CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Twenty-fifth meeting of the Plants Committee
Geneva (Switzerland), 17 and 20-23 July 2020

Species specific matters

TRADE IN MEDICINAL AND AROMATIC PLANT SPECIES

1. This document has been prepared by the Secretariat.

Background

2. At its 18th meeting (CoP18, Geneva, 2019), the Conference of the Parties adopted the following Decisions on *Trade in medicinal and aromatic plant species*:

    18.300 Directed to the Secretariat

    The Secretariat shall:

    a) liaise with key players of medicinal and aromatic plant trade supply and value chains to raise awareness and understanding of CITES regulations for medicinal and aromatic plant species and of the impact of the trade in medicinal and aromatic plants on the conservation of CITES-listed medicinal and aromatic plant species in the wild;

    b) subject to available resources, analyse challenges and opportunities in matters related to trade in medicinal and aromatic plants, including by:

    i) providing an updated overview of the international trade in CITES-listed plant species traded as medicinal products, and assessing whether existing databases with trade names of CITES-listed medicinal and aromatic plant species can be linked to the CITES Checklist database;

    ii) reviewing ongoing work on sustainable and traceable supply and value chains for medicinal and aromatic plant products, focusing on certification schemes, standards and guidelines;

    iii) examining case studies involving local and traditional knowledge, and participatory assessments, monitoring and management of CITES-listed medicinal and aromatic plant species; and

    iv) Based on the findings of i) to iii), developing recommendations to inter alia complement existing tools relating to the implementation of the Convention for CITES-listed medicinal and aromatic plants, and create synergies, as appropriate, with relevant intergovernmental organizations and stakeholders;

    c) report to the Plants Committee on the outcomes of the work outlined in paragraphs a) and b).

18.301 Directed to Parties

Parties are invited to take actions to raise awareness and understanding of CITES regulations for conservation of medicinal and aromatic plant species amongst those trading in species used for this purpose.

18.302 Directed to the Plants Committee

The Plants Committee shall inform and advise the process as per Decision 18.300, taking into account information document CoP18 Inf. 11 and other relevant information, and review the Secretariat's report as per Decision 18.300 and make recommendations to the Standing Committee or the Conference of the Parties, as appropriate.

18.303 Directed to the Standing Committee

The Standing Committee shall review any report from the Plants Committee as per Decision 18.302 and make recommendations to Parties, as appropriate, and to the Conference of the Parties.

Implementation of Decision 18.300

3. The full implementation of Decision 18.300 requires an estimated USD 70,000 in external funding to commission a study as per paragraph b) of the Decision; complement existing tools as per subparagraph b) Iv); and cover potential staff travel. At the time of writing, these funds remained to be secured (see Notification No. 2020/032), and the Secretariat will continue to seek the necessary resources to undertake that work. In the meantime, the Secretariat initiated research to progress the implementation of relevant aspects of Decision 18.300, as detailed below.

Decision 18.300, paragraph a)

4. In line with Decision 18.300, paragraph a), the Secretariat raised awareness and understanding of CITES regulations for trade in medicinal and aromatic plants with key players throughout its implementation of Decision 18.300 (b), as detailed in the following sections.

Decision 18.300 paragraph b) i)

Progress in providing an updated overview of the international trade in CITES-listed plant species traded as medicinal or aromatic products

5. Several information documents submitted at recent meetings of the Plants Committee and the Conference of the Parties have described the trade in CITES-listed medicinal and aromatic plant species (MAPs). Annex 1 of information document PC24 Inf. 12 quantifies international trade in 827 CITES-listed MAPs between 2006 and 2015, as recorded in the CITES trade database, showing the quantities and commodities in trade, and the major importing and exporting countries. According to this study, trade in MAPs during this period totaled 54 million kg, of which 25 million kg (47%) were sourced from the wild. In terms of volume, the largest wild-sourced commodities on record are waxes and bark. The volume of extracts in trade is reportedly increasing. Chips, powders, roots, and other commodities are traded in smaller quantities. Most exports originate from Cameroon, Mexico and South Africa; major importing countries are France, Germany, Japan, Spain and the United States of America. Forty-three species were recorded by both importing and exporting countries. Data from importing Parties indicate that the most significant trade is in *Euphorbia antisyphilitica* waxes from Mexico (10 million kg), *Prunus africana* bark from Cameroon and Uganda (8.2 million kg), *Aloe ferox* extracts and powder from South Africa (2.7 million kg), *Aquilaria malaccensis* chips and powder from Malaysia, Indonesia, Singapore and Bangladesh (2.2 million kg), and *Cibotium barometz* roots from Viet Nam, China and Indonesia (0.6 million kg). Based on exporter-reported data, *Nardostachys grandiflora* roots and derivatives from Nepal are also among the species with the highest trade volumes (0.9 million kg). On a higher taxa level, six orchid species of the genus *Dendrobium* show a combined importer-reported trade volume of 0.5 million kg. Similar information that confirms these findings is also published in a peer-reviewed study (Timoshyna et al., 2019).

6. There are no dedicated customs codes (harmonized system codes: standardized codes for classifying traded products used by customs authorities and trade statistics) for reporting on international trade in MAPs, except of some codes for specific taxa. For example, starting from 2022, trade in products of *Prunus africana*

will be reflected in the harmonized reporting system under HS code 1211.60 (FAO, 2020). These and other species-specific HS codes for CITES-listed taxa may facilitate and complement the monitoring of trade.

7. The importance of trade in MAPs is further illustrated by their share in reported seizures of CITES-listed specimens. This is exemplified by the analysis of CITES-related seizures reported by the Member States of the European Union (EU). Between January and December 2017, 27% of the reported seizures involved medicinal plant and animal products, and parts and derivatives for medicinal use. This included 218,693 plant-derived medicinal items (and an additional 13,511 kg and 32 litres), with many Appendix II-listed MAPs seized, including *Aloe arborescens, Gastrodia elata orchid, Hoodia gordonii, Prunus africana* and *Euphorbia antisyphilitica* (TRAFFIC, 2019). In 2018, 23% of all seizures reported by EU Member States were medicinal plant and animal parts and derivatives. This included 260,562 plant-derived medicinal items (and an additional 6,685 kg and 23 litres) (TRAFFIC, 2020).

8. Several studies suggest substantial e-commerce in CITES-listed plant species that is not reflected in the CITES trade database. For example, Hinsley et al. (2016) counted between 1,100 and 2,300 posts that offered various quantities of wild orchids for sale on a single social media platform during a 12-week period. Sajeva et al. (2013) compared online transactions of 24 sellers of Appendix I cacti on an online platform to exports registered in the CITES trade database and concluded that large discrepancies in the number of plants for which permits were issued and the number of plants traded in online transactions suggest that only 10% of the plants traded were potentially legal. Further examples are referred to in document CoP18 Doc. 55. Information document PC23 Inf. 10 shows the results of the Secretariat's analysis of medicinal plant products offered for sale on Amazon and eBay that contain (or claimed to contain) at least one of a selection of 365 CITES-listed medicinal plant species. While the analysis did not assess the sources of these products or possible exemptions through annotations, information document PC23 Inf. 10 suggested that an unknown but possibly important portion of the international e-trade in CITES-listed medicinal plant products may occur outside the Convention's purview, and/or that some actors may not be aware of applicable CITES regulations.

9. Follow-up research examined the online trade in the same 365 species in 2017 and 2018 and allowed more specific conclusions[1]. The offers that contained (or claimed to contain) CITES-listed specimens, displaying their full scientific name, remained approximately stable, numbering 14,000 in 2017 and 13,000 in 2018. Offers for specimens that are, according to the species' annotation, subject to CITES control, numbered 4,500 in 2017 and 4,900 in 2018. Offers of specimens subject to CITES controls frequently involved *Aloe arborescens, Aloe ferox*, *Encephalartos* spp., *Euphorbia tirucalli*, *Galanthus nivalis, Hoodia* spp., *Turbinicarpus* spp. (listed in Appendix I), *Panax ginseng,* and *Panax quinquefolius*. Most of these species were frequently offered in both 2017 and 2018, thus suggesting a stable trade pattern. Of the 4,900 CITES-regulated products found on offer on eBay in 2018, 63.1% were offered for international trade, but only 21 indicated awareness of applicable CITES regulations in the product descriptions.

10. The Secretariat notes that the research mentioned in paragraphs 8 and 9 was constrained by a limited selection of MAPs, its focus on products labelled with scientific names, and the short time during which the two online sales platforms were screened. The number of annual trade transactions in CITES-regulated products also remains unknown, since it is unclear how long offers remain online, and how often new offers are published. The analyses were largely based on time-consuming manual work, and it remained unclear what e-commerce might be ongoing on other platforms. To start addressing these limitations, the Secretariat successfully submitted a challenge (problem description) to the "Zoohackaton" on illegal wildlife trade, held in Geneva in 2019 with the support of the Permanent Mission of the United States of America to the United Nations and other International Organizations. It envisioned an automated search algorithm for comprehensive and systematic screening of e-commerce platforms for trade in CITES-regulated MAP products and provided some initial suggestions on the feasibility and approaches that could enable such a tool. To further explore the topic, the Zoohackaton organizers decided to submit the same challenge to 15 other Hackatons worldwide. In collaboration with the University of Geneva's hub of digital sciences for environment and health, a possible IT MSc. thesis that might advance preliminary versions of such a tool is anticipated to be offered to students in fall 2020. Finally, another way to gather more data could be to bring e-commerce in CITES-listed MAPs to the attention of the Global Coalition to End Wildlife Trafficking Online or other initiatives addressing wildlife trafficking online (see also document CoP18 Doc. 33.1 on *Combating wildlife cybercrime*).

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[1] *Jina Choi, MSc. thesis in the CITES Masters at the International University of Andalucía, supervised by Dr. David Roberts, Kent University, unpublished.*

Assessing whether existing databases with trade names of CITES-listed medicinal and aromatic plant species can be linked to the CITES Checklist *database*

11. Linking the *CITES Checklist* to a database of medicinal and aromatic plants with their trade names could facilitate and strengthen the implementation of the Convention.

    a) For Management Authorities (MAs) and enforcement focal points: Being able to swiftly search for the scientific name of products potentially containing CITES-regulated MAP ingredients, but only labelled with a non-scientific trade name, can help to determine whether certain products contain specimens of CITES-listed species that are subject to trade regulations. This is particularly relevant because many MAP products are marked and labelled with names in multiple languages that do not contain the botanical names of the plant ingredients. At present, very limited assistance is available to CITES Authorities in case products are not marked and labelled with scientific plant names, making them therefore often not 'readily recognizable' as defined in Resolution Conf. 9.6 (Rev. CoP16) *on Trade in readily recognizable parts and derivatives*. By providing comprehensive and searchable guidance on trade names of MAPs, the ability to readily recognize, trace and identify products of CITES-listed MAPs would greatly be enhanced.

    b) For Scientific Authorities (SAs) and researchers, this feature could enhance transparency and traceability of trade chains, since it renders products readily recognizable under trade, pharmaceutical and common names. Decision-making at the level of individual non-detriment findings (NDFs), listing proposals, and general monitoring of trade chains in CITES-listed MAP species, could thus take into account a wider variety of products containing specimens of CITES-listed MAPs.

    c) For the entire CITES community, improved information on trade, pharmaceutical and common names for CITES-listed MAPs would facilitate monitoring and understanding their e-commerce, as described in paragraph 11 a) *supra*. A searchable feature could improve traceability of MAP specimens in trade by informing stakeholders throughout the supply chain on applicable CITES requirements (such as permits and certificates).

    d) As indicated in information document PC24 Inf. 7, CITES has not adopted a definition of MAPs. MAPs are not defined in terms of botanical taxonomy, aromatic characteristics or medicinal effectiveness, but rather as culturally determined uses, which are also subject to change. 'Medicinal and aromatic plants' encompass thousands of species. Previous research on trade in CITES-listed MAPs (e.g. information documents PC23 Inf. 10 and PC24 Inf. 12) has established more or less arbitrary selection criteria. These analyses can therefore often not be compared with one another, and the overall understanding of trends in trade in CITES-listed MAPs remains vague. An authoritative and continuously updated global database of medicinal and aromatic plants would come close to a comprehensive definition of this group of taxa. It would thus enable more comparable and reliable analyses of CITES-listed MAPs in trade.

12. The Secretariat has initiated discussions with the Kew Medicinal Plant Names Services (MPNS) and the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), which is hosting and maintaining the Checklist of CITES species and the associated Species+ database. The MPNS is a global nomenclatural indexing and reference service for medicinal plants. It is an online portal that provides access to medicinal plant data and medical citations using any pharmaceutical, drug, common or scientific plant name. The 9th version of its database (published in January 2020) contains 27,734 medicinal plant species, which are linked to 266,000 scientific plant names (drawn from Kew's taxonomic reference resources) and 210,000 non-scientific, pharmaceutical, herbal drug and common plant names in multiple languages and scripts. This information is drawn from 170 medicinal plant and health regulatory sources, covering all six CITES regions. Thus, MPNS provides arguably the most comprehensive database on trade names of medicinal plants.

13. Both the Kew MPNS and UNEP-WCMC kindly agreed to a preliminary trial data exchange to better understand each other's data formats, harmonization requirements, and other features of the two databases. This exercise assisted in identifying objectives, processes, challenges and requirements for incorporating MPNS trade names for CITES-listed MAPs into the *CITES Checklist*.

Decision 18.300, paragraph b) ii)

Progress in the review of ongoing work on sustainable and traceable supply and value chains for MAP products, focusing on certification schemes, standards and guidelines

14. Certification schemes, standards and guidelines exist in many industries to evaluate performance against a set of criteria. They can be led by governments, third parties or the industry. In the private sector, many voluntary certification schemes were created to address consumer concerns regarding social, environmental and ethical aspects of a product's lifespan[2]. Well-known examples with relevance to the sustainable use of flora biodiversity include the Forest Stewardship Council (FSC), and the FairWild and Biotrade standards. Companies wishing to obtain such certifications are required to demonstrate their alignment with sustainability principles, amongst others, which are audited and confirmed by a certification body and the standard holding organization as independent third parties.

15. The Secretariat is aware of a few instances where companies that export CITES-listed plant species were certified. These include FSC certification for companies exporting CITES-listed timber species (*Cedrela*) from Brazil and Guatemala, and an ongoing project aimed at FairWild certification of *Nardostachys grandiflora* exports from Nepal. While not CITES-listed, a *Boswellia*-exporting company from Somalia was recently certified against the FairWild Standard. However, such instances seem limited and there is a need for more concrete experiences on how certification benefits the implementation of CITES. TRAFFIC, in collaboration with the German Scientific Authority, is assessing how certification schemes could support MAs and SAs in their implementation of CITES for trade in Appendix II-listed plants, with a focus on the certification of *Nardostachys grandiflora* harvests in Nepal (see information documents PC24 Inf. 12 and CoP18 Inf. 36).

16. Information document CoP18 Inf. 36 assesses four certification schemes [FairWild Standard, Union for Ethical BioTrade/UTZ, Forest Stewardship Council (FSC) and EU Organic Regulations] against the concepts and non-binding guidance for making non-detriment findings that are recommended in Resolution Conf. 16.7 (Rev. CoP17), as well as the provisions on legal acquisition found in Article IV, paragraph 2 (b) of the Convention. The assessment suggests that the FairWild Standard has indicators relevant to all these provisions. UEBT/UTZ and FSC have indicators that could be helpful to MAs and SAs when making NDFs and legal acquisition findings (LAFs), but some of the indicators are site-specific rather than species-specific. A matrix summarizing the principal findings can be found in Annex 1 to this document.

17. In September 2018, TRAFFIC and Germany distributed a survey to CITES SAs and MAs and industry on CITES-listed MAPs and voluntary certification standards. Responses were received from 18 Parties [Austria, Belgium, Canada, China, Croatia, Germany, Latvia, Mexico, Montenegro, Norway, Portugal, Slovakia, South Africa, Switzerland, the United Kingdom of Great Britain and Northern Ireland (two responses), and the United States of America (two responses)] and 15 industry stakeholders. Half of the respondents working for CITES Authorities were of the view that documentation provided through certification could assist in the making of NDFs, and three-quarters of considered that such documents could aid in the making of LAFs. The most important documents that the respondents identified are listed in Table 1. Businesses were asked if there were restrictions on the documents that they could share with CITES MAs and SAs, and 10 out of 15 industry respondents stated there were no restrictions on the documents that they could share (two respondents stated there were restrictions and three did not respond to the question).

Table 1: Top five responses from CITES Authorities representatives as to what documents derived from certification processes could help them in making NDFs and LAFs (Timoshyna et al., 2019).

Documentation to help with NDFs	**Documentation to help with LAFs**
Harvesting plan	Proof of origin
Description of species	Information on traceability systems
Population estimates	Unique identifiers
Monitoring areas and methods	Reports on quantities of species used
Methods of collection	Documents relating to local level regulation

18. In the same context, TRAFFIC and the German SA organized a stakeholder workshop (January 2019, Cambridge, UK) to assess the potential of certification schemes to support MAs and SAs with the implementation of CITES Appendix-II processes. It brought together CITES SA and MA Authority representatives from China, Germany, Mexico, Norway, Portugal, the Republic of Korea, South Africa,

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[2] *An online tool to compare and filter ca. 250 standards for the criteria and indicators they employ can be found here.*

Switzerland and Liechtenstein, and the United Kingdom, the CITES Secretariat, industry associations (American Herbal Product Association and Natural Resources Stewardship Circle), company representatives, FSC, FairWild, and BioTrade bodies, intergovernmental organizations and non-governmental organizations. Industry and CITES Authorities agreed that certification is potentially useful in the implementation of CITES for Appendix II-listed MAPs, even though local or regional certification would not be able to provide all required information on harvest and conservation status of species at a national level. The main benefits that both groups saw were that NDFs, LAFs, and the Review of Significant Trade process could benefit from the technical expertise, field-based resource assessment information, management plans, external auditing, and traceability required from certified companies. Finally, certification schemes tend to have principles relating to benefit-sharing, customary rights and ensuring benefits for collectors and their communities, which go beyond CITES permitting requirements, but align with work on CITES and livelihoods. Participants agreed that certification-based approaches would be particularly useful for taxa in international trade that are mainly of wild source; commercially traded in high volumes; and whose products are of high value in destination markets with high interest in certification, and that can absorb the cost of certification (information document CoP18 Inf. 36). CITES-listed MAPs that were suggested as examples are *Aniba rosaeodora*, *Euphorbia antisyphilitica*, *Nardostachys grandiflora, Prunus africana, Hydrastis canadensis*, and *Panax quinquefolius*.

19. Workshop participants recommended to develop guidance on how certification can contribute to NDFs and LAFs for MAPs and identify appropriate certification schemes, standards and guidelines, including those developed at national levels based on their degrees of equivalency with CITES measures.

Decision 18.300, paragraph b) iii)

Progress in examining case studies involving local and traditional knowledge in assessments, and participatory monitoring and management of CITES-listed MAPs

20. In line with Decision 18.300, the present document applies a working definition of the term '*local and traditional knowledge*' as *knowledge that local stakeholders or communities have about the populations of locally occurring species, through their own experience, observation or experimentation, or through non-formal and non-scientific knowledge transfer from other local stakeholders or community members*. However, the Secretariat notes that various terms are used in policy processes and literature to refer to such knowledge, including: traditional or indigenous knowledge (TK, IK), traditional or local ecological knowledge (TEK, LEK), indigenous and local knowledge (ILK), and aboriginal traditional knowledge (ATK).

21. The integration of local, indigenous and traditional knowledge in biodiversity policies is emphasized in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) framework and assessment processes (Decision IPBES-2/4, IPBES/5/15, IPBES/3/INF/7). It is also an important objective in several processes under the Convention on Biological Diversity, including the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. In CITES, the relevance of local and traditional knowledge to the making of NDFs is recognized in paragraph 1 a) x) of Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings*. Participatory decision-making is at the core of Resolution Conf. 13.2 (Rev. CoP14) on *Sustainable use of biodiversity: Addis Ababa Principles and Guidelines*. Both concepts are also acknowledged in the sections on '*empowerment of rural communities*' and '*engagement of rural communities in combating illegal trade in wildlife*' of Resolution Conf. 16.6 (Rev. CoP18) on *CITES and livelihoods*. Multiple NDF guidances mention local and traditional knowledge, participatory assessments, and participatory monitoring and management of CITES-listed species (see document AC31 Doc. 14.1/PC25 Doc. 17 on *Non-detriment findings*). The incorporation of local and traditional knowledge in CITES processes is developed for some ranched animal species (e.g. crocodiles) and animal species used as hunting trophies (e.g. Leopard). For other taxa, in particular MAPs, guidance for the use of local and traditional knowledge and participatory assessments is less developed in available NDF materials, and examples of its application are rare.

22. As described in document CoP18 Doc. 55, MAP species are often of particularly high cultural salience. Long-standing local and traditional experience and experimentation may result in knowledge on ecological requirements, population dynamics and sustainable harvesting techniques. Local and traditional knowledge can be used to understand and predict environmental events and can be integrated into comprehensive monitoring and management strategies through long-term participatory collaboration (Berkes, 2000; Chamberlain et al., 2018; Sheil et al. 2015). Asking local communities about MAPs is often considered as quicker and cheaper than conducting ecological research (Berkes, 2000, Rist et al., 2010 and Ziembicki et al., 2013). Community engagement could enhance local acceptance, long-term sustainability, and local livelihood benefits; contribute to work on CITES and livelihoods; and complement approaches provided in the *Handbook on CITES and livelihoods*. Local and traditional knowledge is particularly valuable for providing

long time series, for recording unusual observations and variations, and for providing shortcuts to relevant hypotheses (see also Fraser et al., 2013; Gilchrist et al. 2015: Hellier at el., 1999; Rist et al. 2010; Sobral et al. 2017 and Turvey et al. 2013).

23. To address Decision 18.300, paragraph b) iii), the Secretariat reviewed relevant literature, including 12 published case studies on the use of local and traditional knowledge for biodiversity assessments. These range from detailed studies of local and traditional knowledge for the management of individual species in specific sites [Rist et al. (2010); Senkoro et al. (2019)] to studies of population trends and conservation status of multiple species at a regional scale [Parry and Perez (2015); Turvey et al. (2013); Ziembicki et al. (2013)]. To broaden the range of available experiences and collate additional case studies, the Secretariat developed a short questionnaire and liaised with the Scientific Authority of the United States of America, the Medicinal Plant Specialist Group of the International Union for Conservation of Nature (IUCN), the IPBES Technical Support Unit on Indigenous and Local Knowledge hosted by UNESCO, TRAFFIC, Plants and People International, the Swiss Ethnobiology Network and Dr. Tomasini, lead researcher and author of quantitative comparisons of scientific and local knowledge for the assessment and conservation of MAP populations. Based on contacts facilitated through these networks, the Secretariat conducted 13 expert interviews. The Secretariat also took into account a recently proposed '*Guidance for Integrating Indigenous and Local Knowledge (ILK) in IUCN Red List Assessments*' (Cross et al. 2017) that was elaborated under the lead of the IUCN Sustainable Livelihoods Specialist Group.

24. Wherever possible, case studies and experiences with (CITES-listed) MAP species were prioritized. CITES-listed MAPs for which relevant case studies could be identified include: ginseng and goldenseal (in the United States of America and Canada), *Orchis* spp. (Albania), *Prunus africana* (Cameroon), *Nardostachys grandiflora* and *Dendrobium nobile* (China). Case studies that seem to illustrate relevant and transferable experiences with other species, especially with regard to used methods and approaches, were included as well. The questionnaire is presented in Annex 2, and the list of interviewed experts in Annex 3. The case studies are presented in Annex 4. As a rough indication of their relevance to NDFs making, they are classified with regard to the considerations A-H in paragraph 1 a) ix) of Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings*. They were further synthesized with regard to the assessed species and geographic scale; applied fieldwork methods for gathering knowledge and enabling participation; methods for enhancing the objective validity of the knowledge collected and for reducing potential biases; and case study conclusions.

25. The **12 literature case studies** that were examined cover all CITES regions [Central and South America and the Caribbean: three cases; North America: three cases; Africa: two cases; Asia: two cases; Europe: one case; Oceania: one case]. They describe the use of local and traditional knowledge for various taxa. Five studies focus on one particular species (i.e. medicinal *Warburgia salutaris* trees in Mozambique; Senkoro et al., 2019). Seven studies compare methods for using local and traditional knowledge for the management of several species or higher taxa (e.g. participatory resource assessments of six MAP taxa, including *Orchis* spp. in Albania; Tomasini and Theilade 2019). Eight case studies focus on small and short spatiotemporal scales. Yet, four case studies demonstrate that local and traditional knowledge that is systematically collected from a sufficient number of sources across larger geographic areas can be aggregated into large-scale, semi-quantitative spatiotemporal population assessments: the entire state of Amazonia in Brazil (Parry and Perez 2015), the Yangze river in China (Turvey et al. 2013), remote rivers in Canada (Fraser et al. 2013), and the Australian northern territories (Ziembicki et al. 2013). Five case studies exclusively focus on plants, two compare plant and animal taxa, and five focus on animal taxa, but use methods that that seem relevant to plant species. Of the seven case studies that research plant species, four focus explicitly on MAPs, and three focus on local and traditional knowledge on plant taxa with various uses, of which some are also known as MAPs [e.g. knowledge on *Eucalyptus* spp. in the context of firewood collection (Jones et al., 2008)]. Overall, the 12 studies describe the use of traditional knowledge for species management purposes for 67 plant species, and 106 animal taxa.

26. The majority of the **13 interviewed experts** contributed experiences from more than one case study. Overall, the interviews complemented the literature reviews by providing information on 28 additional case studies from each CITES region. Six experts referred to North American case studies; five referred to African case studies; two experts referred to Asian case studies; two to Central and South American case studies and two to European case studies. One expert contributed case studies from Oceania. Twenty-four case studies focus on specific MAP species. Some of these species are referred to in several case studies (e.g. *Prunus africana*, reported by Abdon Awono and Sarah Laird). Overall, these 24 case studies refer to a total of 19 MAP species, of which several are CITES-listed (*Cistanche deserticola*, *Dendrobium nobile*, *Hydrastis canadensis, Nardostachys grandiflora, Panax quinquefolius,* and *Prunus africana).* Four case studies focus on larger groups of MAPs (case studies to document local and traditional knowledge on MAPs in Madagascar, Mozambique, and Peru, reported by Sarah-Ian Mathez-Stiefel, and a case study on MAPs in

Egypt reported by Marwa Halmy). One case study reports a specific approach for participative species assessments (e.g. the Canadian model for including local and traditional knowledge in species assessments via an institutionalized consultation process (Committee on the status of endangered wildlife's aboriginal traditional knowledge sub-committee COSEWIC-ATK reported by Gloria Goulet and Danna Leaman).

27. A synthesis of the case studies shows that local and traditional knowledge, and participatory monitoring and management can be useful to many aspects of NDF making, in particular each of the considerations A-H in paragraph 1 a) ix) of Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings* (see Annex 4). The case studies suggest various fieldwork methods for collecting local and traditional knowledge, and participatory approaches for species assessments, which could provide examples for implementing similar approaches for making NDFs for CITES-listed MAPs. They also indicate several approaches to ascertain the reliability, validity, completeness and objectivity of the information collected. When making NDFs for CITES-listed MAPs using local and traditional knowledge, such approaches are crucial to enable science-based NDFs that ensure non-detrimental use of CITES-listed MAPs. These aspects are further analyzed in Annex 5.

Decision 18.300, paragraph b) iv)

Recommendations to inter alia *complement existing tools relating to the implementation of the Convention for CITES-listed medicinal and aromatic plants, and create synergies, as appropriate, with relevant intergovernmental organizations and stakeholders*

28. Based on the analyses in the present document, the available data suggests that international trade in MAPs is large and growing, but that trade monitoring and reporting remains incomplete. One challenge is the complexity of trade, and the pharmaceutical and common names under which products of CITES-listed MAPs are traded. To support national CITES Authorities in implementing CITES regulations for MAP species, enhance awareness and transparency of CITES regulations for stakeholders, and enable better monitoring and reporting of international trade in these, it seems essential that the *CITES Checklist* contains the scientific but also trade, pharmaceutical, and common names of CITES-listed MAPs. The Secretariat identified the Kew MPNS as the best partner for this effort due to the comprehensiveness of its database, and its experience with the requirements of regulatory (pharmaceutical) bodies in the field of MAP species. Further measures that could improve trade monitoring and reporting are detailed in information document CoP18 Inf. 11.

29. Certification schemes, standards and guidelines, as well as voluntary and market-based mechanisms, have the potential to support industry in enhancing the sustainability of trade in MAPs, and the livelihoods of rural populations at local or national level. Additionally, information generated through certification processes can support SAs and MAs in the making of NDFs and LAFs. CITES and the sustainability of trade in MAPs can be strengthened by creating incentives for the industry to certify CITES-listed MAPs. Guidance could be developed to clarify how certification could contribute to NDFs and LAFs, and to advise how certification schemes, standards and guidelines may be compatible with CITES regulations.

30. The 40 case studies on CITES-listed MAPs and other taxa that were examined demonstrate that local and traditional knowledge, and participatory assessments, monitoring and management, can provide information on many key aspects for making NDFs. In at least some instances, gathering local and traditional knowledge may be the most cost-effective way to gather information relevant to NDFs. Under ideal circumstances, information from ecological monitoring and from local and traditional knowledge would complement each other, but even if no other data is available, traditional knowledge can already provide crucial information. The collection, verification and analysis of traditional knowledge requires particular skills and methodologies. Specific guidance could be developed to support Scientific Authorities in using local and traditional knowledge in making NDFs for trade in CITES-listed MAPs.

Recommendations

31. The Plants Committee is invited to establish an intersessional working group on *medicinal and aromatic plant species* in support of Decision 18.302 with the mandate to:

    a) review the Secretariat's report on progress in the implementation of Decision 18.300, as contained in the present document and its Annexes;

    b) take into account, in line with Decision 18.302, information document CoP18 Inf. 11;

c) draft recommendations in preparation for reporting to the Standing Committee or the 19th meeting of the Conference of the Parties; and

d) submit the outcomes of its work to the Plants Committee for its consideration.

Matrix comparing the general guidelines for making NDFs (Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings*) **and LAFs** (Article IV, paragraph 2 (b) of the Convention) **against four certification standards** (FairWild Standard, Union for Ethical BioTrade/UTZ, Forest Stewardship Council (FSC) and EU Organic Regulations)

Source: CoP18 Inf. 36, Table 1

NDFs Res. Conf. 16.7 (Rev. CoP17).	9-step NDF for perennial plants (steps where relevant information would be collated)	FairWild Standard Version 2.0 Performance Indicators	Field Checklist for UEBT/UTZ Certified Herbal Tea	FSC International Generic Indicators	EU Organic Regulation, from: (EC) 834/2007 and (EC) 889/2008
A. Species biology and life-history characteristics	Steps 1 and 5	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines	no relevant indicator
B. species range (historical and current);	Steps 4, 5 and 6	full consideration of guidelines	partial consideration of guidelines	full consideration of guidelines	partial consideration of guidelines
C. population structure, status and trends (in the harvested area, nationally and internationally);	Steps 4, 5 and 6	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines
D. threats	Steps 4, 5, 6 and 7	full consideration of guidelines	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines
E. historical and current species-specific levels and patterns of harvest and mortality (e.g. age, sex) from all sources combined	Steps 3, 4, 5, 6 and 7	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines	no relevant indicator
F. management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance	Step 8.	full consideration of guidelines	partial consideration of guidelines	full consideration of guidelines	no relevant indicator
G. population monitoring	Steps 6, 7 and 8	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines	no relevant indicator
H. conservation status	Steps 4 and 6	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines	no relevant indicator
Article IV, paragraph 2 (b)					
a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora [i.e. Legal Acquisition Findings – LAF]	Step 3	full consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines	partial consideration of guidelines

Questionnaire for expert interviews regarding Decision 18.300, paragraph (b), iii

Interviewee:
State / Institution:
Role:
How we got the contact / who recommended the contact:
Reason for the recommendation:

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Please note that we are aware of some terminological diversity regarding the topic of this interview. Local knowledge is variously referred to as traditional or indigenous knowledge, as well as traditional or local ecological knowledge (TEK, LEK). For the purpose of this interview, our interest is the *knowledge that local stakeholders or communities have about the populations of locally occurring CITES-listed medicinal and aromatic plant species (MAPs), through their own experience, observation or experimentation, or through non-formal and non-scientific knowledge transfer from other local stakeholders or community members*.

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Instances of using local knowledge in species assessment, monitoring, or management:

1) Have you been involved in assessments, monitoring or management efforts for CITES-listed MAPs, in which local knowledge was used? [*If so, specify species, location, time frame, objective*].
2) Are you aware of instances, in which other people or institutions used local knowledge in assessments, monitoring or management of CITES-listed MAPs? [*If so, specify responsible person / institution, species, location, time frame, objective*].
3) Are you aware instances in which local knowledge was used in the assessment, monitoring or management of other species groups? [*If so, specify responsible person / institution, species, location, time frame, objective*].

Process of using local knowledge in species assessment, monitoring, or management:

4) How was the contact with local communities or stakeholders established, and for how long were the relations maintained?
5) Who were the local communities or stakeholders that you collaborated with?
   [*Start with open question, then ask for specific categories, if required:*
   a) *Local community members who are not employed by natural resource management institutions but possess relevant knowledge (e.g. plant collectors or traders, herbal medicine practitioners, holders of traditional knowledge)*
   b) *Resident professionals, local government staff or civil servants involved in natural resource management (including local botanists or researchers from local universities if resident in the area of concern)*
   c) *Volunteers and amateurs collecting data according to predefined protocols (e.g. citizen scientists carrying out species counts or similar)*
   d) *Local authorities with leverage about community decision-making (e.g. mayors, elders, people of high standing and reputation*)].
6) How were the communities or stakeholders involved in species assessment, monitoring or management?
   a) In providing local knowledge.
      [If applicable, ask follow-up question:
      i) *What were your methods for eliciting knowledge (workshops, focus groups, interviews, questionnaires, other please explain)?*
      ii) *What information was researched? (Conservation status, -trends, and -concerns; intrinsic biological risk / vulnerability / regeneration, harvest impacts, trade impacts, species monitoring, species management, other please explain)*

   iii) *How did the knowledge contribute to CITES NDFs, species monitoring or management?]*

b) In conducting fieldwork or implementing assessment, monitoring or management protocols.
   [If applicable, ask follow-up question:
   i) *How were local collaborators selected and trained?*
   ii) *What methods were used and how were they implemented?*
   iii) *How did the fieldwork contribute to CITES NDFs, species monitoring or management?]*

c) In jointly designing assessment, monitoring or management protocols.
   [*If applicable, ask follow-up question:*
   i) *What were crucial steps of the collaboration, and what agreements were made?*
   ii) *What methods were used and how were they implemented?*
   iii) *How did the collaboration contribute to CITES NDFs, species monitoring or management?]*

Benefits, challenges and conclusions regarding using local knowledge in species assessment, monitoring, or management

7) Which aspects of using local knowledge in species assessment, monitoring, or management do you consider successful and transferable?
8) Which aspects of using local knowledge in species assessment, monitoring, or management do you consider challenging or non-transferable?
9) If CITES was to develop guidance for using local knowledge in species assessments, monitoring and management, what would you recommend the Plants Committee to focus on – where is the most urgent need?
10) Could you recommend us any other experts to contact, or any relevant literature to consult?
11) Do you have any additional observations, suggestions or comments?

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List of interviewed experts

Name	**Affiliation**	**Main field of relevant expertise**
Ms. Yan Zeng	Chinese Academy of Sciences, Office of the China Scientific Authority for CITES	- IPBES sustainable use assessment author - NDF making and CITES NDF guidance - Community-based management of *Dendrobium nobile, Cistanche deserticola*, and *Nardostachys grandiflora* in China
Ms. Joanna Sucholas Ms. Anja zur Loye	PhD students, Universities of Regensburg, Freiburg, Germany	- Wild collection of plants and their economic importance in medicinal and health sectors (PharmaPlants project) in Poland and Romania
Ms. Christine Mitchell	Researcher, Artis College of Science, Department of Geospatial Science, Radford University, US	- Involved in US NTFP report - Extensive expertise in local knowledge for *Sabal palmetto* - Pertinent fieldwork in Bhutan, Indonesia, Micronesia (Federated States of)
Ms. Mathez-Stiefel	Senior Research Assistant, Centre for Development and Environment, University of Bern, Switzerland	- Ethnobotanical assessments of plants in Madagascar - Work with traditional healers in Mozambique - Traditional knowledge of Quechua people in Peru and Bolivia (Plurinational State of)
Mr. Rainer Luick	Professor of nature and environmental protection, University of Applied Sciences Rottenburg, Germany	- Long-standing involvement in the development of biodiversity indicators (High Nature Value Farmland Indicator, used by European Union and CBD, i.a.) - MAP wild collection and primary forests in Eastern Europe
Ms. Danna Leaman	Co-Chair IUCN Medicinal Plant Specialist Group, Red List Authority Coordinator, Canadian Museum of Nature, Canada	- National and global species assessments, including *Hydrastis canadensis* (Goldenseal), *Nardostachys grandiflora* (Jatamansi), *Panax quinquefolius* (American Ginseng) - Collaboration with the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Aboriginal Traditional Knowledge (ATK) Subcommittee - Collaboration with UNDP on involvement of traditional harvesters in development of sustainable wild harvest practice and monitoring for sustainability certification scheme for O*riganum syriacum* in Lebanon
Ms. Sarah Laird	Co-Director, People and Plants International, USA	- 20+ years of experience on research with local communities on medicinal plants, including *Prunus africana*, on Mount Cameroon
Ms. Marwa Halmy	Department of Environmental Sciences, Alexandria University, Egypt	- Collaborator in GEF-funded UNDP project coordinated by the Environmental Affairs Agency of Egypt on the sustainable use and local knowledge of MAPs by nomadic tribes of North-Western Egypt - IPBES sustainable use author
Ms. Gloria Goulet	Co-chair Aboriginal Traditional Knowledge Subcommittee, Committee on the Status of Endangered Wildlife in Canada	- Former member of COSEWIC Secretariat, lead person who set up ATK subcommittee, and its current co-Chair - Involved in many species' assessment processes (mainly fauna) from the perspective of indigenous knowledge
Ms. Marla Emery	Research Geographer, Forest Service, Northern Research Station, USA	- IPBES Sustainable Use Chair - 25+ years' experience in working with local communities and individuals that harvest plants and fungi - Expertise on Ginseng
Mr. James Chamberlain	Forest Products Research Technologist, Forest Service Southern Research Station, USA	- Long-standing experience on community-based management of *Allium tricoccum*, *Hydrastis canadensis*, *Actea racemosa* - Involved in relevant NDFs
Mr. Eric Burkhart	Director, Appalachian Botany and Ethnobotany Program, Ecosystem Science and Management Department, Pennsylvania State Univ., USA	- Ethnobotanical work with USAID in Nicaragua - Long-standing researcher and educator on MAPs and NTFPs in the Appalachian area, *Panax quinquefolius*, and *Allium tricoccum*, i.a. - Community-based research on economically important plant species in Madagascar
Mr. Abdon Awono	Center for International Forestry Research (CIFOR), Cameroon	- 20-year experience in forestry research at CIFOR in Cameroon - Focus on *Prunus africana*, among others - Expertise on value-chains

Summary of expert interviews on using local and traditional knowledge in species assessments, and of participatory monitoring and management of CITES-listed MAPs

Addressed considerations [Res. Conf. 16.7 (Rev. CoP17), para. 1 a) ix)]	**Methods used in the case study to collect local and traditional knowledge**	**Methods used in the case study to validate local and traditional knowledge and case study conclusions**	**Source**
A: Species biology & life-history B: Species range C: Population status & trends D: Threats E: Mortality from all sources F: Management measures G: Population monitoring H: Conservation status	Species: *Dendrobium nobile*, *Cistanche deserticola*, and *Nardostachys grandiflora* in China. Participatory approach: Stakeholders were contacted during face to face surveys, online contacts, or through introduction from other stakeholders, and included local village or party authorities, company or institution staff, and individuals such as religious lamas, local doctors, and teachers. Information was collected in interviews, questionnaires and information sharing forums. Contributions of local and traditional knowledge: Contributions of local knowledge included species distribution, trends, concerns, intrinsic vulnerability, habitat quality, uses, harvest impacts, trade impacts, efficiency of local monitoring, management and enforcement, similar species and hybrids or mixed species, interspecies competition, regeneration, material collection and processing, livelihoods, demand and community awareness. Communities can also contribute to the NDF itself, but depending on information confidence, the SA decides how much local knowledge the NDF can incorporate.	Validation of local and traditional knowledge: Assuring credibility is a key challenge, since local knowledge may be blurry, requires more effort to verify, and reasonable verification methods are not always straightforward. The CITES Scientific Authority of China and the Chinese Academy of Sciences used several strategies: - While scientists may not have area- or culture-specific knowledge to directly validate local knowledge, indirect validation of those aspects that are not specific to an area or culture is possible, such as species' life-history. If local knowledge is accurate on these, one can assume is may also be accurate in observing local situations. - The snowball method helps to find knowledgeable people. For example, traders tell where they got the herbs. In these local towns, there will be local agriculture or development departments, or offices, and they will lead to the local specialists and collector families. - China is planning a study to assess coherence of local knowledge and survey techniques through random sampling and sample plots. Conclusions: Local and traditional knowledge is very important in the 9-Steps NDF guidance (Wolf et al. 2016) and can contribute to almost all of its steps. It may supplement some trends and conclusions when scientific information is lacking and suggest inferences or hypothesis for testing. The importance of local knowledge should be highlighted, but the credibility challenge needs to be kept in mind, and some developing countries might not have the required capacity.	Yan Zeng interview
A: Species biology & life-history B: Species range C: Population status & trends D: Threats	Case study species: *Panax quinquefolius, Hydrastis canadensis, Pelargonium sidoides, Nardostachys jatamansi, and Origanum syriacum.* Participatory approach: a) Workshops/symposia based on pre-existing ties between national CITES Authorities and stakeholder/harvester communities; b) field research/interviews; and	Validation of local and traditional knowledge: The COSEWIC-ATK subcommittee has no standard process for data collection and collaboration between federal and territorial authorities. For a national species assessment of polar bears, there was insufficient collaboration and contradictory information between traditional and scientific knowledge, and disagreements on the weight of anecdotal behavioural information. But legally, protocols mandate to give equal weight to both. For plants, such conflicts might be less relevant. The transfer of observational, anecdotal, or non-numerical data into scientific paradigms (sustainable harvest levels, etc.) is difficult for the scientific community to understand, accept and use. There has to be a commitment on both sides to	Danna Leaman interview

E: Mortality from all sources F: Management measures G: Population monitoring H: Conservation status	c) an institutionalized consultation process (Committee on the status of endangered wildlife's aboriginal traditional knowledge sub-committee COSEWIC-ATK) that was jointly developed with Canadian First Nations organizations who have legal authority over resources in their recognized lands. The COSEWIC-ATK subcommittee has aboriginal co-chairs and developed formalized community and species assessment protocols. Contributions of local and traditional knowledge: Information for *P. quinquefolius* and *H. canadensis* contributes to species management. Scientists detected diminished genetic diversity, while local and traditional pointed out to a reduction of harvestable area and material, which were complementary insights. For *P. sidoides* in South Africa, a sustainable harvest protocol was developed to prevent a CITES listing. For *O. syriacum* in Lebanon, a standardized understanding of sustainable harvest and its regulation was developed by looking at comparative harvesting practices, and how they could be managed. In many cases, adopted practices were the old ones used by previous generations.	understand both types of knowledge at the same level. People evaluating that knowledge need to be crossing the boundary, which is very hard. There is an increasing number who cross that barrier, but they are completely oversubscribed. What is needed are bridge persons. Conclusions: There are at least two perspectives on making the use of local knowledge in species assessments. The academic community requests massive structures to manage interpersonal relations, which poses practical challenges. In contrast, the COSEWIC-ATK subcommittee has been designed by First Nation communities in collaboration with indigenous COSEWIC co-chairs. It is important to agree which questions should be asked. If questions are imposed from the outside, it is really difficult for indigenous communities to see why participation would be in their interest. Case studies are very helpful and contribute to identifying factors that made assessments successful or not; rules of engagement; good practice; and how to approach a research question. It is important to agree at the outset; to understanding that local and scientific knowledge would be treated with equal value; and to understand that information does not have to be in the same format, and does not have to be numerical to be given weight. A shared sense of purpose of what the information is used for (trust) is required.	
A: Species biology & life-history B: Species range C: Population status & trends D: Threats E: Mortality from all sources F: Management measures G: Population monitoring H: Conservation status	Species: *Prunus africana* in Cameroon. Participatory approach: One starts contacting civil society organizations already active in the field, including government, traditional authorities, non-governmental or international development organizations. In north-west Cameroon, we worked with a local organization (MOCAP) and traditional authorities. Governmental and academic institutions, including the CITES Scientific Authority (ANAFOR) and the Ministry of forestry are also involved. We explained the purpose of the assessment, its international context, and asked for their permission and collaboration. We then conduct a problem analysis workshop with several actors, and decided with whom to collaborate. Another option is to decide based on observations of how actors work in the field. Workshops also serve to jointly develop implementation strategies. In some instances, these ended up differently from what scientists envisioned beforehand. Such activities also create ownership and help to ensure the sustainability of the initiatives. Contributions of local and traditional knowledge: For species assessments, we researched how people access the products, their utilization and conservation strategies.	Validation of local and traditional knowledge: It is important to consider the gender aspect. Men and women have different knowledge. One needs to understand how communities function. Otherwise a lot of information is lost that is specific to some entities. Conclusions: While people and communities are very diverse, a bottom-up process can work everywhere. Details may change, but a common guideline is possible. Language can be a challenge in areas where local languages are spoken. Middlemen can solve the problem, but they need to be trained to translate accurately. The objective of a collaboration needs to be extremely clear. Communities will not be open if they do not accept external people wishing to collaborate with them. Therefore, things should be presented plainly, without wishful thinking or unrealistic expectations, otherwise the spirit of collaboration in the long term. During any activities, and after their conclusion, steps of the process should be explained along the way, and results should first be reported back to communities.	Abdon Awono interview

A: Species biology & life-history C: Population status & trends E: Mortality from all sources F: Management measures G: Population monitoring H: Conservation status	Species: NTFPs (*Allium tricoccum, Actea racemosa*, and more tangentially *Panax quinquefolius,* and *Hydrastis canadensis*). Participatory approach: To initiate contacts for *A. tricoccum*, I went to local onion festivals, interviewed community groups and got myself invited to go with harvesters, who were surprised about my interest. Trust building happens by spending time, conversing, and demonstrating interest. For *A. racemosa*, contacts were via industry people, not harvesters. Data collection and fieldwork was via volunteers (students, industry and NGO people). For *H. canadensis*, collaboration was with landowners. Contributions of local and traditional knowledge: For *A. racemosa*, we weighed harvests for the first time ever. Participatory below-ground biomass measurements are the only way to estimate harvestable material of *H. canadensis*. Landowners were trained in plant measurement protocols (height, leaf area, below ground biomass/harvestable material). From the next year onwards, they apply them for data collection.	Validation of local and traditional knowledge: Responses can be validated by repetition. Permanent sampling plots with specific harvest treatments allow for participatory monitoring of harvest impact and for the development of guidelines based on that information. Doing measurements jointly leads to mutual learning, but citizen science needs to pay particular attention to variations of measurement accuracy. Methods and tools require field validation, joint methods design, or co-developed protocols to ensure there are understood and user-friendly. Conclusions: Local and traditional knowledge can assist with CITES NDFs. Informal interviews provide hypotheses, and subsequently joint validation produces reliable data that would otherwise be hard to obtain. Being reliable and building trust is key. At times, unreliable or biased information is provided (e.g. only showing bad harvesting patches). In that case, use the information, analyse it, come back after a few months and present results. That will build trust. Local knowledge is a good place to start. It provides hypotheses and can contribute data that is otherwise hard to obtain, but it needs to be backed up with evidence.	James Chamberlain interview
E: Mortality from all sources F: Management measures G: Population monitoring	Species: *Panax quinquefolius*, among many other NTFP species. Participatory approach: Communities are approached via institutions that they trust, which could include churches, first responders, or community assemblies. A key task is to understand social structure, and which institutions are most authoritative and recognized for the problem at hand. Receiving free, prior, and informed consent is a key requirement, and is a global standard, not a western concept. It entails transparency of purpose and control over how information is gathered and used. It might entail that some available information cannot be used. Further keys are integrity, honesty and respect. Transparency on pressures and requirements is usually appreciated. The integrity of the individuals engaging with the community, the perceived integrity of CITES Authorities as institutions, and of CITES as a global Convention with a common purpose are key to establish a collaboration based on trust. For full and complete collaboration and information, partnerships need to be long term; days or weeks are insufficient. Ethnographic methods are the gold standard for eliciting indigenous knowledge. Communities might have younger members with more formal education who can serve as bridge persons and trust-builders	Validation of local and traditional knowledge and conclusions: Trust-building, including long-term partnership, free, prior and open consent, honesty, integrity and respect are key to the collection of full and honest information. If done participatively, research designs, development of metrics and indicators, analysis and interpretation of results are more robust. For example, awareness of differences in plant taxonomies is key for asking the right questions and for getting a valid interpretation of the responses. Researchers should also demonstrate strong ecological and ethnographical skills, since documentation of local knowledge by pure ecologists might produce results of lesser validity. Therefore, not only the 'how' and the 'methods' are important, but also the required skills. Professional associations, such as the International Society of Ethnobiology (ISE) are well-positioned to help with such standards. Reliability can be further strengthened through triangulation, multiple sources and multiple types of sources, and comparison of local and scientific knowledge. Communities have divisions: gender, class, age, authority structures, and internal power relationships. Communities are not happy, egalitarian, or monolithic institutions. Who is an insider versus an outsider? Who is involved in harvest and distribution along the commodity chain? Where do profits accumulate? Understanding supply chain characteristics and social power dynamics and understanding who will benefit or who might be harmed ensure not only comprehensive information but are also a confidence measure. This is particularly relevant for high-volume export harvest. Scale, context and purpose matter. There may be a wealth of knowledge where species were used for several generations for subsistence purposes with high local salience. When a global market opened up, there were wholesalers who contracted	Marla Emery interview

	between scientific and indigenous knowledge and do data collection and analysis.	people, and drove them to collect in forests that were unfamiliar to them in term of terrain, ecology, and mushrooms. In such instances, collectors still have knowledge, but it has other purposes, is used in other context and scale, and thus results in other impacts. Such influences can also come from armed conflict or climate migration.	
A: Species biology & life-history B: Species range C: Population status & trends D: Threats H: Conservation status	Species: Various species, but focus is on the COSEWIC-ATK sub-committee in Canada, to which Ms. Goulet has been contributing since its initiation 20 years ago. She now serves as indigenous co-chair. Participatory approach: The initial drive of the ATK subcommittee was through the Convention on Biological Diversity (CBD). It was then mandated in the 'species at risk' act. It was developed with the Canadian congress of indigenous people. Processes were discussed at four workshops across the country. Indigenous members are appointed and funded by the government, and three PhD students work on assessment processes. There is a two-step process once COSEWIC identifies a species for assessment with two years' advance notice. ATK scopes how much local knowledge there is available, based on public information. Based on a source report and a gap analysis of existing information, a decision is made on whether ATK gathering reports are conducted. In the case of the latter, all indigenous communities are notified to inquire internally, whether they can contribute. If so, COSEWIC hires from within the community, usually through a high-level organization. Information is sent back to communities for validation (incl. possible amendments) and integrated into the COSEWIC assessment but can be held confidential. All species-specific COSEWIC committees have indigenous members who review information and identify to which sections they can contribute. They also serve as bridge people to build trust with indigenous communities. Contributions of local and traditional knowledge: There is a legal obligation to include local knowledge in COSEWIC assessments, but there are a lot of species for which no knowledge is available. For some species, e.g. endemic plants in remote areas, there simply is no other information. The COSEWIC-ATK subcommittee provides the legally mandated mechanism to access such knowledge.	Validation of local and traditional knowledge: The integration of information is often quite straightforward and not at all difficult. For several assessments, ATK contributed knowledge that was very accepted by science (e.g. relationship between salmonberry seasons and salmons populations on the west coast, and an assessment on trouts). In one instance, scientists did not accept an ATK differentiation between two kinds of shinnock salmon. Genetic work was done for validation and showed some differences, but the indigenous distinction was nevertheless rejected. An assessment of polar bears was also conflictive. Some communities perceived population increase in some places. When scientists and ATK disagree, the assessment will most likely be done with more precaution. But Inuit knowledge basically says that species go away for a while and then come back – animals move around. Scientists did not believe and found many reasons for why people reported seeing more bears. Individual people have agendas, but if many of them report similar sightings, having been out on their lands a lot, and in various communities, there is something to it. There also is a built-in validation system, since people in communities know each other and who can be trusted, and they understand that report outcomes can affect them, and they want to do it right. The chair of COSEWIC reminded members to give equal weight to both knowledge systems and the assessment came out with the conclusion that the bear was ´of special concern´ (rather than ´threatened´ which it would have been otherwise). Conclusions: Overall, one starts with a political process to ensure people have a chance to recommend how they would like to do the assessment. We started like that and it was then incorporated into an existing COSEWIC process. Financial and other support is needed. One identifies knowledge holders (individuals that have knowledge) and knowledge keepers (individuals that know how knowledge sharing works and who are the centre of a network of people who would then conduct ATK gathering) and understands how communities work with their information. It is important to provide infrastructure so that communities can maintain their own information. One ought to be respectful to spiritual connections to the species – the loss of a species is a loss for the people's future and existence.	Gloria Goulet interview

C: Population status & trends D: Threats E: Mortality from all sources F: Management measures	<u>Species</u>: MAPs used by nomadic tribes in coastal deserts of north-west Egypt (e.g. *Panicum turgidum*, *Urginea maritima,* and *Colchicum* spp.). <u>Participatory approach</u>: Once fieldwork started, people got curious and asked what we were doing. From there, we got to know more people through fieldwork (snowball sampling). We talked to different types of people (knowledge holders, healers, herbalists, collectors, elders (men and women), herd keepers who collect plants while keeping herbs), but questionnaires were done informally, since people do not accept formal interviews. Where we could, we met heads of families or tribes. <u>Contributions of local and traditional knowledge</u>: Questions included whether habitats were shrinking, drivers of decline, enrichment planting, and collection activities.	<u>Validation of local and traditional knowledge</u>: One needs to ask people whether they would be able to help. Informal interviews and snowball sampling work best. To enhance accuracy and understanding, it helps to ask more than once in different ways, in non-direct ways, in a chatting way to get the answer validated. One should ask more than one person and distribute questions between men and women - they have their own tasks and specialised knowledge. The older the person, the more information they have. <u>Conclusions</u>: Collaboration should be of benefit to both sides. It will work better if it is positively impacting people's lives, especially if outcomes might require behavioural change. There should be something communities understand and benefit from. Therefore, conservation should be connected to livelihoods and innovative ways to ensure the plants' sustainable use, such as access of certified products to larger markets. Communities need to understand it is not about stopping their practice, but about being in international supply chains.	Marwa Halmy interview
F: Management measures	<u>Case study species</u>: MAPs and NTFPs in Madagascar, Mozambique, and Peru. <u>Participatory approach</u>: Research was carried out in collaboration with local NGOs that had long-term relations with communities. The research was introduced at community assemblies, where formal authorization was given. There were always some products or booklets to give results back to the community. Collaborators were herbalists, local herbariums, laypeople with plant knowledge and communities at large. Methods included questionnaires, sample collection, participatory tools like community workshops, focus groups, group discussions, group ranking evaluations, in addition to in-depth interviews and walks. Joint learning is usually a long process and requires good facilitation skills from researchers. An example of a tool for joint learning is the agro-ecological knowledge toolkit (University of Bangor) software to codify and document local ecological knowledge. <u>Contributions of local and traditional knowledge</u>: We analyzed management practices and elaborated recommendations to come up with agroforestry options that are based on local knowledge and local perceptions of needs and benefits.	<u>Conclusions</u>: Including experiential knowledge is extremely useful, since it is often very rich, even in areas where there is not much literature. Some experiential knowledge is more cultural, spiritual, or relates to worldviews, norms and social organization. Experiential knowledge cannot simply be taken out of context. But practical knowledge is rather similar all around the world. Methods and tools are transferable and should be applicable in any context. Choices depend a lot on how much time can be invested. When time is limited, it is best to do a more participatory rapid assessment; when there is more time, ethnographic and in-depth fieldwork can be used. Work with local experts can be quicker than with the general population. But expert knowledge may not be representative of the knowledge of women or other societal groups. Ethical aspects are important - how to engage with local knowledge, legal requirements, and research ethics. The International Society of Ethnobiology has an elaborated ethics code.	Sarah-lan Mathez Stiefel
E: Mortality from all sources	<u>Species</u>: Wild MAPs in Germany and Eastern Europe, including *Arnika* spp., *Primula* spp., *Euphrasia* spp. and *Crataegus* spp. <u>Participatory approach</u>: Dialogues included NGOs and local biodiversity experts or biodiversity amateurs.	<u>Validation of local and traditional knowledge</u>: Due to the lack of evidence-based knowledge of collectors and harvesters, it makes only limited sense to work with their qualitative judgements. <u>Conclusions</u>: Working with traditional knowledge in wild collection is challenging. There is no corporate social responsibility or sustainability management in large commercial MAP supply chains, and various factors lead to supply chain problems	Rainer Luick interview

	Contributions of local and traditional knowledge: In Germany, there are some professional collectors with limited plant knowledge. In Eastern Europe, harvesters and collectors are not experts, with very little empirical knowledge. They are precarious day laborers, transported to harvest areas they do not know, who are shown plant pictures and collect anything looking remotely similar to those.	(climate change, socio-economic change, land use chains, and others). Quality is decreasing and there are fights for claims – resources are kept secret. Therefore, artificial propagation is thriving.	
B: Species range C: Population status & trends E: Mortality from all sources F: Management measures G: Population monitoring	Species: Wild MAPs in Germany and Eastern Europe, including *Arnica montana*. Participatory approach: Contacts were established through snowball sampling, sometimes initiated through pre-existing established contacts. They include local farmers with grassland properties, local collectors, local traders, national park employees, and companies. Both informal and semi-structured interviews are used, with some more structured questions. Contributions of local and traditional knowledge: Questions focused on which species and plant parts are collected, their identification, range and habitat, collection methods, quantities and seasons, and changes in the population over time. Questions to national park employees and traders also focused on trade controls and supply chain characteristics.	Validation of local and traditional knowledge: Knowledge is reliable if cross-checked with different people since this indicates that it is real community knowledge. If it has been learnt from other generations, then it is likely to have been there for a while and is not only an opinion., Identification, pictures and visual stimuli are used to aid elderly people who cannot go anymore on field walks. Language issues can be challenging. Researchers can be perceived as strangers. Local communities can consider nature protection regulations as limitations and that research could lead to additional regulatory burden. Sensitive economical aspects might make informants hesitate to be completely honest. Contact should not be stressful and take place in an atmosphere of trust. It helps to have a long relationship with community representatives. Group discussions or asking various people are best and help identify repetitive information. Transparency, dialogue on an equal footing, meetings and plenary discussions with neutral moderators are important. Conclusions: Local knowledge also exists in Europe. It is less common, and elderly people with more special knowledge are also dying out, but even here we have it. Knowledge is heritage. One should consider the rewards for using their knowledge. Partners should have the feeling to be empowered and to have influence, not controlled and voiceless.	Joanna Sucholas and Anja zur Loye interview
E: Mortality from all sources F: Management measures G: Population monitoring	Species: *Panax quinquefolius, Allium tricoccum, Hydrastis canadensis* and other native MAP and NTFP species in Madagascar, Nicaragua and the United States of America. Participatory approach: People might be intimidated by academic scientists; it is important to tear down walls. It is all about relations and starts with learning. It is key to get out there, meet harvesters, growers, and to offer educational events, workshops, or forest walk, not behaving as an expert, but as an apprentice in local knowledge. Internationally, snowball sampling works. As relationships deepen, one can educate stakeholders on what is going on and on how big and international this trade is; start mechanisms for conservation and pathways to adopt responsible behaviors; strengthen what works well; address knowledge deficiencies and behaviors; analyse gaps; how to adjust language in regulation; and understand how to strategically use information. There is reticence towards cooperation if	Validation of local and traditional knowledge: - It is important to understand what people know and do not know, and why they act as they do; and to learn to ask the right questions. A lot of people not trained in social sciences could go out and engage in very arrogant ways, not thinking about how they come across. They should listen first before standing up with a presentation. - Interviews and meetings can shed light on reasons for misreporting. These reasons may include intentional acts ('reporting as wild-sourced enhances prices', 'keep good sourcing areas secret from competitors', 'fear to be taxed once artificially propagated resources are classified as crops'), but also differences in concepts, vocabulary, and understanding, sometimes even superstition. - Certification can improve evidence and reporting by encouraging the establishment of a paperwork trail. Conclusions: Overall, regulation tends to leave proactive stuff behind and go to the reactive side of things. Not everybody acts in the best interest of the resource. One has to engage to get more buy-in and check on what is going to work or not and to understand correct reporting categories. Therefore, a framework is needed to identify	Eric Burkhart interview

	imposed, but willingness to participate in conservation programmes that engage people as partners. Contributions of local and traditional knowledge: Joint fieldwork can engage communities for mapping their territories, including boundaries of cultural sites and natural resource extraction areas, including for NDFs. The United States of America is attempting to set up a citizen science platform for reporting information, a national phenology network.	who should be involved; to make sure to ask the right questions; and to involve both top-down and bottom-up mechanisms. How researchers engage is important. Some stakeholders do not want friends and family to "give away" knowledge. How to gently correct is important. We should think about it creatively and passionately. Traders are often considered the best information sources, since they buy the material.	
A: Species biology & life-history B: Species range C: Population status & trends D: Threats E: Mortality from all sources F: Management measures G: Population monitoring H: Conservation status	Species: NTFPs in Cameroon, including *Prunus africana*. Participatory approach: Contacts started through field botanists from a botanical garden and proceeded quite organically and informally, via traditional leaders, and by going from house to house in communities, and also with community meetings at large. There is a need for constant dialogue and clarity about benefits. There were community research agreements to define what knowledge is used and what for, since they do not want to share much information on MAPs. Conversations can be very superficial for a long time, and they can collapse due to a few individuals. For twenty years, methods included local field researchers independently implementing research protocols, but the instruments need to be straight and clear. Contributions of local and traditional knowledge: The more communities use locally a species, the more they understand the relationships between species, where they grow, habitats, management, ecological roles, interspecies relations, even microorganisms. Research questions addressed uses (spiritual, building, food, medicine, etc.) and species management (how people use different habitats, differences between communities, indigenous vs. migrant communities and between different groups in the communities).	Validation of local and traditional knowledge: It is best to start with understanding local management strategies and to start a consultation process to explain what, why and how. It is often not obvious how it works, not like 'seeing a field with the species'. One should hire people who have already done that, wildlife experts with local expertise, and use a team approach, with initial pilot research and community consultations. One needs two sets of expertise: ethno/community/local, and sustainability expertise. There may be many cultural sensitivities. Initially, it takes a year to get information that is remotely of interest. The information gets better over five years. Conclusions: It takes a long time to build relationships and get proper consent, and to understand traditional knowledge. It is easy to look at only one species, but traditional medicine systems are incredible complex and manage hundreds of species at a time. To access that complexity of knowledge is not easy, and to get the most interesting knowledge is really hard. People will not always tell, not only because of hiding, but also because they do not understand what researchers want, because of different taxonomies, and because they will not take just any specimen - they may have one single tree in a particular place that they know. The shortcut is to work with people in the communities, to get the right team with local skills, but even with that it remains challenging. In Cameroon, there are lots of tensions between communities and the State. *Prunus africana* is overharvested, but it is of not much use in local medicine, and is only one among many NTFPs, and not a critical one locally. A lot of overharvesting is through outside people, not the locals.	Sarah Laird interview
A: Species biology & life-history B: Species range C: Population status & trends D: Threats	Species: Highly traded MAPs and NTFPs in Bhutan, Indonesia, Micronesia (Federated States of) and the United States of America, including Kava (*Piper methysticum*), and *Sabal palmetto*. Participatory approach: Government databases were used to identify landowners. On excursions, local students that take part in teaching activities might know relatives who collect, and who can be asked for information. Once there are first contacts, the snowball system works to identify buyers, middlemen, traders, companies. Immigrants tend to be	Validation of local and traditional knowledge: There are multiple strategies to ensure truthfulness and reliability of information: - To verify information in several different ways, and mixed methods approaches. If someone talks about money they make, ask middlemen or companies what they pay. Habitats can be participatively mapped in GIS to see where populations should be. This information can be verified in the field, to see whether they talk about the right habitats. If there is a drought according to satellite information and informants do not report that populations have been affected, they do not tell the truth.	Christine Mitchell interview

F: Management measures G: Population monitoring H: Conservation status	cautious and current generations are less interested. Even the pharmaceutical industry does not find enough collectors and hires more and more Roma people and immigrants, but they have no relevant knowledge. Local people conducting fieldwork or implementing assessment, monitoring or management protocols is complicated. If authorities preselect people, you may not control the selection criteria. Whether it works and you receive unbiased information depends of people's motivation. Jointly designing assessment, monitoring or management protocols are absolutely useful and can be learnt by trial and error, asking informants for better ways to ask questions. Methods can be qualitative and quantitative. One can start with open-ended questions, then semi-structured interviews, and then a survey. Focus groups may not work, since topics can be sensitive to the industry because species are protected or because participants fear competition. <u>Contributions of local and traditional knowledge</u>: Knowledge may include conservation status, trends, and concerns, intrinsic biological risk, vulnerability, regeneration, which parts to harvest to allow regeneration, or impact of major disasters, plant populations and trends, artificial propagation, and uses.	- One can partner with local institutions and develop reliable resources in a long-term relationship, as part of a long-term development of trusted sources from middlemen and industry. - One should make the relevance of the work understood and highlight its financial and other benefits to the community. <u>Conclusions</u>: People do not like to share information outside of their personal trust circle. It is thus crucial to find entry into the community, understand whether activities are legal, and design studies accordingly. If there are language challenges, it is necessary to use interpreters. One needs the right people and the right funding. Overall, it is important to understand the historical context of the place, to put aside judgement and to adapt the research to the context as one goes along. Culturally pertinent communication and becoming an expert on the region is key.	

Summary of literature case studies on using local and traditional knowledge in species assessments, and of participatory monitoring and management

Addressed considerations [Res. Conf. 16.7 (Rev. CoP17) Para. 1 a) ix)]	Methods used in case studies to collect local and traditional knowledge	Methods used in case studies to validate local and traditional knowledge and conclusions	Source
C: Population status & trends G: Population monitoring H: Conservation status	Species: 6 MAP taxa, including *Orchis* spp. in Albania. Participatory approach: Participative resource assessments along with four groups of eight key informants, who represent the currently most active and experienced harvesters for each species. Contributions of local and traditional knowledge: Locally used assessment indicators were elicited with semi-structured interviews. 45-73 plots per species along random transects in areas in which the species were perceived as 'rare' or 'common' were assessed against local indicators. Harvesters used between 6 and 25 indicators per taxon including: - Population status by area (areas in which species are perceived by harvesters to be 'rare', 'locally abundant' or 'common'). - Population status and harvest-related aspects by sampling plot (presence-absence, density, age classes, harvest signs, habitat, vegetation community, soil characteristics). - Population trends ('decreasing', 'stable', 'increasing') during three periods of time: before 1990, 1990-2010, 2011-2015.	Validation of local and traditional knowledge: Harvesters were shown pictures of assessed species to ensure correct identification. For each species, 20 plots along transects in areas in which the species was 'common', and 'rare' were jointly assessed by harvesters and scientists. Reliability of each statement was assessed against five binary criteria of the reliability index developed by Ziembicki et al. (2013): - informant correctly identified species; - informant was an active harvester at the time of the research; - informant was an active harvester under communism; - informant' statements were confirmed by other informants; and - informant was a recognised knowledge holder by other harvesters. Conclusions: Local and scientific assessments mostly matched, in particular when ordinal (ranking) scales were used, for common, culturally and economically significant species, and in areas in which such species are 'rare'. Harvesters detect signs of previous harvests better than scientists. Mental models of harvesters refer to harvestable material and tend to holistically integrate observations from extended time spans or areas, while scientists refer to the totality of specimens of a species in a particular plot or area at a given time. Harvester's indicators tend to be fuzzy, overlapping and complementary, distinguishing quantitative ranges perceived to be 'normal' vs. 'outliers'. Scientists use fewer, more concise indicators, but cannot easily contextualize observations.	Tomasini, Theilade (2019)
C: Population status & trends H: Conservation status	Species: Forest taxa (4 mammals, 3 birds, 3 plants) in Nicaragua. Participatory approach: Two communities were contacted through a civil society organization, and the survey was approved by their general assemblies. Scientists and community members agreed on the taxa important to the communities. The survey was co-designed in participative planning workshops. Two focus groups of 10-20 harvesters, hunters, loggers, and local park rangers were established, each facilitated by non-indigenous park rangers. Information provided by the community members was discussed in indigenous language. Focus group validation involved time, commitment, and underlying trust. Community members were in control of the process -	Validation of local and traditional knowledge: Focus group assessments were validated by line transect walks in nine sites. Scientists and community members (selected by village leaders based on their interest and experience with hunting and collecting forest products) recorded taxa signs and sightings over 2 hours along predetermined 2 km transects, once every 3 months. Scientists and community members kept similar walking speeds and starting times along the same routes, but on different days. Persons involved in transect walks were not involved in focus groups. Conclusions: Scientists and locals observed similar numbers of most taxa, especially birds and plants, with a tendency for community members to observe higher numbers. According to transect line data, focus group discussions were precise in distinguishing taxa with 'many individuals' from other categories but could not distinguish between categories 2-4. The definition of 'many' used by focus groups varied by taxon – focus group discussions integrated expectations of species' natural density. Line transect assessments incurred costs eight times higher than focus groups. The study recommended to:	Danielsen et al. (2014)

	agreeing what was right and wrong. From 2007-2009, focus group meeting took place every three months to discuss the abundance of each taxon. Contributions of local and traditional knowledge: Abundance estimates in the following categories: (1) "Many individuals": more than 10 individuals were recorded in 4 hours of forest walks; (2) "Some individuals": 1–9 individuals were recorded in 4 hours of forest walks; (3) "Few individuals": More than 4 hours of forest walks are required to record one individual, but the taxon is recorded more than four times during the 3-month period; and (4) "Very few individuals (or none)": The taxon is recorded less than four times during the 3-month period.	1. establish independent focus groups in multiple communities that know resource abundance in the same geographical area (triangulation across communities); 2. convene regularly village meetings to present and discuss data and interpretation and obtain feedback from the community (triangulation across community members); 3. facilitate the collection of auxiliary data through, e.g., community members' direct counts of resources in the same area (triangulation across methods); 4. include individuals within the focus groups who are directly involved with using and observing natural resources (thereby increasing the number of primary data providers); 5. use unequivocal categories for resource abundance; and 6. ensure that the moderator of the focus group discussions has skills and experience in facilitating dialogues.	
A: Species biology & life-history C: Population status & trends D: Threats E: Mortality from all sources H: Conservation status	Species: Mistletoe-infected trees in southern India. Participatory approach: The study collects local knowledge of 47 tribal harvesters from 16 out of 57 villages located in a forest sanctuary. Harvester had 10-30 years of harvest experience and were selected based on peer recognition. All respondents were interviewed in the local language by a local research assistant, who was well trusted by harvesters to the point that they would also share practices which they knew were prohibited by the forest department. Contributions of local and traditional knowledge: Species ecology and management, population trends, ecological relations between trees and mistletoe parasites, reproduction, and threats. Local and traditional knowledge also contributed information on current and past (between 1990 and 2015) harvesting activities: average yield per day, number of harvest days, and standard rate earned per unit collected. The perceived total amount collected per season for each harvester was calculated based on the number of days spent harvesting multiplied by the individual daily collection amount.	Validation of local and traditional knowledge: Interview responses were compared with ecological data from field studies. Accuracy of recalled harvest quantities during a 15-year period was inferred indirectly, by comparing their recalled yields per unit to official price records. Conclusions: In general, data from ecological studies and local knowledge matched well. Local knowledge provided information more efficiently (in terms of data collection effort expended by scientists) and of equivalent or higher accuracy than conventional ecological studies. For example, phenological studies required 288 man hours over a 12 month period, while social science methods for gathering closely matching harvester information took approximately 70.5 hours. For some rare events, for example rare mistletoe associations or uncommon dispersal mechanisms, local knowledge provided insight which a survey of 60 forest plots was not able detect. Authors emphasise that scientific studies may offer precise measurement but can be narrow in focus and expensive to implement. Local knowledge may compromise on accuracy for some variables but may be inexpensive and draw on larger temporal or spatial sample sizes. Trade-offs between information accuracy, precision and available resources make rapid surveys of local knowledge valuable information sources.	Rist et al. (2010).
C: Population status & trends	Species: Four arctic bird species in Canada. Participatory approach: Knowledge is gathered through structured interviews, and meta-analysis of previously recorded local and traditional knowledge. Contributions of local and traditional knowledge: Comparison of local and scientific knowledge regarding population status and population trends.	Validation of local and traditional knowledge: Local knowledge is compared to scientific data on population status and trends of the species. Good degrees of coherence between the sources of knowledge are observed for three out of four species. Conclusions: Reliability depends the relationship of the species in question to the local community. Quality is higher for species with which local peoples had greater familiarity through harvest or year-round contact. Since the accuracy of knowledge varies, an adequate sample size of individuals must be questioned to increase confidence in the	Gilchrist et al. (2005)

		information. Quantitative information may be available for the distribution of species, but lacks the necessary detail for tracking population change, except for catastrophic declines.	
A: Species biology & life-history C: Population status & trends D: Threats H: Conservation status	Species: Trout populations in 3 remote Canadian rivers at 200km distance from next settlements. Participatory approach: Longitudinal study (2000-2002 and 2011). Local fishermen were selected with the indigenous trapper's association. Traditional knowledge was accessed in consultative meetings of 2-9 participants, and 14 semi-directed interviews. Contributions of local and traditional knowledge: Spatiotemporal distribution, trends over 11 years, and conservation concerns. For two rivers, local knowledge suggested stable spatial distribution and stable population trends. In one river, stable or slightly decreasing overall population trends were observed, but populations reportedly show higher mobility, and are caught in places where they did not previously appear. In all three rivers, trout arrival in rivers had shifted to later periods of fall. Identified population pressures were intense fishing, and climate change. Respondents were almost unequivocal about most responses.	Validation of local and traditional knowledge: Degree of consistence of responses between 14 local experts in three locations allows to distinguish common perceptions and outliers. Traditional knowledge was complemented with an array of scientific studies, including experimental analysis of catch per unit effort, life-history characteristics, genetic and genomic diversity, and breeding numbers in populations. Conclusions: Scientific studies confirmed local knowledge in every aspect. Declining population trends in one river are statistically inconclusive and might not have been noticed without local knowledge. Scientific research additionally detected that trout length-at-age had reduced within the 11-year time span. Authors recommend pluralistic monitoring approaches for scientific, pragmatic, and financial reasons. Yet, pluralistic studies need to be carefully interpreted, especially if there is some overlap in the samples used for each individual line of evidence. If multiple interpretations of results derive from the same biased sample, then one becomes more confident in a biased result. A trade-off exists between increasing the number of metrics adopted and ensuring reliable sample sizes. While not the case in the present study, inconsistent results of multiple data types remain possible. Yet, such inconsistency among data types may reflect true uncertainty in the biological system.	Fraser et al. (2013)
C: Population status & trends	Species: Multiple plant and animal species in two Mexican communities. Participatory approach: Evaluation of rapid rural appraisal and participatory rural appraisal tools, including semi-structured interviews, transect walks and participatory mapping. Contributions of local and traditional knowledge: Detection of biodiversity trends. Between 60% and 96% of useful plants and animal species were considered to have declined within living memory. These declines appear to result from overutilization as well as habitat changes.	Validation of local and traditional knowledge: Authors indirectly assess reliability and accuracy of local knowledge by evaluating indigenous knowledge on patterns of change in vegetation type with remote sensing imagery and GIS tools. Conclusions: Rapid surveys of indigenous knowledge may inform about trends in biodiversity, including changes in abundance of particular species and dynamics of vegetation types. This approach requires to ensure that remote sensing and local knowledge refer to the same spatial and temporal scales and use similar classifications of vegetation and land-use types and might otherwise lead to seemingly contradictory information.	Hellier et al. (1999).
C: Population status & trends E: Mortality from all sources G: Population monitoring	Species: Crayfish and 4 categories of firewood (*Eucalyptus* spp., *Psidium cattleianum, Harungana madagascariensis*, mixtures of undefined forest species) in a community in Madagascar. Participatory approach: A year-long study (2004-2005) and rapid assessment interviews with the same informants. 22 households were regularly interviewed in three-weeks-cycles for their daily resource collection. Informants were asked about the location and nature of each household member's activities that day. Crayfish and firewood	Validation of local and traditional knowledge: Accuracy of rapid (annual) semi-structured interviews was assessed through cumulative harvests elicited during regular interviews of daily harvest. The probability of detecting a change in harvesting behaviour from interview responses was statistically estimated. Conclusions: Interviews provided reliable information on quantities, effort, and the spatial pattern of harvesting, i.e. rapid interviews would detect changes in catches and harvesting effort with sufficient accuracy to allow monitoring of changes in harvester behaviour. Accuracy is higher when the same informants are questioned in repeated interviews. There is a tendency to report closer to the mean of all informants than true personal value, that	Jones et al. (2008).

	collected were brought to the interview, the number of crayfish counted, and the species and number of firewood bundles recorded. At the end of the study period each household was privately interviewed for overall list of sites they had collected from, and the amount collected per site, distinguished by three locally appropriate seasons. Contributions of local and traditional knowledge: Harvest quantity, timing and spatial collection patterns.	is, informants at the lower range of the population tended to overestimate and those at the higher end tended to underestimate. To yield quantitative information useful for detecting trends, questions must be formulated that respondents can answer accurately. Focusing questions on activities which respondents are likely to remember may make results more reliable. If informants have reasons to under- or over-report activities, results will be biased; thus, possible incentives faced by informants should always be considered. One of the most significant influences on the validity of responses is the perceived attitude of the researcher to harvesting, and researchers must make every attempt to appear neutral.	
C: Population status & trends G: Population monitoring	Species: Ten large-bodied vertebrate species around 161 statistically selected riverine settlements (household size between 1 and 281) located along 7 rivers species in the Brazilian Amazon. Participatory approach: Rapid interview surveys in 2007. In each settlement, all available hunters were asked for the nearest locations in which they had encountered direct or indirect evidence of each species within the last 12 months. Well-known inhabitants of each river assisted as guides and to establish contacts. Research objectives were discussed with hunters and community members prior to interviews and researchers identified themselves as independent of any governmental organization. Contributions of local and traditional knowledge: Estimation of landscape-scale depletion.	Validation of local and traditional knowledge: The plausibility of statements was assessed using triangulation, such as between recall of offtake and distances to nearest observed locations, as well as between statements of different informants. Multiple human settlement and landscape variables were statistically tested with regard to their power to predict the size of observed depletion zones around settlements (including human population density, settlement characteristics, distance to the primary forest, upland terra firme coverage, distance to the nearest urban centre). With these statistical relations, depletion zones for the entire state of Amazonia were modelled. Conclusions: Four species were heavily depleted and had highly predictable responses to both settlement and landscape drivers. The study demonstrates that local knowledge, combined with quantitative data provides a cost-effective way to monitor the depletion of forest wildlife over large spatial scales, ideal for resource-limited and spatially extensive tropical contexts.	Parry and Perez (2015).
A: Species biology & life-history C: Population status & trends F: Management measures	Species: *Warburgia salutaris* (pepper trees) in Southern Mozambique. Participatory approach: Stratified random, semi-structured interviews with 182 informants in 13 villages in three study areas, complemented by 17 focus groups with 5 to 7 key informants, identified by local leaders to explore in-depth knowledge. Contributions of local and traditional knowledge: Local management practices, species ecology, and past, present and expected trends in local abundance and status.	Validation of local and traditional knowledge: Information from interviews and focus groups were triangulated. Conclusions: Two-thirds of respondents could identify harvesting approaches that result in significant damage to plants. Respondents mentioned 17 characteristics that described favored habitats of *W. salutaris*. Very few respondents had knowledge of the flowering time of *W. salutaris* or pollinators. More than half of the respondents stated that the abundance of *W. salutaris* had declined in their areas. Four drivers were identified including bark trade, cutting for charcoal production, wildfires, and opening up land for construction. Respondents felt that the abundance was likely to decrease in the future, largely as a consequence of the bark trade.	Senkoro et al. (2019).
A: Species biology & life-history C: Population status & trends D: Threats	Species: *Caryocar coriaceum*, an important NTFP in protected national forest communities in Brazil. Participatory approach: 61 informants in three communities were interviewed. Selection was by snowball sampling to access the knowledge of collectors that are recognized by their peers.	Conclusions: Frequency of references to indicators, and ecological understanding expressed in judgments of their severity allow to detect instances of strong ecological understanding. Local indicators perceived as higher risks express a holistic view of factors that influence the sustainability of the species. The authors suggest that the local knowledge of extractive populations has the potential to directly contribute with local monitoring processes. In addition, local knowledge can contribute to reduce social-environmental conflicts between resource users and protected	Sobral et al. (2017).

	Contributions of local and traditional knowledge: Local indicators to monitor conservation status, the frequency indicators were mentioned, and the severity of conservation risks they were perceived to indicate. Communities mentioned between 19 and 35 indicators relating to species management, population structure, climate, environment, ecology, and phenology.	area managers, and their observations may constitute new hypotheses for future ecological studies.	
A: Species biology & life-history B: Species range C: Population status & trends E: Mortality from all sources	Case study species: Yangtze finless porpoise (*Neophocaena asiaeorientalis*) in China. Participatory approach: Informants were identified with assistance of community leaders in 27 fishing settlements distributed approximately evenly along the species' entire recent geographical range. Of an estimated total of 1677 fishing vessels, 599 fishers were interviewed by a native Chinese speaker, who followed a questionnaire containing descriptive, structured and contrast questions. Project staff remained neutral during interviews and avoided leading questions. The protocols were field tested to improve clarity of questions and to train interviewers. Concerted attempts were made to ensure that responses were standardized and quantifiable. Particular care was taken to encourage informants to report all known porpoise mortality events, by asking for details about total numbers of dead porpoises they had seen and also about porpoise deaths associated with anthropogenic factors. Contributions of local and traditional knowledge: A spatiotemporal population status assessment of relative spatial abundance and decline. Informants were asked about porpoise sighting frequency, group size and seasonality; perceptions about porpoise decline; their reaction to by-catch events; regional use of rolling hooks and electro-fishing; detailed information about all past sightings of dead porpoises, including date, location, and cause of death if known; and how many hours/day and days/week they typically spent fishing.	Validation of local and traditional knowledge: While not strictly necessary for this iconic species, photographs of wild and captive life specimens were shown to ensure correct identification. Careful in-depth questioning allowed to distinguish responses based on empirical observations (e.g. mortality from observed wounds inflicted by fishing gear and vessel strikes), and indirect hypothetical inferences (e.g. instances of porpoise mortality attributed to general environmental pollution). Representativeness of the sampled ecological experiences was ensured through a large number of informants with varied socio-cultural characteristics and fishing practices, and by excluding from the analysis river sections with few responses. Some information (e.g. excessively large reported group sizes) were considered scientifically implausible and thus excluded. A wide variety of hypotheses relating to spatial and temporal variations among the remaining responses were statistically tested. To validate temporal trends and relative significance of threats, mortality data from interviews were grouped into two decade-long intervals that roughly correspond to independent abundance surveys. Conclusions: Authors suggest that the cumulative experience of informants spending a considerable proportion of their lives on the water may sometimes provide more comprehensive information than is obtainable from short-term surveys. Compared to scientific surveys, interview data added timelines of population dynamics spanning two decades, evidence of seasonal upstream–downstream movements, possibly in response to annual water cycles, and of at least periodical porpoise populations in river sections previously considered depleted. Authors suggest that survey techniques can be labour- and cost-intensive, placing restrictions on survey regularity and limiting the ability to detect population trends. In contrast, community interviews represent a relatively inexpensive approach for collecting data across wide geographical areas and can provide both historical and current information. While local knowledge was very informative for understanding patterns and trends in porpoise abundance and status, the identification of threats may be prone to biases, since fishermen cannot unambiguously distinguish some causes of mortality.	Turvey et al. (2013).
A: Species biology & life-history B: Species range C: Population status & trends	Case study species: 51 mammal species across Australia's northern territories. Participatory approach: Interview protocols, including the selection of appropriate elders and other interview participants (chosen on the basis of in-depth traditional knowledge or continued hunting practice and connections with the land), were developed in consultation with indigenous representative groups, local indigenous	Validation of local and traditional knowledge: A collection of mounted mammal skins in life-like postures was used to help facilitate discussions and verify identifications. Further identification aids were books containing photographs of all species and, in some instances, live specimens. Due to changes in local lifestyle away from subsistence hunting, and inherent susceptibilities to fading memories, mistakes and biases, a system to assess reliability is elaborated. Each record was scored with regard to whether the informant correctly identified species or its local name; was resident, or otherwise familiar with the specific location; statements were confirmed by other informants and/or with scientific or historical data; and whether the participant's overall knowledge was reliable. The database	Ziembicki et al. (2013).

G: Population monitoring	rangers, and ethnologists. In total, 55 semi-structured interviews with open-ended questions were held at 32 locations with 134 participants (aged 25-80) between 2005 and 2009. Records were obtained for 213 localities. Interpreters were used in areas where local languages are still spoken. Contributions of local and traditional knowledge: For each species, interviews addressed local names; species' ecology (i.e. habitat, shelter, diet, breeding biology, behaviour); uses; and the locations the species is or was found in three general time periods: in the past when the participant was a young man or woman, in the recent past, and the current status. For each period, participants were asked to indicate whether the species was common (many individuals seen often), present in low numbers (some seen occasionally) or absent.	thus comprised a set of records, each including participant name, time period, abundance category, species, reliability score and location. Only records of medium and high reliability were used; other records were omitted. The database was statistically analysed, with average scores for each species, period and region combination, and graphically displayed. Conclusions: For common species still hunted, there was no historical trend in the reliability of records, but for many smaller or no longer hunted species, there was a clearly decreasing reliability trend, or participants were unable to give clear information. Overall, reliability declined across the three time periods. Results support previous, numerically precise, but localised and short-term monitoring studies and complement it with a broad geographic scope and longer time frame. Scientific thinking and local knowledge differ regarding the spatial and temporal progression of mammal decline from interior to more coastal areas. The authors suggest that declines in the lower rainfall areas may have preceded the memory span of informants, with some species disappearing from these regions more than 50 years ago.	

Synthesis and lessons learned from 40 case studies involving local and traditional knowledge, and participatory methods for assessments, monitoring and management of CITES-listed MAPs

Benefits of using local and traditional knowledge in species assessments, and of participatory monitoring and management of CITES-listed MAPs: Local and traditional knowledge may in certain cases improve scientific assessments through very detailed and comprehensive information. It is usually location specific and can thus complement global scientific knowledge with local details. It is often holistic and contextual and may thus shed light on aspects that are complementary to scientific analyses, such as complex societal or ecosystem relations, or drivers of change. It frequently spans longer time frames and may thus add longer term perspectives to short scientific data series. It may be the only available source of knowledge for species with very little scientific information, in particular species of high cultural salience and recognizable appearance, but geographically restricted range. Local and traditional knowledge is usually acquired through purposeful utilization of a species. Therefore, it tends to be most detailed and reliable for considerations that are relevant to its use. In many cases, the best local knowledge of a species may be acquired by individuals that are keen observers and have a long-standing personal experience of its use. Where existing, local knowledge may also be acquired through thorough education by traditional experts with high local reputation (plant healers, sages, elders, leaders of traditional collector or trade networks).

Involving local and traditional knowledge and participative species monitoring and management can enhance species conservation. Involving local and traditional community members in monitoring and management can ensure that crucial information (e.g. about local species populations) is included and may contribute valuable recommendations based on local perspectives. It also increases the validity and legitimacy of assessments, monitoring and management from a community perspective, enhances community buy-in, and may strengthen its adherence to and collaboration in conservation efforts. Building on local resources and empowering local capacity can support the long-term autonomy of conservation efforts and the sustainability of their impacts. Overall, conservation efficiency and effectiveness may be enhanced.

Involving local and traditional knowledge and participative species monitoring and management can enhance community livelihoods, which may be generated from the long-term conservation of the utilized resource base, from enhanced local capacity, and from direct benefits through participative monitoring and management programmes. If well explained and maintained over time, these benefits can in turn enhance information provision and collaboration in monitoring and management by local communities.

Challenges of using local and traditional knowledge in species assessments, and of participatory monitoring and management of CITES-listed MAPs: Accession to local and traditional knowledge requires planning and time investment. It is crucial to address communities respectfully, to explain transparently the purpose of collaboration, possible benefits to local livelihoods, and to receive free, prior, and informed consent on all aspects of collaboration and knowledge utilization. To ensure community support, respected community leaders (elders, mayors, government representatives, religious or clerical leaders, or reputed and well-connected individuals) should be contacted first. They will enhance legitimacy, and frequently be able to facilitate contact with knowledge holders, who can in return recommend others (snowball sampling). In many cases, their knowledge of community members is influenced by their geographic context and their societal roles and positions. Ideally, there should thus be numerous informants that represent geographic and cultural diversity. To collect tacit knowledge, interactive methods that trigger a variety of inputs may be appropriate, such as landscape walks or group discussions. The longer good relations are maintained, the more likely it is to build trust and to receive access to full and undistorted local and traditional knowledge.

The utilization of local and traditional knowledge is not always straightforward. Botanical and local or traditional taxonomies are not usually identical, which is why emphasis should be put to clarify the species in question, for example through pictures, or joint identification in the field or in gardens, where available. Local and traditional knowledge is almost always qualitative and might be inconsistent between different local and traditional sources, or with scientific information. As any other knowledge, it may also be biased, or in some cases even purposefully incomplete or misleading. Semi-quantitative weighting of information, and assessments of information quality are possible through the best possible selection of sources, observing their reliability and motivations for collaboration, and the frequency of similar information among informants. Likewise, careful interviewing, ranking exercises, triangulation of methods, or partial validation through scientific knowledge or field observations are useful tools. Some disagreements may derive from local or traditional assumptions, terminologies and explanations that may seem unfamiliar or even implausible to scientific investigators. Reflection, and where required, additional dialogue can serve to distinguish key empirical content, cultural explanations that may be deemed less relevant to conservation science, and those explanations that may be considered additional, valuable perspectives. To ensure information quality, reduce misunderstandings, build trust, and enhance local ownership, results and conclusions should be presented to, and validated with the communities from which knowledge was gathered.

Managing participative processes in species monitoring and management is a challenging task that may frequently require intercultural skills and commitment. Where feasible, it would greatly benefit from institutional arrangements that can maintain long-term community relationships, and staff with dedicated training, for example in anthropology, ethnobotany, or community-based participative work. It is often observed that trust-building and collaboration greatly benefits from 'bridge-persons': individuals with a personal, long-standing background and trustworthy reputation in both scientific or governmental and local communities.

Methods to obtain relevant local and traditional knowledge that can inform the making of NDFs for CITES-listed MAPs:

i) Case studies and expert interviews emphasize the importance of building trustful relationships between communities and researchers. Key features widely referred to are: (i) transparency regarding the objectives of the research (reported by Abdon Awono and many others); (ii) obtaining free, prior, and informed consent from communities and informants (reported by Marla Emery, among others); (iii) ensuring that collaboration provides tangible benefits for the community (including livelihood benefits, reported by Marwa Halmy and others); and (iv) try to establish long-term collaboration, which is reported to build trust and improve quality of collected knowledge over time. In the context of NDFs, this could be realized in repeated or annual joint quota setting, which are exemplified by various NDFs for mammals and other hunting trophies available in the NDF database on the CITES website. But case studies indicate that useful knowledge can also be obtained from short assessments (e.g. Parry and Perez 2015, Jones et al. 2008, Hellier et al. 1999).

ii) The Canadian '*Committee on the status of endangered wildlife's aboriginal traditional knowledge sub-committee*' (COSEWIC-ATK) provides an institutional model that combines long-term engagement with relatively short-term individual species assessments. It was jointly developed with Canadian First Nations organizations that have legal rights over resources and lands. The COSEWIC-ATK subcommittee has aboriginal co-chairs and members. It developed formalized community and species assessment protocols that are called upon when, for example, NDFs are to be made (reported by Danna Leaman and Gloria Goulet). COSEWIC thus coordinates the provision, integration and validation of information through participatory mechanisms that are adopted and implemented by scientific and local or indigenous experts and institutions. This approach seems to have commonalities with the approach taken at a global level by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (see Annex II to IPBES Decision IPBES-5/1 on *Approach to recognizing and working with indigenous and local knowledge in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*).

iii) Almost all experiences show that initial contacts between researchers and communities was established through institutions or individuals that were locally reputed, trusted, and recognized. Crucially, such institutions do not need to be specialized in a topic relevant to NDFs, but rather need to be willing and able to facilitate relevant local networks and help gaining the trust of local resource users or local experts with relevant knowledge. Such institutions could be councils of elders, mayors, party representatives, other local authorities, or religious leaders. Once initial contacts were made, almost all report that the snowball method (chains of referrals from one resource user or local expert to the next) ensure that relevant knowledge holders can be accessed. Only in few cases were there opportunities to strategically select informants from comprehensive databases (such as landowner registries reported by Christine Mitchell).

iv) Sources emphasize the benefits of collaborating with individuals who are part of and rooted in both western (possibly even academic) education and local communities (reported by Joanna Sucholas, Anja von der Loye, Danna Leaman, among others). Such persons not only facilitate the building of mutual understanding and trust, help to overcome potential cultural or language challenges, but can also be key in analysing, interpreting and validating results.

v) The tools that were applied to collect information ranged from semi-structured interviews, questionnaires, and facilitated workshops, to joint mapping exercises or collaborative field projects. They should be simple, understandable and tangible. In some instances, case studies mention the use of photographs (Turvey et al. 2013), mounted animal skins (Ziembicki et al. 2013), or field walks and herbarium specimens (Tomasini and Theilade 2019) to ensure that species identification is clear to informants. Otherwise, methods and tools seem as manifold as the case studies themselves, allow for much creativity, and need to be adapted to local context. For example, formal or semi-structured interviews would not be accepted by nomads in Egypt (reported by Marwa Halmy) and focus groups or moderated workshop discussions can be challenging in situations of high economic competition between knowledge holders, or where some activities might be considered controversial within the community (reported by Christine Mitchell).

Methods to ensure information is complete and objective, enabling science-based assessments in accordance with Resolution Conf. Res. 16.7 (Rev. CoP17):

i) Many of the approaches referred to in the section *supra*, in particular the involvement of bridge persons, building trustful relations with communities and ensuring selection of good informants through locally recognized institutions and snowball sampling are tools that enhance the quality and validity of responses.

ii) Participation and involvement of community members and informants in the research design is a form of pre-testing tools and methods, detecting possible misunderstandings of differences in assumptions early on, ensuring to ask the right questions (Eric Burkhart), and to make communities see their interest in providing information (Danna Leaman, Gloria Goulet).

iii) Similarly, validating results by presenting and re-discussing them with communities and informants reduces misinterpretations, and allows communities to share their interpretation of observed patterns. It is also described as a demonstration of respect to communities, and a means to give something back in exchange for their knowledge (Eric Burkhart, Sarah-Lan Mathez Stiefel).

iv) Virtually all sources concur that validity can be enhanced by triangulating information across multiple informants, communities or methods. Multiple examples of such validation approaches can be found in extensive detail in the case studies.

v) Many literature sources empirically validated indicators (e.g. for population trends, conservation status) by direct comparison of observations made by local community members and scientists. Examples are joint fieldwork, the comparison of observations of scientists and community members after clearly defined ‘experimental forest walks’ or sampling plots collaboratively monitored between scientists and local informants (Danielsen et al. 2014, Tomasini and Theilade 2019, Yan Zeng, James Chamberlain, Eric Burkhart).

vi) Several case studies indicate that local knowledge might not in all cases be directly validated with scientific sources (it also is particularly useful where no such knowledge exists), but overall plausibility can be judged by indirect inference. For example, Yan Zeng reports that the scientific plausibility of local knowledge in Chinese species assessments is reviewed through specific questions of more general, verifiable nature that reveal the accuracy of informant statements (such as questions on a species’ life-history). Turvey et al. (2013) exclude certain observations from their analysis, due to perceived scientific implausibility.

vii) Assessments of plausibility can be elaborated into reliability indices, in which informant statements are rated according to various indicators of an informant’s knowledge. Indicators may include whether an informant correctly identified a species, was an active harvester at the time of the research, was already actively harvesting for extended time spans, whether his statements were confirmed by other informants; and whether he is a recognised knowledge holder by other harvesters (see for example Tomasini and Theilade 2019, and Ziembicki et al. 2013). Based on overall plausibility ratings, certain statements may be excluded from an analysis, or considered less credible.

viii) When global markets open up for trade in a species that was previously used for local subsistence purposes, utilization and harvest might change, for example through large-scale collection activities in areas that were not previously exploited, or the employment of harvesters who are taken to sites where they have no interest in long-term conservation. Therefore, collectors may still have knowledge, but the scale and purpose of its utilization might result in different conservation impacts (reported by Marla Emery and Rainer Luick). An understanding of the scale and purpose of the documented knowledge is an important confidence measure of particularly relevance for high-volume export harvest. Such understanding can be improved by understanding the social structure (gender, class, age, authority structures, internal power relationships) and context of a community (who is an insider versus an outsider? Who is involved in harvest and distribution along the commodity chain, where do profits accumulate?).

ix) Where divergences between local and scientific knowledge persist despite validation and discussion with community members, deeper understanding of their causes might improve species assessments. Such causes might include differing spatial or temporal observation scales used in scientific reports and by local informants, differing species and ecosystem taxonomies, scientifically unrecognized rare or extreme events, or different implicit assumptions about species management strategies (Ziembicki et al. 2013, Rist et al. 2010, Christine Mitchell, Sarah Laird, among others). While intentional or unintentional biases might be at play in some instances, contradicting knowledge could also lead to new or better hypotheses (Moller et al. 2004), or point to the need for additional monitoring.

x) Several experts suggested that, under ideal circumstances, well designed research of local and traditional knowledge would require researchers or assessors that have both ecological, and anthropological skills (Marla Emery, Sarah Laird).

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