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DIGITAL ACCESSIBLE KNOWLEDGE OF THE PLANTS OF BRAZIL



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Biodiversity data

- * Digital Accessible knowledge (DAK): Set of primary data that has been made both digital and accessible in global standard formats
- * Primary biological data: data records that place a given taxon at a given time in a particular place
- * Only recently been converted broadly to digital formats
- * More recently primary biodiversity data have been shared openly on the Internet

- ✳️ DAK has reached critical mass: policy-making
- ✳️ 91.4% of all Brazilian angiosperm species listed in the *List of Species of the Brazilian Flora* are currently served by *speciesLink*
- ✳️ 88 Brazilian herbaria, 5 international herbaria



The screenshot shows the homepage of the *Plants and Fungi* website. The header includes navigation links: plants & fungi, news, providers, indicators, data cleaning, tools, tips, and preferences. The main content area features a description of the INCT - Virtual Herbarium of Flora and Fungi, a list of terms of use, and a statistics sidebar. The URL <http://www.splink.org.br/index> is prominently displayed.

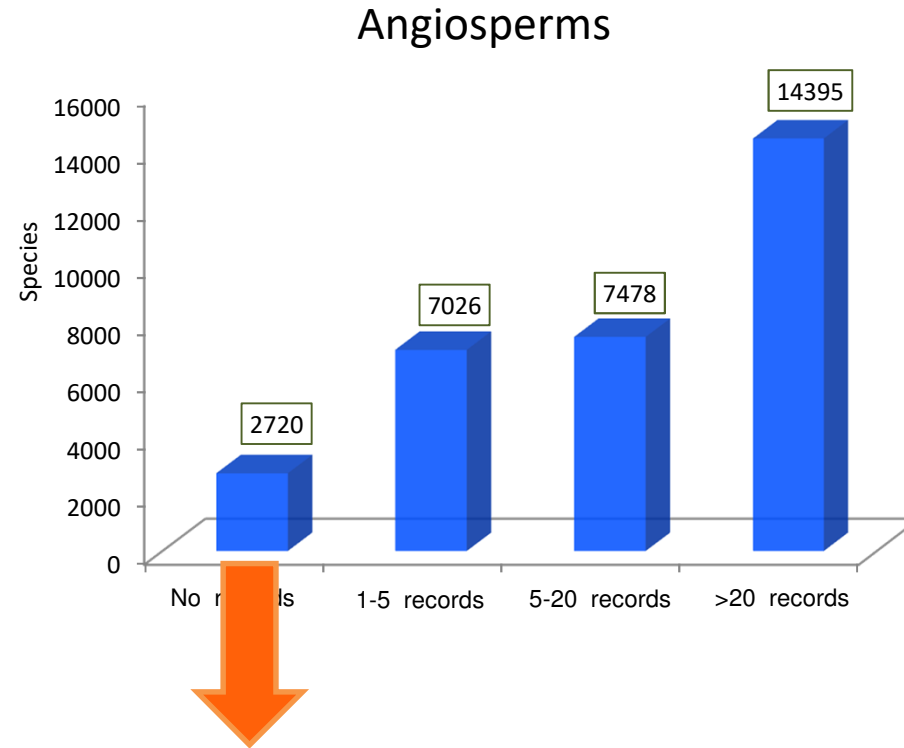
Statistics:

collections and subcollections	102
online records	3,882,915
georeferenced records	1,826,664
records with images	174,722
type records	80,512
records of species in redlists	127,722

See also the INCT - Virtual Herbarium website

Logos at the bottom: FINEP, CNPq, FAPESP, SBT, J.R.S. BIODIVERSITY FOUNDATION, Ciência e Tecnologia, CRIA.

Digital Accessible Knowledge for Plants



Only 8,6% of angiosperm species are NOT online (*species*Link)

Articles

- ➔ **Completeness of Digital Accessible Knowledge of the Plants of Brazil and Priorities for Survey and Inventory.** Mariane de Sousa-Baena, Letícia C. Garcia, and A. Townsend Peterson (submitted to American Journal of Botany)
- ➔ **Data *versus* Knowledge in Conservation Status ecisions: "Data Deficient" Brazilian Plant Species.** Mariane de Sousa-Baena, Letícia C. Garcia, and A. Townsend Peterson (submitted to Biological Conservation)
- ➔ **How Complete are the Floristic Inventories of Conservation Units in Brazil?** Letícia C. Garcia, Mariane de Sousa-Baena, and A. Townsend Peterson (in prep.)
- ➔ **Measuring Uniqueness of Brazilian Herbaria Concerning their Contribution to the Knowledge of the Flora.** Dora Ann L. Canhos, Mariane de Sousa-Baena, Letícia C. Garcia, and A. Townsend Peterson (in prep.)

Methods - Input data



First step

Angiosperms

Brazil

Valid name

Second step

Georeferenced

County-level information

Collection date

Total of records
~2,500,000

Data effectively used
1,600,000

➔ Completeness of Digital Accessible Knowledge of the Plants of Brazil and Priorities for Survey and Inventory.

Mariane de Sousa-Baena, Letícia C. Garcia, and A. Townsend Peterson

(submitted to Global Ecology and Biogeography)

Objectives:

- * Identify areas that have not been sampled, and that are unique in geographic and environmental characteristics
- * Identify sites where survey effort should be focused, such that investment in further biodiversity assessment in Brazil is maximally efficient and productive

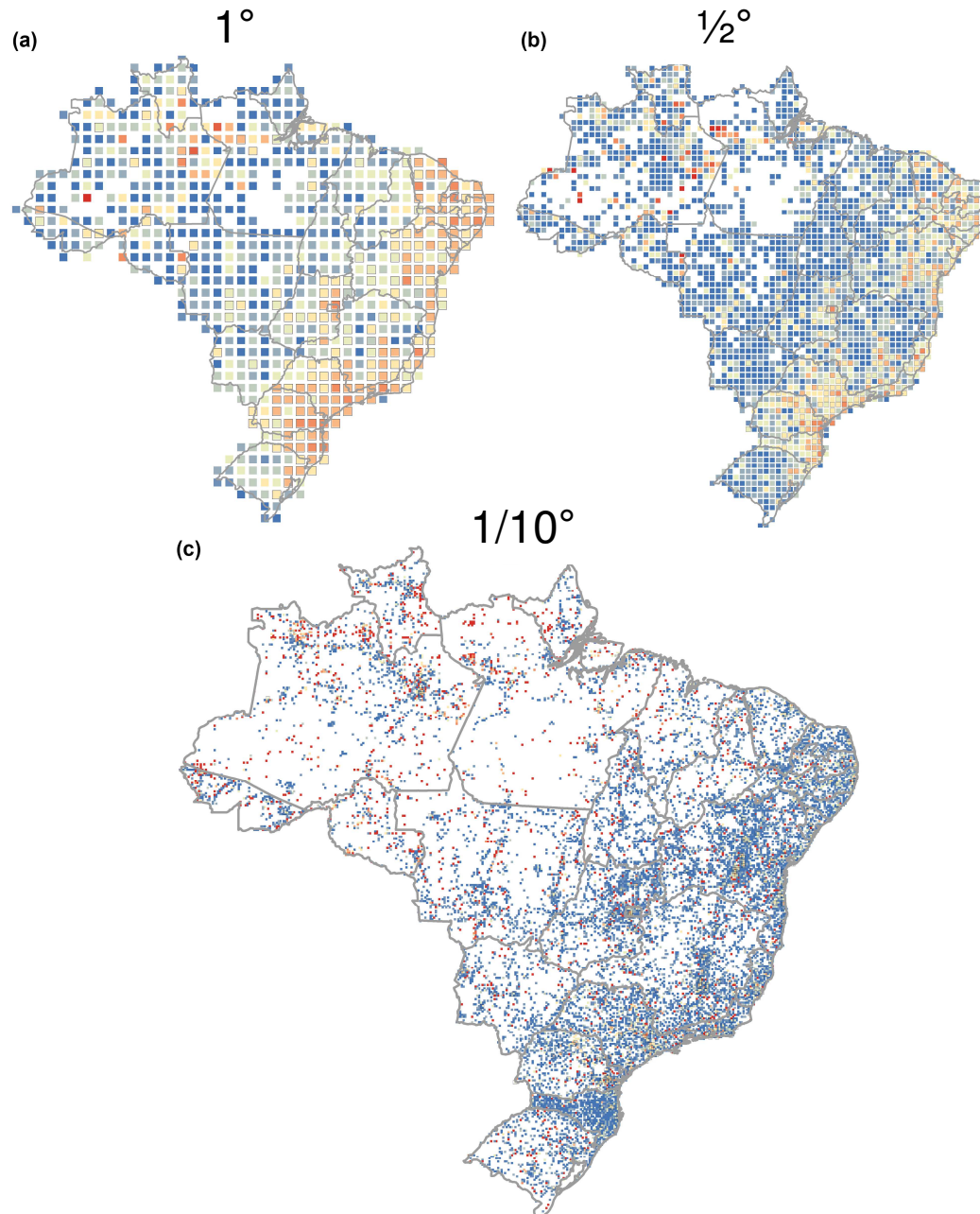
Methods

- * Calculate inventory completeness for a diversity of areas across Brazil
- * For each site we calculated:
 - ◆ Observed number of species (S_{obs})
 - ◆ Number of species that had been observed on one day only (a)
 - ◆ Observed on two days only (b).
 - ◆ Expected number of species at a given place as:

$$S_{exp} = S_{obs} + a^2/2b$$

- ◆ Inventory completeness as:

$$C = S_{obs} / S_{exp}$$



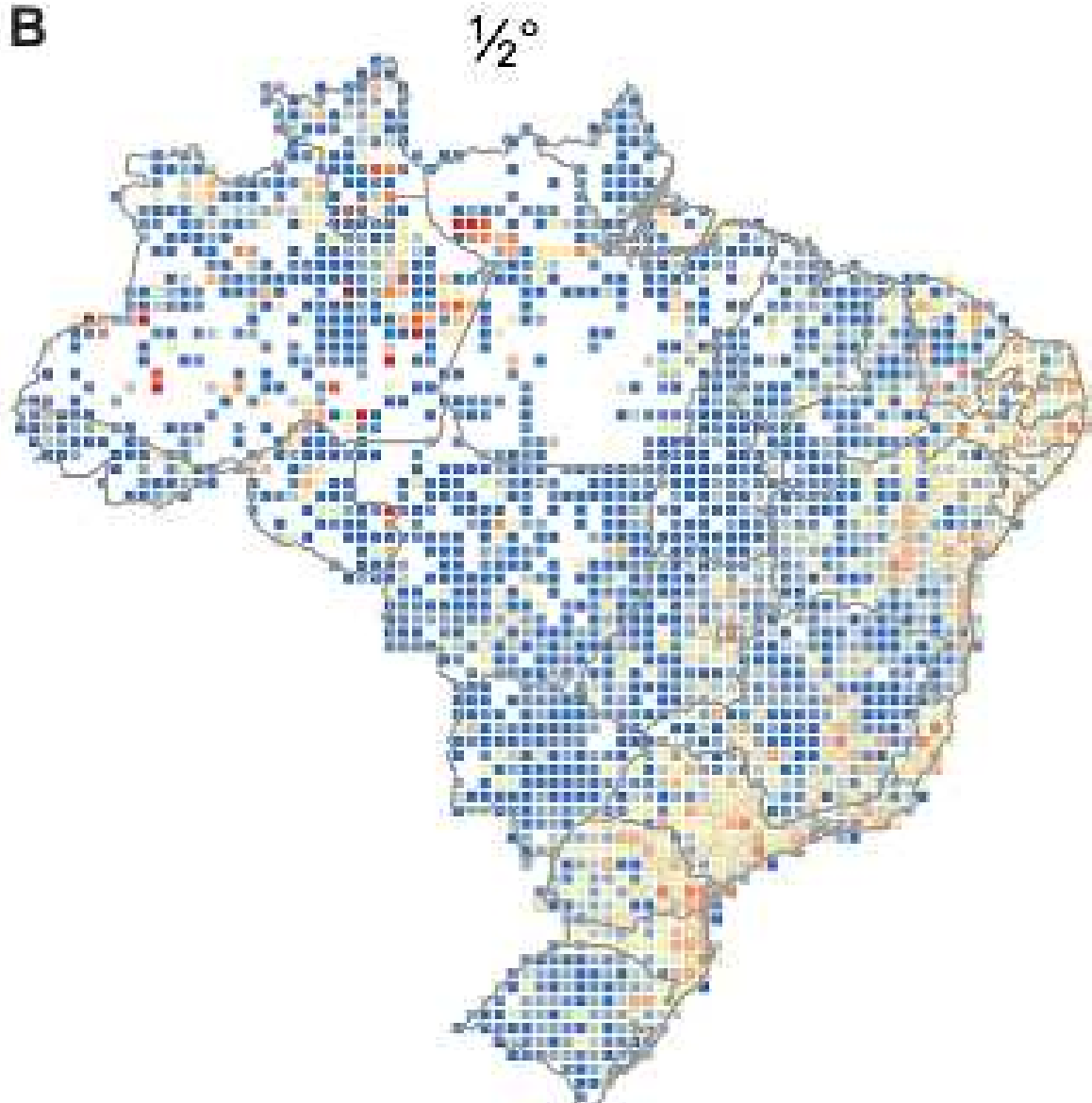
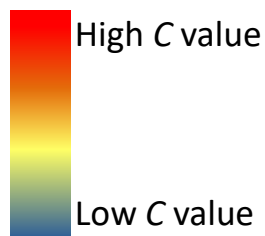
Geographic patterns of inventory completeness across Brazil based on grids of differing spatial resolutions

- ✧ 1° resolution map: inventory completeness as more evenly distributed
- ✧ 1/10° resolution: botanical knowledge restricted to a few areas, separated by many broad gaps.
- ✧ 1/2° resolution: some well-known regions, but with less-pronounced gaps
- ✧ 1/2° resolution: offers the best balance between spatial resolution and inventory completeness at the national

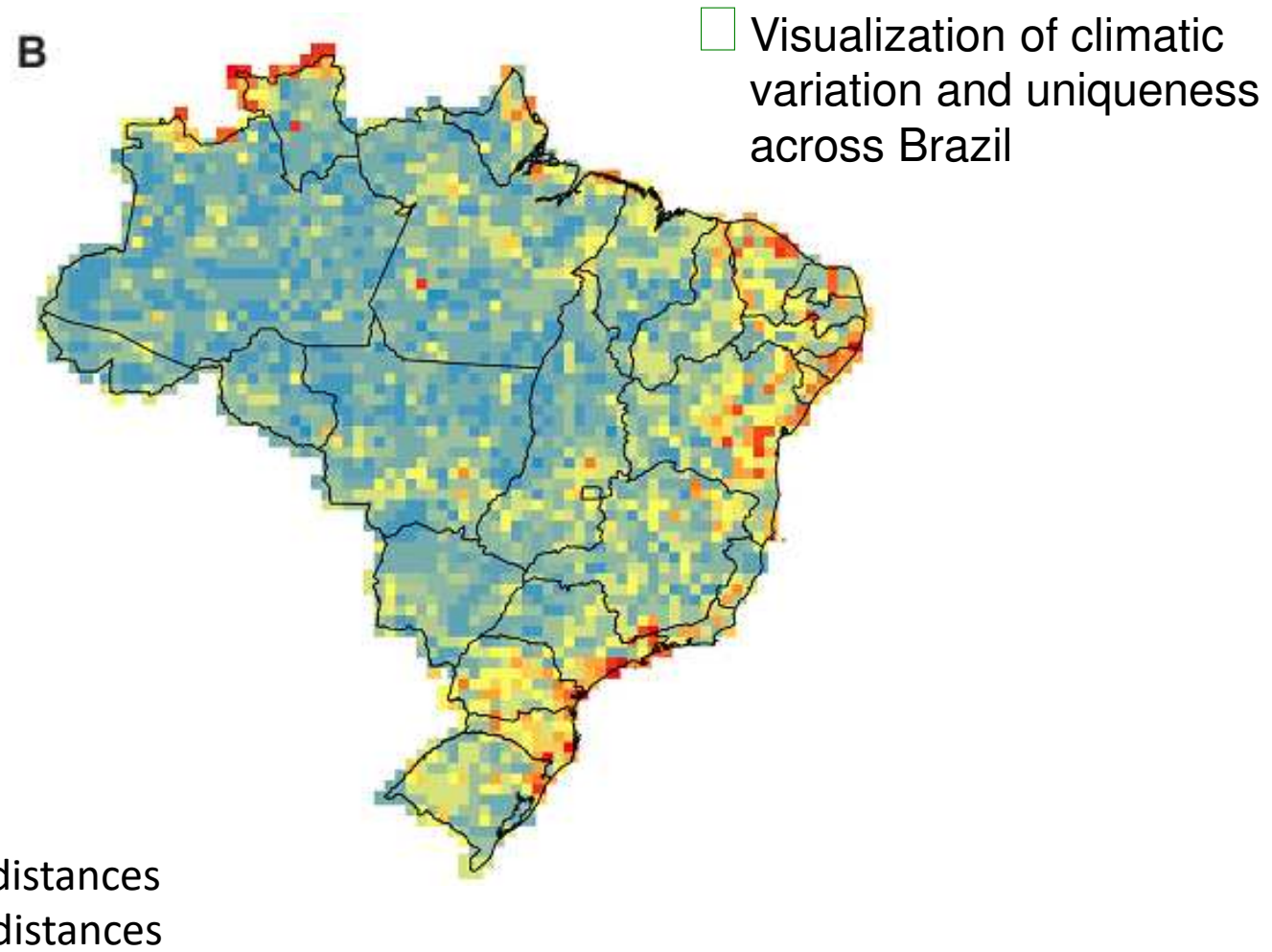
Geographic patterns of inventory completeness across Brazil based on 1/2 degree grids

'Well sampled' criterion:
 $C \geq 0.5$
 $N > 1000$ records.

- Brazilian coast had high densities of well-known cells
- Scattered sites in the Amazon and elsewhere in the interior that were well-characterized



Map of climatic uniqueness in terms of nearest-neighbor distances to the closest other pixel in environmental space

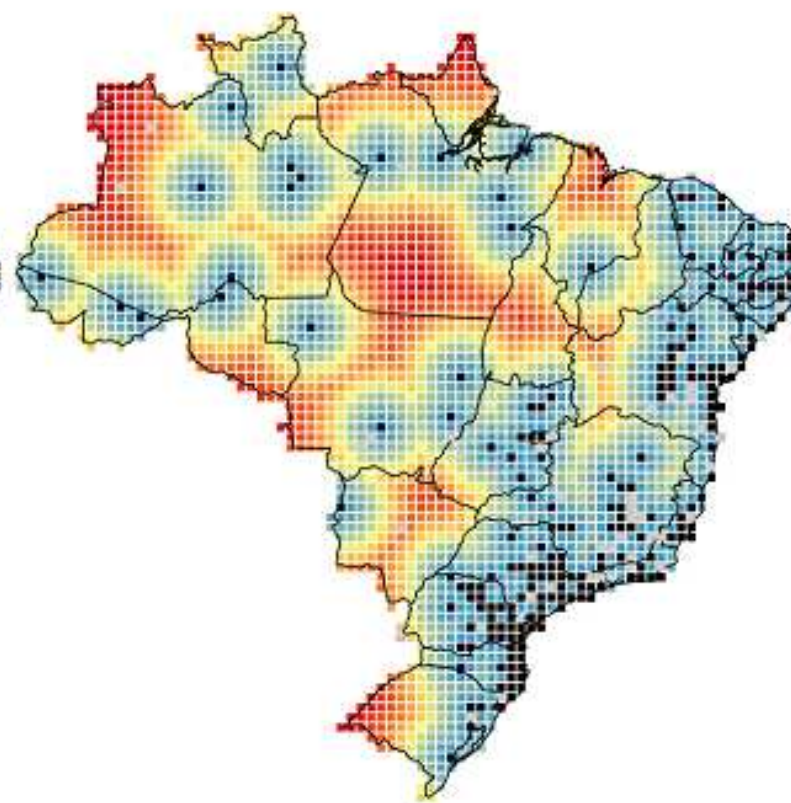
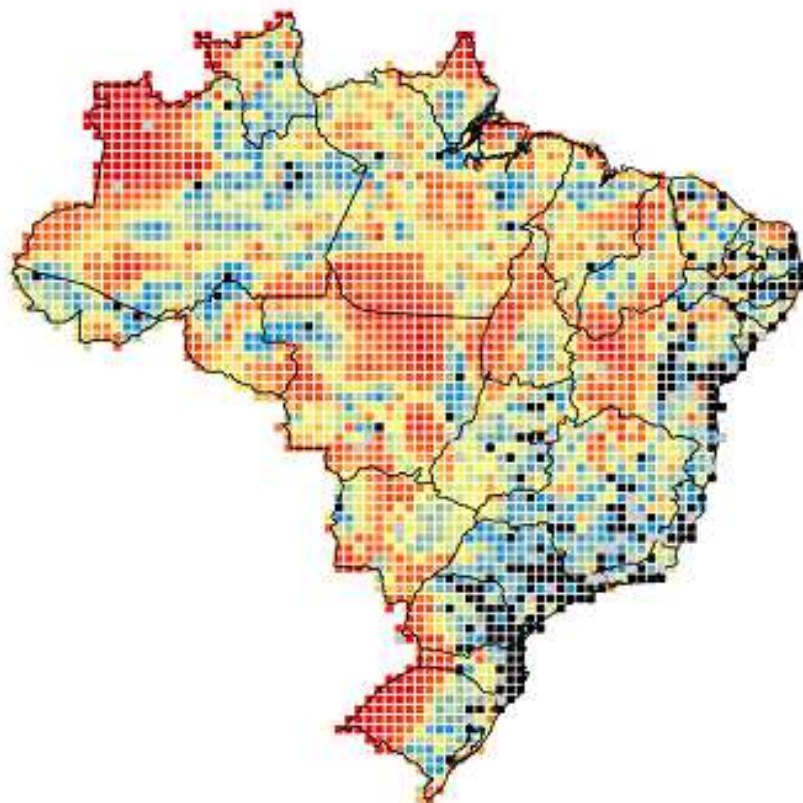


Areas environmentally distant from well-known sites

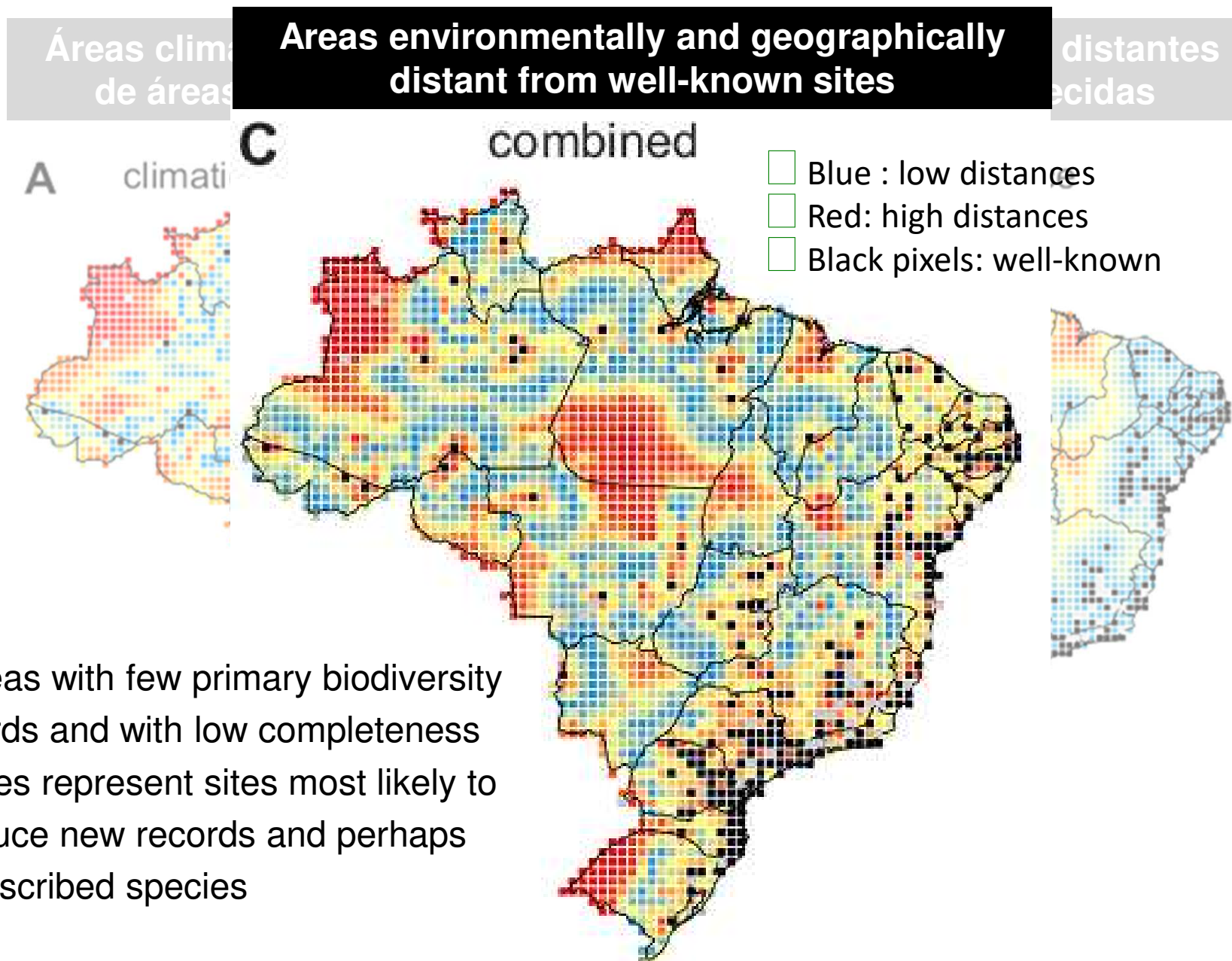
Areas geographically distant from well-known sites

A climatic uniqueness

B geographic distance

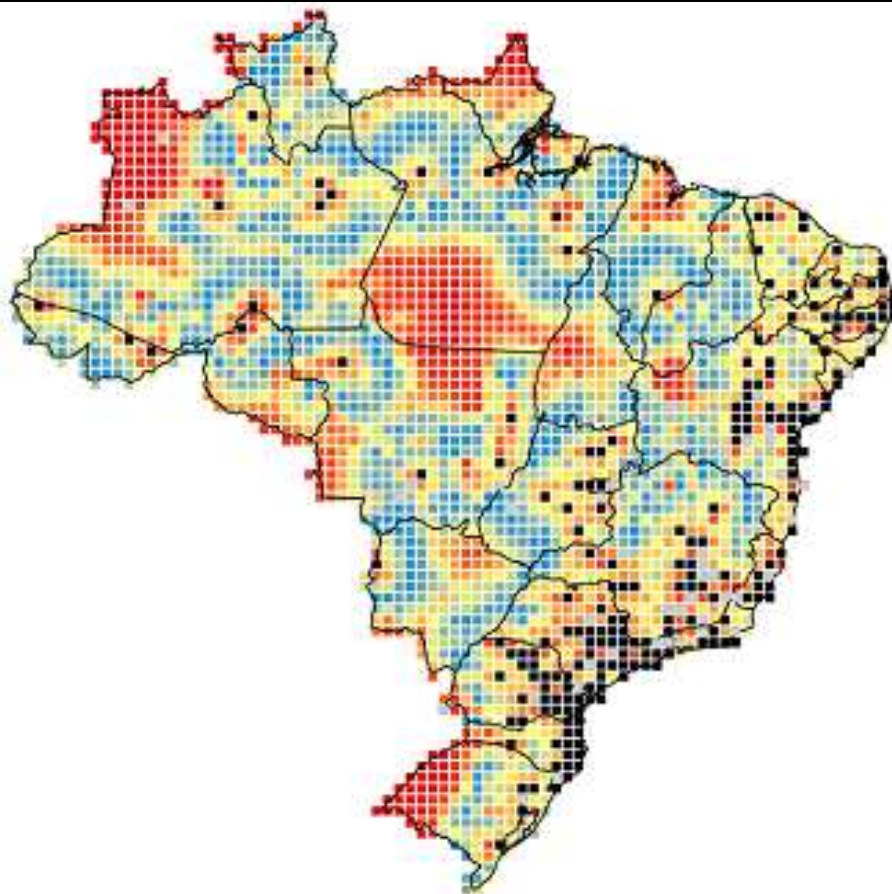


- Blue shading: low distances
- Red shading: high distances
- Black pixels: well-known floristically

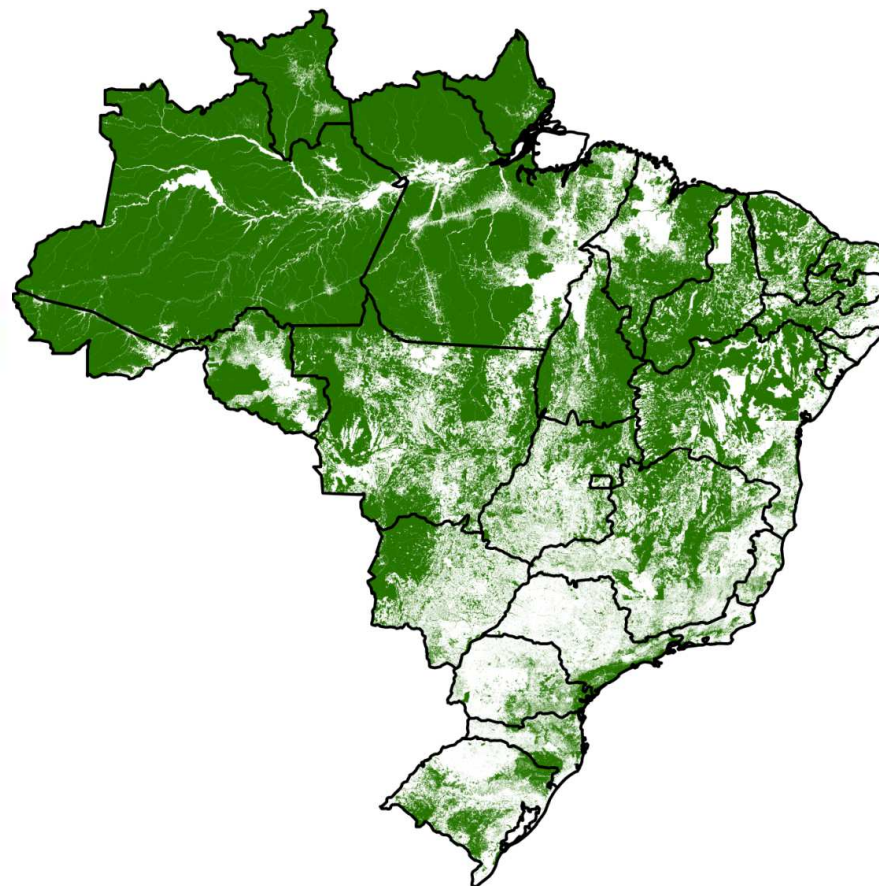


✱ areas with few primary biodiversity records and with low completeness indices represent sites most likely to produce new records and perhaps undescribed species

Areas environmentally and geographically distant from well-known places



Native vegetation cover

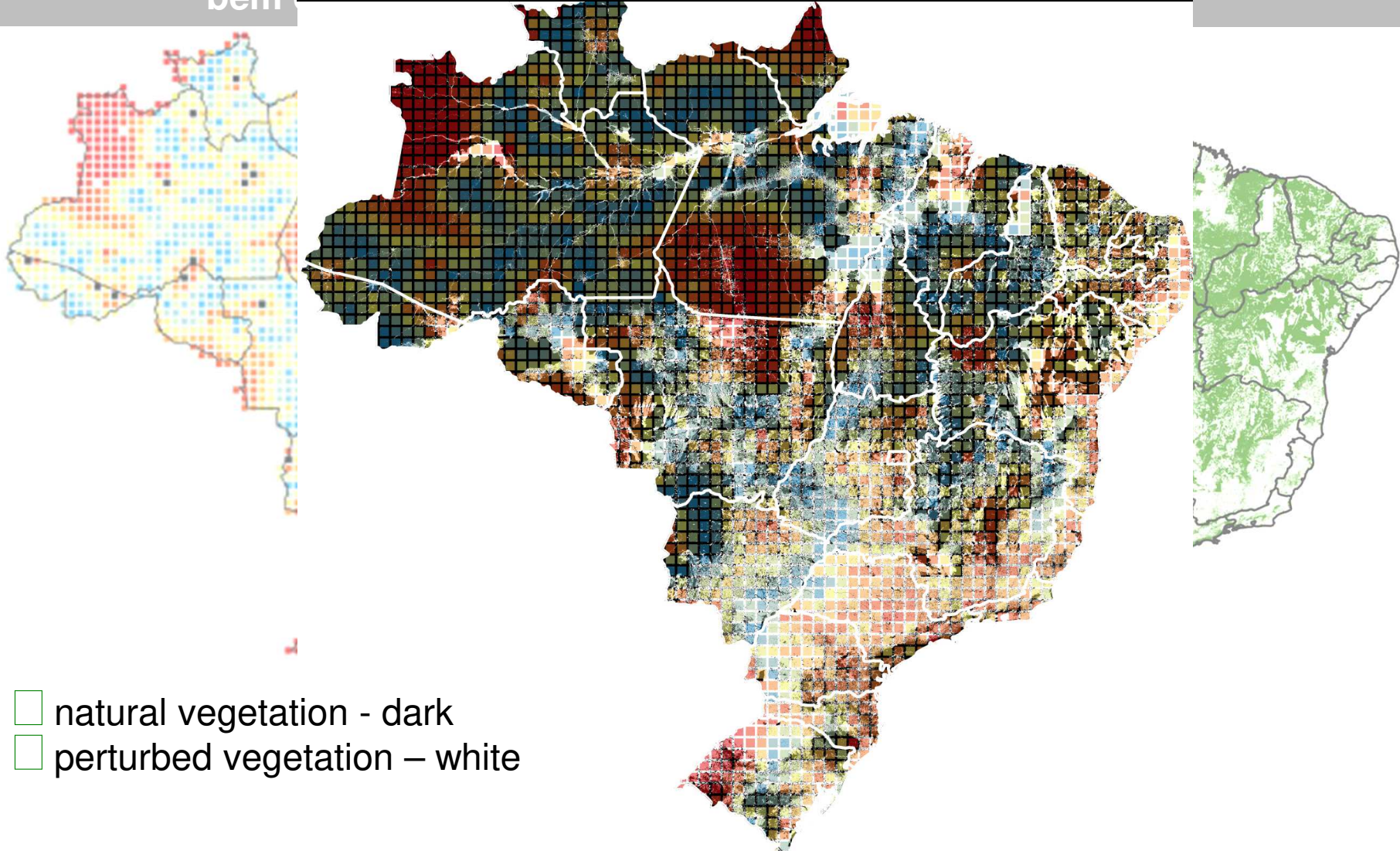


Overlaid coverage gaps on areas still covered by native vegetation...

Áreas climaticamente e geograficamente bem conhecidas

Areas environmentally and geographically distant from well-known places + native vegetation cover

over

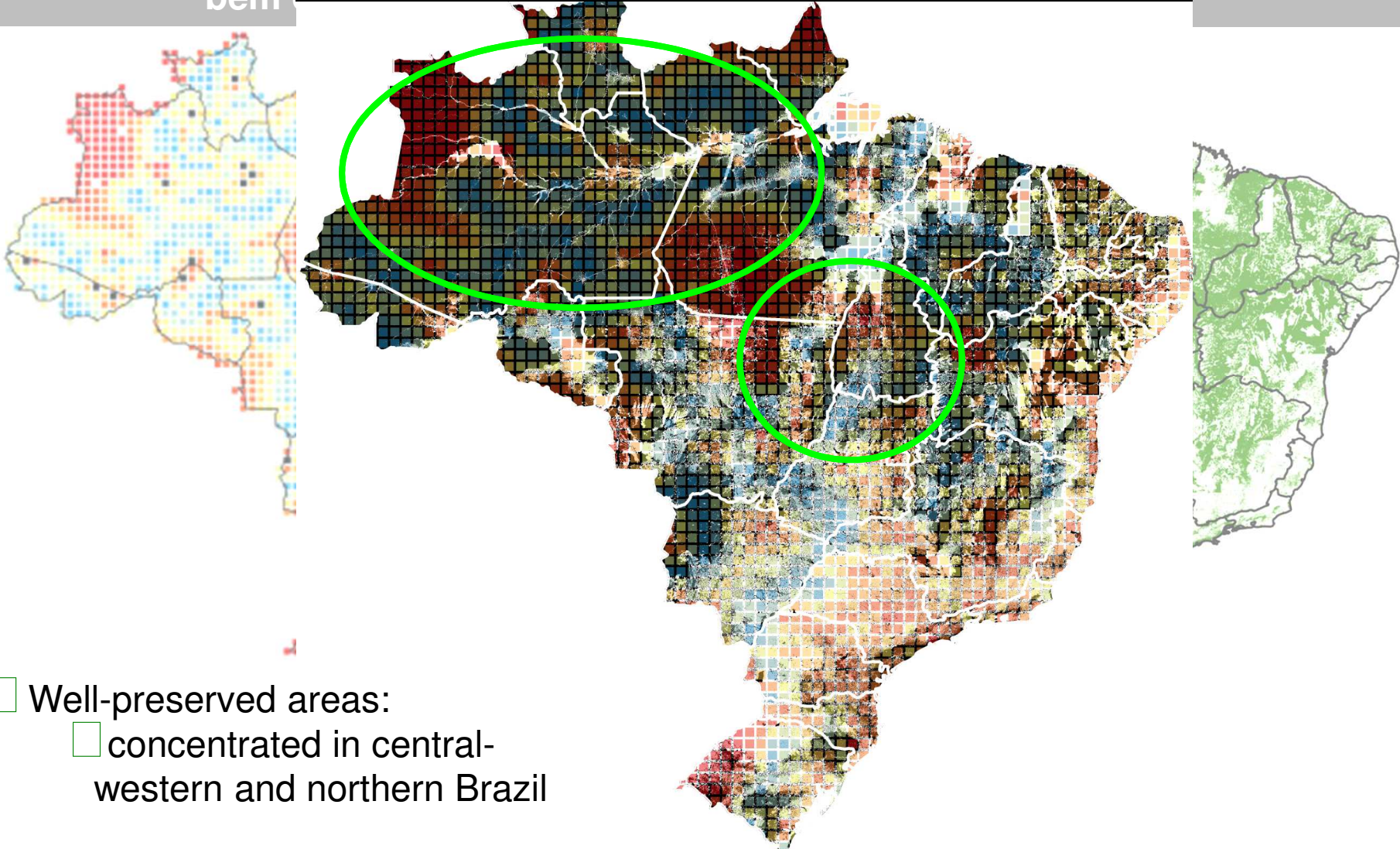


- natural vegetation - dark
- perturbed vegetation – white

Areas environmentally and geographically distant from well-known places + native vegetation cover

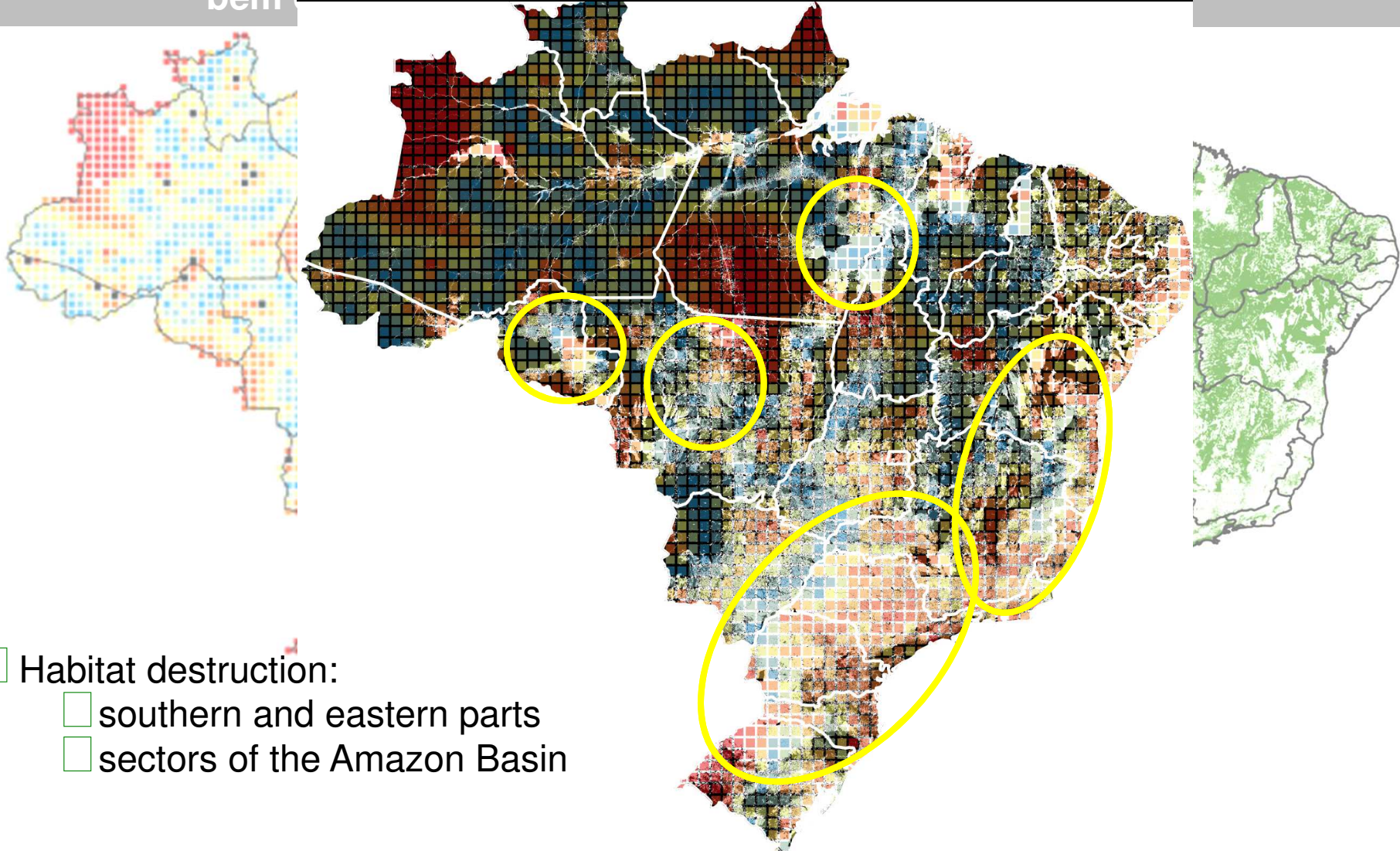
Áreas climaticamente e geograficamente bem preservadas

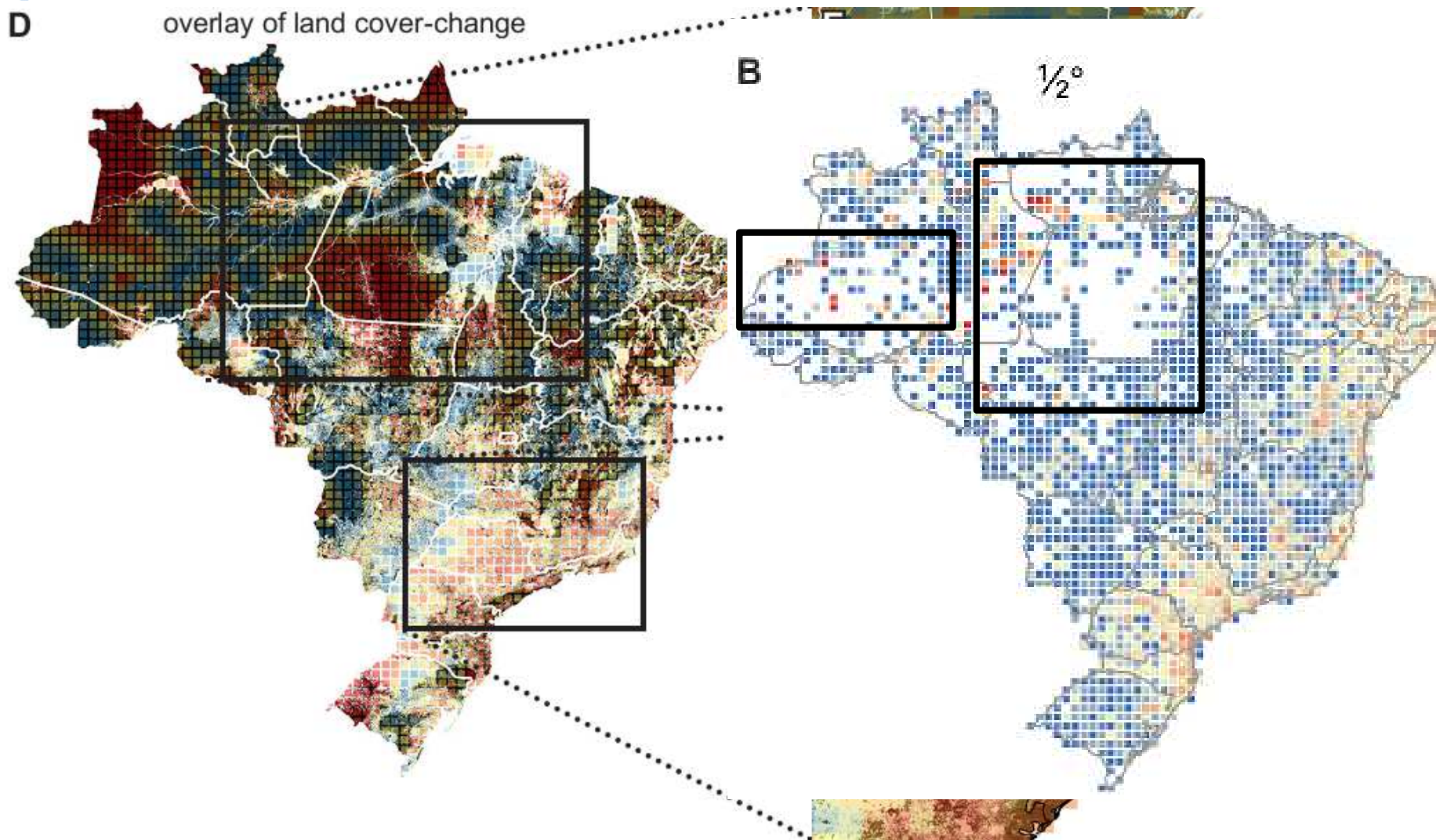
Áreas com baixa cobertura de vegetação nativa



- Well-preserved areas:
 - concentrated in central-western and northern Brazil

Áreas climaticamente e geograficamente bem representadas
Areas environmentally and geographically distant from well-known places + native vegetation cover
 over








- ✱ Areas with few primary biodiversity records and with low completeness indices - sites most likely to produce new records and undescribed species
- ✱ Geographic distance from well-known sites and environmental difference from well-known sites enhance these probabilities

- Digitization efforts to improve these numbers should be prioritized
- Large part of current Brazilian herbarium records do not yet exist in digital format - if added to DAK would approximately double information available.
- Institutions already participating in *speciesLink*: Museu Nacional have added only small fractions of their overall collections to the DAK data store
- Participation of additional herbaria that hold important data represents yet a third frontier for immediate enrichment of DAK.
- Finally, more field sampling need to be carried out, and should be supported generously

Broader perspective on improving DAK for global biodiversity

-  This study illustrates the benefits to be reaped from biodiversity data sharing and integration

-  Such dense information resources exist for only a very few countries, and exist in Brazil thanks to the open-minded and forward-thinking biodiversity and informatics communities in the country.

-  Such information offer important support for policy-making

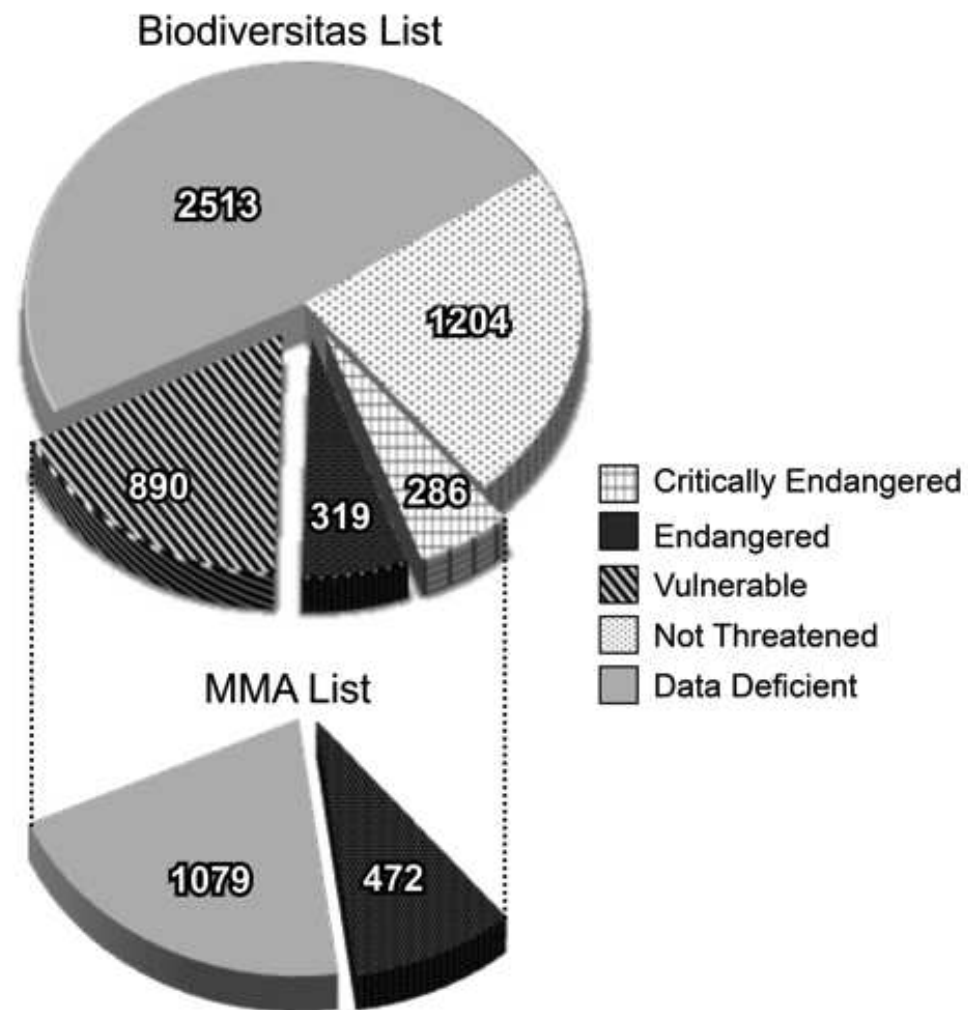
➔ Data *versus* Knowledge in Conservation Status Decisions: "Data Deficient" Brazilian Plant Species

Mariane de Sousa-Baena, Leticia C. Garcia, and A. Townsend Peterson

(submitted to Biological Conservation)

Brazilian List of Threatened Plant Species

- ✳️ Attributing “conservation status” to a species: uses, distribution and collection effort
- ✳️ Lack of sufficient information prevents this evaluation and requires new collection or digitization efforts
- ✳️ Official List published by the Ministry of Environment (MMA): based on Biodiversita’s list and classify plants as “Endangered” or “Data Deficient”



* Biodiversitas Foundation's List: follows the rules of IUCN, considering the 5 categories of threaten

Objectives:

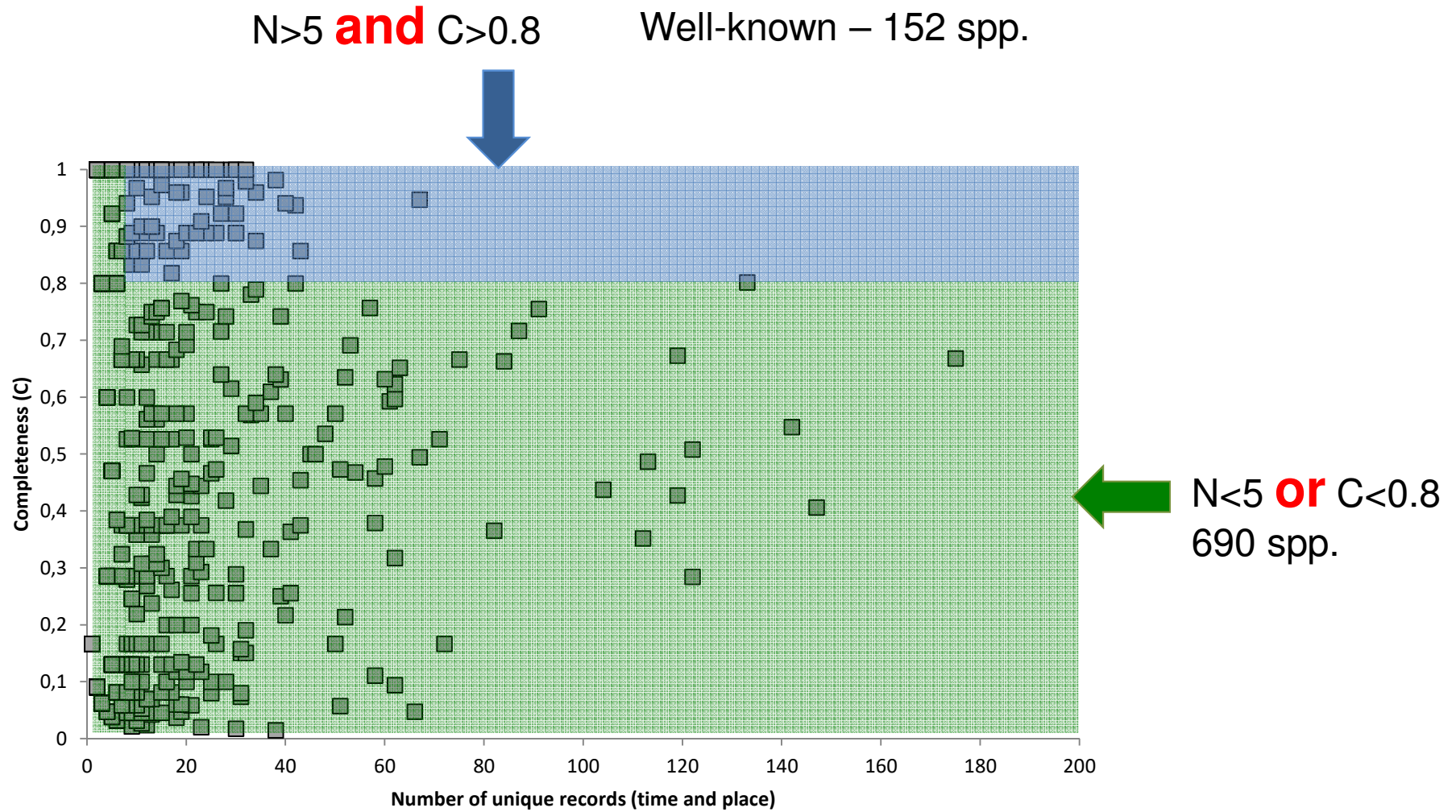
- ✱ Examine, whether DAK is really lacking or insufficient for angiosperm species classified as Data Deficient in the Official List of Threatened Brazilian Plants.
- ✱ Use DAK to identify which species are genuinely Data Deficient versus species for which data are available actually.

- * How well-known species' distribution is: calculated C based on occurrence points for all DD species
- * For each species we calculated:
 - ◆ Observed number of occurrence sites (L_{obs})
 - ◆ Number of sites that had been collected on one day only (a)
 - ◆ Collected on two days only (b).
 - ◆ Expected number of occurrence sites for a given species:

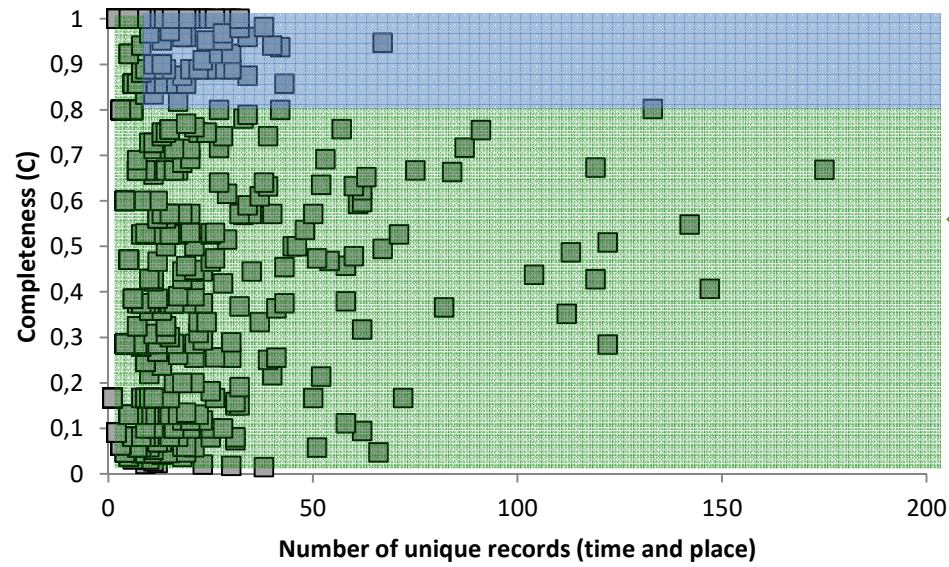
$$L_{exp} = L_{obs} + a^2/2b$$

- ◆ Completeness of knowledge of species distribution as:

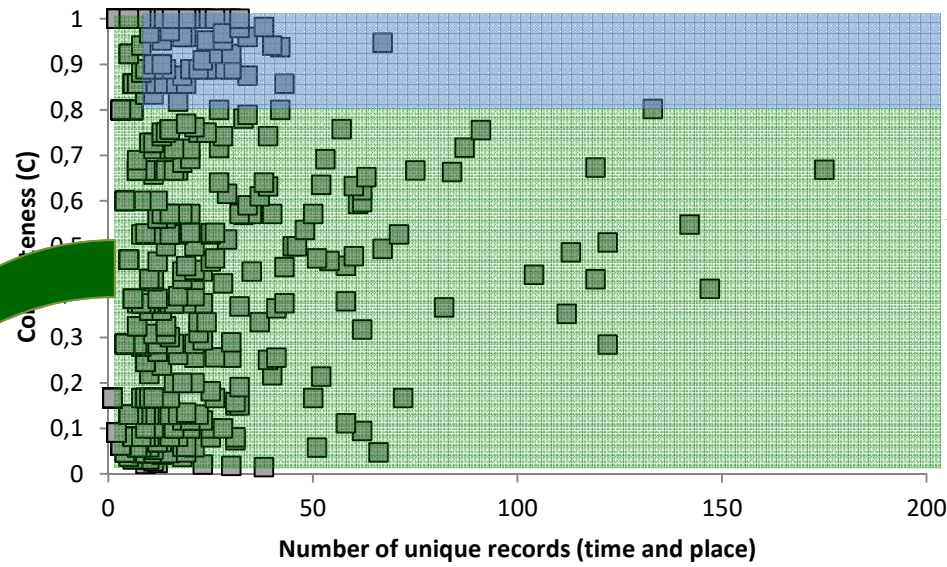
$$C = L_{obs} / L_{exp}$$



Data versus knowledge in conservation status decisions: "Data Deficient" Brazilian Plant Species

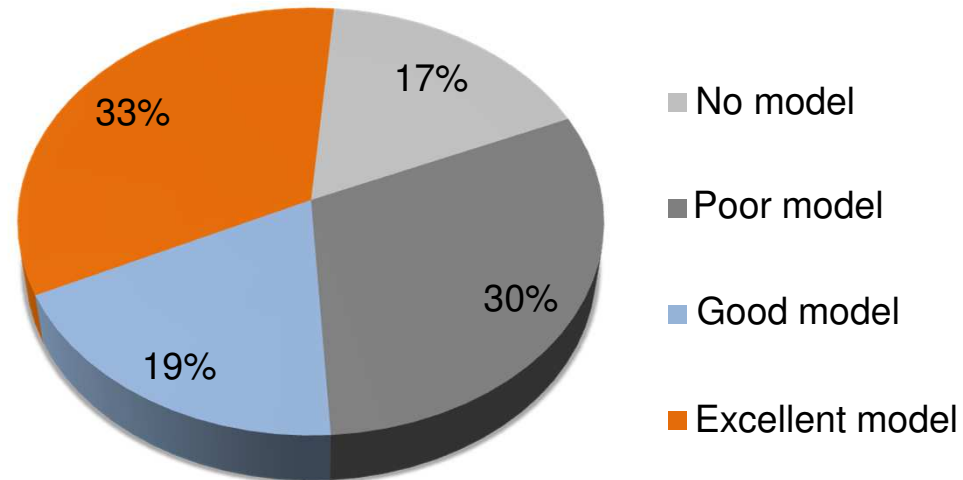


← N < 5 **or** C < 0.8
690 spp.

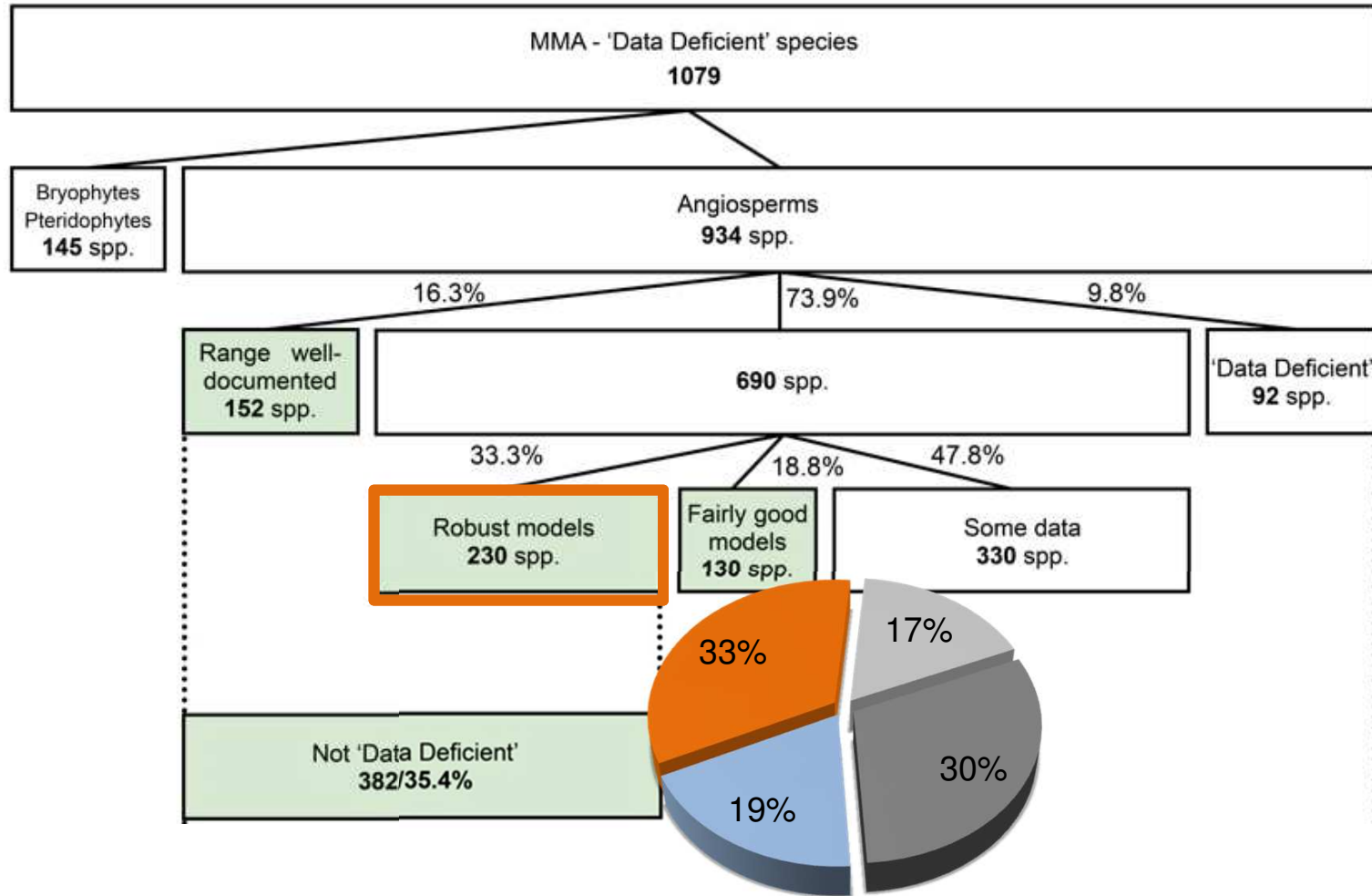


$N < 5$ **or** $C < 0.8$
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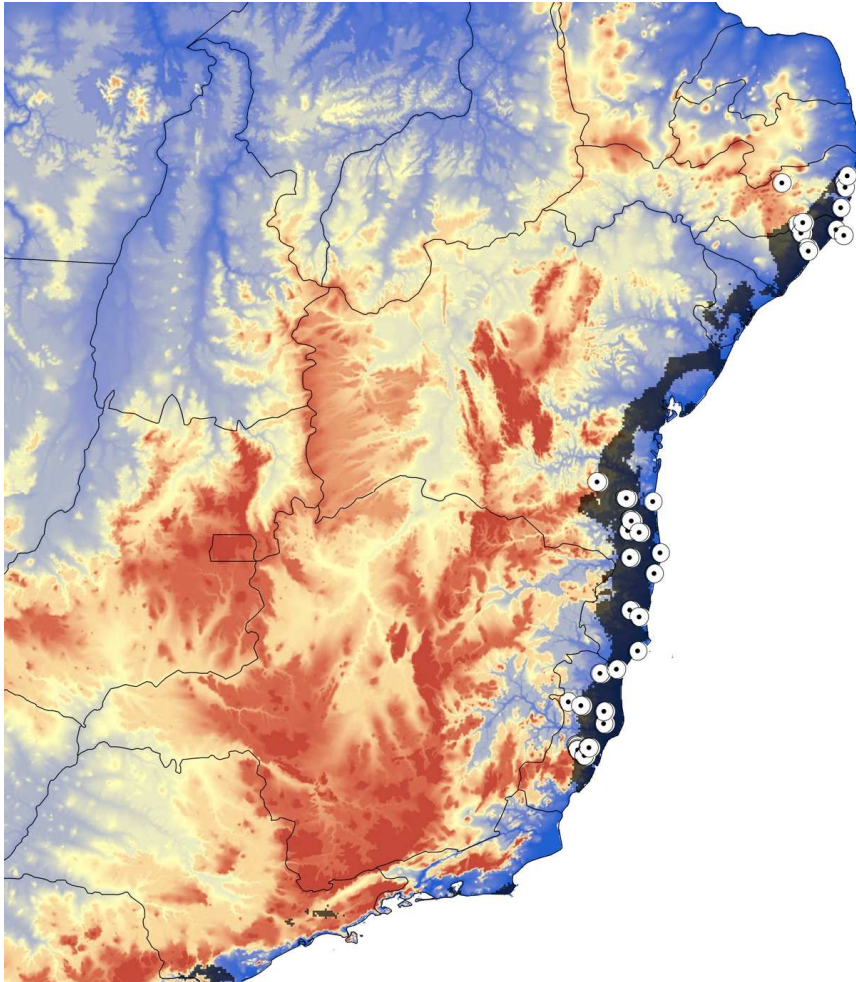
Ecological niche modeling



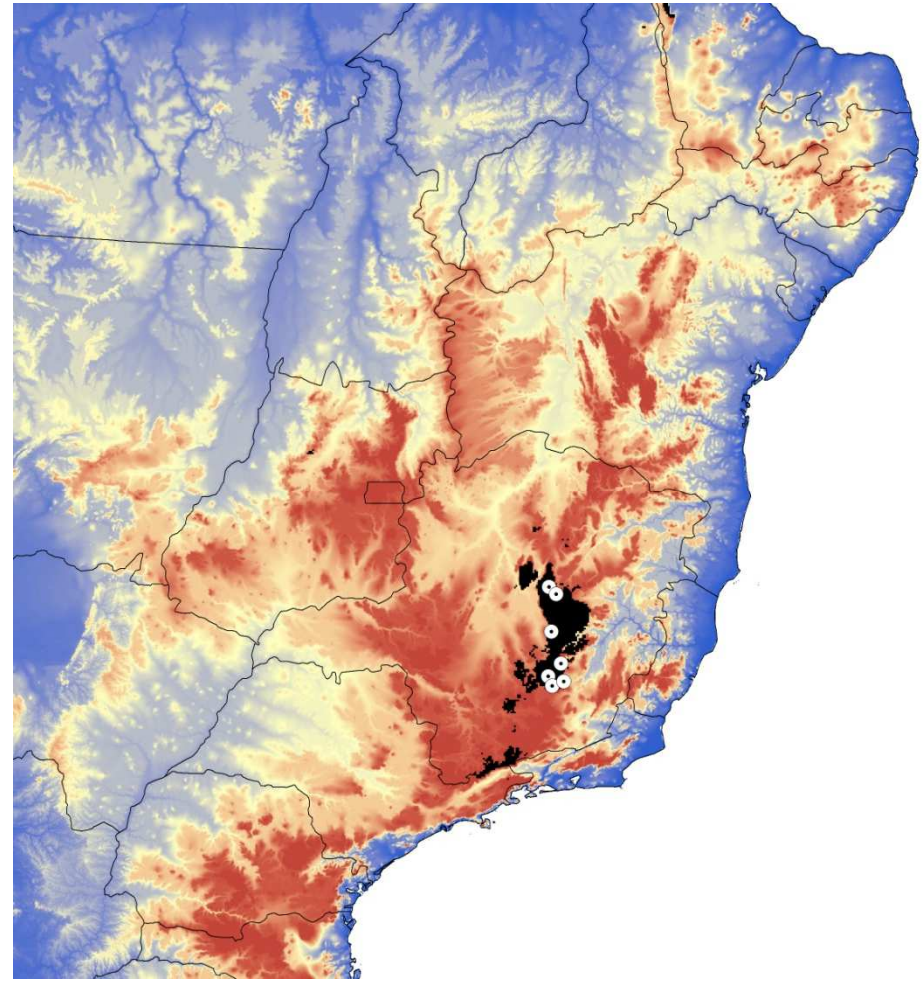
Data versus knowledge in conservation status decisions: "Data Deficient" Brazilian Plant Species



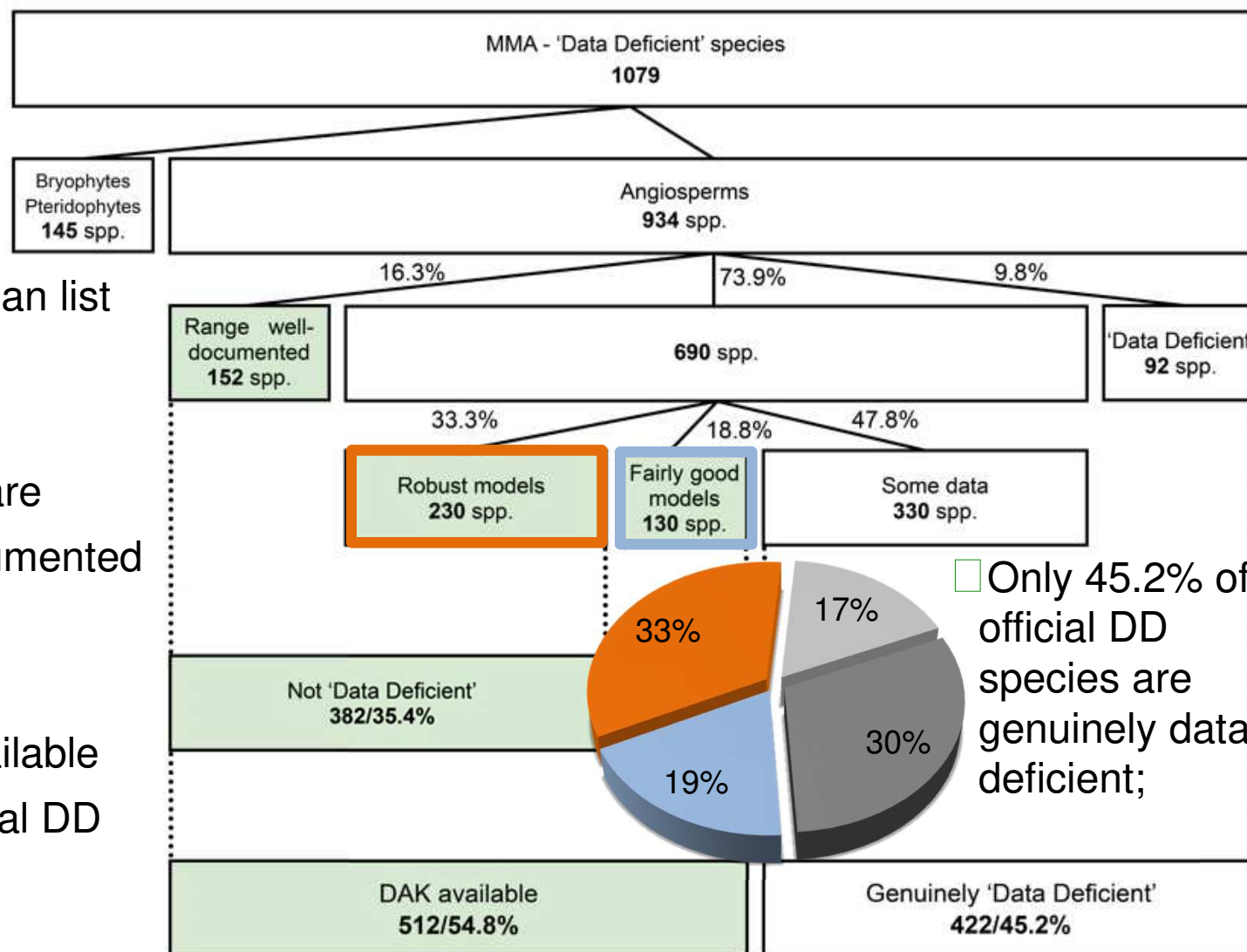
Good models $N > 5$ **or** $C < 0.8$



Bactris pickelli



Dickya rariflora



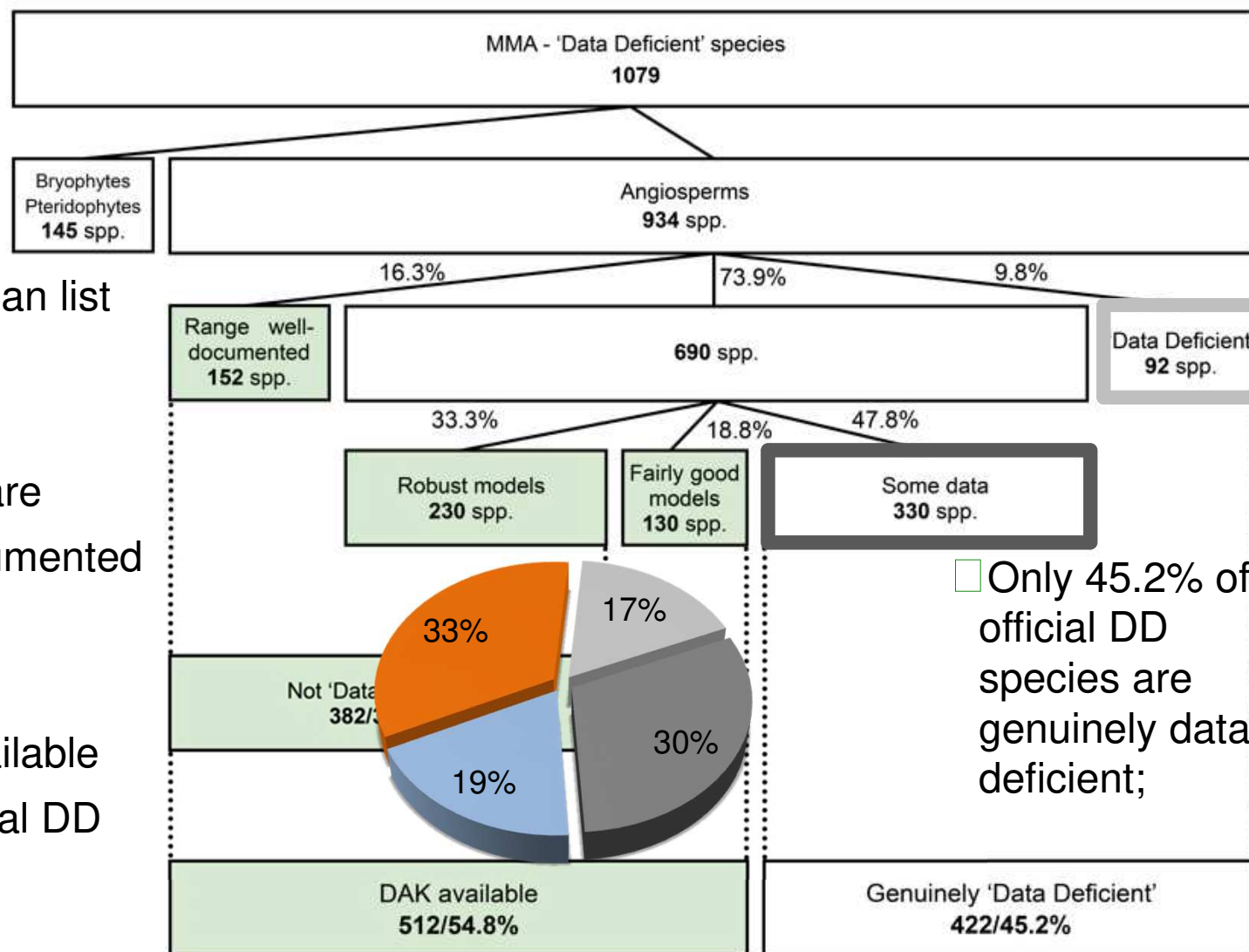
□ The official Brazilian list includes 934 DD

□ 152 DD species are actually well-documented

□ Digital Accessible Knowledge is available for 54.8% of official DD species;

□ Only 45.2% of official DD species are genuinely data deficient;

□ Truly data deficient species have not yet seen formal taxonomic description.



- The official Brazilian list includes 934 DD
- 152 DD species are actually well-documented
- Digital Accessible Knowledge is available for 54.8% of official DD species;

Only 45.2% of official DD species are genuinely data deficient;

Truly data deficient species have not yet seen formal taxonomic description.

ACKNOWLEDGEMENTS



A. Townsend Peterson



Leticia Garcia



Dora Canhos



Sidnei de Souza



Thank you!!

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