Disentangling land-use change in Central Africa to understand the role of local and Indigenous communities in forest restoration and conservation

Elsa Ordway, Benis Egoh, Sassan Saatchi, Sumalika Biswas, Ruksan Bose, Fanny Djomkam, Landing Mané, Epie Njume, Ernest Simpoh, Jean Michel Takuo, Zita Tchengo, Virginia Zaunbrecher

NASA LCLUC Meeting – April 2, 2024

Grant # 80NSSC23K0533

Project Team

Benis Egoh
UC Irvine

Sassan Saatchi
NASA JPL

Ernest Simpoh
CBI-SILK

Hannah Stouter
UCLA

Sumalika Biswas
UCLA

Landing Mane
OSFAC, DRC

Fanny Djomkam
CBI-SILK

Ruksan Bose
CBI-SILK

Zita Tchengo
CBI-SILK

Epie Njume
UC Irvine

Jean-Michel Takuo
CBI-SILK

Virginia Zaunbrecher
UCLA

Raïssa Billong
IBAY-SUP

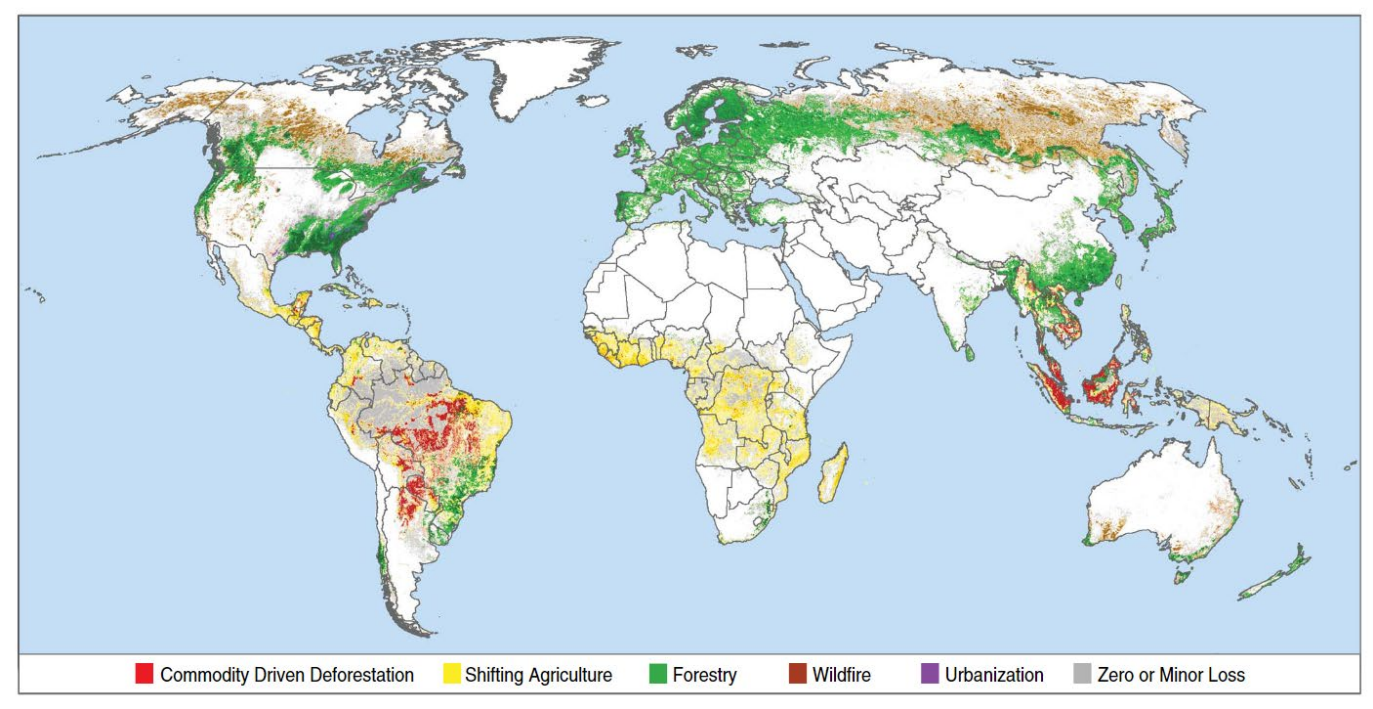
Alysson Bery
IBAY-SUP

Lindsay Land
UCLA

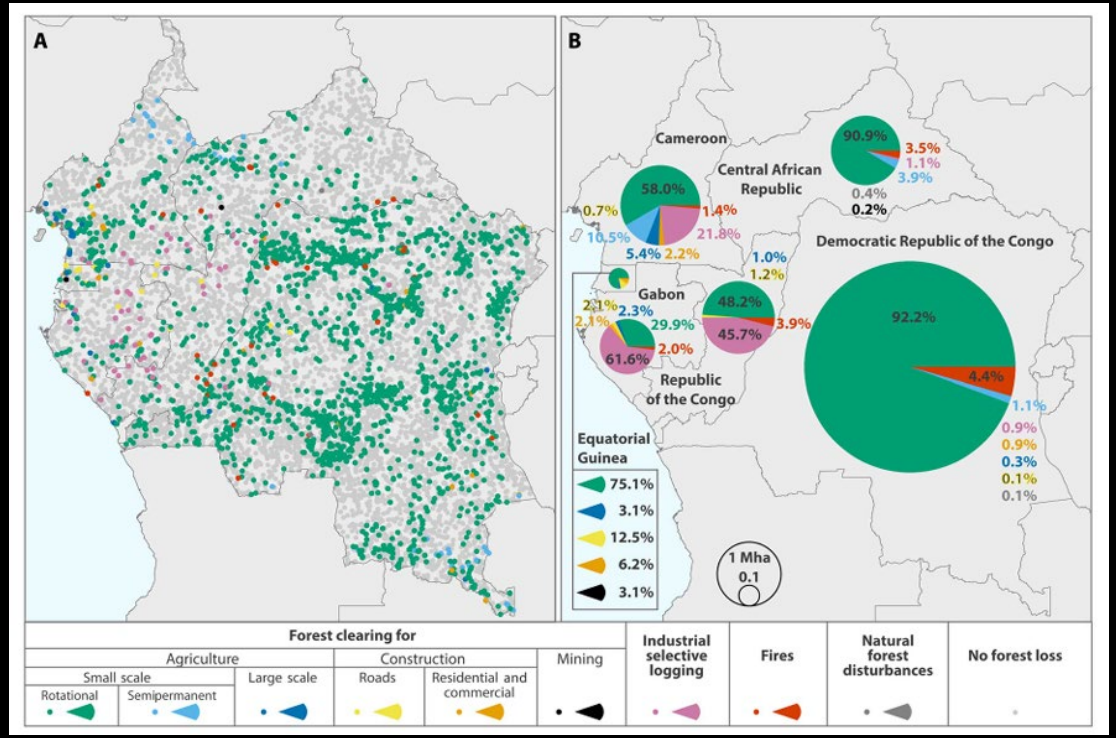
Michaela Dennis
UCLA


Chad
Khartoum
Eritrea
Yemen
Nigeria
Kano
Maiduguri
Djibouti
Benin
Togo
Ethiopia
South Sudan
Central African Republic
Lagos
Lomé
Cameroon
Port Harcourt
Douala
Yaoundé
Bangui
Juba
Gulf of Guinea
Somalia
Equatorial Guinea
Uganda
Kisangani
Kampala
Eldoret
Kenya
São Tomé and Príncipe
Libreville
Gabon
Republic of the Congo
Nairobi
Rwanda
Democratic Republic of the Congo
Burundi
Arusha
Mombasa
Kinshasa
Tanzania
Dar es Salaam
Luanda
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Google Earth
Imagery Date: 12/13/2015 lat 3.088162° lon 23.254462° elev 1463 ft eye alt 2364.60 mi

Background & Motivation



Curtis et al. 2018 *Science*



Tyukavina et al. 2018 *Science Advances*

Food Security

Development

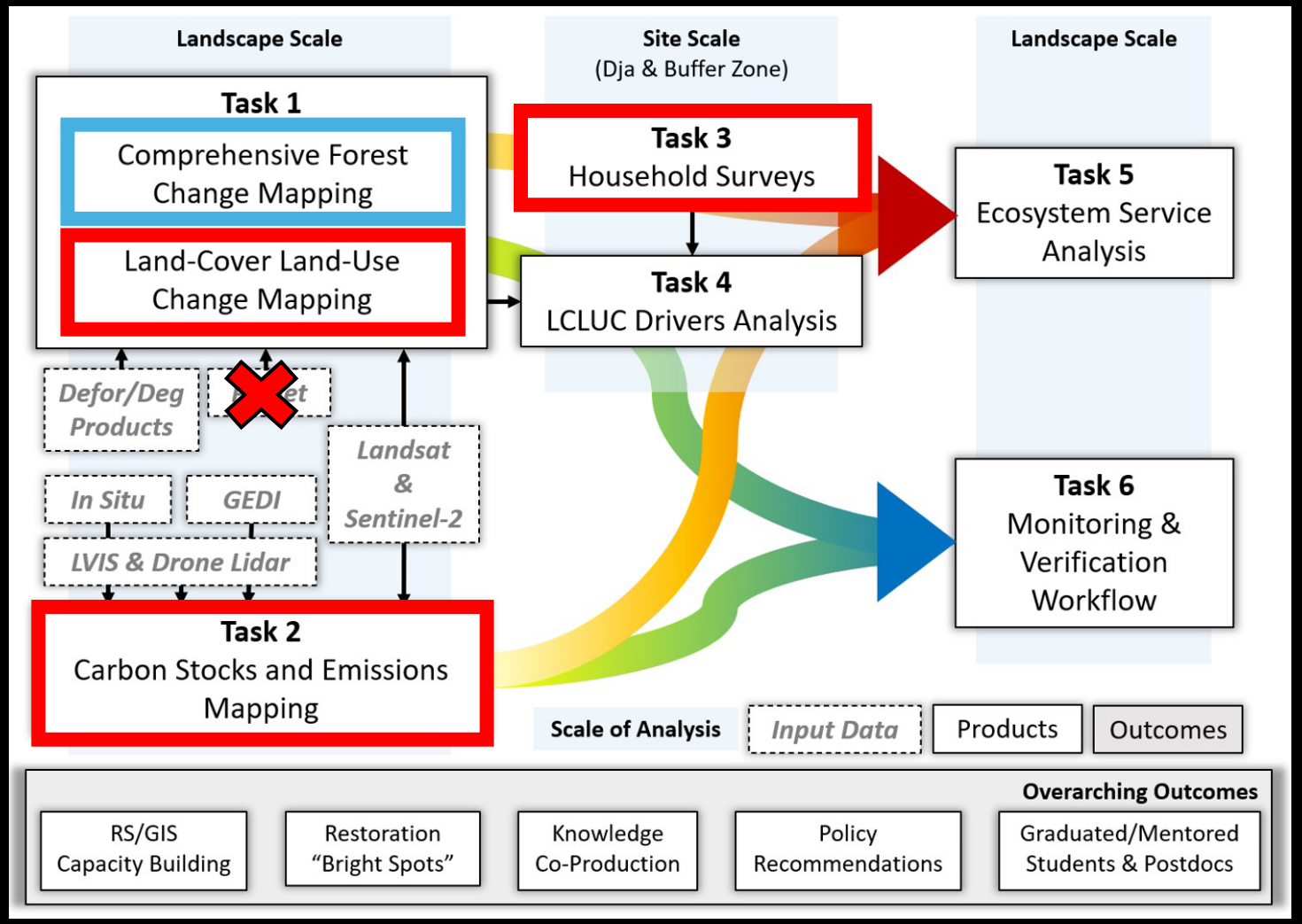
Biodiversity &
Carbon
Conservation

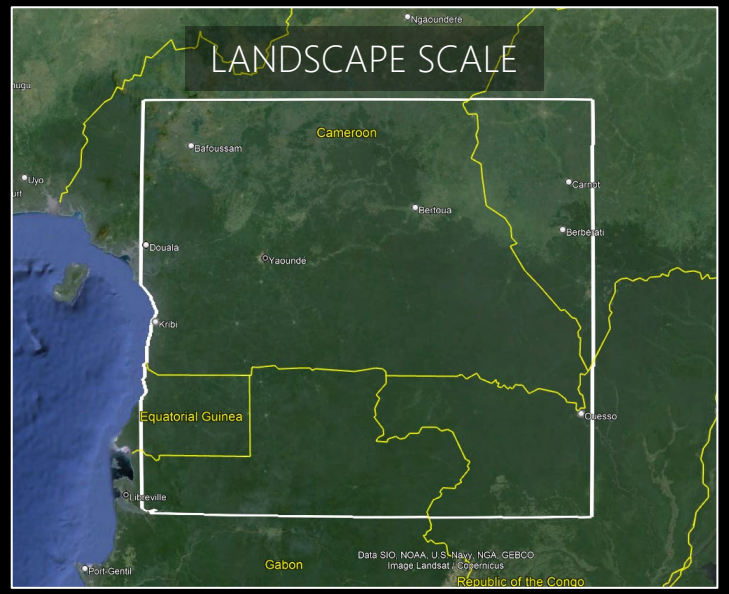
LAND

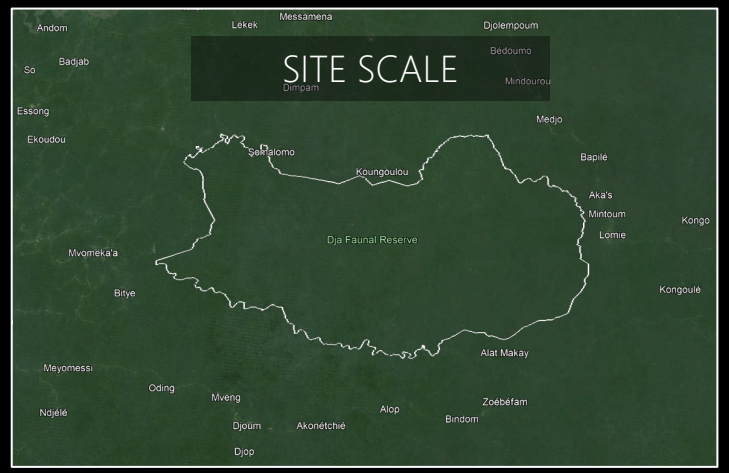
Project objectives

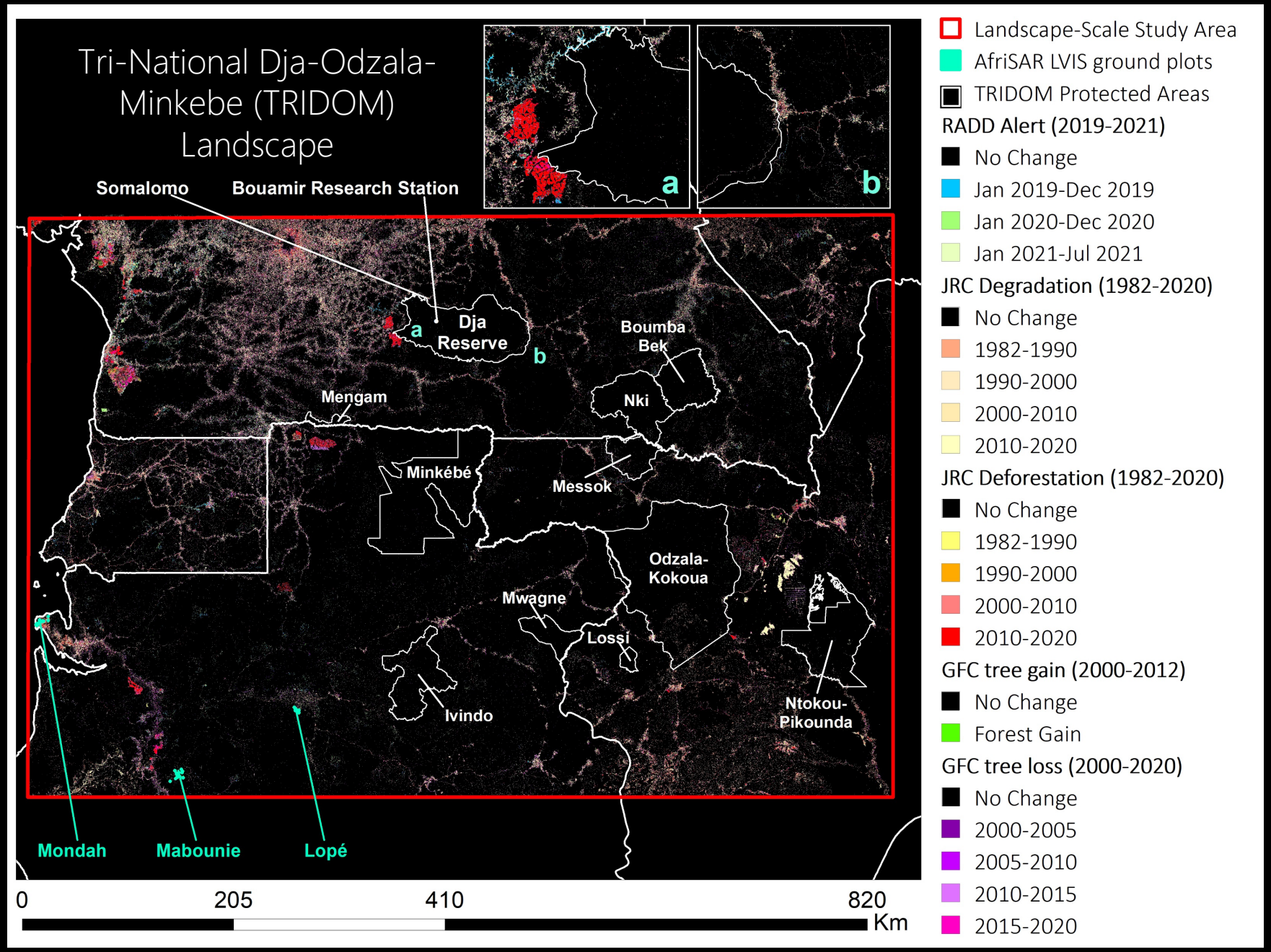
1. Map and quantify LCLUC and recent carbon emissions across an understudied and ecologically important region of the Congo Basin
2. Determine the influence of conservation and livelihood projects on land-use and land cover change
3. Explore possible restoration or forest gain ‘bright spots’ for future scaling
4. Examine ecosystem service tradeoffs and synergies associated with land-use decision making and policies related to carbon sequestration, biodiversity conservation, and food security and livelihoods under different forest restoration scenarios

Multi-scale work plan

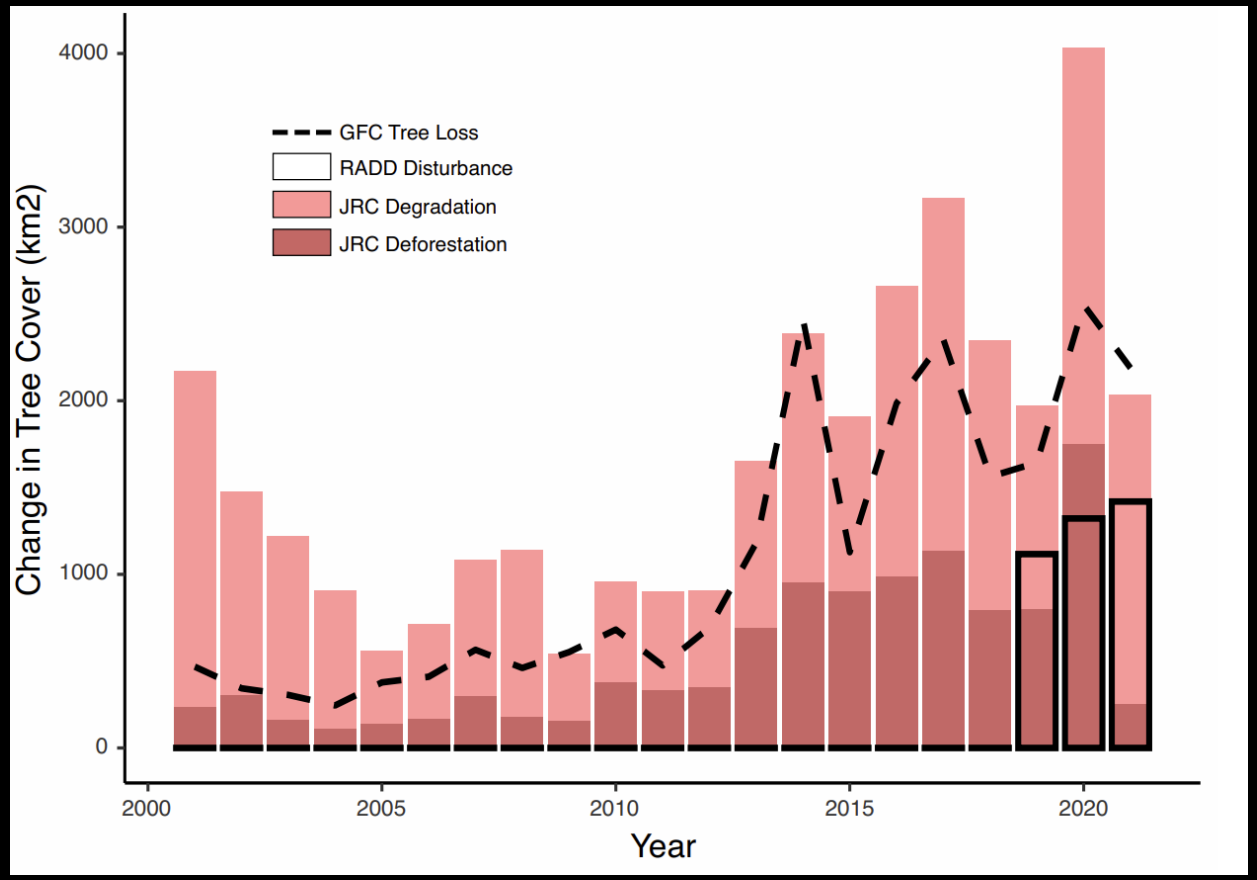


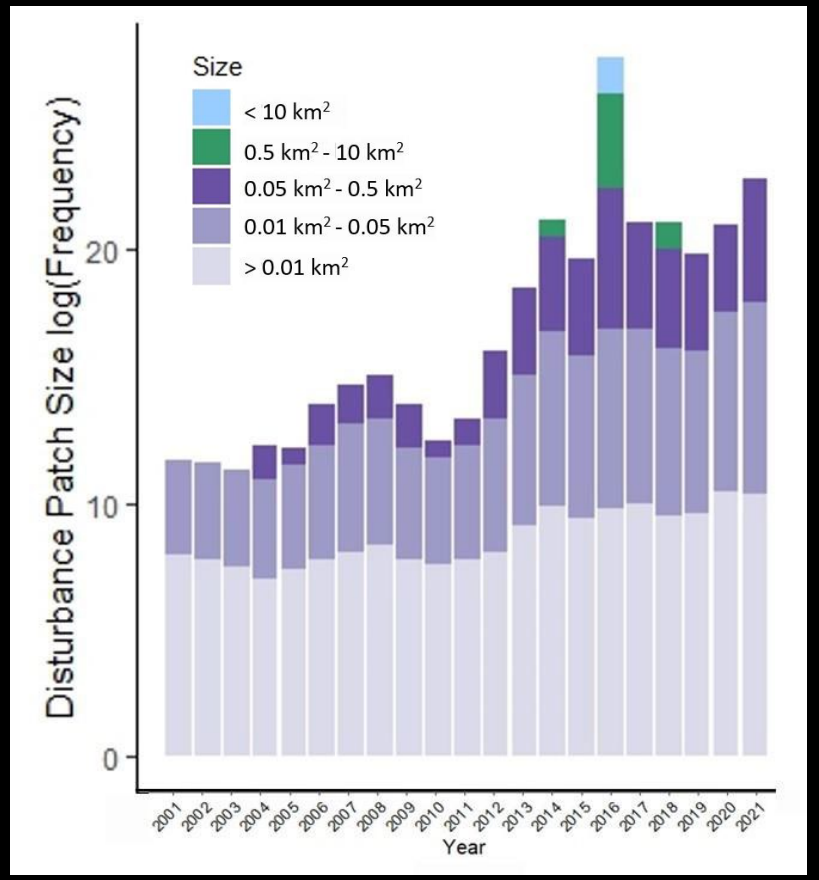





Tri-National Dja-Odzala-Minkebe (TRIDOM) Landscape
Somalomo
Bouamir Research Station
a
b
Dja Reserve
Boumba Bek
Nki
Mengam
Minkébé
Messok
Odzala-Kokoua
Mwagne
Lossi
Ivindo
Ntokou-Pikounda
Mondah
Mabounie
Lopé
0
205
410
820
Km
Landscape-Scale Study Area
AfriSAR LVIS ground plots
TRIDOM Protected Areas
RADD Alert (2019-2021)
No Change
Jan 2019-Dec 2019
Jan 2020-Dec 2020
Jan 2021-Jul 2021
JRC Degradation (1982-2020)
No Change
1982-1990
1990-2000
2000-2010
2010-2020
JRC Deforestation (1982-2020)
No Change
1982-1990
1990-2000
2000-2010
2010-2020
GFC tree gain (2000-2012)
No Change
Forest Gain
GFC tree loss (2000-2020)
No Change
2000-2005
2005-2010
2010-2015
2015-2020

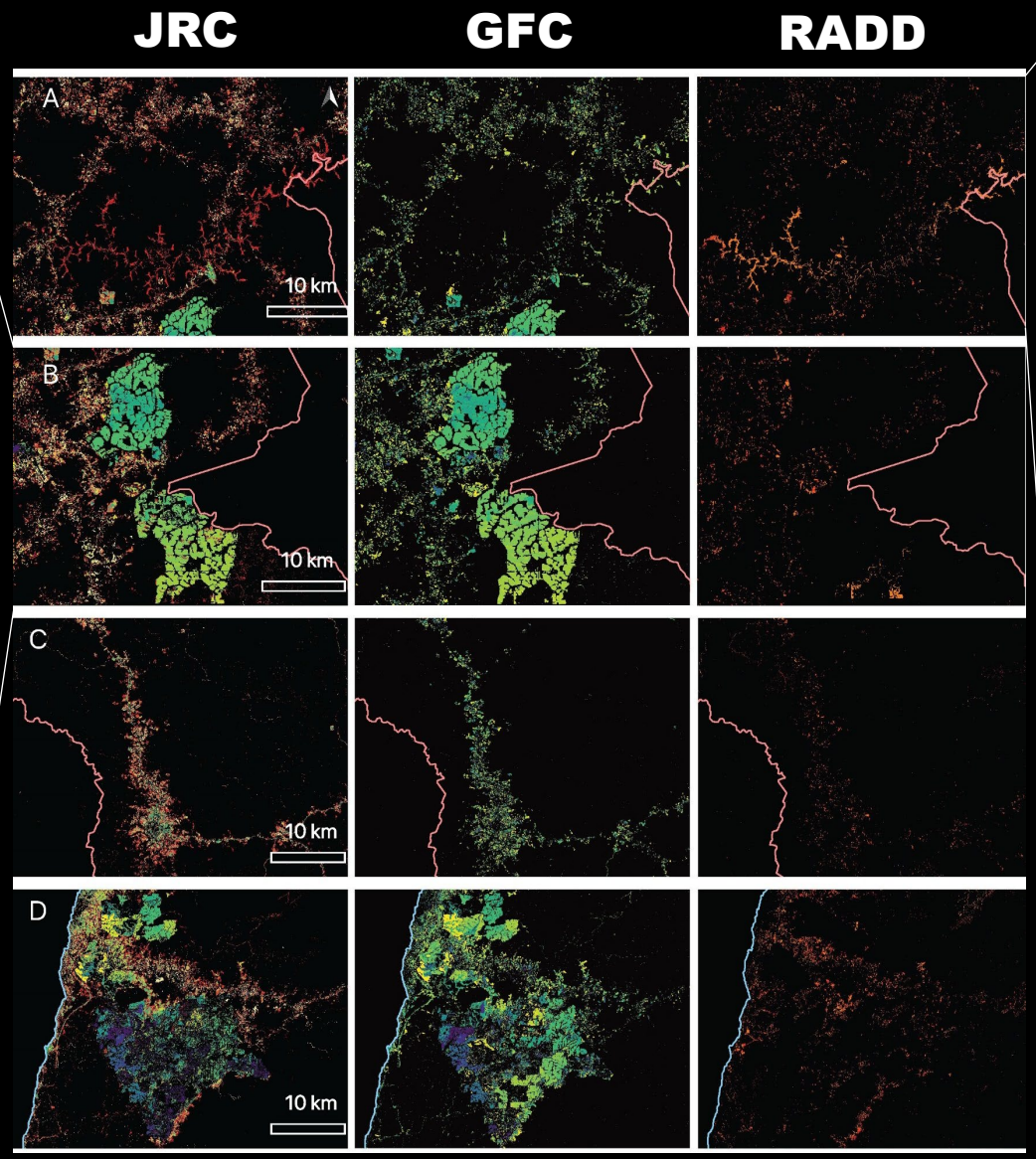
Increasing forest disturbance

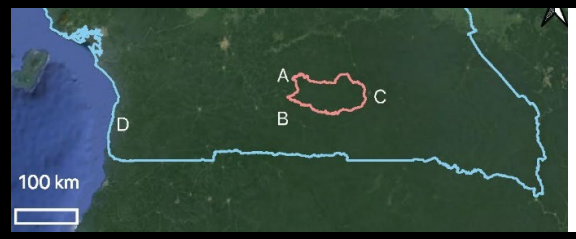


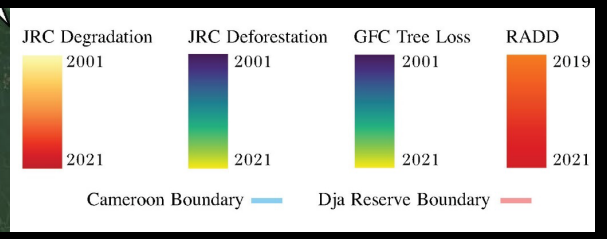


Biswas et al. *in prep*

SkySat image collection over a rubber plantation east of the Dja.



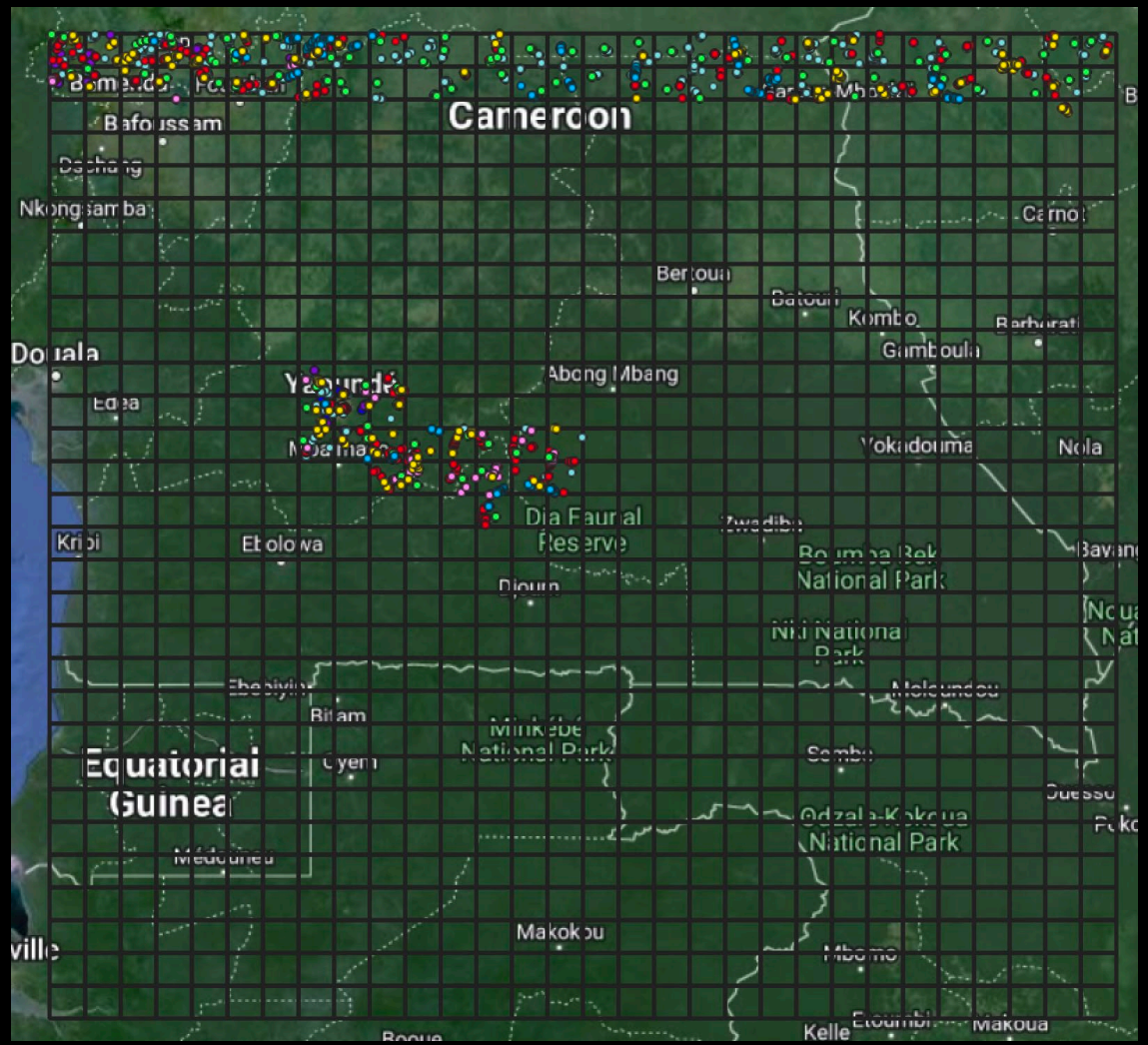




Forest disturbance due to flooding of Dja river after dam construction.

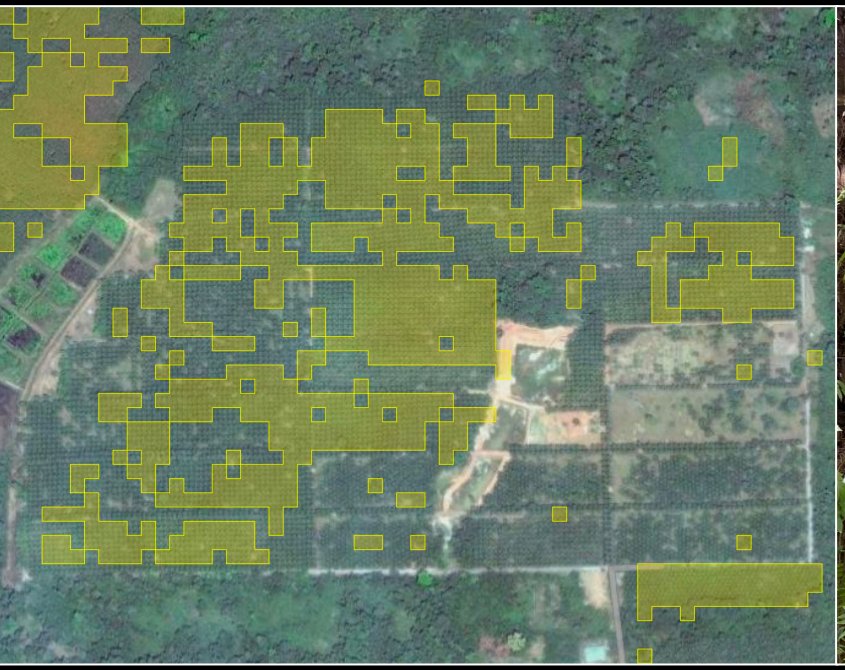
Biswas et al. in prep

Land change mapping (labeling)

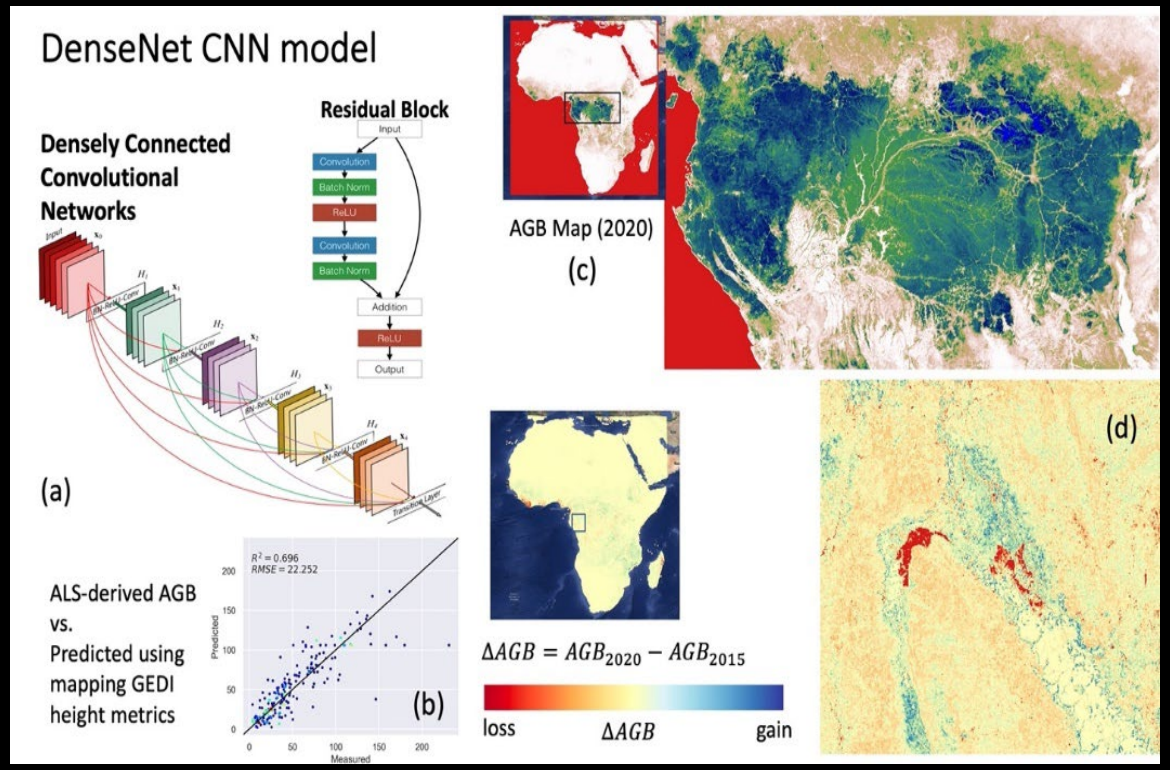


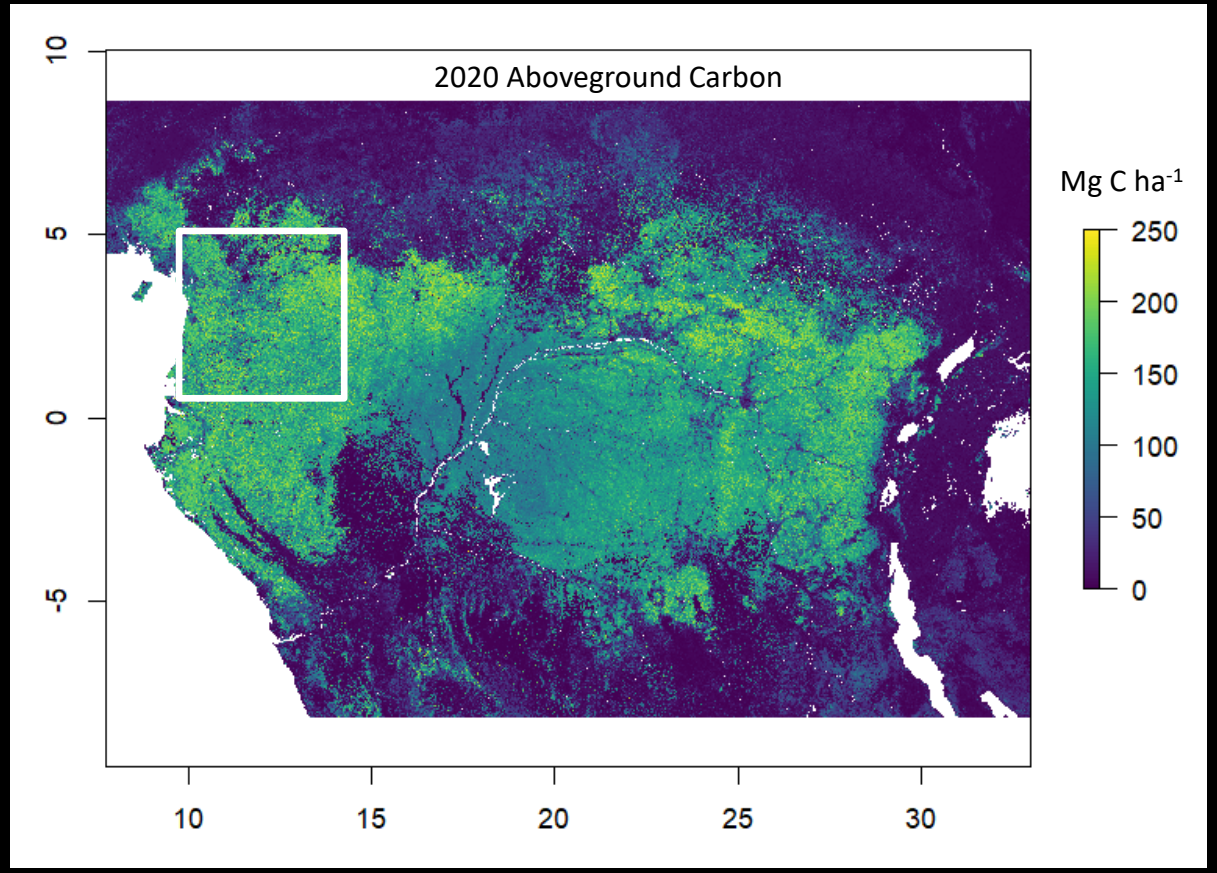
- Forest
- Mixed agriculture
- Monoculture ag.
  - Oil palm
  - Rubber
  - Banana
- Bare soil
- Built environment
- Mining
- Water

Most gain is occurring in plantations



Mapping aboveground carbon

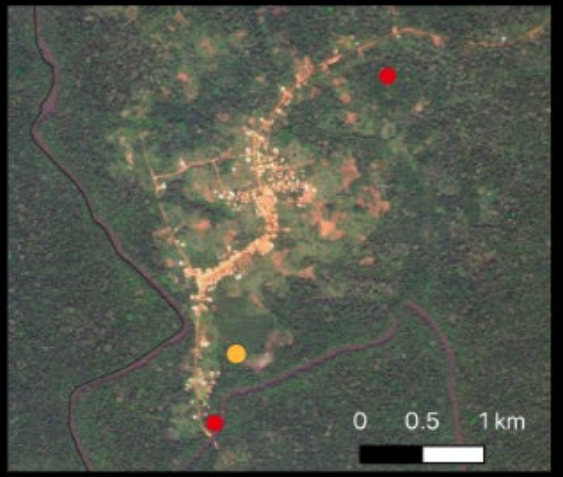


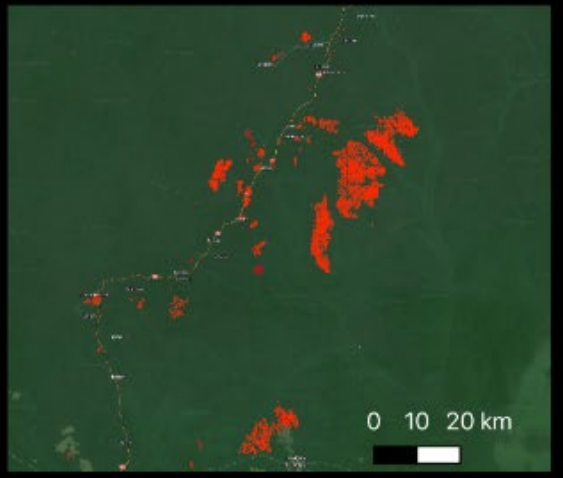


Interviews & Surveys

Interviews & Surveys

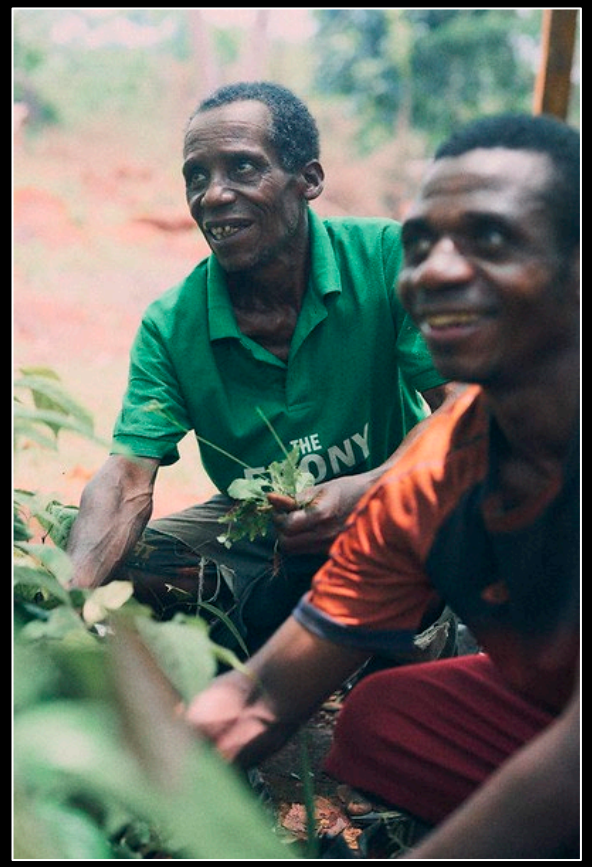
Only 2% of loss attributed to fire?

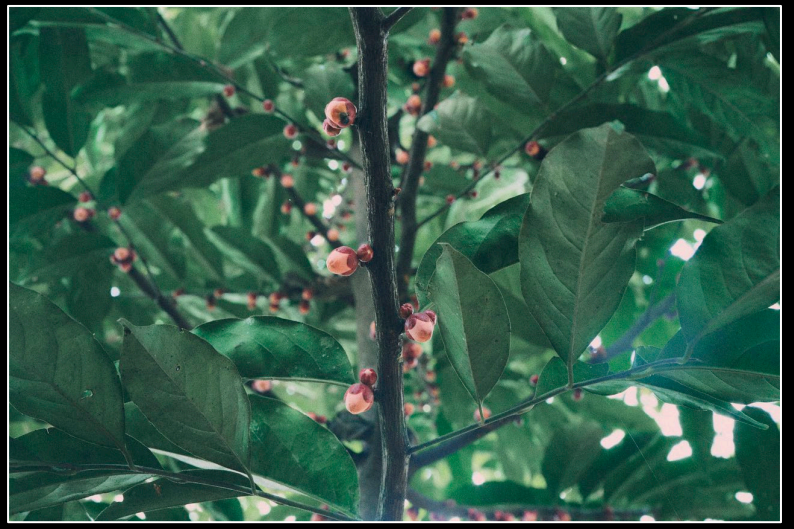




Turkavina et al. 2022

Bright spots





Early insights & next steps

Early Insights

- Conservation projects appear to have unintended land use change consequences
- Additional gain mapping is needed to more effectively examine 'bright spots'
- Strong community dependency on and connection to forests and forest resources
    - Differences between Baka and Bantu communities, but less distinct than initially thought
- Fire plays an important role in agricultural expansion, but low detection rates in existing datasets

Next Steps

- Land cover mapping, gain mapping (Ordway lab)
- Carbon mapping (Saatchi lab)
- Survey work – July & August (Entire team)
- Ecosystem service analysis (Egoh Lab)
- Methods training with the Central African Forest Satellite Observatory (OSFAC) & National Climate Change Observatory (ONACC) (Entire team)

Thank you!