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Keys to Improving Outcomes of Tree Planting Campaigns

Karen Holl, Matthew Fagan and Pedro Brancalion

kholl@ucsc.edu, holl-lab.com

Many forest restoration & tree planting campaigns

BONN CHALLENGE

350 million hectares globally by 2030

Initiative 20x20

WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD

1t.org

PLANT FOR THE PLANET

TRILLION TREES

WCS

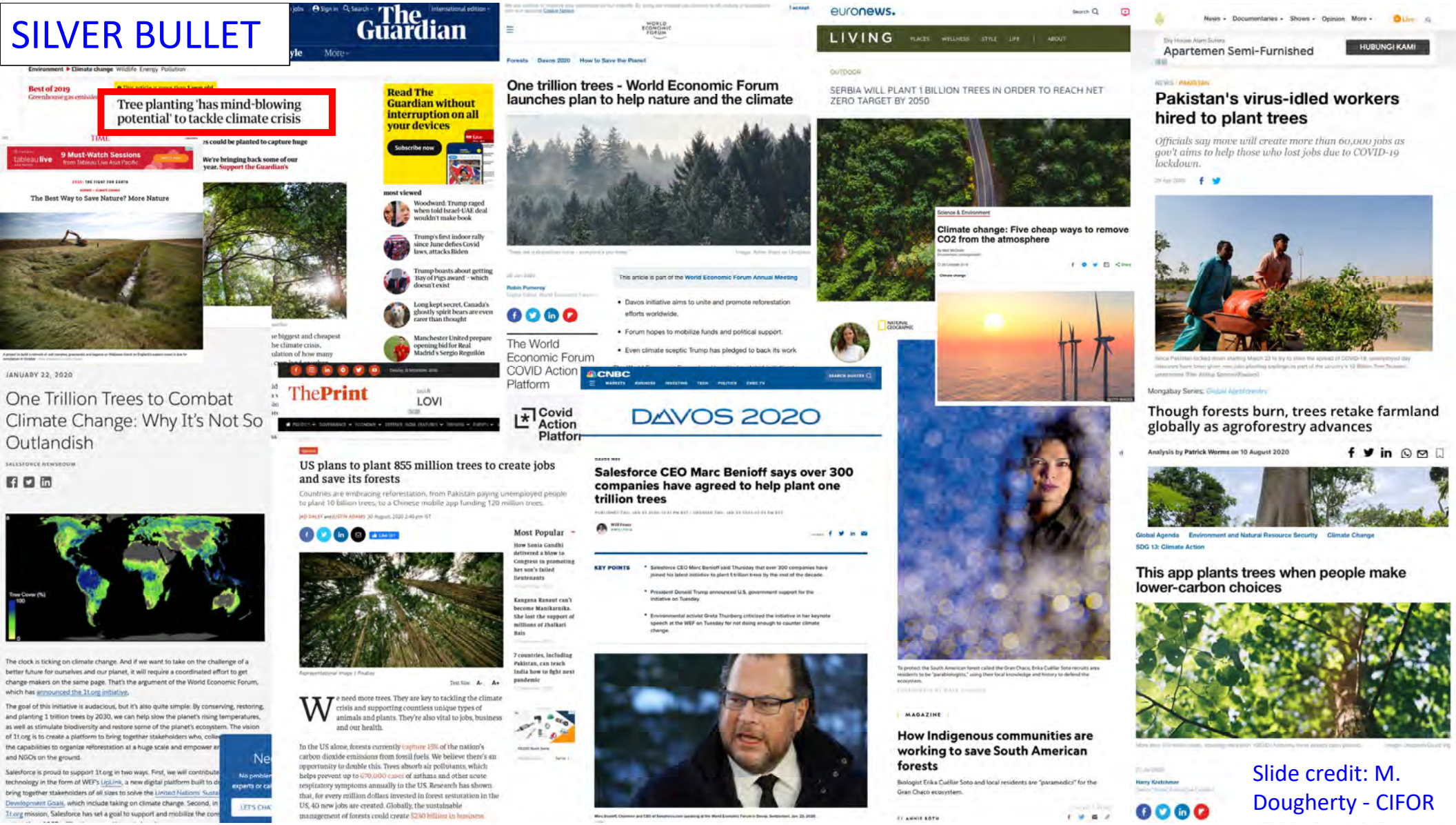
WWF

BirdLife INTERNATIONAL

PLANET IN CRISIS

Slide credit: M. Dougherty - CIFOR

SILVER BULLET



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THE CRITIQUE

THE VERGE

PLANTING 1 TRILLION TREES MIGHT NOT ACTUALLY BE A GOOD IDEA

The World Economic Forum's plan to plant 1 trillion trees is backed by controversial science

By Justine Calma | @justcalma | Jan 31, 2020, 9:00am EST

GreenBiz

Conserving and restoring forests won't be cheap and easy after all

grist

PERSPECTIVES

ECOLOGY

Tree planting is not a simple solution

Tree planting must be carefully planned and implemented to achieve desired outcomes

By Karen D. Holl and Pedro H. S. Brancalion

A plethora of articles suggest that tree planting can overcome a host of environmental problems, including climate change, water shortages, and the sixth mass extinction (1–3). Business leaders and politicians have jumped on the tree-planting bandwagon, and numerous nonprofit organizations and governments worldwide have started ini-

The New York Times

Opinion

OP-ED CONTRIBUTOR

To Save the Planet, Don't Plant Trees

By Nadine Unger

GIZMODO

We come from the future

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Trump's Vow to Help Plant a Trillion Trees Is Worse Than Stupid

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Science & Environment

Climate change: Planting new forests 'can do more harm than good'

Climate change

TREEBEARD 4EVR

So should we just plant a bunch of trees everywhere, or what?

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See the forest for more than the trees — why reforestation isn't working

WIRED

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A new podcast from the most trusted voice in music THE Pitchfork REVIEW SUBSCRIBE

We Might Not Be Planting the Right Kinds of Forests

As the world scrambles to combat deforestation, experts warn our efforts could have far fewer benefits than we think.

Why Planting Trees Won't Save Us

If a climate solution sounds too good to be true, it probably is. Two new studies expose the magical thinking around the trillion trees initiative

Children planting trees in Ethiopia, a country which has embrac

OPINION

Global Change Biology WILEY

A lesson unlearned? Underestimating tree cover in drylands biases global restoration maps

M. E. Fagan

Trend

Planting trees to take on climate change isn't as easy as YouTubers might think

Planting trees can have massive payoffs, and potential pitfalls

By Justine Calma | @justcalma | Oct 25, 2019, 4:18pm EDT

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2 How Far Will Dona Win?

3 'Fargo' Heads Sou

4 Miley Cyrus Cover Gates' 'Maneater' Show'

5 'The Princess Brid for Hilarious Table

Ad

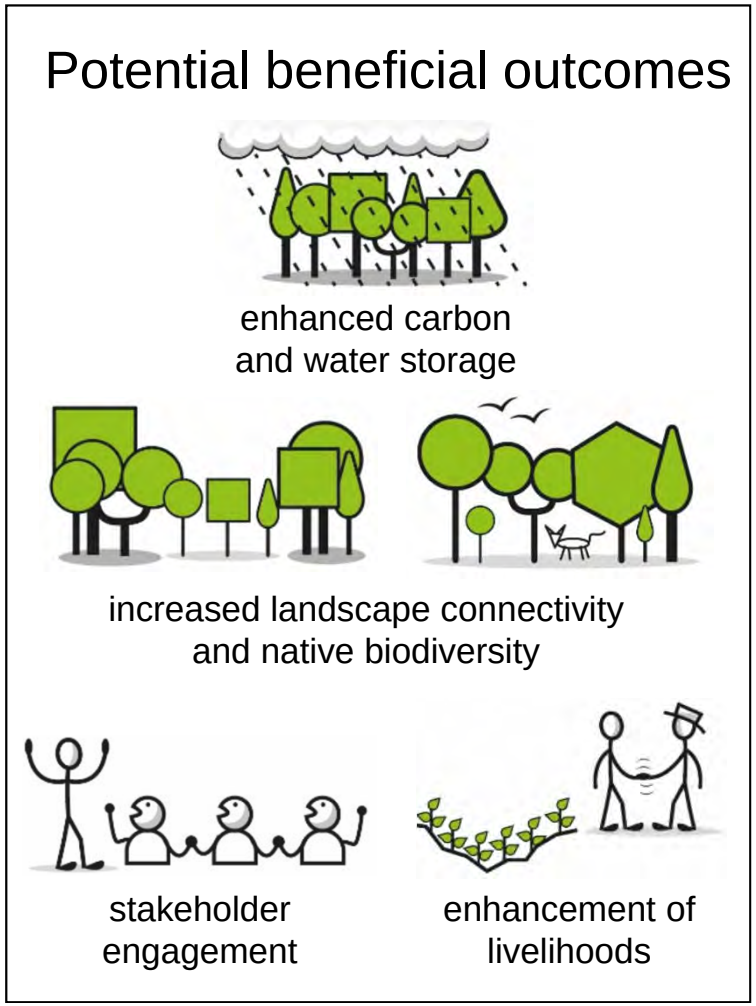
molecutrack - Carbo Technologies

Using Drones to Plant 20,000,000 Trees

Slide credit: M. Dougherty - CIFOR

Tree growing has many benefits

Holl & Brancalion 2020 *Science,* Brancalion & Holl 2020 *J. Applied Ecology*

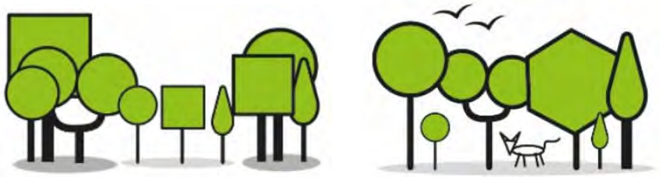


..and potential negative effects, depending on where and how it is done.

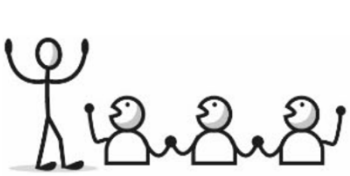
Holl & Brancalion 2020 *Science*
Brancalion & Holl 2020 *J. Applied Ecology*

Potential beneficial outcomes

enhanced carbon
and water storage



increased landscape connectivity
and native biodiversity



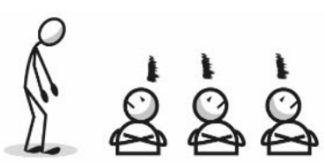
stakeholder
engagement

enhancement of
livelihoods

Potential negative effects

water yield reduced

destruction of native grasslands and
spread of invasive tree species



social conflicts

displacement
of farmland

Poor planning and top-down projects have led to disappointing outcomes

In India, Indigenous Tribes Clash With the Government Over Trees

A government campaign to plant more trees has sparked a negative response from the indigenous communities of India.

The Guardian

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This article is more than 7 months old

Most of 11m trees planted in Turkish project 'may be dead'

Agriculture and forestry union says up to 90% of saplings they have looked at so far have died

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Tree planting effort in Cambridge a failure

Letter to the Editor

OPINION Jun 09, 2020 by Doug Smith Cambridge Times

THE WEEK MAGAZINE

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Pakistan: Locals at Khyber uproot trees planted by government

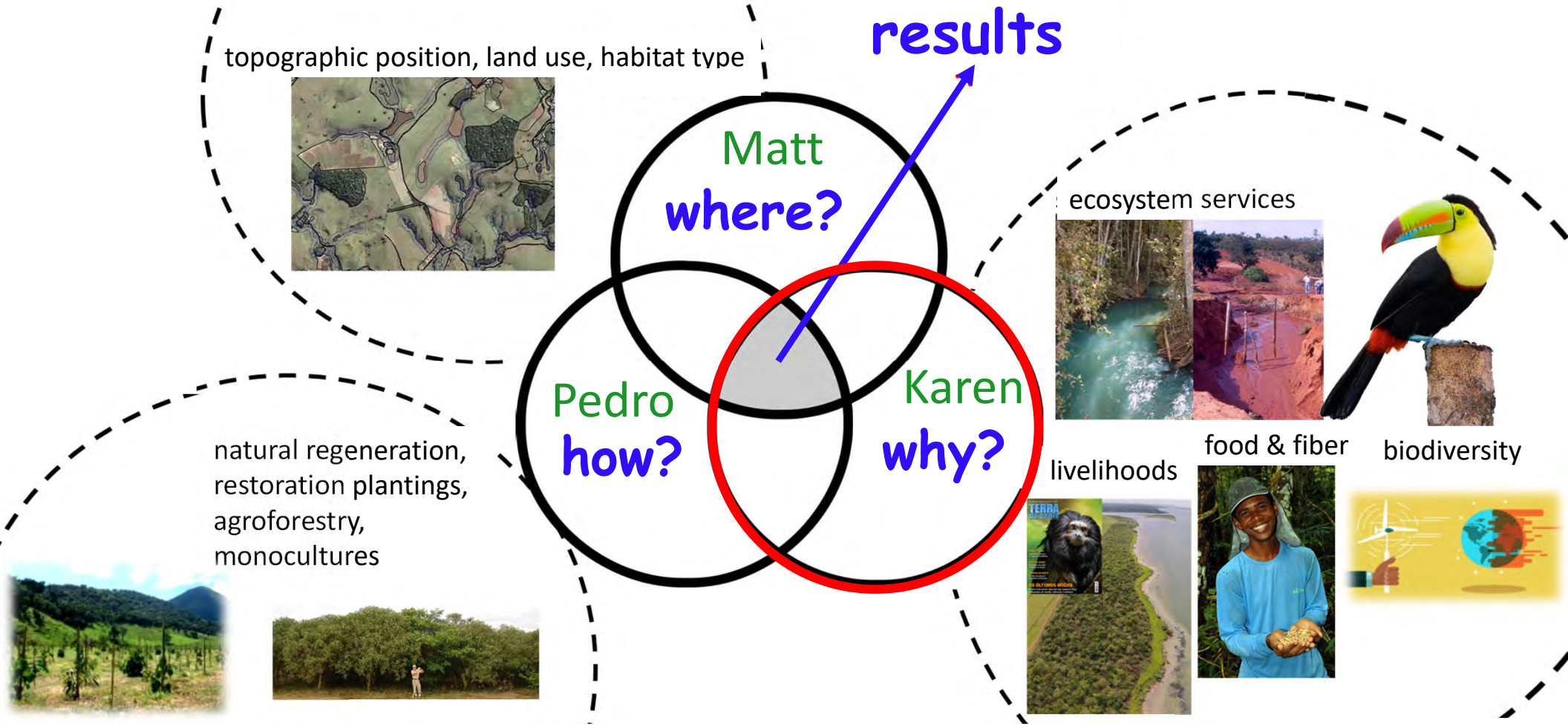
The initiative was part of the Imran Khan government to mark 'Tiger Force Day'

Web Desk | August 10, 2020 14:05 IST

Our aim: improve outcomes of tree growing campaigns over space and time

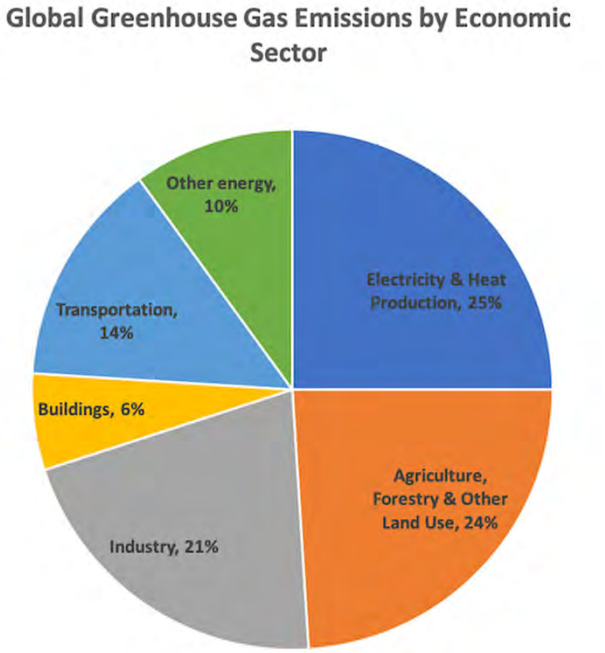
Finlayson 2020. World Agroforestry blog.
http://www.worldagroforestry.org/blog/2020/02/17/planting-trees-or-growing-them-do-words-matter-restoring-land

Our aim: improve outcomes of tree growing campaigns over space and time

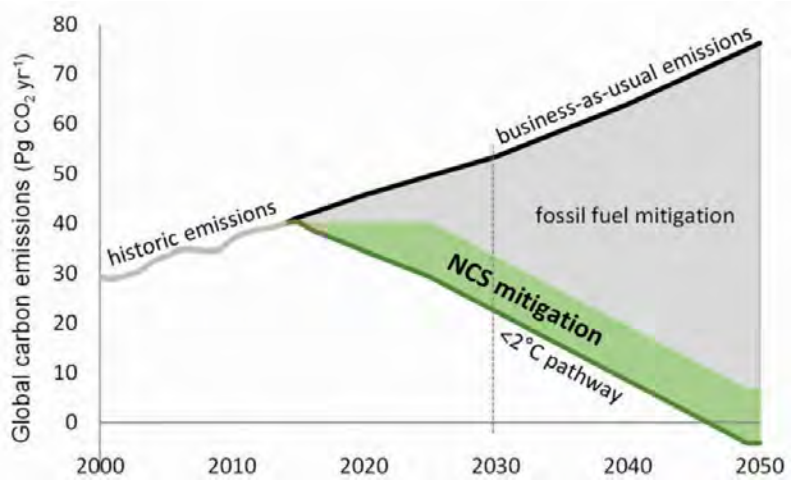


Key premises

- Tree growing or other natural climate solutions (NCS) are not a substitute for reducing greenhouse gas emissions



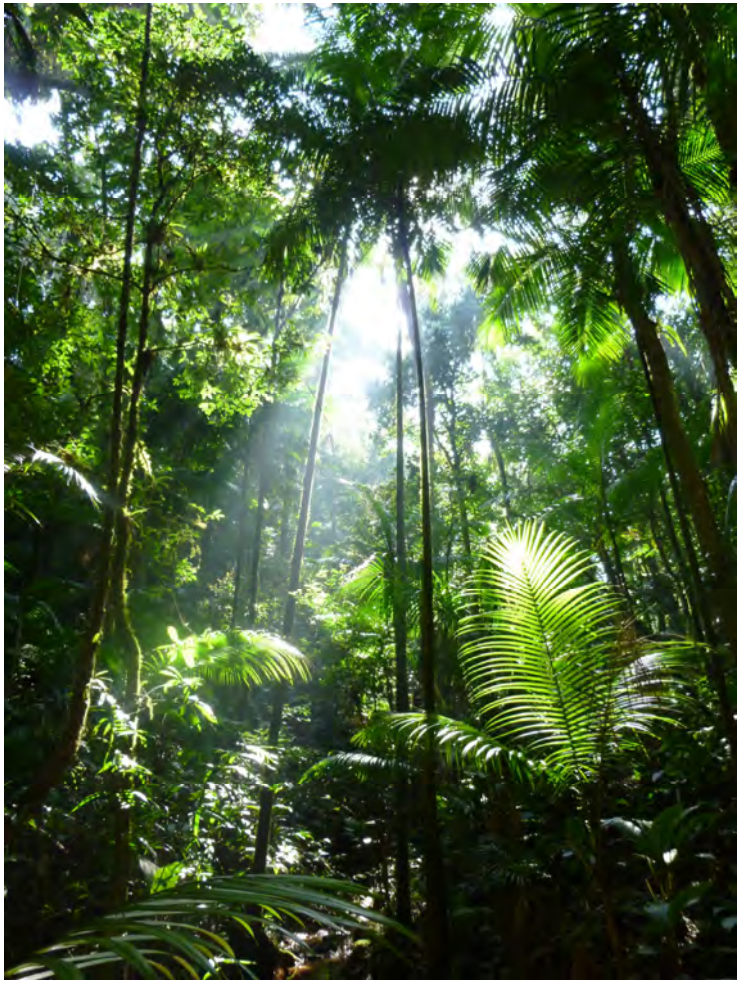
IPCC 2014 https://www.ipcc.ch/report/ar5/wg3/



Griscom et al. 2017. *PNAS*

Key premises

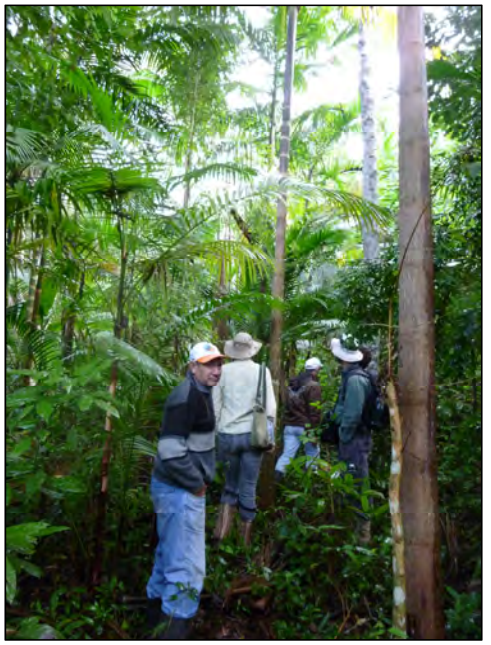
- Tree growing or other natural climate solutions are not a substitute for reducing greenhouse gas emissions
- Need to reduce drivers of deforestation and prioritize protecting existing forest



People grow trees for different reasons

- Conserve biodiversity
- Sequester carbon
- Improve water and air quality
- Provide shade and increase green spaces in cities
- Practice agroforestry
- Earn money from timber, wood pulp, or other products
- Any many more

There are tradeoffs



(Brancalion & Holl 2020 *J. Applied Ecology*)

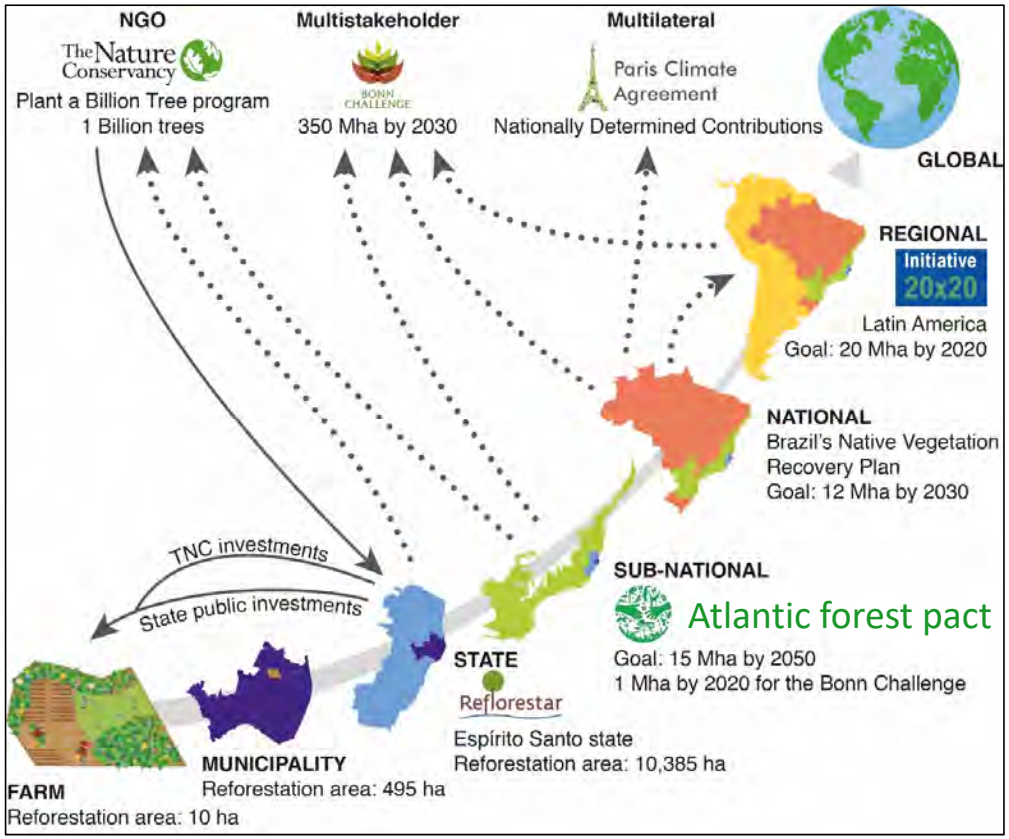
Potential conflicting goals within & across scales

(Brancalion & Holl 2020 *J. Applied Ecology.* Table 3)

Carbon sequestration

Conserve biodiversity

Brazilian Atlantic Forest as an example of the hierarchy of tree growing scales and differing goals



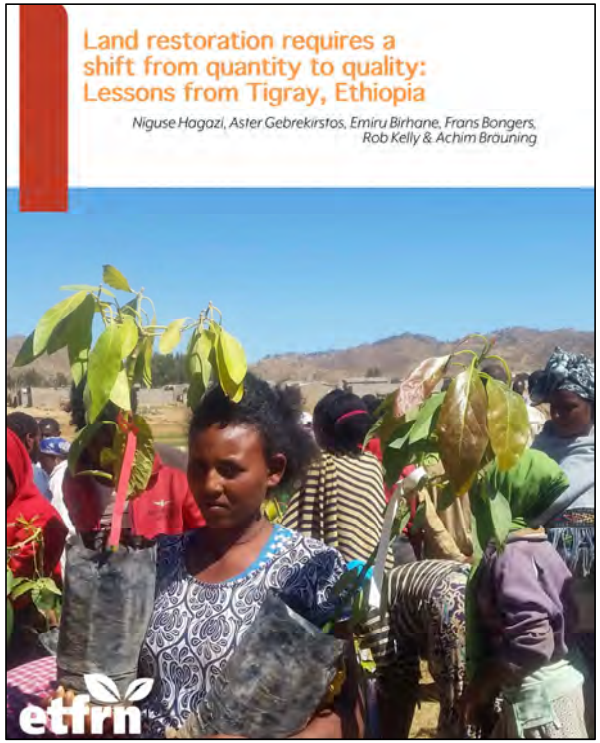
Improving water quality

Provide food, firewood, and income

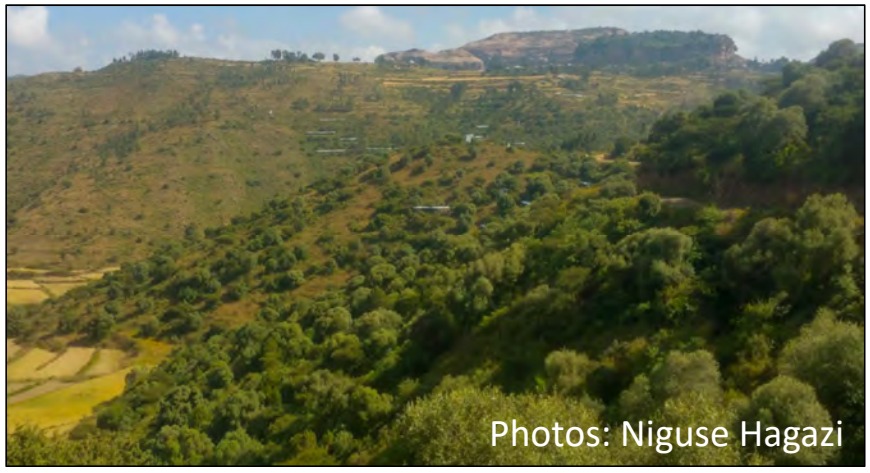
Keys to improving efforts to grow trees

- Clearly define and agree to goals among stakeholders of given projects
- Select where to achieve those goals (international groups)
- Go through a careful planning process of whether and how to plant trees to improve success
- Plan for permanence – maximizing desired impacts over time and not just scale – requires monitoring and adaptive management

Scaling up quality of tree growing



www.tropenbos.org/file.php/2349/etfrnnews60-hagazi-land-restoration-requires-shift-from-quantity-quality.pdf



Why, where, and how to grow trees

topographic position, land use, habitat type

results

Matt
where?

Pedro
how?

Karen
why?

ecosystem services

food & fiber

biodiversity

livelihoods

natural regeneration,
restoration plantings,
agroforestry,
monocultures

Where should we grow trees

Where should we focus tree growing, at a global scale?

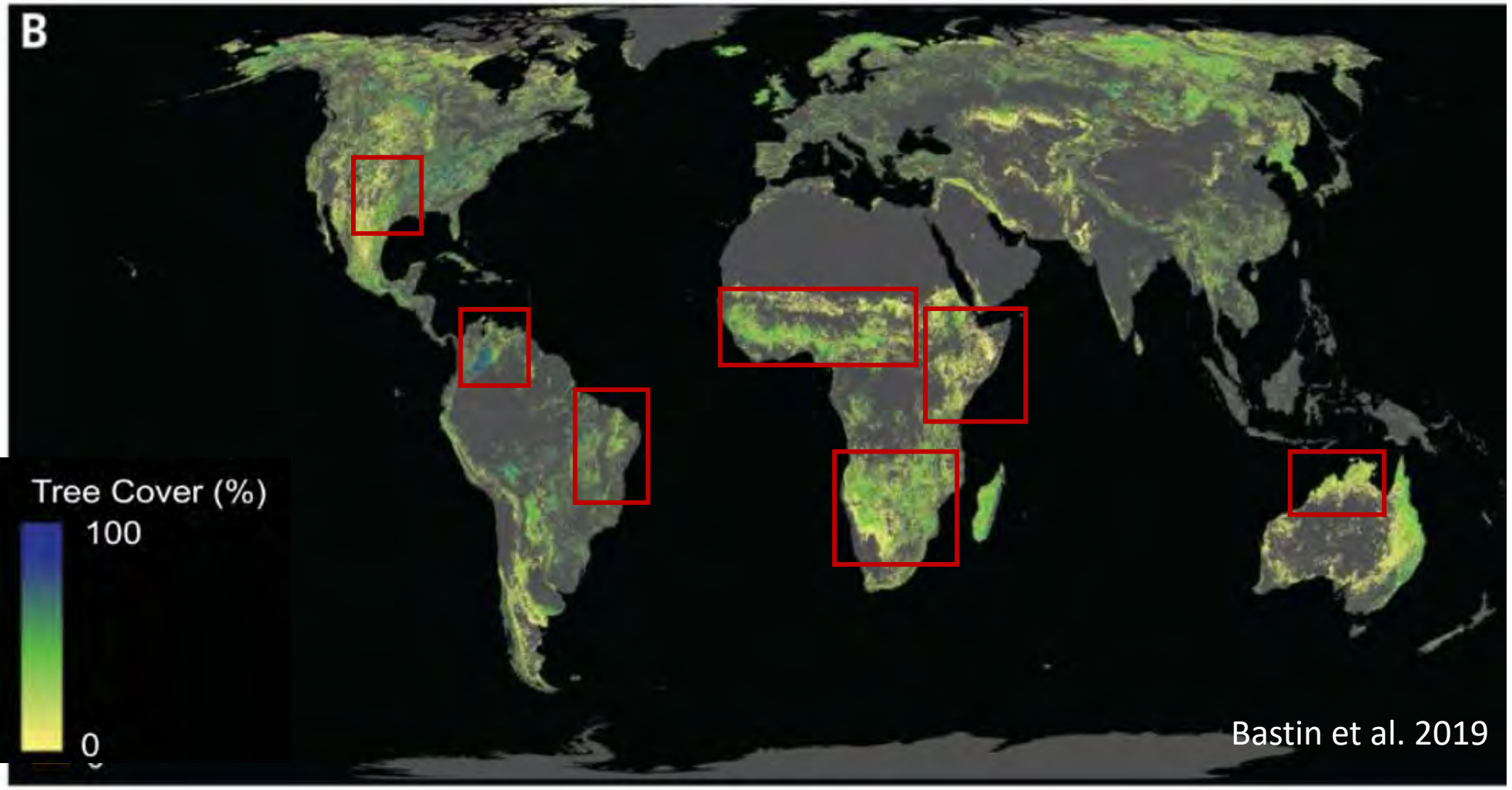
- Biomes, countries, landscapes
- Long-term carbon sequestration
- Flow of funds

At regional to local scales, where should we target tree growing?

- Connectivity, ecosystem services
- Improve human well-being

Identifying global tree growing opportunities

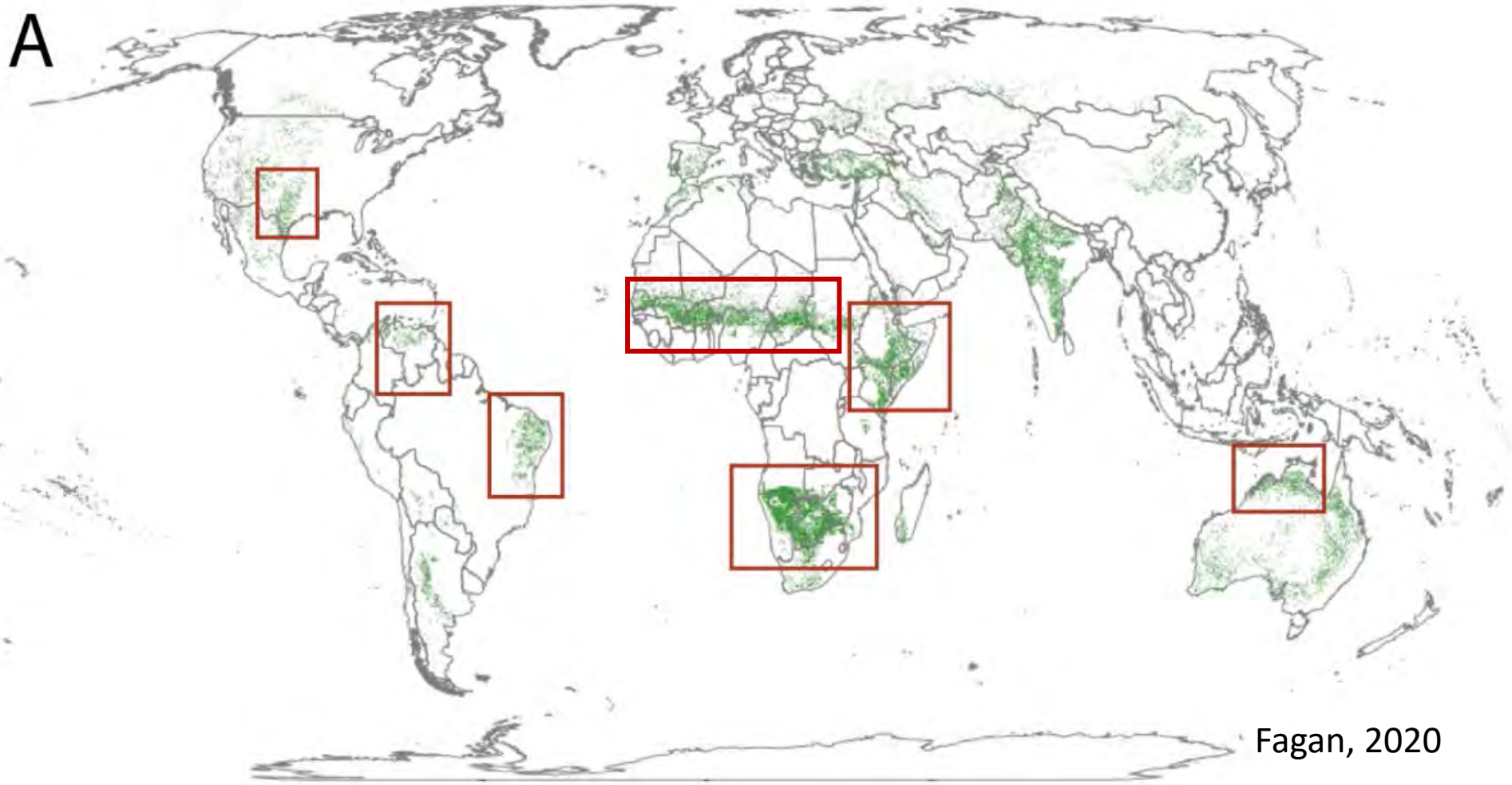
1. Map potential tree cover vs. current tree cover



Pros: Big maps!
Huge areas!

Identifying global tree growing opportunities

1. Map potential tree cover vs. current tree cover



Fagan, 2020

Pros: Big maps!

Huge areas!

Cons:

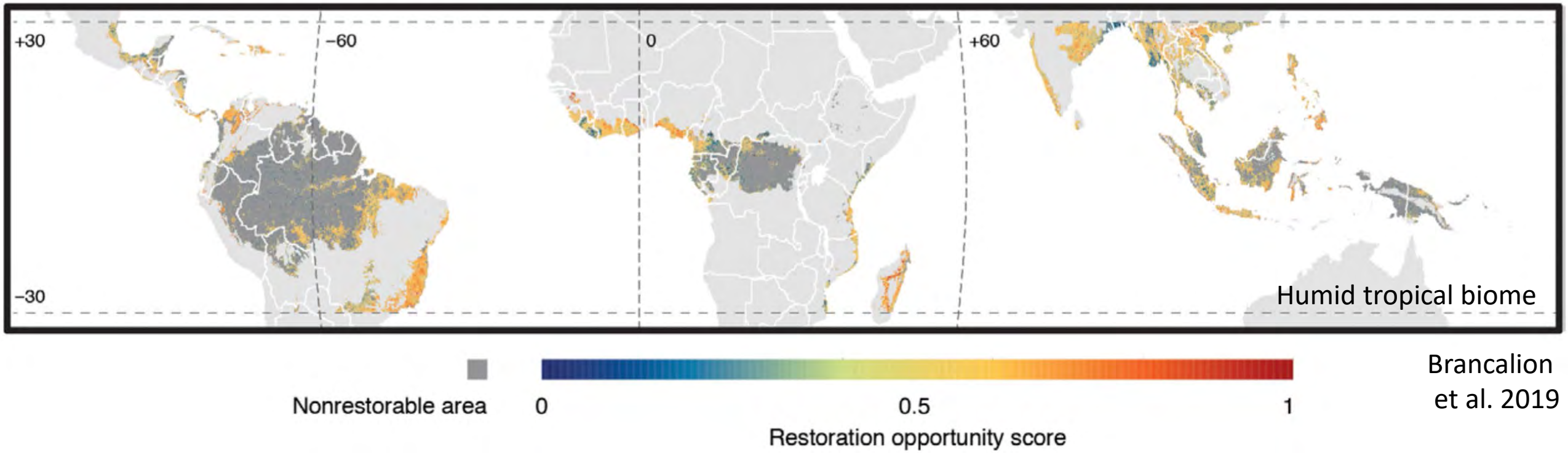
Overestimates drylands restoration.

Ignores fire.

Omits people, agriculture.

Identifying biome tree growing opportunities

2. Map opportunity, benefits, and feasibility



Brancalion et al. 2019

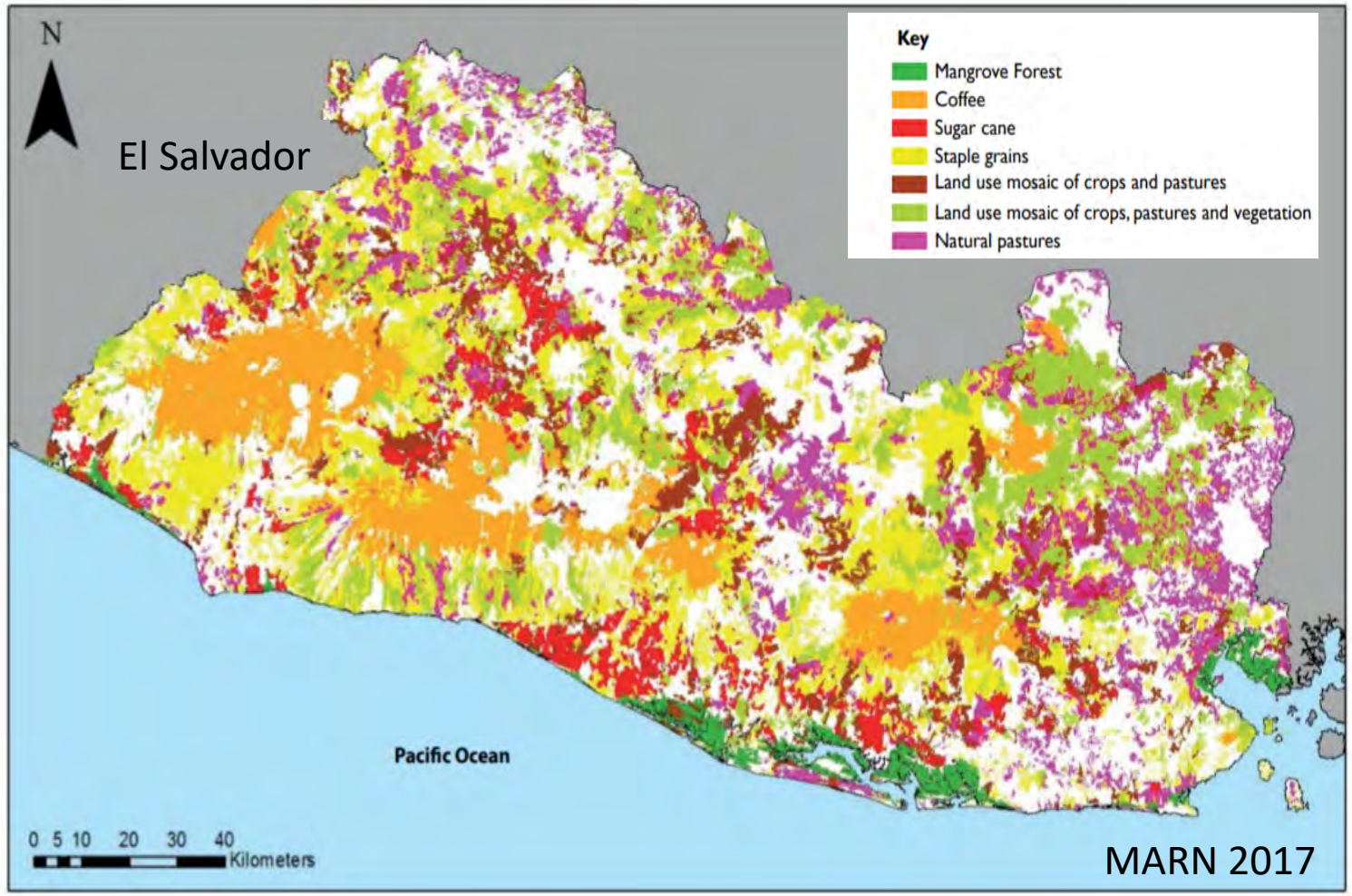
Pros: Defensible targeting recommendations.

Cons: Hard to measure opportunity and feasibility across biomes and ecosystems.

Identifying national tree growing opportunities

3. National ROAM assessments, commitments

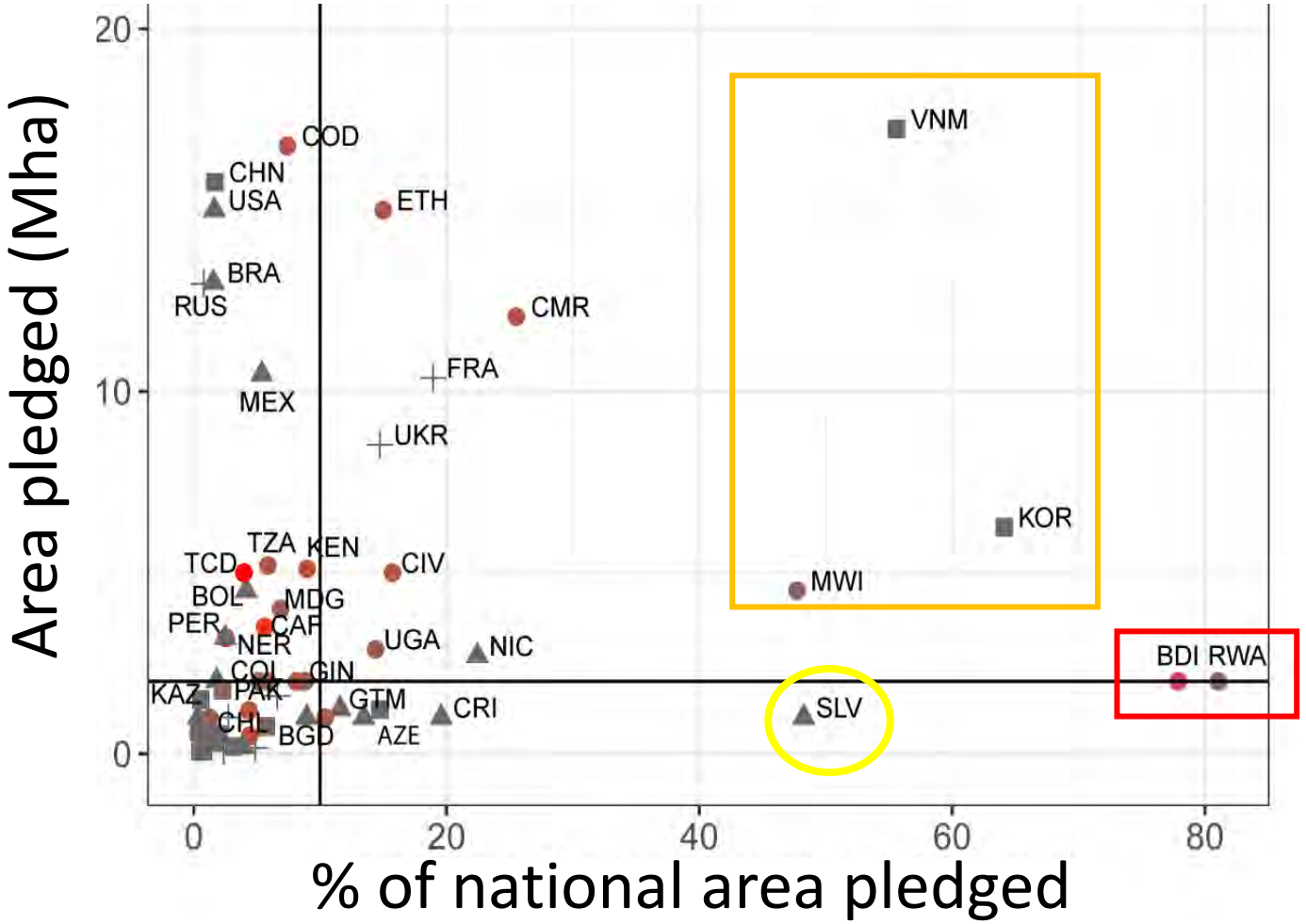
Restoration **O**pportunities **A**ssessment **M**ethodology (IUCN)



Pros: Local expertise, engagement, and buy-in.

Identifying national tree growing opportunities

3. National ROAM assessments, commitments



Fagan et al. 2020

Pros: Local expertise, engagement, and buy-in.

Cons: Political, optimistic estimates, volunteered data, and lack of detail.

Spatial planning prepares for opportunity.

- Tailor
- Target
- Anchor

Copyright Matthew Fagan, UMBC

Tailor tree growing

Forests have a time and place

Tailor tree growing

Forests have a time and place

Tailor tree growing

Avoid converting “degraded” natural ecosystems

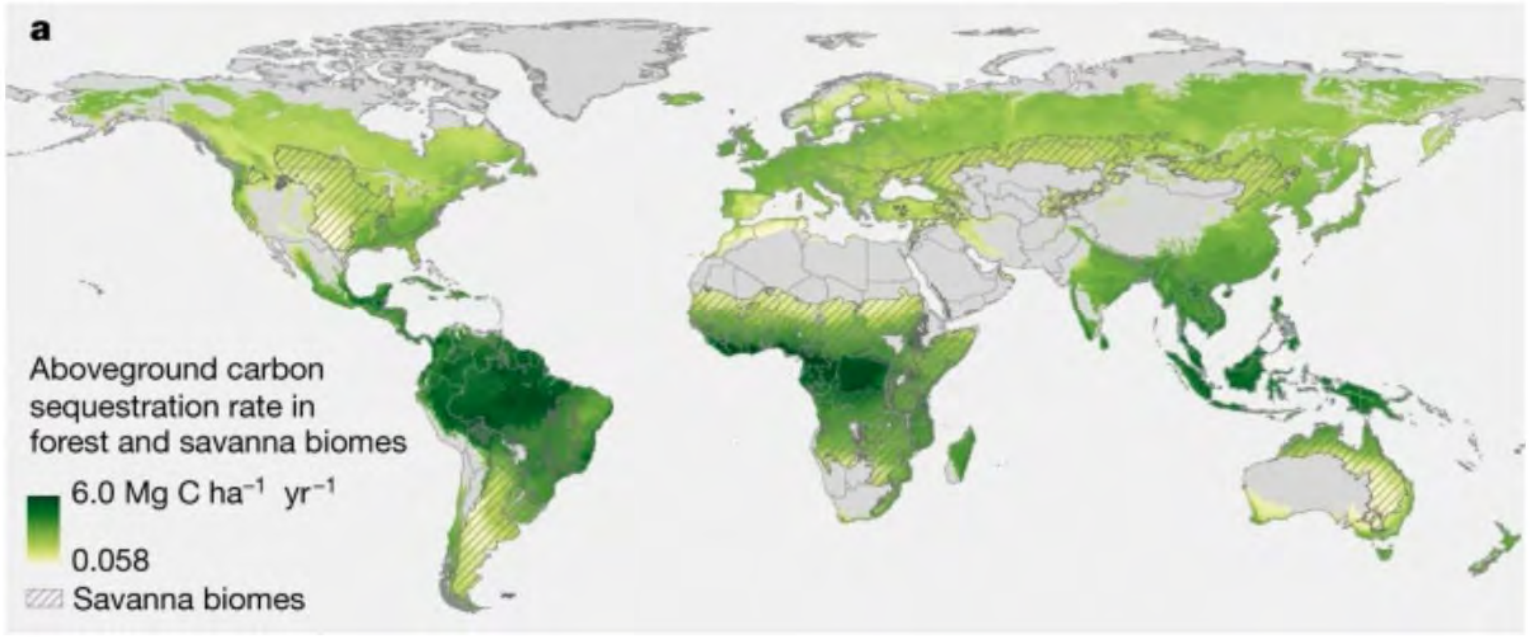
1. Where has natural habitat loss been occurring?
2. Where has tree cover been naturally increasing?
3. Communicate

Telangana, India; photo courtesy F. Fleischman

Fleischman et al. 2020

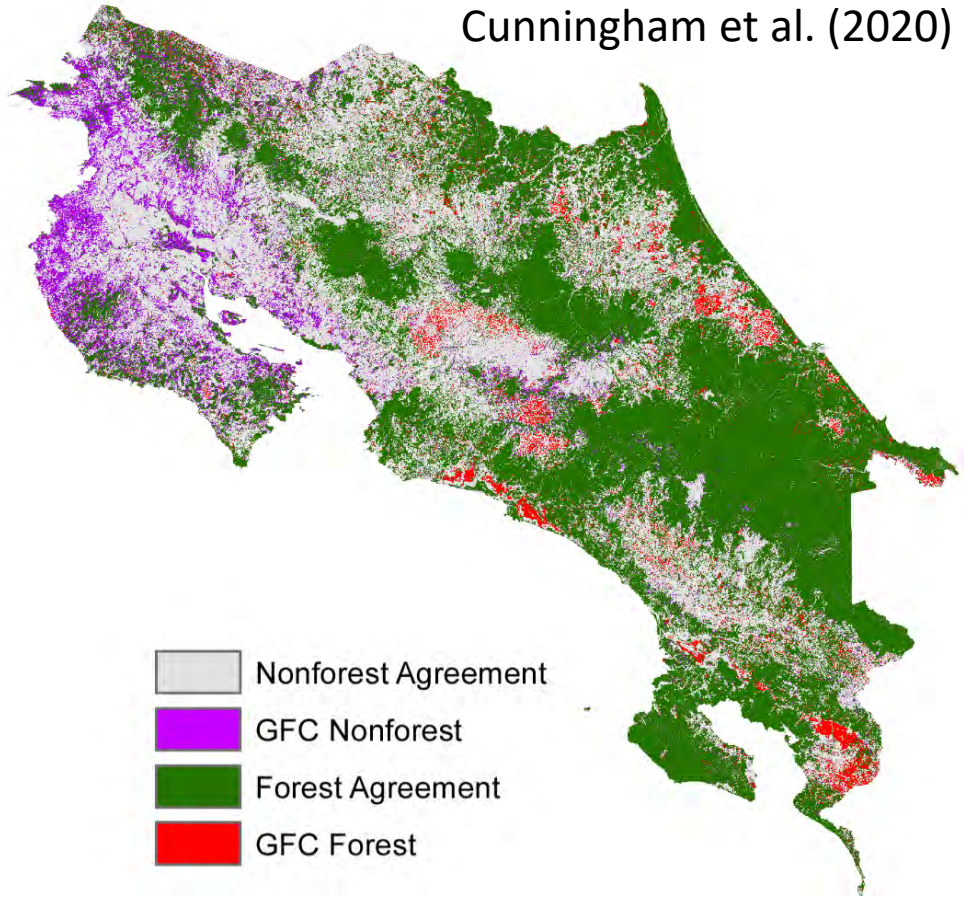
Tailor tree growing

Spatial data can help assess local tree growing potential and the extent of native ecosystems



Cook-Patton et al. 2020

Cunningham et al. (2020)



Leverage global products…

…but know their limits

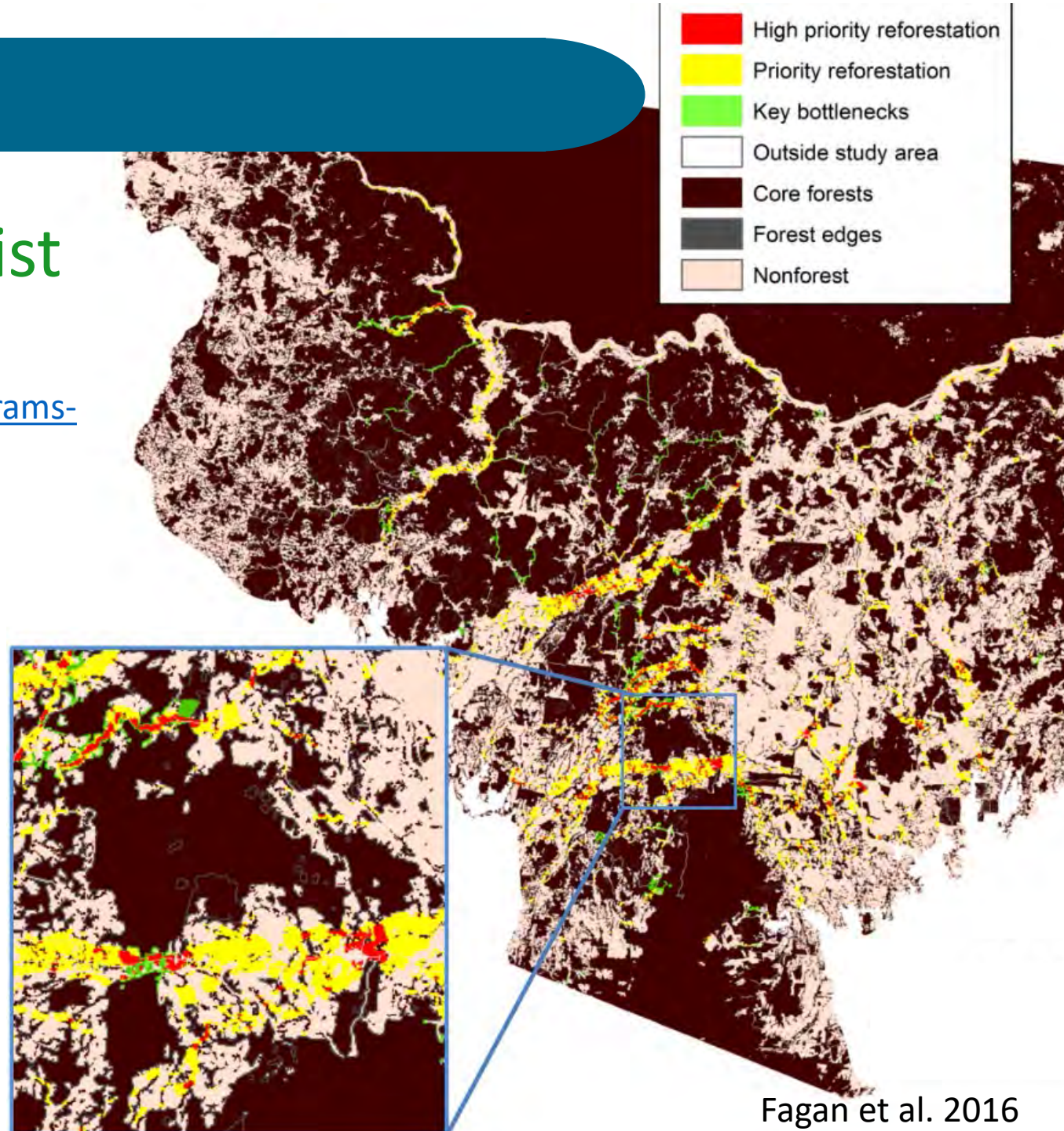
Target tree growing

Spatial analysis tools can assist with landscape prioritization

https://conservationcorridor.org/corridor-toolbox/programs-and-tools/

Where possible, target plantings to provide both global and local benefits.

The longer new trees persist, the more services they provide.



Fagan et al. 2016

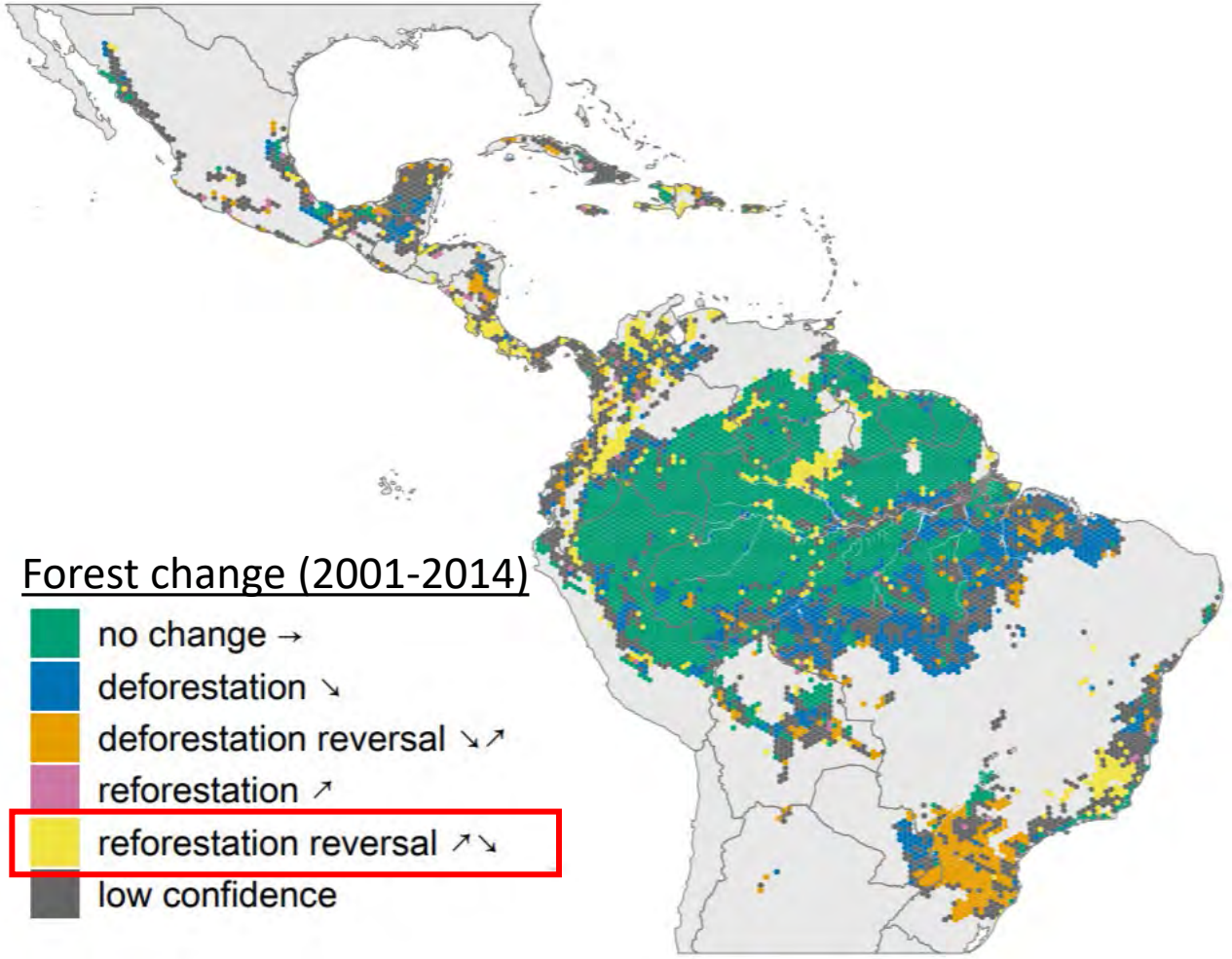
Target tree growing

Permanence: most reforestation is not long for this world

"Unproductive" new forests are at risk, but so are productive ones

Where do forests tend to persist?

- Communal places (churches, wells, hunting/grazing/harvesting reserves)
- Inaccessible or unproductive locations / near existing forests
- Steep slopes
- Near rivers



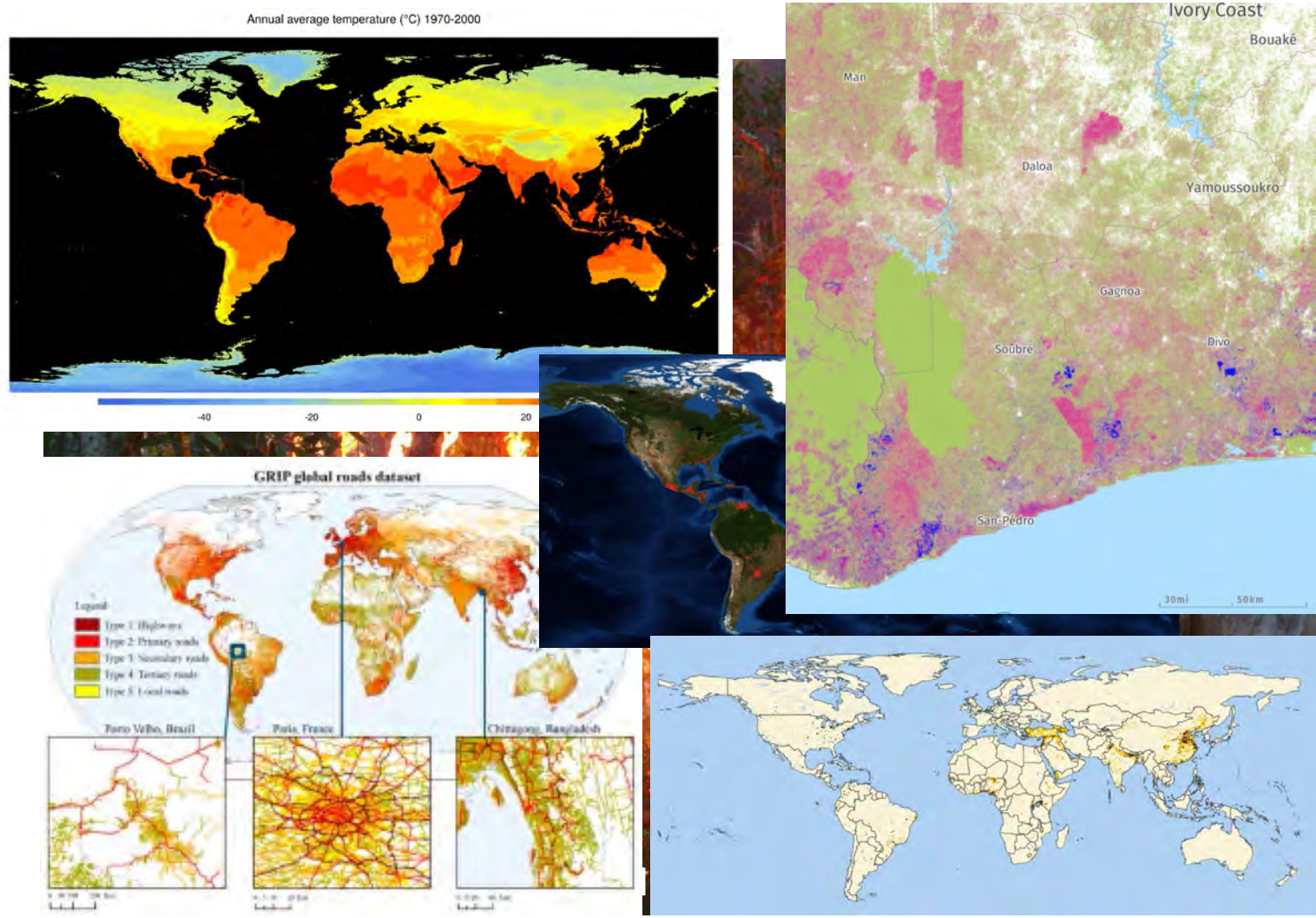
Schwartz et al. 2020

Target tree growing

Prepare for pressure: How can spatial data help?

Global/regional data on:

- Climate change projections (WorldClim2)
- Past fires (NASA Earthdata)
- Deforestation* (GFW)
- Road building (GRIP)
- Urban expansion (SEDAC)



https://news.mongabay.com/2020/08/ex-wall-street-quant-wields-data-to-replant-charred-madagascar-rainforests/

Anchor tree growing

Settle down into a landscape for the long run

Minimize opportunity costs

- Lost agricultural production
- Pre-empted communal land

Local communities control the future of regional land use

Natural regrowth in Costa Rica along a semi-abandoned road

Anchor tree growing

Partner long term: no tree growing project is an island

To maximize impact, spatial planning should involve local partners, from the beginning

Involve social scientists

Costa Rican tree plantation with illegal understory clearing

Anchor tree growing

Plan long term: monitor regularly using satellite imagery

Expect reversals and disturbance, and report accordingly

Fires (red) over Madagascar: planted trees from year 3 may not survive to year 10.

Anchor tree growing

Plan long term: monitor frequently using satellite imagery

Expect reversals and
disturbance, and
report accordingly

To quantify net impact,
regional monitoring is
needed to capture
leakage

Literature cited

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