**Title: IPBES Sustainable Use of Wild Species Assessment - Systematic review on academic conceptualizations of the sustainable use of wild species in Chapter 2**

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**Associated documents:**

* CH2\_Litreview\_Historical\_conceptualizations.bib
* CH2\_Expert\_judgement\_Historical\_conceptualizations.bib
* CH2\_Snowballing\_Historical\_conceptualizations.bib
* CH2\_Summarizedresults\_Hunting.xlsx
* CH2\_Summarizedresults\_Gathering.xlsx
* CH2\_Hunting\_Search\_All.bib
* CH2\_Logging\_WoS.bib
* CH2\_Logging\_Additional.bib
* CH2\_Logging\_Reviewed.bib

**Reference document:** Chapter 2 of the IPBES assessment of the sustainable use of wild species

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**Geographical coverage:** Global

**Taxonomic coverage**: Global but limited to wild species

1. **Type of study**

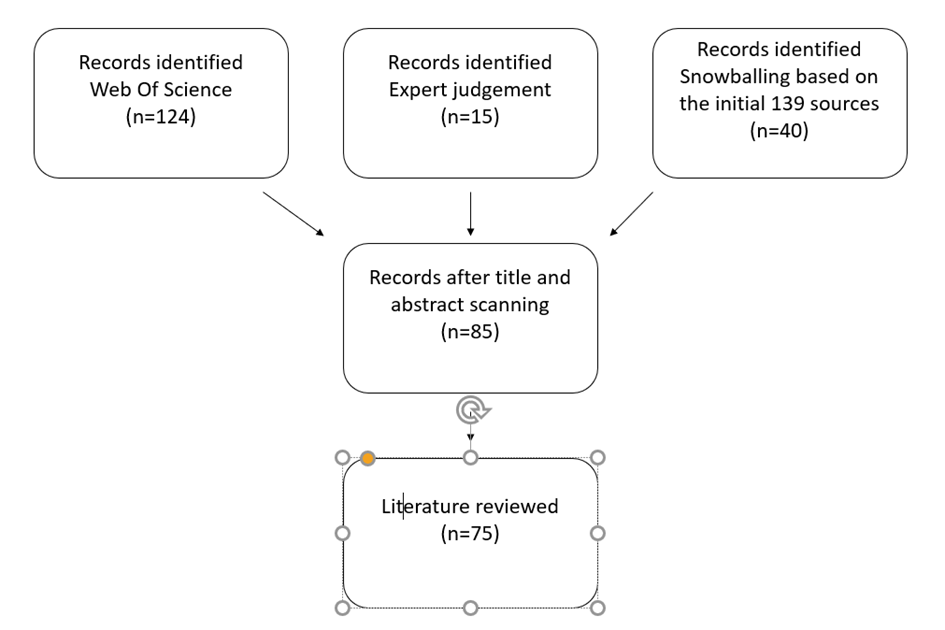
In Chapter 2 of the IPBES thematic assessment of the sustainable use of wild species, a series of literature searches on the conceptualization of ‘sustainable use’ was conducted. This included a broad review of the historical background of the western conceptualization of ‘sustainability’ and ‘sustainable use’ (section 2.2.2 in Chapter 2), and a set of reviews with two time periods (pre- and post-2010) on the conceptualization of ‘sustainable use’ from each practice (i.e., fishing, gathering, terrestrial animal harvesting, logging, and non-extractive practices) (section 2.2.3 in Chapter 2).

1. **Process overview**

The following six individual literature reviews were conducted for sections 2.2.2 and 2.2.3 of Chapter 2.

* 1. Conceptualization of “sustainable use” in the global conservation arena {2.2.2}

The historical accounts presented in this section are based on a literature review of 183 sources. The sources consist of academic papers and books, as well as grey literature. 124 papers were identified by a literature search on Web of Science with the following search string: ((TS= “history of sustainability”) OR (TS=(sustainability AND history)) AND (SU=(biodiversity OR conservation OR wild species))). In addition, 19 sources were identified by expert judgment. These were largely relevant historical books that did not show up in the literature search. 40 sources were identified by snowballing based on the initial 124 sources (Diagram 1).



**Diagram 1.** Literature review on the historical background of the conceptualizations of the sustainable use of wild species.

* 1. Conceptualization of “sustainable use” in each practice {2.2.3}

To be comprehensive, a review on the conceptualization of “sustainable use” in each practice would have required reviewing hundreds of journals and thousands of publications. That was well beyond the capacity of the team of authors. Therefore, it was decided that the review of recent literature would be done in two parts for each practice, based on the same review protocol to assure methodological consistency across practices. The first part of the review is a higher-level summary of the broadly accepted conceptualization of sustainable use for each practice by 2010. The second part is a more intensive review of what new ideas or new interpretations of older ideas emerged in the literature of the 20-teens.

Another challenge was the many scales and value systems within which sustainable use may be conceptualized. Historically the research community has undervalued research on small-scale uses of nature. Yet it was important to this literature review (and this assessment) to capture developments in those areas. With regard to knowledge systems, the academic literature has an intrinsic bias towards reporting developments from scientific types of knowledge, so innovative thinking from other systems would be under-represented. To deal with the possible bias of scale, the screening of the search results was directed to be vigilant for papers with a focus on small-scale uses of nature, to ensure they would be well-represented in the papers evaluated in this review. There was no readily implemented strategy to address any publication bias towards scientific knowledge, although again the screening step was directed to be vigilant for papers using diverse knowledge systems.  Interpreting the findings of this literature review should be done with an awareness of this potential bias in the academic literature, and information on the indigenous peoples and local communities’ conceptualizations of sustainable use (see section 2.2.4 of Chapter 2, data management report available at 10.5281/zenodo.6049358) needs to complement any uses of these findings from the academic literature.

The pre-2010 assessment drew on review papers published in front-rank journals or chapters in key books. Papers selected were, in general, highly cited, but the assessment did not use citation rate alone to determine which articles to review because (i) this favors reviews of bio-ecological aspects of uses over those focused on social factors and (ii) some papers have acquired high citation rates because they triggered many papers challenging their finding and conclusions. The reviews were based on approximately 3-10 major review papers per practice.

The second part was a more intensive review of emerging ideas in the literature of the 20-teens. To deal with differences in rates of publication between practices, all searches used Web of Science and started with the same string of keywords and phrases e.g., ([Name of practice] AND ("sustainab\*" OR "unsustainab\*")) and variations on that, excluding papers that refer to farmed species or systems. The search covered articles published after 2010 and up to the date when the searches were conducted (approximately between August and October 2020). For practices that yielded thousands of hits (i.e., fisheries, logging), authors focused on review papers. The search results were first screened by title or abstract for relevance and were analyzed in detail. To deal with the differences within practices, a set of four eminent journals were chosen and searched for articles on each practice: *Nature*, *Nature Sustainability*, *Proceedings of the National Academy of Sciences of the United States of America* (*PNAS*), and *Science*. Experts in each practice were also asked to select three to five high profile journals in their fields that were likely to present developments in social, economic, governance, and cultural aspects of sustainable use, as well as target species of the use and ecosystem in which they occur. The details of the post-2010 review process for each practice are described below. Numbers in bracket refer to the relevant sections in Chapter 2.

*2.2.1) Fishing {2.2.3.2}*

In 2019, 72 journals were listed as having impact factors above 1.0 and publishing papers on fisheries (https://sites.google.com/a/uw.edu/most-cited-fisheries/impact-factors-fish-journals). Approximately 2/3 of them specifically focused on aquatic sciences relevant to sustainable use. Even restricting journals searches to the four broad science journals cited above plus three fishery-oriented journals [*Fish and Fisheries, ICES Journal of Marine Sciences, Fisheries Research*] the generic search terms applied for other uses of wild species (See 2.2 above) produced over 3,000 hits in Web of Science. However, minor modifications of search terms to exclude papers solely about the application of existing conceptualizations of sustainable use to specific cases reduced the number of hits to 496 papers in seven journals (Table 1). 500 papers were considered to be near the capacity limit for the review and sufficient to give a reasonable insight into ideas emerging as either completely new concepts, or significant revisions of existing concepts regarding the sustainability of fisheries.

Even with the additional screening during the literature search, when the abstracts and discussions of the papers were read, nearly two-thirds were applications of existing conceptualizations of sustainable fisheries to new sites, new species, or new fisheries, but did not expand or change the conceptualization of sustainable use. Nevertheless, many of these papers discussed how some contextual features of the stock, oceanographic or benthic features of the ecosystem, or the human context of the fishery itself affected sustainability. Articles all along the gradient from presentation of new conceptualizations of sustainable use, through new interpretations of existing conceptualizations, to rigorous examinations of how existing conceptualizations performed in new contexts were found to potentially provide insights into how what comprises a sustainable fishery is presently conceptualized by voices in the expert community. Of the 496 papers reviewed (see Table 1), 82 were considered to not actually address sustainable use of wild species directly or indirectly, and are not included in the final tabulation. The remaining 414 papers were used with effort made to clearly identify major new lines of emphasis emerging from the review.

**Table 1. Literature review for fisheries**. Number of papers reviewed for the selected journals (Total), the number of papers considered to discuss a new aspect of sustainable use (New), the number putting a new spin on a factor generally accepted as an aspect of sustainable fisheries in 2010 (Tweak), and the number that were applications of established concepts or methods to new fisheries or ecosystems (Application).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Journal** | **Total** | **New** | **Tweak** | **Application** |
| Science | 18 | 6 | 6 | 6 |
| Nature | 13 | 4 | 5 | 4 |
| Nature   Sustainability | 12 | 5 | 5 | 2 |
| PNAS | 84 | 20 | 15 | 49 |
| Fish and Fisheries | 90 | 15 | 18 | 57 |
| ICES J. Marine Sciences | 130 | 12 | 28 | 90 |
| Fisheries Research | 149 | 16 | 18 | 115 |

*2.2.2) Gathering {2.2.3.3}*

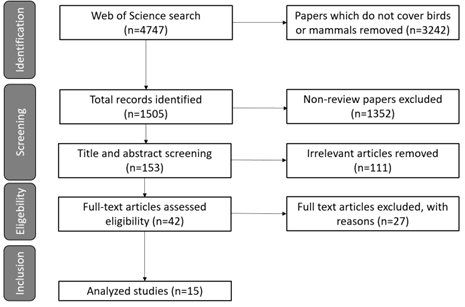
For the post-2010, five journals were chosen, spanning ecological, economic, anthropological and socio-cultural /and interdisciplinary aspects of sustainable gathering: *Ecological Economics*, *Ecology and Society*, *Human Ecology*, *Journal of Applied Ecology*, *Journal of Ethnobiology*. Web of Science was used to search in those five journals, plus the four high profile journals, using the search terms in Section 2.2. above. For the term to encompass the practice, combinations of “gathering”, “nontimber”, “non-timber”, “medicinal plants”, and “fungi” “frogs”, “turtles” and crocodil\*” were used. This generated 87 papers that were screened on the basis of their abstracts, to 54 papers that might have material on new or adapted conceptualizations of sustainable use in collecting. These were individually scored for a presence of range of content features.

*2.2.3) Terrestrial animal harvesting (focus on hunting) {2.2.3.4}*

2.2.3.1 Systematic literature search in Web of Science (WoS)

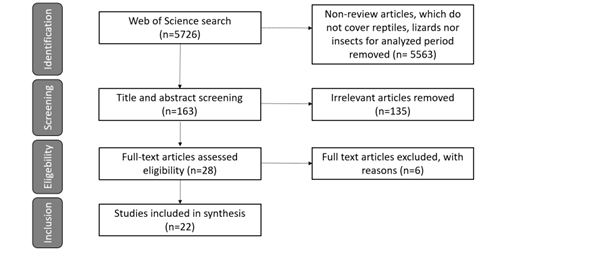
This method was used to collect relevant scientific articles on sustainable hunting through systematic literature search. For that purpose three independent searches were performed for the period 2010-2020. Every search included all WoS databases.

The first one considered papers’ content with the following search formula: TS=((sustainab\* OR unsustainab\*) AND (hunting OR poaching OR "wildlife management" OR "game management" OR "human wildlife conflict" OR "human wildlife coexistence" OR "wildlife trafficking" OR “ecosystem services”) NOT (fish\* OR insect\* OR snake\* OR bat\* OR lizard\* OR aqua\* OR plant\* OR tree\* OR forest)). The search resulted with 4,747 papers. Within this group 1,505 papers are dealing with mammals and birds, while only 153 are review papers. Out of these papers 31 were rejected according to their title and 80 more because of their abstracts’ content. Remaining 42 papers were analyzed according to their content, but only 15 were selected for the coding (Diagram 2).



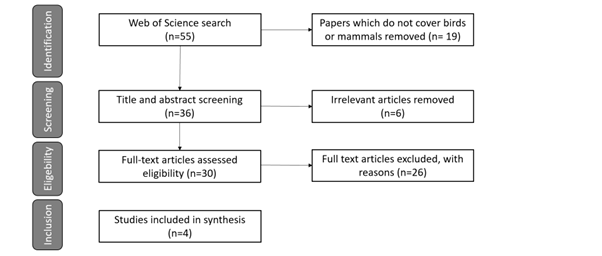
**Diagram 2.** The first search in Web of Science database for articles about mammals and birds.

The second analysis used the similar search string like the previous systematic literature search, with the following formula: TS=((sustainab\* OR unsustainab\*) AND (hunting OR poaching OR wildlife management OR game management OR human wildlife conflict OR human wildlife coexistence OR wildlife trafficking OR ecosystem services) NOT ( fish\* OR aqua\* OR plant\* OR tree\* OR forest)). It resulted with 5,726 papers. When refined for the period 2010-2020 and articles which discuss reptiles or amphibians or insects harvesting 163 articles remained. Out of these papers 79 have been rejected for the title, and 56 for the abstract content. Finally 6 more papers were rejected according to their content, while remaining 22 papers have been analyzed (Diagram 3).



**Diagram 3.** The second search in Web of Science database for articles about lizards, reptiles and insects.

The third analysis was limited only to title content with the following search formula: TI=((sustainab\* OR nonsustainab\*) AND (hunting OR poaching)). For the required time span 55 papers were selected, out of which only 36 were dealing with mammals or birds. Only 4 papers were selected for the coding, the 6 papers were rejected according to their abstracts, while the other 26 did not have satisfactory content (Diagram 4).



**Diagram 4.** The third search in Web of Science for articles about mammals and birds.

Systematic search in WoS was focused only on review papers and those which discussed sustainable hunting from the aspect of more than one group of features. Papers which did not include features from more than one group (ecological, socio-economic, key aspects of governance and sociocultural) were excluded. This method resulted with only 41 papers selected. Thus other ways were used to ensure more comprehensive findings.

2.2.3.2 Review of selected scientific journals

This method included analysis of 9 scientific journals. All issues for the period 2010-2020 were analyzed which resulted in total with 154 papers which deal with any aspect of harvest of birds, mammals, reptiles, amphibians or insects. Following journals were covered:

• *Animal conservation* – in total 5 papers were used for the analysis

• *Biodiversity and Conservation* – 2 papers selected

• *European Journal of Wildlife Research* – 4 papers were analyzed

• *Journal of Wildlife management* – in total 74 papers selected for the analysis

• *Nature* – 3 papers were used for the analysis

• *Nature sustainability* –2 papers selected for the analysis

• *Oryx* – in total 52 papers selected for the analysis

• *Science* – in total 11 papers selected for the analysis

• *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* – only 1 paper was included in the analysis

In contrary to WoS search, here every paper (both reviews and original articles) which discusses or mentions “sustainable hunting” was included in the analysis, even if many of them cover only one ecological feature. Papers which deal with poaching were excluded, since they analyze unsustainable and illicit hunting activity.

2.2.3.3 Search in Google scholar

Google scholar was used for the last literature search. Since WoS systematic review did not result with many coded papers, in Google scholar only one search phrase was used: “sustainable hunting”. Time span was from 2010 to 2020 and the results were listed according to the relevance. The first ten pages were used for analysis, each with 10 results per page. Each document which discussed or mentioned “sustainable hunting” was taken in consideration. Out of 100 analyzed documents, 27 were used for coding.

2.2.3.4 Data analysis

The literature review thus identified 222 documents suitable for this analysis, which were coded and analyzed. Papers were coded according to different features of sustainable use that fell into the broad groupings of ecological, socio-economic, governance, and socio-cultural (see Table 2 below). In order to identify the most represented features of sustainable use, one point was awarded to each paper for each of the features it covered. Scores were then summed for each feature to identify those that were most represented. To identify which broad groups were most represented, the average value per feature for each group was calculated. An average value was used because groups have unequal number of features and as such simple counts of features were not suitable for the comparison. Finally, the average group values were used to present results as percentages of all papers reviewed. The findings are presented in section 2.2.3.4.2 of Chapter 2.

**Table 2. For Hunting, the five most referenced aspects of sustainable use within a) ecological, b) socioeconomic, c) governance and d) sociocultural categories.** Only three aspects are listed under socio-cultural due to the very low number of references to any other features in this group. However, contributions to subsistence or culturally established livelihoods, listed under socio-economic group, is also part of this category.

**a)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Feature** | **Group** | **%** |
| 1 | Populations used directly and intentionally, whether harvested in whole or part | Ecological features | 98 |
| 2 | Aggregate spatial features (e.g., portion of area impacted by use) | 25 |
| 3 | Specific mention of impacts on Endangered, threatened, or protected species or habitats | 25 |
| 4 | Aggregate biotic community properties (e.g., biodiversity) | 23 |
| 5 | Structural habitat features | 14 |

**b)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Feature** | **Group** | **%** |
| 1 | Contribution to subsistence or culturally established livelihoods [could also be a socio-cultural feature] | Socio-economic features | 27 |
| 2 | Market value of intended product(s) harvested | 19 |
| 3 | Contribution to stability of economy at local scale | 14 |
| 4 | Diversification and/or stability of household economy | 12 |
| 5 | Contribution to national economy (financial and/or labor) | 11 |

**c)**

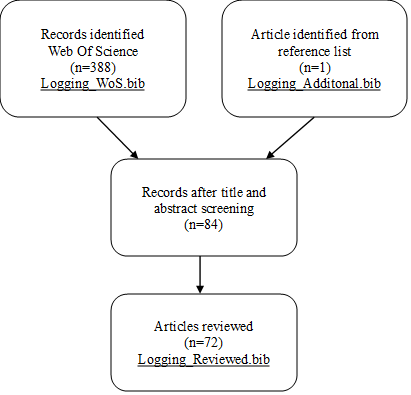
|  |  |  |  |
| --- | --- | --- | --- |
|  | **Feature** | **Group** | **%** |
| 1 | Adaptive management | Governance features | 25 |
| 2 | Monitoring, evaluation and review | 18 |
| 3 | Inclusion of multiple knowledge systems in management plans or policies | 14 |
| 4 | Respect for indigenous peoples and local communities’ customary rights and access and/or sovereignty | 12 |
| 5 | Transparency of decision-making | 12 |

**d)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Feature** | **Group** | **%** |
| 1 | Community wellbeing | Socio-cultural features | 22 |
| 2 | Educational activities | 12 |
| 3 | Perpetuation of indigenous peoples and local communities’ cultural, social and spiritual needs and values | 12 |

*2.2.4) Logging {2.2.3.5}*

For logging, five practice-specific journals (i.e., *Current Forestry Reports*, *Current Opinion in Environmental Sustainability*, *Forest Ecology and Management*, *Forest Policy and Economics*, and *Ecology and Society*) and the four high-profile journals were searched by Web of Science (WoS). The search was completed by October 2020. The search string was as follows: TS=((sustain\*) AND (forest\* OR timber\* OR wood\* OR charcoal\* OR fuelwood\* OR firewood\* OR "fuel wood" OR "fire wood" OR "wood fuel")). The second half of the search string specifying timber resources was not used for forestry journals (i.e., *Current Forestry Reports*, *Forest Ecology and Management*, and *Forest Policy and Economics*). The search was limited to review papers for the practice-specific journals. For *Ecology and Society*, review, meta-analysis, and synthesis papers were manually sorted based on title and abstract because of insufficient tagging in the WoS database. Note that *Current Forestry Reports* only covers review papers published after 2015, which is when the journal started. A total of 388 articles from WoS database plus one paper identified from the reference list of one of the articles were extracted. Papers that had a focus on plantation forestry or were off-topic were removed. The screening took two steps: the initial screening was based on title and abstract, and the second screening was based on the main text, reducing the number of articles to 84 and 72, respectively (Diagram 4).



**Diagram 4.** Search and screening results for the post-2010 literature review on logging

*2.2.5) Non-extractive practices{2.2.3.6}*

For non-extractive practices, the review focused on wildlife viewing using five practice-specific journals (i.e., *Journal of Sustainable Tourism*, *Annals of Tourism Research*, *Journal of Ecotourism*, *Tourism in Marine Environments*, *Journal of Outdoor Recreation and Tourism*, and *Current Issues in Tourism*) and the four high-profile journals. The search was conducted in Web of Science and Google Scholar using the following search string: TS=(("sustainab\*" OR "unsustainab\*") AND ("wildlife watching" OR "wildlife viewing" OR "wildlife tourism" OR "non-consumptive wildlife tourism" OR "animal tourism"). Pre-2010 search focused on review articles, species-focused or geographic-area-focused articles together with main books in the field, such as *Wildlife Tourism: Impacts, Management and Planning* (Higginbottom, 2004), *Wildlife Tourism* (Newsome et al., 2005). For post-2010 literature, the following leading journals in the field related to tourism and wildlife watching were reviewed: *Journal of Sustainable Tourism, Annals of Tourism Research, Journal of Ecotourism, Tourism in Marine Environments, Journal of Outdoor Recreation and Tourism, Current Issues in Tourism*). In addition, major books in the field were added to the review, such as *Natural area tourism: Ecology, impacts and management* (Newsome et al., 2012), *Animals and tourism: Understanding diverse relationships* (Markwell, 2015); *Wild animals and leisure: Rights and wellbeing* (Carr & Young, 2018). Overall, 201 articles, of which 63 were selected for review as the most relevant, based on preliminary screening of abstracts and titles. Overall, given very few review articles as well as absence of practice-focused journals, the search net had to be cast wider and author’s previous experience in the field had to be utilized in order to find the most relevant literature.