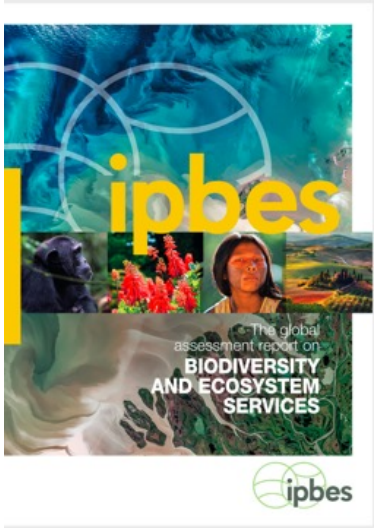
# Don‘t we know it already? Research Data Management in Earth System Sciences - A contribution to Pressing Global Challenges

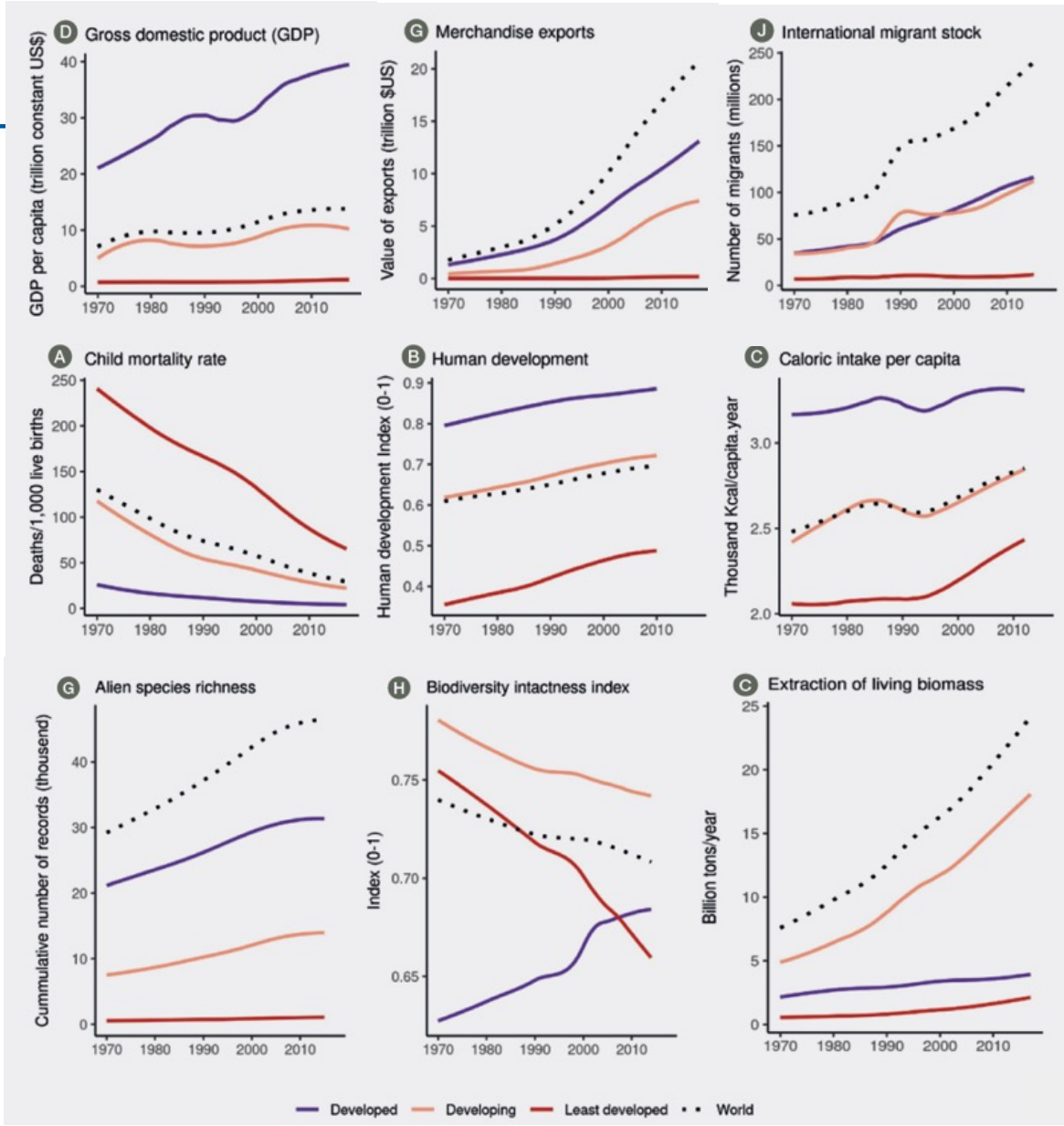
NDFI4Earth Kick-off, 9.6.2022, TU Dresden, Prof. Dr. Ralf Seppelt @RSeppelt

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

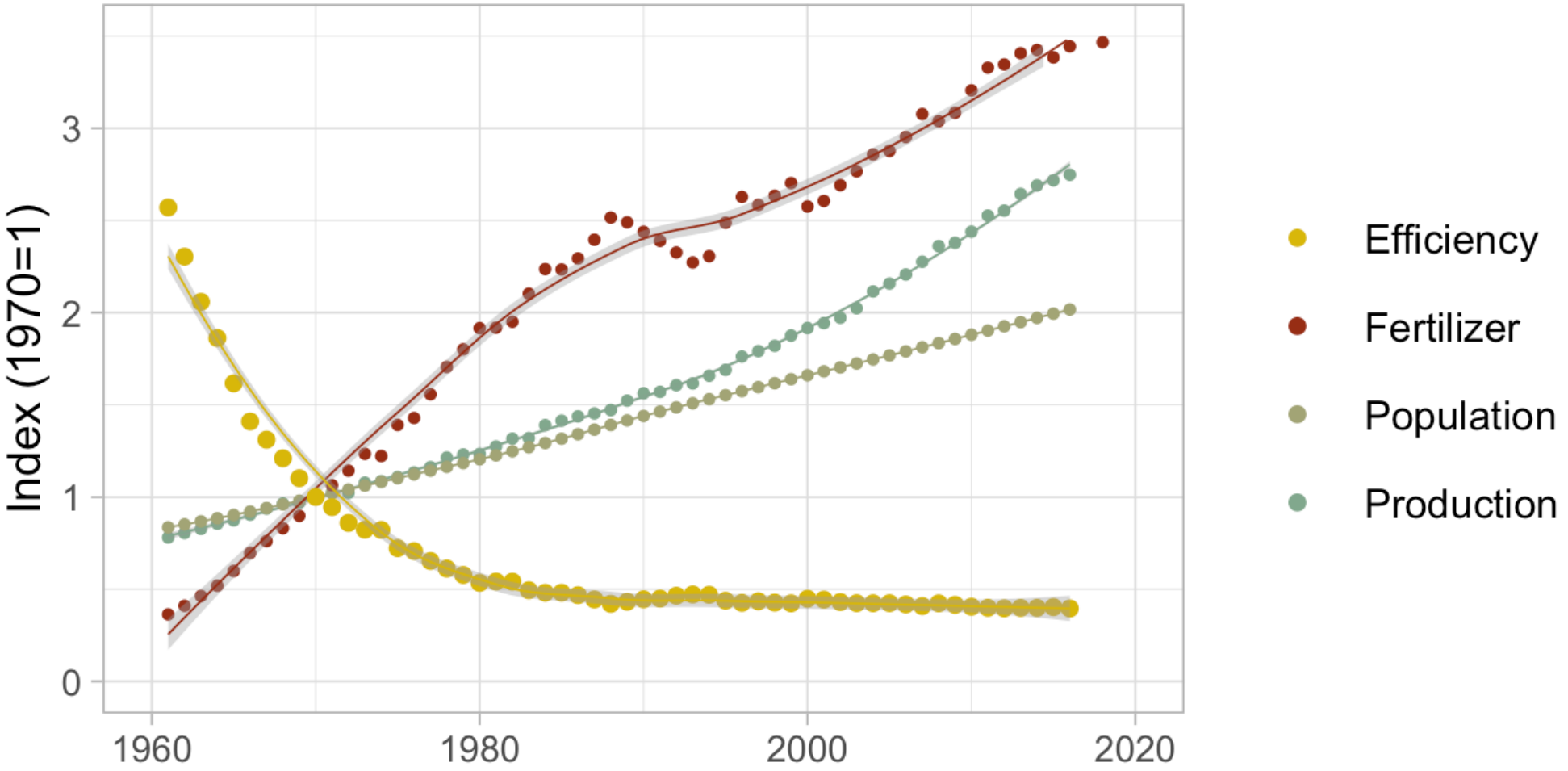
# IPBES Global Assessment




2019, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)



# A closer Look: The Global Food System




Hertel et al. 2020. Europ. Econ. Rev.

# „We reached Peak Chicken“


Seppelt, R., A. M. Manceur, J. Liu, E. P. Fenichel, and S. Klotz. 2014. Synchronized peak-rate years of global resources use. *Ecology and Society* **19**(4): 50. http://dx.doi.org/10.5751/ES-07039-190450

E&S

*Research*

## Synchronized peak-rate years of global resources use

Ralf Seppelt[1,2,3], Ameur M. Manceur[1,4], Jianguo Liu[5], Eli P. Fenichel[6] and Stefan Klotz[2,7]

SUSTAINABILITY

## Resource use peaks worldwide

The rates at which humans consume multiple resources such as food and wood peaked at roughly the same time, around 2006. This means that resources could be simultaneously depleted, so achieving sustainability might be more challenging than was thought.

Ralf Seppelt of the Helmholtz Centre for Environmental Research in Leipzig, Germany, and his colleagues estimated the peak rate of extraction for 27 resources. For 20 of them, mostly renewables such as meat and rice, the peak-rate years occurred between 1960 and 2010, with many clustering around 2006. Only coal, gas, oil, phosphate, farmed fish

29.01.

ampp3d from Mirror

News Ampp3d Food

## "Peak chicken" was 2006 - how food production isn't keeping pace with population

Production of the world's most important foods could begin declining. Here's why you should be just as worried as this chicken

62 Shares Share Tweet +1 Email

## Food peak production

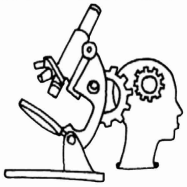
Peak production refers to the point at which the growth in production of a crop, animal or other foodstuff begins to slow down. From this time, production will continue to increase but at a decelerating rate. This is the first stage of a process that typically continues with a flattening of production and then a decrease. Peak production is the point at which things begin to go wrong, acting as a warning signal of what is to come.

YEAR IN WHICH FOOD TYPE REACHED ITS PEAK-RATE

2015
2014
2013
2012
2011 — SOYBEANS
2010
2009
2008 — SUGARCANE
2007
2006 — POULTRY
2005
2004 — MILK
2003
2002 — WHEAT
2001
2000
1999 — VEGETABLES
1998
1997

*Was* WISSEN *schafft*

## *Schluss mit der Agrarromantik!*



*Um Teller und Tank zu füllen, müssen Erträge steigen*

Von Ralf Nestler

Morgens um zehn rollt der Trecker zurück auf den Hof. Frohgemut steigt der Landwirt von der Maschine, setzt sich an den Tisch mit der Karodecke unter der großen Linde, wo schon die Großfamilie und alle Angestellten versammelt sind und herzhaft in ihre Stullen beißen. Wogt der goldene Weizen auch erntereif im Wind – so viel Zeit muss sein. Eine solche Agrarromantik, die von der Werbeindustrie gelegentlich bis ins Groteske übersteigert wird, ist dieser Tage auch wieder bei der Grünen Woche in Berlin zu besichtigen.

Die Realität sieht anders aus. Während der Traktor GPS-geführt wahlweise Saaten oder Pflanzen-

zahlt. Biobauern geht es kaum besser, die Zahl der Öko-Betriebe ging zuletzt sogar zurück.

Landwirtschaft ist ein knallhartes Geschäft, die Erträge müssen stimmen, sprich: weiter nach oben gehen. Doch das wird immer schwieriger. Nachwachsende Rohstoffe, lange Zeit für weitgehend unerschöpflich gehalten, kommen an ihre Grenzen. Zu diesem Schluss gelangen Landschaftsökologen um Ralf Seppelt vom Helmholtzzentrum für Umweltforschung. Sie haben im globalen Maßstab für 20 nachwachsende Ressourcen wie Mais, Reis, Weizen und Soja die jährlichen Zuwachsraten angeschaut. 18 von ihnen haben demnach ihr Maximum

ter, die der Mensch für die Ernährung braucht, sind limitiert.

Vorbei sind die Zeiten, in denen die Agrarproduktion noch beträchtlich zulegte, unter anderem dank Kunstdünger und Bewässerung. Diese Trümpfe sind ausgespielt. Der wichtigste war das Anlegen neuer Ackerflächen, aber auch der sticht nicht mehr. Wälder und Grasland sollen – zu Recht – geschützt werden, Siedlungen werden immer größer, Wüsten breiten sich aus. Wertvoller Boden ist endlich.

Das lässt sich in Deutschland gut studieren. Angetrieben vom Wunsch, Teller und Tank zu füllen, wurden die Ackerflächen immer größer. Fast 12 Millionen

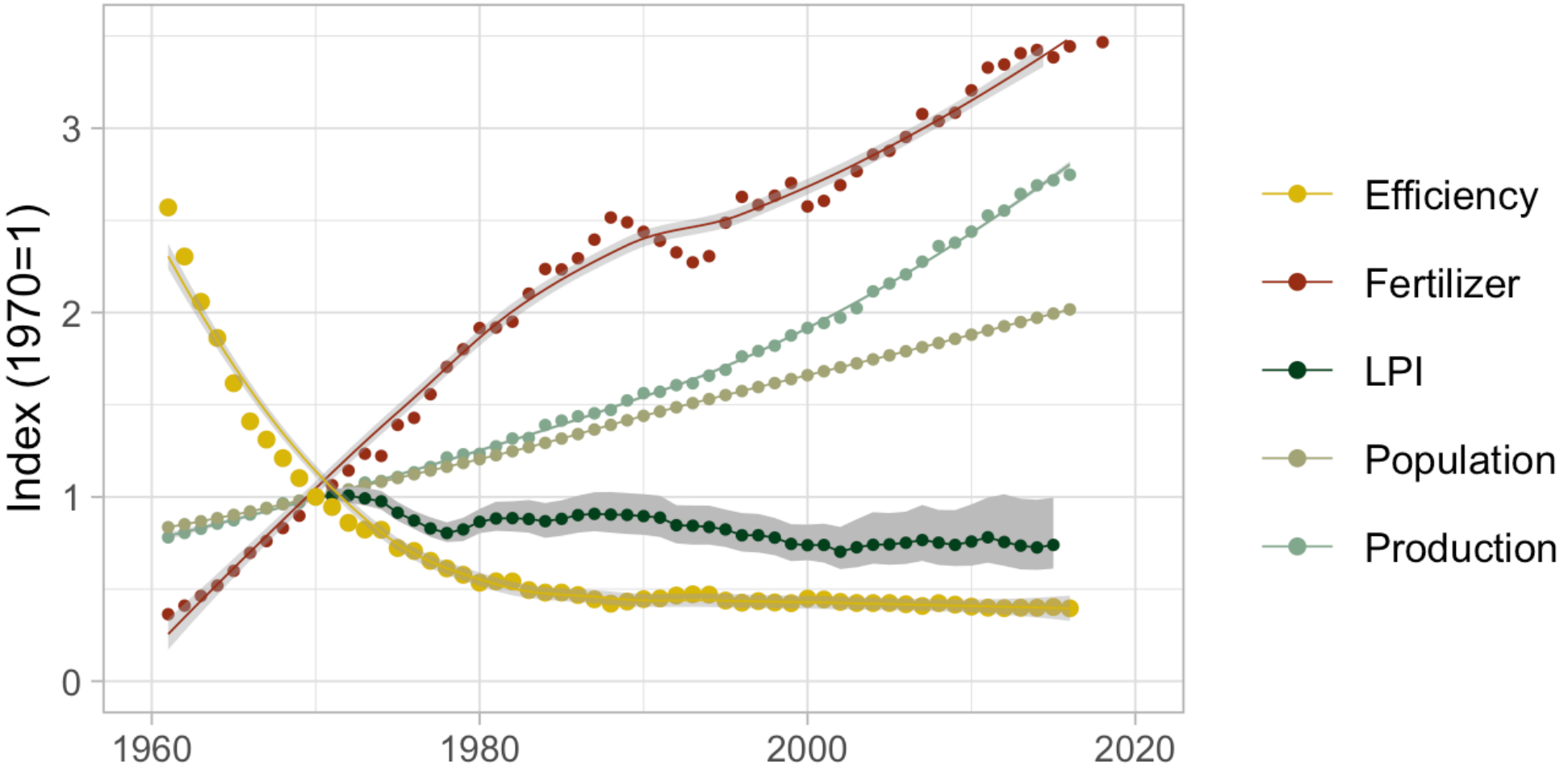
det werden, kommen rund 5 Millionen Hektar im Ausland hinzu.

Das kann nicht gut gehen, zumindest wenn es alle so machten. Was ist zu tun? Drei Antworten. Erstens so wenig wie möglich wegwerfen. Nach wie vor landen mühevoll herangezogene, geernte und verarbeitete Produkte aus Stall und Feld zu häufig im Abfall. Zweitens den Fleischkonsum auf ein menschliches Maß bringen. Es ist skandalös, dass Hühnchenfleisch teilweise billiger ist als Allerweltsgemüse. Wenn die Politik Gesetze erlässt und durchsetzt, die zu einer artgerechten und umweltverträglichen Haltung der Tiere führen, wird der Konsum sinken. Weil er endlich einen rea-

rohstoffe großflächig durch
wachsende zu ersetzen. Int
gente Bewässerung und Dü
können dazu beitragen, ebe
wie maßvoller Einsatz von S
lingsbekämpfungsmitteln. V
beiden letzten Methoden fü
zichtbar hält, sollte bedenke
dass ökologischer Landbau
che im Schnitt 20 Prozent w
Ertrag bringt. Das zeigt eine
studie mit Daten aus aller W
die niederländische Forsche
gewertet haben.

Nicht zuletzt sind leistun
hige Pflanzen vonnöten, die
benenfalls auch mit schlech
Wasserversorgung und wid
Klima zurechtkommen oder
ders nahrhaft sind. Die Grün

# A closer Look: The Global Food System




Hertel et al. 2020. Europ. Econ. Rev.

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IN FOCUS NEWS

Humanity facing 'urgent threat' from loss of Earth's natural life

Landmark UN report says a million species at risk of extinction

'We should have gone to the doctor sooner. We are in a bad way'

The Guardian

Tuesday
7 May 2019
£2.20
£1.60 for subscribers

"All the News That's Fit to Print"

The New York Times

VOL. CLXVIII . . . No. 58,320 NEW YORK, TUESDAY, MAY 7, 2019

Wildlife Facing Extinction Risk All Over Globe

U.N. Says Humans Are Eroding Ecosystems

As Washington Accuses Iran, Relations Hit a Trump-Era Low

Tax Returns and Barr Subpoena Fuel Latest Clash on Capitol Hill

ara

ara.cat

SOS NATURA

L'ONU alerta que un milió d'espècies estan en perill d'extinció per l'acció dels humans

Le Monde

UN MILLION D'ESPÈCES MENACÉES DE DISPARITION

« IL N'EST PAS TROP TARD POUR AGIR... »

LE FIGARO

LE FIGARO ENTREPRENEUR

L'AGRICULTURE FAIT sa RÉVOLUTION

BIENNALE DE VENISE

LE RENDEZ-VOUS MONDIAL DE L'ART CONTEMPORAIN

Avec Toyota derrière moi, je pourrai me concentrer sur l'avenir.

ce extinction

Landmark United Nations report finds that human a

en ecosystems around the world.

The Boston Globe

TUESDAY, MAY 7, 2019

A million species face peril, UN says

20 minutes

Biodiversité

Selon l'Ipbes, un million d'espèces est menacé d'extinction dans les décennies à venir

Mardi 7 mai 2019

EUROPÉENNES

Premier meeting pour Philippe à Caen avec Lebreton, Wauquiez au côté de Bellamy à Marseille

PRISONS

Les détenus violents ont leurs quartiers

TURQUIE

Istanbul : nouveau vote convoqué et victoire de l'opposition annulée

FOOTBALL

Un million d'espèces menacées: peut-on encore les sauver ?

Le rapport remis par le groupe d'experts de l'ONU sur la biodiversité réuni à Paris souligne

# Global indicators of land systems

## A: Land-use inputs/outputs

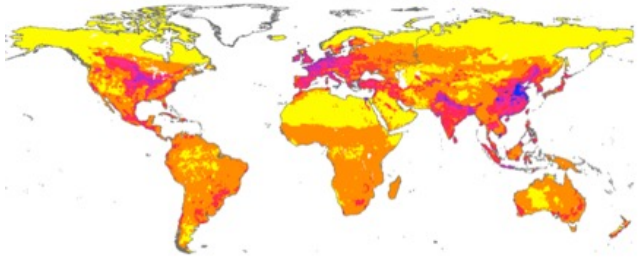
| Factor | Unit |
|---|---|
| Cropland area | $km^2$ per grid cell |
| Cropland area trend | $km^2$ per grid cell |
| Pasture area | $km^2$ per grid cell |
| Pasture area trend | $km^2$ per grid cell |
| N fertilizer | kg $ha^{-1}$ |
| Irrigation | Ha per grid cell |
| Soil erosion | Mg $ha^{-1}$ $year^{-1}$ |
| Yields (wheat, maize, rice) | t $ha^{-1}$ |
| Yield gaps (wheat, maize, rice) | 1000 t |
| Total production index | index |
| HANPP | % of $NPP_0$ |

## B: Environmental conditions

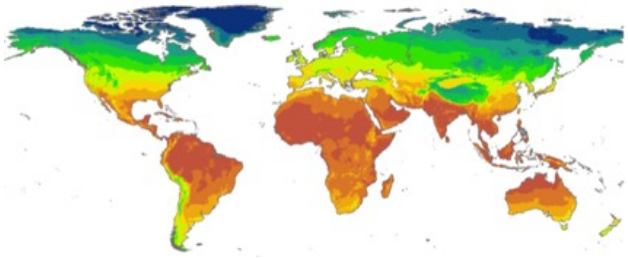
| Factor | Unit |
|---|---|
| Temperature | °C × 10 |
| Diurnal temperature range | °C × 10 |
| Precipitation | mm |
| Precipitation seasonality | coeff. of variation |
| Solar radiation | W $m^{-2}$ |
| Climate anomalies | °C × 10 |
| NDVI – mean, seasonality | index |
| Soil organic carbon | g C $kg^{-1}$ of soil |
| Species richness | # of species |

## C: Socioeconomic conditions

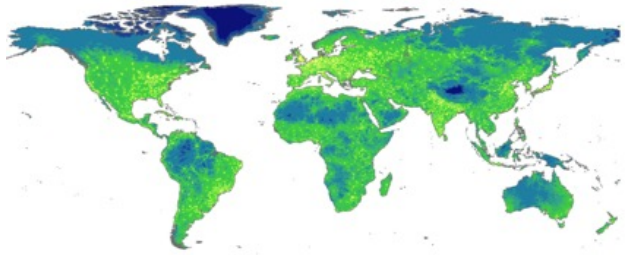
| Factor | Unit |
|---|---|
| Gross Domestic Product | $ per capita |
| GDP in agriculture | % of GDP |
| Capital Stock in agriculture | $ |
| Population density | persons $km^{-2}$ |
| Population density trend | persons $km^{-2}$ |
| Political stability | index |
| Accessibility | travel time |



*Nitrogen fertilizer*



*Mean annual temperature*



*Accessibility to cities and market places*

Václavík et al. 2013, GEC

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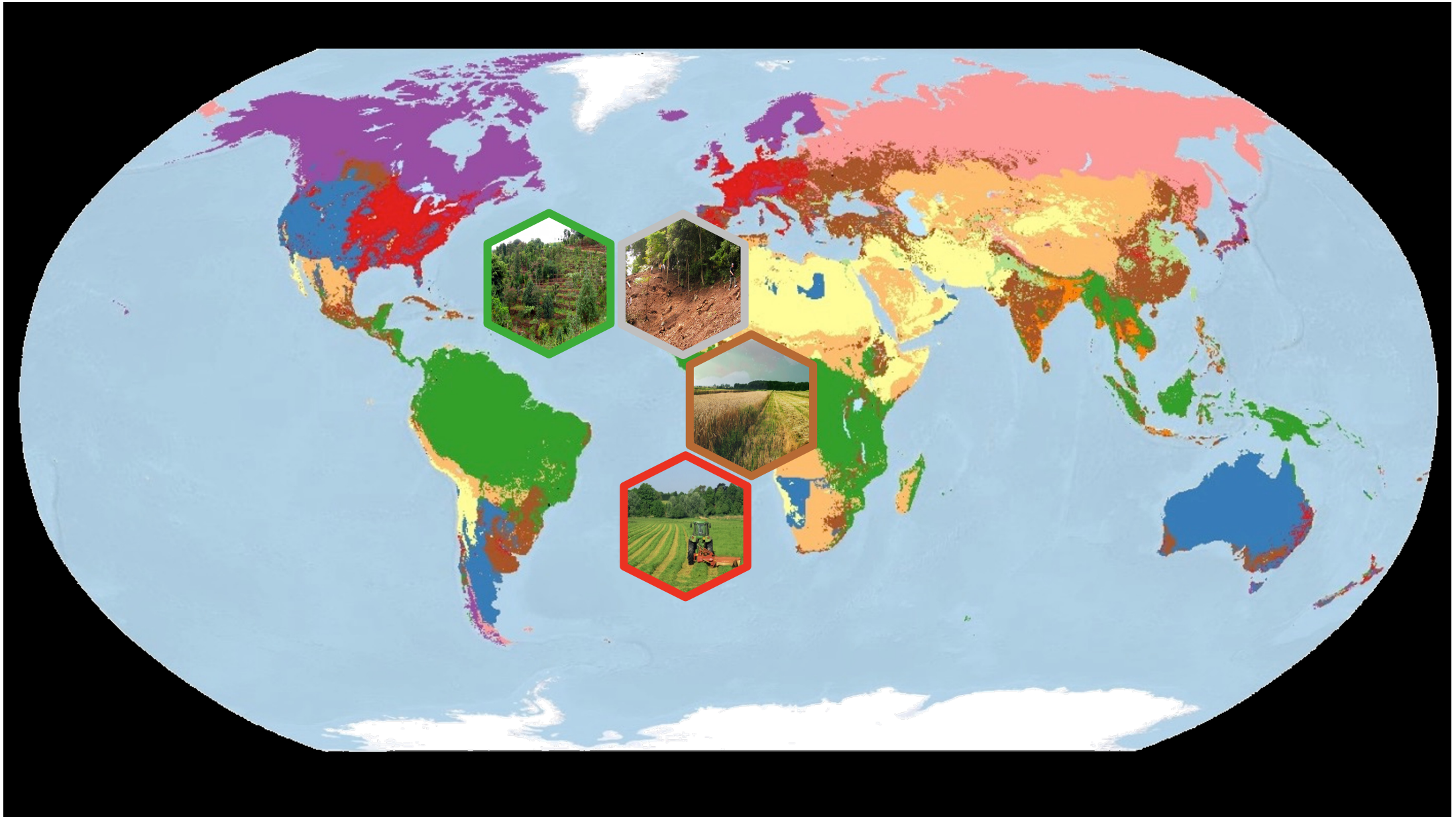
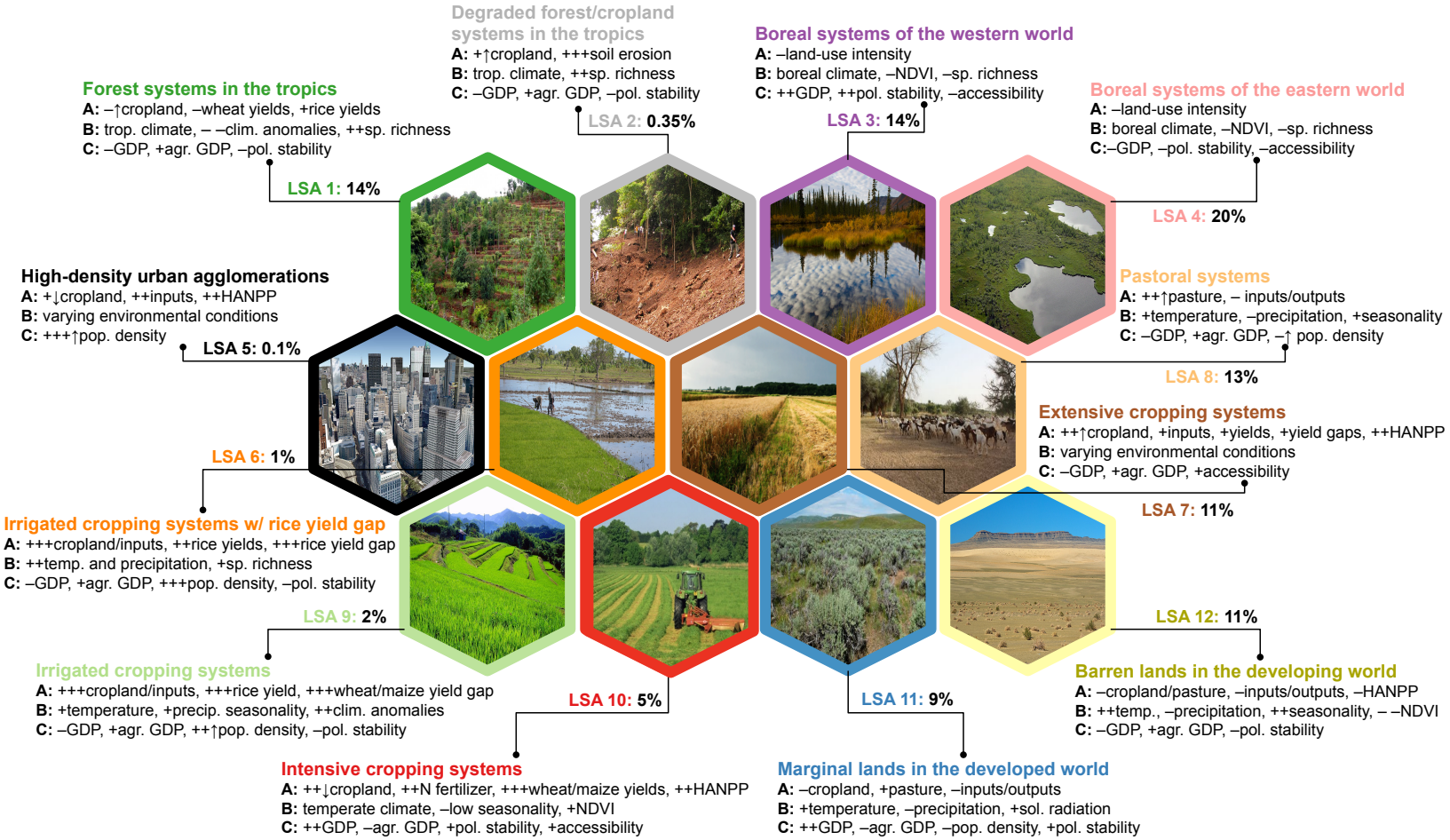


# Land System Archetypes




Václavík et al. 2013, GEC

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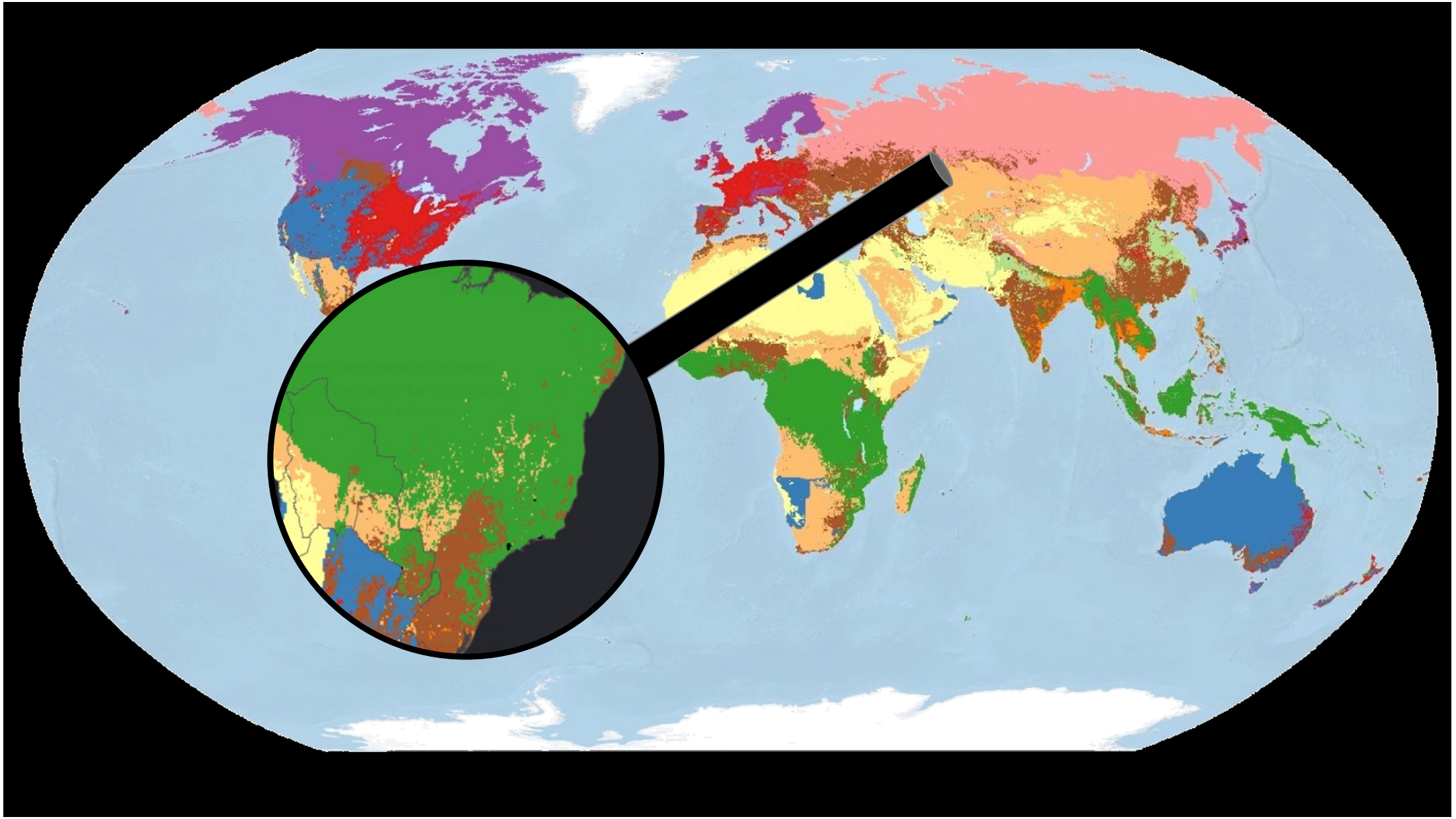
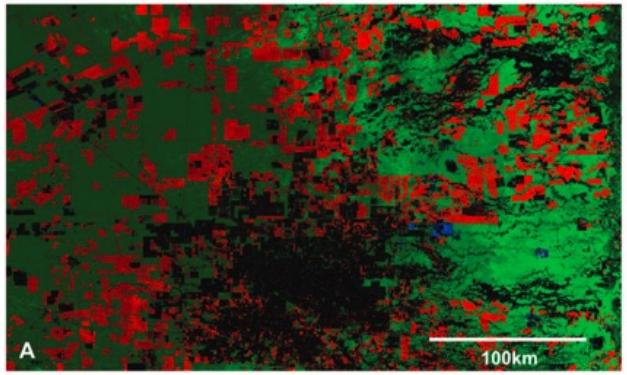
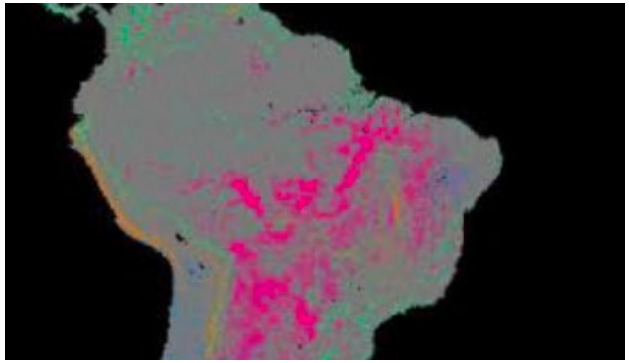


# Forrest Fragmentation reaches Critical Levels

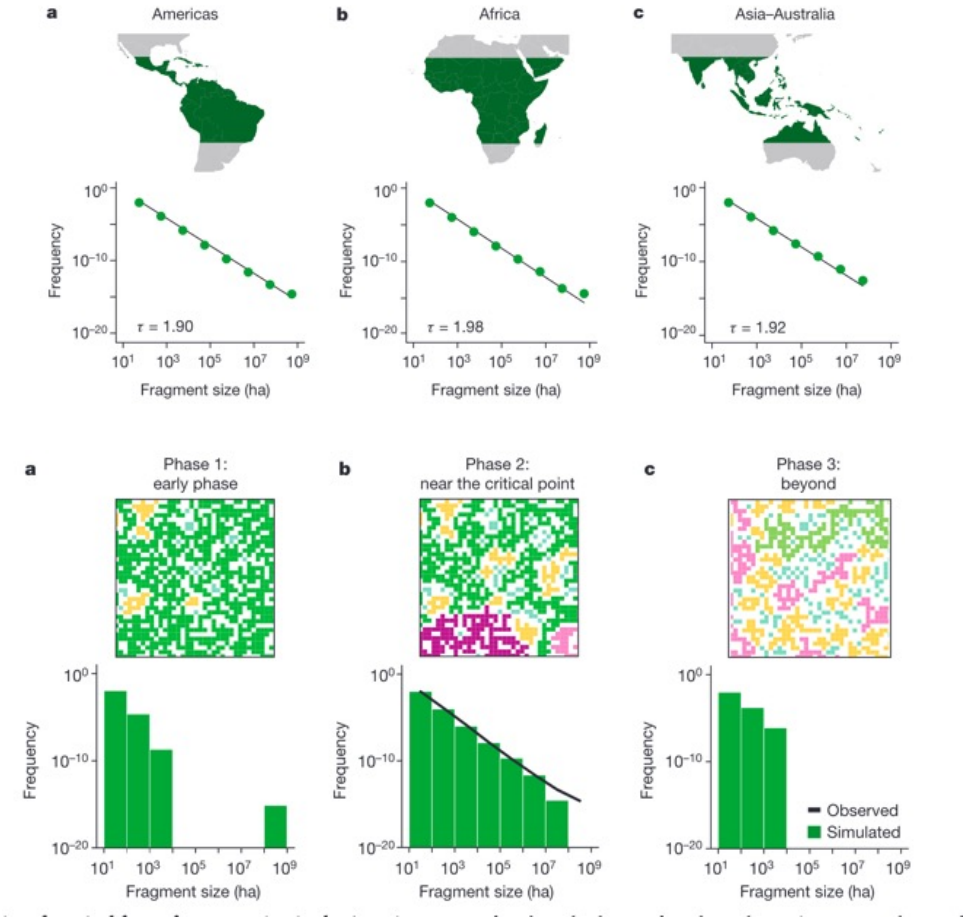



Red: Deforestation 2000-2012

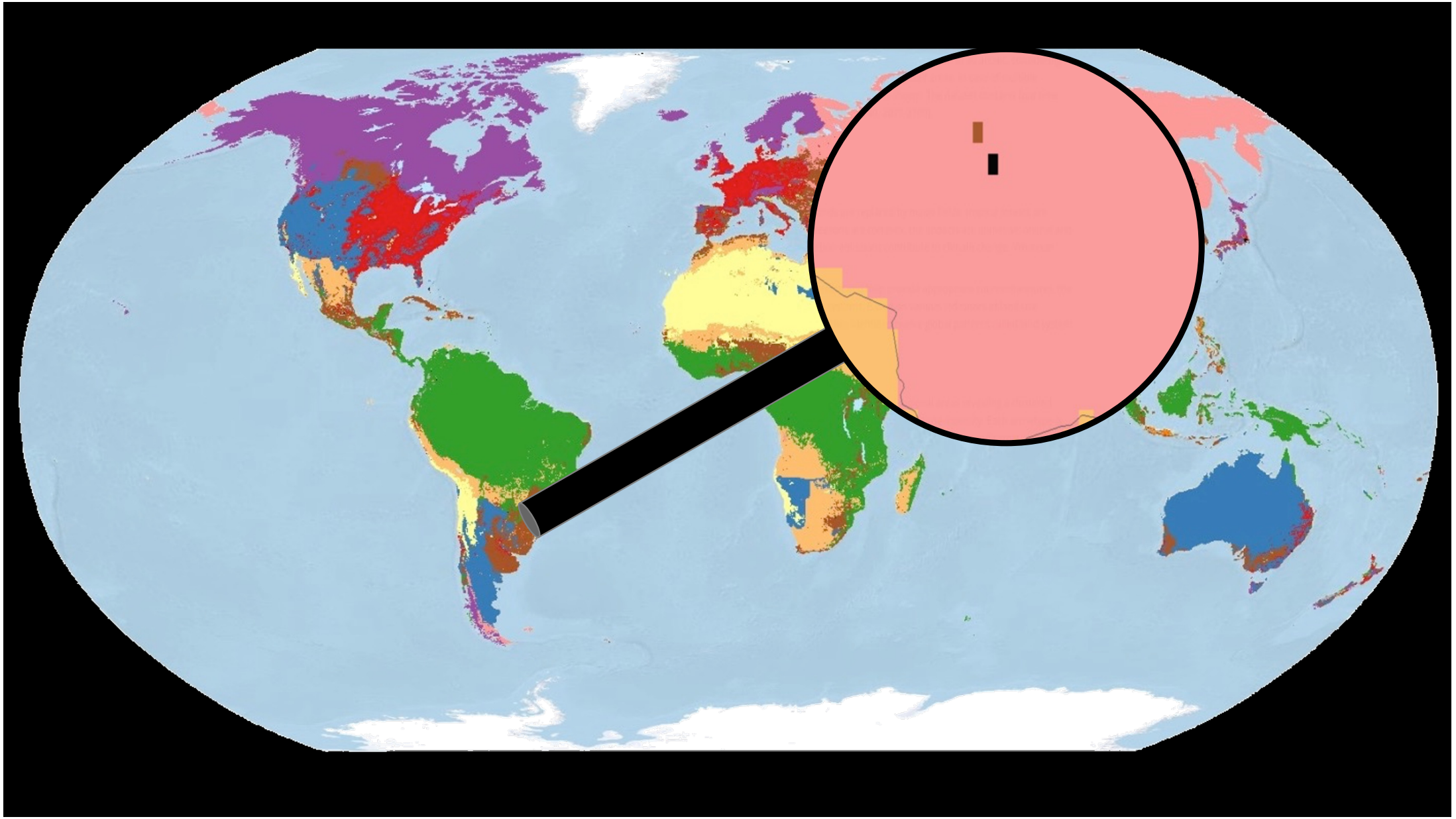


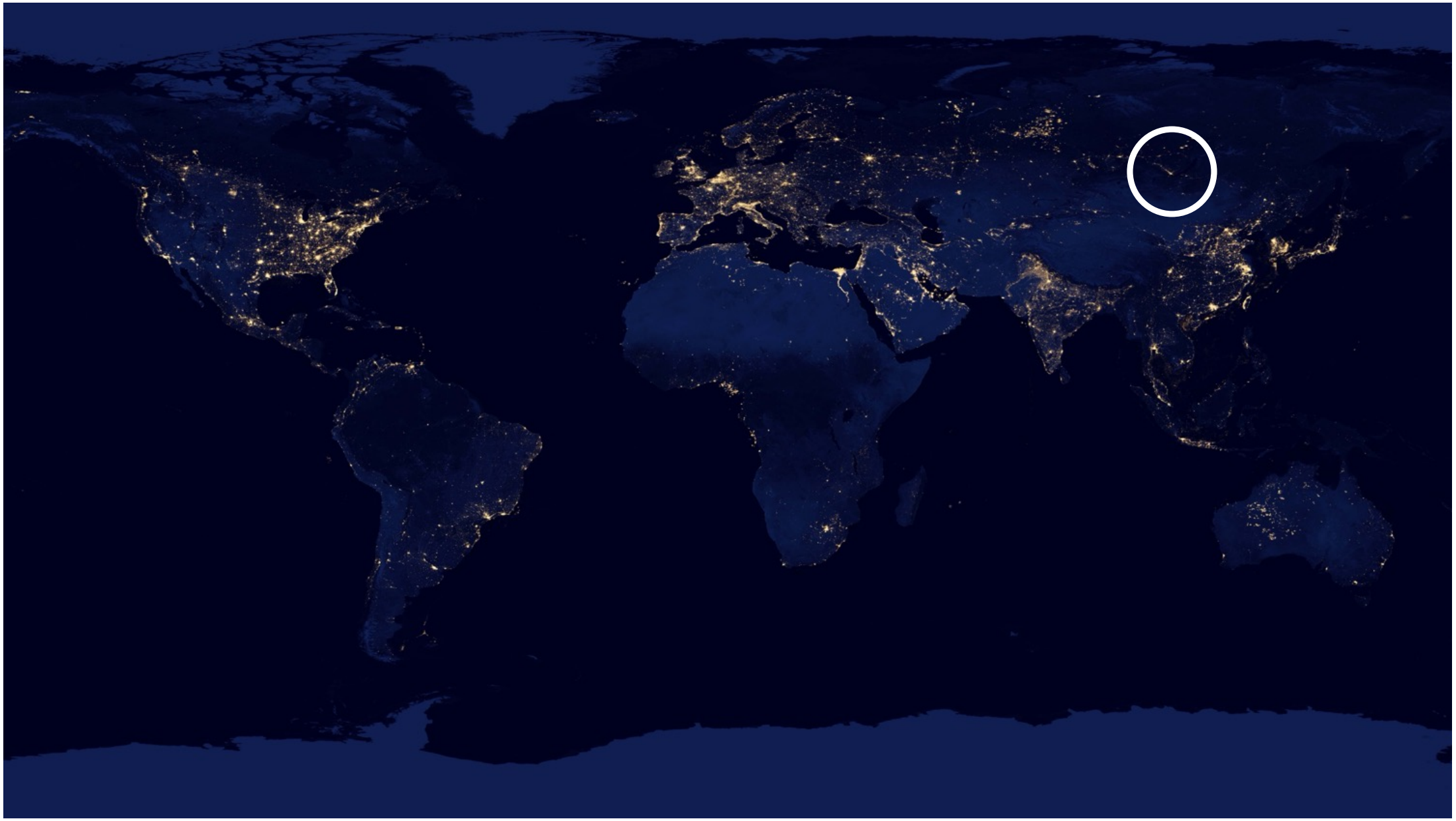
Red: Increase of short vegetation, 1982-2016

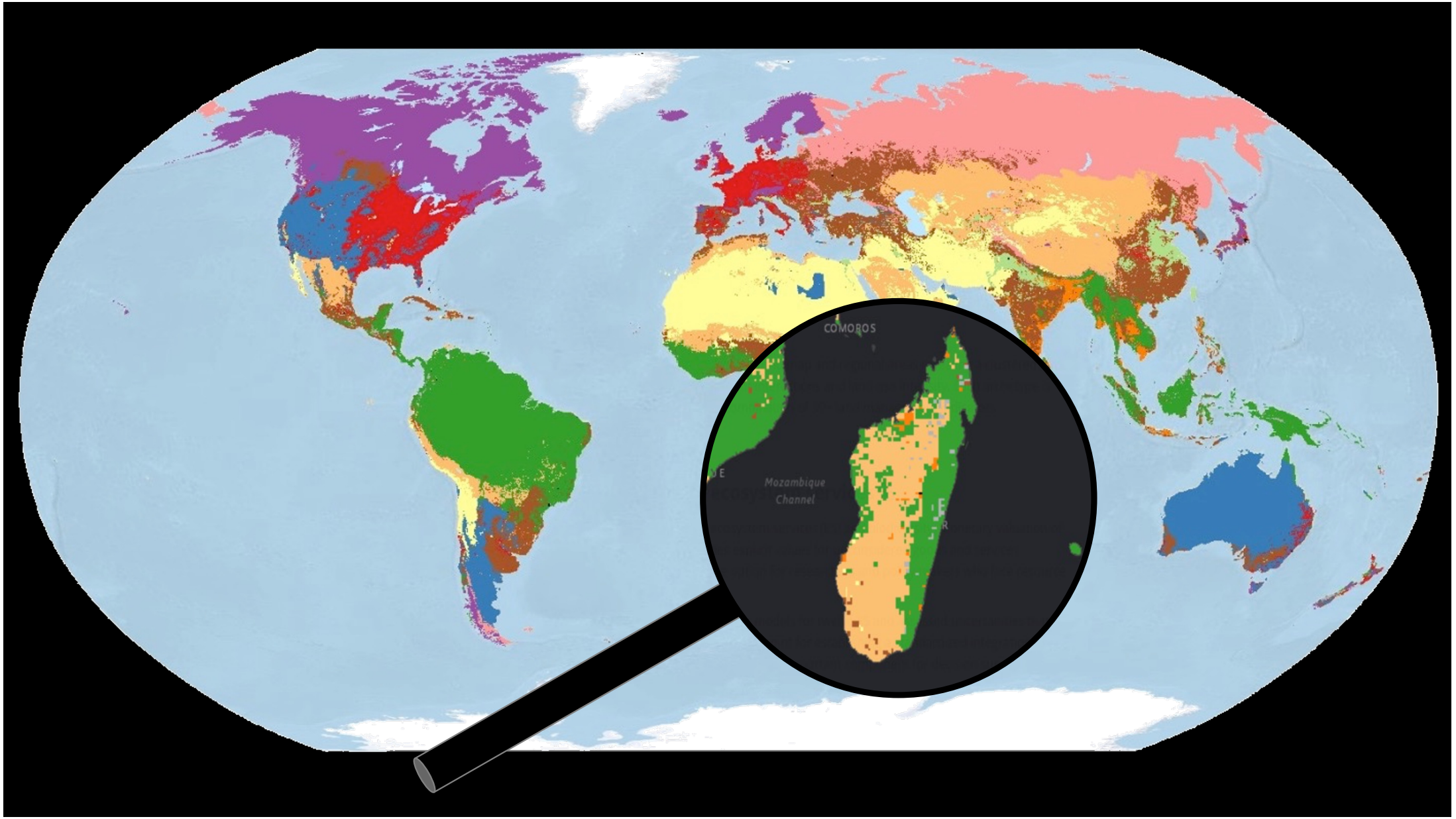
Hansen et al. 2013, Science,
Song et al. 2018, Nature




Taubert et al., 2018, Nature





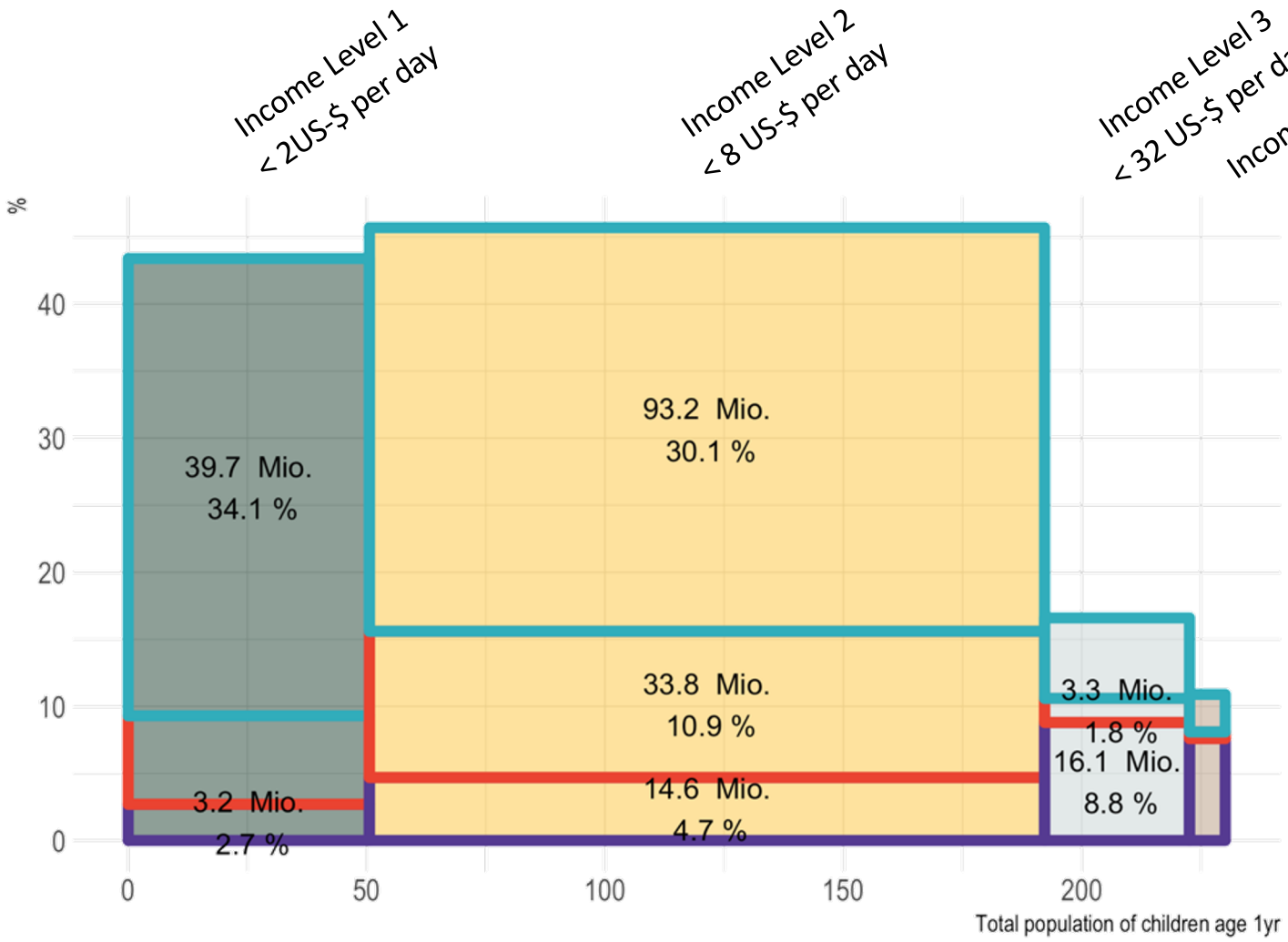

COMOROS
Mozambique
Channel

Hungersnot in Madagaskar

# Verzweiflung lässt Menschen Lehm essen

09.10.2021 14:18 Uhr

# The “demand-side”: Malnutrition of 220 Mio. Children below 2yrs




Stunting: Children below -2 SD median height-for-age

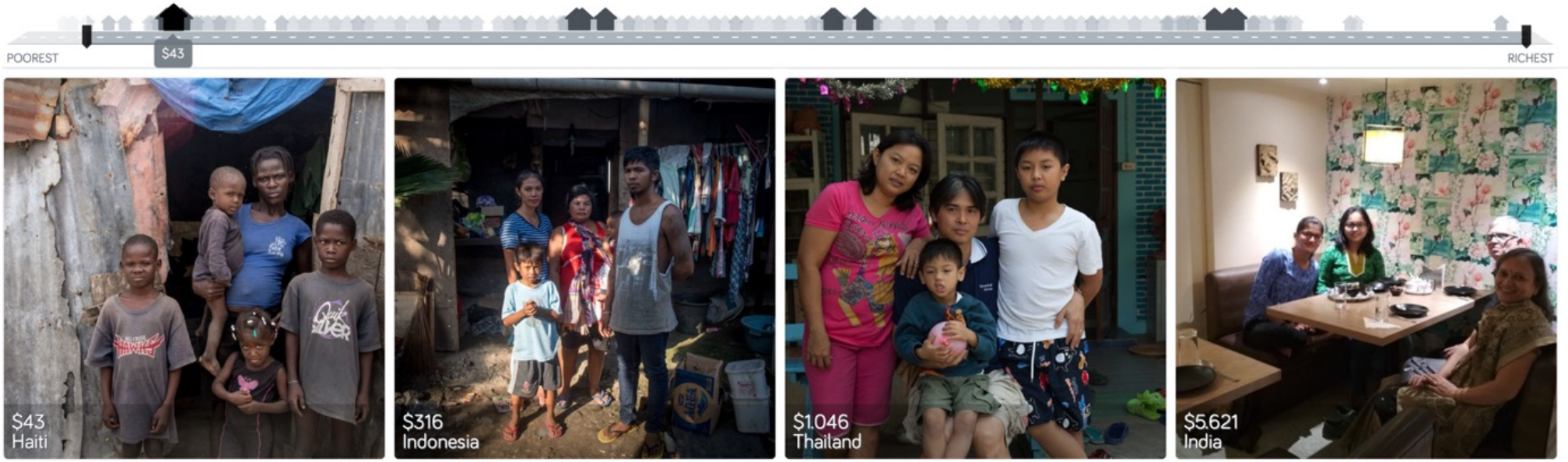
Wasting: Children below -2 SD from median weight-for-height

Overweight: Children weighing 2 SD above median weight-for-height

unicef World Health Organization UFZ

# Socio-Economic conditions: Picture or almost any facets of life

| Income Level 1 | Income Level 2 | Income Level 3 | Income Level 4 |
|---|---|---|---|
| < 2US-$ per day | < 8 US-$ per day | < 32 US-$ per day | … |




https://www.gapminder.org/dollar-street/?p=1

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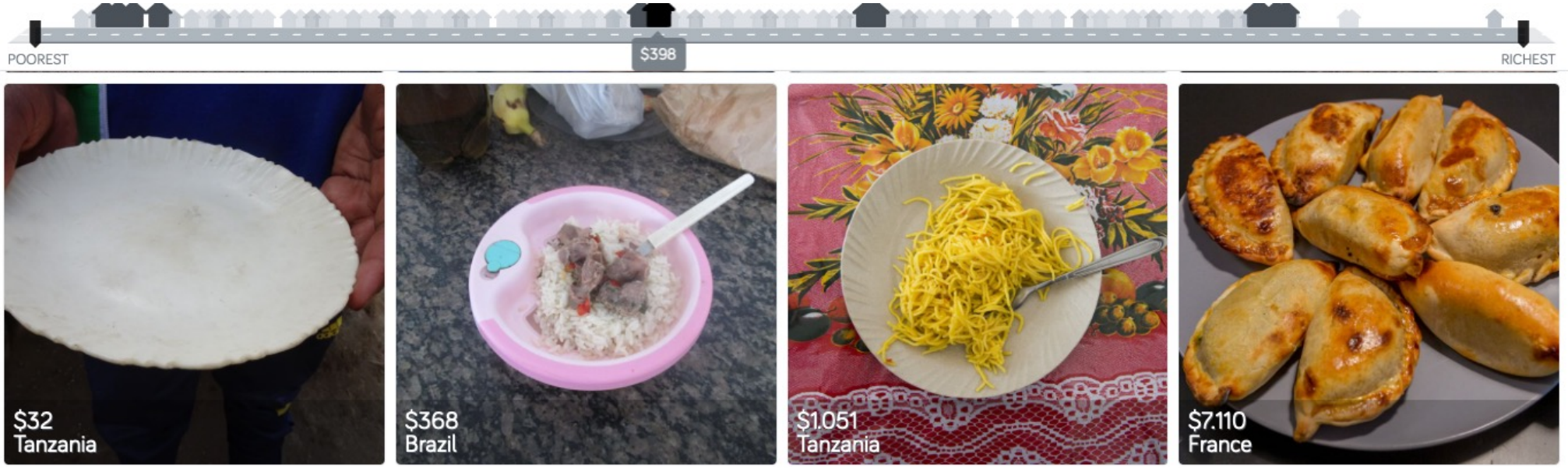


https://www.gapminder.org/dollar-street/?p=1

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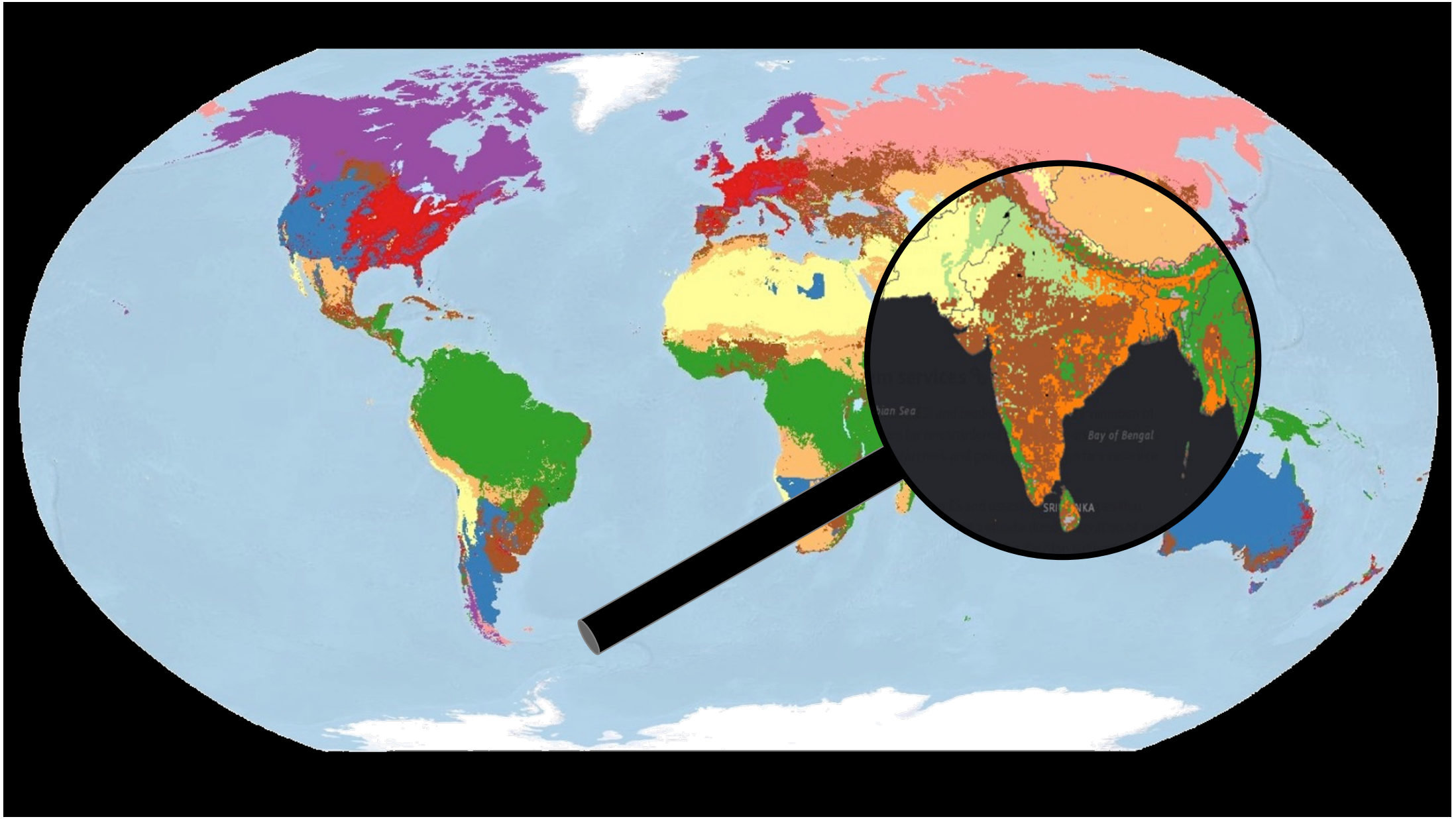
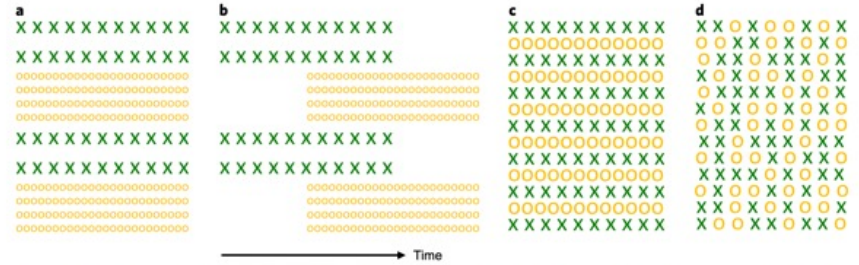
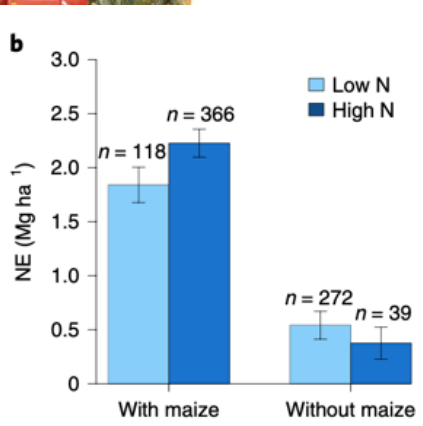

Bay of Bengal

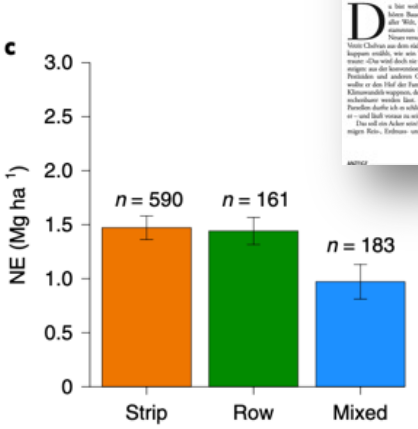
# *“Brahma, Krisha und Öko”* (Die Zeit, 2020)

Both low- and high-yield intercropping strategies save 16–29% of land and 19–36% of fertilizer compared with monocultures








WISSEN I

ÖKOLOGIE · CORONA · GESUNDHEIT · ALLTAG

Brahma, Krishna und Öko

In Indien läuft ein riesiger Feldversuch für eine alternative Landwirtschaft. Eine halbe Million Bauern vertraut dabei auf buntes Pflanzen-Nebeneinander, die Weisheit der Götter und einen Guru

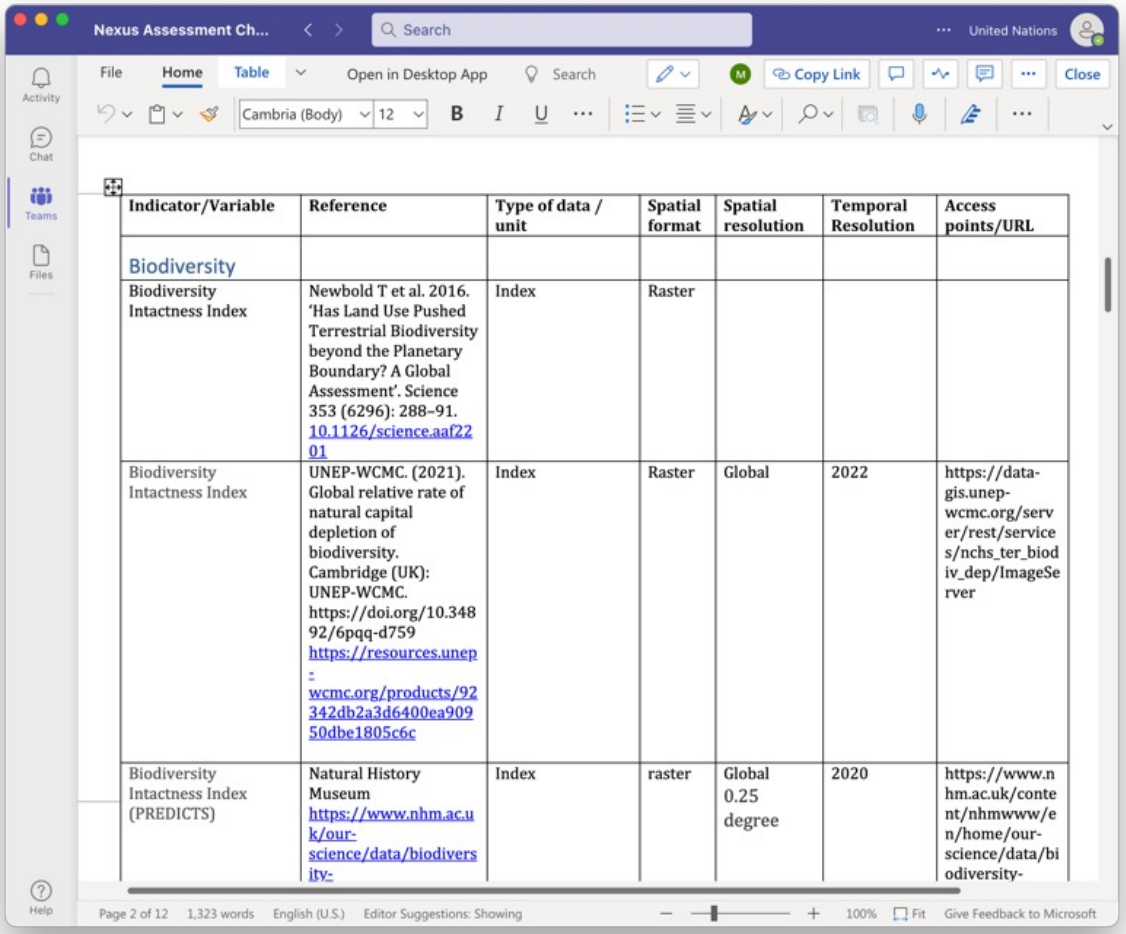
Die Zeit, Juni 2020

Li et a. 2020. *Nature Plants*

What could we achieve if heterogeneous data could be brought together in a seamless manner?

# Assessments: Make our life easier… please

IPCC, IPBES, UNEP, WHO etc. are to provide policy relevant information and knowledge in a concise and easy to grasp way




| Indicator/Variable | Reference | Type of data / unit | Spatial format | Spatial resolution | Temporal Resolution | Access points/URL |
|---|---|---|---|---|---|---|
| Biodiversity | | | | | | |
| Biodiversity Intactness Index | Newbold T et al. 2016. 'Has Land Use Pushed Terrestrial Biodiversity beyond the Planetary Boundary? A Global Assessment'. Science 353 (6296): 288–91. 10.1126/science.aaf2201 | Index | Raster | | | |
| Biodiversity Intactness Index | UNEP-WCMC. (2021). Global relative rate of natural capital depletion of biodiversity. Cambridge (UK): UNEP-WCMC. https://doi.org/10.34892/6pqq-d759 https://resources.unep-wcmc.org/products/92342db2a3d6400ea90950dbe1805c6c | Index | Raster | Global | 2022 | https://data-gis.unep-wcmc.org/server/rest/services/nchs_ter_biodiv_dep/ImageServer |
| Biodiversity Intactness Index (PREDICTS) | Natural History Museum https://www.nhm.ac.uk/our-science/data/biodiversity- | Index | raster | Global 0.25 degree | 2020 | https://www.nhm.ac.uk/content/nhmwww/en/home/our-science/data/biodiversity- |

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# Implementation: Monitoring for Decision-Making?

UN environment programme

CBD

Convention on Biological Diversity

Distr.
GENERAL

CBD/POST2020/PREP/2/1
17 August 2020

ORIGINAL: ENGLISH

PREPARATIONS FOR THE POST-2020
BIODIVERSITY FRAMEWORK

**UPDATE OF THE ZERO DRAFT OF THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK**

*Note by the Co-Chairs*

**I. BACKGROUND**

1. In decision 14/34, the Conference of the Parties set out the process for developing a post-2020 global biodiversity framework, established the Open-ended Working Group on the Post-2020 Global



**B. 2050 Goals**

10. The Framework has four long-term goals for 2050 related to the 2050 Vision for Biodiversity.[5] The four goals are:

(a) The area, connectivity and integrity of natural ecosystems increased by at least [X%] supporting healthy and resilient populations of all species while reducing the number of species that are threatened by [X%] and maintaining genetic diversity;

(b) Nature's contributions to people have been valued, maintained or enhanced through conservation and sustainable use supporting global development agenda for the benefit of all people;

(c) The benefits, from the utilization of genetic resources are shared fairly and equitably;

(d) Means of implementation are available to achieve all goals and targets in the framework.

**C. 2030 Mission**

11. The 2030 Mission for this framework is:

To take urgent action across society to put biodiversity on a path to recovery for the benefit of planet and people.[6]

- How to monitor if these agreements are followed, or not?
- What could economic incentives to foster these?

The Guardian, Mai 2021

## 'Catastrophic': Sierra Leone sells rainforest for Chinese harbour

**Controversial deal with China would be 'disastrous' for fishing and protected rainforest, say opponents**

The beach earmarked for development fringes the Western Area Peninsula national park, home to endangered species including pangolins. Photograph: Issouf Sanogo/AFP/Getty

# Communication: Mobile-Apps tracking a supply chain*?


*Lieferkettensorgfaltspflichtengesetz: §1 Gesetz über die unternehmerischen Sorgfaltspflichten in Lieferketten

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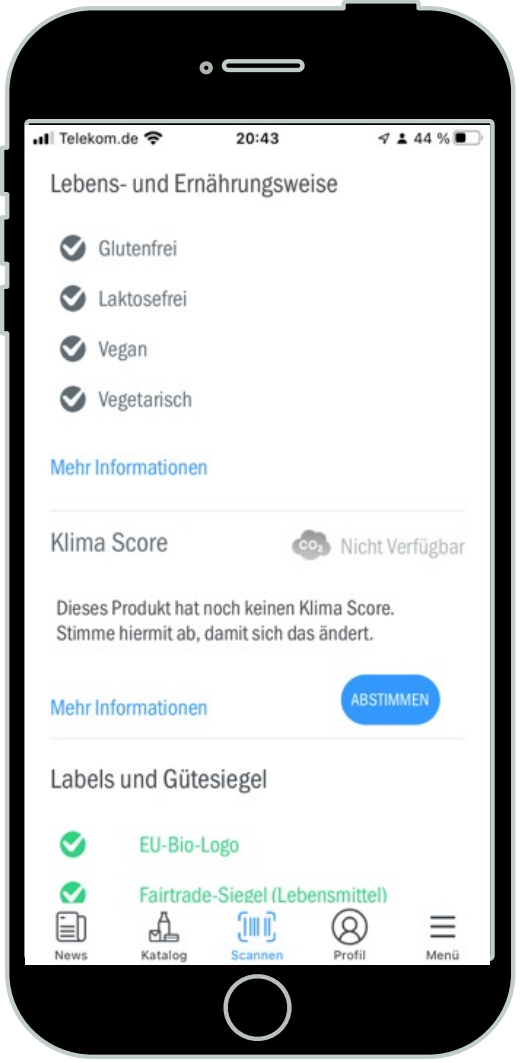
# Communication: Mobile-Apps tracking a supply chain?



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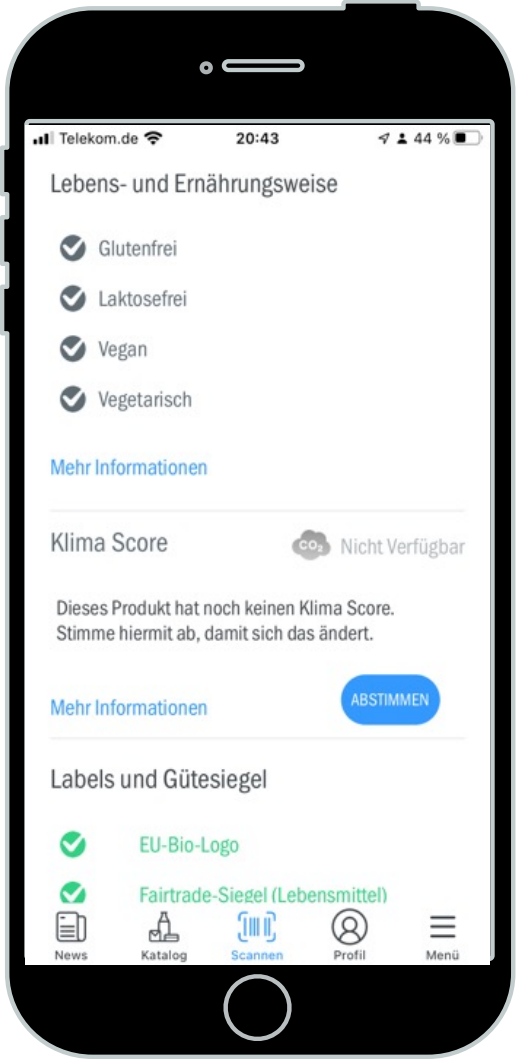
# Communication: Mobile-Apps tracking a supply chain?



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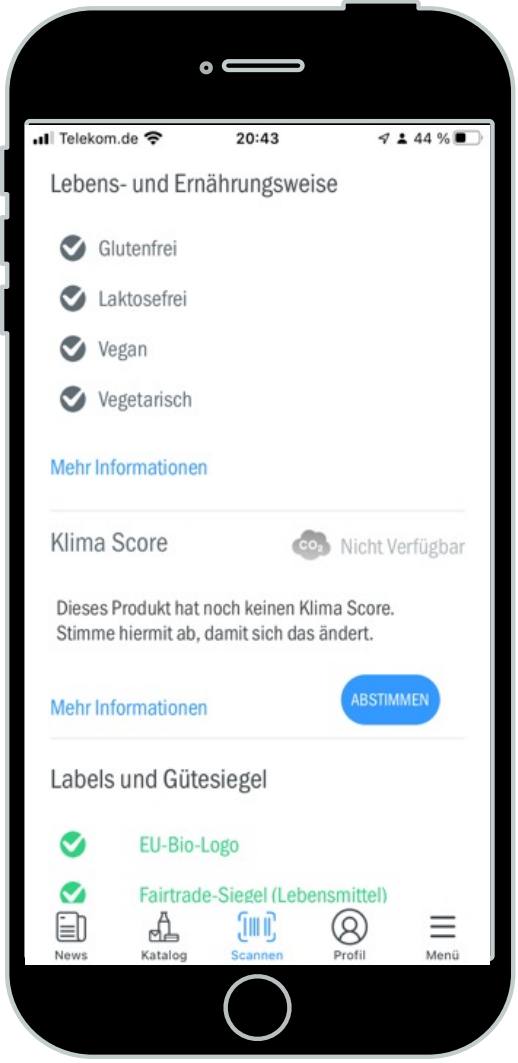
# Communication: Mobile-Apps tracking a supply chain?



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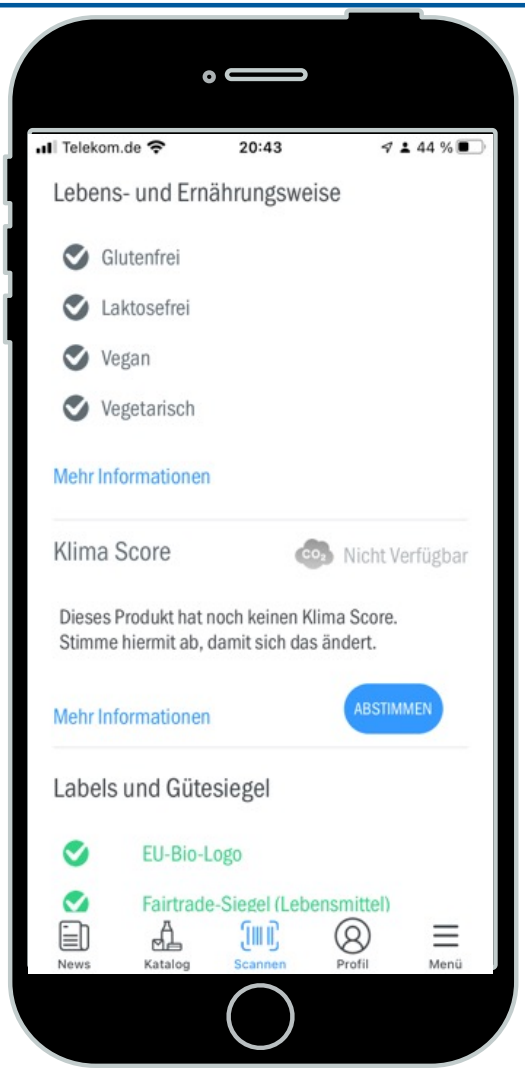



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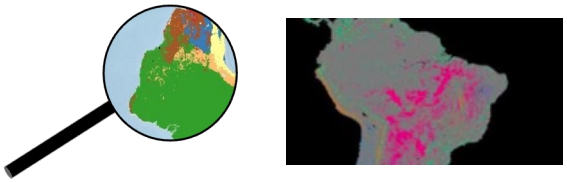
# What is a at the table: Four Challenges*



- Provide tools to access data, assess provenance and reproducibility, to
- support smart integration across scale and different resolutions, which
- assist interpretation, and
- support communication!

*from the perspective of an environmental scientist doing science-policy communication

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*Anyone who believes in indefinite growth in anything physical, on a physically finite planet, is either mad or an economist.*

Kenneth E. Boulding