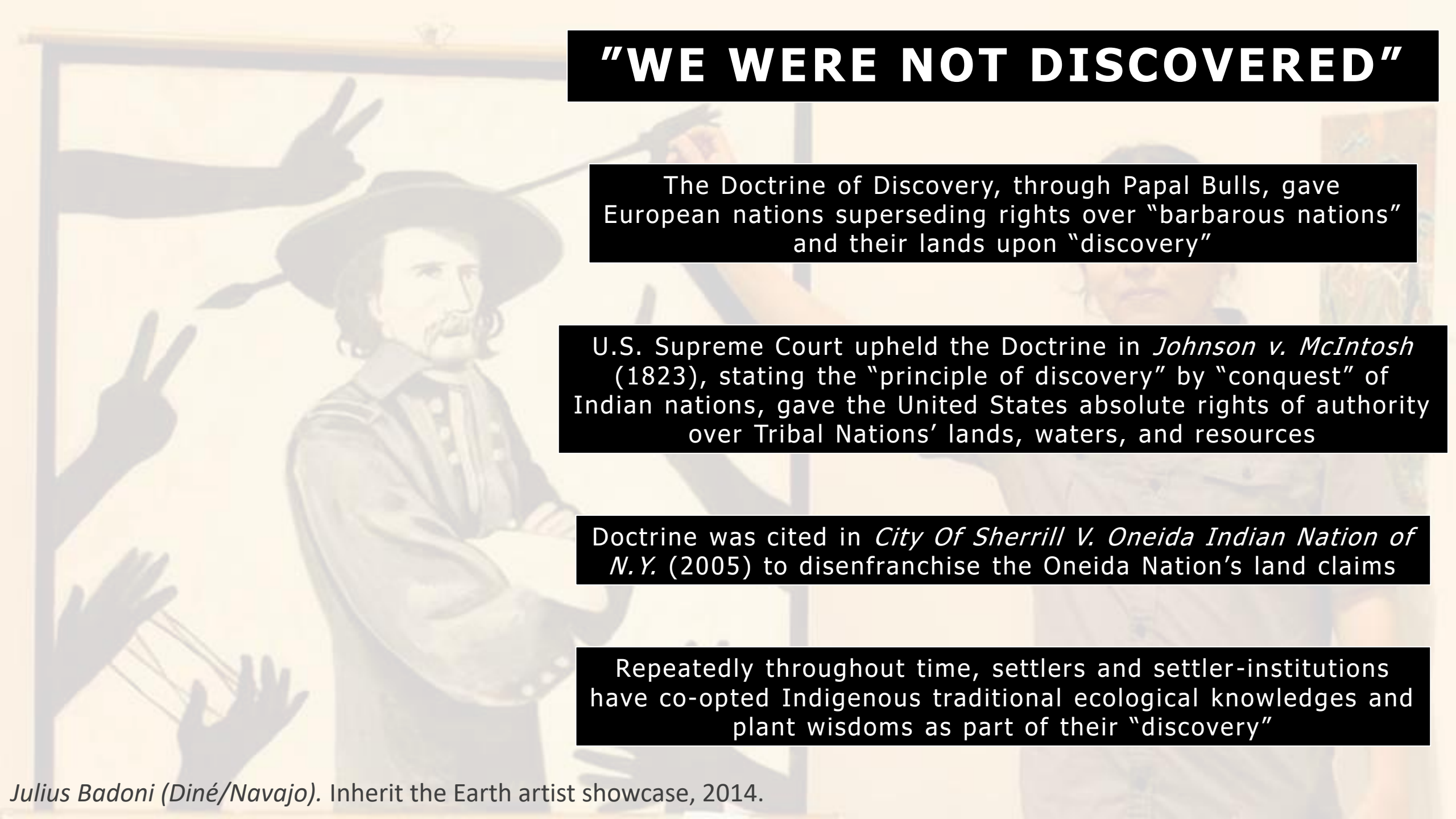




Appropriated Indigenous Intelligences

KRYSTAL TSOSIE, PHD, MPH, MA



"WE WERE NOT DISCOVERED"

The Doctrine of Discovery, through Papal Bulls, gave European nations superseding rights over "barbarous nations" and their lands upon "discovery"

U.S. Supreme Court upheld the Doctrine in *Johnson v. McIntosh* (1823), stating the "principle of discovery" by "conquest" of Indian nations, gave the United States absolute rights of authority over Tribal Nations' lands, waters, and resources

Doctrine was cited in *City Of Sherrill V. Oneida Indian Nation of N.Y.* (2005) to disenfranchise the Oneida Nation's land claims

Repeatedly throughout time, settlers and settler-institutions have co-opted Indigenous traditional ecological knowledges and plant wisdoms as part of their "discovery"

Biocollections and Biopiracy

Much of biology is rooted in the colonial act of “discovering” natural specimens and **collecting them in museums and biocollections** for the sake of science.

Often these collections claim credit for medicinal and plant knowledges from enslaved Africans and Indigenous peoples but attribute that science to naturalists instead.

“Gilded Canopy” – mural depicting plants that fueled the British Colonies

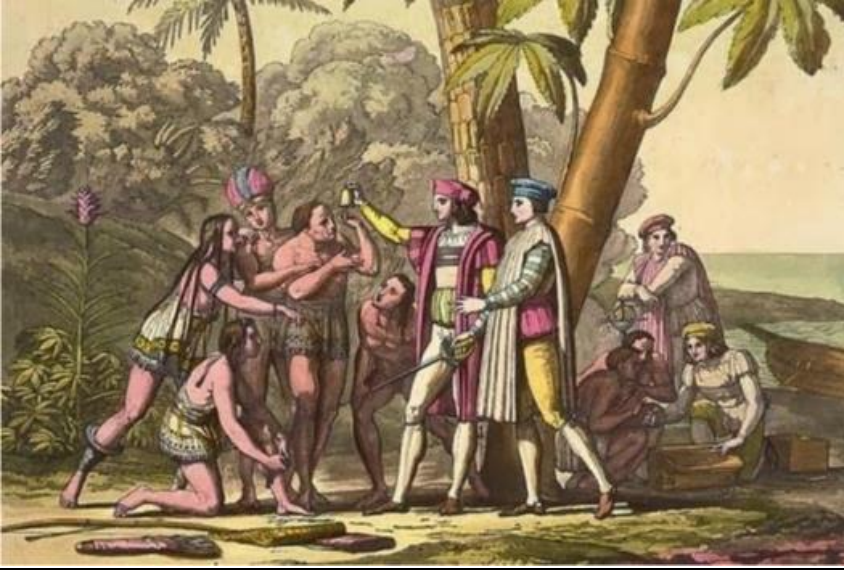
SCIENCE NEWS

Are natural history museums inherently racist?

By Josh Davis

First published 16 July 2019

Das, S. & Lowe, M. (2018). Journal of Natural Science Collections



Pre-Settler-Colonial State

- Estimated 30,000 edible plant species worldwide
- Indigenous agrisystems considered “**backwards**” or “**primitive**”
- Many cash crops and medicines from colonized lands and knowledges



Green Revolution

- Only 30 plant species constituting majority of diets
- 60% biodiversity loss
- Contributing to 1/3 of greenhouse gas emissions
- Degrading local ecosystems
- Inequities: power, wealth concentrated by corporations



“Rescue” Indigeneity

- Indigenous knowledges “**key**” to sustainability
- Seeds and varieties stewarded by Indigenous peoples deposited in global seedbanks and used from museums
- Gene editing approaches on the horizon to reintroduce biodiversity



Open Data for "Everyone"

In order to advance
biomedicine...
we need more data that is
freely accessible.

However, unethical research conduct involving collection of data and knowledges from Indigenous communities has strained trust relationships, resulting in **Indigenous nation policies that restrict open data sharing**



An aerial photograph showing a coastline. On the left, there's a sandy beach meeting the ocean. To the right of the beach is a vast, dense forest covering a hillside. The sky is overcast with soft, grey clouds. The entire image is framed by a thin white border.

Comprising less than 5% of the world's population,
Indigenous people protect 80% of global biodiversity.

The next genomic "discoveries" may co-opt Indigenous knowledges or disenfranchise Indigenous peoples, who are often last to benefit and are least protected from intellectual property claims.

For Whose Benefit?

PHASE 1

Collect
Indigenous
Genetic
Knowledge

PHASE 2

?

PHASE 3

~~Community
Benefit~~
Profit

**If Indigenous peoples are not benefiting from
their traditional knowledges, then who is?**

Equity entails ensuring that benefits are distributed fairly

French institute agrees to share patent benefits after biopiracy accusations

Malaria scientists patented a new drug without acknowledging the contribution of indigenous populations from French Guiana

10 FEB 2016 • BY [ELISABETH PAIN](#)



Simalikalactone E (SkE) isolated by the Institute of Development Research (IRD) in France from *Quassia amara*.

Scientists learned of the traditional antimalarial after interviewing Kali'na, Palikur, and Creole communities.

Published 2009 on its therapeutic activity

Granted patent from the European Patent Agency in 2015 without attribution

The failure by IRD researchers "to obtain the prior and free consent of their informants raises some ethical issues.... In a postcolonial context, it is time for actors to respect each other."

White Sage: Cultural Appropriation

“The sale of Native spirituality is easily a million dollar industry—not even including all the culture vultures and white shamans who sell fake ceremony.

Who is benefitting from the sale of these products? Not Native peoples.

- Adrienne Keene, EdD (Cherokee Nation), Brown University



Walmart · Out of stock
Sage Spirit Smudge Wand ...



Environment

The White Sage Black Market

As “smudging” has been appropriated from Native American use, the selling of sage offers a cautionary tale for the wellness economy—one where the intentions of users can be subverted by suppliers, and many sellers have no idea of their impacts.

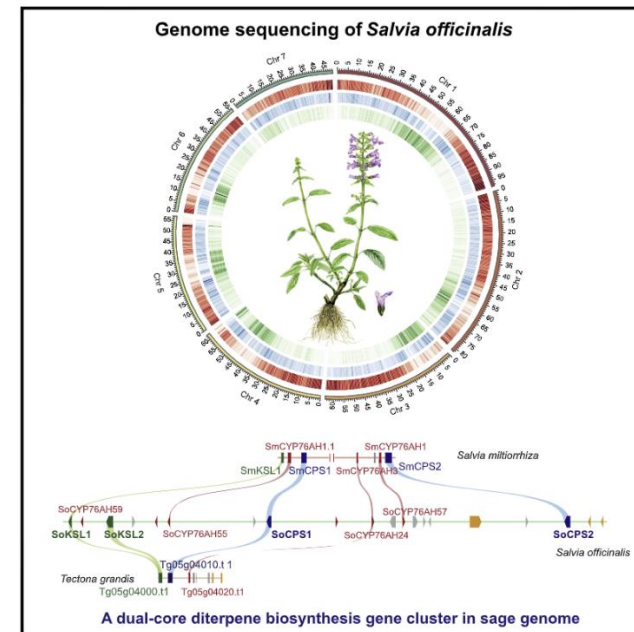
KD By Kimon de Greef

TS Photos By Todd Seelie

Cell Reports

The sage genome provides insight into the evolutionary dynamics of diterpene biosynthesis gene cluster in plants

Graphical abstract



Highlights

- A chromosome-level genome of *Salvia officinalis* is presented

Authors

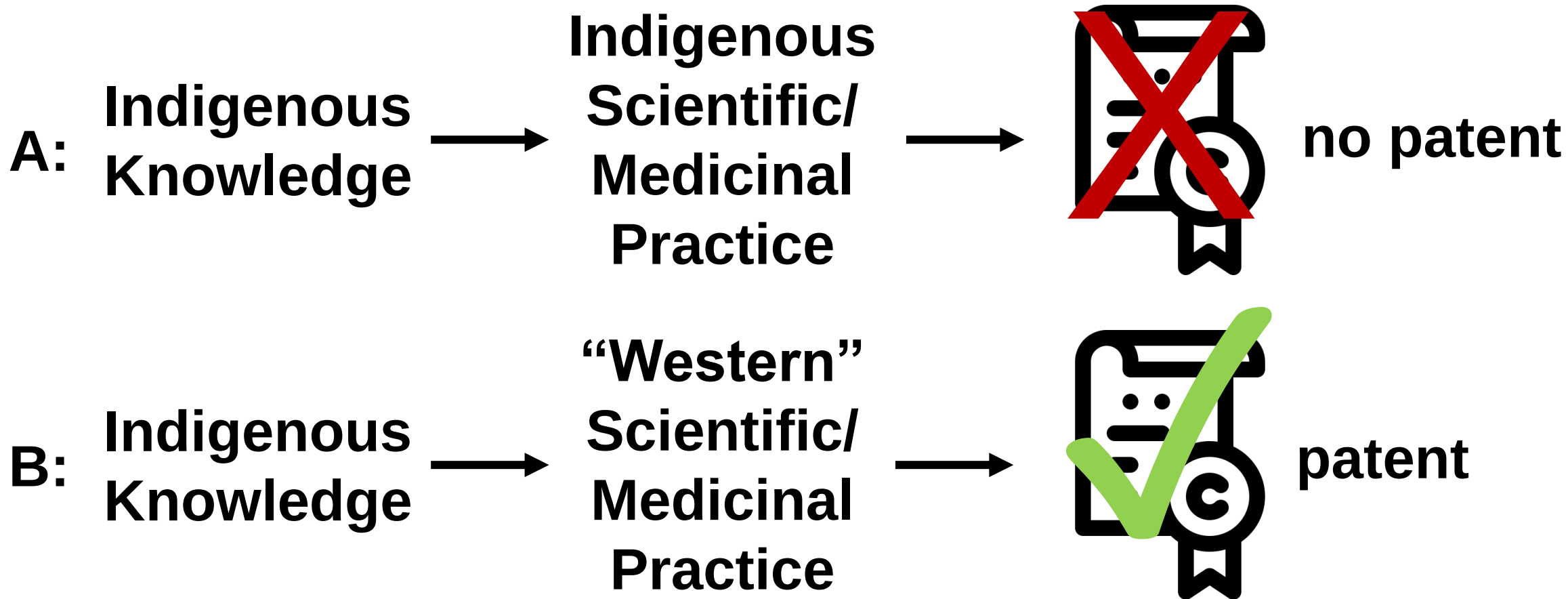
Chen-Yi Li, Lei Yang, Yan Liu, ..., Yi-Jing Zhang, Cathie Martin, Xiao-Ya Chen

Correspondence

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In brief

Li et al. report a chromosome-level genome of *Salvia officinalis* (sage), a widely cultivated plant for medicinal, ornamental, and culinary usages. They identify a biosynthetic gene cluster (BGC) harboring two sets of genes responsible for production of either root or shoot diterpenoids, indicating growth type-associated evolution of BGC.



The path to rights and attributions is unequal and unilaterally benefits one system.



UNIVERSITIES

Bayh-Dole Act (1980) permits ownership by universities of inventions resulting from federally-funded research.
Can have large legal teams.

CORPORATIONS

Can have large legal teams.
Can access publicly available datasets and keep data private.

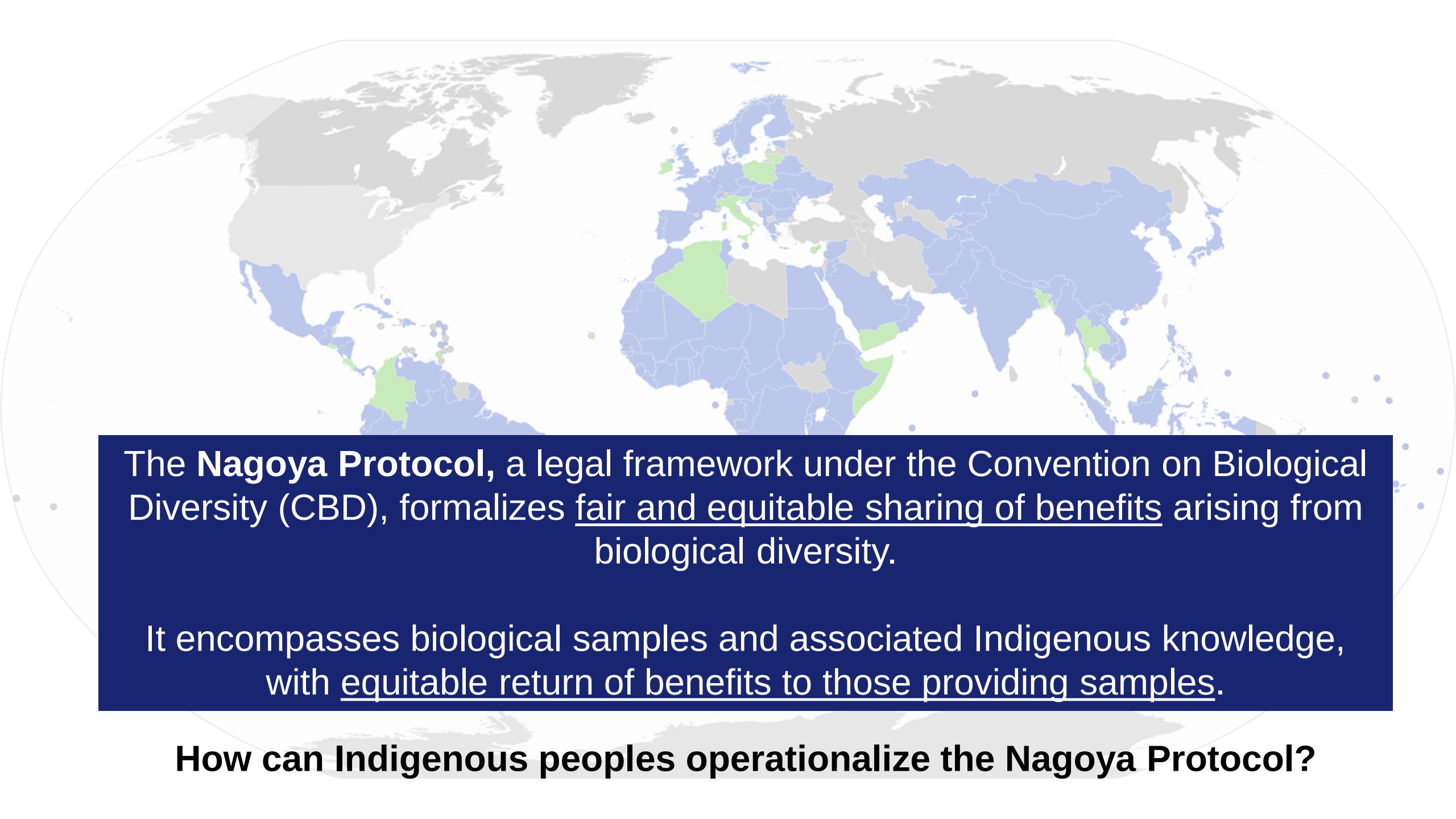
INDIGENOUS PEOPLES

Existence may not be legally recognized by colonial government.
“Ownership” may be incongruent with Indigenous stewardship.
“Novelty” of Indigenous associated genetic knowledge hard to prove.
Requires legal capacity.

INDIGENOUS GENOMIC DATA SOVEREIGNTY

The right of Indigenous nations and people to exercise autonomy to protect their interests related to genomic data.

This “sovereignty” is intrinsically-defined, and not colonially-defined.



The **Nagoya Protocol**, a legal framework under the Convention on Biological Diversity (CBD), formalizes fair and equitable sharing of benefits arising from biological diversity.

It encompasses biological samples and associated Indigenous knowledge, with equitable return of benefits to those providing samples.

How can Indigenous peoples operationalize the Nagoya Protocol?



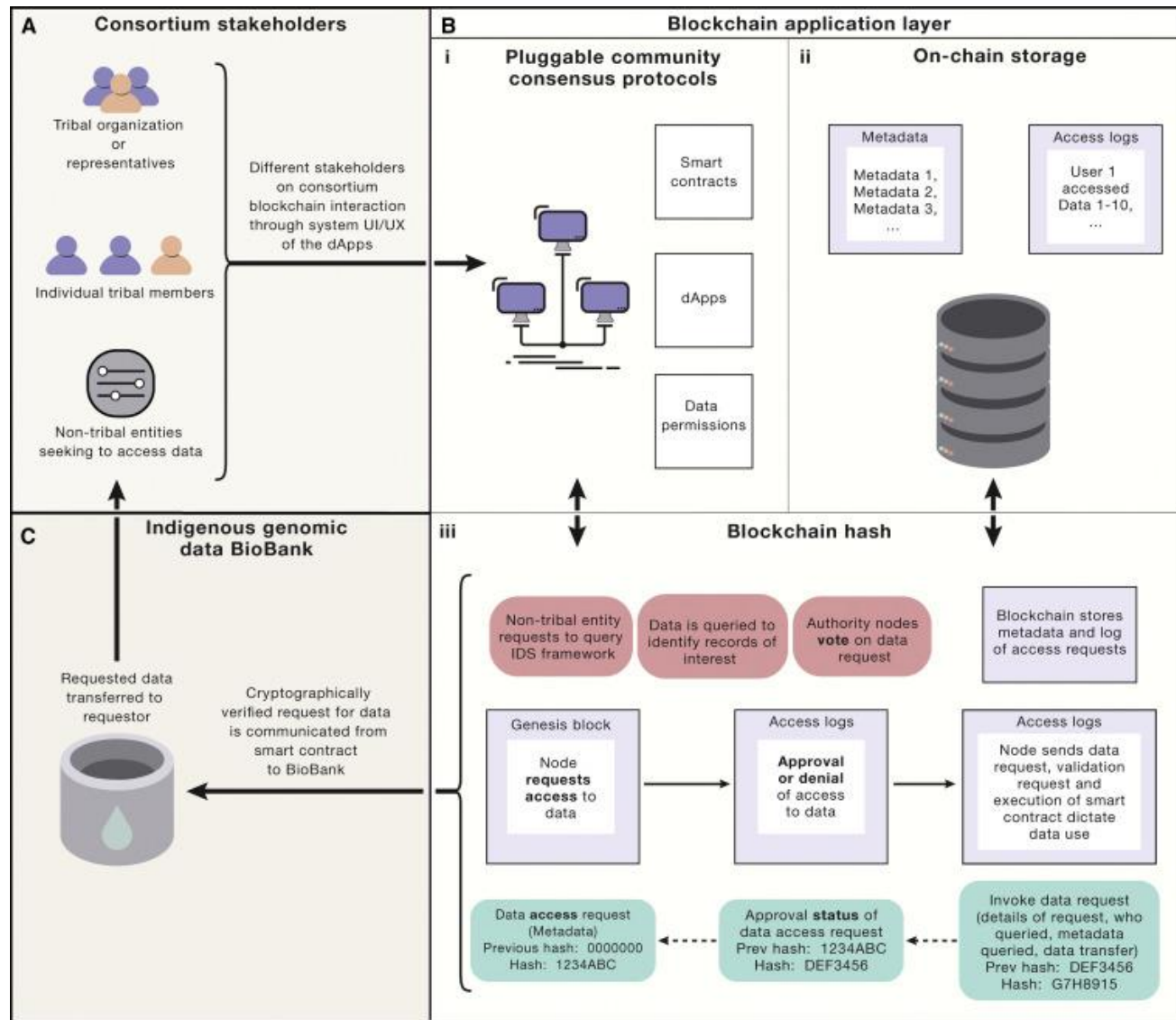
Native BioData
consortium

DIGITAL TOOLS TO PROTECT INDIGENOUS GENOMIC DATA SOVEREIGNTY

- ✓ **Blockchain.** A distributed ledger system that tracks sharing via transactions, can fine-tune user access, attribute provenance, and facilitate data governance.
- ✓ **Federated learning.** To facilitate secure and community-consented data sharing.
- ✓ **Traditional Knowledge (TK) Labels.** Digital markers that define attribution, access, and use rights for Indigenous cultural heritage
- ✓ **Biocultural (BC) Labels.** Digital markers for provenance, transparency and integrity in research engagements related to community expectations and consent for use of collections and data.



Native **BioData**
consortium



Establishing a blockchain-enabled Indigenous data sovereignty framework for genomic data

Tim K. Mackey^{1 2 3 4}, Alec J. Calac^{3 5 6}, B S Chenna Keshava⁷, Joseph Yracheta⁸, Krystal S. Tsosie⁸, Keolu Fox^{1 8 9}  

Blockchain: a distributed ledger that cryptographically links “blocks”, or transactions

Indigenous members act as “authority nodes” with ability to access the network, accept or reject transactions, and view history of transactions.

External, non-Indigenous members have read only access of metadata to query.

Indigenous genomic bio-database administers governance, storage, security per community rules.

An example:



IndigiDAO: Bringing Blockchain to Indigenous Communities

IndigiDAO founder Henry Foreman believes blockchain technology can be used to help authenticate handcrafted work made by Indigenous artisans.

By David Z. Morris ⌚ Oct 14, 2022 at 9:26 a.m. MST

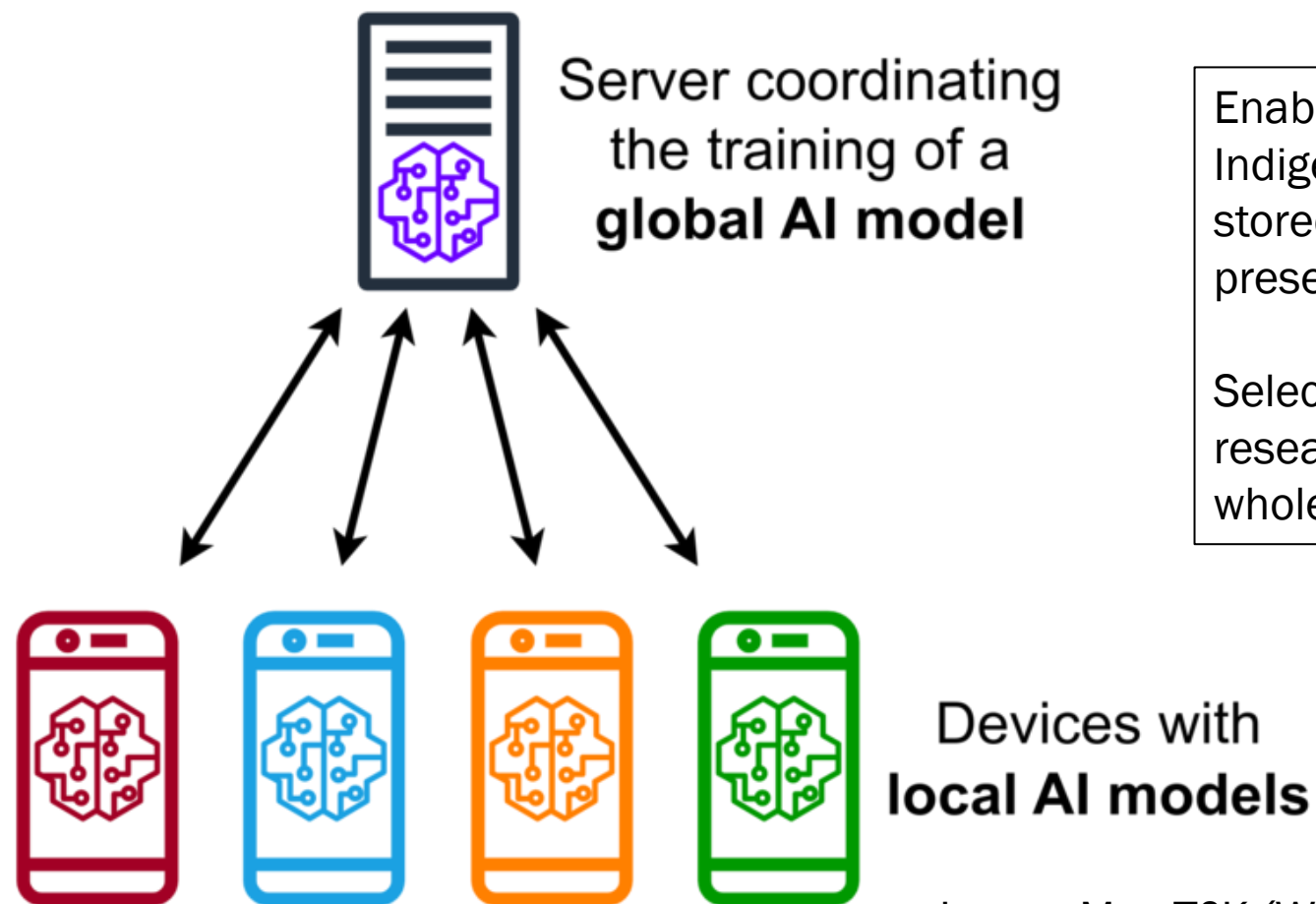
“It’s a big issue – people making fake Indigenous art, jewelry, copying designs.... Our traditional makers aren’t making enough income, aren’t being [properly] valued in the traditional marketplace.”



Henry Foreman, founder of IndigiDAO and program manager at New Mexico Community Capital. (Google/YouTube)

Federated learning and Indigenous genomic data sovereignty

Nima Boscarino, Reed A. Cartwright, Keolu Fox & Krystal S. Tsosie



Enables the ability to train algorithmic models on Indigenous genomic community-held data that is stored and governed on independent nodes, while preserving privacy and access rules.

Selectively restricts data access to external researchers to parts of genomes, metadata or whole sequences.

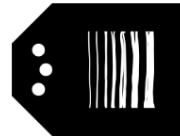
Image: MarcTOK (WikiMedia)

Local Contexts recognizes the inherent sovereignty that Indigenous communities have over knowledge and data that comes from their lands, territories, and waters.

Local Contexts Labels and Notices were created to ground intellectual and cultural property rights in cultural heritage, data, and genetic resources within digital environments.

Indigenous communities

reinforce rights by applying TK and BC Labels



Traditional Knowledge (TK) and Biocultural (BC) Labels establish Indigenous cultural authority and governance over Indigenous data and collections by adding **provenance** information and contextual metadata (including community names), **protocols**, and **permissions** for access, use, and circulation.



BC Multiple Communities (BC MC)

Why Use This Label?
This Label should be used to indicate that multiple communities have responsibility, custodianship and/or ownership over the geographic regions where this species or biological entity originates/is found. This Label recognizes that whilst one community might exert specific authority, other communities also have rights and responsibilities for use and care.

BC Label Template Text
This Label is being used to affirm responsibility and ownership over this information, collection, data and digital sequence information is spread across several distinct communities. Use will be dependent upon discussion and negotiation with multiple communities.

Unique ID: BC00000000

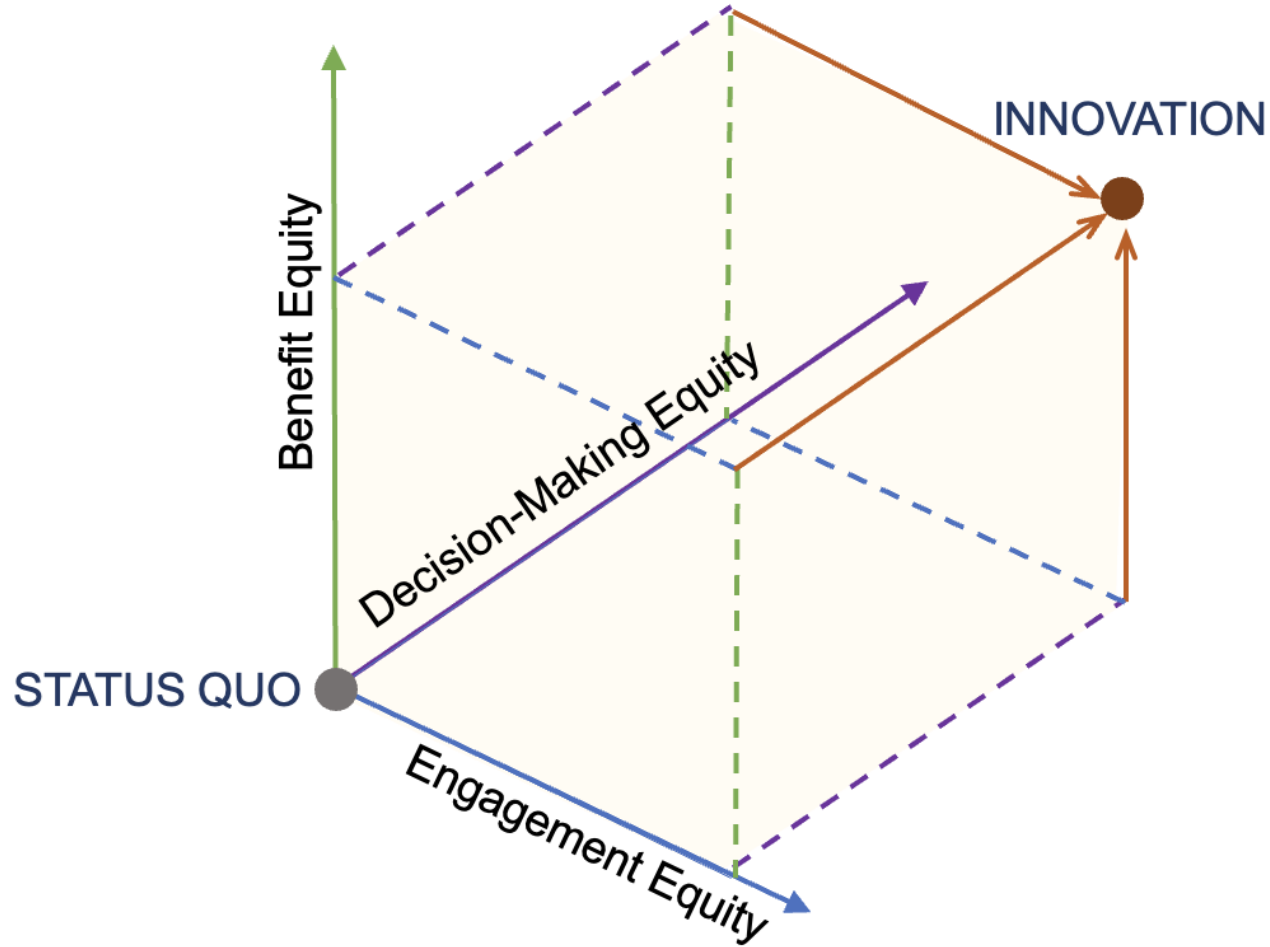
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GTCGCCCCGAGACGGTGCTTGTGCGGGCGGTGCTGCGACACGCGCATCTGAAAGACTCTCGGCAAC...

ENSURING DATA DIRECTLY BENEFITS INDIGENOUS PEOPLES

- Indigenous Data Repositories
- Indigenous-Trained Data Experts
- Using AI/ML for Cultural and Language Preservation
- Expanding Broadband Capacity to Ameliorate Digital Divide
- Indigenous Cloud Solutions



- We can no longer ask for Indigenous data without calling for more proximate benefits
- Ensure Indigenous nations are equally empowered for intellectual property claims



Tsosie (unpublished)

If we truly want to drive INNOVATION and EQUITY, we need to advance equity along all 3 dimensions.

Equity is both a process and an outcome.

Equity involves uplifting Indigenous data sovereignties and rising against power dynamics to ensure equitable opportunity and access for Indigenous communities.



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Tsosie Lab for Indigenous Genomic Justice