Working with indigenous, local and scientific knowledge in assessments of nature and nature's linkages with people

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Abstract

Working with indigenous and local knowledge (ILK) is vital for inclusive assessments of nature and nature's linkages. Indigenous peoples' concepts about what constitutes sustainability, for example, differ markedly from dominant sustainability discourses. The Intergovernmental Platform on Biodiversity and Ecosystems Services (IPBES) is promoting dialogue across different knowledge systems globally. In 2017, member states of IPBES adopted an ILK Approach including: procedures for assessments of nature and nature's linkages with people; a participatory mechanism; and institutional arrangements for including indigenous peoples and local communities. We present this Approach and analyse how it supports ILK in IPBES assessments through: respecting rights; supporting care and mutuality; strengthening communities and their knowledge systems; and supporting knowledge exchange. Customary institutions that ensure the integrity of ILK, effective empowering dialogues, and shared governance are among critical capacities that enable inclusion of diverse conceptualization of sustainability in assessments.

INTRODUCTION

Global deterioration of nature continues unabated, driving major changes to earth's life support systems and human societies who depend on them[1]. In response, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) was established in 2012 with the overall purpose of strengthening "*the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, and long-term human well-being.*" IPBES recognizes that the diverse social, cultural and environmental knowledge of indigenous peoples and local communities (IPLC) contributes extensively to sustainability across large parts of the globe, and thus has a major role to play in assessments and policy formulation for biodiversity and ecosystem services [2-5].

IPBES therefore committed to "recognize and respect the contribution of indigenous and local knowledge[1] to the conservation and sustainable use of biodiversity and ecosystems" as one of its eleven operating principles (UNEP 2012, p. 8). The IPBES Plenary, the governing body involving all member states, at its 5th Plenary meeting in 2017, adopted the " Approach to recognizing and working with indigenous and local knowledge in IPBES" (IPBES 5/15/Annex II to decision IPBES-5/1, hereafter the ILK Approach. This commitment reflects wide-spread international recognition, for example through the UN Declaration on the Rights of Indigenous Peoples, that IPLC have the right to be meaningfully engaged in decision-making processes that impact their livelihoods, cultures and societies. Furthermore, the scope and content of ILK brings insights of great relevance for ecosystem governance, such as in controlling deforestation, reducing carbon dioxide emissions [3] understanding climate change and in sustaining and restoring resilient landscapes [2, 3, 5].

The ILK Approach builds on a substantial body of work where IPLC have taken opportunities to promote recognition of the value of their knowledge, including the Millennium Ecosystem Assessment (MEA) (Reid *et al.* 2006) and the Convention on Biological Diversity (CBD), especially the adoption of the Nagoya Protocol~~. It also builds on IPLC' ongoing efforts to promote international respect and recognition, for example through the UN Declaration on the Rights of Indigenous Peoples~~. The ILK Approach is composed of three elements: (i) concepts, practices, and steps to undertake IPBES assessments; (ii) enabling conditions for the inclusion of ILK, including policy support tools and capacity building; and (iii) institutional arrangements, including a participatory mechanism. Here we present, for the first time in the international literature, the concepts, practices and steps to undertake IPBES assessments, with case studies from experiences globally that illustrate

[1] The Conference of Parties to the CBD at its 12th Meeting in October 2014 decided to replace the term "indigenous and local communities" with "indigenous peoples and local communities" in documents, reflecting many years of advocacy led by the International Indigenous Forum on Biodiversity about the problematic simplification in the original term in the CBD. IPBES is using the term "Indigenous and Local Knowledge" (ILK) as a shorthand to capture the immense diversity and complexity. In this article, we adopt the Indigenous and Local Knowledge (ILK) shorthand and the term "indigenous peoples and local communities".

their rationale. We identify potential solutions to ongoing challenges for working across knowledge systems in assessments more broadly. As IPBES is establishing new standards and platforms for co-production across knowledge systems that hold implications for action and equity in other science-policy-practice arenas, we begin with a brief discussion of the key issues for working across ILK and science.

IPBES has recognized that ILK systems are verified, implemented, challenged and applied within their own processes of validation [6] and their own conceptualizations e.g. of what is 'nature' and 'sustainability'. Diverse internal practices of IPLC who occupy their traditional territories (Box 1) ensure legitimacy and credibility for their ILK, based, for example, on historical experiences via natural experiments, expert peer-review, cultural norms and collective procedures to evaluate and validate knowledge [7,8]. The crucial distinguishing feature of ILK systems is that they are established, controlled and managed by IPLC through formal and informal institutions that guide practice [9-11]. These institutions arise *in-situ*, some spanning regions and continents, reflecting beliefs, values and learning from collective practices, lived experience, everyday observation and monitoring of the environment, within the context of long-term people-nature interactions. They are transmitted through myriad forms, including song, dance, paintings, rituals, accounting and tenure systems organising the lives of millions of people across the world [12,13].

Box 1: Who are indigenous peoples and local communities (IPLC)?

The United Nations recognizes that no formal definition of whom are indigenous peoples and/or local communities is needed—self-identification is the key requirement. Descriptions provided here, based on prior studies [14-16] are for guidance and information in the context of working with ILK in assessments of nature and nature's contribution to people and their quality of life.

Indigenous peoples include communities, tribal groups and nations, who self-identify as indigenous to the territories they occupy, and whose organisation is based fully or partially on their own customs, traditions, and laws. Indigenous peoples have historical continuity with societies present at the time of conquest or colonisation by peoples with whom they now often share their territories. Indigenous peoples consider themselves distinct from other sectors of the societies now prevailing on all or part of their territories.

Local communities are groups of people who maintain inter-generational connection to place and nature through livelihood, cultural identity, worldviews, institutions and ecological knowledge. Local communities may be settled together, or they may be mobile depending on seasons and customary practices. Communities who come together in urban or peri-urban settings around common interests, such as beekeeping or tree-planting, are considered here to be "communities of interest" or "communities of practice" rather than local communities.

Box 1. Who are indigenous peoples and local communities? Based on [14-16]

Building synergies between ILK and scientific knowledge systems has been recognized as a key opportunity to move towards sustainable ecosystem governance at multiple scales [9,17,18]. ILK encompasses diverse worldviews and transmission contexts that incorporate cultural, economic, religious and pragmatic dimensions. Conceptualizations of sustainability include the ideas of living in harmony with nature and living in balance and harmony with Mother Earth with deep spiritual dimensions [6,19]. Scientific initiatives have at times resulted in ILK being removed from their ~~societies' customary practice and cultural milieu~~cultural context, distilled and synthesised to the extent that undermines their original meaning~~ing~~ and their on-going capacity for validation, change and adaptation, [10]. As a result, there is a legacy of mistrust; communities identify risks such as knowledge theft, lack of appropriate benefit sharing, and heightening of power inequities [20,21]. Equitable partnerships that address power asymmetries, and provide IPLC with opportunities to navigate the engagement between science and ILK in ways that strengthen their rights and governance, and do not further entrench histories of oppression, are critical [22]. Efforts to build synergies, therefore, require time to build trust, identify differences and commonalities, generate common visions, and co-produce knowledge and practices through respectful partnerships that reflect the interests of all parties and support mutually beneficial outcomes~~that reflect the interests of both parties~~ [9,23]. This paper, about the IPBES ILK Approach, provides evidence-based guidance about concepts, practices and steps that will meet the diverse challenges in working across knowledge systems for inclusive assessments [24]. While several of the authors have played various roles in IPBES, this paper represents their individual views and scholarship, and has not been formally endorsed by IPBES.

BUILDING AN APPROACH TO WORKING WITH ILK THROUGH ONGOING LEARNING

The ILK Approach adopted by the IPBES Plenary in 2017, presented and analysed in this manuscript, reflects practices of dialogue and co-production across knowledge systems, developed through global workshops [8,25,26], literature review, expert working groups, debates, including at the 2016 and 2017 IPBES Plenaries, and collections of relevant case studies. These cases were assembled, based on information-richness, within the IPBES Indigenous and Local Knowledge Task Force, a group of experts appointed by the IPBES Plenary for the first work program, 2014-18, whose key role was to advice on procedures for working with ILK. The ILK Approach incorporates lessons from the pollination assessment, completed in 2016, and the regional and sub-regional dialogues held in 2016 for the four regional assessments (completed in 2018) [9,27-31]. Testing has continued through the Land Degradation and Restoration Assessment, and the Global Assessment, completed in 2018 and 2019 respectively, and the ILK Task Force provided further advice on methodologies in 2019 (IPBES/7/INF/8). Outcomes from the later assessments, application of improved methodologies, and greater ongoing engagement by IPLC in IPBES, will undoubtedly lead to greater learning, insights and

potentially future changes to the ILK Approach by the IPBES Plenary, based on accumulated evidence of what works (or doesn't) and why[32]. Here we focus on showing how the Approach supports ILK in assessments, the evidence behind it, and case studies that contributed to its development, through consideration of four components: (i) key concepts; (ii) practices; (iii) steps; and (iv) specific challenges identified in the text of the ILK Approach. We then discuss gaps that require ongoing attention and conclude with identifying key opportunities.

KEY CONCEPTS FOR WORKING WITH DIVERSE KNOWLEDGE SYSTEMS IN ASSESSMENTS

Three evidence-based premises, (clause 6[2]) underpin working with ILK in assessments. First, ILK is dynamic and holistic, encompassing governance, social, economic accounting, tenure and family institutions, language, naming and classification systems, resource use practices, rituals, spirituality and worldviews [33]~~(ICSU 2002)~~. Through practice (seeing, doing, devising solutions, applying proven successful institutions, principles and frameworks), knowledge is transmitted across generations, and problems are resolved, based on experiences accumulated through centuries of people-nature interactions [11,13].

Second, ILK is highly diverse, existing at the interface between the enormous variety of ecosystems and of cultural systems (e.g. farmers, fishers, beekeepers, pastoralists, hunter-gatherers, traditional medical practitioners) and their co-evolved biocultural diversity worldwide [16,34]. Diversity reflects the history of interactions, for instance through trans-continental contacts over millennia, migrations and the more recent processes of colonization and post-colonial assertion of rights [35,36]. While generally rich at the fine scale, and more limited at broader scales, ILK has multi-scalar dimensions, for example in relation to migratory species in the Americas and "dreaming tracks" that cross Australia [37,38] (Box 2).

Box 2

Indigenous and local knowledge systems are in general understood to be bodies of integrated, holistic, social and ecological knowledge, practices and beliefs pertaining to the relationship of living beings, including people, with one another and with their environments. Indigenous and local knowledge is grounded in territory, is highly diverse and is continuously evolving through the interaction of experiences, innovations and various types of knowledge (written, oral, visual, tacit, gendered, practical and scientific). Such knowledge can provide information, methods, theory and practice for sustainable ecosystem management. Most indigenous and local knowledge systems are empirically tested, applied, contested and validated through different means in different contexts.

[2] Numbered clauses refer to the clauses in the IPBES ILK Approach, found at IPBES 5/15/Annex II to decision IPBES-5/1

Maintained and produced in individual and collective ways, indigenous and local knowledge is at the interface between biological and cultural diversity. Manifestations of indigenous and local knowledge are evident in many social and ecological systems. In this context, the approach understands "biocultural diversity" as biological and cultural diversity and the links between them. The definitions of "indigenous and local knowledge" or "indigenous peoples and local communities" are often context specific and vary within and across regions.

Box 2 What are indigenous and local knowledge systems? Excerpt from IPBES 5/15/Annex II to decision IPBES-5/1

Third, ILK is managed by distinctive cultural institutions, each with their own methods of validation, and rules about who can hold what types of knowledge, where and when it can be transmitted, and how it can be shared [7,39]. Who is involved in working with ILK is therefore critical. The IPBES approach recognizes the need for three types of actors in assessments: ILK-holders; ILK-experts; and Experts on ILK (Table 1) (clause 6d).

Indigenous and local knowledge holders (ILK-holder)	Persons from indigenous peoples and local communities with knowledge from their own indigenous peoples and local communities.
Indigenous and local knowledge experts (ILK-experts)	Persons from indigenous peoples and local communities who have knowledge about the issues and contexts of indigenous and local knowledge across their region and/or globally. They may also be indigenous and local knowledge holders.
Experts on indigenous and local knowledge (Experts on ILK)	Persons who have knowledge about the issues and contexts of indigenous and local knowledge across their region and/or globally, who are not from indigenous peoples and local communities.

Table 1 Types of actors required for working with ILK in assessments. Adapted from IPBES 5/15/Annex II to decision IPBES-5/1

PRACTICES FOR ENSURING IPLC AND ILK INVOLVEMENT IN ASSESSMENTS

Our analysis of the IPBES decision document, the ILK Approach, identified sixteen discrete sets of practices scattered across the clauses, which we have grouped into four categories: respecting rights; supporting care and mutuality; strengthening IPLC and their knowledge systems; and supporting knowledge exchange. ~~(~~Table 2 introduces these four categories, together with the number of the relevant clause from the Approach, ~~-~~and presents the practices associated with each category, the associated evidence base and a case study for each practice~~.includes explanatory text, sources to the evidence base for each practice, and case studies~~)~~. **Respecting rights** involves:

ensuring adherence to Free Prior and Informed Consent (FPIC); building on positive initiatives of relevant multi-lateral agreements such as the *UN Declaration on the Rights of Indigenous Peoples* and the *CBD*; and avoiding any activities potentially prejudicial to rights. **Supporting care and mutuality** focuses on key capacities including: building trust;~~,~~ promoting inclusiveness and cultural plurality;~~,~~ acknowledging the (relatively slow) time frames of customary decision-making;~~,~~ and respecting diverse styles of engagement, e.g. rituals and ceremonies. **Strengthening IPLC and their knowledge systems** requires; promoting activities *in-situ* where the knowledge is produced, governed and validated; ensuring that information storage adheres to relevant standards; building capacity; ensuring meaningful participation; and working with existing IPLC organisations and networks**. Supporting knowledge exchanges** relies on: collaborative problem definition; catalysing exchanges that recognize knowledge systems as working in parallel, each with their own histories and validation methods; and supporting empowering dialogues as iterative two-way processes.

195 **Table 2. Practices for working with ILK recognized in the IPBES ILK Approach, evidences behind practices and selected case studies**

#[3]	Practices for working with ILK recognized in the IPBES Approach	Evidence behind this practice	Case study example
Respecting rights			
11	Seek ~~for~~ free prior informed consent	FPIC is recognised as a human right under international law and some nation-state laws [40]; good FPIC practices have been shown to strengthen collective knowledge and culture, while poor FPIC practices can undermine these [41,42].	*Projects on Resilience of Coastal Social-Ecological Systems* at Hakai-Simon Fraser University in eastern Canada, that supported power-sharing through FPIC (and the right of the community to decline involvement in research) and led to broader relevance, richer ideas and interpretations in research [43].
5c	Involve collaboration with and build on initiatives and guidelines of multilateral agreements and other entities	Discourse analysis has demonstrated that the *CBD* initiatives have opened positive recognition of ILK and IPLC [44]; World Heritage and other multi-lateral environment agreements have produced some positive practices for working with ILK, providing a foundation [45] for ongoing improvement [46].	*CBD Action Plan for customary sustainable use (global):* The CBD supported IPLC to document their own case studies that facilitated their full and effective participation and resulted in the adoption of Plan of Action. The case also highlighted the challenge for recognition of the role of IPLC in areas less clearly directly linked to ILK [9].
11	Activities should not occur where they would prejudice the internationally recognized rights of IP and interests of LCs	Evidence is accumulating that ILK, and its role in biocultural conservation, is strengthened through activities that fully respect internationally-recognised rights—e.g. to self-determination, to maintain their social and cultural institutions, to practice and revitalise their cultural traditions and customs etc. [47].	*The Circumpolar Biodiversity Monitoring Program (circling Europe, Asia, North America and Arctic Islands):* This international program has a co-governed Board that recognises the rights of 8 nation-states and 6 Indigenous Peoples' Organisations, including the Sami Council [48]. They collaborate based on mutual rights-recognition, leading to Arctic community-based monitoring that features traditional and ecological knowledge [49].
Supporting care and mutuality			
7a	Build mutual trust between ILK-holders and natural and social scientists through	Cultural respect and sensitivity is important to trust-building and increases the success of cooperative work and knowledge coproduction [50].	*Supporting traditional meadow management in Hungary and Romania, Europe:* Trust and respect between local traditional farmers and scientists was developed through following ethical guidelines. As a result, ILK and ecological evidence was co-

[3] #Provides the number of the relevant clause from the IPBES ILK Approach IPBES 5/15/Annex II to decision IPBES-5/1

#[3]	Practices for working with ILK recognized in the IPBES Approach	Evidence behind this practice	Case study example
	cultural respect and sensitivity		produced, leading to new policies to protect traditional management practices and their biodiversity [51]
7e	Promote non-discrimination, inclusiveness and the recognition of social and cultural plurality	Inclusiveness and the recognition of social and cultural pluralities in the world promotes the full and effective participation of IPLC, enabling effective dialogues across knowledge systems. [20,52]	*Reinstatement of customary seabird harvest by Māori in New Zealand:* Recognition of the social and cultural significance of harvest of *kuia* (Grey-faced petrel chicks) led to co-produced population models informed by Māori traditional knowledge and science, and the first harvest in 50 years in 2010 [53]
7c	Acknowledge the time needed for decision-making by customary and traditional institutions	Experiences with FPIC highlight the need to ensure people represent themselves through their own institutions and make decisions according to procedures and rhythms of their choosing, which may take considerable time [54,55].	*Transforming cross-cultural water research in Australia*: Allowing sufficient time for Aboriginal community members to decide whether and how to partner increased mutual trust and resulted in detailed documentation of the complex, diverse ecological and hydrological values of Ngan'gi speakers about the Daly River, and outputs of direct interest to the Indigenous research partners [56].
7d	Work in culturally appropriate environments, respecting diverse styles of engagement	Intercultural respect, the ability to nurture an equitable intercultural space and the participation of local intermediaries, where leaders and interpreters can effectively help dialogues, negotiations and knowledge co-productions [55]	*Story-telling by leaders and elders (Africa, South America):* has been identified as effective for linking revitalisation of ILK with conservation practices among communities including Tsimane (Bolivia); Betsilio and Tanala (Madagascar); Daasanach (Kenya); and other places [57]
Strengthening IPLC and their knowledge systems			
7f	Promote and strengthen the conservation of the i*n-situ* knowledge systems of IPLC where it is gathered, used, applied, renewed, enhanced, tested, validated, transmitted, shared and governed	Strengthening knowledge *in-situ,* through the work of the knowledge-holders using their customary institutions*,* has been shown to ensure its relevance, legitimacy and energy: "the leaves of a tree, connected to their vital source, display health and vigour" [58], p. 285	*Mayan-Q'anjob'al "Chib'al", Guatemala (Central America):* The cultural tradition and practice of hunting birds and dragonflies during migration enabled the identification, using traditional knowledge, of the peak migratory period; scientific surveys using this information confirmed dramatic population declines [37].
18b	Facilitate, as appropriate, the access to and management of available sources of ILK, in line with relevant standards	Locally focused cultural community revivals globally are producing many ILK resources *in-situ*, in diverse languages [59]. Several international standards and conventions, including the Nagoya Protocol requires agreements and	*Communities researching their own Customary Tenure Systems to ensure benefits from REDD (Reducing Emissions from Deforestation and Degradation)*: Indigenous researchers, working with non-government organizations, documented their

#[3]	Practices for working with ILK recognized in the IPBES Approach	Evidence behind this practice	Case study example
	and conventions	protocols to protect IPLC rights [60]	own people's customary tenure systems, shared through a network of indigenous peoples' organizations across continents, which became important input to global issues (climate change) and processes (REDD) [61]
17e	Build the capacity of IPLC to engage in and benefit from IPBES	Experiences with IPLC engagement in the *CBD* identify that specific mechanisms to build capacity at multiple scales, local, domestic and international, result in greater participation and benefit-sharing [62].	*Satoyami Initiative in Japan and globally*: Japanese government recognized that specific mechanisms were needed to keep ILK of rice terrace and other satoyama-satoumi landscapes, and introduced Payment for Ecosystem Services schemes that provide financial and labor support for knowledge-holders and youth [63]
8b	Ensure meaningful participation and engagement of IPLC	The engagement of the IPLC actors who manage the validity and integrity of their knowledge systems through their cultural institutions has been identified as critical to weaving ILK together with science [9]	*Himalayan healers' knowledge in Dolpo, Nepal*: Participatory building of a Traditional Tibetan Clinic increased recognition for the senior knowledge-holder, *amchi*s, Nepal. Meetings of amchis during workshops to share knowledge without intervention by scientists facilitated their development curricula and recognition at the national level by the Ministry of Health [64]
7b, 26, 27a,	Work with existing organizations and networks of IPLC	Several IPLC networks and organizations have gained important skills and capacity in working with international biodiversity processes, such as the CBD, through influence and learning [65]. Useful assessment materials, such as the Local Biodiversity Outlooks, have emerged from the work of such networks [5]	*Peer-to-peer learning promotes the use of ILK in the Kimberley region, Australia:* Knowledge exchange among 250 Indigenous Rangers at an on-country workshop empowered their learning through social cohesion, collegiality, a sense of pride, and cultural connections [66].
Supporting knowledge exchange			
13	Search for collaborative definition of problems and goals in assessments	A process for joint problem definition has been identified as critical for successful collaborations between disciplines, sectors, and knowledge systems [67]. Collaborative approaches to biocultural indicators had led to re-conceptualizations of Sustainable Development Goals challenges in ways that produce benefits to ILK [68]	*Muluri Farmers Conservation Group, Kenya* : Bringing traditional knowledge and science enabled collaboration definition of a multiple-benefit solution, domestication of medicinal plants, training, partnerships in communal libraries, developing technologies to generate a commercial natural product, resulting in enhanced biodiversity conservation [69].
18c	Promote and catalyze the mobilization of indigenous and local knowledge… in ways that reflect the concepts of	ILK can contribute to holistic and systemic understandings and actual governance of complex environments and adaptive responses to change. Realizing this potential requires ensuring that ILKS are not compromised by	*Farmers innovations to produce pesticides in Cameroon, Africa:* Farmers developed, validated and shared, alternative local pesticides to treat their cocoa plantations due to the non-availability and unaffordability of conventional pesticides

#[3]	Practices for working with ILK recognized in the IPBES Approach	Evidence behind this practice	Case study example
	parallel validation, co-production, co-management or Community Conserved Areas.	scientific evaluations that reduce complexity and remove knowledge from cultural context [70].	following structural adjustment. The main successful pest control is a prohibited plant, hemp, highlighting the need for policy change [71].
7b and e	Provide opportunities for participatory and empowering dialogue with IPLC on topics relevant to IPBES	Dialogue approaches allow for respectful interactions between knowledge systems that acknowledge the integrity of each system, and institutional and epistemological barriers [9, 23, 2]. Platforms for interactions need to acknowledge asymmetries in rights as well as knowledge [72]. Indigenous-led initiatives are proving fruitful to overcome these asymmetries[39].	*Hin Lad Nai* dialogue: A contribution to IPBES post-assessment uptake, this dialogue revisited key messages from the Pollinatorsions, Pollinationors and Food Production assessment. It also contributed to objectives articulated by the local community and organizations representing IPLC in the collaborative partnership underpinning the dialogue. A walking workshop approach, where participants, local and non-local, discussed while walking through the biocultural landscape of the indigenous community hosts, proved highly empowering [52]
7f	Strengthen the dialogue between knowledge systems as an iterative two-way process	Outcomes in terms of e.g. conservation and climate change action are shown to have higher relevance and be more effectively implemented when mutual understanding and usefulness for communities are emphasized and processed along with external goals [73].	*Fiji Locally Managed Marine Areas Network*: Ongoing iterative engagement over many years has produced a proliferation of useful two-way material, including fish lists, marine biodiversity assessments, books on the floras of Nauru and Tuvalu, and other useful resources for assessments [74].

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The practices in these four categories are not mutually exclusive but interact and reinforce each other through underlying capacities and challenges. First and foremost is the ongoing capacity of IPLC to maintain the customary institutions and governance systems that ensure the integrity, validity and ongoing transmission of their knowledge systems and vice-versa. ILK has governance-value, and is recognized by IPLC as an irreplaceable source of guidance in building the future of their societies [22]. The second underlying capacity is that of individuals being able to work across knowledge systems, to develop strategies for dealing with the subtle, sometimes unconscious manifestations of power that emerge from the encounter, and undertake the deep processes of negotiation and reflection required to respect different worldviews [75]. Scientists need to recognize that both science and ILK include knowledge and practices that undermine, as well as support, ecosystem sustainability. Third is the capacity of the dialogue workshops to support knowledge exchange. Several factors have been identified as important: hosting the dialogue with an IPLC in their territory where the *in-situ* functioning of an ILK becomes more evident (scaling-deep); respecting cultural protocols, rituals and institutions that regulate knowledge-sharing; ensuring collaborative partnerships with the local hosts in carefully preparing the dialogue together from the very beginning; creating a safe space for sharing, reciprocity and mutual benefits; and using boundary objects, such as maps, visual aids and posters, that connect across multiple knowledge systems [52,76].

The IPBES Approach (clause 8) identifies four specific challenges for working across knowledge systems: scale; participation and representation; formats; and methods and tools. Challenges of scale (8a) are both horizontal and vertical, related to collating and combining knowledge across multiple knowledge systems; up from finer local-community scales to global syntheses, and down from these syntheses to the finer scale, [77]. Keeping the local cultural contexts and meanings of ILK is a particular challenge for up-scaling and synthesis, while the multi-scale diverse interactions of ecosystems and IPLC test the application of generic frameworks during the assessment process [15, 16]. Different responses underway are showing promise e.g. “Local Biodiversity Outlooks” for the 4th Global Biodiversity Outlook to scale-up [5]; collated indices such as the vitality index of traditional environmental knowledge, for cross-scale application of locally meaningful biocultural indicators [68]; multi-scale scenarios to cross both horizontal and vertical boundaries [78]; thematic analysis of cases of biocultural approaches to pollinator conservation, to scale horizontally [16]; and place-centred dialogues bringing global and local actors together to down-scale from assessment for policy implementation [66] .

Challenges of participation and representation of IPLC (8b) in ways that fit the rules and resources of IPBES are formidable. The participatory mechanism, centrally a web-based platform (clause 28) which is yet to be implemented, and includes consultations, shared learning through discussions and strategic partnerships (clause 27) will assist in meeting this challenge. However, previous *CBD* experiences highlight that specific mechanisms to empower IPLC at local, national and international levels are needed [62]. International experiences in ensuring gender and regional balance may prove useful: the UN Permanent Forum on Indigenous Issues (UNPFII); the Local Communities and Indigenous Peoples Platform resulting from the Paris Climate Agreement [79]; Centres of Distinction for Indigenous and Local Knowledge [59]; and International Indigenous Forum on Biodiversity and Ecosystem Services [5]. Experts on ILK and especially ILK-holders and ILK-experts (see Table 1) are still poorly represented in IPBES task forces, expert groups and assessment author teams—different selection criteria beyond scientific metrics and excellence may need to be piloted. Specific calls for nomination of relevant expertise have been made, although key gaps remain [80,81].

Challenges of ILK formats (clause 8c) are related to the mismatch between the relatively inflexible text-based format of assessments, and the ~~difficulties for access and collation of~~ILK material in different languages, in grey literature, in ritual, ceremonial, oral, dance, song and visual manifestations, symbols, documentaries and artwork [82]. Clause 17(d) of the Approach recognizes the need to portray these diverse "practices, worldviews, voices and faces." Creation of 'boundary objects' (e.g. drawings, seasonal calendars) can provide material that links with IPLC and the global biodiversity audiences, and is suitable for inclusion in biodiversity assessments [76]. Digital platforms that can include video and story-telling may be the way of the future [57].

Finally, the challenge of methods and specific tools (8d), ~~which~~ arises because most methods to work with ILK in assessments are new or yet to be developed. Strategic and innovative partnerships and investments are needed. Novel methods such as photovoice, yarning, many types of culturally specific practices (e.g. Kaupapa Māori method, Australian Aboriginal pathways, Anishnaabe Symbol-Based Reflection) are emerging to form an~~in an~~ arena where much more work is needed [83].

STEPS FOR ENSURING IPLC AND ILK INVOLVEMENT IN ASSESSMENTS

IPBES has developed a guide on the production and integration of assessments for experts who take part in their assessments [84]. The guide functions as a road map at global, regional and sub-regional levels across all scales and has the potential to aid local, national, sub-regional assessments inspired from the IPBES assessment process. The ILK Approach integrates additional steps to ensure engagement with ILK systems and IPLC throughout all four phases of the process, presented as a

262 separate track in Figure 1 to aid understanding. The aim is to encourage, empower and inform IPLC in
263 each stage. The processes provide many different entry points for IPLC and provide~~s~~ for many different
264 roles as nominators, authors, reviewers, dialogue participants, fellows, observers at the Plenary
265 sessions, organisers of communication events and other activities (see Supplementary Table 1 [at the
266 end of this document] for details of these entry points).

267 The ILK Approach presents some generic questions as a starting point for scoping, focusing on the
268 contributions of IPLC to sustainability in management of biodiversity, the pressures and factors
269 undermining their contributions, and policy measures that will strengthen their roles, knowledge and
270 practices (clauses 13 a, b and c). In addition, IPLC may have their own questions, and so it is vital to
271 engage their networks in the initial scoping stage. Where detailed scoping is required, a dialogue
272 workshop will be held to allow for active participation and engagement. In the second phase of the
273 assessment, the expert evaluation of the state of knowledge phase, engagement of ILK-holders and
274 ILK-experts as authors and reviewers, and of IPLC in the dialogues more broadly, is critical. In the third
275 stage, approval and acceptance of the assessment, the roles of IPLC as observers at the Plenary comes
276 to the fore. In the fourth and final stage, use of the assessment findings, IPLC are engaged in
277 knowledge-policy workshops and in developing complementary communication and capacity-building
278 tools. IPLC networks can support the monitoring of implementation of assessment findings by IPLC at
279 local, national, regional and global levels.

280

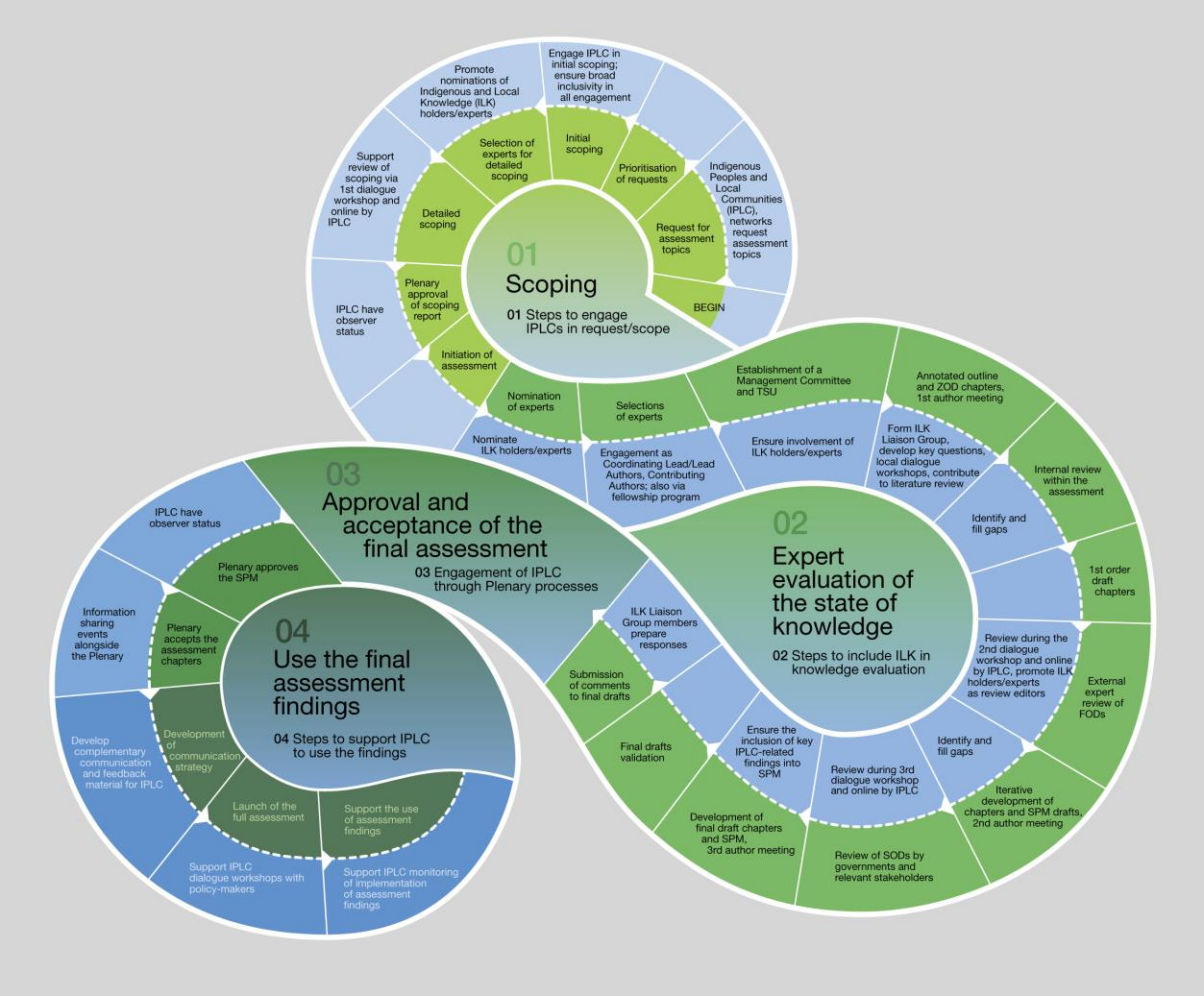

Figure 1 Steps to ensure inclusion of ILK in assessments, shown in parallel for ease of understanding. Source: Based on IPBES (2018), and the Approach clauses 13-17 (IPBES 5/15/Annex II to decision IPBES-5/1)

KEY GAPS IN THE IPBES APPROACH

The ILK Approach, which is breaking new ground, is understood to be a first step in an iterative process in which IPLC are key partners. Here we highlight some of the more prominent gaps where further attention and action are needed.

Sharing governance with IPLC (e.g. in the IPBES Bureau), *and a commitment to equity across ILK and science,* will help ensure the different customary institutions that shape ILK and ensure its legitimacy and validity are able to operate effectively [85]. The Local Communities and Indigenous Peoples Platform of the *United Nations Framework Convention on Climate Change*, which has been established with a governing body of seven each from IPLC and governments, is a step towards shared governance [79]. Power asymmetries remain at the heart of many of the challenges in

working with indigenous, local and scientific knowledge systems. IPBES could consider how shared governance can shift power imbalances—e.g., by ensuring IPLC are sufficiently supported with time and resources to request assessment topics, influence decisions about key messages from assessments, have adequate resources for tailored policy uptake initiatives and an equitable share of the overall resource allocation. Shared governance approaches require the ability to move beyond consensus to find ways of accepting contestation and incommensurable perspectives [32].

Addressing t~~T~~ransformation of ILK. A recent review has highlighted the ongoing loss of ILK in the face of globalization, modernization, market integration, with losses in some places disproportionately affecting medicinal and ethnobotanical knowledge [86]. Nevertheless, innovations are also transforming ILK, for example through traditions and technologies combining to solve new spatial problems arising from environmental change in the Arctic region [87]. Persistence of knowledge occurs where traditional practices are maintained consciously, where hybrid knowledge results from certain types of economic incentives, and where IPLC' engagement with their environment is enabled [88,89]. IPBES and other global initiatives can help promote policies that incentivise maintenance of ILK, including Indigenous languages and education approaches, in both conservation and development initiatives.

Protection of intellectual property rights associated with ILK is among the most morally compelling issues in international intellectual property law today, as conventional law does not provide adequate protection [60]. New, well-designed national and international laws and policies ~~are needed, and a thoughtfully designed custom-built public domain for ILK has the potential to~~ can provide protection both for IPLCs' rights over ILK and for the public domain within the overall architecture of the global innovation framework [90]. Capability and tools are needed that support the human rights for protection of ILK, which currently is not adequately recognized in international law, as well as the well-established protection of intellectual property in inventions, literary and artistic works, designs, symbols and images through patents, copyright etc. [91].

Experts in boundary-crossing and bridging knowledge systems are important to support the roles of ILK-holders and ILK-experts in bringing in ILK through participatory action research, dialogue, use of boundary objects (such as maps) and other methods [76,92]. Individuals with boundary-spanning expertise, commonly drawn from disciplines such as ethnobiology or human geography, and from working in transdisciplinary research, can help explore new concepts such as "nature's contribution

to people". Experts of IPLC backgrounds who have training in scientific disciplines are an emerging group with crucial boundary-crossing expertise.

Conclusion

The diverse elements of the ILK Approach, including recognition of key practices—for respecting rights, supporting care and mutuality, strengthening IPLC and their knowledge systems and supporting knowledge exchange—and the diverse entry steps into the assessment cycle provide a strong foundation for engaging ILK and IPLC. The respect given to the diversity of humanity's knowledge has allowed IPBES assessments to give space for different worldviews about nature and nature's linkages with people. This progress relies on the underlying capacity of IPLC to maintain the customary institutions that ensure the integrity of their knowledge systems; of individual experts being able to work across knowledge systems; and of effective dialogue workshops that support knowledge exchange. The benefits are beginning to emerge, through provision of much richer and more meaningful assessments that can account for diversity, such as unique Indigenous conceptualizations of sustainability. Policy options that are relevant at multiple scales are emerging. For example, a recent dialogue workshop found that the IPBES pollination assessment resonated strongly with the Karen indigenous people in northern Thailand and identified practical and useful policy-relevant findings about rotational farming systems for both local and national governments [52]. The ILK Approach appears to have many elements that will mitigate the potential risk of neo-colonialism, hegemony and further entrenchment of power asymmetries, in working with ILK.

The Approach provides an evidence-based pathway which recognizes that many key challenges remain including those related to scale; participation and representation; formats; and methods and tools. Our review has identified an array of potential solutions to these challenges where further testing and piloting are required. Our analysis also highlighted some key gaps that are yet to be considered in the Approach: shared governance with IPLC and a commitment to equity between ILK and science; transformation, loss and innovation within ILK; protection of intellectual property rights associated with ILK; and the requirement for experts in boundary-crossing and bridging knowledge systems. Power asymmetries remain a formidable barrier to working across knowledge systems in IPBES and other environmental assessments.

The journey along the path to working equitably across knowledge systems in assessments of nature and nature's contributions to a good quality of life for people, has begun. We do not yet have all the vehicles and the tools, to move well along this path and overcome the many hurdles identified.

However, the outcomes of the recent Hin Lad Nai dialogue [52] suggest that working ~~across~~ with ILK in global assessments can leverage policy-change that enables local people to secure the blue-green innovations that reflect their conceptualizations of sustainability, and are meaningful to their futures. Specific institutional arrangements within IPBES to further empower the contributions of IPLC can stimulate step-change in this important journey. Recognizing, respecting and engaging with humanity's diverse knowledge systems can help secure the future of nature and nature's linkages with people.

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See next page for Supplementary Table 1

724 **Supplementary Table 1**

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Steps in each Phase shown in Figure 1 (green)	**Entry points for ILK/IPLC shown in Figure 1 (blue)**	**Detailed explanation of the Entry Points**
Requests for assessment topics	Indigenous Peoples and Local Communities (IPLC) networks request assessment topics	IPLC networks specifically targeted and encouraged to request assessment topics
Prioritization of requests		
Initial scoping	Engage IPLC in initial scoping; ensure broad inclusivity in all engagement	IPLC networks engaged in initial scoping Processes for enabling geographical and gender equity, and for recognizing the diversity of IPLC approaches to representation, are critical
Selection of experts for detailed scoping	Promote nominations of Indigenous and Local Knowledge (ILK) experts	Promoting nominations of ILK-experts (used here generically for all three types, ILK-holders, ILK-experts and Experts on ILK) in response to IPBES call for the scoping expert group
Detailed scoping	Support review of scoping via 1st dialogue workshop and online by IPLC	• Organise 1st ILK dialogue workshop • Support the dialogue • Support the online review of the scoping document
Plenary approval of scoping report	IPLC have observer status	IPLC have an observer status
Initiation of assessment		
2. Expert evaluation of the state of knowledge		
Nomination of experts	Nominate ILK-holders/experts	• ILK-experts encouraged to seek nomination
Selection of experts	Engagement as Coordinating Lead/Lead Authors, via fellowship programme, as Contributing Authors	• Roles for ILK-experts as Coordinating Lead and Lead Authors important. • ILK-experts also engaged through the fellowship programme • ILK-experts as Contributing Authors (CAs) added here and later in the assessment if necessary
Establishment of a Management Committee and TSU	Ensure involvement of ILK-holders/experts	• Formation of an ILK Liaison Group for the assessment • Support the mobilisation of ILK • Support local dialogue workshops • Specialist ILK literature review • Developing key ILK related questions • Online call for ILK related contributions
Annotated outline and ZOD chapters, 1st author meeting	Form ILK Liaison Group, develop key questions, local dialogue workshops, contribute to literature review	
Internal review within the assessment	Identify and fill gaps	Opportunity to identify gaps and initiate gap-filling (including through additional ILK-experts as CAs); also to identify overlaps between chapters
1st order draft chapters		

External expert review of FODs	Review during the 2nd dialogue workshop and online by IPLC, promote ILK-experts as review editors	• Organize and support 2nd ILK dialogue workshop • Encourage ILK-experts to register as external reviewers • Encourage ILK-experts to apply to be nominated as review editors of each chapter
Iterative development of chapters and SPM drafts, 2nd author meeting	Identify and fill gaps	
Review of SODs by governments and relevant stakeholders	Review during 3rd dialogue workshop and online by IPLC, promote ILK-experts as review editors	• Organise and support 3rd ILK dialogue workshop • Encourage ILK-experts and members of IPLC to apply to be nominated as review editors; register as external reviewers and provide input; Discuss draft and provide feedback
Development of final draft chapters and SPM, 3rd author meeting	Ensure the inclusion of key IPLC-related findings into SPM	Information sharing side events to provide updates to IPLC
Final drafts validation		
Submission of comments to final drafts	ILK Liaison Group members prepare responses	Governments submit comments in the lead-up to the Plenary
Approval and acceptance of the final assessment		
Plenary approves the SPM	IPLC have observer status	IPLC have observer status
Plenary accepts the assessment chapters	Information sharing events alongside the Plenary	Information sharing events alongside the Plenary
Use the final assessment findings		
Development of communication strategy	Develop complementary communication and feedback material for IPLC	• Communication materials targeting IPLC • Outreach plan to IPLC • Knowledge-policy and other dialogue workshops • Complementary IPLC-appropriate feedback material
Launch of the full assessment	Support IPLC dialogue workshops with policy-makers	Strategic partners encouraged to support dialogue workshops between policy-makers and IPLC at local, national and regional levels
Support the use of the assessment findings	Support monitoring of implementation of assessment findings	Support monitoring the implementation of the assessment findings

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Conflict of Interest Declaration: Working with indigenous, local and scientific knowledge in assessments of nature and nature's linkages with people

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

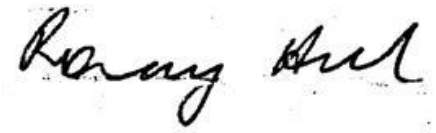
We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

We understand that the Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). She is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. We confirm that we have provided a current, correct email address which is accessible by the Corresponding Author and which has been configured to accept email.

All the co-authors approvals have been collected by email on an Excel-spreadsheet and extensive consultation has occurred about the order and the inclusion of co-authors. I am signing on behalf of all co-authors.

Yours faithfully



Rosemary Hill on behalf of

Hill, R., Adem, Ç., Alangui, W.V., Molnár, Z., Aumeeruddy-Thomas, Y., Bridgewater, P., Tengö, M., Thaman, R. Adou Yao, C.Y., Berkes, F., Carino, J., Carneiro da Cunha, M., Diaw, M.C., Díaz, S., Figueroa, V.E., Fisher, J., Hardiston, P., Ichikawa, K., Kariuki, P., Karki, M., Lyver, P.O'B., Malmer, P., Masardule, O., Oteng Yeboah, A.A., Pacheco, D., Pataridze, T., Perez, E., Roué, M., Roba, H., Rubis, J., Saito, O., Xue, D.

Response to reviewers

Thanks very much for the very helpful reviews of our manuscript. We have responded to each comment and revised the manuscript accordingly, as set out in the Table below.

Reviewer 1:

Thank you for the opportunity to review your paper. It was a pleasure to read - It has been clearly structured, well composed and its argument is accessible to a wide audience. I have made some minor suggestions for improvement, including some editorial comments, on the attached marked-up copy. The paper would also benefit from a close edit.	Thanks very much, your comments and input have been very helpful
There are only two areas that could be (marginally) improved -1) the tone of your introduction could be a little stronger/more compelling - it is really important that Indigenous and local communities are provided opportunities (through International platforms such as IPBES) to be meaningfully engaged in decision-making processes that impact their livelihoods - this argument could be strengthened	Thanks, we have added two sentences at the end of the second paragraph of the introduction to strengthen our argument as suggested: “This commitment reflects wide-spread international recognition, for example through the UN Declaration on the Rights of Indigenous Peoples, that IPLC have the right to be meaningfully engaged in decision-making processes that impact their livelihoods, cultures and societies. Furthermore, the scope and content of ILK brings insights of great relevance for ecosystem governance, such as in controlling deforestation, reducing carbon dioxide emissions [3] understanding climate change and in sustaining and restoring resilient landscapes [2, 3, 5]." As a result of this change, we have deleted the reference to the UNDRIP in the second sentence of the third paragraph, and added a short phrase to the first sentence so that it now reads: “The ILK Approach builds on a substantial body of work where IPLC have taken opportunities to promote recognition of the value of their knowledge, including the Millennium Ecosystem Assessment (MEA) (Reid *et al.* 2006) and the Convention on Biological Diversity (CBD), especially the adoption of the Nagoya Protocol.”
Second, you mention in two places the goal of IPBES to create a public database for ILK - I note that you recognise the huge task of this concept when first mentioned, but in the conclusions this is glossed over as: 'a custom-built public domain for ILK has the potential to provide protection within the overall architecture of the global innovation framework'. This statement without any qualifying comments about the barriers	Our apologies, we have phrased this very poorly. There is no intention to create a public database for ILK. Instead, we were intending to promote the idea of protection of Indigenous Intellectual and Cultural Rights through the application of custom-built laws and policies that clearly demark ILK as separate to the public domain. We draw on the recent work of OKediji 2018 (ref 89) which explores the legal details and concludes this can be done. We have rephrased the sentence and it now reads “New, well-designed national and international laws and policies can

to creation and adoption of such a database weakens your paper. A follow up sentence demonstrating your awareness of this huge task is strongly recommended.	provide protection both for IPLCs' rights over ILK and for the public domain within the overall architecture of the global innovation framework [89]."

42	IPLC' (typo)	Not a typo – but the apostrophe looks odd so we have rephrased the sentence to avoid its use "the ongoing efforts of IPLC"
44	conditions for what? Enabling conditions for the inclusion of ILK in assessments?	Yes, have added a qualifying phrase as suggested to the sentence
49	rationale for adopting the ILK approach?	No, "their rationale" here refers to the "concepts, practices and steps. Perhaps the reviewer read "the rationale" rather than "their rationale". We prefer to leave the sentence as is.
57	build? (instead of ensure)	Ensure is preferred
57	(credibility_ of their knowledge systems?	Agree, have added "of their ILK"
57	Delete on	Have left "on" as its removal would cause a grammatical error in the sentence
86	often site-specific/highly localised	Thanks, adding this phrase here would disrupt the sentence, and this is covered in lines 68-70
91	Also distilled or synthesised to the point that the ILK loses its meaning	Thanks, have added ", distilled and synthesised to the extent that undermines their original meaning and"
97	…and co-produce knowledge and practices within partnerships that respect multiple knowledges, reflect the interests of both parties and support mutually beneficial outcomes.	Thanks, have revised the sentence to: "build trust, identify differences and commonalities, generate common visions, and co-produce knowledge and practices through respectful partnerships that reflect the interests of both parties and support mutually beneficial outcomes"
107	case studies selected based on their richness of information?	Information-richness is a recognised sampling method
Table 2, clause 11	For (highlighted)	Have deleted, not necessary
Table 2 clause 11	And (add?)	Added "and"
Table 2 clause 7	Pollinators, pollination and food production	Have corrected
192-194	Yes - good to see this articulated here	Thanks
224	check phrase (Experts on ILK…etc)	Phrase is correct, and have included a reference to Table 1 where these terms are defined.
228	Is the challenge the ILK format, or the inflexibility of the assessment	Thanks, good point. Have change the sentence to "Challenges of ILK formats

	process and presentation? Challenges to the presentation/inclusion of ILK in assessments include…difficulties arise in effectively representing ILK due to the diversity of forms in which ILK is held (?) This includes oral forms, through song…	(clause 8c) are related to the mismatch between the relatively inflexible text-based format of assessments, and the ILK material in different languages, in grey literature, in ritual, ceremonial, oral, dance, song and visual manifestations, symbols, documentaries and artwork [81]"
235	Which (highlighted)	Thanks, have deleted
239	much more work to…(grow understanding across knowledge systems?)..is needed	Have changed "in an arena" to "to form an arena" to clarify the meaning
246	One process or many?	Many processes
282	and allowing the time for this to occur in the assessment process?	Thanks have added "with time and resources"
288	Modernization, market (highlighted)	No change made
298	The Nagoya Protocol should be mentioned here	The Nagoya protocol doesn't provide for the legal protection – it relies on State parties who are signatories to devise their own legal systems to do this.
302	This is a huge undertaking that regional/national Indigenous corporations in the 1st world are struggling to achieve for themselves at the local level. This sentence comes across as being somewhat naive - in discussions with IP lawyers just today, they are recommending to their Indigenous clients and research partners that ILK not be stored in digital forms due to the risk of appropriation (for pharmaceuticals/patents) even where layered permissions exist in the data portal (due to risk of human error releasing sensitive knowledge). Consider a further sentence that demonstrates your awareness of the challenges and risks of this idea…and challenges more broadly of Indigenous peoples trying to maintain their own knowledge databases within their communities.	As noted above, we phrased this very poorly as there is no intention to build a digital data base. The sentence now reads ""New, well-designed national and international laws and policies can provide protection both for IPLCs' rights over ILK and for the public domain within the overall architecture of the global innovation framework [89]."

Reviewer 2:

Overall I find this article to be competently presented and well structured. The boxes	Thanks

and tables are effective and help the reader work through the material more systematically.	
I suggest adding a footnote to the abstract to indicate that the views expressed here are those of the individual authors and not formally endorsed by IPBES.	We have included a sentence to this effect at the end of the Introduction, after we have made clear how the "Approach" described in the article is drawn from an IPBES plenary decision which is IPBES formal policy. We further point to various clauses in this decision (as per footnote 2 in the article) and therefore highlight what is IPBES policy. We are reluctant to put the footnote as requested in the abstract, as it could easily mislead the reader without this context.
Some further opening explanation of the case studies in table 2 would be very useful. At present they appear only in the table 2 boxes: i.e. without a preparatory general context provides to the readers.	Lines 166-182 are explanatory text in support of the table. We have re-written the second sentence in this text to make that more apparent: Table 2 introduces these four categories, together with the number of the relevant clause from the Approach, and presents the practices associated with each category, the associated evidence base and a case study for each practice~~includes explanatory text, sources to the evidence base for each practice, and case studie~~.
The introduction section reads as institutional in focus: whereas I think more elaboration of the great importance of ILK for a range of highly important issues including the conceptualization of sustainability; preservation and conservation of biodiversity and eco systems; and knolwledge and practices to combat climate change in diverse areas of the World, could be highlighted.	Thanks, this comment is very similar to comment made by reviewer one, and as noted above, we have added two sentences at the end of the second paragraph of the introduction to strengthen our argument as suggested (Lines 40-45): "This commitment reflects wide-spread international recognition, for example through the UN Declaration on the Rights of Indigenous Peoples, that IPLC have the right to be meaningfully engaged in decision-making processes that impact their livelihoods, cultures and societies. Furthermore, the scope and content of ILK brings insights of great relevance for ecosystem governance, such as in controlling deforestation, reducing carbon dioxide emissions [3] understanding climate change and in sustaining resilient landscapes [2, 3, 5]."
The issue on p 12 concerning challenges of scale: horizontal and vertical: linking local and global scales could effectively be further elaborated and again emphasised in the final Conclusions of the paper.	We have further elaborated with this sentence (Lines 217-220)"Keeping the local cultural contexts and meanings of ILK is a particular challenge for up-scaling and synthesis, while the multi-scale diverse interactions of ecosystems and IPLC test the application of generic frameworks during the assessment process [15, 16]." We carefully considered adding more in the Conclusions, but don't feel we can do this without

	also adding more about the other challenges, which would require too much additional text.