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Knowledge for the twenty-first century: indigenous knowledge, traditional knowledge, science and connecting diverse knowledge systems

Note by the secretariat

The annex to the present note contains a study commissioned by the Ministry of the Environment of Sweden entitled "A knowledge dialogue for the 21st century: indigenous knowledge, traditional knowledge, science and connecting diverse knowledge systems". The study was prepared by the Resilience and Development Programme at the Stockholm Resilience Centre, Stockholm University, and the Swedish National Programme on traditional ecological knowledge at the Swedish Biodiversity Centre, in collaboration with the International Indigenous Forum on Biodiversity and other partners. The annex is presented as received from the Resilience and Development Programme and has not been formally edited.

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Annex

A knowledge dialogue for the 21st Century: Indigenous knowledge, Traditional knowledge, Science and connecting diverse knowledge systems

The Resilience and Development Programme (SwedBio) at Stockholm Resilience Centre (SRC), Stockholm University and NAPTEK at the Swedish Biodiversity Centre[1]

1. Introduction

The concern for declining biodiversity, global environmental change, and an unsustainable human impact on the biosphere, as well as the urgency of the situation is perceived across cultures, geographical scales, and knowledge systems. We want to contribute to a dialogue on how we can build on these concerns and mobilize all sources of knowledge as well as processes for generating new knowledge and understanding towards sustainable governance of ecosystems and biodiversity. In this dialogue, we want to emphasize *connections, exchange, and cross-fertilization* between knowledge systems[2] rather than integration of aspects of one knowledge system into another.

The need for such a dialogue is expressed in several global science-policy initiatives such as the Convention for Biological Diversity (CBD) and the developing Intergovernmental Panel for Biodiversity and Ecosystem Services (IPBES) [3]. Ecosystem assessments to monitor conditions and trends of biodiversity and ecosystem services are one response to global environmental change from a science-based perspective. Given the rate and extent of environmental change and the complex interactions between social and ecological processes, it is recognized that we need to link information, knowledge and understanding existing in different contexts to enhance the general understanding of environmental change and dynamics, and to strengthen our capacity for governing ecosystem services for human wellbeing at all scales[4]. In particular, indigenous, traditional, and local knowledge systems are brought forward as sources of understanding on ecosystem dynamics, sustainable practices, and interdependencies between people and nature; sources that often have not informed decision making on ecosystem management beyond the local level. Furthermore, indigenous peoples and local communities are actors in processes assessing

1 This document is compiled by Maria Tengö, with substantial contributions from Joji Carino, Torbjörn Ebenhard, Jorge Ishizawa, Tirso Gonzales, Caroline de Jong, Marie Kvarnström, Pernilla Malmer, Onel Masardule, Gathuru Mburu, Douglas Nakashima, Malia Nobrega, Maria Schultz, and Yvonne Vizina. The work was supported by The Resilience and Development Programme (SwedBio) at Stockholm Resilience Centre, Stockholm University and with economic support from Swedish International Development Cooperation Agency (Sida), Ministry of the Environment, Finland, the International Union for Conservation of Nature and the Gordon and Betty Moore Foundation . For more information please contact Maria Schultz, maria.schultz@stockholmresilience.su.se

2 We will use terms denoting different kinds of knowledge, and what we may call knowledge systems, in this paper, such as indigenous knowledge, traditional knowledge, local knowledge, and scientific knowledge, with full realization that these terms are used and understood differently by different actors and groups and that there are no absolute distinctions between different kinds of knowledge. We encourage further dialogue on the use of these and other terms denoting different ways of knowing about the environment and about human-nature relationships, and on the relations between such knowledge systems. We further encourage constructive critique on the content and views expressed in this paper.

3 MA 2005; Report of the third ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, Annex ('Busan Outcome'): paragraph 7d): Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems.

4 See more on management of complex social-ecological systems in Carpenter et al. 2009.

the state of ecosystems and the services they depend upon and cherish. Thus, there is a demand for ways to mobilize a diversity of knowledge systems to benefit ecosystem assessments and knowledge generation such as under the IPBES, and linked processes such as Sub Global Assessments (SGAs) and the Programme on Ecosystem Change and Society (PECS). This benefit includes the processes of identifying and addressing knowledge gaps, supporting policy tools and methodologies, and identification and addressing of capacity building needs.

The first global and multi-scale attempt to assess the health of ecosystems and how people's well-being depends on them was the The Millennium Ecosystem Assessment (MA), a UN-driven initiative that ran 2000-2005. The initiative gave wide recognition to the concept of ecosystem services[5], as a way to express and analyze human dependency on ecosystems and biodiversity. Within the MA, there were efforts to include diverse sources of knowledge in ecosystem assessments, although mainly applied in the studies at regional and local levels, rather than the in the global syntheses[6]. According to the MA, the inclusion of diverse knowledge systems into ecosystem assessments would be beneficial to 1) increase the amount and quality of information about particular issues, 2) make the assessment findings more useful for stakeholders at different levels, in particular the local, 3) empower the local communities that are the holders of knowledge.

Several follow-up initiatives have emerged in the aftermath of the MA, the most extensive is the emerging intergovernmental panel dealing specifically with biodiversity and ecosystem services, IPBES. IPBES sets out to "be a leading global body providing scientifically sound and relevant information to support more informed decisions on how biodiversity and ecosystem services are conserved and used around the world". At the second meeting on IPBES held in Nairobi in 2009, participants stressed the importance of local and traditional knowledge, along with other forms of knowledge, to inform policy processes to ensure that the outcomes (research, data and tools, and good practices for the sustainable use of biodiversity and ecosystem services) were useful to actors at all levels[7]. The third and final inter-governmental and multi-stakeholder meeting on IPBES (Busan, Korea, 7-11 June 2010)[8] stated that in carrying out its work, the platform should recognise and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems, but it is not yet clear how these contributions will be integrated and applied. The 3rd intergovernmental and multi-stakeholder meeting acknowledged that "bridging across knowledge systems in a manner that capitalizes on opportunities for positive synergies, while acknowledging strengths and limitations of both indigenous and scientific knowledge systems, will be one of the major challenges for IPBES (…)".[9]

It should also be noted that within the Convention for Biological Diversity (CBD), there are significant efforts to build on local and indigenous knowledge[10]. UNESCO's Local and Indigenous Knowledge Systems (LINKS) programme recognizes the important role played by traditional knowledge in biodiversity conservation, natural disaster response, and climate change

5 Ecosystem services are the benefits that humans derive from ecosystems, including direct benefits such as the production of food, fibers, construction material, and generation of clean water, and indirect benefits such as moderations the effect of disturbances such as a flood or drought, but also spiritual health and mental wellbeing (MA 2005). The concept of ecosystem services was introduced to analyze and communicate the human dependency on ecosystems and became widely spread during the MA.

6 See Millenium Ecosystem Assessment, 2005. Ecosystems and human well-being: general synthesis. ME Assessment - World Resources Institute, Washington, DC, 2005 and Reid et al. 2006. Bridging scales and knowledge systems- Concepts and applications in ecosystem assessments. Island Press, Washington.

7 See more on IPBES and diverse knowledge systems in Appendix 1.

8 Report of the third ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, Annex ('Busan Outcome'): paragraph 7d): Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems.

9 UNEP/IPBES.MI/1/INF/3/Add.1 paragraph 32.

10 See for example http://www.cbd.int/tk/ and www.unutki.org/.

assessment and adaptation[11]. Also the IPCC, in the framework of its Fifth Assessment Report, to be released in 2014, is working with the Secretariat of the CBD, UNDP-GEF, UNESCO and UNU, to broaden the recognition of indigenous knowledge as a resource for climate change assessment and adaptation processes[12].

Although increasingly recognized as essential, the practice of connecting across knowledge systems remains a significant challenge. This challenge has two edges. Credible and rigorous approaches for including and respecting knowledge that is not academically peer-reviewed and generated outside scientific institutions are required in science-based ecosystem assessments, such as the IPBES. On the other hand, the connections and exchange between science and indigenous or local knowledge systems (for a discussion on definitions see below), needs to be done in ways that not only respect the rights and worldviews of the knowledge holders, but also creates insights that are legitimate and useful at multiple scales, for local communities and scientists alike. As will be discussed further below, there are divergences between knowledge systems, creating critical tensions that need to be openly acknowledged and discussed. Furthermore, the needs and interests in knowledge generation and knowledge platforms created may differ significantly between different stakeholders or groups. Credibility and transparency are essential when addressing the double-edged challenge.

There is clearly a demand for more and better information on tools and approaches to enable connections and exchanges between diverse sources and types of knowledge for ecosystem assessments and knowledge generation for ecosystem stewardship and governance. This demand does not emanate only from science and policy communities, but also from indigenous and local communities and organizations, concerned with the loss of valuable knowledge and understanding along with the threats towards biodiversity and ecosystems[13]. There are numerous projects and initiatives emerging at the local levels that may not use an ecosystem services label, but that have strong potential for improving ecosystem management.

This document is one step in a project aiming to create and support a dialogue on potential pitfalls and opportunities, as well as novel ideas for exchange between knowledge systems in an open process with partners and interested stakeholders. The project is initiated by The Resilience and Development Programme (SwedBio) at the Stockholm Resilience Centre (SRC) and NAPTEK at the Swedish Biodiversity Centre (CBM) and carried out in collaboration with representatives from the International Indigenous Forum for Biodiversity (IIFB) and other partners. The purpose is to inform IPBES, SGAs, PECS, and other relevant initiatives for better exchange amongst diverse knowledge systems and cross-fertilization between them in an equal, legitimate, and transparent way, for the benefit of sustainable ecosystem stewardship. Furthermore, we hope that the dialogue will benefit also other objectives, such as cultural revitalization projects, as carried out by communities, NGOs, or any other actor.

The document outlines the context of connecting diverse knowledge systems. We start out with a section on characteristics of knowledge systems and a discussion on definitions. Although definitions can be problematic and contested, we believe an elaboration is needed for a fruitful dialogue. The proceeding sections present a scanning of key issues of concern, followed by a list of key questions to address in creating a legitimate and credible context for knowledge exchange. Boxes with case studies and examples provide illustrations. We further present some examples of ideas and perspectives from science, policy, NGOs, and indigenous peoples and local communities as potential ways forwards. Please note that we do not intend to carry out a full literature review or make a complete list of initiatives of knowledge system exchanges in relation

11 www.unesco.org/links

12 www.ipmpcc.org

13 See e.g. Aikenhead and Michell (2011) and Anon 2011. Potentials and pitfalls in exchange of knowledge systems in cross-scale ecosystem assessments. Report from an informal expert meeting with representatives of the International Indigenous Forum on Biodiversity (IIFB), EU experts and scientists engaged in TK and IPBES. Jokkmokk June 21-22, 2011.

to ecosystem stewardship, but rather to point at critical issues and potential pathways and provide a starting point for further dialogue. We hope that this will be a dynamic and interactive document, evolving along with a dialogue, and all critiques, comments and inputs are welcome[14].

2. Characteristics of knowledge systems

Protagonists of indigenous and traditional knowledge tend to either emphasize its similarities with scientific approaches, to underpin its validity, or to emphasize the dissimilarities and the uniqueness of indigenous and traditional knowledge. To look for universal distinctions between knowledge systems is complicated, as there has always been a significant intersection between science and other knowledge systems, and there is great variation among traditional and local knowledge systems, as well as among scientific disciplines, in particular when including social science and the humanities (cf. experimental physics and social anthropology). It is clear that the often used distinction between types of knowledge and knowledge systems has political connotations. One may argue that the differences between indigenous and scientific knowledge as generated within academic institutions are a matter of perception rather than epistemology. It is worth noting that like indigenous, local and traditional knowledge, science and scientific knowledge also exists in a cultural and social context, albeit this is rarely made explicit and reflected upon[15]. For example, when searching key documents and websites of IPBES, IPCC and ICSU, we find no easily accessible definition of what is meant by science in the context of climate change and biodiversity and ecosystem services. Here, we prefer to discuss diverse knowledge systems as multiple domains and types of knowledge with differing logics and epistemologies[16]. However, it is also clear that there are differences between knowledge systems that need to be acknowledged and understood for a successful exchange of knowledge. Diverse knowledge systems are referred to under many terms that are partly overlapping and without clear-cut definitions: traditional knowledge, indigenous science, aboriginal knowledge, local knowledge, traditional ecological knowledge and citizen's science. In the following, we will present some definitions and characteristics that are often used to define knowledge systems.

A useful starting point is the definition of Traditional Knowledge (TK) given by the International Council for Science (ICSU), as it touches upon many of the key elements that are often used to characterize traditional, as well as indigenous and local knowledge:

> *Traditional knowledge is a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview.*[17]

This definition emphasized the multi-facetted nature of TK, that it is embedded in practice and know-how as well as in cultural expressions, and has a time-depth and builds on interactions between people and specific environments. Much writing about TK addresses its' spatial, cultural, and temporal context[18], i.e. how it has developed at a particular place, is unique to a particular culture, has a historical continuity and developing over time. When related to ecosystem management, it is emphasized that TK is evolving by adaptive processes that generates learning on the complexities and dynamics of ecosystems and human use[19]. Traditional knowledge may or

14 Please contact Maria Schultz, SRC, maria.schultz@stockholmresilience.su.se for comments or questions.

15 E.g. Agrawal 1995, Turnbull 2000.

16 Agrawal 1995, p 4

17 ICSU 2002. Science and traditional knowledge. Report from the ICSU Study Group on Science and Traditional Knowledge. International Council For Science

18 UNEP/CBD/WG8J/4/INF/4 Composite report on the status and trends regarding the knowledge, innovations and practices of indigenous and local communities. R*egional report: Asia and Australia*

19 See for example Berkes et al 2001.

may not be indigenous knowledge (IK), i.e. know defined as held by a specific people. Traditional knowledge may or may not be indigenous knowledge (IK), i.e. knowledge defined as held by a specific indigenous people. In many definitions of IK, who is indigenous is not defined as it should be open to people to define themselves as indigenous[20]. Also, depending on the where you are in the world, the word indigenous has different connotations[21].

Indigenous and traditional knowledge systems acknowledge and build on social and ecological interdependencies and relationships. They typically develop in response to concrete problems and relates to all areas of the everyday life of communities, including how human health and spiritual well-being is dependent on ecosystems. The knowledge in itself is at once empirical and spiritual (see Box 4). On the other hand, science has a history of separation between nature and culture, and in particular natural science has conventionally used an experimental, quantitative approach with assumed objectivity which contrasts with the holism of IK/TK. However, a growing trend in science emphasizes transdisciplinary, i.e. learning across the divides of social and natural science and the humanities, and systems approaches that are better equipped to study complex relationships between nature and people[22]. Recent development within ecosystem management research carry potential for creating bridges for exchange and mutual understanding between diverse knowledge systems, for example within participatory research approaches[23], social-ecological systems (i.e. interdependent and linked complex systems of people and nature)[24], and trans-disciplinary theoretical frameworks such as resilience thinking. Resilience thinking emphasizes the capacity of intertwined social-ecological systems to persist, adapt, and transform in the face of change[25]. Box 1 elaborated further the concept of social-ecological systems.

Local knowledge (LK) is used in reference to place-based experiential knowledge, held by a specific group of people and largely oral and based on practice as contrasted to knowledge acquired by formal education or books. It is described as a mix of scientific and practical knowledge; it is site-specific and often involves a belief component[26]. When the term LK is used there is strong emphasis is on the spatial context and generally less emphasis on the historical and cultural continuity of resource use (however some definitions for LK include history as a criteria).

Relevant to discussion of knowledge generation for ecosystem stewardship is also the term experiential knowledge and practitioners' or practical knowledge. Experiential knowledge refers to knowledge generated through learning-by-doing and distilled through observation. It may be tacit, e.g. that it cannot be articulated or easily shared with others[27]. Local resource management systems can be looked upon as natural experiments; they are experiential through learning-by-doing rather than experimental in the scientific sense[28]. Whereas science has a history of explicitly making a separation between science and technology, experiential knowledge or knowledge embedded in and transmitted through practice is often an acknowledged component of local or traditional knowledge systems. Practitioners' or practical knowledge in the environmental science literature generally refers to knowledge held by formal managers and their learning-by-doing in relation to ecosystems or natural resource management, whether concerning ecology or related social processes.

Box 1. Ecosystem services and stewardship of social-ecological systems People constantly shape and re-shape the conditions under which ecosystem services are generated, e.g. through land use transformations, emission of pollutants, farming practices, and harvesting patterns. Thus, ecosystem

20 E.g. Mauro and Hardison 2000.
21 Nakashima and Roué 2002
22 E.g. Carpenter et al 2009
23 E.g. Fabricius et al. 2006
24 E.g. Ostrom 2009, Folke 2006
25 E.g. Folke 2006
26 Gadgil et al. 2003, Zermoglio et al. 2005, Olsson and Folke 2001
27 Fazey et al. 2006
28 Olsson and Folke 2001

services are usefully seen as generated by social-ecological systems rather than ecosystems alone[29]. MA and much of the research on ecosystem services have focused on the negative impacts that human activities have on ecosystems that in turn affect human wellbeing. While such studies are essential for improving management of ecosystems, it is essential to keep in mind that humans also organize their activities and management practices as to enhance biodiversity and generation of certain ecosystem services, such as in small scale farming in different parts of the world. One example is sacred sites in southern Madagascar, where pockets of forest are scattered across the human-dominated agricultural landscape. These pockets, albeit small, generate essential ecosystem services such as capturing moisture and regulating the microclimate and crop pollination by wild or semi-domesticated bees. Furthermore, they serve as a memory of past generations, a mark of land tenure and identity, and the spirits in the forest protect community well-being. Respect for these forest islands is deeply embedded in local norms and rules, and transgressions of taboos protecting the forest are strongly enforced.[30] Under certain conditions, people are stewards of ecosystem services. Such stewardship is typically based on traditional and local ecological knowledge, generated over time and embedded in practices, norms, and belief, within a locally evolved governance system. This knowledge has often evolved over long time periods and embrace responses to incremental environmental change, such as degrading soil fertility, as well as rapid change such as floods or disease outbreak. Facing global environmental change, including increasing global temperatures, locally evolved knowledge is a critical source for the understanding of how people can live with change and build resilience, as a source of memory of a diversity of ways and experiences, and a source for innovations for the future[31].

The recognition that ecosystem services are not generated by ecosystems alone, but by social-ecological systems, is a key feature of the Program on Ecosystem Change and Society (PECS), a recently launched 10-year research program sponsored by ICSU and UNESCO[32]. PECS has an explicit focus on interdisciplinary and acknowledging people's connection to the biosphere. The research within PECS will be place-based and address how stewardship of ecosystem services is shaped by the dynamic interplay between the global and the local, past, present and future.

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A cornerstone in science is the peer-review process that serves to validate the generated knowledge. The peer-review process implies that the findings and how they were generated are scrutinized by 'peers', or other researchers with an experience in the particular field, before it is published in a scientific journal and thus acknowledged as valid knowledge. In addition to studies published in peer-reviewed journals, many assessments of human ecosystem relationships are done by indigenous and local communities, NGOs, as well as local and national authorities across the world. They are a useful source for knowledge of sustainable management of biodiversity and ecosystems, but referred to as 'grey literature' as they have not passed through the standard science peer-review process. For grey literature to be applied within for example IPBES an alternative peer-review processes will be required. Developing transparent, inclusive, and legitimate procedures for peer-review of for grey literature as well as for knowledge from other systems than science is a key challenge for IPBES.

29 Chapin et al. 2010, Carpenter et al 2012.

30 Tengö et al. 2007. Taboos and Forest Governance: Informal Protection of Hot Spot Dry Forest in SouthernMadagascar. Ambio Vol. 36:8

31 See more in Research Insight on Knowledge Systems and Learning from Stockholm Resilience Center, available at http://www.stockholmresilience.org/download/18.1fc8315a135cb03b559318/Insights-knowledge.pdf

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Through cross-fertilization between knowledge systems, important insights can be gained on stewardship of ecosystems, how it can emerge and develop over time, and how learning is generated and maintained and embedded into management and governance of linked social-ecological systems[33]. The innovation component of traditional and indigenous as well as local knowledge is increasingly emphasized, where tradition can play a critical role as a source of memory for framing and inspiring innovation. Mechanisms for continued learning combined with a memory of past dynamics may enhance the capacity of the knowledge holders to respond adaptively to e.g. climate change[34]. The mechanisms for learning and innovating in relation to the local environment that is embedded into traditional and local knowledge systems may be highly relevant for enhancing future sustainable ecosystem management.

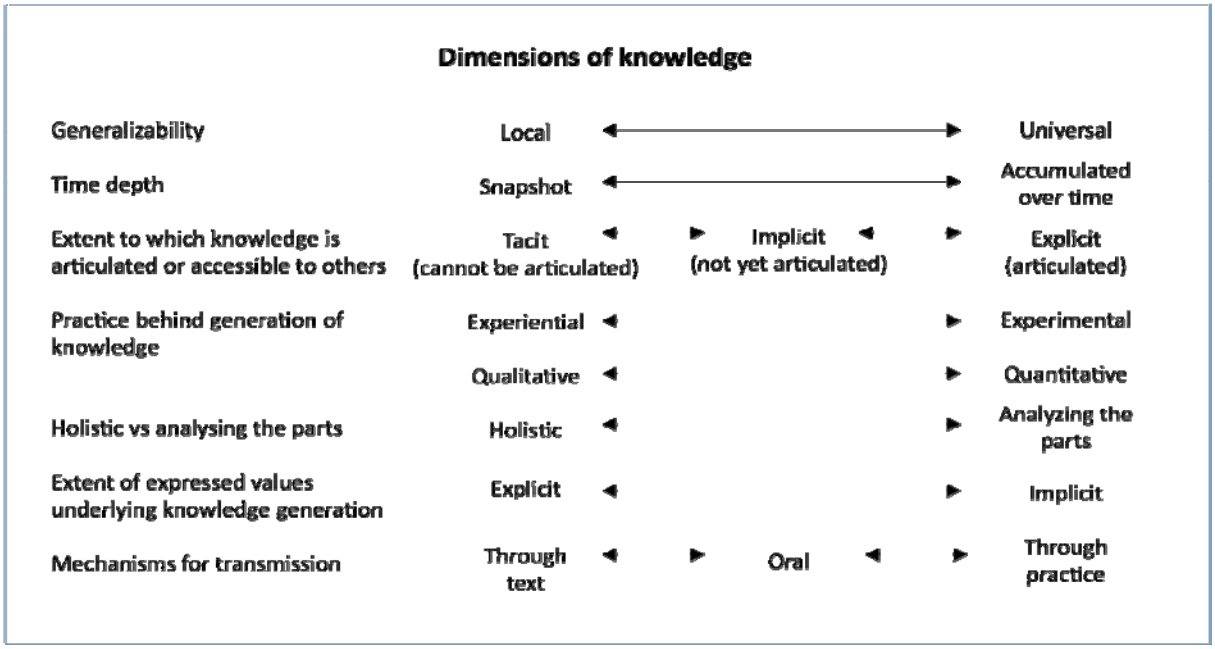

Figure 1. Dimensions of knowledge as a basis for discussions on the overlaps and mismatches across knowledge systems. The terms represents the extreme ends of a spectrum, where most kinds of knowledge are somewhere in between. Different kinds of knowledge in a knowledge system may be located differently along the gradient. Please note that different sides of the spectrums carry different potential dependent on the context and the problem at hand. Developed from Raymond et al. (2010) and Fabricius et al. (2006).

There are clearly differences between knowledge systems, their underlying assumptions and values, what is perceived as credible and legitimate knowledge, as well as the context in which the knowledge is applied. Part of the issue is often that these tensions are not recognized or brought to the fore. It may thus be useful, instead of sorting knowledge systems into boxes, to discuss where differences in understanding and interpretation may be, and how synergies can be achieved based on a deeper comprehension of specific epistemologies and worldviews. One way to discuss divergences among knowledge systems may be to think about positions along a set of gradients. Figure 1 presents a set of aspects of knowledge that may be useful as a starting point for a discussion, with terms representing the extreme ends of the gradients where most knowledge are located somewhere in the middle. Different kinds of knowledge within a knowledge system may be placed differently along the gradients in the figure, and may also be useful in different contexts. For example, fine-grained experience-based knowledge may be very useful in identifying local trends of change in an ecosystem assessment whereas determining the general effects of a specific intervention may require a quantitative comparison of several case studies. Driven by the urgency of the issues at stake, how can we explore synergies and complementarity between knowledge systems to move towards more sustainable futures with secured and enhanced ecosystem integrity

33 Ernstson and Sörlin 2009, Carpenter et al. 2009.

34 See for example Berkes and Folke 2003.

and human well-being, while also respecting the worldviews of knowledge holders? In the next section, we will turn to important hurdles to achieve such synergies.

3. Key issues of concern, problems and pitfalls

Here we would like to outline some of the key issues that have been raised in relation to exchange of knowledge system. The points below are further developed from discussions held in Jokkmokk in June 2011[35].

– **Recognizing the people and the knowledge system behind knowledge.** We want to emphasize that knowledge, as a set of particular insights that may be valuable for e.g. assessing trends in ecosystems or species, is part of a knowledge system; it is embedded in a context of practices, beliefs, social order and institutions, governance, and cosmology[36]. It may thus be valuable not only for understanding ecosystem change but also provide essential guidance for stewardship of ecosystems. Each type of knowledge system has its own mechanisms for determining validity and utility[37]. Recognizing a diversity of knowledge systems that include science as well as e.g. indigenous and local knowledge, implies recognizing the holders of knowledge and their social and cultural context, including ways of learning and knowing, the system that generates, maintains, and applies knowledge, while continuously learning for sustainable futures[38]. One example where indigenous knowledge systems are recognized within education comes from Saskatchewan, Canada, where the education systems have been transformed to integrate the needs and perspectives of First Nation and Métis peoples (Box 2).

35 Anon 2011. Potentials and pitfalls in exchange of knowledge systems in cross-scale ecosystem assessments. Report from an informal expert meeting with representatives of the International Indigenous Forum on Biodiversity (IIFB), EU experts and scientists engaged in TK and IPBES. Jokkmokk June 21-22, 2011

36 Gadgil et al. 1993, Berkes 2008.

37 E.g. Reid et al. 2006

38 Agrawal, 1995

Box 2. Aboriginal Education in Saskatchewan, Canada

Saskatchewan's education system has attempted to respond equitably to the needs of First Nations and Métis peoples. In the 1980s, the Department of Education's *Core Curriculum* initiative endorsed the integration of First Nations and Métis content and perspectives as a foundation for provincial curriculum and resources for all students. Subsequently the 1989 framework, *Indian and Métis Education Policy from Kindergarten to Grade 12*, charted curriculum integration of First Nations and Métis content and perspectives across all required areas of study. In light of the rapidly growing Aboriginal population, the provincial government recognized the need for enhancements in the professional development of teachers, for specialized courses such as Native Studies and Indigenous languages, and for resources that reflect both the face and the voice of First Nations and Métis peoples. Saskatchewan is nationally renowned for transforming the nature of teaching and learning in Aboriginal education. This is demonstrated for example by the increasing number of First Nations and Métis teachers and administrators through highly regarded teacher education programs that include the First Nations University of Canada, the Saskatchewan Urban Native Teacher Education Program, the Indian Teacher Education Program, and the Northern Teacher Education Program.

A critical lesson learned in this journey towards inclusive, responsive, and culturally affirming education indicates that our provincial motto, *From Many Peoples, Strength* serves not only to inspire, but also to indicate the need for partnerships in Aboriginal education. The formation of Elders' Councils to advise school administrations, and joint committees mandated to change curriculum to reflect local priorities and innovations, are examples of such partnering. The intent of the Building Partnership policy is to listen to First Nations and Métis peoples and share responsibility for decision-making in the field of education.[39]

(Adapted from the Encyclopedia of Saskatchewan)

Yvonne Vizina

- **Power relations amongst knowledge systems**. It is important to recognize that relations of power influence and transform the relationships among knowledge systems. Questions about who gets to decide what is knowledge, what is truth, what should inform policy and set conditions for societal control need to be addressed[40]. This relates to validation and rights to knowledge, and concerns the politics of knowledge within communities and between communities and external actors. In many cases, "integration of knowledge" has implied a loss of control of knowledge by the local people[41]. However, the negative consequences of attempts for integration may in many instances have more to do with policy rather than clashes between knowledge systems. Relating knowledge to ecosystem stewardship, it is essential to keep in mind that the underlying values and views on what is considered sustainable or desirable is likely to differ between e.g. groups of scientists, local communities, government officials, business leaders, and international NGOs. Here it may be argued that implicit cultural norms such as economic goals often steer the agenda for policy processes, and that local, indigenous and traditional knowledge, as well as scientific knowledge, may be less influential.

- **Validation** of knowledge is a key concern of the scientific knowledge system in relation to including local and traditional knowledge in ecosystem assessments, such as the IPBES. Scientific credibility of ecosystem assessments requires adhering to scientific principles of peer review, experiment design, reproducibility etc. Some argue that traditional knowledge cannot be appropriately validated using scientific criteria[19]. For example, it is not obvious how spiritual aspects of indigenous knowledge as described in Box 1 can be validated. Within IPBES, a document produced by the UNEP secretariat prior to the first session stated that

39 http://esask.uregina.ca/entry/aboriginal_education.html

40 See Pulsifer et al 2011

41 Nasdady 1999.

"relevant indigenous and local knowledge to be used by IPBES, similarly to scientific knowledge, will need to be subjected to an appropriate peer review process".[42] The procedure of nomination and election of reviewers will determine to what extent holders of local and traditional will participate in the peer review process. In Box 3, the validation mechanisms used to include diverse knowledge systems in the subglobal assessments of the MA are briefly outlined.

Box 3. Experiences of integration and validation of diverse knowledge systems from the MA.
Indigenous, local, traditional and practitioners' knowledge was integrated to varying degrees in some of the subglobal assessments, for example in Kristianstad Water Kingdom, Sweden (practitioners' and local knowledge), South Africa (local knowledge), People's Biodiversity Register, India (local and traditional), Bajo Chirripó, Costa Rica (local and indigenous), and Vilcanota, Peru (indigenous). Criteria of salience (relevance), credibility, and legitimacy were used to reflect upon the different interests of the stakeholder groups involved in the assessments. Specific guidelines were developed for sub-global assessments to develop their own peer review and validation processes[43]. The mechanisms for validation of information from multiple knowledge systems in the MA were science based (triangulation of information, review by other communities, review at other scales etc)[44]. The South African assessment SAfMA, further applied a wide range of participatory research techniques to collect and integrate knowledge, including focus group interviews and workshops, participatory rural appraisal (PRA) techniques, participatory mapping and forum theatre[45]. The Swedish assessments made use of the standard mechanism for validation within science, the peer review process mechanism of scientific journals, to integrate and validate practitioners' knowledge systems.[46]

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- **Rights to and ownership of knowledge**. The methods and approaches for documenting, storing, sharing, and controlling access to knowledge and information from different knowledge systems, including access to scientific knowledge by communities, are critical issues. Among local communities, there is strong concern, mirrored in the negotiations within access and benefit sharing negotiations in relation to biological diversity, about inadequate representation of traditional knowledge holders and of losing access to and control of knowledge. Knowledge holders may for various reasons want or need to restrict what knowledge they may or would like to share. In an exchange amongst knowledge systems, there may be information that can easily be shared, such as certain farming practices or indicators of ecosystem change, whereas communities may want to keep secret or sacred knowledge totally out of bounds for external actors. Box 4 illustrates the role of spirituality and sacredness in indigenous and traditional knowledge systems.

42 UNEP/IPBES.MI/1/INF/3/Add.1 paragraph 32.
43 MA subglobal report 2005
44 Reid et al 2006, p 13
45 Fabricius et al. 2006
46 e.g. Schultz et al. 2007, Andersson et al. 2007.

Box 4. Revelation and the sacred as a source of knowledge and respect

In Venda in South Africa the *makhadzis,* who are women keepers of sacred sites and holders of ecological and spiritual knowledge in their communities, are fighting to protect their sacred sites. Part of this work was done through eco-cultural mapping of the sacred sites, showing how these sites are critical places within the ecosystem - natural springs, forest, wetlands, river basins and waterfalls - which maintain the health and resilience of their ancestral territory. Documenting their traditional knowledge assisted the makhadzis in protecting an important sacred site, as they won part of a court case against tourism development (the case is still ongoing). In Kenya, the Kamba community has female seers who get information about imminent calamities and warn the community about them. In most cases they advice men who are custodians of sacred sites to do rituals to prevent the calamities, such as diseases or crop pests. This revelatory knowledge continues to serve the community even today. In January 2012 for example, the community did rituals to prevent pests from destroying their crops.

The work of African Biodiversity Network (ABN) includes collaboration with partners who support traditions and processes such as in the Venda or the Kamba case. Similar traditions are or have been common in most parts of the world. This includes the role of shamans, sangomas, and paqos, or similar persons who act as intermediaries between the human and more-than-human world. It is acknowledged that the human intellect goes to a certain limit of knowing through logic, measurements or experiments. Beyond this limit, other ways of knowing may bring solutions to the problems at hand. There are many sophisticated ways of stimulating the subconscious mind. Meditating, dreaming and deep trance are ways to tune in to the archetypal world and access knowledge which is not within reach of the intellect. While intellectual capacity may differ from person to person, it is a common phenomenon of humanity. However, revelation is not a common human phenomenon, and this knowledge often comes through selected persons. Sometimes they lead a life different from the rest of the community, to enable them to nurture and sustain their spiritual connection. These intermediaries traditionally have important roles in maintaining respect for the need to limit human activity and ensure sufficient space for other life forms in the ecosystems of which the local community is but one part. Rituals, taboos and sacred sites may also assist in ensuring respect and maintaining space for other life forms. Today, many of these traditions are on the verge of being lost.

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– **The practice of research.** The structures through which traditional knowledge are used and applied ecosystem assessments have generally been determined by science and scientists, and these structures inevitably will alter and not make a full representation of the knowledge.[47] Thus, the practice of research and researchers plays a key role. Insufficient attention is often paid to building trust, establishing and clarifying conditions for the work, dialogues on aim, content and outcomes, recognition and compensation, and needs and desires from the local communities. Box 5 provides an illustration of an ethics guideline for research on humans in general and Indigenous Peoples in particular in Canada. Another example is the Akwé: Kon Guidelines developed within the work of the CBD.[48]

47 Bohensky and Maru 2011

48 http://www.cbd.int/doc/publications/akwe-brochure-en.pdf

Box 5. Ethical Conduct for Research Involving Humans in Canada

In Canada, the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC), and the Social Sciences and Humanities Research Council of Canada (SSHRC), known as the Tri-Council, provides the major source of federal research funding for academic institutions. Successful applicants are required to adhere to rigorous ethical standards required by both the Tri-Council as well as the researcher's university research ethics process. In December 2010, after several years of development and consultation, the Tri-Council released a revision of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans[49]. Chapter 9 entitled *Research Involving the First Nations, Inuit and Métis Peoples of Canada* describes the process researchers need to follow to be in compliance with accepted ethical standards. The chapter interprets the ethics framework in Aboriginal contexts (for example: concerning free, informed and ongoing consent; ensuring the well-being of individuals; justice in power relations between research and participants), and applies provisions of the policy in Aboriginal contexts (for example: respect for Aboriginal governing authorities; working with non-political organizations and communities of interest; working with complex authority structures; diverse interests and views within communities; respect for community customs and codes of practice; recognition of Elders and other knowledge holders). While no document can prepare for all contingencies, Chapter 9 of the Tri-Council Policy Statement provides a good orientation to researchers planning to work with Aboriginal communities.

A significant gap remains, however, in that governments, commercial enterprises, and other funded research are not required to adhere to the Tri-Council Policy Statement. Since many, if not most, Aboriginal communities do not have the capacity to establish councils to screen research applications, researchers working outside Tri-Council requirements can carry out research as they wish. This places high quality academic research at a disadvantage, and Aboriginal communities at risk of exploitation.

Yvonne Vizina

– **Usefulness of ecosystem assessments for local communities.** Insights from ecosystem assessments and tools and approaches for improved ecosystem management may not be expressed in a way that is useful or accessible for improved decision making in local communities. For example, data may be aggregated at larger scales, or only made accessible in English scientific language rather than expressed in popular and local languages. For ecosystem assessments to be valid for local ecosystem management, they need to include a local understanding of human-environment relationships, and the results need to be communicated and discussed with relevant stakeholders. In the Southern Africa assessment in the MA (SAfMA), theatre was used for communication with local communities[27]. There is an expanding number of examples where ecosystem assessments are carried out along with the communities and using local and indigenous knowledge, in ways that are highly valued at the local as well as higher levels, for example within Indigenous Peoples Climate Change Assessments [50], read more in Box 6.

49 http://www.pre.ethics.gc.ca/pdf/eng/tcps2/TCPS_2_FINAL_Web.pdf

50 IPCCA and Tinoc examples, http://www.unutki.org/default.php?doc_id=96

Box 6. Indigenous Peoples Climate Change Assessments and the Tinoc, a Philippine case study.

The Indigenous Peoples Climate Change Assessment is a collaborative initiative under UNU – IAS Traditional Knowledge Initiative[51], to empower indigenous peoples to develop and use indigenous frameworks for assessing the impact of climate change on their communities and ecosystems, and to develop and implement adaptive strategies and building resilience. Observations of ecosystem change by indigenous peoples could at the same time function as a valuable early-warning system for climate change.

The Montanosa Research Development Centre and Tebtebba Foundation have since 2008 been working together with the Kalanguya people on assessing the status and trends on land and resource use and ecosystem management in the Kalanguya peoples areas of Tinoc and Ifugao, Philippines. The project has customized the ecosystems approach of the CBD and used it as the conceptual framework for the assessment. Workshops, focus group discussions and community mapping were used to document land use patterns, biodiversity, ecosystems services, resource sharing and customary sustainable use, and to define how these related to the ecosystems functioning and people's well being. People related well to the concept of the ecosystems approach and this enabled them to analyze negative and positive trends regarding erosion, forest coverage and watershed management. From this analysis people unified to arrest negative trends such as deforestation and shrinking water tables, and to re-affirm commitment to restore their landscape and the resilience of the ecosystems, in the same way promoting people's well being. As a next step a steering committee composed of local researchers, NGO's and the local government spearheaded the assessment of communities' vulnerability and resilience to climate change. The assessment documented a wealth of knowledge among people on seasons, weather and climate and how the knowledge is used to adapt the calendar of the year to the suitable activities, e.g. the different times of sowing and planting, time to hunt and to fish and to ensuring the regeneration of wild and domesticated animals. People are associating expected changes in weather and timing of certain activities with blooming of flowers, fruit bearing of trees, the arrival of certain birds, animal's behaviour, the drying and falling of flowers, leaves and fruits of plants and indigenous fruit bearing trees. They are also determining incoming weather condition based on the observed formation and colours of the clouds and the movement of the wind, while combining these observations with the phases of the moon. Problems identified as brought about by climate change include drought, increase of pests and diseases, decreased yields, unexpected typhoons and increased illness due to erratic change in weather. Measures were also taken to mitigate effects of climate change. In response to extended droughts, people adjusted their planting time to make sure that water was available. They prioritized traditional rice varieties that they knew thrive in rainfed lands. The traditional seed selection systems for choosing the best seeds were revived as it is experienced that these have higher survival capacities under extreme conditions.

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51 See http://www.unutki.org/

- **Representation of relations and values.** Indigenous and traditional knowledge is often generated in a cultural context of respect for nature and the deep inter-relations between people and nature, where the practical and spiritual life is inseparable (see Box 4). Knowledge is associated with certain places, persons, rituals, and is highly interconnected with the ways of life of communities. Such relations are often not fully recognized and also not very easily translated in a knowledge system exchange or when brought out of its context[52]. Furthermore, the values that are an embedded component of indigenous knowledge system[53] can also be lost or misinterpreted in knowledge integration. A shared understanding of local ecosystem management and sustainable use that can benefit a wider audience than the local needs to recognize the relations, values and rituals that uphold a respectful and sustainable ecosystem stewardship. For example, sacred groves protected across an intensively used agricultural landscape can generate ecosystem services that underpin agriculture such as crop pollination, pest control, and micro climate regulation (see example in Box 1). However, failing to recognize the cultural ecosystem services they generate as sacred sites may jeopardize their protection and undermine the services.[54] Erosion of culture and social-ecological integrity is often an unintended result of market-driven economic change that has wide-ranging consequences for ecosystem management.

- **Scale of knowledge and understanding**. Some progress has been made on knowledge exchanges at the local level, for example using GIS techniques for mapping and making tools available for local monitoring of key resources. But how can the insights and wisdom from local communities, for example about detecting new patterns of ecosystem change and dynamics and sustainable ways to relate to nature, inform science and decision making at higher scales, including at the global level?[55] The ambition in the MA was to include multiple knowledge systems at all scales of assessment, but this proved difficult, both because of insufficient mechanisms for knowledge exchange, and the challenge of scaling up knowledge[56]. In the sub-global assessments, in particular in the SAfMA, efforts were made to link and integrate knowledge and information across scales[57], but there was limited evidence of the influence of diverse knowledge systems in the global level synthesis.
- **Resource constraints.** A very practical challenge for exchange amongst knowledge systems in ecosystem assessments is resource constraints concerning time and money. To build trust and engage in truly participatory processes with communities takes time, and funds to do an assessment often allow a timespan of a few years only. The demand for results in projects may not recognize the need to invest in a valid and legitimate exchange. Decisions about resource allocation and trade-offs in science and policy processes are often determined by external decision makers, rather than the directly affected parties making societal choices through a democratic process. Resource constrains also affects the potential for representatives of local or indigenous communities to participate in larger scale policy processes such as climate change negotiations, CBD and IPBES, and external funding or support is generally needed. Developing countries may also lack capacities as well as funding to successfully engage in

52 E.g. Nadasdy 1999, Pulsifer 2011
53 E.g. Berkes 2008.
54 Tengö et al. 2007.
55 For example the recent research on Planetary boundaries (Rockström et al 2009)
56 Reid et al. 2006
57 Fabricius et al. 2006

such processes. Location of meetings and language can also be an important barrier for participation.

– **Economic drivers of change in social and ecological systems.** Among the major drivers of ecosystem degradation is the commercial demand for resources held by both governments and corporations. The exploitation of land, water and the connected biodiversity and ecosystems, is one of the basic driver behind the loss of indigenous livelihoods and ways of life. Unfortunately, often neither indigenous, local and traditional forms of knowledge, nor scientific knowledge on the state and trends of ecosystems find their way in any major way into economic policies and economic decision-making.

4. Key questions

In this section we list key questions and challenges for connections among knowledge systems in the context of ecosystem stewardship and governance that have emerged in the preparation of this document. We see the list as a first cut to be further developed and refined.

– What knowledge and understanding, perspectives and procedures are missing to make partnerships between knowledge systems feasible and interesting for relevant parts involved in knowledge generation for ecosystem stewardship?

– What are the features and characteristics of knowledge platforms which are inter-cultural, complementary and collaborative across diverse knowledge systems?

– Is it possible to develop validation mechanisms that are legitimate across knowledge systems?

– How can the integrity of diverse knowledge systems, their relations and values, be safe-guarded in documentation processes and in exchange with other knowledge systems?

– What are the roles of research and researchers to contribute to processes of strengthening the exchange between knowledge systems? What is the role of science-policy processes such as IPBES? What are the roles of local communities and their representatives and organizations?

– How can the knowledge generation processes and outcomes of ecosystem assessments become relevant for decision making at all levels, including broadening decision making processes affecting indigenous and local communities?

– How can we counter loss of indigenous and traditional knowledge and strengthen existing mechanisms for continuous learning? How can policy processes enable new knowledge and learning processes that provide for more equitable participation across cultures and generations in decision-making and policy processes?

5. Potential future pathways

Numerous activities and projects are on-going and initiated at the local level as well as across scales, involving local communities, indigenous people, NGOs, government agencies, and other actors. Below is an initial scan of interesting initiatives or approaches that may provide potential ways forward, a list which is to be expanded and developed.

- Inclusion of representatives of knowledge holders from a diversity of knowledge systems at all stages in science-policy processes. In the IPBES-process, holders of local and indigenous knowledge can usefully contribute not only in knowledge generation and assessments, but also in identifying and addressing knowledge gaps, supporting policy tools and methodologies, and identification and addressing of capacity building needs[58]. In ecosystem assessments, overseeing committees with representatives from science, natural as well as and social science, indigenous and local communities, and from the policy realm, can safeguard the rights of knowledge holders as well as the relevance and legitimacy of the findings of the assessment at multiple scales. It is desirous to have broad involvement of local and indigenous representatives. In the IPBES, it would probably be most functional to recognize two different roles for indigenous and local communities, one being experts on their diverse knowledge systems, and the other being stakeholders with a vested interest.

- Going beyond ownership of knowledge. Knowledge on ecosystem management may be less contested in comparison to knowledge on genetic resources and biodiversity and thus less contentious to share and exchange. Within local or indigenous knowledge systems, some knowledge is secret and sacred and shared only among a small group of people. Other knowledge has a strong cultural context and needs to be understood and interpreted within that context, while other types of knowledge can be easily and willingly shared and disseminated. There may be ways of establishing gradient of accessibility of knowledge within communities; however it is essential that the community itself is in charge of determining which knowledge belongs in which categories, and in charge of the protection and promotion of that knowledge. One example of an approach where the focus is shifted towards mechanisms for learning is stewardship of knowledge, which is concerned with the processes that cultivate and promote conditions that support the continued existence of knowledge systems[59]. A stewardship approach acknowledges that knowledge and learning processes change, and seek to understand how policy processes can allow for evolving knowledge and mechanisms for generating and transmitting knowledge. In a global consultation survey on Farmer's rights, the informants preferred a 'stewardship approach' that focuses on sharing and documentation of the knowledge to keep it from disappearing rather than awarding them property rights as the means to protecting and promoting their knowledge and avoid misappropriation, the 'ownership approach'[60]. However, there are strong drivers towards an ownership approach, emerging from needs to defend Indigenous Peoples traditional land and resources, and from demand for Intellectual Property Rights on genetic resources and the connected traditional knowledge on its values and use, including the misappropriation of their knowledge sometimes indigenous peoples and local communities have experienced over time. There are various international fora that have put attention to this issue. For Indigenous Peoples, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[61], adopted in 2007 has evolved as an important cornerstone and reference point.

58 See the comments from Forest Peoples Programme (FPP) on IPBES Works programme of the platform, http://www.ipbes.net/plenary-sessions/intersessional-process/172-comments-on-the-revised-work-programme-of-ipbes.html

59 Pulsifer et al 2011

60 FNI 2011

61 http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf

– "Dual evidence base", a parallel approach for assessments such as IPBES, where key issues for ecosystem management are addressed in parallel by peer-reviewed academic work and local/indigenous/practitioners knowledge, using separate mechanisms for validation. This is what is suggested with the "dual evidence" base approach from the International Science Workshop on Assessments for IPBES[62]. "The dual evidence-based peer-review process takes into account that different criteria of validation should be applied to data and information originating from different knowledge systems. 'Dual evidence-base' means that in the assessments, the different knowledge systems are viewed as generating equally valid evidence for interpreting change, trajectories, and causal relationships"[16]. Challenges to be resolved would be who determines the validation mechanisms for the parallel databases, and who controls the information stored, and ensuring the equal value of the knowledge system, both in the presentation of and in the actual applications the information.

– Indigenous researchers and local databases. In many indigenous communities, researchers from within the communities develop and conduct research. This is one way of strengthening the control of the processes locally, and allowing for an endogenous interpretation of the knowledge. Databases have been a general approach for documenting IK/TK which has received critique for e.g. misrepresenting and compartmentalizing the knowledge and focusing on knowledge while losing the role of people or their social and political context.[63] A response is the development of data management by local communities or Indigenous Peoples, often in collaboration with NGO or researcher. New technology that is easily accessible and cheap can shift the control over to the hands of knowledge holders and indigenous researchers. One example is the online Atlas of Inuit Sea Ice Knowledge and Use (Siku Atlas)[64]. The program uses a wide set of tools to collect information, including participatory GIS, individual and focus group interviews, ice trips. They also applied a knowledge documentation approach in collaboration with community members to relate map features to associated environmental, social, and political contexts using a variety of multimedia representations (e.g. audio and video recordings, photographs and textual accounts). The aim was to mitigate the risk of destructive reduction of Inuit knowledge. Central in this process was genuine dialogue and exchange of views with community members around the identification of important phenomena and the relationships. Another example is The Indigenous Partnership for Agrobiodiversity and Food Sovereignty described in Box 7.

62 Workshop report, International Science Workshop on Assessments for IPBES, United Nations University, Tokyo, Japan. 25-29 July 2011

63 e.g. Agrawal 2002

64 Pulsifer et al 2011

Box 7. Connecting between diverse knowledge systems - The Indigenous Partnership for Agrobiodiversity and Food Sovereignty and the Banaue Declaration

There are many ongoing initiatives seeking ground for cross-fertilization between knowledge systems in an equal, legitimate and transparent way. One example is the Indigenous Partnership for Agrobiodiversity and Food Sovereignty. The Indigenous Partnership is a network of indigenous communities and organizations committed to defining their own food and agricultural practices that sustain agrobiodiversity, assisted by scientists and policy researchers who value participatory agricultural research approaches. Its mission is to improve ways of linking indigenous peoples and local communities interested in pursuing self-determined development and to facilitate such communities in taking a leadership role in agrobiodiversity dialogues. The Indigenous Partnership places importance on the collaboration between science and traditional knowledge as science can complement local knowledge when communities believe it to be necessary and welcome.

On the occasion of a regional gathering in Banaue, The Philippines, in January 2012, 43 people among them scientists, researchers, NGOs, and government staff from 13 countries - with 17 indigenous communities represented – were brought together. The participants discussed and exchanged ideas on how to ensure food sovereignty, conserve agricultural biodiversity and protect local food systems. A joint document; "The Banaue Declaration" was drafted, that outlined key points that the present organisations agreed upon. Key points of the Banaue Declaration are:

- Provisions and principles contained in the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA) and the Intergovernmental Panel for Biodiversity and Ecosystem Services (IPBES) are important and all those who are concerned about indigenous issues to be informed of and sensitive to them.
- Shifting and rotational cultivation is important and relevant for the food security and the sustainable livelihood practices of millions of indigenous peoples and has an important role in biodiversity conservation.
- Shifting cultivation practices in Asia are very diverse and their nature is evolving. Such systems, and their associated foodways, risk to be marginalised and potentially lost unless indigenous communities are freed from repressive policy directives and given the power to make their own culturally appropriate decisions regarding their agricultural practices.
- Issues surrounding shifting cultivation and pastoralism are fairly similar because both systems are environmentally friendly, equitable, adaptive, innovative, culturally embedded and decentralized.
- Traditional knowledge holders can be identified. These are individuals grounded in communities, innovative, passionate, practical, conciliatory and mindful of the present and future needs of indigenous peoples.
- Food Festivals build solidarity, revive the cultural identity of a community and are particularly very important for youth identity. They can be an excellent way to identify indigenous wisdom holders and to promote local foodways.
- Intercultural dialogue between indigenous knowledge holders and scientists who accept other epistemologies must be promoted. While scientists must partner with local communities, keeping in mind the principle of free, prior and informed consent, they must also work together in multidisciplinary teams.

Tirso Gonzales

Along with the thinking that different kinds of knowledge should not and cannot be viewed from the rationality of one, it has been suggested that there is need for a third space, an arena that is co-created by the actors involved and not located within either sphere of knowledge.[65] In this view, exchange or connection of knowledge systems is not about crossing a bridge but creating a new island. Such knowledge platforms can enable a shared understanding of the social-ecological system including key drivers of change and uncertainties, for example in place based learning

65 Turnbull 2000, 227-228

communities.[66] Procedures for conflict resolution and facilitation skills are important components of platforms for connecting knowledge systems.

6. Concluding words

In the literature on indigenous and traditional knowledge, it is pointed out that the knowledge is not only concerned which resources can be used and how, but is a body of knowledge that guides human societies in their interactions with nature. What kind of knowledge is needed to guide human societies in the Anthropocene, on a biosphere dominated by human activities? Sustainable stewardship of ecosystems in a time of global environmental change is a daunting task. Different knowledge systems are complementary and combining insights and enabling exchange will create a richer understanding on which to base decision making at multiple scales. Furthermore, to deal with rapid environmental change, not only do we need all sources of information and knowledge, we also need a diversity of ways to think and learn, adapt and transform. It is imperative that we collaborate and build synergies with our collective efforts and concerns. However, to be able to achieve this, we need mindsets that recognize and build on an understanding of our dependence on ecosystems and biodiversity, that reconnects us to the biosphere. We need mindsets that recognize and cherish the diversity of knowledge systems and the multiplicity of logics and practices that underlie their creation and maintenance[67], and avoid the dominance of single perspectives. Such a mindset also needs to be expressed in practices and procedures.

66 See for example Hahn et al. 2006, Schultz and Lundholm 2010, and Davidson-Hunt and O'Flaherty 2007

67 Agrawal 1995.

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10. List of abbreviations

ABN	African Biodiversity Network
ABS	Access and Benefit Sharing
CBD	Convention on Biological Diversity
IIFB	International Indigenous Forum for Biodiversity
IK	Indigenous Knowledge
IPBES	Intergovernmental Platform for Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
LINKS	UNESCO's Local and Indigenous Knowledge Systems
LEK	Local Ecological Knowledge
LK	Local Knowledge
MA	Millennium Ecosystem Assessment
NAPTEK	*Nationellt program för lokal och traditionell kunskap relaterad till bevarande och hållbart nyttjande av biologisk mångfald* [A national programme on local and traditional knowledge concerning the conservation and sustainable use of biological diversity]
PECS	Program for Ecosystem Change and Society
SGA	SubGlobal Assessments
SRC	Stockholm Resilience Center
TEK	Traditional Ecological Knowledge
TK	Traditional Knowledge
UN	United Nations
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNESCO	United Nations Educational, Scientific and Cultural Organization

Appendix 1.

The IPBES Gap Analysis, which provided an overview of gaps in the science-policy interface on biodiversity and ecosystem service as a preparation for the second meeting on IPBES identified that: "While awareness of the need to draw more systematically on a broad range of knowledge types is growing, there remains a lack of processes for ensuring the effective incorporation of types of knowledge into the knowledge base, including the incorporation of knowledge from other sectors and disciplines, non-formal knowledge and mutual learning".[68] At the second meeting on IPBES, held in Nairobi in 2009, participants stressed the importance of local and traditional knowledge, along with other forms of knowledge, to inform policy processes to ensure that the outcomes (research, data and tools, and good practices for the sustainable use of biodiversity and ecosystem services) were useful to actors at all levels.

The third ad hoc inter-governmental and multi-stakeholder meeting on IPBES (Busan, Korea, 7-11 June 2010)[69] stated that in carrying out its work, the platform should "recognise and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems". The Busan Outcome has guided the process forward, but it is not yet clear how these contributions will be integrated and applied.

Following the Busan meeting, as a preparation for the subsequent IPBES plenary meeting, the UNEP secretariat for IPBES, in collaboration with UNESCO, UNDP, FAO and WCMC, produced a document on options for implementing the knowledge generation function of the IPBES. The document stated that "bridging across knowledge systems in a manner that capitalizes on opportunities for positive synergies, while acknowledging strengths and limitations of both indigenous and scientific knowledge systems, will be one of the major challenges for IPBES and an indicator of its success, and relevant indigenous and local knowledge to be used by IPBES, similarly to scientific knowledge, will need to be subjected to an appropriate peer review process".[70] The UNEP secretariat also produced a document on options for implementing the assessment function of the IPBES, which highlighted that "the inclusion of traditional and local knowledge into assessment processes allows assessments to draw on a wider knowledge base, and may result in stronger findings as a result".[71] The document also stated that while "there have been many discussions on the use of traditional and local knowledge in assessment initiatives, comprehensive guidelines on the use of traditional knowledge in scientific assessment have not yet been developed."

68 IPBES Gap analysis finding 3.3, see UNEP/IPBES.MI/1/INF/3/Add.1 paragraph 35c.

69 Report of the third ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, UNEP/IPBES/3/3, Annex Busan Outcome, paragraph 7d.

70 UNEP/IPBES.MI/1/INF/3/Add.1 paragraph 32.

71 UNEP/IPBES.MI/1/INF/4/Add.1 paragraph 23-24.