



INTOSAI
Working Group
on Environmental
Auditing

Nexus Area:

Climate & Biodiversity

Climate and Biodiversity Hub '23-25



Climate and Biodiversity

Climate and Biodiversity Hub '23-25

Connecting the dots:

How applying the Biodiversity and Climate Nexus lens can help tackle the dual crisis

The INTOSAI Working Group on Environmental Auditing (WGEA), established in 1992, aims to increase the expertise in environmental auditing and to enhance environmental governance. The INTOSAI WGEA's vision of innovative environmental auditing for a common sustainable future is operationalized with projects in thematic areas that are relevant for countries around the world. This report is a direct product of the Nexus Area: Climate and Biodiversity work package. The purpose of this report is to increase awareness and understanding of the interconnectedness of biodiversity and climate change among Supreme Audit Institutions (SAIs) and key international stakeholders. This document provides:

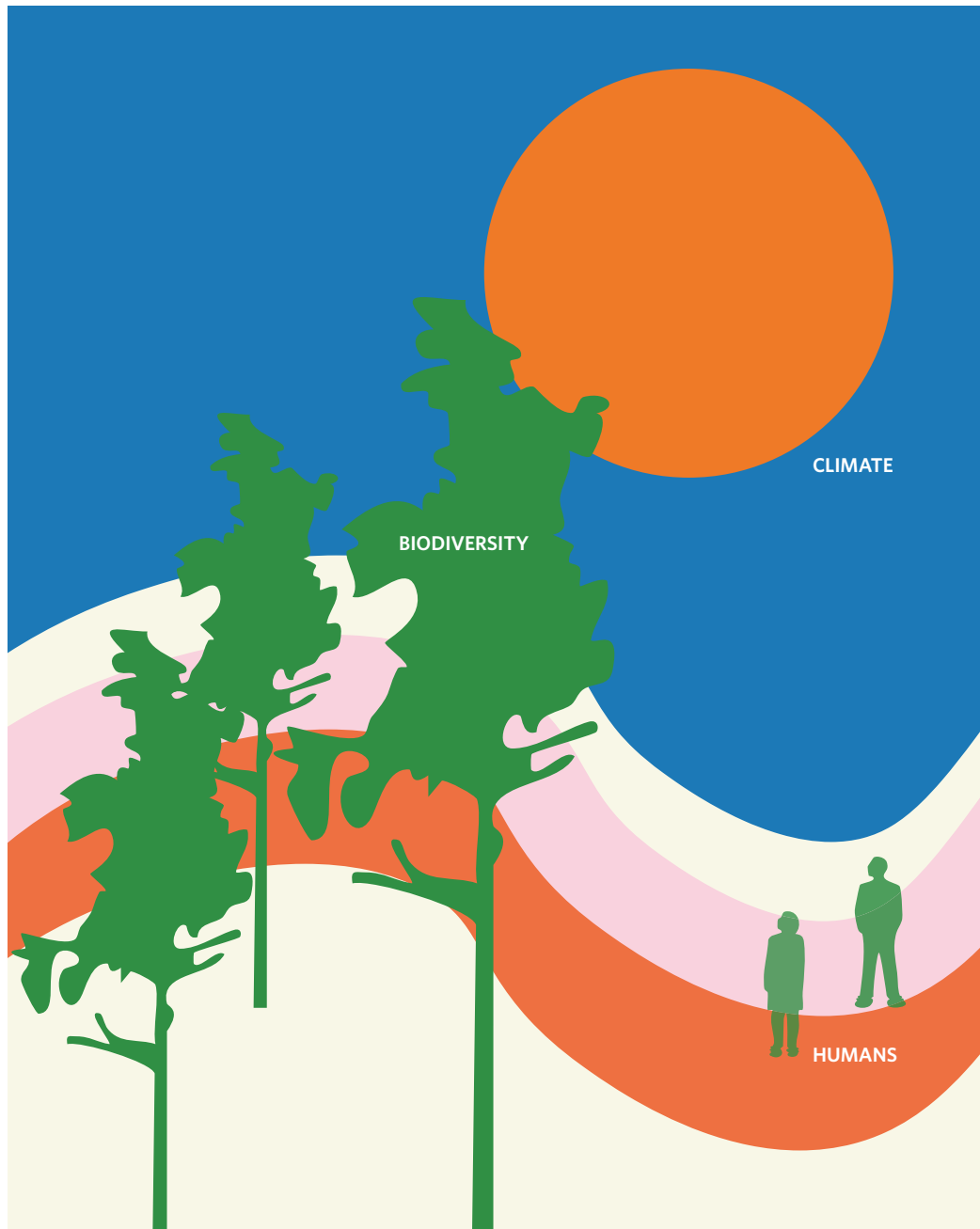
- A summary of the issue and specific challenges posed by the biodiversity-climate change nexus.
- An overview of key international commitments, how they align with the nexus, and how they could be applied as sources of criteria in environmental audits.
- Specific ecosystems and trade-offs along with tips and considerations for auditors when examining biodiversity and climate policy together.
- Case studies that provide examples of how SAIs have audited nexus topics before, to identify lessons learned for the future.

This work is complemented by:

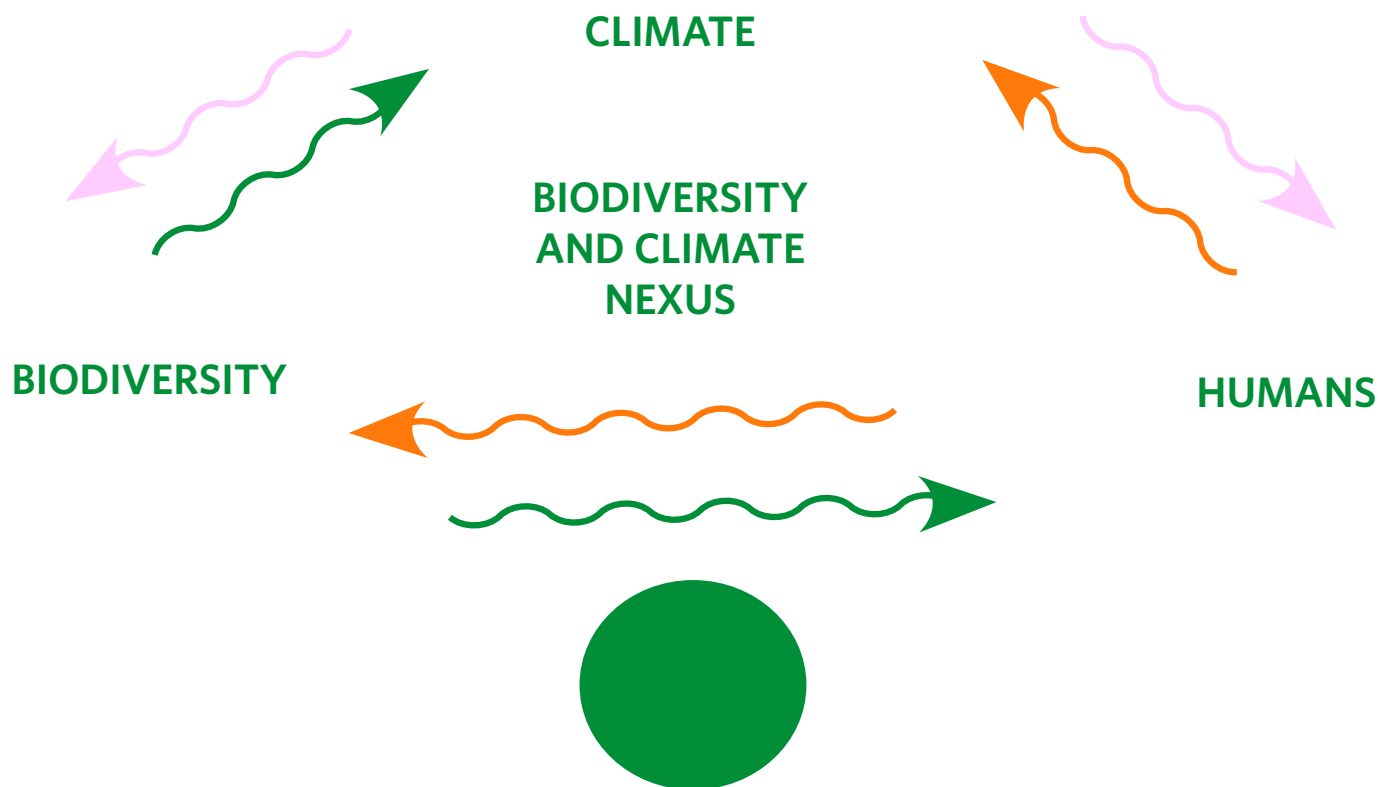
- A literature review on Climate – Biodiversity Nexus: relationship of climate change mitigation and biodiversity policy measure.
- A bank of audit criteria and questions providing auditors a tool and starting point on how to approach an audit related to the Biodiversity-Climate Change Nexus.

"Increase awareness and understanding of the interconnectedness of biodiversity and climate change"

Climate change and the loss of biodiversity are inseparable threats to humankind and must be addressed together



BIODIVERSITY AND CLIMATE NEXUS



Biodiversity and climate are interconnected

- Biodiversity loss can further accelerate climate change by reducing nature's ability to regulate greenhouse gas emissions and protect against extreme weather events
- Mitigating climate change can help to conserve biodiversity, while protecting biodiversity and/or reversing biodiversity loss can help to mitigate climate change

Biodiversity is critical for humans

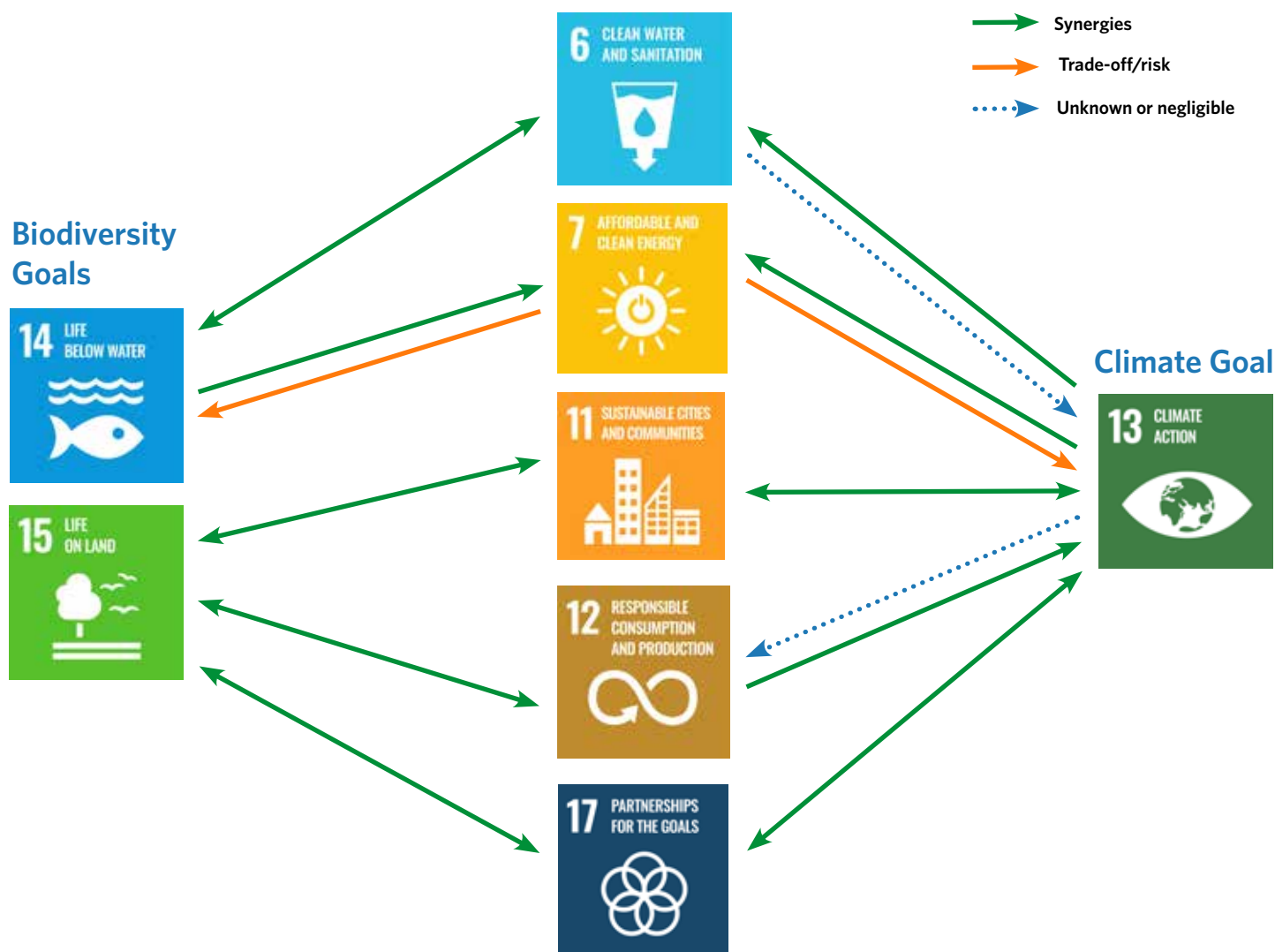
- Biodiversity is critical to human wellbeing (individual and communities) by providing food, water, air, energy, medicines, genetic resources, materials, cultural or spiritual benefits, etc.
- **Human activities can impact biodiversity:**
 - Positively via protection, restoration, sustainable practices etc.
 - Negatively via habitat loss and degradation, pollution, harvesting etc.

Climate change, caused by humans, affects living conditions

- Increased temperatures and extreme weather events impact mental and physical health, natural and urban habitats degradation etc.
- Nature-based solutions and sustainable agriculture, forestry, industrial, energy and product practices and consumption can reduce carbon footprint
- Environmental auditors play an important role in making governments accountable

Sustainable development goals: interconnectivity and policy coherence

As members of the United Nations, countries have commonly agreed on Sustainable Development Goals. In 2017, the International Organization of Supreme Audit Institutions adopted the SDGs into its strategic plan. Supreme Audit Institutions (SAIs) can use these Goals, and their targets and indicators, as part of their work including conducting audits on their governments' governance, policy issues and activities. All Goals are interconnected and have potential for some synergies and/or trade-offs.



Goal 17, as especially target 17.4 “Enhance policy coherence for sustainable development”, is key in tackling the dual biodiversity and climate crisis, however applying this concept is often a challenge. Environmental actions and issues are too often approached individually, and their interlinkages and indivisible nature is not well understood. Strong leadership and whole-of-society approach are needed to drive progress toward climate commitments. The principal of leaving no one behind is also key as issues and potential solutions are assessed, implemented, monitored and audited.

*Based on the Scientific Outcome of the Intergovernmental Panel on Climate Change and the Intergovernmental Platform Biodiversity and Ecosystem Services workshop on Biodiversity and climate change.

Biodiversity Goals



Climate Goal



- Habitat loss/degradation for clean energy infrastructures and commodities (e.g., electric batteries)
- Loss of connectivity for migratory species
- Support transition from fossil-based economy
- Reduction of pollutant emissions

- Loss of carbon capture via habitat loss/degradation for clean energy infrastructures
- Support transition from fossil-based economy
- Sustainable energy consumption

*Based on the Scientific Outcome of the Intergovernmental Panel on Climate Change and the Intergovernmental Platform Biodiversity and Ecosystem Services workshop on Biodiversity and climate change.

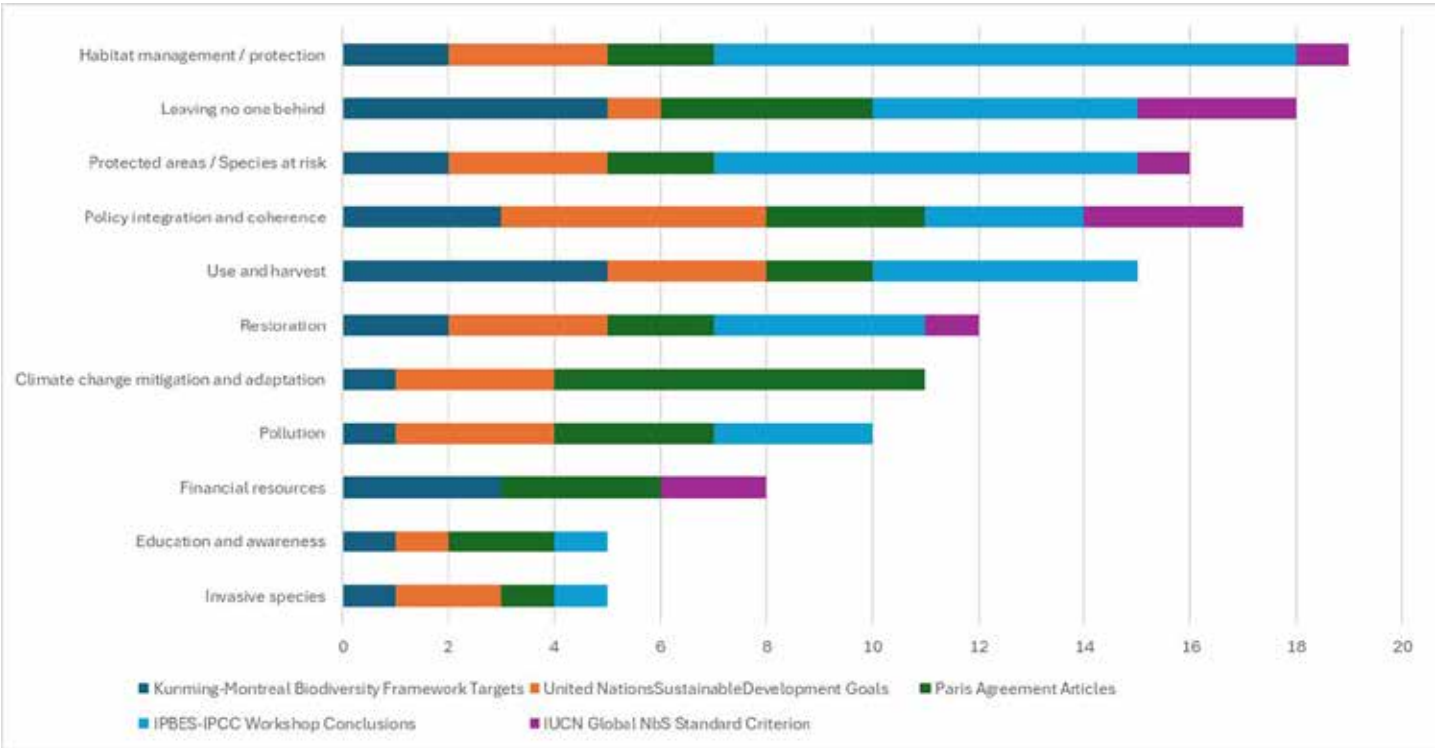
Biodiversity and Climate Nexus lens and international framework

Beyond the Sustainable Development Goals, other key international framework and commitments* can help to apply the Biodiversity and Climate Nexus lens as part of environmental audit work related to a vast number of thematic areas . The matrix below maps the most direct connections between potential audits subjects and key international frameworks and commitments that can be used as sources of criteria.

International Framework / Potential Audit Subjects	Habitat management / protection	Restoration	Protected areas / Species at risk	Use and harvest	Invasive species	Pollution	Climate change mitigation and adaptation	Policy integration and coherence	Financial resources	Leaving no-one behind	Education and awareness
Kumming-Montreal Biodiversity Framework Targets	1, 12	2, 11	3, 4	5, 9, 10, 13, 16	6	7	8	14, 15, 18	18, 19, 20	12, 13, 21, 22, 23	16
United Nations Sustainable Development Goals	13, 14, 15	13, 14, 15	13, 14, 15	13, 14, 15	14, 15	13, 14, 15	13, 14, 15	12, 13, 14, 15, 17		17	13
Paris Agreement Articles	2, 8	2	2, 8	2, 5	2	2, 4, 7	2, 3, 4, 6, 7, 8, 10	2, 4, 6	2, 5, 6	2, 3, 6, 7	6, 12
Workshop Conclusions	1, 9, 10, 12, 16, 18, 19, 25, 26, 27, 31	10, 12, 13, 19	1, 7, 9, 10, 12, 13, 19, 24	1, 14, 18, 19, 20	19	5, 10, 28	ALL	31, 32, 33		30, 32, 33, 34, 35	39
Global Nature-based Solutions Standard Criterion	3	3	3					3, 4, 6	2, 4	1, 5, 8	

*Other framework and commitments that those represented can apply, such as the Taskforce on Nature-related Financial disclosures.

Many of the key international frameworks and commitments can be used to varying degree as source criteria for a vast number of potential Biodiversity and Climate Nexus audit subjects. Depending on the audit subject, these audit source criteria can be leveraged during the course of an audit. For example, they can be used to develop audit questions in the planning phase to determine areas of highest risk, create a series of audit questions in areas to help guide the examination of audit evidence, and guide reporting structure and identify trends. The table below illustrates the degree of connections between potential audits subjects and the key international frameworks and commitments as identified in the previous matrix.

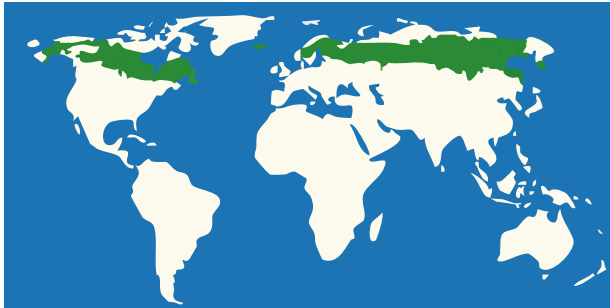


A full suite of potential audits questions has been developed to support audit in key Biodiversity and Climate Nexus thematic areas. Please see the link for these questions along with their criteria and other helpful Biodiversity and Climate Nexus audit tools at the end of this report.

Examples of ecosystems biodiversity and climate Nexus considerations

The following examples showcase different ecosystems, including common pressures, as well as the interconnections and potential for some synergies and trade-offs.

Adapted from Wikipedia



 Boreal forests

Boreal Forests – World's largest terrestrial carbon storage

Boreal forests are vital ecosystems and form the largest terrestrial carbon storage on earth. This ecosystem has many anthropomorphic pressures such as logging, renewable energy, bioenergy and wood-based products play as well as carbon pricing and offsets actions.



Photo: GettyImages, Onfokus, 9th October 2018.

Pressures

Biodiversity

Climate

Logging

(i.e., clear cutting)

- Habitat loss/degradation
- Loss of connectivity for migratory species
- Loss of species (e.g., fungi, insects, birds, mammals)

- Emission resulting from logging

Renewable energy

(e.g., wind, solar)

- Habitat loss/degradation
- Loss of connectivity for migratory species

- Support transition from fossil-based economy

Bioenergy and wood products

- Habitat loss/degradation

- Emission resulting from logging
- Support transition from fossil-based economy

Carbon pricing or offsets

- Tree planting
- Plantation of monoculture and/or non-native tree species

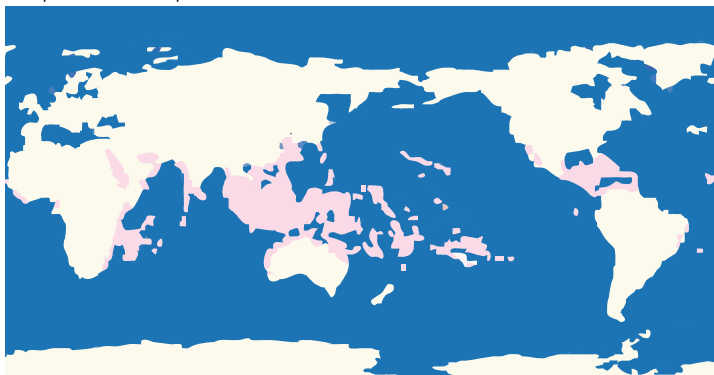
- Carbon capture

Nexus considerations for environmental auditors

- harvesting practices such as continuous cover, dead wood, and mixed species can benefit biodiversity
- harvest quantities and extraction of biomass technique for renewable energy can threaten biodiversity and carbon balance of forests
- tree planting and forest protection can benefit biodiversity and human health impact in addition to carbon capture
- balancing economic utilisation and biodiversity conservation is a key in sustainable forest management practices



Adapted from Wikipedia



Coral reefs

Coral Reefs - Highly climate sensitive biodiversity hotspots

Whilst climate change mitigation measures greatly support coral reefs by limiting climate change, mitigation measures placed in, or in the vicinity of, ocean ecosystems, might inadvertently negatively affect them. Anthropomorphic pressures on this ecosystem include renewable energy, mining and carbon storage.

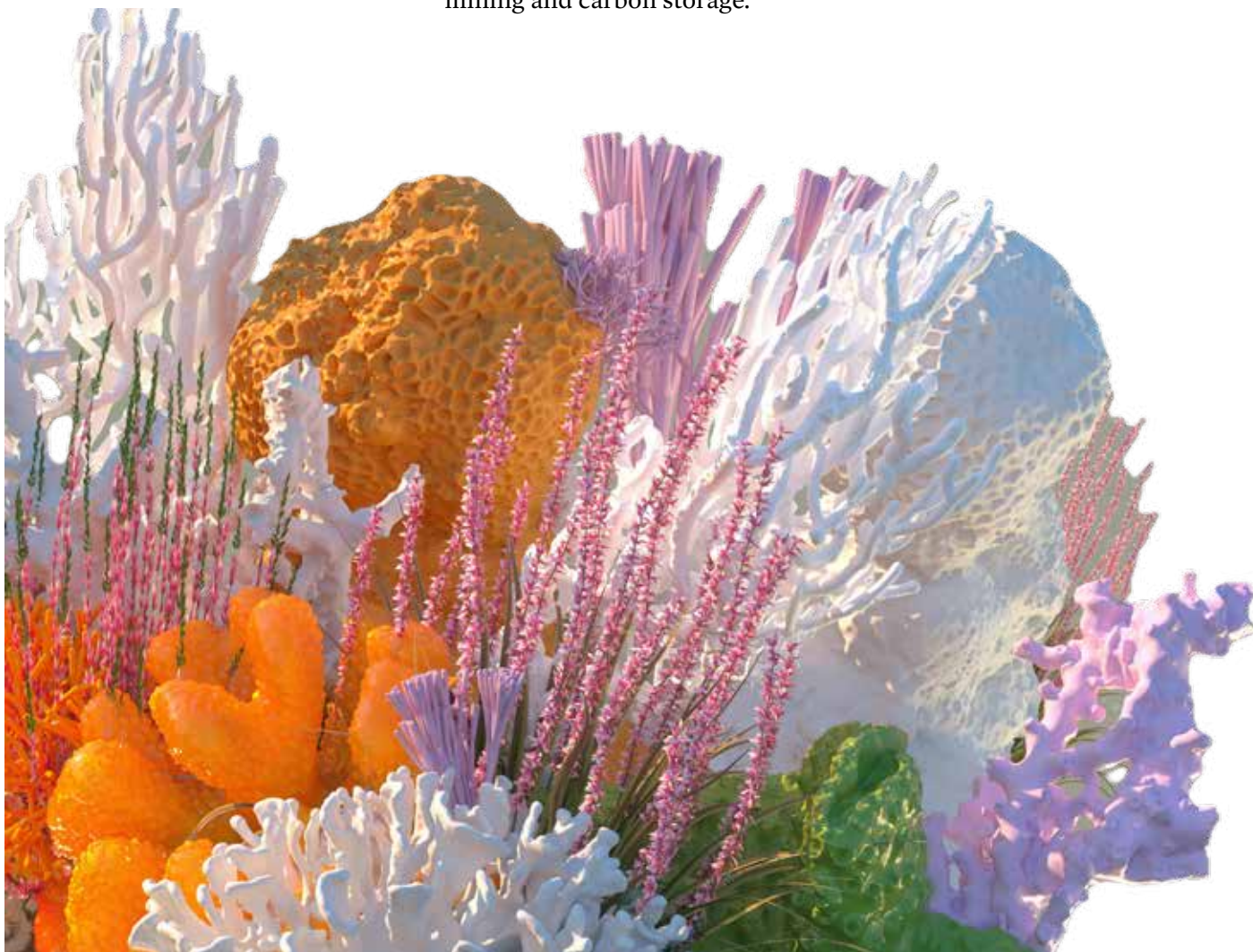


Photo: GettyImages. Andriy Onufriyenko, 25th November 2019.

Pressures

Wave and tidal power generation

Biodiversity

- Changes in temperature (increased heat = coral bleaching)
- Changes in nutrient levels, leading to increased algal growth
- Other unknown and complex interactions with marine ecosystems

Climate

- Support transition from fossil-based economy (renewable energy production)

Deep sea mineral mining

- Habitat loss/degradation
- Other unknown and complex interactions with marine ecosystems

- Support transition from fossil-based economy (rare minerals)

Ocean carbon storage

- Impacts on ocean chemistry
- Deemed as potentially risky

- Support transition from fossil-based economy (carbon sequestration)
- Wind and wave damage protection

Nexus considerations for environmental auditors

- marine ecosystems changes and how it impacts coral reefs through complex interactions is not fully understood
- sustainable management of coral reef is important as a source of food, economy income, as well as protection against rising sea levels and extreme weather event
- ocean-based projects and climate change and mitigation measures should consider the connectivity of ecosystems



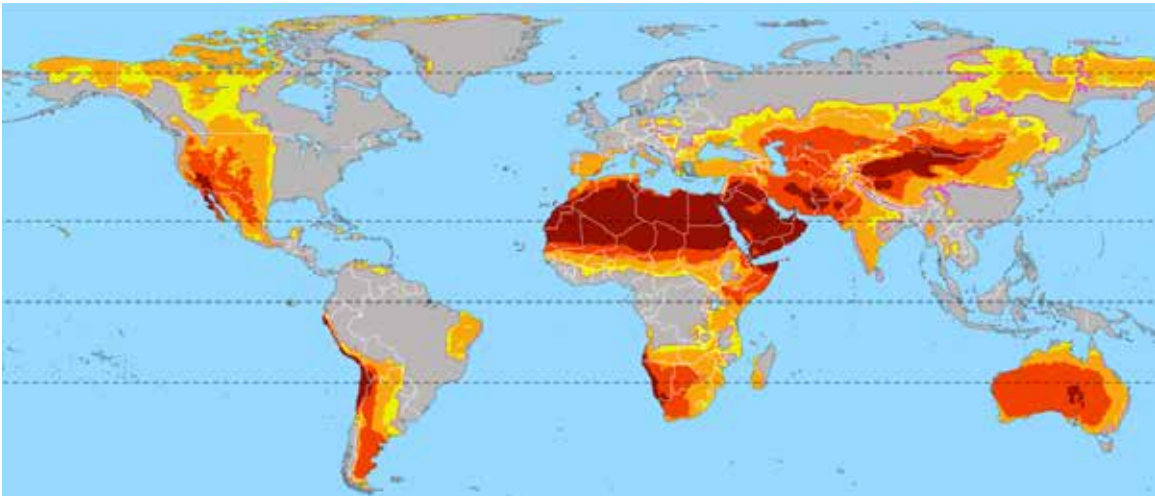


Photo: GettyImages, Manoj Shah, 30th September 2018.

Deserts and grasslands – High carbon sequestration potential often mistaken for a low biodiversity environment

Deserts/semi-deserts and arid/semi-arid grasslands harbour rich biodiversity and are also home to some of the most vulnerable and marginalized groups. Some of these areas, particularly grasslands, are under high land-use change pressure. Those include land clearing for renewable energy, bioenergy and afforestation

- Hyper-arid
- Arid
- Semi-arid
- Dry sub-humid



Adapted from Wikimedia

Pressures

Land clearing for renewable energy (solar, wind)

Biodiversity

Climate

- Habitat loss and degradation due to erosion
- Loss of keystone species, direct animal mortality due to power installations

- Land clearing affect carbon dynamics or local microclimate
- Increased need for water in solar energy production
- Support transition from fossil-based economy

Bioenergy production

- Loss of keystone species, increased animal mortality

- Support transition from fossil-based economy

Afforestation

- Negative impacts on native grassland biodiversity
- Positive impacts on degraded land

- Support transition from fossil-based economy

Nexus considerations for environmental auditors

- sustainable management of grasslands, grassland protection, avoided conversion and restoration can yield both climate and biodiversity benefits – they can also help reduce the impact on some of the most vulnerable and marginalized groups of people
- mitigation measures can reduce the environmental impacts cause by renewable energy project and ensure ecosystem protection
- drylands which are often mistaken as degraded land, thus easily becoming a target for biofuel production or afforestation
- open lands are often ideal for renewable energy installations due to their high wind and solar potential



Freshwater ecosystems - High biodiversity ecosystem interacting with climate system

Freshwater ecosystems are crucial for supporting global biodiversity and contain a disproportionately high percentage of the world's species and a vast amount of genetic diversity. Anthropomorphic pressures on these ecosystems include solar and hydro power production, agriculture and forestry, as well as shale development.



Photo: GettyImages, Thibaud Chanfray, 22nd January 2021.

Pressures

Solar energy production (floating PV)

Biodiversity

- Water pollution (chemicals, heat)
- Disturbance to bird species
- Impacts of light penetration to water

Climate

- Support transition from fossil-based economy

Hydropower dams

- Negative impacts on fish migration
- Loss of habitat connectivity
- Changes in water timing, flow, oxygen sediment content = negative impacts on aquatic biodiversity

- Support transition from fossil-based economy

Agriculture and forest management

- Agricultural runoff and/or increased use of nitrogen for forest management = negative impacts on aquatic biodiversity
- Erosion control practices = improve biodiversity

- Carbon capture (afforestation; agricultural practices)

Shale development

- Unknown impacts on biodiversity, habitat fragmentation, cumulative effects

- Potential for replacement of coal with natural gas plants to meet short-term climate targets

Nexus considerations for environmental auditors

sustainable freshwater management can have significant benefits:

- biodiversity conservation
- help to avoid or reduce emissions by acting as a carbon sink
- natural inland water flows can prevent floods and draughts and prevent increase of pathogens and human disease
- economic impacts related to recreational activities

protection of forests around freshwater from degradation can also:

- help reduce soil erosion
- protect water resources
- and conserve biodiversity in the watershed
- while afforestation may lead to: increased water use and reductions in streamflow



Key Biodiversity and Climate Nexus considerations for environmental auditors

Globally, governments are considering, implementing and are encouraged to take and contribute to local, regional and worldwide initiatives to achieving sustainable development and preventing catastrophic consequences for future generations. Governments at all levels need to lead by example and apply the Biodiversity and Climate Nexus lens, as well as their impact on human quality of life as they are making policy decisions. Environmental auditors can play an important role in making governments and authorities accountable. Many considerations can be integrated as part of audits to help support global movements to reduce biodiversity loss, climate change impacts and inequality.

Governments are considering and encouraged to

- Apply the Nexus lens as they select and implement governmental action and policies
- Use Nature-based solutions to address societal challenges
- Maintain and adopt sustainable agriculture and forestry and infrastructure practices
- Apply a whole-of-society approach and seek global and local action



Environmental auditors are considering and encouraged to

HOLISTIC SCOPE

Adopt the Nexus lens to promote mutually reinforcing practices and action:

- Depart from narrow audit approaches or governance sector towards larger understanding of system risks and system change
- Prioritize pressing issues and areas of governmental (in)effectiveness
- Consider short and long term outcomes and recommendations

DATA AND EVIDENCE DRIVEN

Promote sustainable practices and government actions:

- Use data and solid evidence (e.g., data analytics, artificial intelligence)
- Monitor progress and alignment to national targets (e.g., Paris Agreement, Montreal Biodiversity Convention, SDGs)
- Conduct and recommend value for money assessment

CONTINUOUS LEARNING

Promote innovation and continuous improvement:

- Celebrate successes and promote transparency of failures and challenges as learning opportunities
- Use of improvement cycle as measures and action are planned, implemented, measured and monitored, and course corrected

LEAVE NO-ONE BEHIND

Promote effective actions through whole-of-society and leaving no-one behind principles:

- Encourage and horizontal approaches with multiple level of government and stakeholders (e.g., scientists, policymakers, NGOs, private sector)
- Pay particular attention to how indigenous people, vulnerable populations and local communities are considered as they provide valuable insights related to problem and solution identification

Applying the key Biodiversity and Climate Nexus considerations in an audit context

As environmental auditors are applying those key considerations as part of their audit work, they can use the following potential audit questions to guide their planning, examination and reporting approaches.



Measuring, evaluation and learning

- Relevant social, economic and environmental factors in action design addressed?
- Baseline data on the state of the ecosystem and climate including on the factors contributing to the problem documented?
- Clear and measurable targets for biodiversity and climate outcomes established?
- Continuous improvement and feedback imbedded in the action implementation as well as measuring and monitoring?



Leadership and whole-of-society approach

- Affected stakeholders and communities identified and involved in action design?
- Results of consultations/engagement processes, including how input was considered, documented?
- Other jurisdictions collaboration to ensure coherency and consistency of the action across administrative boundaries?
- Progress reporting is transparent



Synergies and trade-offs

- Costs and benefits of the action documented?
- Monitoring of any potential unintended consequences or policy incoherence instances of the action undertaken?
- Targets for ecological integrity/connectivity improvements established or incorporated?



Leaving no-one behind

- Action linked to UN Sustainable Development Goals linked?
- National sustainable development strategy, biodiversity target or climate target linked to action?
- Gender-based and/or vulnerable population analysis undertaken?
- Indigenous groups and communities identified, and involved in the development and implementation of the action?

Bio- diversity and Climate Nexus

Nexus cases studies – SAI's Nexus lesson learned

Canada – Biodiversity and climate potential of tree planting

In 2020, the Canadian government announced a 10 year and \$ 3.2 billion program to plant two billion trees. The objectives of this effort were to capture carbon to reduce greenhouse gas emissions, enhance biodiversity, and support human well-being.



Audit objective

To determine if the tree planting program designed and implemented adequately.

Findings

1

+/- 15% of the total trees planted were monoculture sites. These single-species plantings do not support biodiversity and other benefits as more diverse plantings would.

2

The program did not provide to all planting partners:

- financial incentives
- key information such as habitat and species range maps to undertake habitat restoration

3

The program was unlikely to achieve its emission reduction and is predicted to be a carbon generator until 2031.



Nexus lessons learned

The Nexus lenses helped support the government accountability related to carbon capture, biodiversity and habitat-related benefits of the tree planting program over the long term. These efforts contribute to Canada's biodiversity and climate goals.

Estonia – Preservation of natural values in protected forests

In Estonia, forest harvesting is the main reason for the biodiversity loss in forests. For example, the Estonian forest bird composite index showed the decline of forest birds by 30% between 1983 and 2018.



Audit objective

To determine whether forest harvesting in protected areas ensured the preservation of the natural values for which these areas had been created.

Findings

1

Lack of reliable and up-to-date information:

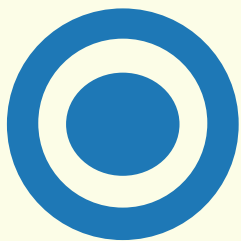
- total area under protection
- extent of tree harvesting in the protected forests
- cumulative effects of forest harvesting relative to the protection objectives
- multiple tree harvesting permits had resulted in large clear cut areas
- condition of several local species, including plants and animals was declining
- subsidies were not being used to compensate for harvesting restrictions and were being even after clear cutting

Nexus lessons learned

This important audit concluded that the authorities had not ensured the protection of protected forest and their natural values. With the added nexus lens, then audit could have also assess the carbon emission associated with the loss and deterioration of the protected forested area.

Philippines – Reforestation’s environmental and socio-economic impact

The Philippine government’s National Greening Program, launched in 2011, aimed to reforest denuded lands, promote biodiversity, and contribute to climate change mitigation, food security, and poverty reduction. Initially targeting 1.5 million hectares by 2016, the program was extended to 2028 with an ambitious goal of reforesting an additional 7.1 million hectares.



Audit objective

To evaluate the environmental and socio-economic impact of the National Greening Program, and its adherence to established procedures.

Findings

1

The drive to rapidly achieve targets led to detrimental consequences, including:

- targets beyond agencies’ capacity to implement resulted in rushed and inefficient implementation
- projects were initiated without proper surveys, mapping or planning
- complexities and issues around land tenure

2

Use of fast-growing exotic tree species, instead of indigenous species, raised ecological concerns (biodiversity loss, invasive species).

3

Inadequate monitoring and post-planting maintenance led to lower survival for planted trees.



Nexus lessons learned

This audit recognized the important contributions to socio-economic and reforestation efforts, while also highlighting the need for environmental sustainability - including monitoring over the long term.

European Court of Auditors – Biodiversity protection in forests

Sustainable management practices are key to maintaining biodiversity and addressing climate change in forests. Funding for forested areas from the EU budget is focussed on support for conservation measures and support for planting and restoring woodland.



Audit objective

**To examine whether
EU action supports
biodiversity
protection and
addresses climate
change in EU
forests.**

Findings

1

The quality of conservation measures for forest habitats covered by the Habitat and Birds Directives continues to be problematic.

Issues such as adapting forests to climate change and setting ecological boundaries on the use of forests for energy are less well developed than the Renewable Energy Directive and the LULUCF Regulation.

2

Rules and procedures do not guarantee greater biodiversity and resilience to climate change.

- The legislative proposals gave Member States more flexibility in the design of forestry support schemes and did not address these weaknesses.
- The common EU monitoring system did not measure the biodiversity and climate change effects of forestry measures.



Nexus lessons learned

While the EU is increasingly addressing forests in its climate change policies, efforts to improve the focus of woodland climate adaptation strategies have been hampered by a lack of knowledge and information.

Morocco – Sustainable and economically viable agriculture practices

In 2023, SAI Morocco effectively and efficiently used the national greenhouse gas inventory system to conduct an exhaustive comparison between the expected emissions forecasts and actual emissions from agriculture practices.



Audit objective

**To evaluate
the measures
undertaken by the
government to
reduce greenhouse
gas emissions by
42% by 2030.**

Findings

1

- Mitigation measures are not sufficient to be able to achieve the emission objective by 2030.
- Agricultural sector was continuing to display an overall upward trend, which risks hindering the achievement of the expected emissions objective.

2

Audit concluded that there was a persistent imbalance between crops and that allow carbon sequestration and crops that emits greenhouse gas.

3

Audit recommended to improve the mitigation measures and monitoring of agriculture practices.



Nexus lessons learned

This important audit highlights the linkages between climate, agriculture and economic development. The nexus concept can be applied to assess the connectivity between climate and biodiversity, but also other potential synergies and tradeoffs.

China – Desertification control and prevention

China is one of the countries with the largest area desertification in the world. After years of continuous exploration, positive results have been achieved in sand control and prevention by using "grass grid". This is a widely used sand control method in China and selected as one of the 500 Best Environmental Protection Practices by the United Nations.



Audit objective

To examine whether there are any issues such as substandard project quality and inadequate post-construction maintenance and management in the "grass grid" sand control.

Findings

1

In some areas, the quality of materials such as wheat straw and rice straw used to make grass grids is subpar, with problems such as mold or insufficient toughness, which affects the service life and sand fixation effect of the grass grids.

2

In some areas, inadequate maintenance and management has resulted in low survival rates and poor growth of sandfixing plants, affecting the stability of grass grids and biodiversity.



Nexus lessons learned

This audit confirms the significant role of "grass grid" sand control in improving the local ecological environment and protecting biodiversity and also emphasizes the importance of monitoring and continuously strengthening maintenance and management.

Photo: GettyImages, Yaorusheng, 19th March 2022.

For more information on these audits please consult the WGEA audit database (<https://wgea.org/audit-database/>).



Photo: GettyImages, Marcus Timms, 31st January 2021.

Additional sources of information

LITERATURE REVIEW

[Literature review](#) on climate - biodiversity
Nexus: relationship of climate change
mitigation and biodiversity policy measure.

AUDIT QUESTIONS

List of environmental audit questions
for environmental auditors based on the
SDGs, Kunming-Montreal convention, Paris
Agreement and IPBES-IPCC workshop
conclusions.

(The project leaders and project group SAls as well as links to the Quality Assurance Certificates will be included here)