ISTA ANNUAL MEETING
29 MAY-01 JUNE, 2023
VERONA, IT

Reconciling standards and biodiversity: the challenge for seed analysis

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LASEM
Laboratório de Sementes e Mudas Florestais
REMAS
REDE MATA ATLÂNTICA DE SEMENTES

Topics

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01

THE GLOBAL RESTORATION CHALLENGE

02

HOW TO PRODUCE DIVERSITY ON A LARGE SCALE ?

03

HOW TO INCORPORATE DIVERSITY INTO QUALITY STANDARDS AND SEED ANALYSIS?

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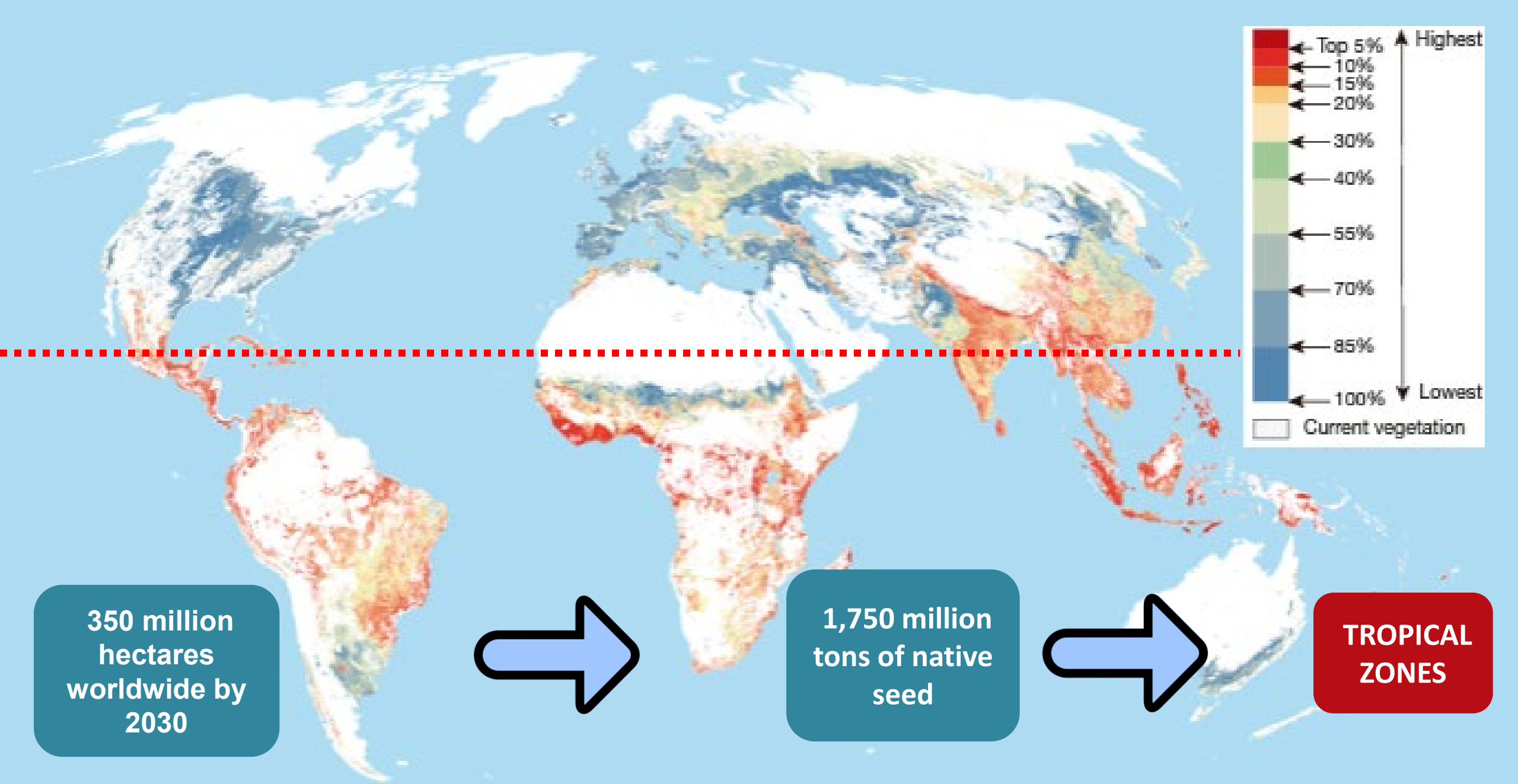
Diversity

≈ 60,000 to 100,000 tree species worldwide

Global Tree Assessment (2017) by the Botanic Gardens Conservation International (BGCI) and the International Union for Conservation of Nature (IUCN) Global Tree Specialist Group.



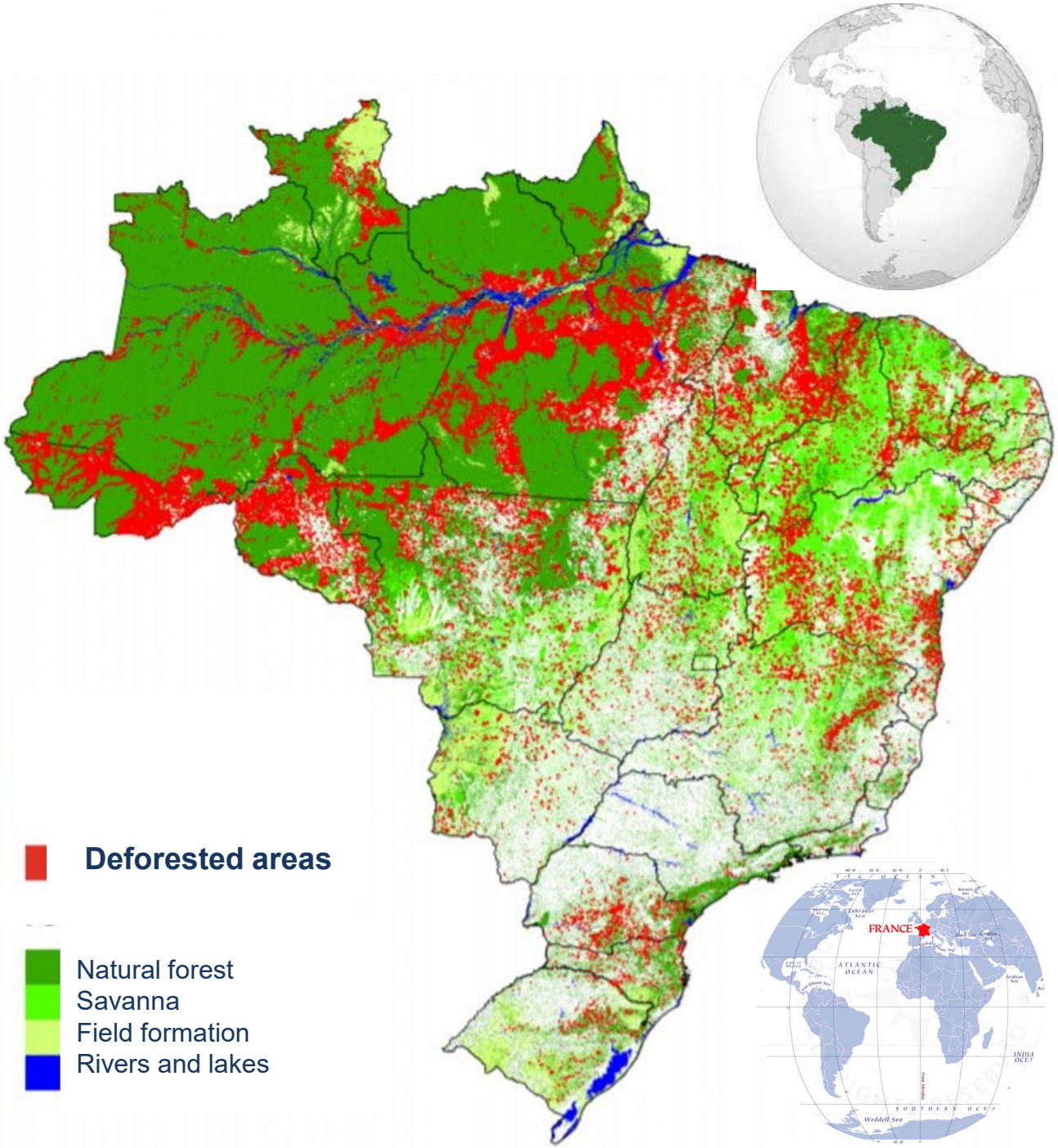
Strassburg *et al.* Global priority areas for ecosystem restoration. *Nature* 586, 724–729 (2020). https://doi.org/10.1038/s41586-020-2784-9
Pedrini et al. (2022). Seed quality and the true price of native seed for mine site restoration *Restoration Ecology* doi: 10.1111/rec.13638

BRAZIL: HOW MUCH DO WE HAVE TO RESTORE?

± 40% of **FRANCE!!!!!!!**

± 12.5 to 21 Million hectares!!!!

800,000
Trucks
Madrid, Spain - Moscow, Russia



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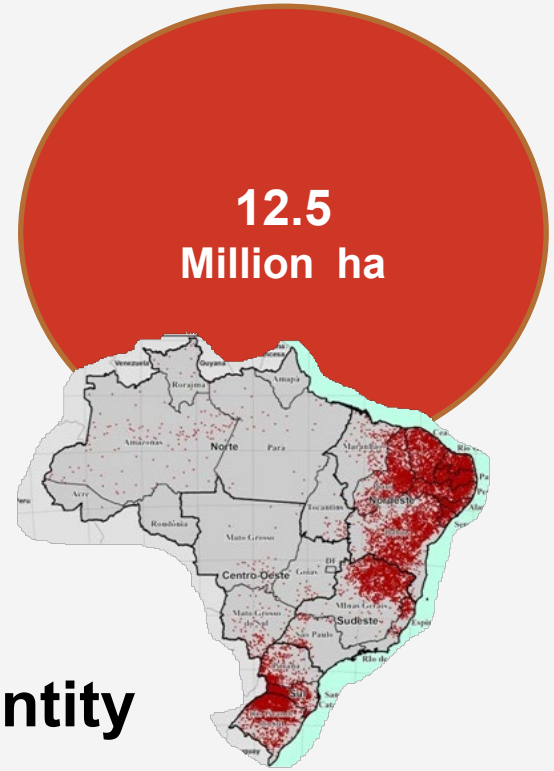
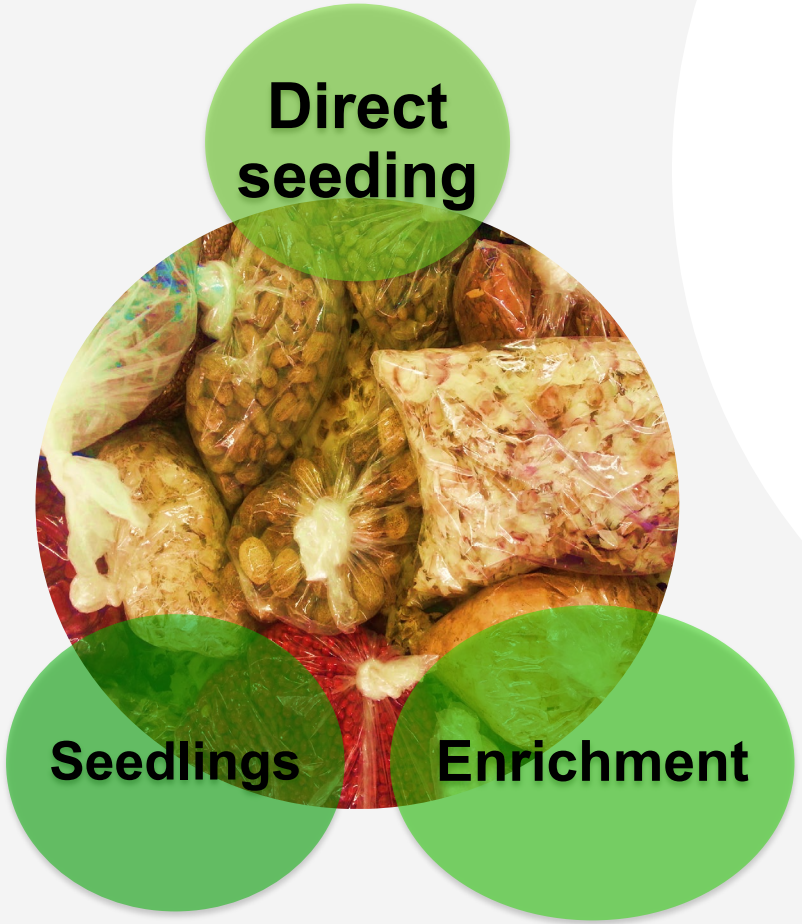
REMAS
REDE MATA ATLÂNTICA DE SEMENTES

1. Quantity





2. Quality

Low quality seed	15.6 million ton
High quality seed	3.6 million ton

Sources:
Soares-Filho (2013). *Science*
Freire, Urzedo; Freire & Piña-Rodrigues (2017). *Seed News.*
Urzedo, Piña-Rodrigues et al. (2020) Forests.

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Can we restore diversity?

XINGU seeds NETWORK 10 years

Instituto Socioambiental

THE UNIVERSITY OF SYDNEY

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SEEDLING

$$$
COST

687 to 977
species

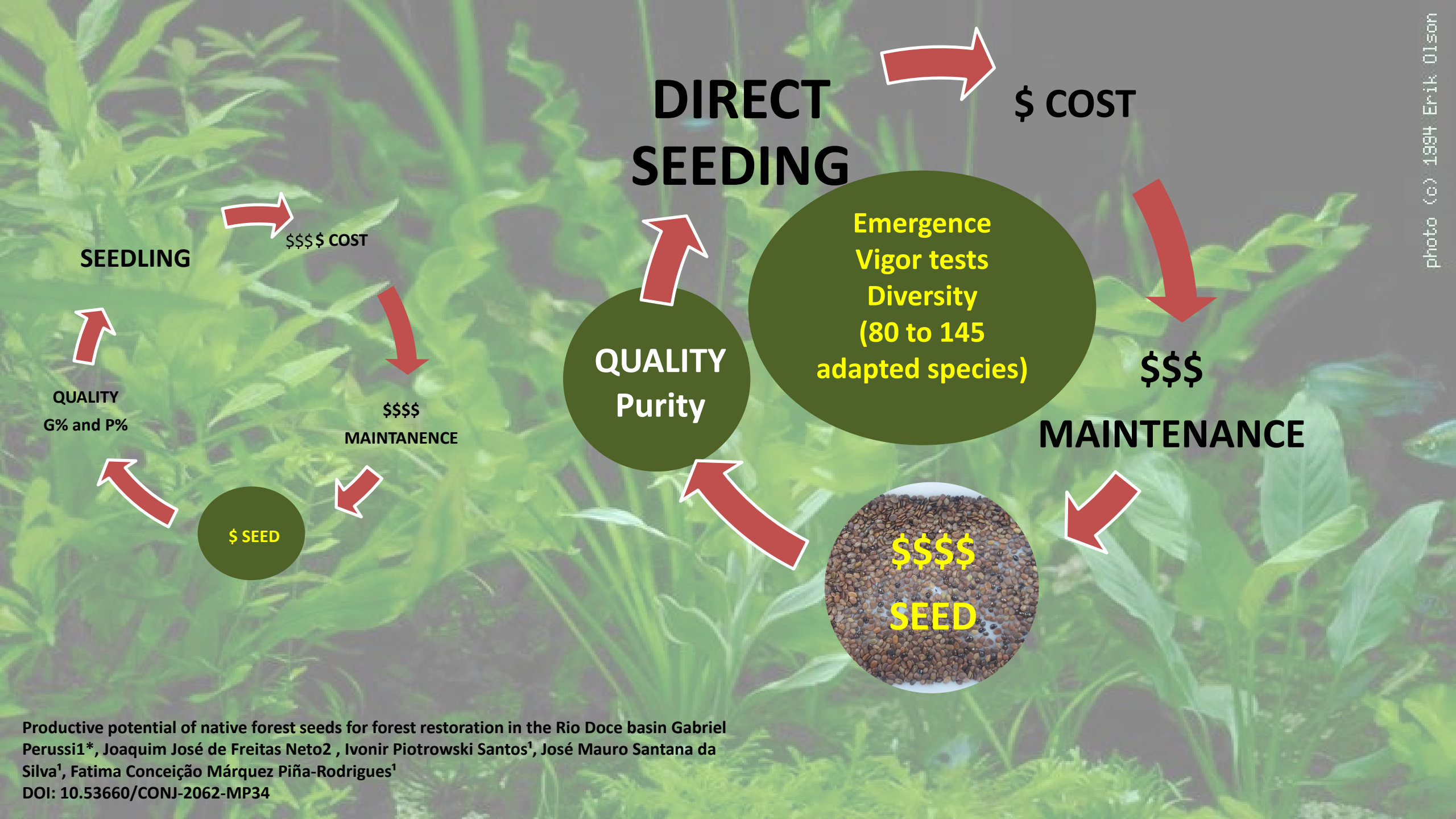
(15,000-20,000 sp)

$$$$
MAINTENANCE

$ SEED

QUALITY
G% and P%

Freire et al. (2022)
Embrapa



Productive potential of native forest seeds for forest restoration in the Rio Doce basin Gabriel Perussi1*, Joaquim José de Freitas Neto2 , Ivonir Piotrowski Santos[1], José Mauro Santana da Silva[1], Fatima Conceição Márquez Piña-Rodrigues[1]
DOI: 10.53660/CONJ-2062-MP34

Drone
Seeds-balls
Pellets
Encapsulation
Diversity

Seed vigor, purity tests and direct seeding techniques

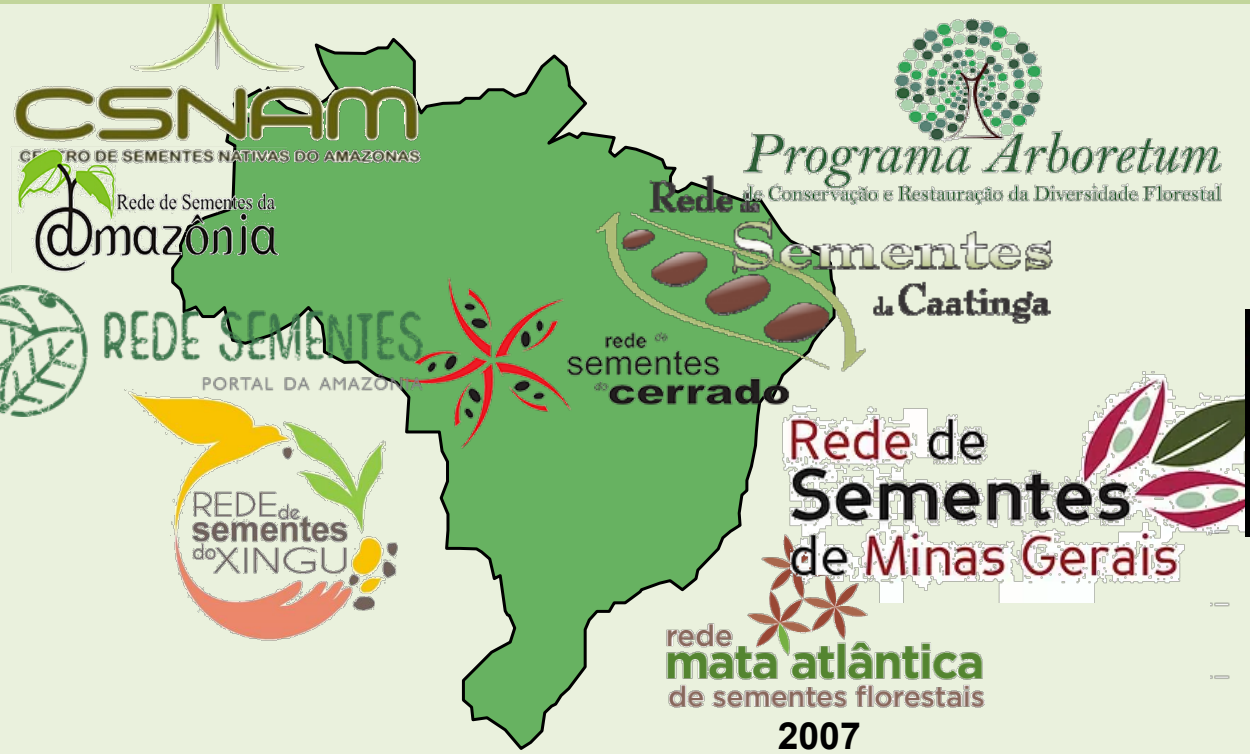
SEEDS FOR DIRECT SEEDING RESTORATION

250,000 seeds/ha

5 a 10% of field emergence (90-95% loss)

Community based Seed Networks (CBSN)

3rd to 5th generations- Production



10 to 100 ton.
4 to 5 years

REDE DE SEMENTES DO VALE DO RIBEIRA

REDE DE Sementes e Mudas da Bacia do Rio Doce

1999-2000

2003-2004

2007

2021

2nd generation Seed Network

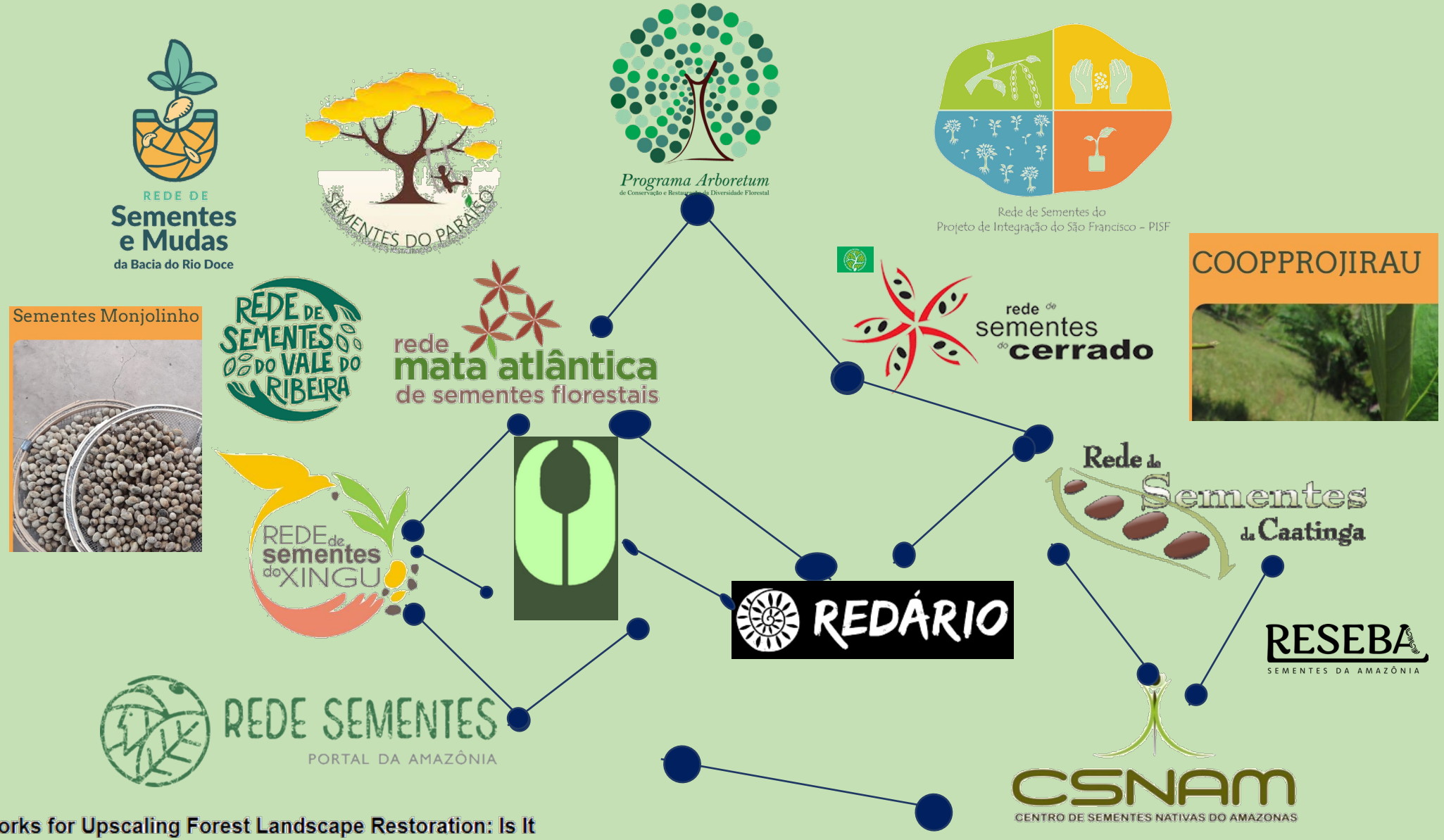
3 to 5th generation of Community based Networks

Seed Networks for Upscaling Forest Landscape Restoration: Is It Possible to Expand Native Plant Sources in Brazil?

by Danilo I. de Urzedo [1,*], Fatima C.M. Piña-Rodrigues [2], Rafael Feltran-Barbieri [3], Rodrigo G.P. Junqueira [4] and Robert Fisher [1,5]


SOCIAL
SEED
Matrices
Local
Regional
TERRITÓRIO INDÍGENA
5/29/2023

How to produce diversity in a large scale?



Seed Networks for Upscaling Forest Landscape Restoration: Is It Possible to Expand Native Plant Sources in Brazil?

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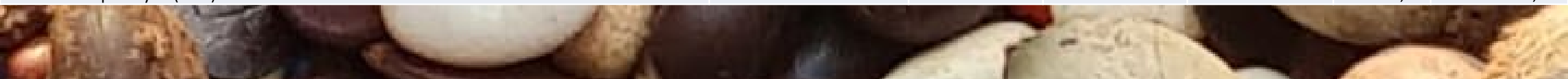
340 Species (CBSN)
11 Suppliers (39 collectors)
2014 a 2021

High variation within batches

Sampling?
Dormancy? Adaptation?
Small seeds
(> 800 seeds/kg)

Local diversity?
Diversity between and within populations or even between matrices?

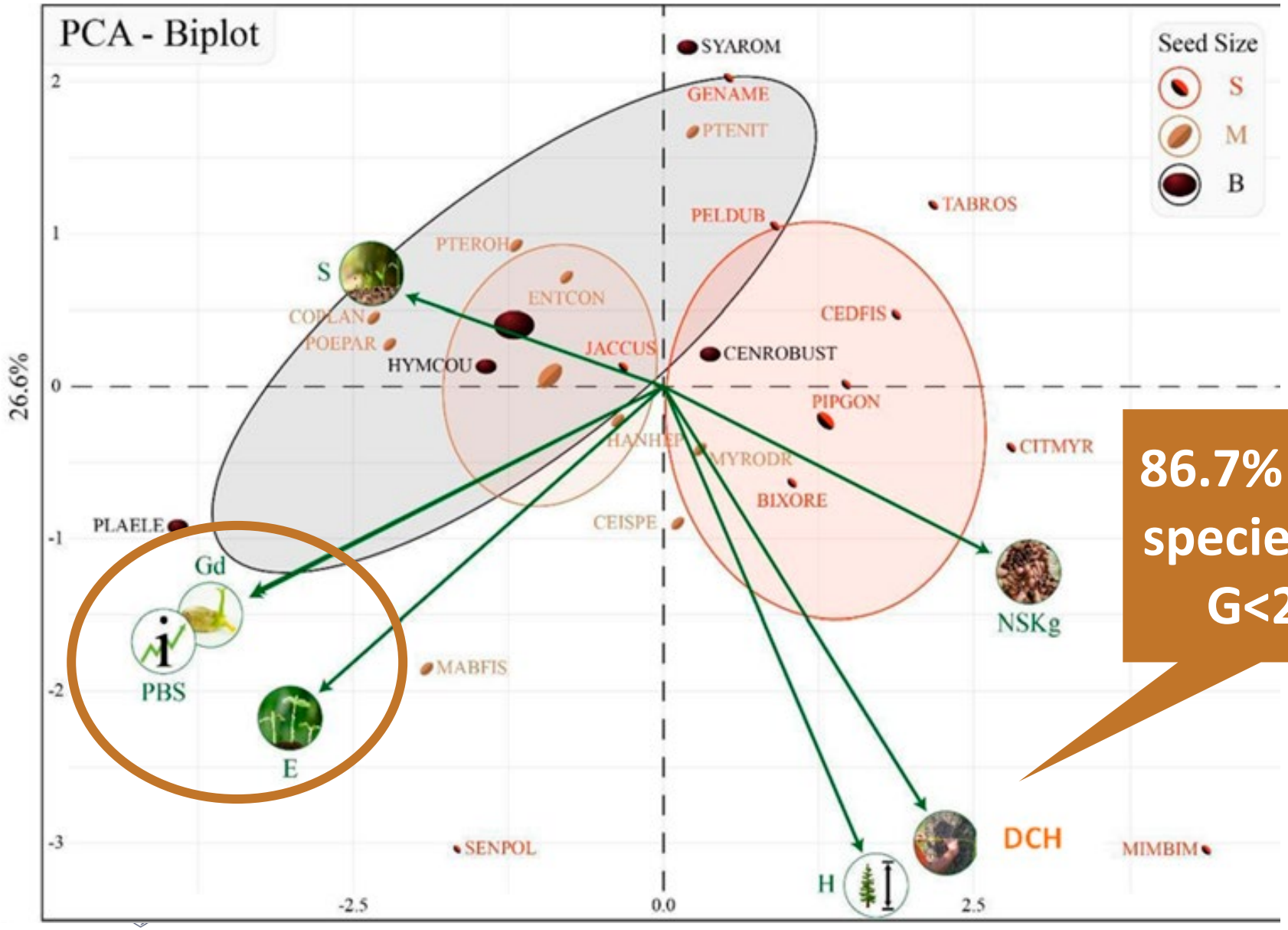
Scientific Name	Family	Supplier	Batches (n)	% Germination	St. deviation	Variance coeff. (%)
Albizia niopoides (Spruce ex Benth.) Burkart	Fabaceae	F1	3	41	38,9	94,1
Cecropia pachystachya Trécul	Cecropiaceae	F1	3	19	18,7	100,9
Citharexylum myrianthum Cham.	Verbenaceae	F1	3	6	10,4	173,2
Croton floribundus Spreng.	[illegible]orbiaceae	F1	2	4	5,5	145,3
Croton urucurana Baill.		F1	3	1	1,4	141,4
Genipa americana L.	Rubiaceae	F1	2	21	18,7	89,0
Handroanthus chrysotrichus (Mart. ex DC.) Mattos	Bignoniaceae		2	9	12,0	141,4
Handroanthus heptaphyllus (Vell.) Mattos	Bignoniaceae	F1		33	38,9	116,6
Maclura tinctoria (L.) D.Don ex Steud.	Moraceae	F1	3	[illegible]	39,3	131,5
Peltophorum dubium (Spreng.) Taub.	Fabaceae	F1	2	39	36,4	93,2
Schinus terebinthifolia Raddi	Anacardiaceae	F1	2	19	24,0	126,5
Enterolobium contortisiliquum (Vell.) Morong	Fabaceae	F3	2	16	17,0	108,6
Gallesia integrifolia (Spreng.) Harms	Phytolaccaceae	F6	2	22	22,8	105,8
Handroanthus chrysotrichus (Mart. ex DC.) Ma[illegible]				[illegible]	[illegible]	173,2
Handroanthus heptaphyllus (Vell.) Mattos		[illegible]	2	10	15,2	159,5
Solanum erianthum D.Don	Solanaceae	F7	3	5	8,7	173,2
Solanum granulosoleprosum Dunal	Solanaceae	F7	2	12	17,0	141,4
Vitex megapotamica (Spreng.) Moldenke	Verbenaceae	F7	2	9	9,9	110,0
Schizolobium parahyba (Vell.) Blake	Fabaceae	F8	2	4	5,3	141,4



Is germination a characteristic of the species or a batch problem?

03

HOW TO INCORPORATE DIVERSITY INTO QUALITY STANDARDS AND SEED ANALYSIS?



86.7% of the species with G<25%

forests

Article

Seeds' Early Traits as Predictors of Performance in Direct Seeding Restoration

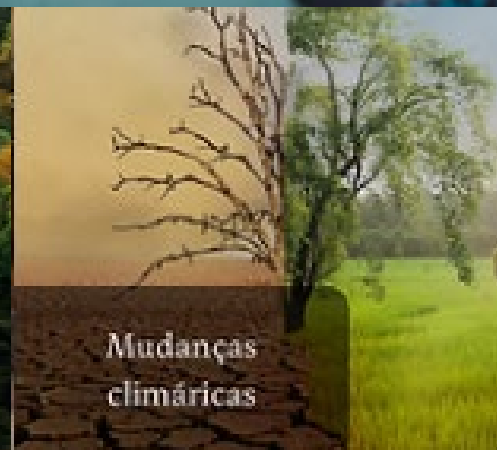
Ivonir Piotrowski [1,*], Harvey Marin Paladines [1], Lausanne Soraya de Almeida [2], Alex Mauri Tello López [1], Felipe Bueno Dutra [1], Bruno Santos Francisco [1], José Mauro Santana da Silva [1] and Fatima C. Márquez Piña-Rodrigues [1]

Taxonomic diversity index

Seed Vigor > Seed Germination

September 28, 2022

THE BRAZILIAN NATIVE SEED SECTOR DEBATES TECHNOLOGICAL INNOVATIONS AND QUALITY CONTROL PROCEDURES FOR ECOSYSTEM RESTORATION



NATIVE SEEDS FOR RESTORATION

DISCOVER THE NETWORK

INTERNATIONAL NETWORK FOR SEED-BASED RESTORATION

HOME ABOUT NEWS WEBINARS EVENTS OPPORTUNITIES RESOURCES TAKE ACTION

Resources

INSR MATERIAL

NATIVE SEED PROTOCOLS

ECOLOGICAL RESTORATION

SER section SOCIETY FOR ECOLOGICAL RESTORATION
INTERNATIONAL NETWORK FOR SEED-BASED RESTORATION

We foster understanding and advancement of seed ecology, conservation, and seed-based restoration of degraded systems.

One of the goals of SGI's Native Seed Program is to help provide better coverage of seed collections in the Southeast for the Seeds of Success program. Photo credit: BLM Plant Conservation & Restoration Program

Seed Zones

Evaluating the genetic diversity of seeds for restoration of degraded areas on a large scale provide insights into the genetic variation within and among seed populations

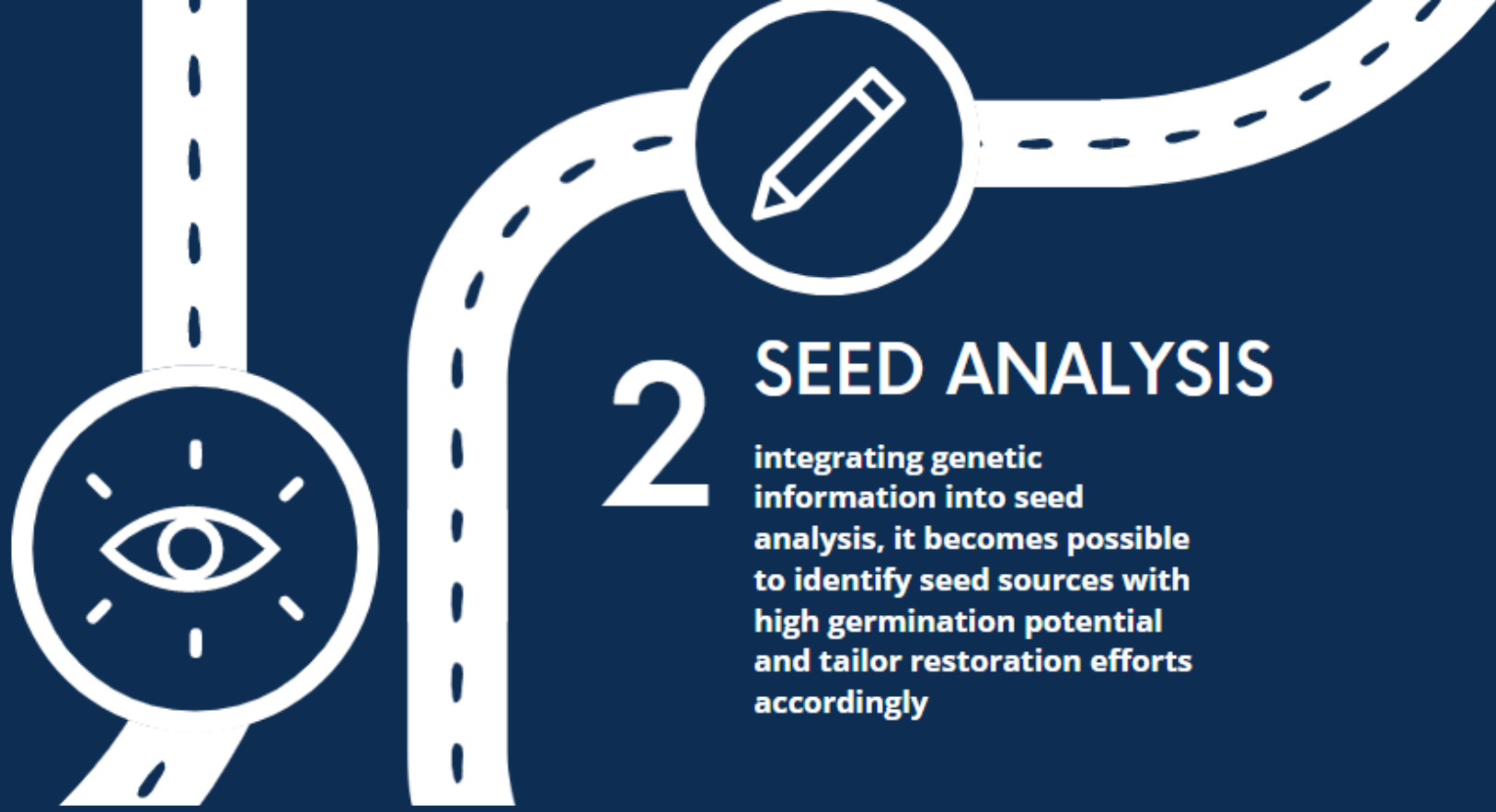
TROPICAL ZONES

https://www.blm.gov/programs/natural-resources/native-plant-communities/native-plant-and-seed-material-development/collection

1

GENETIC DIVERSITY

Genetic markers associated with germination performance can be identified through genetic analyses.



2

SEED ANALYSIS

integrating genetic information into seed analysis, it becomes possible to identify seed sources with high germination potential and tailor restoration efforts accordingly

Require collaboration between seed testing laboratories, seed producers, and geneticists.

3

DATABANK

Research and development efforts are necessary to establish the genetic basis of germination performance and understand the relationship between genetic diversity and seed quality traits.

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Genetic Reference Collections

Establishing genetic reference collections that represent the diversity of the target species can serve as a benchmark for seed quality analysis.

Germination tests can be conducted on seeds from these collections to establish species-specific tolerance ranges that encompass the genetic diversity observed within the species.

Species-Specific Germination Tolerances

Instead of relying solely on generic tolerance tables, species-specific germination tolerances can be developed by analyzing the germination performance of diverse seed sources.

This involves testing seeds from different populations or ecotypes under standardized conditions and recording their germination rates.

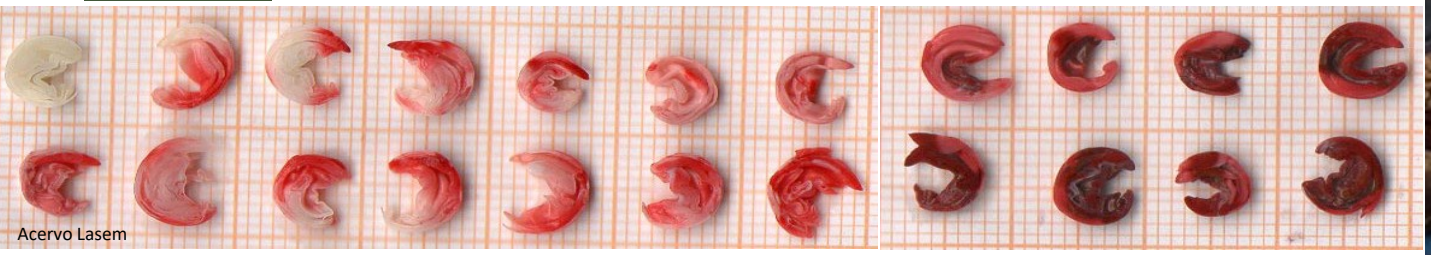
Germination

Several methodologies for the same species
Different morpho and behaviors due to local adaptation

Germination

Primary root emission (microorganisms)
Germination does not reflect emergence in direct seeding
More standardized vigor tests

Validation of Emergency test (nurseries)
Validation of vigor tests
Tetrazolium test
Image tests with IA



Acervo Lasem

What we also need in the quality assessment?

https://www.lasemufscar.com/

sementesflorestaistropicais.blogspot.com