LICCI | Local Indicators of Climate Change Impacts

POLICY BRIEF

Key Messages

Indigenous Peoples (IPs) and local communities (LCs) are disproportionately affected by climate change, usually living in climate hotspots and dependent on nature-based livelihoods. Often marginalised due to historical and ongoing inequalities, climate change is among several challenges they face within a wider context of environmental degradation.

IPs and LCs have a rich, nuanced and site-specific knowledge of climate change impacts and ways to adapt. Connected with their natural environment across generations, they have a holistic understanding of the cascading effects of climate change impacts, from changes in the atmospheric, physical and biological systems through to impacts on their livelihoods.

IPs and LCs' responses to climate change impacts are varied and can inspire effective adaptation pathways for other climate vulnerable communities.

The Local Indicators of Climate Change Impacts (LICCI) protocol enables systematic reporting of these valuable insights, bridging understanding of climate change from mainstream science and Indigenous and local knowledge systems.

Institutions involved in assessing climate change impacts and designing adaptation policies and plans, at local, national and international levels, should incorporate IPs and LCs and their climate change knowledge systems in decision making.

Particular attention should be paid to the rights of Indigenous Peoples, including respecting their knowledge sovereignty, as well as to the rights of other nature-dependent groups, ensuring that they genuinely participate in all assessment, decision-making and redress mechanisms.

The LICCI consortium recognizes the growing political sensitivities and terminology distinctions between Indigenous Peoples (IPs) and local communities (LCs). Researchers worked with groups and individuals who self-identify as Indigenous (IPs) or as members of specific local communities (LCs) and who maintain intergenerational connection through livelihood, cultural identity and worldviews, institutions, and ecological knowledge.

Introduction

Indigenous Peoples (IPs) and local communities (LCs) who have historically contributed the least to current climate change are disproportionately affected by it (1). Their nature-based livelihoods are deeply impacted by climate variability and extremes in unique, often remote climate change hotspots like Arctic regions, small islands or mountainous ecosystems. Yet, despite their valuable, grounded expertise, their knowledge is not taken into account enough in climate change reporting and policies, even in regions where climate change data is scarce or when the adaptation measures are applied in their territories. As legitimate custodians of knowledge regarding climate change and its impacts on the local environment, IPs and LCs should have a more central role in the scientific and policy processes of understanding and adapting to climate change, at both local and international levels.

This policy brief presents the learnings of the **Local Indicators of Climate Change Impacts (LICCI) project** and responds to the UNFCCC call for more inclusive, rights-based and context-specific climate change impact assessment and adaptation strategies.

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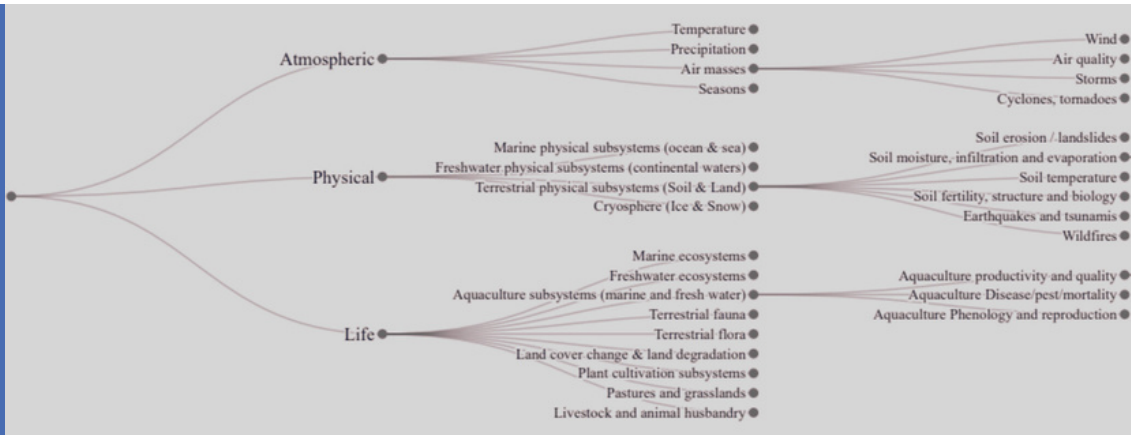
ICTA Institute of Environmental Science and Technology - UAB
laseg Social-Ecological Systems Research Group
erc European Research Council Established by the European Commission

1. Indigenous Peoples and local communities report diverse, tangible and nuanced climate change impacts

1.1. Local Indicators of Climate Change Impacts (LICCI), a global collaborative research initiative on Indigenous and local knowledge systems on climate change. The LICCI project has created a worldwide network of 48 research partners working closely with IPs and LCs, across a diverse range of climates, ecologies and socio-economic contexts. The goal of the partnership is to report, in a systematic and participatory way, IPs and LCs' observations of climate-related changes in elements of atmospheric (e.g. temperature or rainfall variability), physical (e.g. changes in soil moisture or wetlands surface) and life systems - impacts on ecosystems e.g. the emergence of invasive species or different flora distribution, and on livelihoods (2).

The interactive LICCI tree captures details of the types of significant changes inventoried in each system



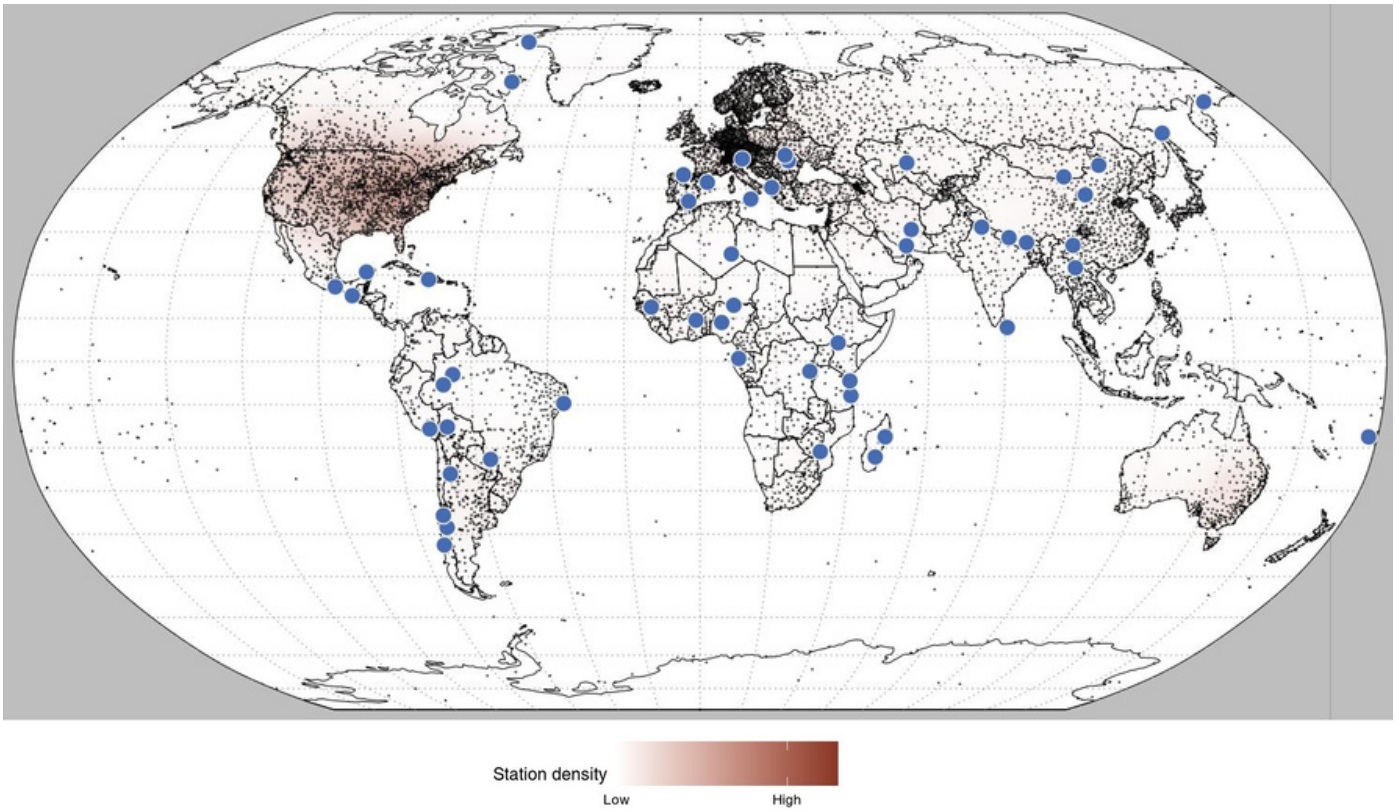


Fig 1. LICCI sites provide valuable knowledge on climate change impacts across a wide range of social-ecological contexts, e.g. Arctic, desert, rainforest, small islands or mountainous regions, not well covered by international climate research observatories (station density map using CRUTS v3.22 Counts).

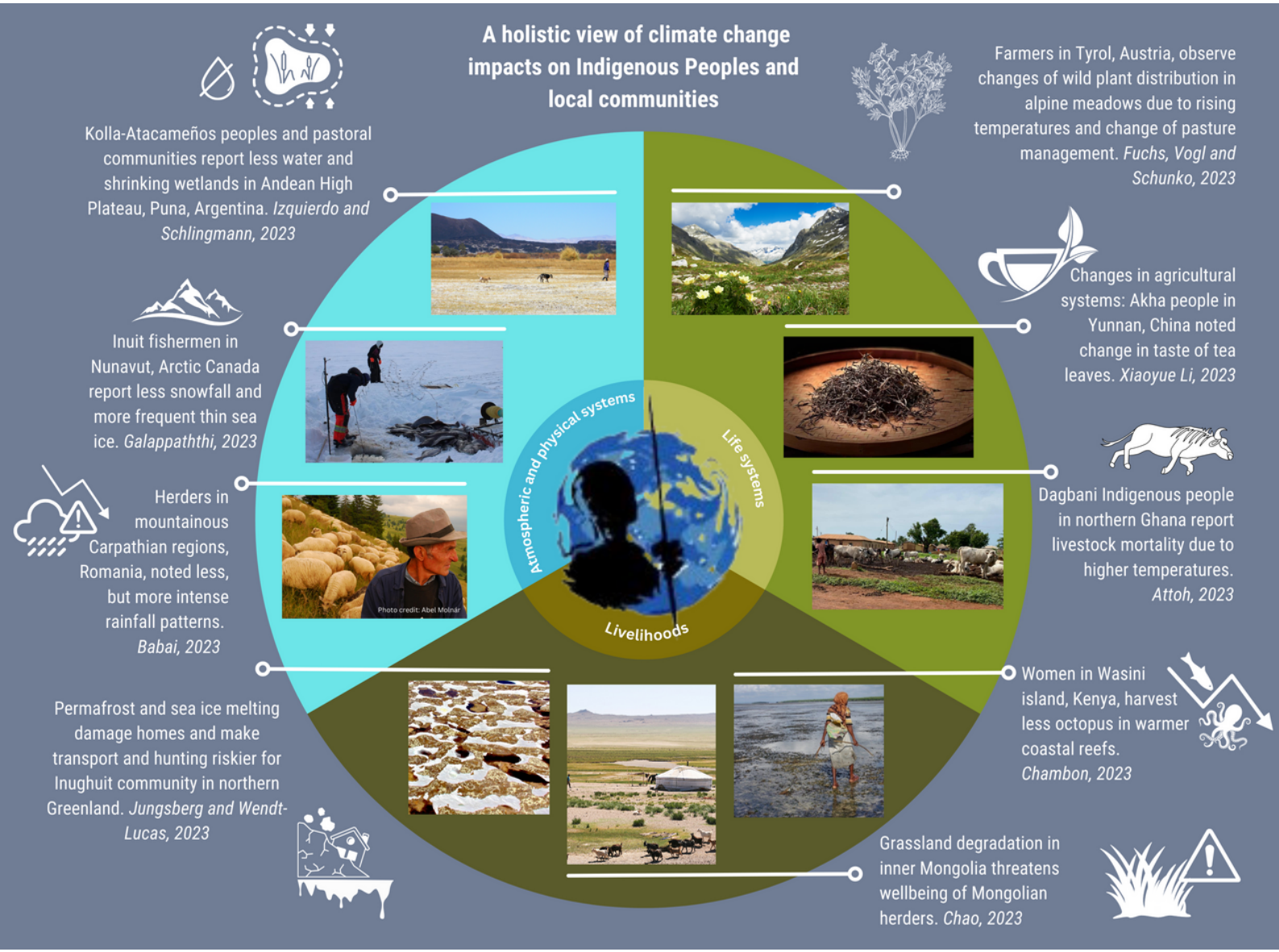
Living in remote places, often missed by international climate observatories, IPs and LCs describe the impacts of climate change through the lens of their worldview, based on their specific cultural values and socio-ecological context. LICCI's unique database of place-based indicators of climate change impacts could transform the process of climate change impacts assessments, providing alternative, grounded insights and directions on how to respond to such changes.

1.2. IPs and LCs report numerous, ongoing tangible environmental changes in the local social-ecological systems that they have managed over generations. Since the IPs and LCs in this research live in close interaction with their surrounding natural environment, they have a holistic understanding of the complex and cascading effects of climate change, from changes in rainfall through to impacts on their livelihoods. For instance, the communities surveyed report that changes in precipitation in mountainous regions in Europe affects the wild flora, reducing the duration and extension of grazing areas, which in turn changes fauna and flora distribution across the ecosystems (3, 4, 5, 6, 7).

IPs and LCs' reports of environmental change vary across geographies and household livelihood strategies. For example, weather instability makes farming increasingly speculative and stressful in Peru or Mexico (8, 9) and sea-ice based hunting in Arctic regions extremely risky (10, 11).

1.3. Reports of climate change impacts vary across gender, age, or level of dependence on the environment. For example, women in small-scale fishing communities in Wasini island, Kenya, have detailed knowledge about the tides as they rely on catching resources from shallow reefs. They report fewer octopuses to hunt, which they attribute to the changing tides and sea temperature. The community's male fishermen fish in the open ocean beyond the reef, and have observed changes in currents, winds and pelagic species (12).

Fig 2. Holistic view of climate change impacts on Indigenous Peoples and local communities.



1.4. Indigenous and local knowledge on climate change does not always overlap with mainstream science, thereby providing new perspectives. Indigenous and local knowledge can reveal new georeferenced climate impact observations in regions missed by global weather observation networks like parts of the Arctic, mountainous regions, deserts or rainforests. For example, Meru farmers in Mount Kenya report changes in fog patterns, a climate variable not recorded by weather stations (13). In Brazil, traditional fishing and farming communities living along the Juruá river have a clear local record of wetter summers while climate models show inconclusive precipitation trends, thus improving the scientific understanding of climate change impacts in this region (14).

1.5. Impacts reported are not solely due to climate change. A consistent finding in the LICCI sites is that climate change impacts are not isolated from other development challenges that are being experienced locally. IPs and LCs recognize climate change as one of several drivers of environmental degradation. Natural resources over-extraction (e.g. logging, fishing), poorly designed development programmes, new infrastructures, or state policies may represent more immediate and significant threats for them (6, 7, 15, 16). For example, Daasanach agropastoralists in Northern Kenya report water infrastructure projects and conservation policies as major drivers of environmental changes in their territory (17).

IPs and LCs can map the complex and intertwined connections between the types of changes aggravating climate change impacts on their social-ecological system. While reporting rainfall reduction over time, pastoral communities in the Argentinian Dry Puna have seen a degradation of the vegas, natural wetlands providing important water and grazing resources, against the backdrop of transport and lithium mining developments (18).

In many cases, climate change exacerbates the effects of historical marginalisation of IPs and LCs. In Siberia, Russia, Koryak reindeer herders from Kamchatka Peninsula report that climate change impacts are worsened by legacies of social transformation from the soviet era followed by rapid post-soviet disruptions of their local economy (19).

2. Indigenous Peoples and local communities are best placed to guide local climate change adaptation strategies

2.1 IPs and LCs respond to climate change impacts to different degrees. Most responses include autonomous coping strategies like communal food sharing in iTaukei villages, in Fiji (20) or the adoption of incremental measures such as farming system diversification. For example, Bassari people in Senegal (21) and Betsileo communities in Madagascar (22) use landscape and crop diversity to cope with drought and climate variability.

In some cases, climate change impacts force IPs and LCs towards more transformative adaptations, including migration and switching to livelihoods that are less dependent on nature. This can result in detrimental trade-offs for some, such as a decline in traditional activities, reduction in food production and self-sufficiency and higher market-dependency, as reported by Inuit fishing communities, in Nunavut, Canada (10). While allowing them to cope with climate change impacts in the short term, such strategies may become maladaptive in the long-term. For example, by adopting a more market-oriented agriculture, Quechua farming communities in Peru's Colca valley have become less food resilient as they produce fewer traditional crops like quinoa and fava beans (8).

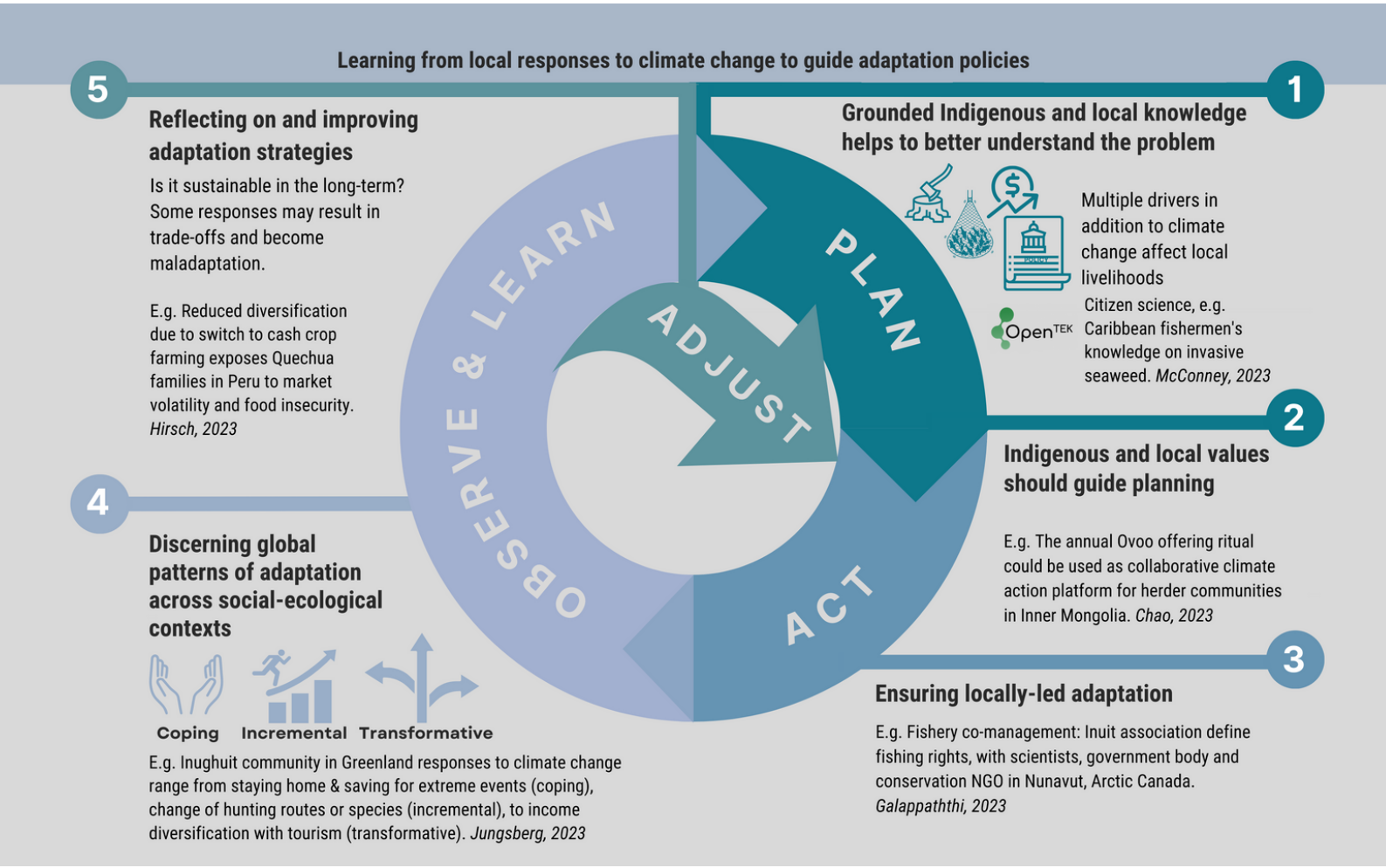
2.2. Social, political, and cultural barriers hamper IPs and LCs' adaptive capacity. Limited political agency, poverty, unequal access to financial and natural resources and other development challenges, often rooted in past histories of colonialism, continue to hamper IPs and LCs' capacity to adapt. The Mapuche-Pehuenche in Southern Chile attribute their vulnerability to the progressive degradation of their land from logging and historical exclusion from decision-making processes (23).

Certain groups may face additional layers of environmental and economic injustice like Indigenous women in patriarchal systems, who may not benefit equally from certain adaptation strategies. For instance, the shift to cash crops like cotton in the Bassari community in Senegal, reduced women's control over household finances and could result in family nutrition trade-offs as farming becomes less diversified (21).

2.3 Indigenous and local knowledge systems provide suitable context-specific adaptation options. Based on long histories of interaction with their natural surroundings, IPs and LCs' responses to climate change often reflect their local livelihoods and cultural preferences. Their local adaptation strategies can guide more sustainable, biodiverse and locally-owned action plans. For example, Indigenous populations in Fiji favour resource sharing over individual interests to ensure food security after climate disasters. This communal way of living is not often reflected in national adaptation plans (20).

Weaving Indigenous and local knowledge with climate science can result in novel adaptation and mitigation responses at local, national and global scales. For example, Inuit fishermen in Arctic Canada are working with scientists, embracing technology to cope with changing sea ice fishing risks and defining fishery co-management plans, improving food security, fostering social learning, and co-producing knowledge (10). To better manage recent invasive seaweeds in the Caribbean, local fishermen's knowledge could be mobilised through marine citizen science platforms to guide policies while research gathers pace (24).

Fig.3. LICCI collaborative adaptation cycle: Scientists and climate adaptation stakeholders to engage with IPs and LCs for grounded, participatory and culturally-appropriate planning and climate adaptation action.



INDIGENOUS AND LOCAL RESPONSES TO CLIMATE CHANGE GUIDE APPROPRIATE, LOCALLY-LED ADAPTATION STRATEGIES

Climate disaster response / climate becomes unreliable 	**Need for localised weather forecasts:** some Kenyan farmers prefer to rely on elders' knowledge to predict sowing date.	Meru and Kikuyu farmers in Kenya (13)
	Cultural acceptability of National Adaptation Plan: integrate communal food sharing practices when designing national food aid schemes.	Three Indigenous iTaukei villages, Fiji (20)
Water scarcity and reduced farm viability 	**Water access and social equity**: Resurgence of ancestral *qanat* communal irrigation governance system and cooperative actions like women's tapestry workshops as responses to climate change and harsh socioeconomic conditions.	Takab community, Lut desert, Iran (29)
Changing sea ice conditions and invasive fish 	**Fishery co-management:** Indigenous hunting and fishing association works with government to define fishing rights and ensure sustainable fishery. Fishing safety and efficiency improved by modern technology. **Knowledge co-production**: Integrate local observations of LICCI e.g. changes in Arctic char taste/colour & flesh structure .	Inuit, Nunavut, Arctic Canada (10)
Biodiversity loss and ecosystem degradation 	**Community response**: Fishing community engaged in community-led reef and mangrove restoration to respond to more frequent coral bleaching and rising sea temperature.	Wasini island, Kenya (12)
	Social network: during annual Ovoo ritual celebrations, herders renew pasture-sharing agreements between families to cope with next drought and minimise overgrazing.	Nomadic herders, Inner Mongolia (28)
Crop yield decrease Food insecurity 	**Diversification for resilience**: Change of crops and farm landscape as incremental adaptation strategy.	Bassari farmers, Senegal (21)
	Social memory elements: Tuareg adjust their ecological calendar for pastoral move to grasslands and planting millet/ veg gardens in *wadis*.	Tuareg agropastoralists, Algeria (30)
Increase in pests and diseases 	**Use of traditional practices:** ashes of sacred trees (*mutovhoti* and *munondo*) to treat against rising weevil infestation in grain storage; medicinal plants e.g. *aloe sp.* to treat livestock tapeworms	Shona rainfed farmers, Zimbabwe (31)

Fig. 4. Examples of how Indigenous and local responses to climate change could inform adaptation strategies

Policy recommendations: Six steps towards a better inclusion of Indigenous Peoples and local communities to improve climate change understanding and adaptation

The data collected from this research can be useful for international environmental and climate negotiations, not just in highlighting impacts, but perhaps more importantly in demonstrating cases of loss and damage, or the strength of locally led adaptation measures. Climate change decision makers at both local and international levels should recognise IPs and LCs as legitimate custodians of knowledge regarding climate change and its impacts, and honour their rights to participate in climate change decision-making related to their territory, in a just, equitable and effective manner. Adding to previous voices (e.g., International Work Group for Indigenous Affairs), we suggest six potential steps to achieve this:

1. **Build decision makers' competence and capacity** to receive, comprehend, and value insights from IPs and LCs, both at the individual and institutional levels (epistemic climate justice).
2. **Instil a rights-based approach for policy and programming:** Uphold Indigenous Peoples' Rights (as enshrined in the UN Declaration on the Rights of Indigenous Peoples, 2007) in climate policy, which involves comprehensive and continuous consultation and Free, Prior Informed Consent (FPIC) before establishing any policies for climate mitigation, adaptation, and reparation that affect their territory.
3. **Include representatives of IPs and LCs and incorporate their holistic knowledge at all levels of climate decision making** from need assessments and funding, to adaptation planning, monitoring and evaluation. Given the intergenerational relationships with their territory, IP&LC should have a prominent and defined role in designing local climate policy and adaptation programmes. Their participation in national and international processes and bodies should be guaranteed, permanent, effective and meaningful (e.g. right to vote, authorship).
4. **Ensure just climate finance.** As IPs and LCs must adapt to changes they are not responsible for, governments must cover the rising costs associated with dealing with climate change and its impacts. IP&LC should have a leading role in deciding where mitigation and adaptation funding is used and be included in any climate change accountability bodies, like loss and damage or redress mechanisms (e.g. UN REDD or Green Climate Fund).
5. **Enable locally-led inclusive solutions:** Shift the focus away from techno-centric investments that exclude IPs and LCs and may create new dependencies (technology lock-in, e.g. carbon capture). Prioritise contextualised, integrated local solutions that address all drivers of change and the needs of vulnerable groups (e.g., Indigenous Peoples, ethnic minorities, women, children, landless people)
6. **Improve the coherence in climate adaptation policies** across sectors and geographic scales to holistically address the multiple and simultaneous challenges faced by IPs and LCs.

LICCI researchers learn about experiences of herders in Bulgan Soum, Arkhangai Province, Mongolia, where droughts have reduced lifestock since 1990s

Climate change is affecting plant flowering times in the Eastern Carpathian mountain ranges, Romania. Local herders use local innovations to ensure good hay quality for cattle feeding during harsh winters

Research recommendations: Six steps for research institutions and funding agencies

Throughout the project, the LICCI consortium has observed that Indigenous scholars, communities and policy advocates continue to face many challenges and inequalities within institutional research processes. Six steps to address this include:

1. **Enable local ownership:** Include representatives from IP&LC in scientific, advisory and decision bodies of climate and environmental change research programming. Promote more IPs and LCs lead authorship in flagship publications like IPCC assessment reports. Implicating more global south scholars from IPs and LCs and building their capacity would reduce the risk of parachute science and the needs for international travel due to more locally-managed fieldwork.

2. **Support collaborative research:** Create specific opportunities integrating extra time to co-develop inclusive contextualised proposals with IPs and LCs as research partners.

3. **Instil a rights-based approach:** In the context of research conducted on or with Indigenous peoples, institutions should develop and implement research protocols that follow Indigenous data sovereignty and governance principles, with IPs and LCs representation in research, ethics and data regulating bodies.

4. **Develop communities of practice:** Foster national and international networks and exchanges of experiences (e.g., via workshops, development of open access online courses) among IPs and LCs around climate change impacts to ensure a safe space for exchanging and valuing thei knowledge and worldviews, without necessarily seeking to transfer it into mainstream scientific terms.

5. **Evaluate research based on criteria that goes beyond traditional academic metrics.** This includes factoring in time and cost required to prepare proposals for collaborative research, type of relationship established with the community, and research benefits to communities.

6. **Minimise environmental impacts of research:** Climate change research projects could significantly reduce their carbon emissions by reviewing research travel needs and project digital footprint, with possible trade-offs on researchers' well-being and research quality (25). Promote a transparent debate to establish normative standards of research practice that encourage, value or even impose the reduction of environmental impacts.

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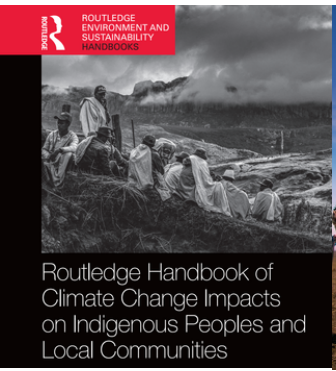


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