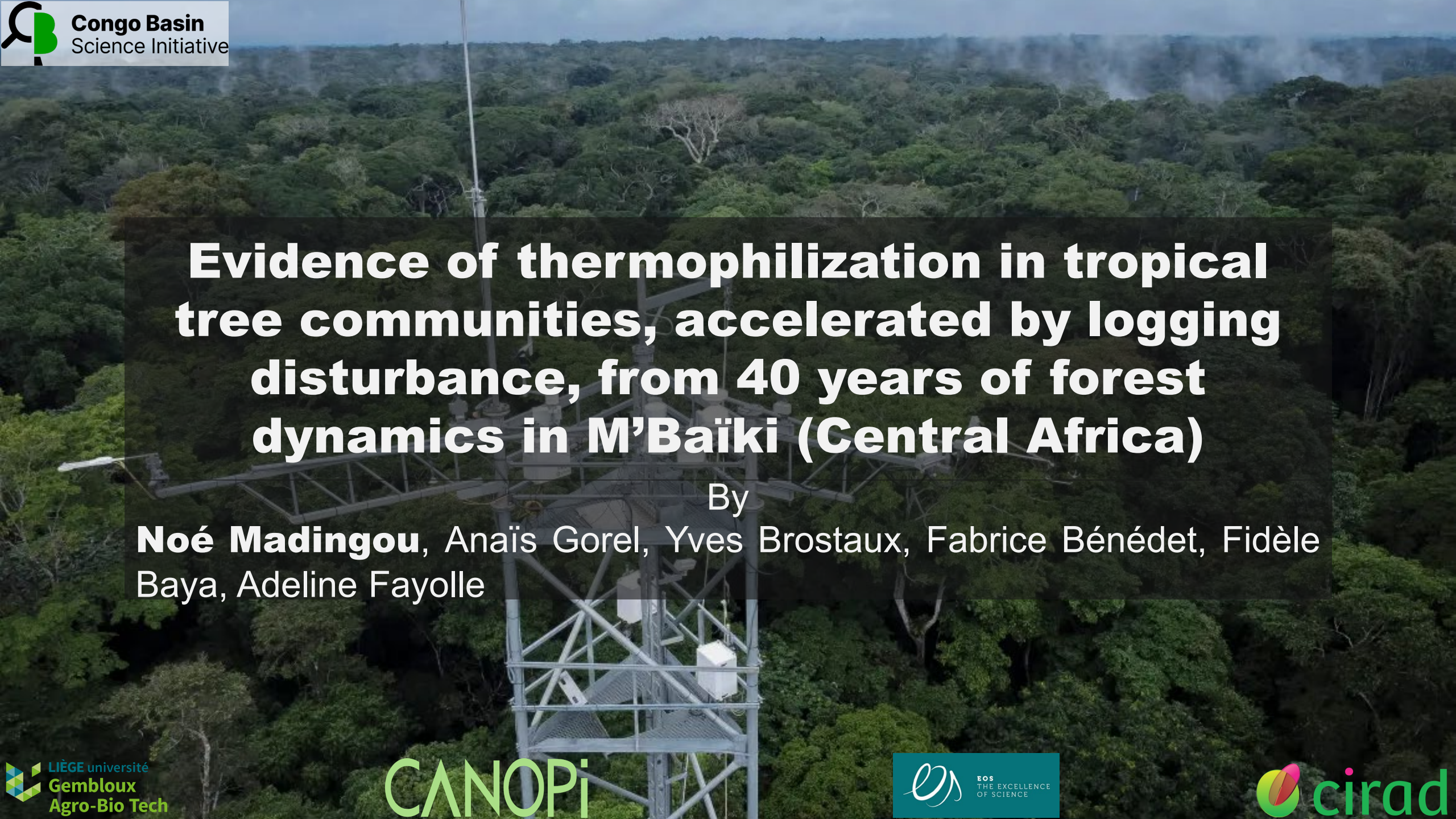
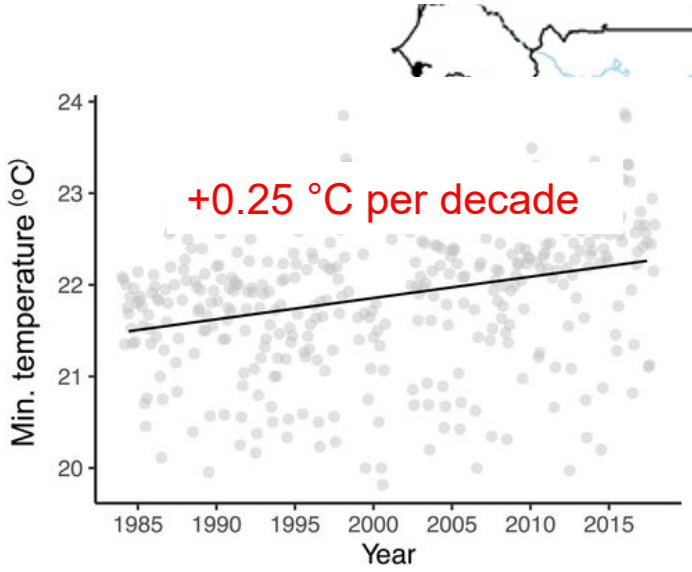


Evidence of thermophilization in tropical tree communities, accelerated by logging disturbance, from 40 years of forest dynamics in M'Baïki (Central Africa)

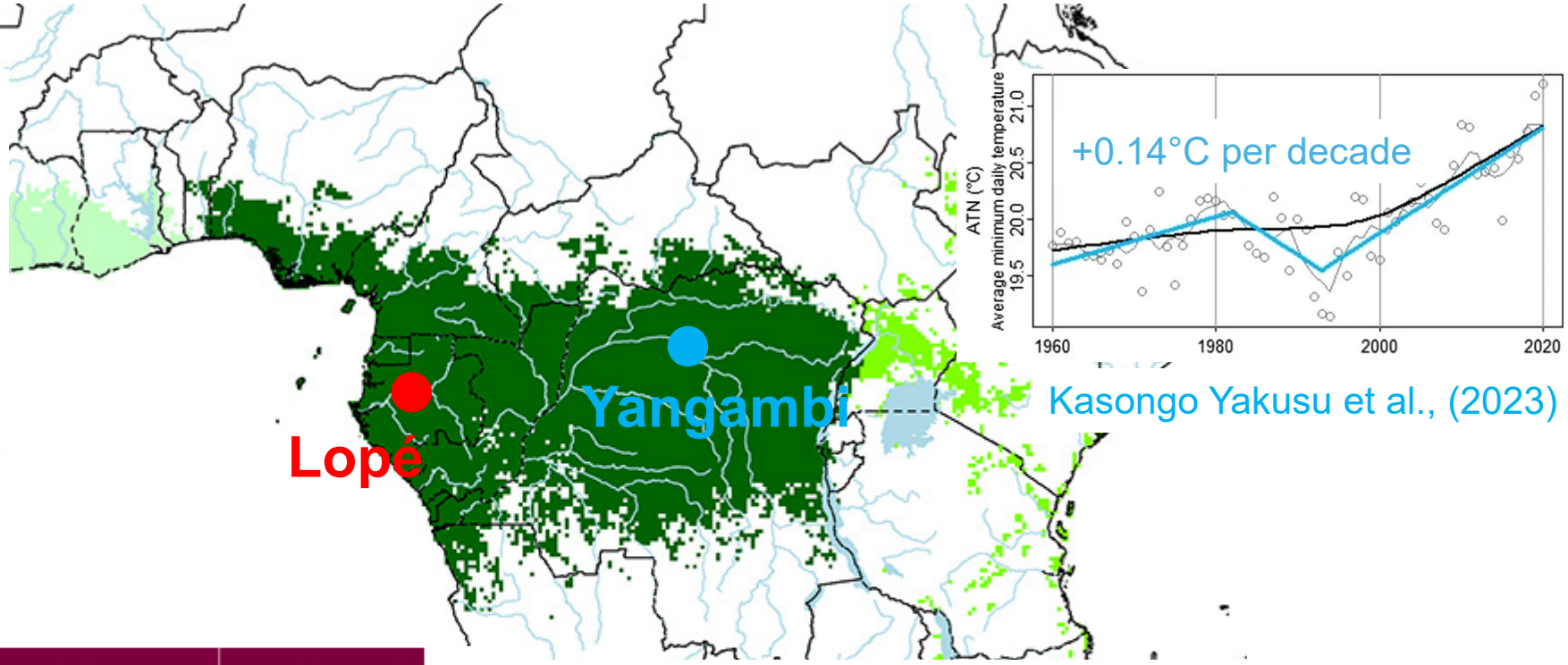
By

Noé Madingou, Anaïs Gorel, Yves Brostaux, Fabrice Bénédet, Fidèle Baya, Adeline Fayolle

Ground-based climate observations reveal significant warming and intensified rainfall seasonality in central Africa



Bush et al., (2020)



Kasongo Yakusu et al., (2023)

Diversity and Distributions
Open Access
A Journal of Conservation Biogeography

RESEARCH ARTICLE | Open Access

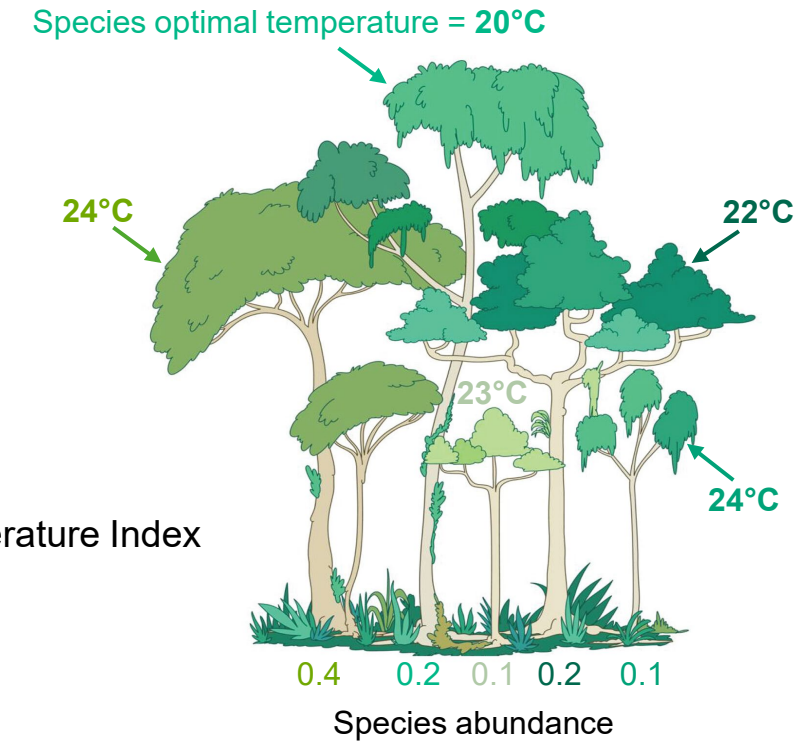
Vulnerability to Climate Changes of Tropical Forests Across Africa

Mady Parfait Noé Madingou, Gilles Dauby, Adeline Fayolle, Anaïs-Pasiphaé Gorel

*"**High climatic risk** across the African forest biome driven by **widespread warming** and **narrow species safety margins**"*

Climate warming affects species fitness, favouring warm-adapted species and reshuffling community composition: “**thermophilization**”

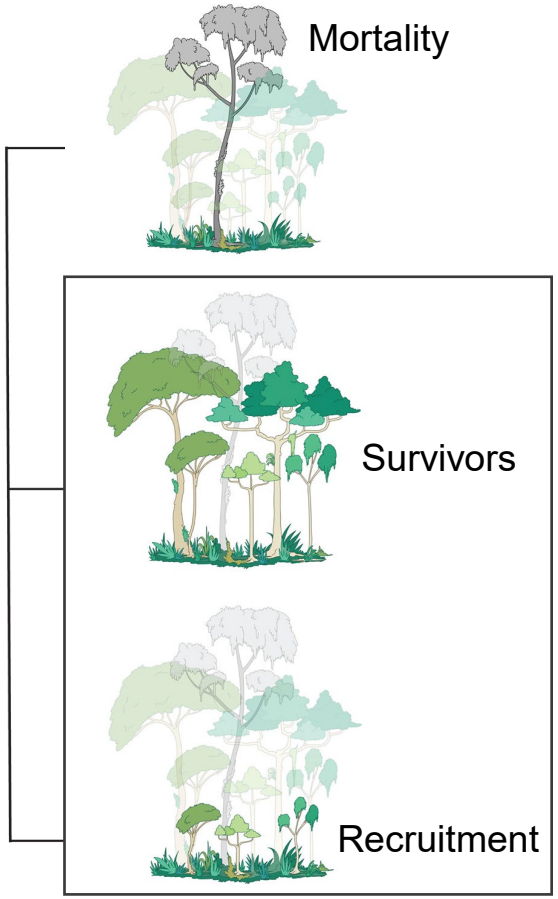
Initial community assemblage



Community Temperature Index (CTI) = 22.7 °C

Time

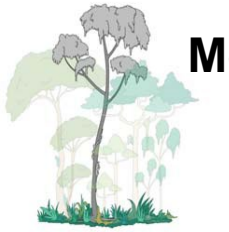
Community assemblage at **t+n**



CTI= 23.4 °C

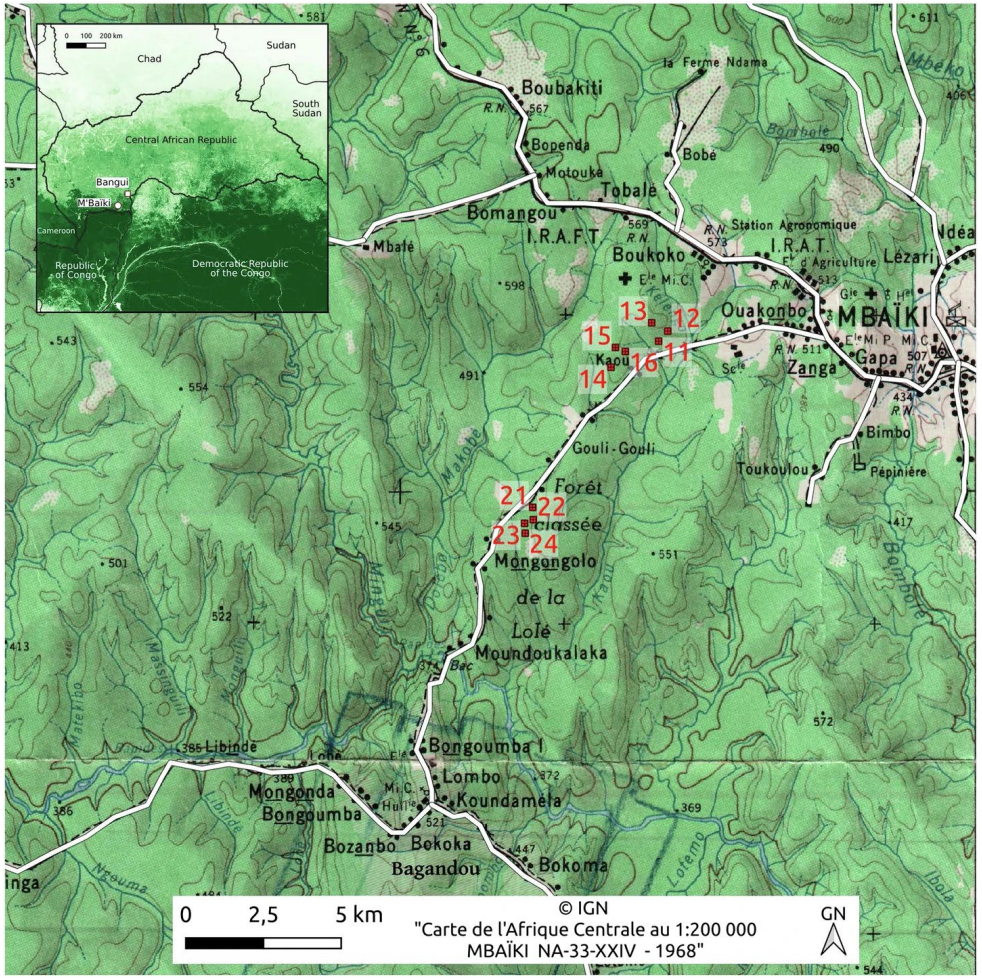
How do Central African forests respond to global change (climate warming and logging disturbance)?

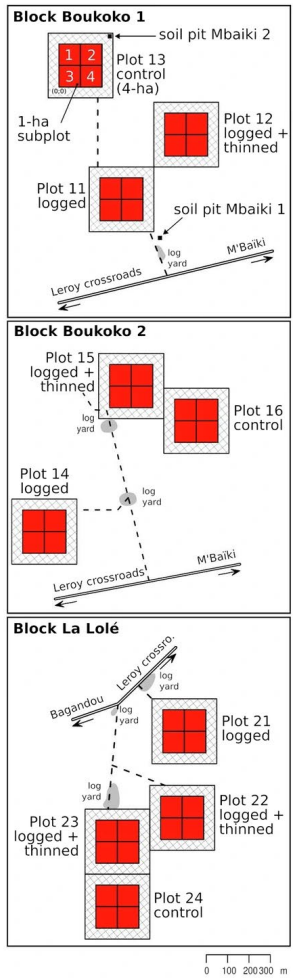
1) Have forest communities undergone **thermophilization** over the past four decades, and do **forest disturbances intensify** these directional changes?



2) Which **demographic processes** underpin these directional changes, and to what extent are they altered or intensified by forest disturbance?

Study site of M'Baïki (Central African Republic) : Experimental design and Tree measurements



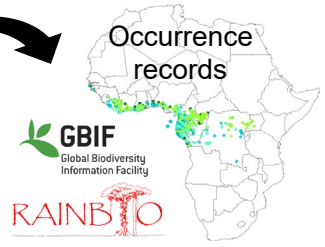


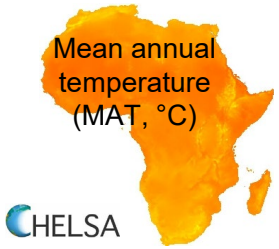
Trees with a **dbh ≤ 10 cm** have been identified, measured and monitored **since 1982**

Analytical Framework for Assessing Tree Community Thermophilization and Underlying Processes

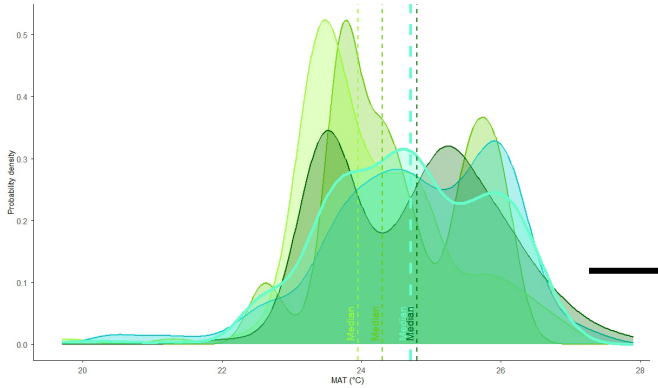
Step 1: Inventories, occurrences and climatic data

Subplot





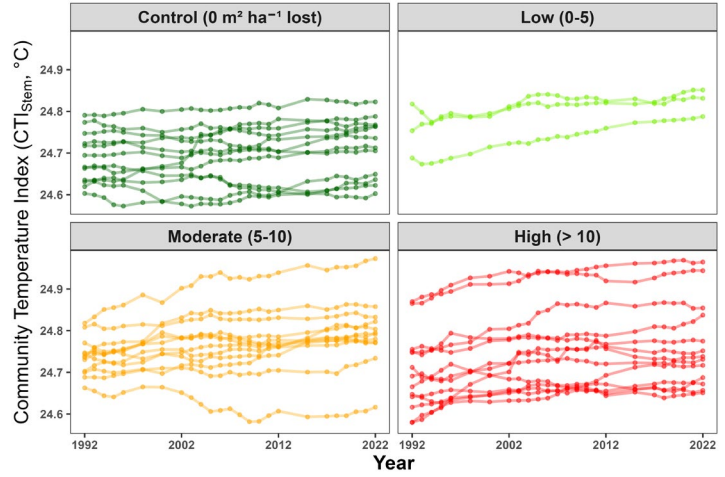
Step 2: Optimal temperature for the species



Step 3: Community temperature index (CTI, °C)

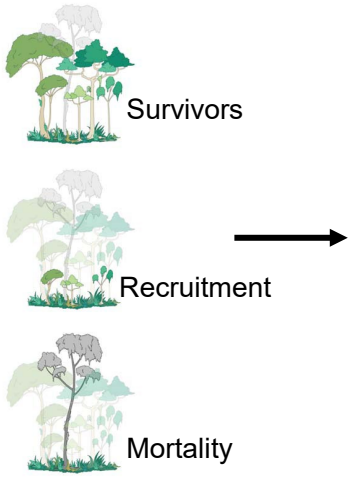
$$CTI_{plot\_year} = \frac{\sum_{i=1}^{S}(Nbr_i * MAT.opt_i)}{\sum_{i=1}^{S} Nbr_i}$$

Step 4: Long-term dynamics

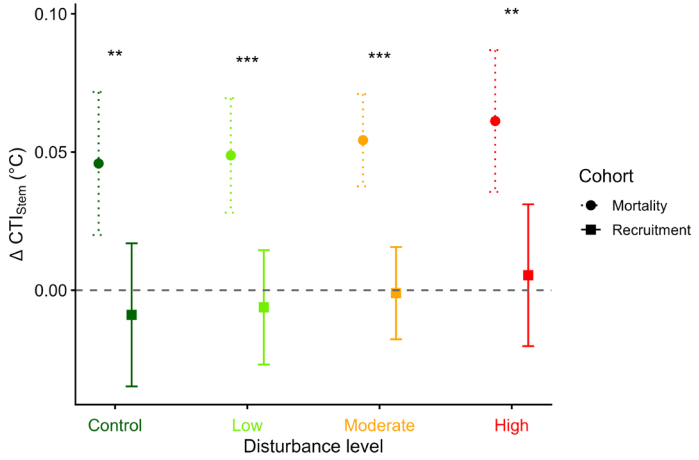


Step 5: Cohorts

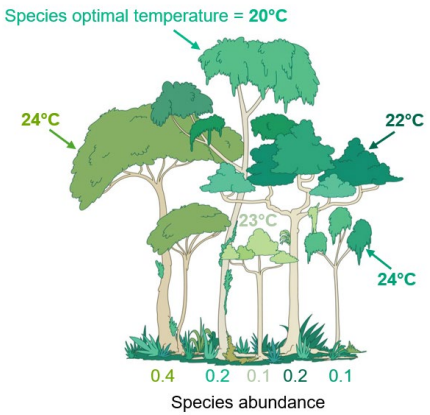
Time



Step 6: Demographic processes



1) **Have forest communities undergone thermophilization** over the past four decades, and **do forest disturbances intensify** these directional changes?



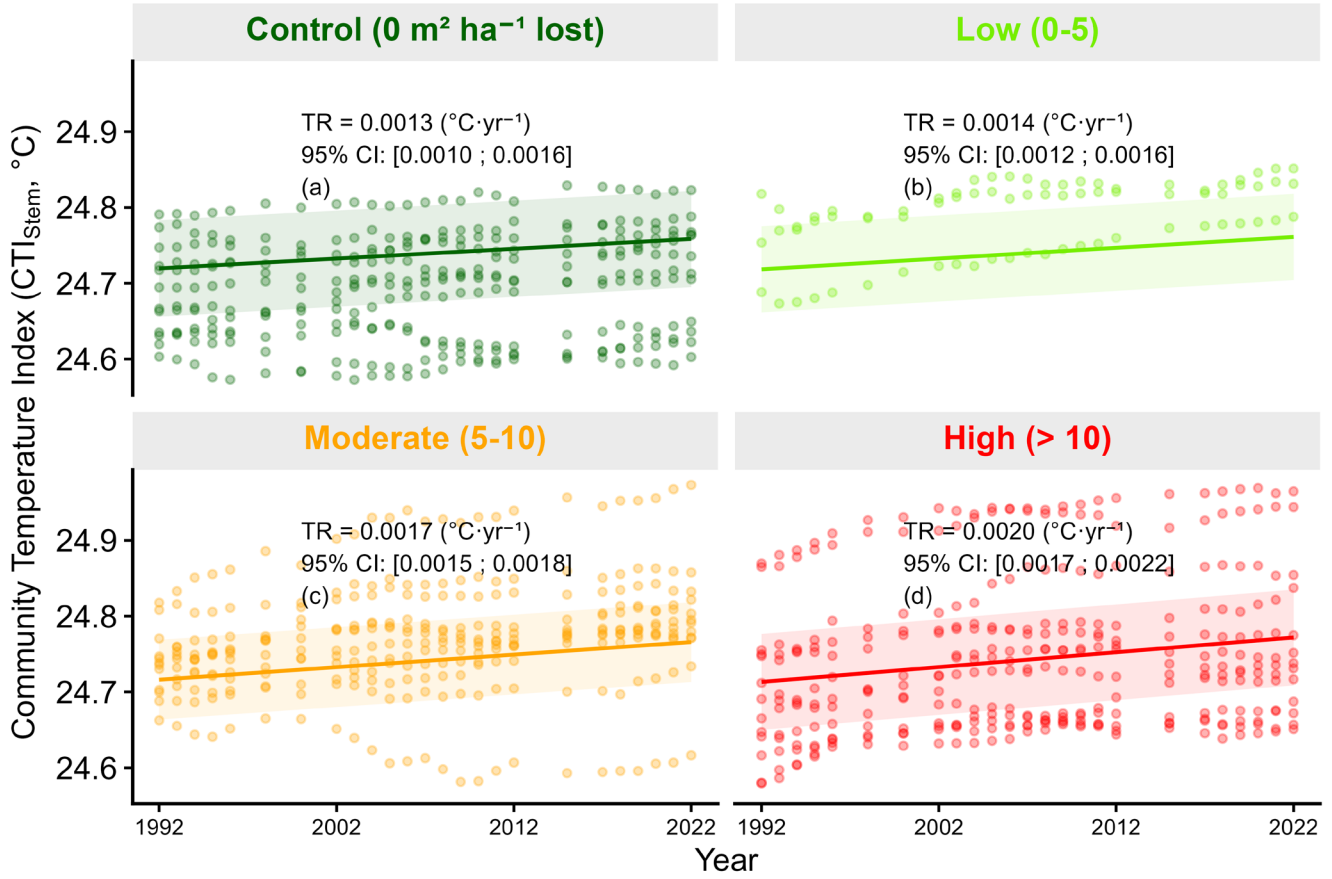
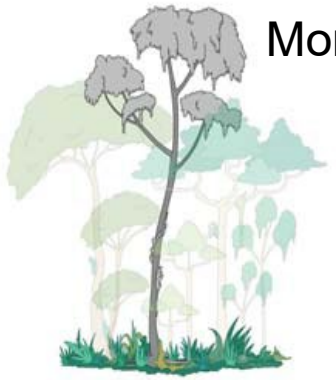


Fig 1: TR estimated at 0, 2.5, 7.5, and 12.5 m² ha⁻¹ of basal area loss for Control, Low, Moderate, and High respectively

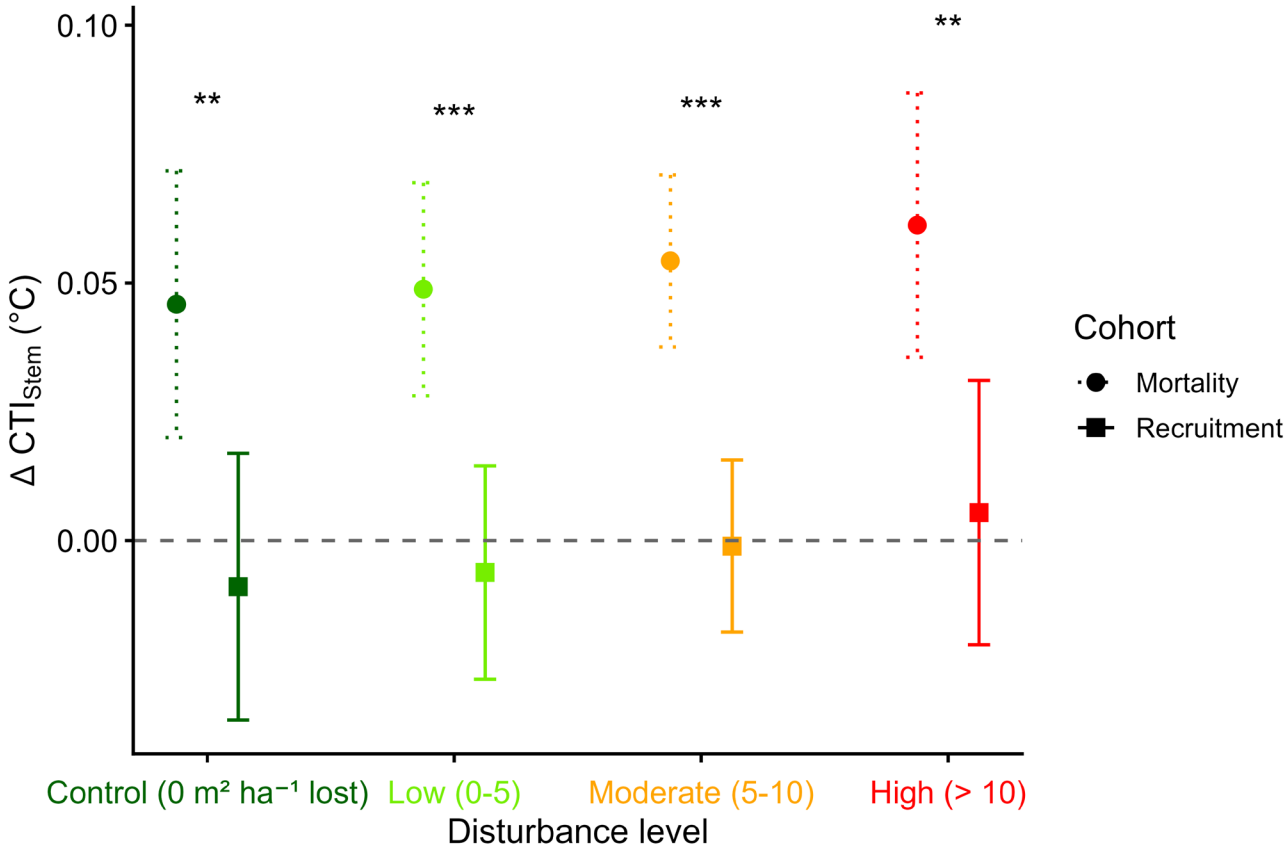
- **Over the past four decades, forest communities have undergone thermophilization, which is intensified by forest disturbance**

2) Which **demographic processes** underpin these directional changes, and to what extent are they **altered** or **intensified by forest disturbance**?



Mortality

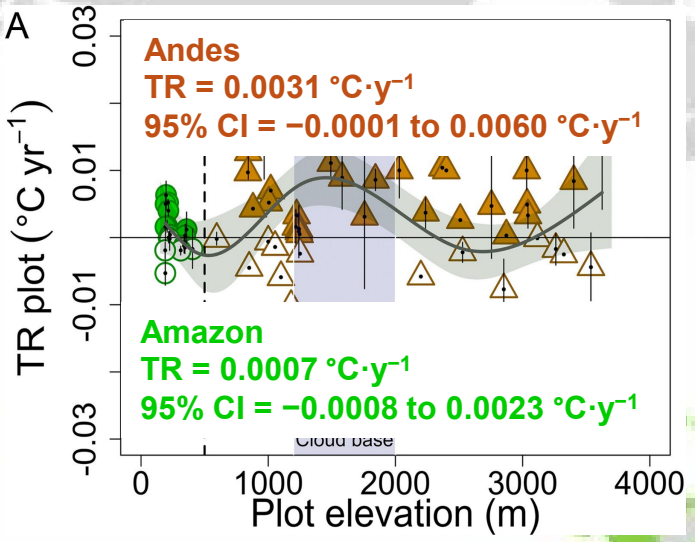
Recruitment



- **Thermophilization is mainly driven by selective mortality rather than recruitment**

Discussion

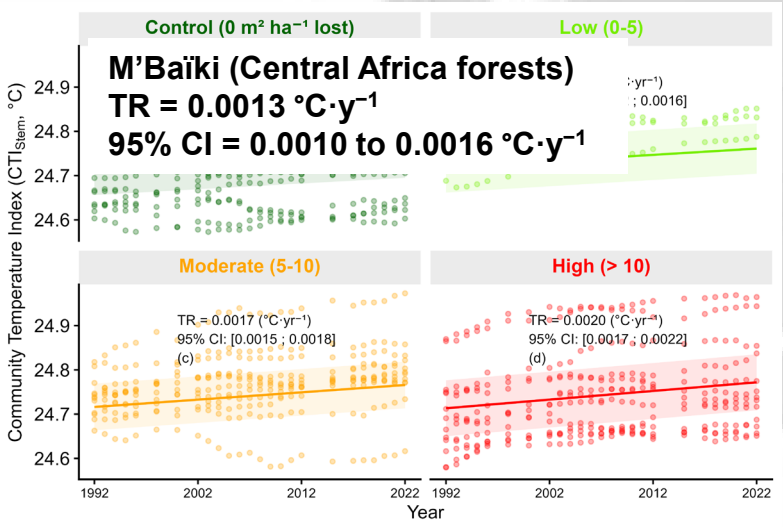
Pattern



>

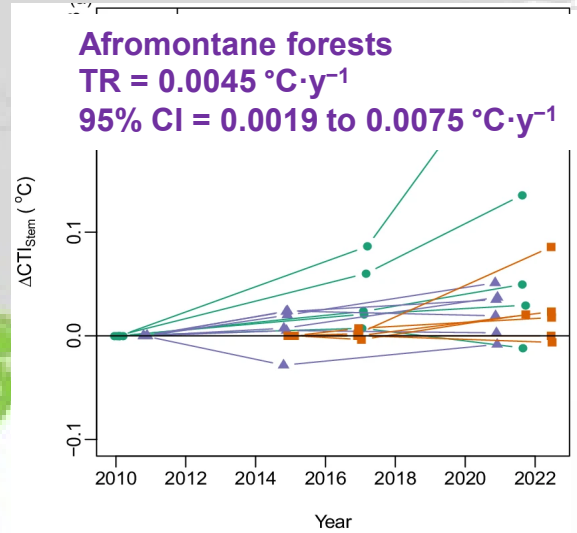
<

Pattern



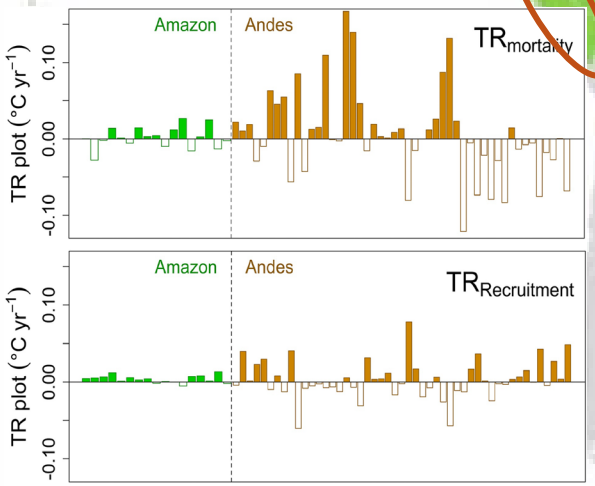
<

Pattern



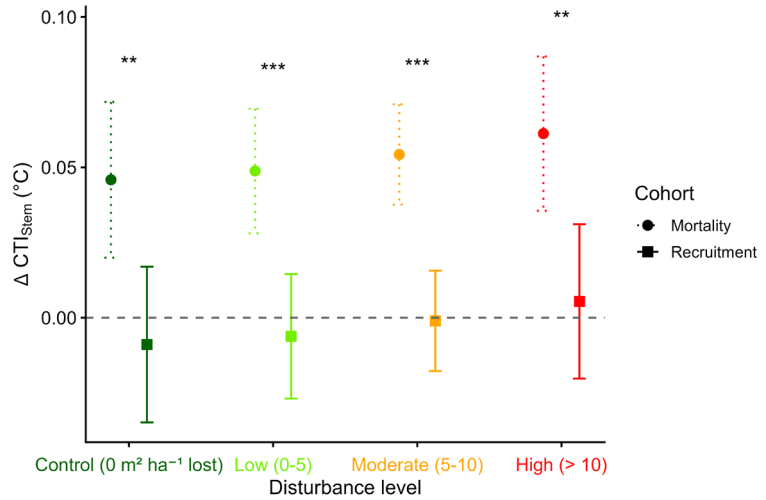
Farfan-Rios et al., (2025)

Drivers



=

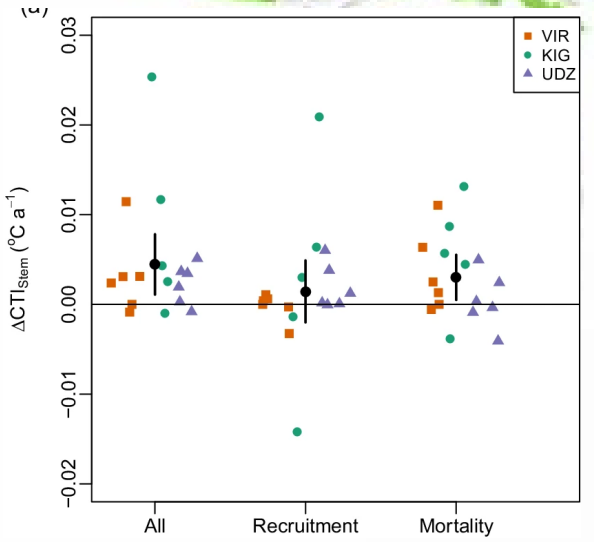
Drivers



≠

Cuni-Sanchez et al., (2024)

Drivers



Sylvie Gourlet-Fleury (CIRAD, Montpellier, France)

MATONDO! ! !

CANOPi

EOS
THE EXCELLENCE
OF SCIENCE

Diversity and Distributions
Open Access
A Journal of Conservation Biogeography

RESEARCH ARTICLE | Open Access

Vulnerability to Climate Changes of Tropical Forests Across Africa

Mady Parfait Noé Madingou, Gilles Dauby, Adeline Fayolle, Anaïs-Pasiphaé Gorel

First published: 16 October 2025 | https://doi.org/10.1111/ddi.70104

Get it@ULiège

LIÈGE université
Gembloux
Agro-Bio Tech

cirad

Email:
mmadingou@uliege.be