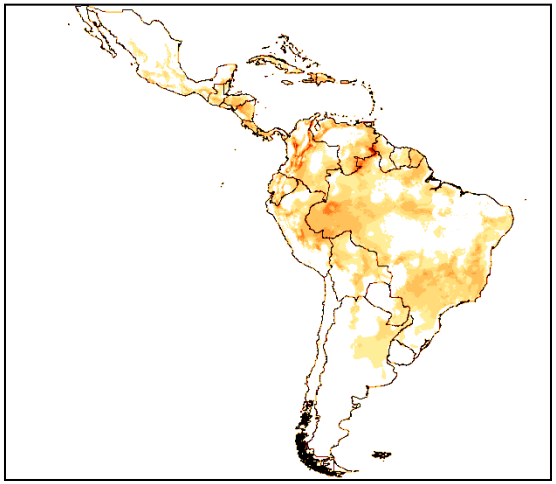
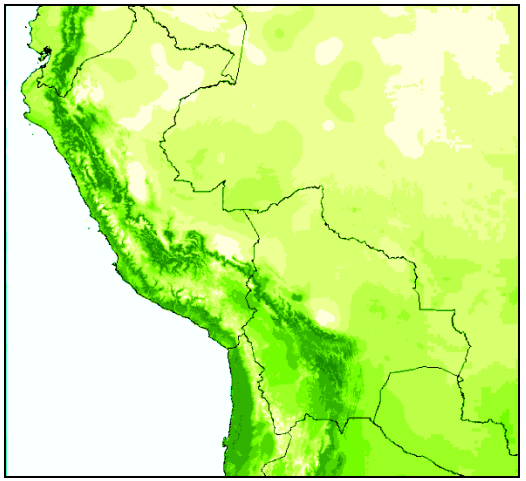
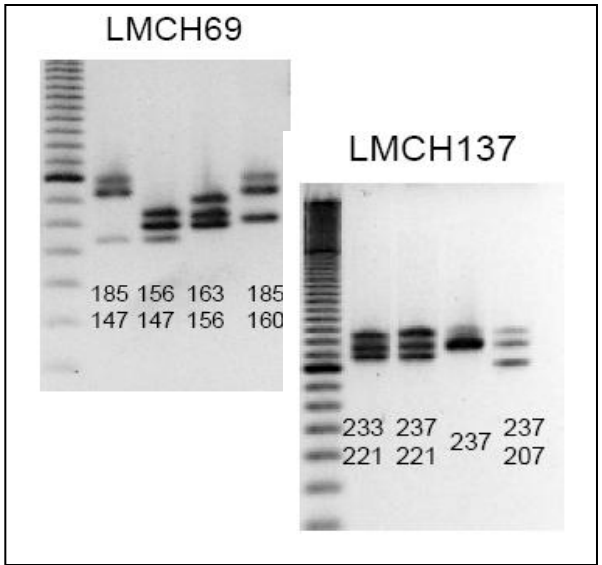
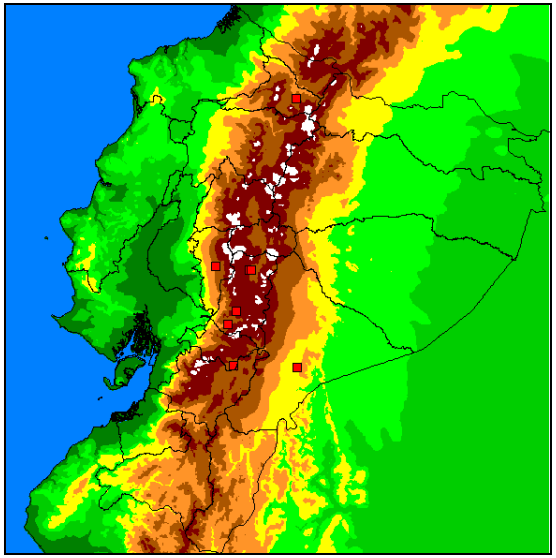
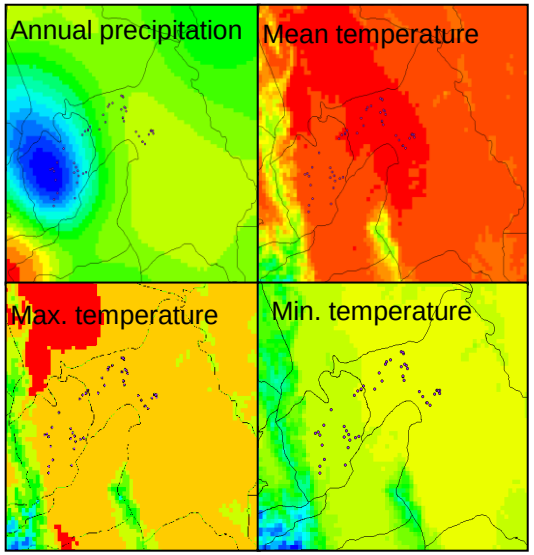
Introduction to diversity analysis and its implications





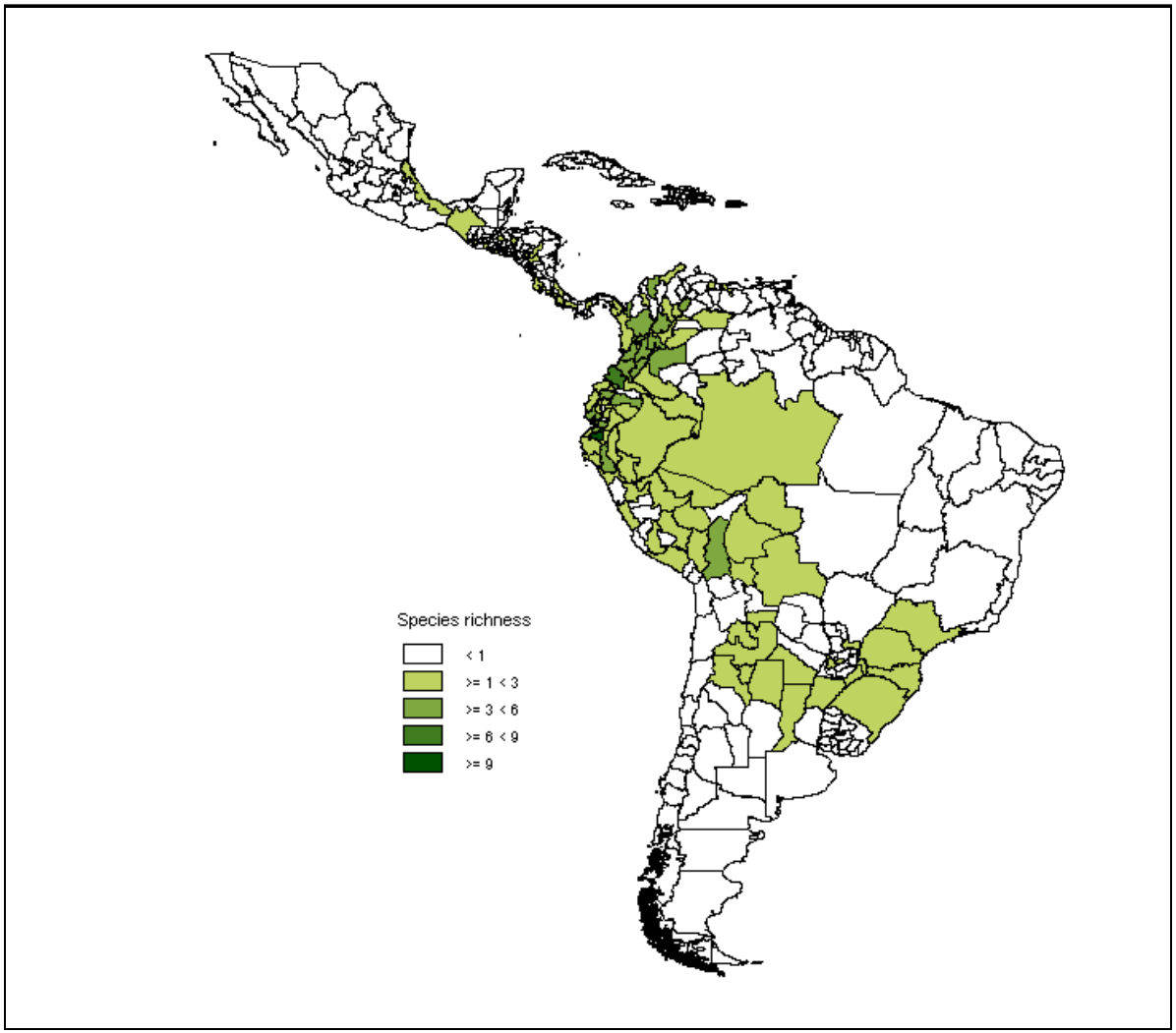


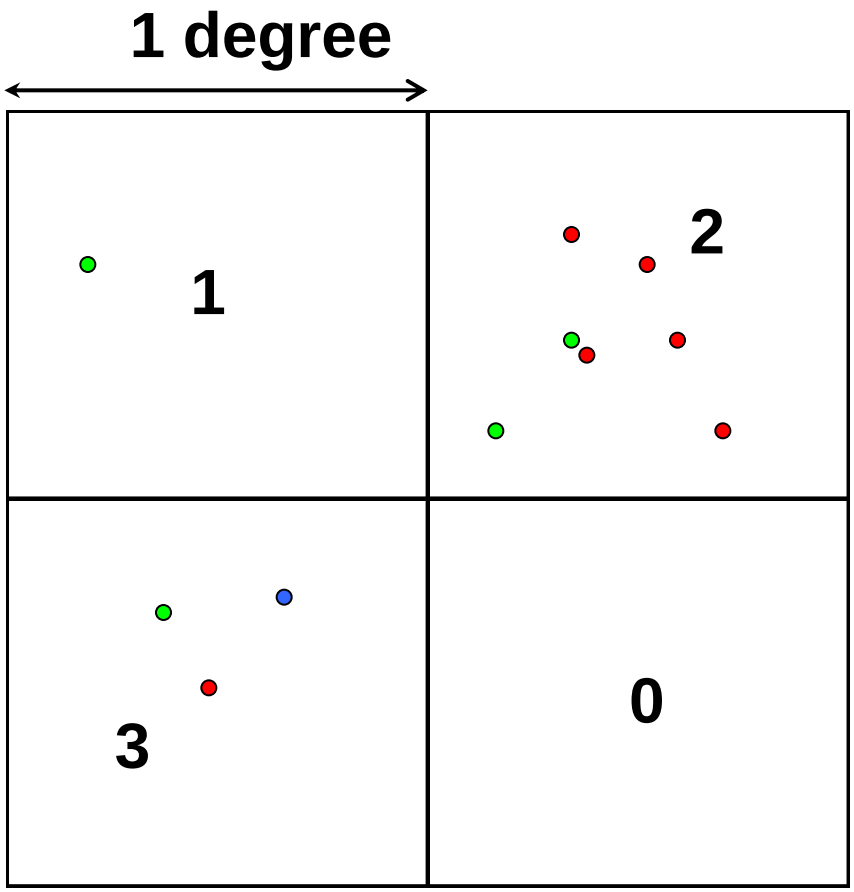


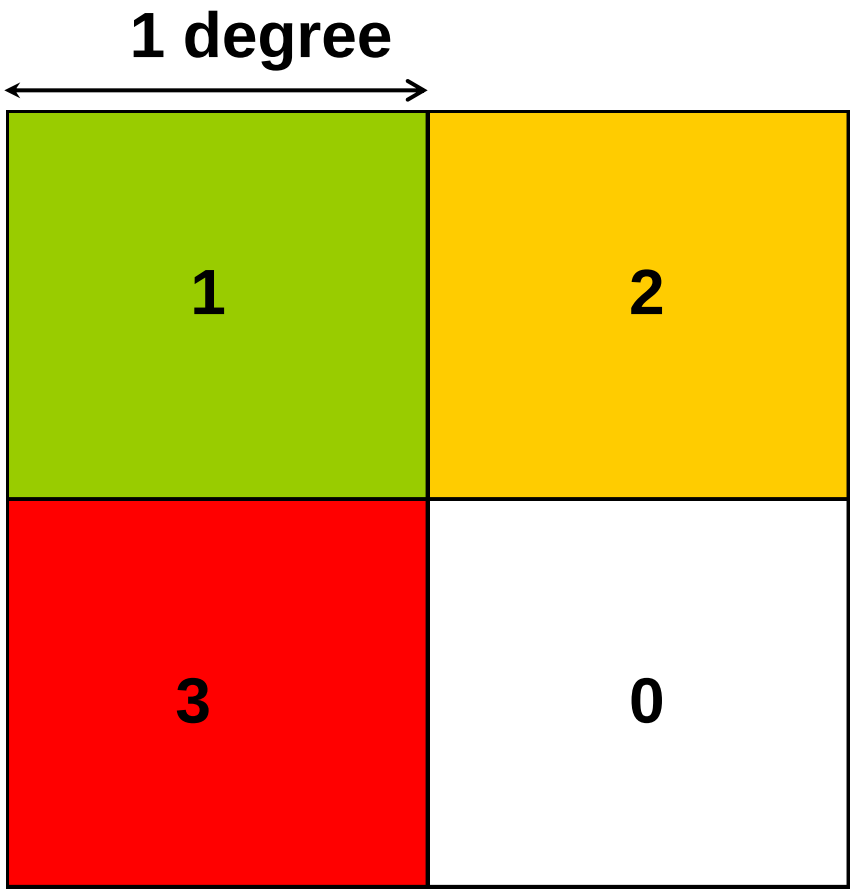


Diversity question…

Where can the highest *Vasconcellea* diversity be found?




1 degree
1
2
3
0


1 degree
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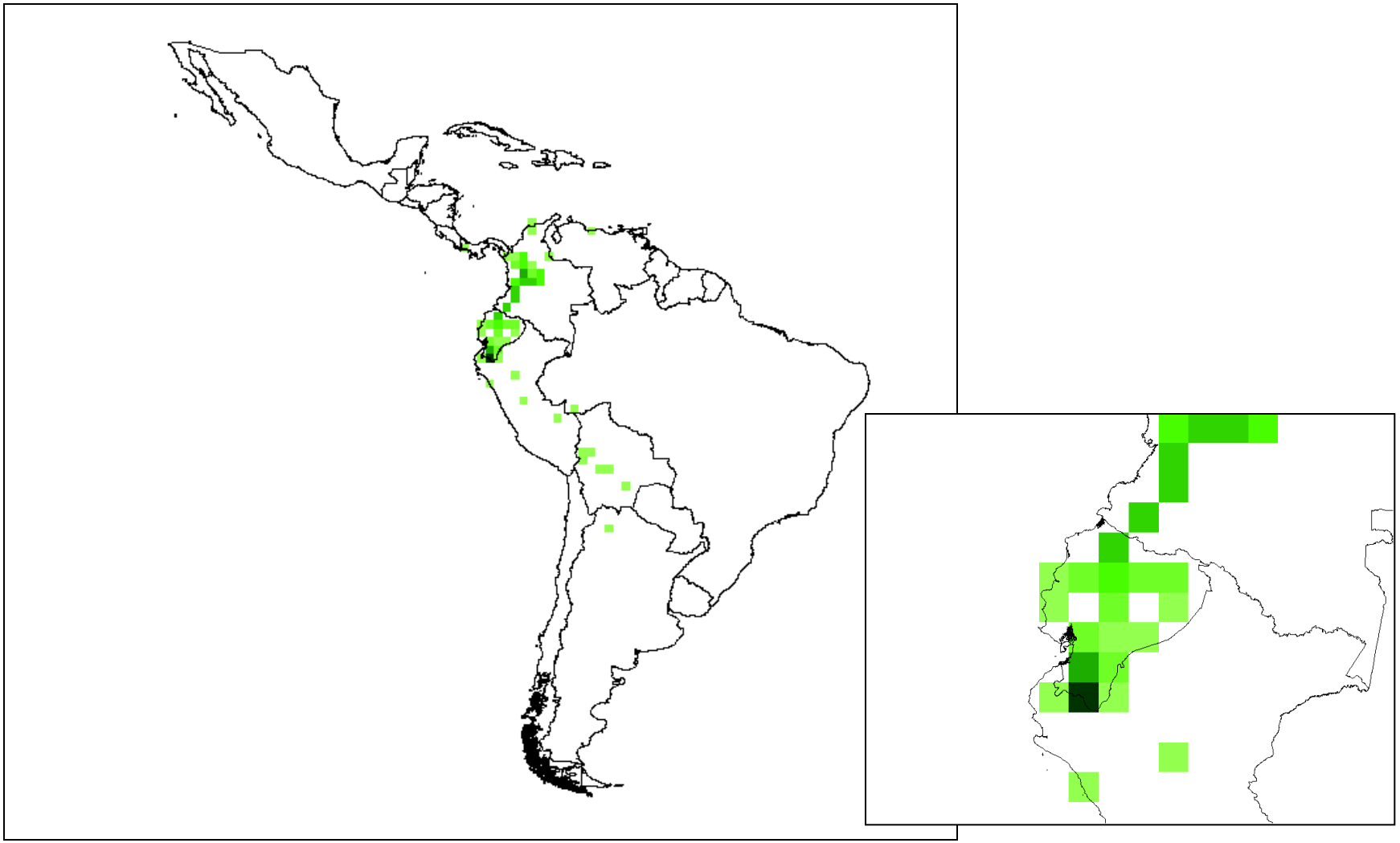
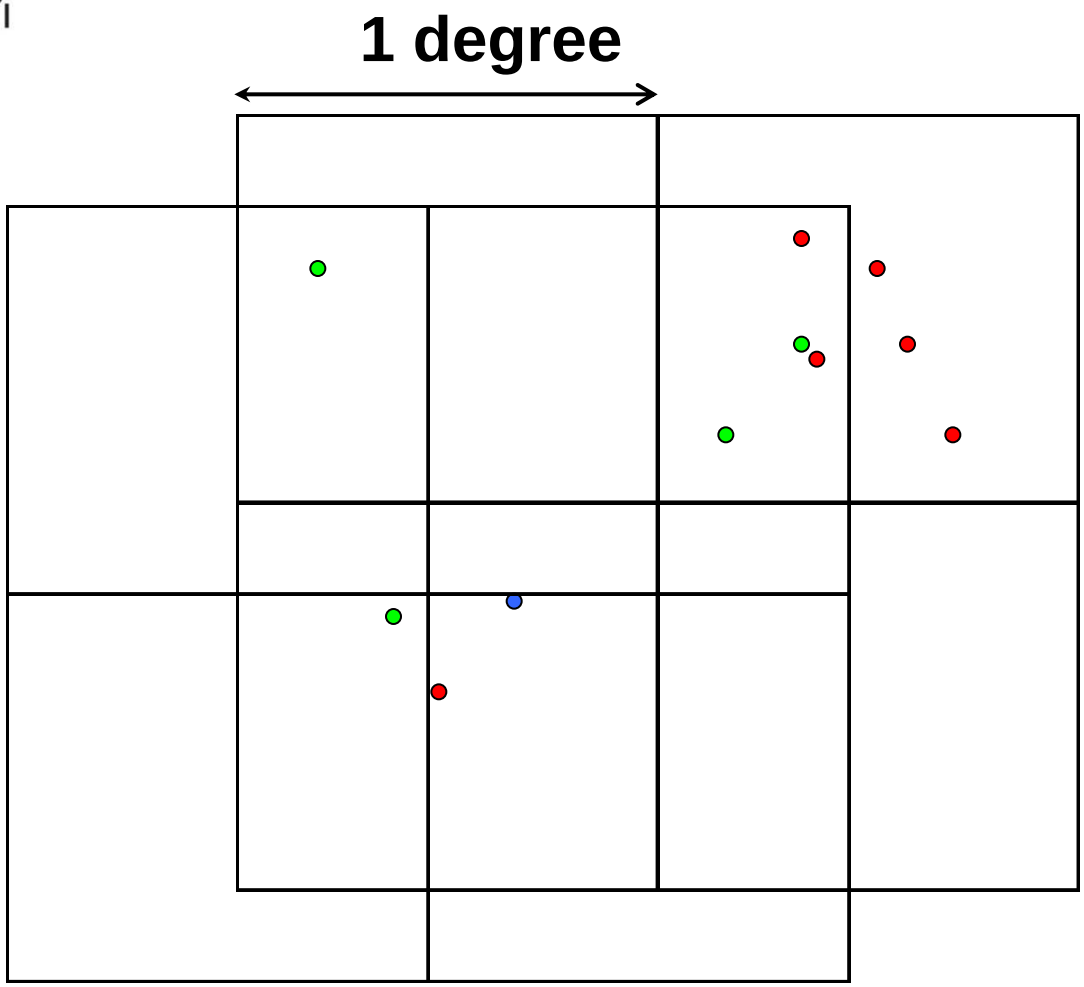
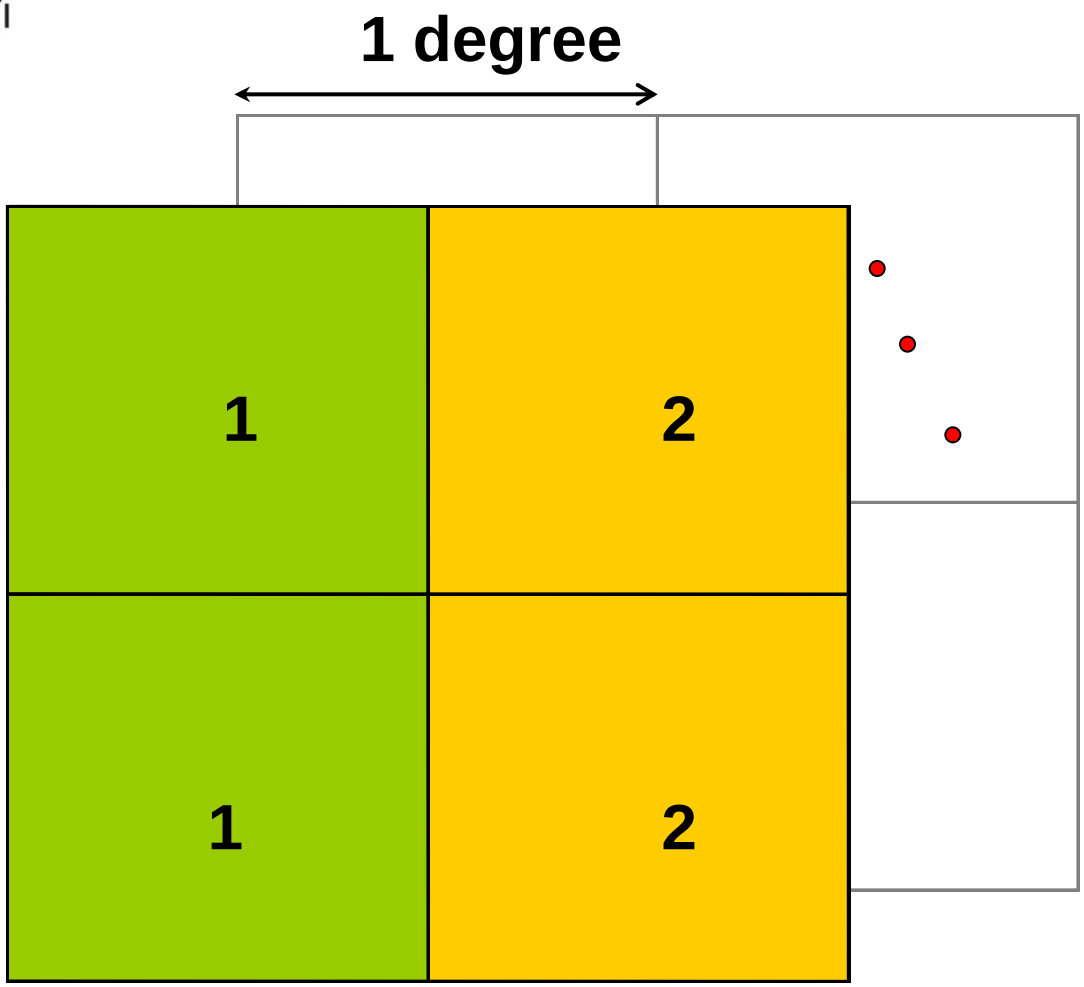
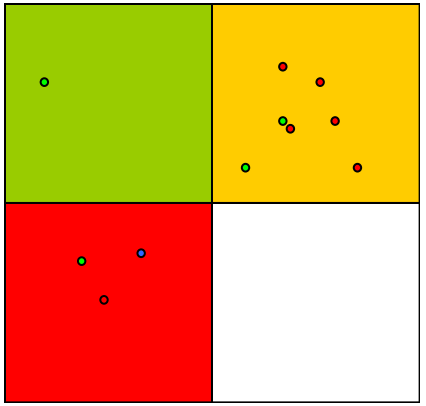


Bioversity International



Bioversity International





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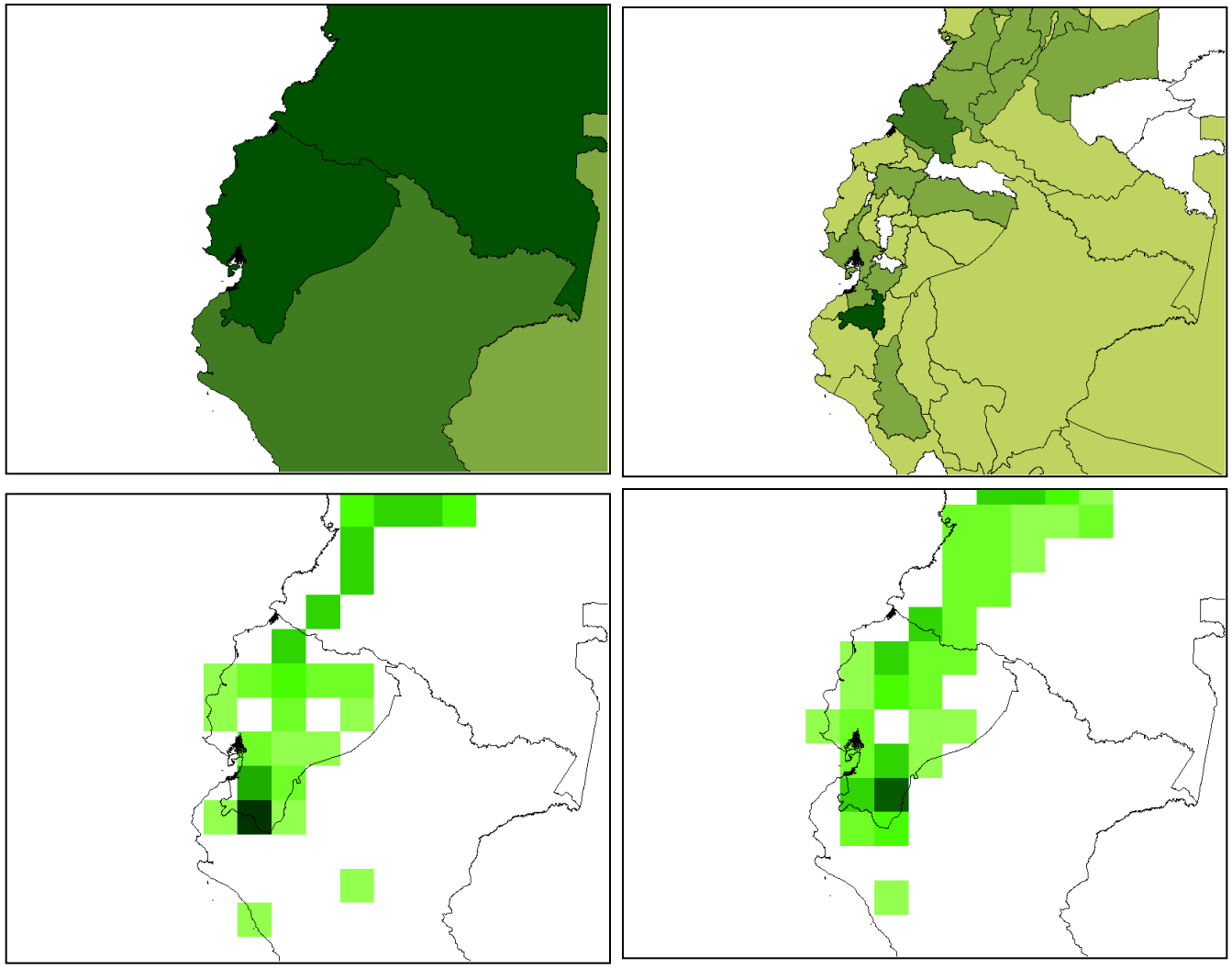
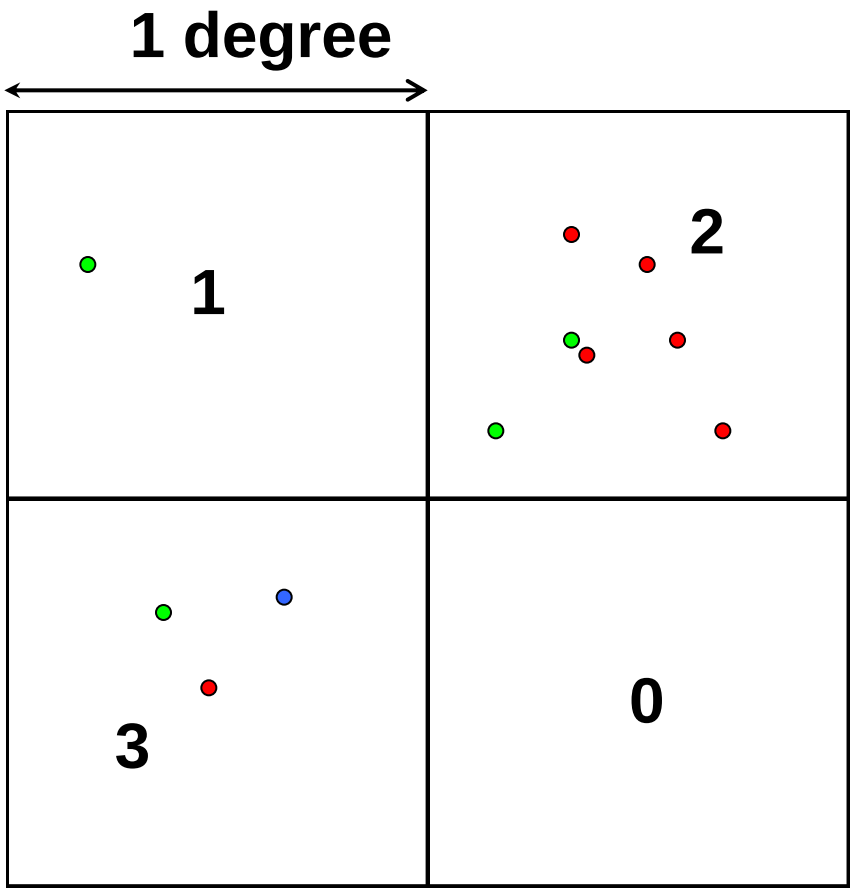
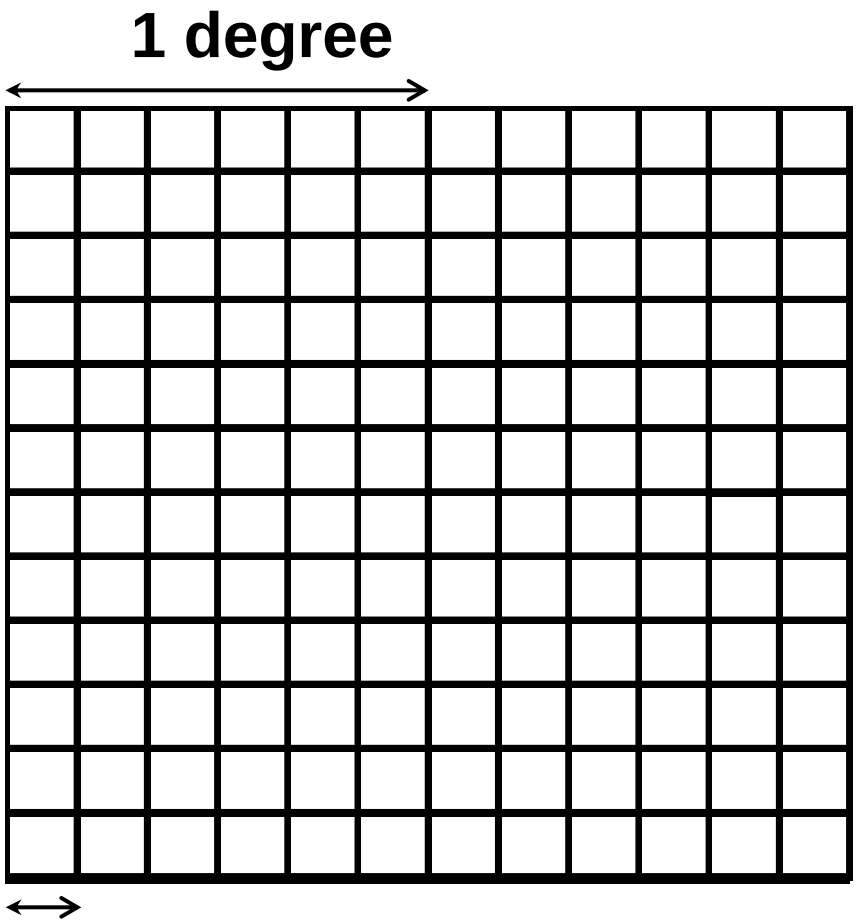
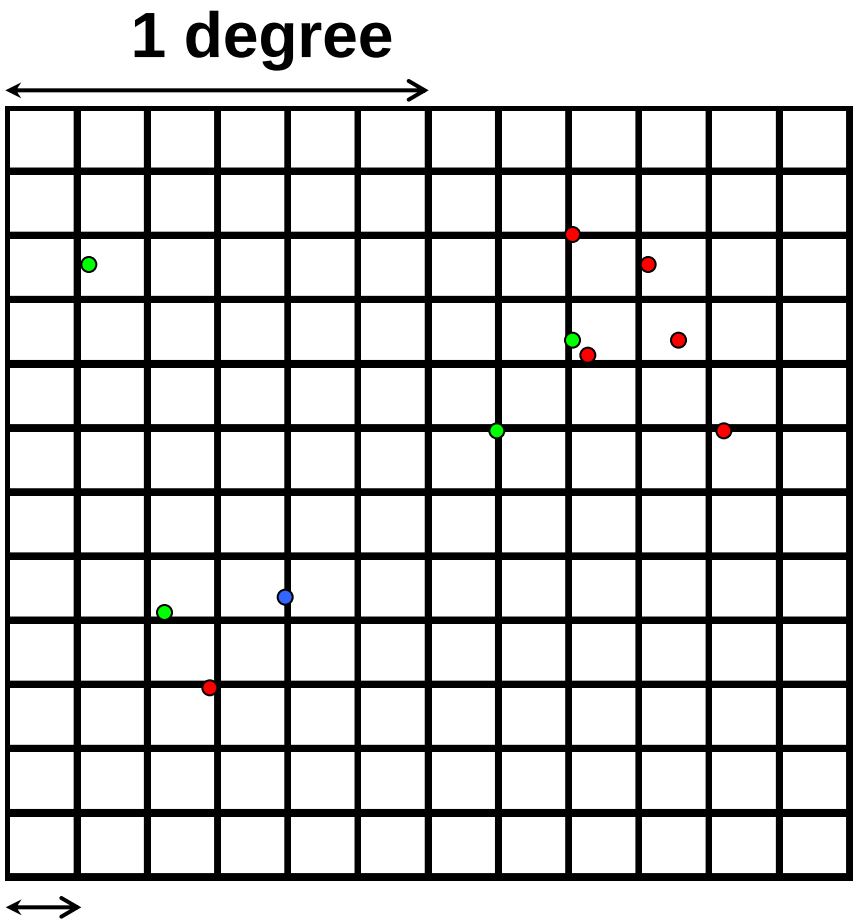



1 degree
1
2
3
0

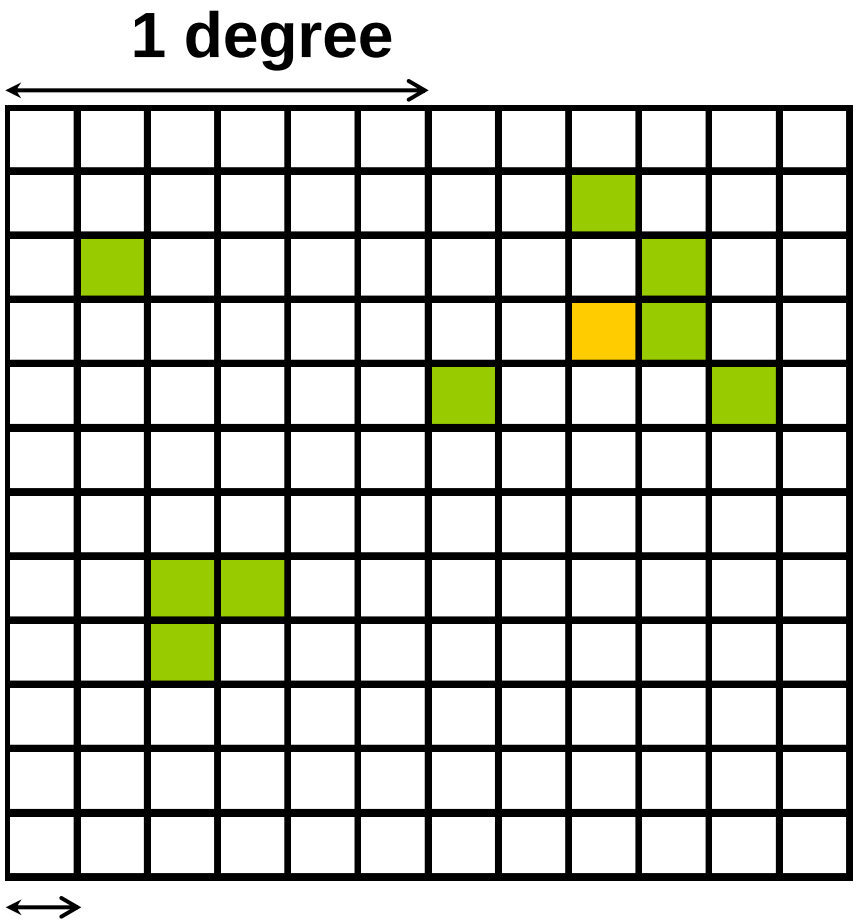
Bioversity International



Bioversity International



Bioversity International



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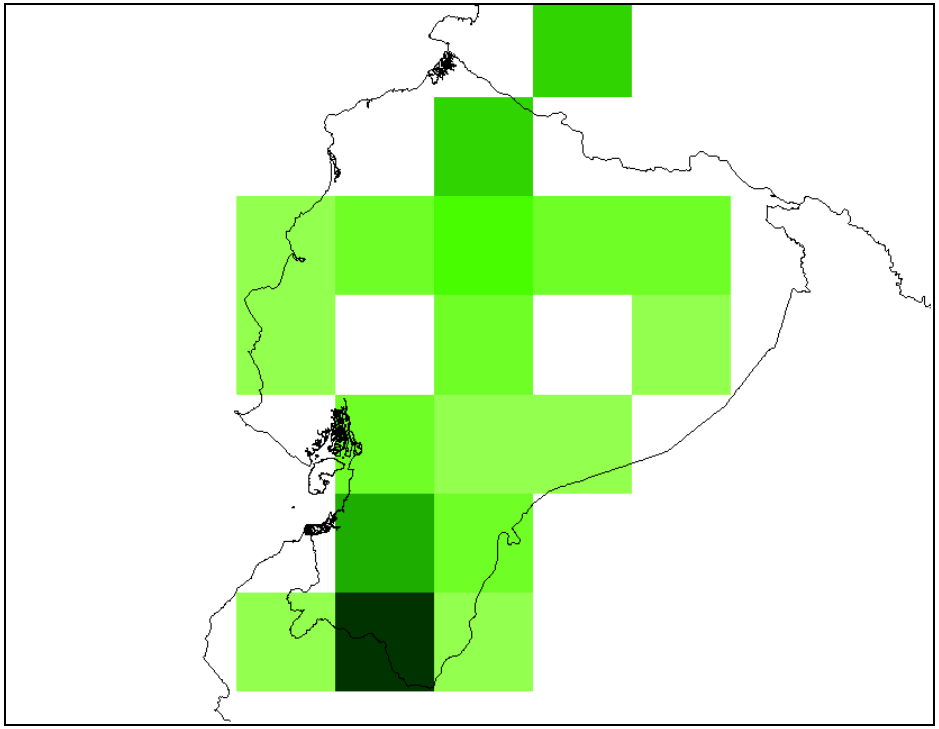
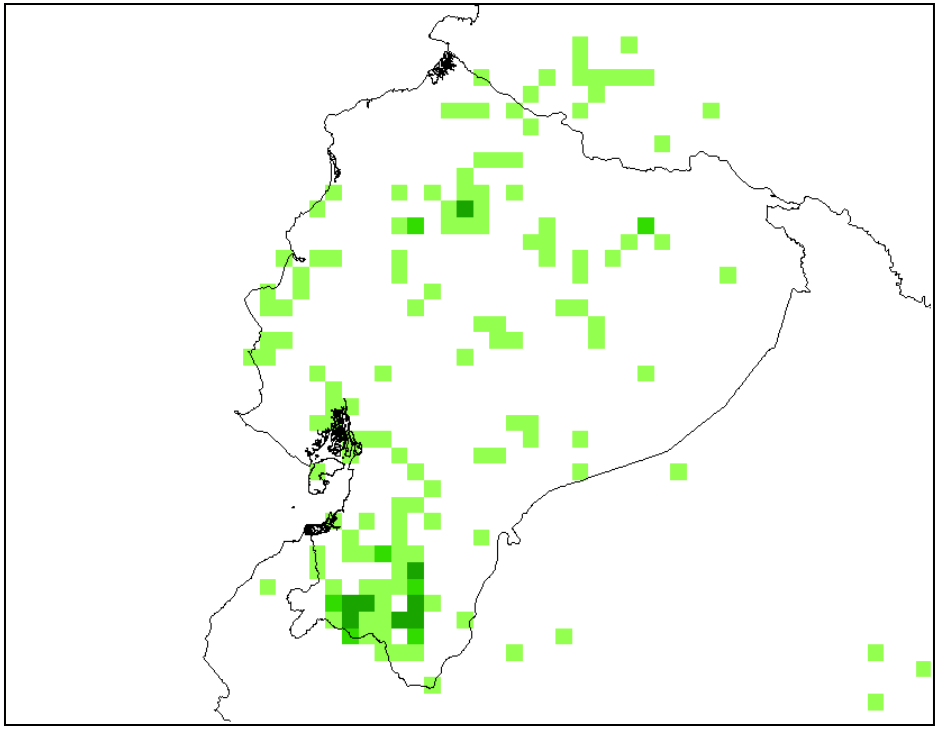
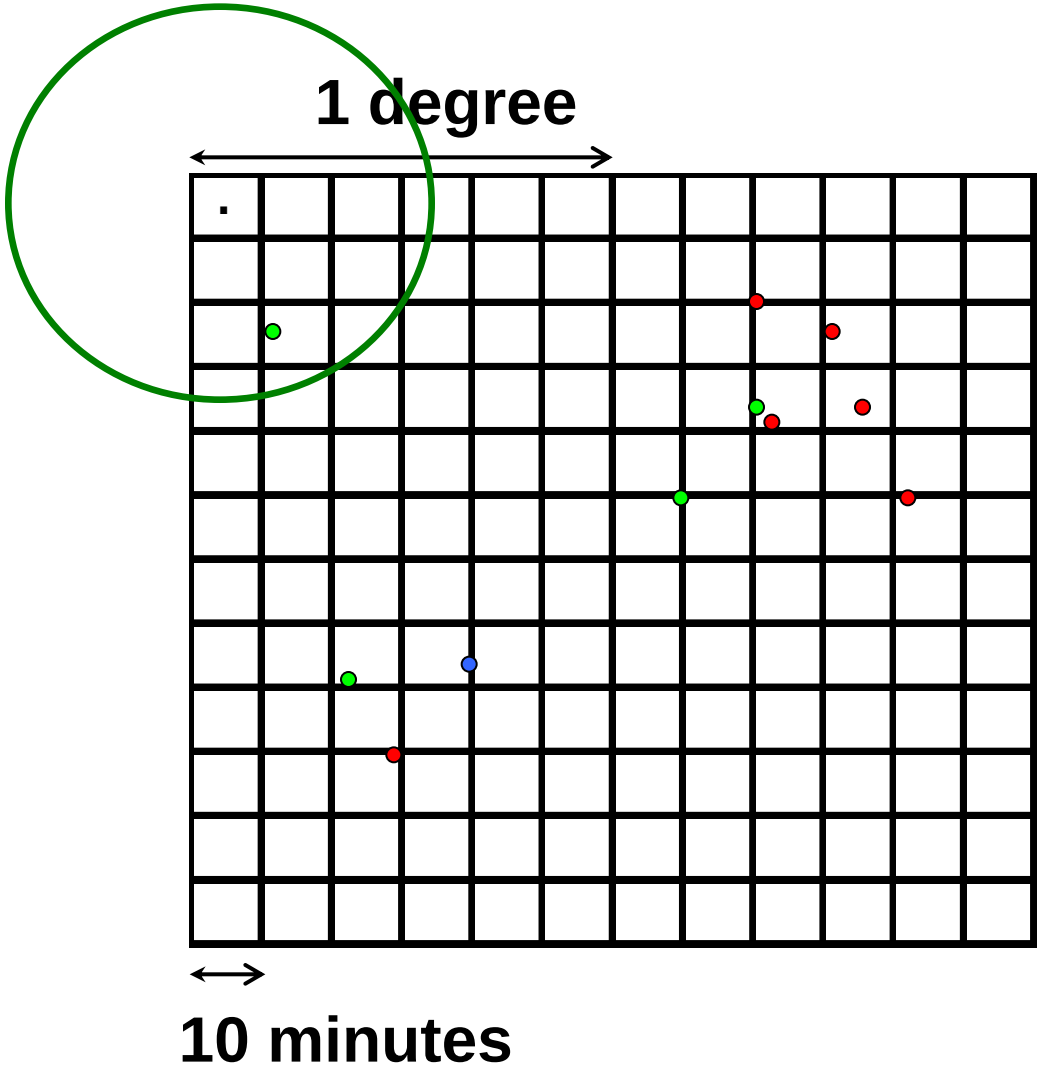
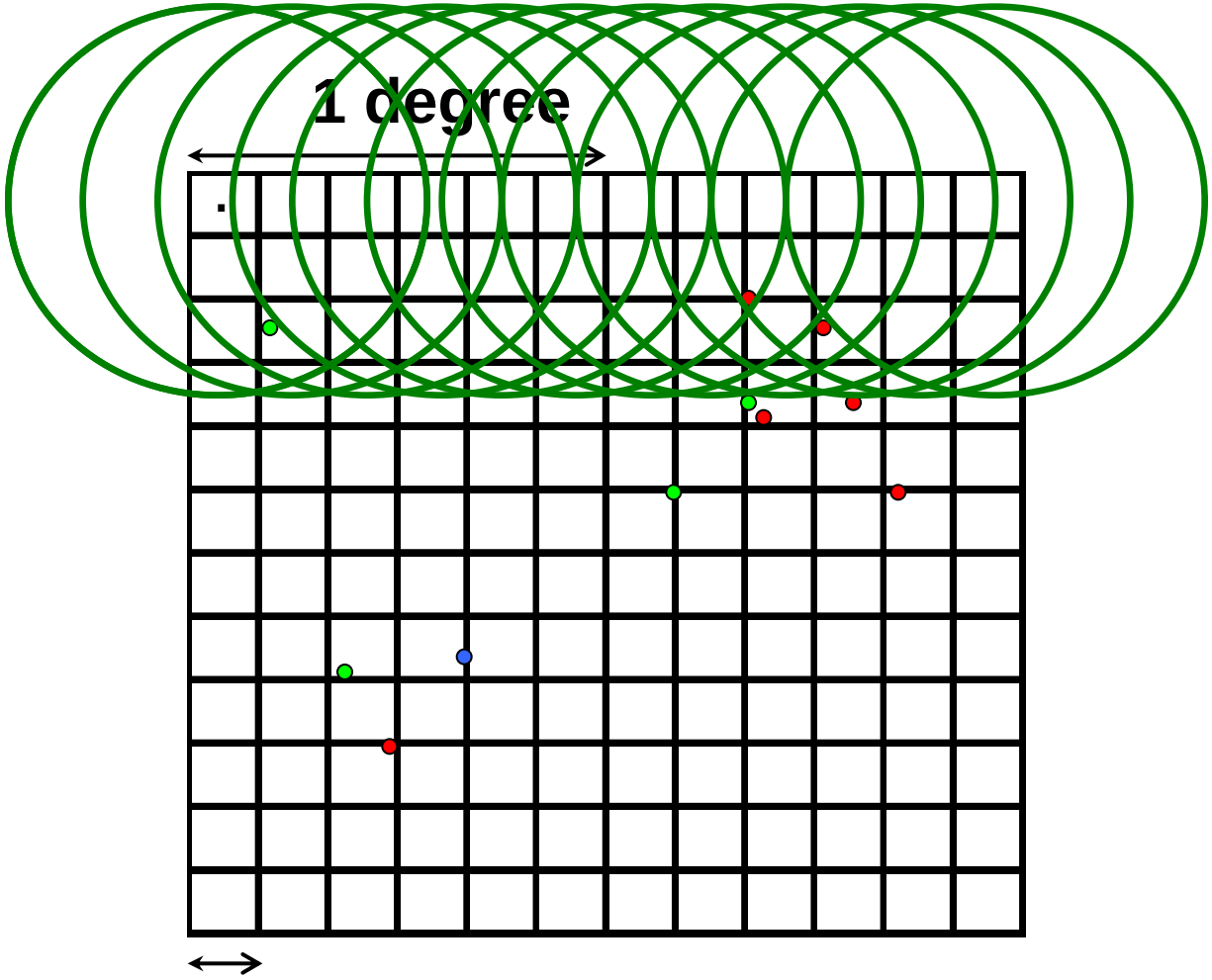
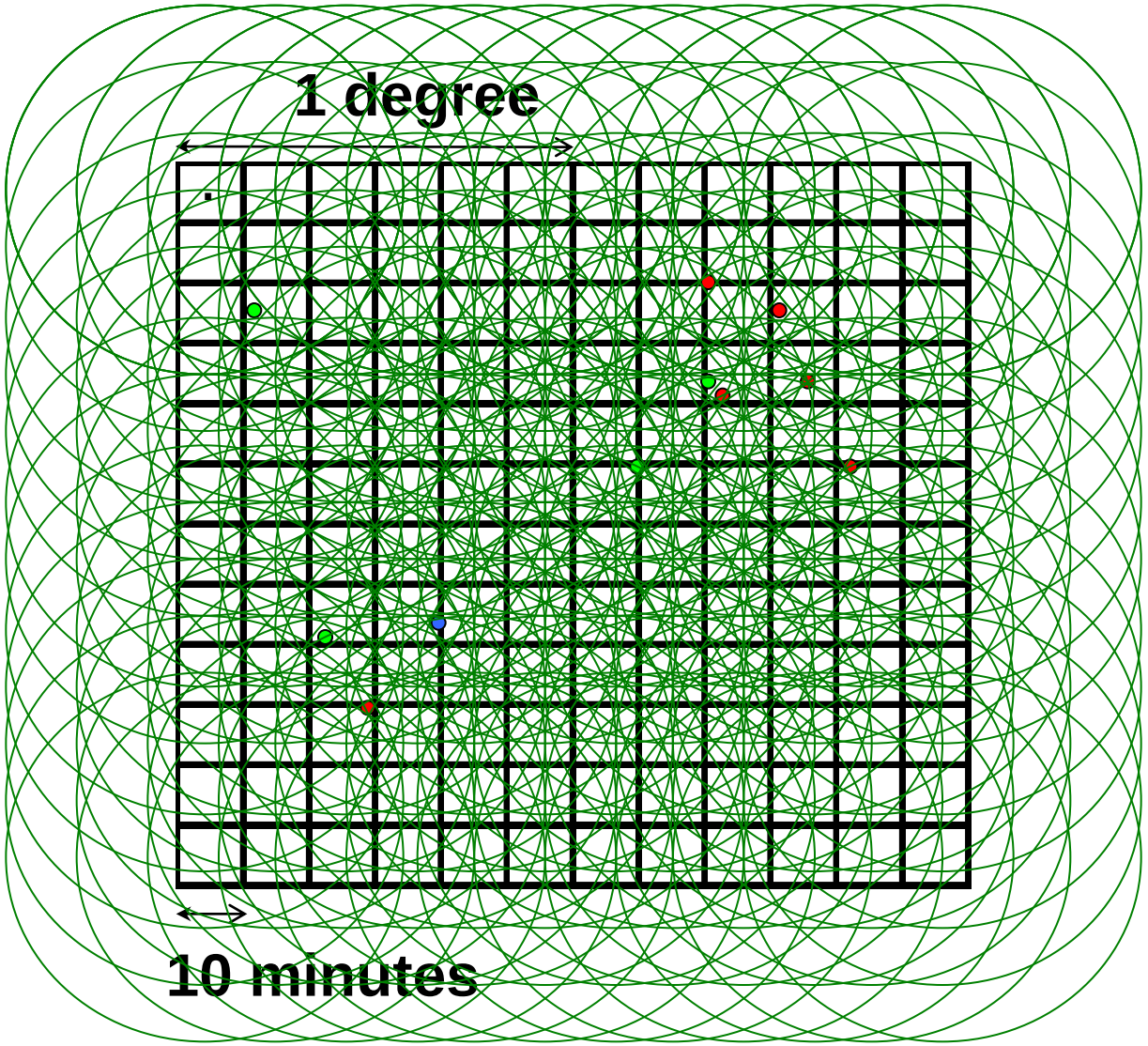





1 degree
10 minutes

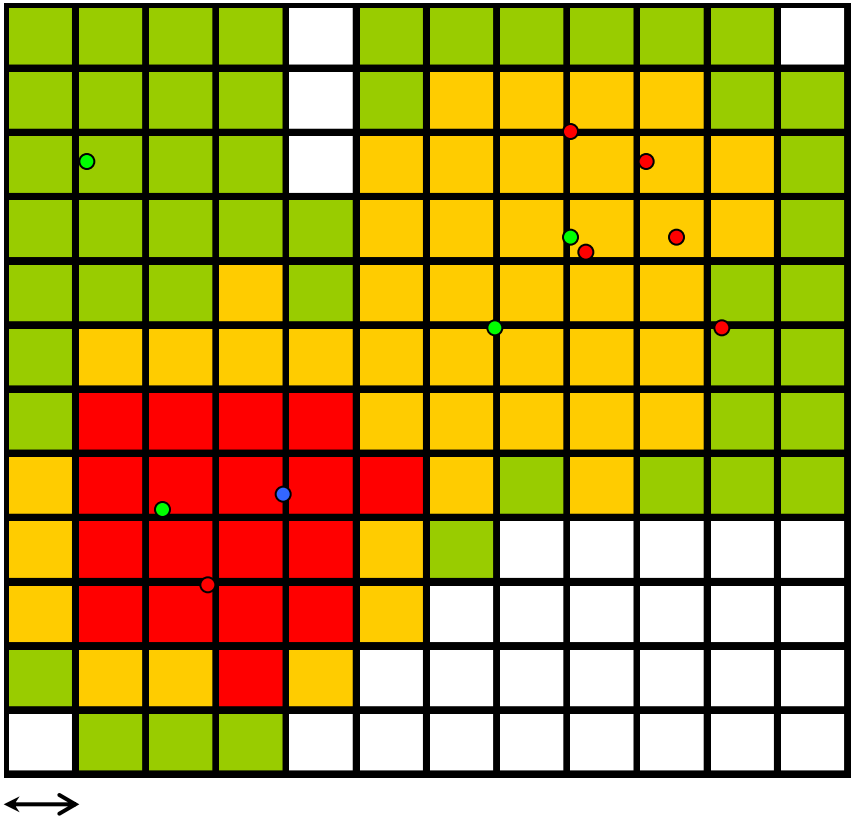

1 degree
10 minutes

Bioversity International



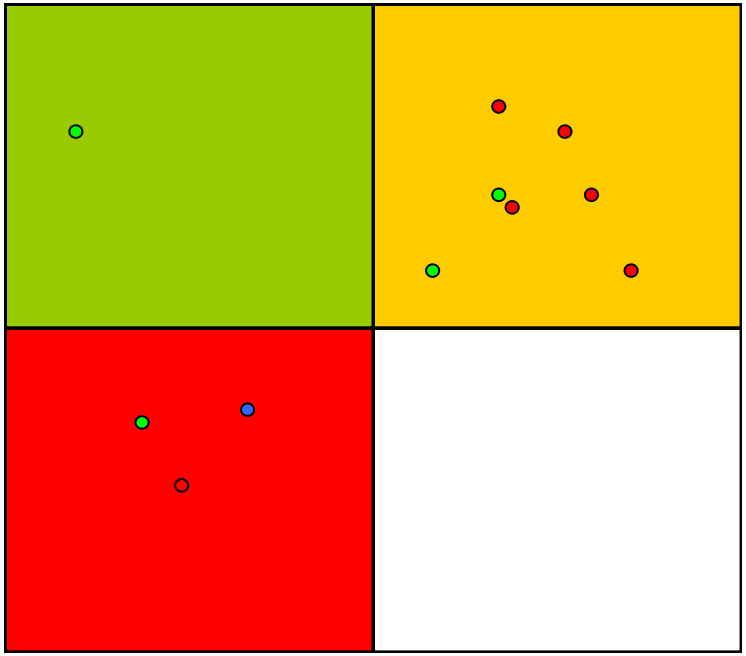
Bioversity International

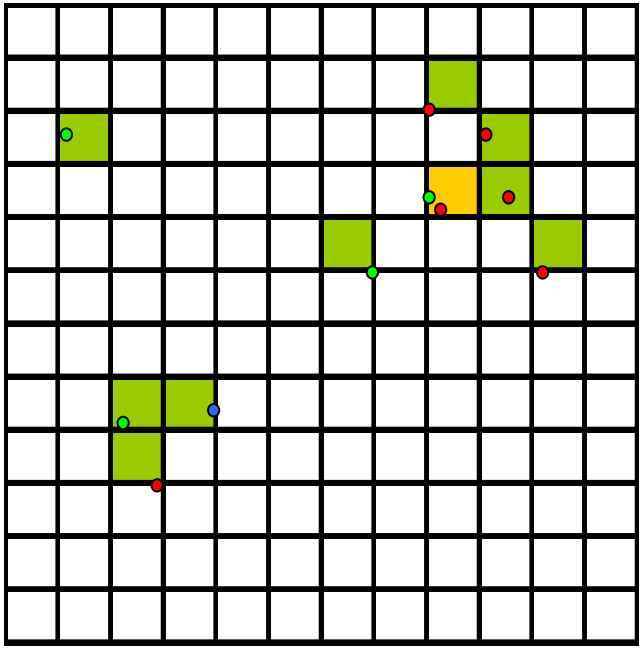
1 degree

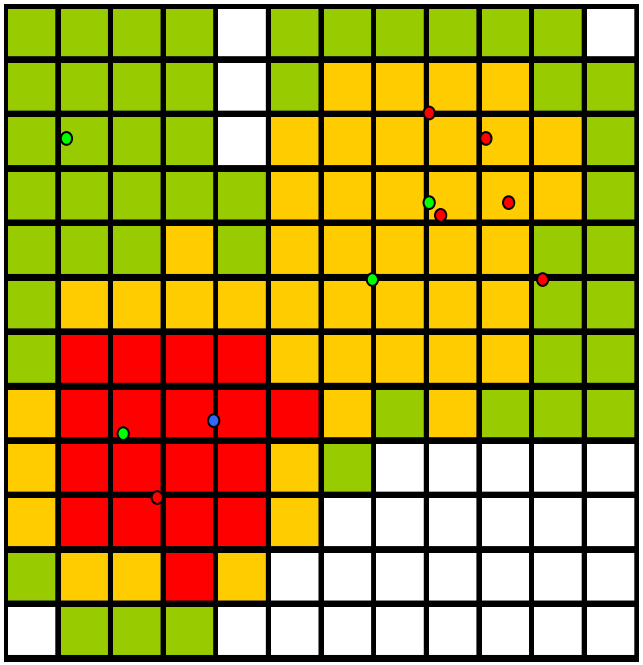


10 minutes

Bioversity International







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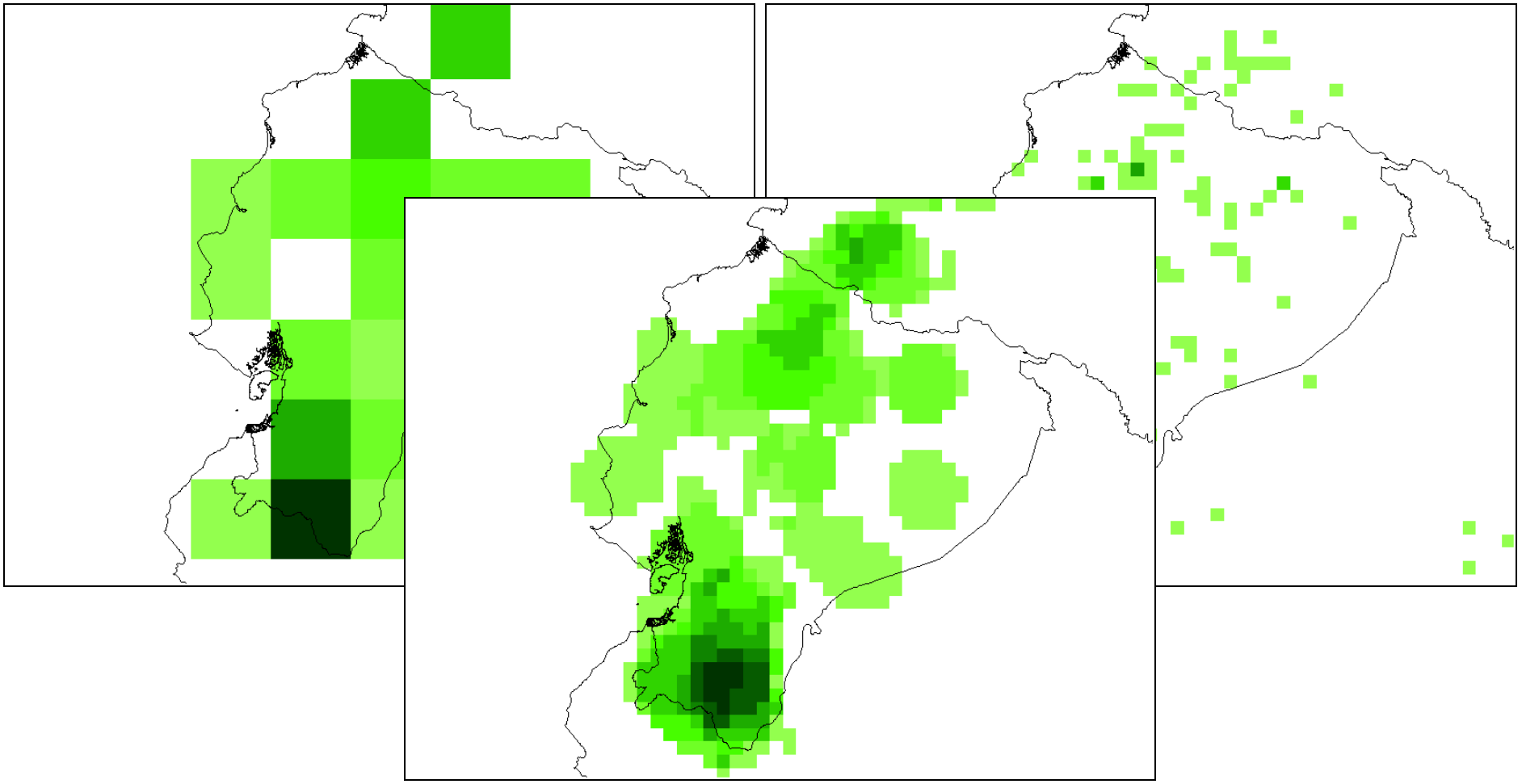

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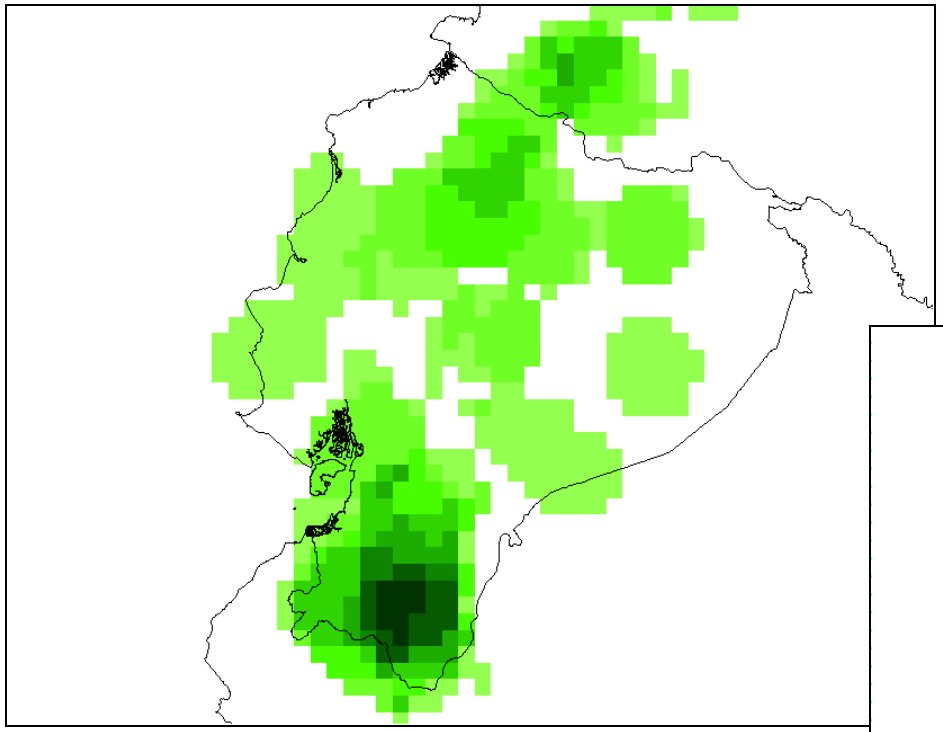
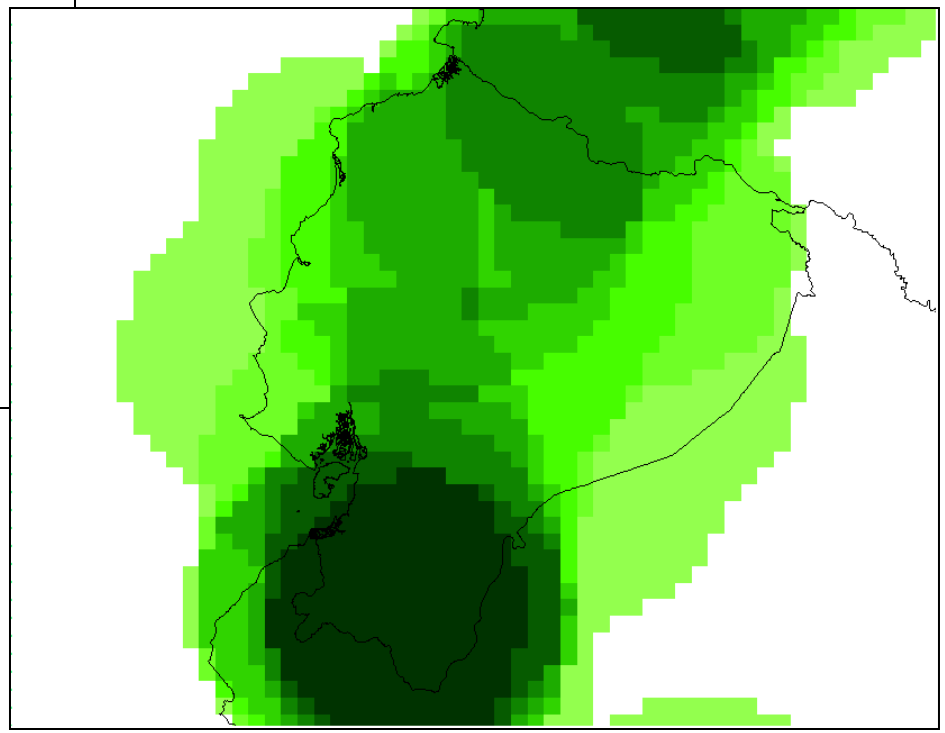


Cell: 10 minutes
Circle: 1 degree

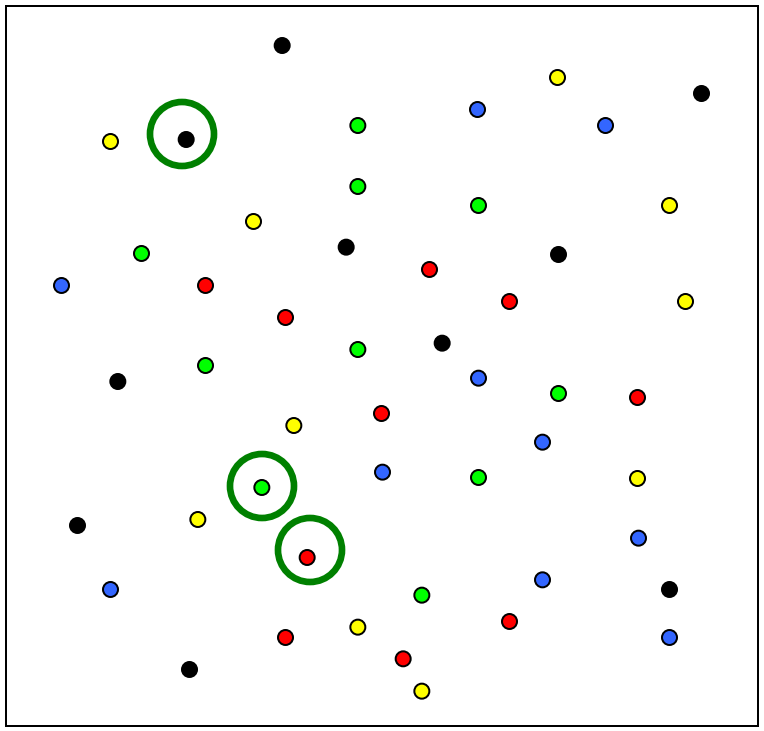
Optimal circle radius?

Cell: 10 minutes
Circle: 3 degrees



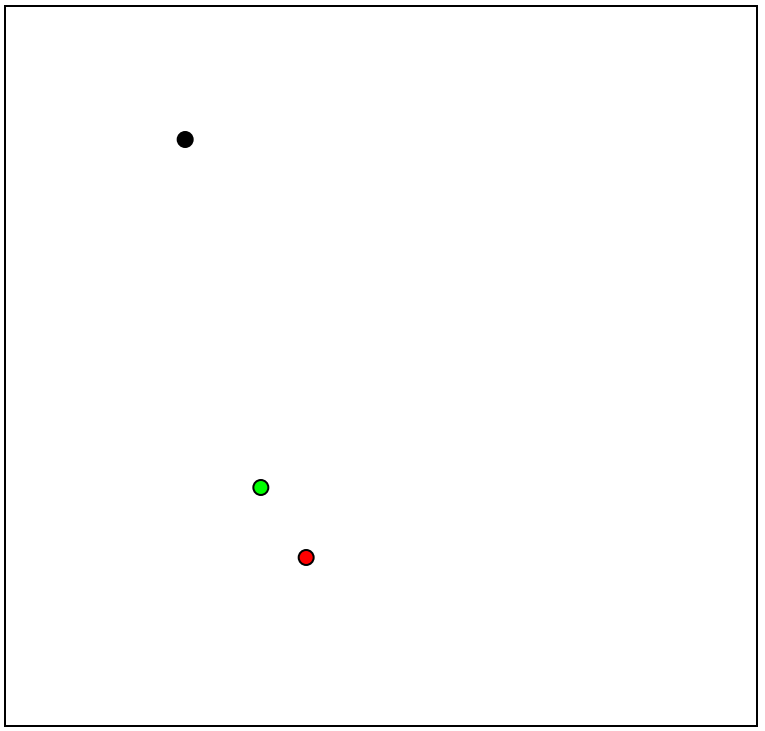
Sampling bias

50 observations



5

3 observations



3

Richness

Possible solutions

Reduce resolution (bigger cells)

Prediction of missing distribution (modelling)

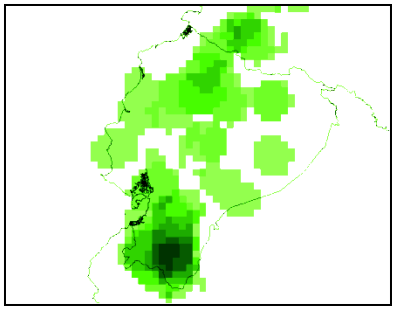
Sampling bias

Rarefaction

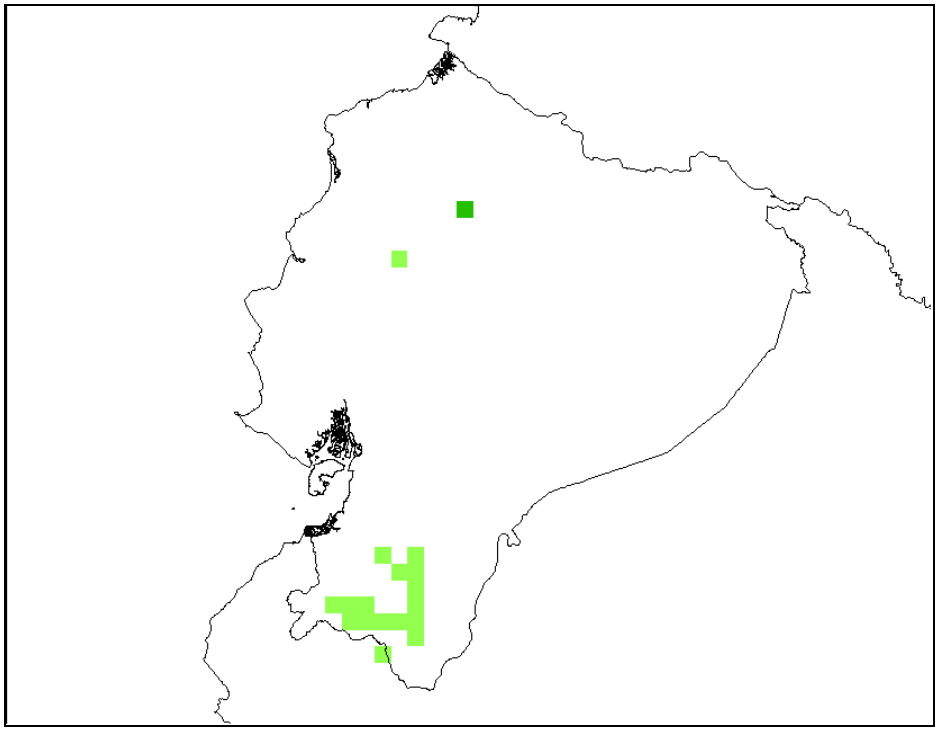
The rarefaction technique re-calculates the number of classes (species in this case) that would have been observed given a number of observations that is specified by the user (based on hypothetical subsampling)

User defined number of observations?	Final cell value	Number of cells	Final results
Too low (e.g. 5)	Max richness defined by defined number of observations (e.g. 5)	Many	**Loss of information – loss of detail of final cell value**
Too high (e.g. 15)	High	Only those cells with a number of observations above the selected number will be included (e.g. 15)	**Loss of information – loss of cell value**

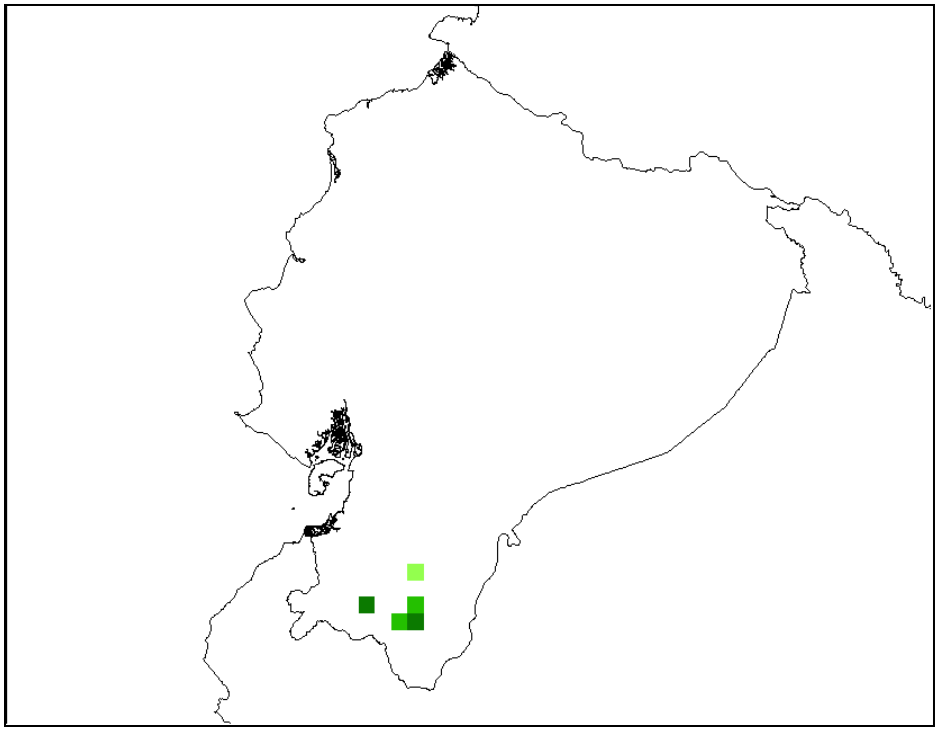
Sampling bias



Rarefaction



reduction to 3 observations



reduction to 10 observations

Applicability in case of limited number of observations?

Sampling bias

Estimators of Richness

Chao 1

$$S_1 = S_{OBS} + \left(a^2 / 2b\right)$$

Chao 2

$$\mathbf{S}_{\mathrm{Chao2}} = \mathbf{S}_{\mathrm{obs}} + \frac{\mathrm{Q}_1^2}{2\mathrm{Q}_2}$$

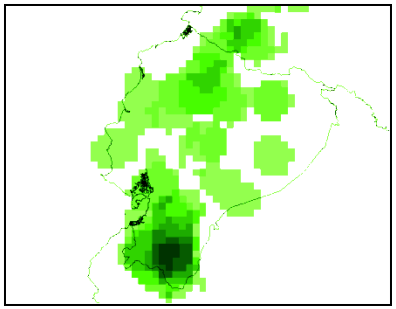
Chao 1 Corrected

$$\mathbf{S}_{\mathrm{Chao1}} = \mathbf{S}_{\mathrm{obs}} + \frac{\mathrm{F}_1^2}{2(\mathrm{F}_2+1)} - \frac{\mathrm{F}_1\mathrm{F}_2}{2(\mathrm{F}_2+1)^2}$$

… (cf DIVA manual)

Applicability in case of limited number of observations?

Sampling bias



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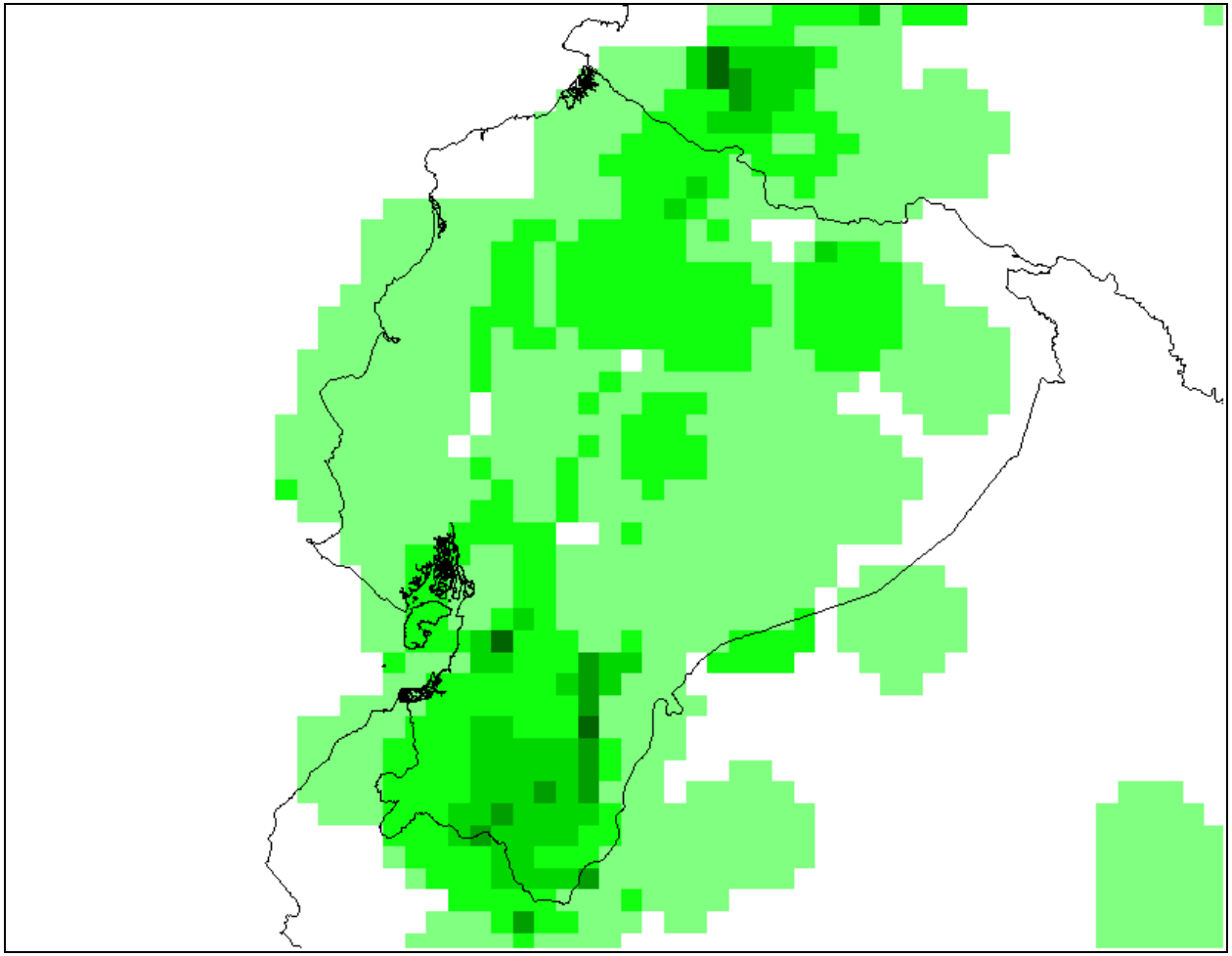
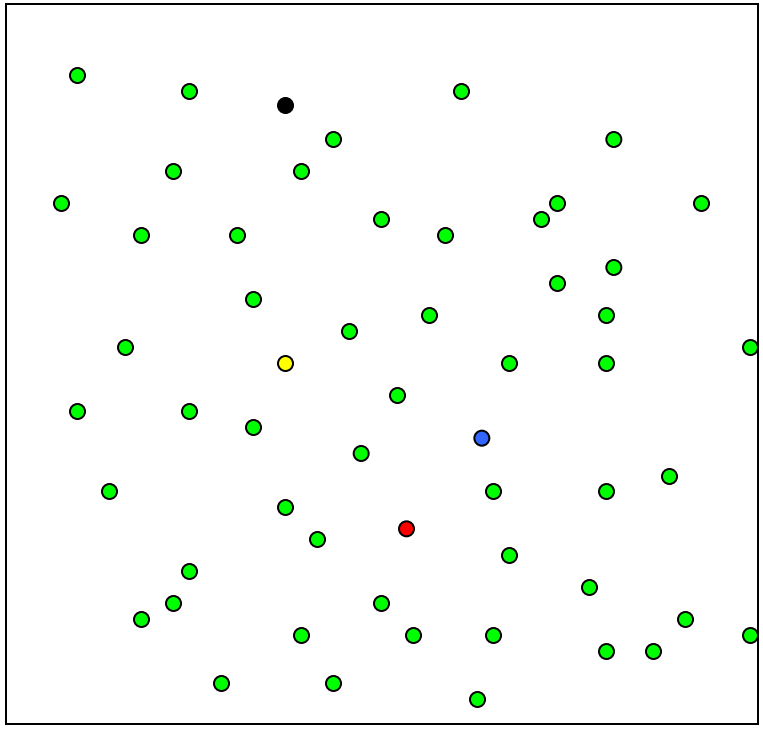
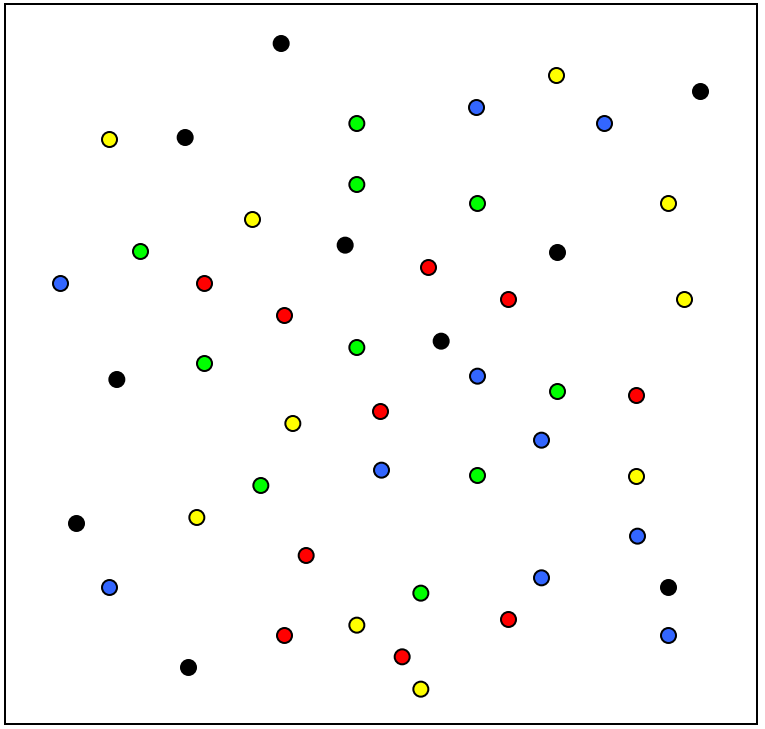


Chao 1 Corrected

Other measurements of diversity

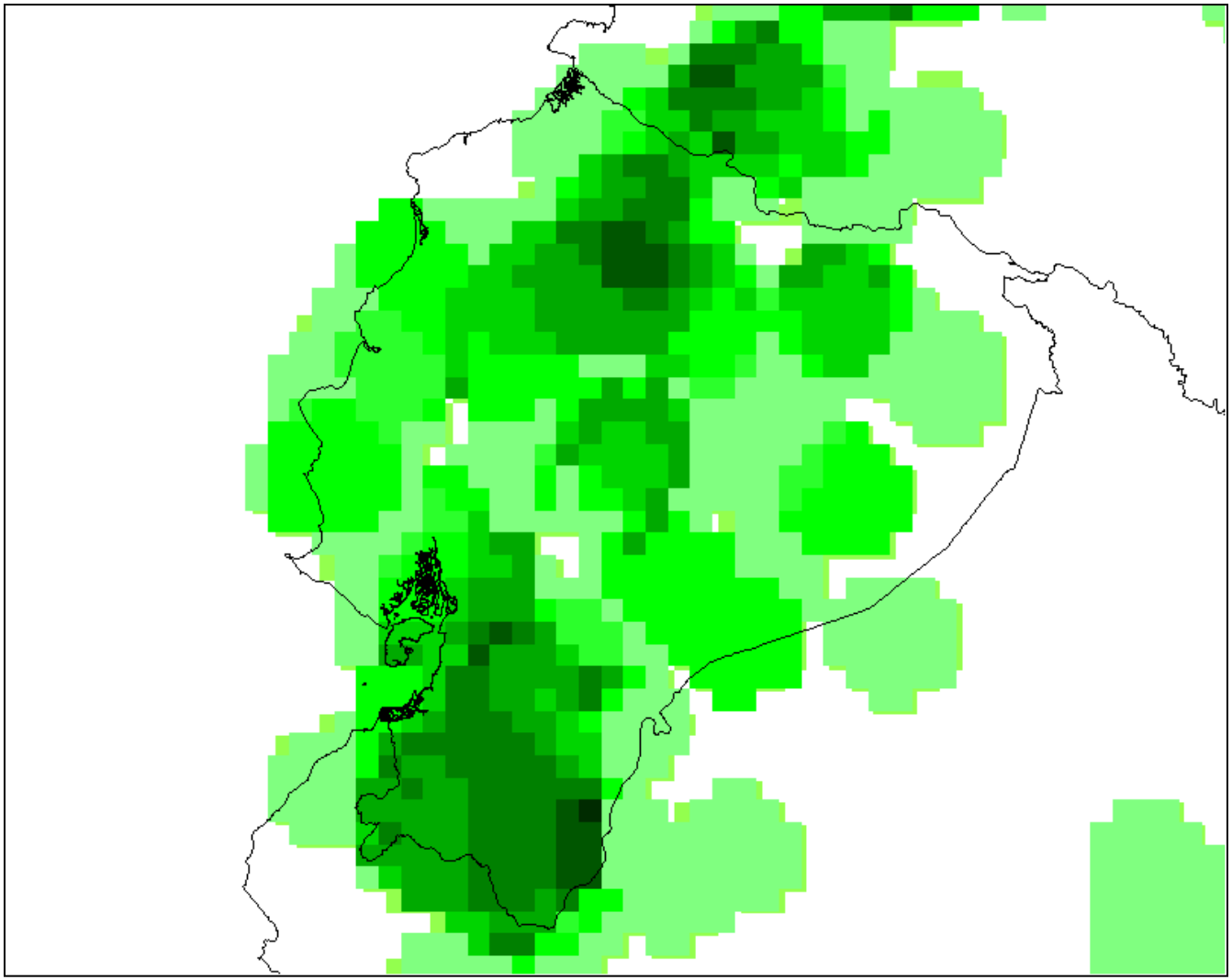
50 observations





5 **Richness** 5

Other measurements of diversity



Shannon diversity

Other measurements of diversity

Quantitative data

- Range
- Range / Mean
- Standard deviation
- Coefficient of variance

Molecular data

- Observed allele number
- Heterozygocity (external software)
- Effective allele number (external software)

Going beyond the cell level

Alpha versus beta diversity

- ***Alpha diversity*** *(**α-diversity**) is the biodiversity within a particular area, community or ecosystem and is usually expressed by the number of species (**i.e.**, species richness) in that ecosystem*

-***Beta diversity*** *(**β-diversity**) is a measure of biodiversity which works by comparing the species diversity between ecosystems or along environmental gradients.*

- **Gamma diversity** (γ-diversity) is a measure of the overall diversity for the different ecosystems within a region

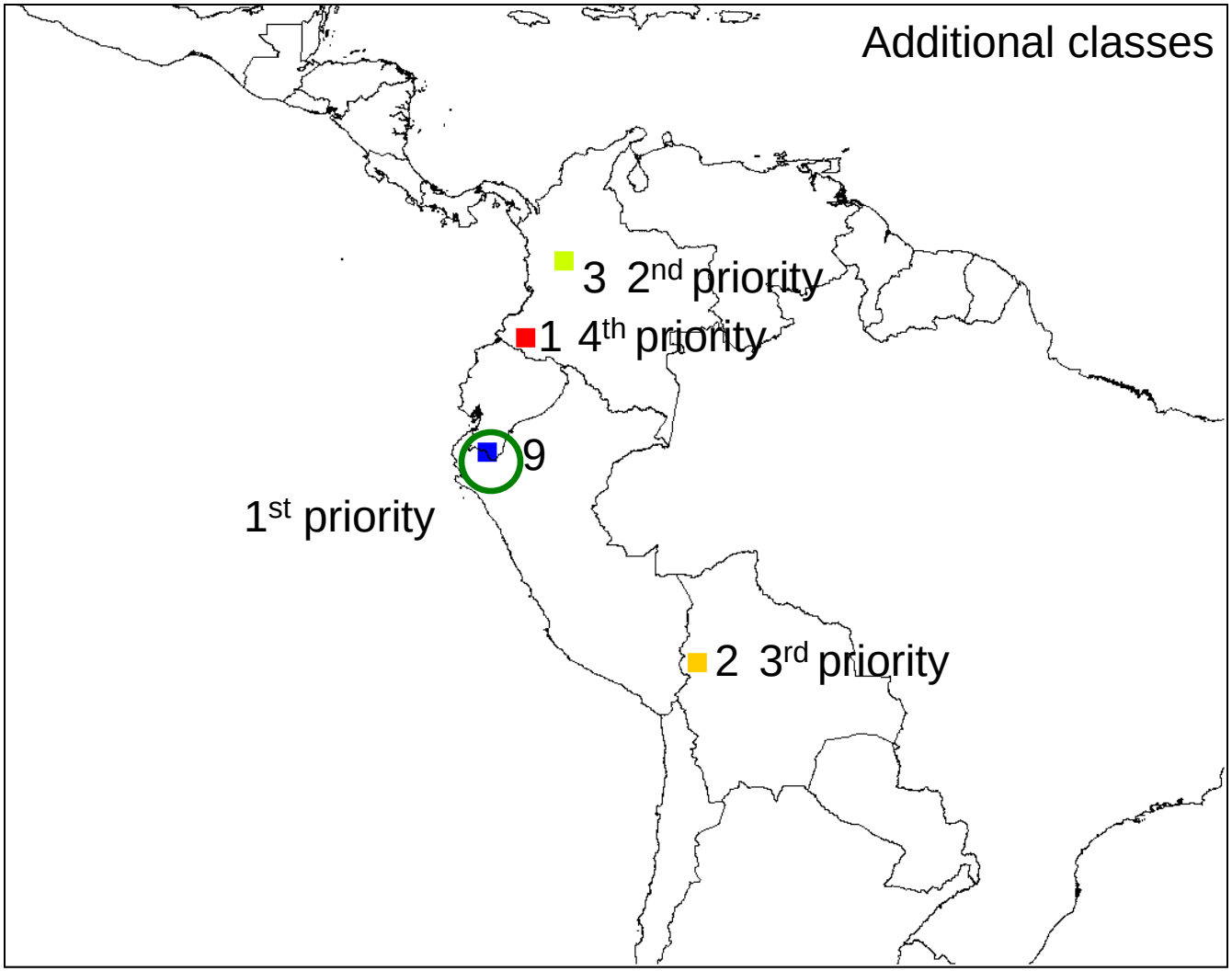
$\beta = (S1 - c) + (S2 - c)$

$\gamma = S1 + S2 - c$

Whittaker's measure

$$\beta = \frac{S}{\bar{\alpha}} \quad or \quad \beta = \frac{S}{\bar{\alpha}} - 1$$

Reserve Selection



Priority areas for in situ conservation?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Thanks