UNDERSTANDING TRENDS AND DYNAMICS OVER THE LAST FOUR DECADES OF VEGETATION GREENNESS IN CHILE

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RESEARCH AIM

The study aims to understand growth dynamics of vegetation in Chile in relation to other physical variables such as precipitation, temperature, soil moisture, and evapotranspiration over the last 40 years. This is a lack of studies that makes a relation between vegetation state and the different processes that might affect its present and future distribution on coverage, especially in the selected study area, Chile. The respective trends of the previous mentioned physical variables will be evaluated on a yearly basis and in the respective years (May to October), to determine the why and where of the changes on vegetation dynamics.

METHODOLOGY

Precipitation (ECMWF) and Vegetation (AVHRR) station data are used to extract the values according to the following criteria:

- Negative trends in vegetation and precipitation are significant results.
- Significant negative trends in vegetation indicate “browning” and are affected by negative precipitation trends or the increase in temperature over the last 40 years. Future work will explore the reasons and drivers of this process around the physical variables evaluated, but at the moment, changes in vegetation greenness are mainly controlled by changes in precipitation.
- Significant positive trends in vegetation indicate “greening” and are affected by positive precipitation trends or the decrease in temperature over the last 40 years. Future work will explore the reasons and drivers of this process around the physical variables evaluated, but at the moment, changes in vegetation greenness are mainly controlled by changes in temperature.

RESULTS

- Significant negative trends in vegetation and precipitation are significant results.
- Significant negative trends in vegetation indicate “browning” and are affected by negative precipitation trends or the increase in temperature over the last 40 years. Future work will explore the reasons and drivers of this process around the physical variables evaluated, but at the moment, changes in vegetation greenness are mainly controlled by changes in precipitation.
- Significant positive trends in vegetation indicate “greening” and are affected by positive precipitation trends or the decrease in temperature over the last 40 years. Future work will explore the reasons and drivers of this process around the physical variables evaluated, but at the moment, changes in vegetation greenness are mainly controlled by changes in temperature.

DISCUSSION

Initial results suggest that:

- Vegetation trends display significant negative trends in both extremes of Chile, and a significant positive trend in the central/south area of the country. It is important to note that in the same areas that present a significant increment in NDVI values, there are also areas with no significant changes over the last 40 years.
- Precipitation, as a variable and possible driver, presents a significant negative trend in the central/south area of Chile, affecting mainly temperate evergreen forest and shrublands (Guerrieri, F. & Pliscoff, P. 2017).
- Temperature displays a positive trend all along the country, which can be translated to an increment in temperature on a range between 0°C to 0.5°C. The rest of the continental territory displays no significant trends (either positive or negative).
- From Coquimbo to Los Lagos, there is an ongoing “greening” process (~24 km²), this area presents a positive trend in its NDVI values over the last four decades.
- This “greening” process is not affected by the vegetation trends of precipitation or the increase in temperature over the last 40 years. Future work will explore the reasons and drivers of this process around the physical variables evaluated, but at the moment, changes in vegetation greenness is mainly controlled by changes in precipitation.
- The opposite scenario of “browning” is present at the moment in ~47 km² of the continental territory of Chile. It affects mainly semi-arid and shrubland environments in the north and arid environments in the central area of Chile.
- This “browning” process is highly affected and sustained by negative precipitation trends over the last 40 years. Future work will explore the physical variables affecting and look upon the human effects in the same area.

FUTURE WORK

- Further spatial analysis will be undertaken to identify geographic distribution of key drivers of vegetation changes in the past and future scenarios.
- Evaluation of different phenomena that can affect vegetation cover and its distribution, such as land degradation, desertification or changes related to human and urbanization.
- Evaluation of changes in land cover use, agriculture and agriculture irrigation, affects of urbanization and population density, looking to understand the different dynamics within the territory and how this dynamics does not always result in a diminution of vegetation cover.
- Links to different phenomena that can and does affect the country, especially desertification, will be analysed including both physical and human variables results. Exploring land degradation dynamics, types of vegetation affected and what are the human drivers of changes in land and land cover.
- Machine learning algorithms such as linear regression, support vector regression, and random forests will be developed to model the patterns of present and future vegetation changes considering all possible drivers of vegetation change.
- Finally, key areas of changes in vegetation cover under future climate change and development scenarios will be identified to develop a management strategy.

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