AMAZON WEEK
BERLIN - BRUSSELS - PARIS - 2024

Biodiversity and Biotechnology for Sustainable Development

Amazon Week, Brussels

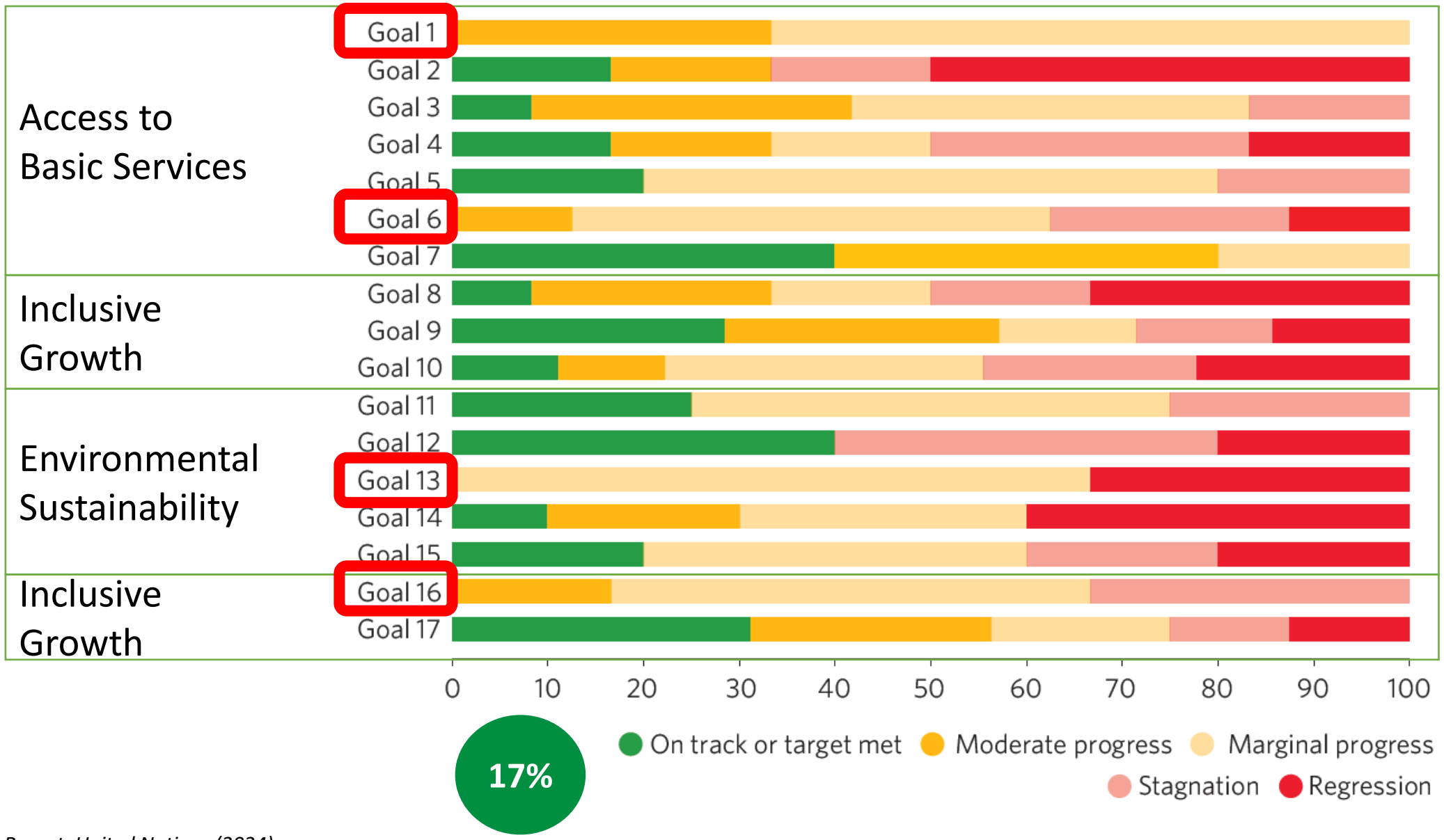
Eduardo do Couto e Silva
Director, Brazilian Biorenewables National Laboratory (LNBr)
Brazilian Center for Research in Energy and Materials (CNPEM)
September 25th ,2024

lnbr brazilian biorenewables national laboratory
CNPEM Brazilian Center for Research in Energy and Materials
MINISTRY OF SCIENCE TECHNOLOGY AND INNOVATION
BRAZILIAN GOVERNMENT BRASIL UNITING AND REBUILDING

The world is off track to realize the 2030 Agenda

promote integrated frameworks

to address knowledge fragmentation



The Sustainable Development Goals Report, United Nations (2024)

The First Global Conference on Strengthening Synergies between the Paris Agreement and the 2030 Agenda for Sustainable Development, Denmark (2019)

Knowledge Fragmentation and the Global Environmental Crisis

Adapted froom UNEP Annual Report (2023)

Bio-based industrialization

climate emergency

pollution

defossilization

circularity

Reforestation

ecosystem degradation

ecosystem balance

Knowledge Integration for the Ecological Transition

International Partnership

CNPEM Centro Nacional de Pesquisa em Energia e Materiais · CHALMERS UNIVERSITY OF TECHNOLOGY · University of Exeter

Restoration of ecosystems (carbon storage)

Biomass for biorenewables (fossil substitution)

Synergy and trade-offs are central elements

Agroforestry systems (social equity)

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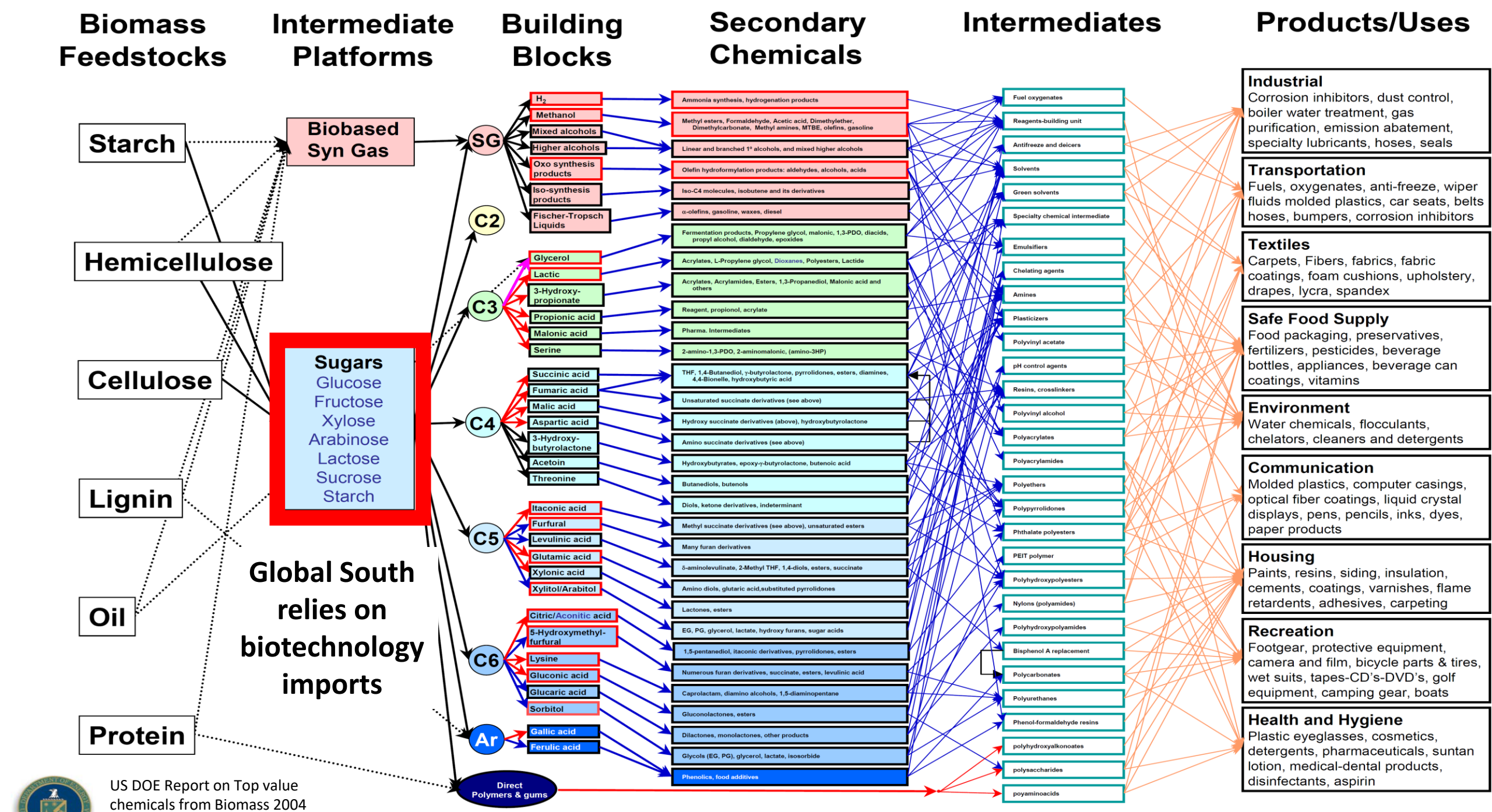
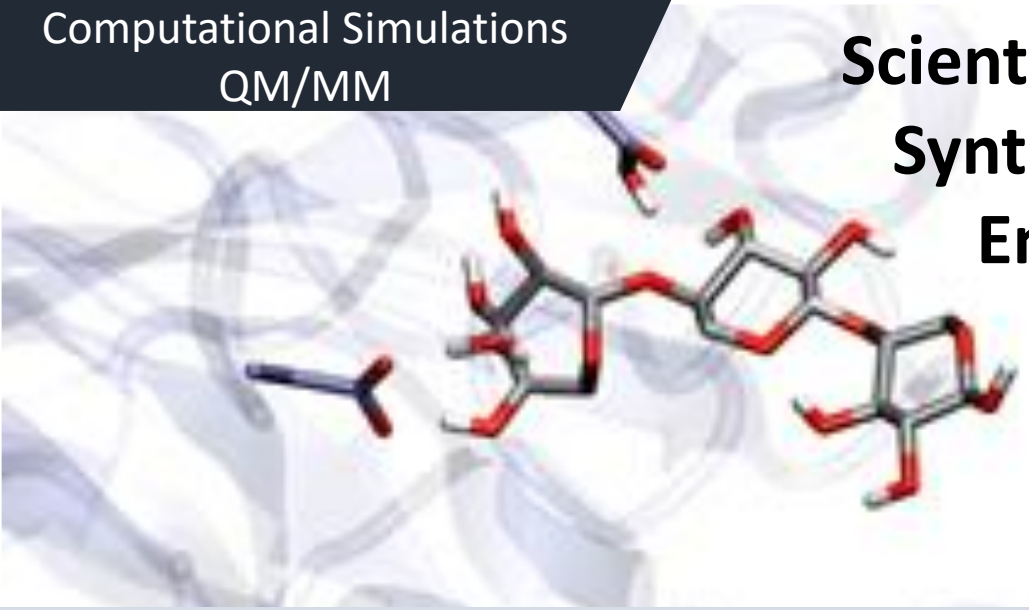
Padgurschi, M. et al Transforming Degraded Pasturelands: A Multifunctional Landscape Approach to Curb Climate Change and Enhance Biodiversity, Nature Sustainability (2024) – under review

Central elements for bio-based industrialization
Technology & Renewable feedstocks



US DOE Report on Top value chemicals from Biomass 2004

Computational Simulations
QM/MM



Scientific Computing
Synthetic Biology
Engineering

Scaling-up

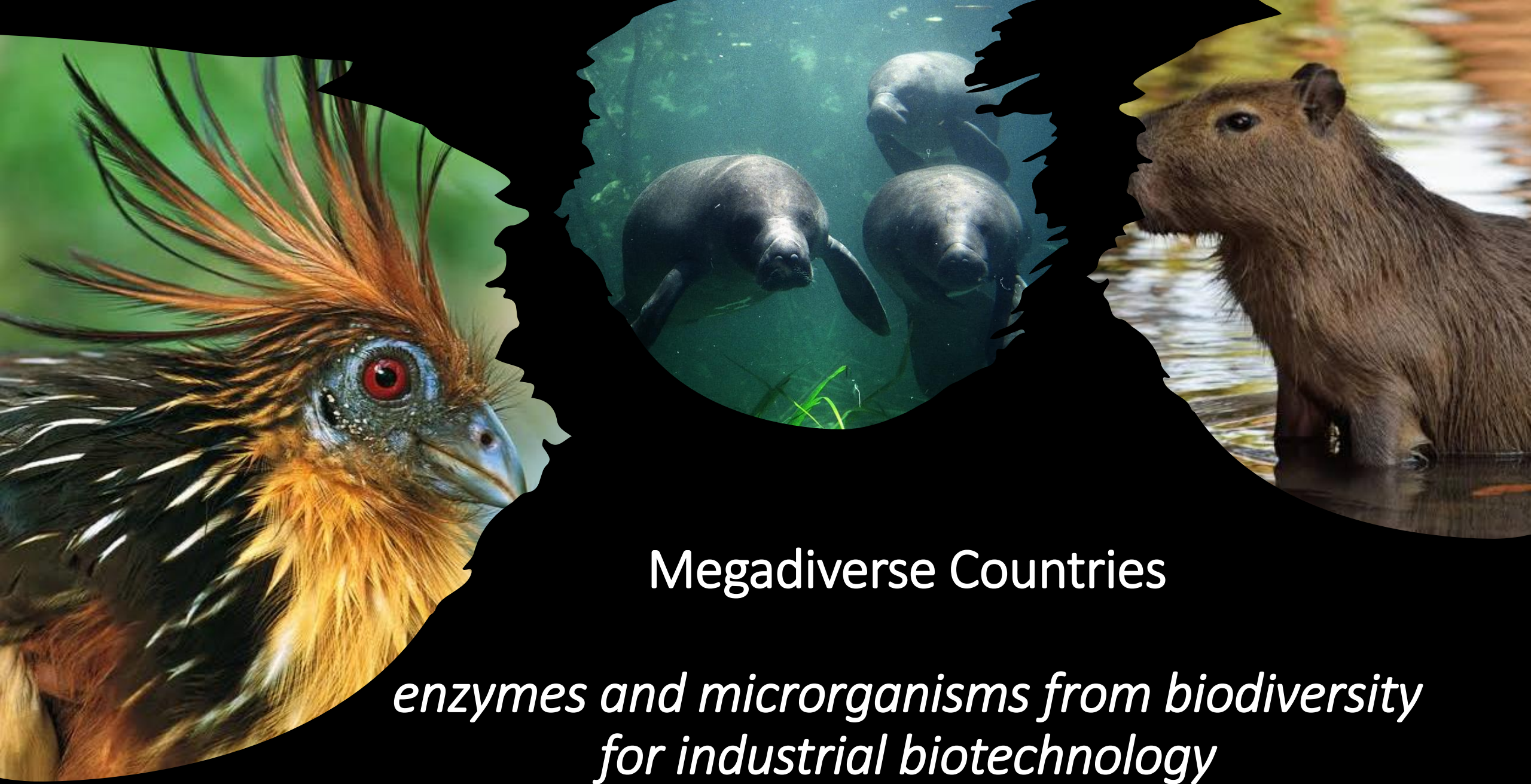
CNPEM approach to advanced biofuels and biochemicals

multiscale and multidisciplinary R&D to design, control and scale-up **complex biological systems**

Cryomicroscopes

open-acess facilites free of charge for academic use

Sirius

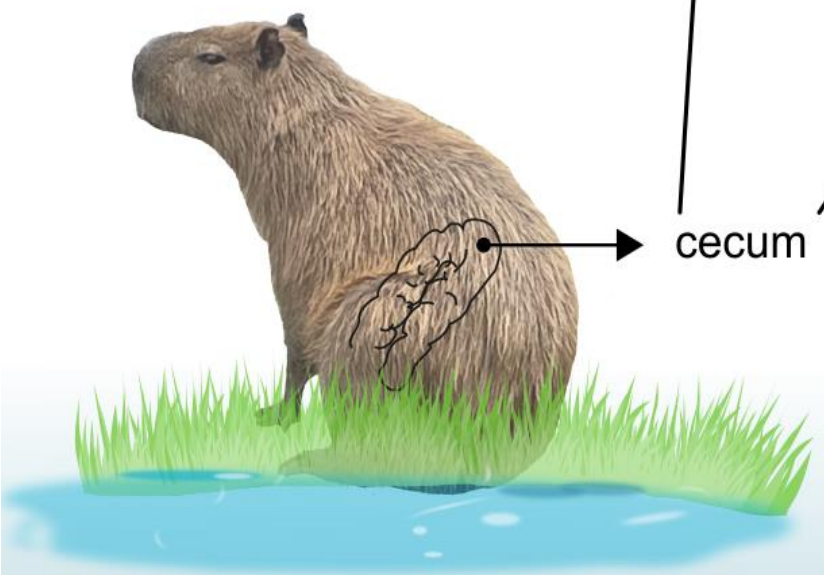


Megadiverse Countries

enzymes and microrganisms from biodiversity for industrial biotechnology

Capybara
(eats sugarcane)

Microbiome as source of enzymes



Cabral L et al, ***Nature Communications. 2022,*** *13(1):629*

International Collaboration

CNPEM UNICAMP DTU cnrs

Fibers need to be depolimerized

Main degraders of dietary fibers

Fibrobacteres (cellulose) + **Bacteroidetes (hemicelullose and pectin)**

New enzymes with biotechnological potential

biofuels

Food and beverages

Multidisciplinary approach

Metagenomics e metatranscriptomics – structure and composition of microbial community and their enzymes

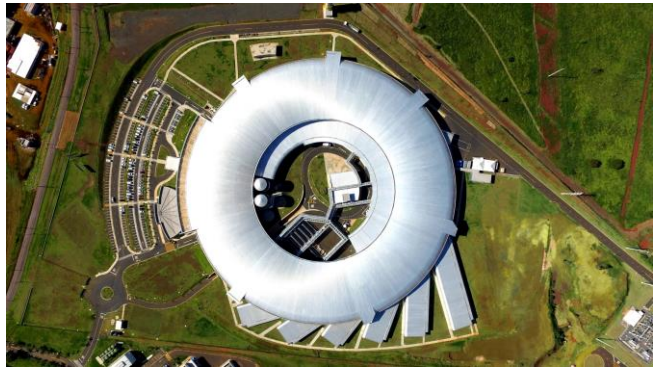
Metabolomics – routes to convert sugar in energy

Synchrotron – structure of new enzymes

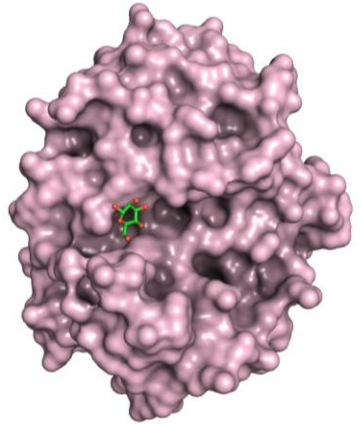
Microrganisms and Enzymes from Amazon Biodiversity

__Enzyme__ from the microbiome of __manatee__ has the potential to valorize __residues of local value chains__

INPA
INSTITUTO NACIONAL DE PESQUISAS DA AMAZÔNIA
UNIDADE DE PESQUISA DO MCTI



Sirius



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ORGANIZAÇÃO SOCIAL DO MCTI

Industrial Biotechnology Platform
(LNBR/CNPEM/MCTI)

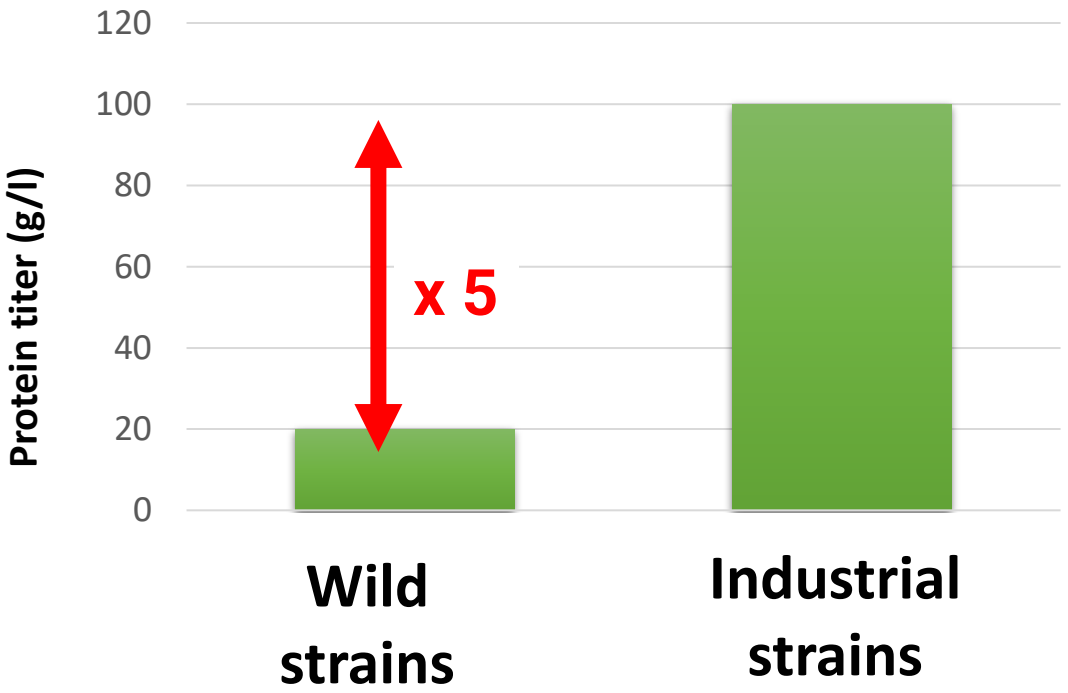
Mapping the Brazilian Genetic Heritage

Biomanufacturing and Industrial Biotechnology

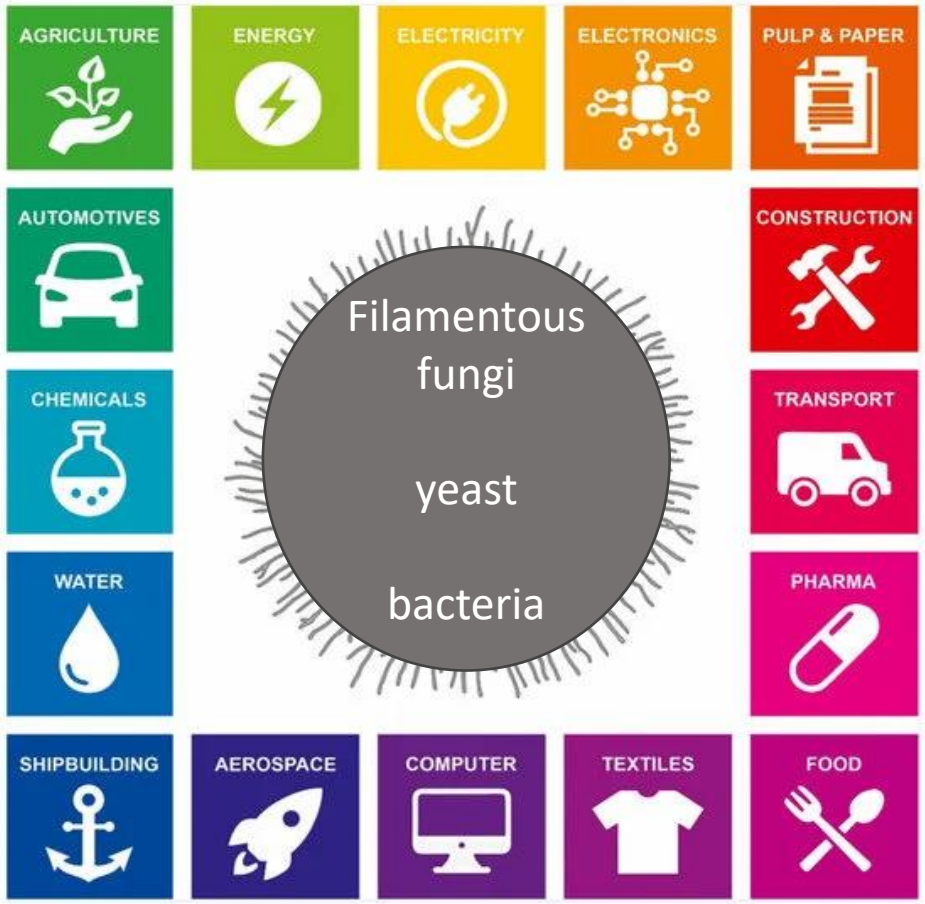
Challenge

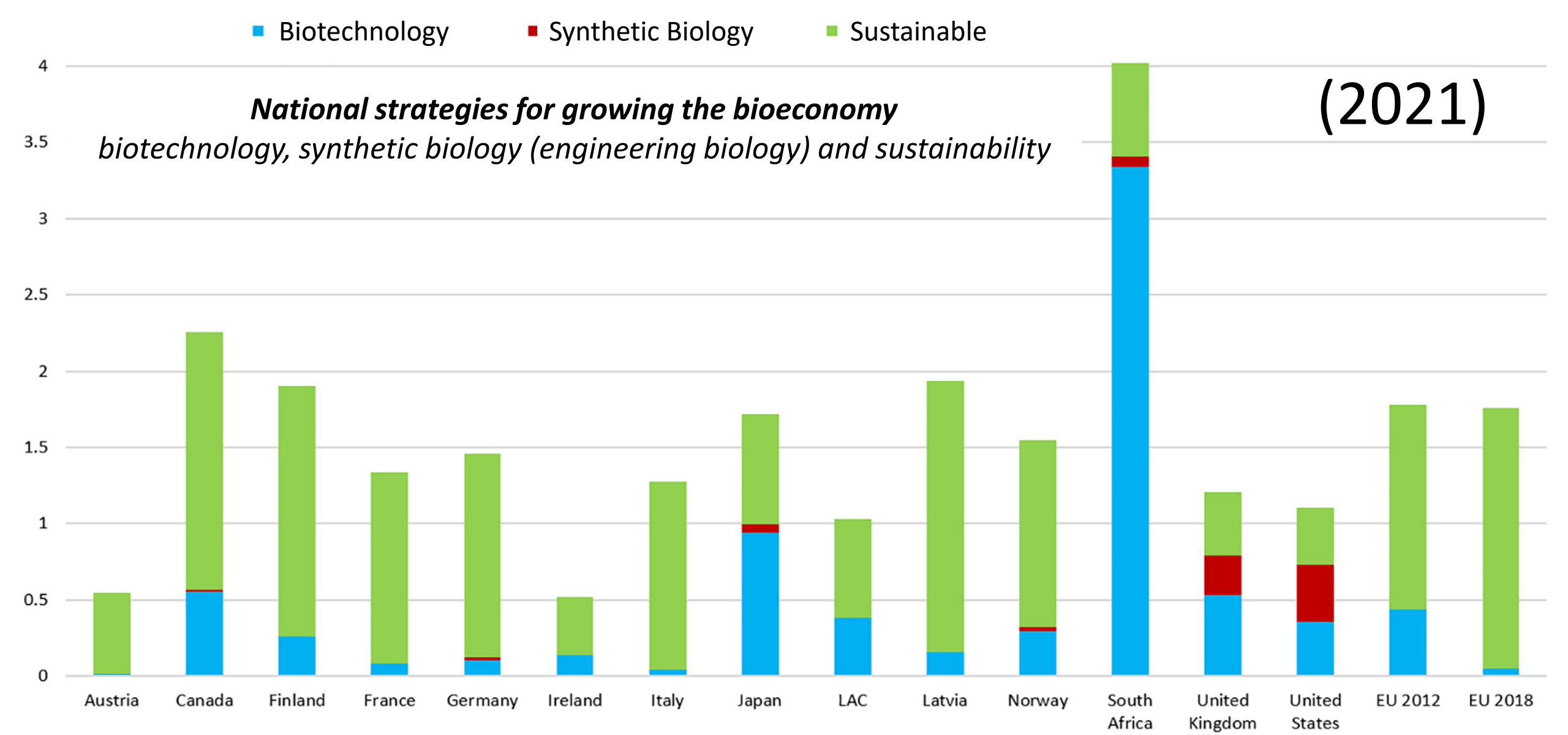
... that can be addressed by synthetic biology

Microrganisms found in Nature **produce low enzyme rates** for industrial applications



Adapted from Cairns, T. *et al, J. Fungi* **2021**, *7*(7), 535;





Is there a risk to increase R&D asymmetries between Global North and South?

Bell, J. et al, Engineering Biology, Volume: 5, Issue: 2, Pages: 21-34, First published: 16 June 2021, DOI: (10.1049/enb2.12008)

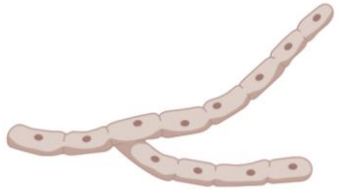
Bioprospection

New microbe from biodiversity

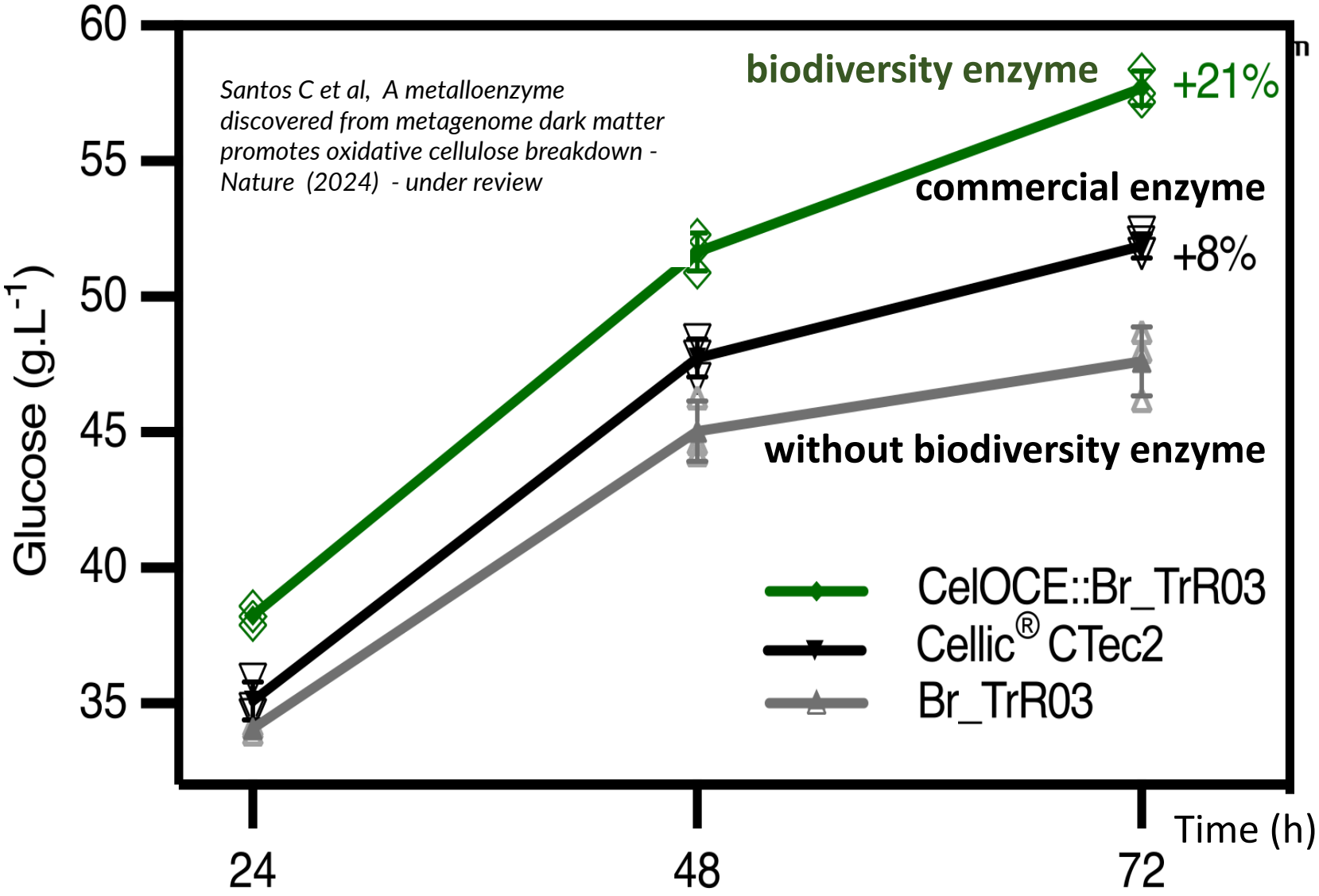
Telluricellulosum braziliensis
(pending registration)

Novel enzyme
(CelOCE)

Synthetic Biology



Fungal strain co-expressing new enzyme (CelOCE)



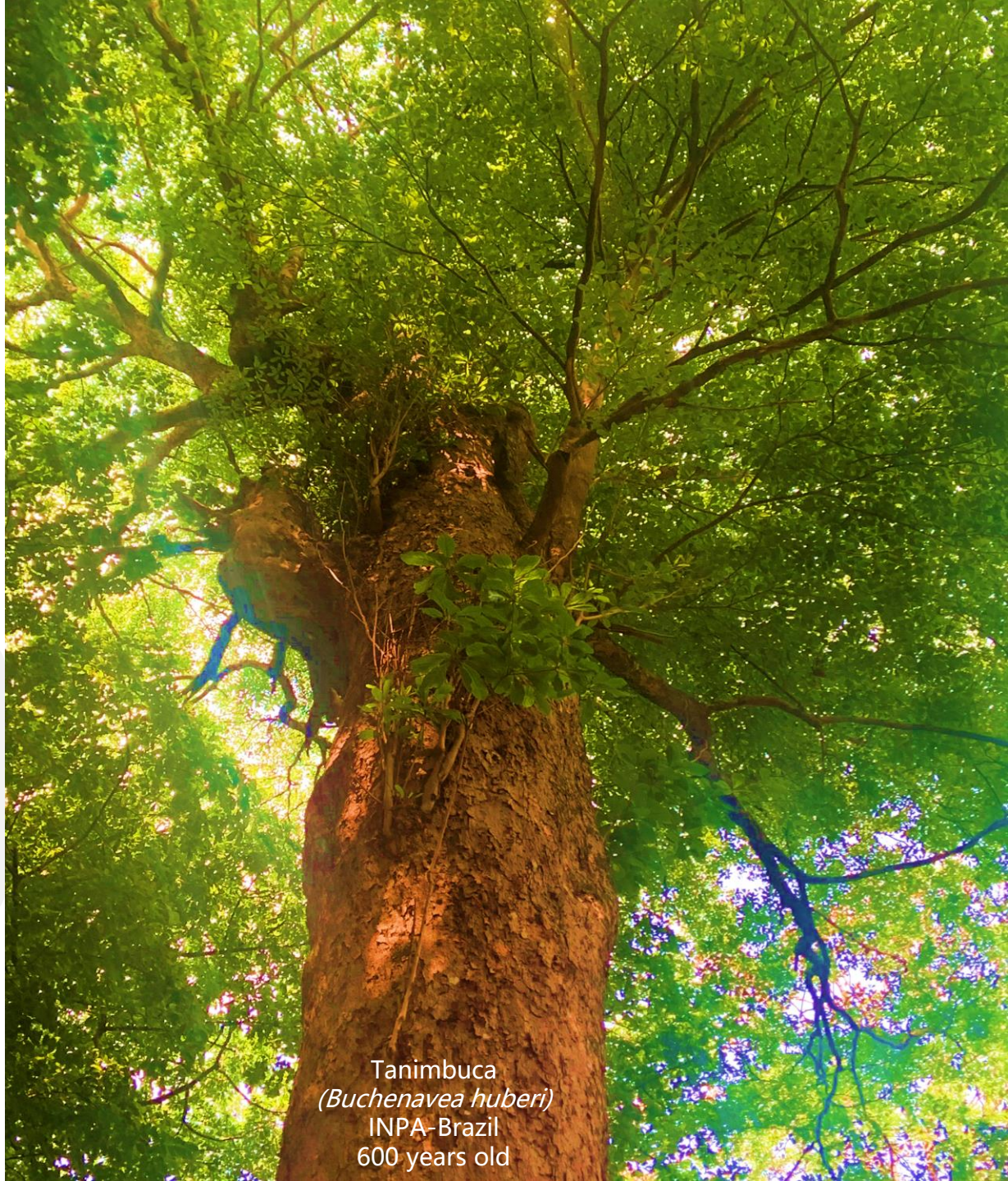
Brazilian sugar platform enhanced by biodiversity enzyme

(for production of renewable hydrocarbons and biofuels)

Take-Home Messages

Restoration of equilibrium of **ecosystems** and **bio-based industrialization** can **integrate biodiversity knowledge** while dealing with the global environmental crisis

We may be witnessing a **biorevolution** that will lead to **new industrial production and consumption models, but** that should not increase the divide between North and South



Tanimbuca
(Buchenavea huberi)
INPA-Brazil
600 years old

Thank you

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