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Impact of climate change on bioclimatic zoning of chestnut trees in Portugal

CL3.2.5 - Impact of climate change on agriculture

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CL

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1 Study description

Species

Chestnut tree
(*Castanea sativa*)

Area

Mainland Portugal

Climate Variables/Datasets

Climatic variables:

- Degrees days : 1900 to 2400 °D
- Annual mean temperature: 8 to 15 °C
- Summer days with maximum temperature below 32°C
- Annual accumulated precipitation: 600 to 1600 mm
- Chestnut suitability Index

Datasets:

- IBERIA01 (1985-2005)
- MPI-M-MPI-ESM-LR
- IPSL-IPSL-CM5A-MR
- ICHEC-EC-EARTH
- CNRM-CERFACS-CNRM-CM5

RCP: RCP 4.5 and RCP 8.5

Period: 2021-2040; 2041-2060; 2061-2080.

Objective: Bioclimatic zoning of chestnut in Portugal

2 Chestnut tree evolution on Portugal

Chestnut Production	Chestnut area distribution by COS	Protected Denomination of Origin

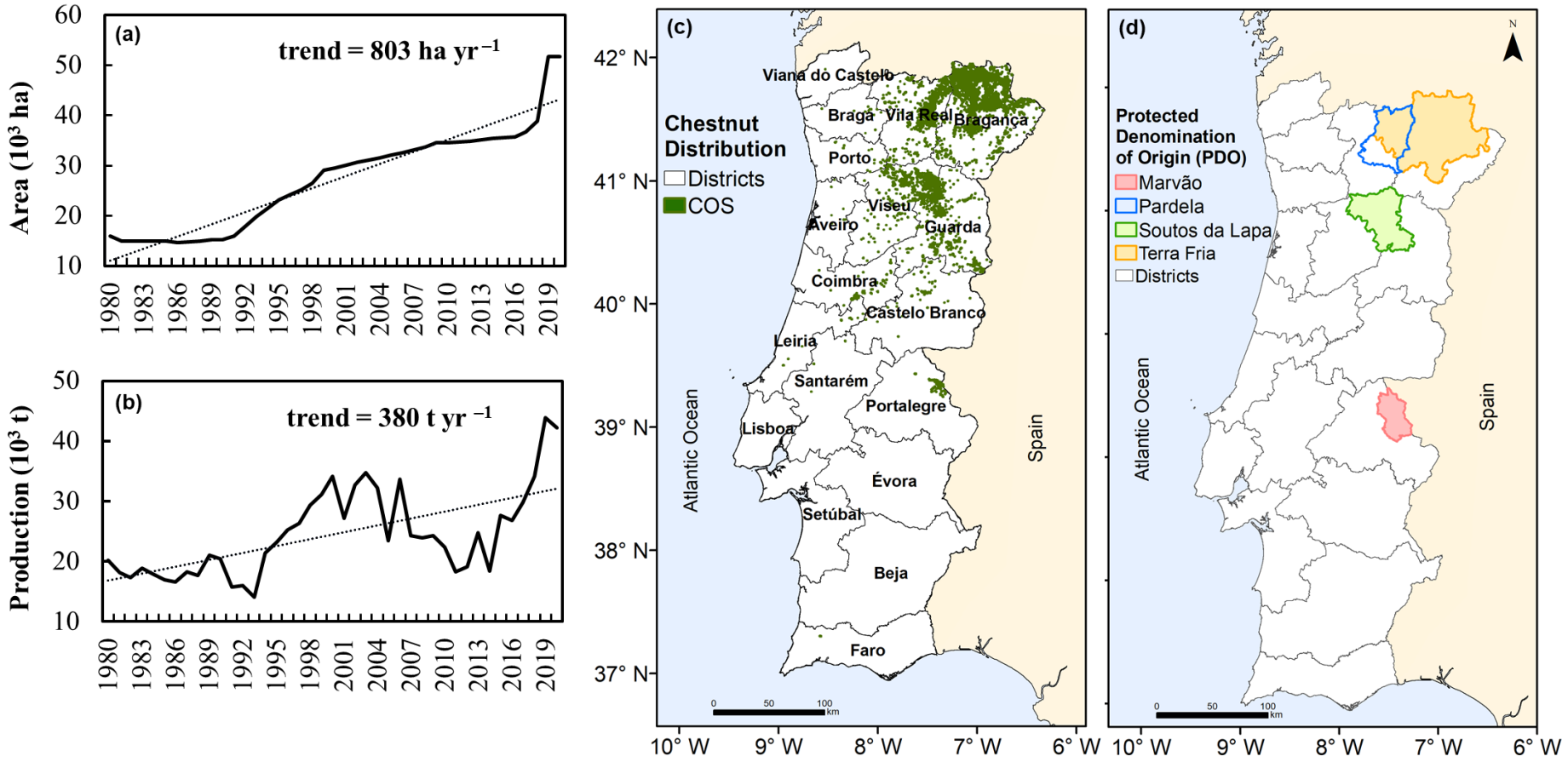

Figure 1. Chestnut (a) land cover area (hectares) and (b) yield (t) in Portugal, between 1980 and 2020. The linear regression trends are also shown, along with the corresponding trend value (c) chestnut distribution areas in mainland Portugal; (d) location of the chestnut Protected Denomination of Origin (PDO) regions.

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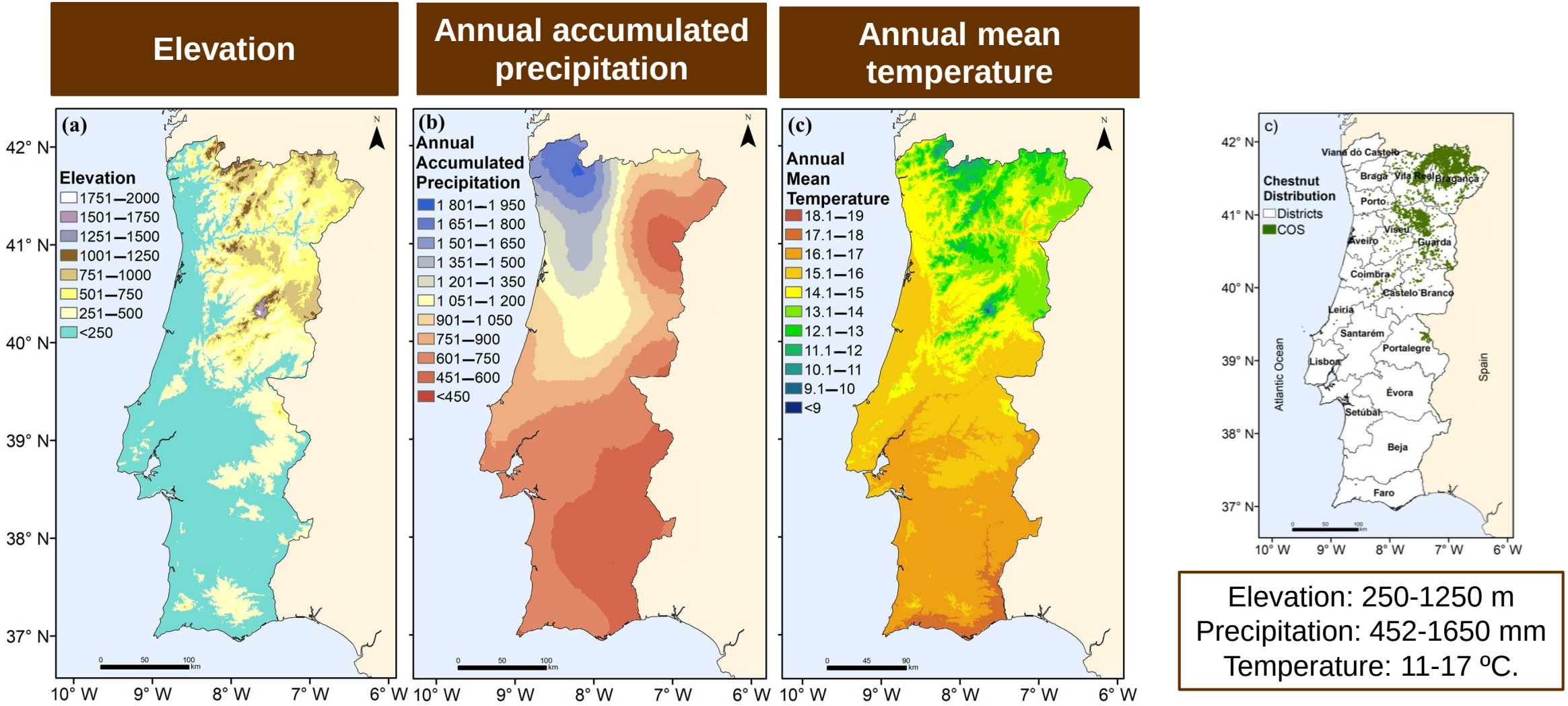
3 Chestnut tree characterization by climate conditions



Elevation: 250-1250 m
Precipitation: 452-1650 mm
Temperature: 11-17 ºC.

Figure 2. Mainland Portugal characterization of (a) elevation; (b) annual accumulated precipitation; (c) annual mean temperature.

4 Results

Bioclimatic Indices

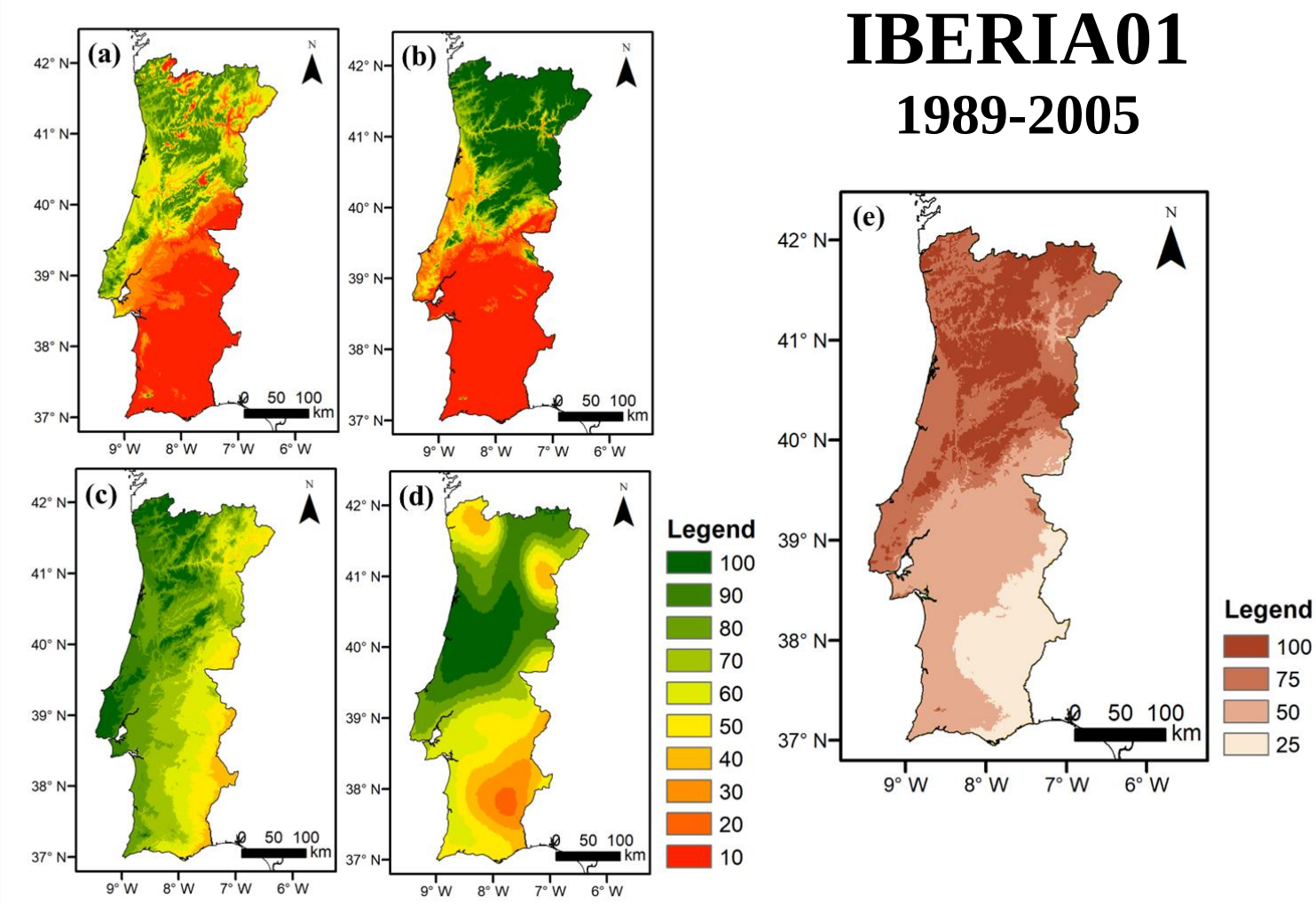


Figure 3. Mean percentage of occurrence of (a) growing degrees days between 1900–2400 °C, (b) annual mean temperature between 8–15 °C, (c) summer days with maximum temperature below 32 °C, (d) annual accumulated precipitation between600–1600 mm and (e) chestnut suitability index, for the baseline (IBERIA01; 1989–2005) period.

Bioclimatic Indices

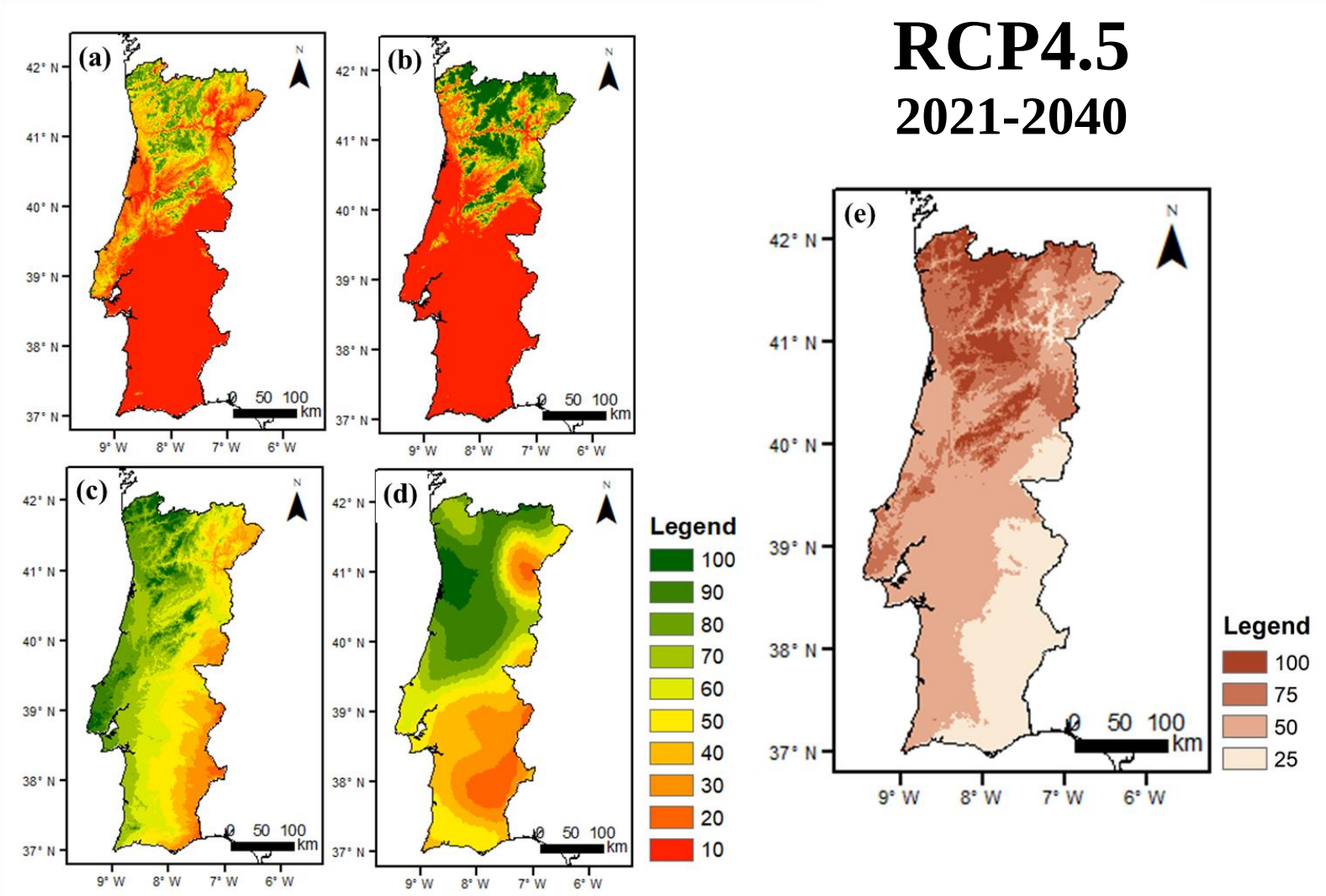


Figure 4. Mean percentage of occurrence of (a) growing degrees days between 1900–2400 °C, (b) annual mean temperature between 8–15 °C, (c) summer days with maximum temperature below 32 °C, (d) annual accumulated precipitation between 600–1600 mm and (e; j) chestnut suitability index, for 2021–2040, four GCM-RCM experiment, under RCP4.5.

Bioclimatic Indices

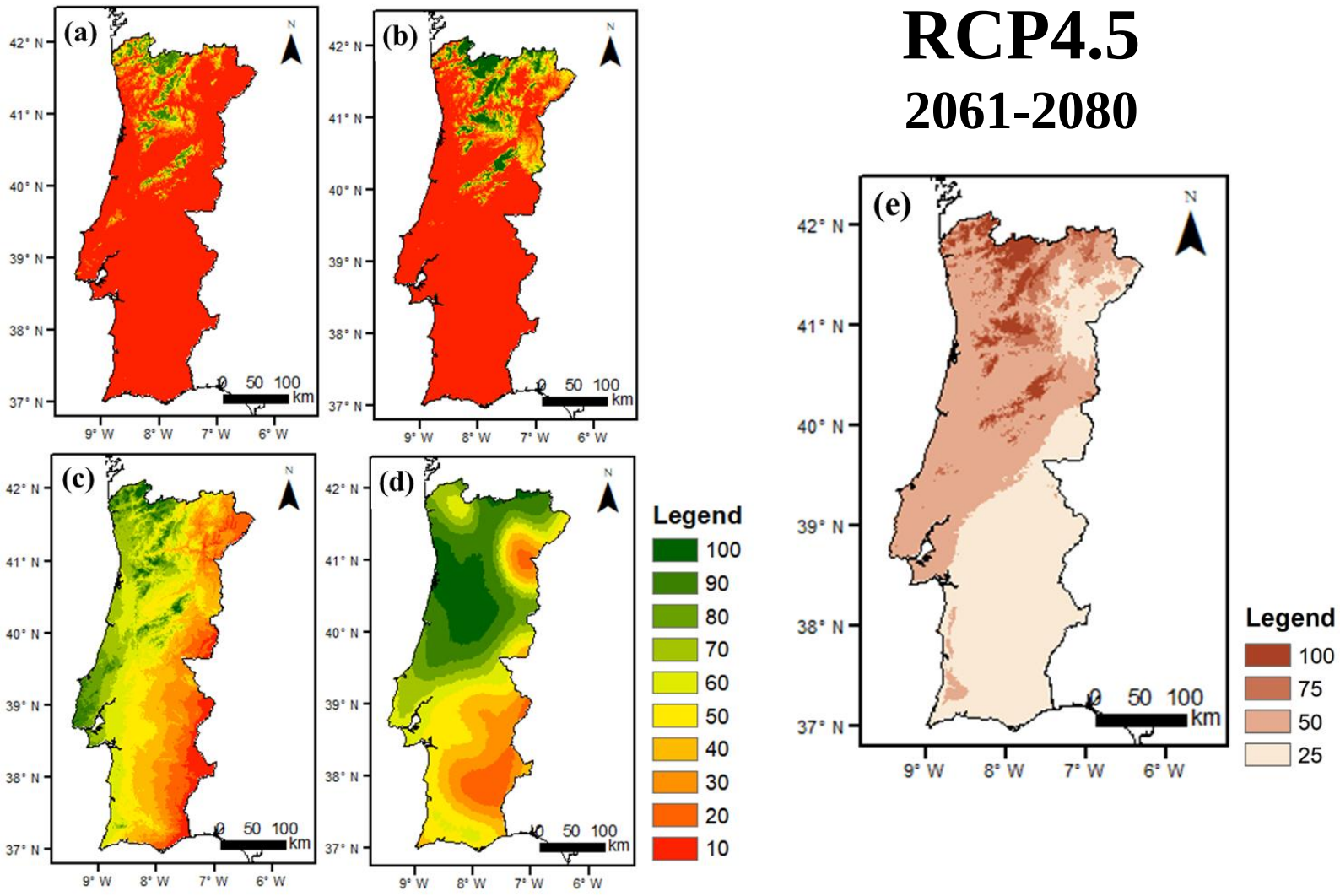


Figure 6. Mean percentage of occurrence of (a) growing degrees days between 1900–2400 °C, (b) annual mean temperature between 8–15 °C, (c) summer days with maximum temperature below 32 °C, (d) annual accumulated precipitation between 600–1600 mm and (e) chestnut suitability index, for 2061–2080, four GCM-RCM experiments, under RCP4.5.

Bioclimatic Indices

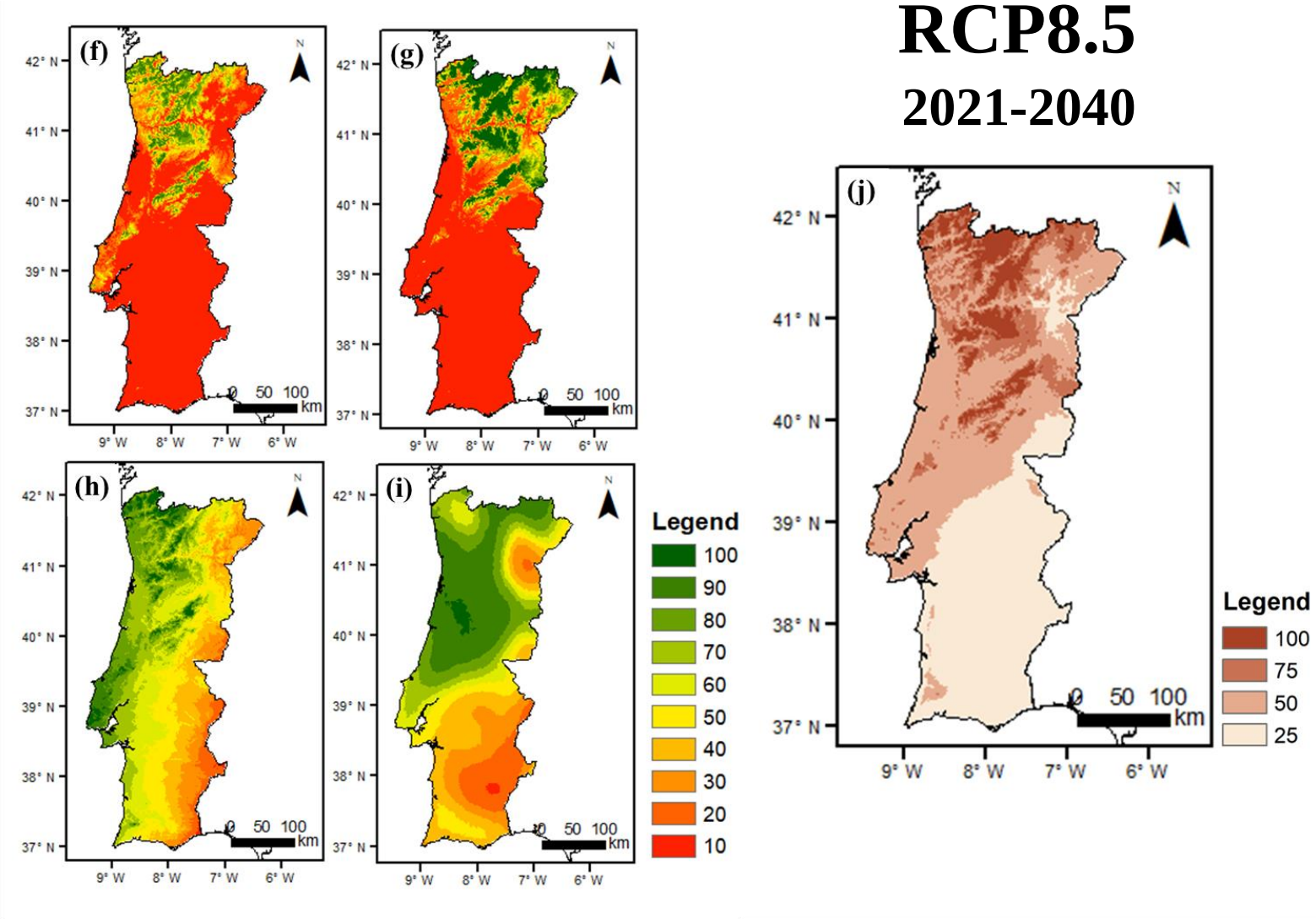


Figure 7. Mean percentage of occurrence of (f) growing degrees days between 1900–2400 °C, (g) annual mean temperature between 8–15 °C, (h) summer days with maximum temperature below 32 °C, (i) annual accumulated precipitation between 600–1600 mm and (j) chestnut suitability index, for 2021–2040, four GCM-RCM experiment, under RCP8.5.

Bioclimatic Indices

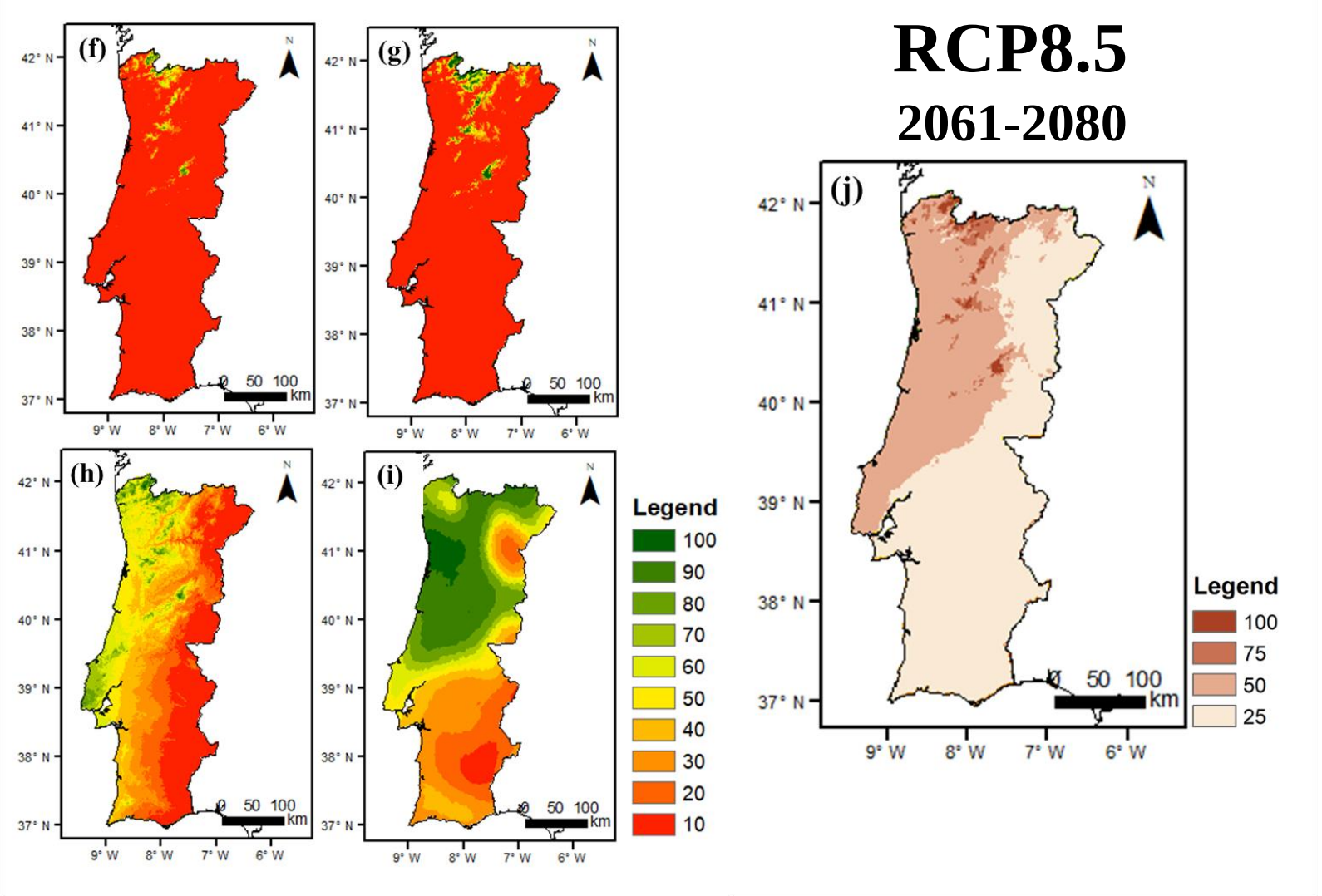


Figure 9. Mean percentage of occurrence of (f) growing degrees days between 1900–2400 °C, (g) annual mean temperature between 8–15 °C, (h) summer days with maximum temperature below 32 °C, (i) annual accumulated precipitation between 600–1600 mm and (j) chestnut suitability index, for 2061–2080, four GCM-RCM experiments, under RCP8.5.

Chestnut Suitability Index

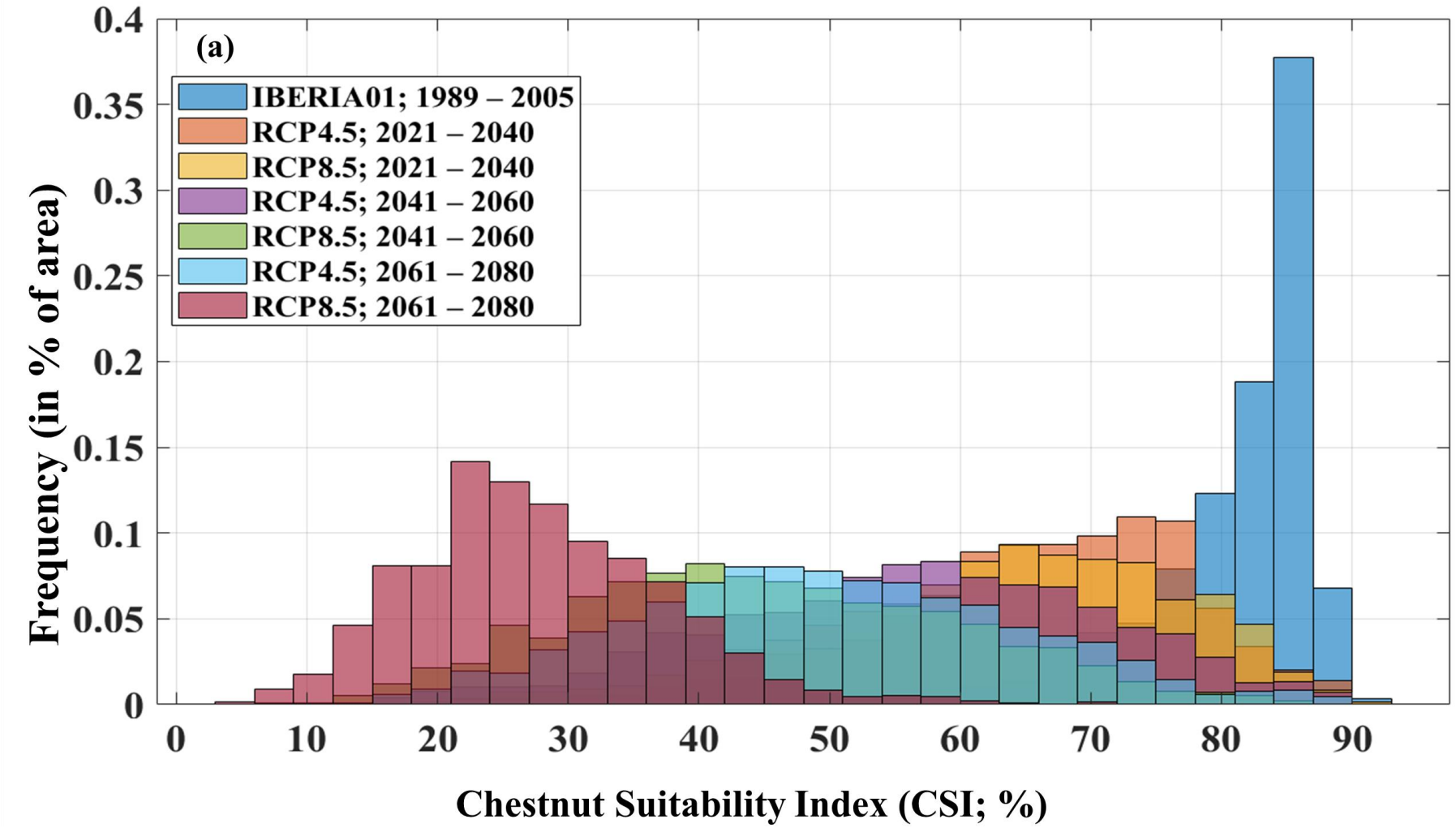


Figure 10. Relative distribution of chestnut areas (%) as a function of the CSI for (a) all periods (2021–2040; 2041–2060; 2061–2080) and the distribution for the baseline period (IBERIA01, 1989–2005).

5 Conclusion

- Climate change impacts on chestnut bioclimatic suitability may have socio-economic and ecological implications;
- This work intended to support chestnut tree sector with the implementation of adequate measures to warrant the sustainability of production and species adaptability.
- Partnerships with research units and agricultural associations are strongly encouraged to acquire more field data and outline strategies to cope with climate change and reduce its derived risks.

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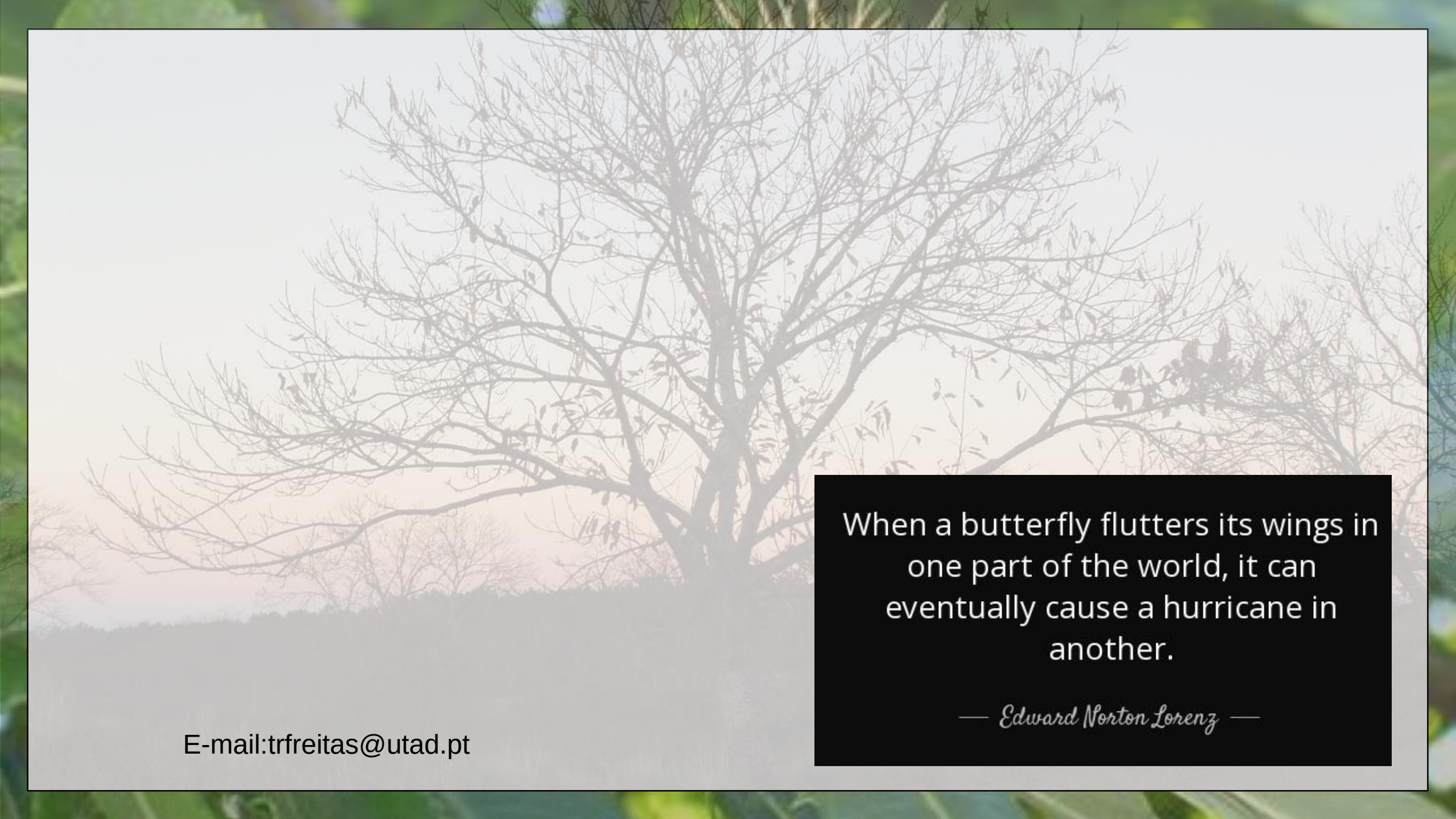

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