Think Tank Award Webinar

Tropical forests: a new approach to measuring carbon density

Dr. Wayne Walker – Woods Hole Research Center

November 7th, 2017

WHAT WE DO

OUR FOCUS: To investigate the causes and effects of climate change to identify and implement opportunities for conservation, restoration and economic development around the world.

We believe in the power of nature to slow climate change.
We work on land-based carbon from the Arctic to the Tropics.

CARBON CYCLE
Baccini *et al.*, *Science* 358, 230–234 (2017) 13 October 2017

Tropical forests are a net carbon source based on aboveground measurements of gain and loss

A. Baccini,[1*] W. Walker,[1] L. Carvalho,[2] M. Farina,[1] D. Sulla-Menashe,[3] R. A. Houghton[1]

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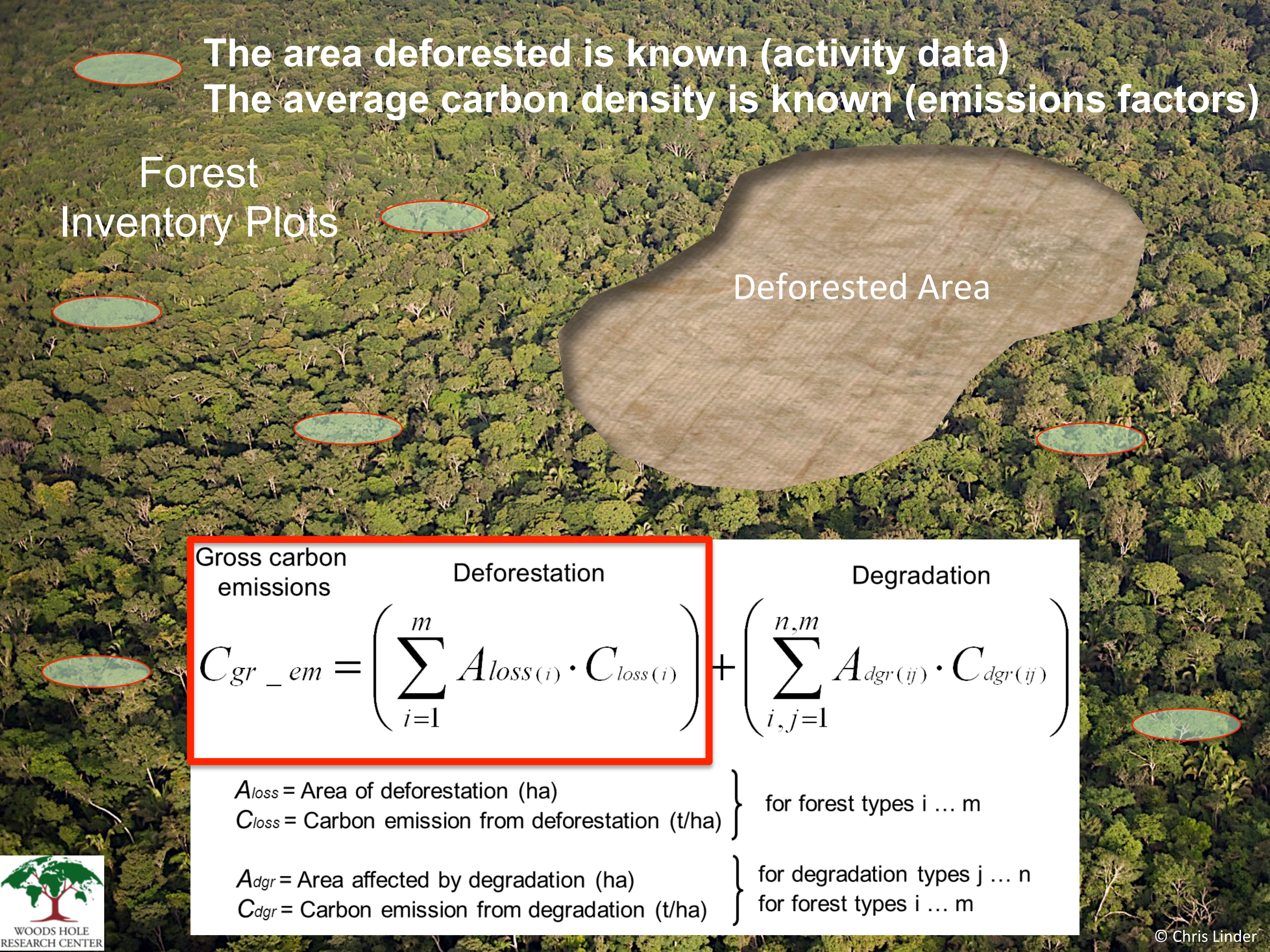
The status quo

The area deforested is known (activity data)
The average carbon density is known (emissions factors)



Gross carbon emissions — Deforestation — Degradation

$$C_{gr\_em} = \left(\sum_{i=1}^{m} A_{loss(i)} \cdot C_{loss(i)} \right) + \left(\sum_{i,j=1}^{n,m} A_{dgr(ij)} \cdot C_{dgr(ij)} \right)$$

A_{loss} = Area of deforestation (ha)
C_{loss} = Carbon emission from deforestation (t/ha)
} for forest types i … m

A_{dgr} = Area affected by degradation (ha)
C_{dgr} = Carbon emission from degradation (t/ha)
} for degradation types j … n
for forest types i … m


Intact Forest
Degradation
Deforestation
Woods Hole
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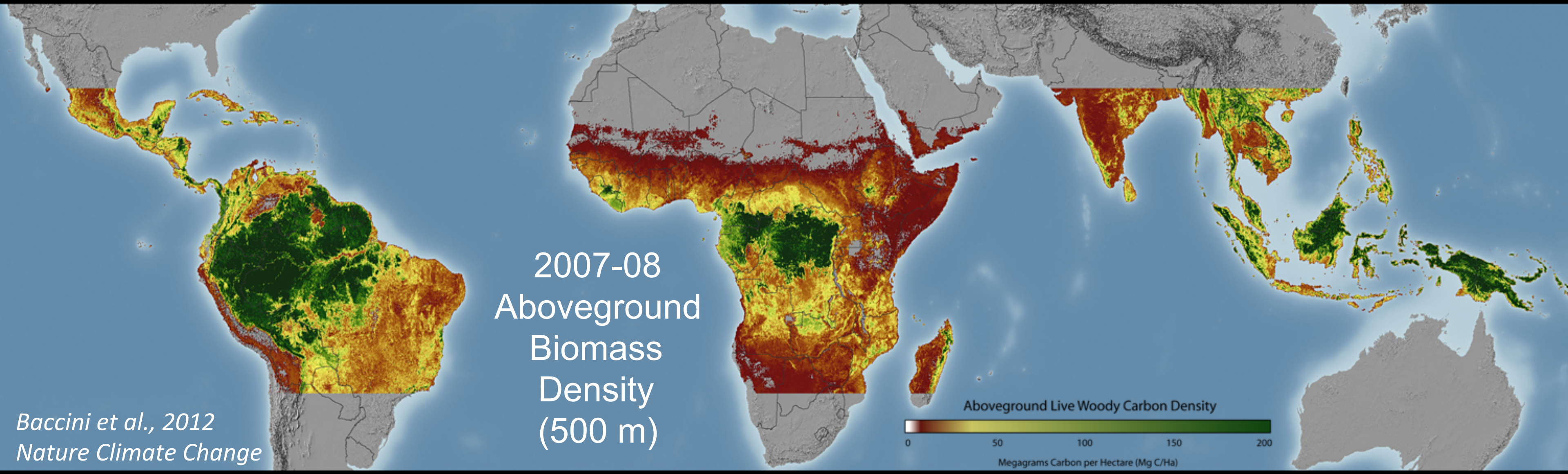
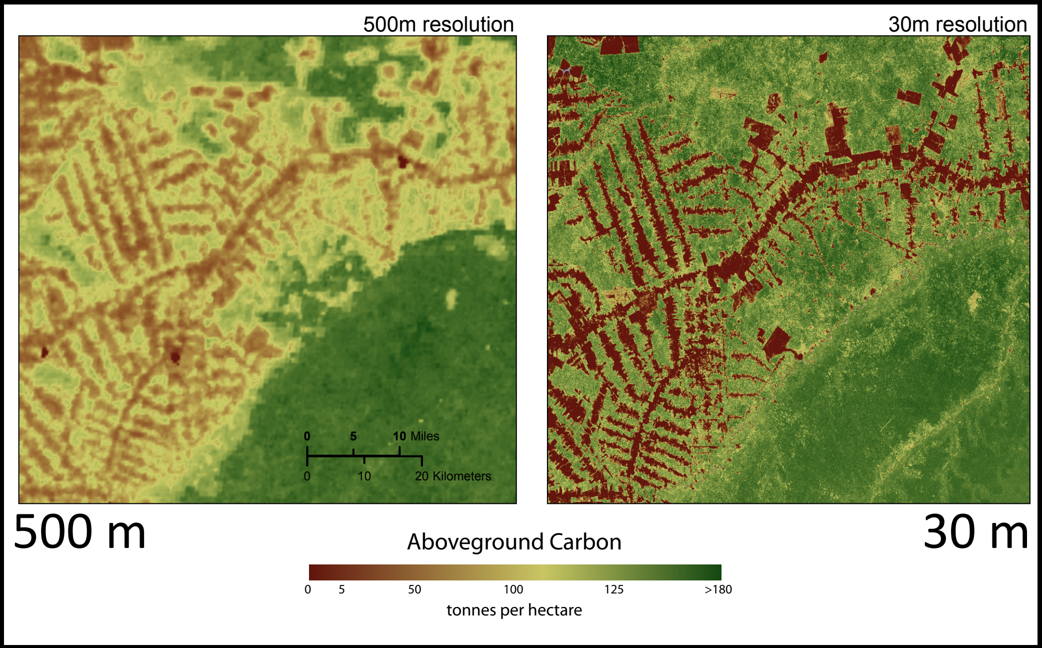
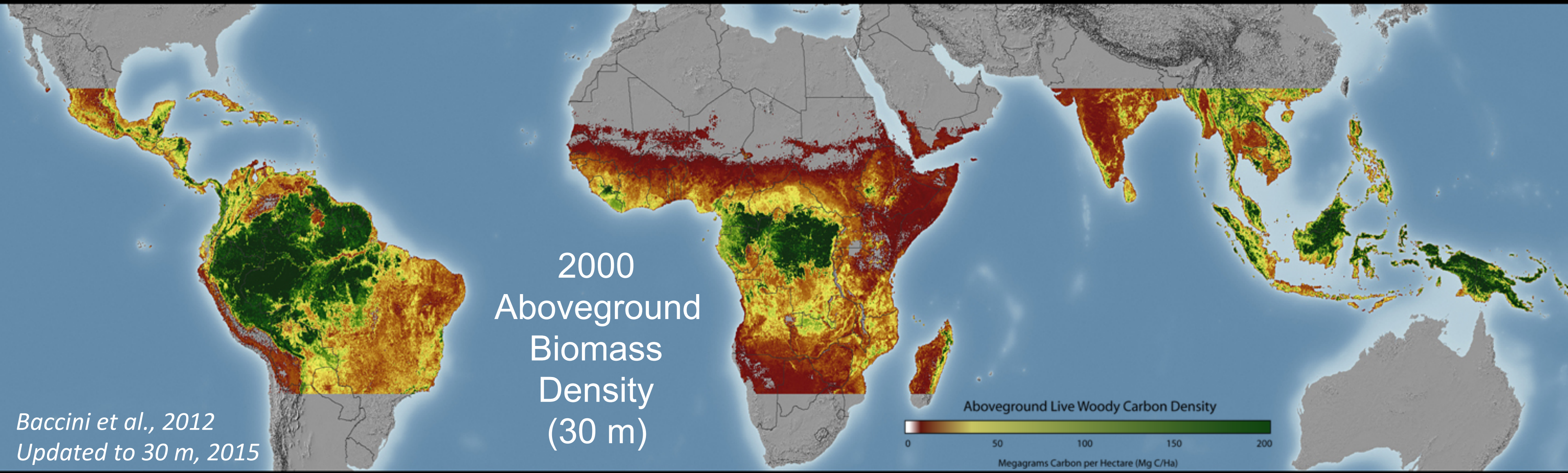
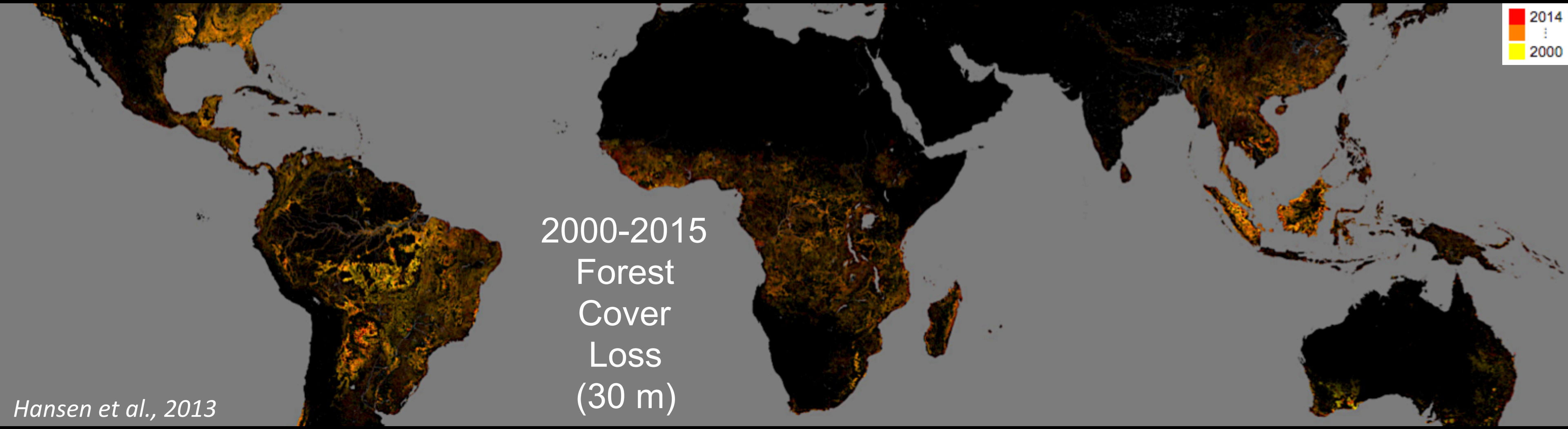




2000
Global
Aboveground
Biomass
Density
(30 m)





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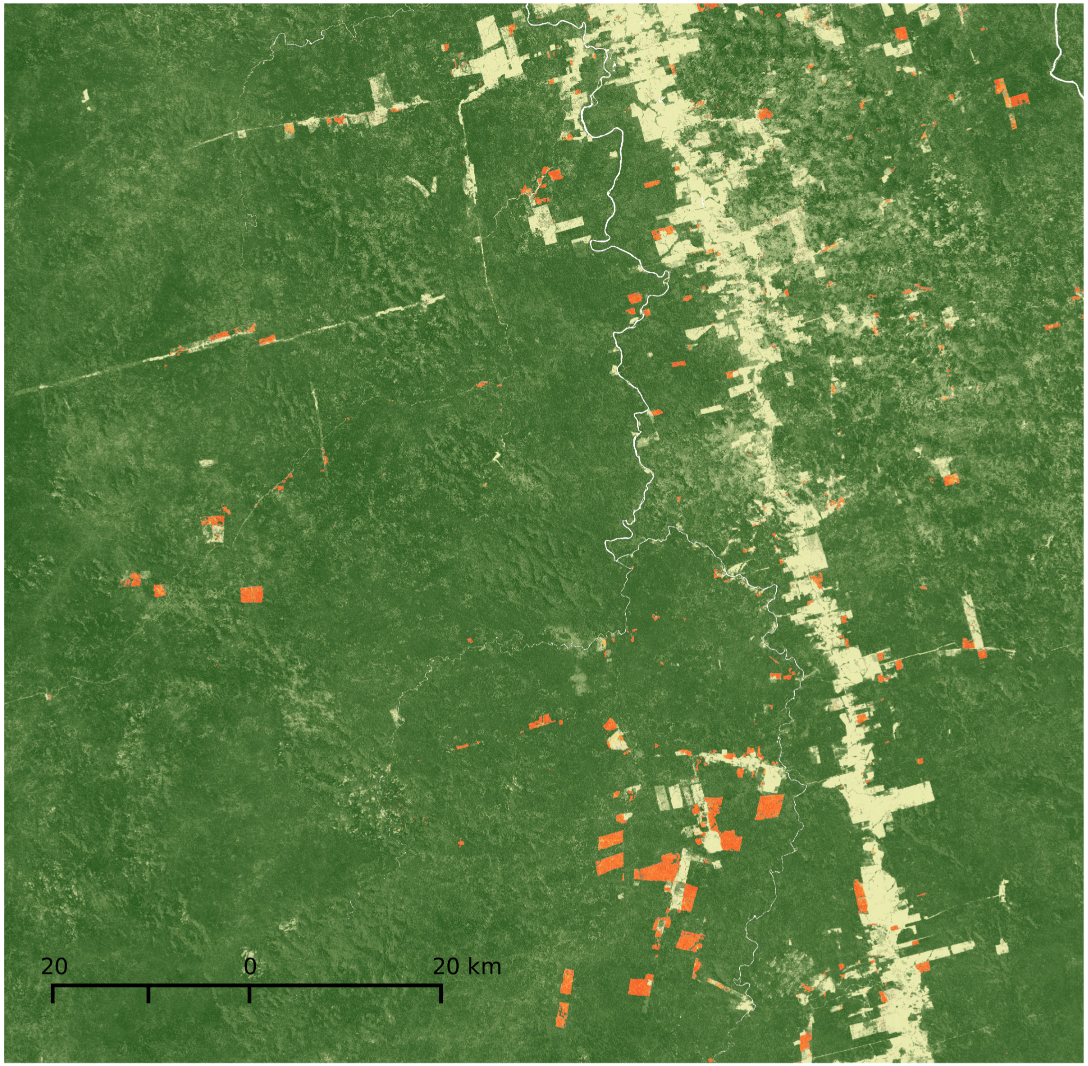
Annual Gross Emissions from Forest Cover Loss

Year: 2001

Tg carbon lost since year 2000: 1.77

Mg carbon loss
High: 20
Low: 0

Biomass (Mg/ha)
High: 350
Low: 0



Circa 2000 Landsat-based biomass density (Baccini et al. 2012, 2017 In Prep.) combined with forest cover loss (Hansen et al. 2013) and published by *Zarin et al. (2015)*

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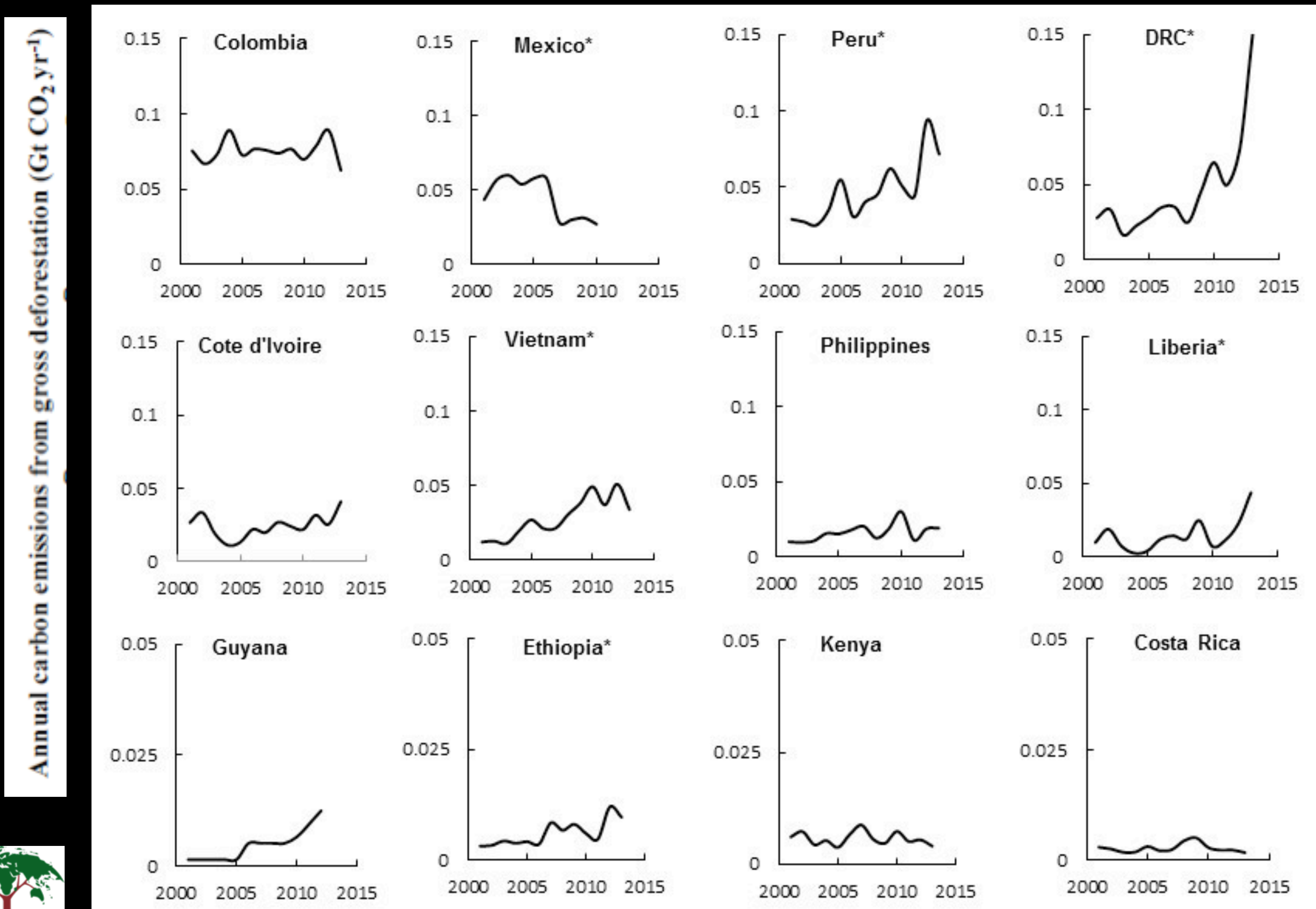
Annual Gross Emissions from Deforestation

Zarin et al. 2015



Limitations of the status quo

- Gross biomass losses are estimated from deforestation only
  - Deforestation: the damage is done
  - Degradation: hope remains
- Gains in biomass (growth/uptake) tend to be ignored

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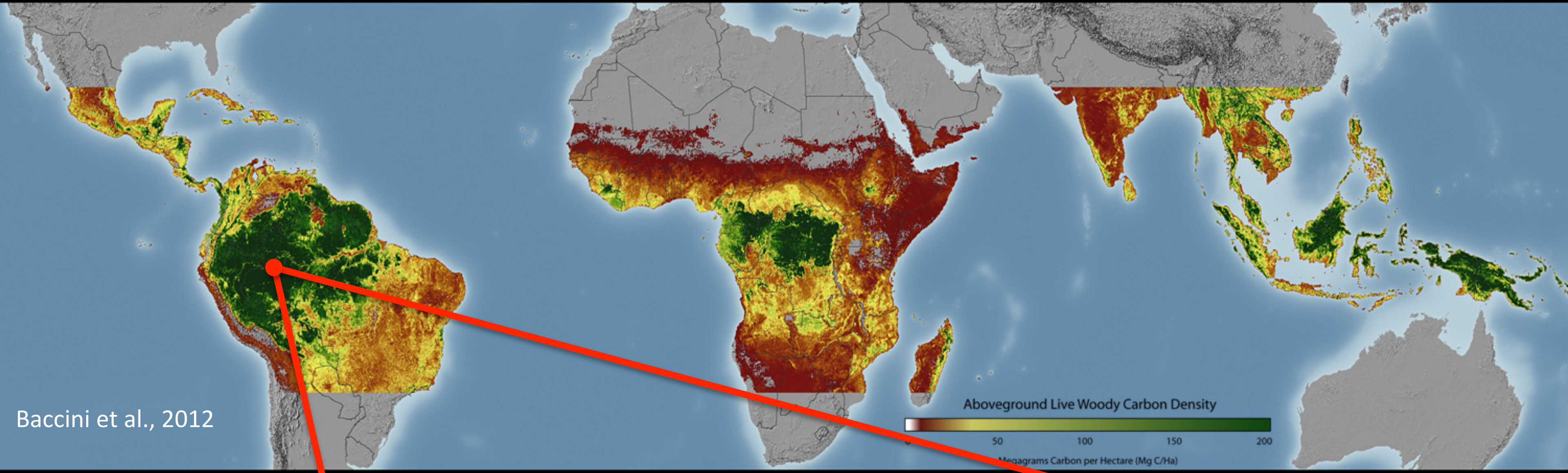
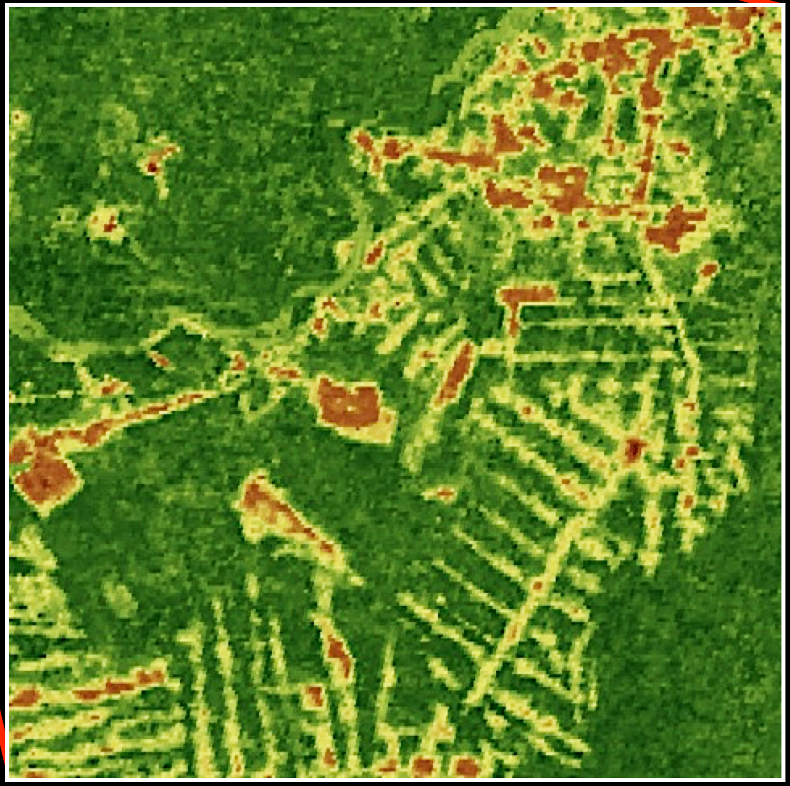
A new paradigm

Woods Hole Research Center
Ranked #1 climate think tank in the world.





2007 Aboveground Biomass Density (500 m)

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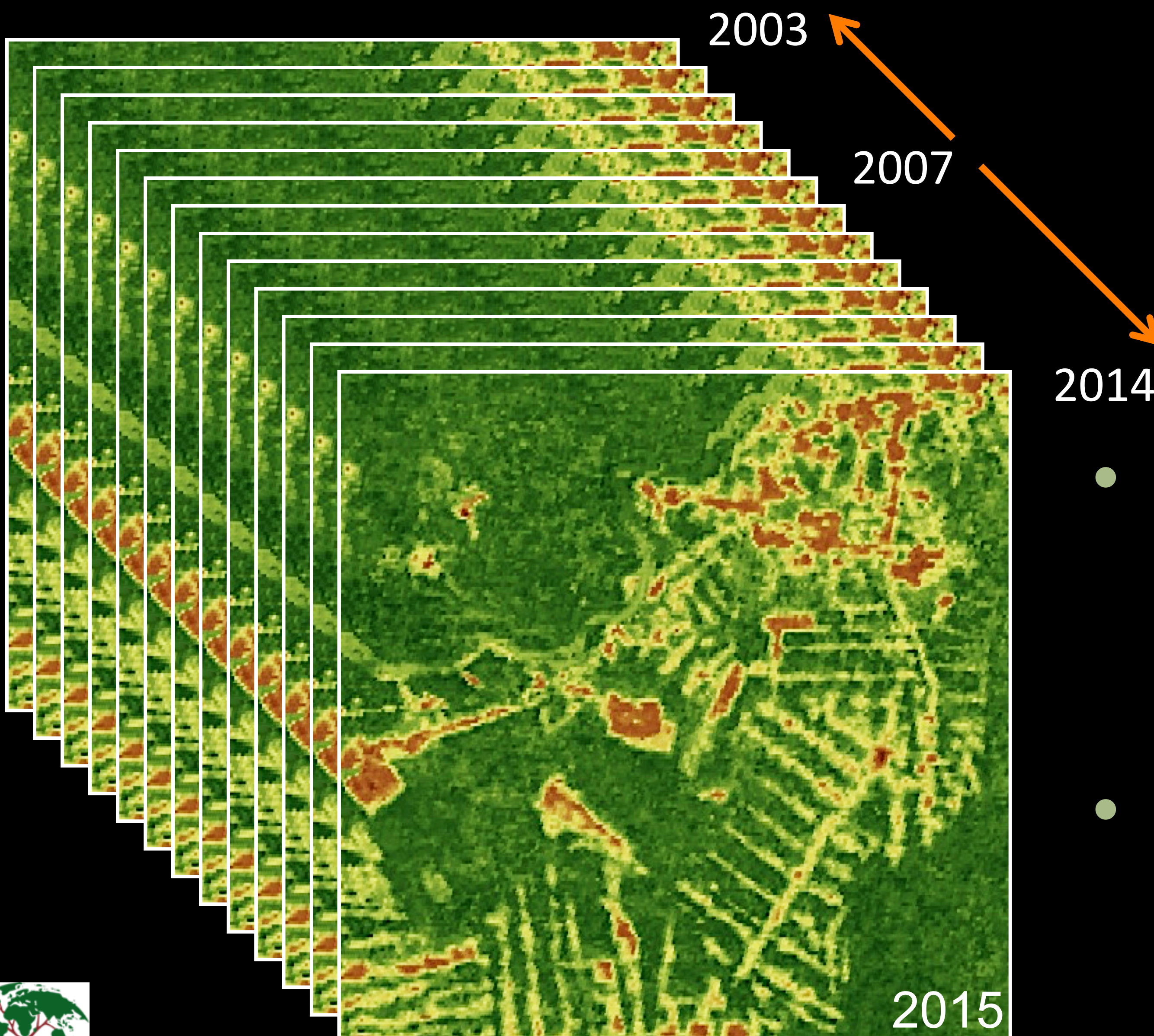
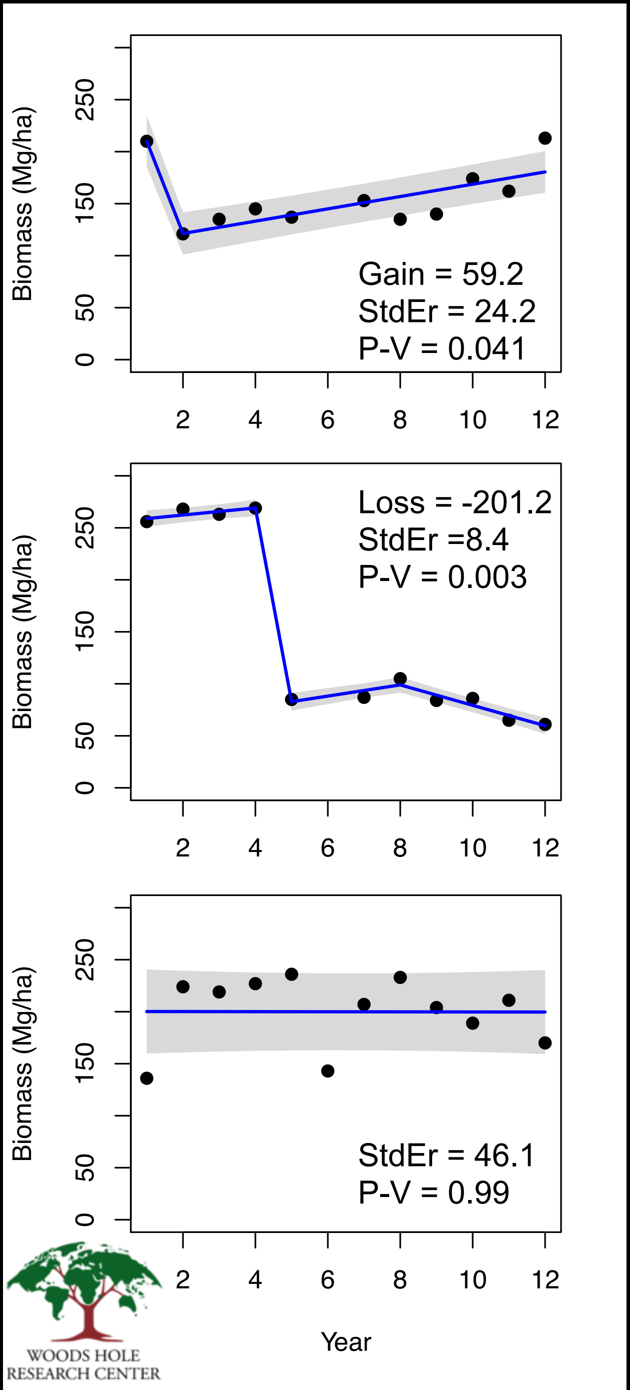
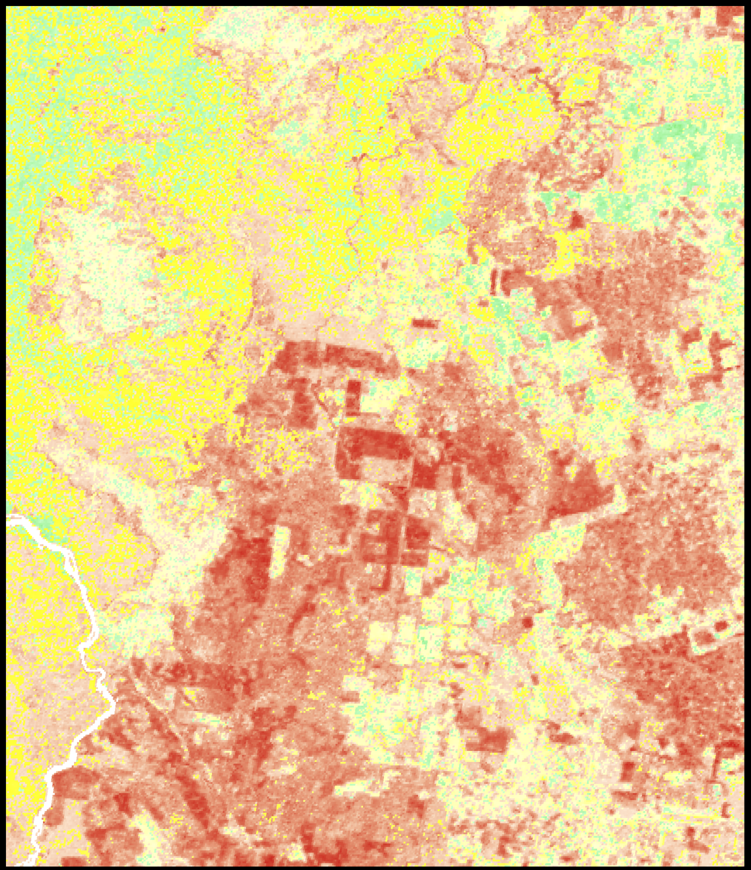
Mapping biomass change through time



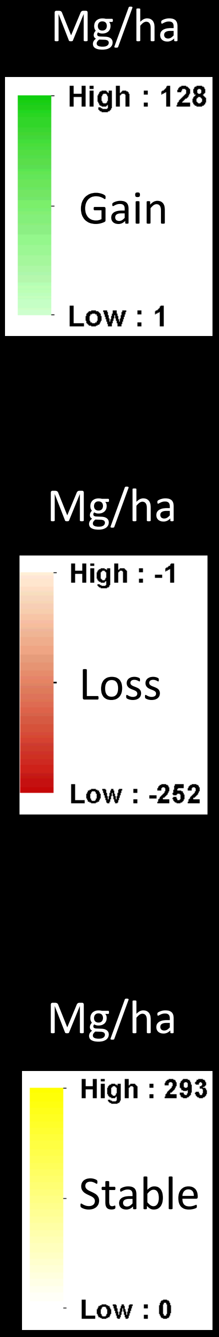
- Time series approach based on "change point" analysis
- For each 500 m pixel we identify the trajectory of biomass change

Continuous spatially explicit biomass change with measurable uncertainty

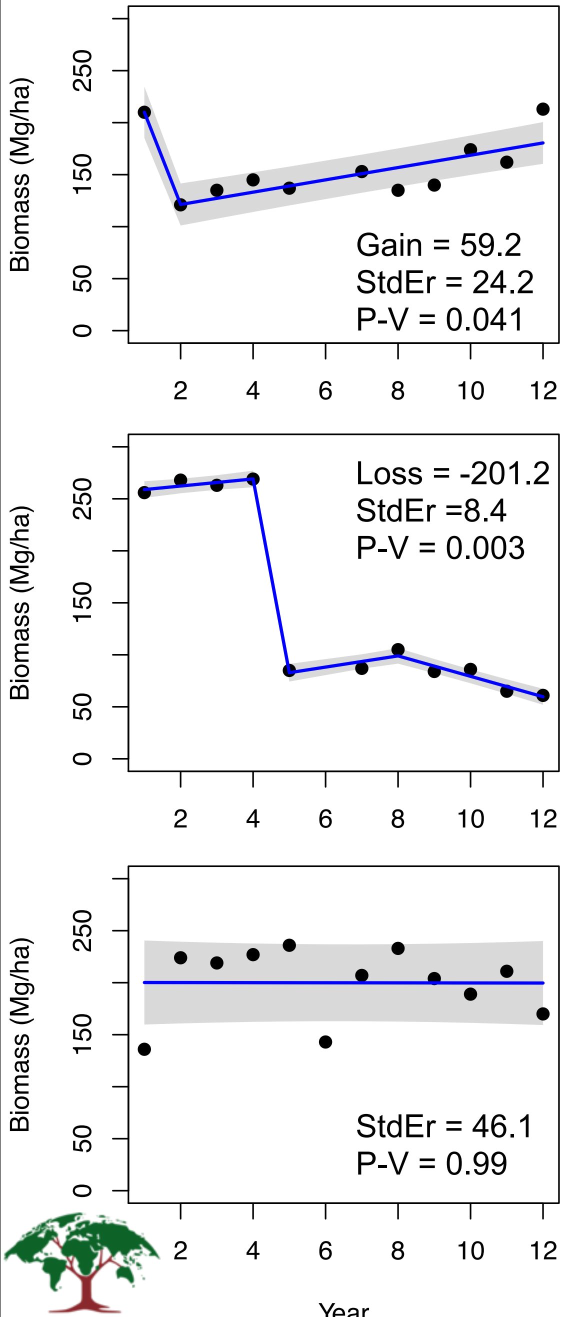




190 x 215 km



Consistent with losses from deforestation and sensitive to losses from forest degradation



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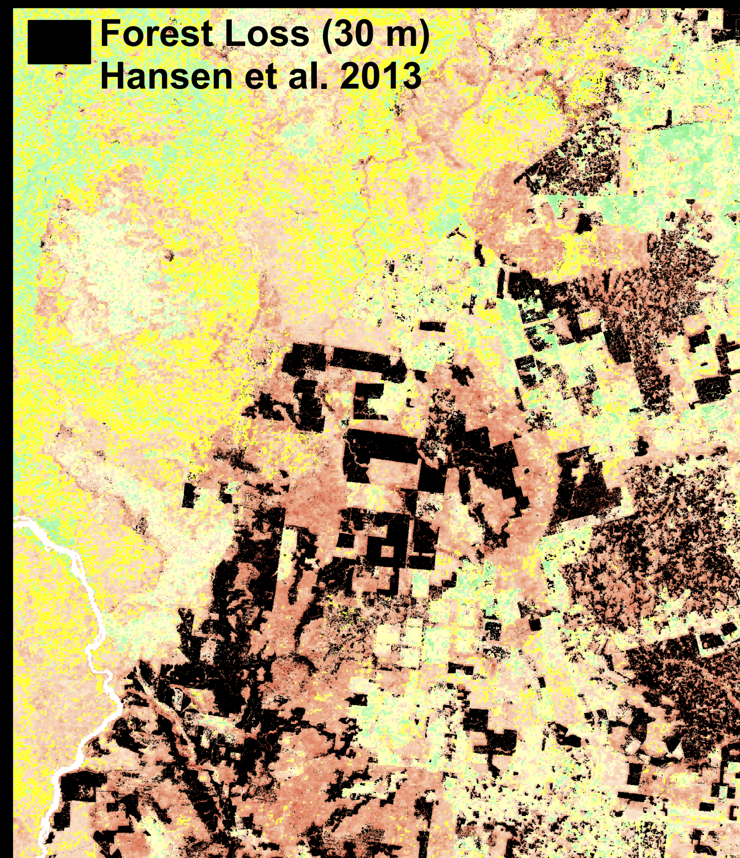

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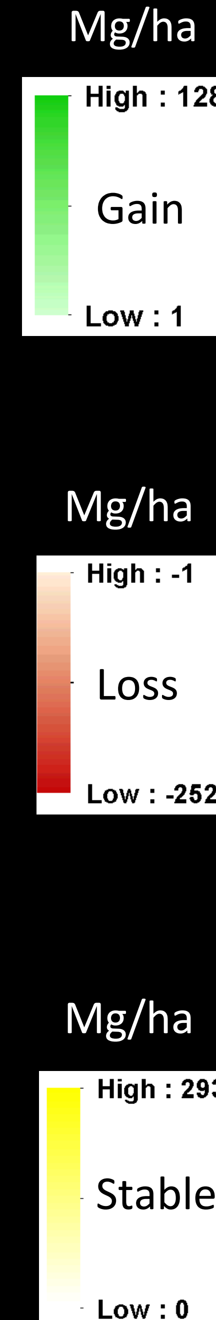

CARBON CYCLE

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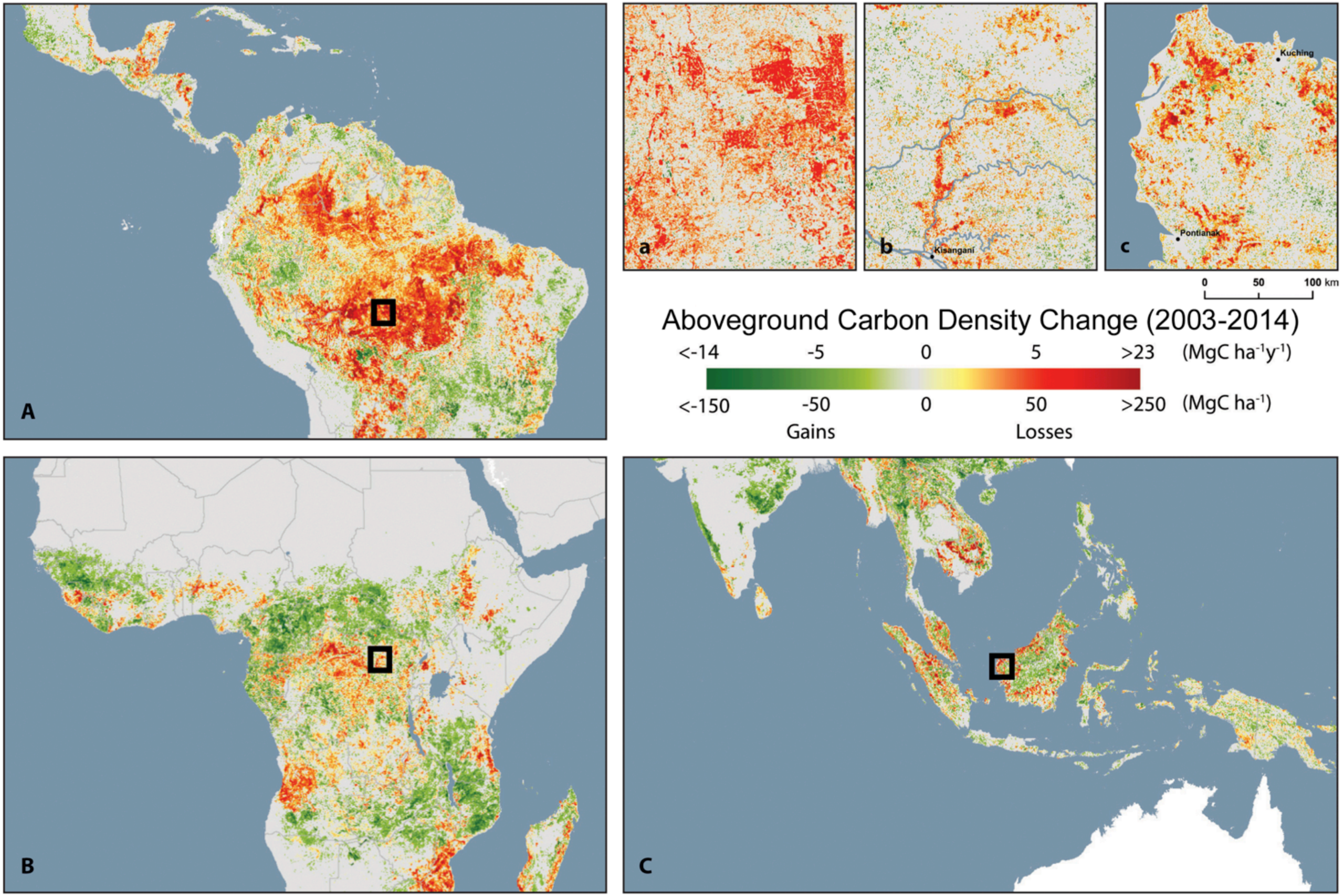
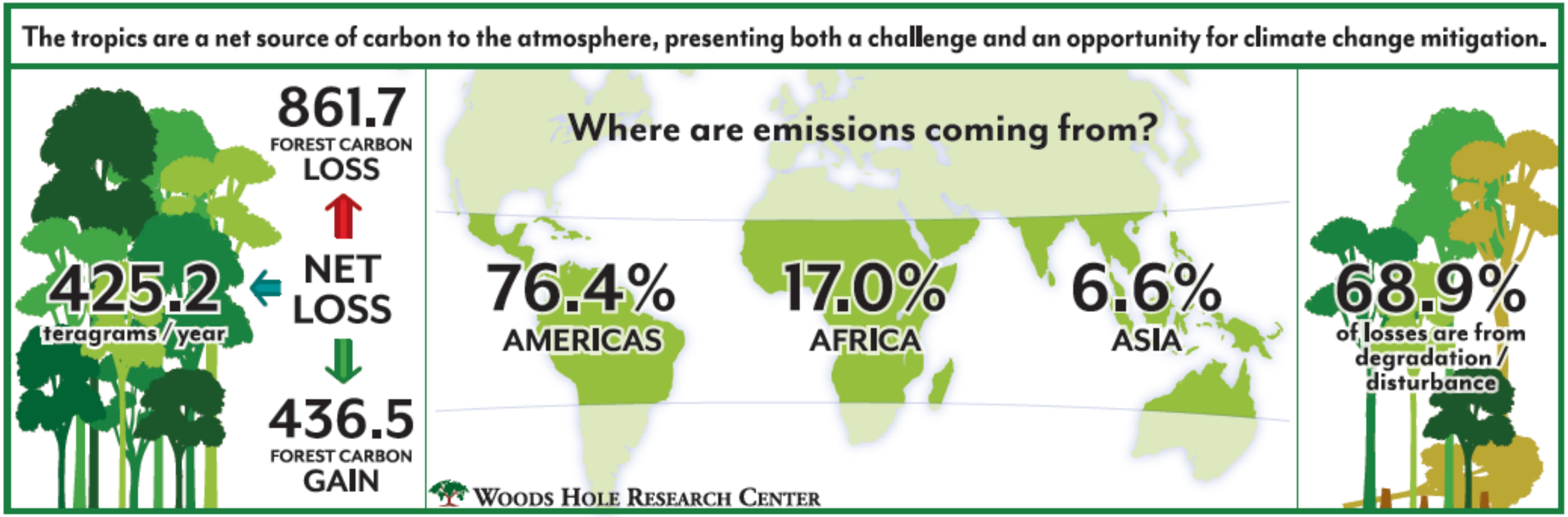


A
a
b
Kisangani
c
Kuching
Pontianak
0
50
100 km
Aboveground Carbon Density Change (2003-2014)
<-14
-5
0
5
>23
(MgC ha-1y-1)
<-150
-50
0
50
>250
(MgC ha-1)
Gains
Losses
B
C



The tropics are a net source of carbon to the atmosphere, presenting both a challenge and an opportunity for climate change mitigation.
861.7
FOREST CARBON LOSS
425.2
teragrams / year
NET LOSS
436.5
FOREST CARBON GAIN
Where are emissions coming from?
76.4%
AMERICAS
17.0%
AFRICA
6.6%
ASIA
68.9%
of losses are from degradation / disturbance
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Strengths of the new approach

- Accounting for losses in forest carbon from:
  - Deforestation
  - Anthropogenic disturbance (forest degradation)
  - Natural disturbance
- Accounting for gains in forest carbon from growth
- Tracking changes with greater frequency, consistency, and accuracy than was previously possible.

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Future Work

- Expand from the tropics to the globe
- Enable automated, (near) real-time processing
- Increase the spatial resolution from ca. 500 to 30 m

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Thank
you!

Q&A

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For time management reasons, we don't assure that all questions will be answered.

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