Regional conference

Climate change effects and adaptation in South-West Europe

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Santiago 24 th. October 2012

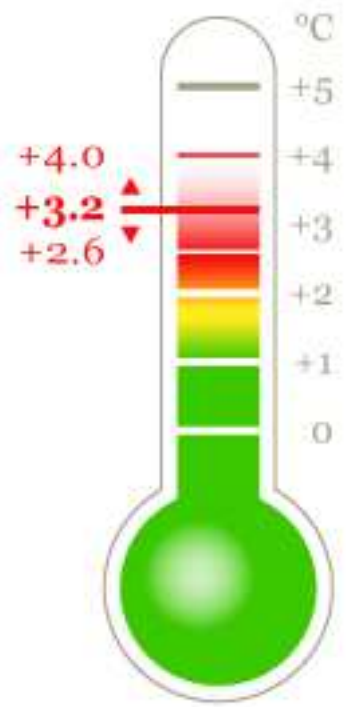
XUNTA DE GALICIA
CONSELLERÍA DE MEDIO AMBIENTE, TERRITORIO E INFRAESTRUTURAS

Galicia cambio climático

Experiences of Galician autonomous region : impact analysis and vulnerabilities of climate change.

Summary

1º Introduction



Climate change:

- ¿Exist? ¿ How progress ?
- Solutions:
  - .- Information and Training
  - .- Mitigation
  - .- Adaptation

2º Climatic scenarios

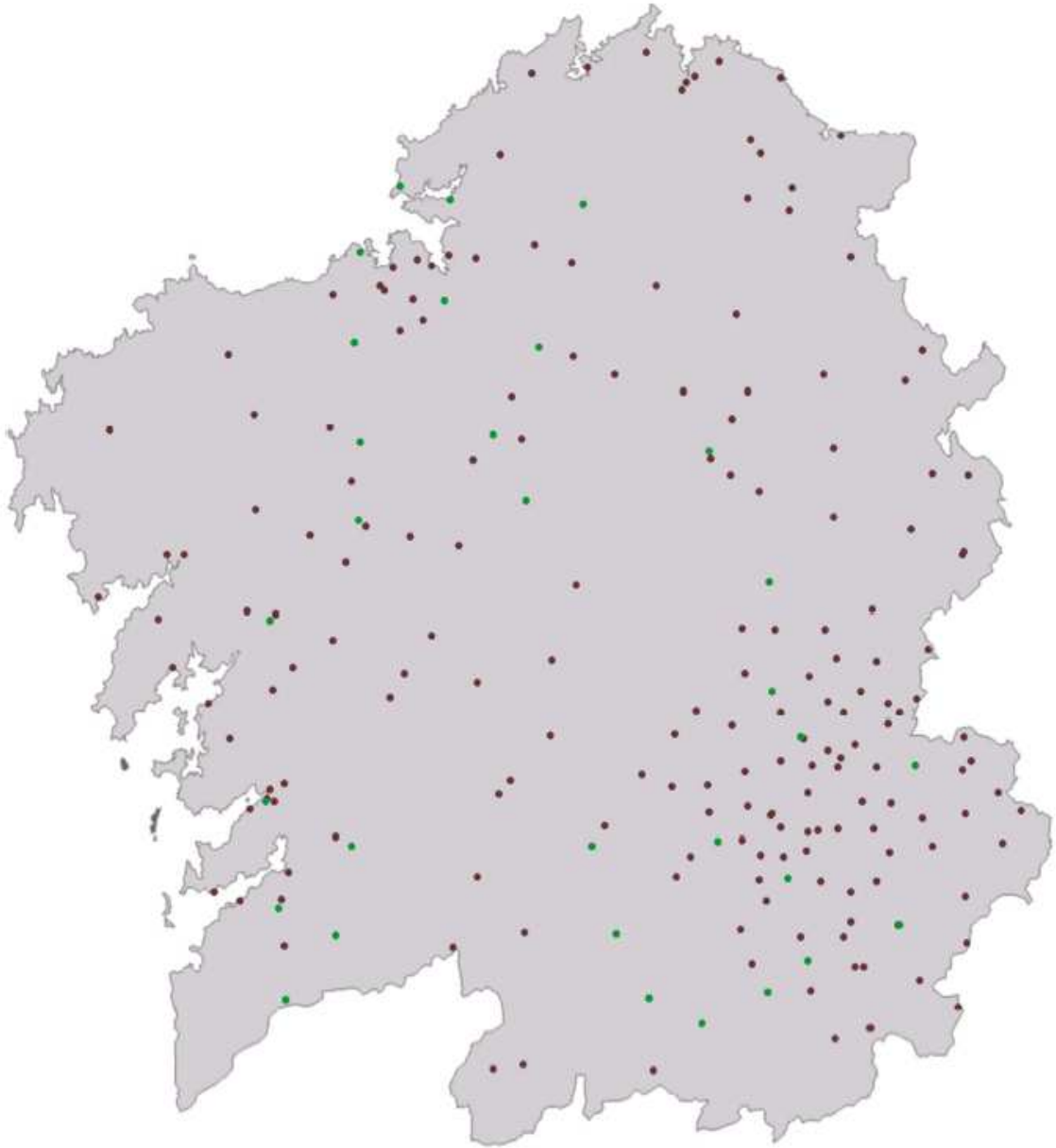
- **Analysis of climate change for Galician region.**

Temperatur e

Precipitation

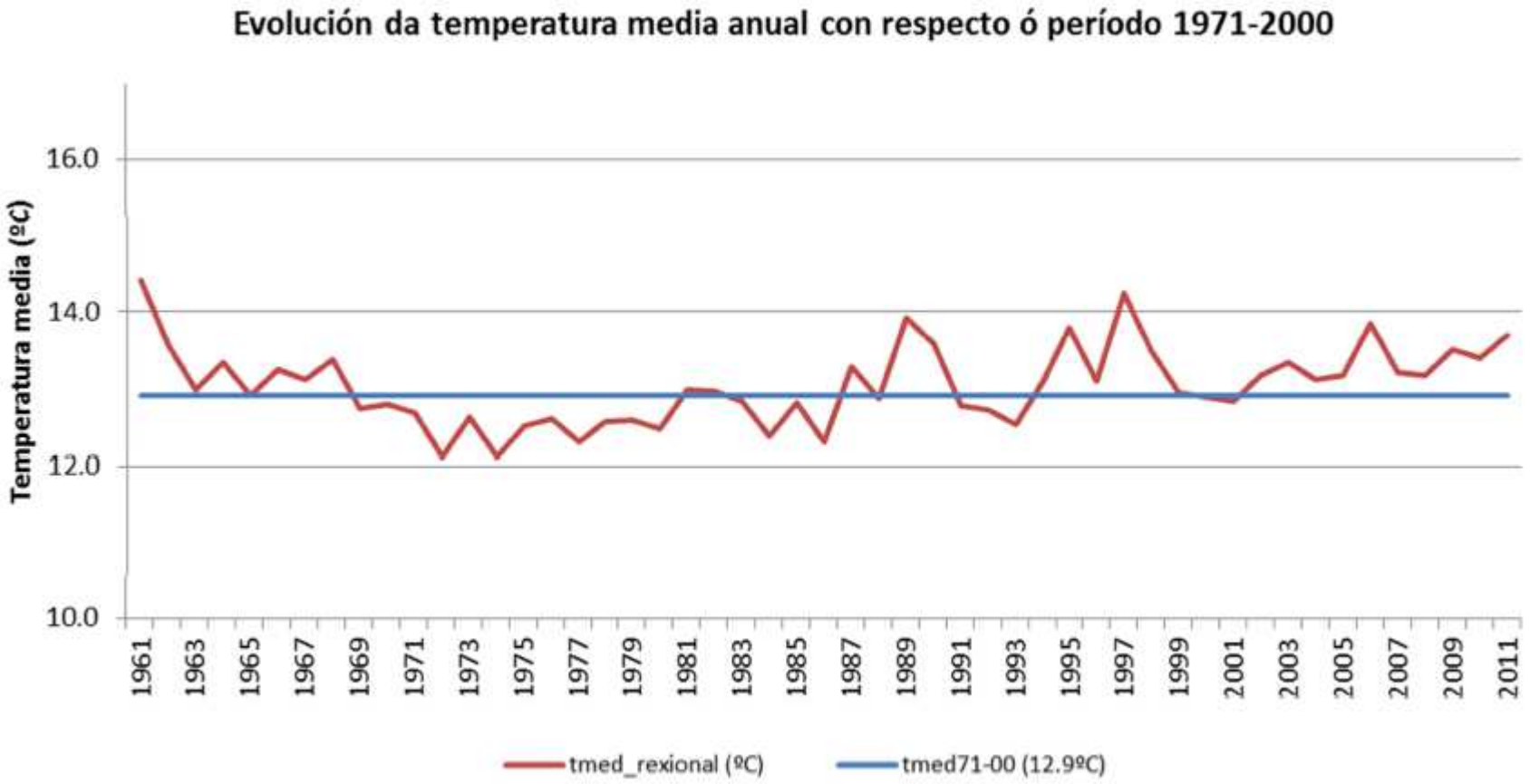
1960 - 2006

- Geographical distribution of weather stations in Galicia.
- Precipitation data for 20 years.
- Green points more temporal length and quality



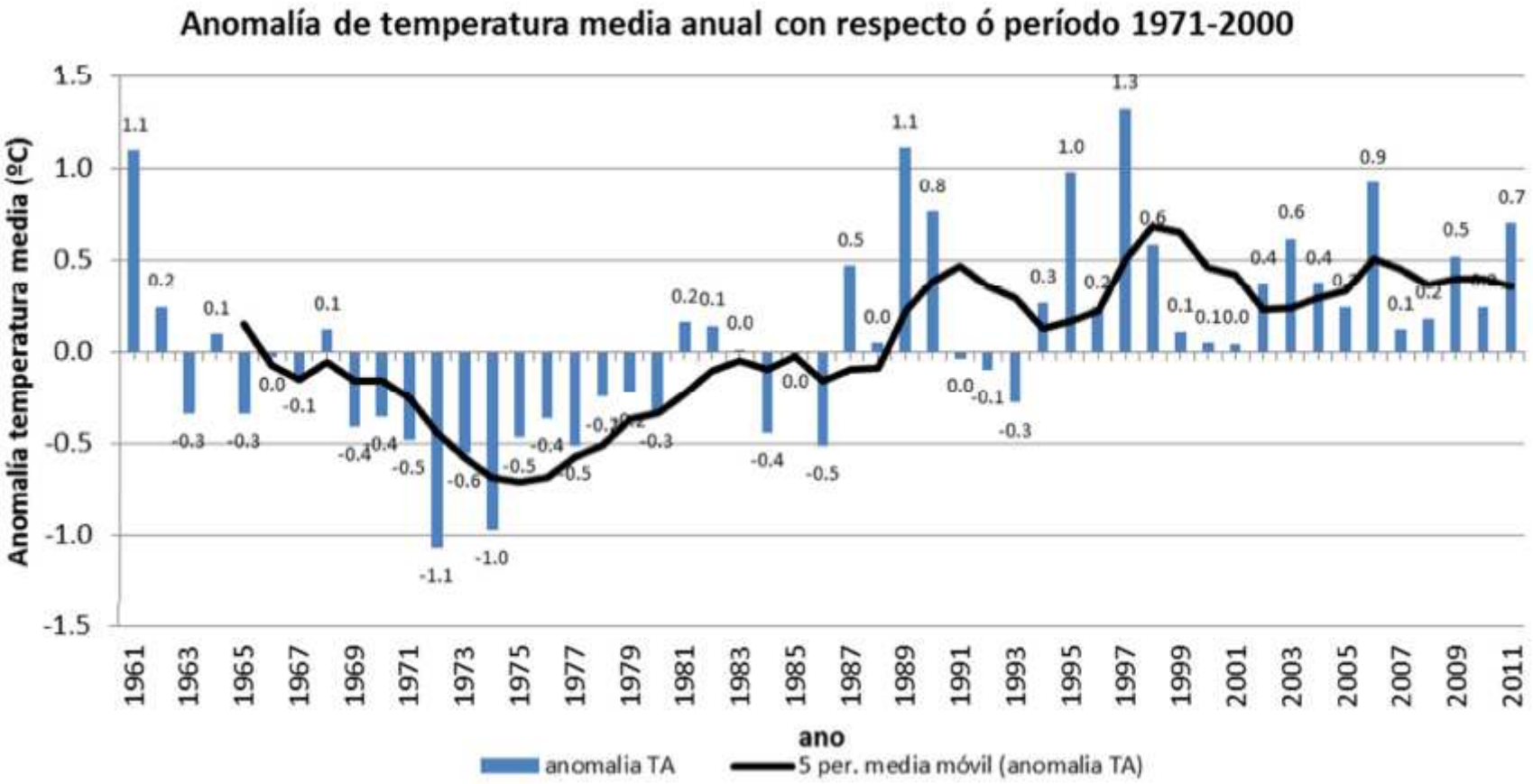
Temperatur
e

❖ Evidences



- **Galicia: Increase 0,18 deg. C/ decade, medium temperature**
- There are now fewer cold days in winter.
- There are more warm days and nights in spring and fewer cold days.

Temperatur e



2011 was the seventh year more warm since 1961in the series with an anomaly of +0.7 deg. C.
1997 was the warmest with an anomaly of +1.3 deg. C.

Precipitation

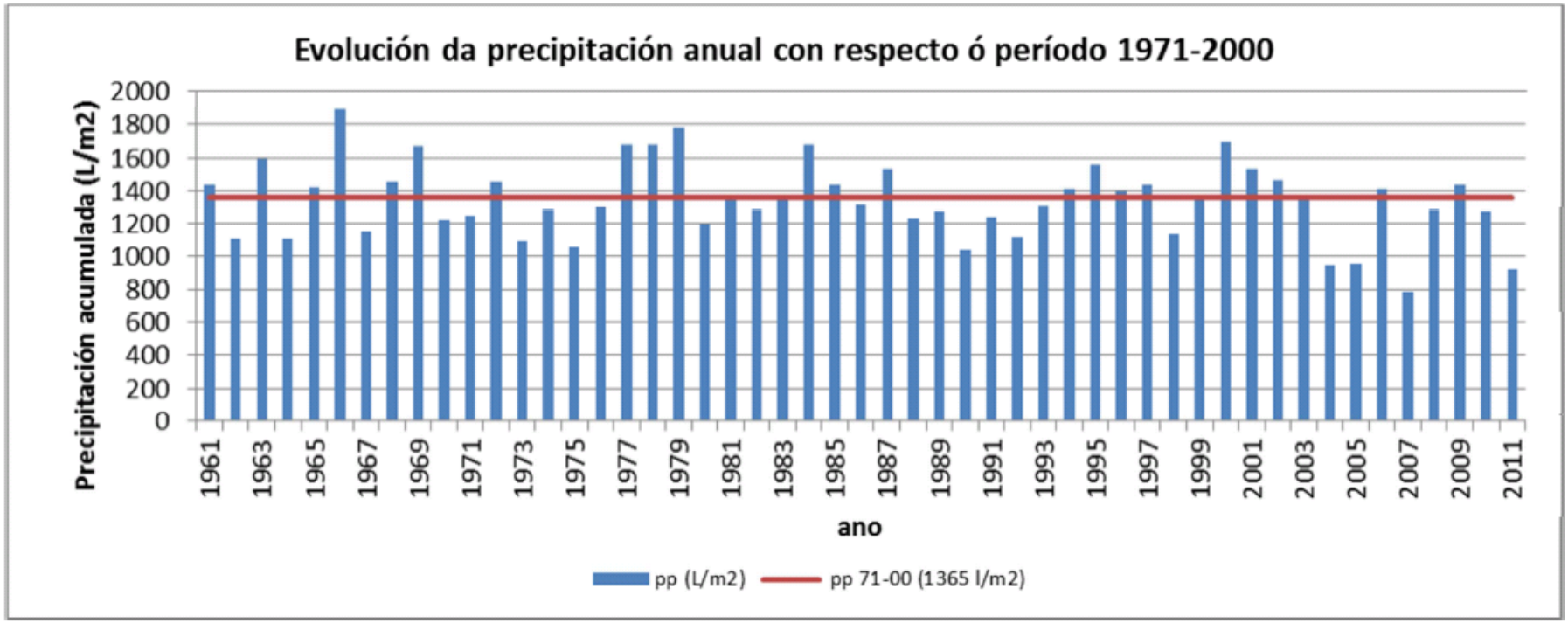
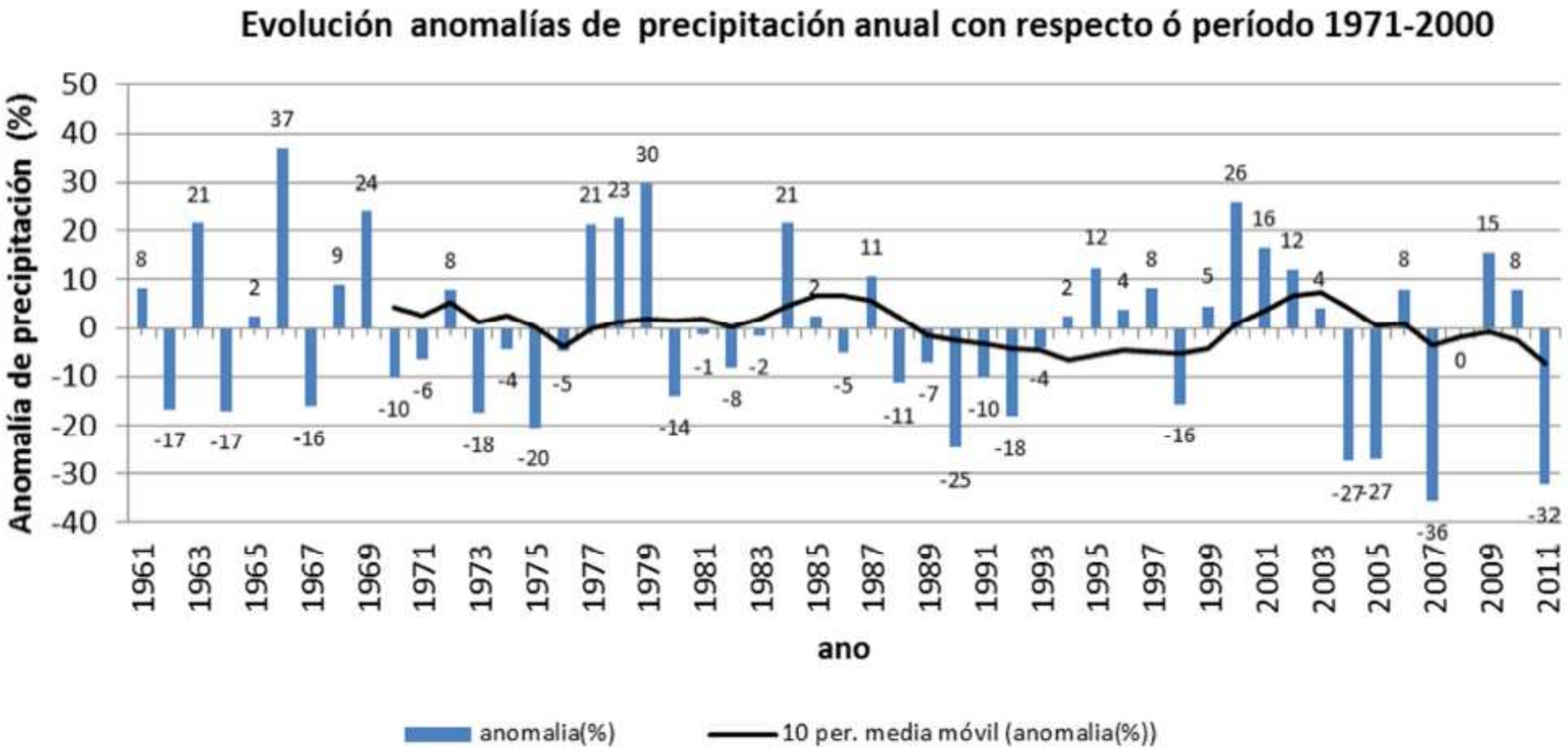


Figura 8: Evolución de la precipitación anual en el período 1961-2011.

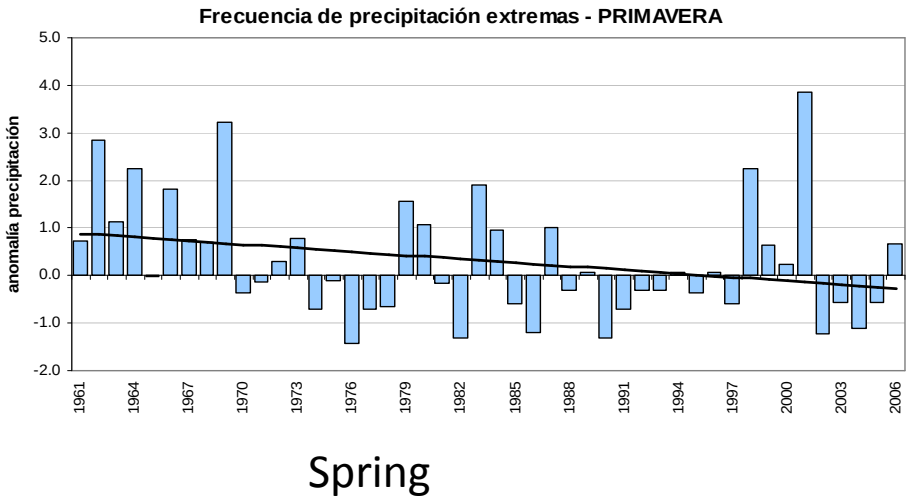
- Slight changes in distribution throughout the years.

Precipitation

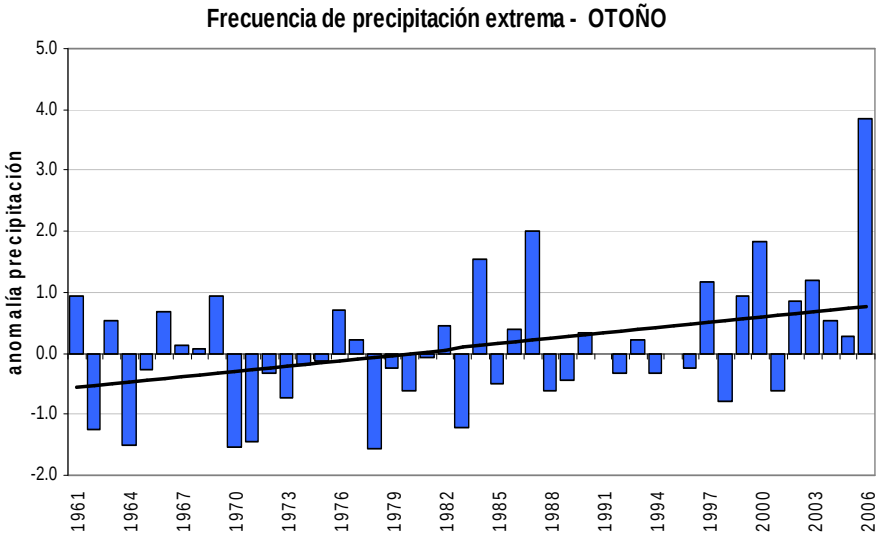


- **2011 is the second driest year in the regional series with an anomaly of 32% lower than a normal value (1971-2000).**

Precipitation



Spring

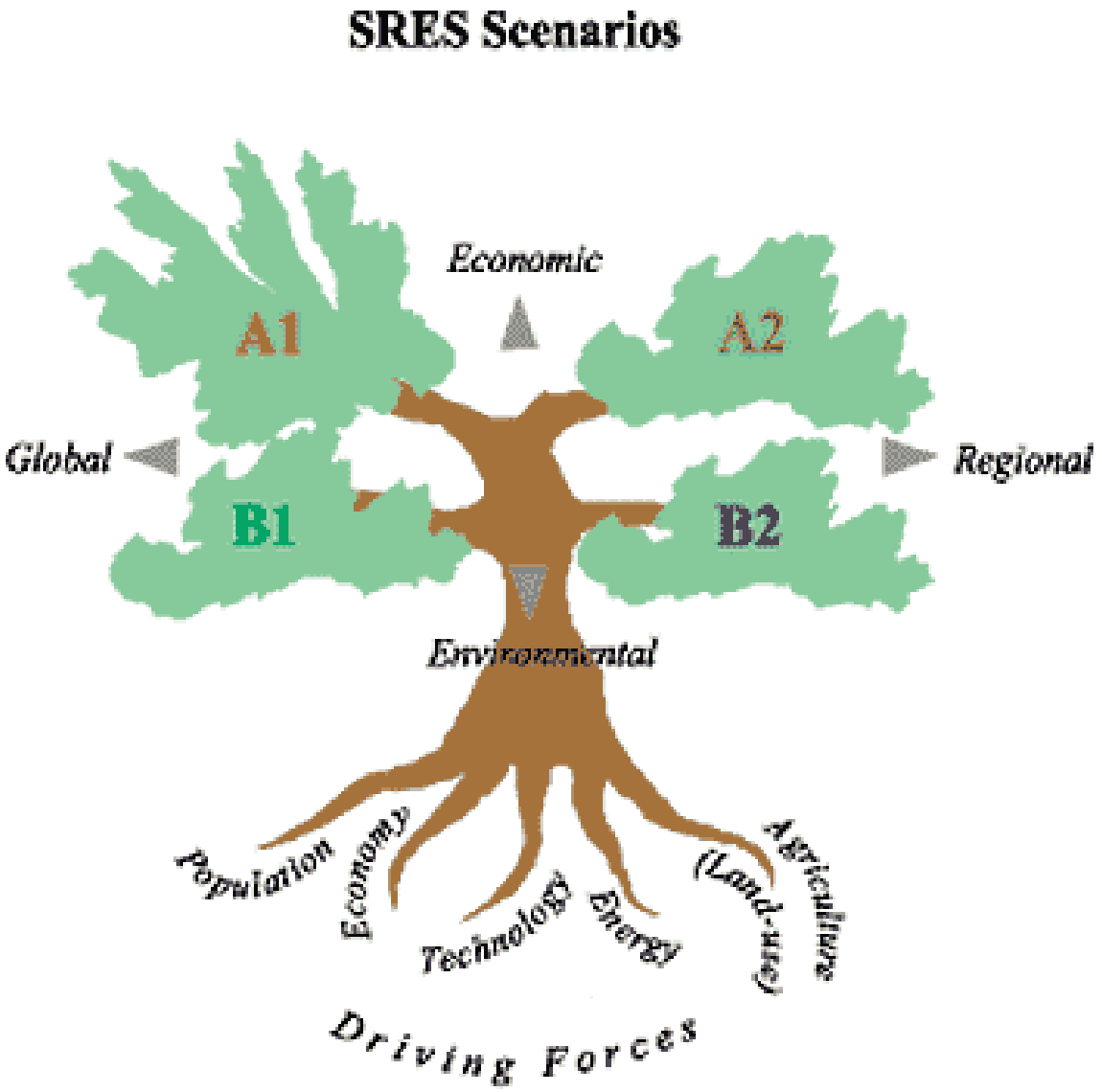


Autumn

- **Main changes in the frequency of days with extreme precipitation: there are fewer in spring and more in autumn.**
- **Extreme events of rainfall will be more frequents.**
- **Fall in February and increase in October. Change in annual distribution but similar total.**

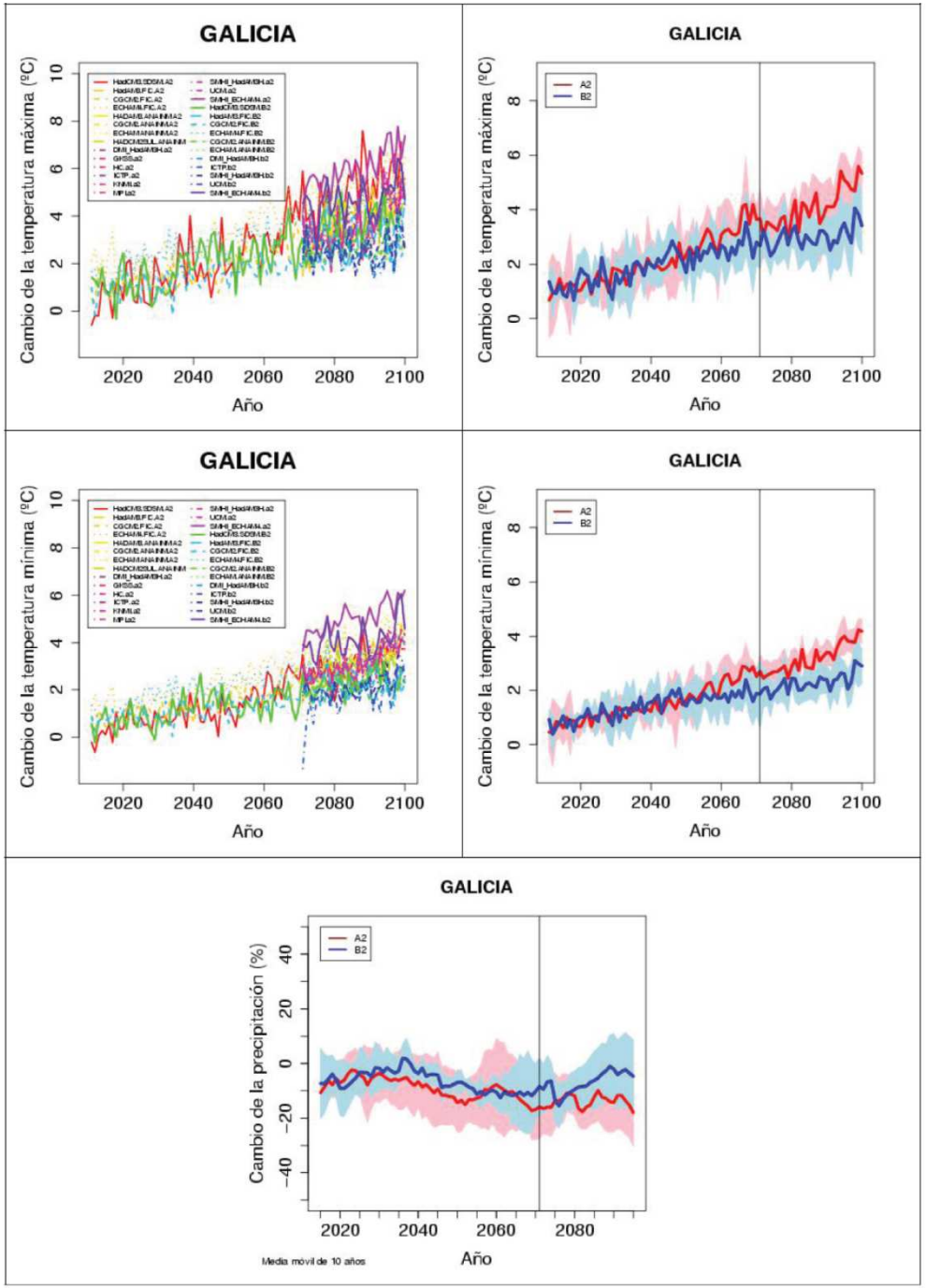
❖ Impacts

SRES Scenarios of IPCC perform future levels of economic activity Emissions, population increase and economic growth.



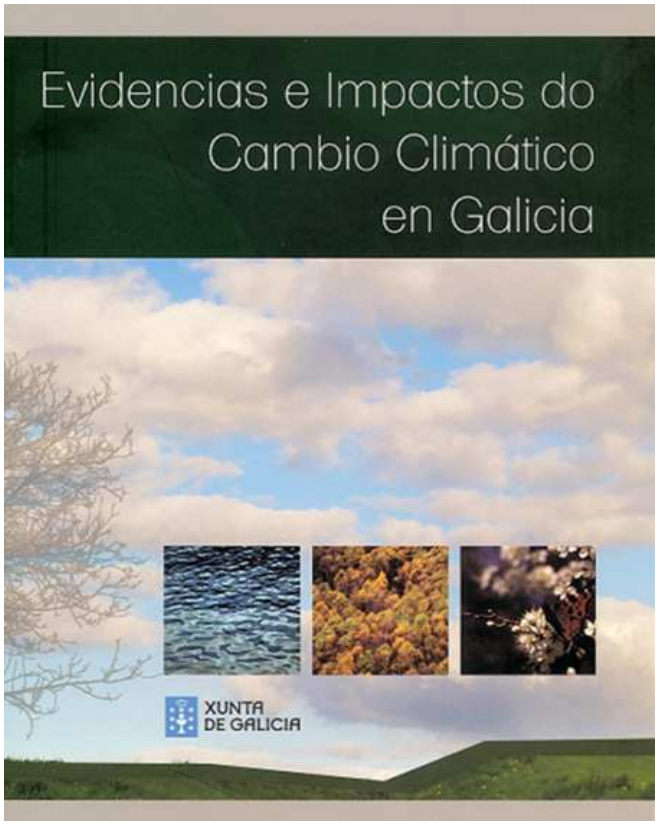
❖ Results

- **Temperature**
  .- Will growth medium 1,5 deg. C and will be more important in summer
- **Precipitation :**
  .- Few variations in total.
  .- Very important reduction in spring and summer ands a similar growth in autumn and in winter



Information source: *Primer informe de seguimiento sobre el desarrollo del Plan Nacional de Adaptación al Cambio climático 2008*. OECC.

❖ Impacts in ecosystems and productive sectors.



Summary for policy makers

XUNTA DE GALICIA
CONSELLERÍA DE MEDIO AMBIENTE
E DESENVOLVEMENTO SOSTIBLE

XUNTA DE GALICIA
CONSELLERÍA DE PESCA
E ASUNTOS MARÍTIMOS

CLIGAL
Análise de Evidencias
e Impactos do cambio
Climático en Galicia

CSIC

UNIVERSIDADE DE VIGO

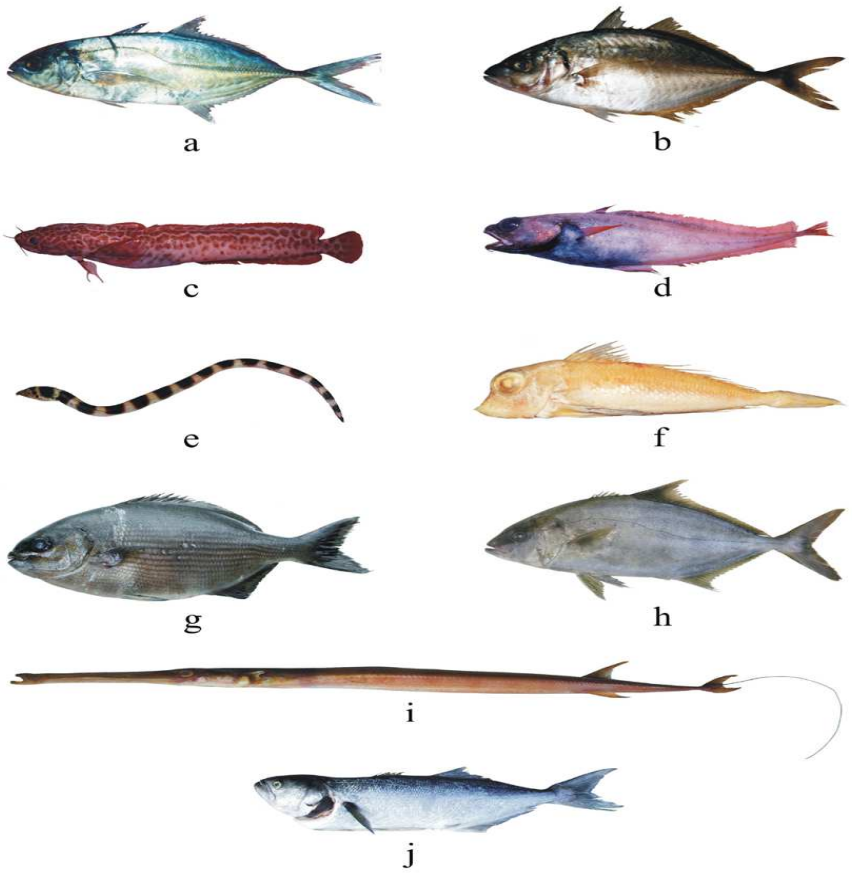
CENTRO TECNOLÓGICO DEL MAR
FUNDACIÓN CETMAR

CIMA
CENTRO DE INVESTIGACIÓNS MARIÑAS

❖ Impacts in ecosystems and productive sectors.

Exemple

21 new species have appear in our costs since 1950

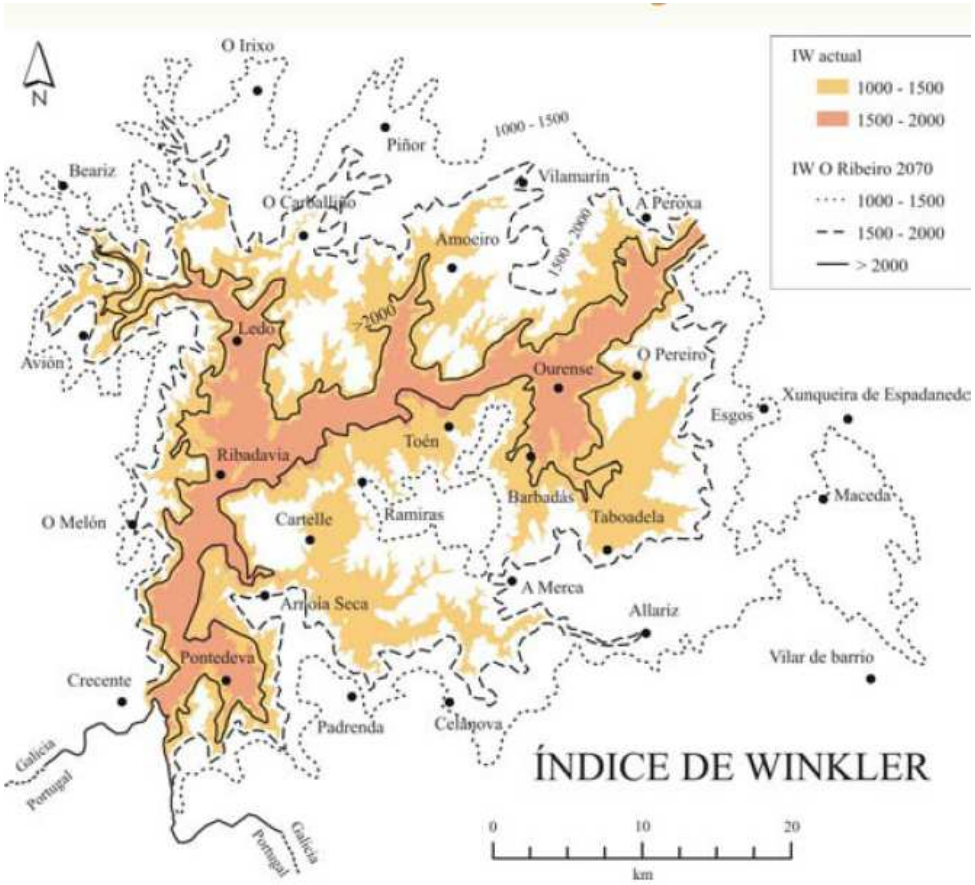


Main species of tropical fish registered in Galicia:
xurelo azul (a), xurelo dentón (b), barbada dos Azores (c), bertorella rosada (d), anguía raiada (e), escacho espiñento (f), choupón (g), medregal negro (h), peixe corneta encarnado (i) e anchova (j).

VINE-GROWING

	WHAT IS HAPPENING? (EVIDENCE)	WHAT COULD HAPPEN? (IMPACTS)
VINE BLOOMING	**HIGH CERTAINTY** • An advance of 15-20 days in the vine blooming date has been noticed from 1970 until 2004 ; it currently takes place in June.	**MEDIUM CERTAINTY** • In 2075-2099 advances of up to 80 days are foreseen in vine blooming dates.
GRAPE RIPENING	**HIGH CERTAINTY** • Ripening dates are currently in September and have moved forward c. 15 days since 1970.	**MEDIUM CERTAINTY** • In 2075-2099 the vine ripening date could move forward by 60 days and thus take place in August.
GERMINATION/FROST RATIO	**HIGH CERTAINTY** • The different Ribeiro varieties over the period 1958-2007 changed from germinating within the period with frost risk (apart from the Treixadura variety) to all currently germinating, most years, outside this period.	**HIGH CERTAINTY** • In most years germination will take place after the last frost since this will have taken place earlier.
WINKLER INDEX (VINE-GROWING POTENTIAL)	**HIGH CERTAINTY** • Over the last 35-45 years the Winkler Index has increased by 100 in Lourizán (Rías Baixas) and 250 in Ourense (Ribeiro), and so in both cases the vine growing potential has improved considerably.	**MEDIUM CERTAINTY** • The index will reach a high potential value (2204) in the Rías Baixas below 290 metres, in Ribeiro below 300 m and in the Ribeira Sacra below 385 m. It is probable that vines well adapted to under 1500 on the index, as is the case with many different traditional types in Galicia, could have quality problems due to excessive temperatures.

Impacts of climate change. 2070-2100 According to Winkler conditions



Sum of daily average temperatures effective from April 1 to October 30, being the effective temperature (Te), temperature active (Ta) minus 10 ° C, i.e. Te = Ta - 10 ° C.
An effective heat summation of Winkler of 2,000 ° C is sufficient to make the area suitable for vine.

3º Vulnerabilities and climate change adaptation

adaptaclima

❖ ANALYSIS OF CLIMATE CHANGE EVIDENCES

Precipitation

Temperature

1960 - 2001

Data suplied for the partners for its meteorological stations.

❖ FUTURE PROJECTIONS OF CLIMATE CHANGE

Project PRUDENCE

Center	DMI	ETHZ	GKSS	ICTP	KNMI	MPI	SMHI	UCM
Model	HIRHAM	CHRM	CLM	RegCM	RACMO2	REMO	RCAO	PROMES

Precipitation

Temperature

Solar Radiation

Evaporation

Wind speed

2071 - 2100

Scenario A2

Scenario B2

Emissions
Population growth
Economic growth

Vulnerabilities

Exemples

SECTOR	VARIABLE	−	+
Agricultura	Temperatura ↑	Phenological Changes. Reduction of development cycles. Loss of productivity More impact of plagues	Introduction new crops. Less frost. Access to new market.
	Precipitación ↓	1 Disminución de la reserva hídrica, aumento del déficit hídrico en el suelo	1 Desarrollo de cultivos no adaptados previamente por exceso de humedad (vid) Disminución de extensión de suelos encharcados y con exceso ua (norte) ento en el número de días disponibles para la enciones en cultivos emento de biomasa vegetal
	Evaporación diaria ↓	Water Shortage : stocks and ground Implications in productivity.	
	Radiación solar incidente ↑	1 Aumento de los daños foliares por rayos uv 2 Aumento de las necesidades generales de agua de las plantas	1 Aumento de la eficacia del "mulching" para favorecer la germinación temprana mediante el calentamiento del suelo 2 Aumento de la producción derivada de la mayor actividad fisiológica 3 Posibilidad de aumentar el potencial de producción por funcionamiento de las variedades de temporada más larga (norte)
	Todas	Mayor utilización de fertilizante, abonos y productos fitosanitarios para el incremento de producción ante cambios ambientales. Mayor riesgo de contaminación	

Adaptation Mesures

Agricultura

Exemples

Improvement of agricultural practices for the conservation of fertility and humidity levels of the soil (padding of the soil with mulching crop residue).

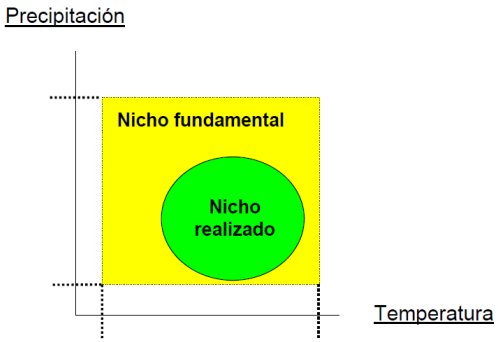
Mejora de prácticas agrícolas para la conservación de niveles de fertilidad y humedad del suelo (acolchado del suelo con restos de cultivo *mulching*). Usos sostenibles y control de cambio de usos del suelo

Adaptation of the choice of crops and the times of plantation to the new climatic conditions. Selection of varieties that are more resistant against extreme weather events. Use of short-cycle varieties

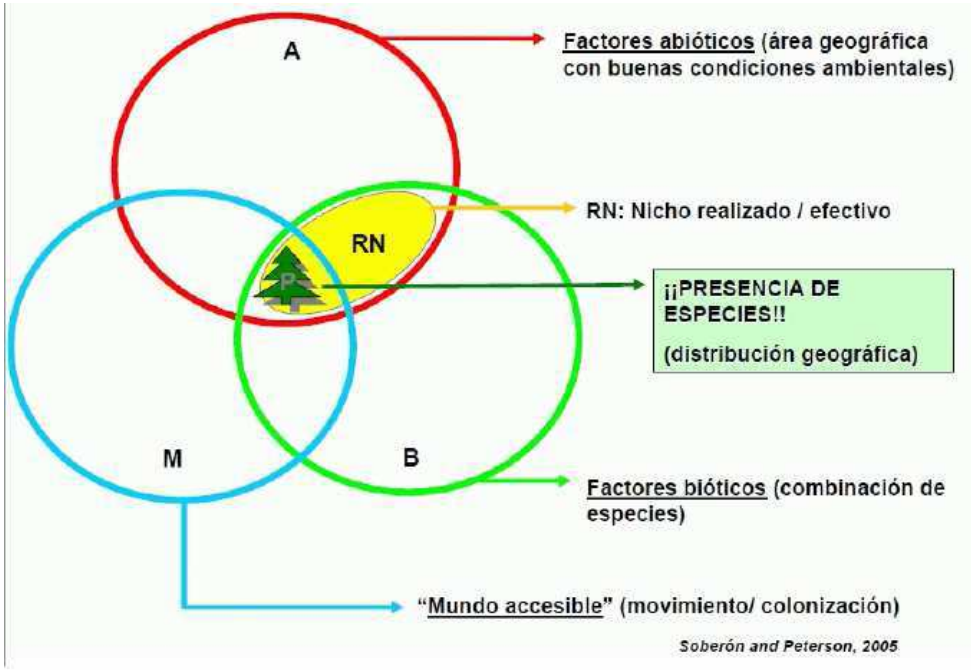
Development of simulation models describing the response of agriculture to the new climate scenario and the behaviour of their pathogens. Ecological niche models

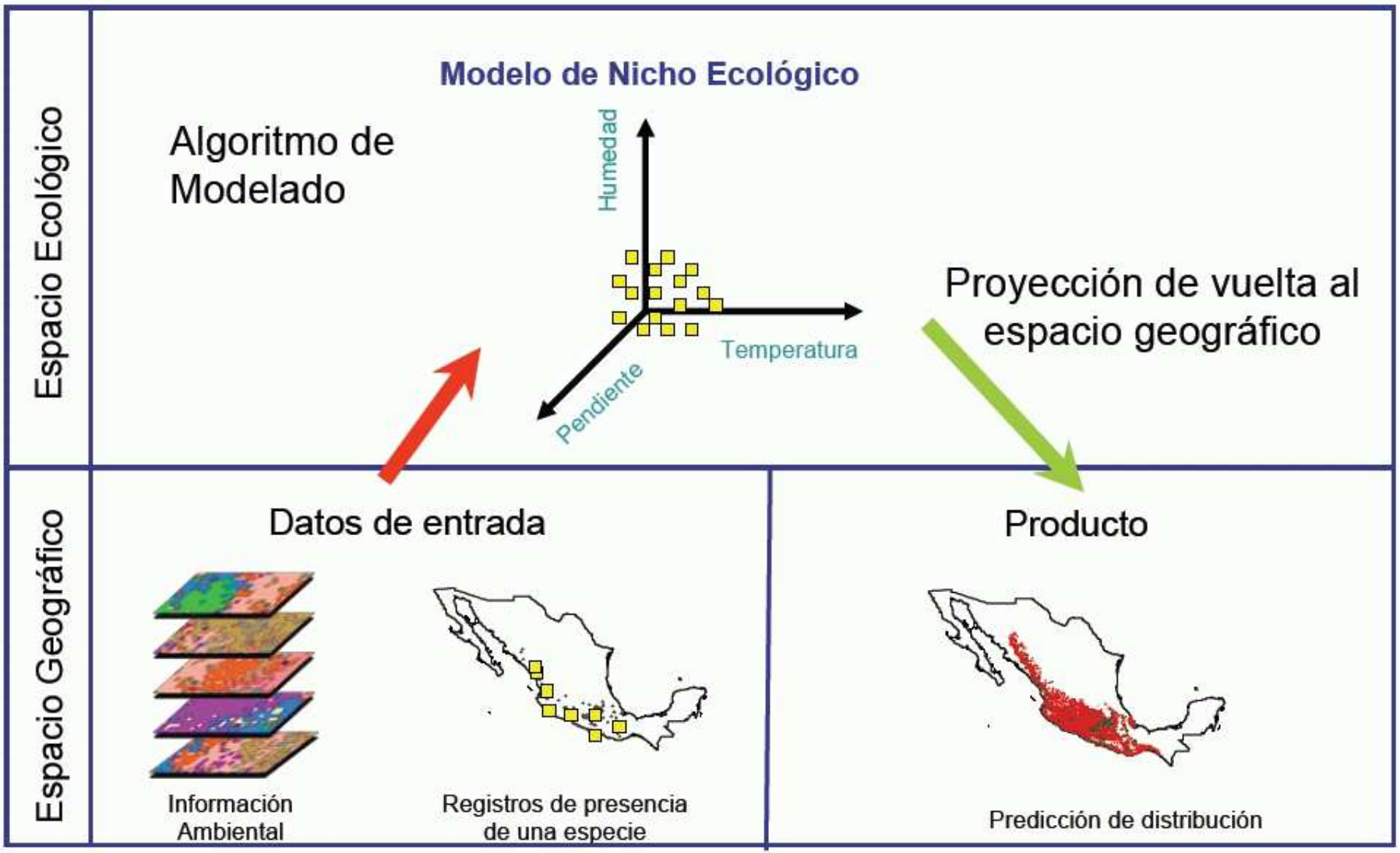
Apoyo a la investigación agraria para el desarrollo de variedades mejor adaptadas a los nuevos condicionantes agronómicos y agroclimáticos

Implantación, desde la Administración, de un sistema de corresponsabilidad de gestión medioambiental con participación de los agricultores, así como, de programas de atención por contingencias climatológicas



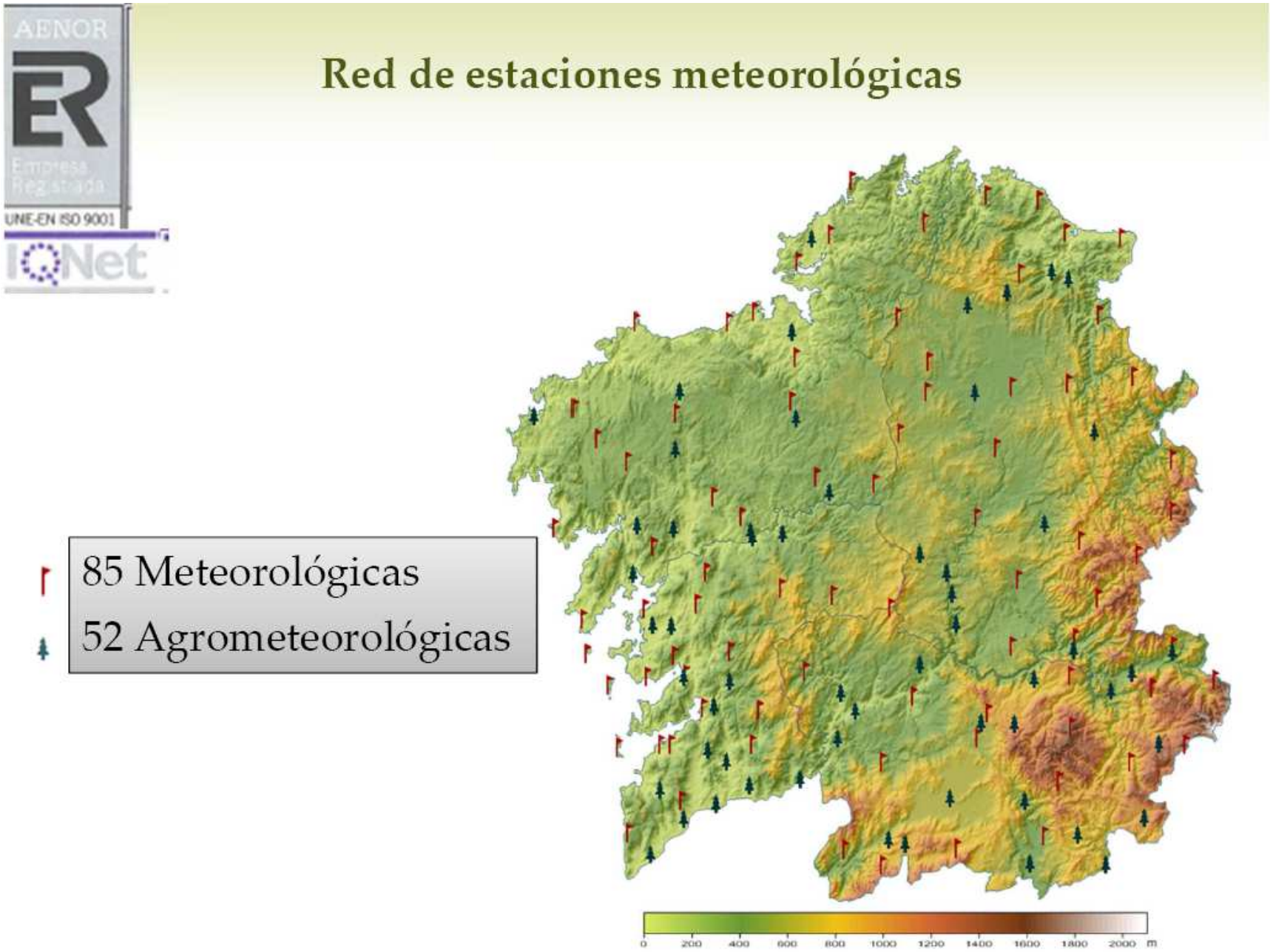
Ecological niche models



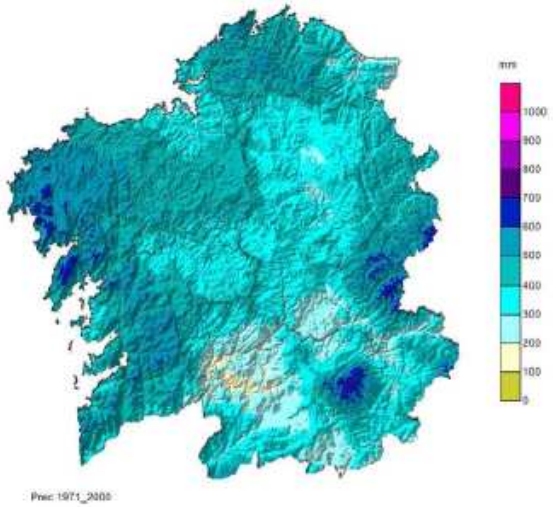

Espacio Ecológico
Modelo de Nicho Ecológico
Algoritmo de Modelado
Humedad
Temperatura
Pendiente
Proyección de vuelta al espacio geográfico
Espacio Geográfico
Datos de entrada
Producto
Información Ambiental
Registros de presencia de una especie
Predicción de distribución

Modelo	*Características*	*Creadores*
BIOCLIM	BIOCLIM también, denominado "Envoltura bioclimática", averigua el rango climático/topográfico de las zonas de presencia para cada variable, y calcula la distribución potencial de dicha especie en lugares con rangos climáticos y topográficos similares (percentiles de los valores más probables). Incluido dentro del software gratuito Diva- gis	Busby , J.R. 1991, Organización de Investigación Científica e Industrial de la Commonwealth (CSIRO). Australia http://www.diva-gis.org/download
DOMAIN	El modelo Domain calcula el parámetro estadístico "distancia de Gower" para cada celda en el mapa. El número resultante es multiplicado por 100. Las zonas con las mejores condiciones de habitabilidad de la especie tendrán un número alto (superior a 95). El resultado es un mapa probabilístico. Incluido dentro del software gratuito Diva- gis	Carpenter et al, 1993, Centro de investigación de bosques tropicales del CSIRO, Australia http://www.diva-gis.org/download
GARP (Algoritmo genético basado en reglas)	Garp trata, de forma iterativa, de encontrar las correlaciones entre los datos de presencia de la especie estudiada con los parámetros ambientales, utilizando 4 reglas diferentes: atómica, regresión logarítmica, envoltura bioclimática y negación de la envoltura bioclimática. Incluido dentro del software gratuito Desktop - Garp	David Stockwell, 1992, creado en el Departamento de Medio Ambienteldel Gobierno de Australia, mejorado en el Centro de Supercomputación de San Diego (EEUU). http://www.nhm.ku.edu/desktopgarp/Download.html
MAXENT	Maxent es un programa que modela la distribución geográfica de las especies, utilizando como datos sólo los sitios de presencia de esa especie y las variables climáticas y topográficas asociadas a cada uno de esos puntos de presencia. Para modelar las distribuciones se basa en el principio de Máxima entropía (es decir, trata de encontrar la distribución de probabilidad más extendida, o más cercana a ser uniforme, dadas ciertas restricciones que representan la información disponible e incompleta sobre el fenómeno o tema estudiado).	Steven Phillips, Miro Dudik, Rob Schapire, 2004 laboratorios de investigación de AT&T, la Universidad de Princeton y el Centro para la Biodiversidad y Conservación del Museo Americano de Historia Natural (EEUU). http://www.cs.princeton.edu/~schapire/maxent/maxent-submit.cgi

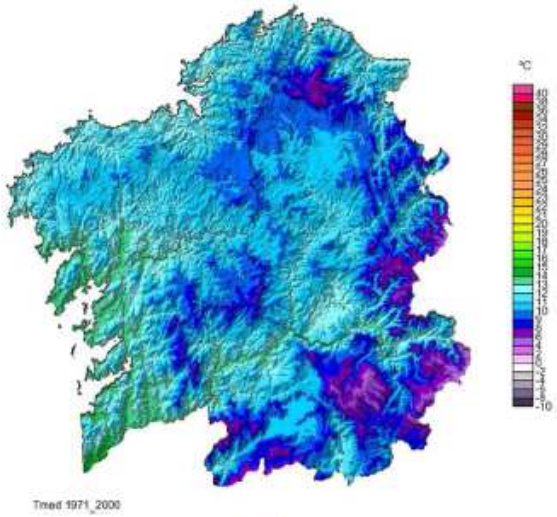
Network of meteorological stations.



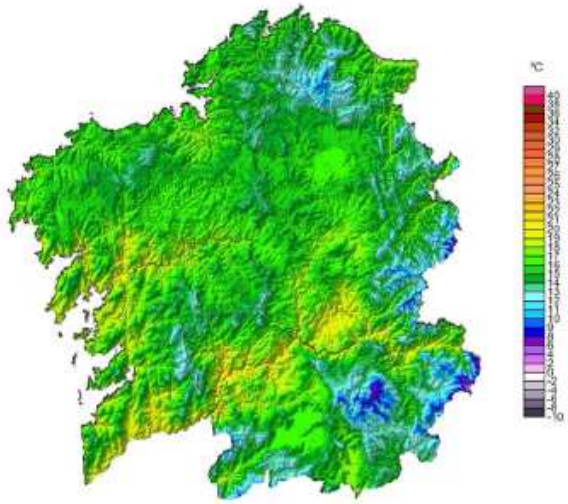
Mapas primavera período 1971 – 2000: estaciones meteorológicas



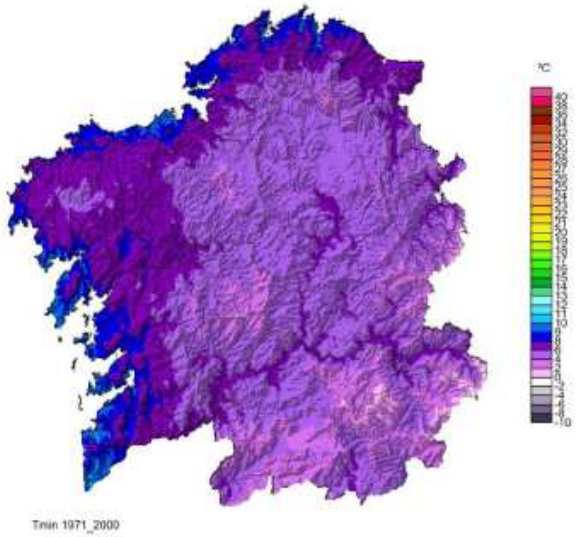
Prec 1971_2000



Tmed 1971_2000

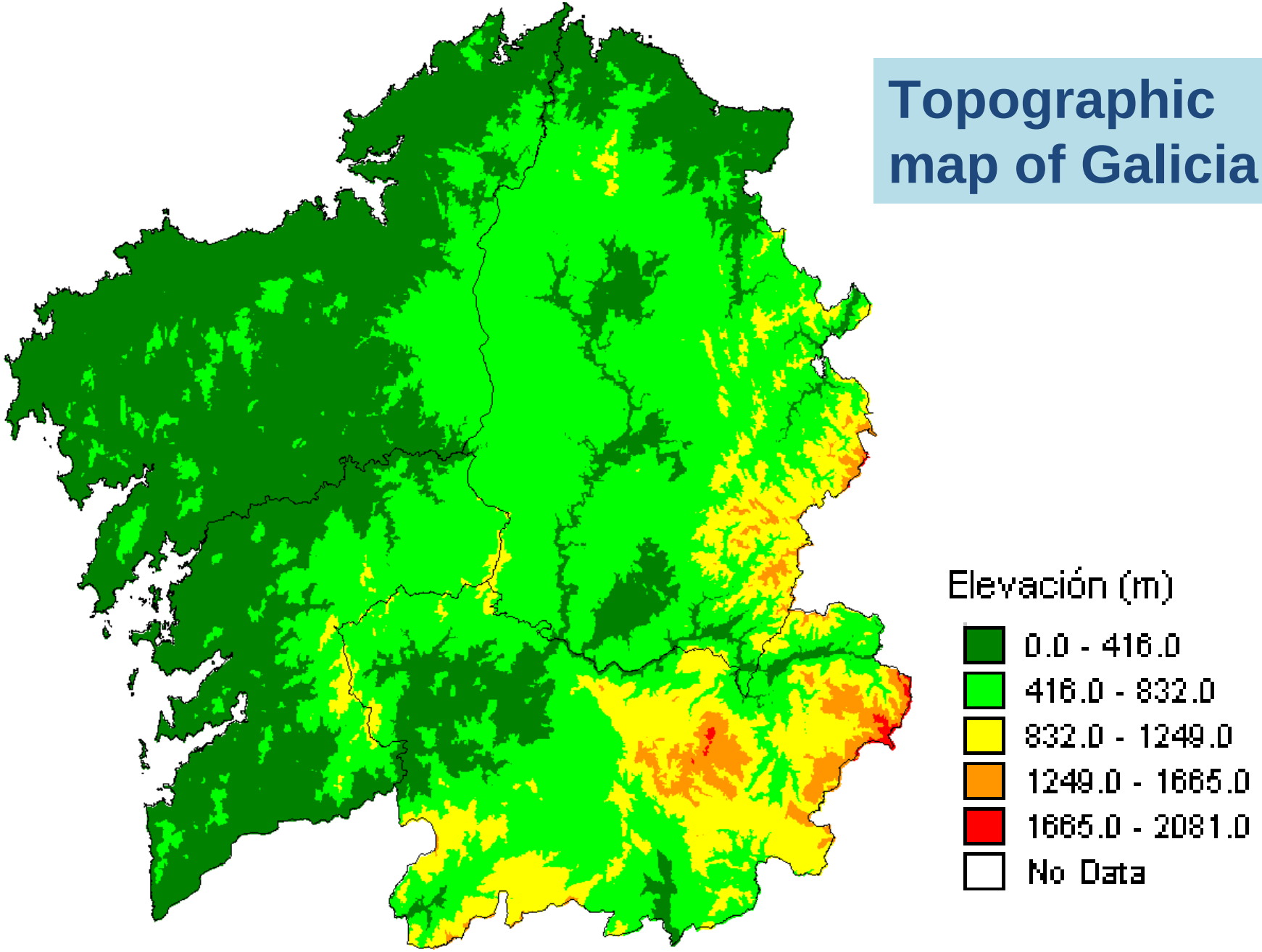


Tmax 1971_2000

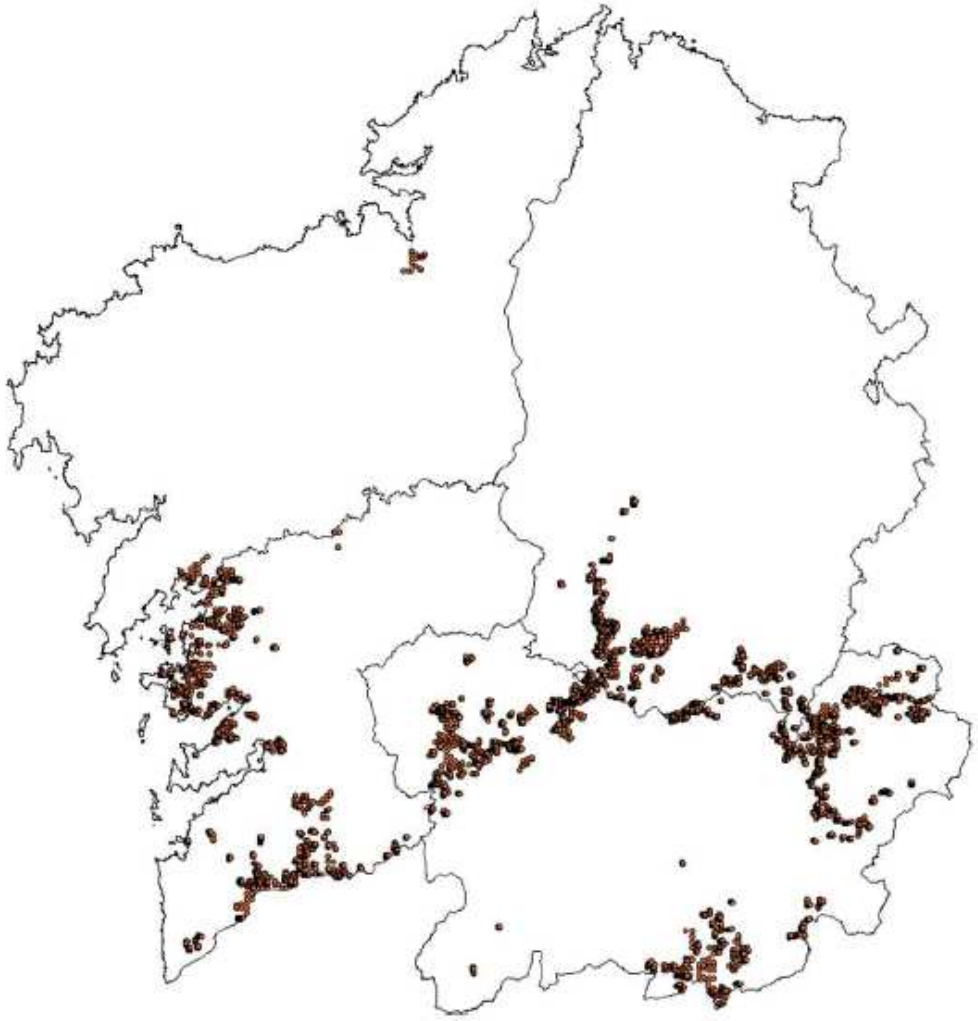


Tmin 1971_2000

Topographic map of Galicia

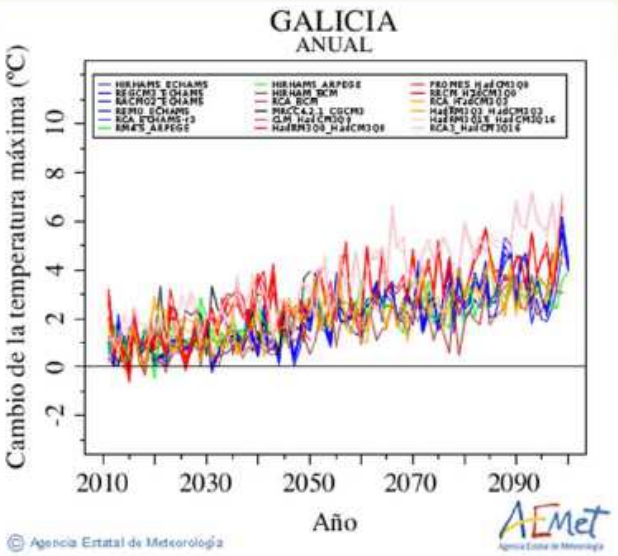


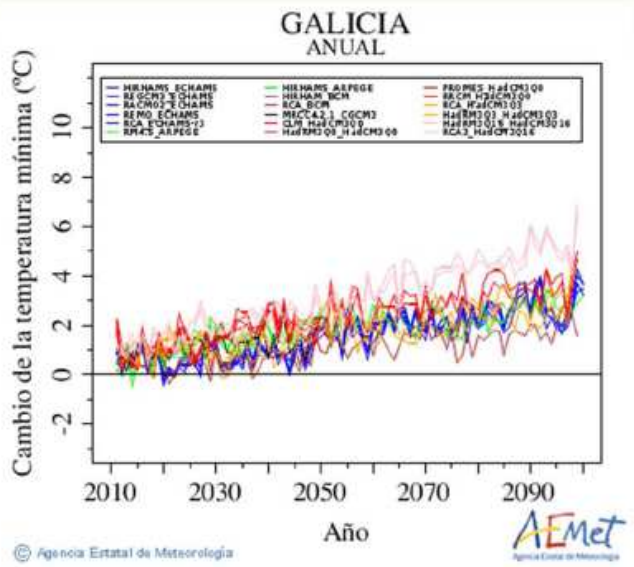
Distribution of the vineyard in Galicia

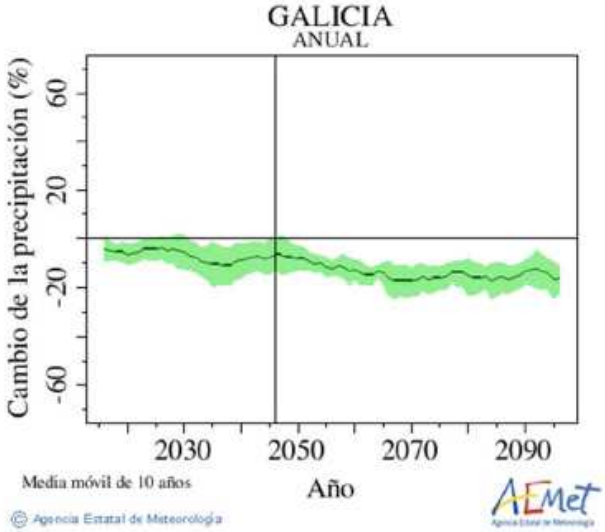


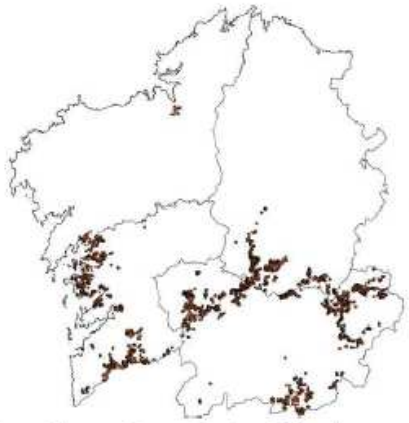
vitis vinifera

Dynamic regionalization for Galicia

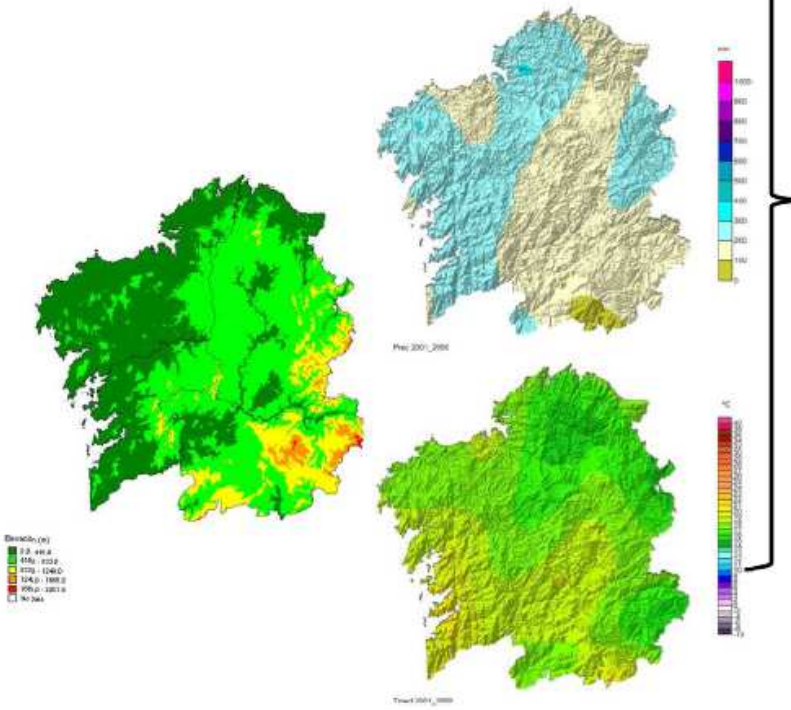




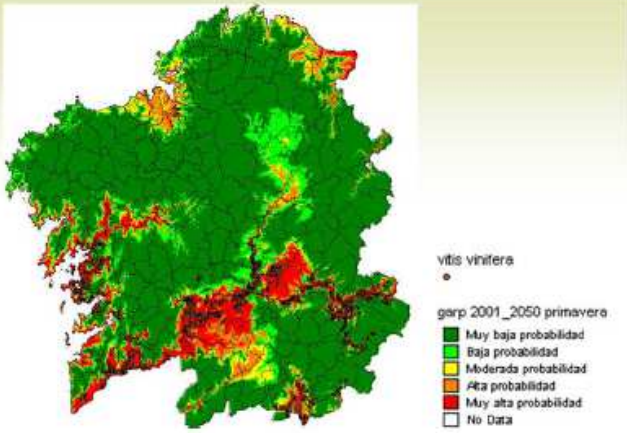




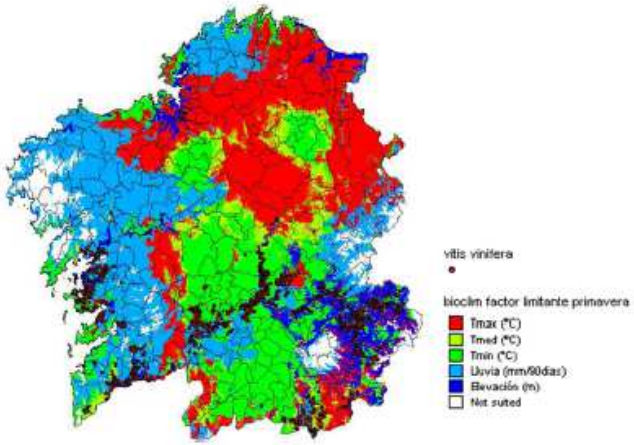
•Distribución del viñedo en Galicia



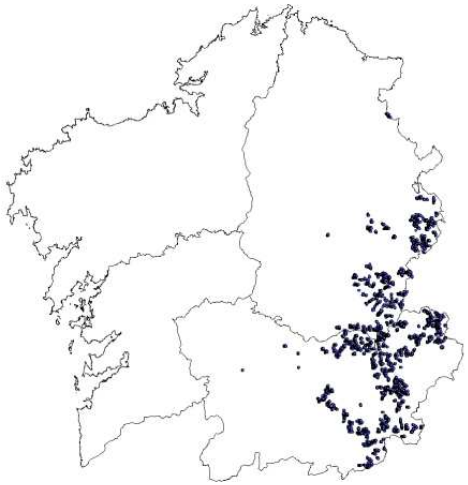
•Mapas climáticos y topográficos



•Mapa de distribución potencial para el periodo primaveral 2001 -2050

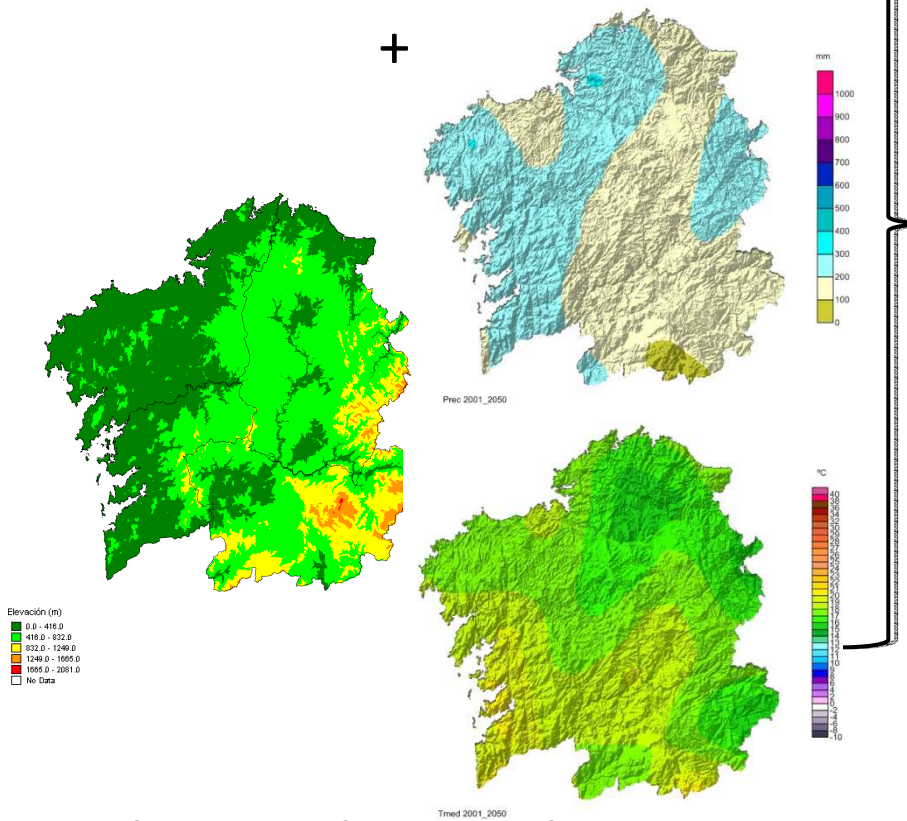


•Factor limitante para el periodo primaveral



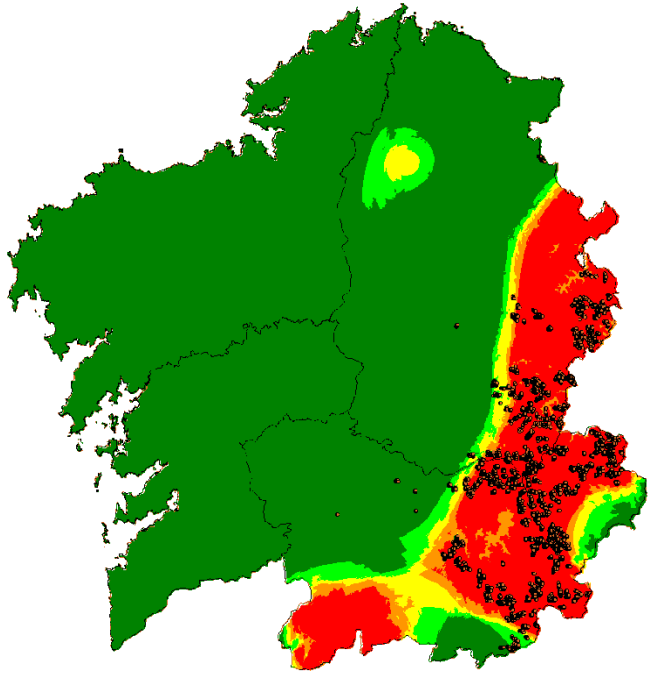
Distribution of chestnut in Galicia

+



Climatic and topographic maps

Map of potential distribution for the spring period 2001-2050

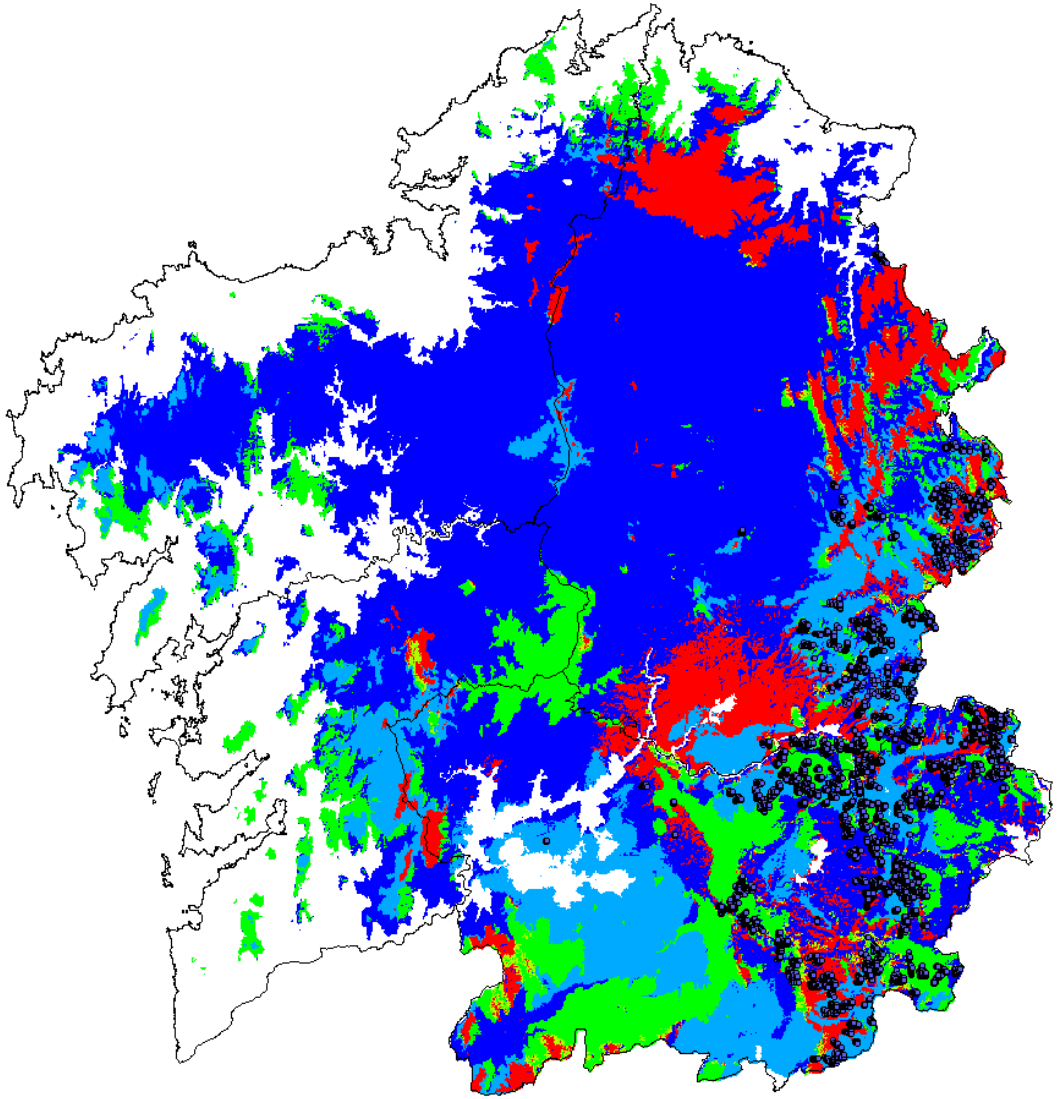


castanea sativa

garp 2001_2050

- Muy baja probabilidad
- Baja probabilidad
- Moderada probabilidad
- Alta probabilidad
- Muy alta probabilidad
- No Data

Limiting factor for the spring period



castanea sativa

bioclim most lim factor 71_00 primavera

- Tmax (ºC)
- Tmed (ºC)
- Tmin (ºC)
- LLuvia (mm/90dias)
- Elevación (m)
- Not suited

Results of the four models

❖Increases the arable area of the vineyard, both during the spring and summer, with respect to the current conditions and in almost all executed models.

❖ The chestnut, decreases the arable area, during the spring and summer, with respect to the current conditions in almost all executed models.

Other applied projects

Viñas Atlánticas

Goal: Reducing the use of sanitarian products in the vineyards.

-Create an integrated control system based on a network of weather stations with sensors located in the vineyards.

-Know the risks of plague in time real and minimize the use of chemicals.

Deputación Pontevedra

Martín Códax

ProyectoDeméter

Goal: Viticultural and winemaking climate change adaptation.

Scenarios: decreased productivity, accelerating the process of ripening of the fruit, dehydrated of vintage, changes in pests and diseases and the gap between the sacarimetrica maturity and maturity of aromas and polyphenols.

Adaptation: system of crop that protects the grapes of insolation and temperature and with water management

Conclusions

Climate change is affecting Galicia: primarily in the increase in temperatures and rainfall distribution. Occurrence of extreme events.

Diversity of impacts, vulnerabilities and adaptation mesures

It has been developed for both mitigation and adaptation management tools. For example: Ecological niche models.

facts!

http://www.siam.medioambiente.xunta.es/cambioclimaticogalicia/index.asp

Thank you for your attention.

XUNTA DE GALICIA
CONSELLERÍA DE MEDIO AMBIENTE, TERRITORIO E INFRAESTRUTURAS

Galicia
cambio climático