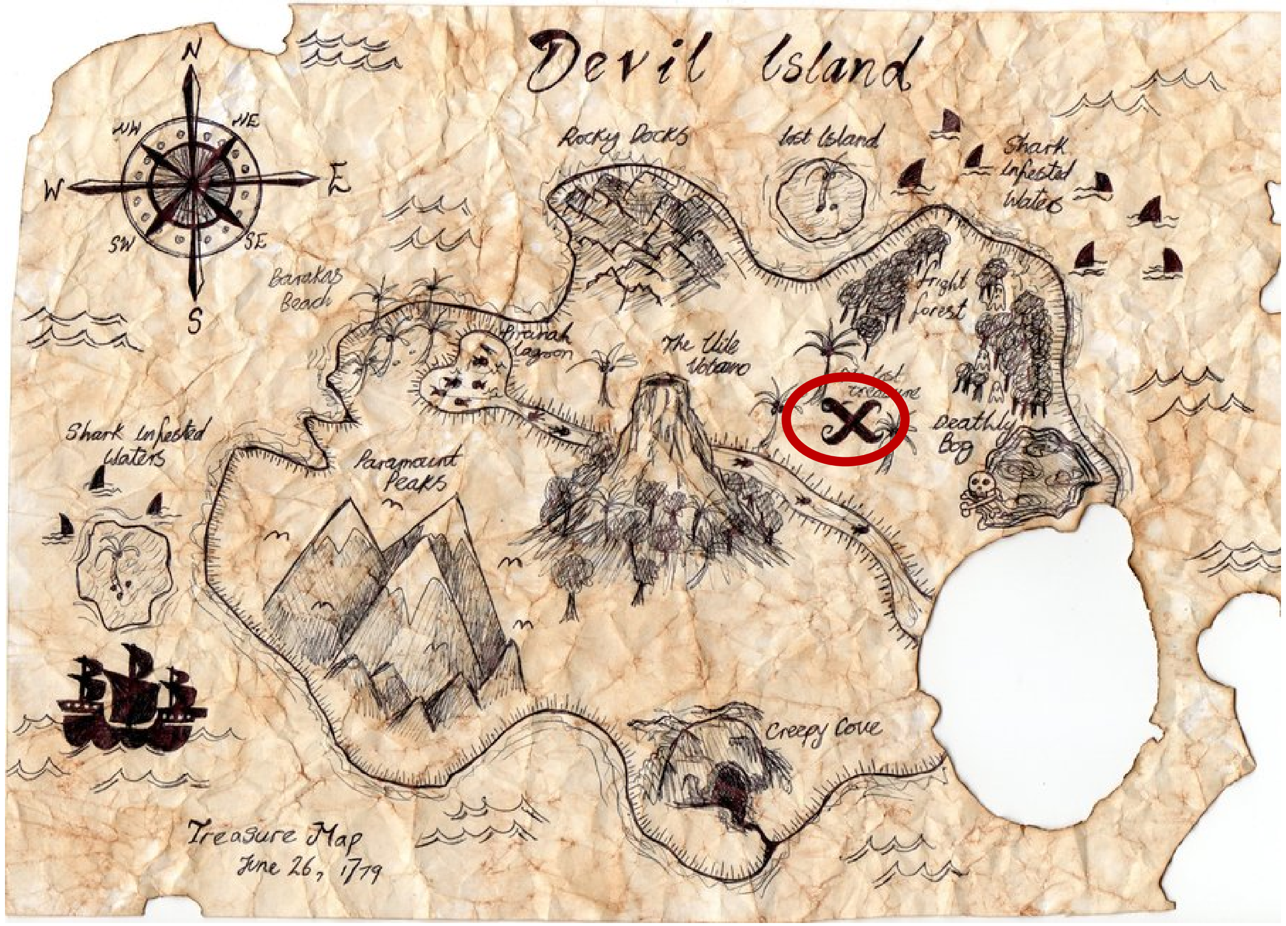
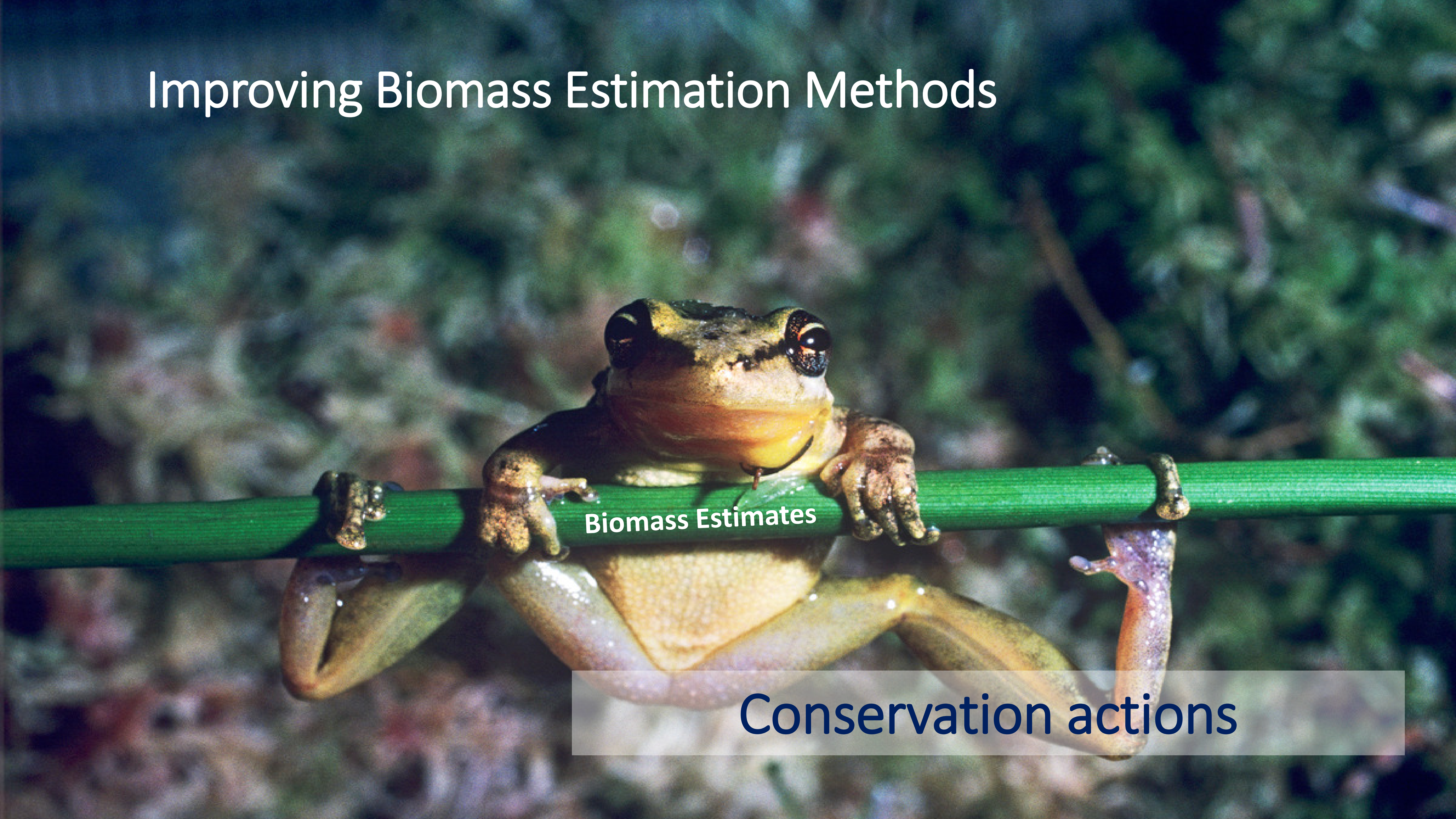
Monitoring Needs for Forest Conservation

Naikoa Aguilar-Amuchastegui PhD
Director Forest Carbon Science WWF-US
aguilaramuchastegui@wwfus.org



A good map is the one that ends up being used

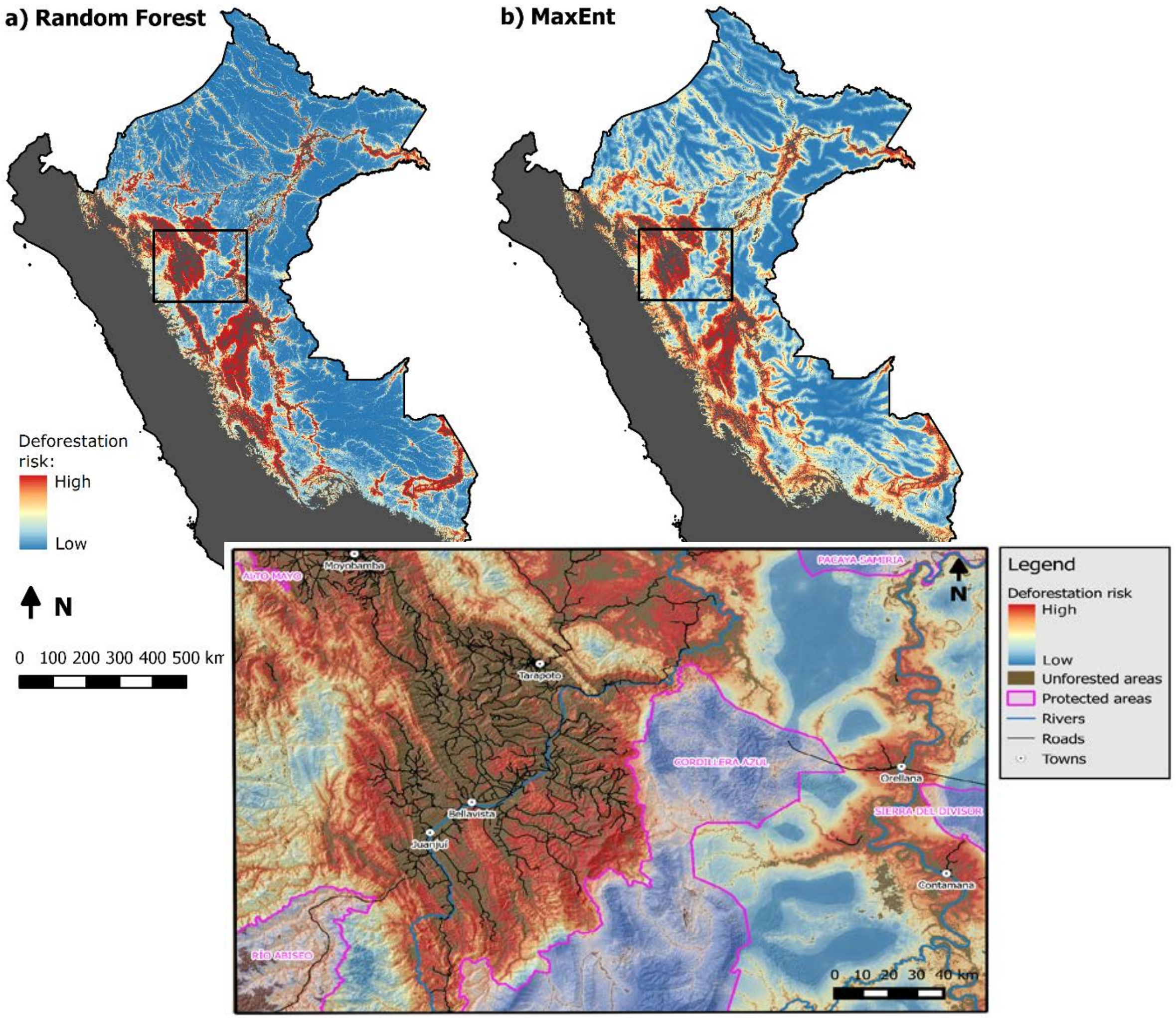
Improving Biomass Estimation Methods



D&D. Deforestation and Forest Degradation

Making the case for Forest Carbon Stocks Finance
Sept 6-8 2017, Woking, UK

Deforestation Risk Modeling Outputs



- In light of 1.5 Deg report emphasis on CCS
- Existing protected areas
- Remote forests without detectable human presence
- Areas listed for “production” but not yet touched
- Indigenous/traditional management areas that maintain ecological integrity
- Areas with little historical anthropogenic disturbance that could be restored to “natural” forests

REL submissions to UNFCCC

Activities: Most countries include deforestation (except Malaysia), but many lack data on degradation and regrowth, and therefore did not include estimates of forests remaining forests (F→F) or non-forest to forest (NF→F)—even though in some cases estimates are provided in the GHGI included in their NC or the summaries of the GHGI in their BURs. Some included forest degradation but have partially included such estimates—for example, using logging data to estimate forest degradation, but not degradation caused by fuelwood harvesting or fire (as these are more difficult to estimate).

	BRAZIL	BRAZIL (II)	CAMBODIA	CHILE	COLOMBIA	COSTA RICA	ECUADOR	ETHIOPIA	HONDURAS	GUYANA	GHANA	INDONESIA	IVORY COAST	MADAGASCAR	MALAYSIA	MEXICO	NEPAL	PARAGUAY	PERU	PNG	REP. CONGO	SRI LANKA	TANZANIA	UGANDA	VIETNAM	ZAMBIA
Deforestation																										
Degradation																										
Enhancement			**	**		**		*			*		*				**			**		*			*	
SMF																										
Conservation																										

*Conversion from non-forest to forest **Conversion from non-forest to forest and enhancements in forest remaining forest

Source: D.Lee and M. Sanz-Sanchez (2017)

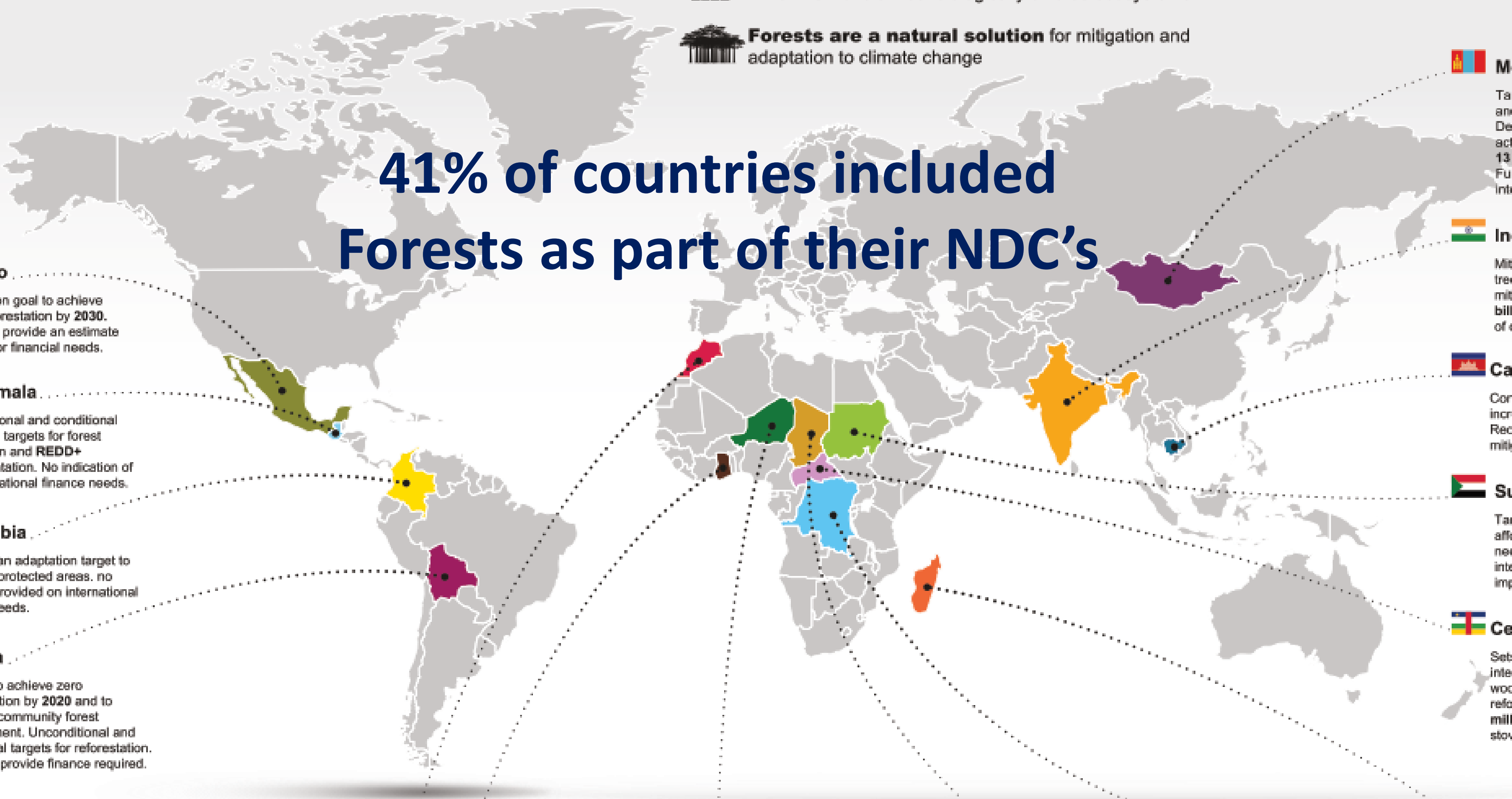
Snapshot of forests in the INDCs

11% of global **GHG** emissions come from deforestation

If we do nothing **170 million hectares** could be lost in 2030:
11 of the world's most biologically diverse ecosystems

Forests are a natural solution for mitigation and adaptation to climate change

41% of countries included Forests as part of their NDC's



Mexico

Adaptation goal to achieve zero deforestation by **2030.** Does not provide an estimate of costs or financial needs.

Guatemala

Unconditional and conditional mitigation targets for forest restoration and **REDD+** implementation. No indication of the international finance needs.

Colombia

Includes an adaptation target to increase protected areas. no detail is provided on international finance needs.

Bolivia

Targets to achieve zero deforestation by **2020** and to increase community forest management. Unconditional and conditional targets for reforestation. Does not provide finance required.

Mongolia

Targets to increase forest cover and reduce forest fire impacts. Detailed cost estimates for these activities: **11 million USD and 13 million USD**, respectively. Funding **80%** dependent on international donors.

India

Mitigation target to increase tree cover. Total cost of all mitigation activities is **834 billion USD**. No indication of conditional targets.

Cambodia

Conditional mitigation target to increase and maintain forest cover. Requires **1.28 billion USD** for both mitigation and adaptation activities.

Sudan

Target to increase forest cover through afforestation and reforestation. Finance needs: **1.5 billion USD**. Also estimates international finance needed for **REDD+** implementation (**1.7 billion USD**).

Central African Republic

Sets conditional targets with international finance needs: improved wood processing (**12.5 million USD**); reforestation and restoration (**37.5 million USD**); and improved cook stoves (**5 million USD**).

Morocco

Unconditional and conditional targets for afforestation and restoration. International finance needs **35 billion USD.**

Ghana

Concrete targets for improved cook stoves, afforestation and reforestation, carbon stock enrichment, and agroforestry. Total international finance required: **7.61 billion USD.**

Niger

Conditional and unconditional mitigation targets for improved cook stoves, afforestation and reforestation, and sustainable forest management. Total international finance: **968 million USD.**

Chad

Emissions reduction commitment for land sector broken down into both unconditional and conditional targets. One of the few to fully integrate **REDD+.**

Democratic Republic of the Congo

Measurable forest sector target for afforestation and reforestation. International finance required is **3.5 million USD.**

Madagascar

Detailed targets for reforestation, improved cook stoves, and forest restoration. Includes overall conditional mitigation target.

“Remembering Photosynthesis”
“The Original CCS”

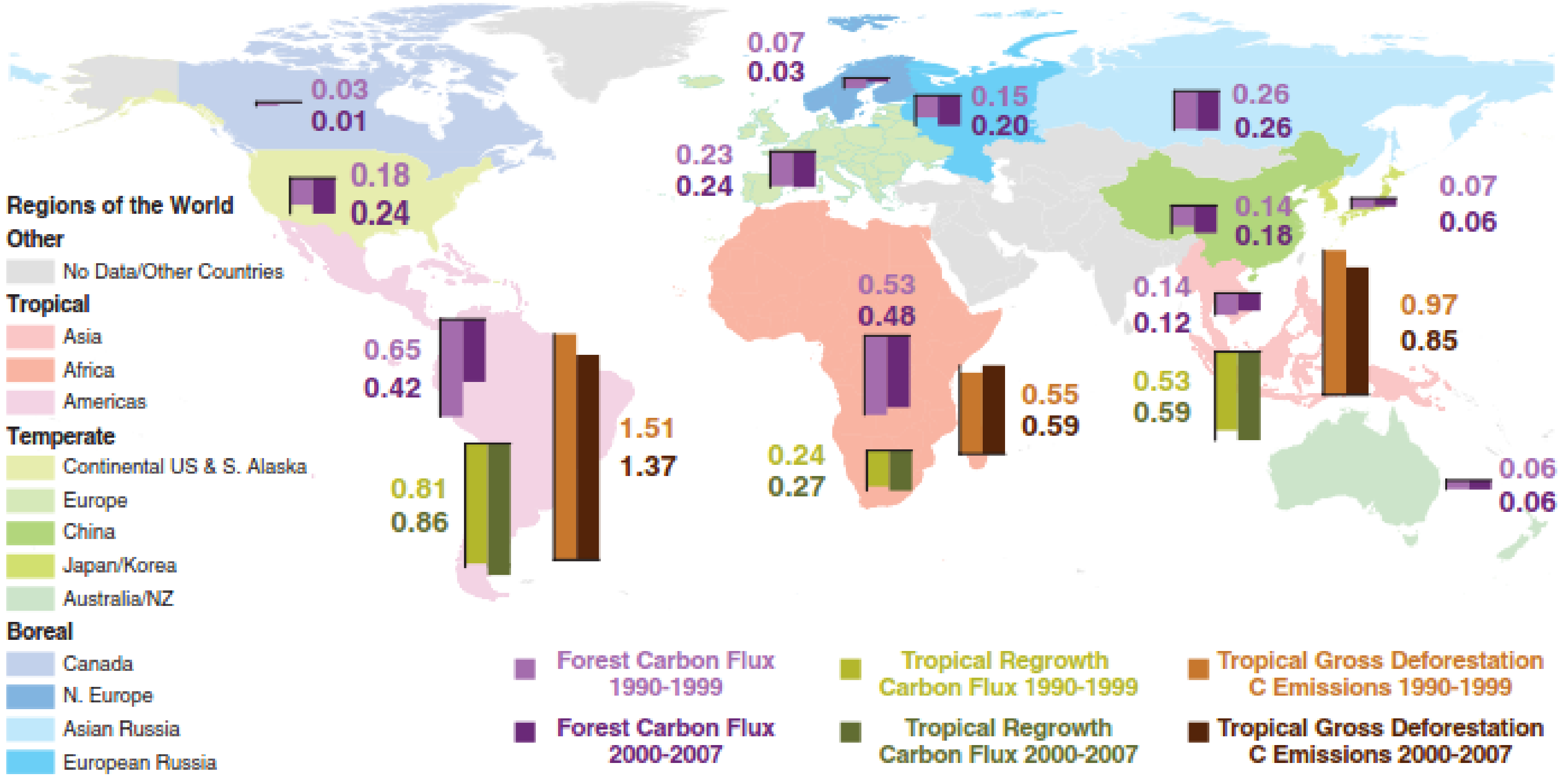


Fig. 1. Carbon sinks and sources (Pg C year^{-1}) in the world's forests. Colored bars in the down-facing direction represent C sinks, whereas bars in the upward-facing direction represent C sources. Light and dark purple, global established forests (boreal, temperate, and intact tropical forests); light and dark green, tropical regrowth forests after anthropogenic disturbances; and light and dark brown, tropical gross deforestation emissions.

A Large and Persistent Carbon Sink in the World's Forests
Yude Pan, *et al.*
Science **333**, 988 (2011);
DOI: 10.1126/science.1201609

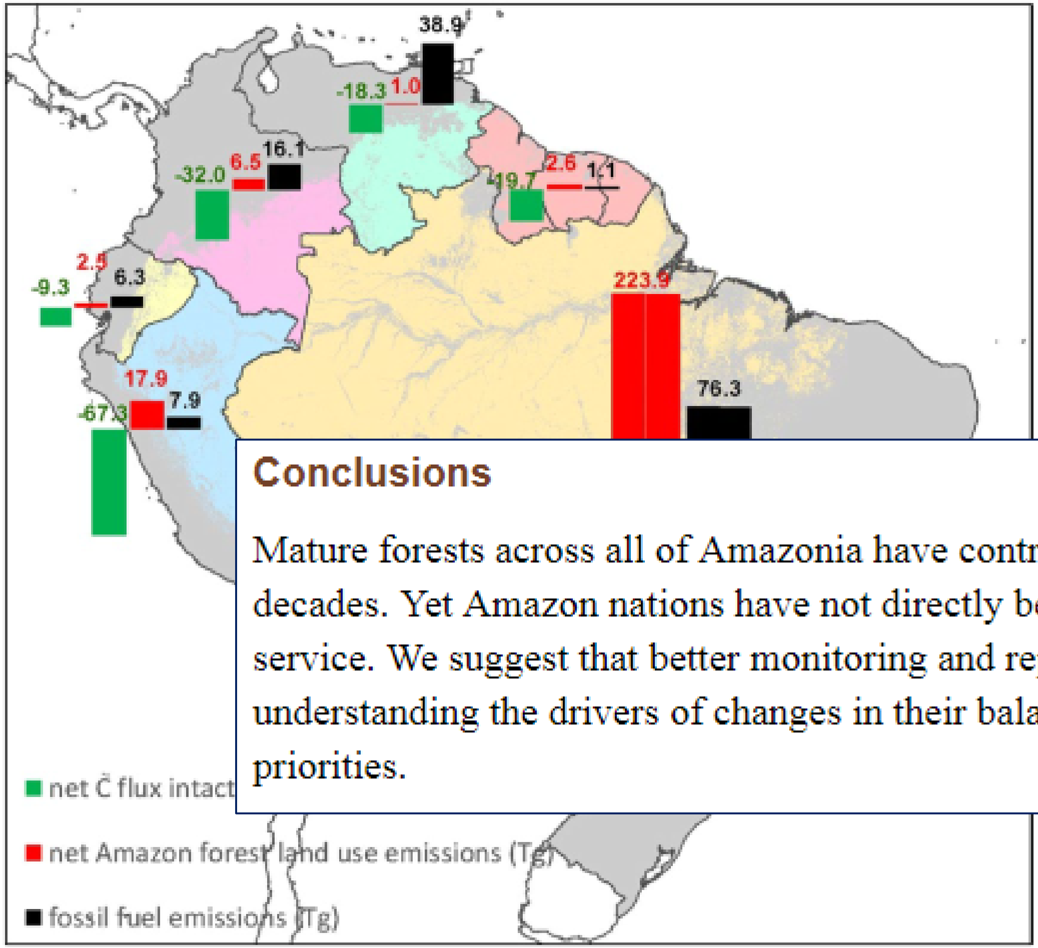
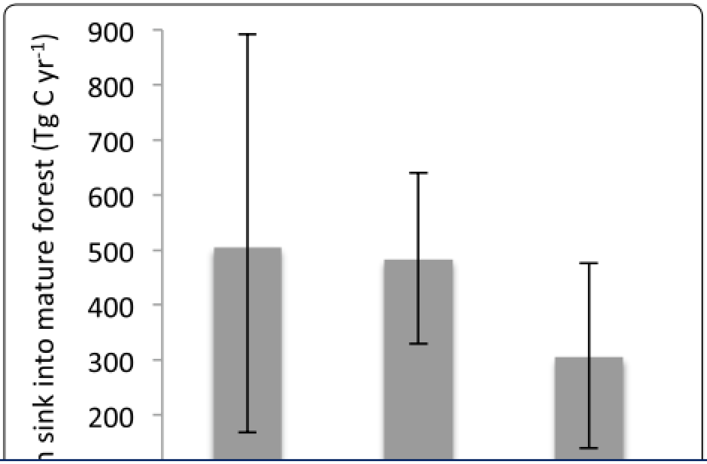


Fig. 2 Estimated Amazon carbon fluxes 1980–2010. For each nation three fluxes are represented: the net C flux mature forests (*green* and negative), the net fluxes from deforestation, i.e., losses from deforestation and degradation minus gains from regrowth (*red* and positive), and fossil fuel emissions (*black* and positive). Units are in Tg carbon per year (=10^{12} g C yr^{-1})



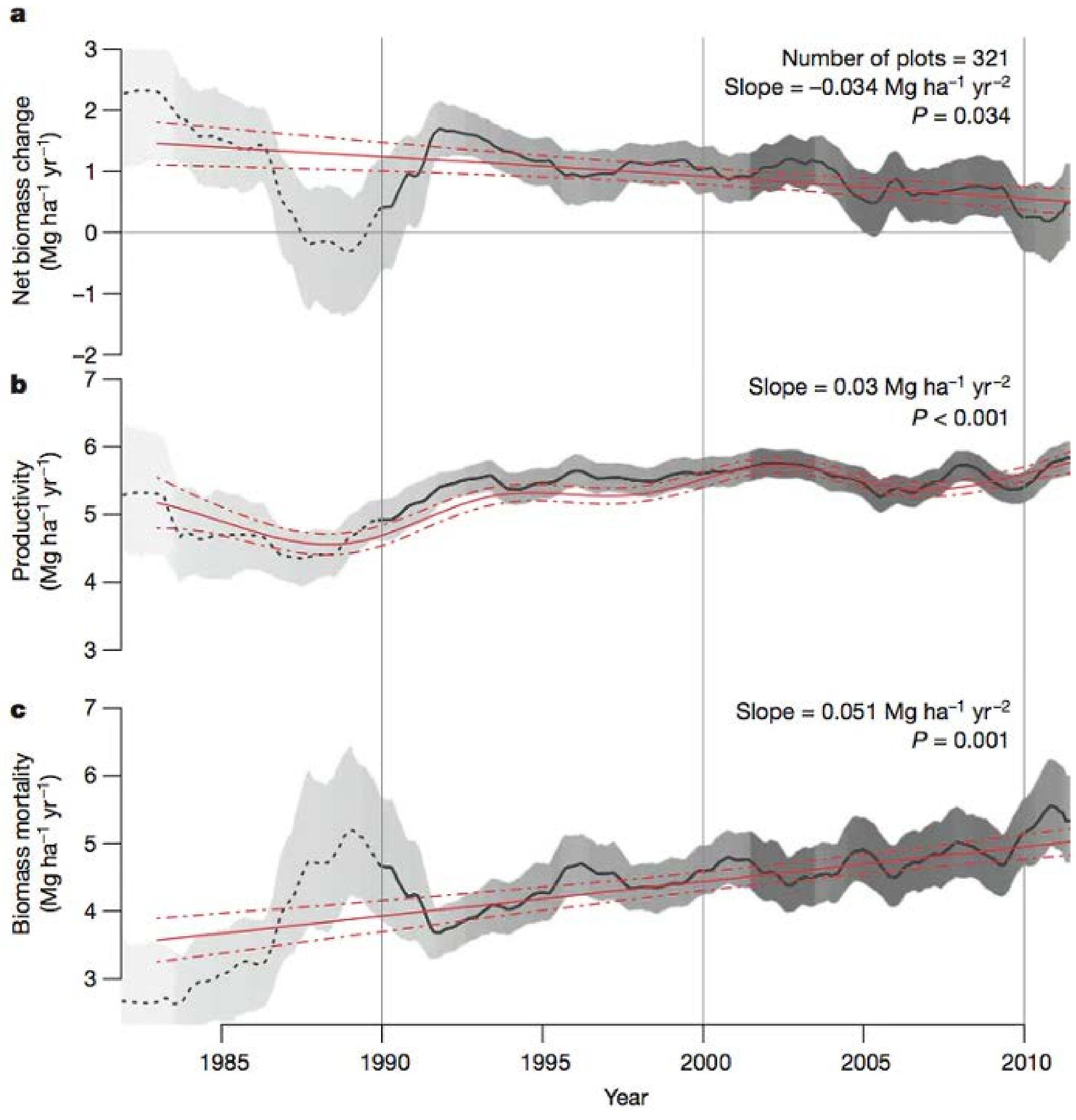
Conclusions

Mature forests across all of Amazonia have contributed significantly to mitigating climate change for decades. Yet Amazon nations have not directly benefited from providing this global scale ecosystem service. We suggest that better monitoring and reporting of the carbon fluxes within mature forests, and understanding the drivers of changes in their balance, must become national, as well as international, priorities.

Period	Mature forest Sink	Land use change	Fossil fuel emissions	Net flux
1980–1989.9	−504.4	317.9	105.2	−81.3
1990–1999.9	−482.1	271.7	139.5	−70.8
2000–2009.9	−305.9	275.4	180.0	149.5
1980–2009.9	−430.8	282.9	149.0	1.1

Fluxes are divided into carbon uptake by mature forests, the fossil fuel emissions, fluxes due to land use change and the resulting net flux. Land use change fluxes include emissions resulting from deforestation and forest degradation, and estimate for regrowth. Negative signs indicate removal of carbon from atmosphere, and positive signs indicate net C fluxes from land to the atmosphere. Units are in Tg carbon per year (=10^{12} g C yr^{-1})

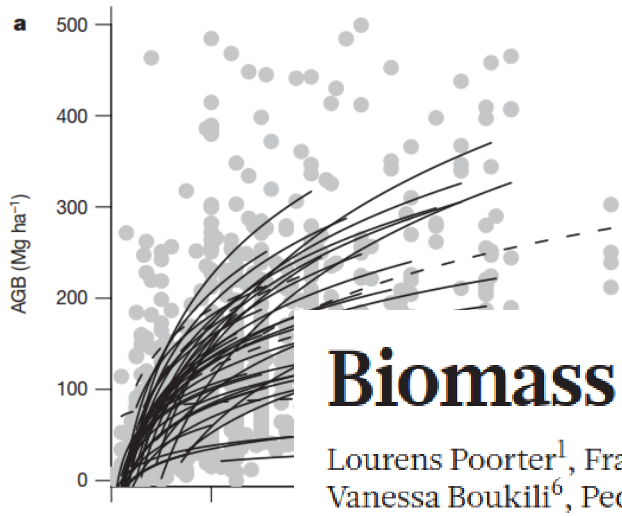
Phillips and Brienen *Carbon Balance Manage (2017) 12:1*
DOI 10.1186/s13021-016-0069-2

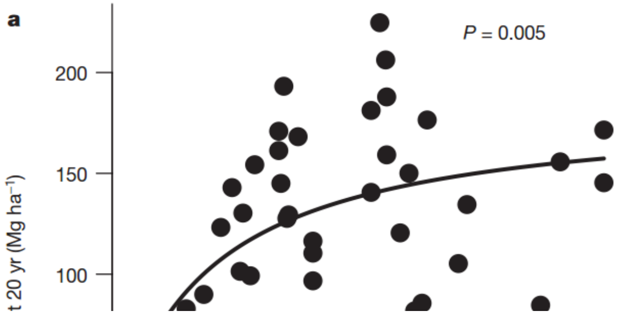


Long-term decline of the Amazon carbon sink

R. J. W. Brienen, O. L. Phillips, T. R. Feldpausch, E. Gloor, T. R. Baker, J. Lloyd, G. Lopez-Gonzalez, A. Monteagudo-Mendoza, Y. Malhi, S. L. Lewis, R. Vásquez Martinez, M. Alexiades, E. Álvarez Dávila, P. Alvarez-Loayza, A. Andrade, L. E. O. C. Aragão, A. Araujo-Murakami, E. J. M. M. Arets, L. Arroyo, G. A. Aymard C., O. S. Bánki, C. Baraloto, J. Barroso, D. Bonal, R. G. A. Boot + *et al.*

Great that a change product is coming out!!!



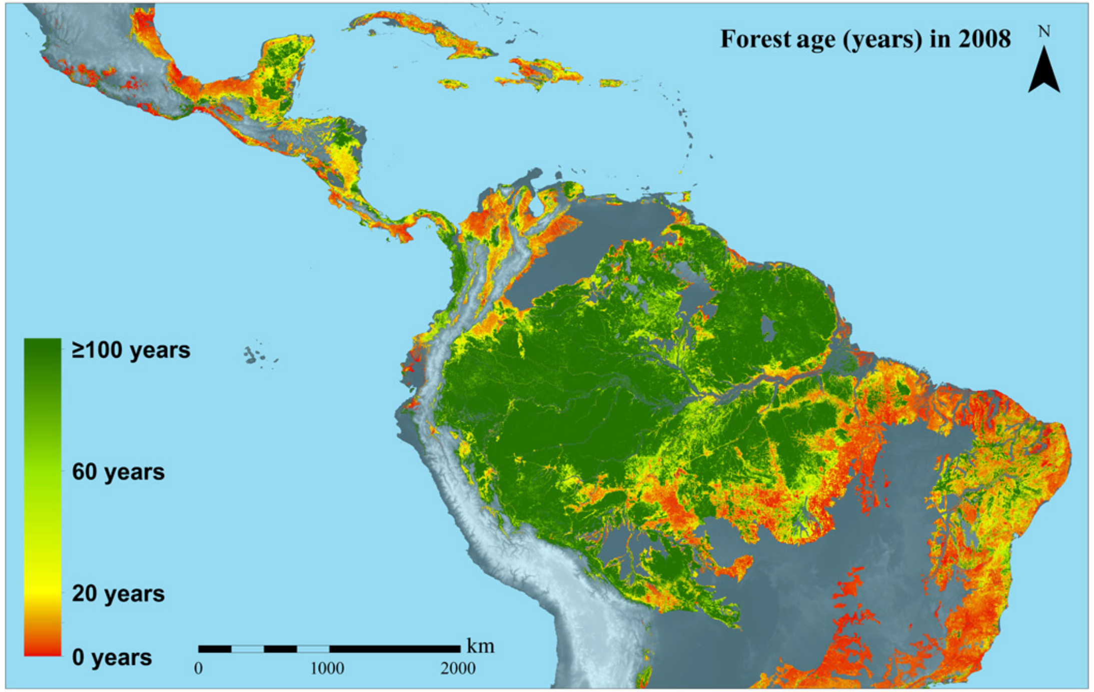


Biomass resilience of Neotropical secondary forests

Lourens Poorter[1], Frans Bongers[1], T. Mitchell Aide[2], Angélica M. Almeyda Zambrano[3], Patricia Balvanera[4], Justin M. Becknell[5], Vanessa Boukili[6], Pedro H. S. Brancalion[7], Eben N. Broadbent[3], Robin L. Chazdon[6], Dylan Craven[8,9,10], Jarcilene S. de Almeida-Cortez[11], George A. L. Cabral[11], Ben H. J. de Jong[12], Julie S. Denslow[13], Daisy H. Dent[14,15], Saara J. DeWalt[16], Juan M. Dupuy[17], Sandra M. Durán[18], Mario M. Espírito-Santo[19], María C. Fandino[20], Ricardo G. César[7], Jefferson S. Hall[8], José Luis Hernandez-Stefanoni[17], Catarina C. Jakovac[1,21], André B. Junqueira[22,23,24], Deborah Kennard[25], Susan G. Letcher[26], Juan-Carlos Licona[27], Madelon Lohbeck[1,28], Erika Marín-Spiotta[29], Miguel Martínez-Ramos[4], Paulo Massoca[21], Jorge A. Meave[30], Rita Mesquita[21], Francisco Mora[4,30], Rodrigo Muñoz[30], Robert Muscarella[31,32], Yule R. F. Nunes[19], Susana Ochoa-Gaona[12], Alexandre A. de Oliveira[33], Edith Orihuela-Belmonte[12], Marielos Peña-Claros[1], Eduardo A. Pérez-García[30], Daniel Piotto[34], Jennifer S. Powers[35,36], Jorge Rodríguez-Velázquez[4], I. Eunice Romero-Pérez[30], Jorge Ruíz[37,38], Juan G. Saldarriaga[39], Arturo Sanchez-Azofeifa[18], Naomi B. Schwartz[31], Marc K. Steininger[40], Nathan G. Swenson[41], Marisol Toledo[27], Maria Uriarte[31], Michiel van Breugel[8,42,43], Hans van der Wal[44], Maria D. M. Veloso[19], Hans F. M. Vester[45,46], Alberto Vicentini[21], Ima C. G. Vieira[47], Tony Vizcarra Bentos[21], G. Bruce Williamson[21,48] & Danaë M. A. Rozendaal[1,6,49]

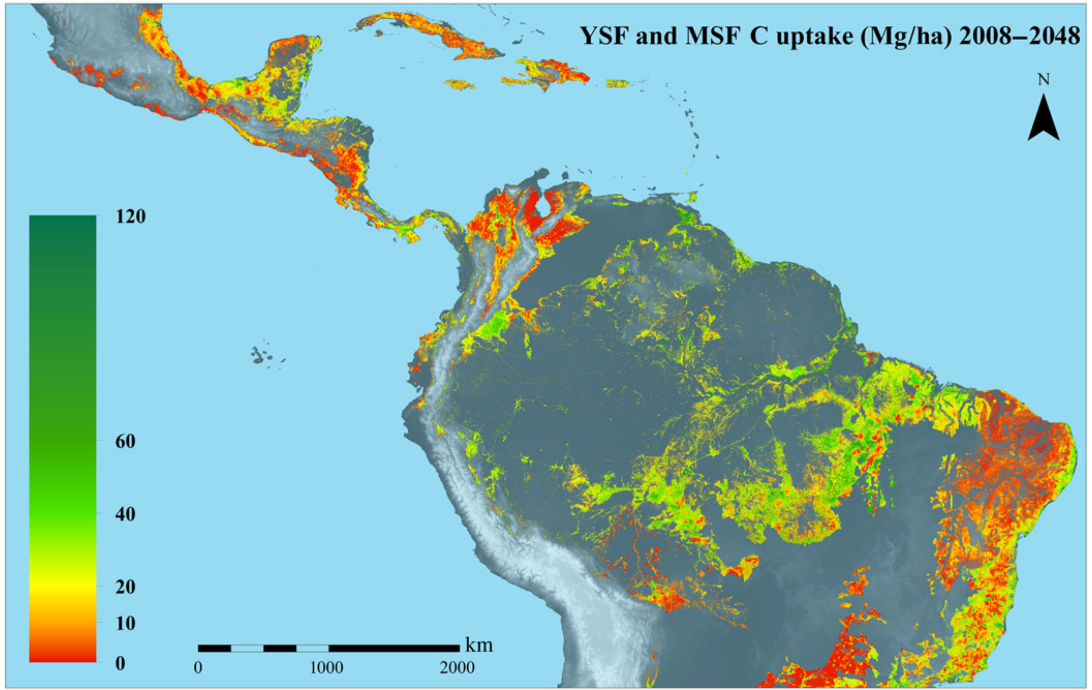
Figure 1 | Relationship between forest biomass and stand age using chronosequence studies in Neotropical secondary forest sites. **a**, AGB ($N = 44$); **b**, AGB recovery ($N = 28$). Each line represents a different chronosequence. The original plots on which the regression lines are based are indicated in grey ($N = 1{,}364$ for AGB, $N = 995$ for AGB recovery). AGB recovery is defined as the AGB of the secondary forest plot compared with the median AGB of old-growth forest plots in the area, multiplied by 100. Significant relations (two-sided $P \leq 0.05$) are indicated by continuous lines; non-significant relationships (two-sided $P > 0.05$) are indicated by broken lines. Plots of 100 years old are also second-growth. See Extended Data Fig. 4 for the same figure with plots colour-coded by forest type.

Figure 2 | AGB after 20 years. **a**, In relation to annual rainfall; **b**, in relation to CWD for Neotropical forest sites. Lines indicate predicted AGB at 20 years based on a multiple regression including 1/rainfall, CWD, and rainfall seasonality ($R^2 = 0.59$). Other variables were kept constant at the mean across sites (two-sided $P < 0.005$ for 1/rainfall; $P = 0.03$ for CWD). The third, less significant factor (rainfall seasonality) is shown in Extended Data Fig. 2. $N = 43$ sites (one site was excluded because no climatic data were available).



Age and carbon sequestration maps of a lowland Neotropical forest.

B



Robin L. Chazdon et al. Sci Adv 2016;2:e1501639

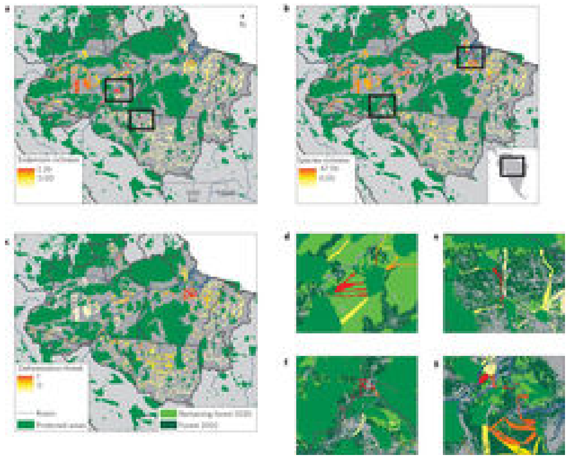
Science Advances

Published by AAAS

Figure 1: Corridors passing through the densest VCS between protected areas.

a–d, Western Africa (**a**), central Africa (**b**), southeast Asia (**c**) and the Guiana Shield (**d**). Corridors are shown in white, protected areas in semi-transparent grey and carbon density of woody vegetation as a gradient from low density in r...

Figure 3: Multicriteria scoring of corridors in the Brazilian Amazon across three dimensions: carbon density, mammalian biodiversity and deforestation threat.



Scores were divided by EOC in units of US$10,000 ha^{-1} to yield multicriteria benefit per US$10,000. **a**,**b**, Biodiversity was measured as either endemism richness (**a**) or species richness (**b**). **c**, Deforestation threat was represented as the f...

Carbon stock corridors to mitigate climate change and promote biodiversity in the tropics

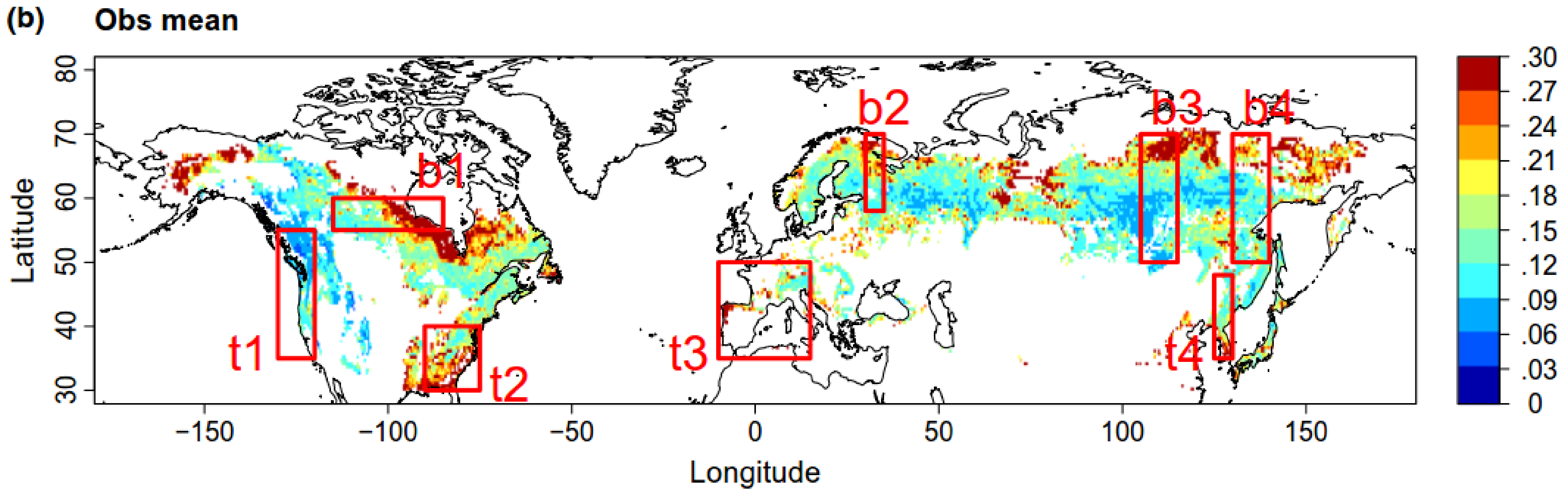
Patrick Jantz, **Scott Goetz** & **Nadine Laporte**

Affiliations | **Contributions** | **Corresponding author**

Nature Climate Change **4**, 138–142 (2014) | doi:10.1038/nclimate2105

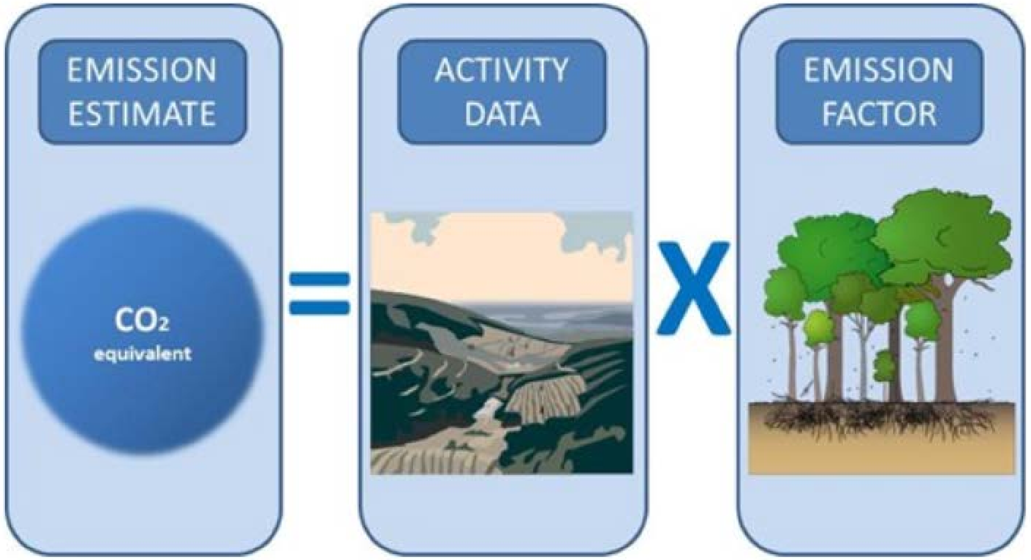
Evaluation of climate-related carbon turnover processes in global vegetation models for boreal and temperate forests

Martin Thurner[1,2] | Christian Beer[1,2] | Philippe Ciais[3] | Andrew D. Friend[4] | Akihiko Ito[5] | Axel Kleidon[6] | Mark R. Lomas[7] | Shaun Quegan[7] | Tim T. Rademacher[4] | Sibyll Schaphoff[8] | Markus Tum[9] | Andy Wiltshire[10] | Nuno Carvalhais[6,11]



Spatial patterns of forest k [yr1] as the ratio of NPP to biomass based on satellite data (Obs mean; using an average of MODIS and BETHY/DLR NPP products and observation-based biomass from Thurner et al. 2014)

The need for integrated systems



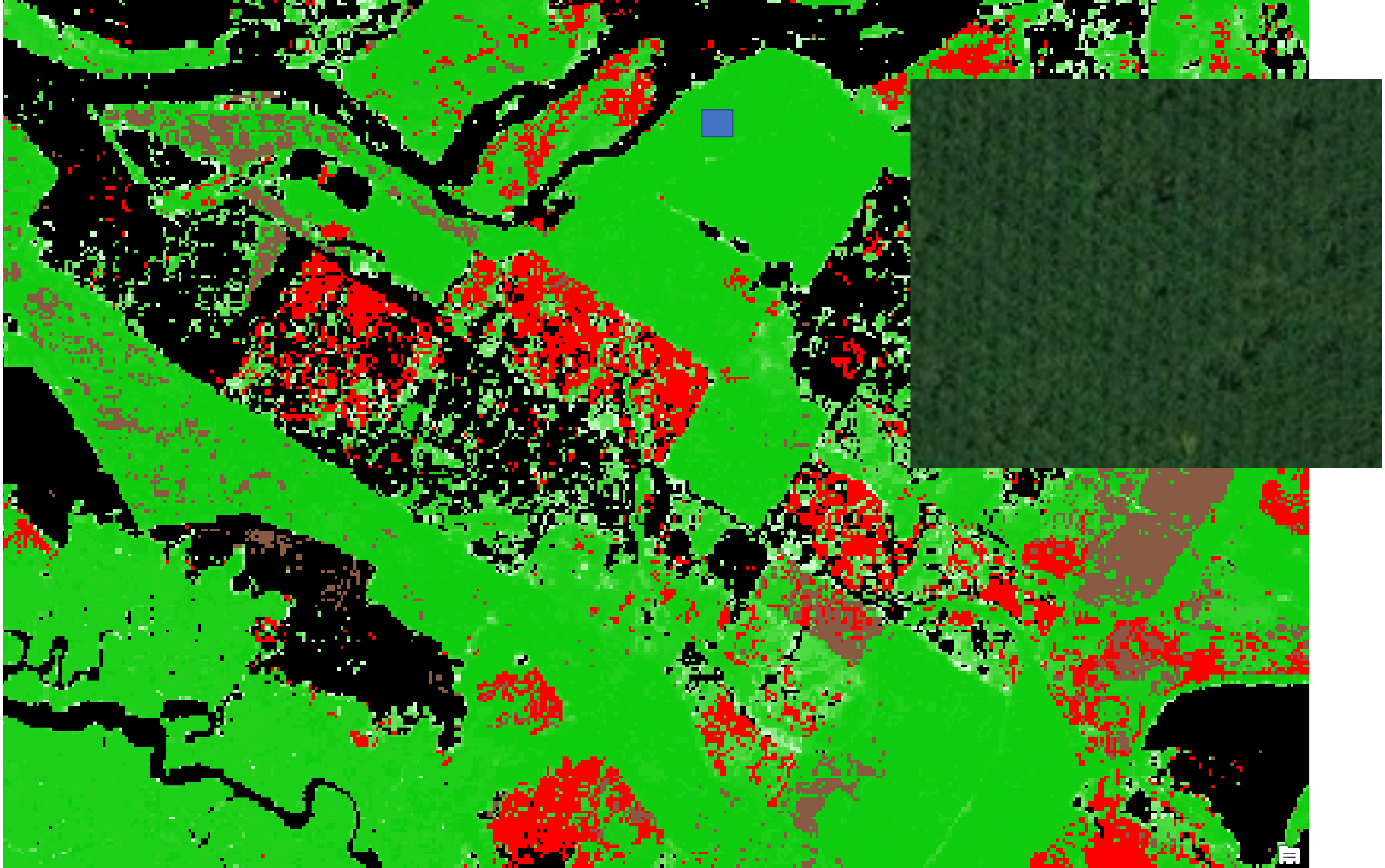
- Change detection
- Emission Factors
- The opportunistic use of plot data
- NFI and AD not linked
- Improper sampling and plot design
- No-RS based regeneration

Attribution

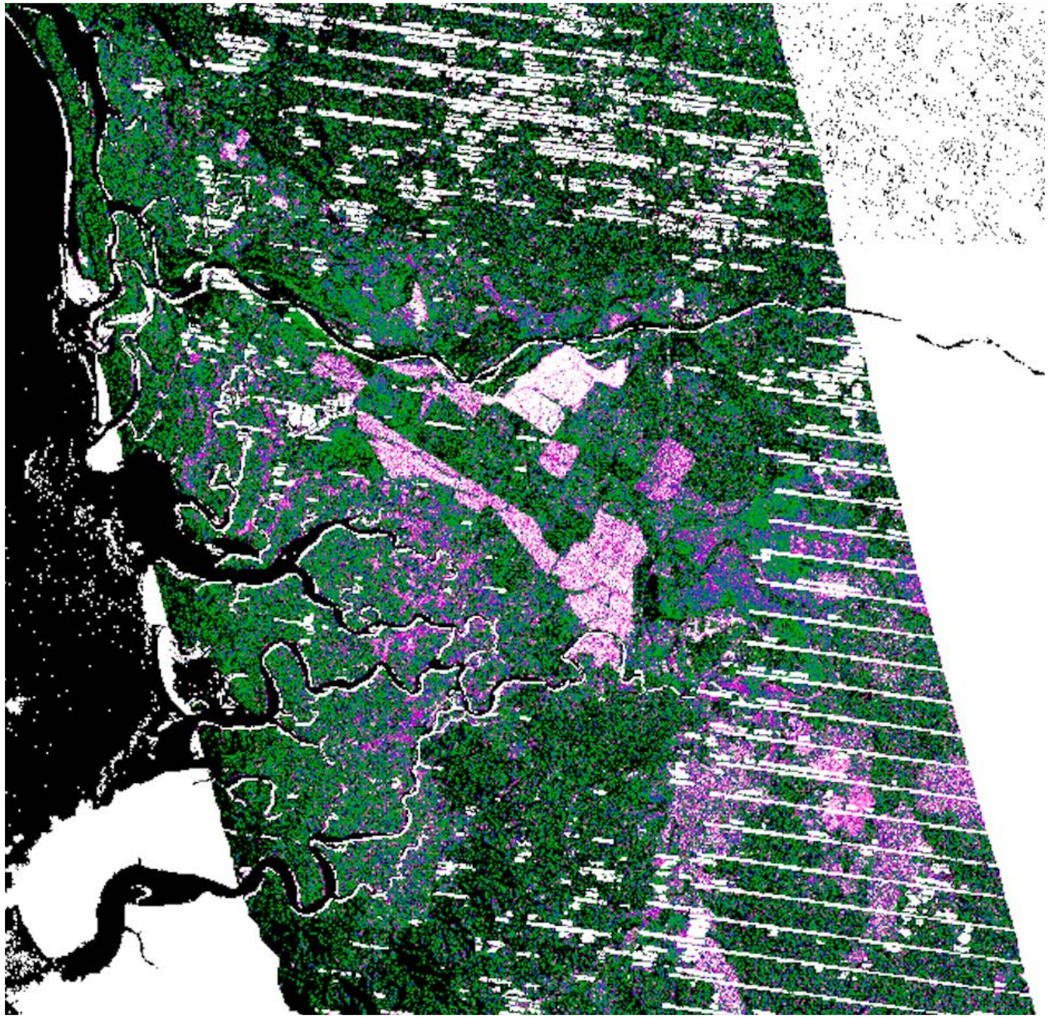
- Incorporating new RS data
- Incorporating new context information (e.g. Validation)
  - FRA vs RS data = LC vs LU.
  - Linking PMRV and NMRV
- Attribution of Change to Drivers (later)
- Enhancing the RS data processing
- Even generate data relevant to the commodities themselves.
  - Estimate yields
  - Locate sources
  - Assess compliance with initiatives like Walmart Gigaton, NY Declaration

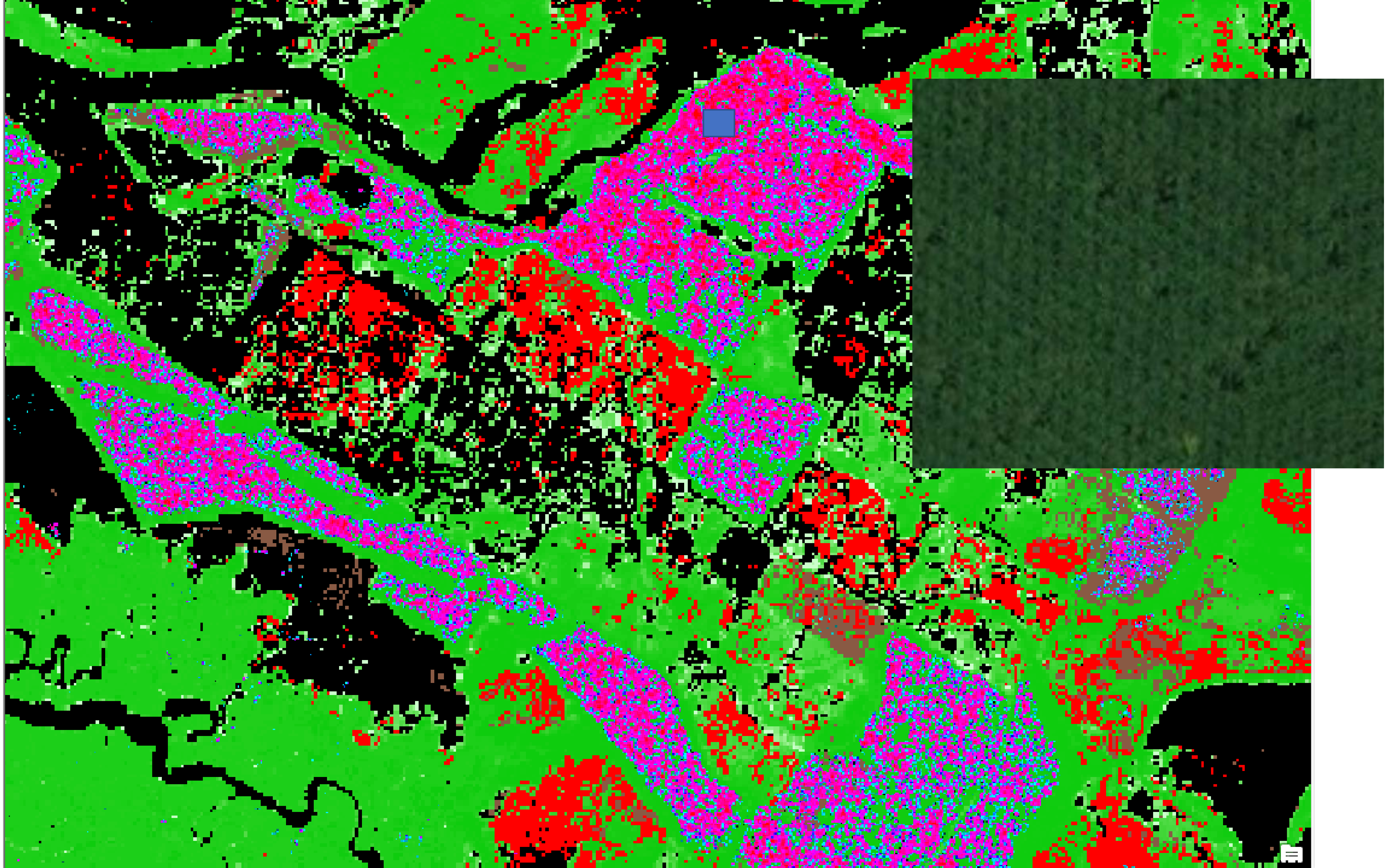
Perhaps the need for a behavioral change…….

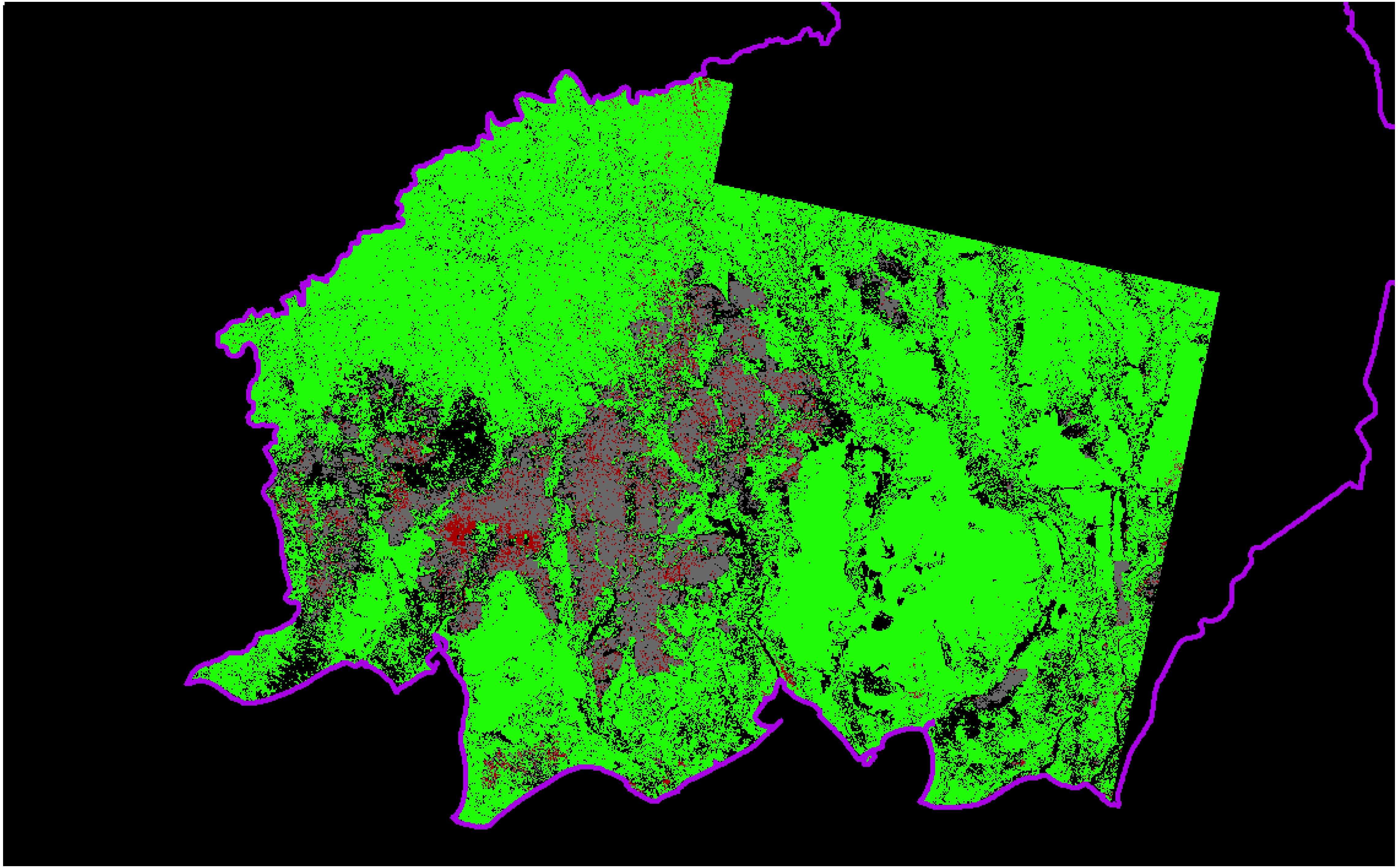
The need for land based and remote observation to be integral part of the system rather than an opportunistic relation? E.g. WWF For local data
The need for more attention given to the Reference Data.



Step 2: Bayesian classifier







Lets get ready and do it?

- Lessons learned and transfer to Sentinel 1?
- The need for a broader user base (As in ALOS meeting report from Chris)
  - Get ready for the upcoming missions for full use!
  - NASA-Servir SAR Manual?
- Capacity building for users
- Communications strategy as integral part of workload

THANK YOU

Naikoa Aguilar-Amuchastegui PhD|Director Forest Carbon Science WWF-US|1250 24 st NW, suite 4017, Washington DC, 20037|
aguilaramuchastegui@wwfus.org|Skype: Naikoa.Aguilar.Amuchastegui|Voice: +1-202-495-4783|Mobile:+1-202 290 7027

WWF