Diversity of Neglected and Underutilized Plant Species (NUS) in Perspective

A review of questions, tools, concepts and methodologies in preparation of Programme Sud Expert Plantes Développement Durable (SEPDD)

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What are Plant NUS?

- Also called '**Orphan Crops**', species and varieties of importance for the rural communities but to which little or no attention is paid by agricultural researchers, plant breeders and policymakers.
- NUS are **not traded** as commodities.
- Wild or semi-domesticated varieties and non-timber forest species adapted to particular, often quite local, environments.
- The lack of a consensual definition of NUS has been a major curb to their international recognition as a valuable component of agrobiodiversity

Why are Plant NUS important?

- NUS are '*promising crops*' offering tremendous opportunities **for fighting poverty, hunger and malnutrition**
- Resources to help make agricultural production systems more resilient to **climate change.**
- Value of NUS in traditional foods and cultures must be recognized to empower local communities (women in particular) and reaffirm their identity
- Important role in advancing agroecological intensification
- Many NUS are being lost at an alarming rate with a wealth of traditional knowledge about their cultivation and use

An Atlas of NUS Hotspots – a resource needed for *in situ* conservation strategies

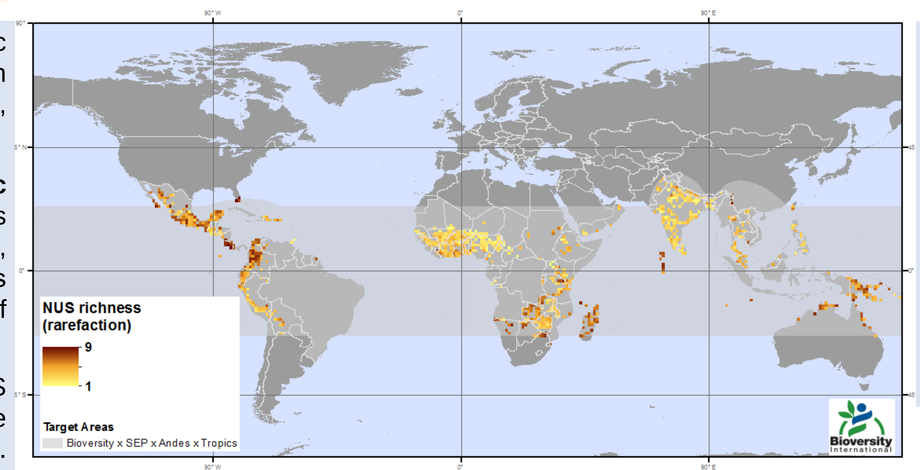
Identification of geographical areas of special interest, called '**NUS hotspots**', in the inter-tropical zone, at the intersection between SEP and Bioversity priority research areas to identify possible synergies or complementarities in data collect and analysis, avoiding duplication of research efforts.
A GIS-based approach that uses available georeferenced data from genebanks, herbarium and collectors to identify species-rich areas. Specific aims of this work are to

- ✧draw **a provisional list of priority NUS species** for the inter-tropical zone where SEP partners are located;
- ✧identify the essential criteria for the identification of hotspots of NUS-diversity and compile baseline maps of priority areas and observation sites;
- ✧draft methodological guidelines for fine-tuning Bioversity's agrobiodiversity strategy and research activities within the framework of SEPDD.

a. Compilation of a base list of NUS : Taxonomic cleaning using existing taxonomic reconciliation tools (GBIF ECAT, TNRS, TNC-GRIN, IT IS, IPNI, WCSP 2012)

b. Data extraction from biogeographic geoportals - The clean list, totaling 1125 taxa, was used to extract species occurrence data from GBIF, SINGER, GRIN, EURISCO, and from Bioversity's Collection Mission Database, yielding a total of **about 1.1 million records**

c. Georectification - Data were analyzed in ArcGIS and the list narrowed down to the inter-tropical zone by excluding records falling outside target areas. Entries with missing or imprecise geographic coordinates were excluded.

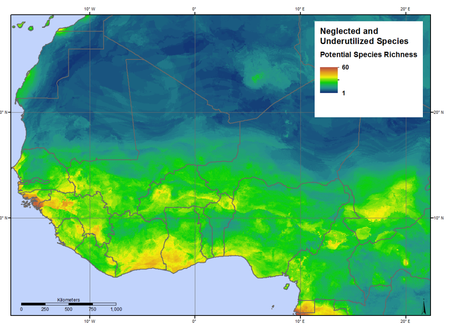


The final dataset used for the Atlas consisted of **85,511 records,** altogether representing **590 species distributed in 107 families**

d. Modeling and mapping the potential distribution of NUS - Potential distribution models for were generated using the maximum entropy (MAXENT) algorithm applied to 19 bioclimatic variables (WorldClim) with a resolution of 2.5 minutes and a "10 percentile training presence" threshold.
The potential richness of NUS was calculated in ArcGIS 10.1, summing the presence/absence raster of the potential distribution (ecological niche) layers of each single species

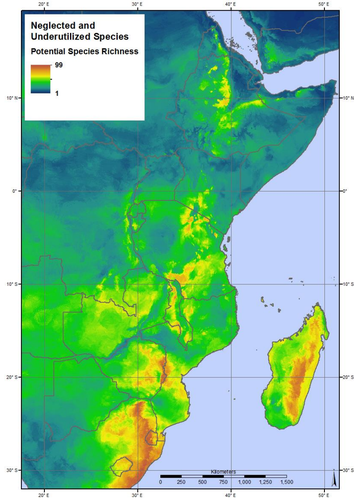
West Africa

NUS diversity appears to be concentrated mostly in Côte d'Ivoire, Ghana, Togo and Benin. Much diversity seems also to be concentrated in Cameroon and the Republic of Central Africa. West Africa had been defined a 'non-center' of crop diversity and the cradle of domestication of several African crops, e.g. *Pennisetum glaucum, Digitaria exilis*.



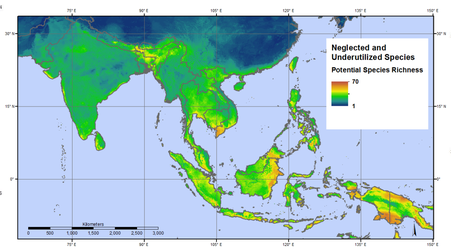
East Africa

NUS appear to be mostly concentrated in Madagascar, on the coast of South Africa, and on the border between Mozambique and Zimbabwe. East African coastal systems, where diversity of NUS and CWR seems particularly high, are listed as potential "hotspots of vulnerability" to climate change.



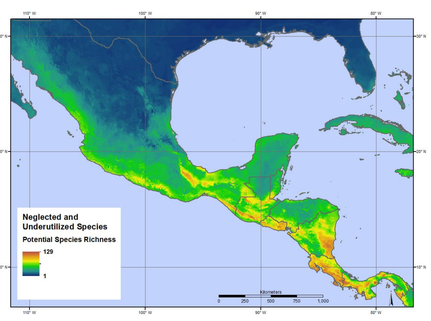
Tropical Asia

NUS appear to be concentrated in highly localized areas, i.e., the west part of Manipur (India), the southern tip of Vietnam, the eastern part of Borneo (eastern Kalimantan in Indonesia and Sabah in Malaysia), and the northern and southern coastal regions of New Guinea (Irian Jaya in Indonesia and Papua New Guinea).



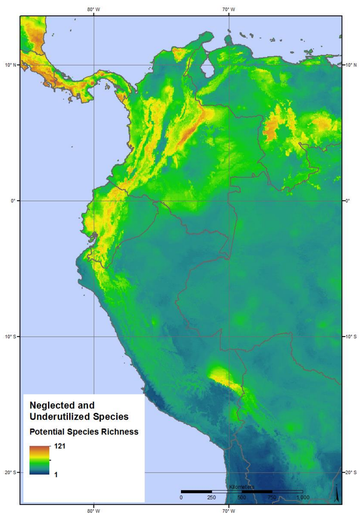
Meso-America

It is the center of origin for more than 200 crop plants and shows high levels of genetic diversity in a number of economically important genera like *Agave, Amaranthus, Annona, Capsicum, Carica, Cucurbita, Lycopersicon, Pachyrhizus, Persea, Phaseolus, Pouteria, Solanum,* and *Zea*. NUS diversity appears to be higher in Guatemala, El Salvador, Costa Rica and Panama.



The Andes

NUS diversity is concentrated at mid-elevations (above 1500m), on the fringes of the Amazonian forest in Ecuador (sierra), in Peru (highlands), and in Bolivia (yungas and puna).
In Colombia and Ecuador, the potentially richest areas for NUS overlapped with the most densely populated areas.



Collaboration with GBIF and SEPDD for NUS data enhancement

- ❑ There is an urgent need for assessing **world patterns of distribution of NUS and identifying 'hotspots',** areas where NUS experience exceptional loss of habitat or are at higher risk of losing habitat as a result of global change.
- ❑ This preliminary work permits to build upon the dataset produced and identify gaps in genebank and herbaria collections with regard to NUS in order to propose adapted research actions and conservation plans.
- ❑ Collecting more georeferenced data, mapping the occurrences of NUS to refine the Atlas is a key activity for the development of a Global monitoring system on in situ conservation and on farm management of Plant Genetic Resources.

Bioversity International is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

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