

How well do we preserve agricultural biodiversity?: Gap analysis and the *Phaseolus* case study

Julian Ramirez¹, Andy Jarvis^{1,3}, Daniel G. Debouck², Colin Khoury⁴, Luigi Guarino⁴, Nora Castañeda¹

¹ Decision and Policy Analysis program, International Center for Tropical Agriculture (CIAT), Cali, Colombia

² Genetic Resources Unit, International Center for Tropical Agriculture (CIAT), Cali, Colombia

³ Challenge Program on Climate Change, Agriculture and Food Security, CCAFS

⁴ Global Crop Diversity Trust, Rome, Italy

Plant genetic resources (PGR) provide traits to better manage and improve cropping systems, their natural environment and associated human livelihoods. However, habitat destruction, invasive species, climate change and the shift to modern agricultural practices among other causes, threaten genetic resources, and so their further conservation is of great urgency.

Gap analysis refers to a **systematic method of analyzing the degree of conservation of taxa** to identify those locations, taxa, and particular traits with deficient conservation status.

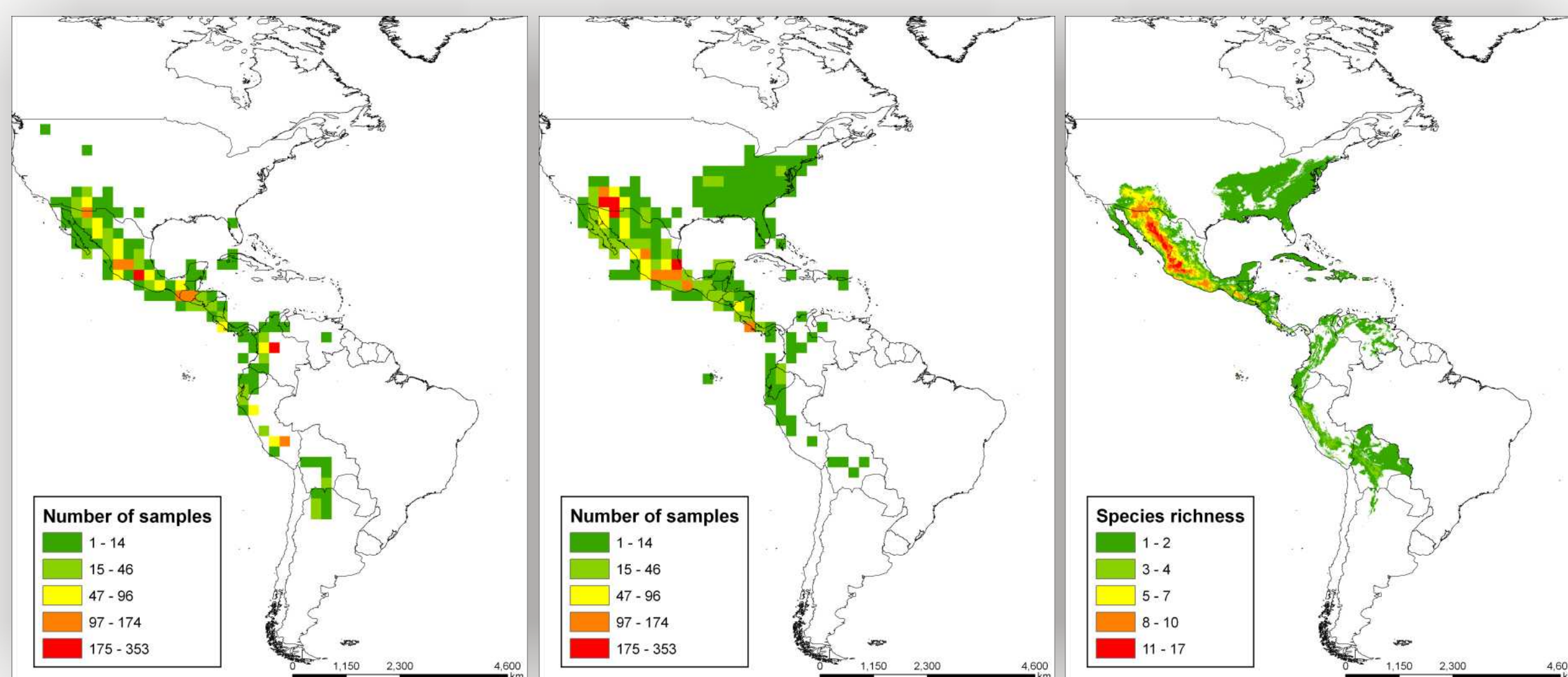
We have created a method for prioritizing plant populations and geographic areas where collections for those populations should be targeted. The method compares the number of herbarium records, genebank accessions and the potential distributions of species to finally obtain a list of high priority taxa and map out geographic areas to target future collections such taxa populations.

The method consists of **9 simple steps: (1)** Target taxa determination and data harvesting, **(2)** target area determination,

(3) data availability assessment, **(4)** sampling deficiencies at species level, **(5)** geographic coverage assessment, **(6)** environmental gaps assessment, **(7)** rarity of species assessment, **(8)** final numeric assessment of species, and **(9)** prioritization of geographic areas for collecting germplasm.

We applied the method to **wild Phaseolus** and compared our results with the most up to date knowledge on wild *Phaseolus* taxa (provided by Daniel G. Debouck, head of the Genetic Resources Unit at CIAT).

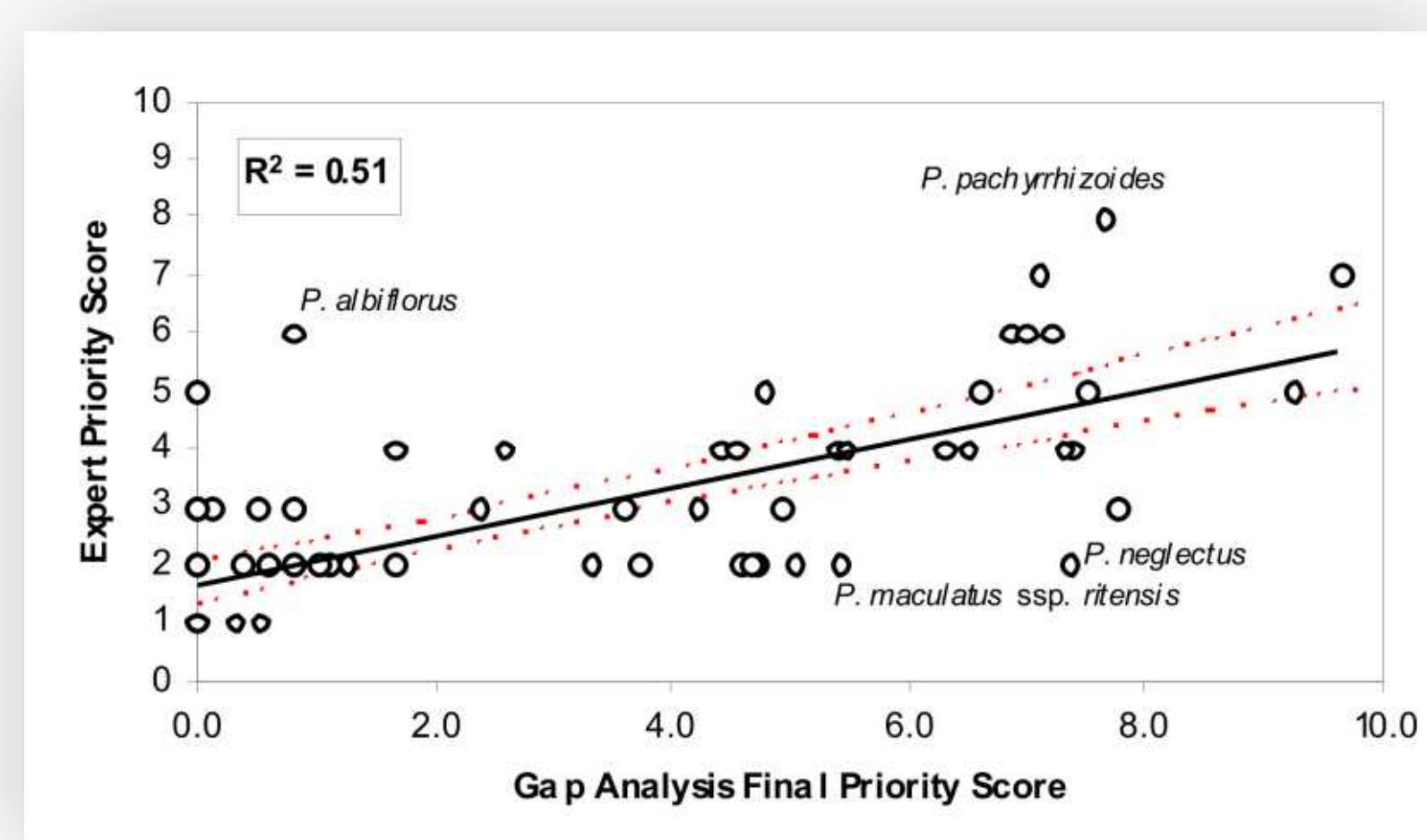
Potential collection richness for the 61 wild *Phaseolus* taxa found as **high priority taxa**. Reddish areas are those where the greatest number of species populations require ex situ conservation.



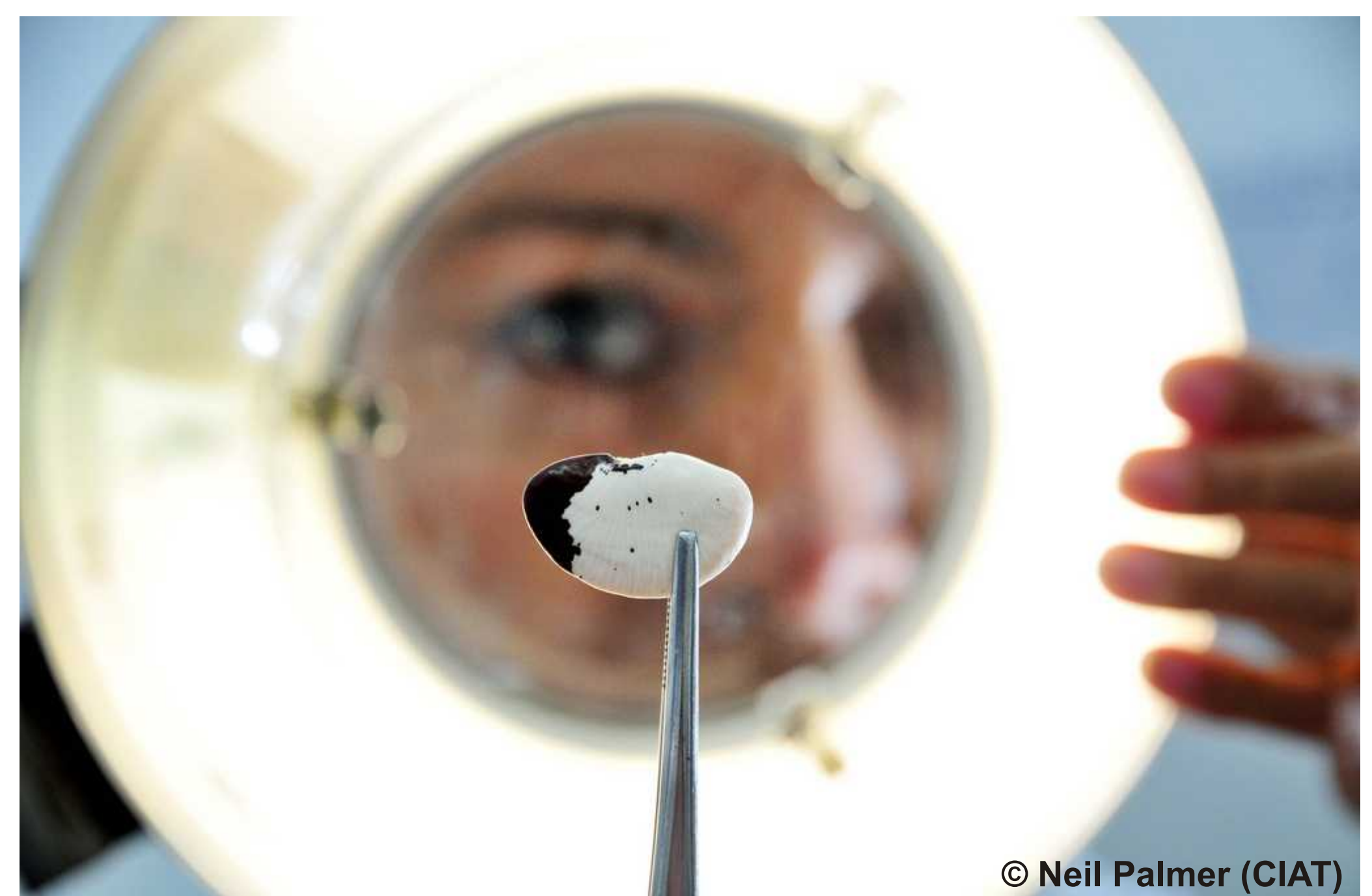
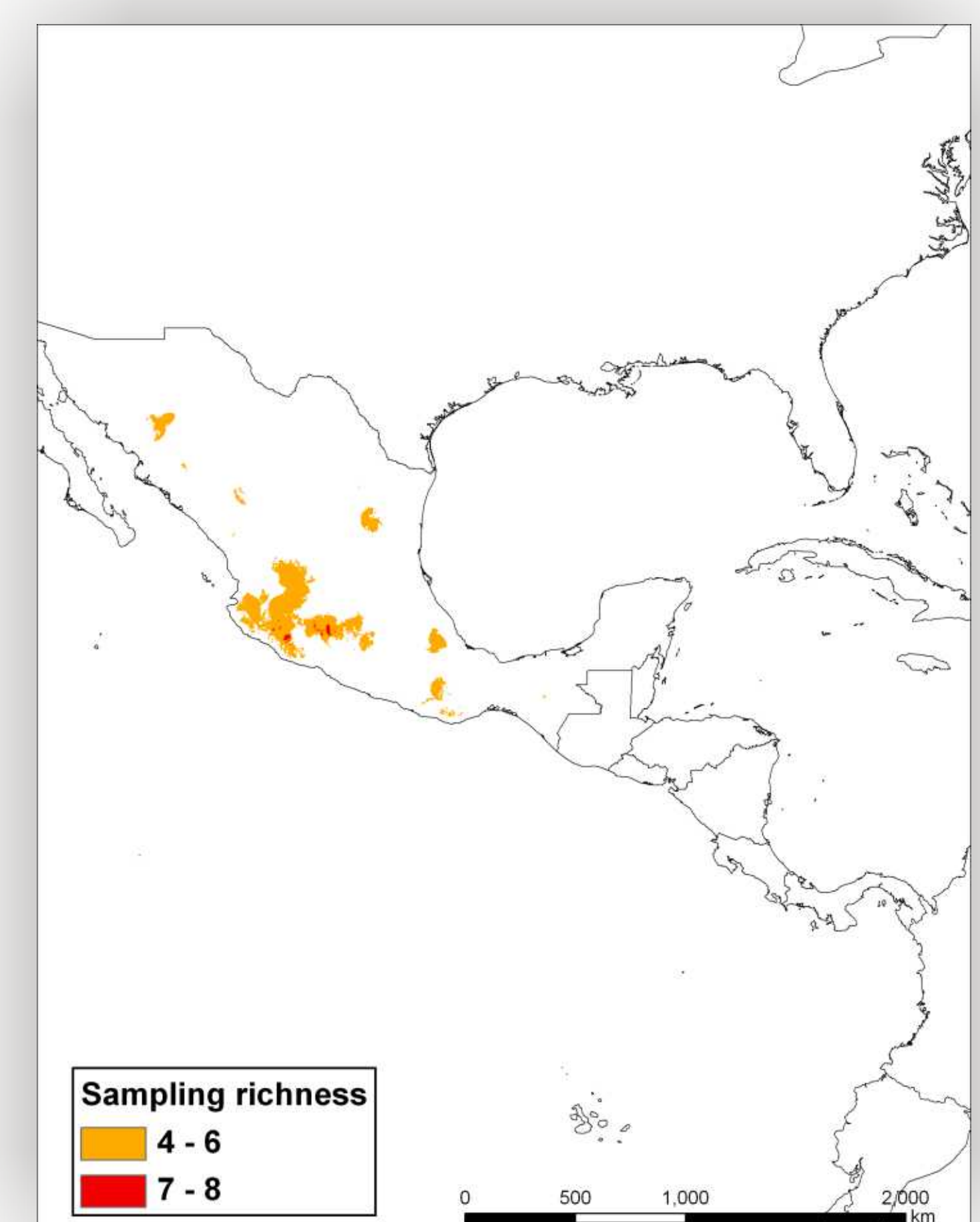
Number of genebank accessions per 200km side cell (left), number of herbarium specimens per 200km side cell (center) and potential species richness as modeled via a maximum entropy approach.

Our results indicated that 71.8% of the 85 taxa analyzed require urgent conservation actions, which is confirmed by expert opinion. Priority areas were found to be concentrated in central Mexico, although some additional isolated areas were also found. Among those taxa, we found several species known to hold important traits for improvement of domesticated species (i.e. common, lima, tepary, runner, and year bean).

Multi-genepool results may be useful for a **global assessment of gaps** in *ex situ* collections of important food crops.



Comparison between the Expert Priority Score and the Gap Analysis Approach Priority Score. A strong relationship was found between both scores, with most of the taxa falling within 95% confidence intervals (dotted red lines).



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