

Trends in Ecology & Evolution



Series: Local and Indigenous ecological knowledge

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The importance of Indigenous and local people for cataloging biodiversity

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Indigenous and local peoples' (ILPs) role in cataloging life on Earth has been significant but underappreciated. ILPs knowledge faces growing cultural and biological threats. Greater participation by ILPs in research would make science more efficient, conservation more sustainable, and traditional knowledge stronger, but formidable obstacles remain.

Traditional knowledge at the service of science

Only a fraction of the millions of species on Earth have been cataloged. How much of species discovery and knowledge of their ecology have their origins in Indigenous and local knowledge (ILK)? All cultures that have interacted for long periods of time with their natural environment have developed rich biological classification systems [1]. The taxonomies of plants and vertebrates used by ILPs often exhibit high correspondence with species recognized by scientific taxonomy. For example, one Papua New Guinean system has 137 names for 138 bird species [2]. Another system in China has a correspondence of 82%, demonstrating a high similarity between traditional and scientific knowledge in botanical nomenclature [3]. It is, therefore, unsurprising that historians are increasingly showing that European explorers did not work alone when cataloging the Earth's biodiversity.

European explorers in the tropics relied heavily on local assistants to find, collect, and classify the rich and varied fauna and flora. Alexander von Humboldt [4] recognized the value of Indigenous peoples' knowledge over 200 years ago: 'The master of one of the canoes offered to remain on board the Pizarro as coasting pilot. He was a Guayquería of an excellent disposition, sagacious in his observations, and he had been led by intelligent curiosity to notice the productions of the seas as well as the plants of the country. By a fortunate chance, the first Indian we met on our arrival was the man whose acquaintance became the most useful to us in the course of our researches. I feel a pleasure in recording in this itinerary the name of Carlos del Pino, who, during the space of sixteen months, attended us in our course along the coasts, and in the inland country.' Alfred Russell Wallace hired at least 1200 local collectors in the Malay Archipelago between 1854 and 1862 and benefited from their knowledge to make some of his famous 'discoveries' – for example, Wallace's flying frog (*Rhacophorus nigropalmatus* Boulenger) [5]. He also relied on the local knowledge of Indigenous peoples in the Amazon to develop his hypothesis that the great rivers of the Amazon function as geographical barriers for primates and birds [6].

Ever since the times of von Humboldt and Wallace, scholars have continued to draw on ILK to explore biodiversity (Figure 1). In Malaysia, ILPs identified 2063 fruit consumption and 1360 seed dispersal interactions involving 164 plant species and 34 animal taxa [7]. That study showed that ILPs gathered better data than professional scientists alone. In the Brazilian Amazon, ILPs have demonstrated their sophisticated knowledge and recorded 92 plant species consumed by six fish species in the rivers Negro, Tapajós, and Tocantins [8]. Finally, in India, Gupta *et al.* showed that ILK was of utmost importance

for assessing endangered species in places with little or no published information [9] (Figure 1).

Indigenous and local knowledge informs conservation

ILK has also brought important insights of practical value for conservation. Indigenous rangers in Australia were better at surveying lizard communities than non-Indigenous researchers as they recorded also more static and cryptic individuals [10]. The scientific and applied conservation benefits of promoting culturally diverse research teams were recently evidenced in a study by foreign and Iban and Dusun researchers in Borneo [11]. By linking Iban and Dusun ILPs biological classification systems with population genetics, Gardner *et al.* recognized two distinct wild-related species (*Artocarpus odoratissimus* Blanco and *Artocarpus mutabilis* Becc.) to breadfruit that were previously considered as a single species in Linnean taxonomy.

Participatory work and recognition in research

To accelerate our understanding of the natural world, we need to draw on the entire pool of human thoughts and experience and give credit where it is due. General principles of collaboration (including respect, legality, and safety) have been proposed to promote inclusive and equitable fieldwork with local communities [12]. The participation of ILPs should be recognized by co-authorship where appropriate – despite their lack of official academic affiliation – for example, by 'group co-authorship' [13]. Further, the names of new species should reflect local geography and/or Indigenous languages and cultures where appropriate. Biodiversity research of many tropical countries is driven by foreign researchers. This poses a serious problem for the development of local research capacity as well as for biodiversity conservation which must be locally driven to be sustainable.



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Figure 1. Examples of Indigenous and local people (ILPs) and the biodiversity they helped catalog. (A) Collecting and discussing the Chocó flora at Tado, Colombia. (B) A researcher from the Chocó (Colombia), identifying Amazonian palms during a study visit at the Aarhus University Herbarium, Denmark. (C) In Africa, the Biota Project worked with ILPs to document the flora of Namibia (e.g., the quiver tree, *Aloidendron dichotomum*). (D) In India, ILPs provide abundance data important for the monitoring and conservation of species (e.g., rhino rays, *Rhina ancylostoma*). (E) In Malaysia, ILPs were key in documenting ecological networks for frugivores (e.g., grey langur, *Semnopithecus entellus*). (F) In Borneo, ILPs contributed to unravel species of breadfruit, *Artocarpus*. (G) In Australia, ILPs monitored populations of the yellow-spotted monitor lizard, *Varanus panoptes*. (H) In Papua New Guinea, ILPs set up experimental plots for a rainforest regeneration experiment in the Saruwaged Mountains. [Photo credits: (A,B) Juan C. Copete; (C) Manfred Knabe; (D–G) Wikimedia; (H) Vojtech Novotny].

Research careers for Indigenous peoples

Paraecologist and parataxonomist are vocations that represent the next step for ILPs from being informants or field assistants [14]. These distinct careers, analogous to paramedics in health professions, combine ILK and familiarity with local ecosystems with formal training in research

methods and taxonomy. Paraecologists and parataxonomists have been shown to increase the efficiency and scope of ecological research, as well as ensure long term on site monitoring impossible to sustain by visiting researchers and students (Figure 1). Despite their proven merits, these careers remain rare in contemporary ecological research. The concept

was originally developed for the study of rich biodiversity in tropical countries by foreign scientists [14]. However, it has not been accepted by the institutionalized science in tropical countries that generally remains reluctant to incorporate paraecologists and parataxonomists from ILPs into its career structure. Further, research projects and institutions should

facilitate progression from paraecologists to university students where appropriate.

Increasing endangerment of Indigenous and local knowledge

Despite the potential for ILPs biological classification systems and ecological knowledge to accelerate biological research, their contribution is highly contingent on the conservation of Indigenous languages, which are globally declining at alarming rates, even faster than biological species. A study on language and ethnobiological skills in Papua New Guinea showed that only 58% of 6190 surveyed students, compared with 91% of their parents, were fluent in Indigenous languages. Moreover, the medicinal uses known to the students fluent in Indigenous languages were replaced by a few, mostly non-native species for students speaking English or Tok Pisin, the lingua franca. The rapid cultural and economic globalization of ILPs also shifts interests of young people away from traditional livelihoods, such as hunting, that would help them to understand and appreciate the value of biodiversity [15].

Although the past role of ILPs in biological discovery is difficult to quantify, the previous examples highlight how current biodiversity research and conservation can be more efficient and yield better results

when ILPs are involved and when local and scientific knowledge integrated, particularly when conducting research on Indigenous lands. And yet, current research practice is poorly suited to take the advantage of the research potential represented by ILPs. A wider involvement of ILPs in research and conservation would benefit both Indigenous communities and academia.

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Declaration of interests

No interests are declared.

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