

# Testing the Dynamic Habitat Indices from MODIS for biodiversity and conservation

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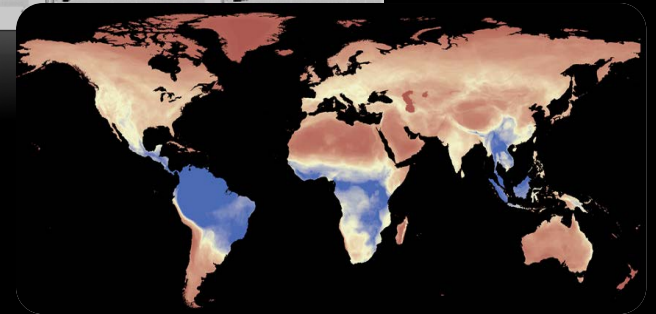
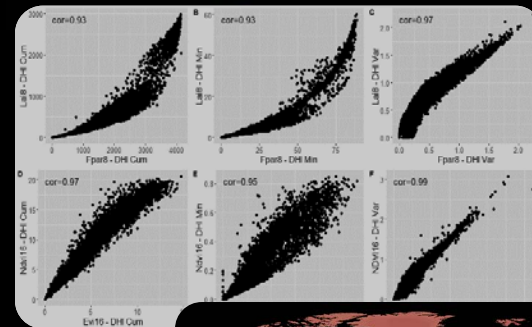
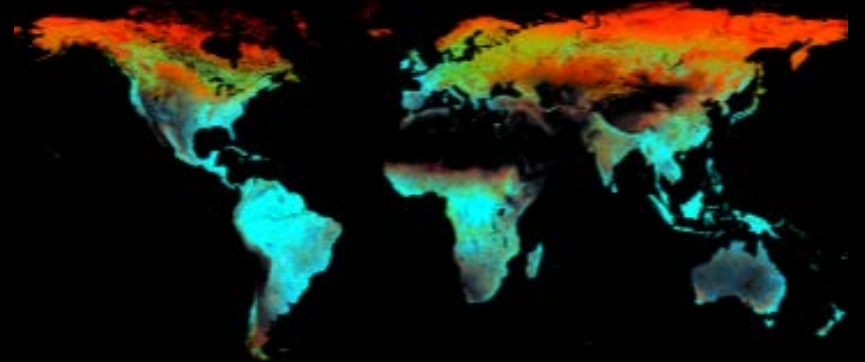
NASA MODIS Science Team Meeting, 6/9/2016

# Outline

I. Background: the Dynamic Habitat Indices

II. Datasets: Composite and annual DHIs

III. Case studies: DHIs and biodiversity



# The Dynamic Habitat Indices

- Understanding biodiversity patterns is a BIG scientific question



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**BBC NEWS**

Front Page Tuesday, 21 May, 2002, 13:48 GMT 14:48 UK  
World  
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**Quarter of mammals 'face extinction'**



Siberian tigers may vanish within three decades

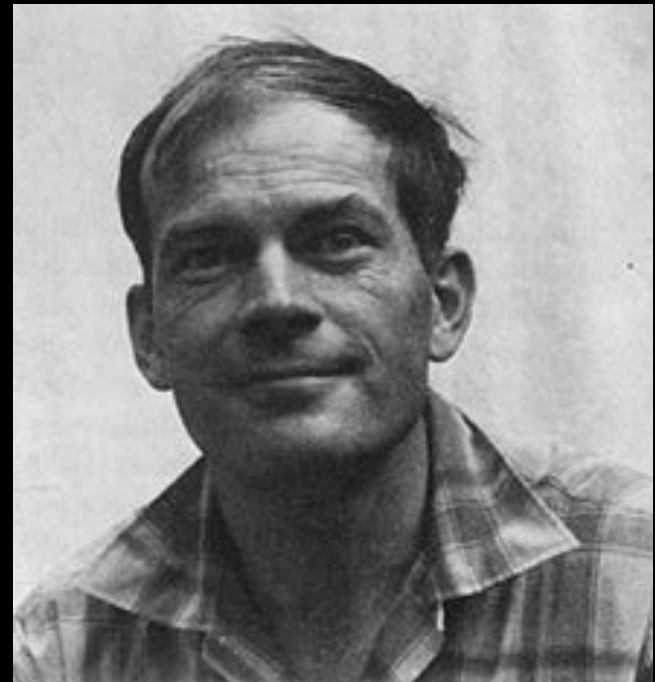
By Corinne Podger  
BBC science correspondent

Almost a quarter of the world's mammals face extinction within 30 years, according to a United Nations report on the state of the global environment.

- Biodiversity loss is a major challenge for society

# The Dynamic Habitat Indices

- Biodiversity theory predicts high species richness where:
  - Available energy is high
  - Minimum energy is high
  - Variability in energy is low





SPOT Vegetation

SAVI

MODIS

LAI

EVI

AVHRR

fPAR

NDVI

NPP

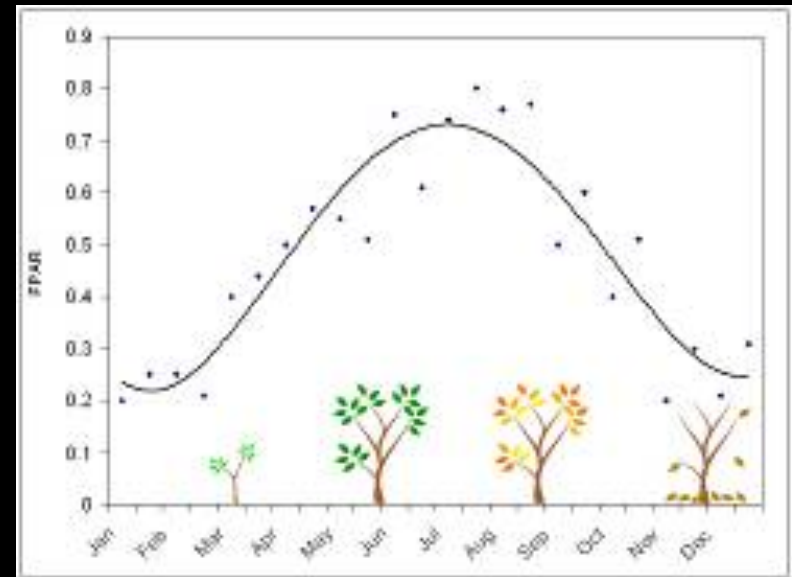




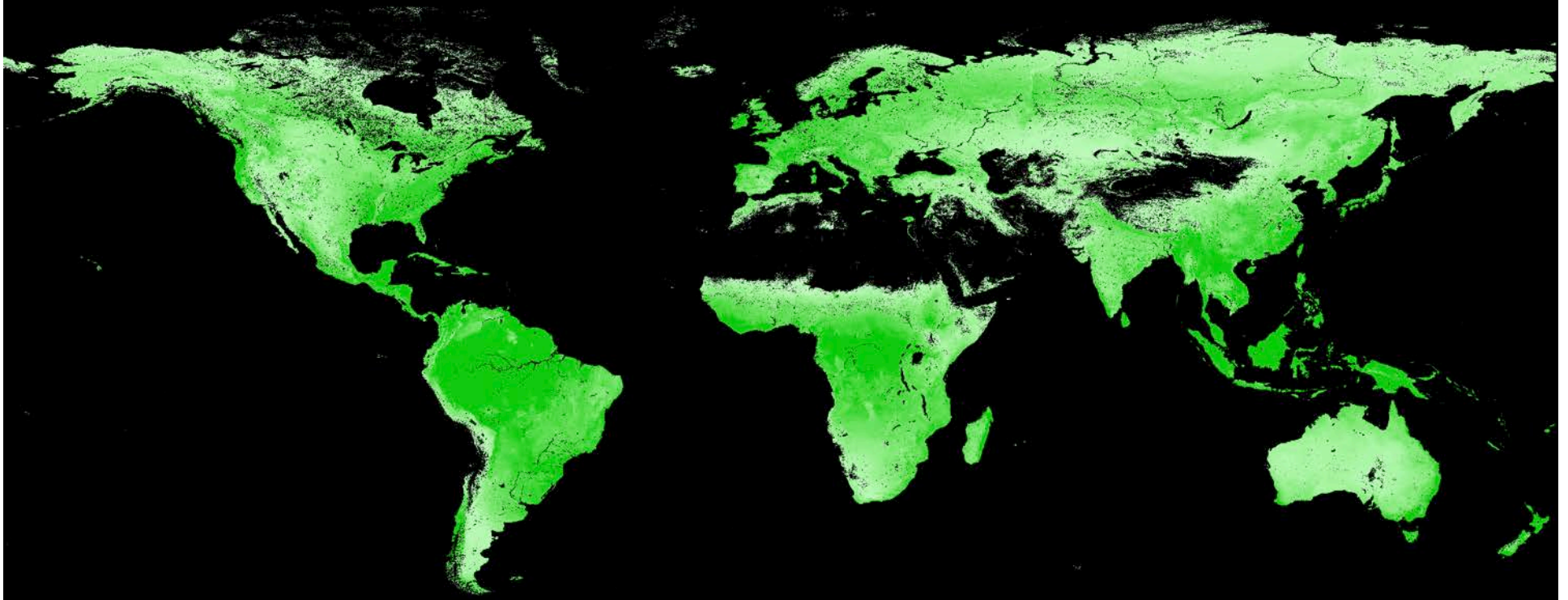


# The Dynamic Habitat Indices

- Plant productivity is a proxy for the energy available for biotic communities
- The DHIs summarize three key attributes of annual productivity
  - Cumulative
  - Minimum
  - Variability (CV)

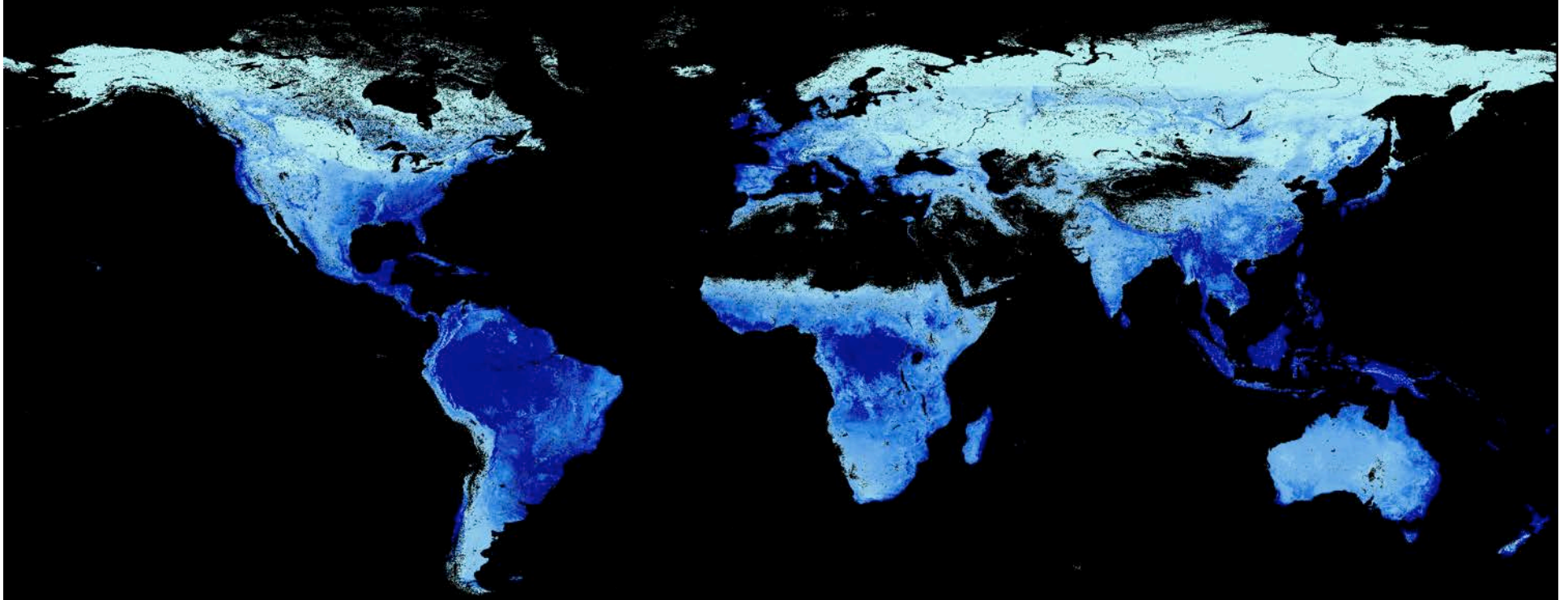


# The Dynamic Habitat Indices



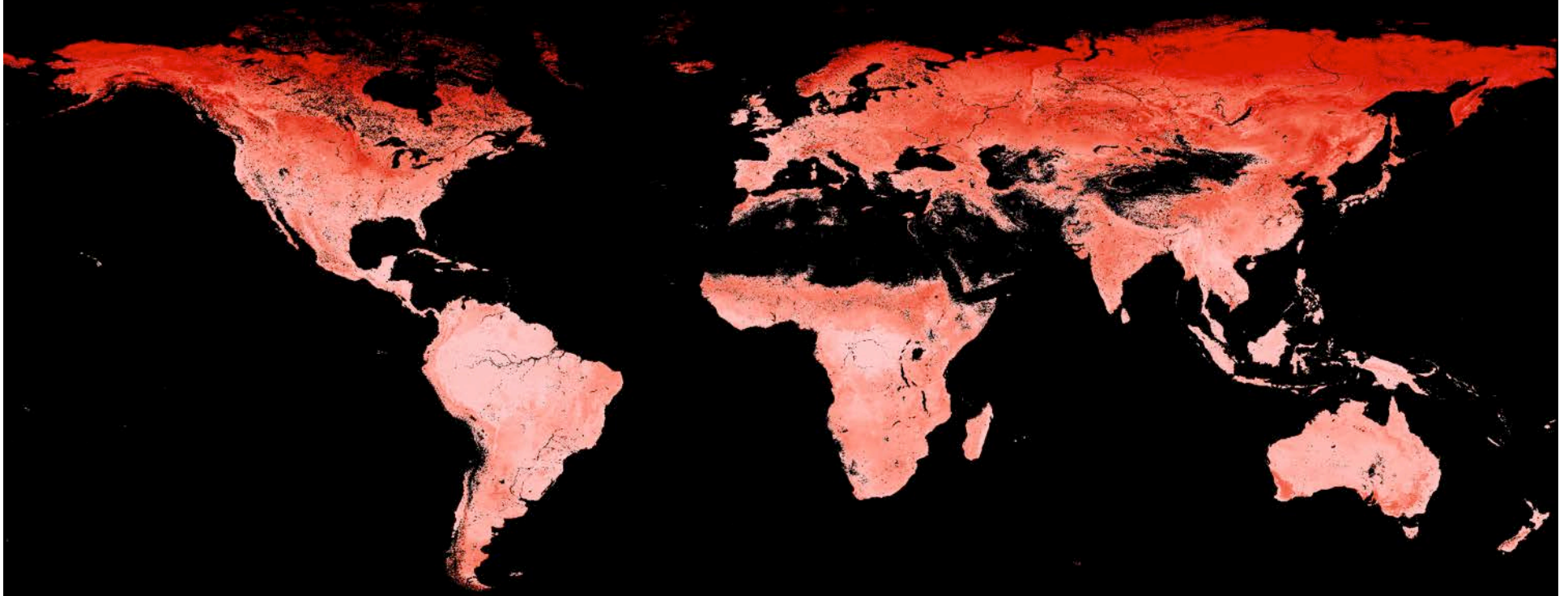
FPAR - Cumulative

# The Dynamic Habitat Indices



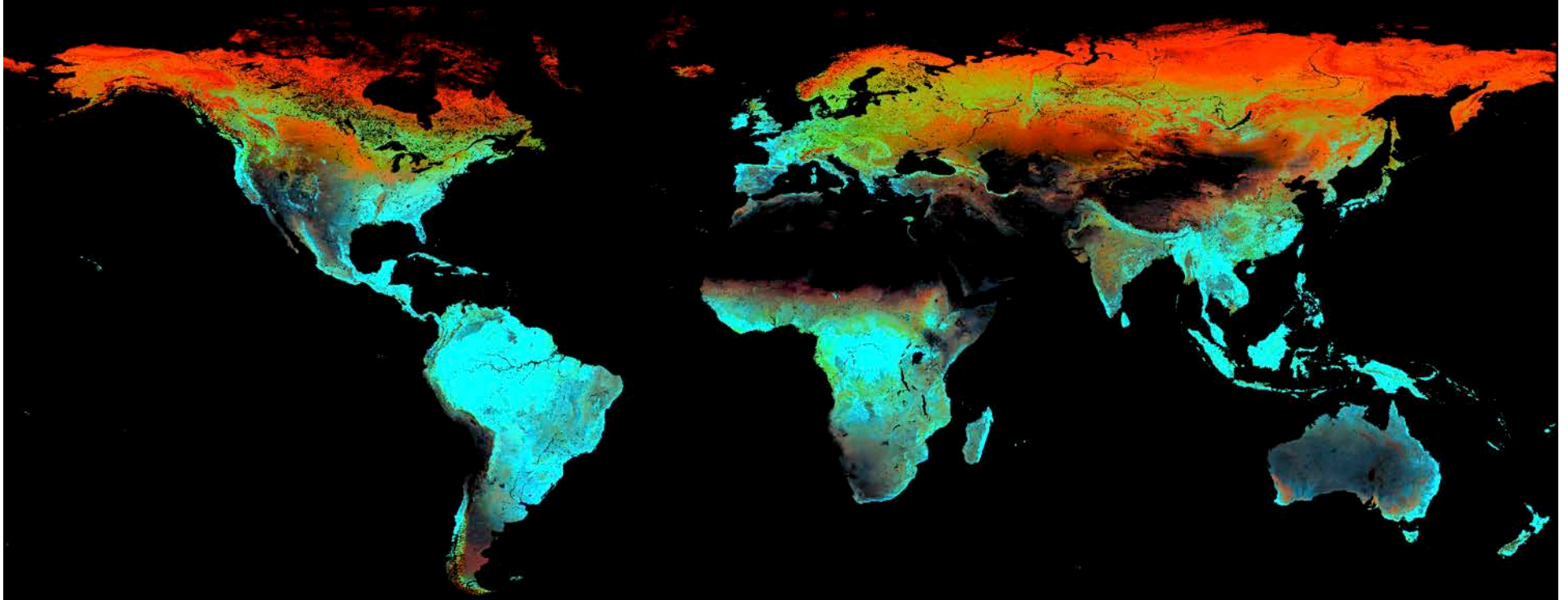
FPAR - Minimum

# The Dynamic Habitat Indices



FPAR – Variability

# The Dynamic Habitat Indices



FPAR DHIs

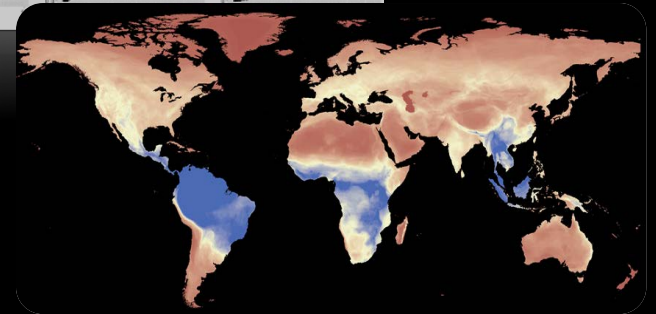
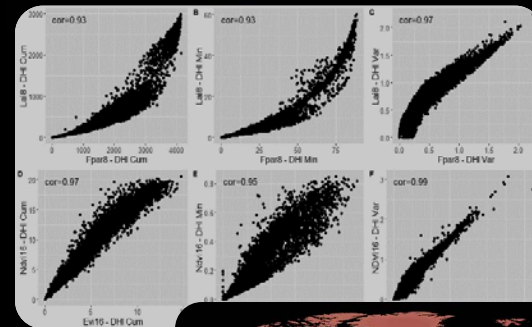
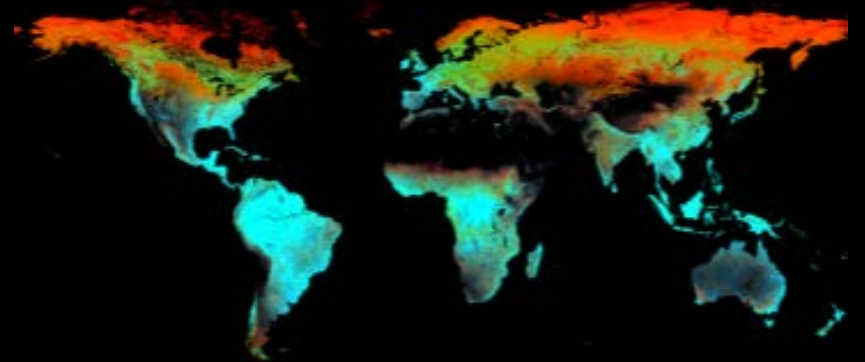
Variability, Cumulative, and Minimum in RGB

# Outline

I. Background: the Dynamic Habitat Indices

II. Datasets: Composite and annual DHIs

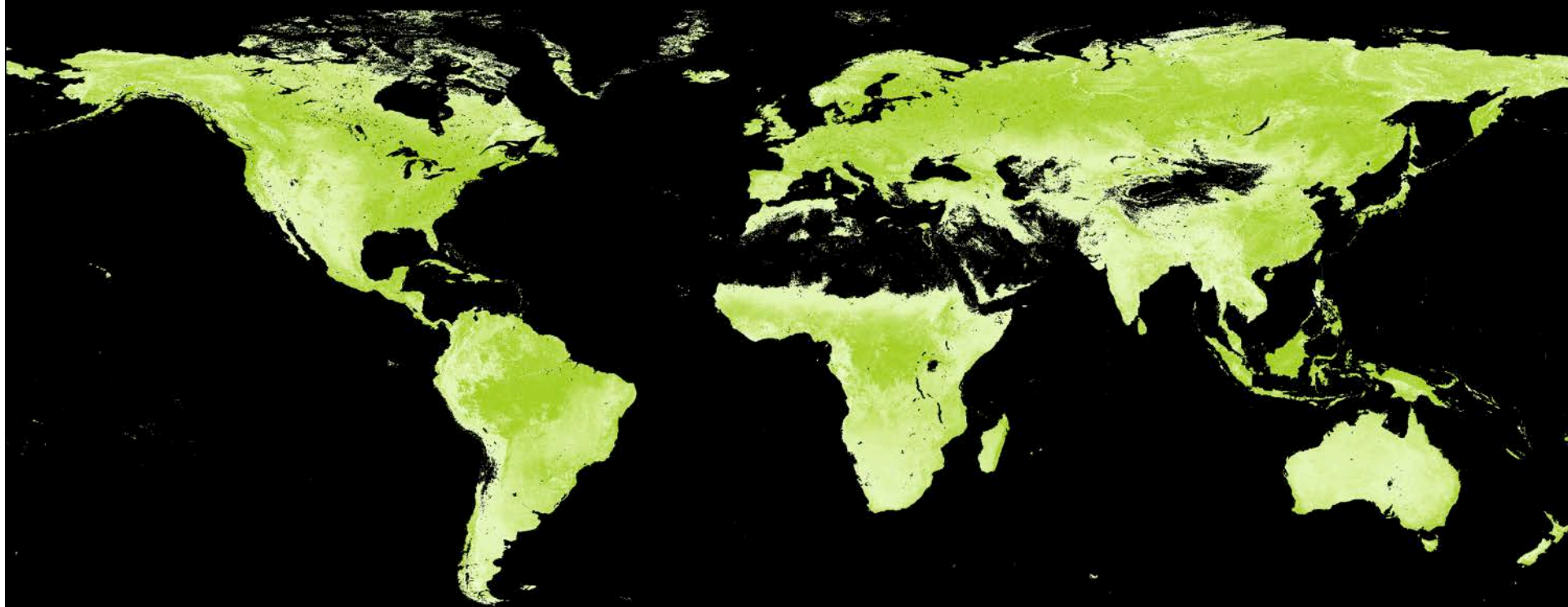
III. Case studies: DHIs and biodiversity



# Datasets

- MODIS Composite DHIs for 2003-2014
  - Why: MODIS vegetation data have some noise and phenology varies among years
  - The median of all observations for a date
  - Only good MODIS QA flags
  - No-data as functional zeros
    - Northern Latitudes
    - Snow and deserts

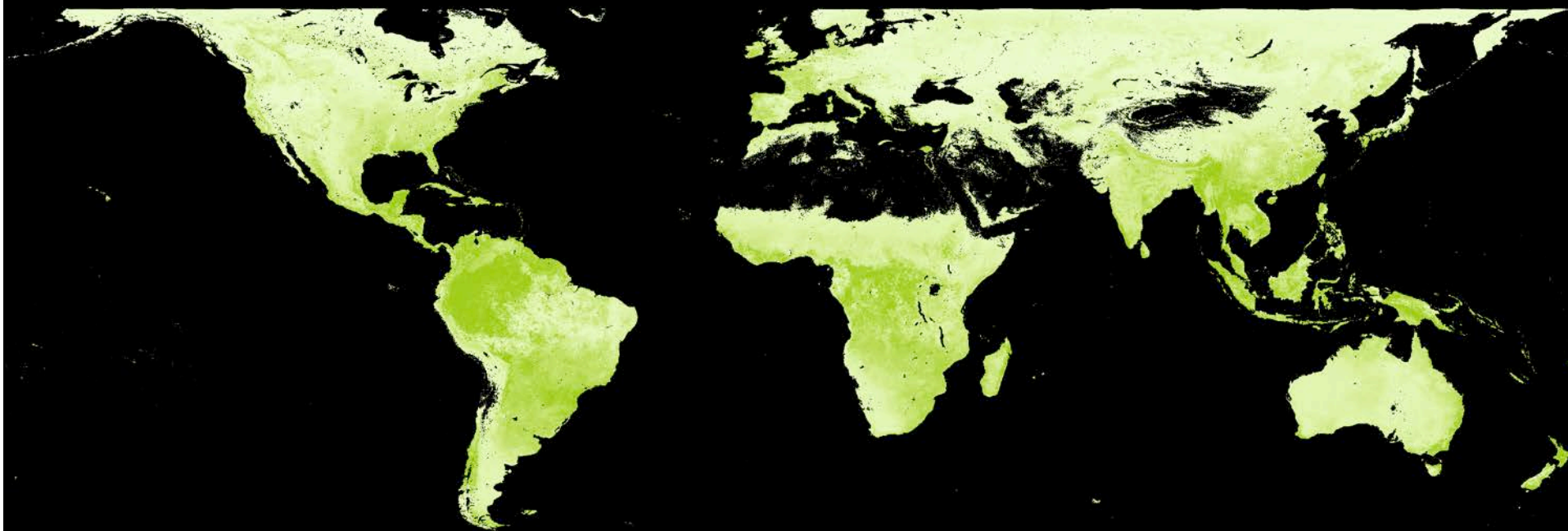
# Datasets



FPAR July 2002



# Datasets

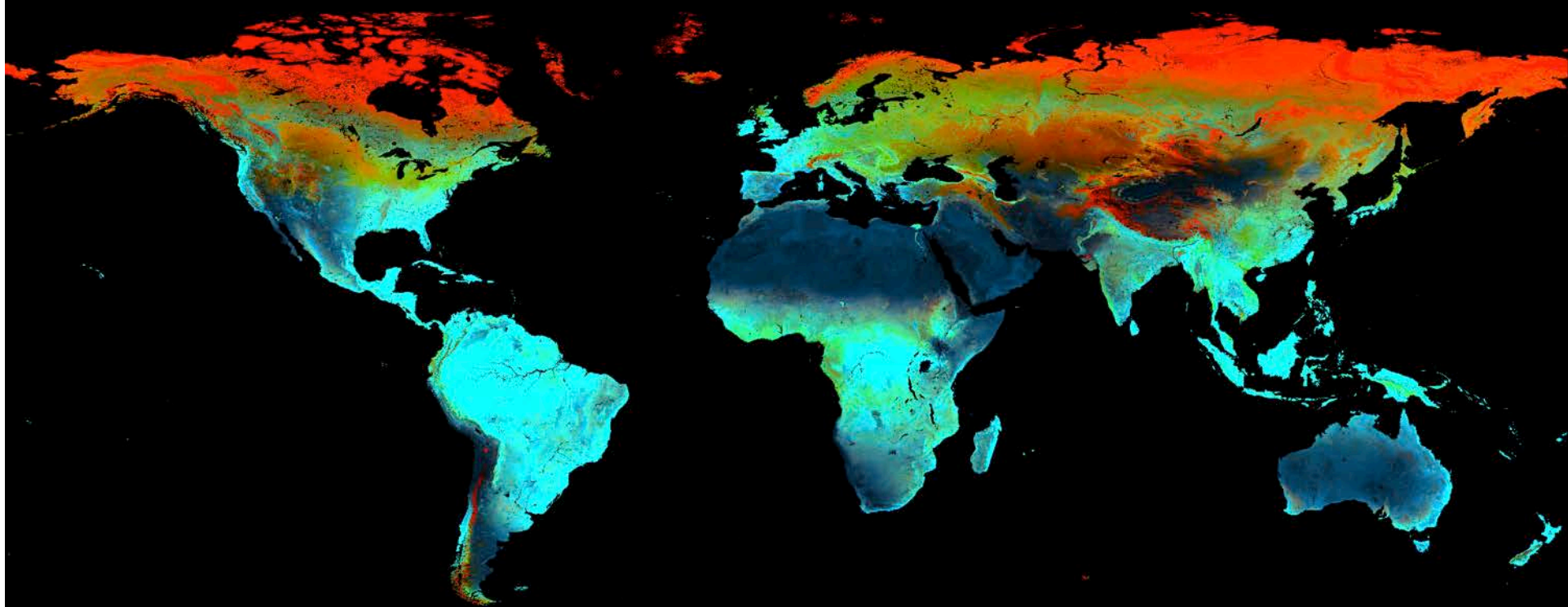


FPAR January 2002

# Datasets

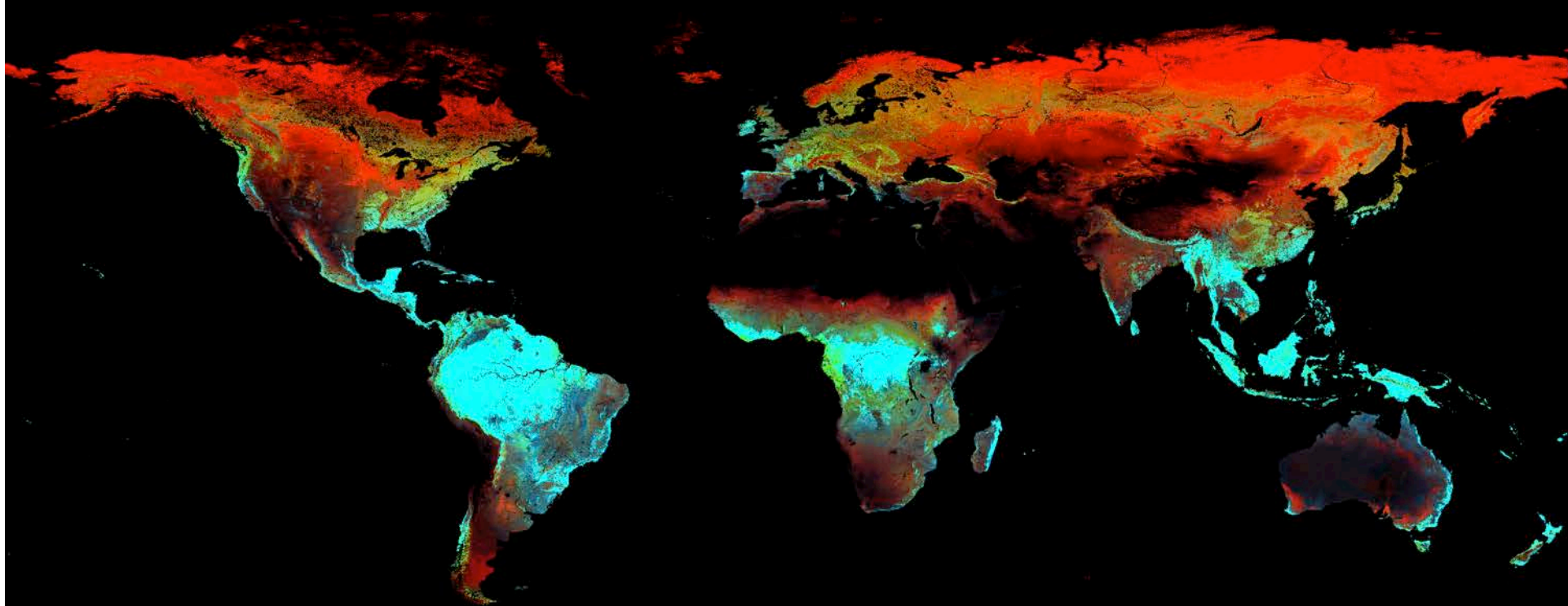
Index	Product	Platform	Temporal resolution	Spatial resolution	Composite DHI
NDVI	MOD13A2	Terra	16-day	1000 m	Done
NDVI	MOD13A1	Terra	16-day	500 m	In progress
EVI	MOD13A2	Terra	16-day	1000 m	Done
EVI	MOD13A1	Terra	16-day	500 m	In progress
FPAR	MCD15A2	Terra/ Aqua	8-day	1000 m	Done
FPAR	MCD15A3	Terra/ Aqua	4-day	1000 m	Done
LAI	MCD15A2	Terra/ Aqua	8-day	1000 m	Done
LAI	MCD15A3	Terra/ Aqua	4-day	1000 m	Done
GPP	MOD17A2	Terra	8-day	1000 m	Done

# Datasets



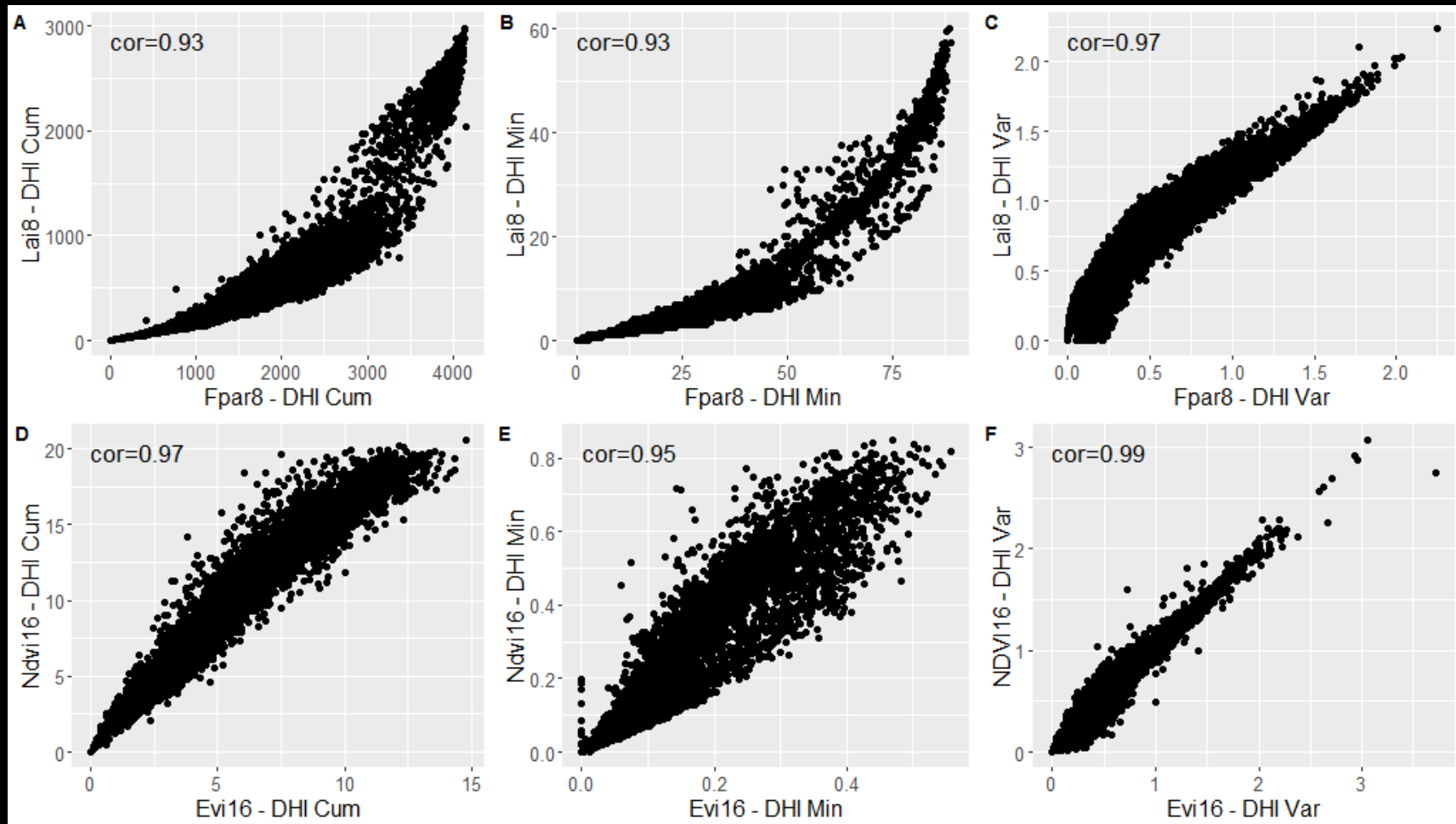
Composite EVI DHIs

# Datasets

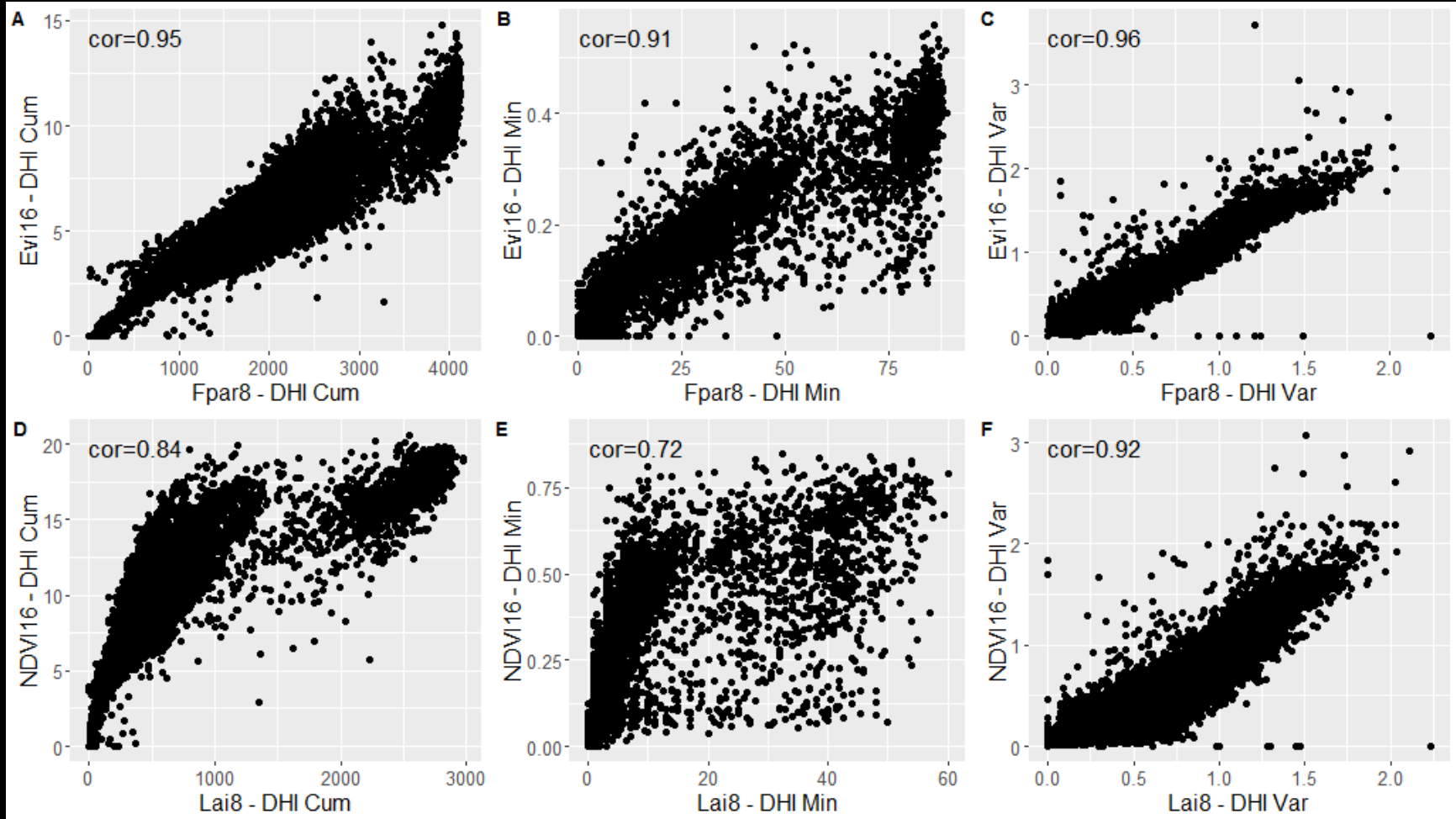


Composite LAI DHIs

# Datasets

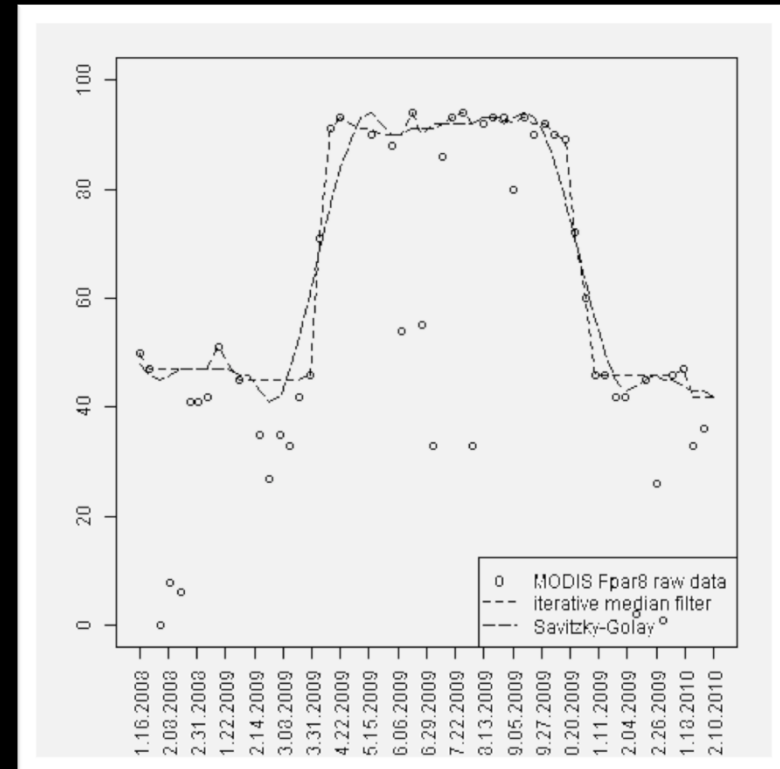


# Datasets



# Datasets

- Annual DHIs
  - Why: One person's noise is another's data
  - Smoothing annual phenology
    - Iterative median
    - Savitzky-Golay

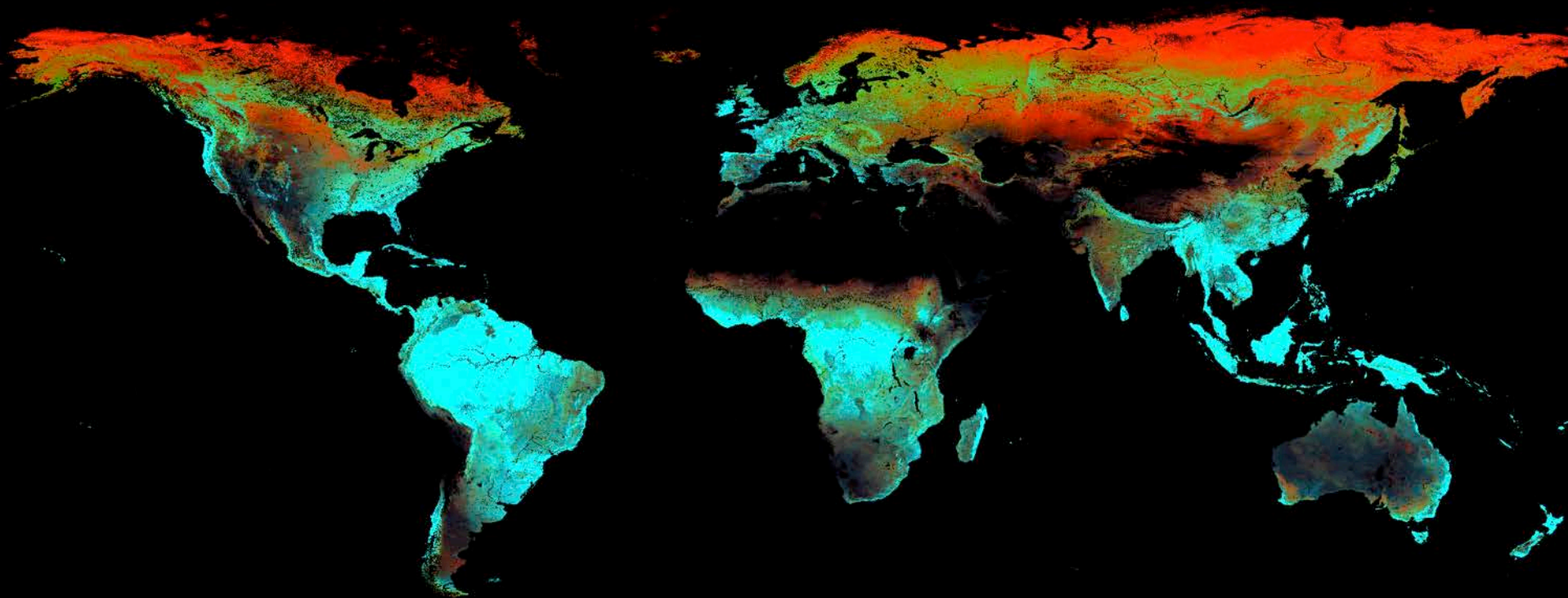


# Datasets

Index	Product	Platform	Temporal resolution	Spatial resolution	DHIs yearly	DHIs smoothed
NDVI	MOD13A2	Terra	16-day	1000 m	Done	I.P.
EVI	MOD13A2	Terra	16-day	1000 m	I.P.	I.P.
FPAR	MCD15A2	Terra/Aqua	8-day	1000 m	Done	Done
FPAR	MCD15A3	Terra/Aqua	4-day	1000 m	Done	N.A.
LAI	MCD15A2	Terra/Aqua	8-day	1000 m	Done	I.P.
LAI	MCD15A3	Terra/Aqua	4-day	1000 m	Done	N.A.
GPP	MOD17A2	Terra	8-day	1000 m	Done	I.P.

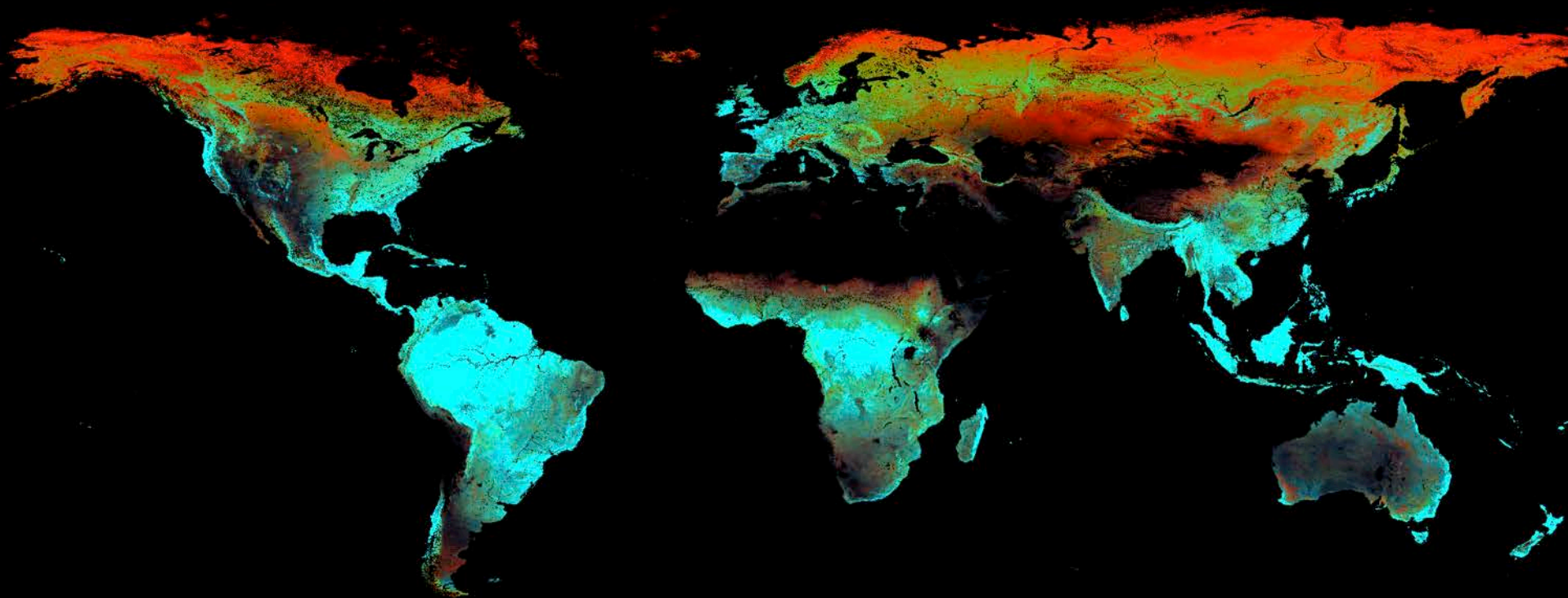


# Datasets



FPAR DHI<sub>s</sub> 2003

# Datasets



FPAR DHI<sub>s</sub> 2012

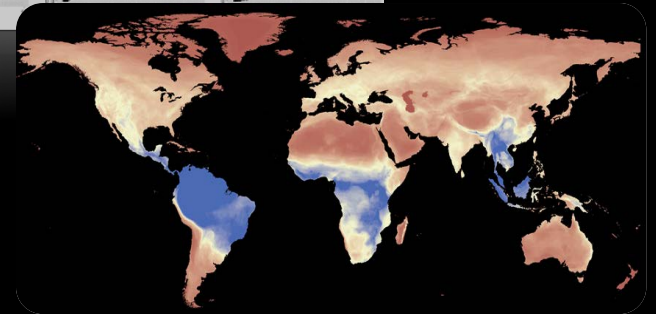
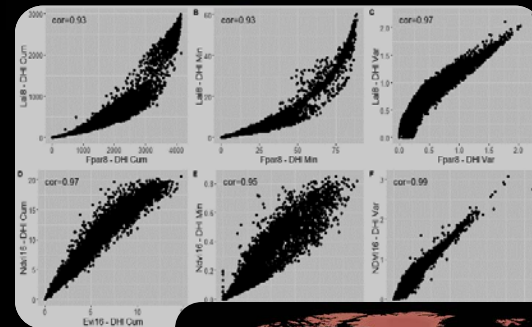
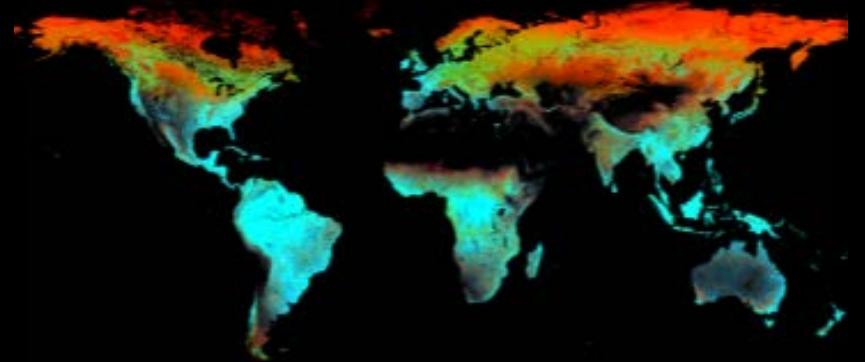


# Outline

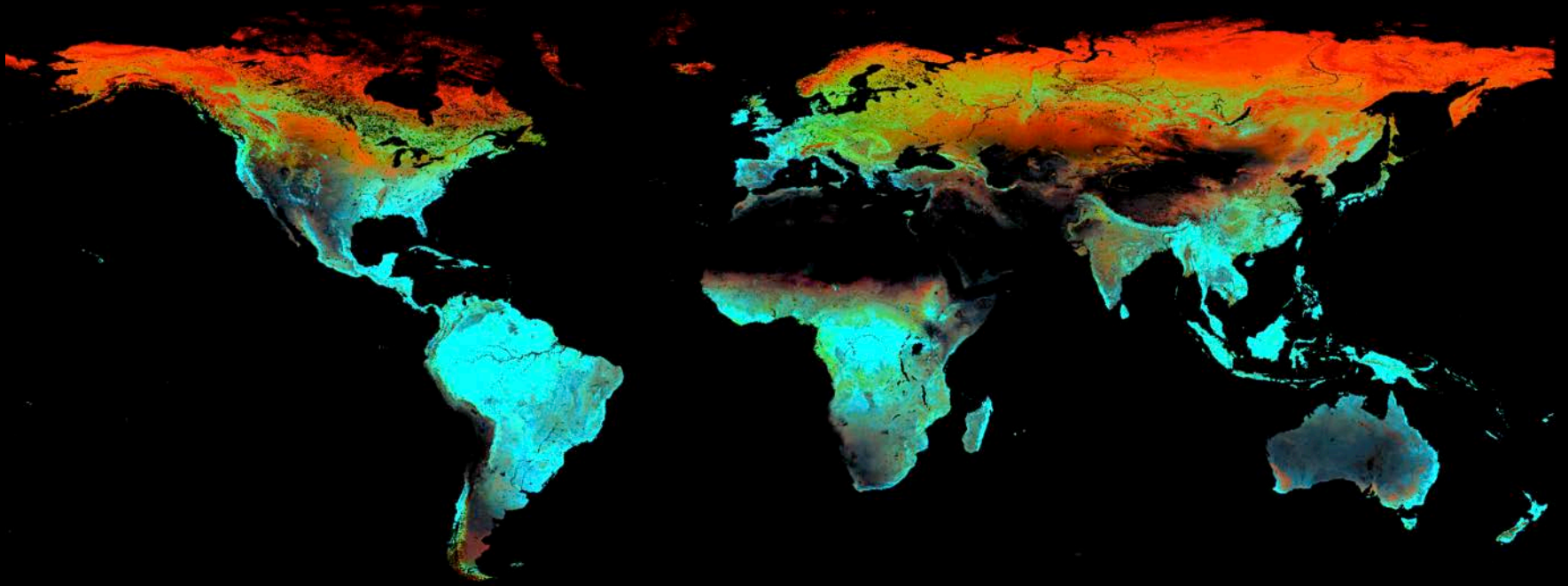
I. Background: the Dynamic Habitat Indices

II. Datasets: Composite and annual DHIs

III. Case studies: DHIs and biodiversity

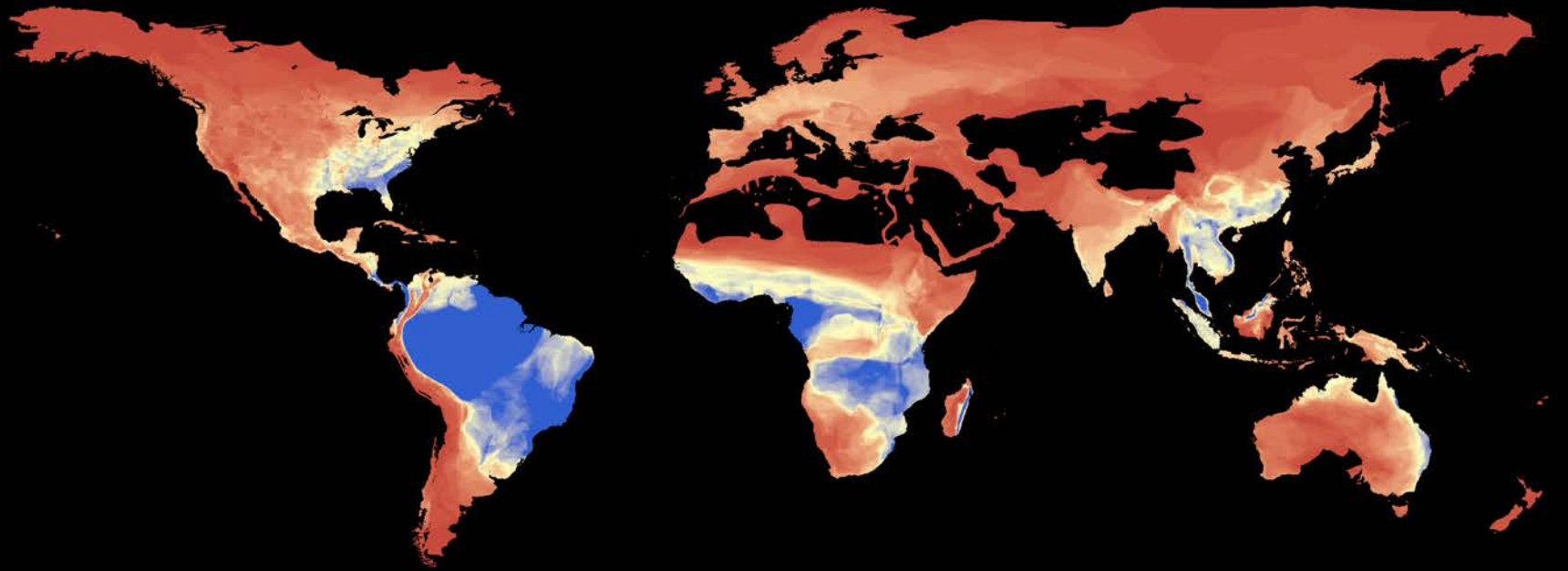


# DHIs and global biodiversity



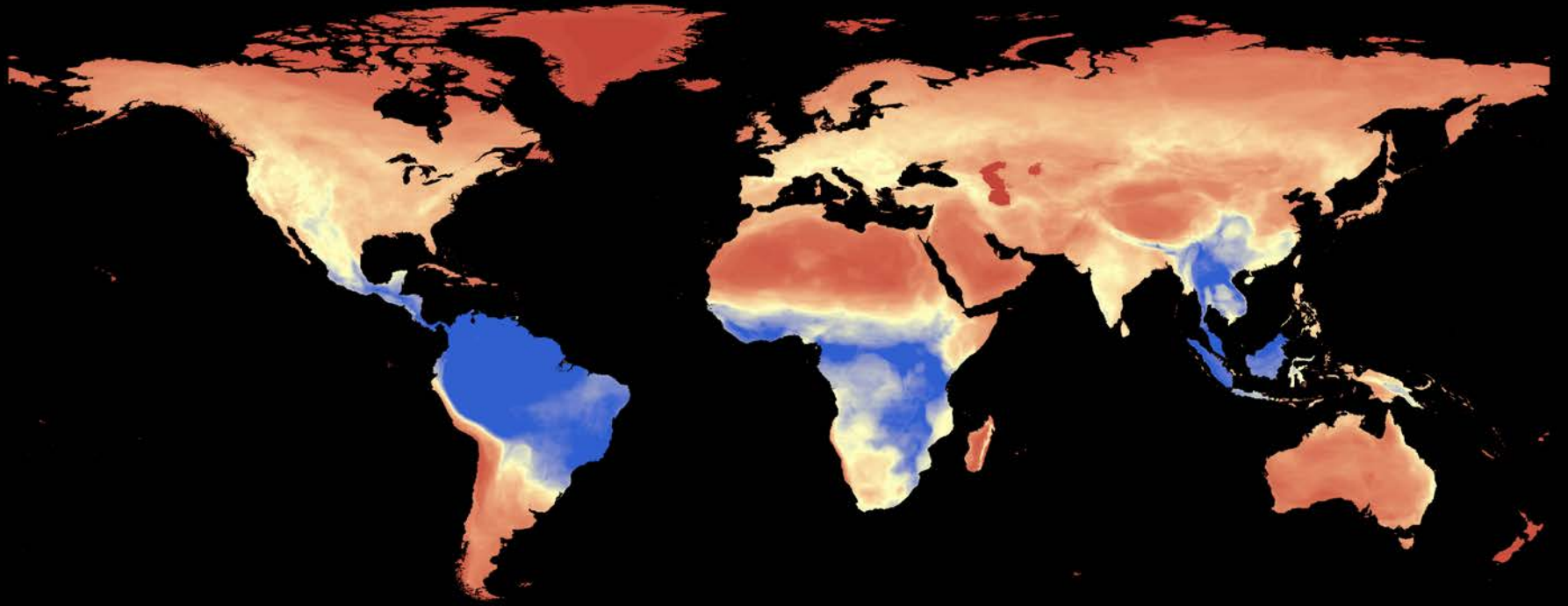
Composite FPAR DHIs

# DHIs and global biodiversity



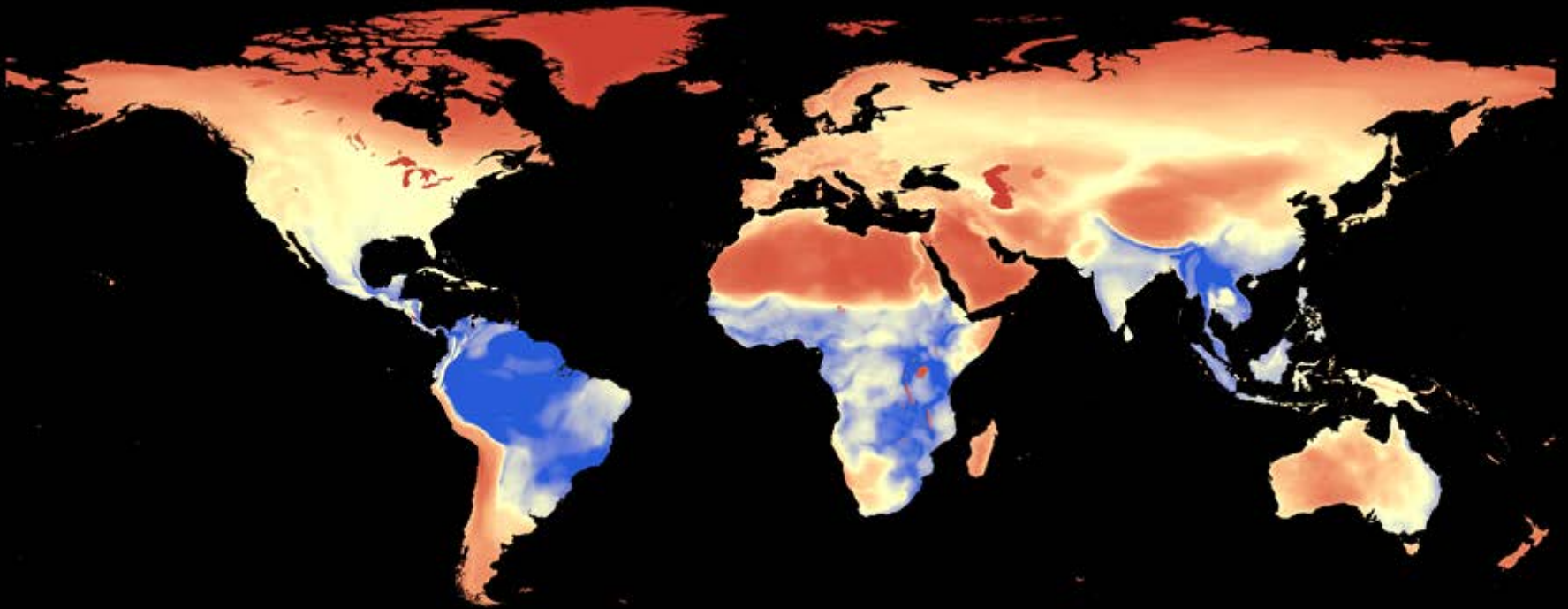
Amphibians

# DHIs and global biodiversity



Mammals

# DHIs and global biodiversity



Birds

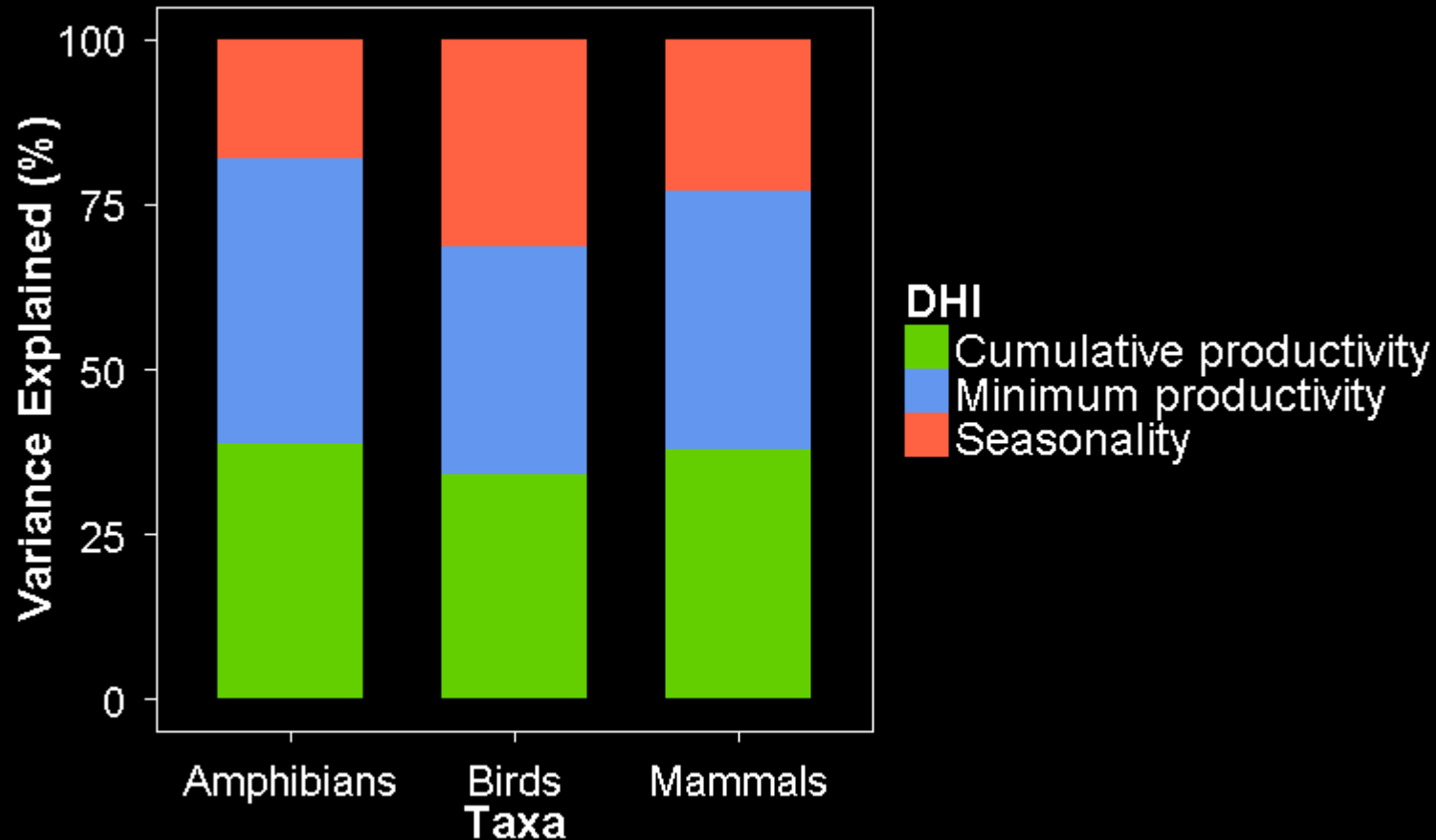


# DHIs and global biodiversity

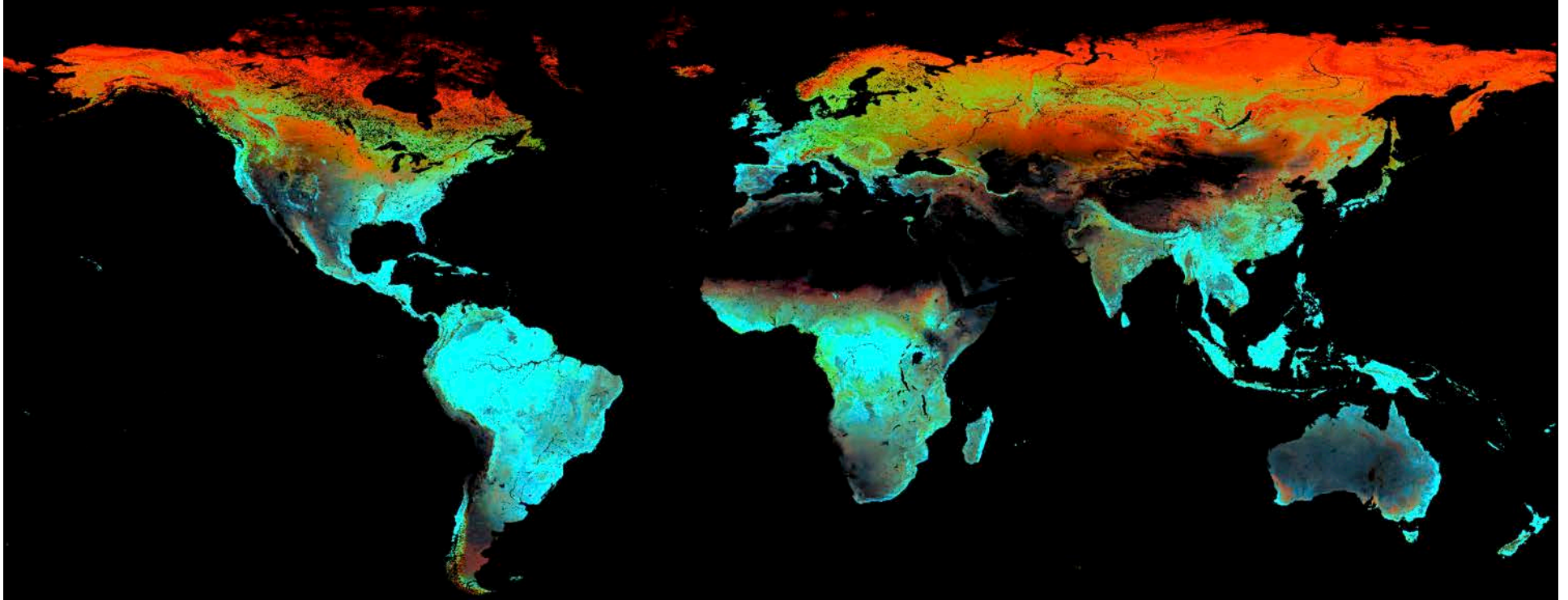
	DHI-Cumulative	DHI-Minimum	DHI-Variability
Amphibians	0.68	0.70	-0.51
Birds	0.70	0.71	-0.68
Mammals	0.70	0.71	-0.58

Pearson's correlation coefficients ( $r$ )

# DHIs and global biodiversity

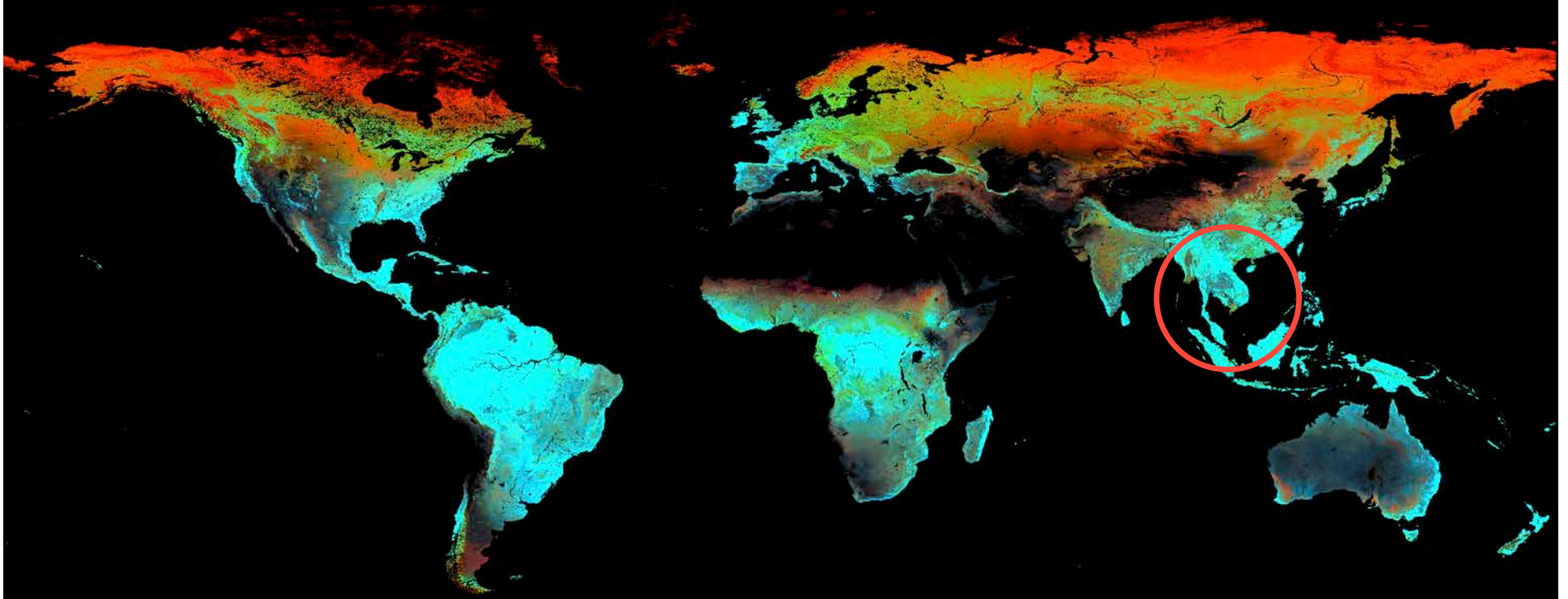


# DHIs and global biodiversity



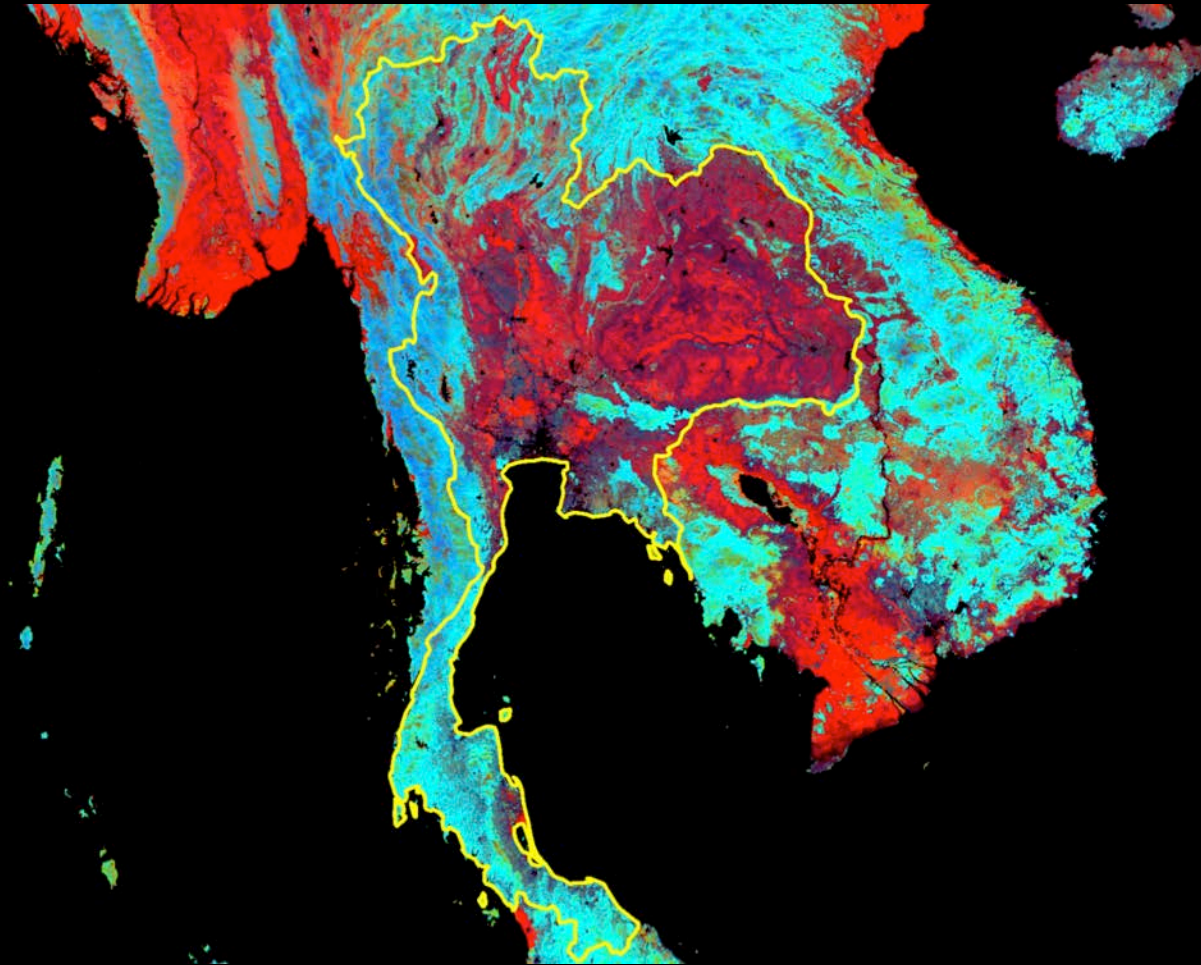
Composite FPAR DHIs

# DHIs and global biodiversity

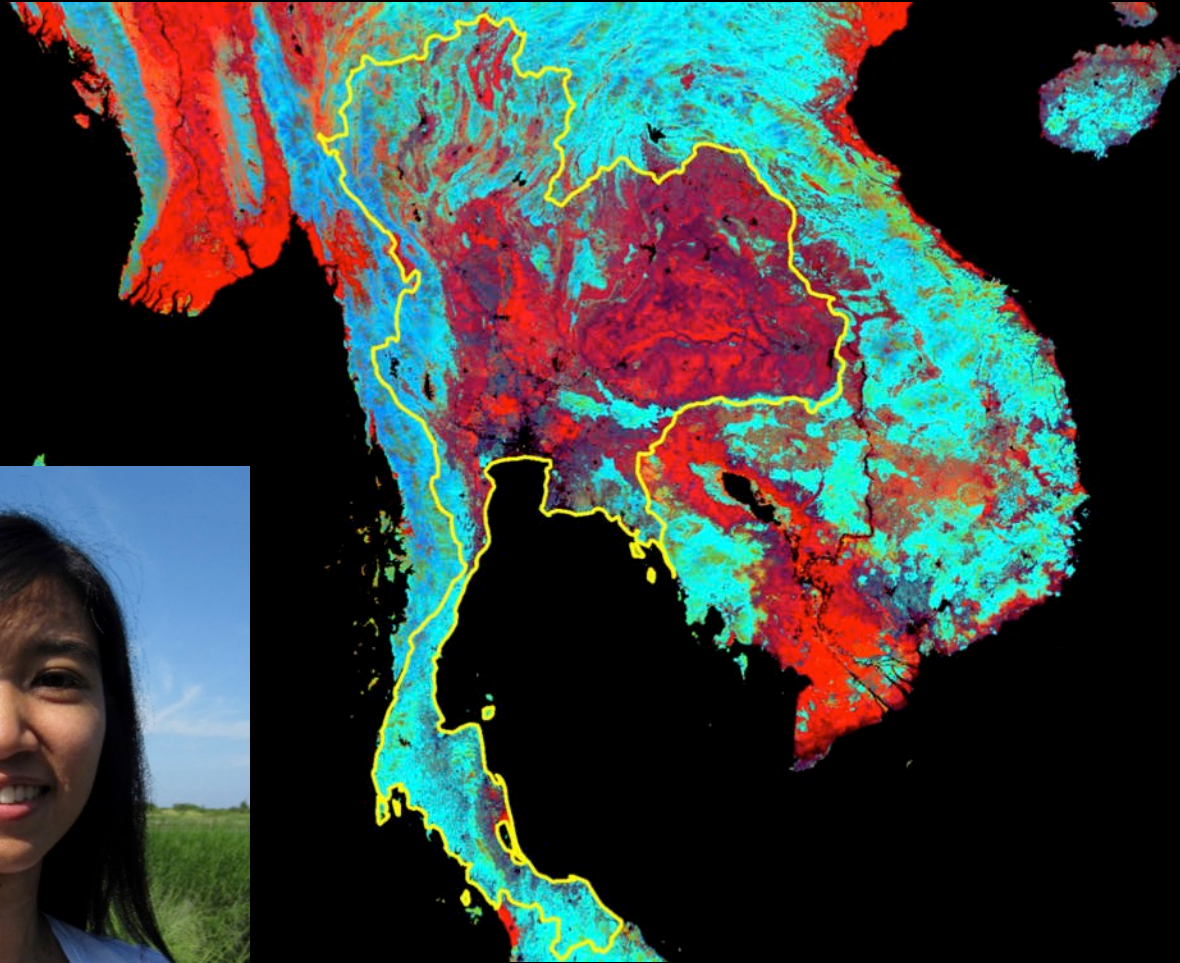


Composite FPAR DHIs

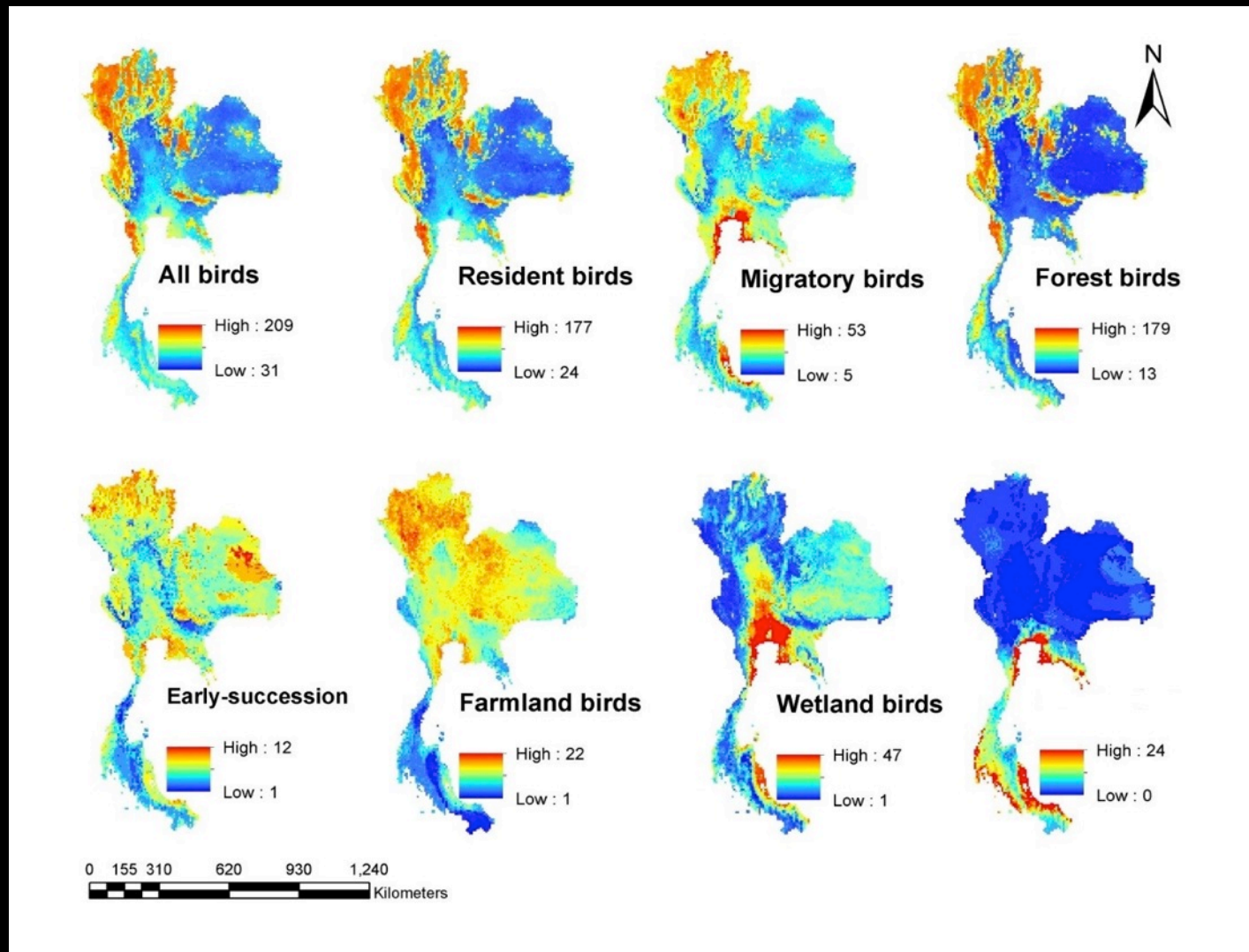
# Composite FPAR DHIs



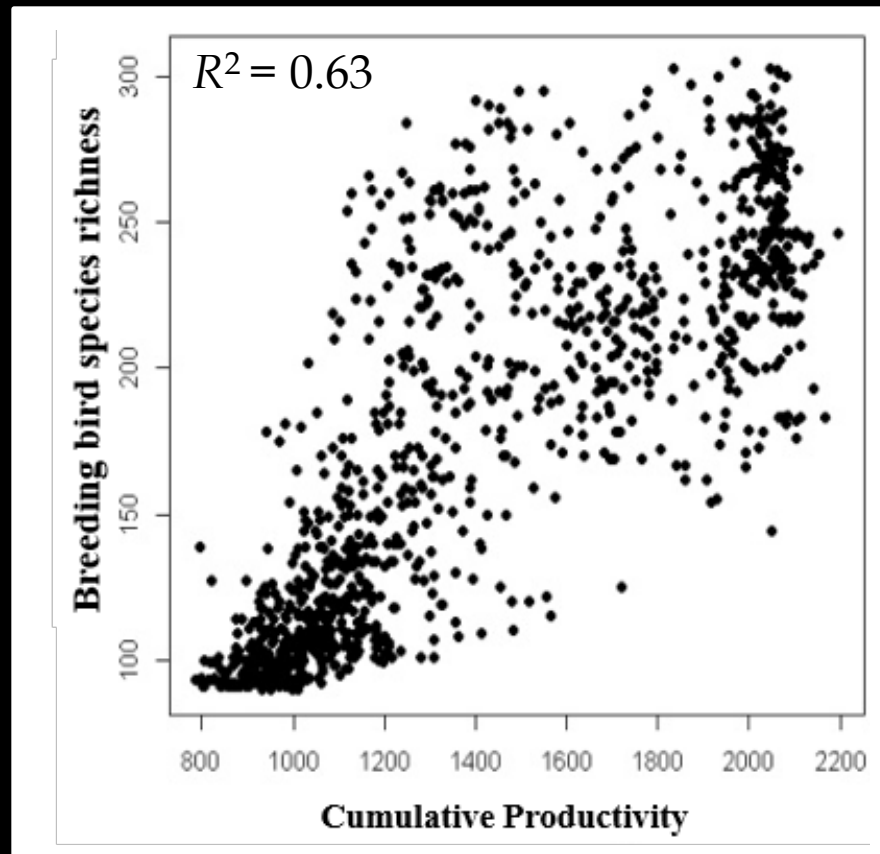
# Composite FPAR DHIs



# Thailand – bird species richness

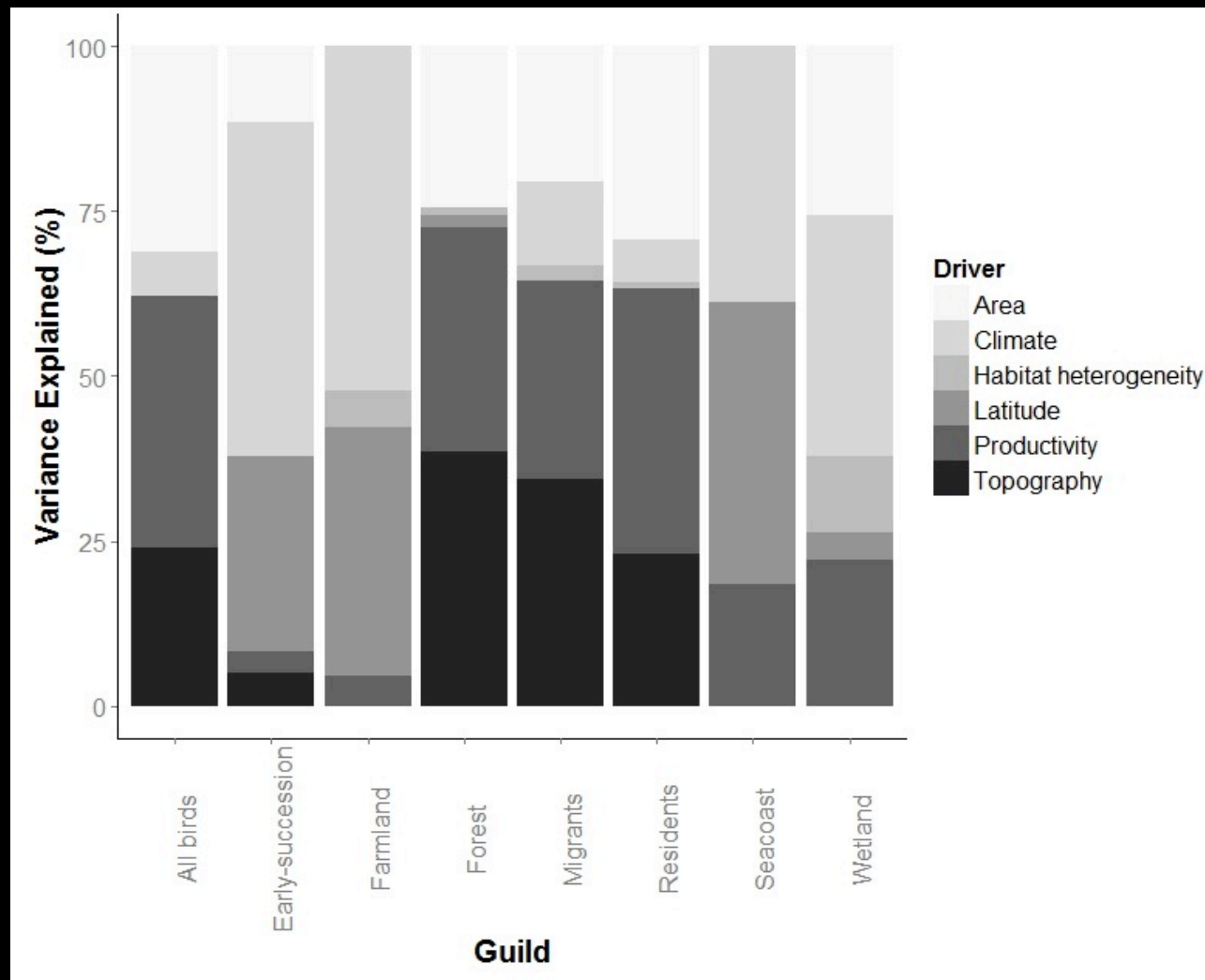


# Thailand – bird species richness

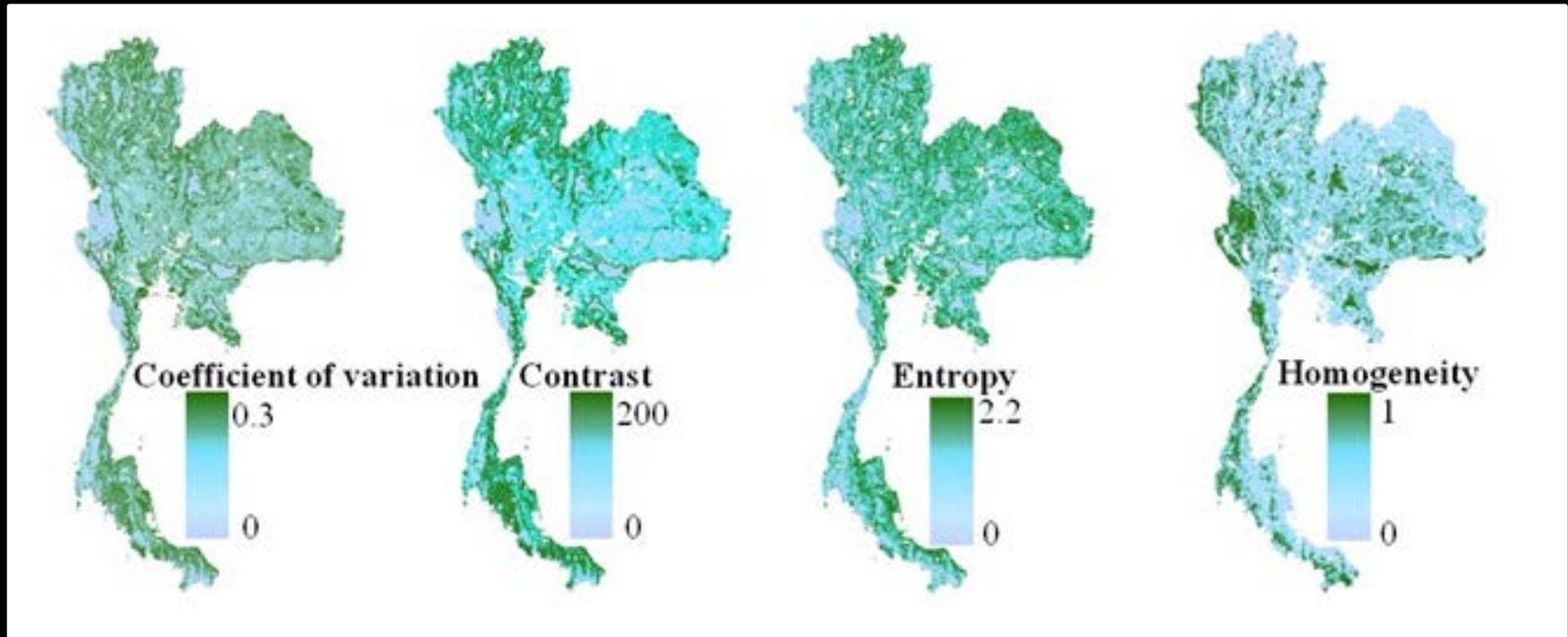




# Thailand – bird species richness



# Thailand – Bird habitat



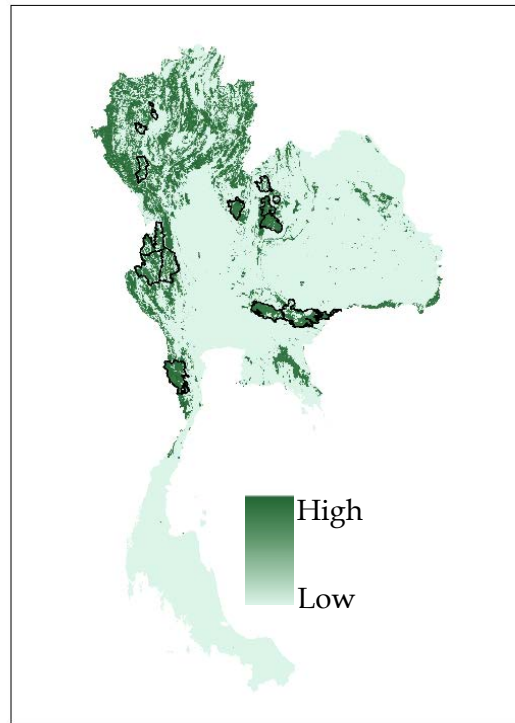
Texture of FPAR DHI-1 (cumulative)

# Thailand – Bird habitat

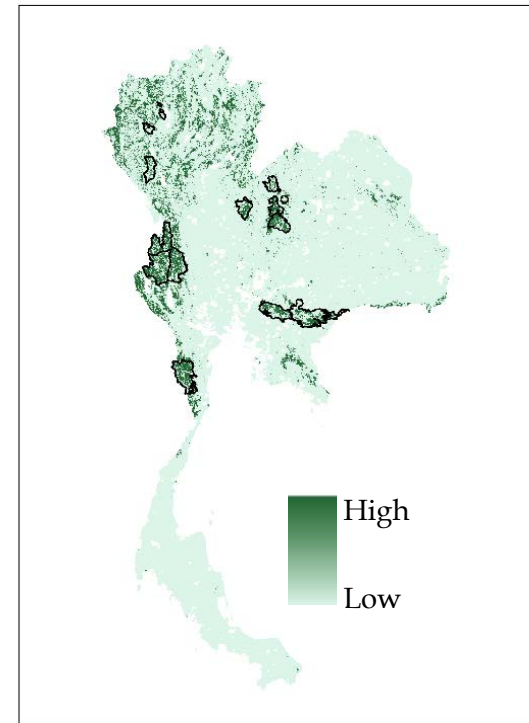
*Anorrhinus tickelli*



Habitat composition model



Habitat + texture model

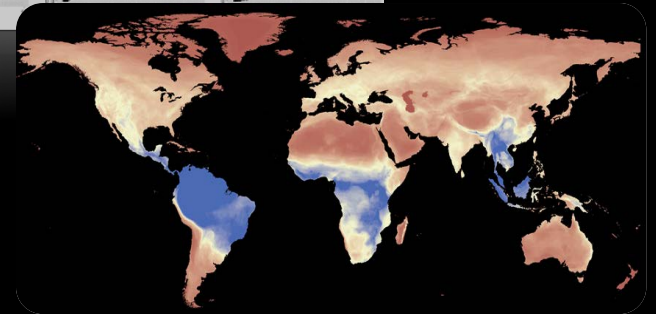
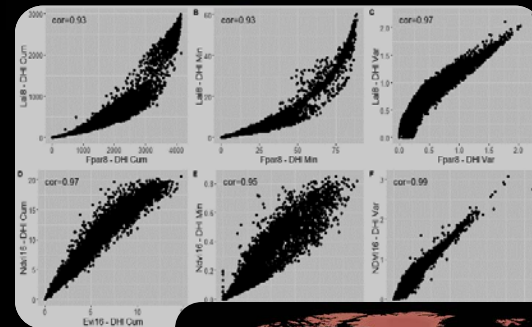
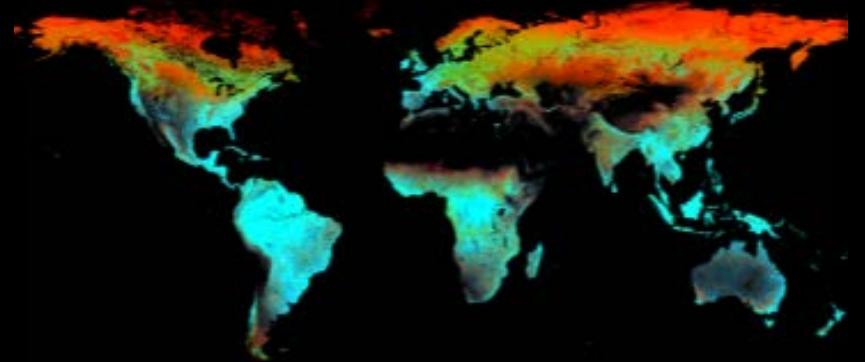


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I. Background: the Dynamic Habitat Indices

II. Datasets: Composite and annual DHIs

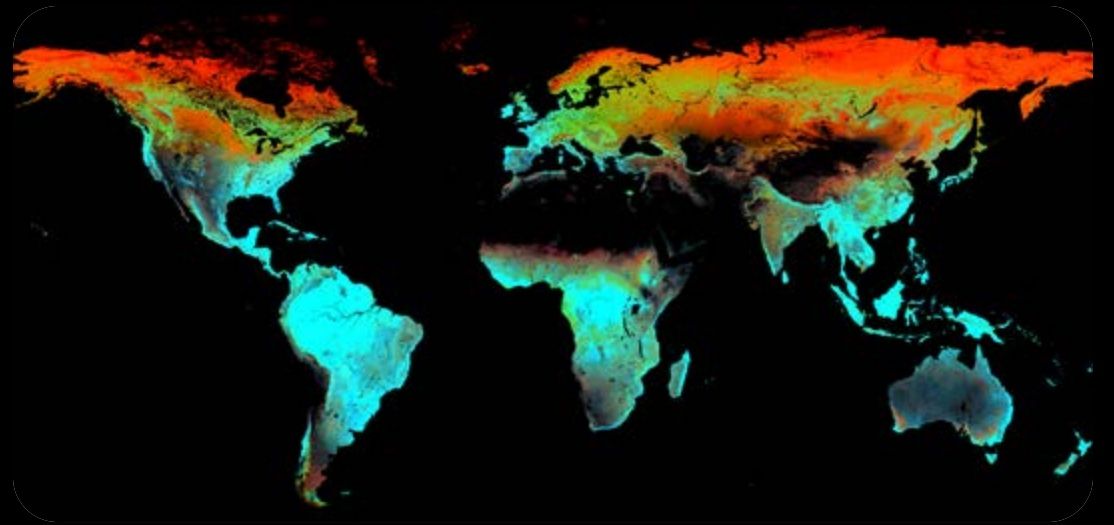
III. Case studies: DHIs and biodiversity



# Conclusions

## I. Background

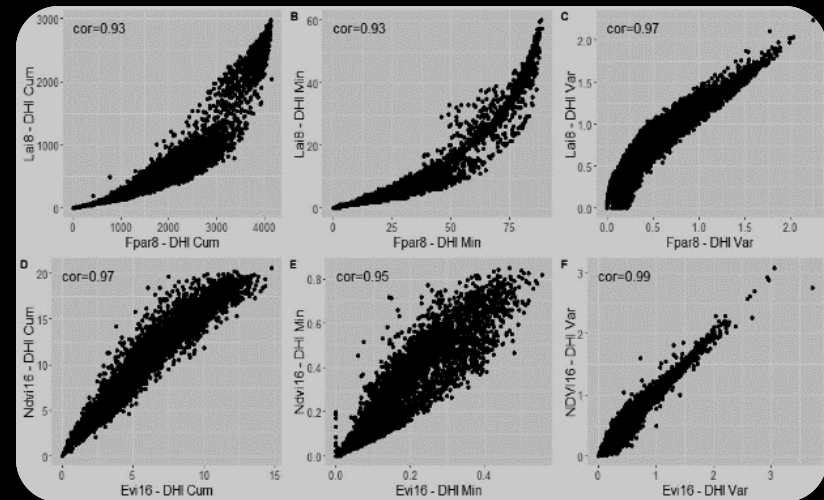
- The DHIs are based on biodiversity theory
- Three aspects of productivity that are key for biodiversity



# Conclusions

## II. Datasets: largely completed

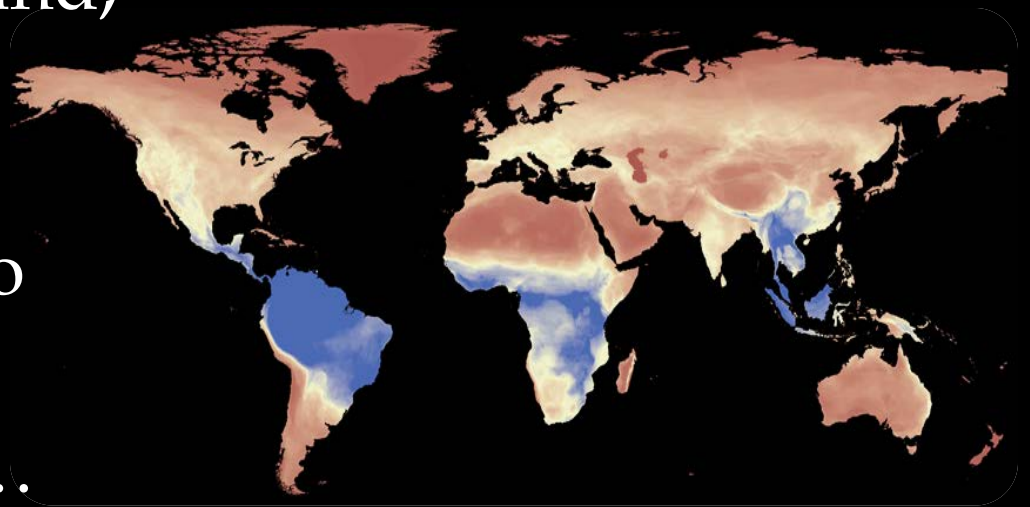
- Composite DHIs
- Annual DHIs
- Next: online data viewing and downloading

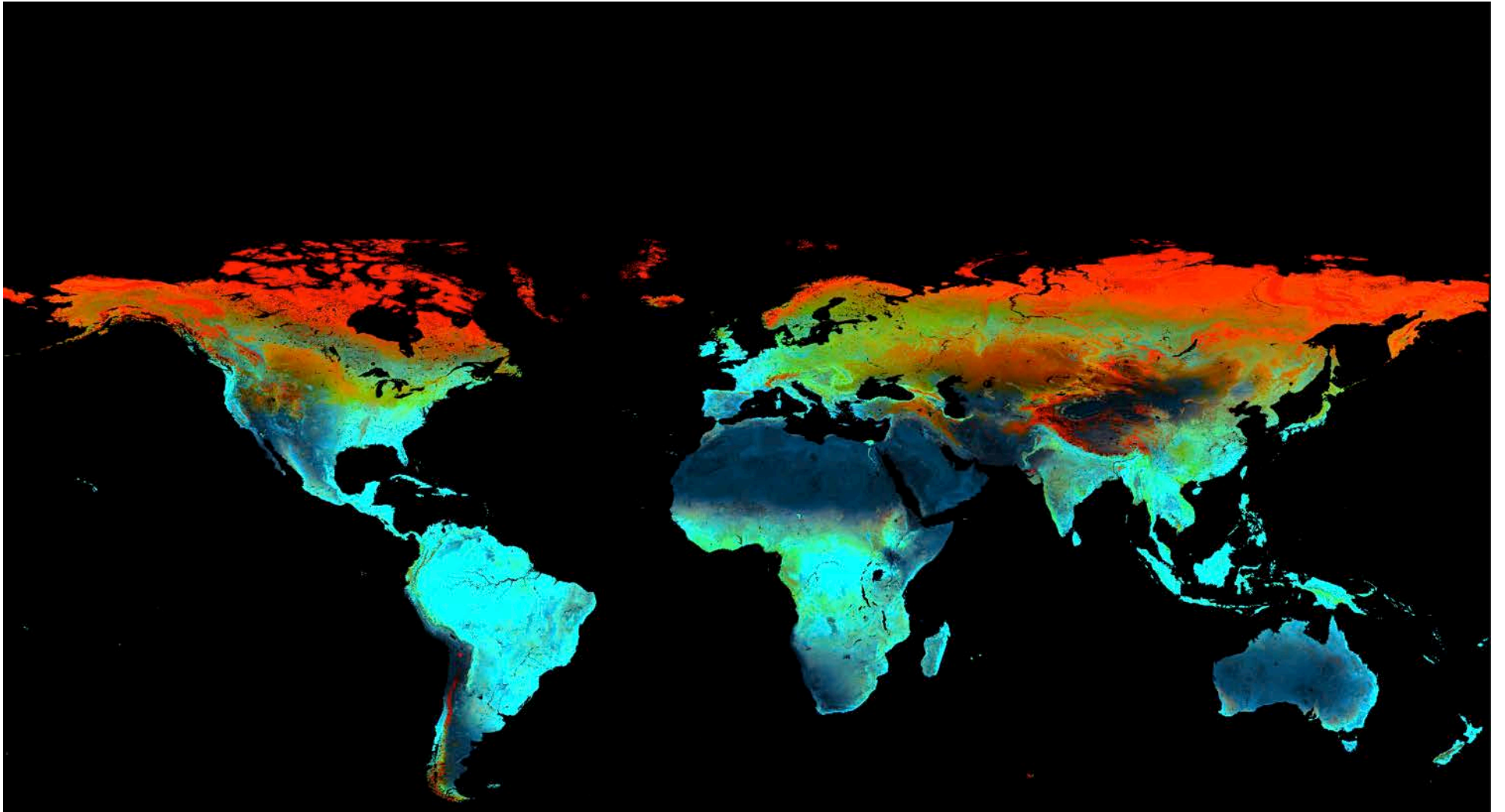


# Conclusions

## III. DHIs and biodiversity

- All three DHIs predict global species richness of amphibians, mammals, and birds
- For birds in Thailand, cumulative DHI mattered most
- Complementary to other predictors
- More in progress...



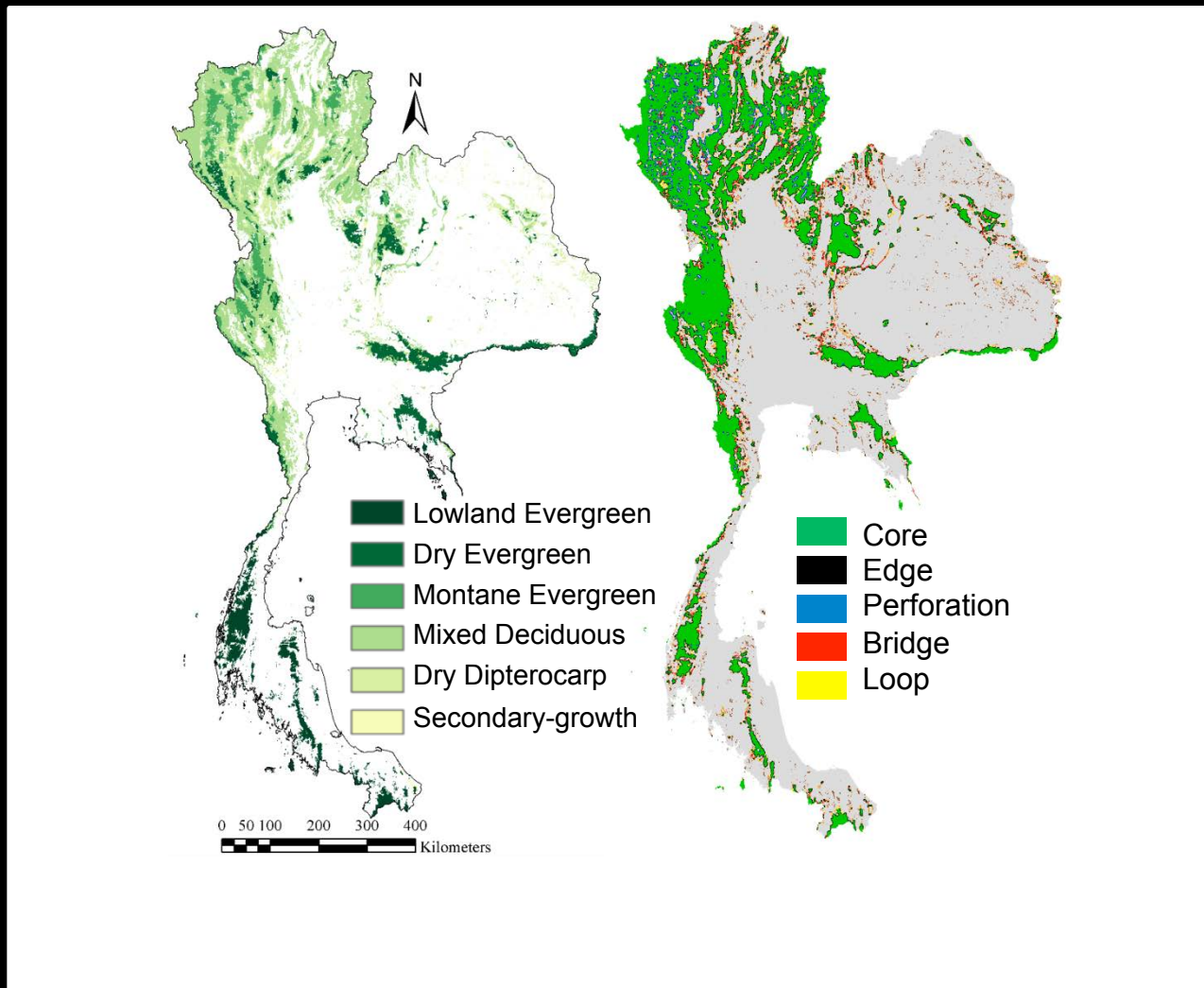


Thank you!





# Thailand - DHI-1 texture



# Thailand – Bird habitat

