Remote-sensing supported global terrestrial biodiversity monitoring

EarthEnv

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Yale

Walter Jetz
EEB, FES
Yale University

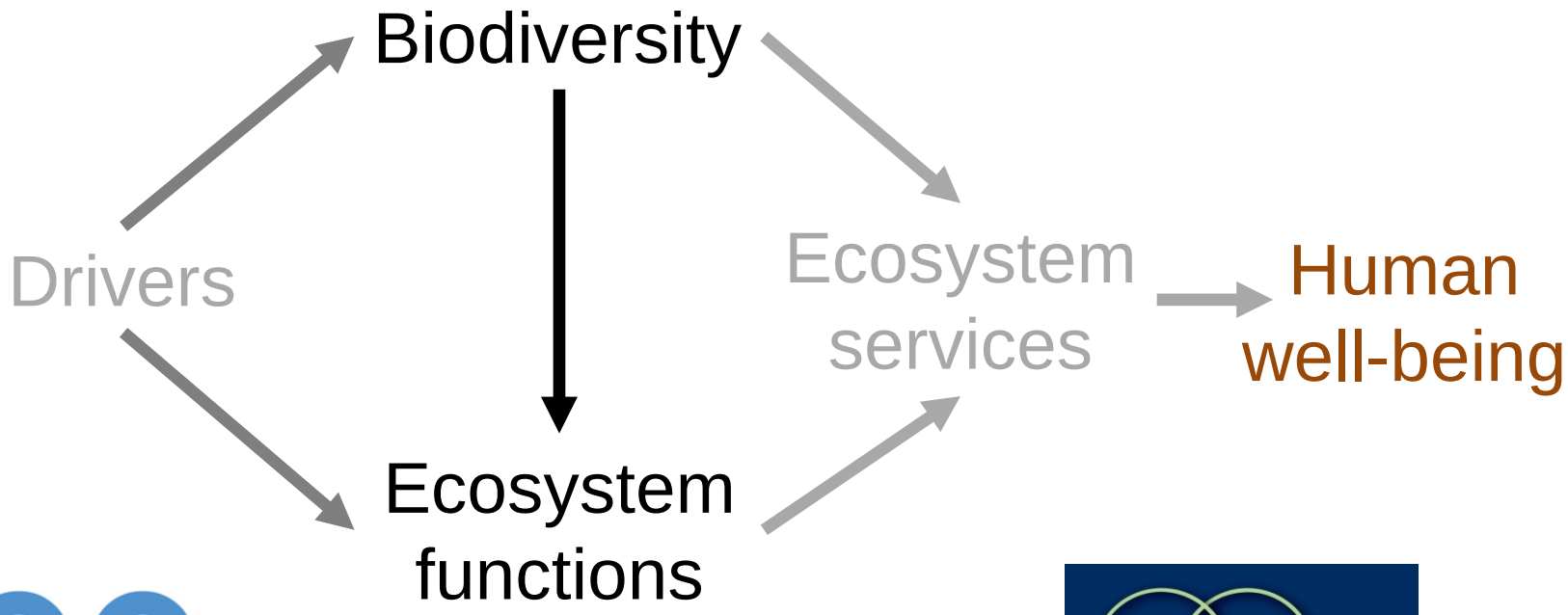
Remote-sensing supported global terrestrial biodiversity monitoring

<u>PIs:</u> Walter Jetz (Yale U), Rob Guralnick (CU Boulder, Brian McGill (U Maine), Rama Nemani (NASA Ames), Forrest Melton (NASA Ames)

<u>Postdocs, Students:</u> Dr. Mao-Ning Tuanmu (Yale U, NASA-funded), Dr. Adam Wilson (Yale U, YCEI-funded), Dr. Benoit Parmentier (NCEAS/ U Maine, iPlant-funded), Brian Stucky (CU Boulder, NASA-funded), Giuseppe Amatulli (Yale U)

<u>Others:</u> Jeremy Malczyk (Yale U), Map of Life Team (Yale, Boulder), Dave Thau (Google)

Monitoring the health of our planet

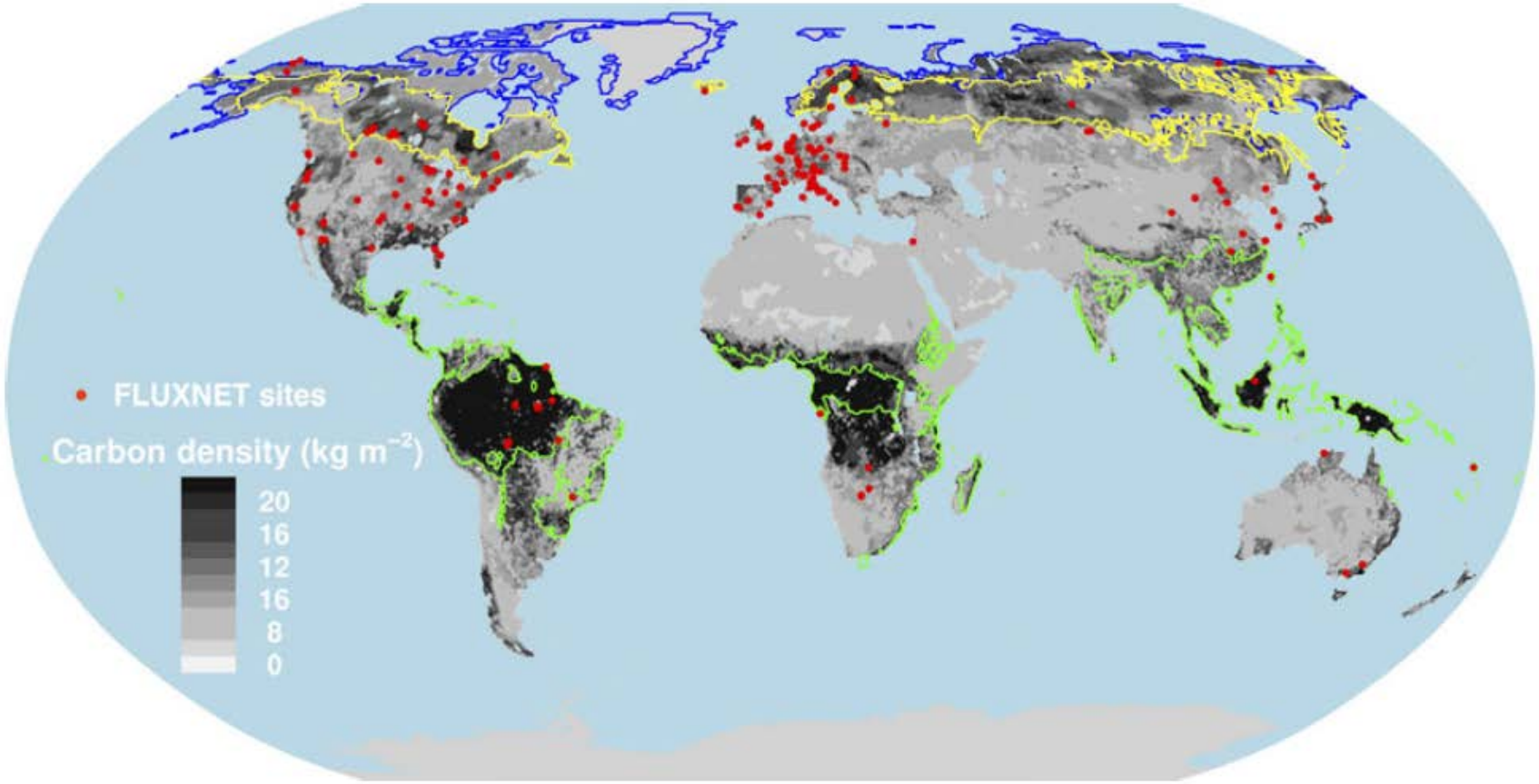


INTERGOVERNMENTAL PANEL ON climate change

Intergovernmental Platform for Biodiversity & Ecosystem Services

Monitoring the health of our planet

Biased evidence – Ecosystem functions



Schimel et al. (Global Change Biology, 2015)

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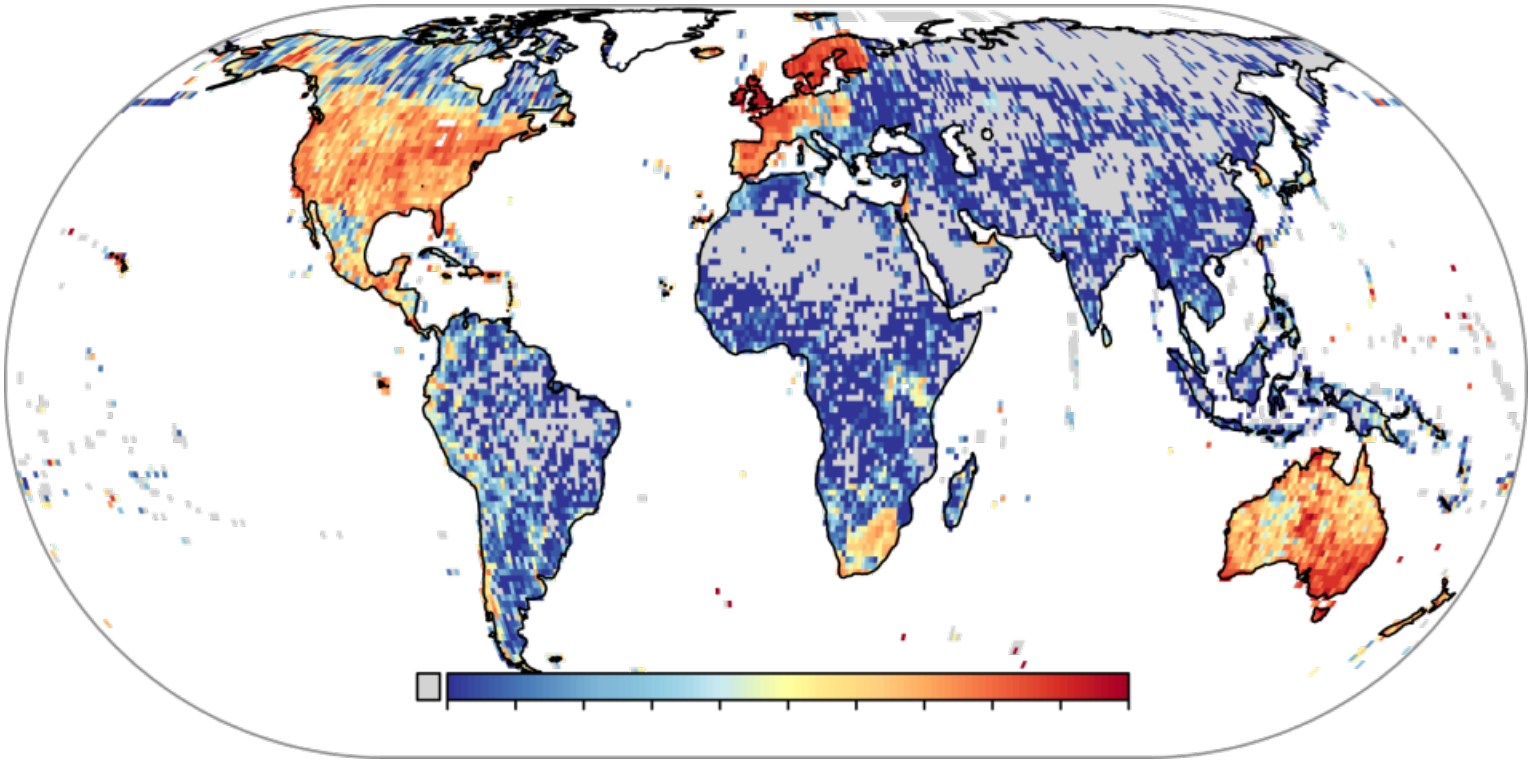
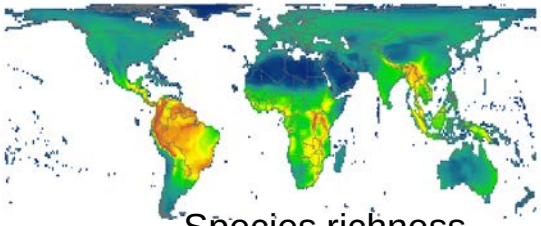
Biased evidence – Biodiversity





Species richness

Inventory completeness (%)
Terrestrial vertebrates

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Meyer et al., Nature Communications 2015

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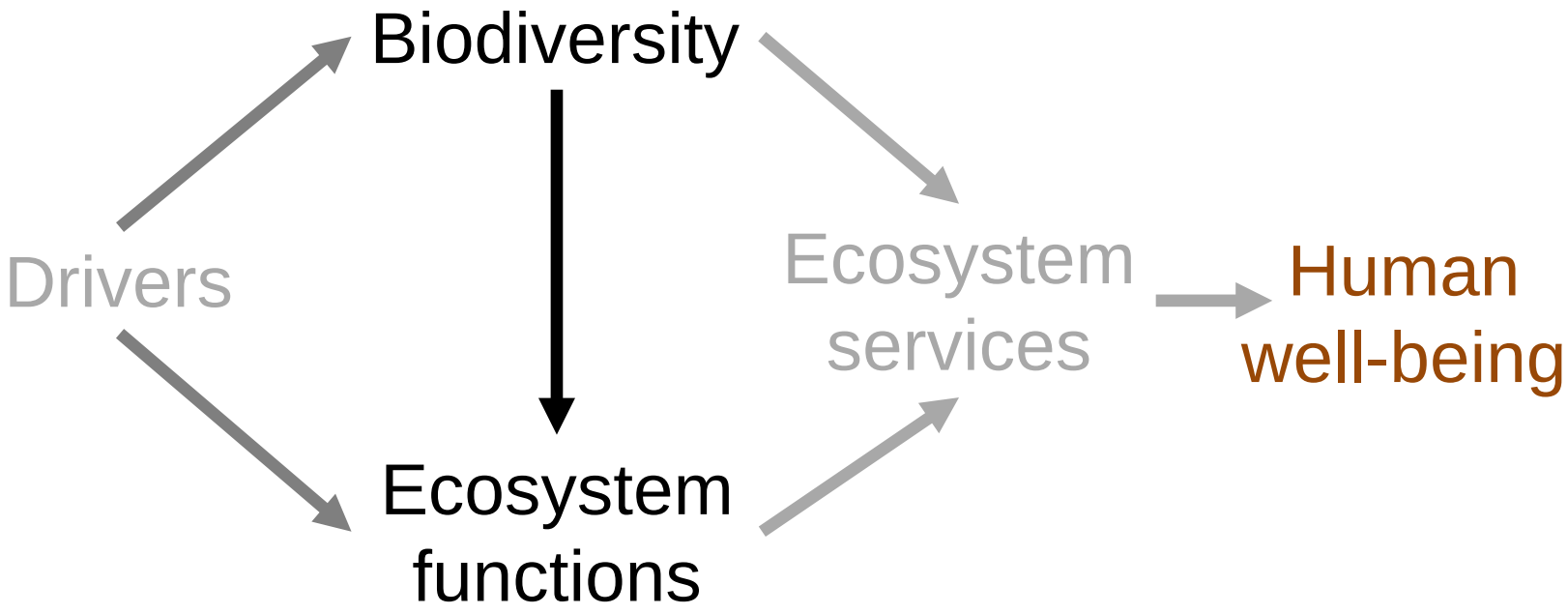
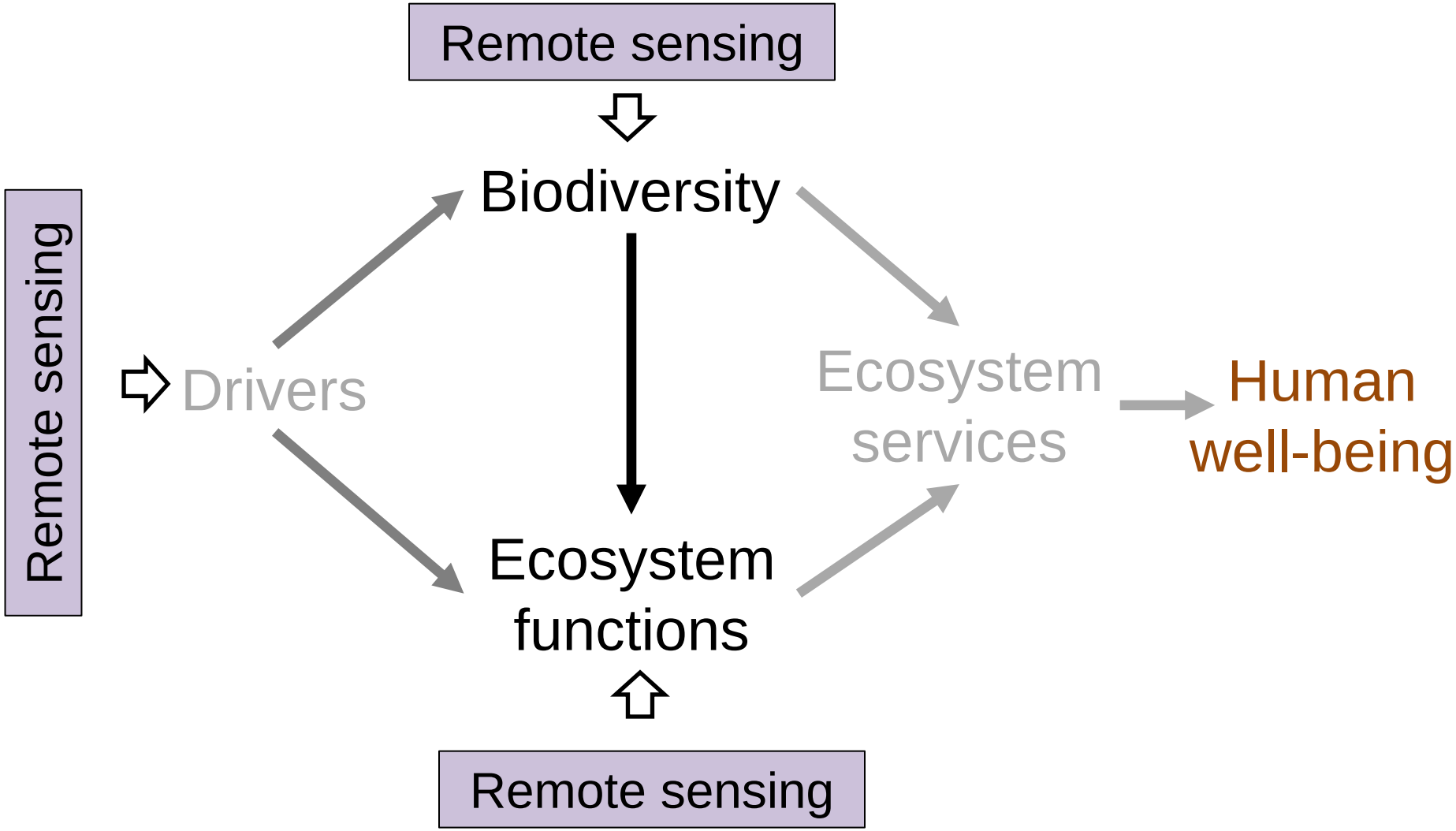
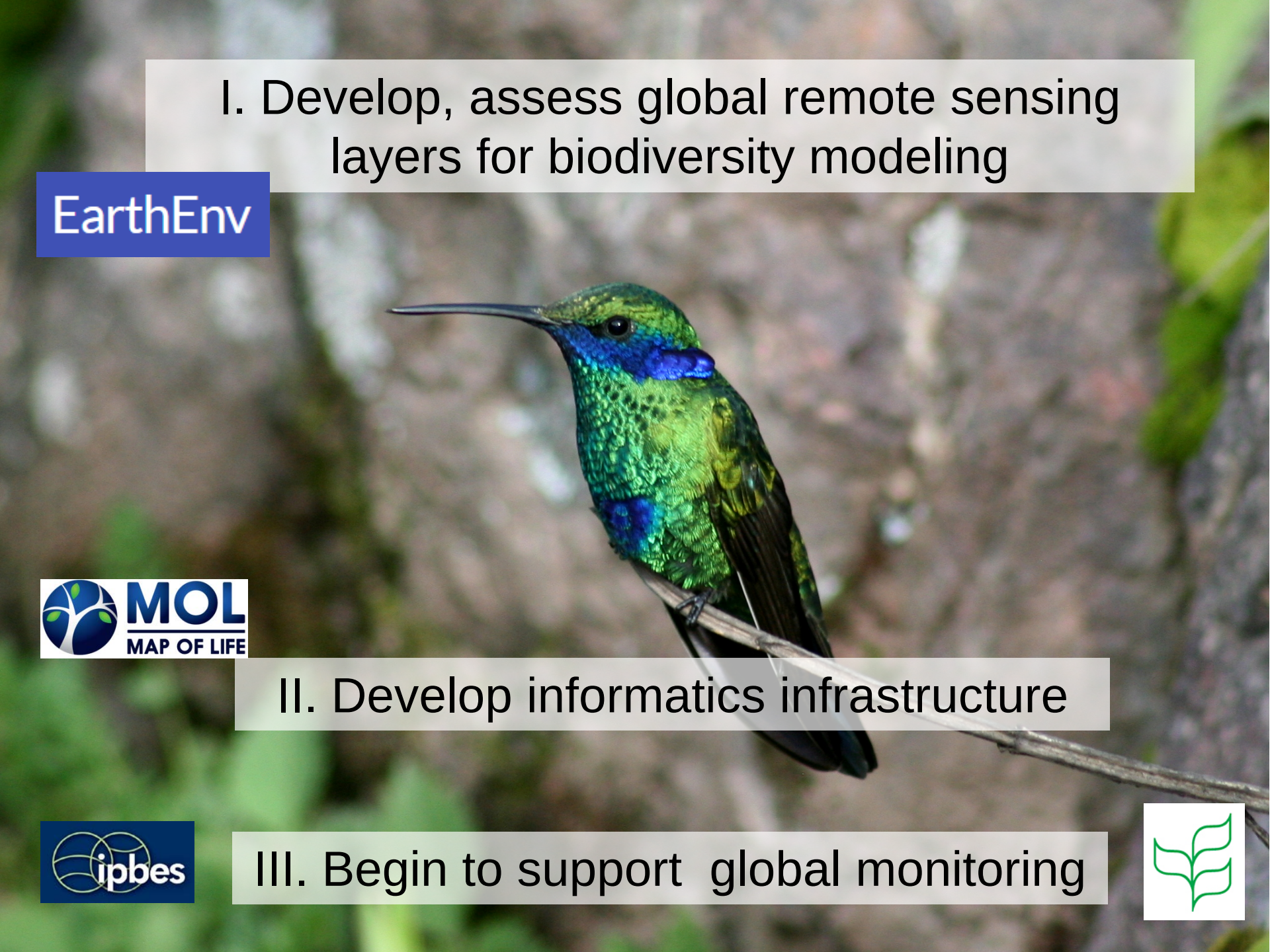


Monitoring the health of our planet




I. Develop, assess global remote sensing layers for biodiversity modeling
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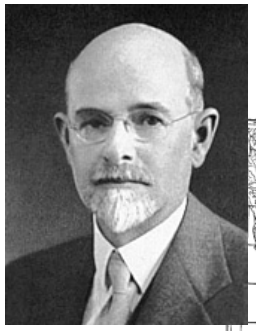
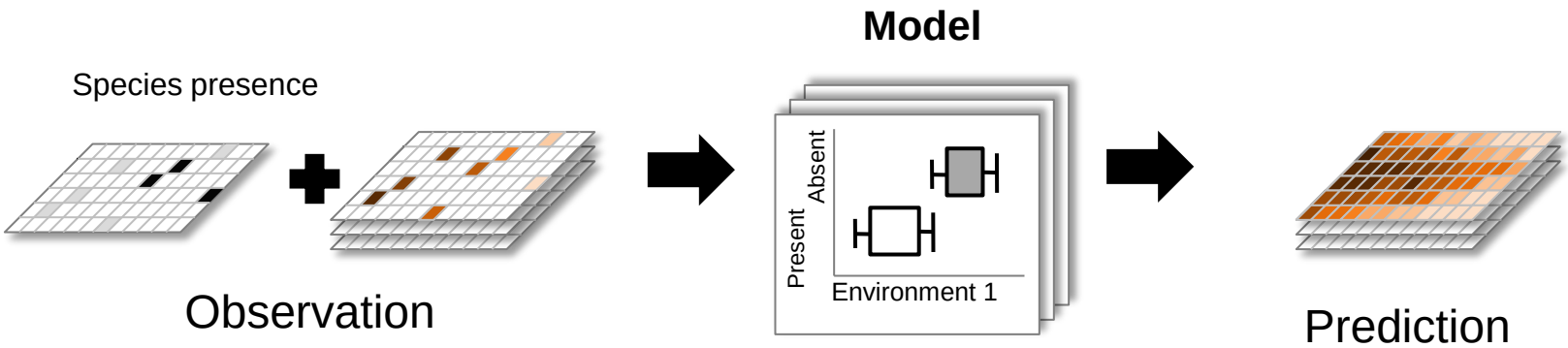
II. Develop informatics infrastructure
ipbes
III. Begin to support global monitoring

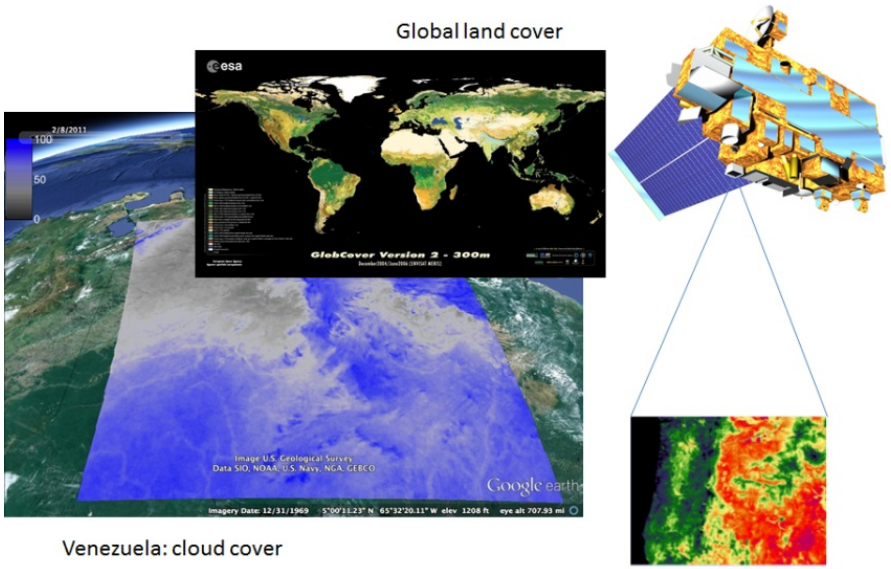
Environmental niche modeling

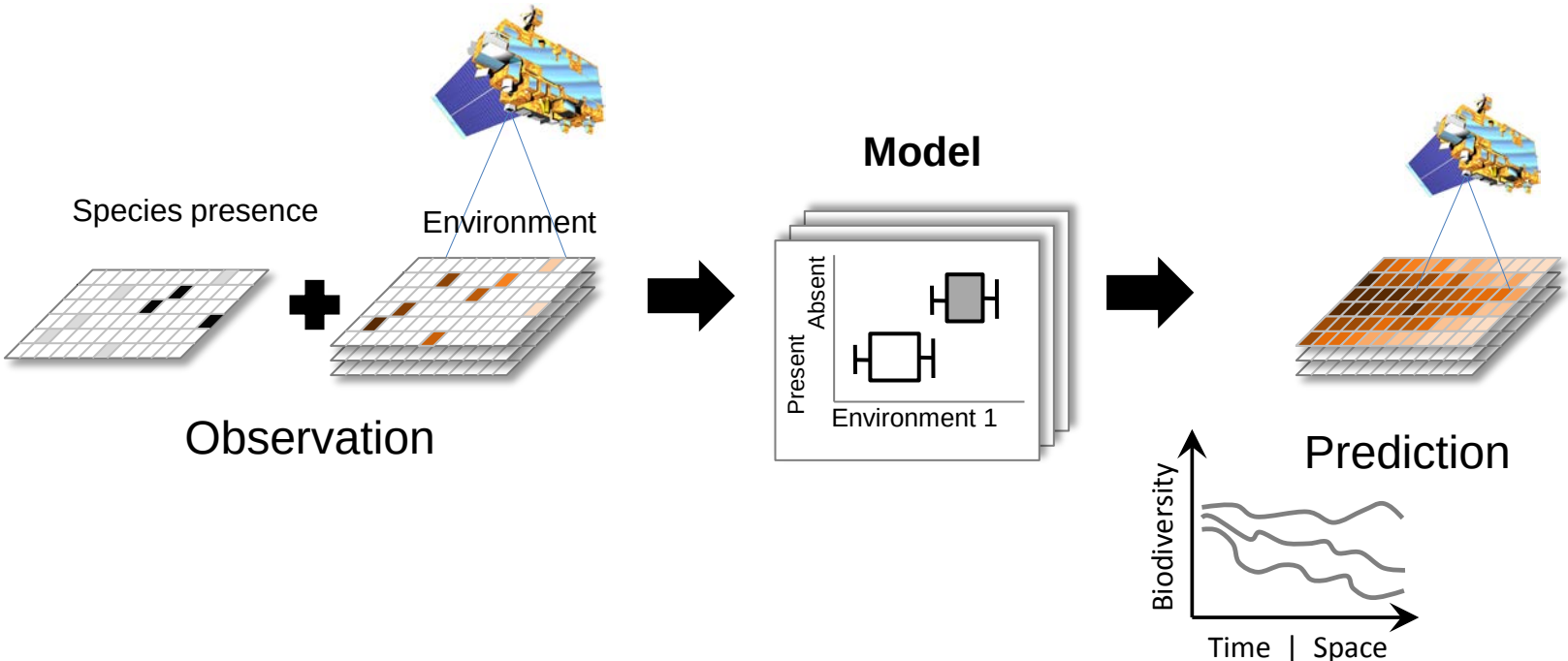


Joseph Grinnell
(Berkeley)



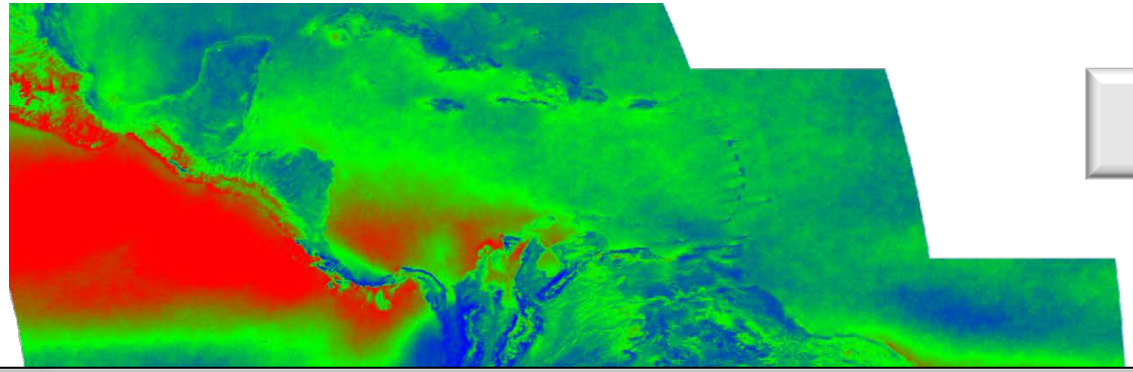
Environmental niche modeling





Jetz & Wilson, PLoS Biology 2016

Adam Wilson
Yale



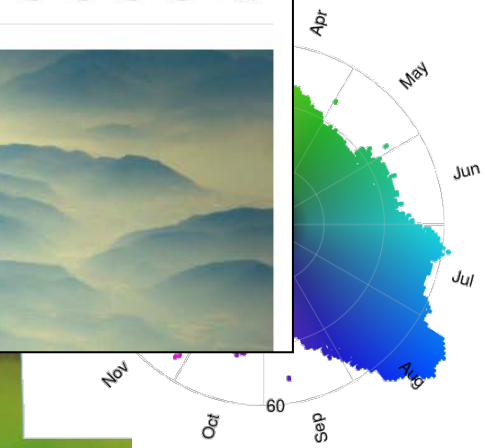
Clouds

SECTIONS HOME SEARCH The New York Times LOG IN

SCIENCE

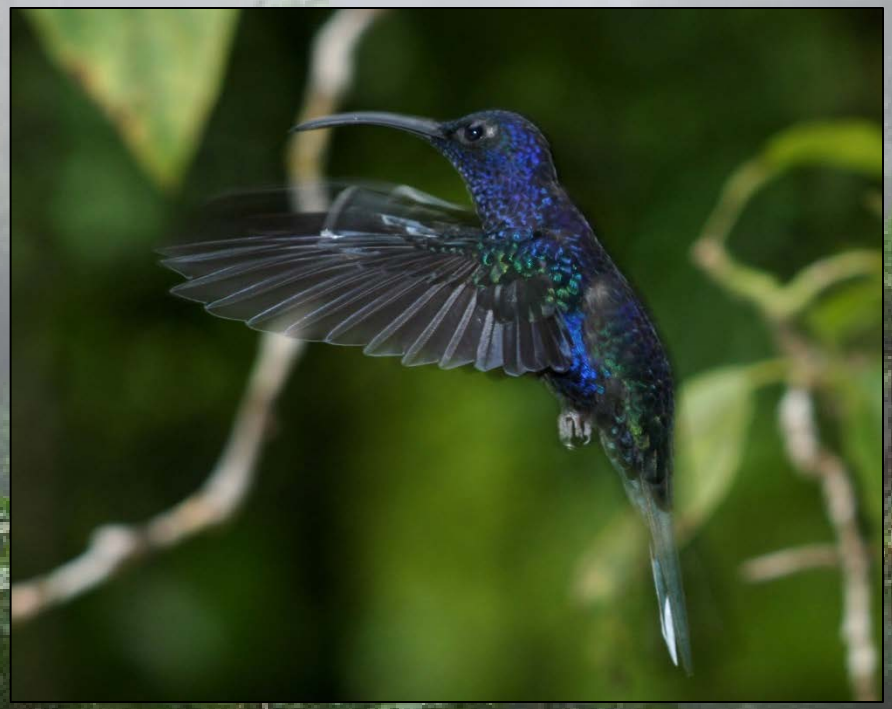
A Cloud Atlas Provides Clues to Life on Earth

Trilobites
By JOANNA KLEIN APRIL 4, 2016

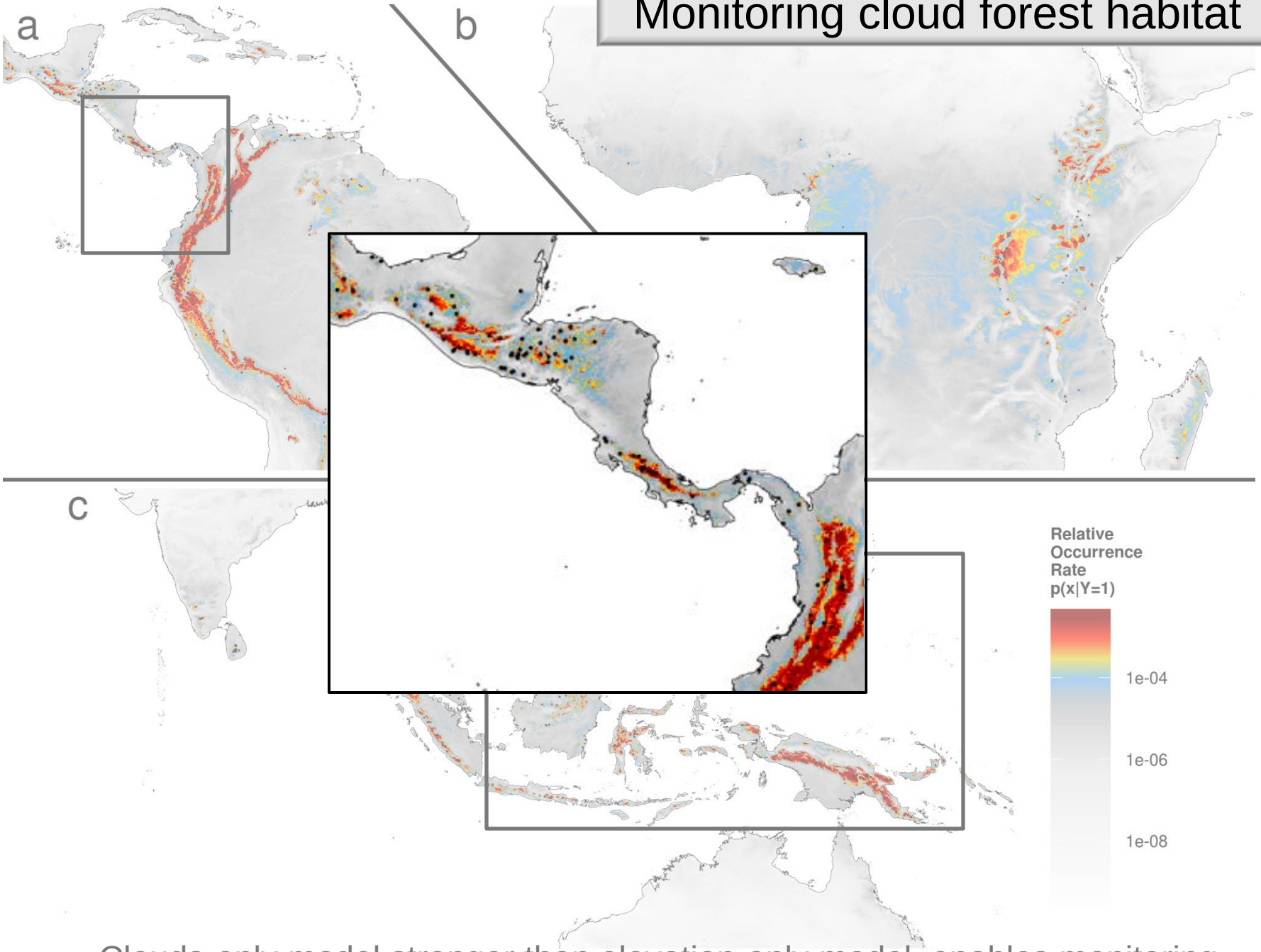


Seasonality

Monitoring cloud forest habitat



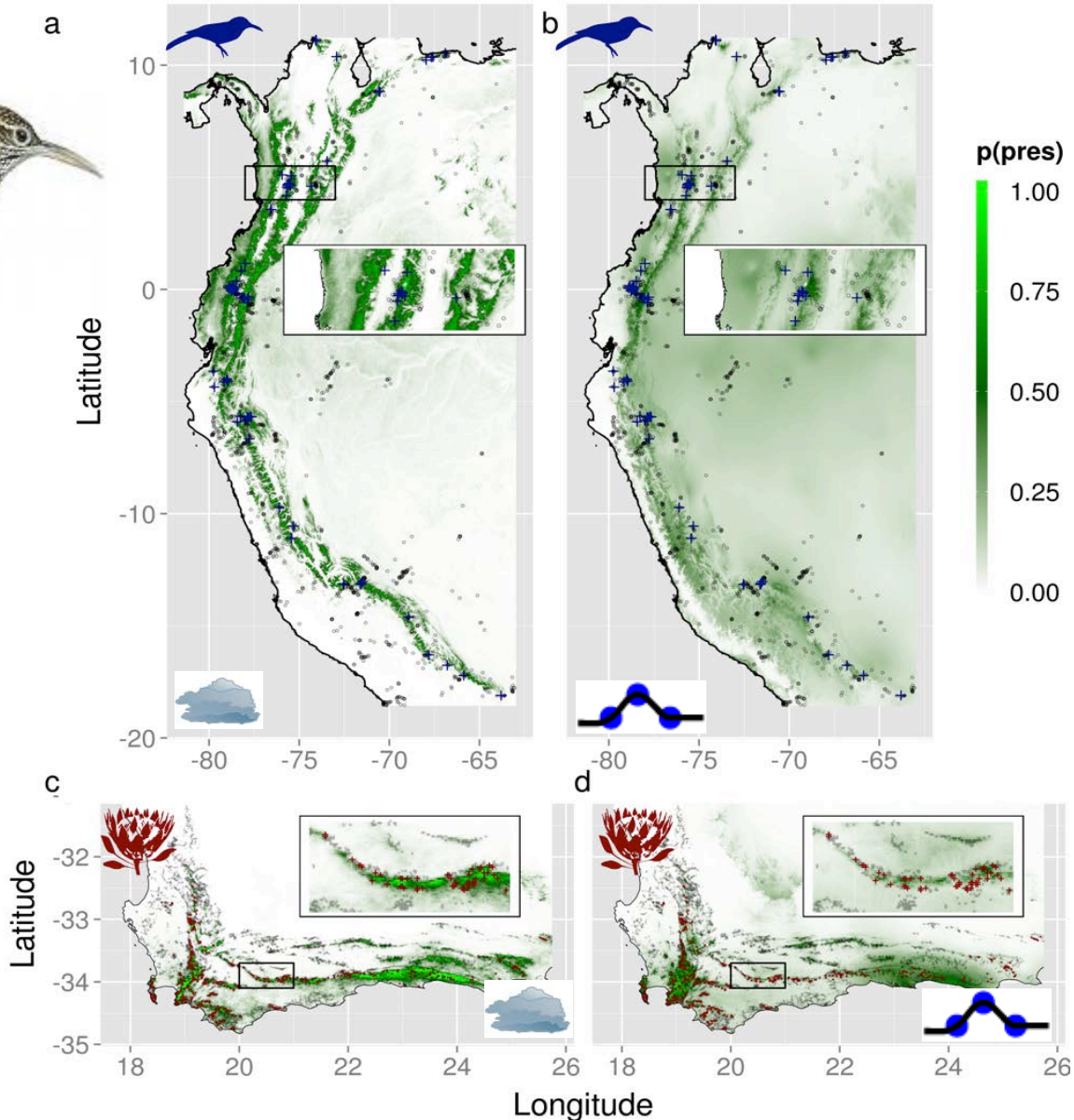
Monitoring cloud forest habitat



Clouds-only model stronger than elevation-only model, enables monitoring

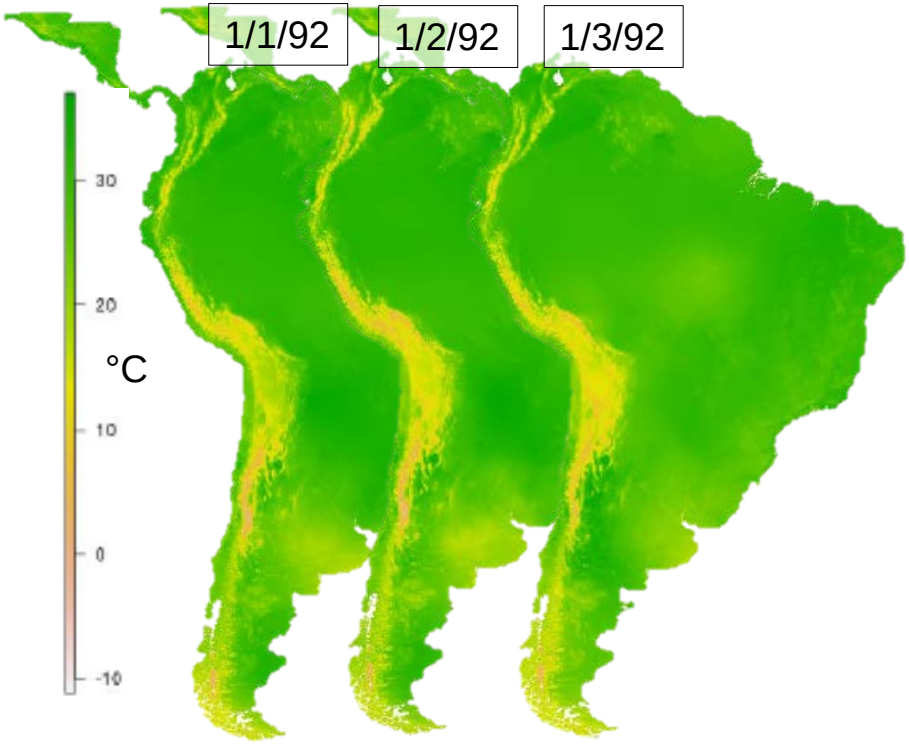
Environmental niche modeling

Species	Data	AUC
		0.87
		0.68
		0.87
		0.82



A multi-decadal time series of 1km daily temperature and precipitation

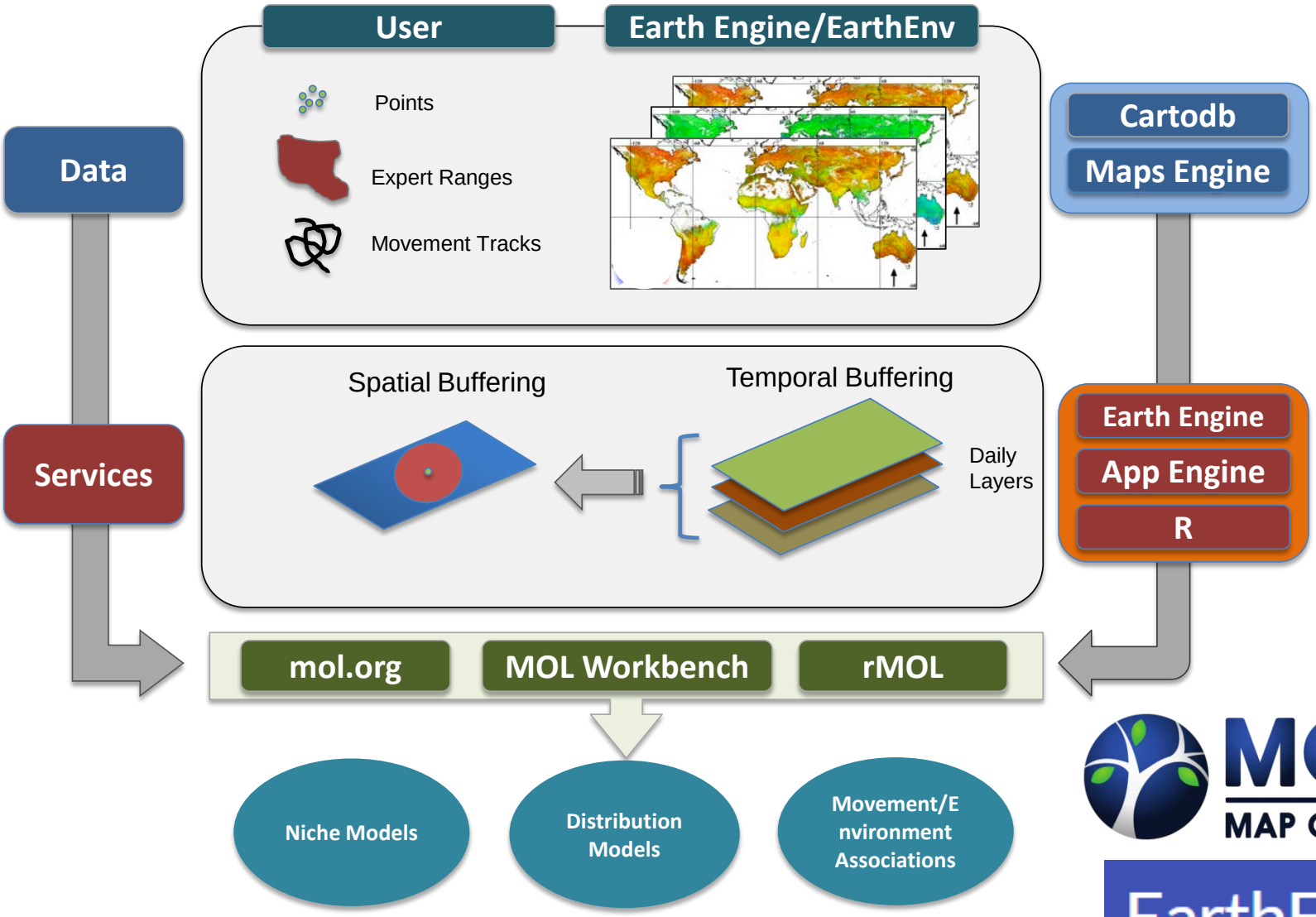
- MODIS cloud mask and LST data + met station data
- Available late 2016: *earthenv.org*



Benoit Parmentier

II. Develop informatics infrastructure

II. Develop informatics infrastructure



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Ben Carlson

III. Support global monitoring

GEO BON

Global Biodiversity Change Indicators

Model-based integration of remote-sensing & in situ observations that enables dynamic updates and transparency at low cost

GBIF NASA NSF Google Yale UNIVERSITY CSIRO MOL MAP OF LIFE

SHI Species Habitat Indices

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Species Info | Map a Species | Species Lists by Location | About MOL | News | Help

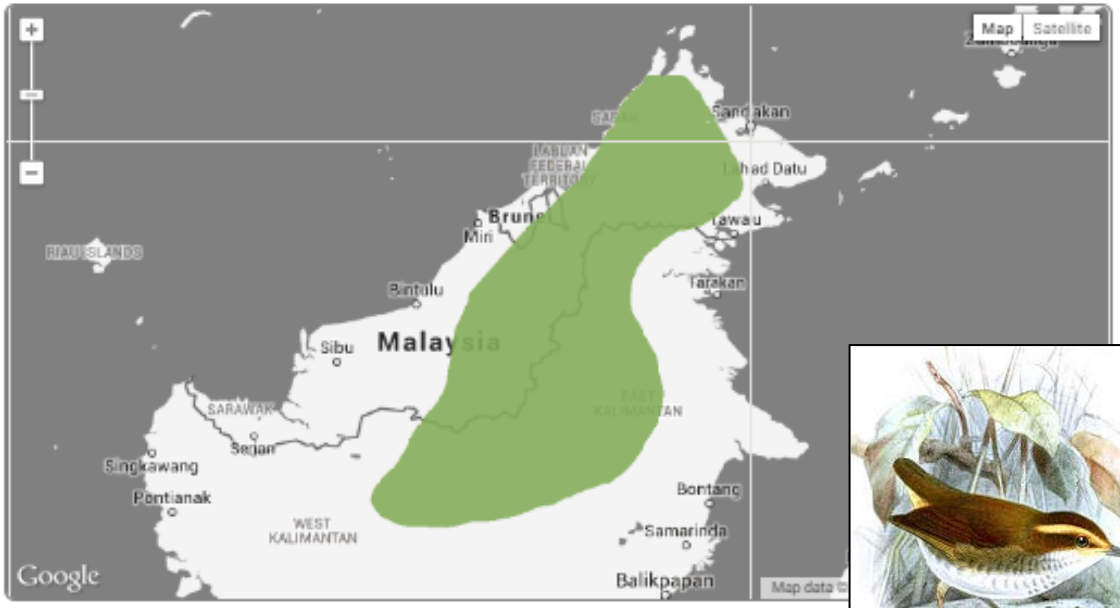
Overview | Habitat Distribution | Habitat Change | Reserve Coverage | Info | Select a species | Pick random | Birds

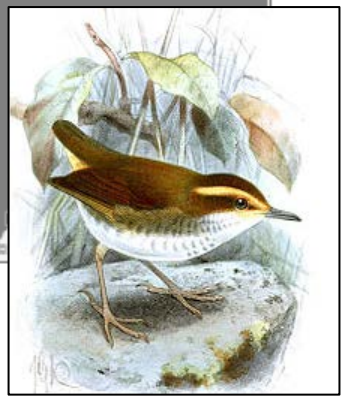
Bornean Stubtail
Urosphena whiteheadi

Learn more

Update

Records outside suitable range | Records in suitable range | Suitable range





Habitat Associations ON OFF

Elevation ON OFF
900 - 2600 meters

Tree cover: ON OFF
75 - 100%

Landcover ON OFF

Woodlands | Cultivated

Species in Reserves — Pre-Release

Explore habitat suitability and reserve gaps for a set of species pre-released at the 2014 World Parks Congress

SHI Species Habitat Indices

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Select a species | Pick random | Birds

Bornean Stubtail
Urosphena whiteheadi

Learn more

Update

Records outside suitable range | Records in suitable range | Suitable range

Habitat Associations ON OFF

Elevation ON OFF
900 - 2600 meters

Tree cover: ON OFF
75 - 100%

Landcover ON OFF

Woodlands: Forests | Woody Savannas

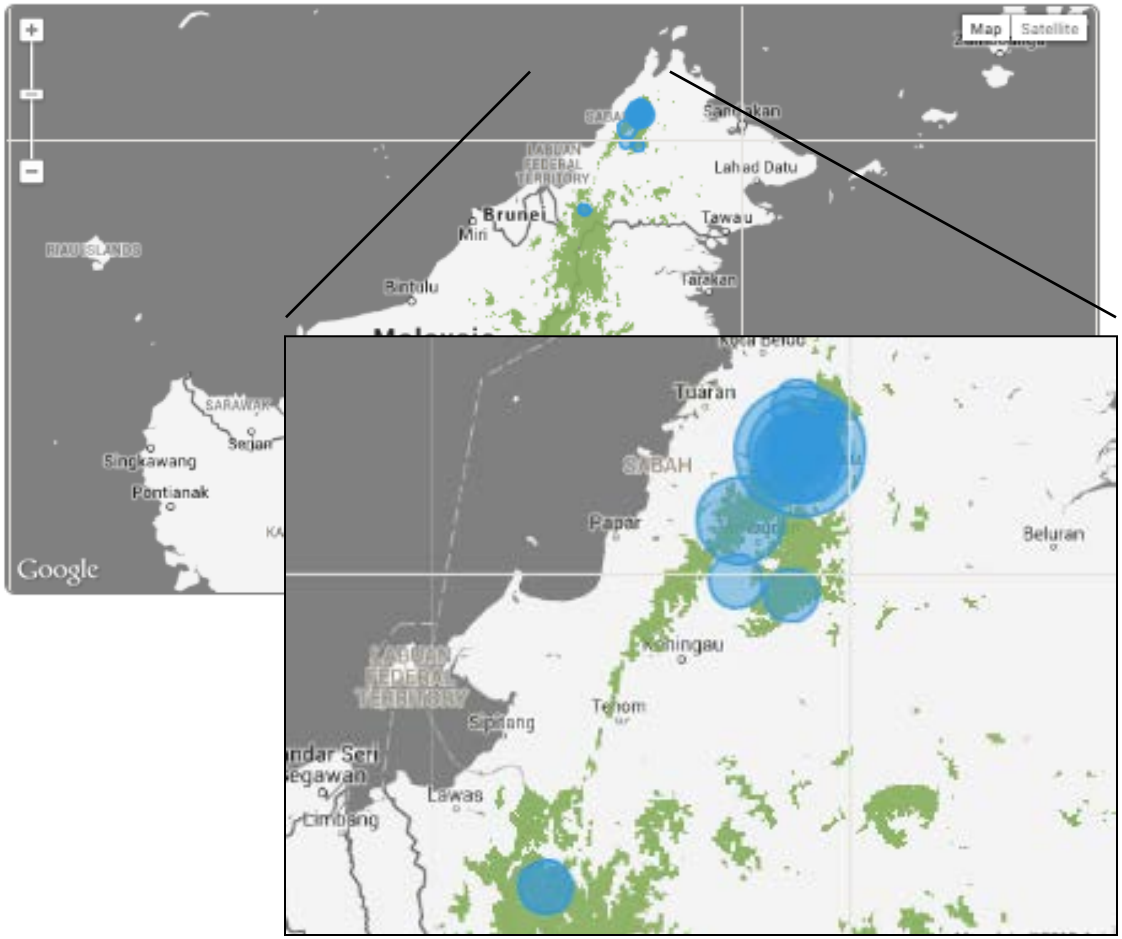
Cultivated: Cropland | Cropland Mosaics

Shrublands: Open | Closed

Barren Urban: Barren | Urban

Herbaceous: Savannas | Grasslands

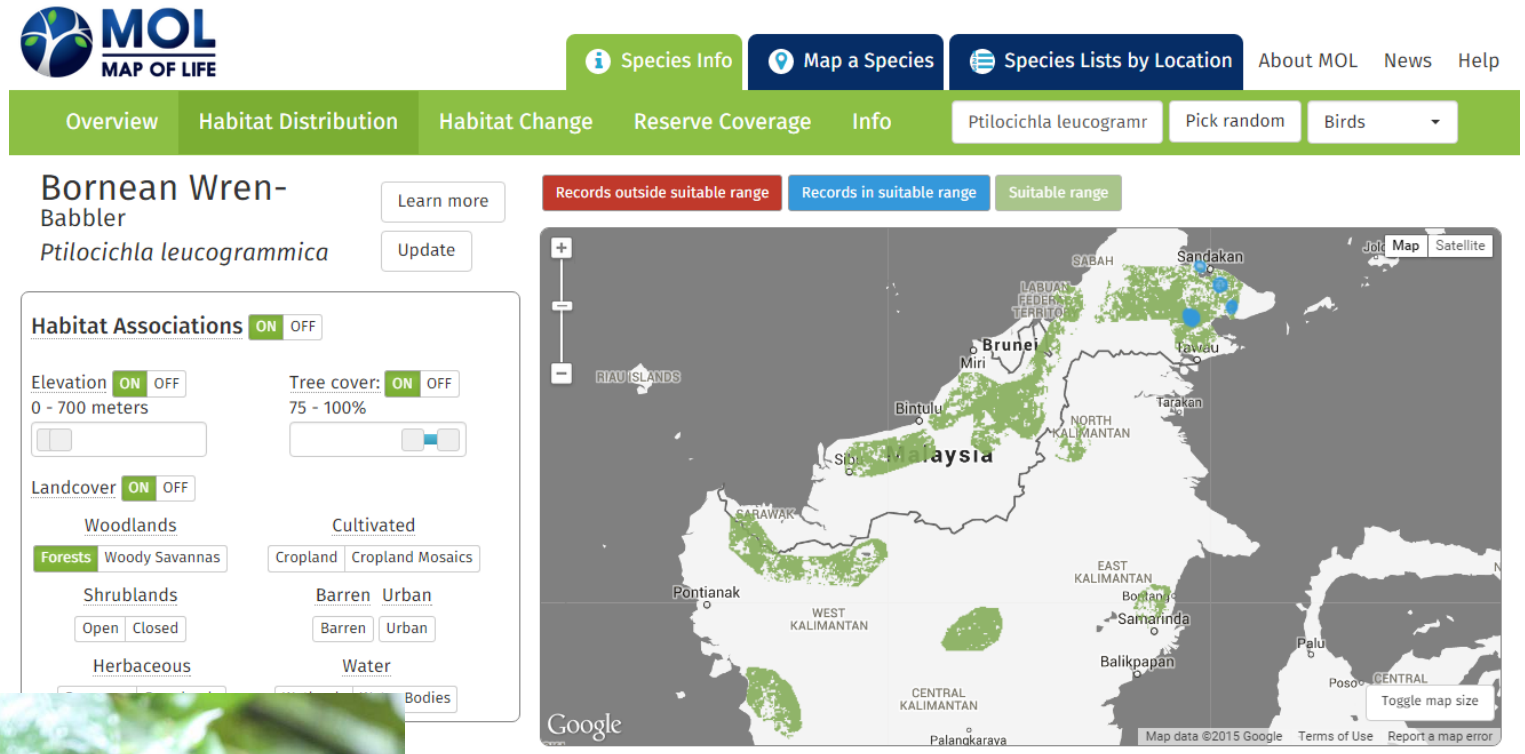
Water: Wetlands | Water Bodies



Geographic distribution

Range size	47,919 km²	218,276 km²

Species Habitat Indices



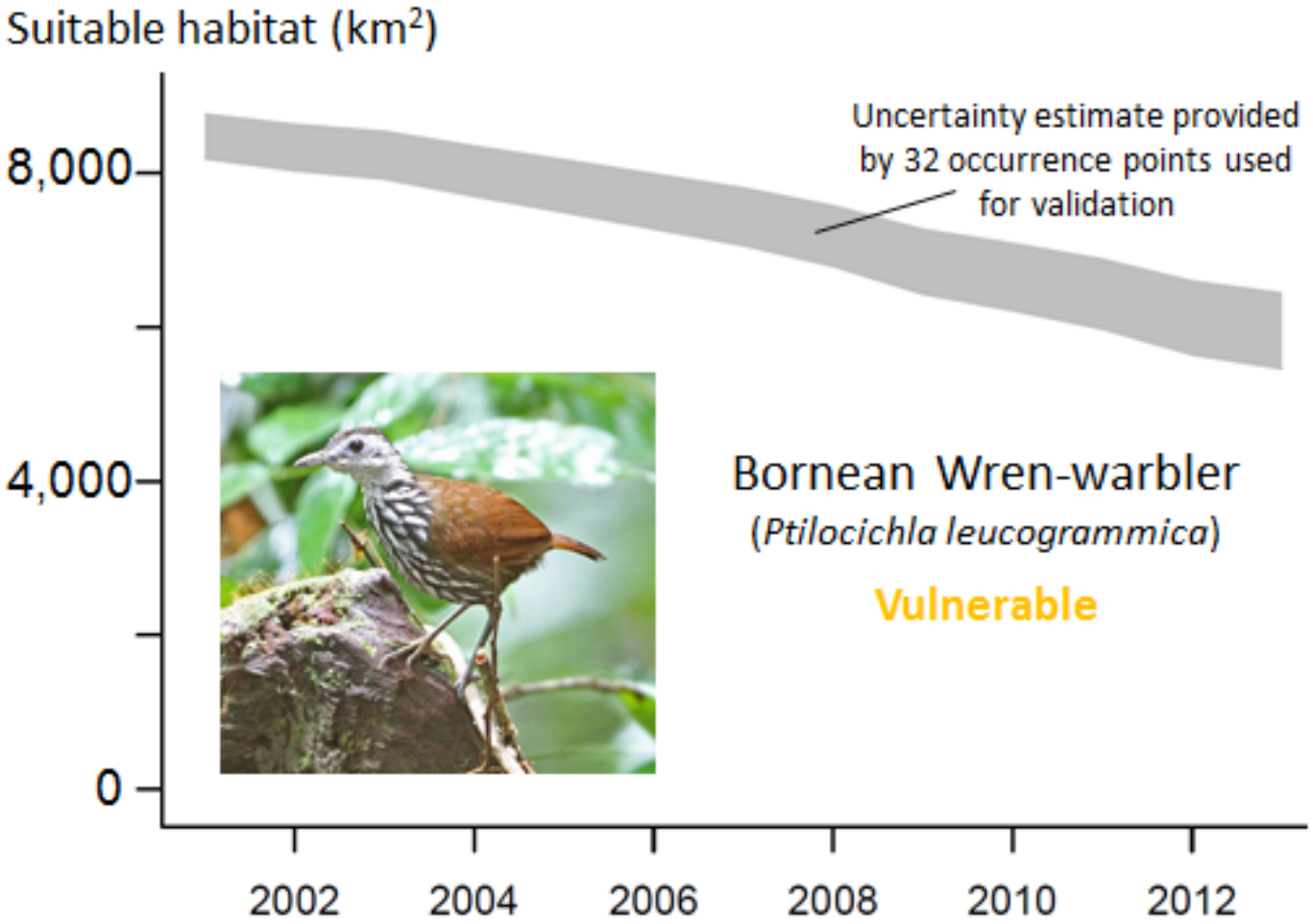
With support from
Google Earth Engine

SHI Species Habitat Indices MOL MAP OF LIFE

MOL MAP OF LIFE

Species Info | Map a Species | Species Lists by Location | About MOL | News | Help

Overview | Habitat Distribution | Habitat Change | Reserve Coverage | Info | Ptilocichla leucogramr | Pick random | Birds



Thanks!