

Modelling current and future  
distributions of selected species

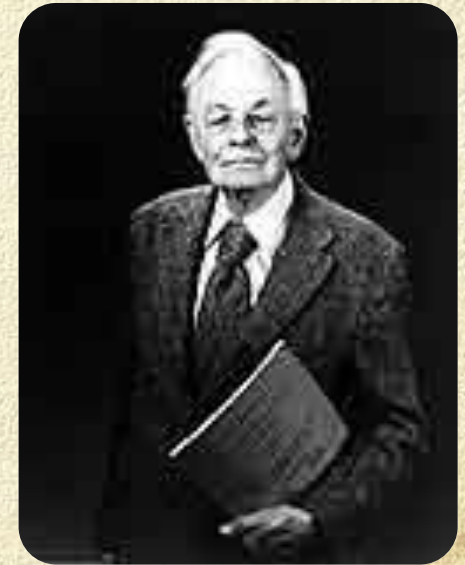
Climate change impacts

Ecological Niche Modelling

Using DIVA-GIS

# Ecological niche

- Describes the limits of abiotic and biotic conditions within which a species can survive and reproduce
- The ecological niche
  - has many dimensions



G.E. Hutchinson

**Attention!!!**



***The term ecological niche has no spatial connotation!***

- The distribution of a species is spatially limited (**why?**)
  - For a population to be able to exist in space and time, all abiotic and biotic conditions, including the provision of food to be within the limits



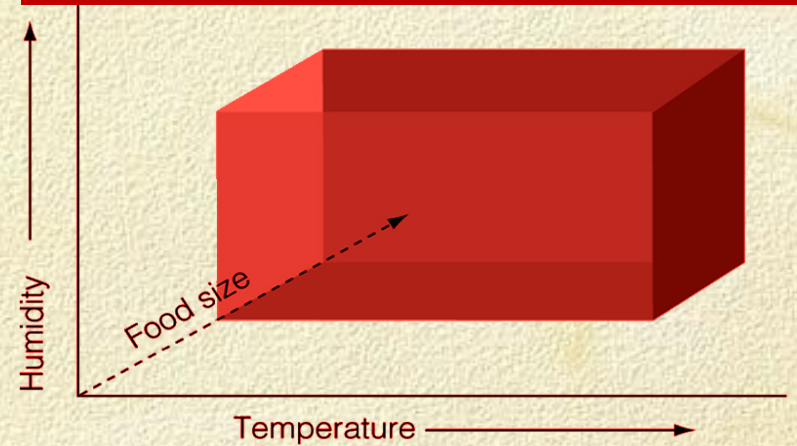
Environmental factor e.g. temperature

# Dimensions of the ecological niche

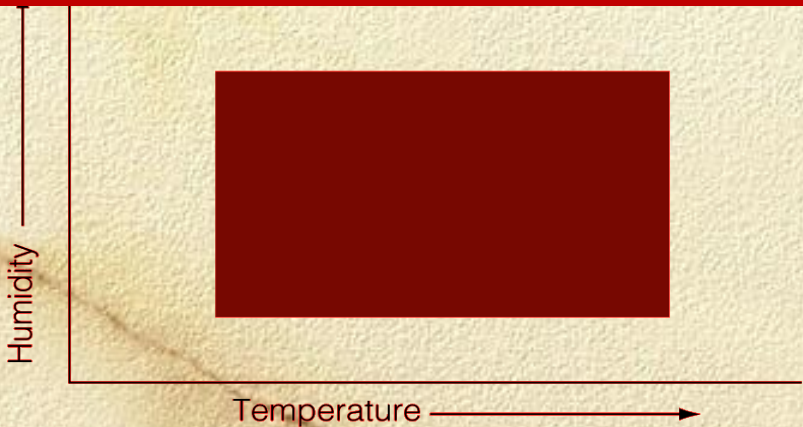
## One dimension



## Three dimensions



## Two dimensions



● **Ecological niche**= multidimensional body with n dimensions

● The dimensions can be:

● temperature

● humidity

● salinity

● pH

● food size

● ...

# The software DIVA-GIS

- Free at: <http://www.diva-gis.org>
- Calculates likely species distributions based on species data (presence data) and climatic data (Worldclim)
- Uses the algorithms Bioclim και DOMAIN
- An important tool for the protection of the environment and individual species

***19 climatic factors***

- Annual Mean Temperature [1]
- Mean Monthly Temperature Range [2]
- Isothermality (2/7) (\* 100) [3]
- Temperature Seasonality (STD \* 100) [4]
- Max Temperature of Warmest Month [5]
- Min Temperature of Coldest Month [6]
- Temperature Annual Range (5-6) [7]
- Mean Temperature of Wettest Quarter [8]
- Mean Temperature of Driest Quarter [9]
- Mean Temperature of Warmest Quarter [10]
- Mean Temperature of Coldest Quarter [11]
- Annual Precipitation [12]
- Precipitation of Wettest Month [13]
- Precipitation of Driest Month [14]
- Precipitation Seasonality (CV) [15]
- Precipitation of Wettest Quarter [16]
- Precipitation of Driest Quarter [17]
- Precipitation of Warmest Quarter [18]
- Precipitation of Coldest Quarter [19]



- Projection Graticule
- Shift Shape
- Georeference Image
- Geo Calculator
- Toolbars ▶
- Options

Options

Layer Climate

Folder c:\program files\diva-gis\environ\diva\_worldclim\_2-5m\

worlclim\_2-5m

	Columns	Rows
Min	-180	-60
Max	180	90

Cell size 0.04166666667

Index index\_2-5m

Altitude alt\_2-5m

Min Temperature tmin\_2-5m

Max Temperature tmax\_2-5m

Precipitation prec\_2-5m

Projection GEOGRAPHIC

Map units DEGREES

Datum WGS84

OK Apply

Browse for Folder

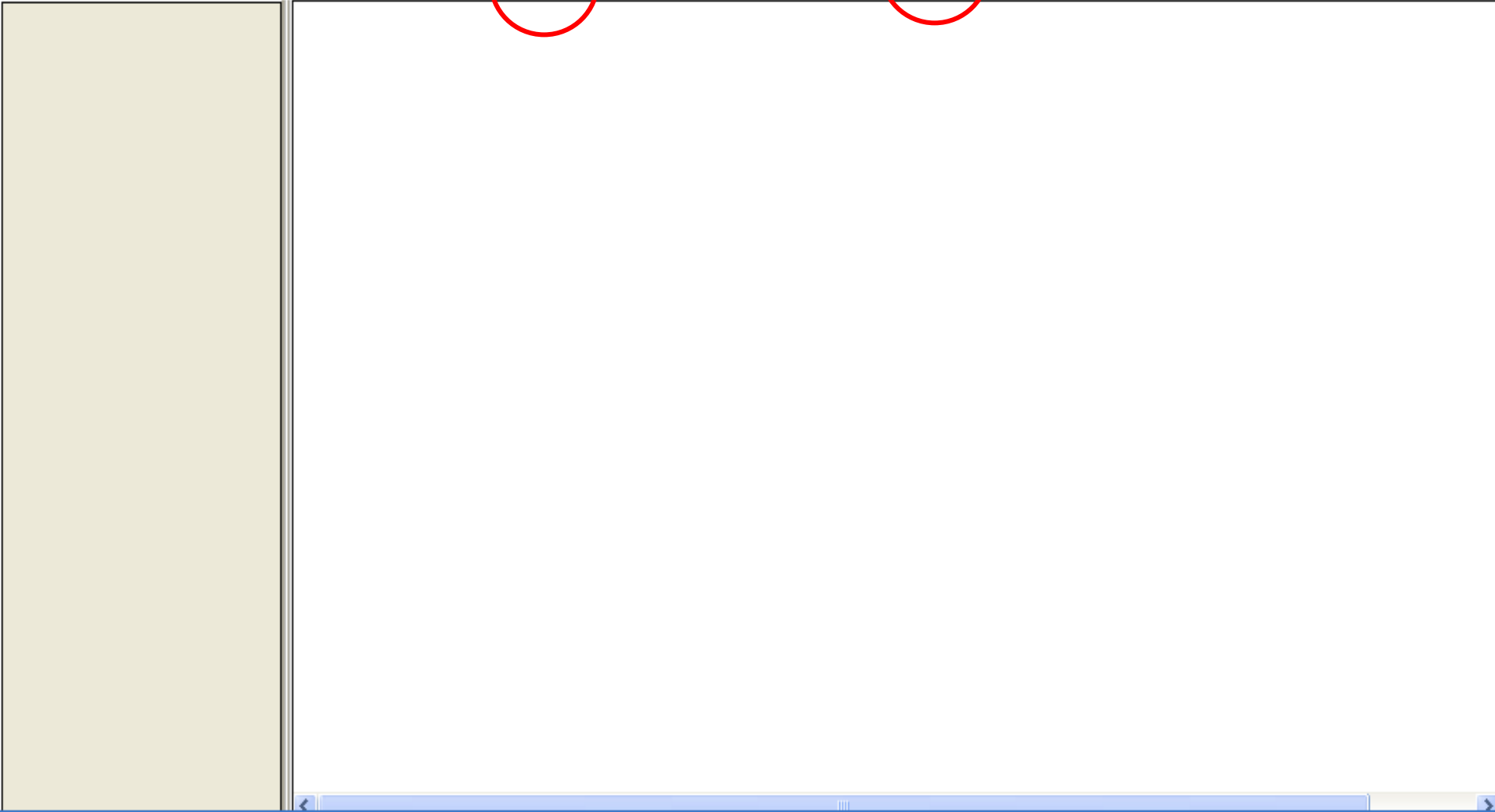
Select a directory

- Program Files
  - 7-Zip
  - 52N
  - Adobe
  - adt-bundle-windows-x86-201309
  - Altova
  - AnswerWorks 4.0
  - AppInventor
  - Apple Software Update
  - ArcGIS
  - ArcSWAT
  - oHarc

OK Cancel



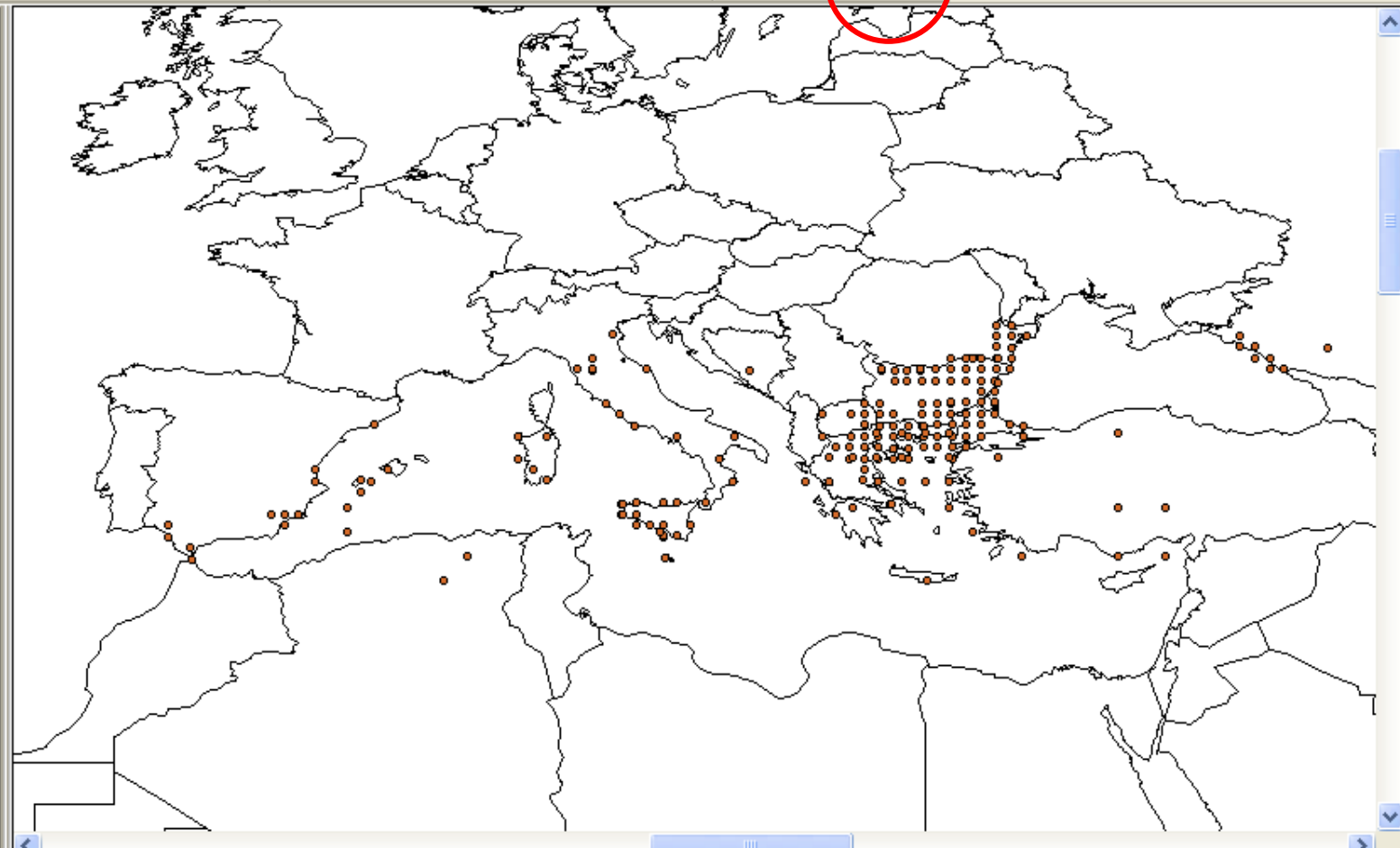
Species	Latitude	Longitude
Testudo_graeca	35	5
Testudo_graeca	35.0025	25.0823
Testudo_graeca	35.0046	25.0811
Testudo_graeca	36.3456	-5.50717
Testudo_graeca	36.3438	-5.50715
Testudo_graeca	36	6
Testudo_graeca	36.8205	14.7197
Testudo_graeca	37.2465	-6.46207
Testudo_graeca	37.2444	-6.46331
Testudo_graeca	37.7208	-2.14837
Testudo_graeca	37.7192	-2.149
Testudo_graeca	37.7137	-1.5818
Testudo_graeca	37.7055	-1.01479
Testudo_graeca	37.7073	-1.01437
Testudo_graeca	37.2645	13.589
Testudo_graeca	37.7055	13.0148
Testudo_graeca	37.7073	13.0139
Testudo_graeca	37.2686	14.1541
Testudo_graeca	37.2699	14.1533
Testudo_graeca	38.1698	15.8562
Testudo_graeca	38.1717	15.8552

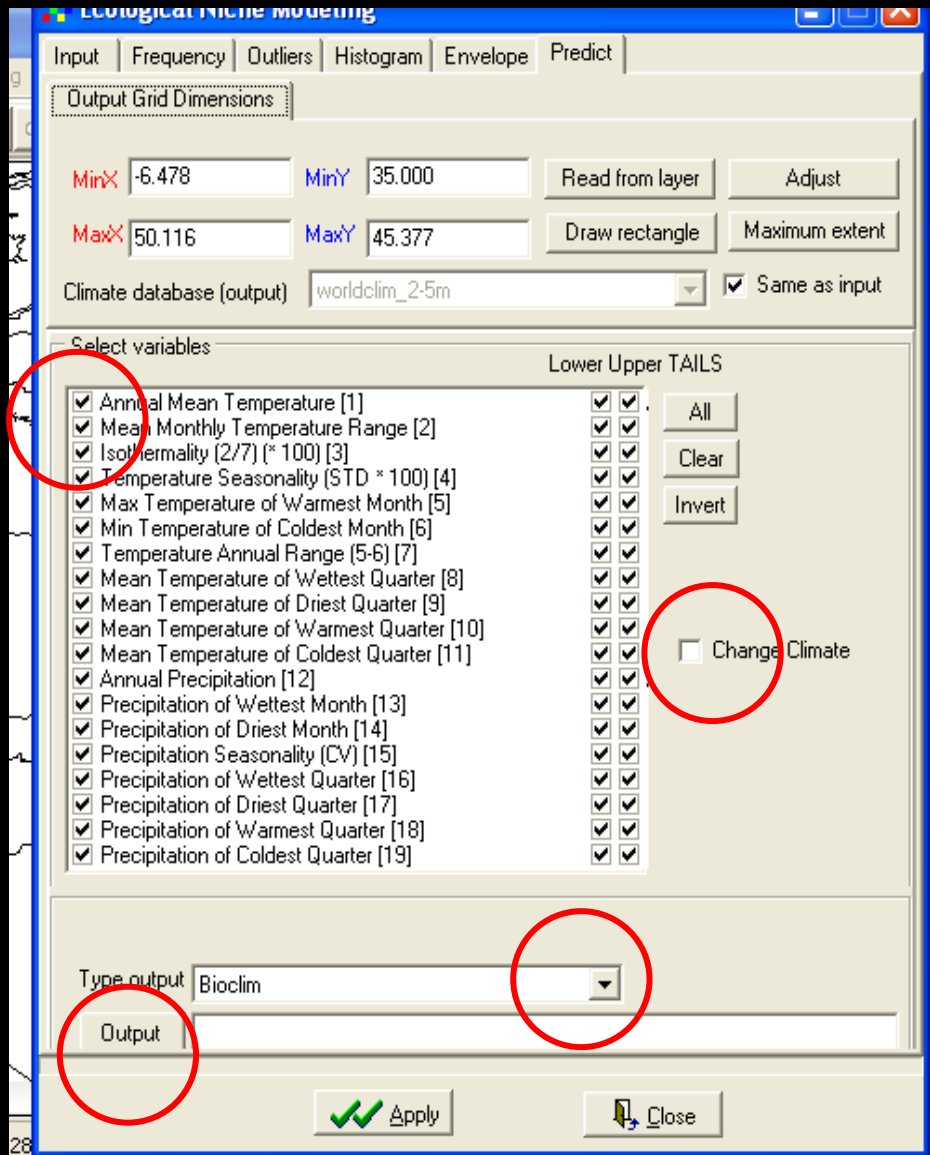


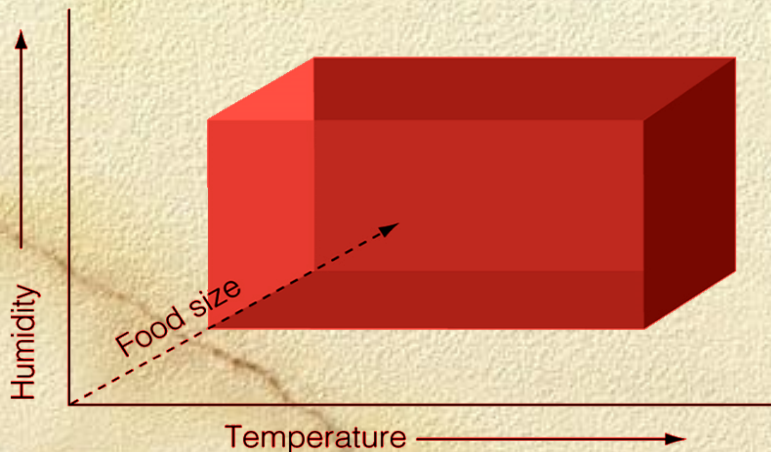
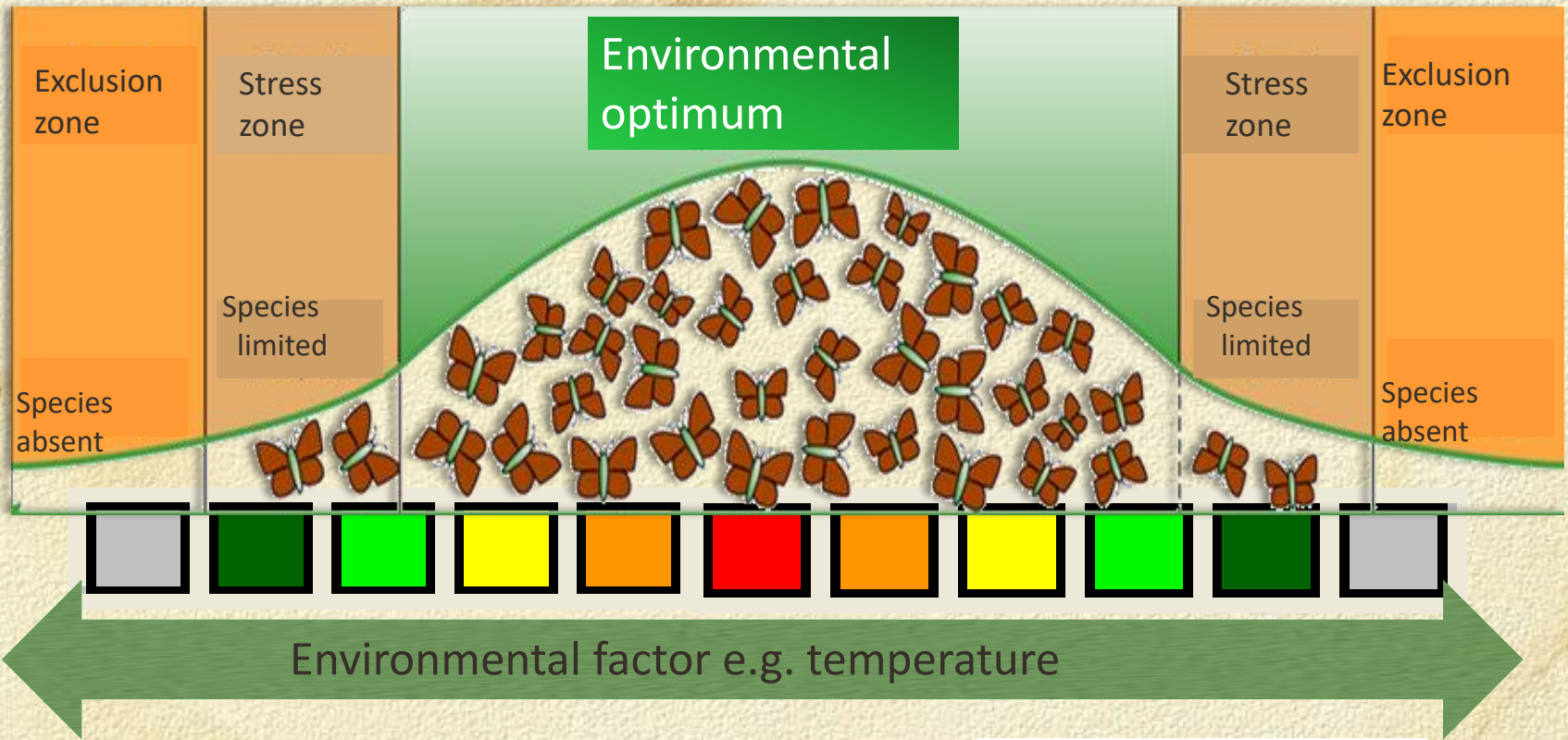


Layer list panel with the following items:

- Testudo
- world\_adm0







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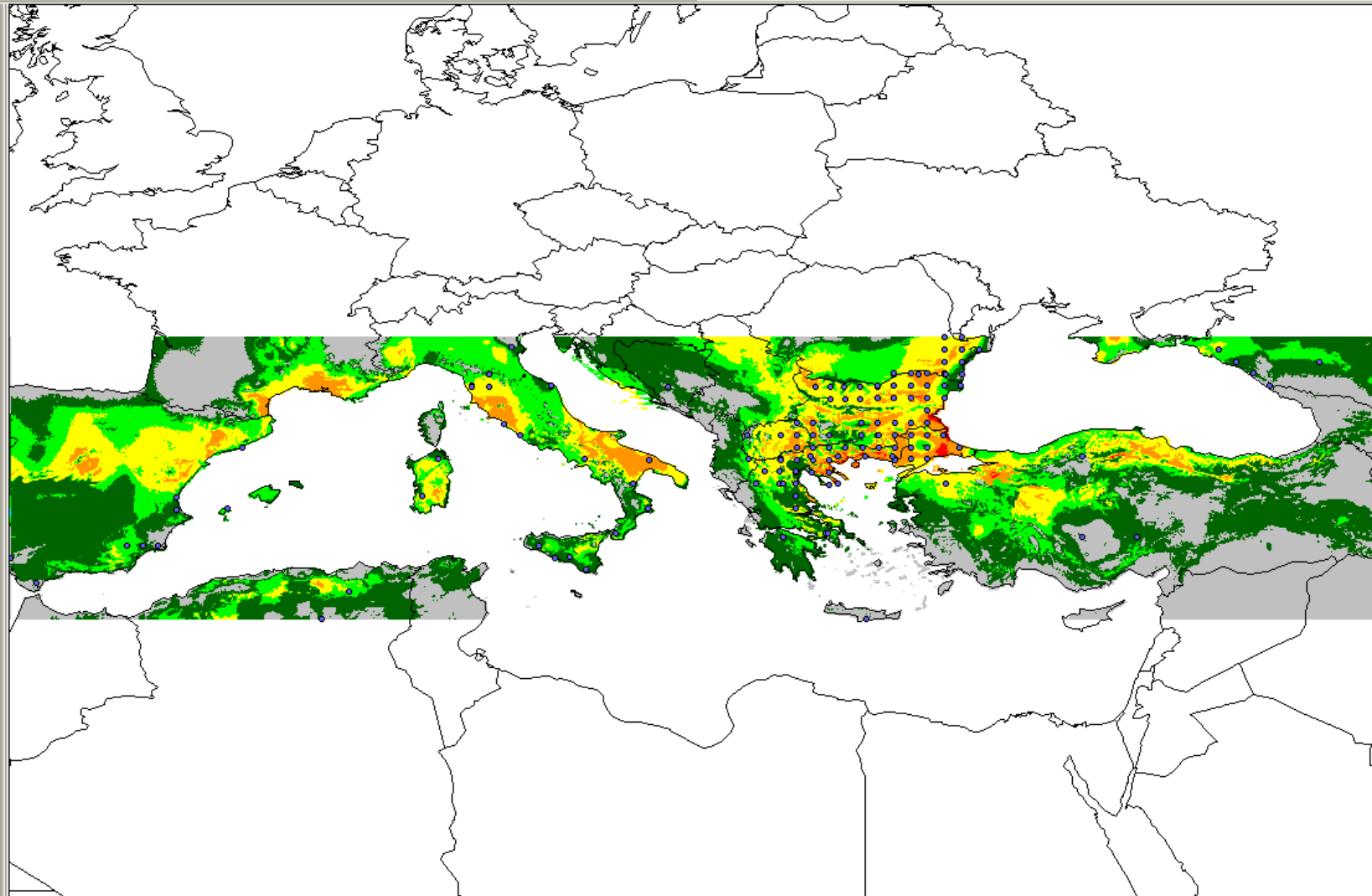


testudograeca

world\_adm0

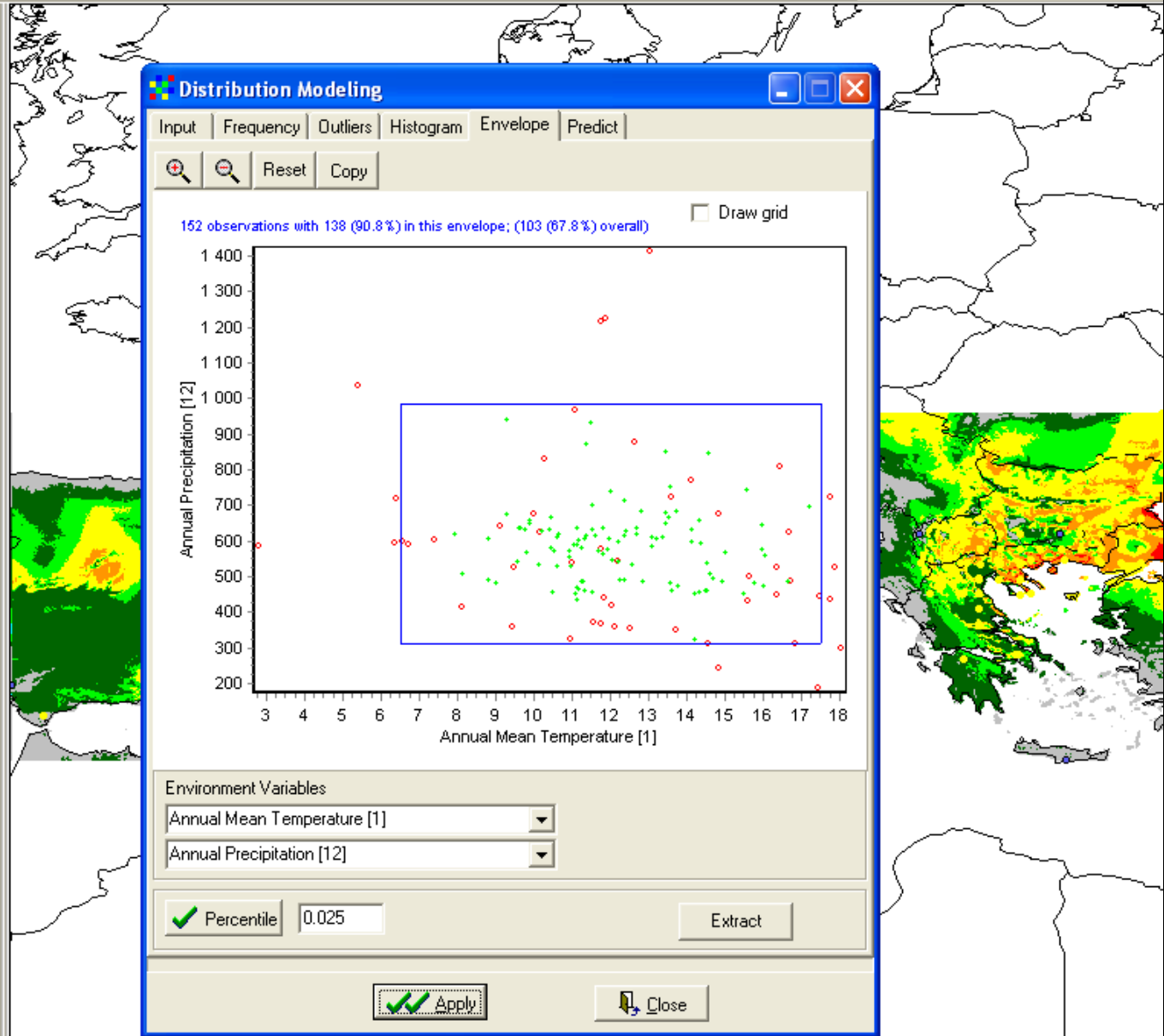
test

- Not suitable
- Low (0-2.5 percentile)
- Medium (2.5-5 percentile)
- High (5-10 percentile)
- Very High (10-20 percentile)
- Excellent (20-31 percentile)
- No data





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### Distribution Modeling

Input | Frequency | Outliers | Histogram | Envelope | Predict

Draw grid

152 observations with 138 (90.8%) in this envelope; (103 (67.8%) overall)

Annual Precipitation [12]

Annual Mean Temperature [1]

Environment Variables:  
Annual Mean Temperature [1]  
Annual Precipitation [12]

Percentile 0.025

Extract

Apply



*Testudo graeca*

*Predicting current  
distribution and future  
distribution (1, 2, 3°C  
temperature increase)*

*Achillea holosericea*

*Predicting current  
distribution and future  
distribution (1, 2, 3°C  
temperature  
increase)*





## Suitable areas for olive cultivation

current:

Worldclim

future:

CCM3 model (2xCO<sub>2</sub>)





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