



Good practices in using genetic resources in ecosystem restoration

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Ecological Restoration

The scale of on-going and planned restoration projects is enormous

- Aichi 15 ~ **300 Mha** by 2020
- Bonn challenge **150 Mha** by 2020
- Initiative 20x20 **20 Mha** by 2020 in Latin America and the Caribbean
- Vision 25x25: **25 Mha** by 2025 in Africa small holder farmers land
- Countries level initiatives (e.g. Benin: 1 tree / inhabitant = 10 Millions trees)

Huge ecological, social and economic opportunities:

Contributes to objectives of 3 Rio conventions: biodiversity conservation, combating desertification, climate change mitigation and adaptation

+ ecosystem services, income generation...

Risks of failure



- Initial mortality
- Poor growth
- Delayed mortality or after extreme climate events (eg. Plantation of 30.000ha of *Pinus pinaster* in France with non-frost resistant germplasm from Spain destroyed in winter 84/85)
- Reduction in quantity and quality of seeds in established tree stands, compromising viability

How to reduce the risks of failures



- Appropriate **species choices**
- **Genetic principles** in selection of planting material
- Good silvicultural practices

Genetic diversity is the foundation for:

Survival of trees on the restoration site

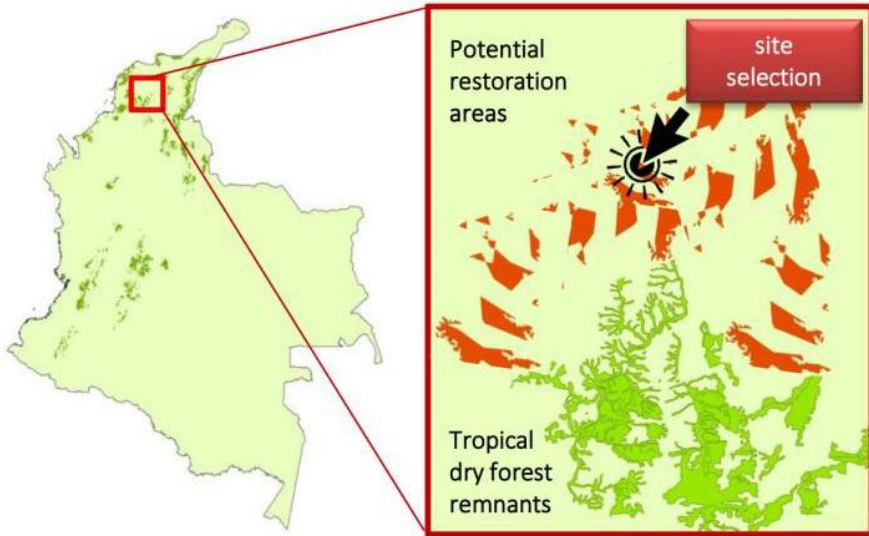
- Origin of seed must match site conditions to ensure **adaptedness**

Promoting good growth, reproduction and resilience over generations

- Seed sources must be genetically diverse enough to avoid **inbreeding** and to contain sufficient genetic building blocks for natural selection

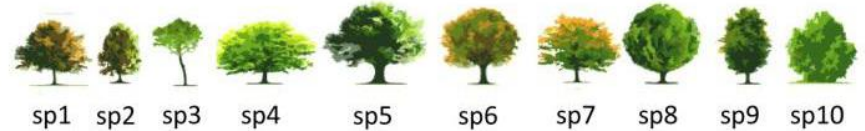
A model for guiding restoration practice

1 Suitability modeling to assess species' adaptive potential under current and future climate conditions



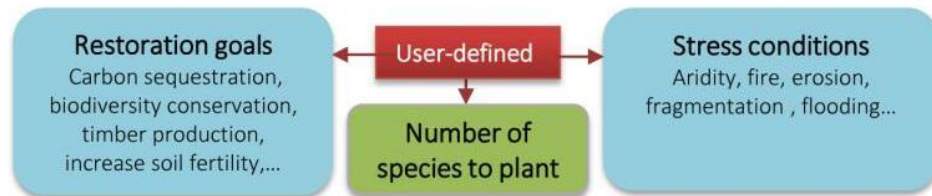
2 Functional and other traits for selection of tree species that are best-matched to restoration goals and site-specific stress conditions

2.1. A list of all possible tree species with known propagation protocols and habitat suitability under current and future climate for any given area



2.2. Different options of species combinations:

- prioritize species with traits that correspond best with restoration objectives and have adaptive potential to stress conditions at planting sites
- optimize functional diversity of other traits to maximize niche complementarity.

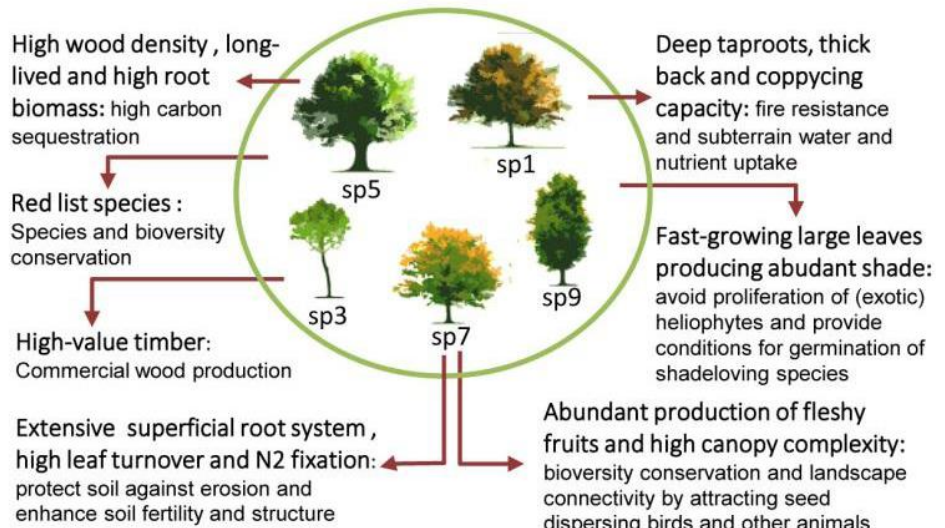
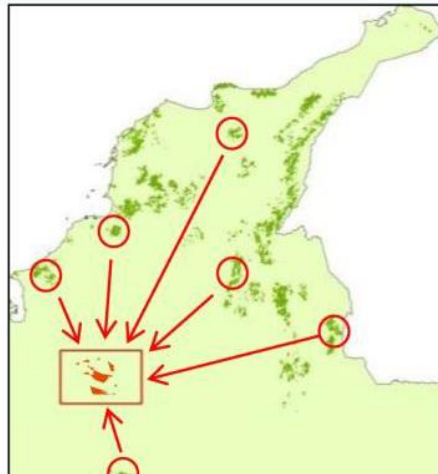


3 Ensuring the genetic quality of planting material and recommendation on best practices for collecting seeds

3.1. Promote site adaptability of planting material, particularly in light of climate change

3.2. Ensure genetic diversity: of planting material: source populations should be large, and seeds should be obtained from a high number of (>30-60) mother trees

3.3. Seed provision: List of seed providers (small-scale farmers, private land owners, indigenous and local communities, protected areas...)



COLOMBIA

1

Which degraded areas are suitable for restoration of TDF ?



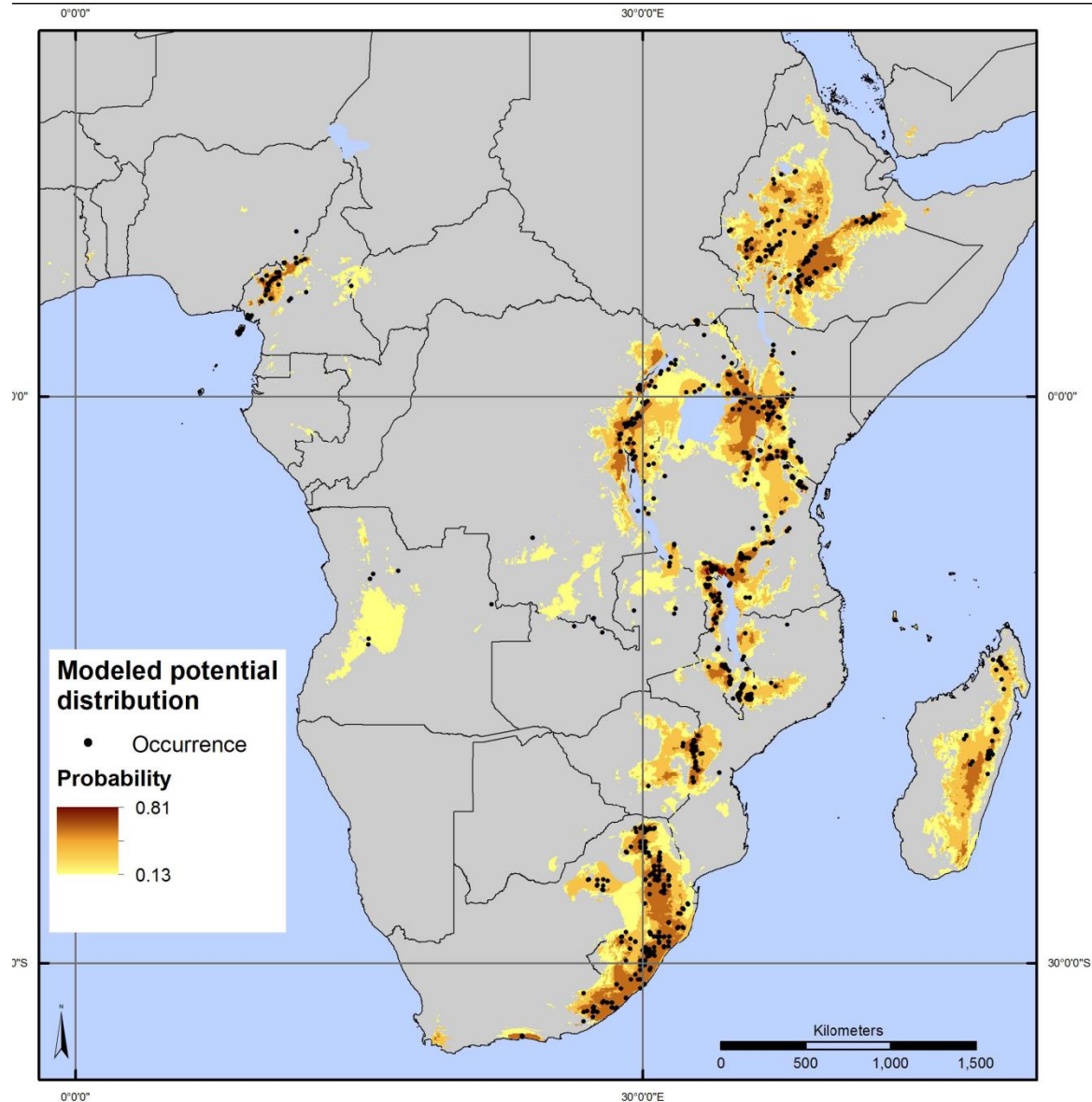
Base map: Current distribution TDF + potential areas for TDF restoration

Potential areas for restoration



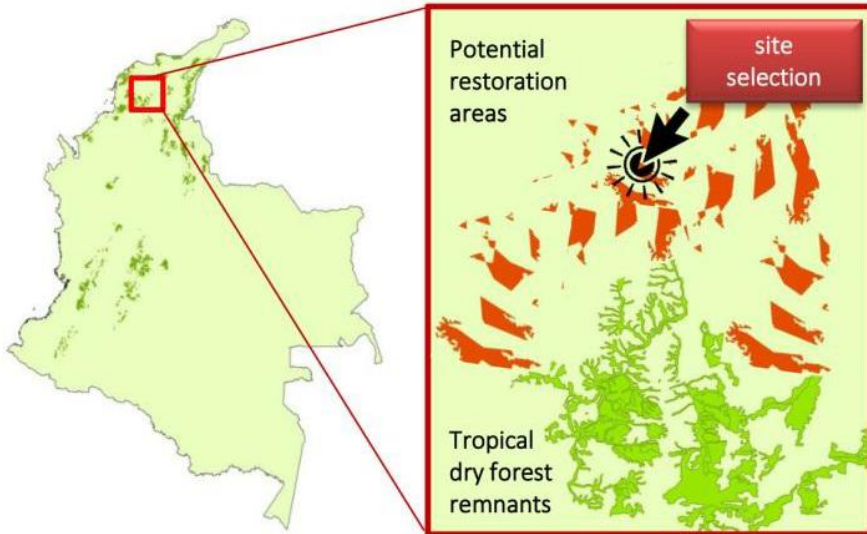
Relicts of TDF

Prunus africana



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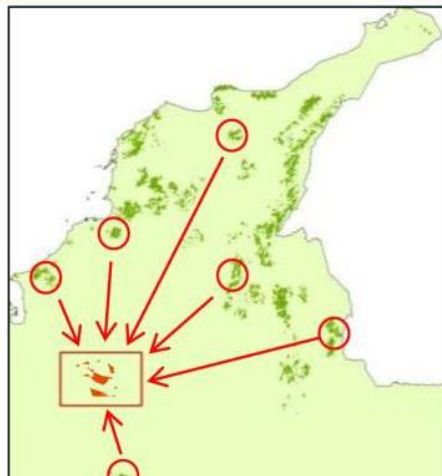


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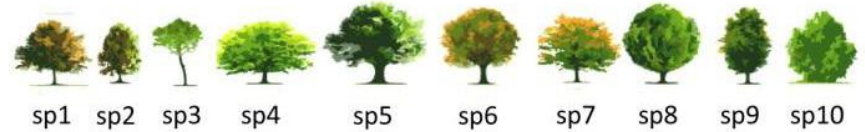
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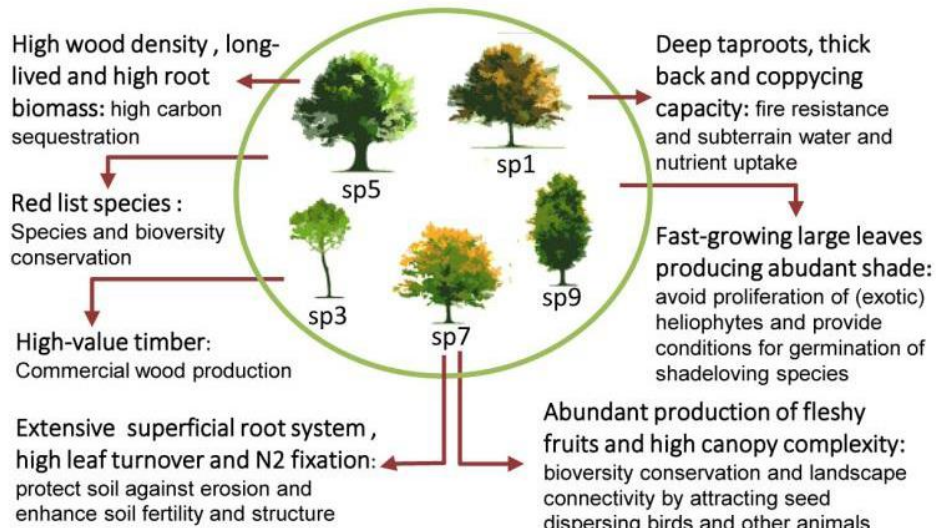
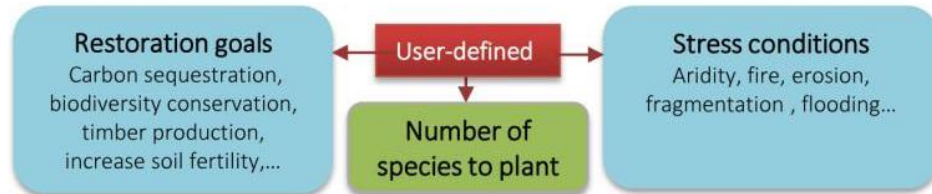
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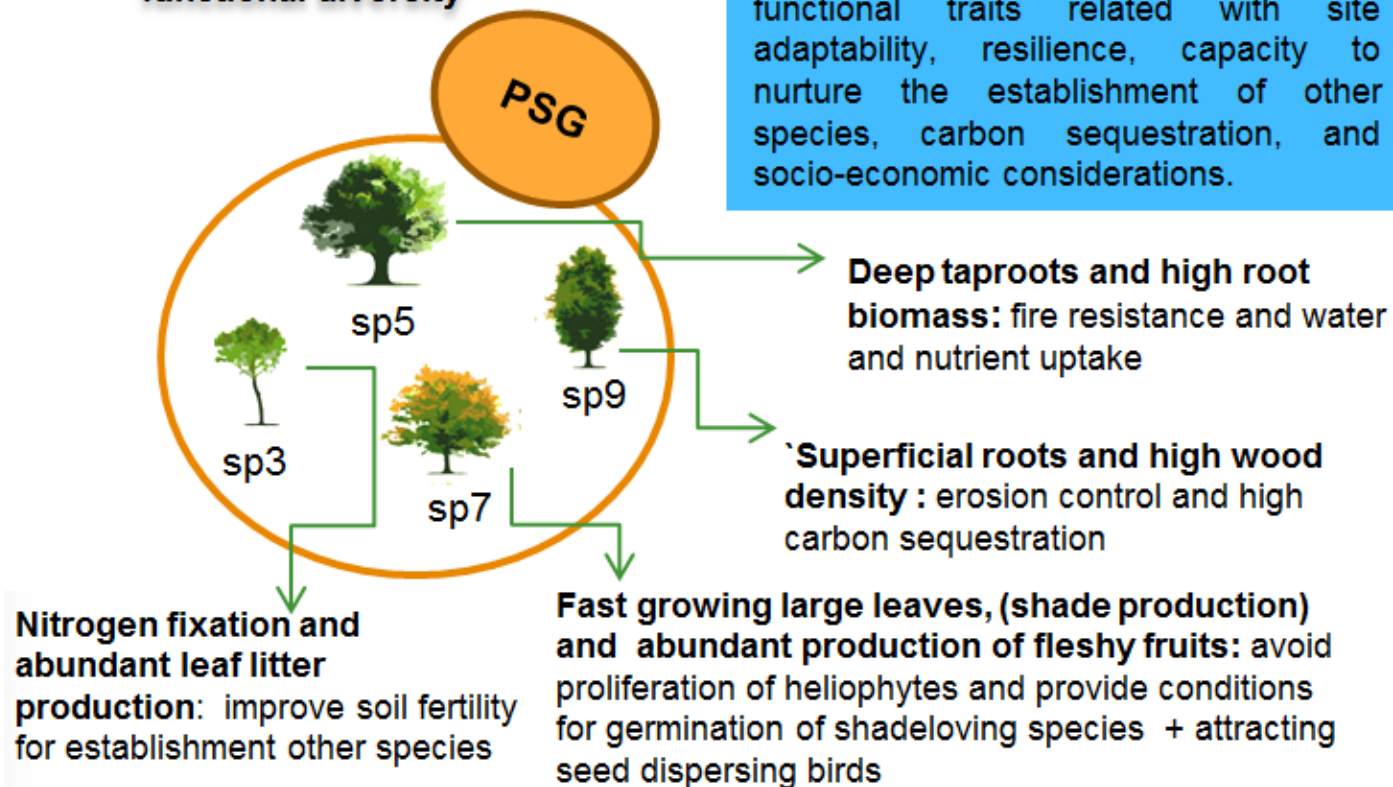
2

What species or groups of species are most recommendable for restoration objectives in each area ?

- a. A list of all possible species with known propagation protocols and habitat suitability, now and in the future

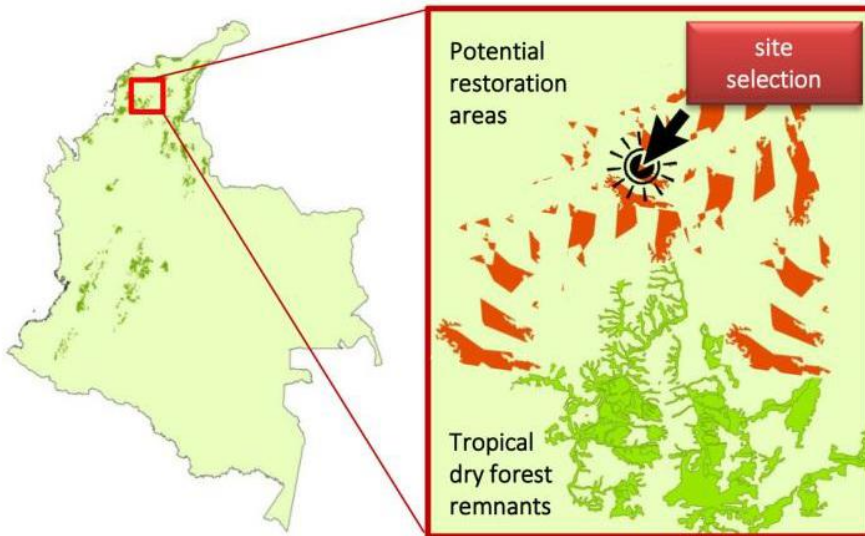


- b. Different options of species combinations that maximize functional diversity



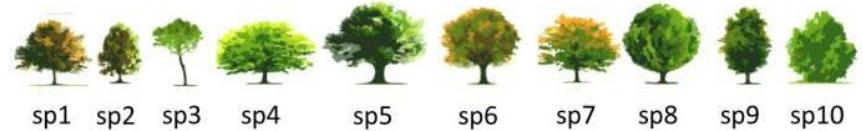
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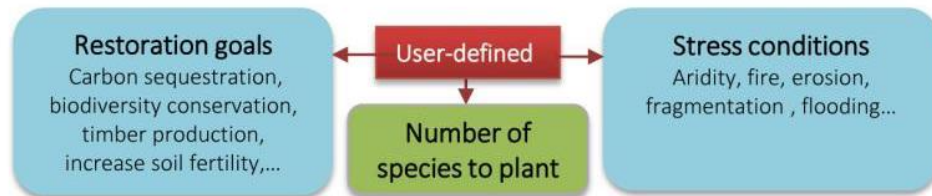
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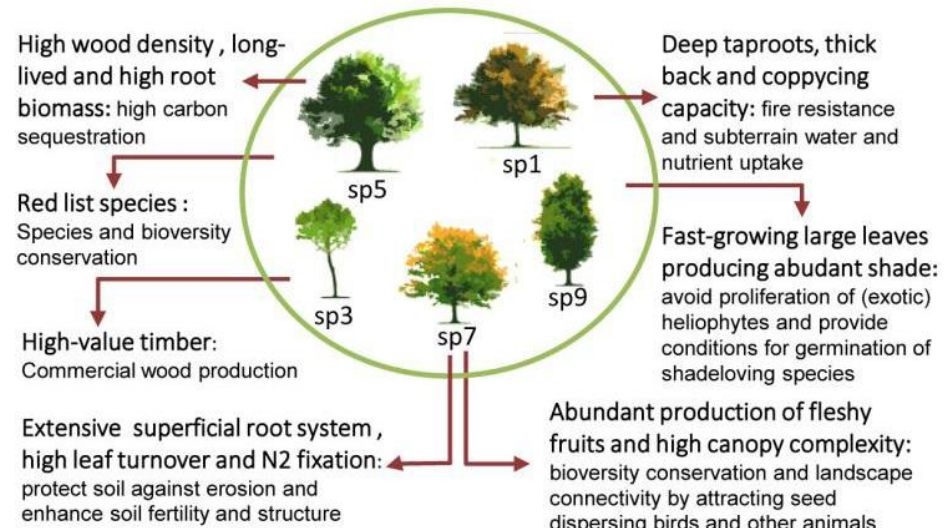
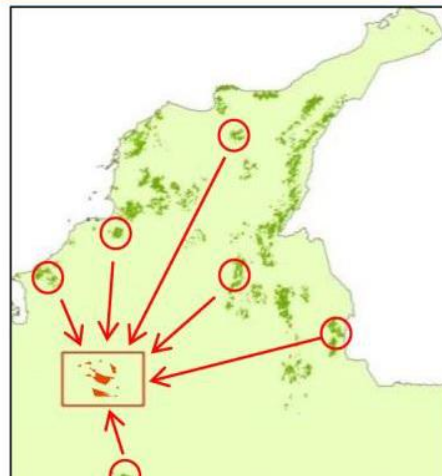


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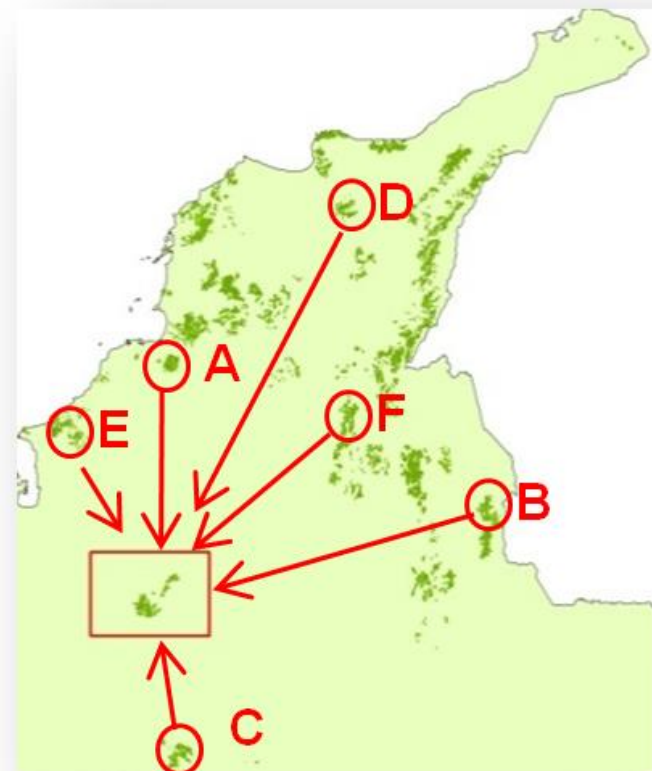
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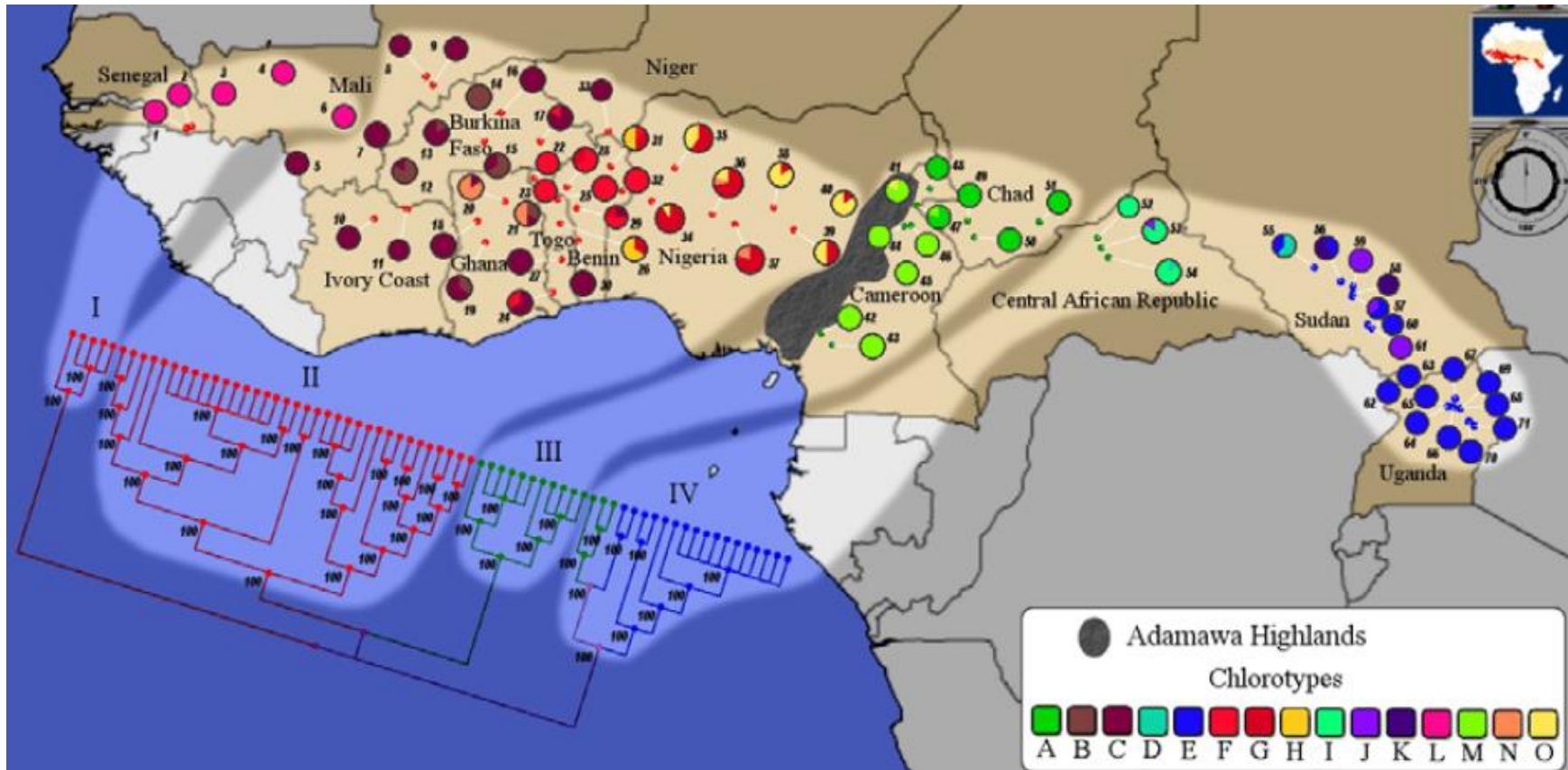
What is the most appropriate combination of seed sources for each of the species, ensuring site adaptability and genetic diversity of planting material? + Recommendations on best practices to collect seeds

sp3	40%	20%	40%
Forest	A,E	B, D	C
sp5	10%	50%	40%
Forest	A,F	B,D	C,E



Vitellaria paradoxa

Phylogeography and demographic history



Allal et al. Heredity (2011)

Concluding remarks

- Aichi Target 15: quantitative but also qualitative
- One of the decisions of 12th COP of the CBD:
*“[...] Invites Parties and other Governments, intergovernmental organizations and other relevant organizations [...] to **give due attention to both native species and genetic diversity in conservation and restoration activities**, while avoiding the introduction and preventing the spread of invasive alien species”*



Concluding remarks



- Need for political commitment: create demand for good quality seeds of native species through regulatory frameworks and resource allocation
- Decision making by restoration practitioners needs to be knowledge-based: guidelines and protocols have to be available in useful format
- Apply adaptive management: learn from mistakes and failures and continuously integrate new knowledge

Concluding remarks

- Landscape approach to promote connectivity (gene flow and species migration)
- Evaluate effectiveness of different methods to establish viable ecosystems and restore genetic diversity: adequate indicators and monitoring protocols
- Great potential of restoration for contributing to conservation goals (endangered species, assisted migration, etc)

