

Sébastien Mirolo

GUAnches and
aboriginal people from
the **CA**nary islands
MOLecular impact on
biodiversity





Google Earth

Landsat / Copernicus, Data SIO, NOAA

La Palma

La Gomera

El Hierro

Ténérife

Gran
Canaria

Fuerteventura

Lanzarote

Hotspot of biodiversity

Isolation from mainland

- Ecological release
- Niche expansion



La Palma



La Gomera



El Hierro



Ténérife



Gran Canaria

47%

Insular syndromes

Self-compatibility



Lanzarote

Fuerteventura

Hotspot of biodiversity

47%

Insular syndromes

Self-compatibility



Digitalis canariensis



La Palma



El Hierro

CANARIAS



Gran Canaria



Lanzarote

Fuerteventura

Hotspot of biodiversity

Isolation from mainland

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La Palma



La Gomera



El Hierro



Ténérife



Gran Canaria



Lanzarote

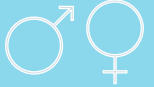


Fuerteventura

47%

Insular syndromes

Self-compatibility



Pollination syndrome



CANARIAS

Hotspot of biodiversity

Isolation from mainland



Canarina canariensis



El Hierro

47%

Insular syndromes

Self-compatibility



Pollination syndrome



CANARIAS



Gran Canaria



Fuerteventura

Lanzarote

Hotspot of biodiversity

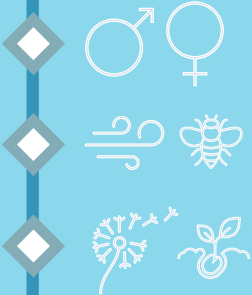
47%

Isolation from mainland

- Ecological release
- Niche expansion

Insular syndromes

- Self-compatibility
- Pollination syndrome
- Loss of dispersal capacities



La Palma



La Gomera



Ténérife



El Hierro



Gran Canaria



Lanzarote



Fuerteventura

Hotspot of biodiversity

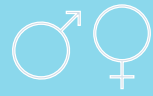


El Hierro

47%

Insular syndromes

Self-compatibility



Pollination syndrome



Loss of dispersal capacities



Gran Canaria



Lanzarote

Fuerteventura

Hotspot of biodiversity

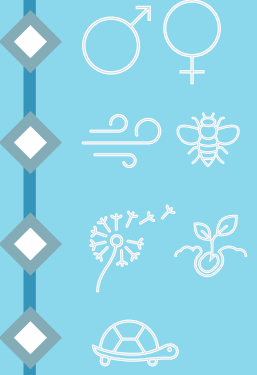
47%

Isolation from mainland

- Ecological release
- Niche expansion

Insular syndromes

- Self-compatibility
- Pollination syndrome
- Loss of dispersal capacities
- Gigantism



La Palma



El Hierro



La Gomera



Ténérife



Gran Canaria



Lanzarote



Fuerteventura

Hotspot of biodiversity

47%

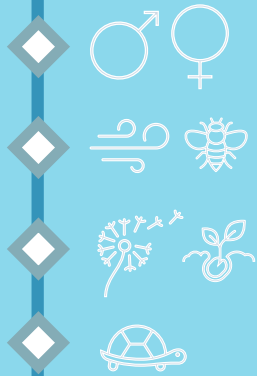
Endromes

Compatibility

Syndrome

Capacities

Gigantism



Echium wildpretii



Sonchus acaulis

Gran Canaria



Centrochelys burchardi

La Restinga
El Hierro

Hotspot of biodiversity

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La Palma



La Gomera



El Hierro



Ténérife



Gran Canaria



Lanzarote

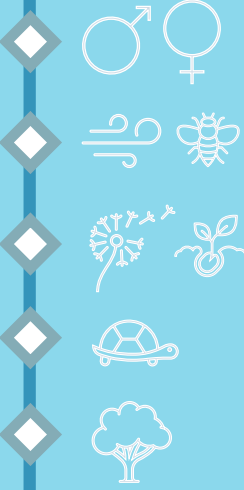


Fuerteventura

47%

Insular syndromes

- Self-compatibility
- Pollination syndrome
- Loss of dispersal capacities
- Gigantism
- Lignification



CANARIAS

Hotspot of biodiversity

47%

syndromes

Self-compatibility



Autogamy syndrome



General capacities



Gigantism



Lignification



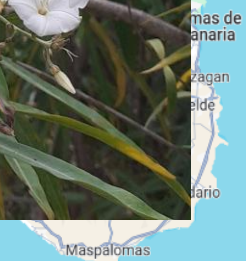
Echium virescens



Convolvulus floridus



El Hierro



Gran Canaria



Lanzarote

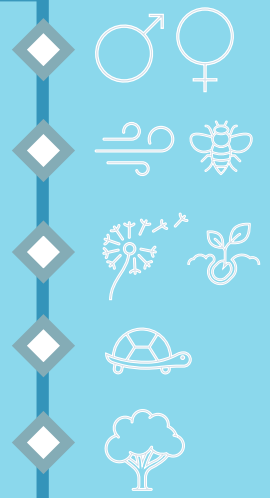
Fuerteventura

Hotspot of biodiversity

47%

syndromes

- Self-compatibility
- Autogamy syndrome
- General capacities
- Gigantism
- Lignification



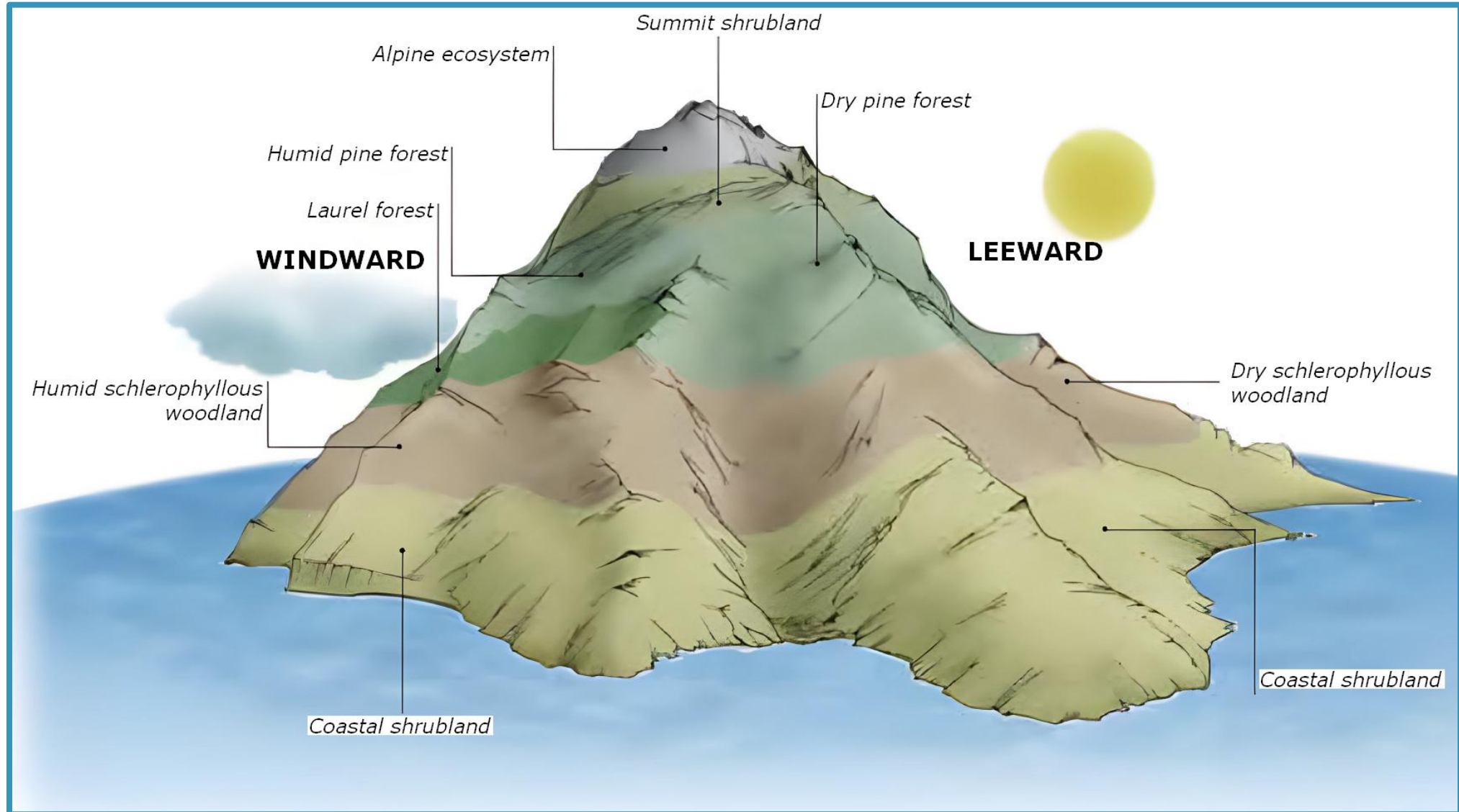
Echium vulgare

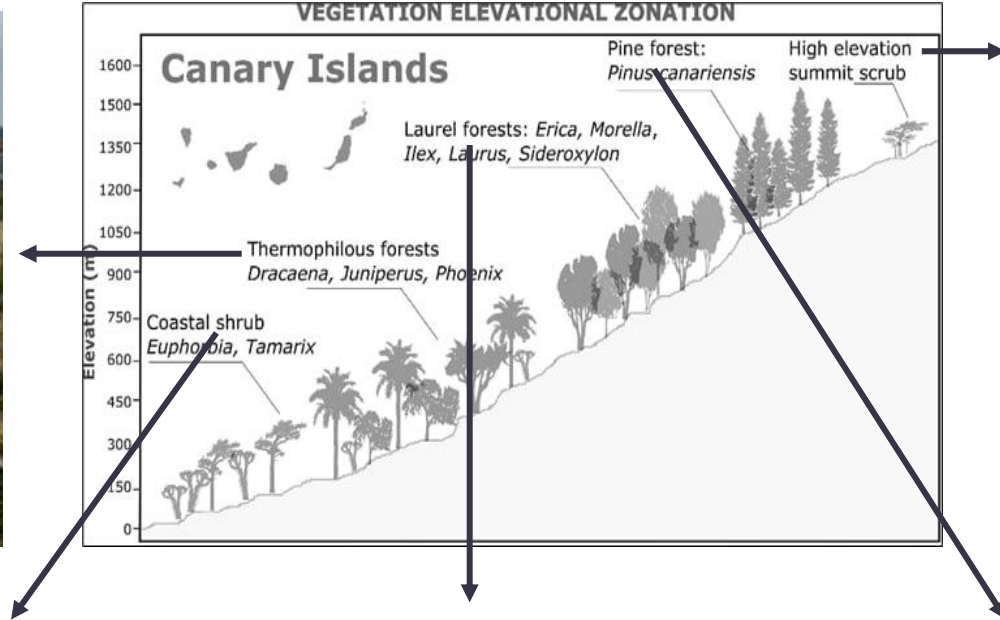


Calystegia sepium

mas de anaria
zagan
Elde
ario
has
naria

Altitudinal gradient





Impacts

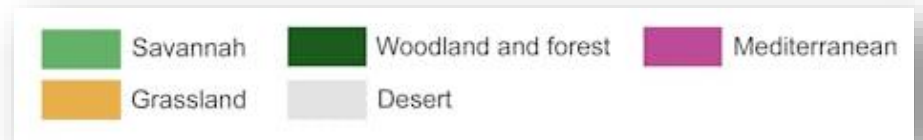
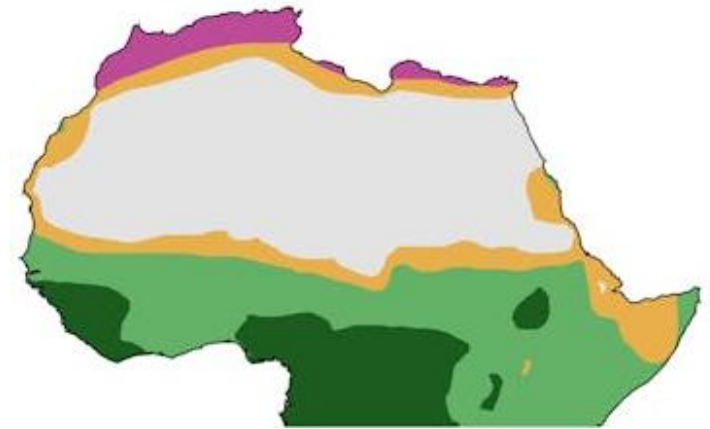
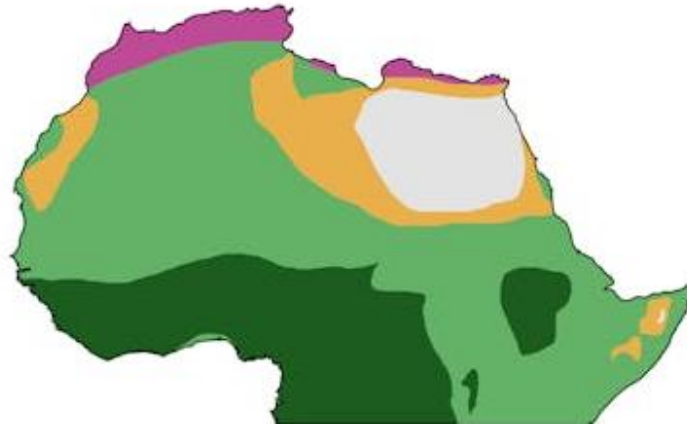
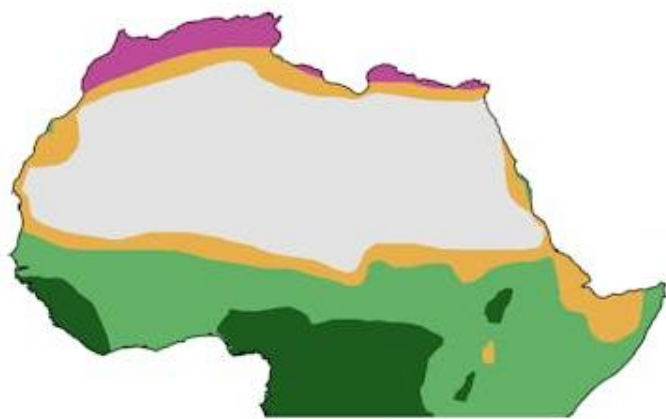
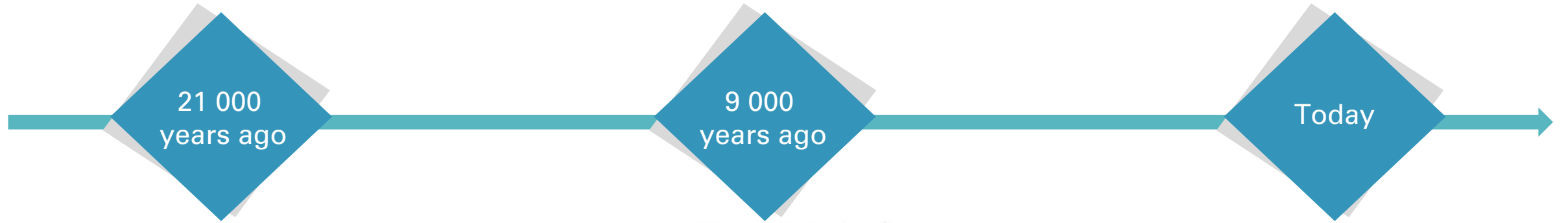
Climatic



Anthropic



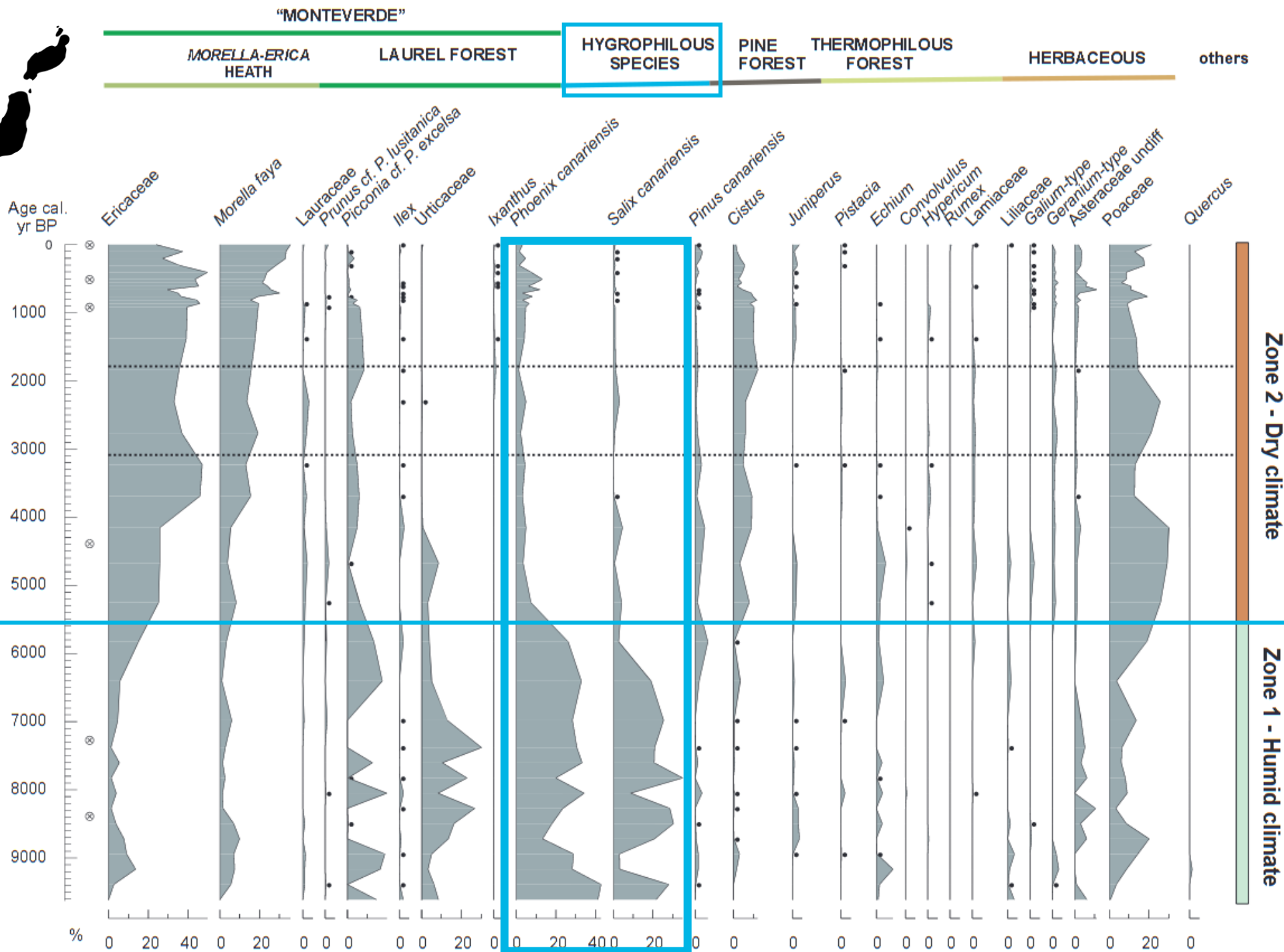
Historic climatic variations





La Gomera

Palynological diagram



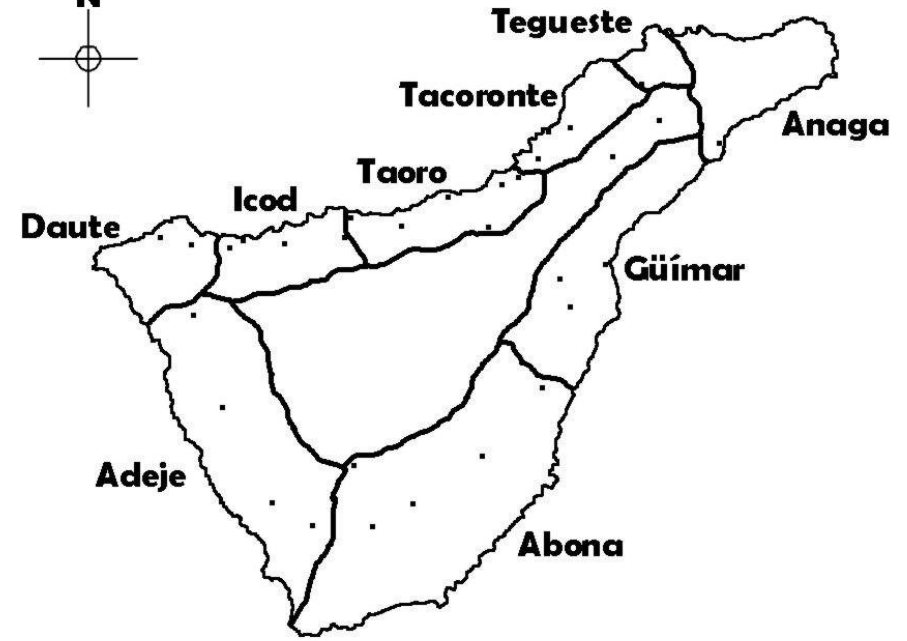
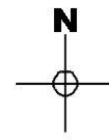
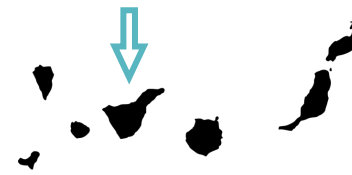
First colonization wave



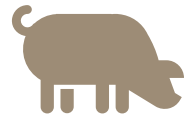
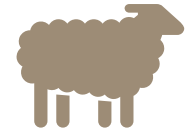
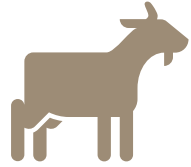
Guanches

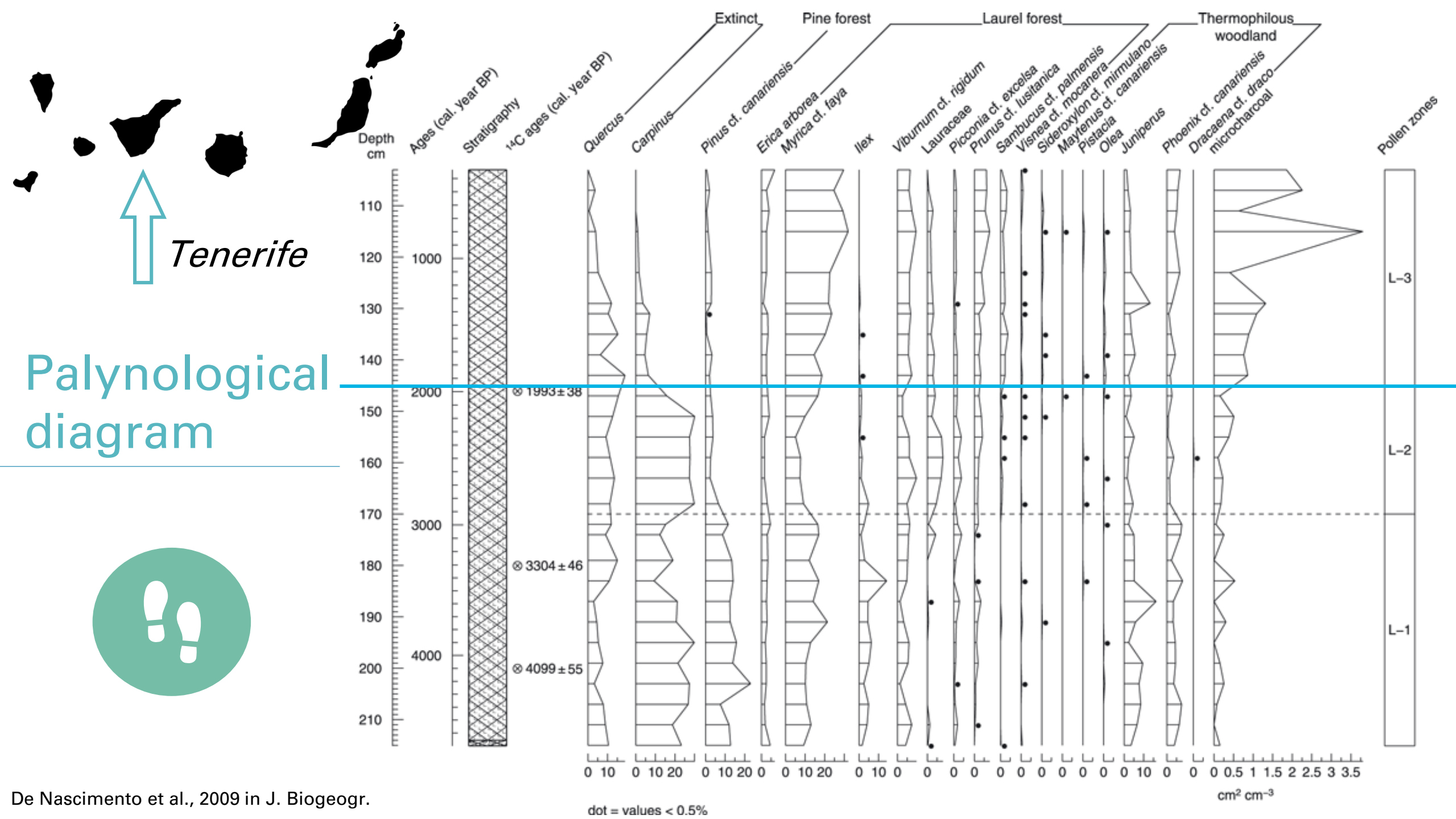


First colonization wave

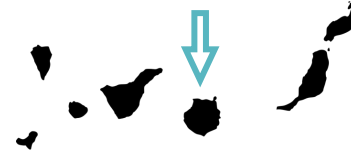


Guanches





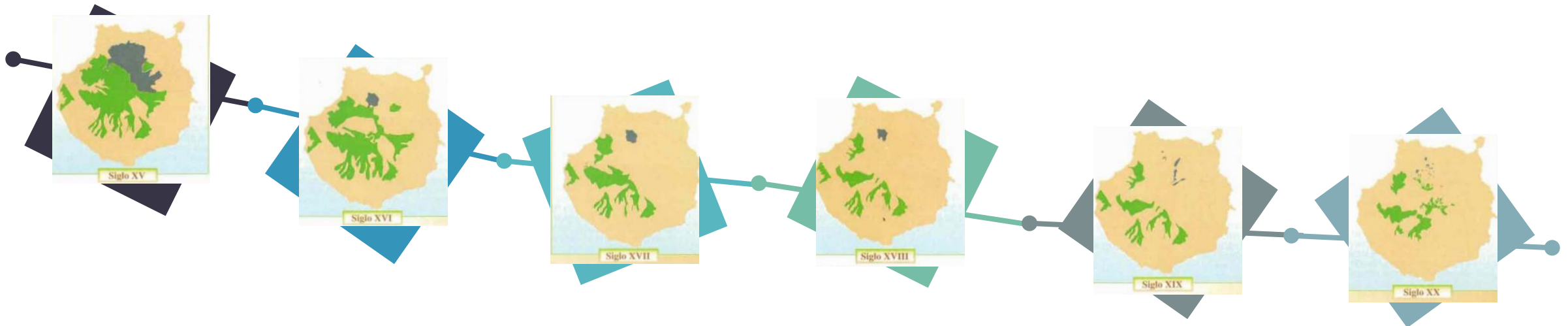
Second colonization wave



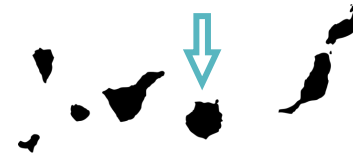
Europeans
1402-1496



Gran Canaria
Llanos de la Pez
1960's

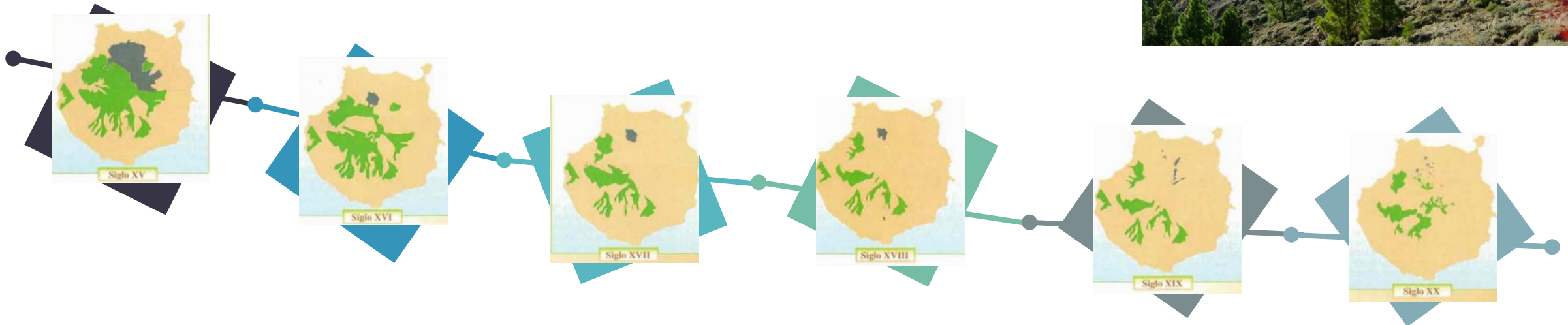


Second colonization wave



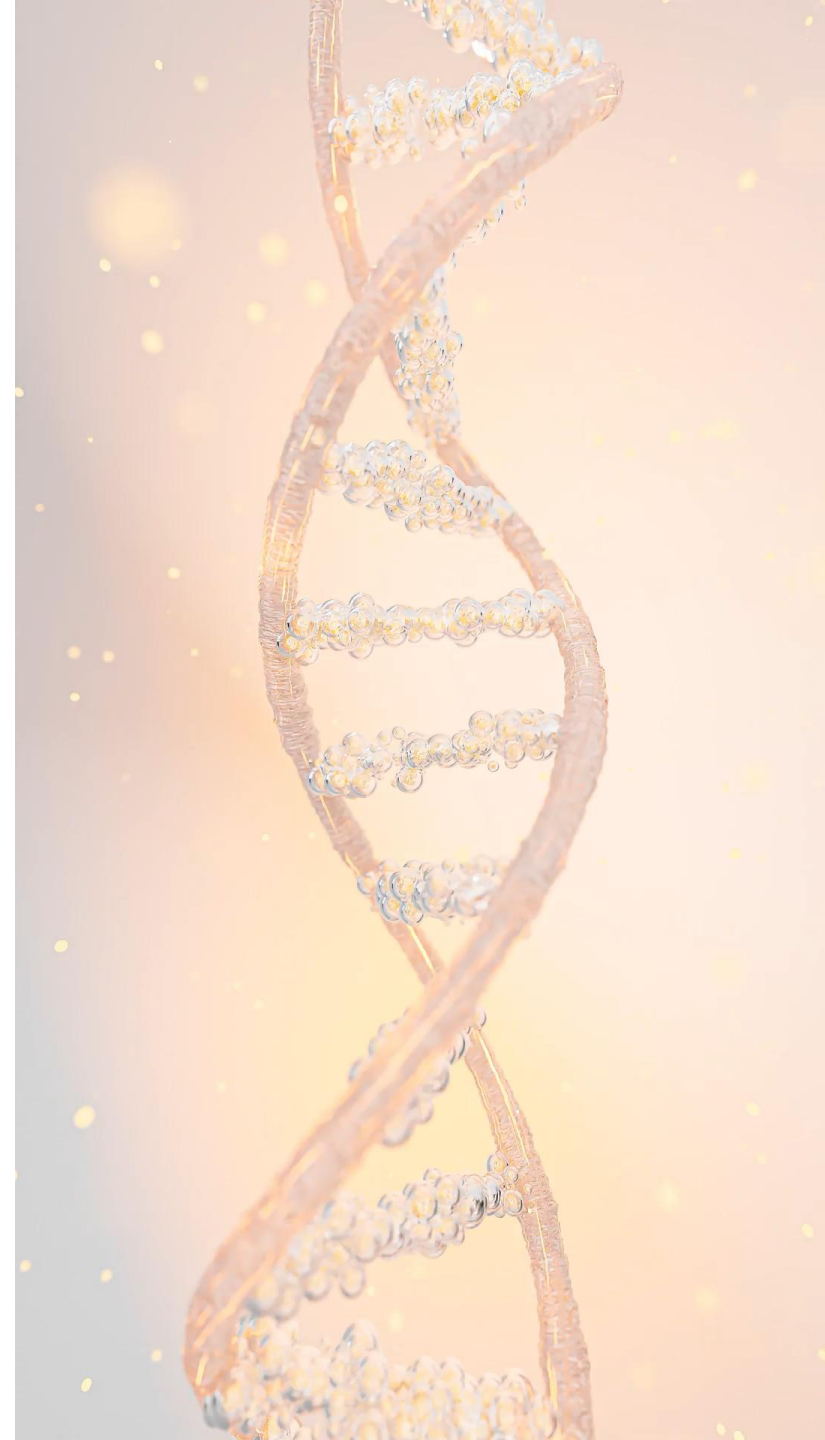
Europeans
1402-1496

Gran Canaria
Llanos de la Pez
1960's





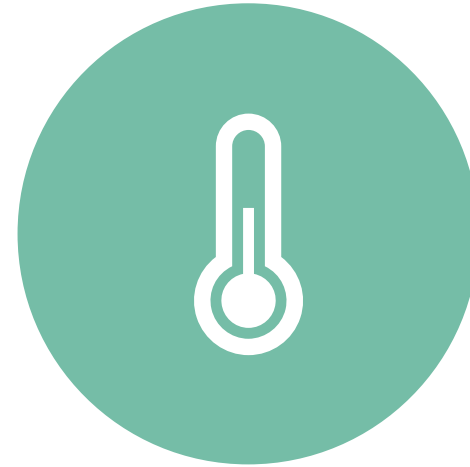
Human impact



Objectives



HUMAN IMPACT ON THE
GENETIC DIVERSITY



COMPARISON TO CLIMATE
IMPACT

M&M – Sampling

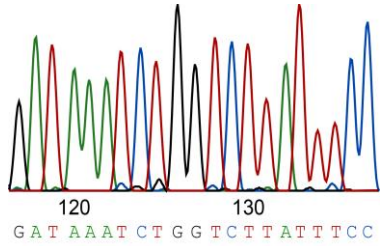


M&M – DNA Sequencing



f1 ATCGATGCATG
 f2 TCGATGGATGAAT
 f3 ATGCATGCATGCAA
 f4 ATGAATGCATGCA
 f5 CATGCA

Aligned Fragment Sequences

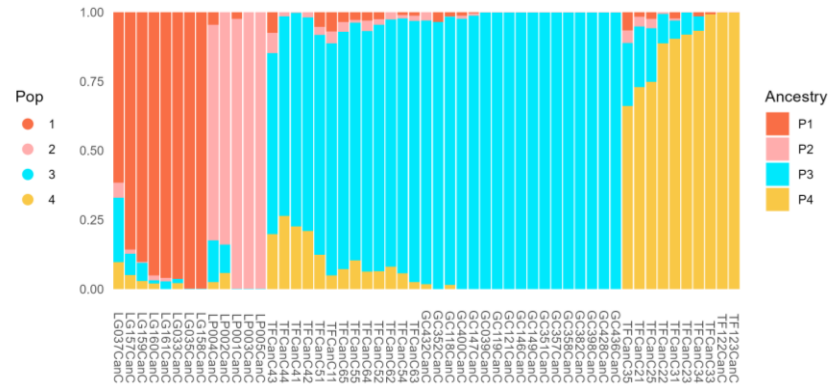
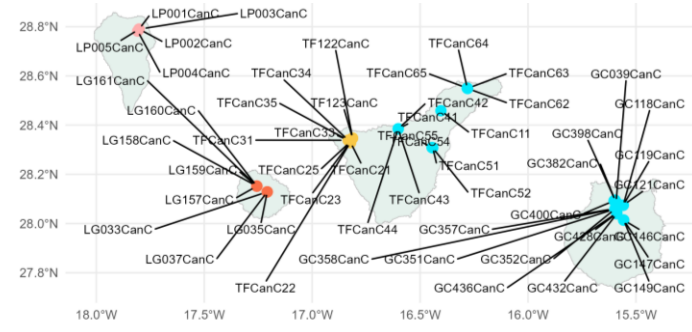


Ipyrad

	S1	S2	S3
f1	A		
f2	B	A	
f3	A	B	A
f4		A	B
f5			B

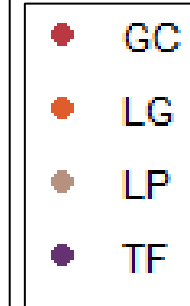
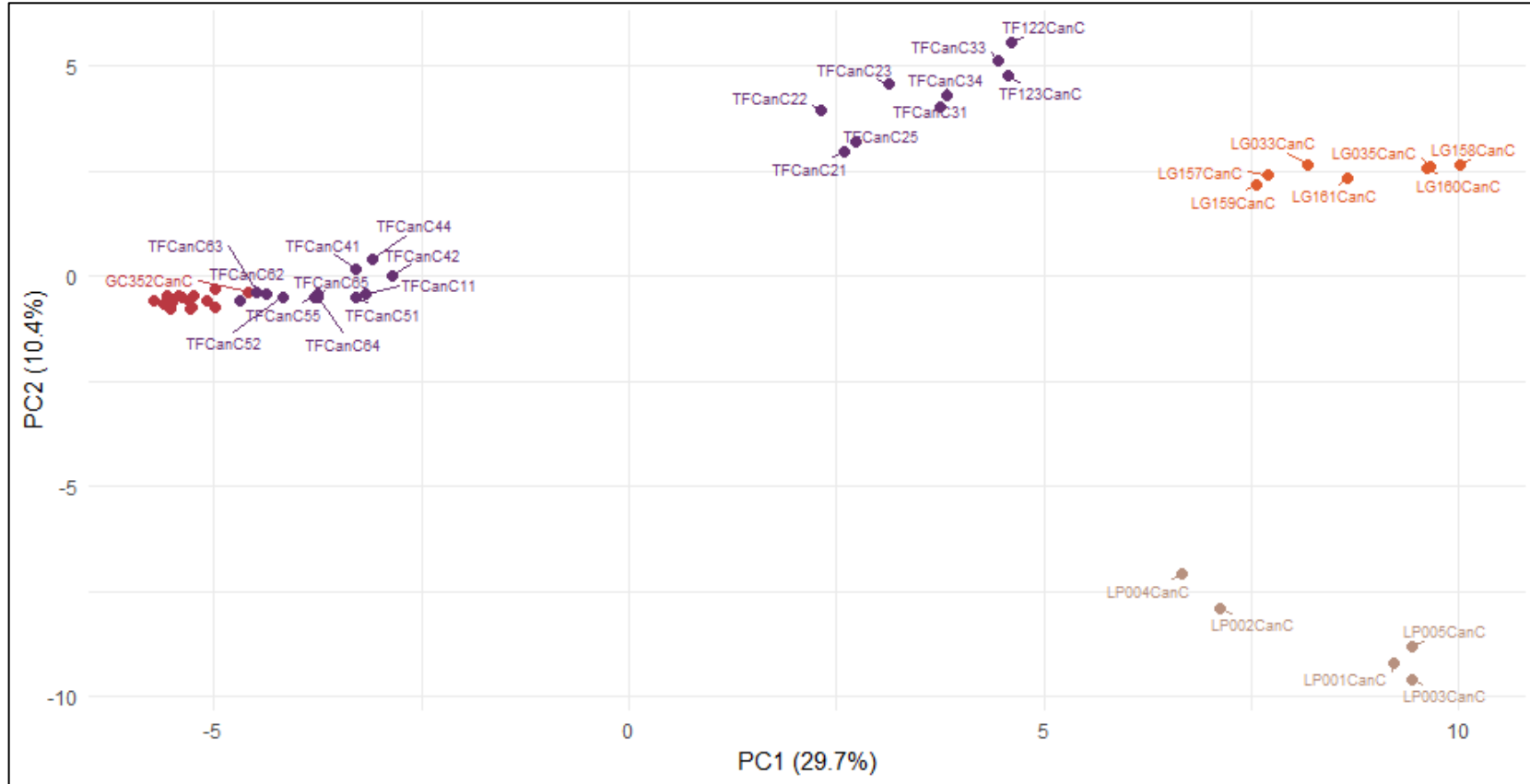
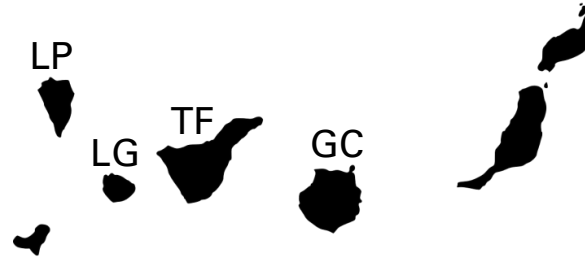
SNP Matrix

	S1	S2	S3
f1	0	-	-
f2	1	0	-
f3	0	1	1
f4	-	0	0
f5	-	-	0



Population genetics

PCA – exploratory

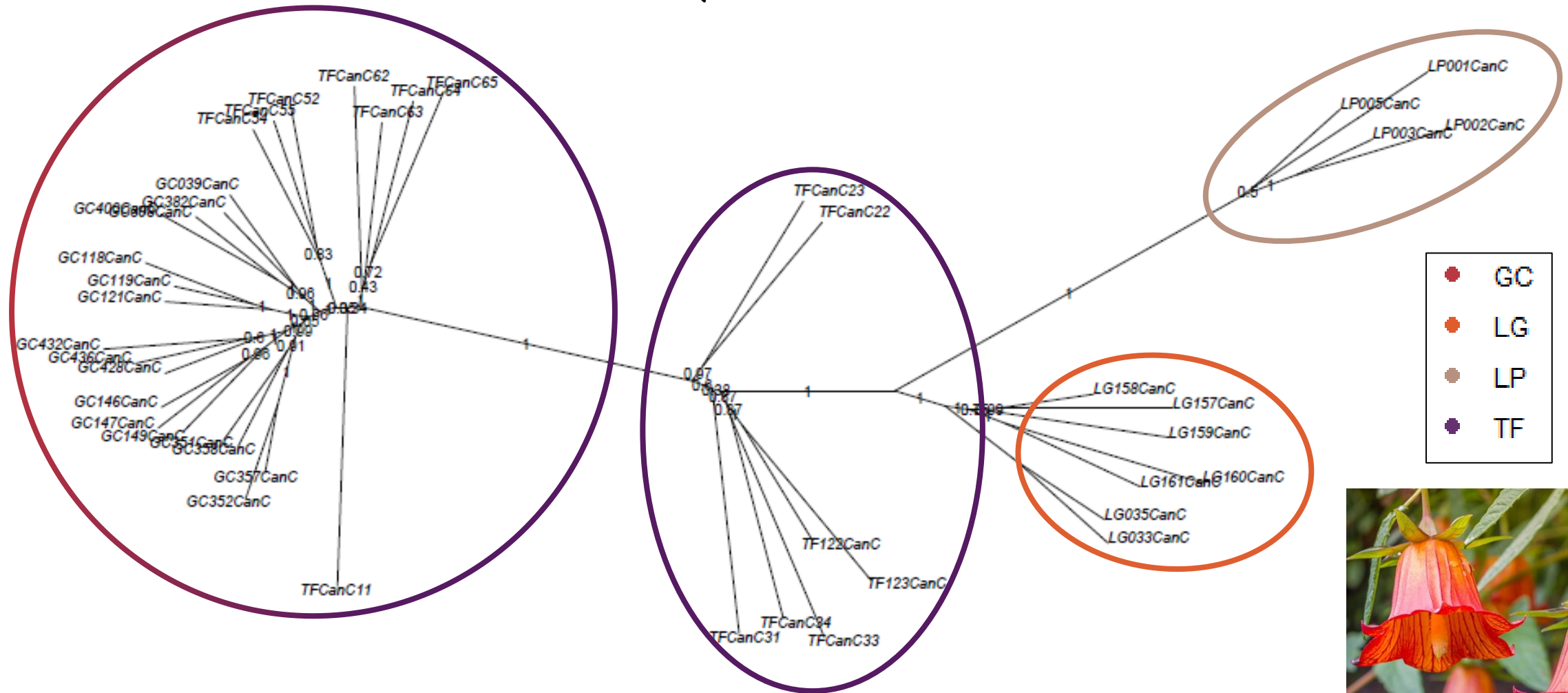


Principal Component Analysis

~1 cluster per island

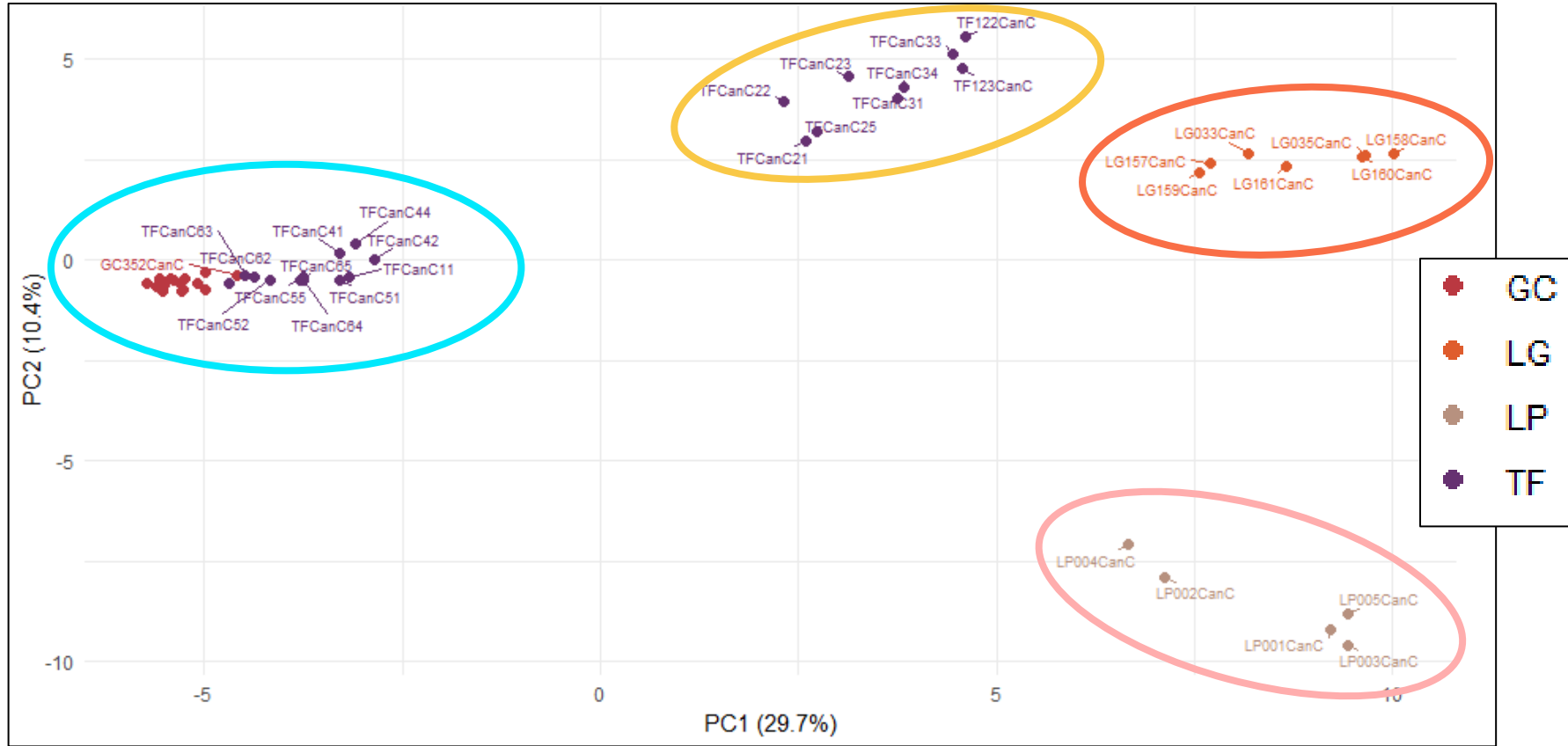
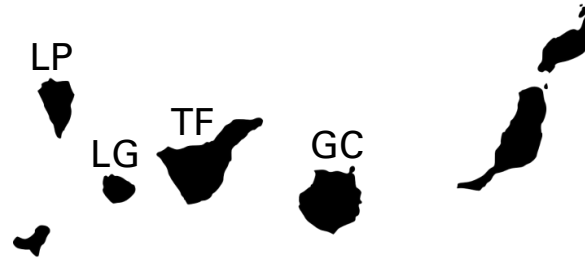
Population genetics

Phylogenies – exploratory

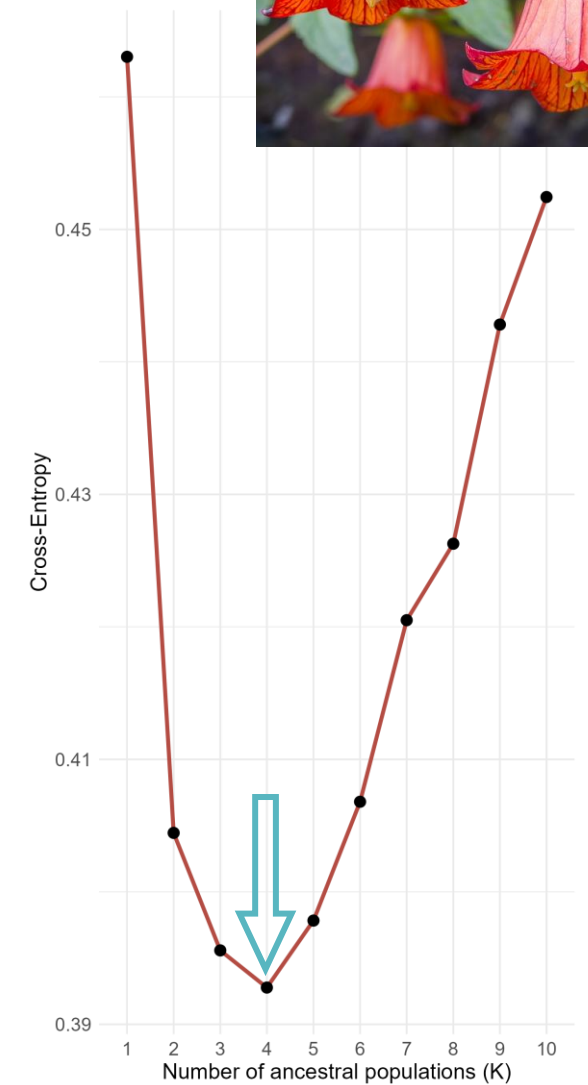


Population genetics

sNMF – genetic clustering

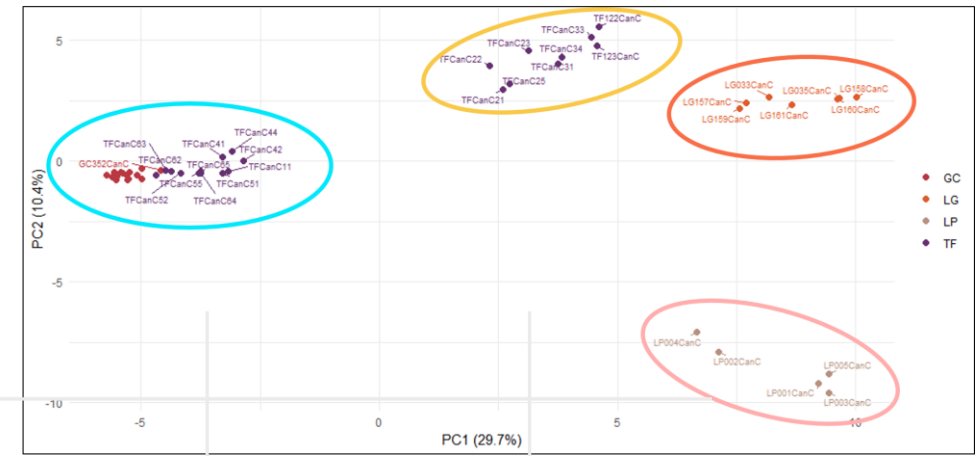
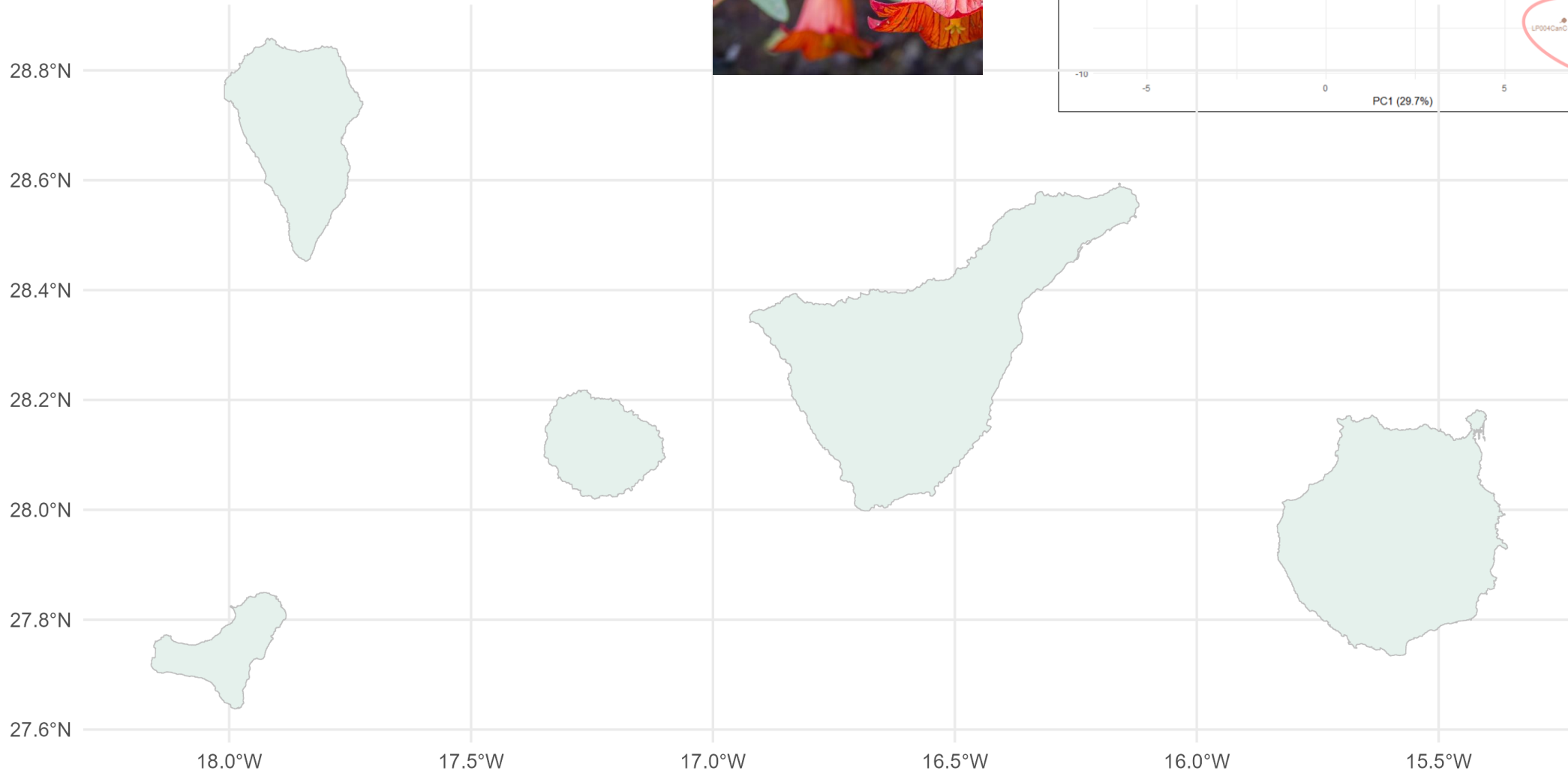


PCA clusters = Genetic clusters



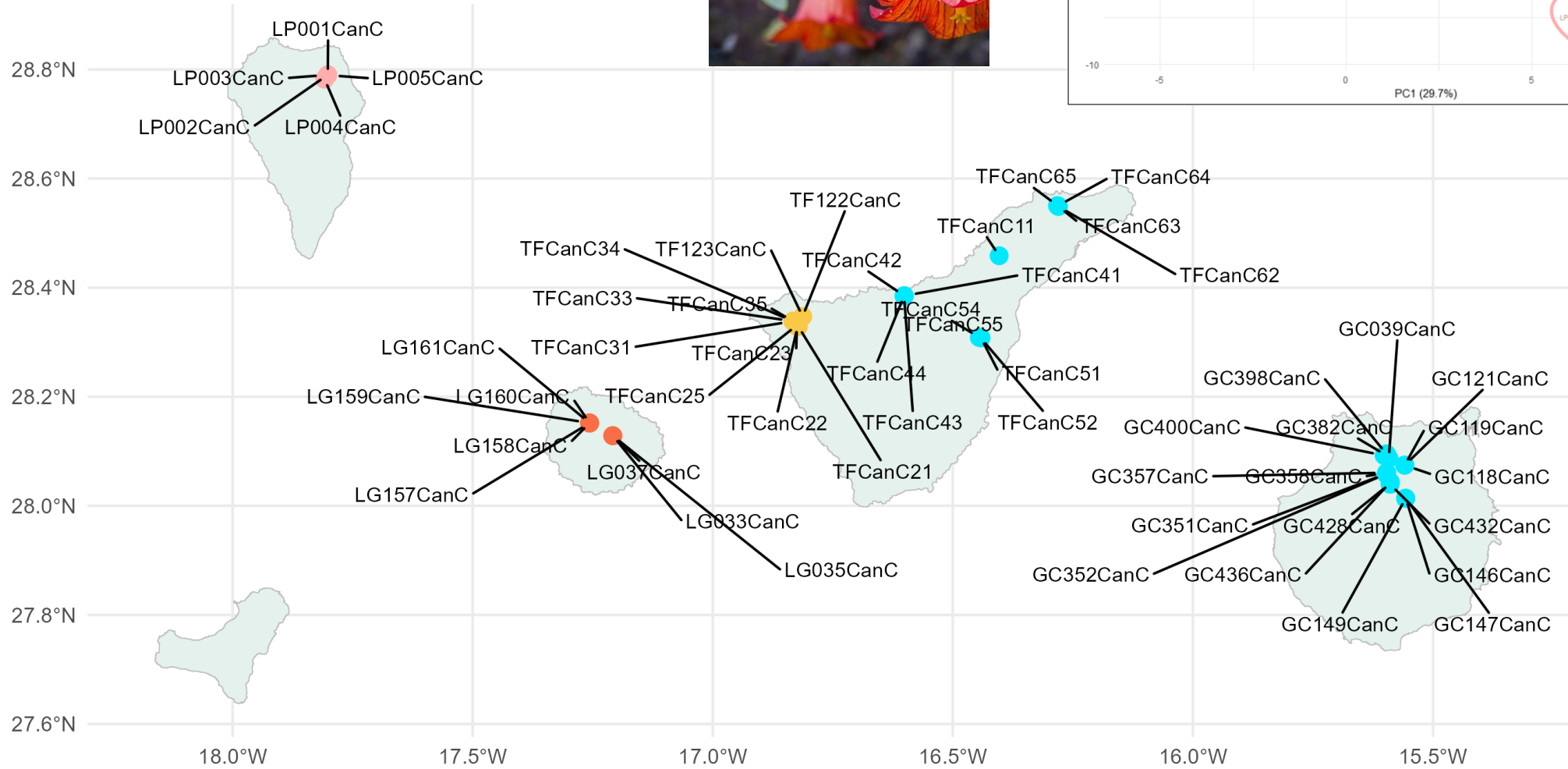
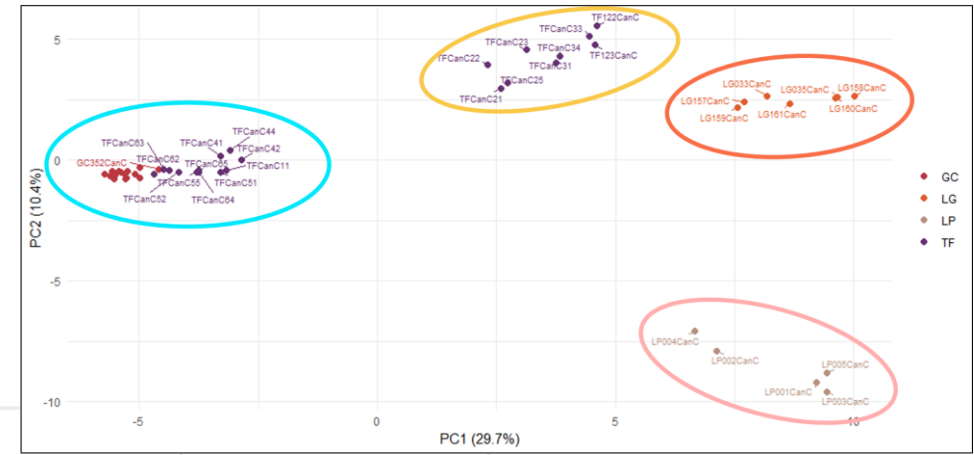
Population genetics

Geographical structure



Population genetics

Geographical structure

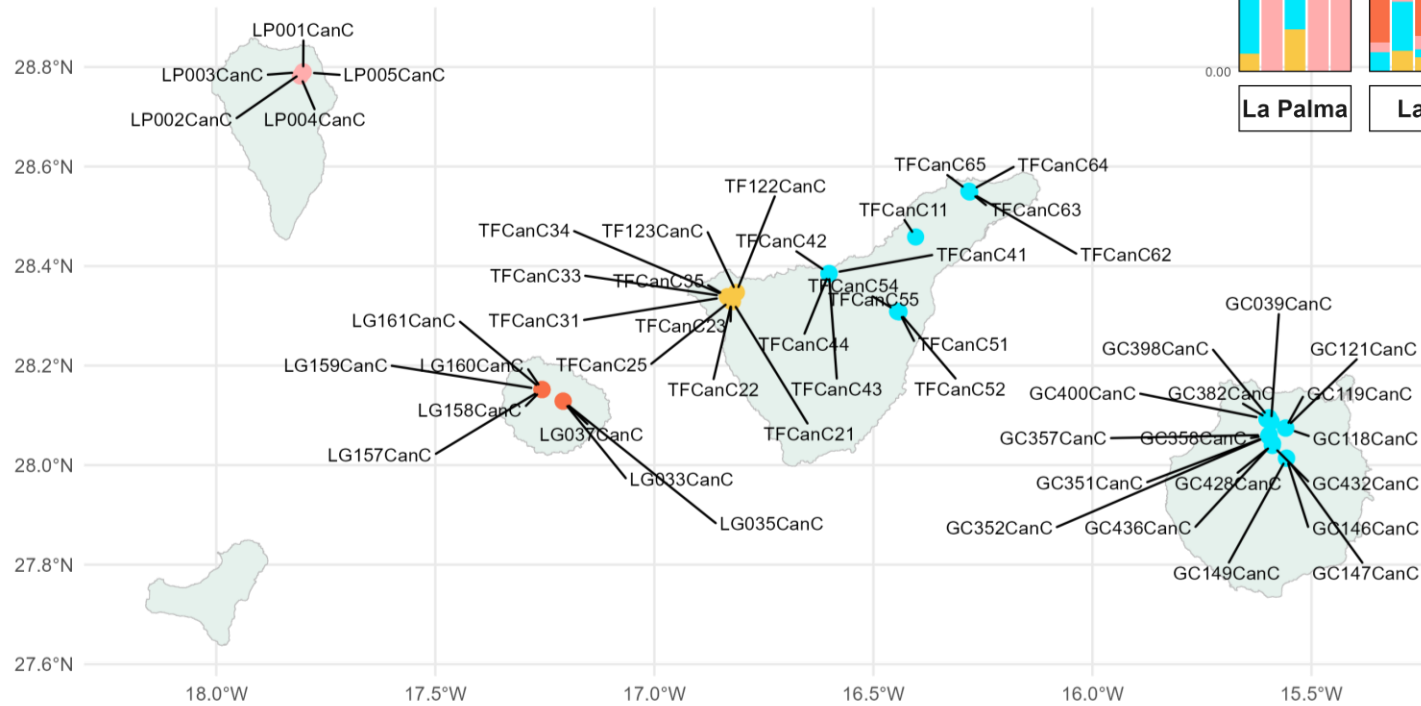
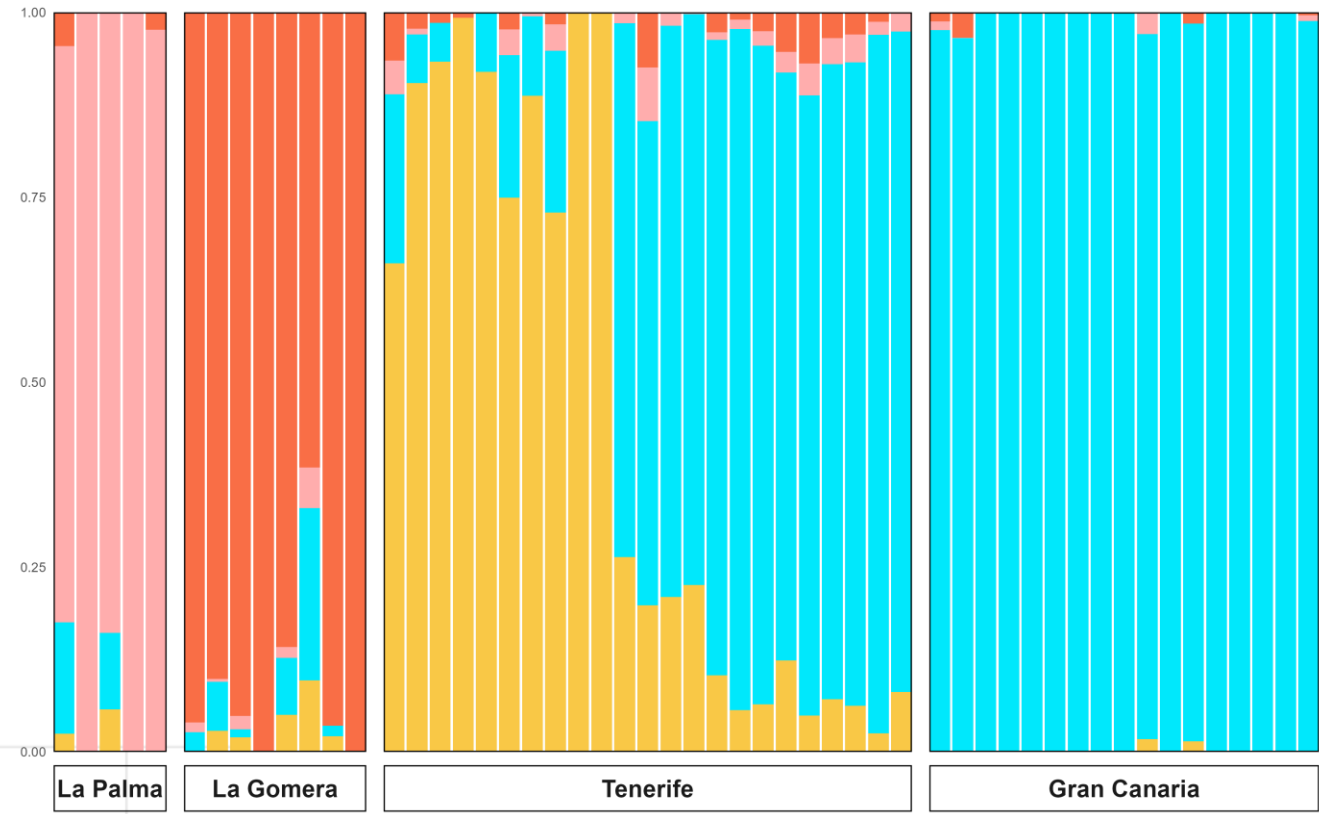


Population genetics

Admixture



Ancestry



Pop

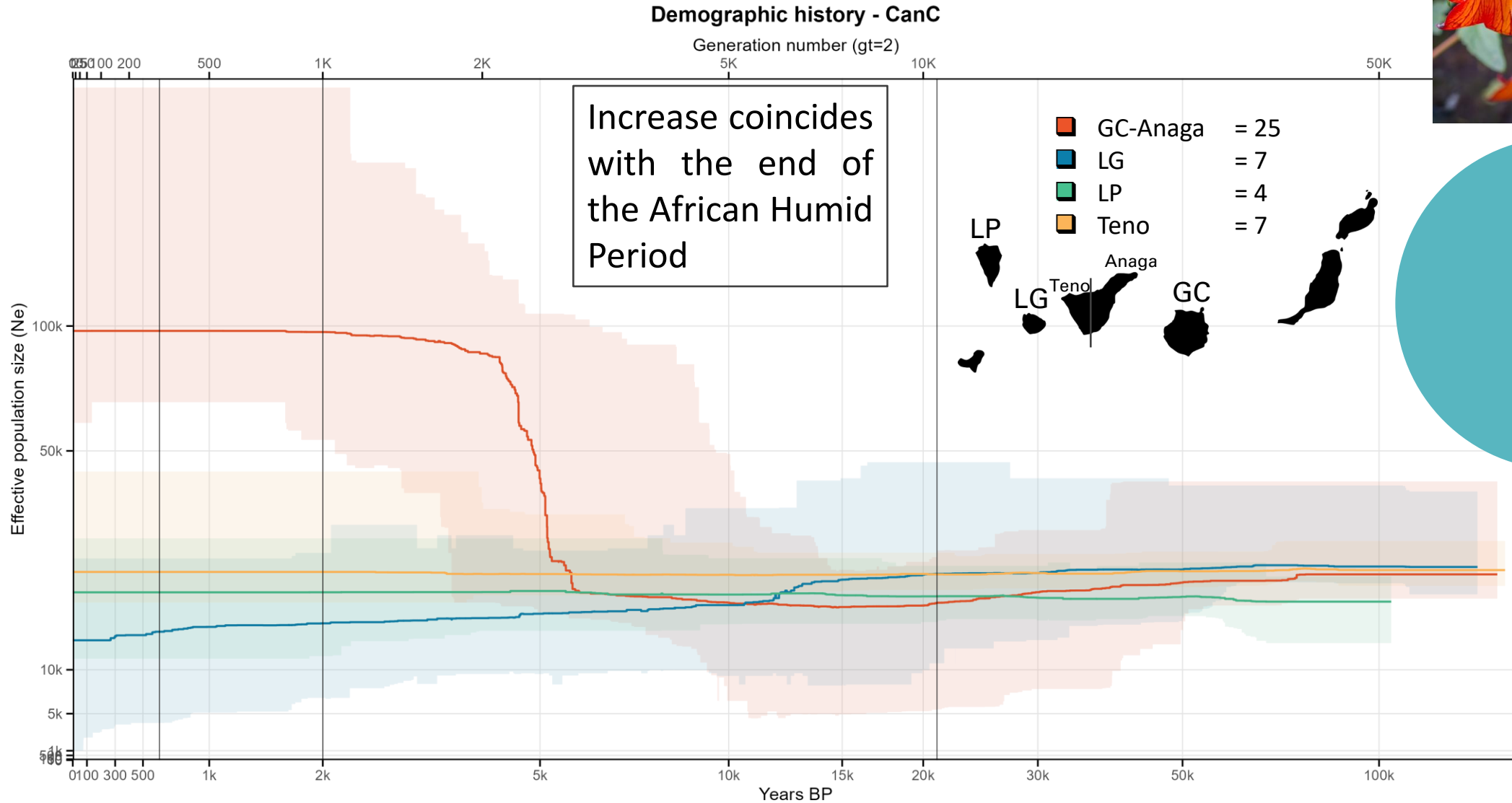


Genetic clusters isolated from one another

Except on Tenerife (gradient from W to E)

Population genetics

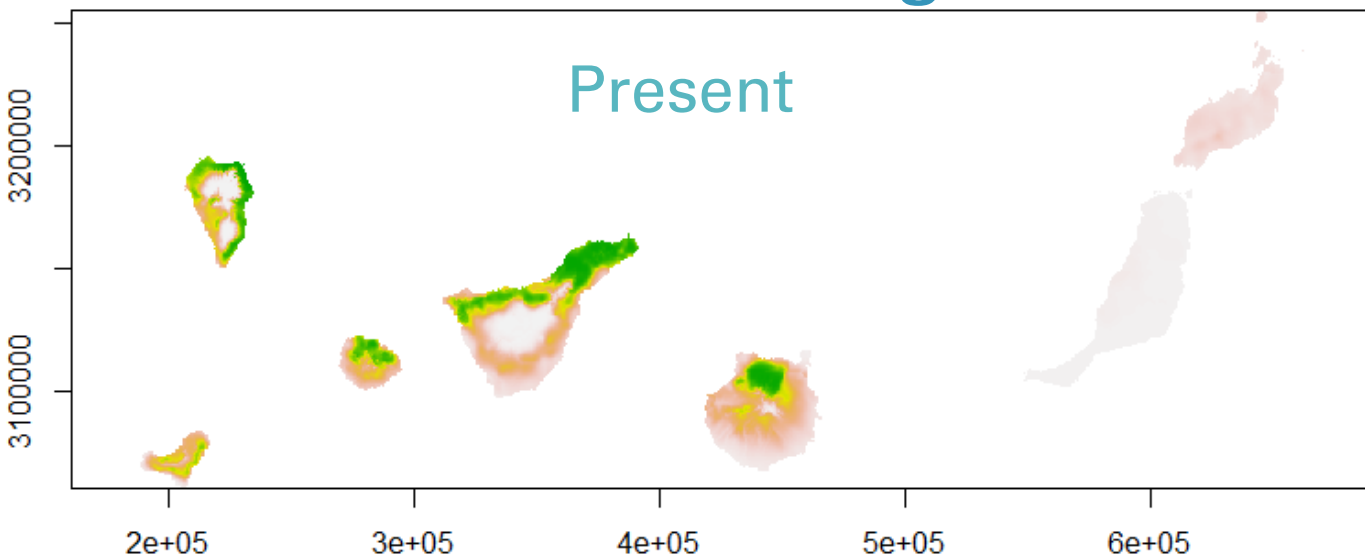
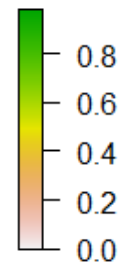
STAIRWAYPLOT2 – Demographic history



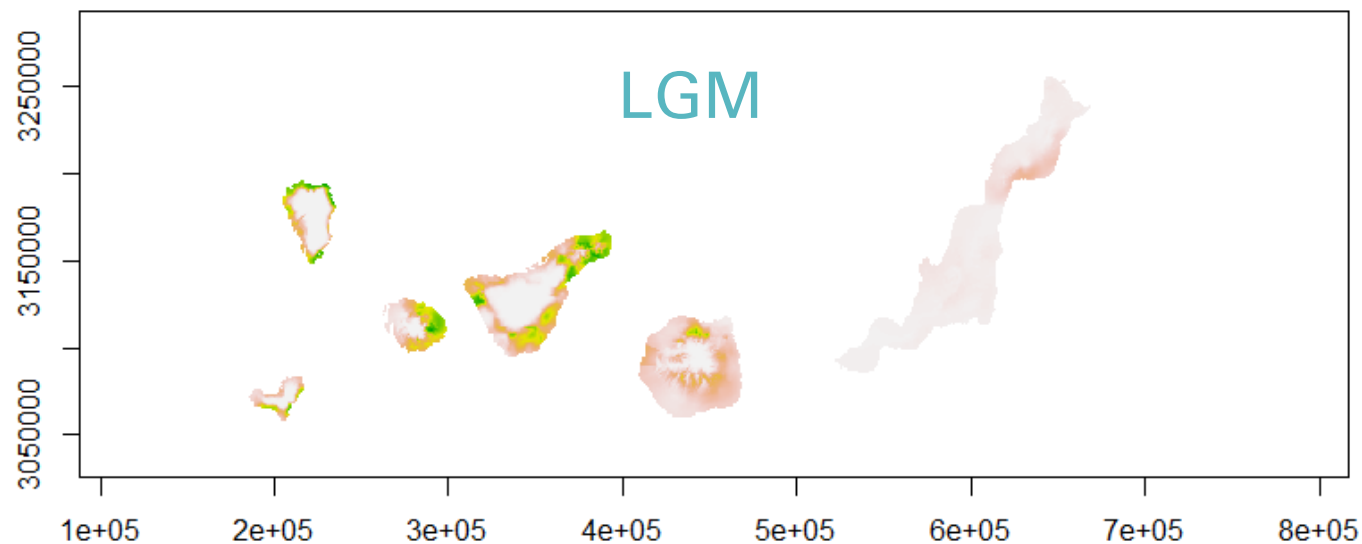
Climatic impact SDM – niche modeling



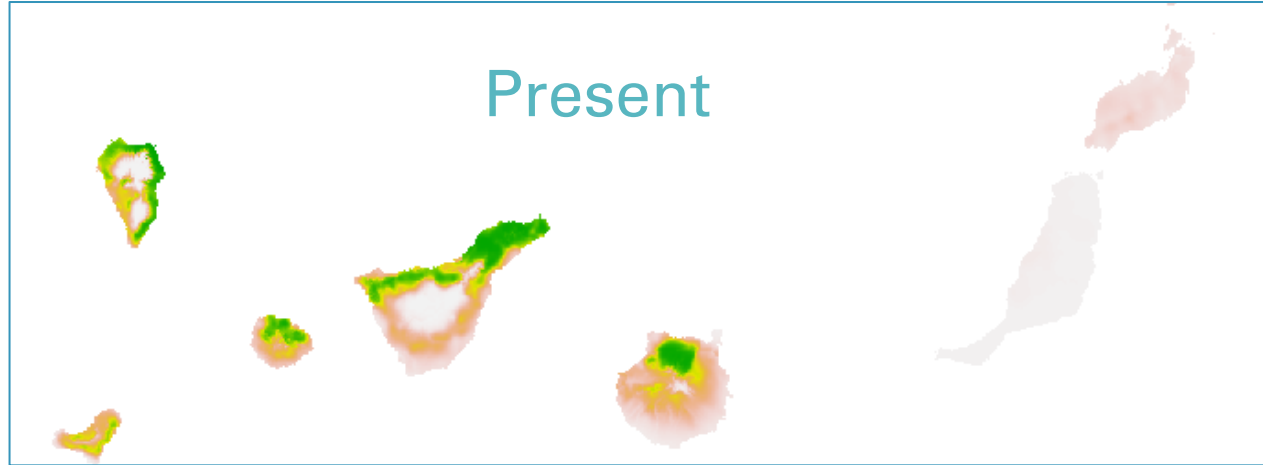
3893 pixels



1903 pixels



Ratios comparison



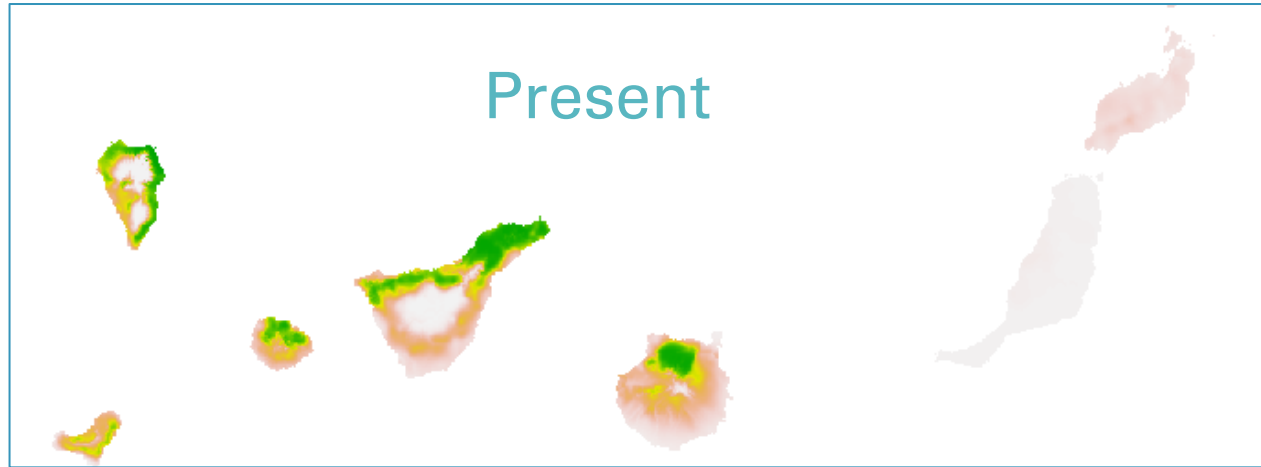
Climatic ratio

1903 / 3893

0.489

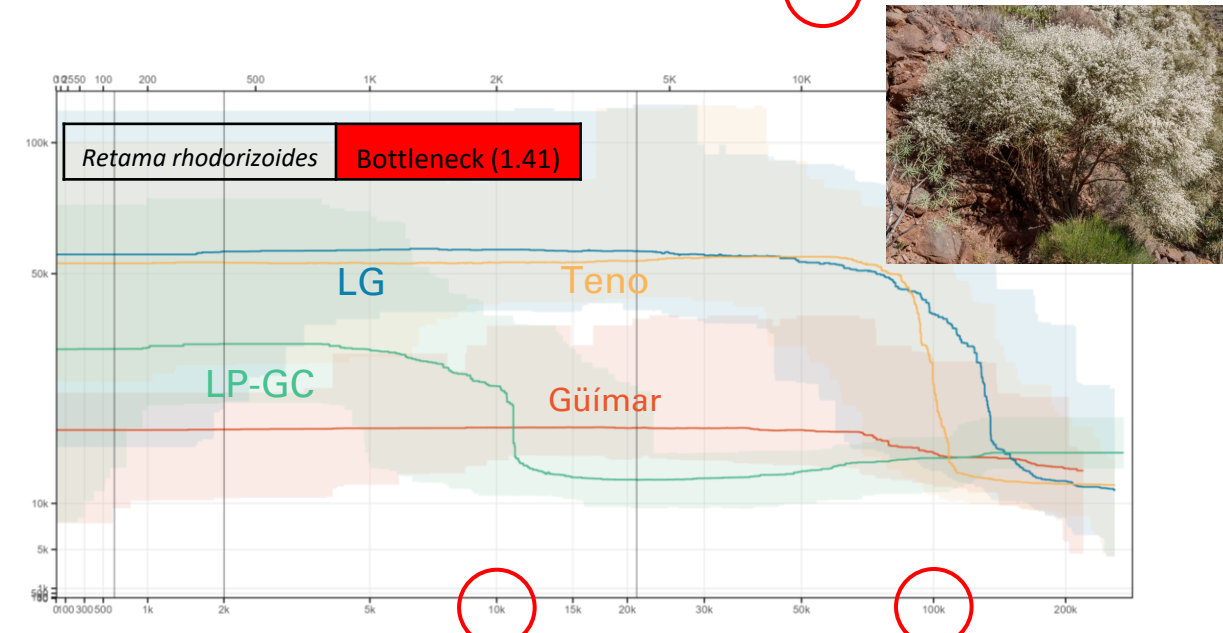
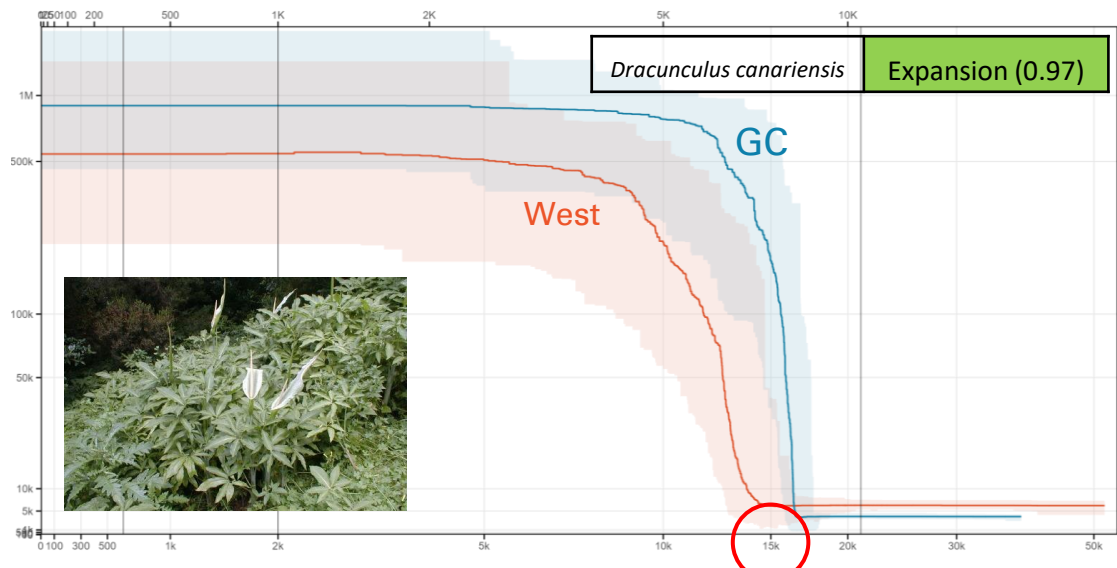
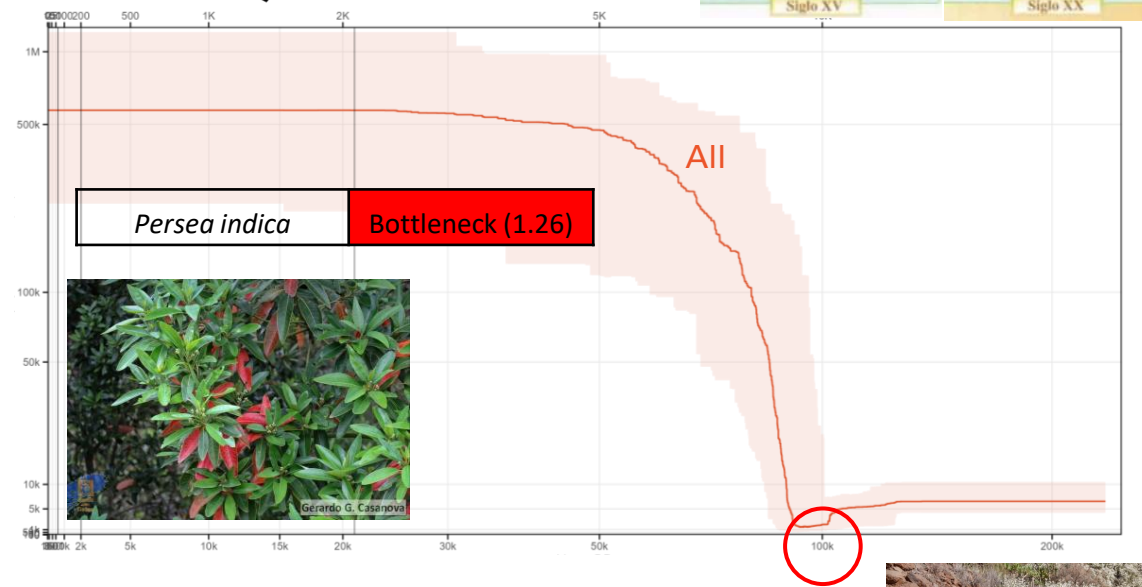
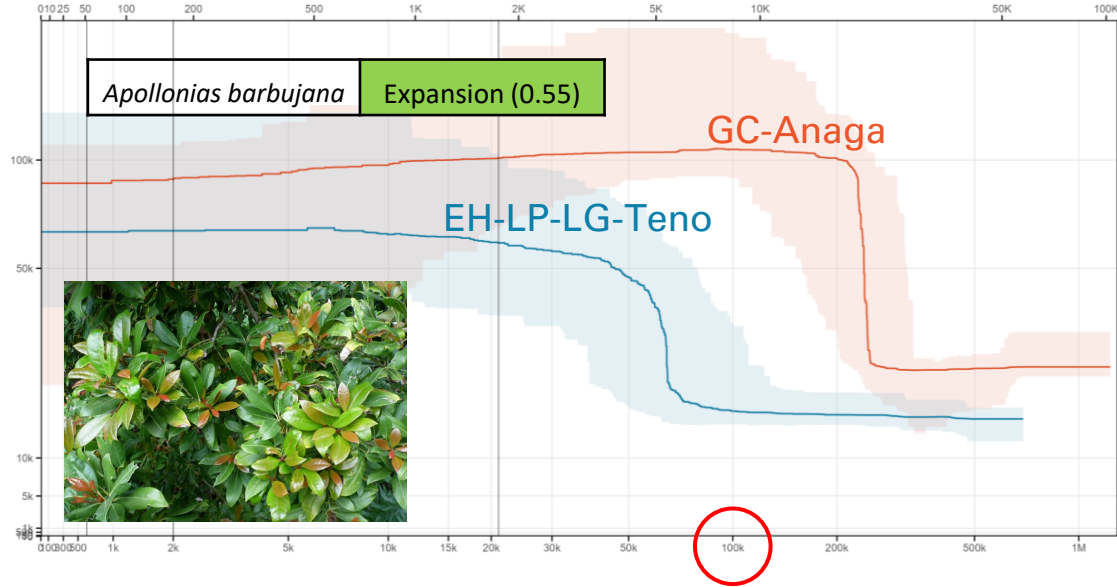
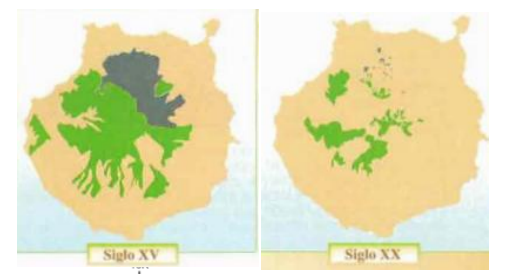
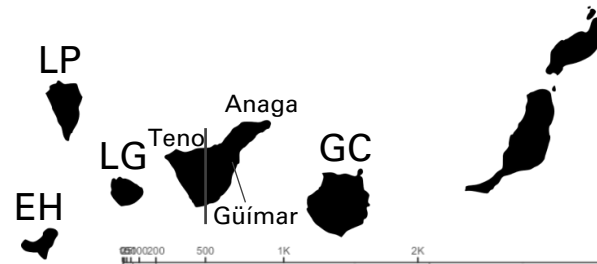
Range expansion

Ratios comparison

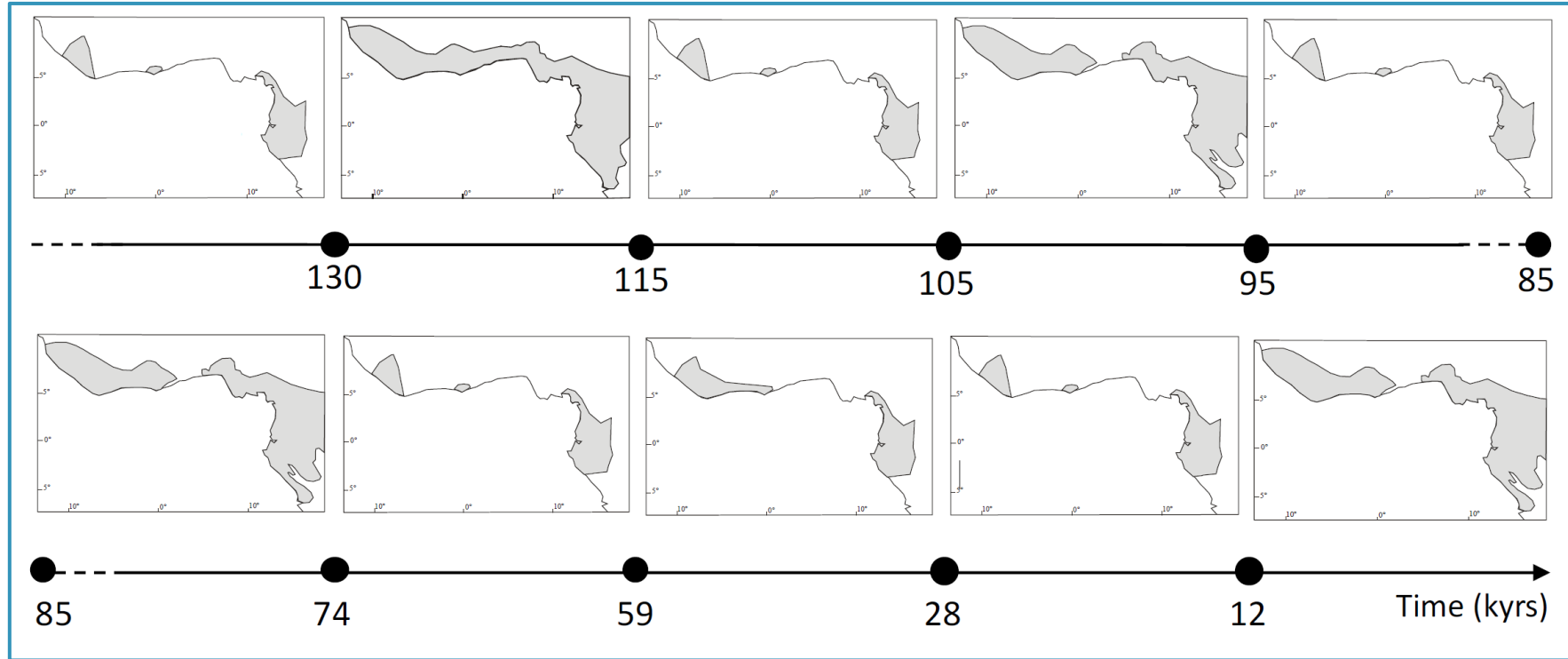
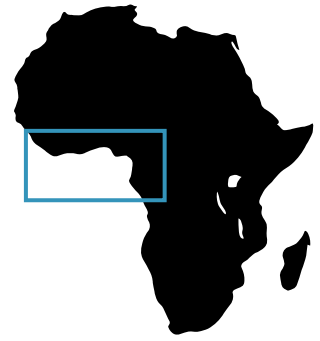


AB	Expansion
AF	Bottleneck
BA	Bottleneck
<i>Canarina canariensis</i>	Expansion
DC	Expansion
HE	Expansion
MF	Bottleneck
PI	Bottleneck
RR	Bottleneck
SS	Bottleneck

Various patterns



Various patterns



Low

Dispersal capacity

High



Short

Generation time

Long



**THANK YOU VERY MUCH
ANSWERS?**

