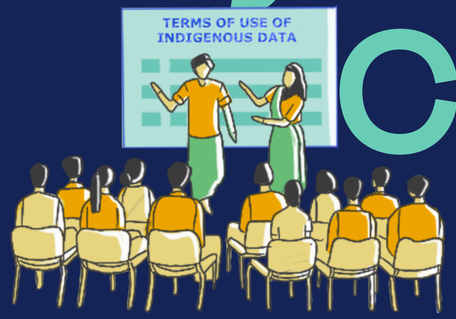
AI + Climate Futures in Asia

Indigenous Knowledge Systems & AI-based Climate Action



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Indigenous knowledge systems and AI-based climate action

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1 The Asian Context

Can traditional ecological knowledge and Indigenous data sovereignty contribute to AI-powered climate action while respecting Indigenous rights?

Indigenous Peoples (IPs) have lived in partnership with their lands and territories[1] from time immemorial.

Several non-homogenous groups across Asia are connected to their environments through ways of knowing coded within their cultural practices.

Their reverence for environmental conservation is a unifying principle and defines their identity as Indigenous Peoples, which is enshrined in their rights under the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).

Under the UNDRIP, IPs have a sovereign right to self-determination – to uniquely define their indigeneity and sovereignty as peoples united by cultural beliefs that promote a holistic understanding of nature, which in turn allows for mutual respect, responsibility, and reciprocity.

Indigenous languages and ways of knowing acknowledge kinship relationships within their communities that extend to other "beings" in their environment, such as animals and plants, wind and rocks, and mountains and oceans.

Thus, "Indigenous languages and protocols enable them to engage in dialogue with non-human kin, creating mutually intelligible discourses across differences in material, vibrancy, and genealogy."[2]

As such, discussions on artificial intelligence (AI) —a non-sentient "being"—need to critically interrogate the absence and invisibility of IP knowledge pertaining to conservation and climate action, which have helped preserve the last remaining intact forest landscapes of our planet, within AI systems.[3]

1 In reference to Indigenous Peoples' the term 'lands and territories' imply; 'land' as the rights of individuals and 'territory' as the rights of a peoples' (collectively), this is uniquely linked to ways in which Indigenous Peoples identity are defined.

2 Lewis, E. L., Arista, N., Pechawis, A. & Kite, S. (2018). *Making Kin with the Machines. Journal of Design and Science.* https://doi.org

3 Fa, J. E. et.al. (2020). *Importance of Indigenous Peoples' Lands for the Conservation of Intact Forest Landscapes.* Frontiers in Ecology and the Environment, 18(3): 135–140, https://doi.org

Traditional Ecological Knowledge

Traditional ecological knowledge (TEK) systems held by Indigenous Peoples have been largely dismissed by national governments and international bodies, which typically rely on a Western-centric scientific model of conservation that promotes disciplinary silos and knowledge "exclusivity."

This approach perpetuates discourses of economic development and frameworks of environmental conservation predicated on the absence of human influences on ecosystems – that is, where humans and nature are viewed as separate entities.[4]

However, the demonization of Indigenous knowledge, such as particular agricultural practices—particularly migratory and subsistence farming—is common in Asia. These practices are construed to be responsible for low productivity and environmental degradation, which contribute to negative portrayals of IPs.

TEK has been "decontextualized" to justify the replacement of IP by others who are supposed stewards of the land and natural environment, often with unsustainable, large-scale agro-industrial monoculture. In the Mekong region, park and forest rangers removed IP communities and forcibly prevented them from re-entering their traditional territories.[5] According to Roth (2008), the strict delineation of protected areas and exclusion zones in Thailand's forests has produced the most conflict between IPs and the state.[6]

Although recent studies acknowledge the importance of holistic ecological integrity across landscapes,[7] IPs' worldviews are still excluded, despite TEK's long-standing understanding of the reciprocal nature of ecosystems. The ability of an ecosystem to withstand and recover from both natural dynamics and anthropogenic stressors is highly dependent upon the interconnection of all ecosystem elements.

However, existing climate science and conservation efforts only address singular issues, and this is also true of the technology development sector[8] where the majority of AI-based climate solutions have been similarly narrow in scope.

The demonization of TEK is reflected in existing trajectories of climate-focused AI development, which increasingly highlight exclusionary and harmful practices without considering the respect, responsibility, and reciprocity with which environmental systems function as a whole as they strive to achieve equilibrium.

4 Adams, W. & Mulligan, M. (2003). *Decolonizing Nature: Strategies for Conservation in a Post-colonial era*. Management of Environmental Quality, 15(1): 81-81, https://doi.org.

5 Domínguez, L., & Luoma, C. (2020). *Decolonising Conservation Policy: How Colonial Land and Conservation Ideologies Persist and Perpetuate Indigenous Injustices at the Expense of the Environment*, EconPapers, 9(3): 1–22, https://EconPapers.repec.org.

6 Roth, R. (2008). *"Fixing" the Forest: The Spatiality of Conservation Conflict in Thailand, Annals of the Association of American Geographers*, 98(20): 373–391, https://doi.org.

7 Elsen, P. R et. al. (2023). *Priorities for Embedding Ecological Integrity in Climate Adaptation Policy and Practice*. One Earth, 6: 632–644, https://doi.org.

8 Rohit Nishant, Mike Kennedy, Jacqueline Corbett. (2020) *Artificial intelligence for sustainability: Challenges, opportunities, and a research agenda*. International Journal of Information Management. Volume 53, ISSN 0268-4012, https://doi.org.

Indigenous Data Sovereignty

In Asia, the integration of TEK into conservation approaches—let alone AI systems—without respect for IPs' sovereign rights over their knowledge and collective governance rights could exacerbate existing human rights abuses of IPs and further displace them from their territories. This is currently the practice across the Asian continent.

With an estimated IP population of more than 411 million,[9] the imperative to protect Indigenous knowledge systems is evident given their contribution to mitigating the climate crisis, its impact on their livelihoods, and the ongoing persecution of Indigenous environmental defenders.[10]

Indigenous Data Sovereignty (IDS) is a way to protect TEK and ensure that IPs have the right to control data and retain knowledge to protect their sovereign right to self-determination and the subsequent ability to govern and manage their lands and territories for the common good.

IDS refers to "Indigenous peoples' possession of the locus of authority over the management of data about their communities, territories, and ways of life."[11] In other words, it refers to how IPs control the ways in which such data are collected, manipulated, managed, and used by themselves and by governments, corporations, and development agencies.

IDS complicates the current understanding of data—which is based on Western notions of individual ownership and use through copyright and licensing—and directs attention to the power relationships and post-colonial dynamics in existing data agendas.

As such, all AI applications that use, house, and store data about IP individuals, collectives, resources, and environments should adhere to IDS principles and frameworks to respect and uphold IP data sovereignty.

The omission of TEK—often depicted as "prelogical" or "irrational" and thus incompatible with new technology[12]—from environmental governance is one of the primary means through which IPs continue to be divested of their rights. This process is likely to accelerate as AI becomes more central to climate mitigation. When information and communication technologies (ICT) are developed uncritically for environmental governance, they can widen the inequality gap between IP and mainstream communities, ultimately disenfranchising IPs even further.

More significantly, they can prevent us from accessing knowledge critical to tackling the climate crisis. Therefore, when we ask if AI can contribute towards climate policy, mitigation, and adaptation, we must consider how TEK integration into AI systems can strengthen and acknowledge the breadth of generations of Indigenous ways of knowing our environment.

Furthermore, we must not only acknowledge TEK in AI-based systems, but must also ensure that the resulting tools drive AI that guides us towards climate interventions rooted in forward growth towards a robust implementation of IDS principles, rather than repeated reductionist past mistakes of ignoring and appropriating Indigenous knowledge.

9 Luithui-Erni, Shimreichon. 2019. *Status of Indigenous Peoples' Lands, Territories and Resources in Asia, The Asia Indigenous Peoples Pact*, www.iphrdefenders.net.

10 Global Witness. (2021). Last Line of Defence, www.globalwitness.org.

11 Kukutai, T., & Taylor, J. (2016). *Indigenous Data Sovereignty: Toward an Agenda, Canberra*, https://press-files.anu.edu.au.

12 Berkes, F. (1993). *Traditional Ecological Knowledge in Perspective*. In Inglis, J.T. (Ed.), Traditional Ecological Knowledge: Concepts and Cases, (pp. 1–9). Ottawa: Canadian Museum of Nature.

2

The Impact of Current AI Climate Interventions on IPs

Examples of the use of AI to address specific climate issues include efforts to: increase food, water, and energy security; map weather and climate patterns; inform land and forest management; and develop carbon assessments and maps for carbon financing.

Many of these examples are limited and apply singular mitigation or adaptive approaches to address problems with a techno-centric, "Fractured Futures" model that fails to consider the consequences for the environment.

For instance, climate offset projects based on carbon credit schemes traditionally carry embedded inequalities and have thus inadvertently driven unjust and ineffective development outcomes.[13] Similarly, applications of technology within the climate finance sector perpetuate existing power imbalances and reinforce the dominant paradigms and assumptions that underlie institutional climate finance structures and incentives.[14]

The development of technology outside of the local context, and without consideration of social, economic, and cultural on-ground realities, generates a vertical benefit capture that has little to do with reducing greenhouse gases and more to do with retaining top-down carbon financial flows.

Additionally, monitoring, reporting, and verification are predicated on northern experts, perpetuating the presumption that southern technology and knowledge is deficient.[15] For example, when AI is used to authenticate and certify carbon credits, it focuses solely upon the verification of the credits, amplifying "the valuation of nature in terms of carbon credits for carbon markets, creating opportunities for inequality through appropriation of land and resources as carbon sinks or green fuel plantations."[16]

Carbon offset projects often focus on Lower-income countries where few IPs or communities have any role within governing structures and access to rights, let alone the authority to equitably participate in issuing and authenticating credits.[17] On top of these barriers, most of these communities lack adequate documentation for identification and are further hampered by the absence of infrastructure and devices to access online financial systems. In this context, their ability to equitably participate in benefit-sharing is limited from the outset.

13 Tebtebba. (2019). *Green Climate Fund Readiness and Indigenous Peoples (PART 2): The Cases of Paraguay, Cameroon, Nepal, Bangladesh and Philippines*, http://tebtebba.org.
14 Foster, K. & Nassiry, D. (2021). *Digital Technologies for an Inclusive, Low-carbon Future that Puts People First*. London: IIED, www.iied.org.
15 Gupta, A., Lovbrand, E., Turhnout, E., and Vijge, M. J. (2012). *In Pursuit of Carbon Accountability: The Politics of REDD+ Measuring, Reporting and Verification Systems, Current Opinion in Environmental Sustainability*, 4(6): 756–731, https://doi.org.
16 Käkönen, M., Lebel, L., Karhunmaa, K., Dany, V., and Try, T. (2014). *Rendering Climate Change Governable in the Least-Developed Countries: Policy Narratives and Expert Technologies in Cambodia*, Forum for Development Studies 41(3): 351–76. https://doi.org
17 Tebtebba (2019).
18 Lewis et. al. (2018).

In an automated AI systems approach, these inequalities would only be further reinforced due to the lack of transparency around how the algorithm has been programmed or on what data the AI is trained on. Strengthening the digital revolution process to enhance TEK and local knowledge systems in a way that reflects and respects IPs therefore requires building AI systems not based solely on data that reflect past and existing circumstance of our environment, but the ability to sense and evolve in harmony within it to ensure ecological resilience.[18]

We are making slow progress on the food security, hunger, and malnutrition targets set under the Sustainable Development Goals to reduce poverty. For decades, large-scale, agro-industrial investments across Asia have been part of the "green revolution" to maximize food production systems. However, studies have shown that this economy-of-scale model has expanded production systems at the expense of social and racial diversity, justice, and human and collective rights. The large-scale agroindustry also inadvertently undermines "food sovereignty, agroecology, revitalisation of biodiversity, territorial markets and a solidarity-based economy."[19]

This situation is continually reinforced even at the highest political forums, including at the UN Food System Summit (2023).

With advancements in technology, propositions to address the climate and food crisis continue to be deeply entrenched in the ethos of economies of scale. Examples of AI agriculture investments include intensive, large-scale vertical farms to produce food, generative AI-enabling predictions, analytics, robotics, and the development of climate-resilient crops.

Apart from the impact of the required resource-intensive infrastructure—which artificially generates foods removed from the context of the natural environment and without human labour—the energy and resources required along the AI value chain are seldom published and have yet to be evaluated against a cost-benefit analysis that might show that their potential to collapse ecosystems and exacerbate global warming is great.[20] This myopic focus on traditional economies of scale ignores the value of small-scale food producers and IPs currently feeding the world and disregards the ways in which supporting gender, social, and economic justice, youth empowerment, workers' rights, and real resilience could potentially better address the crisis.

19 Guttal, S. (2023). *Social Movements and Indigenous Peoples Oppose the UN Food Systems Summit and call for True Food Systems Change*, Focus on the Global South, https://focusweb.org.

20 Crawford, K. (2021). *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence.* New Haven: Yale University Press. https://yalebooks.yale.edu

3

The Knowns and Unknowns of Integrating TEK into Climate-Response AI

Our physical being determines our identity, relationships, and the connections we infer from our environments. In the case of IPs, whose identities are deeply rooted in their relationship to lands and territories, their identity uniquely asserts their self-determination rights and affects how they communicate with their environment. For example, the Kiau Dusan People of Malaysia use certain language only within the collective forest as a sign of respect for the resources that it offers.

To lose the forest would mean losing not only their language but also a part of their identity. "Once [identity is] transferred to the digital realm, this ignores many fundamental relationships with both land and the natural world that undermine many peoples' identities."[21]

In such circumstances, our ability to interact with AI in the digital realm is lost, along with any ability to communicate with our natural environments. How do we build large-scale language models using AI that would then allow us to interpret our worlds, as the Kiau Dusan have done over generations, to converse with the forest and protect it?

Unfortunately, open generative AI systems being developed using Indigenous languages, such as WISPER by OpenAI, have been criticized by a Māori organisation as another form of colonialism that deliberately infringes upon Māori data sovereignty and copyright, misappropriates their culture, and continues to privilege the privileged.[22]

The release of WISPER raises many questions about the use and applications of the natural language processing (NLP) model. Yet, open data, or unlicensed data freely available online – which is sourced for training AI systems – lacks safeguards to protect individual and collective rights. Native speakers have little access to and control over how it is developed, utilized, and evolved beyond their society.

The integration of TEK into generative AI models could be a game-changer for society at large. However, utilizing data without the consent and agency over the ownership, control, and governance of these systems divests IPs of their right to self-determination as a people. Ultimately, it undermines the purpose of the AI systems and harms IPs by diminishing their language sovereignty and control over lands and territories.

21 Trust Over IP Foundation. (2022). *Overcoming Human Harm Challenges in Digital Identity Ecosystems*, https://trustoverip.org.

22 Mahelona, K., Leoni, G., Duncan, S., & Thompson, M. (2023). *OpenAI's Whisper is Another Case Study in Colonisation*, Papa Reo, https://blog.papareo.nz.

Previous Attempts at Integrating TEK into AI Systems

Existing research into Indigenous AI systems is nascent.

A consortium of Indigenous technologists and academics across the CANZUS[23] nations have designed and begun to generate an Indigenous protocol on AI.[24] During consultation processes held in Honolulu, Hawai'i, the network brought together an eclectic group of Indigenous leaders and thinkers to imagine AI from the perspective of Indigenous ways of knowing.

This collective recognizes the heterogeneity of IPs across the world, and instead of offering a one-size-fits-all approach, they offer a selection of case studies and perspectives around how to integrate Indigenous ways of knowing into non-sentient AI applications for language, culture, and ways of knowing territories, which includes an understanding of all biota, minerals, and non-living things within the landscape.

These perspectives preface and prioritize Indigenous thoughts and practices in the development of AI systems to ensure that AI is developed for IPs benefit, and not as yet another oppressive tool used to further marginalise them. However, the large datasets on language, culture, and knowledge required for such systems do not exist, and lower-income communities do not have access to the proprietary technologies and infrastructure necessary to begin collecting and collating them.

Fundamentals, such as comprehensive language dictionaries, are still underdeveloped, so most AI systems rely on English as their lingua franca for object classifiers. Yet, some language models reimagine AI into an Indigenous reality – for example, Hua Ki'i is a polylingual Indigenous language image-recognition app with geo-location functionalities.[25] It proves that it is possible to integrate Indigenous languages into AI applications – and these are likely to be more widely adopted by Indigenous communities and reflective of their territories.

A first-ever robotics-engineering workshop with urban Indigenous Aboriginal children was convened by researchers at the Australian Centre for Field Robotics (ACFR) in Sydney, Australia to investigate how to create meaning from Indigenous knowledge systems through technology. The workshop highlighted that while lands and territories can be defined and navigated from the perspective of knowledge bases that do not necessarily reflect Indigenous realities and maps have always been defined on the basis of Western knowledge, which is often readjusted.[26]

Indigenous modes of knowledge production, on the other hand, evolve to allow human beings to fit into, rather than outside of, the ecology of the physical universe. Thus, "Indigenous Pattern Thinking can lead to a more effective design that considers the entire system lifecycle along with diverse environmental impacts."[27]

23 Canada, Australia, New Zealand, and the United States.
24 Lewis, J. E., ed. (2020). *Indigenous Protocol and Artificial Intelligence Position Paper.* Honolulu: The Initiative for Indigenous Futures and the Canadian Institute for Advanced Research (CIFAR). https://spectrum.library.concordia.ca.
25 Ibid.
26 Abdilla, A. & Fitch, R. (2017). 9 *Indigenous Knowledge Systems and Pattern Thinking: An expanded analysis of the first Indigenous robotics prototype workshop*, The Fibreculture Journal, https://opus.lib.uts.edu.au.
27 Ibid.

The Aboriginal Carbon Foundation in Northern Australia has begun responsible carbon financing schemes that utilize IP knowledge.[28] Their approach hopes to intensify benefit-sharing with traditional landholders and contribute to fire management through traditional practices that curb extreme fire hazards during the dry season.

The consortium also contributes by using drones with AI capabilities for gathering and collecting data and facilitating training and capacity-building for women rangers to ensure that gendered perspectives on conservation are integrated into the models. Carbon credits issued through this consortium are higher in value and traded above market rates, ultimately reflecting the realities of carbon credit generation.

Within Asia, the Asian Indigenous Peoples Pact (AIPP) and partners of the Open Development Initiative (ODI) have formulated a Regional Asian Indigenous Knowledge and Data Sovereignty Framework (IKDS) that hopes to integrate IP knowledge systems into regional agendas. They not only acknowledge and recognize the right to self-determination but also affirm the sovereignty of their data, which is derived through their epistemology and ontology.[29]

Rights held within these principles and interjected into AI systems and other technologies that hope to address climate issues could be transformed through Indigenous knowing and being – which is ecologically profound and interconnect everything and everyone.

Current colonial approaches to conservation and climate action in Asia do not respect these interconnected relationships of being and knowing.

As Abdilla puts it:
"Knowledge is rooted in, and determined by, the partial, embodied insight of multiple individuals, embedded in contexts of differential power, and inextricably affected by place and time."[30]

Current initiatives within Asia look to reappropriate Indigenous knowledge to further justify the status quo and perpetuate conservation practices that exclude the intrinsic and reciprocal nature of humans within the environment. This is furthered within national and transboundary protected-area laws and policies.

28 Aboriginal Carbon Foundation: www.abcfoundation.org.au.
29 Asian Indigenous Peoples' Pact. (2023). Indigenous Knowledge and Data Sovereignty: An Asian Framework, [pending publication].
30 Abdilla &. Fitch (2017).

Integrating TEK into AI climate adaptation systems and ensuring IDS

The climate agenda is in a state of flux.

The current crisis requires new approaches and modalities of thinking around systems processes at a planetary level, yet much of the sector is still disconnected from the recognition that our current practice of Western-centric and empirical science is limited. Regardless of the growing understanding that Indigenous knowledge likely holds key solutions towards repairing environmental damage, the intersection of knowledge from the climate and technology sectors still presents many gaps.

At the same time, the struggle and focal agendas of IP are still heavily rooted in the right to self-determination. It is critical that they assert their legitimate contributions to both climate action discussions and the design and applications of AI technology, which could shift the paradigms towards real solutions.

As Indigenous knowledge is rooted in linkages and connections with the environment, its holistic worldview emphasizes the relational values of living and non-living things. This includes seeing humans and nature as an interrelated community, and guarding spiritual relationships to lands and territories; as such, their worldview calls for collective responsibility for the well-being and respect of all human and non-human life. Interjecting this way of knowing into AI applications goes beyond current algorithmic thinking and learning.

It places upon us the responsibility to reimagine solutions that fall outside of traditional power structures, trust in the unknowns of our environment, and reinvest in equitable and inclusive governance. This way, we could inspire more appropriate legislation and technology infrastructure to support AI development for climate action.

Investing in Indigenous knowledge systems through Indigenous data sovereignty and traditional ecological knowledge is just part of a much-needed broader discussion around climate action – and not just within the AI sector.

About the Project

About DFL

Digital Futures Lab is an interdisciplinary research collective that interrogates the complex interaction between technology and society in the global South. Through evidence-based research, public engagement and participatory foresight, we seek to realise pathways toward equitable, safe and just digital futures.

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About the Project

Commissioned in early 2023 by The Rockefeller Foundation, this project explores the intersection of Artificial Intelligence and Climate Action in Asia. It examines opportunities, challenges and risks across three domains – agriculture and food systems, energy transitions, and disaster response in nine countries - Bangladesh, China, India, Indonesia, Malaysia, Singapore, Thailand, The Philippines and Vietnam.

We assembled a network of regional experts to help guide our investigation and provide context specific insights.

Aaditeshwar Seth (India)
ChengHe Guan (China)
Cindy Lin (Indonesia)
Elenita Daño (The Philippines)
Elina Noor (Malaysia)
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