FORRISK

Mapping *Gonipterus platensis* risk in Portugal

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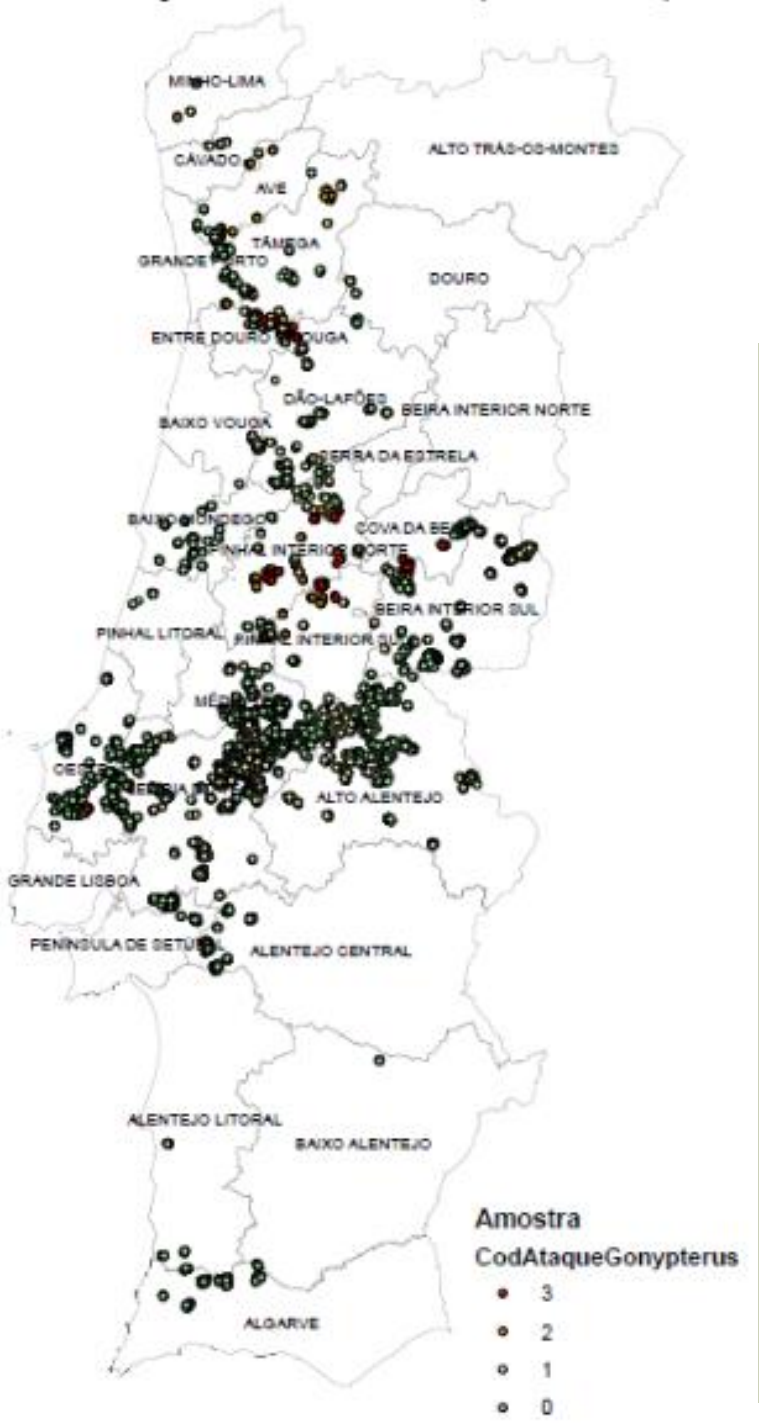
METHODS

- Sample from Altri
  - Ec. globulus: n = 14.949 (2010-2013)
  - Visual observation of *G. platensis* attack (coded 0, 1, 2, 3) during usual inventory

- GLM model logistic regression (using R)
  - probability of attack (coded 0 and 1 for coded attacks 1, 2, 3)
  - selection of significant explanatory variables
- Risk map for Portugal (using ArcGIS)
  - Two climatic variables sources:
    - WorldClim
    - Hadley Centre for Climate Prediction and Research

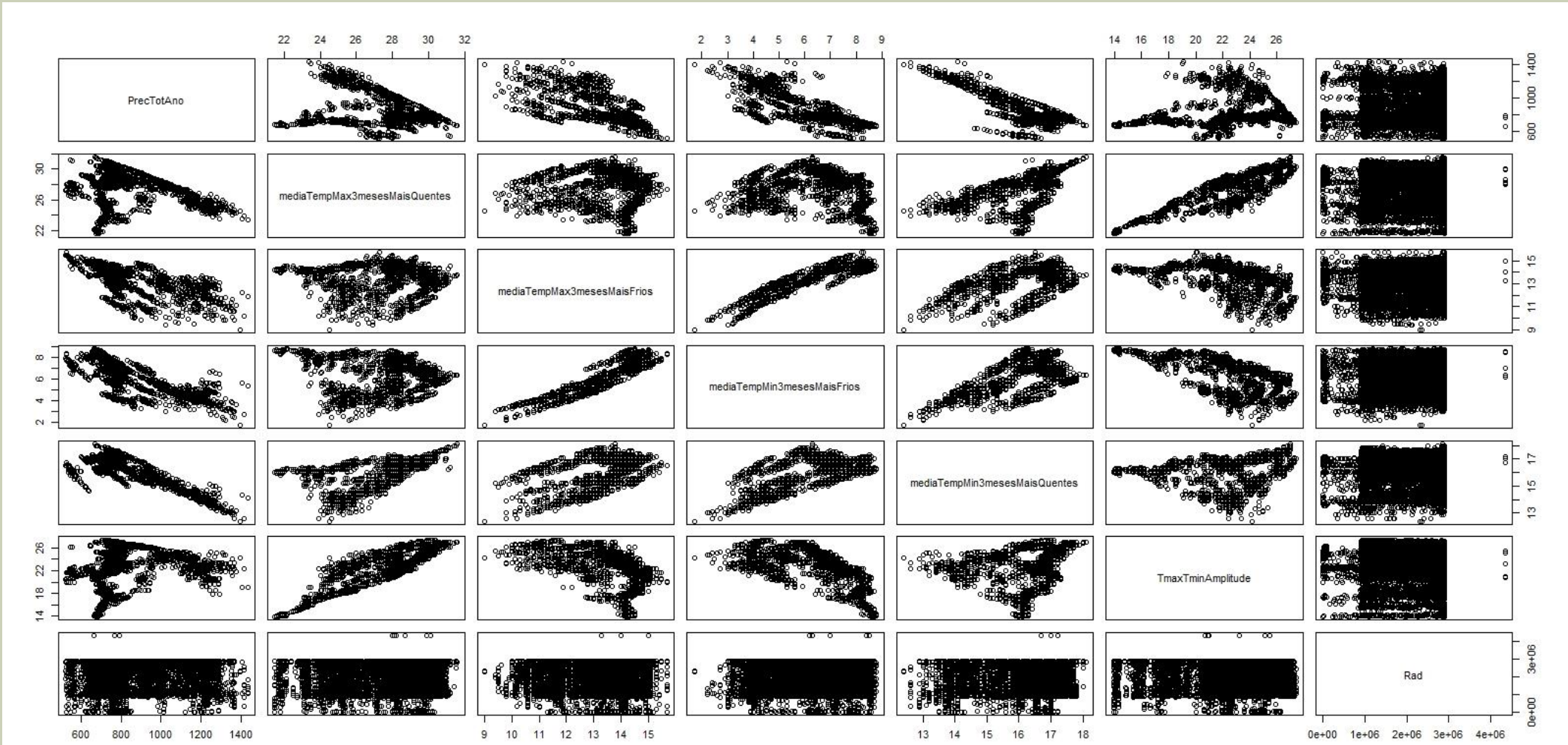
SAMPLE GEOGRAPHIC DISTRIBUTION

Ec. globulus: - 14.949 inventory plots, evaluated from (2010-2013)



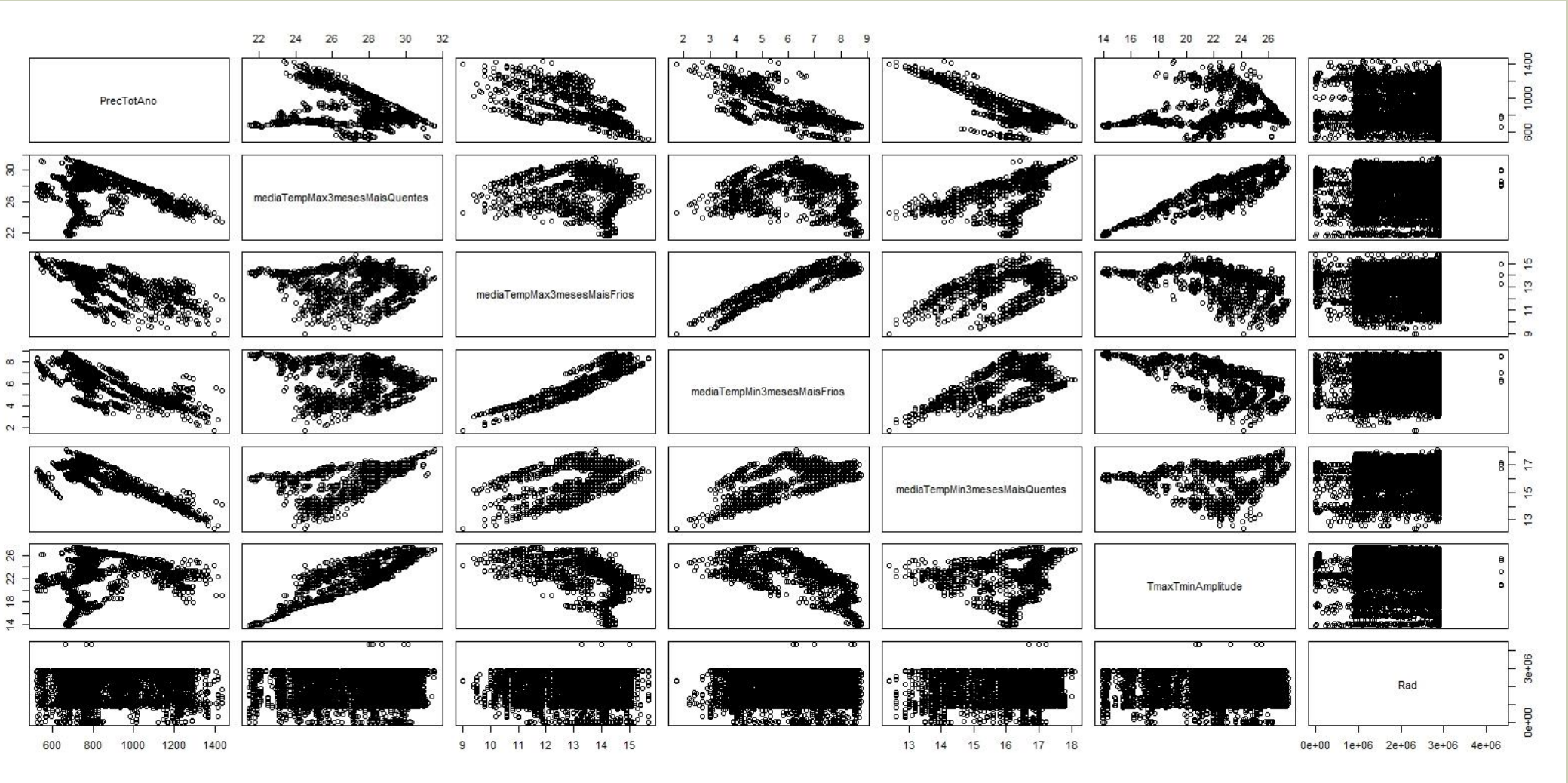
CORRELATION ANALYSIS

- WorldClim



CORRELATION ANALYSIS

- Hadley climatic variables



GLM MODEL

- Using WorldClim variables

Coefficients:					
	Estimate	Std. Error	z	Pr(>|z|)	Signif.
(Intercept)	-3.3737790	1.7689302	-1.907	0.056489	.
tot. precipitation (year)	0.0013880	0.0004036	3.439	0.000584	***
monthly max. temp. (3 warmest months av.)	0.3009963	0.0244451	12.313	< 2e-16	***
monthly min. temp. (3 warmest months av.)	-0.5311313	0.0762928	-6.962	3.36E-12	***
monthly max. temp. (3 coldest months av.)	0.1003121	0.0603849	1.661	0.096671	.
elev. (DTM30) 100 - 200	0.4340838	0.0724767	5.989	2.11E-09	***
elev. (DTM30) 200 - 300	0.2666388	0.0999756	2.667	0.007652	**
elev. (DTM30) 300 - 400	0.9710144	0.1376781	7.053	1.75E-12	***
elev. (DTM30) 400 - 500	1.9034966	0.2139190	8.898	< 2e-16	***
elev. (DTM30) 500 - 600	2.4303045	0.2638300	9.212	< 2e-16	***
elev. (DTM30) 600 - 700	2.6371934	0.3472509	7.594	3.09E-14	***
elev. (DTM30) 700 - 800	4.1639113	1.0368027	4.016	5.92E-05	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Null deviance: 18149 on 14099 degrees of freedom
Residual deviance: 16207 on 14088 degrees of freedom
AIC: 16231

GLM

- Using Hadley variables

Coefficients:					
	Estimate	Std. Error	z	Pr(>|z|)	Signif.
(Intercept)	-19.040000	1.1380000	-16.733	< 2e-16	***
tot. precipitation (year)	0.002286	0.0001277	17.911	< 2e-16	***
monthly max. temp. (3 warmest months av.)	0.665300	0.0263300	25.269	< 2e-16	***
monthly min. temp. (3 warmest months av.)	-0.233400	0.0384100	-6.075	1.24E-09	***
monthly max. temp. (3 coldest months av.)	-0.354600	0.0606400	-5.848	4.98E-09	***
monthly min. temp. (3 coldest months av.)	0.595700	0.0549100	10.848	< 2e-16	***
Potential radiation	9.11E-08	2.46E-08	3.698	0.000217	***
elev. (DTM30) 100 - 200	0.235100	0.0703700	3.342	0.000833	***
elev. (DTM30) 200 - 300	0.118600	0.0852700	1.391	0.164325	
elev. (DTM30) 300 - 400	0.894300	0.1109000	8.065	7.31E-16	***
elev. (DTM30) 400 - 500	2.234000	0.1565000	14.271	< 2e-16	***
elev. (DTM30) 500 - 600	2.819000	0.2104000	13.397	< 2e-16	***
elev. (DTM30) 600 - 700	3.008000	0.3030000	9.928	< 2e-16	***
elev. (DTM30) 700 - 800	4.745000	1.0190000	4.659	3.18E-06	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Null deviance: 18149 on 14099 degrees of freedom

Residual deviance: 15579 on 14086 degrees of freedom

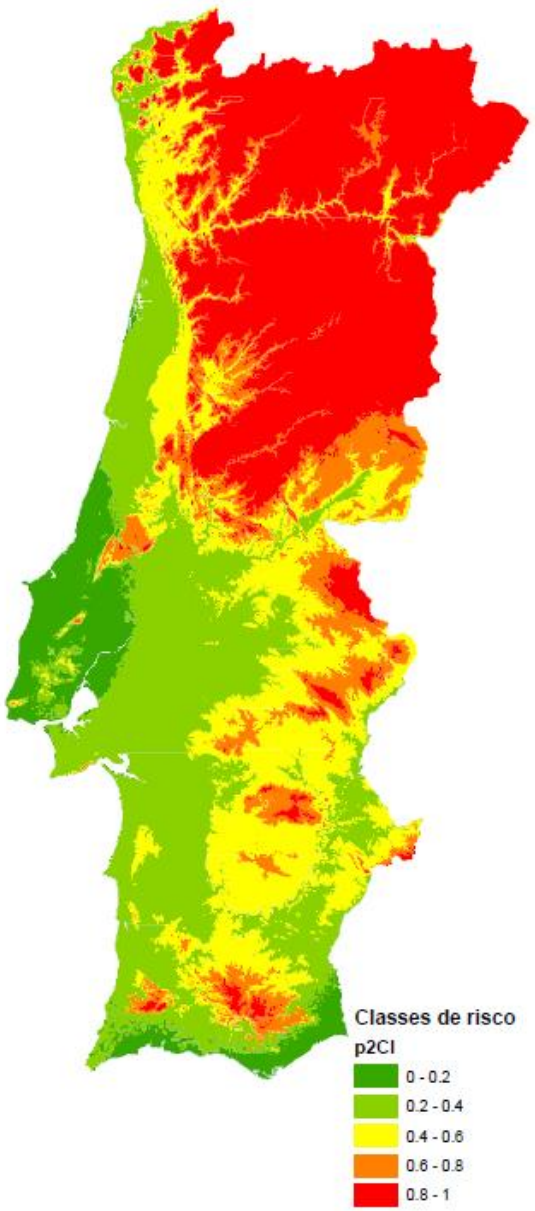
AIC: 15607

RISK CLASSES (EC. GLOBULUS)

- WorldClim variables characterization of the risk classes

risk class	0 - 0.2		0.2 - 0.4		0.4 - 0.6		0.6 - 0.8		0.8 - 1.0	
	Min	max	min	max	min	max	min	max	min	max
tot. precipitation (year)	458	1288	463	1503	504	1543	511	1543	481	1798
monthly max. temp. (3 warmest months)	20.5	29.8	22.0	32.4	21.7	32.4	21.7	32.3	18.0	32.1
monthly min. temp. (3 warmest months	14.6	18.7	13.7	18.2	13.1	18.2	12.9	17.8	8.6	17.4
monthly max. temp. (3 coldest months)	12.5	16.9	10.6	16.7	9.6	15.5	8.9	15.4	3.1	14.7
elev. (DTM30)	0 - 100	300 - 400	0 - 100	300 - 400	100 - 200	500 - 600	100 - 200	600 - 700	300 - 400	2000 - 2100
total area (km^2)	6,403		26,346		18,017		9,535		28,195	
total area (% of total area)	7.2%		29.8%		20.4%		10.8%		31.9%	

RISK MAP (EC. GLOBULUS) / WORLDCLIM VAR.



Sample vs. risk map (WorldClim var.)

		risk class					
		0 - 0.2	0 .2- 0.4	0.4 - 0.6	0.4 - 0.6	0.8 - 1	total
attack code	0	96%	68%	70%	41%	18%	63%
	1	4%	31%	29%	45%	43%	31%
	2	0%	0%	1%	11%	22%	4%
	3	0%	0%	0%	3%	17%	2%
	total	100%	100%	100%	100%	100%	100%

	%	0 - 0.2	0 .2- 0.4	0.4 - 0.6	0.6 - 0.8	0.8 - 1	total
attack code	0	15%	43%	31%	8%	3%	100%
	<> 0	1%	35%	23%	19%	23%	100%
	total	10%	40%	28%	12%	10%	100%

RISK MAP (EC. GLOBULUS) / HADLEY CLIM. VARIABLES

CONCLUSIONS

- Risk modeld were developed for G. platensis based on two sets of climatic variables (worldclim and Hadley)
- Using worldclim ca. 40% of the National territory has a high probability of attack by *G. platensis* (>0.6).
- North and Interior are most susceptible regions, some regions in the South are also susceptible
- Does the two sets of climatic variables provide similar risk models?