Key Challenges in Asia-Pacific Biodiversity and Ecosystem Service Assessments

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The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), established in 2012, is an independent intergovernmental body which aims to provide scientific support for policy-making in the area of biodiversity and ecosystem services (BES). The four key functions of IPBES are to provide regular assessments, capacity building, knowledge generation and policy support. It is expected that IPBES will focus on regional and sub-regional scale scientific activities that contribute to policy-making. In particular, the Asia-Pacific region is expected to play an important role as it houses mega-biodiversity and, at the same time, large human populations. Since many regional, national and local assessments, plans and actions for BES have been carried out in the Asia-Pacific, it is important to collect and share the knowledge from this region, and to identify challenges and future actions needed there. This study reviewed 58 Asia-Pacific BES case studies listed in the IPBES Catalogue of Assessments. The review identified 12 key challenges for IPBES and its member states and observers to improve their assessments. These challenges include under-researched interlinkages between cultivated, urban and marine ecosystems; low integration of local, indigenous, and citizen science knowledge; under-representation of cultural services and non-market regulating services; and low consideration of cross-stakeholder priorities in trade-off analyses.

Key Words : *IPBES, interlinkage,indigenous and local knowledge, trade-off analysis, regional and sub-regional assessment*

1. INTRODUCTION

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), established on 21 April 2012 in Panama, is an independent intergovernmental body which aims to provide scientific support for policy-making in the area of biodiversity and ecosystem services. The four key functions of IPBES are to provide regular assessments, capacity building, knowledge generation and policy support. IPBES has also developed a common conceptual framework that facilitates and realizes these four functions.

It is expected that IPBES will focus on regional and sub-regional scientific activities that contribute to policy-making on securing biodiversity and ecosystem services. In particular, the Asia-Pacific region is expected to play an important role as it houses mega-biodiversity and, at the same time, large populations.

Since many regional, national and local assessments, plans and actions have been carried out in the Asia-Pacific region, it is important to collect and share the knowledge on biodiversity and ecosystem services in this region, and to identify challenges and future actions needed for biodiversity and ecosystem services in the Asia-Pacific region.

This review was conducted to support the Asia-Pacific Regional Workshop on Regional Interpretation of IPBES Conceptual Framework and Knowledge Sharing which was held for three days from 2 to 4 September, 2013 in Seoul, Republic of Korea. This workshop was organized with the generous support of the Asia Pacific Network on Global Change Research (APN) and the Ministry of Environment, Republic of Korea.

The objectives of this review paper are to:

(1) Find the state of knowledge in ecosystem and biodiversity assessments and frameworks for the Asia-Pacific region; and

(2) Identify gaps and needs for further knowledge, capacity-building, and funding.

2. METHOD AND MATERIALS

This review paper used the online IPBES Catalogue of Assessments on Biodiversity and Ecosystem Services [1)] as an embarkation point to compare the frequency of simple indicators reflecting the state of knowledge in Asia-Pacific BES across 46 categories, including knowledge gaps in specific ecosystem types and services, tools and processes employed, stakeholder engagement, and integration of different types of knowledge. 58 global to sub-national scale Asia-Pacific region studies were collated from the Catalogue (**Figure 1**). The IPBES Catalogue is considered the most comprehensive available, and was used to judge the following:

(1) Availability of knowledge on different information groups;
(2) Gaps in geographical range and integration;
(3) Level of temporal consideration and scenario use;
(4) Gaps in ecosystem types and services assessed;
(5) Level of cross-scale stakeholder engagement and consideration of trade-offs;
(6) Level of integration of different types of knowledge; and
(7) Level of policy impact and capacity building.

Figure 1 Location of assessments reviewed in Asia-Pacific Regions [1)]

3. RESULTS

58 assessments covering the Asia-Pacific region were analyzed to identify the state of knowledge and gaps in current research gathered by the IPBES ecosystems assessment database[1)]. A summary of trends in each of the 13 information groups compiled in the database can be found in Appendix 1, with further detail available on request. This table shows the state of knowledge on Asia-Pacific regional assessments, based around the frequency of different types and categories of information. This analysis can be used to indicate areas where coverage may be considered sufficient (such as high representation of food and water ecosystem services across forest, coastal, and cultivated ecosystems), and where gaps in research may need to be addressed (such as low representation in Western Asia; low rates of information provided regarding knowledge generation, assessment outputs, and capacity building; or low integration rates of citizen science with other forms of knowledge).

(1) Most assessments missing information on identified knowledge gaps, assessment outputs, and capacity building

The IPBES Catalogue requests governments, agencies, or other assessment authors enter details in 46 different knowledge categories regarding geographical range, information availability, timing, conceptual frameworks, systems assessed, ecosystem services, scope, assessment outputs, tools and processes, stakeholder engagement, types of knowledge used, policy impact, and capacity building. An average Asia-Pacific assessment only competed 53% of the 46 knowledge categories – 33% had information for less than half of all fields. This could reflect: a) no available data due to shortfalls in assessment; b) ongoing assessments that have yet to process requested information (24% were ongoing); or c) incomplete data entry. 16% of assessments had no assessment outputs, including active websites, to further detail their programs, and two assessments had no information entered in the database at all (**Table 1**).

Analyzing database trends in information deficits can identify areas where knowledge is most lacking, which included: identification and actions to address knowledge gaps, assessment outputs, capacity building, data availability, policy impact, and tools and processes (all with less than 50% of assessments providing this information). Training materials were by far most overlooked, included in only 3.4% of assessments (**Table 1**).

Table 1. Information availability and assessment outputs

Assessment information available	Frequency	N*	No data
Active websites	55.2%	58	*32.8%*
Supporting data	27.6%	58	*72.4%*
Reports	36.2%	58	*63.8%*
Communication materials	13.8%	58	*86.2%*
Journal publications	15.5%	58	*84.5%*
Training materials	3.4%	58	*96.6%*
Documentation on integrating knowledge systems	12.1%	58	*87.9%*
Assessments with no outputs	15.5%	58	*n/a*

* Unit: assessments

(2) Low geographical representation from Western Asia, Polynesia, and East Asia

Over one third (35%) of Asia-Pacific assessments were considered regional, sub-regional, or global in scale. However, almost half (48%) of the 81 countries and territories in the Asia-Pacific region were not represented in any assessments, with particularly low representation from Western Asia, Polynesia, and Eastern Asia (**Table 2**). All Polynesian and Micronesian assessments were undertaken in territories associated with either the United States or France. India and the US Pacific territories were disproportionately represented in 29 assessments, 50% of the Asia-Pacific database.

(3) Changes tracked in one-fifth of assessments; one-third include scenario projections

Most assessments seemed to be static one-offs, raising potential difficulties in tracking changes over time; only 21% were planned to be repeated. 33% used scenarios to project state of biodiversity and ecosystem services into the future.

Table 2. Geographical range

Information Group	Frequency	N	No data
Countries in Asia-Pacific region involved in at least one assessment	42	81*	*0.0%*
Assessments covering more than one scale	15.5%	58**	*8.6%*
Assessments at regional or sub-regional scales	25.8%	58**	*8.6%*
Regions with lowest coverage	11. Western Asia (11% of 19 countries) 10. Polynesia (30% of 10 countries) 9. Eastern Asia (38% of 8 countries)	n/a	*0.0%*

*Unit: Asia-Pacific region countries/territories, ** unit: assessments

(4) Urban, dryland ecosystems and cultural ecosystem services least assessed; non-tradable services under-represented

Forest and marine (including coastal, island, and reef assessments) ecosystems were the most commonly assessed (in 52% and 50% of assessments, respectively, **Table 3**).

Integration of urban ecosystems was fairly low, in 14% of assessments, all of which included forest and cultivated or agricultural ecosystems as well (amongst others). Urban and dryland ecosystems were specifically addressed in less than 20% of assessments. These are important areas of attention for the region as 40% of Asia's land area is classified as drylands [2)] and much of the region is undergoing rapid urban expansion.

As a whole, 38 different ecosystem services were assessed, with an average of seven per assessment (**Table 3**). Cultural services were least addressed in only 52% of assessments, although 'recreation and tourism' was relatively over-represented in 47% of assessments. Where recreation and tourism was included, it was the only cultural service mentioned in the vast majority of cases, with notable exceptions including the Japan Satoyama-Satoumi Assessment. Food and water provisioning services were the most commonly addressed ecosystem service in 64% and 55% of assessments, respectively.

An earlier assessment of MA sub-global assessments (SGAs) also indicated weaknesses in regulating and supporting services[3)], but understanding of these, especially regarding climate regulation and regulation of water flows, appear higher in current Asia-Pacific assessments compared to 2005 when these SGAs were first published. Still, there is need for thematic assessments in less tradable or commonly regulated regulating and supporting services such as pollination, biological pest and disease control, or soil fertility, particularly given that regulating services may be key indicators of regime shift risk[4)]. Ecosystem services addressed in less than 5% of assessments are identified in **Table 3,** although some of these services may overlap with other categorizations. Other services not explicitly addressed by any assessments include differentiation between global and local/regional climate regulation (e.g. microclimate), biosafety, and preservation of traditional knowledge.

Further cross-referencing analysis of ecosystem services could help identify common sets of correlated ecosystem services and ecosystems in which they typically occur, improving understandings of relationships between service bundles[4)]. This understanding also helps improve trade-off synergies by

Table 3. Ecosystems and ecosystem services

Information Group	Frequency	N
Most common ecosystems assessed (>40%)	1. Forest and woodland (51.7%) 2. Coastal (43.1%) 3. Cultivated/ agricultural land (41.4%)	58*
Least commonly assessed ecosystems (<20%)	10. Island (12.1%) 9. Urban (13.8%) 8. Dryland (15.5%)	58*
Average number of ecosystem services assessed	7	38**
Assessments including provisioning services	79.3%	58*
Assessments including regulating services	65.5%	58*
Assessments including supporting services	72.4%	58*
Assessments including cultural services	51.7%	58*
Most common services assessed (>40%)	1. Food (63.8%) 2. Water (55.2%) 3. Recreation and tourism (46.6%) 4. Climate regulation; Regulation of water flows (41.4%)	58*
Least common services assessed (>5%)	33. Education; Genetic resources preservation; Human health; Non-timber forestry products; Productivity of marine fish stocks (1.7%) 31. Commercial and recreational fisheries; Fisheries biodiversity (3.4%)	58*

*Unit: assessments, ** unit: ecosystem services

Table 4. Stakeholder engagement

Information Group	Frequency	N
Stakeholder engagement process identified	34.5%	58*
Most common engagement process	Resource user/stakeholder workshops, meetings, interviews (15.5%)	58*
Assessments engaging trade-off and conflict resolution processes	6.9%	58*
Average number of stakeholder groups engaged	3.2 Stakeholder groups	12**
National/provincial ministries and departments	22.4%	58*
Research organizations and experts	17.2%	58*
Local government	12.1%	58*
National/international NGOs	10.3%	58*
Community-based NGOs and groups	8.6%	58*
Private sector and industry	8.6%	58*
Local residents and householders	8.6%	58*
Indigenous groups	6.9%	58*
Resource and conservation managers	5.2%	58*
Farmers	3.4%	58*
Women	3.4%	58*
Trade unions	1.7%	58*

*Unit: assessments, ** unit: Stakeholder groups

identifying and manipulating drivers that have co-benefits for multiple services.

(5) Low direct engagement of cross-scale public, private, and civil society stakeholders in trade-off resolution

Incorporation of non-elite stakeholders is integral to co-management and bridging links between diverse knowledge of complex socio-ecological issues, a core principle of IPBES (Busan Outcome, paragraph 7(d), UNEP/IPBES/3/3). Broad stakeholder engagement can identify common gaps in ecosystem service inventories and drive innovation and legitimacy in ecosystem management and policy, particularly at regional scales seeking to transcend conventional political and geographical boundaries and realize objectives of more holistic and integrated management.

Cross-scale linkages could be identified through stakeholder engagement at multiple levels. Over one third (35%) of assessments indicated explicit stakeholder engagement, primarily through workshops, meetings, and interviews (**Table 4**). Of these, on average three different groups of stakeholders were involved, usually national or provincial ministries and departments (22%), research organizations and experts (17%), and local governments (12%). Assessments specifically seeking trade union, women, or farmer stakeholder engagement were the least common (in one, two, and two assessments, respectively).

Almost a quarter (22%) of assessments actively included trade-off analysis as a tool for assessment, but only 7% directly engaged stakeholders in understanding different resource uses and addressing trade-off and conflict resolutions (**Table 4**).

(6) Average assessment incorporates at least two different types of knowledge; citizen science and local/indigenous knowledge under-represented

Less than half (45%) of assessments indicated the types of knowledge used. Of those assessments that did, an average of two types of either scientific, traditional, resource expert, or citizen science knowledge were integrated. The most common combination was scientific and resource expert

knowledge (24% of assessments), with citizen science featuring least commonly in 10% of assessments (**Table 5**). About one fifth (21%) of assessments included traditional or local knowledge; and 17% combined it with scientific knowledge as well. Private sector and non-government organization knowledge could also be considered discrete knowledge sources but are not specifically considered in the IPBES Catalogue.

(7) Policy impacts and capacity needs under-reported; researcher ecosystem assessment skills most commonly identified need

The impact of biodiversity and ecosystem as-sessments on policy is still not clearly understood, with IPBES Catalogue assessments mostly focused on cataloguing BES information. Only around 21% expanded to identify impacts on policy and decision-making, new capacity building needs, or gaps in knowledge (**Table 6**). Less than a fifth of assessments in the IPBES Catalogue reported the policy impacts of BES assessments, such as their use in developing local livelihood interventions, prevention of ecologically damaging projects, incorporation into national development strategies, or raising policy-maker awareness.

Almost half (47%) incorporated capacity building on pre-existing issues into their assessments, primarily through workshops, networking, and sharing experiences (formal training, fellowships, exchanges, secondments, and mentoring were the least commonly reported capacity building actions). However, few assessments in the IPBES Catalogue specifically record newly identified capacity needs, making it difficult to prioritize and target enhancements required for future assessment processes in the region. Where they are noted, the area most commonly identified for capacity development was fundamental practitioner skills to understand and implement ecosystem assessment concepts. The capacity of assessments to effectively integrate cross-scale stakeholder knowledge and priorities was also highlighted.

Table 5. Types of knowledge

Information Group	**Frequency** (N=58)
Scientific information only	8.6%
Scientific and traditional knowledge	17.2%
Scientific and resource expert knowledge	24.1%
Scientific and citizen information	8.6%
Most common knowledge type	Scientific information (36.2%)
Resource experts	31.0%
Traditional knowledge	20.7%
Least common knowledge type	Citizen science (10.3%)

*Unit: assessments

Table 6. Policy impacts, capacity needs, and knowledge gaps

Information Group	**Frequency** (N=58)
Impact on policy and/or decision making	20.7%
Independent/other review of policy impact	8.6%
Lessons learnt for future assessments	17.2%
Capacity building needs identified	20.7%
Actions taken to build capacity	46.6%
Gaps in capacity communicated to stakeholders	19.0%
Gaps in knowledge identified	20.7%
Gaps in knowledge communicated to stakeholders	12.1%

4. CONCLUSION

The 58 Asia-Pacific studies collated in the IPBES Catalogue of Assessments indicate common gaps in current biodiversity and ecosystems assessments across the region. This includes where coverage may be considered sufficient, such as high representation of food and water provisioning services focusing on forest, coastal, and cultivated ecosystems, and where gaps in research need to be addressed, such as low integration of local, indigenous, and citizen science knowledge; under-representation of cultural services and non-tradable regulating services; and low consideration of cross-stakeholder priorities in trade-off analyses.

Based on the review of Asia-Pacific case studies in the IPBES Catalogue of Assessments, workshop presentations, discussions, and breakout groups, 12 key messages on developing the IPBES framework in regional and sub-regional contexts were developed in response to the four IPBES core functions and cross-cutting issues[5].

Actions on cross-cutting issues should: (1) establish an IPBES Regional Hub to promote universal methods, policy coherence, regional collaboration, and address assessment shortfalls.

Structure, content, and key questions for assessments should (2) highlight where IPBES can deliver advances beyond the Millennium Ecosystems Assessment framework, especially regarding status and trends in biodiversity; (3) address cultural services beyond recreation and tourism; and regulating and supporting; and services beyond climate regulation and water purification, and (4) integrate biodiversity and ecosystem service co-management across

public, private, and civil society sectors.

Capacity building actions should: (5) facilitate common data storage and sharing of knowledge to track changes over time; (6) address most commonly identified capacity building needs - improved practitioner skills for ecosystem assessment and methods for integrating cross-scale stakeholder knowledge and priorities.

Knowledge generation actions should: (7) expand scope to cover gaps in Western Asia, Polynesia, and Eastern Asia sub-regions; (8) address gaps in assessments on urban and dryland ecosystems; (9) create advanced knowledge systems across scales and institutional levels through the integration of social science, citizen, private sector, indigenous and local knowledge.

Policy-relevant tools and methodologies should: (10) develop scientific methodologies for trade-off resolution that engage cross-scale, non-elite stakeholders; (11) develop verifiable criteria for holistic policy impact monitoring and reporting, and (12) provide communications assistance for policy support tools.

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