

From Reports to Interoperable Knowledge

Strengthening the Digital Foundations of IPBES Assessments

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IPBES Assessments as Structured Knowledge Systems

- **IPBES assessments are not only reports, they are structured knowledge systems composed of:**
 - Scoping report defining mandate, scope and key questions
 - Core chapters
 - Summary for Policymakers with assigned confidence levels for each key statement
 - Figures, tables and assessment boxes
 - Glossary of harmonised concepts and definitions
 - Identified knowledge gaps
 - Data and Knowledge Management reports
 - Underlying pool of evidence from diverse knowledge systems
 - Documented review process including comments and responses
 - Team of experts contributing across regions and knowledge systems

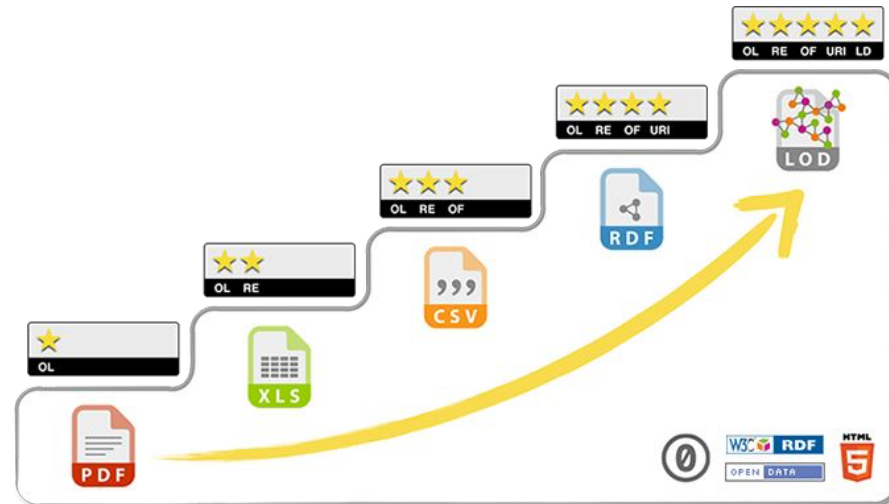
- **Their legitimacy depends on:**
 - Transparency of the process
 - Traceability to underlying evidence
 - Reproducibility and verifiability of conclusions

From Structured Assessments to Interoperable Data

- **IPBES assessments are internally structured but primarily published as static PDF documents.**
 - Structure is embedded in narrative text
 - Claims and evidence are not machine-addressable
 - Cross-assessment reuse is technically limited

To reflect the true architecture of IPBES assessments, structured knowledge must evolve toward 5-star linked data.

- **Where are we on the 5-Star scale?**
 - At 1–2 star level:
 - Accessible and readable
 - But not yet fully interoperable or linked



Why 5-Star Linked Data Matters for IPBES?

- **Interoperable knowledge is not a technical upgrade, it is an institutional requirement.**
 - Structured traceability from SPM statements to underlying evidence
 - Transparent representation of confidence and uncertainty
 - Cross-assessment comparison across cycles
 - Reuse of knowledge gaps and identified drivers
 - Integration with external scientific and policy knowledge systems

- **Advanced analytical tools, including AI systems, require:**
 - Explicit structure
 - Defined relationships
 - Controlled vocabularies
 - Linked references
 - Beyond approximated text and towards validated knowledge architecture

The Role and Limits of PDF in IPBES Assessments

- **PDF fulfils institutional and procedural requirements, thus remains essential for:**
 - Official adoption and legal record
 - Archival stability
 - Formal citation
 - Human readability
 - Layout integrity for figures, tables and SPM

- **However, PDF is:**
 - A document container, not a knowledge model
 - Linear and narrative
 - Not machine-interpretable at semantic level
 - Structurally disconnected across chapters and cycles
 - Technically costly to extract structured claims and evidence

PDF preserves the report, but does not encode the knowledge architecture.



RDF, A Model for Structured and Interoperable Knowledge

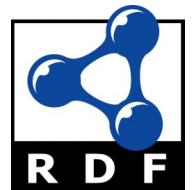
- **RDF (Resource Description Framework) is a graph-based data model that represents knowledge as structured relationships.**
 - Encodes meaning, not just text
 - Makes claims and evidence addressable
 - Enables cross-chapter and cross-cycle querying
 - Supports transparent uncertainty representation
- **Instead of narrative text, relationships become explicit and machine-readable.**
- **It expresses statements as: Subject -> Predicate -> Object**

Pollinator decline —> affects —> crop production

Crop production —> contributes to —> food security

SPM Statement 3 —> has confidence level —> Well Established

Chapter 2 Section 5.2 —> supported by —> Reference X



IPBES Ontology: Semantic Backbone of Structured Assessments

- **Ontology provides the shared vocabulary that makes RDF statements understandable and interoperable.**
- **IPBES Ontology captures the structure of assessments as defined knowledge entities.**
 - Provides a shared vocabulary for key assessment elements
 - Supports consistent interpretation of structured content
 - Underpins the conversion of assessment material into linked data
 - Makes data accessible for queries, analysis and reuse across assessments
- **IPBES Ontology is the semantic foundation that makes stable, interoperable and queryable linked data possible.**

IPBES Ontology: Semantic Backbone of Structured Assessments

- https://ipbes-data.github.io/IPBES_Ontology/
- <https://lod-cloud.net/dataset/ipbes>

```
<http://ontology.ipbes.net/report/sch/> a ipbes:SubChapter ;
ipbes:Chapter <http://ontology.ipbes.net/report/ch/> ;
ipbes:KeyMessage <http://ontology.ipbes.net/report/key/> ;
ipbes:Reference <http://ontology.ipbes.net/report/ref/> ;
ipbes:Report <http://ontology.ipbes.net/report/> ;
ipbes:hasDescription "The text that further describes the content" ;
dcterms:identifier "The identifier of the chapter or sub-chapter or key message in the report" ;
skos:prefLabel "The label that is preferred to be used for a chapter, sub-chapter , report or person"

<http://ontology.ipbes.net/report/person/> a foaf:Person ;
ipbes:Chapter <http://ontology.ipbes.net/report/ch/> ;
ipbes:Report <http://ontology.ipbes.net/report/> ;
ipbes:Role "The role of the person in the stated the chapter and report" ;
owl:sameAs "Link to other resources about the person such as ORCID" ;
foaf:firstName "First name of the person" ;
foaf:lastName "Family name of the person" ;
skos:prefLabel "The label that is preferred to be used for a chapter, sub-chapter , report or person"

<http://ontology.ipbes.net/report/ref/> a ipbes:Reference ;
ipbes:Chapter <http://ontology.ipbes.net/report/ch/> ;
ipbes:Report <http://ontology.ipbes.net/report/> ;
ipbes:SubChapter <http://ontology.ipbes.net/report/sch/> ;
ipbes:hasDescription "The text that further describes the content" ;
ipbes:hasDoi "The DOI number" ;
owl:sameAs "Link to other resources such as zotero repository of the reference" .
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IPBES Reports Available as RDF

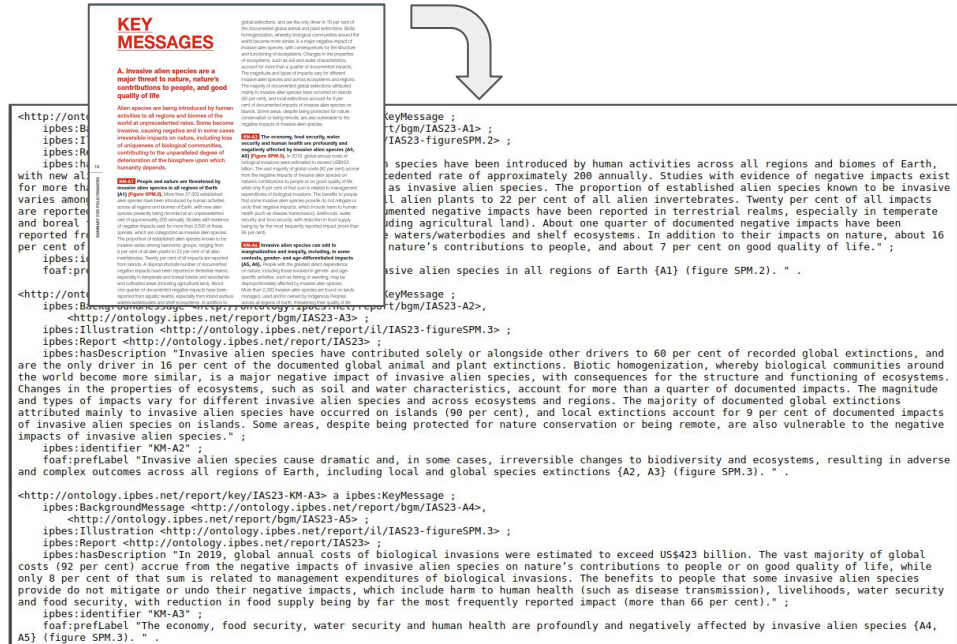
- All IPBES assessments in the 2nd rolling workprogramme have been transformed into structured linked data using:

- The IPBES ontology
- RDF as the data model
- TTL as a publication format

- This includes structured representation of:

- Reports and chapters
- Key messages and SPM statements
- References linked to Zotero
- Figures and tables
- Knowledge gaps
- Contributors

- https://ipbes-data.github.io/IPBES_LOD/



KEY MESSAGES

A. Invasive alien species are a major threat to nature, nature's contributions to people, and good quality of life

Alien species are being introduced by human activities in all regions and biomes of the world at unprecedented rates. Some become invasive, causing negative and in some cases irreversible impacts on nature, including loss of uniqueness of biological communities, contributing to the unprecedented degree of homogenization of the biosphere upon which humanity depends.

2023 **People and nature are threatened by invasive alien species in all regions of Earth** (Figure SP.M.2). In 2019, global annual costs of damage and losses of Earth system services caused by invasive alien species were estimated at approximately 221 billion USD, with most damage and losses occurring in the tropics. The number of established alien species across the world is estimated to be 10,000, with 10 per cent of all alien plants (20 per cent of all alien animals) being invasive. Twenty per cent of all species reported from 2000 to 2019 were invasive. Invasive alien species have caused 1600 species extinctions and 1600 species extirpations since 1970. Global annual costs of damage and losses of Earth system services caused by invasive alien species were estimated at approximately 221 billion USD, with most damage and losses occurring in the tropics.

KeyMessage ;
r/bgm/IAS23-A1 ;
IAS23-figuresSP.M.2> ;

Species have been introduced by human activities across all regions and biomes of Earth, estimated rate of approximately 200 annually. Studies with evidence of negative impacts exist as invasive alien species. The proportion of established alien species known to be invasive (all alien plants to 22 per cent of all alien invertebrates. Twenty per cent of all impacts documented negative impacts have been reported in terrestrial realms, especially in temperate (including agricultural land). About one quarter of documented negative impacts have been in waters/waterbodies and shelf ecosystems. In addition to their impacts on nature, about 16 per cent of all alien species have been introduced by human activities across all regions and biomes of Earth, estimated rate of approximately 200 annually. Studies with evidence of negative impacts exist as invasive alien species in all regions of Earth (A1) (figure SP.M.2). " .

KeyMessage ;
r/bgm/IAS23-A2>,

Changes in the properties of ecosystems and water characteristics, account for more than a quarter of documented impacts. The magnitude and types of impacts vary for different invasive alien species and across ecosystems and regions. The majority of documented global extinctions attributed mainly to invasive alien species have occurred on islands (90 per cent), and local extinctions account for 9 per cent of documented impacts of invasive alien species. " ;
ipbes:identifier "KM-A2" ;
foaf:preLabel "Invasive alien species cause dramatic and, in some cases, irreversible changes to biodiversity and ecosystems, resulting in adverse and complex outcomes across all regions of Earth, including local and global species extinctions {A2, A3} (figure SP.M.3). " .

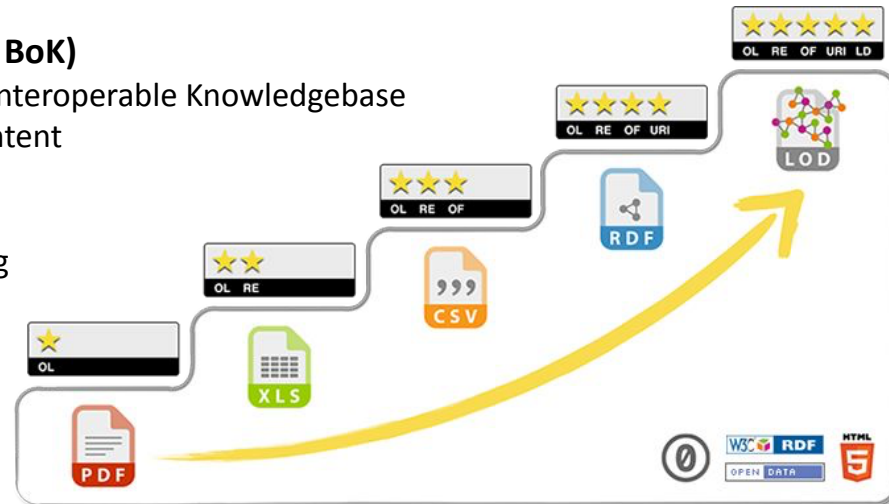
KeyMessage ;
r/bgm/IAS23-A4>,

92 per cent) accrue from the negative impacts of invasive alien species on nature's contributions to people or on good quality of life, while only 8 per cent of that sum is related to management expenditures of biological invasions. The benefits to people that some invasive alien species provide do not mitigate or undo their negative impacts, which include harm to human health (such as disease transmission), livelihoods, water security and food security, with reduction in food supply being by far the most frequently reported impact (more than 66 per cent). " ;
ipbes:identifier "KM-A3" ;
foaf:preLabel "The economy, food security, water security and human health are profoundly and negatively affected by invasive alien species (A4, A5) (figure SP.M.3). " .

Forward Path

IPBES is shaping the future of science-policy by transforming assessments into an integrated and interoperable Body of Knowledge.

- **Transforming past assessments from the first work program from PDF to RDF**
- **Establishing the IPBES Body of Knowledge (IPBES BoK)**
 - From Linked Assessments to a Structured and Interoperable Knowledgebase
 - Consolidated RDF repository of assessment content
 - Validation through the IPBES ontology
 - Version-controlled publication
 - Public SPARQL endpoint for structured querying



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Thank you.

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