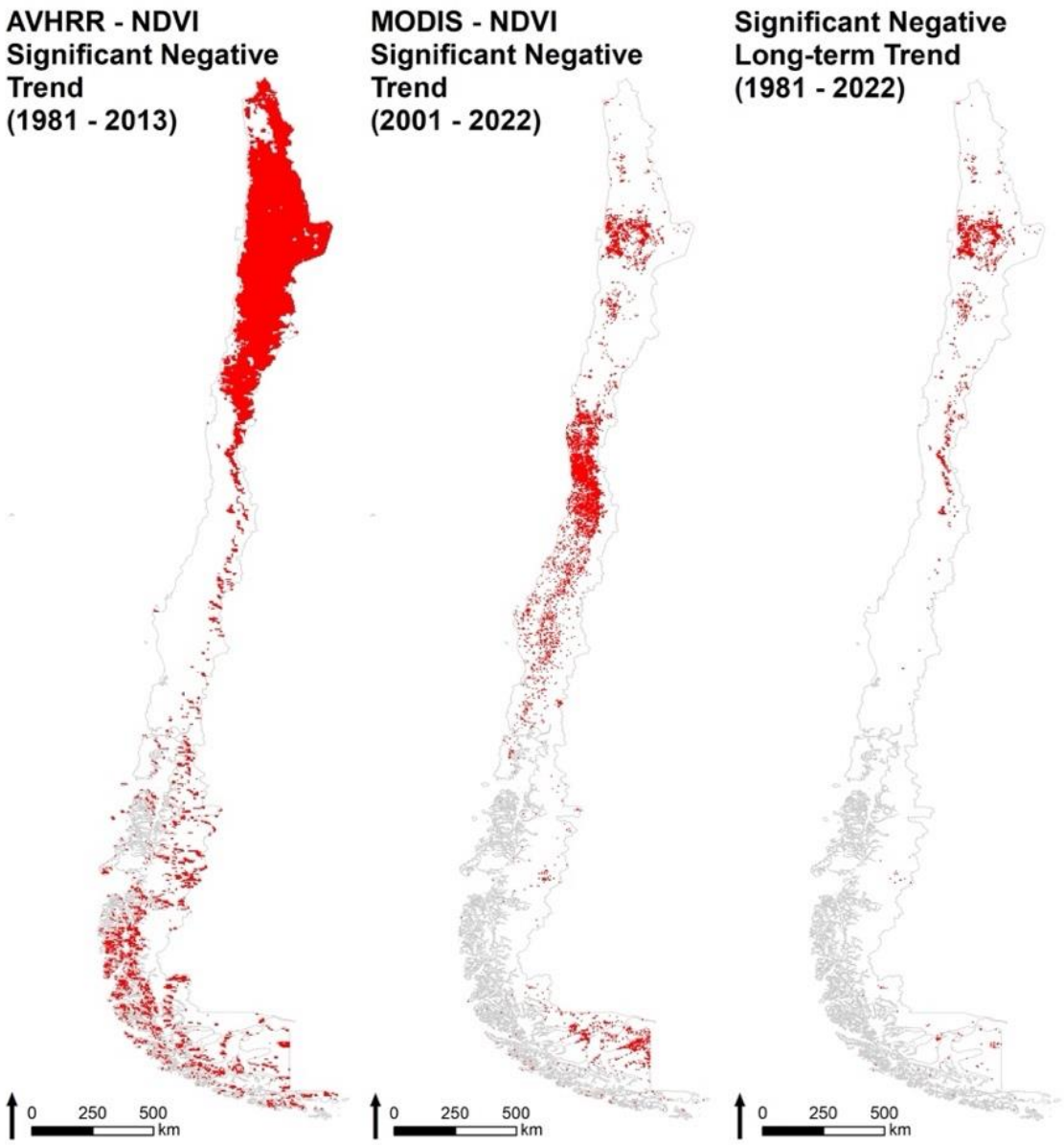




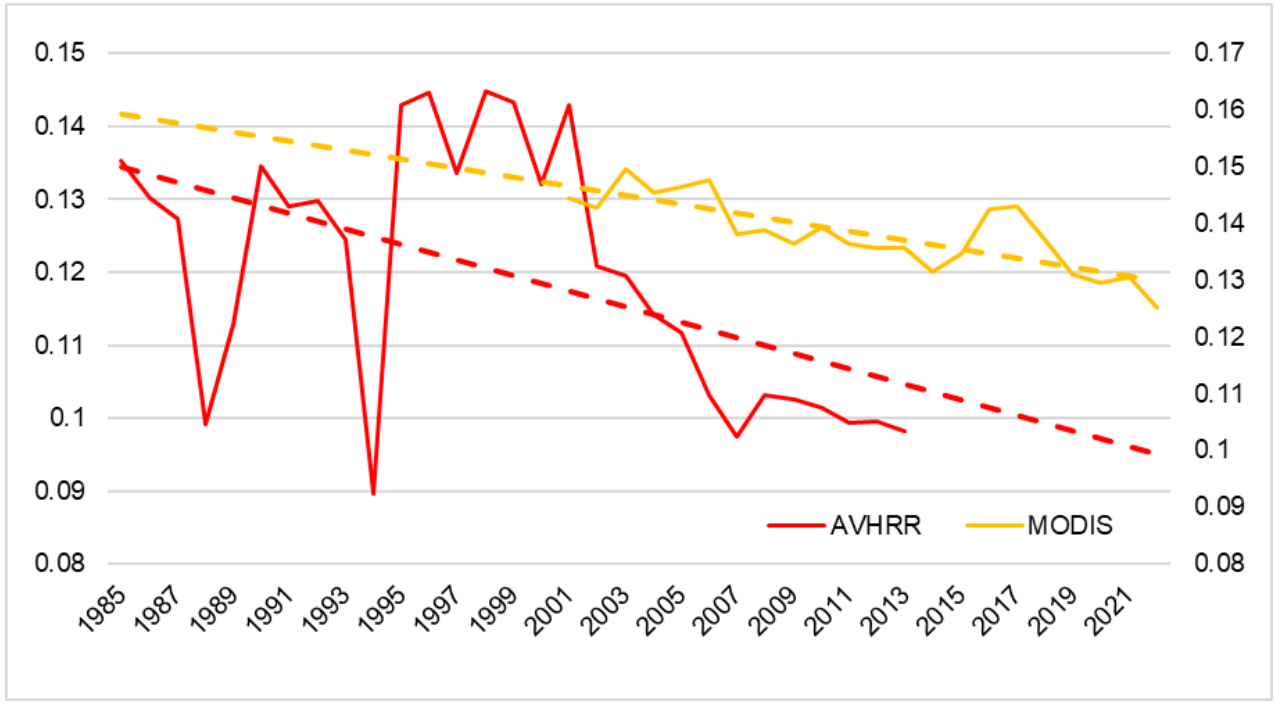




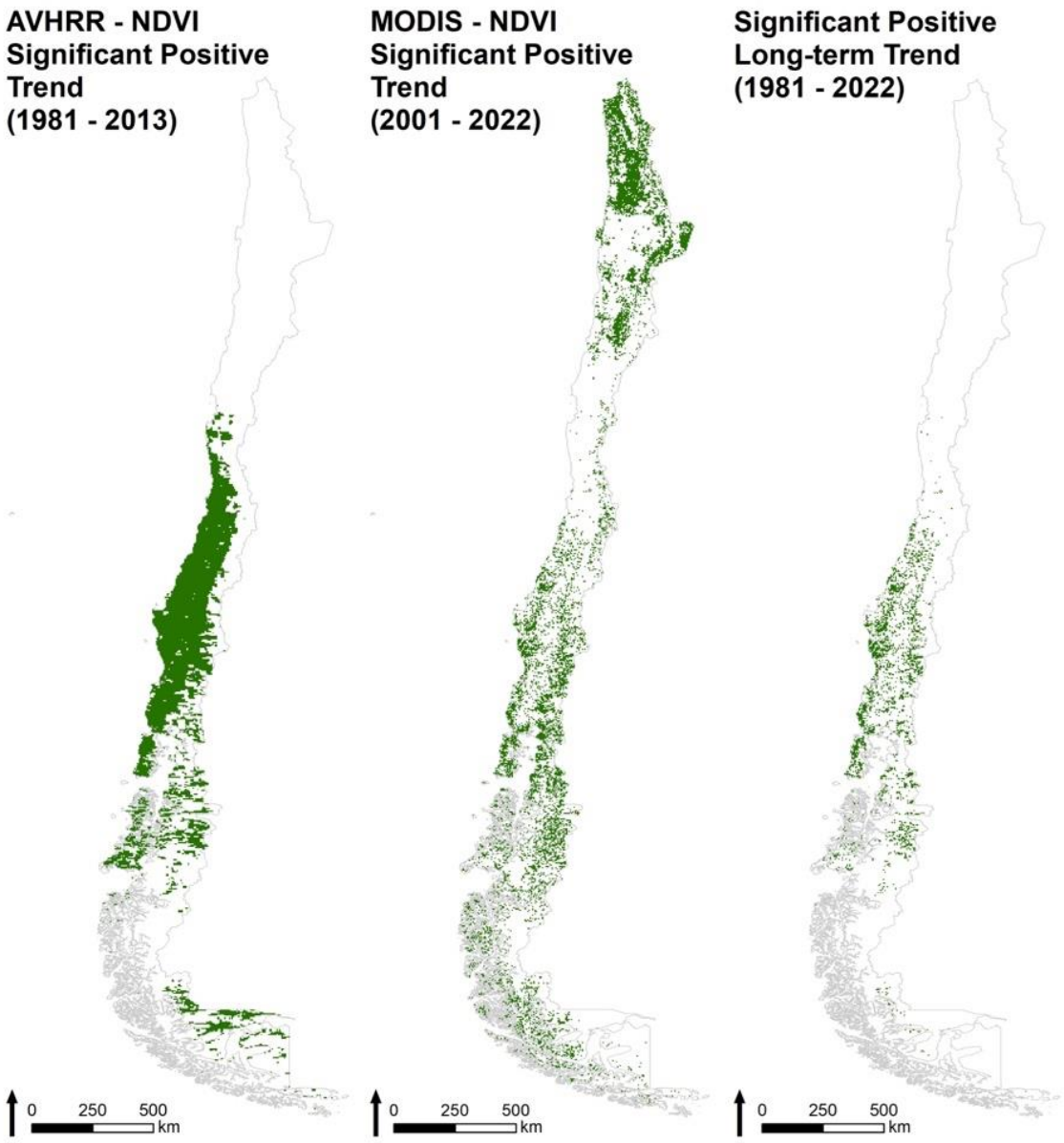
Vegetation dynamics: Browning



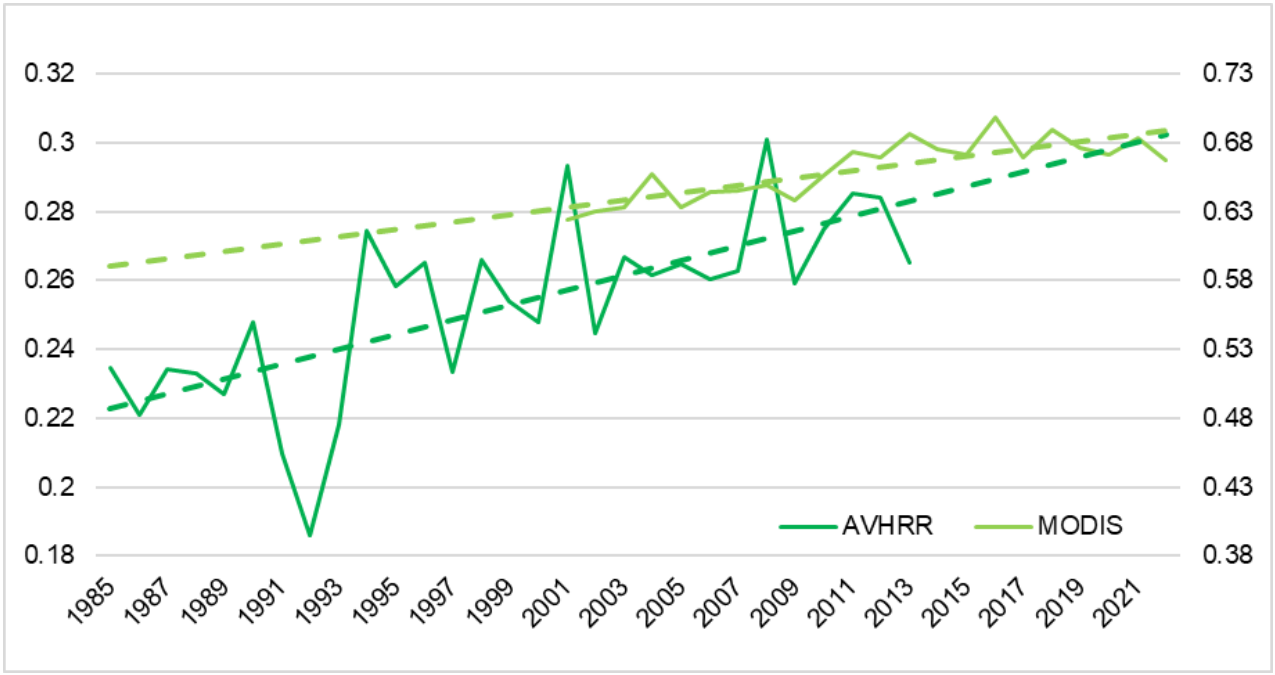
	AVHRR	MODIS	BOTH/COMMON
Browning	340,875 km2 (45.05%)	106,825 km2 (14.12%)	38,850 km2 (5.13%)



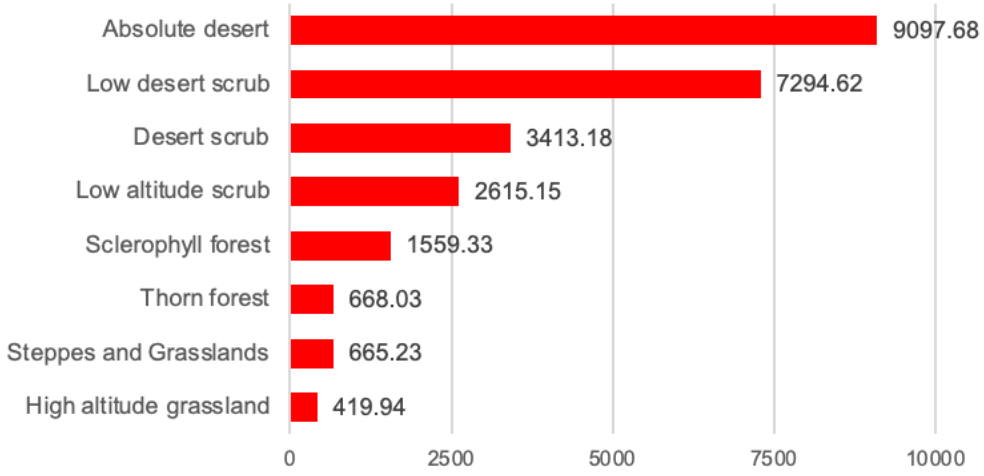
Vegetation dynamics: Greening

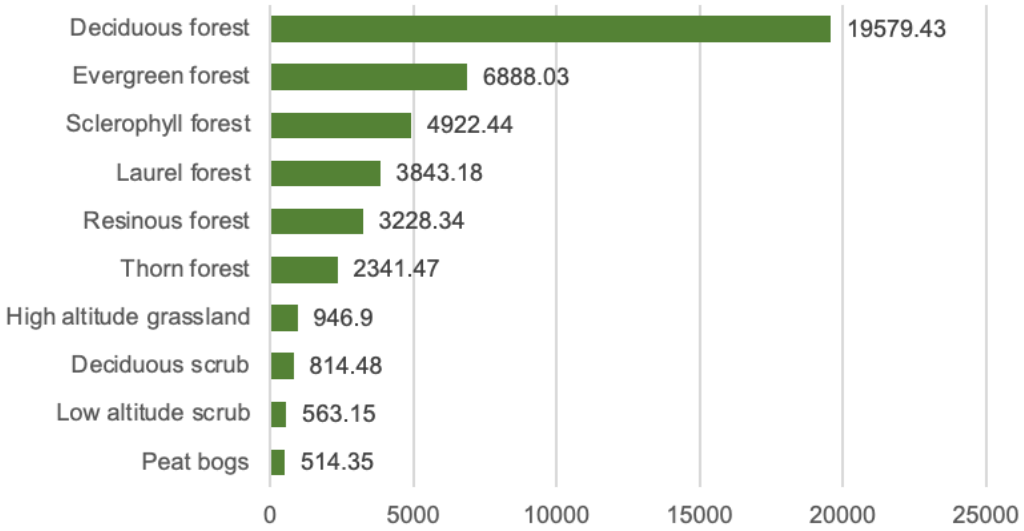


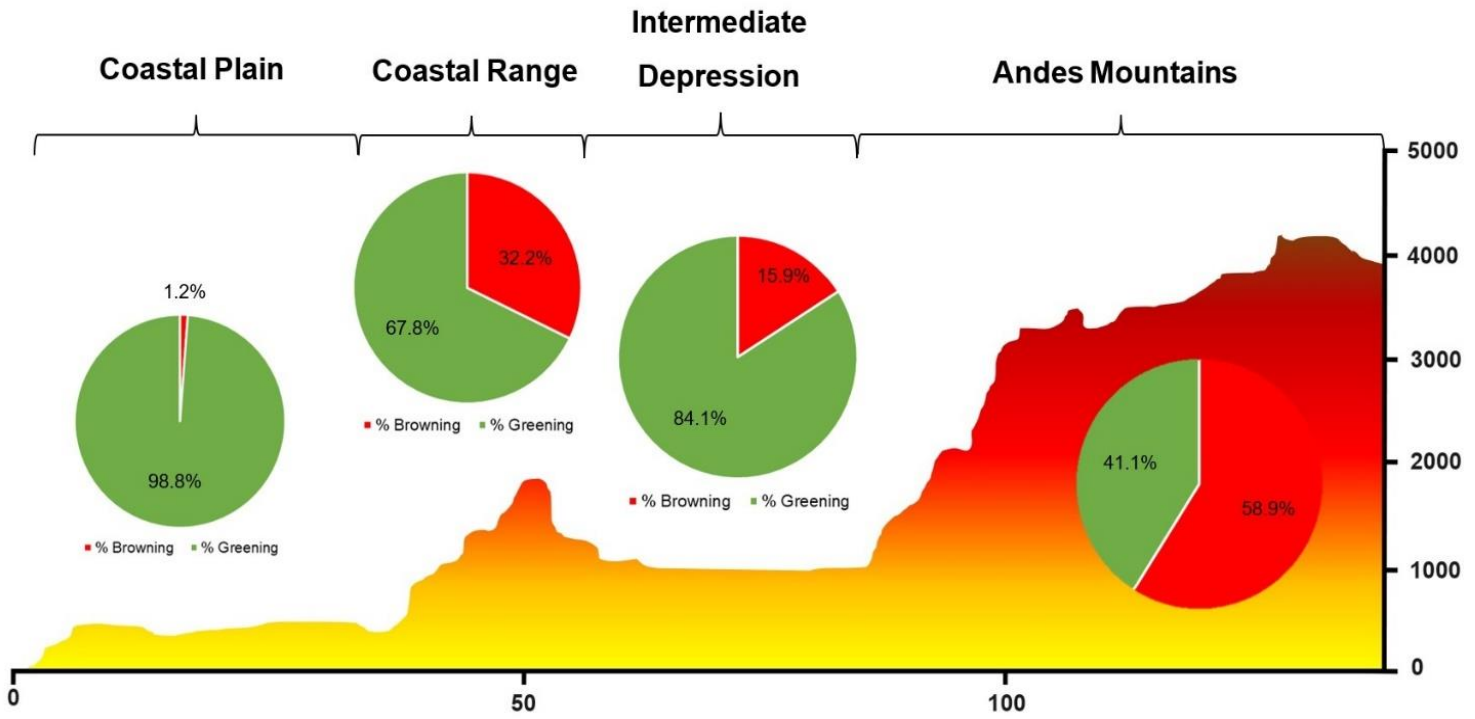
	AVHRR	MODIS	BOTH/COMMON
Browning	340,875 km2 (45.05%)	106,825 km2 (14.12%)	38,850 km2 (5.13%)



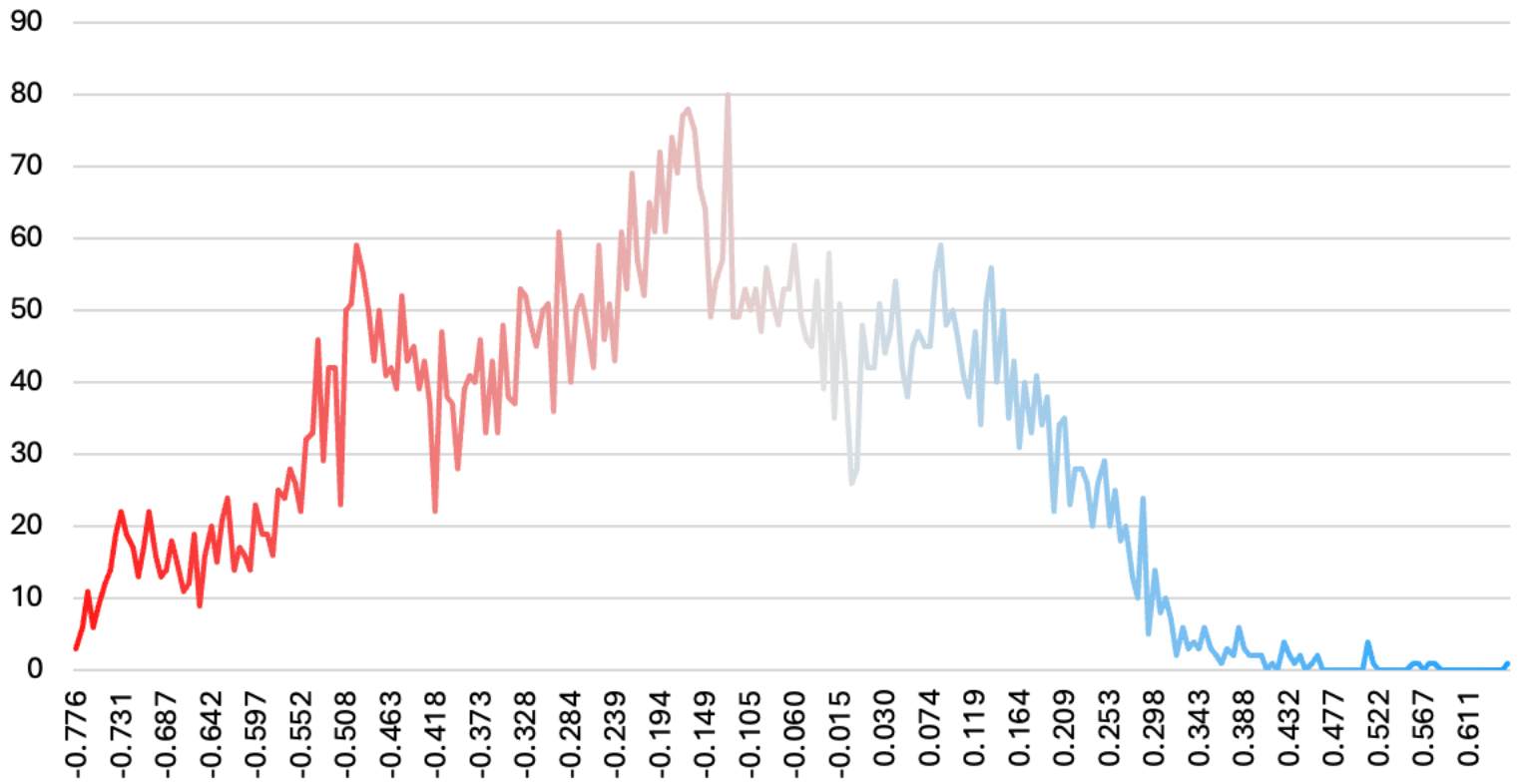
Vegetation dynamics: Characteristics



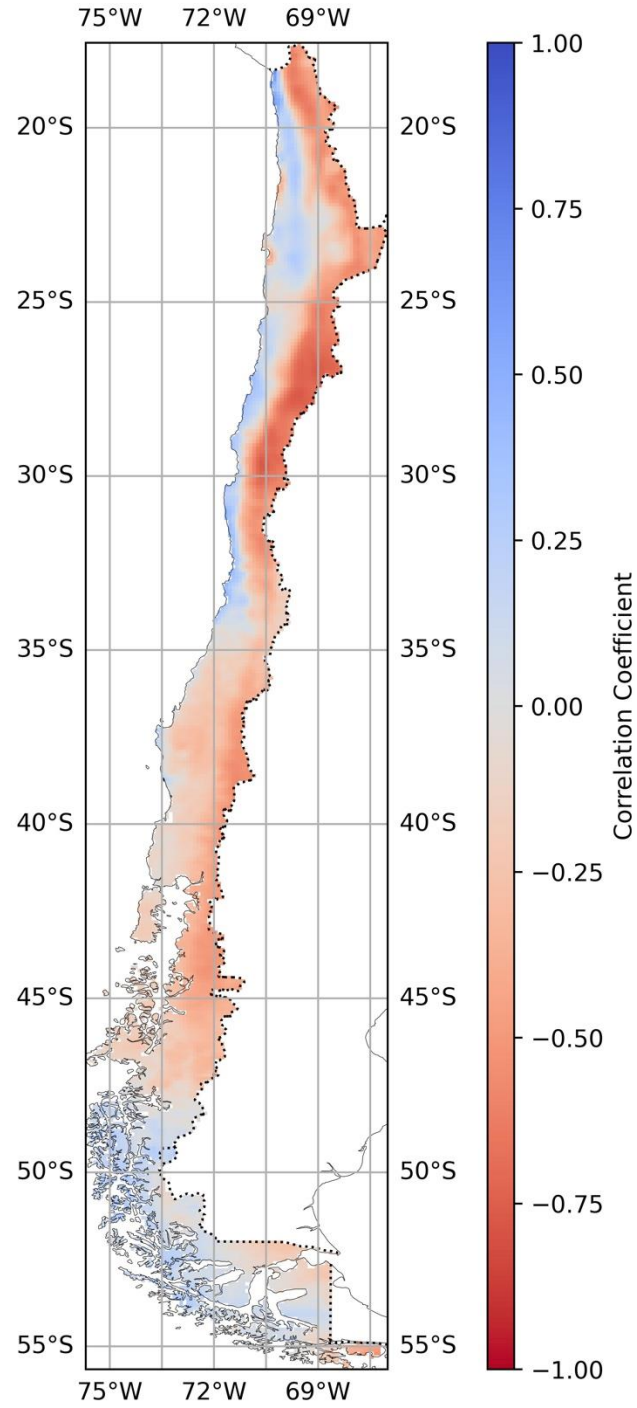




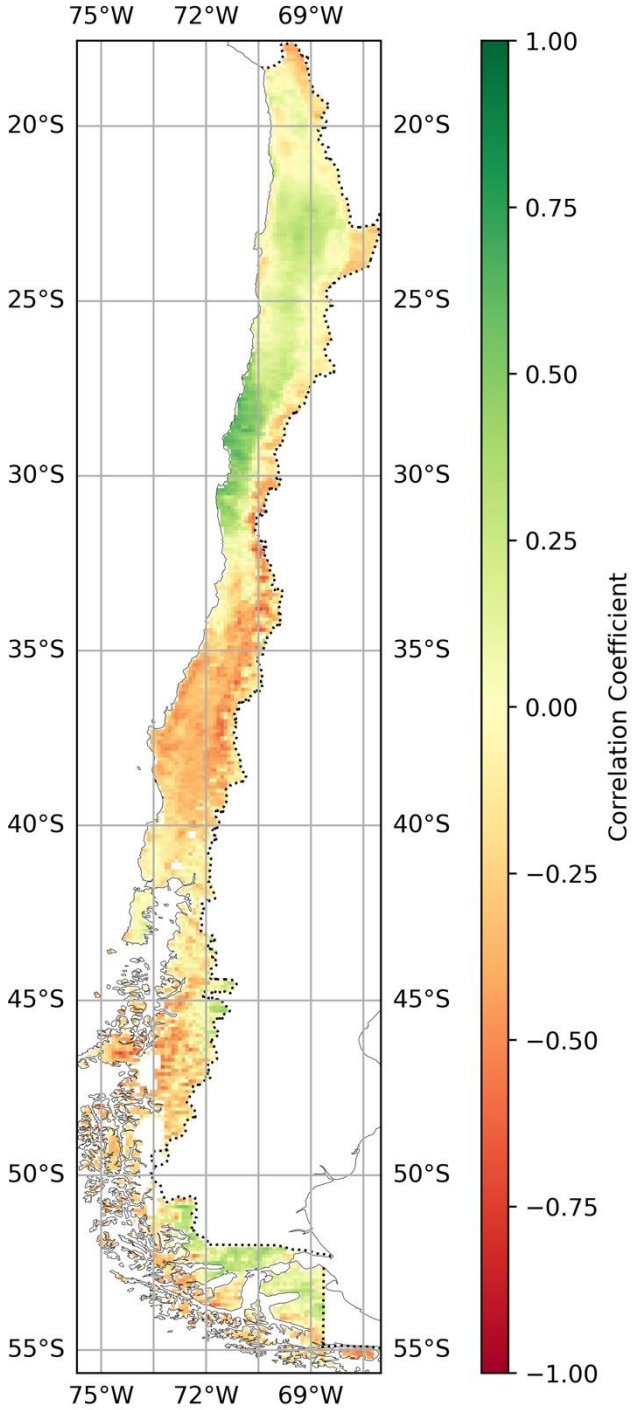
Climate variables correlation

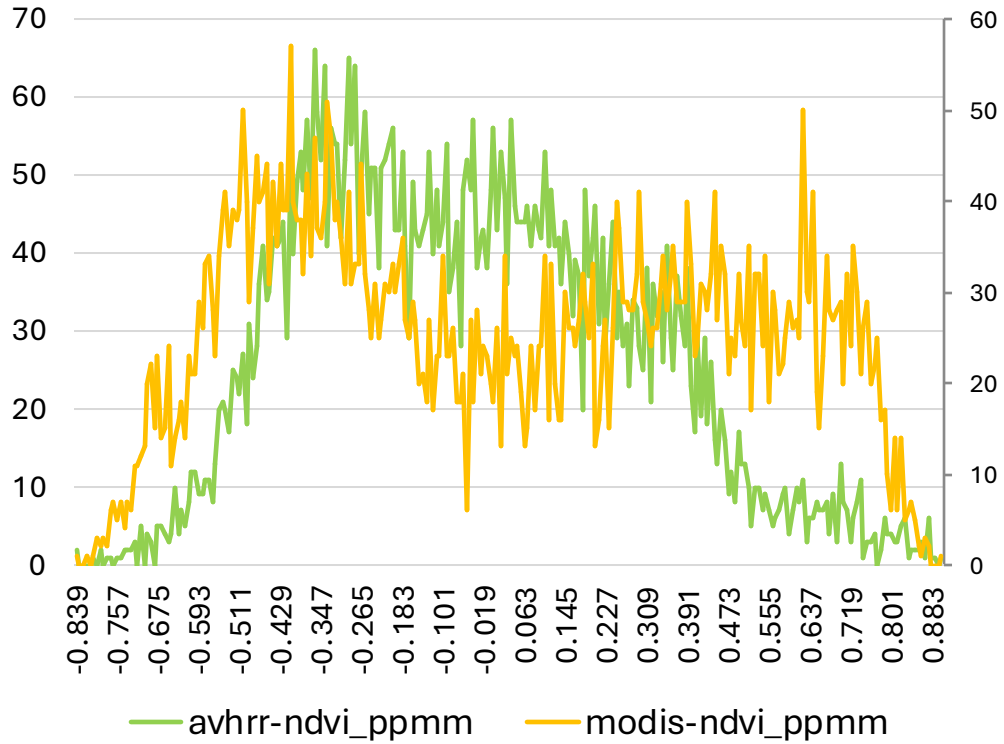


		Temperature ERA5
Precipitation ERA5	Mn.Corr	-0.78
	Mx.Corr	0.65



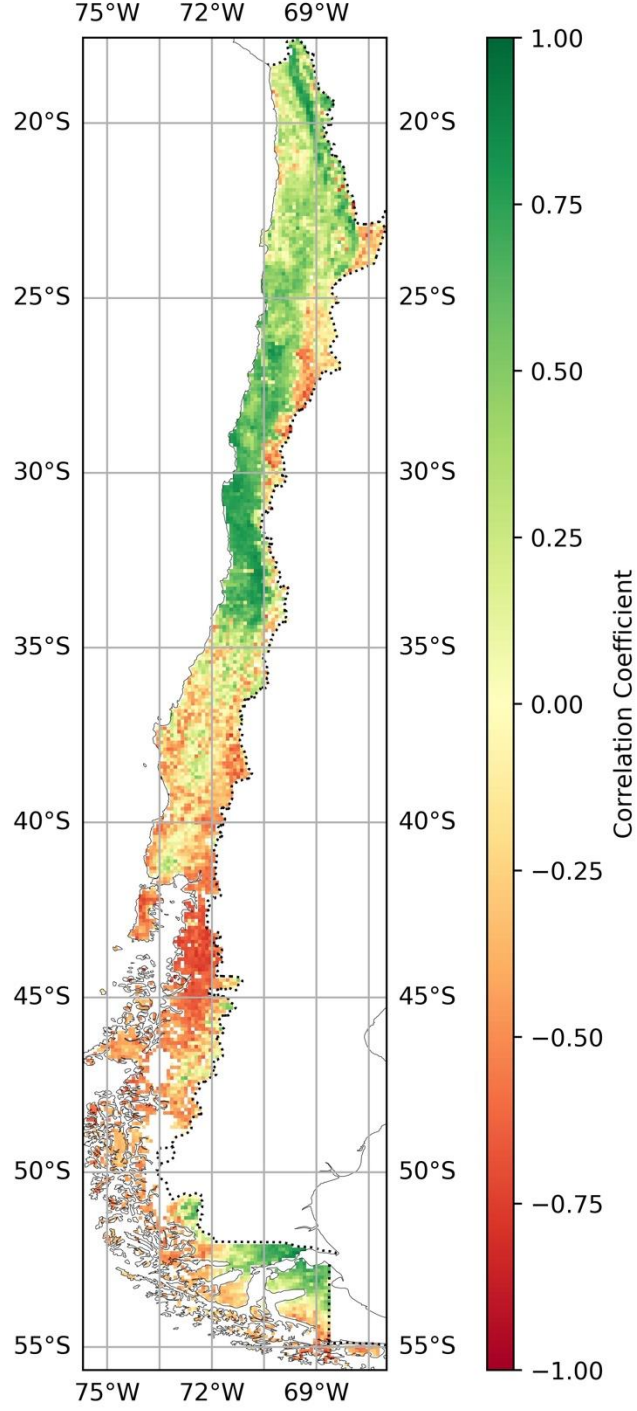
AVHRR-NDVI vs Precipitation (1982-2013)



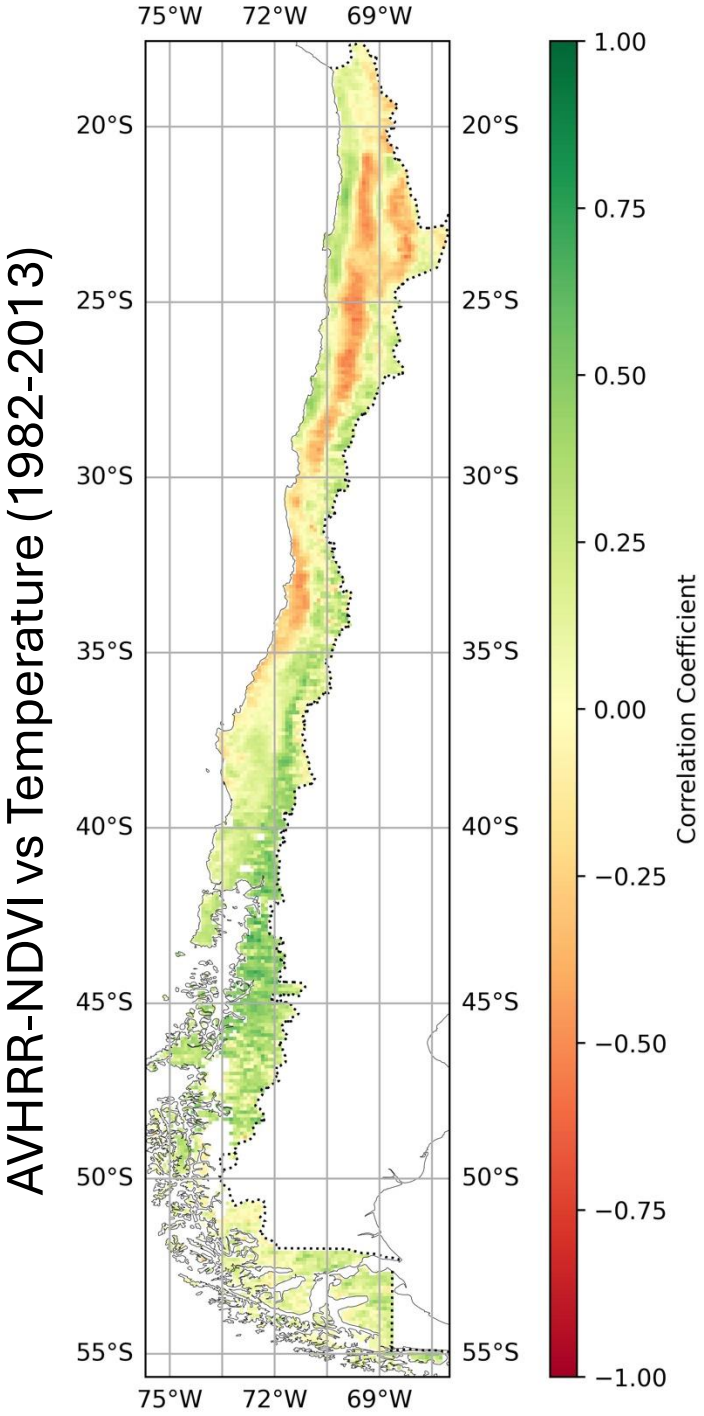


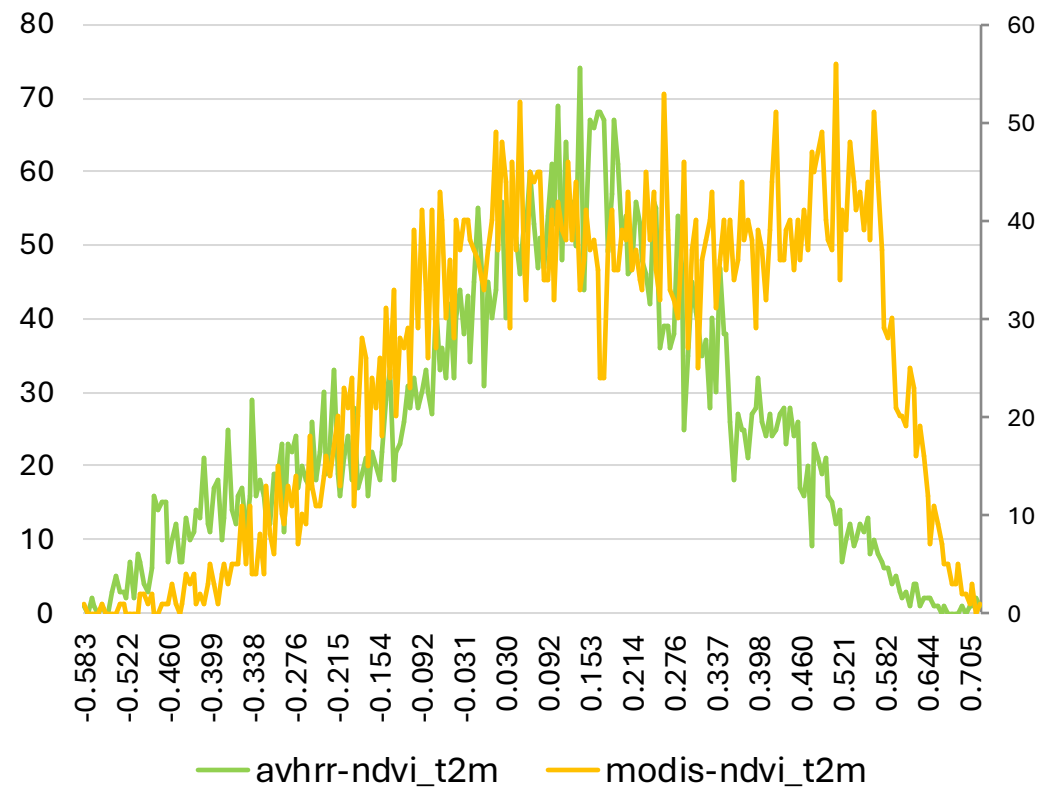
		AVHRR-NDVI	MODIS-NDVI
Precipitation ERA5	Mn.Corr	-0.71	-0.84
	Mx.Corr	0.66	0.90

MODIS-NDVI vs Precipitation (2001-2022)



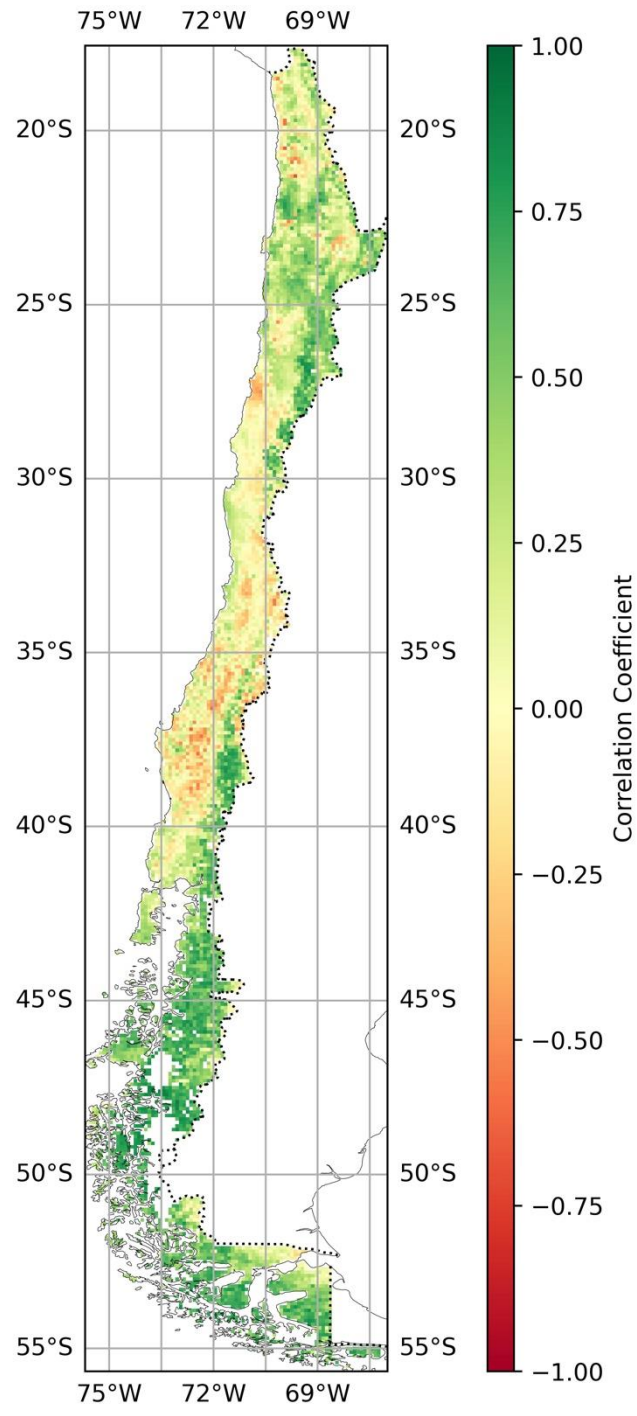
AVHRR-NDVI vs Temperature (1982-2013)



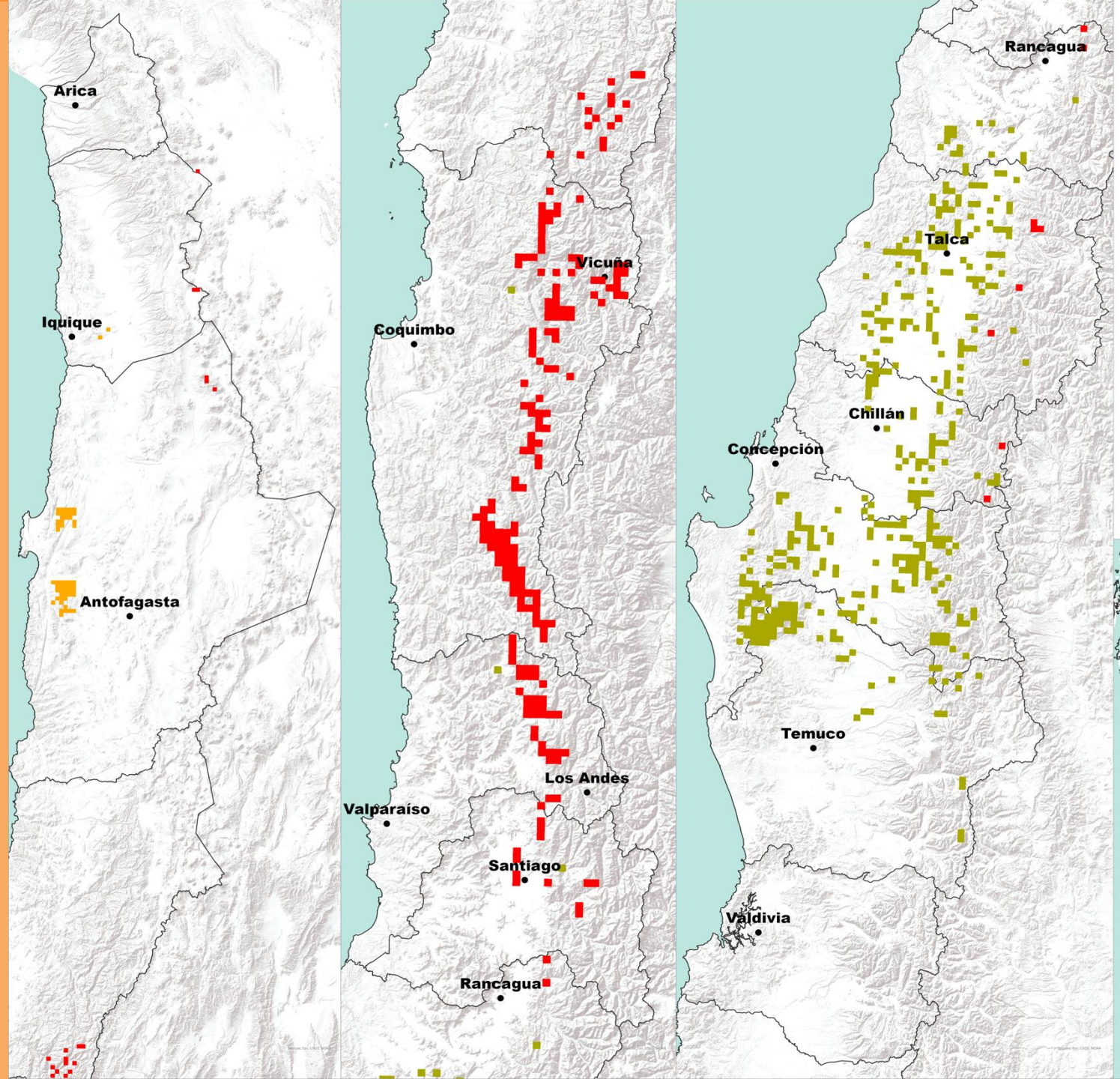


		AVHRR-NDVI	MODIS-NDVI
Temperature ERA5	Mn.Corr	-0.58	-0.69
	Mx.Corr	0.72	0.896

MODIS-NDVI vs Temperature (2001-2022)

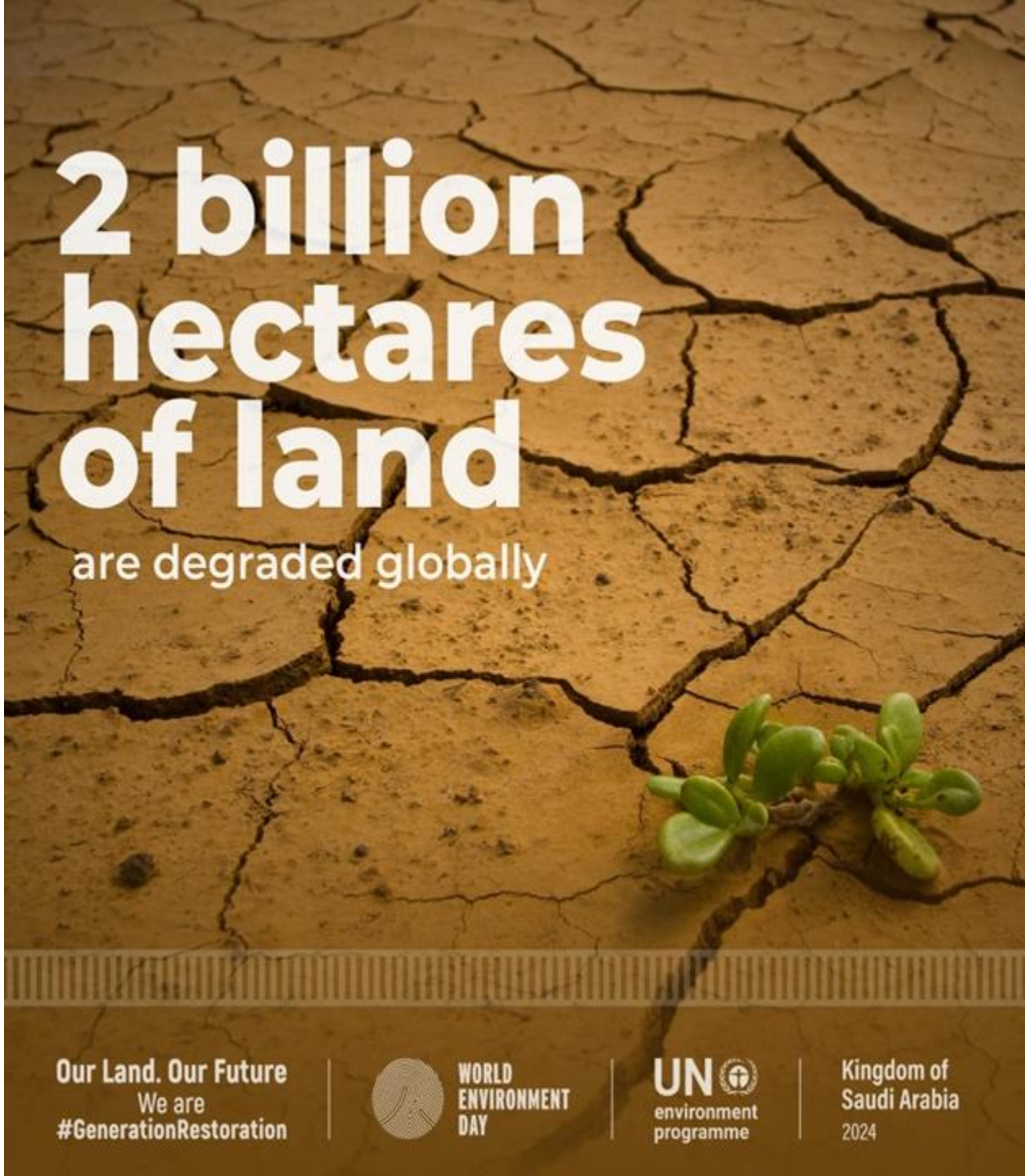


Vegetation-Climate dynamics



Future Work

- Either negative or positive dynamics must be analysed carefully.
- Differences between products are expected, but these different results and analysis can lead or be translated to different mitigations and/or policies
- There is still more than 75% of the resulting analysis that cannot be linked to trends of climate variables
- Link to human activities or population distribution is still to be found



Outreach

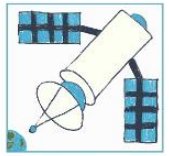
How to teach remote sensing?

… **to kids!!!**

More than Maps

More than Maps *is a platform that shares replicable and open-access skills in mapping and social science analysis as to empower young people in climate change adaptation.*

Covering themes including:

Small Island Developing States		Climate change impacts
Remote sensing		Google Earth Engine
Social data collection		Community science
Stakeholder analysis		Environmental monitoring methods
Disaster risk management		Policy making

University of Southampton

ESRC FESTIVAL OF SOCIAL SCIENCE

OUR CHANGING ENVIRONMENT

Harnessing the Power of Maps and People

Find the 7 differences...

November 10th, 2013 | February 16th, 2014

SOMERSET LEVELS FLOOD

Somerset Levels = coastal plain and wetlands area artificially drained, irrigated and modified for farming.

Factors:

- Above average levels of rain (35 cm of accumulated rain between January and February)
- Saturated grounds
- Bristol channel and clogged local rivers

Impacts:

- Over 600 houses were flooded
- Damage estimated of more than £10 million
- 14 ha of land under water for 3-4 weeks
- Floodwater was contaminated with sewage and other chemicals

Learn how to identify, measure and analyse these differences using...

- Geographical Information Systems (GIS) and Remote Sensing
- Stakeholder Analysis

SARTRAC SargSnap!

Lesson Plan

Timing	Learning Objective	Page and content	Teachers Instructions
5 mins	Learning objectives	3. Teacher to go through the learning objectives with student	
5 mins	(1) Data collection techniques	4. Quantitative method, Qualitative method	Give students time to read the diagram or read them out loud Teacher to share information about the process to obtain information through quantitative and qualitative methods Teacher to share the information on the examples of data collection methods. Ask students for other examples
5 mins	(2) Definition	5. Remote sensing definition	Give students time to read the diagram or read them out loud
5 mins	(2) Uses of remote sensing	6. What can be studied using remote sensing	Give students time to read the diagram or read them out loud Teachers to explain the use of remote sensing to study sargassum as a tool for environmental and ocean monitoring.
5 mins	(3) Types and evaluation	7. Types of remote sensing 8. Advantages and disadvantages 9. Examples of image types	Give students time to read the diagram or read them out loud Teacher to explain the examples, pointing out the changes and/or differences.
5 mins	(6) Image analysis	10. Image analysis checklist	Teacher to explain the checklist
20 mins	(4&6) Uses of satellite data	11. Floodings 14. Gold Mining 12. Earthquake 15. Sargassum 13. Tsunami 16. Activity 1: Object identification	Teacher to share the information the examples while asking students for differences between pre and post event images (use the Flooding example to point out changes). Students should do this independently and then go over the answers together.
20 mins	(5) Photography as a remote sensing method	17. Timeline of use of photography 18-19. Sargassum 20. Coastal Management 21. Fog water collection 22. Conservation 23. Activity 2: Object identification	Teacher to share the information on the uses of photography through history. Let students read about the examples shared in both booklets, discuss the potential uses in the coast of Ghana. Student to share differences found between the images. Students should do this independently and then go over the answers together.
5 mins	(5) Distribution of Sargassum	24. Map of sargassum	Teacher to describe the distribution of sargassum across the Tropical Atlantic
5 mins	Conclusions	25. Activity 3: students will recap what they have learnt	Students should do this independently and the teacher can go over learning points.