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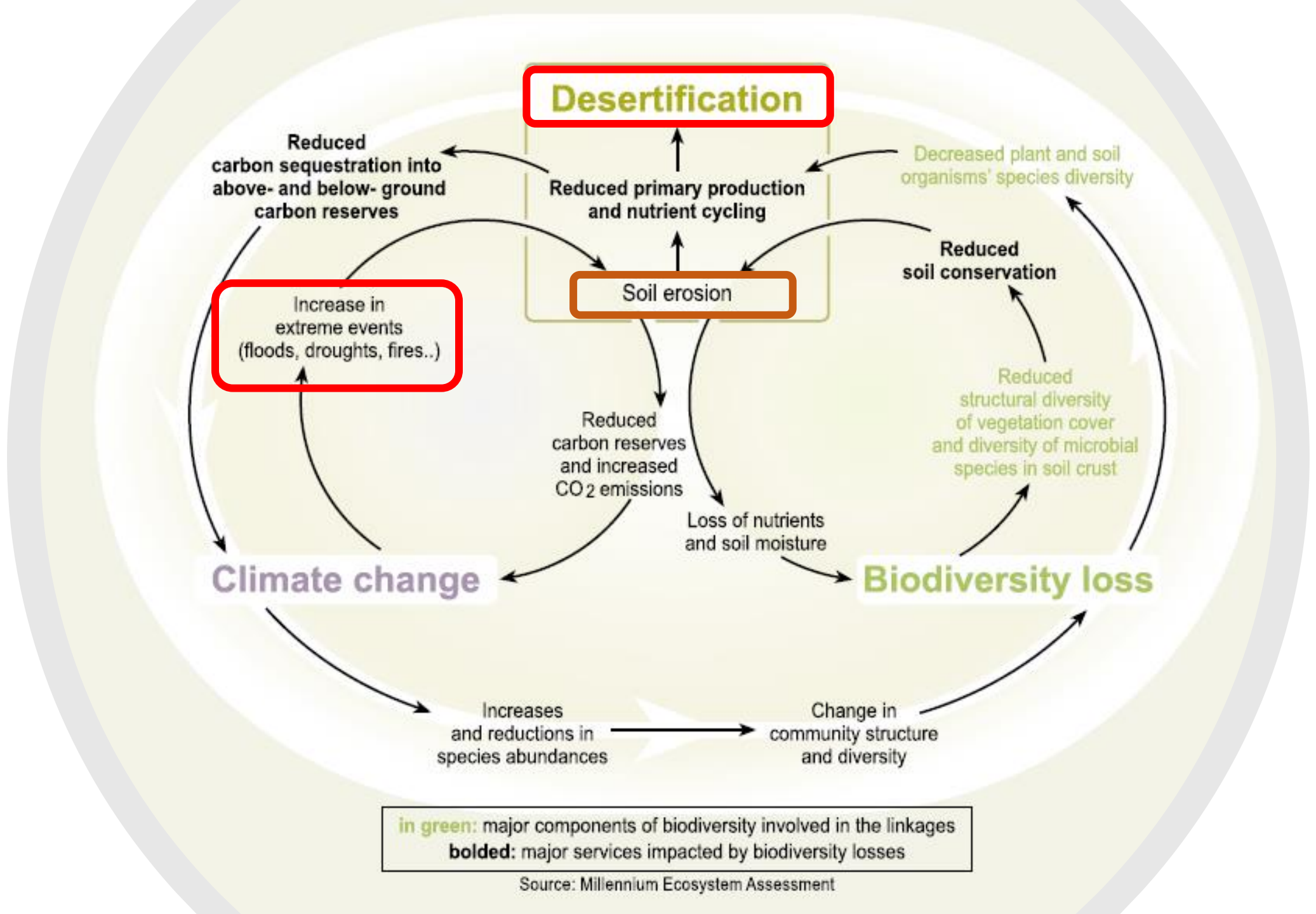
CHANGE TRENDS IN DROUGHT SUSCEPTIBILITY: A CASE STUDY USING SPI IN NORTHEAST PORTUGAL

Coimbra -October, 2020

Introduction

- Clear changes in global climate are being reported and future climate scenarios keep alerting to relevant changes in mean air temperature and in rainfall distribution patterns;

- Increase in weather conditions variability in recent years prospects higher frequency and severity of extreme events, namely an extension of drought periods;

Desertification

Reduced carbon sequestration into above- and below- ground carbon reserves

Reduced primary production and nutrient cycling

Decreased plant and soil organisms' species diversity

Soil erosion

Reduced soil conservation

Increase in extreme events (floods, droughts, fires..)

Reduced carbon reserves and increased CO_2 emissions

Reduced structural diversity of vegetation cover and diversity of microbial species in soil crust

Loss of nutrients and soil moisture

Climate change

Biodiversity loss

Increases and reductions in species abundances

Change in community structure and diversity

in green: major components of biodiversity involved in the linkages
bolded: major services impacted by biodiversity losses

Source: Millennium Ecosystem Assessment

Introduction

Drought Indicators: *Standardised Precipitacion Index* (SPI)

	SPI value		Category
Higher than the average rainfall	> 2.0		Extremely wet
	1.5 a 1.99		Very wet
	1.0 a 1.49		Moderately wet
Average rainfall	-0.99 a 0.99		Near normal
Lower than the average rainfall	-1.0 a -1.49		Moderately dry
	-1.5 a -1.99		Severely dry
	< -2.0		Extremely dry

Source: WMO, 2012

✓ Recomended by WMO

The SPI adjusts data from a historical rainfall series through a gamma probability distribution, which is then transformed into a standardised Gaussian distribution.

Because it is a standardised distribution, it can be applied to dry and humid climate zones.

➢ requires only precipitation series as input data

➢ It can be calculated for different response time scales (1 to 24 months)
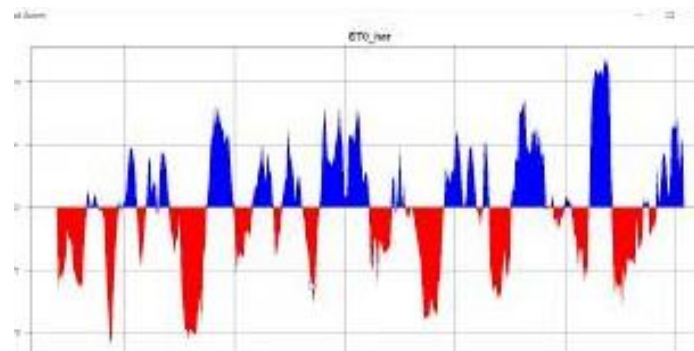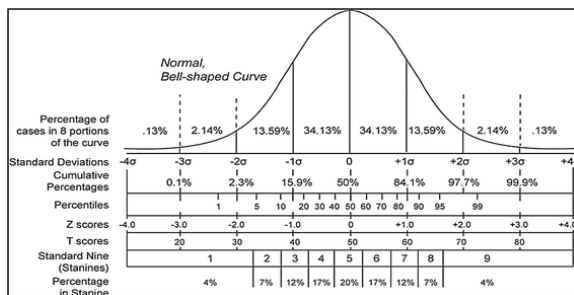
Objective

- Much of Trás-os-Montes mountain region, northeast Portugal, are drylands enduring soil degradation processes, therefore facing medium to high susceptibility to desertification and drought.

- This study aims to analyze temporal change trends in the extension of drought periods in northeast (NE) Portugal.
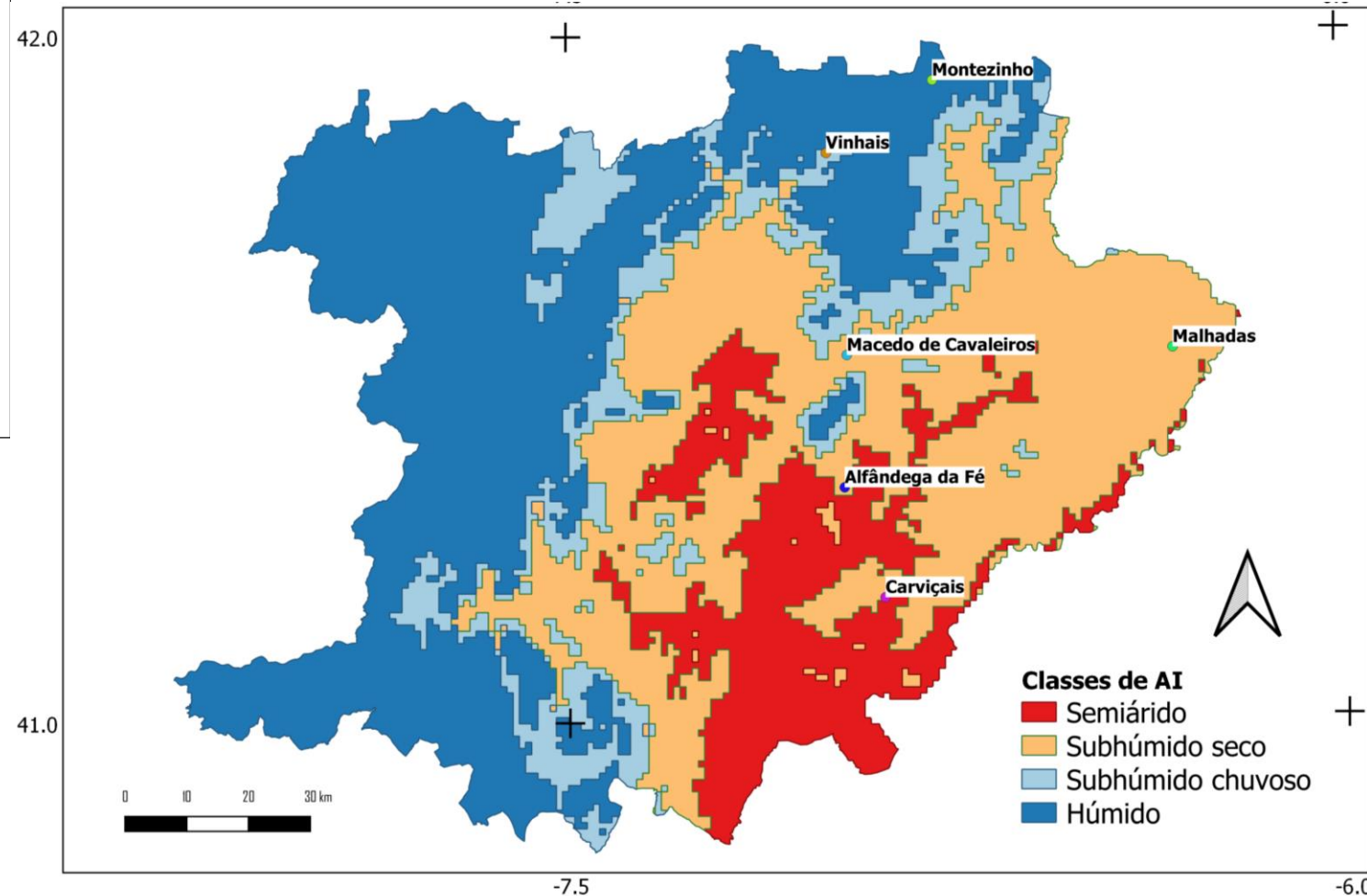

Source: Figueiredo, 2013
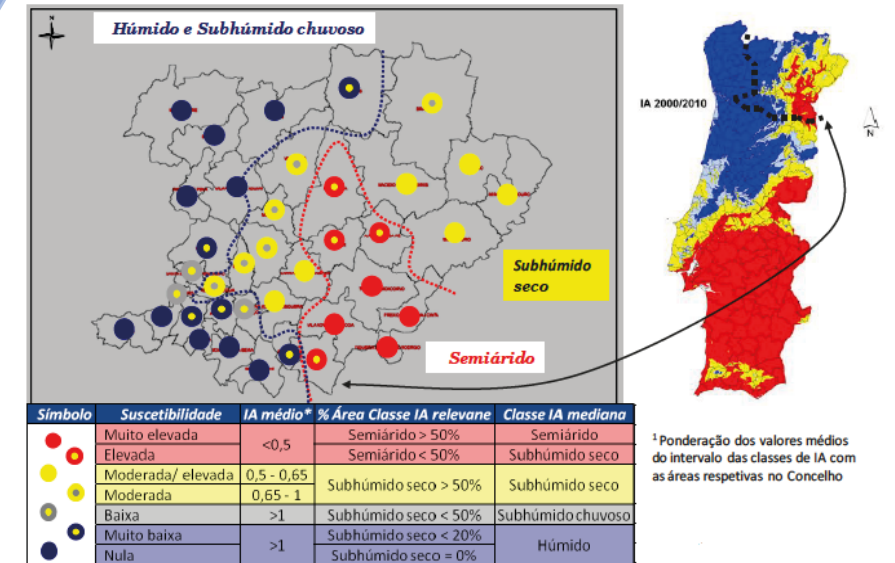
Methodology

Monthly Precipitation Data Series from SNIRH from 6 weather stations, considered as reference due to their long term records (>70 years)
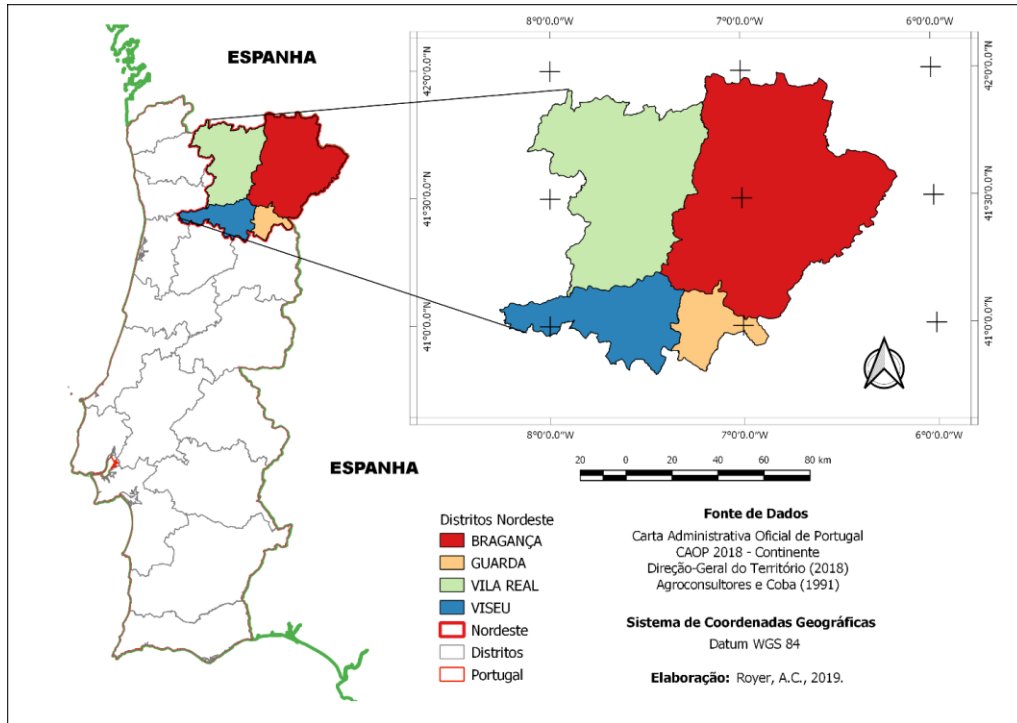
Stations that cover the main climatic domains of the region (humid to semiarid)
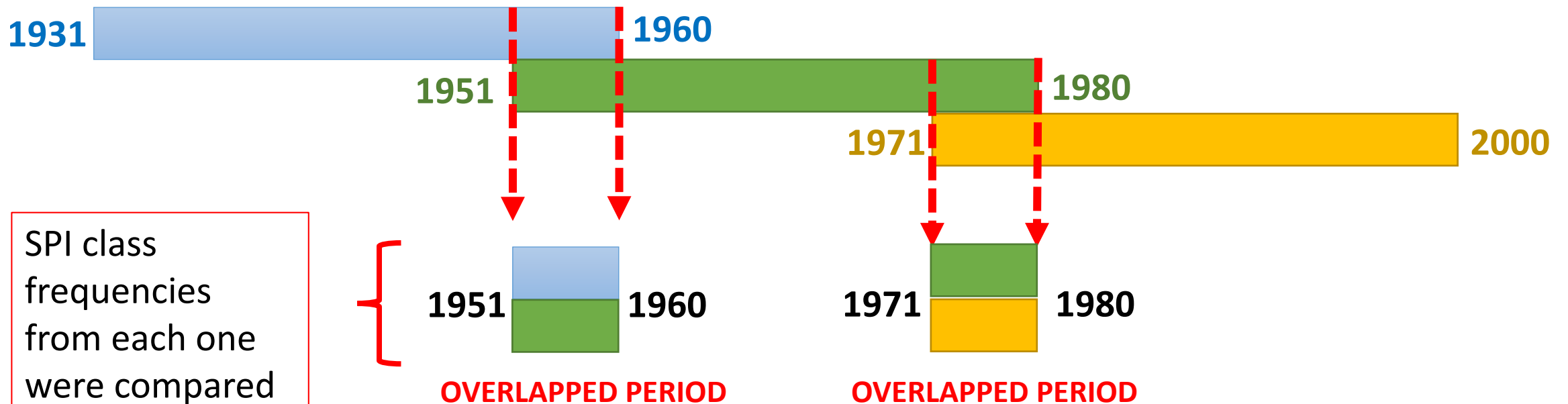
Methodology

SPI temporal time scales adjusts to 1, 3 and 6 months, using 3 **Climatological Normal**

Analysis of overlapped periods (**1951-1960 and 1971-1980 decades, 120 months each)** where SPI class frequencies issued from each one of the two overlapping normal were compared

SPI Generator v 1.7.1

1931   1960
1951

1971   1980

2000

SPI class frequencies from each one were compared

1951   1960   1971   1980

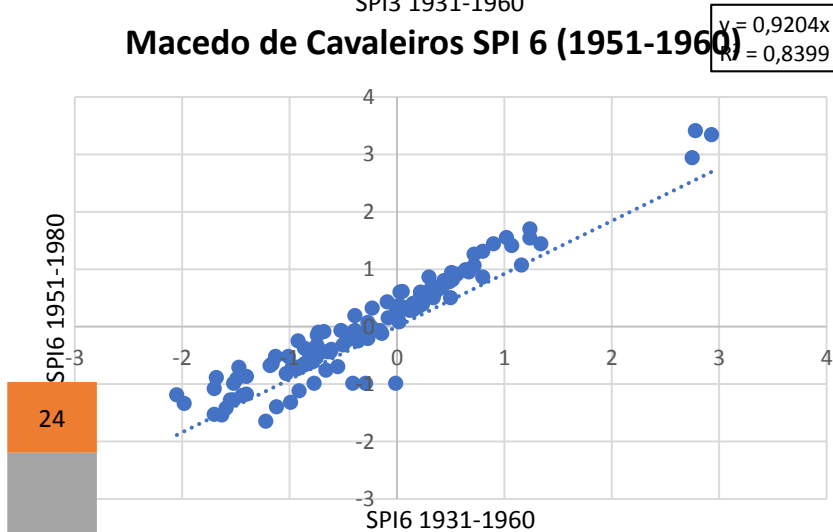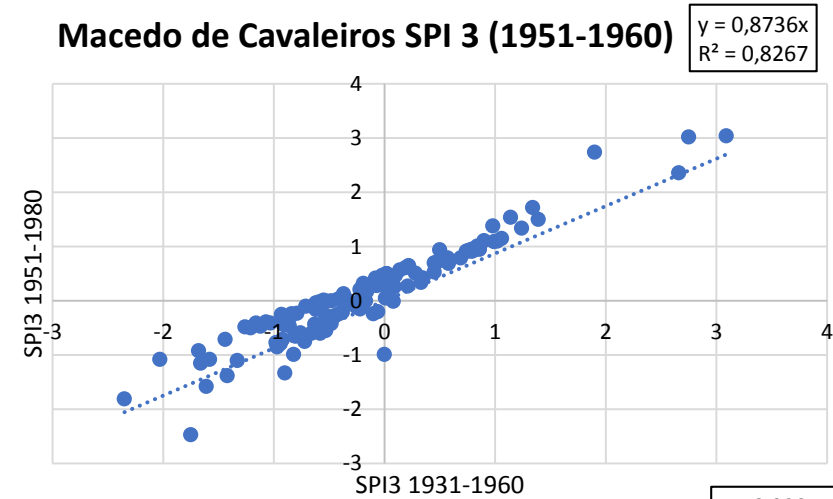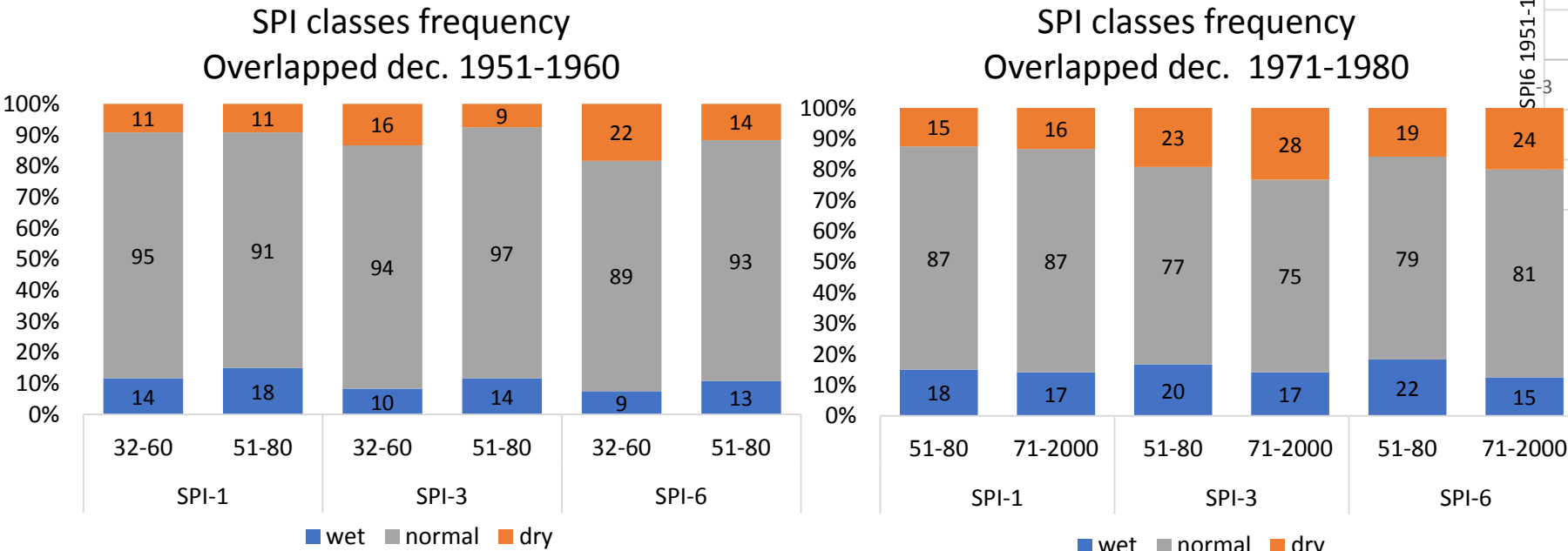OVERLAPPED PERIOD   OVERLAPPED PERIOD

Results and Discussion

- As SPI response time scale increases (1 to 6 months) and a more recent climatological normal is considered (1931-1960 to 1971-2000), the frequencies of dry and wet months in the overlapped periods increased at the expenses of the normal months' frequencies.

SPI class frequency - Vinhais
Overlapped dec. 1951-1960

SPI class frequency - Vinhais
Overlapped dec. 1971-1980
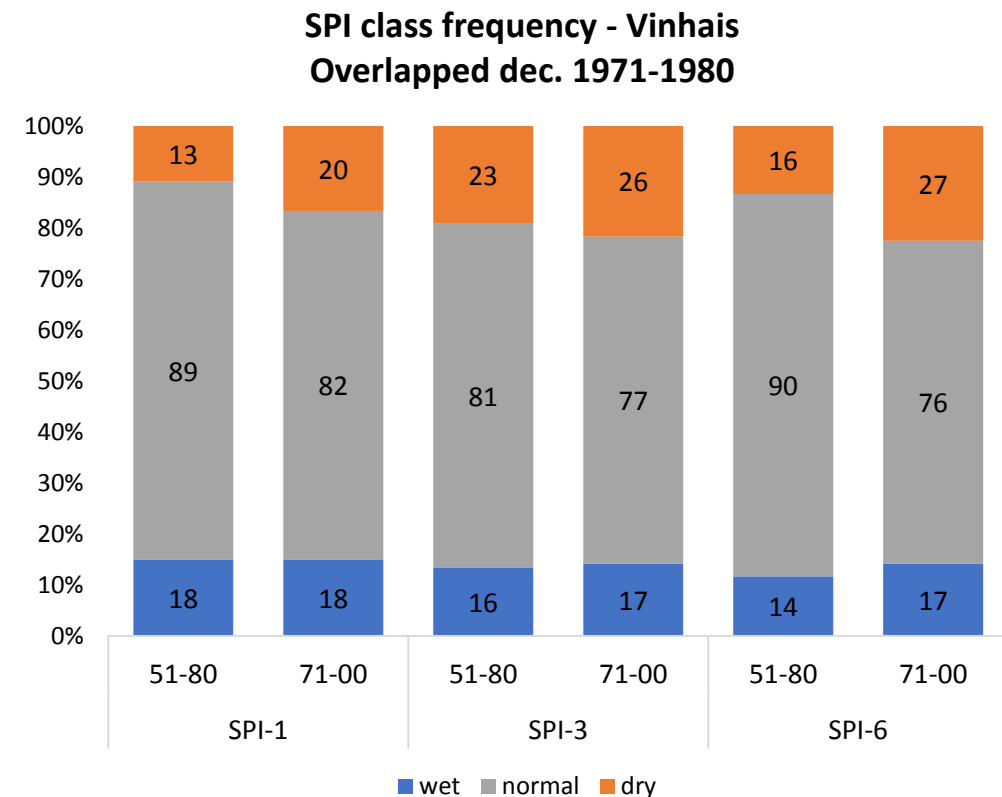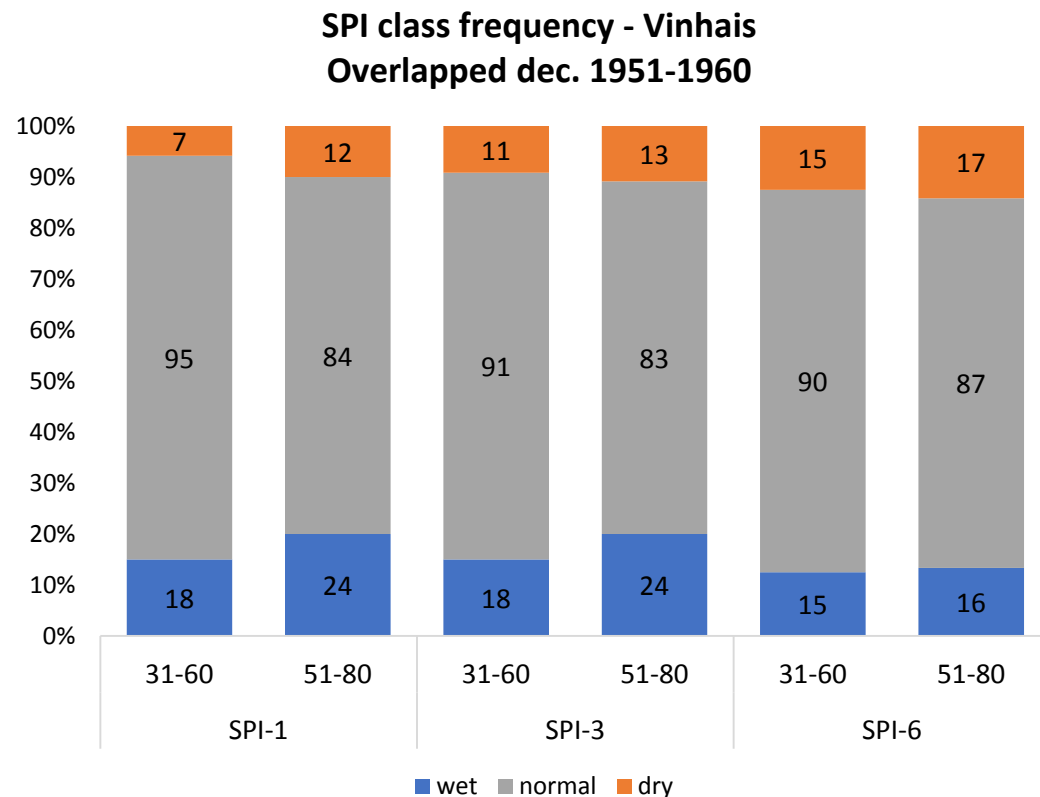
Results and Discussion

- The distribution of the data series is altered by the increase in the number of extreme events, whether wet or dry. The angular coefficient of the trend line tends to increase with the increasing of the SPI time scale.

Weather Station: <u>MACEDO DE CAVALEIROS</u>

Macedo de Cavaleiros SPI 3 (1951-1960)
y = 0,8736x
R² = 0,8267

Macedo de Cavaleiros SPI 6 (1951-1960)
y = 0,9204x
R² = 0,8399

SPI classes frequency
Overlapped dec. 1951-1960

SPI classes frequency
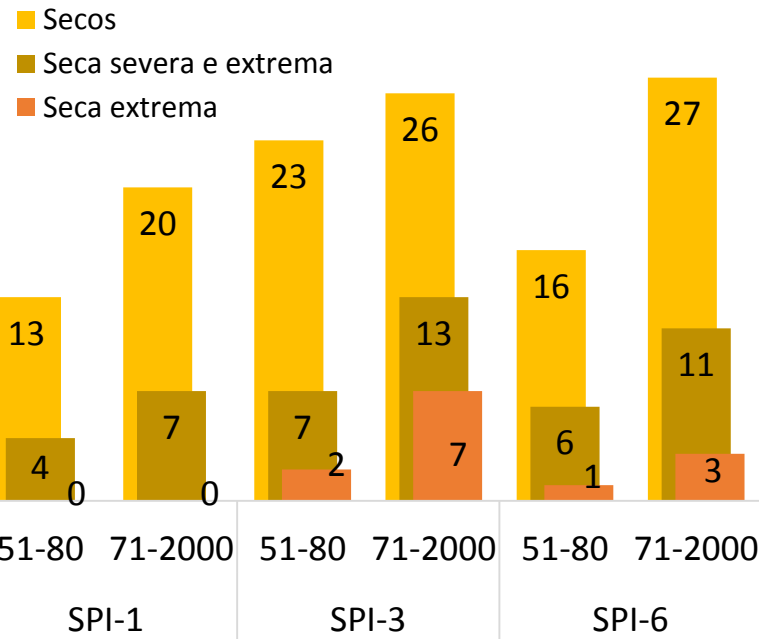Overlapped dec. 1971-1980

Results and Discussion

Frequencies of months with severe and extreme drought during the overlapped periods increased as well, more visible for the SPI 3 months time scale and for stations located in semi-arid zones.
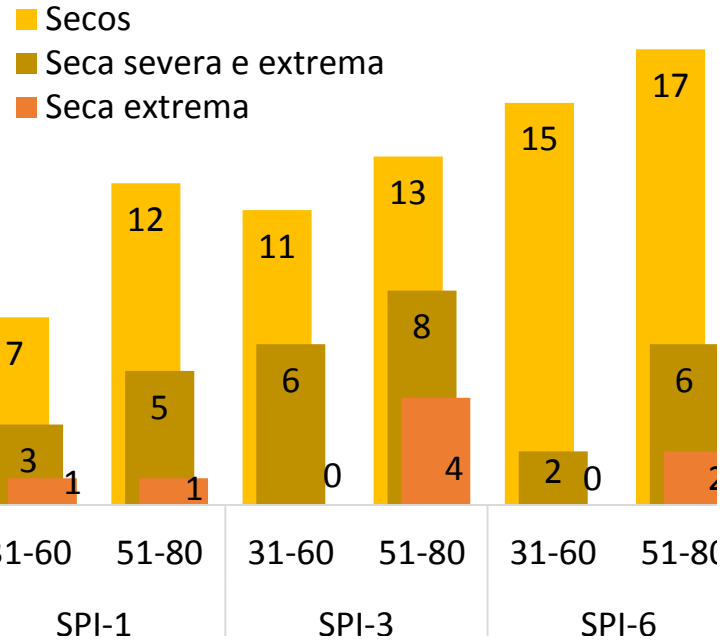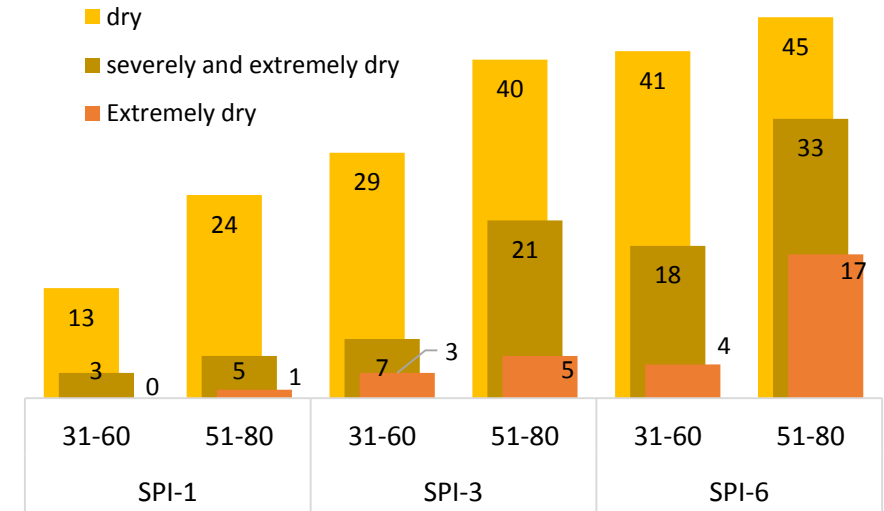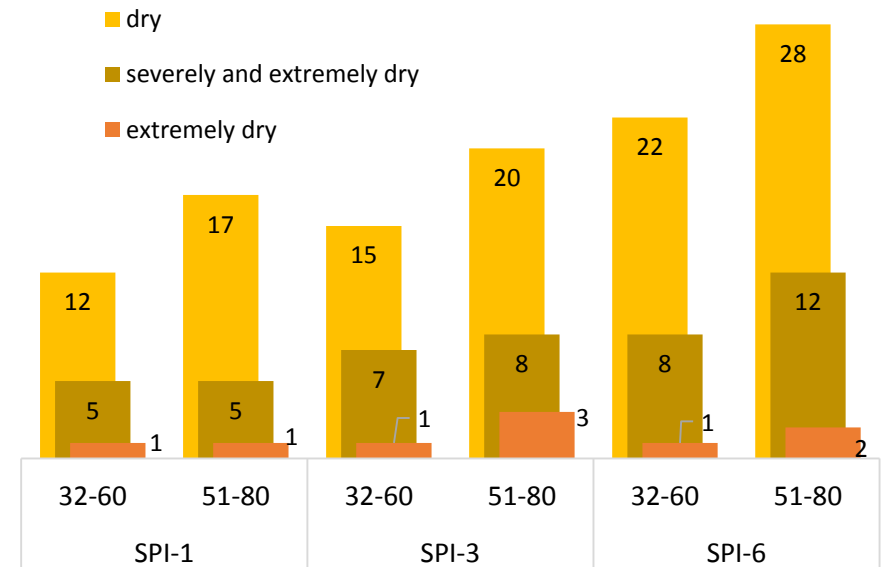

ALFÂNDEGA DA FÉ
Overlapped decade 51-60

VINHAIS Overlapped Dec. 51-60

VINHAIS – Overlapped Dec. 71-80

MALHADAS
Overlapped decade **51-60**

Concluding remarks

- The frequency distribution of SPI classes changes when two distinct climatological normal are used as input data and it shows a trend towards extreme events as the SPI time scale increases and a more recent normal is used.

- Related to the dry periods, the analysis of overlapping series reveals a considerable tendency towards droughts of 3 months duration.

- The general change trend observed in the study confirms a progressive increase in drought extension and severity in a region already facing desertification threat, as in the case of NE Portugal

Thanks for your attention!

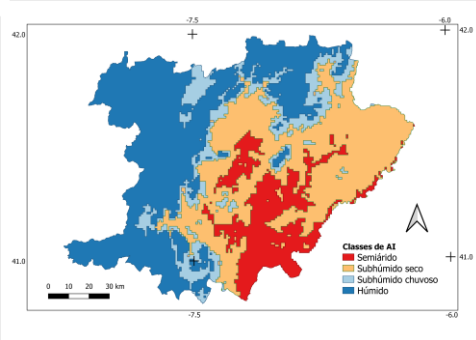ana.caroline.royer@gmail.com

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Acknowledgements