Improving visibility for knowledge holders in ethnobiological and ethnopharmacological publications

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Abstract

Ethnopharmacological relevance: Ethnopharmacology and ethnobiology largely focus on the study of traditional knowledge related to medicinal and other uses of plants, animals or minerals. Despite decades of political advocacy, ethnopharmacological and ethnobiological information is still sometimes published without proper attribution of the cultural identities and affiliations of the communities that shared it.

Aim of the study: Identify key guidelines to ensure the proper attribution of ethnobiological and ethnopharmacological knowledge recorded in scientific publications to the communities who provided it.

Material and methods: This article is based on extensive group discussions that started at a workshop entitled "A worldwide database of local uses of biodiversity: Why? For whom? And how?" (18th Congress of the International Society of Ethnobiology in Marrakech, Morocco, May 15-19, 2024), and was attended by around 50 participants. The guidelines were developed through an iterative revision process.

Results: We propose practical guidelines to improve the attribution and thus, visibility, of communities whose knowledge contributes to ethnobiological and ethnopharmacological publications.

Conclusion: Transparent and consistent reporting of the provenance of place-based ancestral knowledge from communities is essential for advancing the objectives of the Nagoya Protocol, the Treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge, and for strengthening academic inquiry.

Keywords: CARE principles, cross-cultural studies, FAIR principles, guidelines, Indigenous Data Sovereignty, Nagoya protocol, transdisciplinarity.

1. Visibility of knowledge holders in publications including traditional knowledge about biodiversity

Proper attribution is a means of reducing the invisibility and the muting of marginalized social groups in the research process. Invisibility is a form of social and epistemic injustice inflicted on knowledge holders. Epistemic injustice refers to the harm done to people specifically in their capacity as knowledgeable individuals and the systemic discrimination of those who developed specific knowledge (Fricker, 2007). Indigenous and other place-based, non-academic knowledge "holders" are often invisible in public discourses and debates (Levis et al., 2024; Molnár et al., 2023). The quotation marks around the word "holders" serve as a reminder that expressions which refer to the people who collaborate with academics in ethnobiological and ethnopharmacological studies can have different meanings to different audiences. For instance, the "holder" can refer to the one who knows, but can also refer to the one who controls and appropriates knowledge. Indigenous Peoples may learn directly from Mother Nature and may share this knowledge with each other and other peoples spontaneously, it is relational and fluid, not fixed or contained. Academic literature often refers to "informants" or "participants," yet these terms can intentionally or unintentionally frame individuals in passive roles. The more neutral term "participants" may often fall short of capturing the active, reciprocal, and sovereign nature of knowledge exchange in many Indigenous and local contexts. Through the text, we use the term "holders", recognising that it may not be adequate to refer to all peoples having different forms of knowledge about biodiversity.

Ensuring fair and consistent attribution to knowledge holders is a general issue in ethnobiology (encompassing ethnobotany and ethnozoology; Cooke et al., 2021; Walter et al., 2021), ethnomedicine, and ethnopharmacology (Weckerle et al., 2018). At the same time, there are increasing efforts to work collaboratively and equitably with Indigenous Peoples, Afro-descendant communities and other diaspora, and local communities (hereafter "communities", while acknowledging the substantial power imbalances that exist both among these communities, as well as in relation to dominant or majority populations globally) in sustainability decision-making, healthcare planning, and biodiversity conservation (e.g., Carrie et al., 2015; Hill et al., 2020; McElwee et al., 2020; Vandebroek et al., 2023). For example, one of the key discussions at the 2024 United Nations Biodiversity Conference of the Parties to the UN Convention on Biological Diversity (COP16) focused on the role of communities in biodiversity conservation and resulted in the creation of a working group on article 8j (CBD, 2024). The marginalization of traditional medical knowledge—due to limited research, insufficient policy engagement, and poor or lacking integration frameworks—undermines its incorporation into national health systems. As a result, health policies and materials often lack cultural sensitivity (WHO, 2005; Caceres Guido et al., 2015), while respecting cultural acceptance of medical care is fundamental for achieving Universal Health Coverage (WHO, 2013; UN General Assembly, 2015).

To date, knowledge holders are not reliably and consistently acknowledged in publications reporting the use and stewardship of biodiversity (Carmona et al., 2023). In a review about medicinal plant use surveys conducted in the Brazilian Atlantic Forest, 57% of the 162 referenced articles did not provide *any* information on knowledge holders (Zank et al., 2023) while a review of English academic literature about cultural keystone species revealed that 20% of 313 articles did not specify for which sociocultural group the species were important (Mattalia et al., 2024). Identifying a community of knowledge holders can be challenging. Communities are often a mosaic of languages and cultures that have exchanged knowledge for centuries, sometimes through recognised knowledge guardians, and many other times through more diffuse, collectively held practices. However, this should not dissuade the reporting of communities' identity in ethnopharmacological and ethnobiological publications. There is considerable variation in how researchers and research projects engage with knowledge holders during collaborations, as well as in the extent to which communities' identities are acknowledged or disclosed in resulting publications. In publications and databases, a continuum exists between not mentioning who knows and uses specific biodiversity (e.g., Species Use Database https://speciesusedatabase.com) and conducting research and building up databases together with communities (e.g., Ethno-ornithology World Atlas https://ewatlas.net). The Ethno-ornithology World Atlas uses the Mukurtu platform (https://mukurtu.org/) and Traditional Knowledge Labels (https://localcontexts.org), which enable communities to manage, share and exchange aspects of their heritage within a database in culturally relevant and ethical ways. The platform and the labels allow regulating access and tagging knowledge in databases regarding the provenance, permissions, and protocols of use of information. Other examples of co-created databases are the UseFlora (www.useflora.ufsc.br) and the EthnoFlora DB French Guiana. UseFlora is being built by a team including Indigenous and non-Indigenous researchers to structure a database about useful plants and their users in Brazil, respecting both academic and Indigenous perspectives. EthnoFlora has been developed to gather in a single database all the published information about French Guianese ethnobotany in order to repatriate it to the knowledge holders so they gain access on what's been published about them. Transdisciplinary research, co-steered and co-authored with local researchers and community members, is perceived as increasingly relevant and important to foster sustainable development, mitigate biodiversity loss and the

effects of climate change, and contribute to social justice (Ibarra et al. 2023; Norström et al., 2020; Vandebroek et al., 2023). There is a need to increase the quality of publications and databases explicitly reporting the origin of recorded knowledge, improving visibility of knowledge holders, and echoing these voices, territories, knowledge systems, and ways of understanding and engaging with nature (Díaz-Reviriego et al., 2024). After extensive discussions among the co-authoring team, we concluded that shared standards are required for reporting cultural background data of the involved communities because culture affects human-nature relationships, how these relationships are perceived, and how solutions can be developed and pursued.

This contribution emerges from discussions between an international group of ethnobiologists and Indigenous representatives during a workshop entitled "A worldwide database of local uses of biodiversity: Why? For whom? And how?" that took place during the 18th Congress of the International Society of Ethnobiology in Marrakech (Morocco; May 15-19, 2024). The workshop was attended by around 50 participants, who were invited to follow-up discussions leading to the proposed guidelines. To support these discussions, a first review of existing authorship guidelines in journals dedicated to ethnobiology and ethnopharmacology (Supplementary File 1) was conducted. This literature review found that authorship guidelines are often unspecific when it comes to reporting of identities of communities (e.g. 'ethnographic background information'), though they may refer authors to publication standards and best practice literature (e.g., Heinrich et al. 2018; Weckerle et al. 2018). The guidelines presented here were developed through an iterative revision process based on this existing literature, with a specific focus on ensuring the visibility of communities whose knowledge is published in ethnobiological and ethnopharmacological research.

2. Accurate reporting of knowledge holders' identity is essential for fair and consistent knowledge attribution

The Nagoya Protocol on Access and Benefit Sharing (ABS) of the Convention on Biological Diversity aims to ensure the fair and equitable sharing of benefits arising from the utilisation of genetic resources and *associated traditional knowledge* (CBD, 2011; see Footnote 1). The ABS agreement stipulates that knowledge holders must be part of the ABS process for any project concerning their understanding about and use of biodiversity, that Free, Prior Informed Consent is required, and mutually agreed terms have to be established. However, ABS guidelines do not specify how the representation of knowledge holders is to be ensured. Article 12.2 of the Nagoya protocol indicates that "Parties, with the effective participation of the indigenous [sic] and local communities concerned, shall establish mechanisms to inform potential users of traditional knowledge associated with genetic resources about their obligations" (established by community protocols, contracts and agreements establishing mutually agreed terms, and/or contractual clauses for benefit-sharing; CBD, 2011). Thus, the absence of specific instructions does not negate the responsibility to fulfil the ABS requirements towards knowledge holders.

Reporting knowledge holders' group identity in research outputs can establish a direct link between their knowledge and the intellectual property rights owners. This can influence the patentability of interventions that need to fulfil the requirements of novelty and inventiveness. Such requirements are often not fulfilled when applications are already known to communities, which constitutes "prior art" (World Intellectual Property Organization—WIPO, 2024; although a caveat exists as new combinations and applications based on mixing use

applications can sometimes satisfy the requirements for novelty; Patwardhan, 2013). In that case, they would qualify for equitable benefit-sharing agreements. Taking one step forward towards Indigenous data sovereignty and governance, Carroll et al. (2023) proposed the CARE Principles as a measure to strengthen the consistent and accurate attribution of knowledge holders in publications and databases, which can be extended beyond Indigenous communities. CARE principles include Collective benefit, Authority to control, Responsibility, and Ethics, and refer to actions applicable within research, government and institutional data settings (Carroll et al., 2023). For example, the implementation of CARE principles on archaeological data repositories (e.g., universities, libraries) in Canada is under development, by attaching permanent machine-readable information (i.e., meta-data) on authority, consent, and conditions of use to Indigenous digital archaeological data throughout the data life cycle (Gupta et al., 2023).

3. Academic importance of accurately reporting knowledge holders' group identity affiliation

Attributing knowledge to specific communities is critically important when reporting on uses of biodiversity, as cultural context strongly shapes medicinal practices, interpretations of illness, and understandings of disease aetiology (Berlin et al., 1993; Foster and Anderson, 1978; Gesler, 1992; Hofmann and Hinton, 2014; Nichter, 1992), as well as spirituality, ethics and governance, including biodiversity stewardship (Berkes 2018; Chan et al., 2016). Diverse forms of illness prevention and healing practices connecting spirituality characterise traditional medicines. This aspect distinguishes traditional medicines from the biomedical model, which is often perceived as reductionistic, objectifying patients as passive targets of medicalization (Rocca and Anjum, 2020). Also, perceived effectiveness of medicines and responses to therapeutic interventions depend on sociocultural contexts (Browner et al., 1988; Etkin, 1988; Nichter, 1992). Human diet, ingestive behaviour and specific cultural practices are associated with disease risk and epidemiology (Etkin and Ross, 1982; Johns, 1990; Dressler, 2004; Lindeberg, 2010; Nakatsuka et al., 2017; Gajurel and Deresinski, 2021) and thus influence patients' health-seeking behaviour and the selection of medicines.

Connecting specific knowledge about the natural world with knowledge holders also allows for the scalability of environmental stewardship. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services has identified the synthesis of traditional knowledge about the status of biodiversity and environmental trends as a global knowledge gap (IPBES, 2019). Moreover, communities often suffer from detrimental transformations of their environments because of deforestation, environmental degradation, chemical contamination, and climate change (Fernández-Llamazares et al., 2021). These changes can lead to the emergence of new diseases and the spread of old diseases, compromising livelihoods and the full expression and transmission of some cultural practices. Therefore, accurate reporting of knowledge holders' group identity through academic research can inform a large diversity of cross-cultural studies, from cultural history and evolution to commons governance and epidemiology. Without data on group identity, review articles and databases, including those emerging from pharmacological, clinical, retrospective and biodiversity conservation studies, lack cultural meaning and relevance. These data are necessary to scale up results, supporting the importance of local knowledge systems in global science-policy arenas (Geck et al., 2020; Fernández-Llamazares et al., 2024).

4. Suggested guidelines for properly acknowledging the communities of knowledge holders in ethnopharmacological and ethnobiological publications

Most ethnobiologists adhere to the guiding principles of the International Society of Ethnobiology Code of Ethics (ISE, 2006), yet requirements for reporting ethnobiological data from field studies vary widely across journals (Supplementary File 1). Most journal guidelines require the reporting of Linnaean taxonomy and evidence of ethics committees' approval for publication. However, expectations regarding the reporting of communities' identities are less articulated.

Improvements in publication standards by encouraging the inclusion of simple baseline information could contribute towards a major visibility and recognition of knowledge holders' identity. Mandatory inclusion of the ethnographic and linguistic background of knowledge holders in journal submission guidelines would help foster greater awareness and consistency in publication practices. Drawing from advances towards Findable, Accessible, Interoperable, and Reusable (FAIR) data made in cross-cultural anthropology and linguistics (e.g., Forkel and Hammarström, 2022), we suggest a set of minimal information that should be strongly encouraged or required in authorship and data sharing guidelines.

The absence of key information, such as community identity and language, should be flagged during the peer review process. When working with secondary data (e.g., literature reviews, herbarium vouchers, or biocultural collections), original cultural information should be reported wherever possible. If this is missing, all good-faith efforts should be made to retrieve community identity data using the information available in the secondary source (e.g., by contacting the authors of the publications and/or cultural groups). However, we recognise that searching for this information retrospectively is not always possible. If the original source is not available or no longer traceable, this should be mentioned in the final publication.

We suggest the following publication guidelines to ensure attribution and foster the intellectual property rights of knowledge holders through accurate identification of their cultural background:

1. **Document Free Prior Informed Consent:** Include a description of how Free Prior Informed Consent was obtained, along with copy of the institutional ethics approval in the supplementary material (see Footnote 2), and detail the procedures used to comply with specific national legislations and any applicable community protocols (if the latter exist). Include a description of the community-determined actions that enable access to, use of, and publication of data.
2. **Use self-declared group names:** Report the self-declared name for the cultural group in their own language. For example, the terms 'Baka' and 'Amazigh' should be used instead of the pejorative terms 'Pygmies' and 'Berbers'. Reporting non-pejorative group names also supports their autonomy. D-PLACE, the most up-to-date and comprehensive curated database for cross-cultural research (Kirby et al., 2016), maintains lists of validated group names. If communities prefer not to have their identity disclosed, a general statement to that effect should be included.
3. **Include language identifiers:** Use language identification codes (Forkel and Hammarström, 2022). Glottolog language identifiers (or three-digit ISO-639-3 codes; Hammarström et al. 2025; https://glottolog.org/glottolog/language) can be mentioned for the language(s) spoken in the community and the language(s) of vernacular names reported in the study (e.g., plant or animal names, habitat type names). This is especially important for endangered languages and can support linguistic conservation efforts.
4. **Provide geographical information:** Report the name(s) of the locality, geographical coordinates and administrative units of the study area, with the authorization of the

communities involved. Coordinates should be omitted if communities express privacy concerns or cultural sensitivities around sharing location data.

The suggested guidelines align with ongoing efforts by knowledge holders to strengthen governance, decision-making and cultural authority over their data concerning their communities. “Indigenous People’s Data” refer to the information and knowledge recorded by or about Indigenous peoples, their governments, and non-human relations (Taitingfong et al., 2023). Here we extend the concept of Indigenous People’s Data to all communities whose information and knowledge about biodiversity are recorded in ethnobiological and ethnopharmacological research. In practice, upholding Indigenous data sovereignty and governance is done through the inclusion of metadata that provide critical information for the proper attribution and guide access to communities’ knowledge and data (i.e., Taitingfong et al., 2023). Indigenous metadata bundles include information about governance, provenance, physical space, protocols, and data rights (Taitingfong et al., 2023) that are reported alongside knowledge about biodiversity.

These guidelines are not intended to replace the ethical review processes or legal requirements for permits (e.g., Brazil’s national legislation regarding the mandatory registration procedures for accessing traditional knowledge associated with biodiversity; Castro & Santos, 2022), but rather to complement them. Ultimately, these guidelines aim to inform future publication practices linking cultural and ecological information. We encourage ethnobiologists and ethnopharmacologists to actively support communities’ data sovereignty and governance and work towards greater visibility, recognition, and equity in our inter- and transdisciplinary fields of research.

FOOTNOTES

1. While not all countries have yet signed and ratified the protocol, we strongly urge ethnobiology and ethnopharmacology researchers from these countries or working in these countries to follow the best practices outlined here. Moreover, any country may have national rules and permits regarding the documentation of traditional knowledge, which should be followed and obtained by researchers.
2. In many countries, ethics committees only take into account medical and psychological research. Sometimes, an ethics approval can be obtained from the country where a researcher is based, if a committee does not exist in the country where the research is conducted. If this is not possible, researchers should nevertheless follow ethical guidelines (e.g., ISE 2006) and obtain the necessary research permits (Vandebroek et al., 2025).

POSITIONALITY STATEMENT

We are a diverse group of researchers and practitioners working on a range of aspects of Indigenous and local knowledge about biodiversity, including Indigenous data sovereignty. Most of us are based in academic institutions in Oceania, Central and South America (including the Caribbean), and Europe. Although most authors share a Western background, we have long-term experience working with Indigenous Peoples and/or Afro-descendant and local communities with a plurality of knowledge systems, understandings, and visions. We all regularly (co-)write academic publications, but we have multiple sensitivities and affinities

regarding knowledge production, co-creation, and dissemination. Writing this viewpoint has been an exercise of careful listening and compromise.

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AUTHORSHIP STATEMENT

Conceptualisation (ITT, NH, GO), Investigation (all), Writing original draft (ITT, NH, GO, ML, IV, JW), Review and editing (all), Validation (all).

DATA STATEMENT

This article does not use data.

ABBREVIATION LIST

ABS: Access and Benefit Sharing
CARE: Collective benefit, Authority to control, Responsibility, and Ethics
FAIR: Findable, Accessible, Interoperable, and Reusable

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