

Forestry sector

Archetypes of decarbonization pathways and climate policy entry points to raise ambition

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Context

- Appropriate policy entry points across a range of scientists from different disciplines as well as key policy stakeholders and experts.
- Concrete steps on how to incentivize more climate action by national governments.
- Focus on opportunities for climate action at national government level, which includes how non-state actors, including business and financial organizations, help national actors to more ambitious action.

My tasks...

- The role of the forestry sector (focusing on the 'climate policy entry points to raise ambition' part of the WS - based on national example of forestry in Brazil)
- Bottom up forestry mitigation issues, *e.g.* realisms of options taken in big modelling approaches (*e.g.* regrowth of natural vegetation) and reference to current national realities in Brazil

Forests and climate change mitigation

- The potential **role of forests for climate change mitigation** has strongly been recognized in the **Paris Climate Agreement**.
- The global mitigation goals to hold the increase in global average temperature to well below 2°C will require negative emissions of carbon.

Mitigation – Forest options

- Potential climate mitigation for the four largest forest options : (Griscom et al. 2017)
- Avoided forest loss
- Improved natural forest management
- Afforestation and reforestation
- Improved plantation

The low-hanging fruit?



Carbon in tropical forests

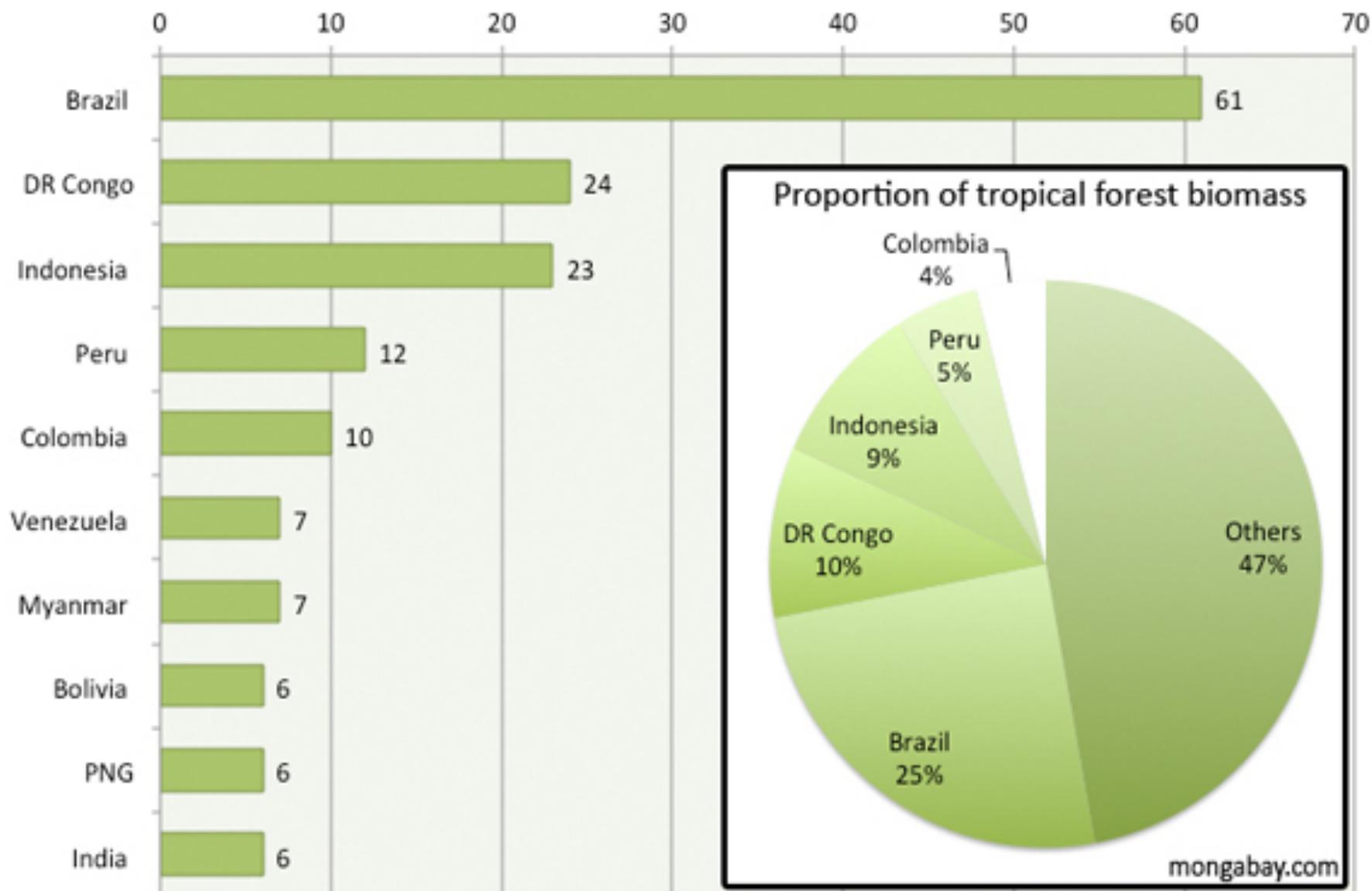
- Saatchi et al (2011) - carbon map for 2.5 billion ha of forests.
- **Tropical forests** across Latin America, Africa, and Southeast Asia store:
 - 193 billion tons of aboveground carbon
 - 54 billion tons of belowground carbon.
- **Total carbon stock in tropical forests:**
 - Latin America 49 %
 - Southeast Asia 26 %
 - Africa 25 %

Saatchi et al (2011)

Forest C stock by country

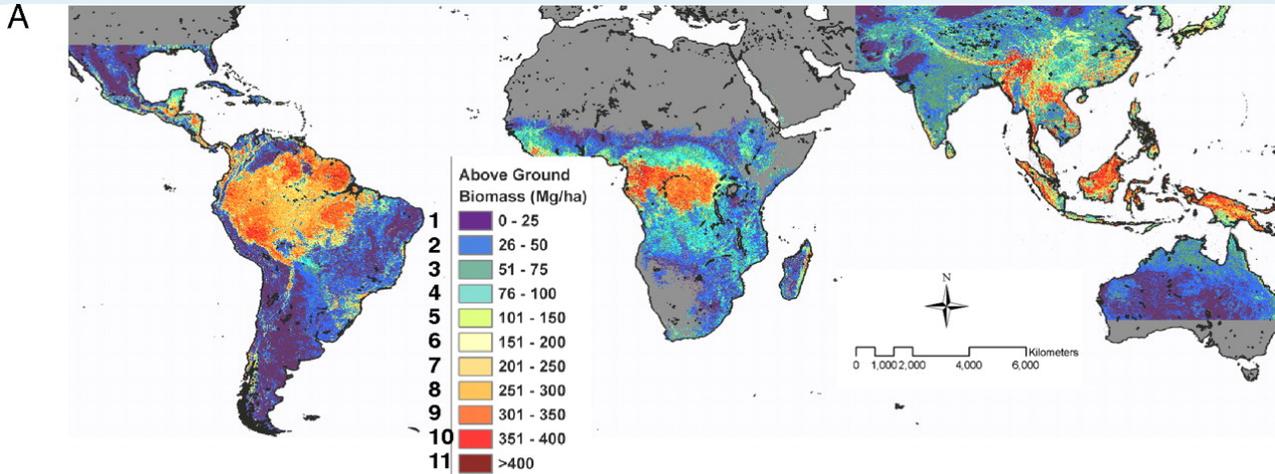
- Top five countries, which together accounted for more than half (52.8%) of tropical forest biomass.
 - Brazil's forests: ~ 25%
 - Democratic Republic of Congo: 9.8 %
 - Indonesia: 9.3 %
 - Peru: 4.9 %
 - Colombia: 4.1 %
- Amazonian countries = 34%
-
- The diagram shows a list of five countries and their respective percentages of tropical forest biomass. Blue arrows point from the percentage values for Brazil (~25%), Democratic Republic of Congo (9.8%), Indonesia (9.3%), Peru (4.9%), and Colombia (4.1%) to a light blue box on the right. Inside the box, the text reads 'Amazonian countries = 34%'. This indicates that the sum of the biomass from these five countries is 34% of the total tropical forest biomass.
- | Country | Percentage |
|------------------------------------|--------------|
| Brazil's forests | ~ 25% |
| Democratic Republic of Congo | 9.8 % |
| Indonesia | 9.3 % |
| Peru | 4.9 % |
| Colombia | 4.1 % |
| Amazonian countries (Total) | = 34% |

Biomass in tropical forests: top 10 countries

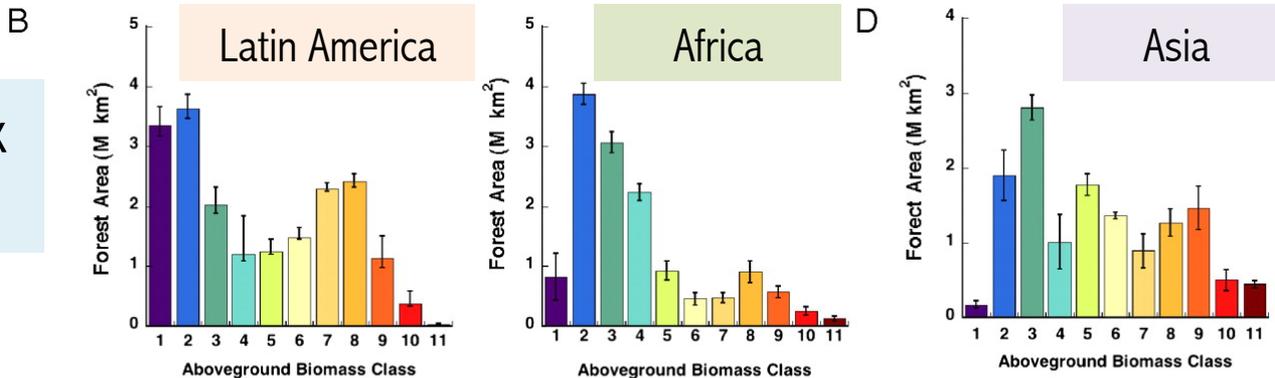


>10% forest cover. Data: Saatchi et al 2011

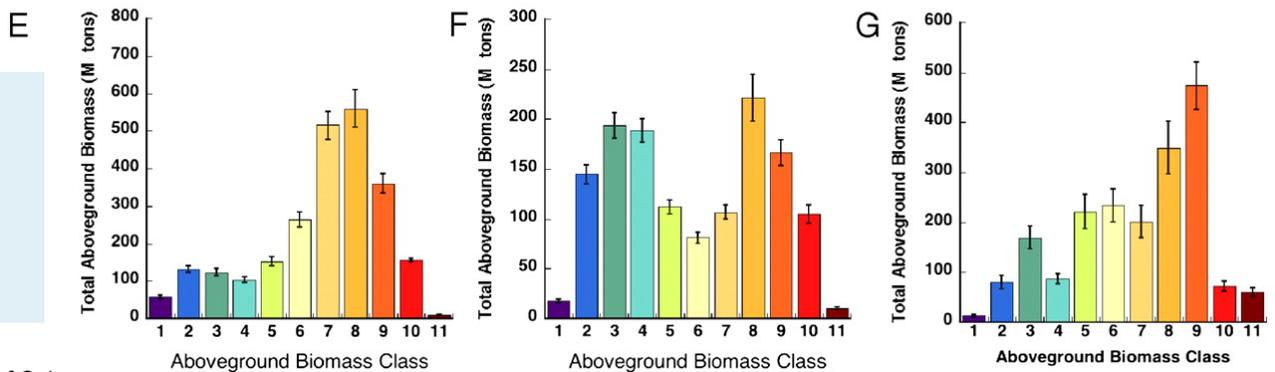
Distribution of forest aboveground biomass (circa 2000)



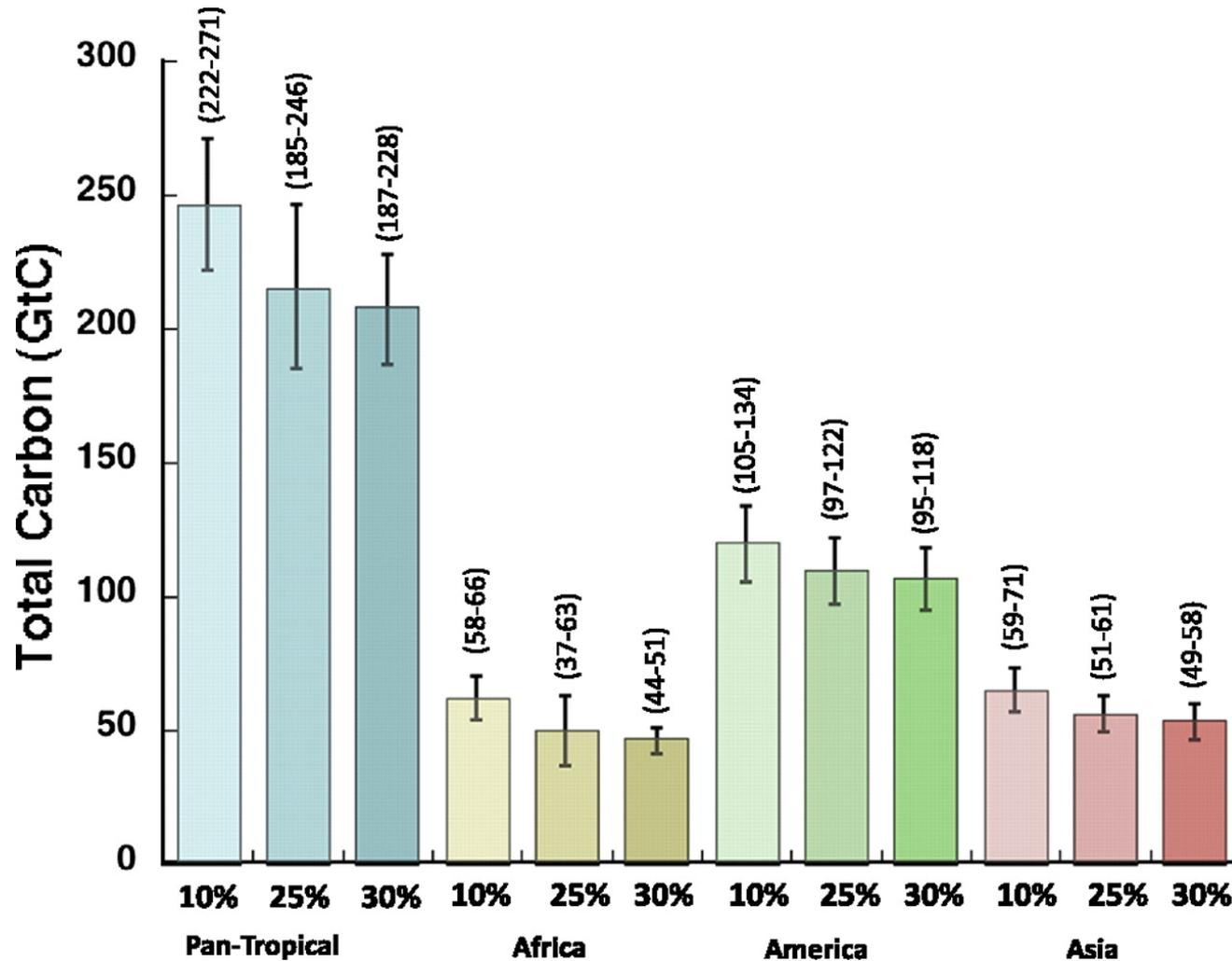
Forest area x
AGB classes



Aboveground
biomass x
AGB classes

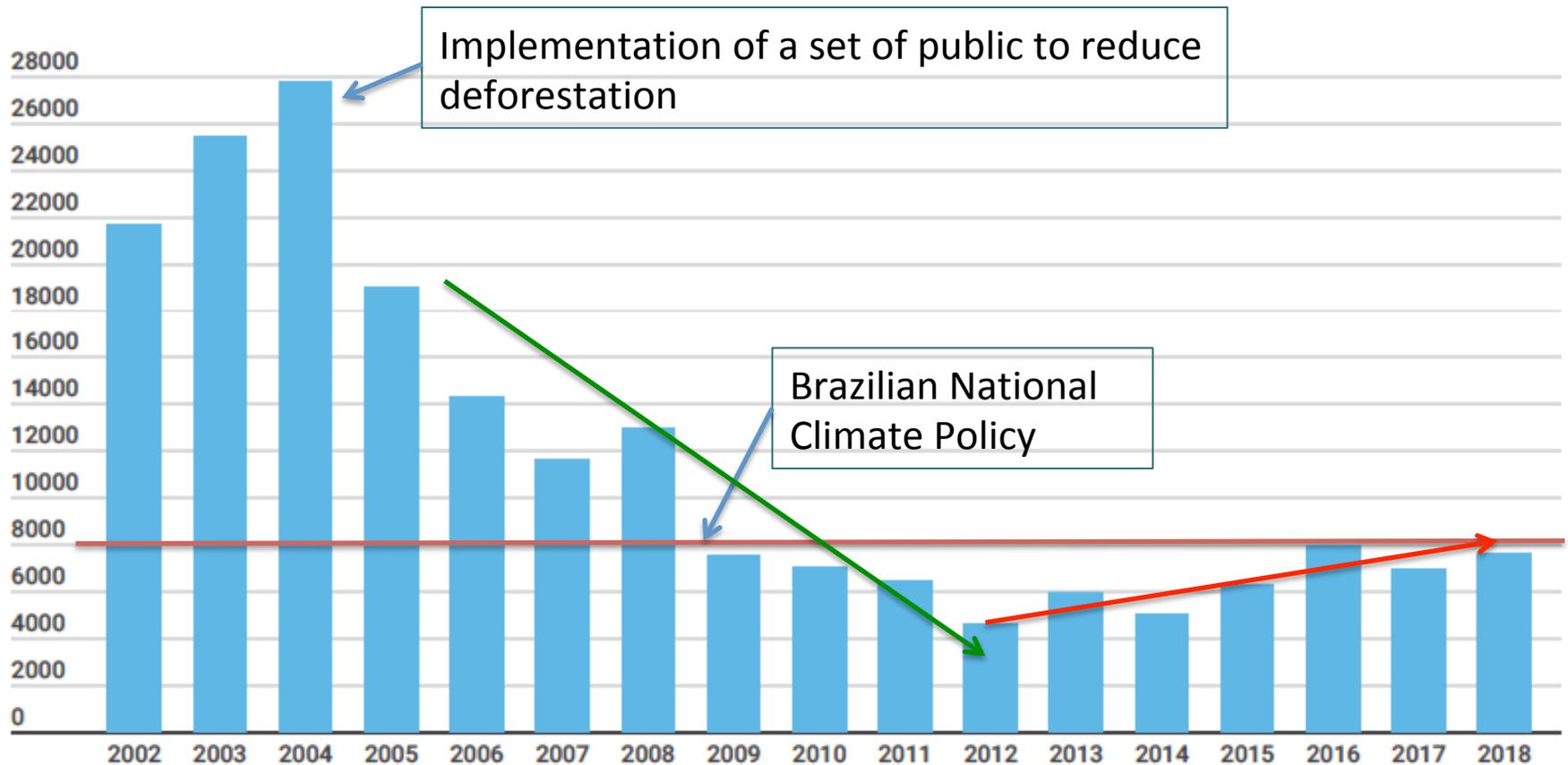


Total carbon stock across the study region at three thresholds of canopy cover



Sassan S. Saatchi et al. PNAS 2011;108:24:9899-9904

Deforestation rates – Brazilian Amazon

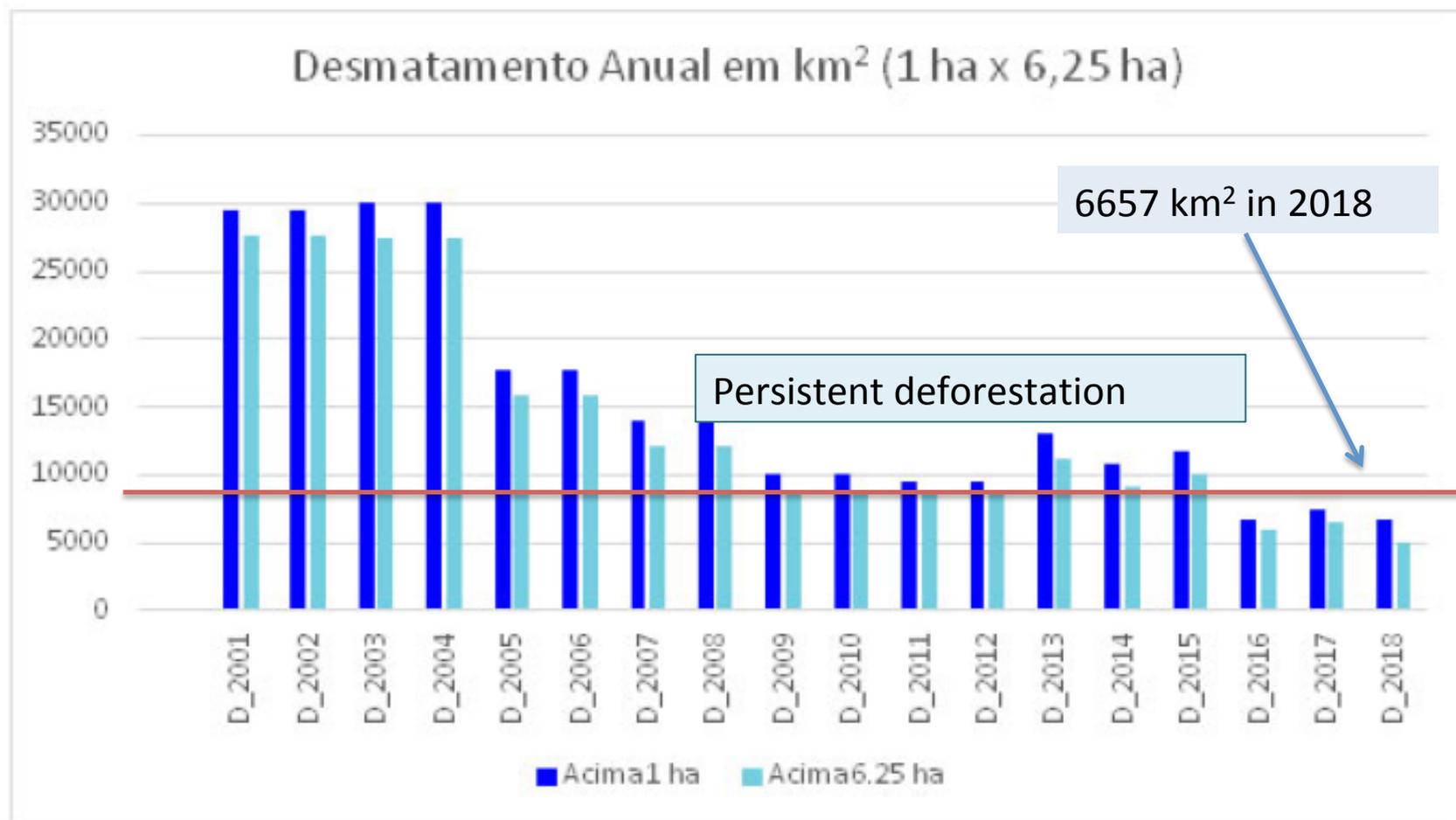


Fonte: Prodes

Role of public policies

- Creation of large protected areas
- Enforcement of environmental legislation,
- Use of advanced technologies to monitoring deforestation by PRODES (Amazon Deforestation Monitoring Program)
- Cut of public credit for municipalities with higher deforestation rates
- Establishment of large logging concessions on public lands

Deforestation rates – Cerrado



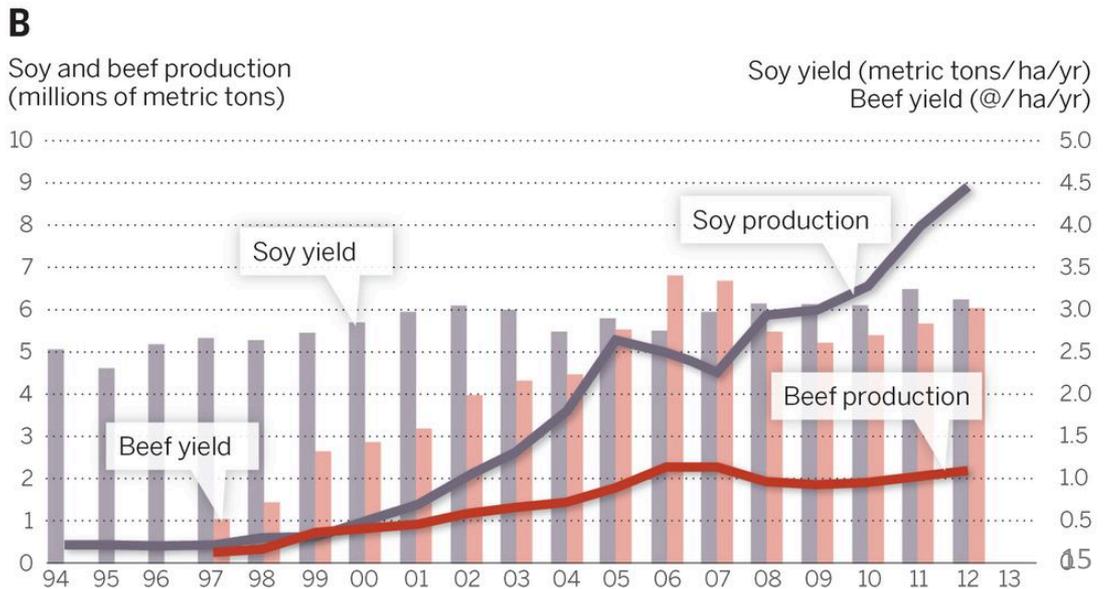
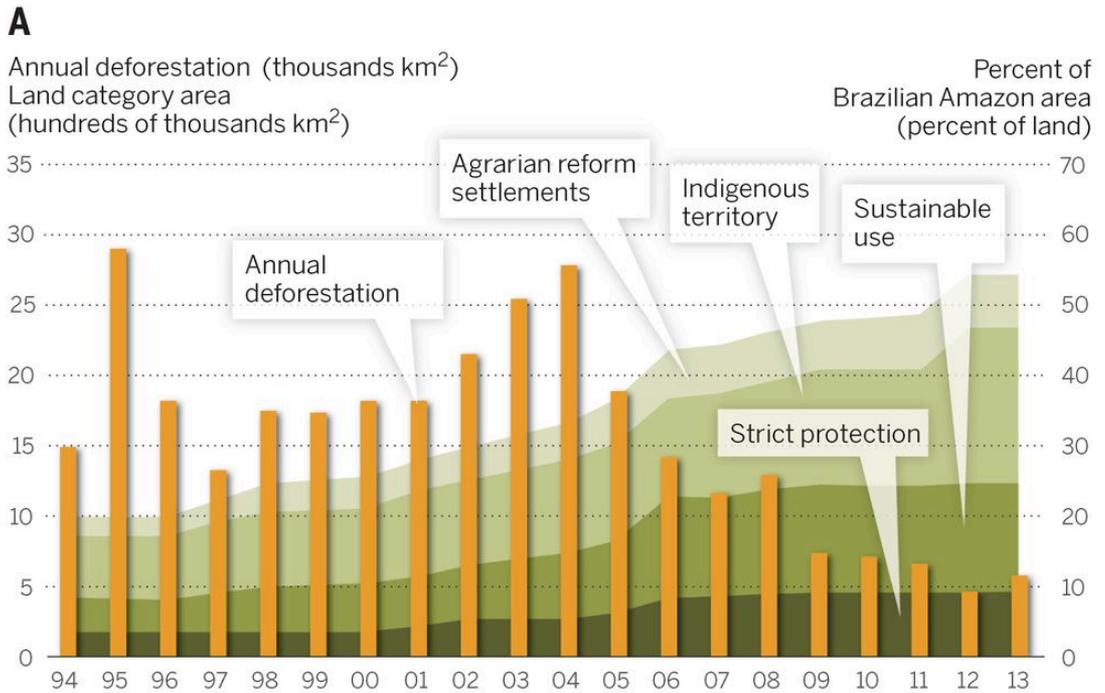
Role of private sector

- Brazil - interventions in the soy and cattle supply chains.
- The response of the private sector to climate change will be key for setting and achieving the commitments made by Parties to the UNFCCC.
- Private commitments to reduce deforestation from supply chains has greatly increased in recent years:
- at least 760 public commitments by 447 producers, processors, traders, manufacturers and retailers as of March 2017 (Donofrio et al. 2017).

Deforestation, area of land use categories, and production (beef and soy) trends in the Brazilian Amazon.

(A) Annual deforestation and the area of indigenous territories, sustainable development reserves (e.g., extractive reserves), strict protection reserves, and agrarian reform settlements.

(B) Soy and beef production and yields (for beef yields, @ = 15 kg of carcass weight) in the Brazilian Amazon. Annual deforestation data are from Instituto Nacional de Pesquisas Espaciais (INPE)



Role of private sector

- But...
- Concern i that corporate commitments related to sustainable and 'deforestation free' supply chains will exclude already marginalized groups as smallholders, who often operate within broader informal economies, resulting in negative social and environmental impacts.

Role of private sector

- Therefore...
- the effectiveness of supply-chain initiatives by private actors also depends on:
 - Transparency and traceability
 - Public policies to enable the adoption of sustainable practices,
 - Creation and maintenance of key infrastructure,
 - Measures and safeguards to address adverse effects on small producers.

(Lambin et al. 2018)

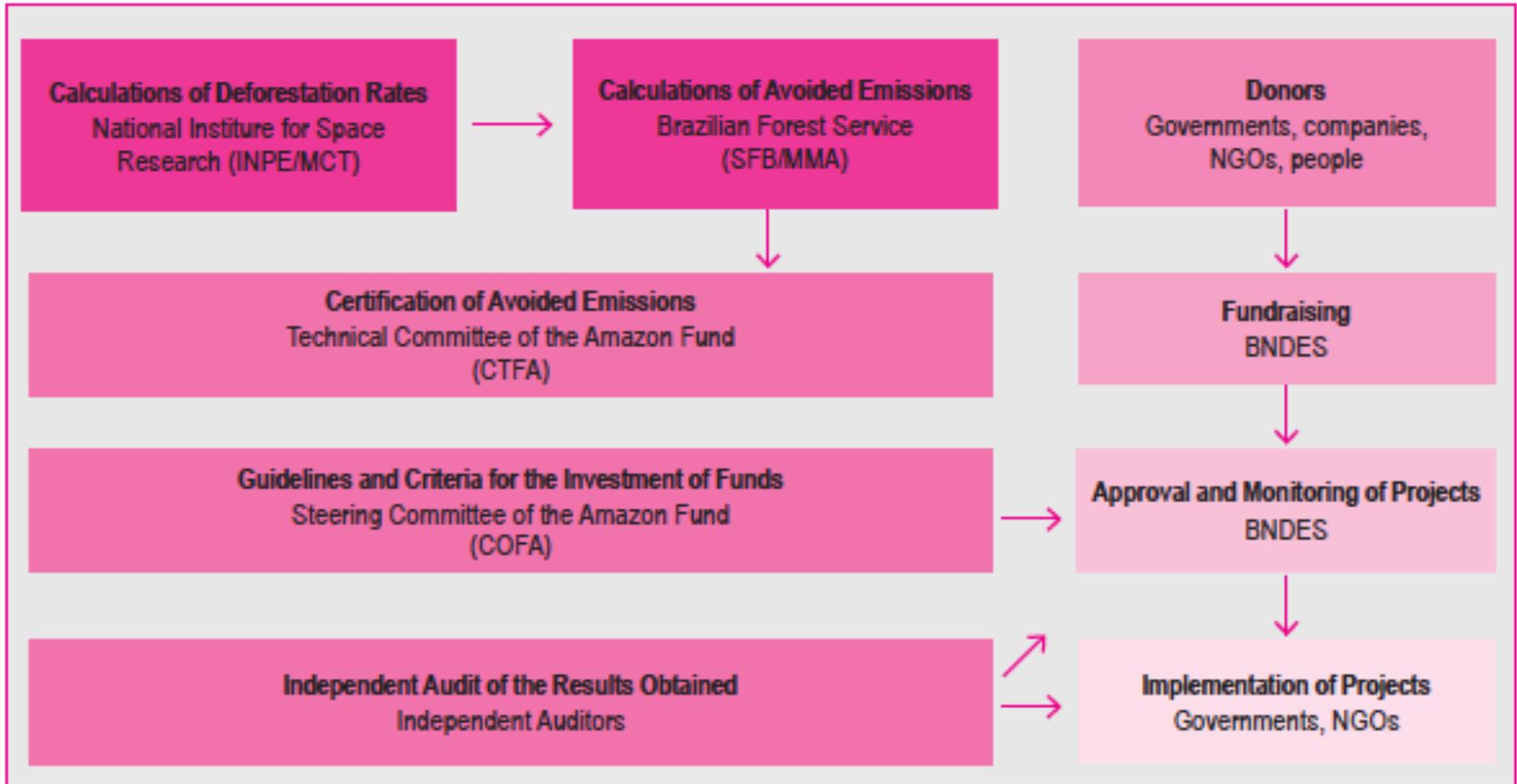
Paris Agreement and the Forest sector

- endorses Reduced Emissions from Deforestation and Forest Degradation (REDD+), sustainable forest management,
- allows for alternative (non-market) policy approaches such as joint mitigation and adaptation,
- and emphasizes the importance of non-carbon benefits and equity for sustainable development.

Amazon Fund

- The Amazon Fund, created in 2008 by the Brazilian Federal Government, was managed by Banco Nacional de Desenvolvimento Econômico e Social (BNDES).
- It was a pioneering initiative to fundraise and manage financial resources to cut back deforestation and support sustainable development for 30 million inhabitants in the Amazon Biome.
- Norway and Germany were the main donors.

Amazon Fund Governance



Source: BNDES (2011, p. 23).

Amazon Fund Model

- The Amazon Fund's management model was unique, combining strategies and knowledge from private philanthropic funds and environmental conservation funds.
- Its innovative characteristic was based on four aspects:
 1. fundraising based on the evidence of results;
 2. multi stakeholder governance with managerial autonomy;
 3. low management cost - staff and infrastructure are provided by BNDES.
 4. forest observation conducted by INPE

Amazon Fund Model

- Relevant experimental model of rainforest conservation where human development is associated with preservation.
- But ...the Amazon Fund is integrated in a complex political environmental context
 - economic interests of different players, changes in the Forest Code (2012), and government programs that overlap each other among others

Challenges of governance

- Changes in the Federal government - discourse and practices – including changes in the orienting Committee of the Fund
- Norway suspended funds
- Indicates the need of multiple strategies to directed mitigation funds

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Norway

Norway halts Amazon fund donation in dispute with Brazil

International concerns grow over deforestation surge since Jair Bolsonaro took power

Deforestation in Colombia

- Several reports state that deforestation has increased in FARC formerly controlled areas.
- The end of conflict had a toll on deforestation.
- The share of deforestation has increased in municipalities subject to FARC's influence before the cease fire agreed in 2015.
- From a policy perspective, replacing or introducing effective governance frameworks that control deforestation in areas formerly under FARC's influence is crucial.
- State weakness in those areas is protracted.
- The rebel group's retrenchment has left a substantial power vacuum in areas that were previously under its control.



Where Is the Amazon Rainforest Vanishing? Not Just in Brazil



New York Times
some days ago

Illegal mining in
Peruvian Amazon

The rule of law and environment

- Environmental rule of law is central to sustainable development.
- It integrates environmental needs with the essential elements of the rule of law, and provides the basis for improving environmental governance.
- It highlights environmental sustainability by connecting it with fundamental rights and obligations.
- Without environmental rule of law and the enforcement of legal rights and obligations, environmental governance may be arbitrary, that is, discretionary, subjective, and unpredictable.

Illegal logging is a huge barrier for using timber markets to promote sustainable use and conservation of forests.

Pará state—the largest timber production state in the Brazilian Amazon—44% (46,149 ha) of all tropical timber harvested between 2015 and 2016 was illegal.

SCIENCE ADVANCES | RESEARCH ARTICLE

APPLIED ECOLOGY

Fake legal logging in the Brazilian Amazon

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Vanessa E. Sontag¹, Saulo E. X. F. Souza¹, Mark D. Schulze³

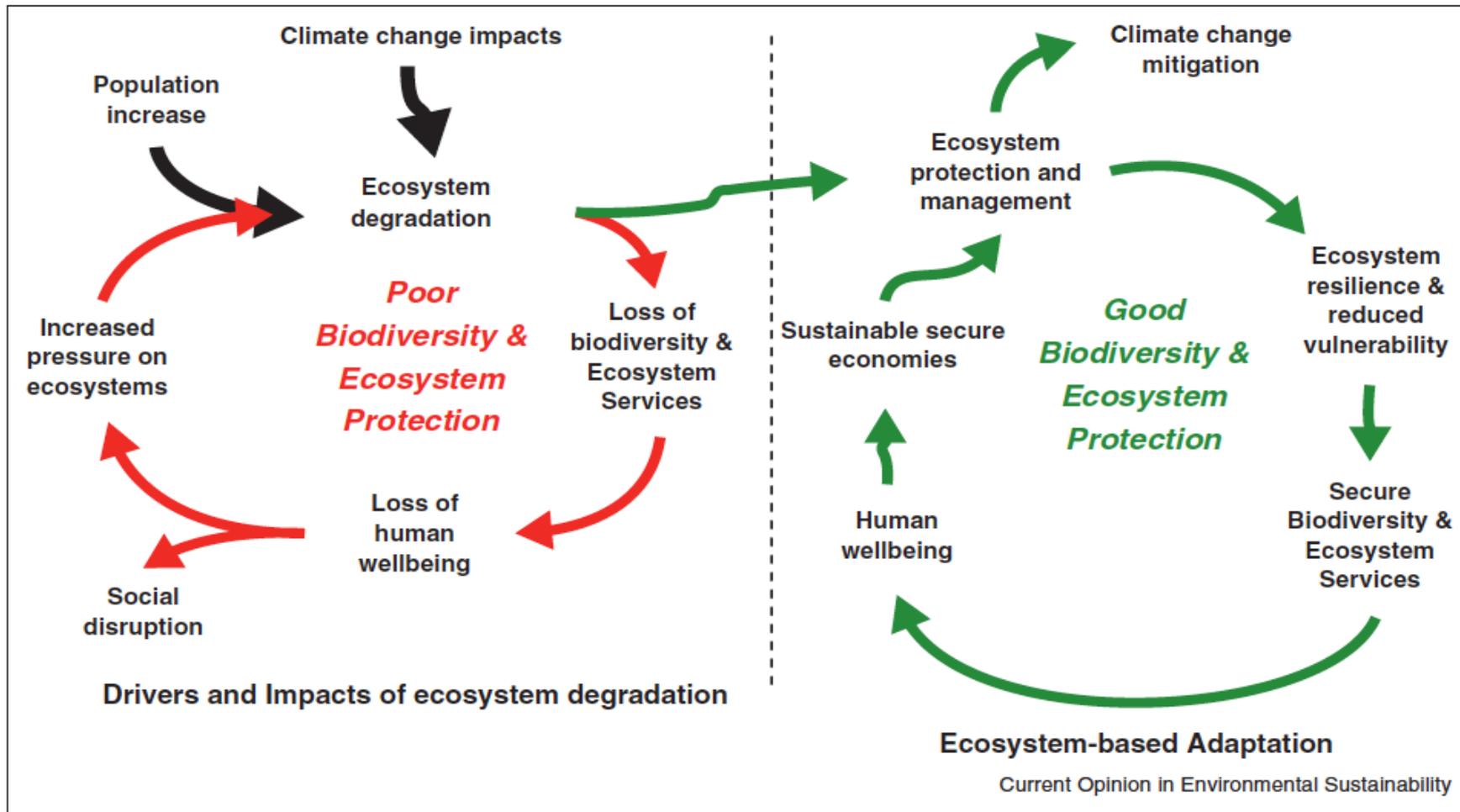
Declining deforestation rates in the Brazilian Amazon are touted as a conservation success, but illegal logging is a problem of similar scale. Recent regulatory efforts have improved detection of some forms of illegal logging but are vulnerable to more subtle methods that mask the origin of illegal timber. We analyzed discrepancies between estimated timber volumes of the national forest inventory of Brazil and volumes of logging permits as an indicator of potential fraud in the timber industry in the eastern Amazon. We found a strong overestimation bias of high-value timber species volumes in logging permits. Field assessments confirmed fraud for the most valuable species and complementary strategies to generate a “surplus” of licensed timber that can be used to legalize the timber coming from illegal logging. We advocate for changes to the logging control system to prevent overexploitation of Amazonian timber species and the widespread forest degradation associated with illegal logging.

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Forest conservation and poverty

- 7.1% (398) among 5565 Brazilian municipalities comprise:
 - 36% of the total area of native remnants in the country
 - 22% of the poor people in Brazil.
- In their majority, these municipalities cover significant portions of the Amazon, Cerrado, Caatinga, and Atlantic forest, and
- these regions are recognized as some of the most vulnerable to climate change in the world.

Beating the vicious cycle of poverty, ecosystem degradation and climate change



R. Munang, I. Thiaw, K. Alverson, M. Mumba, J. Liu, and M. Rivington, Climate change and Ecosystem-based Adaptation: a new pragmatic approach to buffering climate change impacts, Curr Opin Environ Sustain, 2013.

Environmental pressures and conflicts

- Increasing environmental pressures contribute to poverty and to growing social inequalities.
- Conflicts over natural resources and environmental crimes intensify the problems.
- Globally, at least 40% of internal conflicts over the last 60 years have a link to natural resources.
- The risks of violent conflict increase when exploitation of natural resources causes environmental damage, loss of livelihood, or unequal distribution of benefits.



Contents lists available at ScienceDirect

Ecosystem Services

journal homepage: www.elsevier.com/locate/ecoser



Linking inequalities and ecosystem services in Latin America[☆]

Pedro Laterra^{a,b,*}, Laura Nahuelhual^{c,d}, María Vallejos^e, Lina Berrouet^f, Erika Arroyo Pérez^g, Lucas Enrico^h, Cecilia Jiménez-Sierra^g, Kathya Mejíaⁱ, Paula Meli^{j,k}, Alexander Rincón-Ruiz^l, Danilo Salas^m, Jovanka Špirićⁿ, Juan Camilo Villegas^f, Clara Villegas-Palacio^o



Land-use poverty traps identified in shifting cultivation systems shape long-term tropical forest cover

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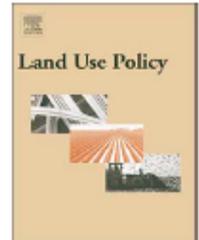
Edited by Christopher B. Barrett, Cornell University, Ithaca, NY, and accepted by the Editorial Board March 11, 2011 (received for review August 31, 2010)



Contents lists available at [ScienceDirect](#)

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol



A trilogy of inequalities: Land ownership, forest cover and ecosystem services distribution



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Drivers of deforestation

- National data from 46 tropical and sub-tropical countries on drivers of deforestation and forest degradation from REDD+ readiness documents and activities (De Sy 2016):

➤ Commercial agriculture - 40% of deforestation and most prominent in the early-transition phase.

➤ Subsistence agriculture - 33% of deforestation.

➤ Thus, agriculture alone causes 73% of all deforestation.

Drivers of deforestation

- Expansion of commercial agriculture into the forest is observed especially in the Amazon region and Southeast Asia.
- Deforestation in Africa is still largely driven by small-scale subsistence activities, but this might change in the coming years.
- Mining activities (illegal and legal) is adding pressure on tropical forests.

Drivers of forest degradation

- The most prominent degradation driver for Latin America and Asia is **unsustainable timber extraction and logging** (> 70%)
- While **fuelwood collection and charcoal** is the main degradation driver in Africa (48%).
- Globally, forest degradation affects approximately 100 million ha of forest per year (FAO, 2006; Nabuurs et al., 2007).

Forest degradation in the Brazilian Amazon

- The average deforestation rate from 2006 to 2010 was 11,922 km² per year, and for forest degradation it was 5,536 km² per year.
- Forest degradation affected an area equivalent to 30% of the total area deforested.
- Forest degradation leads to impoverishment of the forest in terms of biodiversity and carbon stocks.

Forest degradation in the Peruvian Amazon

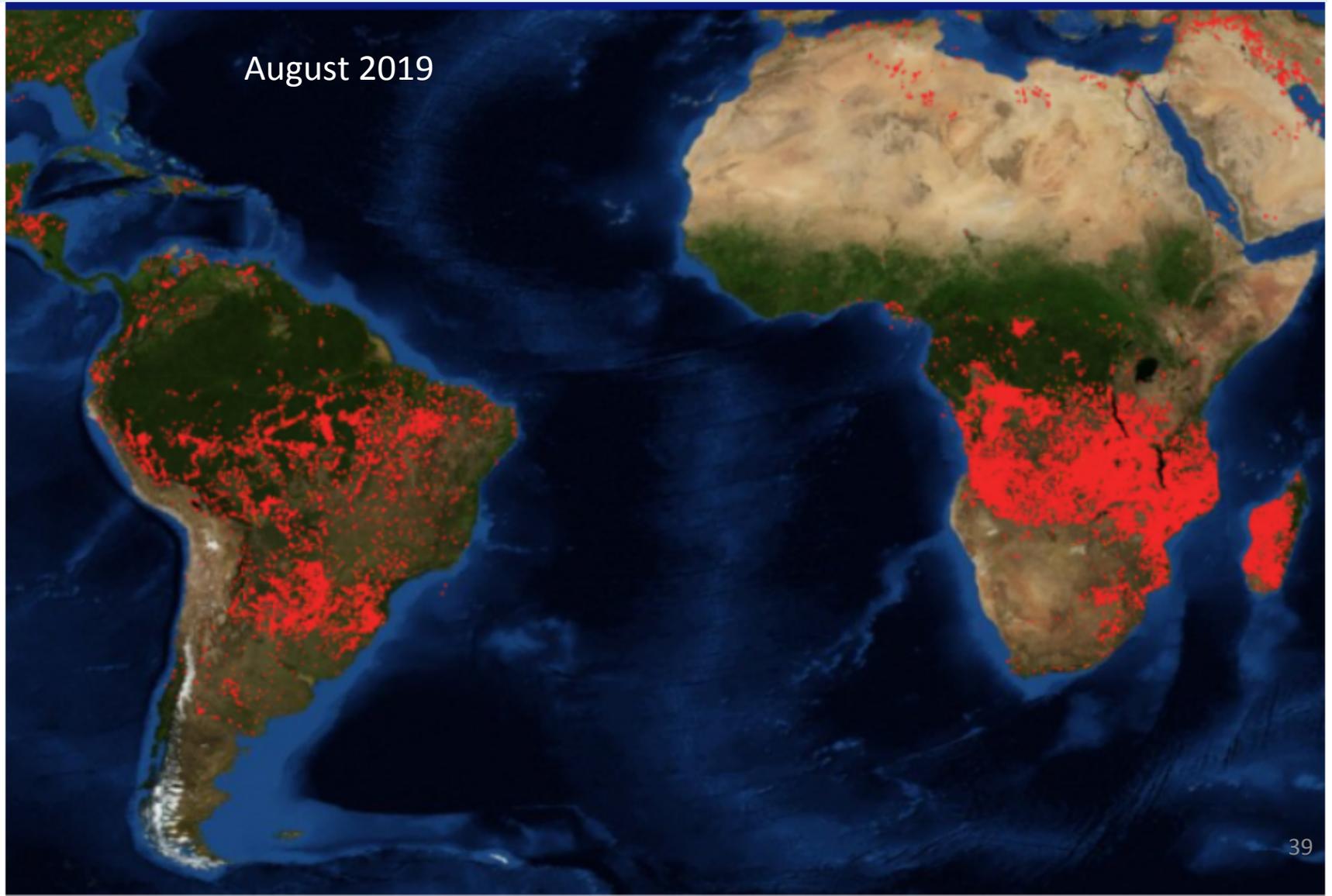
- 4.3 million ha in the Peruvian Amazon (1999–2009)
- High resolution (0.1 ha) satellite imagery
- Forest degradation added 47% more carbon to the atmosphere than deforestation alone.
- Secondary regrowth provided an 18% offset against total emissions in Peru, a high forest cover, low deforestation country.

Asner et al. (2010)

Forest degradation and restoration

- Important consequences of deforestation and forest degradation:
- decreases in environmental, social and economic functionalities,
- increased vulnerability to fire,
- and doubling of net carbon emissions from regional land-use during severe El Niño episodes and other drought years.
- **Thus, reducing emissions from forest degradation is also essential to mitigate global climate change and its impacts on forests and other ecosystems.**

Fires, deforestation, degradation...



Fires

- Fires affect large areas in the tropics and have a wide range of effects on forest structure, carbon storage, and biodiversity.
- In the Amazon, extreme droughts caused by ENSO or other climatic phenomena boost fires.
- Combined effect of drought and forest fires may turn the Amazon into a carbon-source system.
- However, in the last decade (2000–2010), large forest fires were observed even in non-ENSO years.

Natural regeneration

- **Securing a sufficient regeneration of a forest is a great challenge in forest management.**
- Key component for securing the sustainability of forests.
- Tool in the implementation of large-scale restoration programs in degraded forest areas, especially in the tropical regions.
- Affected by both environmental and biological factors.

Expansion of secondary forests

- **Regrowth of secondary forests may remove considerable amounts of carbon from the atmosphere**, and extensive areas of regrowth have been reported in the tropics.
- Reducing deforestation and expanding secondary forests can increase forest resilience.
- But...
- Climate models project more frequent and severe droughts for some tropical forest regions, and increasing the risk from forest fires in coming decades.

Permanence of secondary forests?

- Estimation of the area and permanence of the secondary vegetation in the legal Amazon
- In the Amazon region there is evidence that the the rate of development and the permanence of secondary vegetation may be **associated with the type of land use and also with the stages of consolidation of the agricultural frontier.**
- Period evaluation (1997, 2000, 2003 e 2006)
- Estimated an area of 131,873 km² ($\pm 12,445$ km²) of secondary vegetation for the year 2006.
- **The permanence of the secondary vegetation was estimated as a half-life of 4.9 years for the secondary vegetation.**
- **~every 5 years , half of the area covered by secondary forests is cut again.**

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Ensuring governance at different levels and accountability is crucial

- Implementation of forest-based mitigation options in the Paris Agreement would require large-scale:
 1. Variety of strategies of funding and governance
 2. Address new options of local development
 3. estimation, modelling, monitoring, reporting and verification of GHG inventories,
 4. mitigation actions and their implications and co-benefits, along with reporting on climate change impacts and adaptation

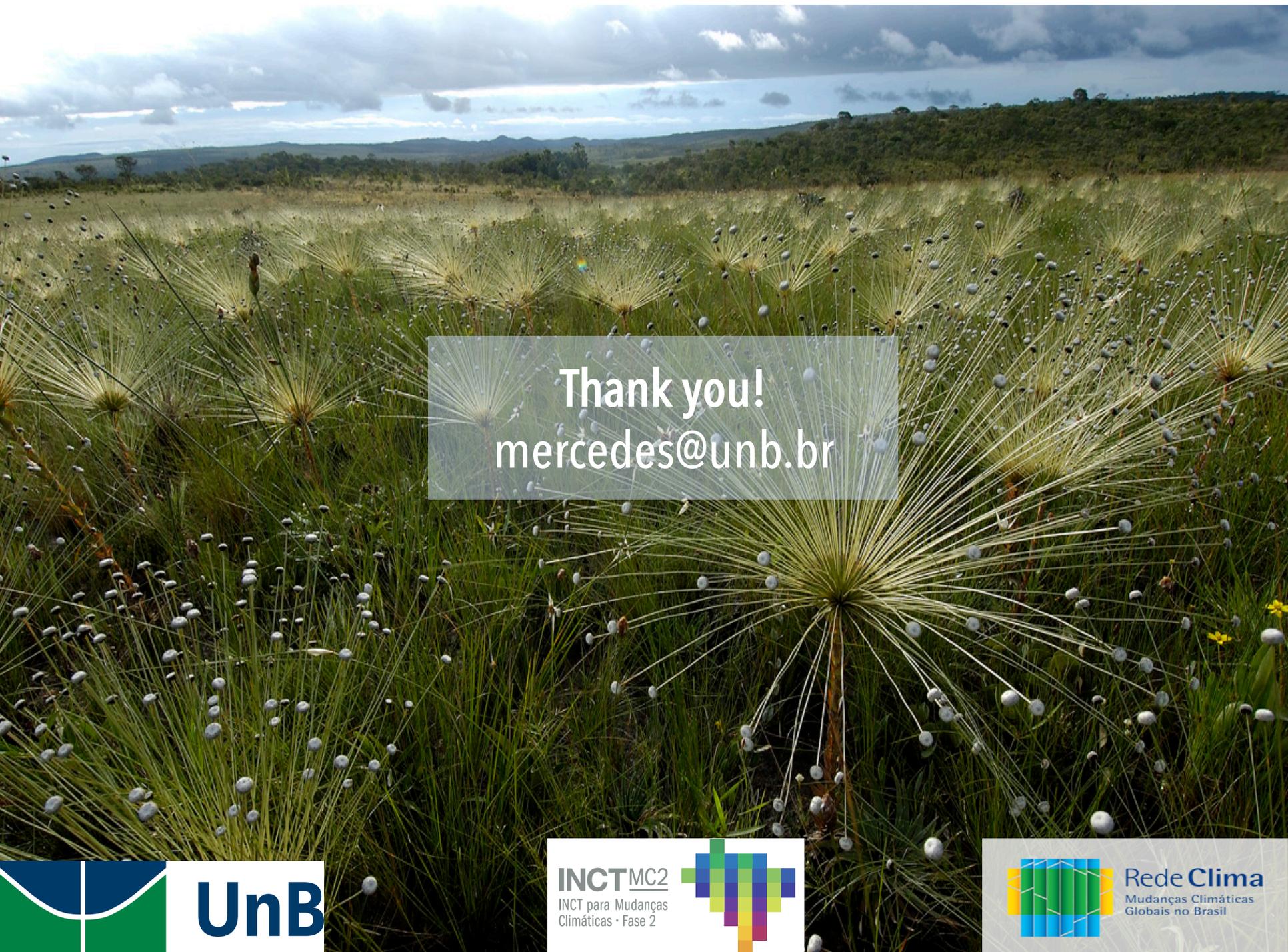
Sustainability demands

- Identify appropriate incentives to reduce deforestation
- Synergies between conservation and restoration priorities
- Benefit people whose livelihoods depend on natural ecosystems



Foto: L.M. Coutinho





Thank you!
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