Auditing Biodiversity: Guidance for Supreme Audit Institutions

INTOSAI
Working Group on
Environmental Auditing

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November 2007

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This publication was prepared by the INTOSAI Working Group on Environmental Auditing (WGEA). The WGEA aims to encourage the use of audit mandates and audit methods in the field of environmental protection and sustainable development by Supreme Audit Institutions (SAIs). The WGEA has the mandate to

- help SAIs gain a better understanding of the specific environmental auditing issues,
- facilitate exchange of information and experiences among SAIs, and
- publish guidelines and other informative material.

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Acronyms and Abbreviations

CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
EI	Ecological Integrity
EIA	Environmental Impact Assessment
GAO	Government Accountability Office - United States
GEF	Global Environment Facility
GMO	Genetically Modified Organisms (see also LMO)
IBA	Important Bird Areas
IBAMA	Brazilian Institute for the Environment and Renewable Natural Resources—Brazil
IEA	International Environmental Agreement
INTOSAI	International Organization of Supreme Audit Institutions
IUCN	International Union for Conservation of Nature and Natural Resources (also named the World Conservation Union)
LMO	Living Modified Organism
MDG	Millennium Development Goal
MA	Millennium Ecosystem Assessment

MMA	Ministry of Environment—Brazil
NBSAP	National Biodiversity Strategy and Action Plan (prescribed in the Convention on Biological Diversity)
NGO	Non-governmental Organization
SAI	Supreme Audit Institution
SEAM	Environmental Secretariat—Paraguay
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHC	World Heritage Convention
WGEA	Working Group on Environmental Auditing

Foreword

In the 2005 *Millennium Ecosystem Assessment*, over 1,300 scientists from around the world issued this sober warning:

> The ability of the planet's ecosystems to sustain future generations can no longer be taken for granted. The loss of biodiversity, caused by habitat destruction, pollution, invasive species, illegal hunting, overexploitation, and more, is occurring at rates unprecedented in human history—at the global, regional, and local levels. Humanity is, in essence, impairing the very foundation of our health and prosperity. Governments have a key role to play in reversing these trends and in protecting our natural heritage. So do environmental auditors.

In recent years, biodiversity has been one of the most frequently audited subjects among Supreme Audit Institutions (SAIs). Many SAIs have expressed their intention to conduct audits of biodiversity in the future. For this reason, the International Organization of Supreme Audit Institutions (INTOSAI) Working Group on Environmental Auditing (WGEA) established biodiversity as its central theme for the 2005–07 work plan period.

The paper, *Auditing Biodiversity: Guidance for Supreme Audit Institutions* was written to support this central theme. It is an indispensable resource for audit practitioners, describing

- what biodiversity means, why it is important, what threatens it, and what action governments are taking;
- a suggested process for choosing and designing audits of biodiversity; and
- practical guidance, information, and case studies related to audits of biodiversity.

The writing of the paper was led by the Tribunal de Contas da União (TCU) of Brazil and the Office of the Auditor General of Canada. I would like to thank Elaine Ferreira Souza and Carolle Mathieu for their efforts as the lead authors of this paper, as well as Sebastião Ednaldo Prazeres Castro, Ismar Barbosa Cruz, and John Reed for their guidance and supervision. My thanks also goes to the many other organizations and individuals who contributed to this paper (see Acknowledgements).

Auditing Biodiversity: Guidance for Supreme Audit Institutions is one of four guidance papers developed by the WGEA in the 2005–07 work plan period. The other three papers are

- *Evolution and Trends in Environmental Auditing*,
- *The World Summit on Sustainable Development: An Audit Guide for Supreme Audit Institutions*, and
- *Cooperation Between Supreme Audit Institutions: Tips and Examples for Cooperative Audits*.

Readers are encouraged to consult these papers as well as Appendix 1 of this paper for information on other WGEA products and services.

Enjoy!

Sheila Fraser

Sheila Fraser
INTOSAI WGEA Chair

Executive Summary

Biodiversity is a growing concern within the international community—the loss of different species of animals, plants, and micro-organisms is accelerating. Life on Earth depends on nature. Humans need the diversity of nature for important services, such as food and water resources. Nature is also a source of economic opportunities. Protecting biodiversity is in everybody's interest because its loss could eventually lead to the

- extinction of species;
- loss of genetic diversity;
- the global spread of common plants and animals, and
- major changes in the way the ecosystems—which are essential to humans (for example, pharmaceutical products, food, timber and purification of air and water)—function.

According to the international Convention on Biological Diversity (1992), biodiversity (or biological diversity) is

> the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

Governments have put legislation, policies, and programs in place to deal with biodiversity issues. Supreme Audit Institutions (SAIs) can play a major role in protecting biodiversity by auditing their government. SAIs do not need special mandates to conduct audits on biodiversity. SAIs around the world conducted at least 180 environmental audits of ecosystems and biodiversity and 247 on nature and recreation between 1993 and 2003.

The Convention on Biological Diversity recognizes five major threats to biodiversity:

- habitat change: loss and fragmentation;
- invasive alien species (bio-invasion);
- overexploitation;
- pollution and nutrient loading; and
- climate change and global warming.

Other known threats include biotechnology, agricultural methods, desertification (spread of deserts), and biopiracy.

Human activities are the main cause of biodiversity loss. As stated in the Millennium Ecosystem Assessment (MA) released in 2005 "Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted." Habitat fragmentation caused by urbanization and agriculture and the overexploitation of resources lead to depletion of species. Because these activities are regulated by government, SAIs can play a major role in auditing government's actions.

There are several ways to protect biodiversity from these threats. Protected areas, such as national parks and conservation areas can be created. Individual endangered and rare species can be protected in biodiversity "hotspots"—areas with a high concentration of those species. The conservation of biological diversity components outside their natural habitats (for example, zoos for living animals and related species, botanical gardens for plants, and gene banks for the preservation of species) can be used and may protect species from extinction.

Because biodiversity is a broad and diverse subject area, selecting audits of biodiversity to conduct can be challenging for SAIs. Once the topic has been selected, it can be difficult to know where to start, because there are many possible

- scopes (for example, genetics, species, and ecosystems);
- threats (for example, habitat loss, pollution, and urbanization);and
- government responses (for example, international conventions, national parks, and environmental impact assessments).

These guidelines have been developed to

- help auditors audit biodiversity;
- educate auditors on the nature of biodiversity and the reason it has to be audited;
- describe the major role that SAIs can play—by auditing their government's actions and reminding them of their commitments; and
- present case studies to SAIs to help them learn how others have approached this audit topic, which involves large amounts of public funds.

In Chapter 1, the topic of biodiversity is introduced and auditors are given useful information on why they should audit biodiversity and how to go about it.

In Chapter 2, the best way to choose and begin audits of biodiversity was looked at, and it is described in detail in the following four basic steps:

- **Step 1.** Identify the country's biodiversity and threats to it
- **Step 2.** Understand the government's responses to these threats and the relevant players.
- **Step 3.** Choose audit topics and priorities.
- **Step 4.** Decide on audit approaches: audit objectives and lines of enquiry.

Finally, in Chapter 3, auditors will find information about 10 different biodiversity audit topics that have been conducted in different countries around the world. For each topic, auditors will find

- sources of potential audit criteria from international conventions, legislation, policies, and programs;
- potential researchable questions; and
- case studies.

These audits demonstrate that each SAI can play a major role in auditing their government's commitment to protect biodiversity.

For other examples of audits of biodiversity go to "Environmental Audits Worldwide" (http://www.environmental-auditing.org/intosai/wgea.nsf/viewAuditsIssue1) on the WGEA website.

Introduction

According to the Convention on Biological Diversity, biodiversity (or biological diversity) is the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes diversity within species, between species, and in ecosystems.

Biodiversity is an area of growing concern—no longer simply a topic for biologists. More and more, the media is bringing biodiversity to the public's attention.

Biodiversity is being lost at rates that are unprecedented in human history. The loss of biodiversity (the number of species of animals, plants, and micro-organisms) is accelerating rapidly, and it directly affects the structure of our ecosystems, natural world, and lives. One of the challenges of maintaining biodiversity is the increasing demand for biological resources caused by population growth and increased consumption. People all over the world must understand the importance of ecosystems and the advantages of biodiversity.

In 2004, at the 9th Meeting of the Working Group on Environmental Auditing (WG9) in Brasilia, members agreed to adopt biodiversity as the central theme of the Working Group on Environmental Auditing's (WGEA) 2005–07 work plan. They realized that many Supreme Audit Institutions (SAIs) find biodiversity to be a broad concept that can be challenging to audit, using traditional audit terms.

These guidelines have been developed to help SAIs audit biodiversity by

- educating auditors on the nature of biodiversity and why it has to be audited,
- describing the major role SAIs can play in auditing the actions of their governments and reminding them of their commitments, and
- presenting case studies that will help SAIs learn how others have approached this audit topic, which involves large amounts of public funds.

Did you know?

Loss of species

- 15,589 species are threatened with extinction.
- 784 species have become extinct in the wild since 1500 AD.

Invasive species

- 388 species are listed on the invasive species database.

Forests

- Forests have disappeared in 25 countries.
- More than 90 percent of forests have been lost in another 29 countries.
- The net loss of forest cover (deforestation minus reforestation) from 2000 to 2005 is estimated at 7.3 million hectares per year—an area about the size of Sierra Leone or Panama.
- 350 million people worldwide, most of whom are poor, depend on local forests for their subsistence and survival.

International awareness of biodiversity

International awareness of the importance of protecting nature has existed since the 1950s. In 1972 in Stockholm, the world's leaders gathered for the first time to discuss environmental issues at the United Nations Conference on the Human Environment. This conference focused on environmental matters and on the steps humans could take to stop environmental degradation.

Since then, various international agreements that protect the environment have been developed, some of them dealing with specific biodiversity issues.

The first global agreement, the Convention on Biological Diversity, dealing specifically with the conservation and sustainable use of biodiversity was signed at the 1992 Earth Summit, in Rio de Janeiro. The Conference of the Parties to the Convention on Biological Diversity recognized that Biodiversity remains the living foundation for sustainable development.

In 2002, they adopted a strategic plan and made a commitment, called the "2010 Biodiversity Target," to significantly slow the decline of biodiversity at the global, regional, and national levels by 2010. One of its key elements is to bring awareness of biodiversity into mainstream economic sectors and development planning.

Other important international agreements deal with specific biodiversity issues, such as wetlands and the trade of endangered species. These agreements and their associated commitments are described in Chapter 3.

The Millennium Ecosystem Assessment (MA) released in 2005 evaluates the relationship between human well-being and ecosystems. The MA is made up of many reports and is the most comprehensive analysis of existing data on the state of ecosystems and biodiversity. Over 1,300 experts from 95 countries contributed to this report, which highlights the main services and essential goods provided by ecosystems. This report reached troubling conclusions:

> At the heart of this assessment is a stark warning. Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted. The provision of food, fresh water, energy, and materials to a growing population has come at considerable cost to the complex systems of plants, animals, and biological processes that make the planet habitable. . . . Nearly two thirds of the services provided by nature to humankind are found to be in decline worldwide. In effect, the benefits reaped from our engineering of the planet have been achieved by running down natural capital assets. . . . The degradation of ecosystems is already a significant barrier to achieving the Millennium Development Goals (MDGs) agreed to by the international community in September 2000.

Governments have put legislation, policies, and programs in place to deal with biodiversity issues. The main tools that governments are using are presented in chapters 1 and 2.

Importance of protecting biodiversity

Life on Earth depends on nature. Humans need the diversity of nature for important services, such as food and water resources. Nature is also a source of economic opportunities. Protecting biodiversity is in everybody's interest.

Humans derive many essential goods from ecosystems including seafood, game animals, fodder (food for animals), firewood, timber, and pharmaceutical products. Ecosystem services include

- provision of medicines,
- purification of air and water,

- mitigation of droughts and floods,
- generation and preservation of soils and renewal of fertility,
- detoxification and decomposition of wastes,
- pollination of crops and natural vegetation,
- dispersal of seeds,
- cycling and movement of nutrients,
- control of the vast majority of potential agricultural pests,
- protection of coastal shores from erosion by waves,
- partial stabilization of climate,
- moderation of weather extremes and their impacts, and
- provision of aesthetic beauty.

Until recently, humans have not appreciated that ecosystems are fundamental to supporting life. For example, deforestation has made it clear what a critical role forests play in regulating water cycles. Biodiversity guarantees the stability of ecosystems. Removing one species can affect the entire food chain and ecosystem.

The MA identified 24 ecosystem services and reported that 15 of them are in decline, including

- provision of fresh water,
- marine fishery,
- number and quality of places of spiritual and religious value,
- ability of the atmosphere to filter pollutants,
- regulation of natural hazards,
- pollination, and
- capacity of agricultural ecosystems to control pests.

Many ecosystem services are neither widely recognized nor adequately valued in economic terms. In 1997, the combined economic value of ecosystem services was estimated at between US$16 and $54 trillion per year. Those services would be extremely costly or impossible to replace.

Recently, natural disasters have shown that human lives could have been saved and damage reduced if ecosystems had been better managed. For example, regions outside the maximum intensity of the Asian tsunami of 2004, where mangrove forests had been preserved, were far less affected than those cleared for shrimp faming or tourist resorts. Similarly, diverting the Mississippi River through a system of canals and levees changed its sedimentation pattern and eroded wetlands. With this natural protection gone, Hurricane Katrina caused extensive damage to the Louisiana coastline in 2005.

Audits of biodiversity

Between 1993 and 2003, SAIs around the world conducted at least 180 environmental audits of ecosystems and biodiversity and 247 of nature and recreation. Any audit that touches on ecosystems, watersheds, forests, agricultural practices, marine environments, and other such topics, could be considered an audit of biodiversity. The case studies in Chapter 3 illustrate the variety of audits of biodiversity.

Content and structure of the document

This paper is a guidance document for SAIs, and it is divided into three chapters. The first chapter

- provides background on biodiversity and will be particularly useful for readers who are new to the subject,
- defines the scope of biodiversity,
- describes the main concerns related to biodiversity and the main threats to biodiversity and their causes, and
- explains why it is important to protect biodiversity and how it can be done.

The second chapter describes an approach for choosing and designing audits of biodiversity. The four steps in this chapter will help auditors choose and prioritize biodiversity audit topics for their countries.

Finally, the third chapter contains case studies conducted by SAIs around the world. It is divided into 10 sections, covering the most common biodiversity topics that SAIs audit. Each section contains background information on the issue and describes international conventions and potential audit approaches that are supported by actual case studies from around the world.

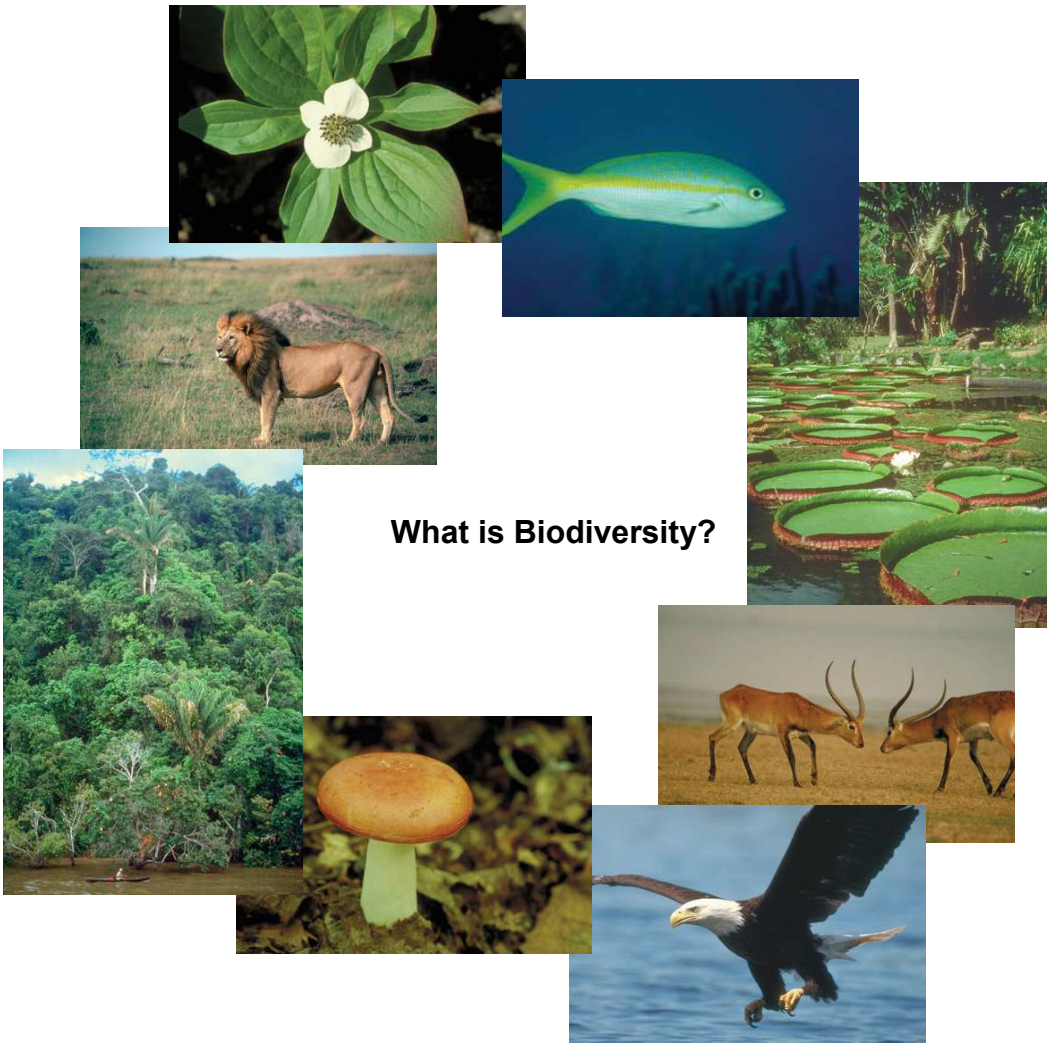
Chapter 1: Background on Biodiversity

Protecting nature means protecting the environment and biodiversity. The environment is a system that is connected and interdependent. Anything that has an impact on one part of the environment can affect the whole environmental system and its biodiversity.

What is the scope of biodiversity and what are the main concerns?

The accelerating loss of biodiversity is a key concern for many reasons. Losses could eventually lead to the extinction of species, reduced genetic diversity, and global spread of common plants and animals—all of which could lead to major changes in the way the ecosystems function.

Biodiversity is a complex subject. It has many facets and can be described in many ways.



Genetics

Genetics refers to the chromosomes, genes, and deoxyribonucleic acid (DNA) that determine the uniqueness of each individual and species. Colour, size, and resistance to disease are all manifestations of genetic diversity. Genetic variation is important for maintaining fitness and adaptability of species to environmental change.

Concerns about the loss of genetic diversity. The loss of genetic diversity, therefore, could lead to the extinction of species. For example, only two species of rice are cultivated worldwide despite the existence of 120,000 genetically distinct varieties. It is important to conserve those distinct varieties because interbreeding of varieties can increase productivity by reducing the loss from pests and pathogens. A reduced population and an impoverished gene pool leave the remaining species more susceptible to disease. For example, some African cheetahs are at risk because the size of their populations has reduced, and they are likely to inbreed.

Currently, a third of the 6,500 breeds of domestic animals are threatened with extinction, due in part to modern farming practices and varieties. Genetic resources have been lost, because modern farmers often farm a small number of crop and animal varieties instead of locally adapted ones. The failure of one variety can have direct consequences on food security.

Species

Species are organisms that are capable of breeding and producing viable offspring. They are grouped into kingdoms of living organisms. Scientists have identified about 1.75 million of the world's species. According to the scientists, up to 100 million species may be still unknown, many of which are likely to come and go without being catalogued.

Exhibit 1: Kingdoms and their species

Kingdom	Identified species
Bacteria	4,000
Protoctists (e.g., algae and protozoa)	80,000
Animals	1,320,000
Fungi	72,000
Plants	270,000
Total	**1,746,000**

Concerns about species extinction. Even though extinction (such as that of the dinosaurs) is a natural process, human activities have dramatically accelerated the current rate of decline. According to some estimates, the current rate of extinction is 1,000 times the natural rate. Human activities over the last 50 years are responsible for the sixth largest extinction event in the history of the Earth—the greatest since the dinosaurs disappeared 65 million years ago. These activities include

- illegal hunting,
- destruction of natural habitats, and
- overexploitation of resources.

Extinction raises specific concerns because it is irreversible. Habitat destruction is the main reason that most species become extinct.

Invasive alien species can have a devastating impact on native animals and plants, as they cause other species to become extinct and affect natural and cultivated ecosystems. They can transform the structure and composition of species in ecosystems, by repressing or excluding the native ones. For example, invasive alien species are endangering 80 percent of the threatened species in the Fynbos biome of South Africa.

Every year, the International Union for Conservation of Nature and Natural Resources (IUCN) assesses the status of threatened species and publishes the *Red List of Threatened Species*. The number and percentage of threatened species in the 2006 Red List are listed in Exhibit 2—more than 16,000 species of animals and plants are threatened.

Exhibit 2: The 2006 IUCN Red List of Threatened Species

Organisms (by group)	Species described (number)	Threatened species (number)	Species Threatened (percentage)
Vertebrates	**58,808**	**5,624**	**10%**
Mammals	5,416	1,093	20%
Birds	9,934	1,206	12%
Reptiles	8,240	341	4%
Amphibians	5,918	1,811	31%
Fish	29,300	1,173	4%
Invertebrates (insects, mollusks and others)	**1,190,200**	**2,101**	**0.18%**
Plants	**287,655**	**8,390**	**3%**

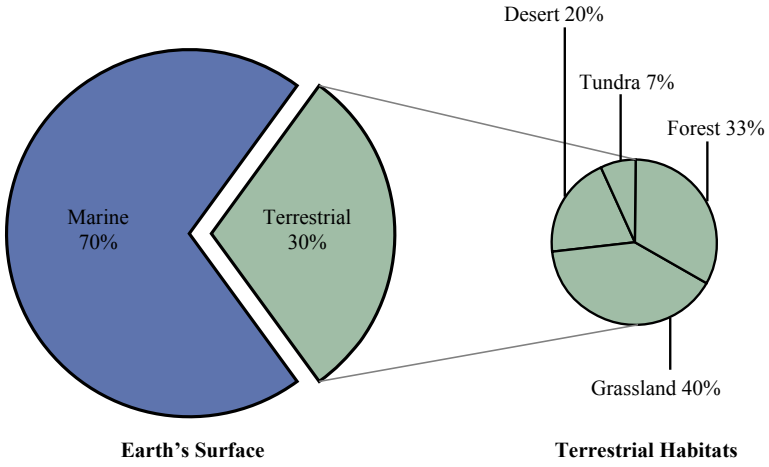
The percentage of threatened species is high for mammals because there is more information about them than about other groups. The percentage of threatened invertebrates may, in fact, be much higher. The Red List also classifies the species that are at higher risk of global extinction (critically endangered, endangered, and vulnerable).

The annual trade in international wildlife is estimated to be worth billions of dollars and to include hundreds of millions of plant and animal specimens. The trade is diverse and includes live animals and plants and a vast array of products derived from them, including food, leather goods, wooden musical instruments, timber, souvenirs, and medicines. Some animal and plant species are heavily harvested to satisfy this trade. Together with other factors, such as habitat loss, this trade may deplete populations and even lead some species to extinction.

Habitat

Habitat refers to the areas in which organisms live. Habitats are usually classified as terrestrial, freshwater, or marine (Exhibit 3).

Exhibit 3: Terrestrial habitats make up a small proportion of the planet



(Freshwater represents about one percent of the Earth's surface. It is not represented on this graphic.)

NOTE: Data for terrestrial habitats may vary, depending on the information source (for example, some researchers classify the savannah as forest while others classify it as grassland).

Terrestrial habitats include:

- **Forest.** In 2000, an estimated 3,866.1 million hectares—approximately one third of the world's land mass—was forested: 95 percent was natural forest and 5 percent was planted. Estimated to contain half the world's total biodiversity, natural forests have the highest diversity and endemism (species restricted to a certain area) of all ecosystems.
- **Grasslands.** Grasslands once occupied 40 percent of the world's land mass. Today, many are being cultivated, including the prairies of North America, the pampas of South America, the steppes of Europe, and the savannah of East Africa.
- **Deserts.** Deserts are defined as land where evaporation exceeds rainfall (for example, the Sahara and Namib in Africa and the Gobi in India).They may range from being extremely

arid (dry) to having sufficient moisture to support life. Species that can survive the intense heat and arid conditions have adapted through natural processes.

- **Tundra.** Tundra is the coldest of all habitats. There are two types of tundra: arctic and alpine. The arctic tundra is around the North Pole and extends south to the coniferous forests in the boreal forest. Tundra is also present around Antarctica and on some islands in the southern Ocean (for example, South Orkneys). The alpine tundra is at high altitudes on mountains, above the tree line.

Freshwater habitats. These include diverse communities found in lakes, rivers, and wetlands—and cover only about one percent of the Earth's surface. Nonetheless, they are highly diverse and contain a large number of the world's species. The majority of the world's human population lives near and depends on freshwater environments for water, food, and employment.

Marine habitats. The marine (ocean) environment covers 70 percent of the Earth's surface. In some places, it is nearly 7,000 metres deep; although the average depth is about 4,000 metres.

All of the Earth's seas (salt water) are connected through currents, dominated by waves, and influenced by tides. Plant life (phytoplankton) is considerably less dense in the water than on the Earth's land surface, because it can only survive in water that is lit by the sun (a depth of 100 metres)—which is a small portion of the total volume.

Coastal and marine habitats are among the most productive in the world. They include terrestrial areas (for example, sand dunes), areas of brackish water, near-shore coastal areas, and open ocean areas. There are more than 1.6 million kilometres of coastline worldwide.

Concerns about biotic uniformity. Across the globe, animals and plants that can tolerate human activities are replacing distinct, regional species. Changes in land use can break up habitats and create uniformity in the landscape, which leads to less variety in types of animals and plants. This uniformity, also called homogenization, is partly the result of global transport and trade that leads to the introduction of invasive species.

Ecosystems

An ecosystem

- is defined as a system of interrelationships, interactions, and processes between plants and animals (including humans) and their physical environment;
- is a more comprehensive concept than a simple habitat; and
- includes the habitat, its organisms, their interactions, and other factors—for example, nutrients, energy, and water cycles.

Destroying ecosystems has a significant impact on biodiversity that, in turn, affects how the ecosystem functions. The process is complicated and varies with each type of ecosystem. Certain key species are fundamental to maintaining certain ecosystems. For example, the beaver is considered a key species in the Boreal forest; it plays a major role in creating new habitats, by cutting down trees and creating ponds.

Concerns about changes in ecological functions. The loss of biodiversity can disrupt the way ecosystems function, making them more vulnerable to shocks and disturbances, which makes them less resilient and less able to supply humans with necessary resources.

When populations are reduced, there may be an important impact on the functioning of their ecosystem. For example, reducing the wolf population in the United States increased the number of deer grazing in sensitive areas. Park managers are now reintroducing wolves to try to regain an ecological balance.

Invasive species are one in a chain of factors that affect ecosystems by competing with, and often winning against, native species for food and resources. However, it is not easy to determine their overall impact. Recently, the rate and risk associated with the introduction of an invasive species have increased significantly because

- human population growth and environment-altering activities have escalated rapidly; and
- increasing travel, trade, and tourism have raised the likelihood of species being spread.

What are the main threats to biodiversity?

The Convention on Biological Diversity recognizes five major threats to biodiversity:

- habitat change: loss and fragmentation;
- invasive alien species (bio-invasion);
- overexploitation;
- pollution and nutrient loading; and
- climate change and global warming.

Other threats include biotechnology, agricultural methods, desertification, biopiracy, and illegal trade of species. These threats and their causes are summarized in Exhibit 4. Human activities are the main cause of biodiversity loss. Habitat fragmentation, caused by urbanization and agriculture and the overexploitation of resources, leads to depletion of species. Because these activities are regulated by government, Supreme Audit Institutions (SAIs) can play a major role in auditing government's actions.

Exhibit 4: Main threats to biodiversity and their causes and consequences

Threat to biodiversity	Causes	Consequences
Habitat loss and fragmentation	Change in land-use and transformation caused by • agriculture, • urbanization, • forestry, • physical modification of river courses or water withdrawal from rivers, and • damage to sea beds due to trawling.	Decline in distribution, size, and genetic diversity of species
Invasive alien species: Bio-invasion	Introduction of (non-native) alien species (intentional and accidental dispersal by human activities)	Native species threatened or extinct through predation, competition, parasitism and hybridization
Overexploitation (especially overfishing)	• Increased demand and harvesting above or near maximum sustainable levels • Unsustainable management of ecosystems • Illegal practices (logging, fishing, and poaching)	Collapse of fisheries and other resources
Pollution and nutrient loading	Discharge and runoff (from agriculture and industry)	• Pollutants: disease or death of aquatic populations • Nutrient loading: algal blooms and dense flora leading to oxygen depletion and mass mortality of fish and bottom-dwelling organisms
Climate change and global warming	Changes in human population, lifestyle and consumption patterns	• Changes in the distribution of species, population size, and reproduction timing or migration events and an increase in the frequency of pest and disease outbreaks • Major episodes of coral reefs being bleached due to higher water temperatures at surface level

Threat to biodiversity	Causes	Consequences
Illegal trade of species	Trade of some species for economic benefits	Many species are threatened
Biotechnology	Genetically modified organisms (GMO): • accidental release • cross-border trade	• Potential adverse effects of GMOs on wild species • Potential adverse effects on biodiversity if GMOs are released into the environment (for example, GMOs commingling with native species)
Agricultural and aquaculture practices	Human may use agricultural and aquaculture practices that do not respect biological diversity	Some species can be threatened
Desertification	Overgrazing, deforestation, and climate change	Decreased ability to support biodiversity
Biopiracy	Foreign entities using indigenous biomedical knowledge without offering compensation	Lack of incentive for the conservation and sustainable use of biodiversity resources

Habitat loss and fragmentation

The most effective way to conserve biodiversity is to prevent the degradation of habitats. According to studies, habitat loss is the main threat to 85 percent of the species on the IUCN Red List.

Studies reveal that urbanization (clearing land for development), deforestation and agricultural expansion have dramatically accelerated habitat loss. Marine and coastal ecosystems have been degraded or altered by changes in land use and habitat destruction (development, tourism, fisheries, deforestation, mining and aquaculture).

Fragmentation refers to the division (from natural causes, road construction or other human activities) of large areas of habitat into smaller patches. Fragmentation makes it difficult for isolated species to maintain large enough breeding populations to ensure their survival. It also diminishes the quality of the remaining habitats.

Inland water ecosystems can be physically altered and destroyed by dams and reservoirs, and by introducing water, drainage, canal and flood-control systems.

For audit case studies on this topic, see Mainstreaming biodiversity into economic sectors and development planning, in Chapter 3.

Invasive alien species

Introduced, alien, or exotic species are plants, animals, or micro-organisms that have been introduced outside their natural distribution (past or present) intentionally or accidentally through human activities. Not all alien species are harmful, and many have been introduced intentionally for the benefits they offer. However, invasive alien species can

- cause disease in or prey upon native plants and animals;
- change local habitat, making it inhospitable to native species; or
- reproduce faster than native species and crowd them out by inhabiting their space and eating their food.

Experts have concluded that invasive species are the second greatest cause of biodiversity loss and that they could lead to local extinction of species.

The World Conservation Union's list of the 100 worst invasive alien species includes purple loosestrife, leafy spurge, Japanese knotweed, green crab, spiny water flea, common carp, rainbow trout, and rats. Since the 17th century, invasive species have contributed to nearly 40 percent of animal extinctions, for which the cause is known. Annual environmental losses caused by pests introduced to the United States, the United Kingdom, Australia, South Africa, India, and Brazil have been calculated at over US$100 billion.

The most common way species are introduced is through ballast water from ships that transports an estimated 3,000 species of animals and plants every day. An example is the zebra mussel, which threatens the ecosystem of the Great Lakes in Canada and the United States by consuming the plankton that is the main food for many fish.

For audit case studies on this topic, see Invasive species, in Chapter 3.

Overexploitation of resources

With the world population currently at more than six billion people, there is an increasing need for living space and food.

Traditional methods of harvesting natural resources are being replaced by intensive technologies, often without controls to prevent overexploitation. Forestry is a major source of income for some countries, but it can cause the extinction of many species if it is not managed properly.

Although seafood is the primary source of protein for many coastal peoples, (especially the poor), they have not been the main factor in the demise of the global fishery. Much of the global catch is for luxury foods or is processed into livestock feed. As the top predators are depleted, progressively smaller or alternative species are being taken. Some fishing equipment (for example, equipment used for bottom trawling) and destructive fishing practices (for example, blast fishing) can be threats to marine species. The threats include entanglement and drowning in fishing nets (for example, of dolphins and sea turtles).

In addition, illegal exploitation of resources (illegal logging, fishing, poaching) can add an additional burden on the environment and its biodiversity.

For audit case studies on this topic, see Freshwater habitats and their resources, and Forest resources, in Chapter 3.

Pollution and nutrient loading

Pollutants affect the health of species directly (for example, when they breathe) or indirectly (for example, when they eat). Pollutants drift with prevailing water and air currents and are often deposited far from their original source or across geopolitical borders. Pollutants such as pesticides or chemicals directly affect the food chain.

Fertilizers such as nitrogen, sulphur, and phosphorus that increase agricultural productivity run off into natural ecosystems and cause nutrient loading. Excessive nutrients negatively affect the ecosystems' nutrient cycles, their functioning, and, ultimately, the species they contain. Species that need low levels of nitrogen, such as temperate grasslands, are particularly vulnerable.

Eutrophication (the depletion of oxygen from an environment due to over-dense flora), nutrient pollution, and sewage are threats to freshwater and marine ecosystems, as they threaten the survival of many aquatic organisms.

Pollution (including eutrophication and oil spills) in water and on land significantly threatens the health of species and contributes to the destruction of biodiversity. These threats must be handled through international co-operation.

For audit case studies on this topic, see Marine habitats and their resources, in Chapter 3.

Climate change and global warming

Many animals, plants, and their communities survive and prosper in areas where they are best adapted to the climate. They are affected by even small changes in the climate.

The Earth is warming faster than at any time in the past 10,000 years. In its fourth assessment report (2007), the Intergovernmental Panel on Climate Change (IPCC) determined that

- the Earth's mean surface temperature increased by 0.74 degrees Celsius over the last century,
- the 1990s were warmest on record so far,
- some precipitation patterns have changed, and
- the global sea level has risen by an estimated .17 metres during the 20th century.

Studies show that climate change has a significant impact on biodiversity—leading to the extinction of species and the destruction of habitats. Some species will move to more suitable areas, where they may interact with new species, but others will disappear altogether.

Global warming can result in a rise in the sea level, which may threaten vulnerable habitats, including mangroves, coral reefs, and coastal wetlands. Recent empirical evidence and predictive modelling studies show that climate change will speed up the decline of certain populations. Changing wind patterns, ocean currents, pH levels, and temperatures affect oceanographic processes and affect marine biology in ways that have not been quantified in models.

Illegal trade of species

Another threat to biodiversity is the illegal trade of animal and plant species. Species are exported for a variety of reasons. For example

- some plants and animals are exported for medical purposes,
- other plants and animals are exported for collections (for example, orchids),
- fish are exported for aquarium markets, and
- birds are exported as pets (for example, parrots).

Exporting these species is only considered illegal under certain circumstances. However, the export of some species—often those that are believed to cure diseases or enhance health (for example, some people believe that the horn of a rhinoceros can be used to improve one's health)—is always illegal.

In many countries, the trade of species can boost the economy. However, exporting some species could threaten their survival.

To address this issue, many countries signed an international agreement in 1975: the Convention on International Trade in Endangered Species of Wild Fauna and Flora. For more information on this convention and for audit case studies on this topic, see Endangered species, in Chapter 3.

Biotechnology

Advances in biotechnology have made it possible to transfer genes from one species to another. Genetic modification could help provide more food for the growing population. However, this technology is still relatively new and many scientists are concerned about its potential side effects on human health (for example, food allergies) and on the environment (for example, biodiversity risks). In particular, genetically modified organisms (GMOs) that are accidentally released into the natural environment could affect biodiversity by reproducing (mating) with native species and causing a reduction in genetic diversity. For example, if the modified genes made them stronger than native species, individual species with the introduced genes could successfully compete for resources with native species and may eliminate the natural genetic diversity.

Agricultural and aquaculture methods

Overgrazing can deteriorate a grasslands system until the ground becomes barren and the original water cycle is disrupted. Rainwater washed away the soil because of scarcity of vegetation. In desert grasslands, overgrazing also affects the natural vegetation.

Natural grasslands have been drastically altered by general agricultural practices. The expansion of agriculture, since the 1970s, has involved cultivating marginal areas and clearing important natural habitats, such as forests and wetlands.

In some countries, deforestation and irrigation may cause the water tables to rise, leading to an accumulation of salts at the surface, which is a major problem for agriculture and the local population. This phenomenon can eventually lead to desertification.

The rapid growth of aquaculture has caused the loss of many coastal ecosystems. Effluents from aquaculture facilities can be pollutant-heavy and can degrade the surrounding habitats and species. Diseases and parasites can be transmitted to wild stocks when farmed fish escape.

Desertification—spread of deserts

Desertification refers to the degradation of land in arid, semi-arid, and "dry sub-humid" areas brought about climatic variations, human activities and other factors. According to the United Nations Convention to Combat Desertification (UNCCD), about 3,600 million hectares, 70 percent of the world's drylands (excluding hyper-arid deserts), are degraded. Human activities have contributed to desertification through deforestation, over-cultivation, overgrazing. Deforestation is especially problematic in the margins of the sub-Saharan Africa because of the need of fuelwood.

Biopiracy

Biopiracy, the unfair exploitation of a country's biological resources, is a new concern. The global market value of pharmaceuticals derived from genetic resources is estimated at between US$ 75,000 and US$ 150,000 million annually. Biopiracy takes advantage of knowledge—often the traditional knowledge of native peoples—that is not protected by the system of intellectual property.

The most controversial aspect of biopiracy is access to genetic resources and the distribution of derived benefits. Fair and equitable sharing of the benefits from genetic resources can encourage conservation and the sustainable use of biodiversity. Around the world, networks are being created to counteract the unauthorized use of genetic resources in pharmacy and medicine. It has been proposed that biopiracy should be regulated by an international regime, within the framework of the Convention on Biological Diversity. The regime would include mechanisms to ensure that holders of traditional knowledge receive a fair share of the benefits.

Traditional knowledge is the sum of what is known about innovations and practices of indigenous and local communities around the world. Today, there is a growing appreciation of the value of such knowledge. It is not only valuable to those who depend on it in their daily lives; it is also valuable to modern industry and agriculture. Many widely used products, such as plant-based medicines and cosmetics, are derived from traditional knowledge. It can make a significant contribution to sustainable development. Most indigenous and local communities are in the same areas as the vast majority of the world's plant genetic resources; their members have used biodiversity in a sustainable way for thousands of years.

For audit case studies on this topic, see Genetic resources, in Chapter 3.

How can biodiversity be protected?

Human activity is the main cause of biodiversity loss. Therefore, the solution to the problem is in the management of resources and human development, in which the government plays a central role. It uses public policy tools (see Step 2. Understanding the government's responses to these threats and the relevant players, in Chapter 2) to regulate human activities, such as urbanization, resource extraction, and agriculture, which will help to protect the environment and biodiversity.

There are several ways to protect biodiversity. One is to create protected areas, such as national parks and conservation areas. Properly managed, protected areas provide a refuge for species and their ecosystems. This is known as *in-situ* conservation or "the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings."

In particular, conservation efforts are important in areas called biodiversity "hotspots." These areas are Earth's richest and most endangered habitats. Hotspots are regions that harbour a great diversity of endemic species and, at the same time, have been significantly affected and altered by human activities. To be declared a hotspot, the region has to have lost 70 percent or more of its original habitat. To date, Conservation International has identified 34 biodiversity hotspots where 75 percent of the planet's most threatened mammals, birds, and amphibians survive within habitats that cover just 2.3 percent of the Earth's surface. Such areas must be protected against illegal activities such as burning, cultivating, hunting, and poaching. Conservation should focus on critical, unique, and representative habitats that may then be considered protected areas.

Where *in-situ* conservation is not possible, *ex-situ* conservation can be used. *Ex-situ* conservation is "the conservation of components of biological diversity outside their natural habitats," such as zoos for living animals and related species, botanical gardens for plants, and gene banks to preserve species. These measures may provide insurance against extinction. Re-integrating animals and plants in nature is not always successful, because they are no longer accustomed to living in their natural ecosystems.

Measures must be taken to prevent the introduction of invasive alien species through trade routes.

Countries will have to reassess the way they are managing their resources. They will have to revise their river management, forestry, fisheries, and agricultural practices. Governments must consider biodiversity when making decisions that affect land use and exploitation of resources.

Governments use a variety of public policy tools to support protective measures. Chief among these tools are international and regional environmental agreements, legislation, and funded programs, which will be covered in more detail in chapters 2 and 3.

Another way to protect and conserve biodiversity is to increase public awareness of biodiversity and ecosystem issues. Public education is often a requirement under international agreements.

Research and monitoring is essential in protecting biodiversity. There is a need to increase the knowledge and understanding of biodiversity, its value, and the threats to it. Assessing the status of biodiversity (genes, species, and ecosystems) is a major challenge. More information must be available on the gain and loss of crop varieties and the change in status of species, threatened or not, to preserve the biological balance. The status of habitats, ecosystems and threats must be covered in the main agenda for ecological meetings today, so that recovery and restoration efforts will show results tomorrow.

Exhibit 5 summarizes actions that can be taken by countries according to the Secretariat of the Convention of Biological Diversity.

Exhibit 5: Ways to slow the loss of biodiversity

1. **Sustainable and efficient agriculture. Improve** the efficiency of land use, water, nutrients, and chemicals in agriculture, aquaculture, and plantations.
2. **Landscape-level planning.** Protect **areas** that are rich in biodiversity and produce essential ecosystem services. Use lands that are already converted, including degraded lands, to expand agriculture, aquaculture, and plantations.
3. **Sustainable consumption.** Limit **over**-consumption of energy, timber, and food (especially meat) by affluent sectors of society.
4. **Over-exploitation of wild resources. Stop** over-fishing and destructive fishing practices. Expand protected marine areas. Stop harvesting endangered species and populations.
5. **Critical ecosystems.** Protect and restore those ecosystems that provide resources for the poor, allow adaptation to climate change, and provide critical ecosystem goods and services.

Chapter 2: Choosing and Designing Audits of Biodiversity

The purpose of this chapter is to guide Supreme Audit Institutions (SAIs) and auditors, as they choose and design audits of biodiversity. Selecting and determining the scope of audits of biodiversity can be challenging for SAIs. There are so many ways of describing the scope (from genetics to species to ecosystems), the threats (from habitat loss to pollution to urbanization), and the responses of governments (from international conventions to national parks to environmental impact assessments). Even deciding where to start can be difficult.

This chapter is designed to help SAIs and auditors make sense of it all. It includes the following four basic steps that are described in more detail in Exhibit 6:

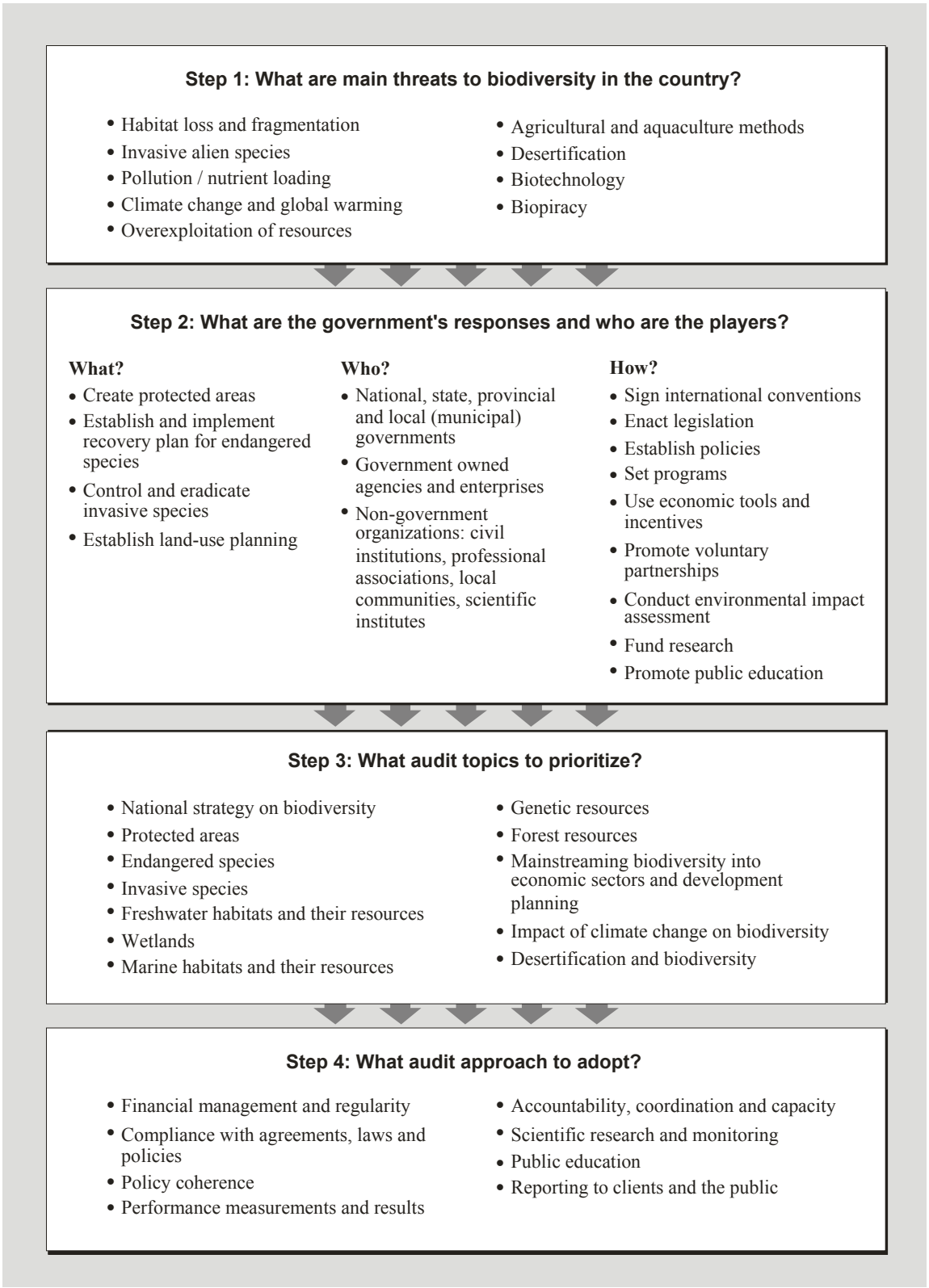
- **Step 1**. Identify the country's biodiversity and threats to it.
- **Step 2**. Understand the government's responses to these threats and the relevant players.
- **Step 3**. Choose audit topics and priorities.
- **Step 4.** Decide on audit approaches: audit objectives and lines of enquiry.

These steps are only suggestions, and they can be adapted to the situation and needs of a particular SAI. They can be used to define the objectives, scope, and criteria of a single audit of biodiversity or to develop a long-term, risk-based plan for a series of audits. Even though the steps are presented in a linear way, they are, in fact, highly inter-related and iterative. The early steps can be omitted if the SAI has already chosen the audit topic. Once a topic has been chosen, the auditor can go to Chapter 3 for information on specific topics.

SAIs do not need special mandates to conduct audits of biodiversity. Like all environmental audits, an audit of biodiversity could examine financial and compliance issues as well as performance issues, depending on the SAI's mandate. For more information about the SAI's mandate and environmental auditing, see the WGEA paper, *Evolution and Trends in Environmental Auditing* (2007). See Appendix 1 for a list of WGEA resources for SAIs.

Since biodiversity issues can be complex and difficult to understand, many SAIs hire experts to help them understand particular issues or to clarify some points. For more information, see the WGEA paper, *Evolution and Trends in Environmental Auditing* (2007)—in particular, the Frequently Asked Questions (FAQ)—for advice on using experts.

Exhibit 6: Four basic steps for choosing a topic and approach for an audit of biodiversity



Step 1. Identify the country's biodiversity and threats to it

Chapter 1 gives a general background on biodiversity and describes the biological resources that exist around the world and some of the common global threats and concerns. The degree of relevance and urgency of certain issues is unique to each country and, therefore, raises unique concerns about biodiversity. To develop domestic approaches for auditing biodiversity issues, SAIs must understand the situation in their country and the main threats to biodiversity.

Key Question: What are the biological resources in the country?

Auditors could consider the following:

- **Economic sectors and activities that depend on biological resources.** For example, is the economy based on fisheries, forests, or agriculture? In a country with a large fishing industry, sustaining the fish population is crucial and should be managed in a way that maintains integrity of the ecosystem. Over-fishing can be very destructive for biodiversity.
- **The nature and sensitivity of various types of ecosystem in the country.** For example, are the ecosystems mainly marine, freshwater, or terrestrial, or are they combinations? Ecosystems of coral reefs, wetlands, mangroves, and mountains are more fragile and often need specific protection. An ecosystem that makes up a small percentage of a country could be considered a priority topic.
- **The contribution that the country's ecosystem goods and services make to the national economy and well-being.** For example, are wetlands and mangroves important to protect against flooding?
- **The nature and status of species in the country.** For example, are any species endemic or endangered?

Key Question: What are the key threats to these resources and its diversity?

The next set of questions focuses on the threats (and their causes) to the resources, such as described in the section, What are the main threats to biodiversity, in Chapter 1. The auditor must now understand the specific threats that exist in the country and the risks that these threats pose to economic development, social prosperity, and the quality of the environment.

In general, it is not the SAI's role to assess the main threats—it is the government's role. To identify local threats, the SAI can seek information from the government agencies that are charged with controlling and overseeing biodiversity in the country. Other sources of information include universities, non-governmental and international organizations, local and state councils, laws, and the media.

When identifying threats to biodiversity, auditors should remember that behind the direct drivers are indirect drivers, such as demographic, economic, socio-political, cultural, religious, scientific, and technological factors that cause changes to biodiversity.

In some cases, governments may not have adequately assessed the threats to biodiversity. As a result, auditors may have to consult NGOs, universities, or any organizations that have done this kind of assessment, or SAIs may hire consultants to help them. Depending on what their mandate is, SAIs can give advice to the government. However, most of the time, they will simply report that the government has not yet assessed the threats to biodiversity and their consequences.

Finally, SAIs need to understand the causes behind these threats (see Exhibit 4). Changes in land use, urbanization, agricultural practices, and many other factors can drive or aggravate the threats discussed in the section, What are the main threats to biodiversity, in Chapter 1. In addition, economic development policy, such as the increasing tourism in the world's biodiversity hotspots, should not be overlooked. In these hotspots, governments have the challenge of promoting economic activity without compromising the integrity of the natural resources. Poorly planned tourism can have a variety of negative effects, such as the logging of original growth forests to build infrastructure, pollution, the introduction of invasive species, water shortages, and degrading water supplies.

Additional information on the impact of tourism on biodiversity can be found in TOURISM AND BIODIVERSITY—Mapping Tourism's Global Footprint (UNEP, 2003) at http://www.unep.org/PDF/Tourism-and-biodiversity.pdf

Step 2. Understand the government's responses to these threats and the relevant players

Governments play a crucial role in protecting biodiversity. SAIs do not audit the environment. They audit government. Therefore, once a SAI has understood the main biological resources in the country and the threats to those resources, it needs to understand what the government is doing to mitigate or prevent them (what programs exist and which policy tools are used) and who is responsible. Armed with this information, SAIs can then consider the traditional questions, such as audit mandate, risk, auditability, and materiality, to select and prioritize audit topics.

Key Question: What is the government doing about these threats?

As noted in the section, How can biodiversity be protected, in Chapter 1, governments can and do take action to protect and conserve biological resources. They establish national parks and other protected areas; they regulate hunting, fishing, and exploitation of resources (for example, forests); and they control pollution and land-use. They can and do use a variety of public policy tools to authorize, finance, and implement these actions. Public policy tools include international agreements, laws, programs, and public education. The following are descriptions of most common environmental policy tools and questions for auditors.

International conventions and treaties. Since many environmental issues affect the entire planet, they require the concerted action of national governments. Various bilateral, regional, and international environmental agreements (IEAs) have been signed by national governments to conserve natural heritage. SAIs can play a major role in auditing how these agreements are carried out and in reminding the government of its obligations under them.

To learn more about international conventions and treaties, see the WGEA publication, *The Audit of International Environmental Accords* (2001), at http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainerPub/eng01pu_studyaudinterenvaccord.pdf/$file/eng01pu_studyaudinterenvaccord.pdf

Auditors should find out from the agency responsible for international relations if the country has signed any regional agreements related to biodiversity. These agreements are numerous, and it is not the objective of this paper to describe them. However, Appendix 2 contains a list of regional agreements, by continent.

The following are the principal IEAs affecting biodiversity; the most notable being the first six. The main features of some of these agreements are described in Chapter 3.

- Convention on Biological Diversity
- The Cartagena Protocol on Biosafety
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) (also known as the Bonn Convention)
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (also known as the Ramsar Convention on Wetlands)
- World Heritage Convention (WHC)
- International Convention for the Control and Management of Ships' Ballast Water and Sediments
- United Nations Convention to Combat Desertification (UNCCD)
- United Nations Framework Convention on Climate Change (UNFCCC)
- United Nations Convention on the Law of the Sea (UNCLOS)
- International Plant Protection Convention (IPPC)
- Sanitary and Phytosanitary Agreement (SPS)

Legislation and regulations. Governments have a variety of legal powers and tools that they can use to address environmental problems and activities. Legal powers include legislation (acts of Parliament or Congress), regulations, permits, licences, bylaws, and ordinances. Governments have varying roles and responsibilities.

Usually, national laws are required to give effect to international agreements. For example, if a country has ratified an agreement, the auditor should find out whether corresponding national legislation has been introduced, and whether it is being enforced. In some cases, countries enact specific laws to implement specific agreements. More often, a single piece of legislation (such as an environmental protection act) can be used to address a number of agreements.

In other cases, national laws are unrelated to international agreements and are simply intended to respond to national needs. Legal powers are used broadly to establish national parks, protect species, limiting pollution, and control invasive species.

For many SAIs, the existence of national laws (and the supporting legal tools) is a prerequisite for conducting compliance audits.

Policies and programs. Governments can also formulate national policies on biodiversity. Policies tend to set direction, but are usually not prescriptive or enforceable. A policy might be a statement of intent or of a desired outcome. In some cases, policies can be supported by specific procedures (action plans) and (funded) programs. For example, it might be the policy of a government to establish a series of national parks. In order for these parks to be established a well funded program is needed to carry forward their implementation and their maintenance.

Success implementation of programs requires that they have sufficient monetary resources, skilled people, goals and authorities. Government should set performance measurements regarding the implementation of their policies or programs.

Governments also establish and support research programs on biodiversity. These research programs are often linked to monitoring databases.

Economic tools and incentives. As other types of policy tools, governments use grants, loans, subsidies, taxes, user charges, and service fees. In some cases, using these types of tool is grounded in financial or environmental legislation.

Environmental impact assessments. Environmental impact assessments (EIAs) are used to examine projects, programs, policies, or activities to ensure that potential impact on the environment, including on biodiversity, is carefully considered before legislation is enacted. EIAs are critical planning tools, given the serious and irreversible damage that humans can cause to the environment. Failure to consider such damage and set appropriate mitigation measures before a policy, program, or project is launched can lead to significant environmental degradation, damage to human health, and economic costs. In some governments, such EIAs are legislated. In others, they are part of the policy tools.

Voluntary partnerships. Voluntary partnerships are agreements between governments, non-profit organizations, or corporations that come together for a common purpose without legislation. Some governments and conservation organizations encourage private landowners to protect ecologically sensitive lands and natural areas through voluntary agreements.

Key Question: Who are the players and what are their roles and responsibilities?

The auditor needs to identify the major players involved. Players can be numerous and can have both converging and diverging interests. The auditor must define each player's role, activities, and scope of influence.

Players may include government departments and agencies at the national (federal), provincial, state, or, local (municipal) level. Government control and preservation frameworks for biodiversity vary from country to country. In many countries, a government authority is in charge of the major environmental policies at the national level, including the preservation and conservation of biodiversity. Among other activities, this authority is responsible for

- ensuring that environmental laws are being enforced by public and private entities
- preparing environmental standards,
- defining environmental policies,
- issuing licences to limit the volume or concentration of pollutants discharged into the environment,
- monitoring to identify potential environmental damage, and
- applying fines when laws are violated.

In some countries, national (federal) agencies are responsible for these activities. In others, responsibilities may be delegated to lower administrative levels. National (federal), state, provincial, and local (municipal) governments have different powers, and their specific roles and

responsibilities can vary widely. For example, national governments tend to develop and formulate policies, and lower levels of government often implement those policies. National governments enact national legislation and regulations, and local levels of government use tools, such as permits and licences. These are not fixed rules, however, so it is important for auditors to understand where an issue fits into the hierarchy, which level of government is involved, and how that level is involved.

Non-government organizations, such as civil institutions, members of social movements, professional associations, local communities, non-governmental organizations, business sectors, academic institutions, and scientific institutes, may have a role to play. In some countries, it is also important to highlight the key role played by indigenous communities. Many countries have established knowledge resource centres, databases, and networks to preserve and disseminate traditional ecological knowledge.

In addition to their roles as policy-makers and regulators, some governments may be "operational enterprises" in their societies. Government actions and projects, including the building of roads, the generation and distribution of electricity, and agriculture can have a negative impact on biodiversity. Auditors may wish to identify the state-run agencies and enterprises that affect biodiversity.

Step 3. Choose audit topics and priorities

The auditor is now ready to identify possible audit topics. As noted throughout this paper, there are many ways of framing and defining audit topics related to biodiversity. SAIs may select an overall threat to biodiversity (for example, invasive species) or select a topic as it affects a specific habitat (for example, invasive species in marine habitats). The important thing is to define the focus of the investigation. Chapter 3 includes detailed information (including possible audit criteria, players, and researchable questions) on the following possible audit topics:

- a national strategy for biodiversity,
- protected areas (parks, conservation areas, and bird sanctuaries),
- endangered species,
- invasive species,
- freshwater habitats and their resources,
- wetlands,
- marine habitats and their resources,
- genetic resources,
- forest resources,
- mainstreaming biodiversity into economic sectors and development planning,
- impact of climate change on biodiversity, and
- desertification and biodiversity.

It is up to the SAI to choose audit topic and set priorities, which involves answering the following questions:

Key Question: What are the highest risks to the environment and the use of public funds?

The SAI will need to do a risk analysis to define where its actions will be most relevant and useful. When assessing threats to biodiversity, the auditor should consider the magnitude of the actual and potential impact on the environment, society, and the economy. When determining the damage to the environment, the auditor should question how reversible that damage is—irreversible damage is especially risky. In addition, the auditor must consider how intense the damage is, since it is a priority to address and prevent acute threats. Usually, auditors rely on their government's assessments. However, if necessary, they may request help from experts in the field.

In the case of specific ecosystems, auditors need to consider existing threats, the level of habitat degradation, and the effects of the damage on the local communities that benefit from the goods and services. For example, a SAI may decide to audit the government's actions to protect mangroves, because they are a very important spawning area or because they play an important role in protecting shores against tsunami. Since fisheries are important for the survival of coastal communities, a SAI may audit how the government is assessing the role of mangroves in assuring sustainable fisheries.

For some SAIs, the level of expenditure by the government is a critical factor; some monies can be earmarked for specific legislation and directives.

Key Question: Does the SAI have the mandate and authority?

After identifying the players, the SAI should determine which ones it has jurisdiction over. Even in the government sphere, it may be able to act only at the national (federal), state, provincial or local (municipal) level. Private players (for example, the private sector, state-run enterprises, or non-government organizations) that are financed by public resources may also fall under the SAI's jurisdiction. Despite the lack of jurisdiction over some players, the auditor must know who they are and what role they play, since the government can regulate or influence their behaviour through public policy tools and instruments. If the most influential players are not subject to the SAI's jurisdiction, auditing the issue may have little value.

Key Question: Is the topic auditable?

First and foremost, the auditor should decide whether there are suitable sources of criteria against which to conduct the audit.

- Has the government signed international biodiversity-related agreements?
- Has the government enacted laws and regulations?
- Has the government made policy statements clear?
- Are biodiversity-related topics included in state budgets?
- Does the government receive external funding from international organizations (for example, the Global Environmental Fund or the European Union) to fulfill its biodiversity obligations related to international agreements?

Key Question: Can an audit make a difference?

A SAI will also have to assess where it will be most effective in improving the way the government protects and conserves biodiversity. The auditor may consider the following questions:

- What are the interests of the users of the audit report, particularly the primary users (e.g., Parliament)?
- What is the relative significance of the topic to overall governmental activities?
- What is the impact of the audit likely to be? Is the audit likely to make a significant difference?
- Has the topic been audited before?
- What is the relevance of this topic to protect basic human needs?

The SAI may then decide that it is not worthwhile to audit a biodiversity issue at this stage. On the other hand, the SAI may include a line of enquiry related to biodiversity in an environmental audit, even though biodiversity is not the main issue. For example, in an audit of climate change, a SAI may include a line of enquiry on the effect of climate change on biodiversity.

Audit of Biodiversity: an Indonesian Perspective. The framework developed by the State Audit Institution of Indonesia to define priority audit areas identified the threats to biodiversity, the government programs to deal with these threats, and key stakeholders involved (Exhibit 7). Through this process, a topic was chosen and potential audit approaches were identified.

Exhibit 7: Audit of Biodiversity: an Indonesian Perspective

Indonesia is under tremendous pressure to maintain biodiversity. A number of factors—including population growth, poverty, and greed—have increased deforestation, water pollution, and the illegal exploitation of natural resources so much that ecosystems are unbalanced.

As a result, Indonesia will have difficulty achieving its millennium development goals (MDGs) by 2015. The Audit Board of the Republic of Indonesia developed a framework for auditing biodiversity to help the Indonesian government address the main obstacles to achieving its MDGs. The framework has six stages:

1. understanding the MDGs;
2. identifying the key role of biodiversity in achieving the MDGs;
3. identifying biodiversity threats (for example, deforestation);
4. identifying the major causes of threats (for example, overexploitation of timber resources, fires and illegal logging);
5. understanding government-led programs that address the major causes; and
6. identifying key players who can help make government programs successful.

After considering the available information, auditors decided that deforestation was the most urgent threat to biodiversity—every minute, an area of forest equivalent to four football fields is clear-cut to provide timber for wood-based industries or land for the palm oil and mining industries—and that they will audit it first.

The audit of deforestation will have the following objectives:

- Document the government's efforts to deal with illegal logging, protecting protected areas, managing timber businesses and promoting transparency and accountability in the forestry sector and to inform the public.
- Examine state-held finances derived from timber operations.
- Investigate possible corruption, fraud and money-laundering, and government efforts to stop illegal logging and to rehabilitate land and forest areas.

At the regional and international levels, collaborative audits will be conducted on the following topics:

- the illegal trade in timber and endangered species,
- forest fires, and
- international investment in forest development.

After determining where their actions will be most useful and choosing the topic, auditors can start planning the audit.

Step 4. Decide on audit approaches: audit objectives and lines of enquiry

For this last step, the auditor needs to select an audit approach and choose audit objectives and lines of enquiry.

Key Question: What are the most relevant objectives and lines of enquiry for this audit?

The following are some possible lines of enquiry and associated researchable questions. See Exhibit 8 for more information on how auditors can combine various topics and approaches.

Financial management and regularity. Using traditional financial audit techniques, auditors can investigate the use of public funds in projects and programs that focus on conservation and biodiversity.

- Are the funds spent on biodiversity programs correctly administered, according to spending authorities and regulations?
- Are adequate financial resources allocated to protection programs?
- Is the disbursement of funds monitored?
- Against what criteria is the disbursement of funds measured?
- Do official trade-offs exist in policies? If so, how do the estimated benefits balance against the losses in biodiversity?

Compliance with agreements, laws, and policies. An audit of biodiversity can address the consistency of government strategies, actions, and programs with laws and regulations, or with the international conventions, to which the country is a signatory. It may answer the question: Is

the government meeting commitments it made in treaties, laws, policies, and programs? The following are some of the lines of enquiry:

- Are there international agreements that protect biodiversity within the country's geopolitical borders or shared protected areas?
- Is the country following the rules and agreements determined by the international conventions that it is a signatory to?
- Has the government enacted laws and regulations to implement its international commitments and domestic policies?
- Are there any conflicts or gaps between national policies on biodiversity and the country's environmental laws?
- Are environmental laws and regulations being adequately enforced?
- Is there any conflict between national policies and the international conventions that the country is a signatory to?

Policy. Auditing policies and programs on domestic biodiversity can be valuable. Policy on biodiversity usually provides a macro vision. Interesting lines of enquiry include the following:

- Are government policies being complied with?
- Has the government developed policies that address the protection and conservation of biological resources in the country? Do the policies deal with the most important threats?
- Have general policies on biodiversity been addressed, specified, and executed in laws and other legal instruments such as plans and budgets?
- What protective measures, with the support of bordering countries, can be taken to protect ecosystems that straddle geopolitical borders?
- What kinds of changes can be suggested that would make national policies achieve better results?

Performance measurement and results. Audits of biodiversity can assess the performance of government programs' actions to deal with threats to biodiversity and ensure the conservation of habitats or ecosystems. SAIs may wish to evaluate the traditional three E's—effectiveness, efficiency, and economy—of the programs. They may also wish to assess the processes used to define and measure success and the results of these processes.

- Have the relevant agencies defined expected results for their programs?
- Have they developed indicators and measures for these results and are they being monitored and tracked?
- Is the data used to measure performance reliable?
- Are policies and programs on biodiversity achieving their objectives and intended results?
- Why are policies and programs not achieving their objectives and intended results, and how can the causes be countered?

Accountability, coordination, and capacity. Because biodiversity topics frequently involve many government entities and other players, SAIs could assess how departments and agencies have demonstrated good governance, for example, whether they can meet their responsibilities for environmental programs and actions, and whether they have the mechanisms to coordinate those actions.

- Are the roles, responsibilities, and accountability of relevant entities (for example, ministries and departments) clearly defined?
- Are any necessary mechanisms to coordinate action in place?

- Do the entities have adequate financial and human resources to carry out their roles and responsibilities?
- Has the staff received adequate training?
- Have the entities developed robust internal management systems?

Scientific research and monitoring. The government's capacity to undertake research and monitor ecosystems can directly affect how biodiversity is protected. In many countries, this responsibility is legally defined. The following are suggested lines of enquiry:

- Does the government have the scientific knowledge (in-house or consultant-based) to prioritize its actions on biodiversity?
- Are there adequate systems in place to monitor the status of biodiversity?
- Is the government developing and maintaining databases on biodiversity either in-house or with research institutions?
- Is information being shared between the national and international monitoring systems?
- Does the public have access to information on monitoring activities?

Public education. National and international, environmental protection programs often have a public education component. Large sums of money can be spent even though the success of these programs has not been measured. SAIs may include, among others, the following lines of enquiry:

- Is the government allocating appropriate funds for public outreach and education at each phase (formulation, planning, implementation, and evaluation) of a policy?
- Is the government encouraging the public and private sectors to protect biodiversity?
- Has the government integrated biodiversity concerns into its public outreach strategies?
- Is the government measuring its public outreach results?

Reporting to clients and the public. The reporting requirements of public policies can be an important source of audit evidence. For example, many international environmental agreements require that national governments report to United Nations agencies or other international agencies (e.g., donor organizations). In addition, regulated entities within a country may be required to report to regulatory agencies that, in turn, may report to their Parliament or equivalent.

Proper monitoring, reporting, and accountability processes—which include collecting data, performing analyses, and reporting on findings—should be in place. SAIs can ensure that such reports and performance comply with appropriate standards, rules, and regulations. SAIs may consider:

- How are departments and agencies reporting their results?
- Are departments and agencies meeting international and national reporting obligations?

Summary of audit approaches

Exhibit 8 summarizes the many possible ways auditors can combine biodiversity topics and audit approaches. An audit of biodiversity may cover more than one of the listed topics, and more than one audit approach can be used for each biodiversity audit topic. However, as with any audit, auditors need to be careful when they decide what the scope will be. In particular, those who are new to auditing biodiversity need to try and choose an audit scope that will be manageable.

For example, one SAI decided to audit a government program that was implementing the international Convention for the Control and Management of Ships' Ballast Water and Sediments. The audit will cover two biodiversity topics: invasive species and marine habitats and their resources, and the audit team decided to evaluate the program to determine whether

- funds allocated to the program are being managed according to national financial law (financial management and regularity);
- the management plan for ballast water, adopted by the responsible authority, respects the international convention (performance measurement and results);
- the authority has been measuring the results of its program (performance measurement and results);
- the program is bringing expected results (performance measurement and results);
- the authority responsible for the program is reporting to the Secretariat of the convention, as requested, and to the relevant players involved with invasive species and marine transport (reporting results and compliance and agreements, laws, and policies); and
- the authority is using the information from its reports to improve its program (reporting results).

Exhibit 8: Biodiversity topics and audit approaches

Biodiversity topics	*Audit approaches (lines of enquiry)*							
	Financial management and regularity	**Compliance: agreements, laws, and policies**	**Policy**	**Performance measurement and results**	**Accountability, coordination, and capacity**	**Science, research, and monitoring**	**Public education**	**Reporting results**
National strategy on biodiversity								
Protected areas (parks, conservation areas, bird sanctuaries)								
Endangered species								
Invasive species								
Freshwater habitats and their resources								
Wetlands								
Marine habitats and their resources								
Genetic resources								
Forest resources								
Mainstreaming biodiversity into economic sectors and development planning								
Impact of climate change on biodiversity								
Desertification and biodiversity								

Chapter 3: Audits of Biodiversity

The main objective of this chapter is to give Supreme Audit Institutions (SAIs) information about audits of biodiversity from around the world. Whenever possible, the examples include information on the audit objectives, scope, findings, and recommendations.

The chapter is divided into the following 10 sections that cover the main biodiversity topics described in Chapter 2:

- a national strategy for biodiversity,
- protected areas (parks, conservation areas, and bird sanctuaries),
- endangered species,
- invasive species,
- freshwater habitats and their resources,
- wetlands,
- marine habitats and their resources,
- genetic resources,
- forest resources,
- mainstreaming biodiversity into economic sectors and development planning.

Each section contains a general audit approach that includes

- a short background;
- audit criteria from international conventions, legislation, policies, and programs;
- potential researchable questions, which may help auditors define audit objectives and lines of enquiry; and
- case studies from SAIs.

“Desertification and biodiversity” and “impact of climate change on biodiversity,” while potentially important, were not included in this report because suitable case studies were not available.

The audit information was mainly collected from

- a questionnaire on biodiversity that was sent to SAIs;
- environmental auditing surveys; and
- the WGEA website, under Environmental Audits Worldwide at: http://www.environmental-auditing.org/intosai/wgea.nsf/viewAuditsIssue1.

Where possible, case studies from around the world were used. However, only a few were available for some regions.

Appendix 3 lists the audits of biodiversity presented in this document as well as some that are not mentioned here but that the auditor may find useful for future audits.

The big picture: a national strategy on biodiversity

Background

Biodiversity is a vast, global issue the effects of which are felt differently in different countries. Individual governments, therefore, must define how they will tackle this topic.

Many SAIs decide to audit their government's progress in developing a national biodiversity strategy and associated action plans. Often, they start by comparing the obligations under the main convention on biodiversity, the Convention on Biological Diversity (CBD), with the government's actions.

Audit criteria

Most of the audit criteria come from the obligations set out in the CBD and the way those obligations are reflected in the legislation and policies in each country.

Convention on Biological Diversity (CBD). The CBD is an international convention specific to biodiversity, under which countries need to develop national biodiversity strategies and action plans.

In 1992, the global community met during the Earth Summit conference, in Rio de Janeiro, to discuss global problems concerning the environment. The Earth Summit brought together people with very different interests from almost 180 countries. They negotiated the CBD to ensure the availability of the Earth's natural resources for future generations.

The CBD was the first international agreement to address all aspects of biodiversity. It was also the first to address the conservation and sustainable use of biodiversity. The CBD and other conventions are discussed throughout this chapter in exhibits 9 to 15.

Exhibit 9: Convention on Biological Diversity (CBD)—at a glance

Date Signed: 5 June 1992 **Date Coming into Force:** 29 December 1993 **Number of parties** (in August 2007): 190 **List of Parties:** http://www.biodiv.org/world/parties.asp **Web site:** http://www.biodiv.org/default.shtml
Goals and objectives • Conservation of biodiversity • Sustainable use of the components of biodiversity • Sharing the benefits arising from the commercial and other uses of genetic resources in a fair and equitable way

Potential lines of enquiry

Under the CBD, governments undertake to conserve and use biodiversity in a sustainable way. They are required to develop **national biodiversity strategies and action plans (NBSAPs)**, to integrate them into broader national plans addressing the environment and development (policies and programs) and to set clear priorities (see article 6). This is particularly important for sectors such as forestry, agriculture, fisheries, energy, transportation and urban planning. Other treaty commitments include the following:

- Having adequate capacity to implement NBSAPs;
- **Identifying and monitoring** the important components of biodiversity that need to be conserved and used in a sustainable way (see article 7);
- **Establishing protected areas** to conserve biodiversity while promoting environmentally sound development around these areas (see article 8);
- Rehabilitating and restoring degraded ecosystems and promoting the recovery of threatened species in collaboration with local residents.(see article 8);
- Respecting, preserving and maintaining **traditional knowledge** of the sustainable use of biodiversity with the involvement of indigenous peoples and local communities(see article 8);
- Preventing the introduction of, controlling, and eradicating **alien species** that could threaten ecosystems, habitats or species (see article 8);
- **Controlling the risks** posed by genetically modified organisms see article 8);
- Promoting **public participation**, particularly when assessing the environmental impacts of development projects that threaten biodiversity (see article 14);
- **Educating** people and raising awareness about the importance of biodiversity and the need to conserve it (see article 13); and
- **Reporting** on how each country is meeting its goals relating to biodiversity. (see article 26)

Note: Appendix 4 provides the full text of the CBD articles mentioned here.

The Global Environment Facility (GEF) provides financial support to developing countries, so they can fulfill their obligations under the CBD. Since 1991, the GEF has made nearly US$ 4.2 billion in grants and co-financing available to developing countries. SAIs may audit how these funds are spent.

In 2002, the Conference of the Parties of the CBD adopted a strategic plan (http://www.biodiv.org/sp/default.shtml) “to achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national level, as a contribution to poverty alleviation and to the benefit of all life on Earth.” Parties committed to achieving the 2010 Biodiversity Target.

The Strategic Plan encourages countries and players to review their activities, especially their national biodiversity strategies and action plans. The Conference of the Parties adopted a framework with specific focal areas, goals, and targets for assessing progress towards the 2010 Biodiversity Target (http://www.cbd.int/2010-target/focal.shtml). These goals and targets could be a source of criteria for auditors.

Legislation, regulations, and policies. Few countries have established dedicated and comprehensive legislation that covers all aspects of biodiversity, because existing legislation may already cover many aspects. However, many countries have developed national biodiversity strategies and action plans to meet the requirements under the CBD.

Programs. Specific programs related to biodiversity may exist, especially if government has enacted legislation. However, auditors should look for any programs that aim to protect nature and habitats, national biodiversity strategies and action plans (NBSAPs), which are required under the CBD, as well as any documents that provide direction to protect biodiversity.

Players

While many departments and ministries have biodiversity responsibilities, developing a national strategy is often delegated to one department or a coordinating unit. Some countries, often as a result of being signatories to the CBD, have biodiversity offices, which are good starting points for finding information.

Researchable questions

When they define their audit approach, auditors may ask whether the government

- developed a national strategy on biodiversity as required under the CBD;
- developed national biodiversity strategies and actions plans (NBSAP), as required under the CBD;
- implemented its biodiversity strategy and action plans;
- implemented the CBD commitments through legislation;
- measured the results of their actions in protecting biodiversity;
- set priorities to achieve the 2010 targets, established under the CBD;
- reported its progress in protecting biodiversity to the CBD; and
- developed programs to educate the public on the importance of protecting biodiversity.

Audit case studies

The following three audit case studies relate to the way countries have met their commitments under the CBD.

SAI of Iceland: The Convention on Biological Diversity—an environmental audit

In 2006, the Iceland National Audit Office audited the efforts of its government, under the Convention on Biological Diversity (CBD).

Audit objectives

Examine how the national government applied its commitments under the CBD.

Scope

Activities of the Ministry of Environment, along with its institutions for the execution and implementation of CBD in Iceland.

Criteria

- Convention on Biological Biodiversity
- Icelandic legislation and public policy in the field of biological biodiversity

Findings

- Signing the CBD had a very limited effect on Icelandic legislation and public policy related to biodiversity.
- Nationwide plans for protecting and monitoring biological diversity had not been made.
- The government had conducted little research regarding the status of Icelandic biodiversity, contrary to the requirements of the CBD.
- It was not clear which government department of agency had the principal responsibility for carrying out commitments under the CBD.

Implementation of the CBD was random and unsystematic.

SAI of Poland: Implementing provisions of the Rio Convention on Biological Diversity

In 2004, The SAI of Poland conducted an audit titled "Implementing Provisions of the Rio Convention on Biological Diversity."

Audit objective

Examine the extent to which the government had harmonized its commitments under the CBD with its legislation and national strategic documents.

Scope

- Audited period: January 2001 to June 2003
- Sixteen units were selected, from four different levels, and were involved in
    - decision-making, coordinating and funding (3);
    - research activities and problem papers development (4);
    - performance of administrative tasks at the local level (7); and
    - *in situ* protection (2).

Criteria

- Rio de Janeiro Convention on Biological Diversity
- National laws and regulations

Findings

- Regulations protecting biodiversity in agriculture were insufficient and ineffective.
- Scientific research aimed at identification, protection and sustainable use of biodiversity was limited because of financial constraints.
- Data on the status of nature in Poland needed to be updated.
- Databases (System for Information Exchange on Biological Diversity) were not up-to-date and not well supervised by the Ministry of Environment.
- Due to amendments to regulations and funding constraints, some tasks regarding *in situ* protection were never carried out.
- Many irregularities were found in the process of selecting and establishing protected areas for the European protection network—Natura 2000.

SAI of Norway: Surveying and monitoring biodiversity and managing protected areas

In 2006, the Office of the Auditor General (OAG) of Norway conducted an audit of government activities regarding the country's commitments, under the CBD. The OAG Norway looked at the inadequate knowledge of the country's biological diversity and, consequently, a risk of insufficient precautionary actions.

Audit objective

Examine the efforts authorities had made to survey and monitor the country's biodiversity (CBD, Article 7) and manage protected areas (Article 8).

Scope

- Audited period: 1997 to 2006
- The efforts of five ministries to survey and monitor biological diversity: Ministry of the Environment, the Ministry of the Agriculture and Food, the Ministry of the Fisheries and Coastal Affairs, the Ministry of the Education and Research and the Ministry of the Petroleum and Energy.
- Two main programs that are important contributors to a new knowledge-based management system for biodiversity—the main element in the Norwegian strategy to apply the CBD: a nationwide municipal mapping and monitoring program, and a national surveying and monitoring program.
- The management of national parks, landscape conservation areas, and nature reserves.

Criteria

- The CBD, articles 7 and 8
- Appropriations Regulations
- National Strategy for conservation and sustainable use of biological diversity
- Guidance on government budgeting
- Reports to the Norwegian Parliament related to biodiversity and sustainable development, including Parliamentary Committee recommendations

Findings

- In the nationwide, municipal mapping program, weaknesses in planning meant that critical factors, such as survey methodology, databases, and cost estimates, had not been sufficiently established before the surveying started.
- Up to 30 percent of protected areas were threatened. Their management contained verified deficiencies. For example, priority was given to protecting certain areas, even though the related cost estimates were not updated.
- The goals for the new, knowledge-based management system were not well defined, making it difficult to assess its achievements and those of the national mapping and monitoring program.
- Weaknesses were revealed in the decision-making process of the national mapping and monitoring program. The OAG Norway emphasized the need for good planning in subsequent work.
- The OAG Norway concluded that, to date, the authorities had been unable to convert high environmental ambitions into specific action.

Protected areas

Background

Protected areas, such as national parks and conservation areas, are key to counter the continuing loss of ecosystems and species. They currently cover about 12 percent of the Earth's land surface.

The World Conservation Union (IUCN) defines protected areas as:

> Areas of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

Protected areas do not only include those on land; more and more countries are setting aside protected areas in oceans to protect marine resources. Conservation planners divide land and sea into management areas. These protected area systems are often a highly protected core surrounded by a buffer zone. The core, such as a strict reserve or no-take area, protects critical habitat and species. The buffer zone may have a larger variety of uses; it is intended to insulate the core from threats to its conservation status.

Protected areas are vital to the conservation of the world's natural and cultural resources. They protect natural habitats and flora and fauna, and they help to maintain the environmental stability of the surrounding regions. Protected areas can be used to provide developing rural areas with opportunities to use marginal lands rationally, generate income, create jobs, do research and monitoring, and educate people about conservation, recreation, and tourism. As a result, most countries have developed systems of protected areas and it is a common audit topic for SAIs. However, the growth in the number and area of protected areas is a fairly crude indicator, and

information on the level of protection these areas afford and how well they are managed is still needed.

Sometimes, parks are not properly established or regulated. Major threats to the integrity of the parks include

- human settlement,
- agricultural conversion,
- fire,
- large-scale drainage and roads that improve access to the area,
- hunting and fishing,
- trade in wildlife,
- collection of fuel wood,
- logging and mining, and
- oil and gas operations.

More information about protected areas can be found in the UNEP publication: *Protected Areas and Biodiversity Report—An Overview of Key Issues* (available at quin.unep-wcmc.org/resources/publications/pa_biodiv/).

Criteria

Convention on Biological Diversity (CBD). Establishing and managing protected areas, conservation, sustainable use, and restoration projects in the adjacent land and seascape are central to Article 8, "*In-situ* Conservation," of the CBD. (see The big picture: a national strategy on biodiversity, in Chapter 3, and Appendix 4)

The Conference of Parties has emphasized that developing and maintaining national protected area systems is a central element of their strategy to apply the CBD.

CBD 2010 Biodiversity Target

GOAL 1: Promote the conservation of the biological diversity of ecosystems, habitats and biomes.

Targets:

1.1 At least 10 percent of each of the world's ecological regions effectively conserved
1.2 Areas of particular importance to biodiversity protected

World Heritage Convention. The mission of the World Heritage Convention (WHC) is to identify and conserve the world's cultural and natural heritage by listing sites of outstanding value and ensuring their protection.

Other conventions. See the section on wetlands in Chapter 3 which describes the Ramsar Convention in this chapter.

Exhibit 10: World Heritage Convention—at a glance

Date Signed: 16 November 1972

Date Coming into Force: 17 December 1975

Number of parties (in October 2006): 184

List of Parties: http://whc.unesco.org/en/statesparties/

Web site: http://whc.unesco.org/

Goals and objectives

In 1972, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) recognized the need to identify and permanently protect the world's special areas. The World Heritage Convention, founded on the principle of international co-operation, provides protection for the world's cultural and natural heritage.

Potential lines of enquiry

State parties agree to identify and nominate sites within their national territory to be considered for inclusion on the World Heritage List.

When a State Party nominates a site, it gives details of how it is protected and provides a management plan for its upkeep.

State parties are also expected to protect the World Heritage values of the listed sites and are encouraged to report periodically on their condition.

Legislation, regulations, and policies. Generally, legislation includes provisions to control activities such as hunting, fishing, and logging in the parks. Auditors can expect to find national legislation and regulations concerning the management of protected areas. In general, each protected area has a management plan and is a good source of criteria.

Some countries allow the private sector to manage protected areas, especially parks that have tourism potential. In these cases, the private sector usually has to respect some requirements. Auditors can develop lines of enquiry to investigate the compliance with these requirements.

In some protected areas, government allows the sustainable extraction of resources, such as seeds or the use of protected areas for scientific research. These activities are usually regulated and can be a source of criteria for auditors.

Programs. Beyond legislation, some governments establish funded programs to identify and monitor protected areas.

Inside protected areas, a wide variety of programs may exist that promote the

- restoration of habitats,
- preservation of threatened species,
- mitigation of invasive species, and
- creation of biological corridors—to ensure connectivity between protected areas.

Monitoring and evaluating program performance provides evidence of success and failure, which helps identify necessary management changes and give an early warning of serious problems.

Players

Departments and ministries, for the environment or natural resources, are usually charged with managing protected areas. However, specific agencies are sometimes set up for that purpose.

Aboriginal peoples, people who live off the land, and residents who live around protected areas are important players, because they may no longer be able to carry out their traditional activities in these areas.

Another important player in the management of protected areas is the private sector—particularly in the mineral industries, which often has an interest in the areas around protected areas and sometimes in the protected areas themselves. In some cases, where minerals have been extracted, the replacement or expansion of protected areas is supported by the industry—to compensate for damages caused to the environment.

Researchable questions

Auditors may ask the following:

- Is the government establishing a network of protected areas that considers the needs of the different species and ecosystems?
- How does the government plan the establishment of new protected areas?
- Has the government assessed whether protected areas are large enough to protect species at risk and whether a corridor is needed between these areas to protect targeted species?
- Is the government establishing policies to ensure that national ecological networks and protected areas are effectively conserving biodiversity?
- Is the government implementing its policies regarding protected areas?
- Are government actions having the desired conservation benefits?
- Is the government periodically reviewing and adapting the management plans of protected areas?
- Is the government providing the necessary infrastructure to maintain and conserve protected areas?
- Are the measures taken by the government to counter illegal activities and over-exploitation of natural resources inside protected areas effective?
- Is the government assessing activities outside protected areas that may influence wildlife in the parks?

- Has the government decided what resources (including costs) are necessary to manage protected areas, and has it allocated them appropriately? How are these resources managed?

Audit case studies

The following four case studies relate to managing protected areas.

SAI of Mongolia: Effective management of protected areas network

In 2004, the Mongolian National Audit Office conducted an audit entitled "Special Protected Area Network and Effectiveness of its Management" to assess the risk of the unsustainable use of resources and the decline of biological species in protected areas.

Audit objectives

- Investigate whether the natural environment in protected areas was adequately protected.

Scope

- The Protected Area Management Division (PAMD) of the Ministry of Nature and Environment
- Fifteen protected area administrations (PAAs)
- Some related entities

Criteria

- Law on Special Protected Areas (1994)
- Law on Buffer Zones of Special Protected Areas

Findings

- Mining activities had been carried out in protected areas in violation of the *Law on Special Protected Areas*.
- Due to a lack of coordination and environment impact assessments by the Ministry of Nature and Environment and other related organizations, too many tourist camps and resorts had been built in the protected areas, causing an ecological imbalance.
- Mongolia's biodiversity had not been systematically assessed or monitored. Common difficulties, such as the lack of a biological resource database and other necessary information, underdeveloped monitoring methodology, and a lack of human resources, exist throughout the system of protected areas in Mongolia.
- Actions against illegal hunting and the improper use of natural resources were inadequate.
- The operating budget of the PAMD was insufficient to carry out its duties effectively. Moreover, no budget had been allocated for enforcement activities.
- The PAAs and their staff were not fully supplied with weapons, communication equipment, vehicles, and horses as per their own standards.
- Investigate whether protected areas were adequately managed and organized.

Recommendations

To the Ministry of Nature and Environment:

- Establish an information database on the biodiversity of protected areas and improve regular monitoring.
- Take step-by-step measures to provide the PAAs with qualified staff and the necessary equipment and resources.
- Improve public awareness and promotional activities for protecting nature and ecology.
- Inspect the licences, certificates, and payment of land-use fees of all legal entities operating in protected areas.
- Evaluate general and detailed environment impact assessments and take necessary actions against violations.

SAI of China: Auditing management of two natural reserves

In 2004, the National Audit Office of China audited Xishuang Banna National Nature Reserve and Jiangsu Yancheng National Wild Bird Reserve. Nature reserves play a leading role in protecting China's great biodiversity.

Audit objectives

Analyze and better understand how the nature reserves were being managed.

Scope

- The State Environmental Protection Administration (SEPA)
- The State Forestry Administration (SFA)
- Two National Nature Reserves

Criteria

- Laws and regulations
- Environmental standards
- Other standards (for example, The 10th Five-Year (2001-2005) Plan for Environmental Protection)
- Expert opinions

Findings

- Management of nature reserves led to some good results. For example, local governments enacted related laws and regulations, such as Xishuang Banna Forestry Resources Protection Regulations and Xishuang Banna Nature Reserve Administration Rules to support the management of nature reserves.
- Both reserves were invaded by foreign species but no effective counteraction was taken. This issue should be addressed in the future.

Recommendations

- Improve control over the core, buffer, and experimental areas of nature reserves.
- Conduct more research to effectively counter invasions by foreign species and balance sustainable development.

SAI of Canada: Ecological integrity in national parks

In 2004, the Office of the Auditor General (OAG) of Canada conducted a performance audit of Parks Canada Agency and its management of ecological integrity in national parks. Ecological integrity means that the native components, processes, biodiversity, and abiotic components of an ecosystem are intact. The OAG Canada examined how the Agency monitors and restores ecological integrity and reported on the condition of the 12 national parks.

Audit objectives

Determine whether

- reporting on ecological integrity (EI) was fair;
- the monitoring and research on EI addressed significant issues, were managed to achieve results, used to maintain or restore ecological integrity and used to enhance public education; and
- active management and restoration reflected significant issues, were managed according to generally accepted practices, used to maintain and restore ecological integrity and enhance public education.

Scope

Parks Canada Agency's monitoring, research, active management, and restoration activities in 12 parks

Criteria

The Agency's ecological integrity management guidelines and its commitments to improve ecological integrity in national parks

Findings

- The Agency's monitoring and restoration activities addressed significant issues, including some related to biodiversity, ecosystem functions, and stress factors.
- Gaps existed in the coverage of what issues to monitor, such as wildlife disease and human activity in sensitive habitat, and in how to plan and manage these issues.
- Monitoring and restoration activities were not used to their maximum effect to enhance public understanding of ecological integrity issues.
- Reporting on the condition of the parks was relatively good but inconsistent.

- Use All national parks are working to have scientifically credible monitoring programs in place that address their ecological integrity goals.
- Guidelines were being developed to improve the consistency of monitoring activities.

Recommendations

- Improve reporting on the condition of national parks by using baselines and benchmarks more consistently and include more information on results, financial information, and concrete examples of the contributions of other parties. the up-to-date management plans the Agency has at its disposal to remedy the gaps in managing restoration activities.
- Improve the Agency's monitoring and restoration programs by
  - applying its data management system and guidelines to monitoring and restoration activities,
  - establishing objectives and actions for integrating public education with monitoring and restoration activities,
  - publicly reporting on an annual basis on the measures being taken to improve monitoring and restoration.

SAI of the Slovak Republic: National parks in Slovakia

In 2005, the Supreme Audit Office of the Slovak Republic conducted a performance audit of national parks and the Slovak Nature Conservancy.

Audit objectives

Evaluate

- how well the management of national parks and the Slovak Nature Conservancy were carrying out their duties to protect national parks;
- management of environmental protection activities in national parks for their economy, efficiency, and effectiveness;
- compliance with international environmental agreements and national legislation; and
- the economy, efficiency, and effectiveness of funds spent to protect nature in national parks.

Scope

- Activities from 2003 to 2004
- Management of National Parks
- Slovak Nature Conservancy

Criteria

- Laws and regulations
- International agreements to co-operate on protecting national parks

Findings

- The budget for monitoring and environmental maintenance had been underestimated.
- There was a limited number of expert employees.
- Insufficient research and scientific activities had been conducted.

Recommendation

Reassess the funding of national parks and develop environmental projects for them that would be financed by European Union structural funds.

Endangered species

Background

Threatened species exist in all kingdom groups, all over the world. In the past few hundred years, it is estimated that humans have accelerated the rate of species extinction by as much as 1,000 times over the typical rate in the Earth's history.

The annual trade in international wildlife is estimated as billions of dollars and includes hundreds of millions of plant and animal specimens. The level of exploitation of some animal and plant species is so high that such trade, combined with factors such as habitat loss, could bring some species close to extinction.

Many governments are developing and supporting recovery plans for endangered and threatened species. Countries may have different classifications of threatened species and different levels of protection for each of them. More and more, the audit topic of endangered species is becoming an area of interest for SAIs. Because an international convention on the illegal trade of endangered species has existed since 1975, this topic has been audited for a long time.

For more information on the issue, see the section on species extinction of the section, What is the scope of biodiversity and what are the main concerns, in Chapter 1.

Audit criteria

Convention on Biological Diversity (CBD). Each Contracting Party of the CBD is to rehabilitate and restore degraded ecosystems and promote the recovery of threatened species. The Parties can do this by developing and implementing plans or other management strategies, developing or maintaining legislation and/or other regulatory provisions to protect threatened species and populations. (see Article 8 in Appendix 4.)

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international agreement between governments to ensure that the international trade of wild animals and plants does not threaten their survival. Currently, the public

is aware of the endangered status of many prominent species, such as the tiger and elephant. However, when the need for CITES was first recognized in the 1960s, international discussion on regulating the wildlife trade for conservation was a relatively new concept.

Because the trade of wild animals and plants crosses geopolitical borders, efforts to regulate it require international cooperation. CITES was conceived in the spirit of such cooperation. Today, CITES protects, in varying degrees, more than 30,000 species of animals and plants, whether they are traded as live specimens, fur or dried herbs. Since CITES came into force, not one species that is protected by CITES has become extinct as a result of trade.

CBD 2010 Biodiversity Target

GOAL 2: Promote the conservation of species diversity.

Targets:

- **2.1** Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups.
- **2.2** Status of threatened species improved.

Exhibit 11: CITES—at a Glance

Date Signed: 3 March 1973

Date Coming into Force: 1 July 1975

Number of parties (in August 2007): 172

List of Parties: http://www.cites.org/eng/disc/parties/index.shtml

Website: http://www.cites.org/

Goals and objectives

Ensure that international trade in specimens of wild animals and plants does not threaten their survival.

Potential lines of enquiry

CITES is limited to controlling international trade in endangered species. It defines international trade as (with very few exceptions) all situations in which a specimen or part of a specimen of an endangered species is taken or sent across international boundaries.

Countries are required to control trade in species in the same manner that they control other trade—through customs and inspection processes at borders and other ports of entry.

Convention on the Conservation of Migratory Species of Wild Animals. The Convention on Migratory Species (CMS) is also known as the Bonn Convention. Signed in 1979, it aims to conserve terrestrial, marine, and avian migratory species throughout their range and habitats. Parties work to provide strict protection for the most endangered migratory species, to establish a regional multilateral agreement for specific species and undertake cooperative research and conservation activities. Fourteen regional agreements have been adopted under this Convention to protect cetaceans (whales and dolphins), bats, water birds, seals, turtles, deer, elephants, and individual species of birds. The largest such agreement, the Conservation of African–Eurasian Migratory Water birds, covers 235 species of birds.

To reduce the rate at which species are becoming extinct, governments must deal with the main factors: the unsustainable use of resources, loss of habitat, and predatory activities—such as hunting and the illegal trade in wild animals.

Exhibit 12: The Convention of Migratory Species (CMS)—at a glance

Date Signed: 23 June 1979

Date Coming into Force: 1 November 1983

Number of Parties (in August 2007): 104

List of Parties: http://www.cms.int/about/part_lst.htm

Website: http://www.cms.int/

Goals and objectives

Every party makes a commitment to

- prohibit or restrict the harvesting of migratory species;
- restrict damage to habitats, introduction of invasive exotic species, and other activities and conditions that might obstruct migrations or interfere with migratory species; and
- enter into separate international agreements on specific migratory species or groups of species whose range or migratory route includes areas within the party's jurisdiction.

Potential lines of enquiry

- More than 100 endangered migratory species are listed in Appendix I of the Convention.
- Parties must endeavour to
  - conserve and, where feasible and appropriate, restore habitats that are necessary to remove the threat of extinction;
  - prevent, remove, compensate for, or minimize the adverse effects of activities or obstacles that impede or prevent migration; and
  - prevent, reduce, and control factors that endanger or are likely to further endanger the species.
- The CMS prohibits the harvesting of the species listed in Appendix I, with exemptions for
  - scientific purposes,
  - improvement of propagation or survival of the species,
  - traditional subsistence use, and
  - extraordinary circumstances.

Legislation/regulations/policies. Laws, international conventions, and policies are essential to prevent the loss of species. In many countries, governments have introduced specific legislation to protect endangered species. These laws usually include mechanisms to identify endangered species and recovery plans. If specific legislation on endangered species does not exist, provisions are likely to exist in other environmental legislation. Auditors should look for policies that deal with protection of endangered species, directly or indirectly.

Regarding the trade of endangered species, specific legislation and regulations may exist that meet commitments under CITES.

Programs. If specific legislation exists to protect endangered species or regulate their trade, there is likely to be a specific program on this subject.

There are some programs that help reverse the decline of an endangered or threatened species. To ensure the effectiveness or the recovery plans, threats must be reduced or removed, which will ensure the long-term survival of species in the wild.

Governments may also implement programs to reintroduce threatened plant and animal species to their natural habitats. This is often necessary to have enough individual members of a certain species in the wilderness to sustain its recovery and ensure its viability.

Players

Departments of environment, or their equivalents, usually have lead roles in protecting endangered and threaten species. In some countries, other departments, such as the departments of fisheries and parks could also have a major role. If the country is a signatory to CITES, the department or ministry charged with border inspections or customs and excise is likely to be involved.

Aboriginal communities that depend on wild animal or plant life are often players in the decision-making process regarding endangered species. The scientific community also plays an important role, especially in *ex-situ* conservation of threatened species.

Researchable questions

Auditors may ask whether the government is

- identifying species at risk in the country;
- implementing its legislation and policies on endangered species;
- controlling the trade of threatened species;
- combating the illegal trade of wild animal or plant life;
- applying international conventions, such as CITES;
- putting habitat recovery programs with specific action plans in place for threatened species;
- setting aside protected areas for endangered and migratory species; and
- controlling the illegal hunting that can affect endangered species or migratory species.

Audit case studies

The following three case studies relate to CITES, the trade of species, and the implementation of recovery plans to protect endangered species.

SAI of Paraguay: Trading species of wild fauna and establishing seasons for hunting and for collecting live animals

In 2003, the Paraguayan SAI (Contraloría General de la República) audited whether the country's Environmental Secretariat (SEAM) was complying with the law when it authorized the preserving, carrying, transporting, and trading of wild fauna, and when it established the hunting season and the season for collecting live animals.

Audit objectives

- Evaluate the management of the wildlife law enforcement agency.
- Analyze resolutions through which hunting quotas or quotas for preserving live animals and the use of leather, meat, and other items are being granted.

Scope

Activities carried out by the Environmental Secretariat in 2002 and 2003.

Criteria

- National Constitution
- Laws and regulations

Findings

- The Environmental Secretariat had no institutional environmental policy for protecting, conserving, and using, or ensuring the sustainable use, of wild fauna.
- The Wildlife Law and the Biological Diversity Law were not being fully complied with. For example:
  - Population studies or censuses were being used to replace the scientific studies that are required by law to authorize the exploitation of natural resources.
  - Neither an environmental impact assessment, nor an environmental licence is required to exploit wild fauna.
  - Authorization was given to extract samples of wild fauna from a reserve, which affected the balance of legally protected ecosystems.
  - There was no plan to manage exploitable species that included conservation actions, biological knowledge and was based on scientific studies, on which “sustainable use” programs could be based.

Recommendations

- Grant no new authorizations to exploit species until the SEAM defines clear procedures—through equitable, specific, and sustainable regulations that ensure the survival and reasonable use of the species.

- Consider more appropriate systems for protecting wild fauna species, such as captive reproduction and release into their habitat.
- With social organizations, academia, municipalities, and governmental organizations, design and apply domestic environmental policies to manage wildlife and habitat, paying special attention to natural resources and wildlife, as the public heritage of Paraguay.
- Emphasize supervising and overseeing field activities, monitoring, and carrying out censuses.
- Prepare formal lists of endangered or threatened species that will help establish rules and regulations to preserve the habitat of the listed species.

SAI of the United States: Audits on protection of endangered species and their recovery plans

Between 2002 and 2005, the Government Accountability Office (GAO) of the United States conducted five audits related to the protection of endangered species. The audits examined recovery programs, the use of science, consultation processes, and spending.

The following is a summary of two of these audits:

A. Research strategy and long-term monitoring needed for the Mojave Desert tortoise recovery program.

Audit objective for A.

Evaluate the scientific basis for key decisions related to the tortoise—assess the effectiveness of actions taken to conserve tortoises, determine the status of the population, and identify costs and benefits associated with recovery actions.

B. Fish and Wildlife Service generally focuses recovery funding on high-priority species but needs to periodically assess its funding decisions.

Audit objective for B.

Evaluate how the Fish and Wildlife Service's allocation of recovery funds compares with its guidelines on recovery priorities and the factors that influence its decisions to allocate funds towards recovery.

Scope for A. and B.

- Federal agencies with obligations under the *Endangered Species Act*
- Non-federal scientific research

Criteria for A. and B.

- Federal laws and regulations
- Federal financial management controls
- Expert opinion

Findings for A. and B.

- In most cases, federal agencies followed federal laws and regulations to carry out the *Endangered Species Act*.
- There were concerns about the efficiency and effectiveness of some programs.
- There was a lack of clarity in how some programs were to be executed.

Recommendation for A.

Develop and implement a coordinated research strategy to link land management decisions with research results and periodically reassess Mojave desert tortoise recovery plan. The Secretary of the Interior should identify and assess options to fund long-term monitoring of the population.

Recommendation for B.

Periodically assess whether higher priority species receive recovery funds and report this information publicly to ensure that the Fish and Wildlife Service is making the best use of available recovery resources.

SAI of Poland: National obligations under CITES agreement

In 1999, the Supreme Chamber of Control of Poland audited the application of national obligations under CITES.

Audit objective

Verify the activities of Polish public administration bodies and other organizations (such as businesses and NGOs) aimed at protecting animals, especially those that house and transport animals. A follow-up audit was performed in 2002.

Scope

Eighty-nine entities, including the National Veterinary Inspectorate, border veterinary inspectorates, and customs offices.

Criteria

- CITES
- National laws and regulations

Findings

- The Ministry of the Environment did not issue regulations to execute the *Animal Protection Act (1997)* that enforces the obligations under CITES.

- In 1998 and in the first half of 1999, the Ministry issued 488 permissions to import wild animals under CITES. It refused to issue several permissions, citing that the animals were wild-caught or that the importer was not able to prove their origin.
- During that period, under the power granted by the veterinary law, the Chief Veterinarian also issued permissions, independently from CITES, to import over 10,000 wild animals—309 of which were issued in the first half of 1999. Most of them were incomplete, making it impossible to determine whether CITES should be applied.
- Customs offices registered 62 cases of animals being imported in violation of CITES provisions (12 of them concerned 360 living animals that represented 6 species).
- Pet wholesalers and shops selling exotic animals did not always have certificates stating the origin and health of their animals, and the animals were not always covered by a veterinary inspection.
- The Ministry did not report annually to the CITES Secretariat on how well it met its obligations under CITES.

Impact of the audit reflected in the follow-up

- In 2002, a regulation of the *Animal Protection Act (1997)* came into force that incorporated provisions of CITES and was geared towards restricting and regulating international trade in the animal species listed under CITES.
- The Ministry launched a media campaign informing citizens of regulations that resulted from obligations under CITES.
- Customs Services and Border Veterinary Inspection reached an agreement to restrict trade in wild animals, through which customs officers were trained to enforce the provisions of CITES.
- Recommendations from the 1999 audit resulted in veterinary inspection rules being extended to pet wholesalers and shops.
- During the audit period, only isolated shipments containing animals covered under CITES into Poland were reported.
- Veterinary permissions to import wild animals continued to be issued independently from CITES permissions (as had been disclosed in the 1999 audit). Because they still did not contain the full species names, it was still impossible to identify whether the imported animals should have been protected under CITES.

Invasive species

Background

Alien species that become invasive are considered to be a main cause of loss of biodiversity around the world. Increased levels of transport, tourism, and trade introduce more invasive alien species, which pose a significant threat to terrestrial and aquatic ecosystems.

Most invasive alien species arrive in their new territory through the accumulation and release of ballast water from ships. However, aquaculture and aquarium releases are equally important sources of invasive alien species and are not as well-regulated as ballast water release.

The problem of invasive alien species is a global one that requires action at all levels. Many countries have established systems to prevent and control the problem and use risk assessments

to predict the likelihood of invasion and the potential ecological and economic cost. Although such systems consider the impact of invasive alien species once they are introduced, more work needs to be done to prevent their introduction. Because these invasive species can have a direct and costly impact on the economy, this is becoming an important audit topic for SAIs.

For more information on the issue, see the following topics in Chapter 1:

- species extinction, on page 7;
- biotic uniformity, on page 9;
- changes in ecological functions, on page 10; and
- invasive alien species, on page 13.

Audit criteria

Convention on Biological Diversity (CBD). Each contracting party is to prevent the introduction of, control, or eradicate invasive alien species that threaten its ecosystems, habitats, or native species. Parties are also responsible for ensuring that activities within their jurisdiction or control do not damage the environment of other countries. (See articles 3 and 8—Appendix 4.)

CBD 2010 Biodiversity Target

GOAL 6: Control threats from invasive alien species.

Targets:

- **6.1** Pathways for major potential alien invasive species controlled.
- **6.2** Management plans in place for major alien species that threaten ecosystems, habitats, or species.

Governments must develop effective strategies to minimize the spread and impact of invasive alien species. Each country faces unique challenges, so their solutions will also be unique. The document, *Guiding Principles for the Prevention, Introduction and Mitigation Of Impacts of Alien Species That Threaten Ecosystems, Habitats or Species* (Secretariat of Convention on Biological Diversity, 2002), lists some principles that give governments clear direction and a set of goals. SAIs can use these principles for their audits, and auditors can address lines of enquiry related to compliance, finance, effectiveness, and others for each one.

International Convention for the Control and Management of Ships' Ballast Water and Sediments. At a conference in February 2004, the International Convention for the Control and Management of Ships' Ballast Water and Sediments was adopted. The Convention could prevent the potentially devastating effects of the introduction, by maritime trade, of invasive species that compete with native wildlife. However, it has not yet come into force. Nevertheless, its principles could serve as good practices for managing invasive species coming from ballast water and sediments, and its guidelines could serve as source of audit criteria.

Exhibit 13: International Convention for the Control and Management of Ships' Ballast Water and Sediments—at a glance

Date Signed: 13 February 2004

Date Coming into Force: Not yet in force

Number of parties (in August 2007): 10

Web information: http://www.imo.org/
(Look for "marine environment" and then "Ballast Water Management")

Global Ballast Water Management program: http://globallast.imo.org/

Goals and objectives

Prevent, minimize, and ultimately eliminate the transfer of harmful aquatic organisms and pathogens by controlling and managing sediments and the release of ballast water from ships.

Potential lines of enquiry

The Convention requires that all ships have a ballast water and sediments management plan. All ships must carry a ballast water record book and manage their ballast water procedures to a given standard.

International Plant Protection Convention. The International Plant Protection Convention (IPPC) was adopted in 1951 by the Food and Agriculture Organization of the United Nations. Under its obligations, countries must act to prevent the introduction and spread of pests of plants and plant products, and to promote appropriate control measures. A revised text of the Convention was adopted in 1997 (https://www.ippc.int/IPP/En/default.jsp).

Legislation, regulations, and policies. Some countries may have developed comprehensive frameworks for national legislation and international cooperation to regulate the introduction of invasive species as well as to eradicate and control them. This legislation may involve different sectors of activity (for example, trade, agriculture and food, and transport (ballast water).

Auditors need to look for

- any policies or strategies that can be used to control invasive alien species,
- any legislation that addresses the intentional and unintentional introduction of invasive species, and
- agreements between and actions of regional trade organizations that may help minimize or prevent the unintentional introduction of invasive species.

Programs. Auditors may find programs that address invasive species in a number of departments and ministries. Usually, the ministry in charge of environmental issues develops programs to prevent the introduction of alien invasive species or to eradicate and control the alien invasive species that have already been introduced in the country.

Often, education programs and campaigns are implemented to minimize and prevent the unintentional introduction of invasive species. These programs may suggest methods to reduce the risk of invasive species being introduced through traded goods, packaging material, ballast water, personal luggage, aircraft, and ships.

Governments also implement research and development programs to address the problem. These programs may identify the major invasive pathways in the countries (for example, international ports and airports) so the pathways can be monitored, and the invasive species can be eradicated.

Players

In addition to the usual players (departments and ministries of the environment and fisheries), departments and ministries of agriculture, food, transport, coast guard, trade, and customs may be involved in managing invasive alien species. Because invasive species are introduced in different ways in each country, the players will be different.

Researchable questions

Auditors may ask whether the government is

- implementing its legislation and policies related to invasive species;
- identifying the key invasive species in the country;
- providing available information on the invasive behaviour of a species to other countries;
- taking appropriate individual and cooperative action to minimize the risk posed by invasive alien species;
- undertaking research and monitoring;
- promoting education and public awareness and performing outreach activities;
- implementing border controls and quarantine measures, where warranted;
- assessing and controlling illegal activities that introduce invasive species;
- signing specific agreements with neighbouring countries;
- implementing measures to reduce the number of invasive alien species through mechanical, chemical, and biological controls, or through habitat management; and
- implementing detection programs to eradicate species in the early stages of invasion and mitigation measures to limit the spread.

Because auditing government actions to control invasive alien species could be a huge topic, it may be advisable to audit only one specific pathway or sector of activity (for example, agriculture, forestry, or shipping).

Audit case studies

The following two case studies relate to the management of invasive species and the prevention of pests and diseases.

SAI of Canada: Invasive species in Canada

In 2004, the Office of the Auditor General (OAG) of Canada audited Environment Canada, Fisheries and Oceans, and Transport Canada to determine whether the federal government had adequately carried out its obligations under the international Convention on Biological Diversity and the Canadian Biodiversity Strategy regarding invasive species.

Audit objectives

- Determine whether the federal government adequately responded to the problem of invasive species, since it signed the Convention on Biological Diversity and, more specifically, since it finalized the Canadian Biodiversity Strategy.
- Investigate whether Environment Canada had information or the tools needed to acquire information on
  - which species pose the greatest threats,
  - which major pathways they are likely to arrive by,
  - who took what action to respond to major risks, and
  - how effective those actions were.
- Examine how the federal government managed invasive species arriving via ballast water. The focus was on whether Fisheries and Oceans Canada acquired the basic information it needed to manage invaders and whether Transport Canada ensured that there is adequate legislation and enforcement to control their introduction into Canadian waters.

Scope

- Environment Canada
- Fisheries and Oceans Canada
- Transport Canada
- Convention on Biological Diversity
- Canadian Biodiversity Strategy

Criteria

- Departmental mandates (including legislative mandates) with respect to invasive species
- Convention on Biological Diversity
- Canadian Biodiversity Strategy

Findings

- Despite its commitments, the Canadian government had not launched an effective response to the problem. Ten years after making commitments under the Convention and the Strategy, the number of invasive species in Canada continues to grow.
- No federal department saw the “big picture” because none of them had the overall authority to make sure that action was taken. Clear roles and responsibilities had not been assigned to specific federal departments.
- The federal government had not identified the species that posed a threat, it had not identified the pathways by which they arrive nor was it able to assess progress against its commitments.

Recommendations

To Environment Canada

- Put a national action plan in place as well as a monitoring and reporting system to track the effectiveness of measures taken against invasive species.
- Secure the commitment of relevant federal departments to act on their contribution to the plan.

To Transport Canada

- Formalize information-sharing on ballast water with the U.S. Coast Guard.
- Enforce future Canadian regulations on discharging ballast water.

To Fisheries and Oceans Canada

- Develop and implement measures to identify and assess the risks associated with aquatic invasive species, and assess priorities and objectives to these risks.
- Track the effectiveness of these measures and report annually to Parliament.

SAI of UK: Protecting UK from plant pests and diseases

In 2003, the National Audit Office of the United Kingdom carried out a value-for-money (performance) audit on preventing the introduction of invasive species.

Audit objective

To examine the way the Department for Environment, Food and Rural Affairs protects England and Wales from the risks of plant pests and diseases.

Scope

- Key risks posed by plant pests and diseases
- Department's record in dealing with outbreaks
- Department’s work to detect pests and diseases and prevent them from spreading

Criteria

- National legislation
- Requirements of the World Trade Organization
- European Union Directive 2000/29/EC
- The UN Food and Agriculture Organization's International Plant Protection Convention (IPPC)

Findings

The Department

- played a key part in the country's good record in preventing major outbreaks of pests and diseases;
- needs to focus more on key risks and results;
- must better coordinate its work, particularly with industry and foreign counterparts;
- had insufficient means to assure the quality of work of its inspectors; and
- must focus on acquiring the necessary scientific capacity in coming years.

Recommendations

- Focus on key risks and outcomes.
- Coordinate with industry and foreign counterparts.
- Assure the quality of work of inspectors.
- Acquire the necessary scientific capacity.

Freshwater habitats and their resources

Background

Freshwater habitats (including lakes, rivers, ponds, streams, groundwater, springs, cave waters, floodplains, bogs, marshes, and swamps) are an important source of food, income, and livelihood—particularly in rural areas of developing countries. These ecosystems also provide water, energy, transport, recreation and tourism, hydrological balance, retention of sediments and nutrients, and habitats for fauna and flora.

Freshwater ecosystems, which humans often change dramatically, are among the most threatened ecosystems of all, through

- physical alteration,
- loss and degradation of habitat,
- drainage,
- overexploitation,
- pollution, and
- the introduction of invasive alien species.

Forty-one percent of the world's population live in river basins that are experiencing stress. More than twenty percent of the world's 10,000 freshwater fish species have become extinct, threatened, or endangered in recent decades.

Industrialization, rapid economic development, and population growth have transformed freshwater ecosystems and have increased the loss of biodiversity to unprecedented level. There is increasing concern about what can be done to maintain the rich biodiversity of inland waters and reduce the risks faced by many species, so that the goods and services they provide will not

perish with them. There is an ever-increasing need and urgency to improve the management of inland water ecosystems to meet the equally ever-increasing demand for fresh water.

The most important threat in freshwater ecosystems in the past 50 years have been the physical alteration of habitat, modification of the flow of water (dams and water reservoirs), and reduced water quality (pollution by the agriculture, industry and municipal (sewage) sectors, sedimentation, and eutrophication).

Pollution of freshwater is frequently audited by SAIs.

Audit criteria

International Agreements. There are no international agreements specifically for freshwater protection. However there are numerous regional agreements on rivers or lakes; SAIs should look at those agreements as a source of audit criteria.

The CBD makes reference to the protection of freshwater and the Conference of Parties has established a specific program for inland water biodiversity.

CBD 2010 Biodiversity Target

Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.

Target 5.1: Rate of loss and degradation of natural habitats decreased.

Legislation, regulations, and policies. Specific freshwater legislation and policies usually exist and include provisions for dealing with quality and quantity of water. They may also include specific provisions for drinking water and the protection of groundwater. Because there is a wide range of users (for example, agriculture, industry, and municipalities), governments often use integrated watershed management as a tool to balance needs and protect the water supply. However, the laws may not directly refer to biodiversity (for example, legislation surrounding production of electric energy resulting from dam construction).

Auditors can examine any legislation on preventing pollution or protecting species. For example, if a SAI is auditing inland fisheries, legislation on fisheries may be an important source of criteria.

Policies on water are usually developed at the national level and include some clauses on the protection of species. Often, such policies are based on the principle, “the polluter pays.”

Programs. Since legislation and policies on water undoubtedly exist, auditors could expect to find specific programs related to water. Some aspects of these programs may relate to biodiversity.

Players

The departments of the environment or of natural resources, or their equivalents, generally have lead role in the management of freshwater. The department of fisheries, or its equivalent, may also have an important role. SAIs should also look at departments and ministries that use water resources, such as those for agriculture and energy. In addition, local government may implement policies that are developed at the national level. Organizations such as water boards or water authorities may also be involved.

Researchable questions

Auditors may ask whether the government is

- enforcing its legislation and policies related to freshwater,
- integrating biodiversity into the management of water resources and river-basins, and into relevant sectoral plans and policies,
- establishing and maintaining protected freshwater ecosystems,
- regulating pollution of water from different sectors,
- monitoring water quality and water quantity,
- regulating sewage discharge,
- preventing invasions of alien species,
- encouraging the use of low-cost technology and innovative approaches to manage water resources,
- providing incentives to conserve and use in a sustainable way the biodiversity in inland waters,
- supervising inland fisheries and protecting resources;
- improving understanding of the biodiversity in inland waters and of the threats to their ecosystems;
- conducting thorough impact assessments; and
- monitoring inland water biodiversity.

For more information, see the WGEA document, *Auditing Water Issues: Experiences of Supreme Audit Institutions*, published in 2004, which includes audit case studies on nature and biodiversity, rivers and lakes, and water quality.

Wetlands could have been included in this section. However, because auditors often audit how their government is protecting wetlands under the Ramsar convention, it has been left as a separate topic (see the section on Wetlands, in Chapter 3).

Audit case studies

The following two case studies relate to river restoration and freshwater fisheries management.

SAI of Czech Republic: River system restoration program

In 2004, the Supreme Audit Office of the Czech Republic (NKÚ) audited the River System Restoration Program, which was intended to return freshwater ecosystems to health by restoring the surrounding landscape. The Program is part of the State Environmental Policy and the State Program of Protection of Nature and the Landscape of the Czech Republic.

Audit objective

Verify the management of state funds set aside to restore river systems.

Scope

- Ministry of Environment
- Organizations run by the ministries of the Environment and Agriculture
- The recipients of funds
- All restoration programs for river systems under the ministries of Agriculture and the Environment

Criteria

- Laws and directives regarding the state budget
- Laws on the protection of landscape
- Acts on public procurement
- Ministry directives on the River System Restoration Program
- State Environmental Policy
- Ramsar Convention (indirectly)

Findings

- There were inadequacies in the Ministry of the Environment's conceptual, management and control work. It had not set gradual or individual targets that could be evaluated after five years, as proposed in the Program.
- Most of the Program funds were spent to build and repair new fish ponds and water reservoirs for commercial use. The Ministry did not remedy the disproportion between the individual purposes (subprograms).
- The Ministry did not make full use of the restoration studies that it both financed and used as documentation for decision-making.
- Activities, such as tender procedures for suppliers and procedures for contracting and invoicing suppliers were not always carried out in a way that showed the proper use of funds.

Recommendations

The Ministry should increase the effectiveness of the controls over subsidies and ensure compliance with the conditions of the Program, once the project is complete.

SAI of Botswana: Fisheries in Botswana

In 2005, the Office of Auditor General of Botswana conducted a performance audit of the fishing industry to determine how unregulated fishing activities, the absence of a policy framework, and operational mechanisms have affected the sustainability of fisheries and the environment.

Audit objectives

Determine whether the Fisheries Division of the Department of Wildlife and National Parks (DWNP) had adequate guidance and operational mechanisms to manage and protect the fishing industry by determining the following:

- whether the Division had a policy framework with clear objectives;
- how much information was collected to devise long term management plans and usage strategies for the fisheries to provide protection, regulations, and the sustainable use of resources;
- how much open fishing affected fish stocks;
- whether routine inspections were carried out;
- whether the Division fulfilled its obligations to protect the aquatic environment, as specified in the Southern African Development Community (SADC) Protocol on fisheries (Articles numbers 14 and 15), and
- whether there was appropriate monitoring in place.

Scope

- Audited period: 2001 to 2004
- The Fisheries Division of the DWNP
- Department of Animal Health and Production (DAHP)
- One district in the north of Botswana, where fisheries activities are conducted

Criteria

- *Fish Protection Act* of 1975 and draft Fisheries regulations.
- DWNP's and DAHP's strategic plans.
- Southern African Development Community (SADC) Protocol on fisheries

Findings

- The Division had not developed a policy framework to provide the necessary direction and guidance to the fishing industry.
- The *Fish Protection Act* of 1975 had become obsolete, since it did not provide for all aspects of fishing, such as managing fish stocks.
- There was no data in the database, on the number of fish (the "catch") and the effort needed for traditional (hook, line, and basket) fishing, recreational, and competition fishing, to measure how much of the total catch is the result of these activities.

- There were no formal protection controls or mechanisms in place to protect fish and habitat. DWNP management educated fishers and encouraged them to practise good fishing methods. However, this initiative lacked measurable targets for fishers to meet.
- The scientific capacity in the Division was lacking—70.6 percent of its staff lacked formal fishing training, although many were self-taught.
- The annual reports produced by the Division were work-related; they did not mention that the programs to protect fish and promote the sustainable use of resources were achieving results.

Recommendations

DWNP management should

- Review the *Fish Protection Act*.
- Devise methods to improve the quality of data (for example, increased inspections) needed to obtain independent verification of the information in the Daily Catch and Effort forms and to improve education programs.
- Ensure that data on fish stocks are analyzed and relevant reports are produced quickly to give decision-makers up-to-date access to accurate information.
- Conduct research to determine the impact of fishing methods where gillnets are not used (for example, basket fishing and trapping) and recreational and competition fishing on catch rates, mortalities, types of hook, types of species, and size of fish. This data will help in the assessment of stock levels.
- Develop a comprehensive strategy to protect habitat that includes clean-up action plans for polluted fishing sites or fish markets.
- Ensure that inspection activities are conducted efficiently and effectively, and ensure that they comply with the *Fish Protection Act*.
- Ensure that the Division has enough qualified staff to perform its mandated activities.
- Ensure that DWNP management reports include the Division's achievements in protecting fish and habitat, and ensure that Parliament and the public are informed of the sustainable use of fish resources.

Wetlands

Background

Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land or where it is covered by shallow water. Covering four to six percent of the planet, wetlands are one of the key life support systems on Earth.

Wetlands provide critical habitats for many species of fauna and flora. They play an important role in filtering and providing water, retaining sediments and nutrients, stabilizing shorelines, and mitigating floods. They are among the most productive ecosystems in the world and are important warehouses of plant genetic material, such as that in rice.

The survival of wetlands depends on their preservation and the conservation of their ecological functions. They have historically been threatened by encroachment, drainage, land reclamation, pollution, and competing uses, such as agriculture and urban development.

The Wetlands are a common audit topic for SAIs.

Audit criteria

Ramsar Convention on Wetlands. The Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention on Wetlands) is the main convention on wetlands, and it is the only one that specifically protects a single habitat. Most countries have wetlands, and most of those have signed the Ramsar convention (153 countries) and have designated Ramsar sites (1630 Ramsar sites around the world).

Commitments under this convention could lead to specific programs or policies and be a source of audit objectives and criteria. It is an international agreement that provides a framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. When auditing wetlands, auditors often start with the Ramsar Convention.

The CBD could also be a source of audit objectives and criteria. As mentioned in the Protected areas section of this chapter, countries have to establish and maintain protected areas, including wetlands.

Exhibit 14: The Ramsar Convention on Wetlands—at a glance

Date Signed: 2 February 1971

Date Coming into Force: 21 December 1975

Number of parties (in July 2007): 155

List of parties: http://www.ramsar.org/key_cp_e.htm

Website: http://www.ramsar.org/

Goals and objectives:

National action and international co-operation to conserve wetlands and their resources.

Potential lines of enquiry:

The Convention includes four main commitments that the Contracting Parties have agreed to.

1. **Listed sites**. The first obligation is to designate at least one wetland to be included on the List of Wetlands of International Importance (the "Ramsar List"), to promote its conservation and, where appropriate, wise use of its resources. The wetland should be chosen based on its significance to ecology, botany, zoology, limnology, or hydrology.

The contracting parties have adopted specific criteria and guidelines for identifying such sites. (Ramsar Information Paper no. 4.)

- As of November 2006, there were 1,630 designated Ramsar wetland sites—for a total of 145.6 million hectares—worldwide.
- The Convention takes a broad approach to its definition of wetlands, which are defined as:

  areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.

In addition, wetlands included in the Ramsar List "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands."

The Convention recognizes five major types of wetland:

- **marine** (coastal wetlands including lagoons, rocky shores, and coral reefs);
- **estuarine** (including deltas, tidal marshes, and mangrove swamps);
- **lacustrine** (wetlands associated with lakes);
- **riverine** (wetlands along rivers and streams); and
- **palustrine** (marshes, swamps, and bogs).

2. **Wise use.** Under the Convention, the contracting parties are obliged to include considerations for conserving wetlands when planning their national land-use. They have to promote, as far as possible, "the wise use of wetlands in their territory" (Article 3.1 of the Convention).

The Conference of the Contracting Parties has approved guidelines on how to achieve "wise use," which has been interpreted as being equivalent to "sustainable use" (Ramsar Information Paper no. 7).

3. **Reserves and training.** The contracting parties agreed to establish nature reserves in wetlands, even for those wetlands not included in the Ramsar List, and to promote training in research, management, and stewardship.
4. **International co-operation.** The contracting parties agreed to consult other contracting parties on how to apply the Convention, especially for cross-border wetlands, shared water systems, and shared species (Ramsar Information Paper no. 13).

Over the years, the Conference of the Contracting Parties has interpreted and elaborated on these four major commitments and developed guidelines to help carry them out. These guidelines are published in the Ramsar Handbook series (Ramsar Information Paper no. 16).

Reporting. The contracting parties report the progress they are making on applying their commitments under the Convention by submitting national reports to the Conference of the Contracting Parties every three years. The national reports become part of the public record.

Legislation, regulations, and policies. Countries may not have specific legislation on wetlands. However, many do have legislation that protects wildlife and their habitats. Wetlands are usually covered under this type of legislation, which generally contains provisions for creating protected areas for wildlife.

Regulations usually prohibit hunting and fishing and other activities that may modify these habitats. Often, these protected areas are called aquatic bird habitats because wetlands are particularly important for birds, especially migratory birds. Many wetlands are designated as Important Bird Areas (IBA).

Many countries have established a wetland conservation policy, which is a requirement of the Convention.

Programs. Departments and ministries may have developed specific programs to implement policies that protect, restore, and ensure that any exploitation of wetlands is sustainable. Sometimes, the programs are not specific to wetlands but have a much broader scope, such as habitat conservation.

Players

Usually, the department of the environment, or its equivalent, is involved. In some countries, the departments of Natural Resources, Nature Management, Parks, and Agriculture could be involved. However, other departments may also be involved in protecting wetlands. The auditor must clarify which is the lead department and whether there are clear, defined roles.

Some institutes and non-governmental organizations—such as the World Wildlife Fund or BirdLife International, hunting associations, national wildlife or nature associations—may be involved in protecting wetlands. Departments and ministries may collaborate with these organizations. It is important to meet these organizations in the first phase of the audit to understand the wetlands issue in the country.

Researchable questions

Auditors may ask the following:

- Is the government complying with the Ramsar Convention?
- Has the government identified any wetlands that qualify under the Ramsar Convention?
- Does the government have a strategy or a national policy framework for protecting wetlands?
- Does the government have the appropriate scientific knowledge to select the wetlands it should protect?
- Has the government established management and restoration plans for its most important wetlands? Have they been applied?
- What are the conservation objectives for wetlands of importance in the country?
- Does the government measure its progress in conserving wetlands? Does it use any indicators?
- Is the government reporting its progress to its Parliament (or equivalent) or to the Ramsar Secretariat?

Audit case studies

The following two audit case studies involve the Ramsar Convention.

SAIs of Austria and Hungary: The Ramsar Convention as applied to Lake Neusiedl-Fertő

In 2003, the Austrian Court of Audit and the State Audit Office of Hungary carried out a coordinated performance audit of the use of state funding to protect Lake Neusieldl-Fertö, under the Ramsar Convention. Bordering Austria and Hungary, the region is unique and one of the most remarkable ornithological sites in Europe. It is an example of how protecting nature may conflict with regional development.

Audit objectives

- Audit the efficiency and effectiveness of funding and the success of programs and measures, both planned and already applied.
- Reveal conflicts in the economic use of the region.
- Suggest solutions to conflicts.
- Evaluate cooperation between the two countries.

Scope

- Audited period: 1997 to 2003
- National park Neusiedler
- Eleven local governments located in the environment of Lake Neusiedl-Fertő
- Activities carried out by the Federal Ministry of Agriculture, Forestry, Environment and Water Management
- Co-operation between Austria and Hungary with management of the national park

Criteria

- **International agreements.** The area is protected by obligations under international agreements signed by both countries. Among them are the Ramsar Convention on Wetlands, the Convention on Biological Diversity, and the European Union directives on bird protection and habitat.
- National acts and decrees.

Findings

- International obligations, under the Ramsar Convention, for preserving water habitats were met.
- Cooperation between the Hungarian and Austrian governmental organizations was outstanding.

- Water quality has greatly improved. The habitat of water fauna and flora can be considered secured.
- Using the lake for economic gains disrupted the natural ecological process. An overwhelming invasion of reeds suffocated native plants and devastated the lake. Agriculture, hunting, fishery, and tourism conflict.
- The quality of reed stock on the Hungarian side of the lake has decreased.

Recommendations

- Jointly analyze the practices of the two countries and adopt the one that better serves the ecological interests of the area.
- Define and document the areas precisely and designate individual highly protected areas, zones, and reservations.
- Gain a comprehensive understanding of development in the region.
- Scrutinize the hunting of waterfowl in a Ramsar-protected area.
- Avoid using the lake for economic purposes.

SAI of Switzerland: Applying the Ramsar Convention to the Lake Constance region

In 2004, the SAI of Switzerland examined how obligations under the Convention had been applied in the region around Lake Constance.

Audit objectives

- Examine the application of the Ramsar Convention on Wetlands.
- Determine whether the condition of nature reserves in the Lake Constance region meet the obligations of the Convention.

Main environmental risks investigated

- Decline and loss of species
- Unsustainable use of resources
- Contamination of ecosystems

Scope

- One region in Switzerland (Lake Constance) bordering Germany and Austria (three cases)
- Coordination between federal and regional authorities
- Coordination between federal departments

Criteria

- Ramsar Convention on Wetlands
- Swiss law and the laws and regulations of the cantons (regions)

Findings

- The Swiss Agency for Environment has integrated Ramsar components in its environmental laws.
- Legislation had not been implemented at all sites. In one canton, the Agency faced many difficulties:
- The canton and commune (local area) were not interested in carrying out the legislation.

- The canton and commune did not enforce the requirements concerning signposts that must indicate the existence of nature reserves.
- The canton had yet to submit an order for the required supervision of the reserve that would be federally subsidized.
- There were relationship difficulties between the federal and the regional levels.
- There were coordination problems within the federal agency and between the federal agency and the regional levels.

Recommendations

- Develop a national strategy for wetlands.
- Establish more and better contacts with neighboring countries (Austria and Germany).
- Include border guards in training sessions for nature reserve wardens.
- Improve coordination within the Swiss Agency of Environment (several divisions are involved with implementing the Convention).
- Promote acceptance of the nature reserve through increased public outreach.
- Work hard to eliminate delays in implementing the Convention.
- Promote cooperation with Baden-Wüttemberg, to meet the Convention goal of creating cross-border nature reserves where ecological units exist.

Marine habitats and their resources

Background

Oceans cover 70 percent of the planet's surface. Marine and coastal environments contain diverse habitats (such as mangroves, coral reefs, sea grasses, algae, pelagic or open-ocean communities, and deep-sea communities) that support an abundance of life. Marine life produces a third of the planet's oxygen, offers a valuable source of protein, and moderates climate change.

The impact of human activities on marine and coastal ecosystems can be grouped into five main categories:

- chemical pollution and eutrophication,
- commercial fisheries,
- global climate change,
- alterations of physical habitat, and
- invasion of exotic species.

Many seas and coastal areas have been degraded beyond rescue. The world's fish stock and, as a result, its fisheries are in danger of disappearing. Other resources, such as mangroves, corals, and species that are subject to bio-prospecting, are also overexploited. Coral reefs worldwide are being degraded and destroyed by human activities and global warming.

Overexploitation has been the most important threat in marine ecosystems in the past 50 years. The global catch peaked in the late 1980s and is now in decline despite larger fishing operations working harder. This pressure is seriously damaging marine biodiversity in many parts of the world, often reducing the availability of fish as a basic staple.

Sewage remains the largest source of contamination by volume of the marine and coastal environment. Coastal sewage discharges have increased dramatically in the past three decades. In addition, nutrient loading resulting from intensive agriculture is becoming a serious concern in the protection of marine habitats. Oil spills and oil discharges at seas are also an important cause of pollution of marine water.

For more information on the important issue of invasive species from and in the marine environment, see Invasive species, in this chapter.

Pollution of marine habitat is frequently audited by SAIs, often in cooperation with other SAIs when assessing respect of international agreements related to marine pollution. In addition, fishery resources are an important issue audited by SAIs.

Audit criteria

United Nations Convention on the Law of the Sea (UNCLOS). This convention was adopted in 1982. It set up a legal regime for the seas and oceans and regulates all aspects of the resources and uses of the oceans. Additional information on UNCLOS can be found on the United Nations website at

http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm

International Convention for the Prevention of Pollution from Ships (MARPOL). This is the main international convention on pollution, from operational or accidental causes, of the seas by shipping. It was created through the combination of two treaties that were adopted in 1973 and 1978, and it has been updated through amendments. Additional information on MARPOL can be found on the International Maritime Organization (IMO) website at

http://www.imo.org/Conventions/contents.asp?doc_id=678&topic_id=258

Parties to the CBD have established a specific program on marine and coastal biodiversity to help countries protect their marine environment and resources.

Legislation, regulations, and policies. Protection of biodiversity in oceans is usually addressed through legislation and regulations of fisheries, shipping and marine protected areas. Many countries have also established specific policies or strategies for oceans.

Auditors may use the legislation for marine areas beyond national jurisdiction and international rules for deep seas as source of criteria.

Some countries have taken measures and enacted legislation to

- stop over-fishing, especially by industrial-scale operations;
- prohibit destructive fishing practices; and
- end illegal, unregulated fishing.

Programs. Auditors can expect to find programs relating to legislation and policies on the marine environment, some of which may directly protect biodiversity. For example, programs that

- establish and maintain marine and coastal protected areas,
- educate to eliminate destructive fishing practices,
- promote the sustainable use of marine and coastal living resources, and
- prevent and mitigate the impact of invasive species on marine habitats.

Players

As well as the Department of Fisheries or Oceans, auditors should look at the activities of the Coast Guard. In addition, if the audit topic warrants it, auditors should consult fisheries associations and the shipping industry at the beginning of the audit.

Researchable questions

Auditors may ask whether the government is

- implementing its policies related to oceans;
- implementing integrated management of marine and coastal areas using appropriate policy instruments and strategies;
- improving the conservation and sustainable use of biological diversity in international waters;
- regulating pollution of water from different sectors;
- regulating sewage discharge;
- establishing and maintaining marine and coastal protected areas that are effectively managed;
- assessing and fining illegal fisheries activities;
- preventing or minimizing the negative effects of exploitation by promoting the use of sustainable aquaculture techniques; and
- putting in place mechanisms to control all pathways, including shipping, trade, and aquaculture that may facilitate the invasion of alien species.

For more information, see WGEA document, *Auditing Water Issues: Experiences of Supreme Audit Institutions*, published in 2004, which contains audit case studies on marine environments.

Audit case studies

The following two audit case studies deal with the protection and rehabilitation of seas and with the implementation of a national ocean strategy.

SAI of Ukraine: Protection and rehabilitation of the Azov and Black seas

In 2003, the Accounting Chamber of Ukraine (ACU) audited the application of the National program on the environmental protection and rehabilitation of the Azov and Black Seas. The current level of contaminants in the Azov and Black Seas far exceeds the ability of ecosystems to assimilate them. The government of Ukraine signed and ratified seven international conventions, on the use and protection of biological resources, to facilitate international rehabilitation and protection activities in the Azov-Black Sea ecosystem.

Audit objective

Analyze the legality, efficiency, and suitability of allocating state funds to carry out obligations under the National Program of the Azov and Black Seas environmental protection and rehabilitation.

Scope

- Audited period: 2001 to 2002
- The actions of government and regional authorities in applying the National Program of Environment Protection and Rehabilitation of the Azov and Black Seas

Criteria

- Convention on the Black Sea protection from pollution
- Strategic Action Plan for the Black Sea Rehabilitation and Protection (approved by Bulgaria, Georgia, Romania, the Russian Federation, Turkey, and Ukraine)
- International treaties on biodiversity, the protection of wild flora and fauna, the protection, and use of cross-border waterways and international lakes

Findings

- A delay in adopting laws slowed the development of integrated environment management systems and limited the recreational potential of the coastal area. This caused an unfavorable investment climate for foreign investors.

- Funds were not used to meet the Program's objective and were inefficiently managed.
- Public funds were allocated for non-priority conservation programs, the mandates of which were not authorized by national ecology programs.

Recommendations

- Amend Ukraine's laws and finance the National Program under a separate budget line.
- Establish an interdepartmental commission, on environmental issues that affect the Azov and Black Seas, to coordinate the activities of central and local executive authorities.

SAI of Canada: Implementing a national oceans strategy

In 2005, the Office of the Auditor General (OAG) of Canada conducted a performance audit of how Fisheries and Oceans Canada (the Department) applied the 1996 *Oceans Act*.

The OAG Canada examined

- the Department's role in developing and implementing a national oceans strategy, oceans management plans and marine protected areas; and
- action taken on marine commitments made by the government and the Department.

Audit objective

Determine whether Fisheries and Oceans Canada

- is meeting its responsibilities set out in the *Oceans Act*, Part II, Oceans Management Strategy;
- is meeting its national and Canada's international oceans commitments;
- has carried out the management recommendations of the Standing Committee on Fisheries and Oceans, based on its review of the administration of the Act; and
- has appropriately measured and reported the performance and results of its ocean management activities.

Scope

- Audited period: September 2004 to June 2005
- Actions taken since the *Oceans Act* was passed in 1996 until June 2005
- The Department of Fisheries and Oceans Canada

Criteria

- 1996 *Oceans Act*
- Canada's Oceans Strategy
- Sustainable Development Strategy
- International ocean agreements
- Standing committee recommendations
- Performance reports

Findings

- After eight years, the *Oceans Act* had not resulted in better management of the oceans and their resources.
- Implementing the Act and the oceans strategy was not a government priority.
- No ocean management plans—the main tool of the Act to manage sustainable development of ocean industries and resolve conflicts between ocean users—had been finalized.
- Little progress had been made to establish marine protected areas—another important aspect of the Act and one of the primary means of protecting marine habitat and biodiversity.

- Parliament had not been given the financial and performance information it needs to hold the Department accountable for its responsibilities under the Act.
- The Department had not met its commitment to report periodically on the state of the oceans.

Recommendations

- Recognize and manage the Oceans Action Plan, in collaboration with participating departments, and lead and facilitate the development and implementation of action plans.
- Finalize its operational guidelines for integrated management planning, including marine protected areas.
- Plan and manage its resources so that commitments and targets will be met.
- Finalize and implement an accountability framework for its ocean management activities.
- Provide sufficient relevant and reliable financial and other performance information to Parliament so that it can be held accountable for its ocean management activities.
- Improve communications to the public, including periodic information on the state of the oceans.

Genetic resources

Background

It is estimated that 40 percent of the global economy is based on biological products and processes. The effective use of biodiversity at all levels—genes, species and ecosystems—is, therefore, necessary for sustainable development.

Genetic manipulation is not new. For centuries, farmers have relied on selective breeding and cross-fertilization to modify plants and animals and encourage desirable traits that improve food production. However, scientists' ability to alter life-forms has been revolutionized by the modern biotechnology that has emerged in the last few decades.

Because genetic resources are so much a part of agriculture, chemistry, medicine and many other areas, many issues must be addressed to guarantee sustainability and biodiversity conservation. The impact of biotechnology on biodiversity is not yet well known. Thus, governments need to apply the "precautionary principle" to deal with questions about genetic resources.

Bio-safety includes a variety of measures, policies, and procedures that minimize the risks biotechnology may pose to the environment and human health. It is critical to establish credible and effective safeguards for genetically modified organisms (GMOs), to maximize the benefits of biotechnology and minimize the risks. These safeguards must be introduced now, while biotechnology is still in its early days.

Another concern in genetic resources is the fair and equitable sharing of the benefits arising from their use. This includes the appropriate access to genetic resources and the appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies.

Some countries have legislation that controls access to genetic resources and a number of benefit-sharing arrangements. Some countries also maintain seed banks in response to the accelerating loss of genetic diversity in crops.

The audit topic of genetic resources is a new one for SAIs. However, because of their government's commitments in this area, many SAIs are starting to show an interest in auditing this topic. In particular, biopiracy could become an important area to audit for countries where high biodiversity occurs.

For more information on the issue, see the following sections under What is the scope of biodiversity and what are the main concerns, in Chapter 1:

- Genetics
- Species extinction

See also the following sections under What are the main threats to biodiversity, in Chapter 1:

- Biotechnology
- Biopiracy

Audit criteria

Convention on Biological Diversity (CBD). The CBD contains provisions to promote the conservation of genetic diversity and the fair and equitable sharing of benefits from the use of genetic resources. It also contains provisions on biotechnology. (see articles 1, 8, 15, 16, and 19—Appendix 4). Moreover, the parties to the CBD have set out specific 2010 biodiversity targets for genetic resources.

CBD 2010 Biodiversity Target

Goal 3: Promote the conservation of genetic diversity

Target: 3.1 Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.

Goal 9: Maintain socio-cultural diversity of indigenous and local communities.

Targets:

9.1 Protect traditional knowledge, innovations, and practices.
9.2 Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit sharing.

Goal 10: Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources.

Targets:

- **10.1** All transfers of genetic resources are in line with the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture and other applicable agreements.
- **10.2** Benefits arising from the commercial and other utilization of genetic resources shared with the countries providing such resources.

The Cartagena Protocol on Biosafety. The Conference of the Parties to the CBD adopted a supplementary agreement, the Cartagena Protocol on Biosafety, on 29 January 2000 in Montreal, Canada. The Protocol is the first legally binding international agreement governing the international movement of GMOs.

Exhibit 15: The Cartagena Protocol on Biosafety—at a glance

Date Signed: 29 January 2000

Date Coming into Force: 11 September 2003

Number of Parties: (in August 2007): 142

List of Parties: http://www.biodiv.org/world/parties.asp

Website: http://www.biodiv.org/biosafety/default.aspx

Goals and objectives:

Ensure that GMOs that have potentially adverse effects on conservation, on the sustainable use of biodiversity, or on human health are safely transferred, handled, and used.

Potential lines of enquiry:

- Exporters of GMOs must ensure that appropriate documentation accompanies all shipments.
- Governments must adopt measures to manage any risks identified by risk assessments and to monitor and control any future risks.
- The country considering importing a GMO is responsible for ensuring that a risk assessment is carried out.

More information about biotechnology can be found in *Biosafety and the Environment* (2003) published by the Secretariat of the CBD and the United Nations Environment Programme (UNEP) at http://www.biodiv.org/doc/press/presskits/bs/cpbs-unep-cbd-en.pdf.

Legislation, regulations, and policies. Biosafety encompasses a variety of measures, policies, and procedures that minimize the risks biotechnology may pose to the environment and human health. Countries with strong biotechnology industries have already introduced national legislation and risk-assessment systems. However, many developing countries are still drafting regulations.

It is critical to establish credible and effective safeguards for genetically modified organisms (GMOs) so that the benefits of biotechnology can be maximized and the risks can be minimized. International rules that deal with GMOs, as an internationally traded, global industry, have not yet been developed, neither has an international regime to promote and safeguard the fair and equitable sharing of the benefits of using genetic resources.

Programs. Auditors can look for a national biotechnology strategy. In addition, programs may exist on biotechnology and the protection of genetic resources, or more specifically, on the long term effects of GMOs on ecosystems.

Governments may also have programs on transfer of technology, exchange of information, and technical and scientific co-operation for the development of biotechnology.

Players

In some countries, there may be a Biotechnology Secretariat. There are also likely to be national research centres that play an important role in research.

Departments and ministries such as those from food agencies, agriculture, fisheries, foreign affairs, international trade, and customs may be involved.

Benefit-sharing arrangements for genetic resources may involve other players, such as local and indigenous communities, private companies, non-governmental organizations, and scientific research institutes.

Researchable questions

Auditors may ask the following:

- Is the government complying with the Cartagena Protocol?
- Does the government have a biotechnology strategy?
- Is the government developing legislation or other mechanisms to ensure that traditional knowledge, and its wider applications, is respected, preserved, and maintained?
- Does the government receive funds from international organizations to maintain genetic resources? If so, how were the funds spent?
- Is the government controlling illegal activities with the import of GMOs?

Audit case studies

The following two audit case studies deal with bio-prospecting and the protection of plant genetic resources.

SAI of Brazil: Intellectual property rights and domestic bio-prospecting

In 2006, the Brazilian Court of Audit carried out a performance audit to assess how the Federal Administration is ensuring intellectual property rights and encouraging domestic bio-prospecting.

Audit objectives

- Evaluate the tools used by the Federal Administration to minimize the illegal trade in specimens of Brazilian fauna and flora and their genetic material across the country's borders.
- Ensure that intellectual property rights were protected and respected.
- Assess the Administration's actions to encourage domestic bio-prospecting.

Scope

- Ministries of the Environment and of Agriculture, Livestock, and Supply
- Brazilian Institute for the Environment and Renewable Resources
- Federal police

Criteria

- National regulations.
- Convention on Biological Diversity.

Findings

- There was not enough equipment and personnel at land borders and airports to inspect the flow of genetic material.
- The procedures for handling and storing foreign cargo that may contain invading species—notably, the Asian beetles found in timber pallets—were inadequate.
- Biopiracy is not considered a crime under Brazil's laws; fines are not defined.
- The law that governs access to genetic material, its shipment, and the identification of its origin when used for commercial research was not enforced.

Recommendations

To the Ministry of Agriculture, Livestock and Supply:

Equip agriculture and livestock surveillance facilities with appropriate equipment to safely destroy seized materials that can host pests and disease-causing agents that pose risks to humans, agriculture, and livestock.

To the Ministry of Agriculture, Livestock and Supply and the Brazilian Airport Infrastructure Company:

Train staff responsible for handling cargo at airports in the correct procedures for handling pallets.

To the Brazilian Institute for the Environment and Renewable Resources:

Consider setting up inspection stations at airports where large exports of Brazilian fauna and flora specimens are known to occur, especially in the Amazon region.

To the Federal Police Department:

Carry out a feasibility study for setting up an automated system to exchange information among its units. The system would be used to combat environmental and other crimes and to train personnel.

To the Ministry of Environment:

- Set up a database on the quantity of genetic resources researched and products derived.
- Control access to genetic heritage and shipments, so public policies in this area can be more effectively enforced.

To the Ministry of Environment and the Ministry of Science and Technology:

Jointly consider releasing research funds only when the Genetic Heritage Management Council has granted its approval.

SAI of India: Conserving plant genetic resources in India

In 2004, the Office of the Comptroller and Auditor General of India audited the management of genetic resources in the country. The audit focused on conserving plant genetic resources and the bio-survey and agro-biodiversity activities of a premier national research and scientific institute, the National Bureau of Plant Genetic Resources (NBPGR).

The NBPGR was established to collect, introduce, evaluate, conserve, document, and exchange plant genetic resources. It is the scientific institute in India responsible for carrying out *ex-situ* conservation efforts related to plant and agro-biodiversity resources. It is also responsible for carrying out quarantine tests to ensure that imported and exported samples of plant germplasm (genetic material) are disease and pest free.

Audit objectives

Assess the effectiveness, efficiency, and adequacy of the NBPGR's efforts to perform its responsibilities. This includes assessing

- research activities from in-house and externally aided projects;
- efforts to conserve germplasm samples of agri-horticultural crops for up to 50 years, to store them for up to 25 years and to document the samples so they can be easily retrieved and used;
- efforts to quarantine and inspect all germplasm samples to detect insect pests, plant parasitic nematodes, and plant pathogens; and
- Germplasm Exchange's efforts to introduce, exchange, and distribute plant genetic resources for research, documentation, and dissemination of information.

Scope

- Audited period: 1997 to 2003
- Issues related to management of plant genetic resources by NBPGR

Criteria

- Administrative rules, regulations, and statutes related to the functioning of the institute
- Expert opinions
- Plants, Fruits and Seed Order (Regulation of import into India)

Findings

The NBPGR made poor progress in conducting explorations to collect samples of germplasm and did an inadequate job of conserving samples of exotic and indigenous germplasm.

In addition, the NBPGR did not

- grow or quarantine samples of germplasm in greenhouses;
- obtain appropriate information from private importers;
- fully observe quarantine regulations for plants, resulting in unauthorized imports of germplasm samples;
- use the National Containment Facility meant for processing transgenic samples of germplasm, conducting quarantine tests, and establishing a molecular biology laboratory; or
- allot National Identity Numbers to germplasm samples conserved in the National Gene Bank.

Responses from the NBPGR

The NBPGR agreed to

- intensify efforts to explore and collect germplasm samples in priority areas, such as crops of national importance, wild relatives of domestic crops, and endangered economic species;
- collect appropriate information from Indian importers (private firms) of germplasms and inspect their premises; and
- issue national identity numbers to germplasm samples after completing a physical verification at the National Gene Bank.

Forest resources

Background

Forests may be the richest of all terrestrial systems. Tropical, temperate, and boreal forests offer diverse habitats for plants, animals, and micro-organisms and hold the vast majority of the world's terrestrial species.

Forest biodiversity provides a wide array of goods and services, including timber and non-timber resources, and it helps to mitigate climate change. It also provides a livelihood for hundreds of millions of people worldwide and plays important economic, social, and cultural roles in the lives of many indigenous and local communities.

Forest biodiversity is being lost due to the rapid deforestation, fragmentation, and degradation of all forest types. According to the Food and Agriculture Organization of the United Nations, there has been an annual net loss of 9.4 million hectares since 1990, the majority of which was natural forest in the tropics. As these figures include the rate of reforestation, the reality may be a loss of 14 million hectares a year or more.

Human activity is the most important cause of the decline of forests and their biodiversity, including

- conversion of forests into agricultural land,
- overgrazing,
- unsustainable forest management,
- illegal logging,
- introduction of invasive alien species,
- infrastructure (roads, hydroelectric development, and urban sprawl),
- mining and oil exploitation,
- forest fires,
- pollution, and
- climate change.

Tree planting, landscape restoration, and the natural expansion of forests have significantly offset the loss of primary forest area. Because plantations and secondary forests have a much lower value of biodiversity than natural forests, efforts need to be focused on conserving natural forest areas, rather than replacing them with plantations.

Forestry is an important area for SAIs to audit, because most countries have legislation regarding forests.

Audit criteria

Convention on Biological Diversity (CBD). The CBD addresses forest biodiversity directly, through an expanded program of work that was adopted in 2002 by the Conference of the Parties at its sixth meeting. The program includes a broad set of goals, objectives, and activities aimed at

conserving forest biodiversity, the sustainable use of its components, and the fair and equitable distribution of benefits from forest genetic resources. The program consists of three elements:

- biophysical aspects, such as reducing threats through restoration, agro-forestry, managing watersheds, and establishing protected areas;
- an institutional and socio-economic environment that enables conservation and sustainable use of forest biodiversity; and
- assessment and monitoring.

Legislation, regulations, and policies. Legislation and regulations for forest practices are usually a good source of audit criteria. Auditors can look at the ways legislation is enforced and at existing policies on forestry. These policies will often include considerations for the sustainable use of forest resources that relate to biodiversity. In many countries, sustainable forest practices have become a rule to follow for forestry companies who want to sell their products nationally and internationally.

Programs. Governments usually have programs that deal with forest resources. For example, there may be specific programs on

- sustainable exploitation of timber resources,
- reforestation of degraded areas,
- creation and maintenance of protected areas,
- prevention and mitigation of invasive species,
- protection of endangered species in forest habitats, and
- public education on deforestation and burning.

Players

Countries usually have a forestry department or ministry or a natural resources department to deal with forest management. In addition, auditors could consult forestry organizations and pulp and paper companies to obtain views from the economic sector. Traditional communities that use forests resources for their survival are also key players in ensuring the preservation of forests habitats.

Researchable questions

Auditors may ask the following:

- Does the government have a forestry policy, does it address biodiversity issues, and is it being implemented?
- Does the government's national forest program help to protect biodiversity?

Auditors may also ask whether the government is

- enforcing its laws related to forestry;
- controlling illegal logging;
- reducing the threats to forest biodiversity;
- protecting, recovering, and restoring forest biodiversity;
- promoting the sustainable use of forest biodiversity;
- promoting sustainable forest practices;
- assessing forest biodiversity and increasing the knowledge of ecosystem functions; and
- undertaking assessment and monitoring.

Audit case studies

The following two audit case studies relate to forest management.

SAI of Ukraine: Management of forests

In 2004, the Accounting Chamber of Ukraine conducted a performance audit of the State Forestry Service, its territorial offices, and its regional administration to determine whether forests were being managed, especially at the deforestation stage, in an ecologically balanced manner.

Audit objectives

Identify

- management systems that provide guidance for an ecologically balanced use of forests in the Carpathian region (Western Ukraine); and
- the greatest effect of deforesting mature stands, and evaluate its ecological impact.

Scope

- Forestry management procedures in Ukraine
- The use of state funds for forestry management
- Legislation, state, and regional programs on forestry management, regulations, and other administrative documents connected with the participants' forest management activities

Criteria

- Forestry Code of Ukraine
- Land Code of Ukraine
- Ukraine's Law on environment protection

Findings

- Management of the Carpathian forest resources was inadequate and needed revision.
- The system lacked an efficient institutional management structure.
- The responsibilities of private landowners regarding reforestation, their care, and protection were not clearly defined.
- There was no national control over the use of forests or forestry activities.
- There was an inadequate charge mechanism for special exploration of the forest resources.
- The pricing of forest products is not nationally regulated, making the market in forest products volatile.

Recommendations

- Apply a comprehensive system of forestry management (planting, care, protection, and deforestation of mature stands).
- Sell timber from the region at state-run auctions.
- Create a state fund-in-trust for forestry management.
- Turn over the ecological control and full responsibility for managing the state forestry to external sources.

SAI of Brazil: Forest policy

In 2004, the Brazilian Court of Audit carried out a performance audit to assess the country's forest policy.

Audit Objective

Identify major problems and make recommendations to improve the management of the 36 federal and state conservation units in the Deforestation Arch area of the Legal Amazon Region.

Main environmental risk investigated

- Destruction and fragmentation of habitats
- Agriculture and the excessive conversion of land into pasture

Scope

The audit evaluated the activities of the Ministry of Environment, and its institutions, in the management of protected areas in the Legal Amazon Region.

Criteria

- National Policy of Environment
- National laws related to protected areas
- Expert opinions
- Standards of quality defined for the Brazilian public service.

Findings

Establishing conservation units did not prevent the overall deforestation of the Legal Amazon Region, because the units did not encourage the sustainable use of natural resources within them or sustainable activities in surrounding areas.

Recommendations

To the Ministry of Environment (MMA):

Draw up a national conservation unit plan that includes guidelines for the integrated management of conservation units and that defines common objectives, strategies, priorities, goals, and performance measurements.

To the Managing Council of the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA):

Set up a research centre to

- consolidate and make available the results of all research carried out in conservation units in a systematically documented, digital format; and
- with universities, map out the forest, fauna, water, and soil resources that are available in conservation units.

To the Secretariats of the MMA (Biodiversity and Forest, Amazon Coordination, and Sustainable Development secretariats):

Draw up a strategic and operational plan with IBAMA that encourages sustainable activities in areas surrounding conservation units and, if possible, in the conservation units themselves. The plan should include

- developing and providing training and extension courses in sustainable practices to communities in areas surrounding the conservation units on subjects, such as
  - sustainable forest management,
  - controlled slash-and-burn procedures,
  - soil conservation in agricultural practices, and
  - sustainable harvesting of natural resources;
- identifying, selecting, and cataloguing the sustainable practices that are being developed, under MMA programs, so they can be shared with the communities in these regions.

Mainstreaming biodiversity into economic sectors and development planning

Background

Slowing the loss of biodiversity can only be achieved by addressing the main drivers of change—by encouraging players in the main economic sectors to make changes that reduce the negative impact on biodiversity. Encouraging the principal players and recruiting allies as advocates make the public more aware of the issues. With this awareness, comes the increased political will and the additional resources need for change, both of which will help to integrate biodiversity concerns into various economic sectors.

Integrating biodiversity concerns into key economic sectors, such as food and agriculture, trade, energy, mining, and economic development is particularly important. The amount of energy used in these sectors contributes to the decline of biodiversity, through climate change, and it is becoming an increasingly significant cause of decline. Each sector of the economy has an impact on biodiversity.

In addition, there are important links between biodiversity and poverty reduction. Just as the loss of biodiversity and the degradation of ecosystem services could undermine millennium development goals, many actions that may be quickly implemented (to promote economic development and reduce poverty) could harm biodiversity, at least in the short term.

Given these complex interrelations, biodiversity must be considered in policies, plans, and programs for sustainable development and in trade discussions.

For more information on the issue, see the following sections under What are the main threats of biodiversity, in Chapter 1:

- Overexploitation of resources,
- Pollution and nutrient loading,
- Biotechnology,
- Agriculture and aquaculture methods, and
- Biopiracy.

Audit criteria

Legislation, regulations, and policies. It is unlikely that auditors will find specific legislation on this broad topic, which involves many players. However, countries may have specific legislation to regulate the environmental impact on specific sectors (for example, energy or petroleum exploitation), which may be a source of audit criteria. Policies to promote development and combat poverty as well as trade policies may be another source of criteria. For more information about legislation on environmental impact and strategic environmental assessments and about how they are integrated in different areas, see Step 2. Understanding the government's responses to these threats and the relevant players, in Chapter 2.

Sustainable development strategies could be also a good starting point to see how the environment and, more specifically, biodiversity are considered in the government's main activities.

For more information on this issue, see also the WGEA papers: *Sustainable Development: the Role of Supreme Audit Institutions* and the *World Summit on Sustainable Development: an Audit Guide for Supreme Audit Institutions* (see Appendix 1 for the list of documents produced by the WGEA).

Programs. Programs can be numerous, depending on the sectors. Auditors can consult colleagues who deal with a particular entity to find out which programs they should consider. Programs that deal with the use of natural resources, economic and social development, and infrastructure (for example, energy, water supply, and transport) all have a direct impact on biodiversity.

Players

The players are different form those discussed earlier because of the wide variety of economic sectors that a country may be active in. In addition to the common departments and ministries, auditors may consider agriculture, rural development, natural resources, energy, industry, economic development, foreign affairs, infrastructure and public works, municipal affairs, land use planning and urban development, and tourism. Because the private sector can mitigate the negative impact of its economic activities, it is also a key player.

Researchable questions

Auditors may ask the following:

- Are environment impact assessments conducted for major projects and do they integrate biodiversity considerations?
- Is land-use planning implemented and are biodiversity considerations integrated?
- Does policy development in different sectors integrate biodiversity considerations, through strategic environmental assessments?
- Is the government integrating biodiversity and environmental concerns into sectoral or cross-sectoral plans, programs, and policies in trade, economy, land use-planning, energy and any other activities that affect biodiversity (either directly or indirectly)?

Audit case studies

The following two audit case studies relate to applying the ecological damage principle to compensate for habitat destruction and the examining the impact of wind power on wildlife.

SAI of the Netherlands: Implementation of the ecological compensation principle

In 2006, the Netherlands Court of Audit audited the implementation of the ecological compensation principle.

Projects such as road construction or the creation of an industrial area can cause ecological damage. The ecological compensation principle is a way to compensate for ecological damage and to avoid or reduce the impact that these kinds of projects have on the environment.

Audit objective

Assess the authorities' efforts in the Netherlands to conserve nature areas, in order to advance sustainable spatial planning.

Scope

- The actions of the ministries of Spatial Planning, Nature, and Infrastructure to address
  - legal aspects of the ecological compensation principle,
  - communication with involved parties, and
  - assignment and fulfillment of responsibilities.
- The actions of local authorities and the private parties that cause ecological damage.

Criteria

- European legislation: the habitat and birds directives
- Dutch legislation on nature protection and spatial planning
- Netherlands Court of Audit standards on the quality of policy information and auditing policy processes

Findings

- Case studies show that the Nature Conservation Policy, as applied, inadequately ensures the conservation of nature areas.
- Ecological damage occurred when it could have been avoided.
- In many cases, necessary ecological compensation was not made.

Recommendations

- The ministries should improve the way they control the implementation and effectiveness of the policy of conservation of nature areas.
- The ministries should make information and training on the relevant laws and standards available, especially to those who must implement them (for example, municipal civil servants).

SAI of the United States: Wind power and protection of wildlife

In 2005, the Government Accountability Office (GAO) of the United States performed an audit entitled Wind Power: Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife. In response to concerns that wind power development was not adequately regulated to protect wildlife, the GAO evaluated the existing laws and regulations.

Audit objective

Assess

- studies and expert opinions on the impact of wind power facilities on wildlife in the United States and possible actions to reduce or prevent the impact; and
- the roles and responsibilities of government agencies in regulating wind power facilities and in protecting wildlife.

Scope

Federal and state laws and regulations related to wind power development and protection of wildlife.

Criteria

Laws, regulations, and expert opinions

Findings

- Wind power affected wildlife in some areas of the country. However, because the original population level of species was mostly unknown, it was difficult to determine whether the impact was serious.
- The development of wind power is regulated at the federal, state, and local levels. Since most development has taken place on non-federal land, it has been regulated by state or local agencies that vary in how they consider the potential impact on wildlife before allowing development.
- Some wildlife killed at wind power facilities was protected by federal laws, and action was taken at these facilities.
- No action was taken where species unprotected by federal law have been killed, although the federal government has issued draft guidelines to help agencies decide on appropriate locations for wind power facilities.

Recommendations

The Fish and Wildlife Service should provide state and local regulatory agencies with information on the

- potential impact on wildlife of wind power, and
- available resources to help them decide where wind power facilities should be approved

Appendix 1—WGEA resources for SAIs

All the documents referred to in this appendix are available at:
http://www.environmental-auditing.org

WGEA meetings and compendia themes

For the past several WGEA meetings, a call for papers has been issued to all SAIs prior to the meeting. From these papers, a compendium is compiled to facilitate information sharing. This list provides the themes of the papers for each year.

11th Meeting of the WGEA—Arusha, Tanzania (25 to 29 June 2007)

- Audits of Global and Regional Environmental Issues
- Audits of Domestic Environmental Issues
- Emerging Topics in Environmental Auditing
- Supreme Audit Institutions' Approaches to Building and Managing Environmental Auditing

10th Meeting of the WGEA—Moscow, Russian Federation (27 October to 1 November 2005)

- Auditing Biological Diversity
- Auditing Climate Change
- Increasing the Impact of Environmental Audits
- Environmental Auditing: Facing the Challenges

9th Meeting of the WGEA—Brasilia, Brazil (30 May to 2 June 2004)

- Environmental Auditing and Biological Diversity
- Concurrent, Joint or Co-ordinated Audits
- Environmental Audit and Regularity Auditing
- Environmental Auditing: Facing New Challenges
- Supreme Audit Institution Approaches to the World Summit on Sustainable Development

8th Meeting of the WGEA—Warsaw, Poland (24 to 27 June 2003)

- Environmental Audit and Regulatory Auditing
- Sustainable Development: The Role of Supreme Audit Institutions
- Water Issues, Policies, and the Role of Supreme Audit Institutions
- Towards Auditing Waste Management

WGEA studies and guidelines

- *Auditing Water Issues: Experiences of Supreme Audit Institutions* (2004)—English, French, German, Arabic
- *Auditing Biodiversity: Guidance for Supreme Audit Institutions* (2007)—English
- *Cooperation Between Supreme Audit Institutions: Tips and Examples for Cooperative Audits* (2007)—English

- *Environmental Audit & Regularity Auditing* (2004)—English, French, Spanish, German, Arabic
- *Evolution and Trends in Environmental Auditing* (2007)—English
- *Guidance on Conducting Audits of Activities with an Environmental Perspective* (2001)—English, French, Spanish, German, Arabic
- *How SAIs May Co-operate on the Audit of International Environmental Accords* (1998)—English, French, Spanish, German, Arabic
- *Sustainable Development: The Role of Supreme Audit Institutions* (2004)—English, French, Spanish, German, Arabic
- *Study on Natural Resource Accounting* (1998)—English, French, Spanish, German
- *The World Summit on Sustainable Development: An Audit Guide for Supreme Audit Institutions* (2007)—English
- *The Audit of International Environmental Accords* (2001)—English, Spanish
- *Towards Auditing Waste Management* (2004)—English, French, German, Arabic

Audits related to environment

Audits and audit summaries from SAIs are available on the WGEA website (in the section "Environmental Audits Worldwide"), listed by environmental issue and by country. Many are available only in their national language.

WGEA / IDI environmental auditing training program

In partnership with the INTOSAI Development Initiative, a two-week training course was created for SAIs. The course was designed by IDI training specialists, has a learner-centred participatory approach, and reflects regional needs. It includes a standardized design for course materials and detailed instructor manuals.

WGEA work plan summaries

2005–2007
Activities and projects focussed on providing guidance, facilitating information exchange and building relationships, and were organized under the following six goals:

1. To expand the number and breadth of environmental auditing tools available to SAIs.
2. To increase information exchange among SAIs and to expand their training in the techniques of environmental auditing.
3. To increase the number of concurrent, joint, or coordinated audits by SAIs.
4. To increase communication of WGEA activities.
5. To increase cooperation between the WGEA and other international organizations.
6. To explore the potential for external funding for the WGEA activities.

Biological diversity was the central theme.

2002–2004
Activities carried out included developing training materials and providing courses in environmental auditing, coordinating environmental audits with other Supreme Audit Institutions (SAIs) related to commitments under the World Summit on Sustainable Development, exchanging information with other SAIs, and preparing environmental auditing papers on such topics as water policy and waste management. Waste management was the central theme.

1999–2001
The “fresh water” theme, first adopted in 1995, continued to be a focus of the Working Group through this period. One of the key issues of this work plan was to emphasize cooperation with the INTOSAI regions in order to effectively cope with environmental issues that are transboundary in nature. Other activities included developing an inventory of international environmental accords and increasing the dissemination of information.

1996–1998
Two specific issues were addressed: audits or coordinated audits of international environmental accords and natural resource accounting. There was also a focus on institutional learning—facilitating the exchange of information and experience between audit institutions, and developing guidelines, methods, and techniques for environmental auditing. “Fresh water” was first chosen as a theme in an attempt to concentrate activities on an issue considered relevant for all countries in all stages of development.

Appendix 2—Regional Biodiversity Agreements

The following is a list of some biodiversity-related agreements by geographic region. These agreements may have a direct or indirect link with the protection of biodiversity. Information on these agreements can be found on the Web through a search engine.

Geographic region	Regional biodiversity agreements
Europe	• Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) • Kyiv Resolution on Biodiversity • Convention on Co-operation for the Protection and Sustainable Use of the Danube River (Danube River Protection Convention, also called the Sofia Convention) • Gothenburg Target of the European Union • Natura 2000 European Union countries adopted legislation to protect habitats and species: the Habitats Directive complements the Birds Directive and calls for the creation of a network of sites called Natura 2000. Signatories are to establish Special Protection Areas (SPC) for birds and Special Areas of Conservation (SAC).
Africa	• African Convention on the Conservation of Nature and Natural Resources • Lusaka Agreement on Cooperative Enforcement Operation Directed at Illegal Trade in Wild Fauna and Flora—for Eastern, Central and Southern African countries • Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region • African Eurasian Waterbird Agreement (with Europe) • Convention for the Protection, Management, and Development of the Marine and Coastal Environment of the East African Region • Convention on Lake Victoria Fisheries Organization
Asia	• Agreement for the Establishment of the Near East Plant Protection Organization • Convention on the Protection of the Black Sea against Pollution • Plant Protection Agreement for the Asia and Pacific Region • Regional Convention for the Conservation of the Red Sea and of the Gulf of Aden Environment • Framework Convention for the Protection of the Marine Environment of the Caspian Sea • Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin

Geographic region	Regional biodiversity agreements
South Pacific Islands	• Convention for the Protection of the Natural Resources and Environment of the South Pacific Region and Related Protocols (SPREP Convention) • Framework Agreement for the Conservation of Living Marine Resources on the High Seas of the South Pacific (The Galapagos Agreement) • ASEAN Agreement on the Conservation of Nature and Natural Resources • Convention on the Conservation of Nature in the South Pacific • Plant Protection Agreement for the Asia and Pacific Region • Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
South and Central America	• Regional Convention for the Management and Conservation of the Natural Forest Ecosystems and the Development of Forest Plantations • The Convention for Cooperation in the Protection and Sustainable Development of the Marine and Coastal Environment of the Northeast Pacific (Antigua Convention) • Agreements on the Exploitation and Conservation of the Maritime Resources of the South Pacific • Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the South-East Pacific • Convention for the Conservation of the Biodiversity and the Protection of Wilderness Areas in Central America • Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific • Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere • Inter-American Convention for the Protection and Conservation of Sea Turtles • Treaty for Amazonian Cooperation
Caribbean	• 1999 Protocol Concerning Pollution from Land-Based Sources and Activities to the 1983 Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region • Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region • Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention)

Appendix 3—List of Audits of Biodiversity Conducted by SAIs

Most of the audits listed in this appendix were provided to the authors of this paper, through a questionnaire that was sent to the SAIs. All the case studies in the Chapter 3 are listed in the following table, along with any available Web links to these audits or their summaries.

Please note that the links to these audits are only listed if they are available in English. Other audits may be available, in other languages, on each SAI's individual website.

For a more comprehensive list of audits of biodiversity produced by SAIs, go to the WGEA website at: http://www.environmental-auditing.org/.

Country	Year	Audit title	Website link (where available)
National Strategy on Biodiversity			
Canada	2004	International Environmental Agreements CESD—Chapter 1	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng04ar_ft_cesdch1agreements.pdf/$file/caeng04ar_ft_cesdch1agreements.pdf
Canada	2005	Canadian Biodiversity Strategy: A Follow-Up Audit CESD—Chapter 3	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng05ar_ft_cesdch3biodiversity.pdf/$file/caeng05ar_ft_cesdch3biodiversity.pdf
Iceland	2005	The Convention on Biological Diversity—Environmental Audit	http://www.rikisendurskodun.is/index.php?module=news&action=show&news_id=34&highlight=biological&language=en
Norway	2005–06	The Office of the Auditor General's Investigation of the Authorities' Efforts to Survey and Monitor Biological Diversity and to Manage Protected Areas	http://www.riksrevisjonen.no/NR/rdonlyres/FFBB1A9B-6063-42E8-9574-5BE9755123E4/0/Eng_Doc_3_12_2005_2006.pdf
Poland	2003	Implementation of the Rio de Janeiro Convention on Biodiversity	

Country	Year	Audit title	Website link (where available)
Protected Areas			
Austria	2004	National Park in the Alluvial Forest of Danube River	
Canada	2005	Ecological Integrity in Canada's National Parks CESD—Chapter 2	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng05ar_ft_cesdch2eco%20integrity.pdf/$file/caeng05ar_ft_cesdch2eco%20integrity.pdf
China	2004	Auditing Investigations Over the Administration and Management of Two Nature Reserves	
Czech Republic	2001	State Budget Funds Earmarked for the Purpose- Environmental Protection	
Mongolia	2004	Network of Special Protected Areas and Effectiveness of Management	
Netherlands	2006	National Ecological Network	
Poland	2000	Functioning of National Parks	
Poland	2002	Functioning of Landscape Parks	
Poland	2005	The Actions Taken by National Parks for Preservation, Sustainable Use and Reconstruction of Natural Resources	
Slovakia	2005	Management of the State Budgetary and Property in Administration of National Parks	
Endangered Species			
Canada	2001	A Legacy worth Protecting: Charting a Sustainable Course in the Great Lakes—St. Lawrence River Basin. Section 5: Species and Spaces at Risk in the Great Lakes St. Lawrence River Basin CESD—Chapter 1	http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c101sec5e.html/$file/c101sec5e.pdf
Paraguay	2003	Authorization to Harvest Wild Fauna Species	
Poland	1999	Animal Protection	http://eurosai.nik.gov.pl/en/site/px_Animal_Protection_Poland.pdf

Country	Year	Audit title	Website link (where available)
Poland	2002	Implementation of Regulations on Animal Protection with a Special Regard to Animal Transportation	
United States	2002	Endangered Species. Research Strategy and Long-Term Monitoring Needed for the Mojave Desert Tortoise Recovery Program	http://www.gao.gov/new.items/d0323.pdf
United States	2002	Endangered Species Program: Information on How Funds Are Allocated and What Activities Are Emphasized	http://www.gao.gov/new.items/d02581.pdf
United States	2003	Endangered Species. Fish and Wildlife Service Uses Best Available Science to Make Listing Decisions, but Additional Guidance Needed for Critical Habitat Designations	http://www.gao.gov/new.items/d03803.pdf
United States	2004	Endangered Species. More Federal Management Attention Is Needed to Improve the Consultation Process	http://www.gao.gov/new.items/d0493.pdf
United States	2005	Endangered Species. Fish and Wildlife Service Generally Focuses Recovery Funding on High-Priority Species, but Needs to Periodically Assess Its Funding Decisions	http://www.gao.gov/new.items/d05211.pdf
Invasive Species			
Canada	2002	Invasive Species CESD—Chapter 4	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng02ar_ft_c4species.pdf/$file/caeng02ar_ft_c4species.pdf
United Kingdom	2003	Protecting England and Wales from Plant Pests and Diseases	http://www.nao.org.uk/publications/nao_reports/02-03/02031186.pdf
United States	2002	Invasive Species. Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem	http://www.gao.gov/new.items/d031.pdf
United States	2003	Invasive Species. State and other Nonfederal Perspectives on Challenges to Managing the Problem	http://www.gao.gov/new.items/d031089r.pdf
United States	2005	Invasive Species. Cooperation and Coordination Are Important for Effective Management of Invasive Weeds	http://www.gao.gov/new.items/d05185.pdf

Country	Year	Audit title	Website link (where available)
United States	2005	Invasive Species. Progress and Challenges in Preventing Introduction into U.S. Waters Via the Ballast Water in Ships	http://www.gao.gov/new.items/d051026t.pdf
Freshwater Habitats and their Resources			
Austria	2005	Measures and Programmes Concerning Nature Protection and Biodiversity in the Thaya River Basin	http://eurosai.nik.gov.pl/en/site/px_Thaya_biodiv_A.pdf
Austria and Czech Republic	2004	Coordinated Audits of Implementation of Tasks Related to Environmental Projects and Measures in the Thaya River Basin	http://www.nku.cz/publications/en/thaya_river_basin_2005.pdf
Botswana	2005	Auditing Fishing Industry in Botswana	
Canada	2001	CESD—Chapter 1—A Legacy Worth Protecting: Charting a Sustainable Course in the Great Lakes and St. Lawrence River Basin. Section 6: Fisheries	http://www.oag-bvg.gc.ca/domino/rapports.nsf/html/c101sec6f.html/$file/c101sec6f.pdf
Czech Republic	2004	Ecological Projects and Measures in the Thaya (Dyje) River Basin Financed by State Funds and Funds Provided to CR from Abroad	http://www.nku.cz/scripts/detail.asp?id=868
Czech Republic	2004	Funds spent on the River Systems Revitalisation Programme	http://www.nku.cz/scripts/detail.asp?id=869
Romania	2002	Report on Compliance by Romanian Government with Provisions of Convention on Cooperation and Sustainable use of the Danube River (Sofia Convention)	http://eurosai.nik.gov.pl/en/site/px_Danube_river_Romania.pdf
Wetlands			
Austria	2002	Implementation of the Ramsar Convention in Austria	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/ateng03ar_sm_ramsar.pdf/$file/ateng03ar_sm_ramsar.pdf
Austria and Hungary	2003	Audit on the Protection of Nature in Region Lake Neusiedl/Fertő	http://eurosai.nik.gov.pl/en/site/px_Neusiedl_Austria_Hungary.pdf
Netherlands	1999	Compliance with International Agreements on Wetlands	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/nleng99ar_sm_wetlands.pdf/$file/nleng99ar_sm_wetlands.pdf

Country	Year	Audit title	Website link (where available)
Switzerland	2004	Examination of the Normative Implementation of the Ramsar Convention on Wetlands, especially as a habitat for water birds and wading birds of international importance, and its implementation in the region around Lake Constance	http://www.sfao.admin.ch/pdf/ZF_e_Ramsar.pdf
Marine Habitats and their Resources			
Canada	2000	The Effects of Salmon Farming in British Columbia on the Management of Wild Salmon Stocks OAG—December—Chapter 30	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng00ar_ft_salmon.pdf/$file/caeng00ar_ft_salmon.pdf
Canada	2004	Fisheries and Oceans Canada - Salmon Stocks, Habitat, and Aquaculture CESD—Chapter 5	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng04ar_ft_cesdch5fisheries.pdf/$file/caeng04ar_ft_cesdch5fisheries.pdf
Canada	2005	Fisheries and Oceans Canada - Canada's Oceans Management Strategy CESD—Chapter 1	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/caeng05ar_ft_cesdch1fish.pdf/$file/caeng05ar_ft_cesdch1fish.pdf
Netherlands	2000	The Deepening of the Western Scheldt Channel	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/nleng00ar_sm_deepwestscheldt.pdf/$file/nleng00ar_sm_deepwestscheldt.pdf
Russian Federation / Korea	2002	Audit of Use of Water Biological Resources Catch Quota in the Exclusive Economic Zone of the Russian Federation	
Ukraine	2003	Audit of Handling of Budgetary Funds Assigned for the State Program on Protection and Recreation of Azov and Black Seas' Environment During 2001–2002	http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainer2/ukeng03ar_sm_azovblacksea.pdf/$file/ukeng03ar_sm_azovblacksea.pdf
Genetic Resources			
Brazil	2005	Government Actions to Protect Biodiversity	
Canada	2000	Working Together in the Federal Government (Biosafety Protocol and Biotechnology Strategy) CESD—Chapter 6	http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c006ce.html/$file/c006ce.pdf

Country	Year	Audit title	Website link (where available)
Canada	2004	Canadian Food Inspection Agency—Regulation of Plants with Novel Traits OAG—March—Chapter 4	http://www.oag-bvg.gc.ca/domino/reports.nsf/html/20040304ce.html/$file/20040304ce.pdf
India	2002–03	The audit of National Bureau of Plant Genetic Resources	
New Zealand	2002	Ministry of Agriculture and Forestry: Management of Biosecurity Risks & Management of Biosecurity Risks: Case Studies	http://www.oag.govt.nz/2002/biosecurity/
New Zealand	2006	Ministry of Agriculture and Forestry: Managing Biosecurity Risks Associated with High-risk Sea Containers	http://www.oag.govt.nz/2006/maf/
Forests Resources			
Netherlands	2000	Supervision of the State Forest Service	http://www.rekenkamer.nl/cgi-bin/as.cgi/0282000/c/start/file=/9282400/modulesf/g02lrziy
Ukraine	2004	Audit of the Forest Resources Management Efficiency in the Carpathian Region of Ukraine	
Mainstreaming Biodiversity into Economic Sectors and Development Planning			
Brazil	2003	Impacts of Highways on Environment	
Brazil	2004	Impacts of Agriculture on Environment—Destruction of Forests	
Netherlands	2006	Implementing the Ecological Compensation Principle	
United States	2005	Wind Power. Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife	http://www.gao.gov/new.items/d05906.pdf

Appendix 4—Convention on Biological Diversity: Selected Articles

Below are some important articles of the CBD that are referred in the document. The full text of the CBD can be found at: http://www.biodiv.org/doc/legal/cbd-un-en.pdf

Article 1. Objectives

The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

Article 3. Principle

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Article 8. In-situ Conservation

Each Contracting Party shall, as far as possible and as appropriate:

(a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;

(b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;

(c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;

(d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;

(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;

(f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies;

(g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;

(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species;

(i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;

(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;

(k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;

(l) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and

(m) Cooperate in providing financial and other support for in-situ conservation outlined in subparagraphs (a) to (l) above, particularly to developing countries.

Article 12. Research and Training

The Contracting Parties, taking into account the special needs of developing countries, shall:

(a) Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components and provide support for such education and training for the specific needs of developing countries;

(b) Promote and encourage research which contributes to the conservation and sustainable use of biological diversity, particularly in developing countries, inter alia, in accordance with decisions of the Conference of the Parties taken in consequence of recommendations of the Subsidiary Body on Scientific, Technical and Technological Advice; and

c) In keeping with the provisions of Articles 16, 18 and 20, promote and cooperate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources.

Article 13. Public Education and Awareness

The Contracting Parties shall:

(a) Promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes; and

(b) Cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programmes, with respect to conservation and sustainable use of biological diversity.

Article 14. Impact Assessment and Minimizing Adverse Impacts

1. Each Contracting Party, as far as possible and as appropriate, shall:

   (a) Introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures;

   (b) Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;

   (c) Promote, on the basis of reciprocity, notification, exchange of information and consultation on activities under their jurisdiction or control which are likely to significantly affect adversely the biological diversity of other States or areas beyond the limits of national jurisdiction, by encouraging the conclusion of bilateral, regional or multilateral arrangements, as appropriate;

   (d) In the case of imminent or grave danger or damage, originating under its jurisdiction or control, to biological diversity within the area under jurisdiction of other States or in areas beyond the limits of national jurisdiction, notify immediately the potentially affected States of such danger or damage, as well as initiate action to prevent or minimize such danger or damage; and

   (e) Promote national arrangements for emergency responses to activities or events, whether caused naturally or otherwise, which present a grave and imminent danger to biological diversity and encourage international cooperation to supplement such national efforts and, where appropriate and agreed by the States or regional economic integration organizations concerned, to establish joint contingency plans.

2. The Conference of the Parties shall examine, on the basis of studies to be carried out, the issue of liability and redress, including restoration and compensation, for damage to biological diversity, except where such liability is a purely internal matter.

Article 15. Access to Genetic Resources

1. Recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.

2. Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention.

3. For the purpose of this Convention, the genetic resources being provided by a Contracting Party, as referred to in this Article and

   Articles 16 and 19 are only those that are provided by Contracting Parties that are countries of origin of such resources or by the Parties that have acquired the genetic resources in accordance with this Convention.

4. Access, where granted, shall be on mutually agreed terms and subject to the provisions of this Article.

5. Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party.

6. Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties.

7. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, and in accordance with Articles 16 and 19 and, where necessary, through the financial mechanism established by Articles 20 and 21 with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.

Article 16. Access to and Transfer of Technology

1. Each Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention, undertakes subject to the provisions of this Article to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.

2. Access to and transfer of technology referred to in paragraph 1 above to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed, and, where

necessary, in accordance with the financial mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. The application of this paragraph shall be consistent with paragraphs 3, 4 and 5 below.

3. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that Contracting Parties, in particular those that are developing countries, which provide genetic resources are provided access to and transfer of technology which makes use of those resources, on mutually agreed terms, including technology protected by patents and other intellectual property rights, where necessary, through the provisions of Articles 20 and 21 and in accordance with international law and consistent with paragraphs 4 and 5 below.

4. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that the private sector facilitates access to, joint development and transfer of technology referred to in paragraph 1 above for the benefit of both governmental institutions and the private sector of developing countries and in this regard shall abide by the obligations included in paragraphs 1, 2 and 3 above.

5. The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.

Article 19. Handling of Biotechnology and Distribution of its Benefits

1. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, to provide for the effective participation in biotechnological research activities by those Contracting Parties, especially developing countries, which provide the genetic resources for such research, and where feasible in such Contracting Parties.

2. Each Contracting Party shall take all practicable measures to promote and advance priority access on a fair and equitable basis by Contracting Parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting Parties. Such access shall be on mutually agreed terms.

3. The Parties shall consider the need for and modalities of a protocol setting out appropriate procedures, including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity.

4. Each Contracting Party shall, directly or by requiring any natural or legal person under its jurisdiction providing the organisms referred to in paragraph 3 above, provide any available information about the use and safety regulations required by that Contracting

Party in handling such organisms, as well as any available information on the potential adverse impact of the specific organisms concerned to the Contracting Party into which those organisms are to be introduced.

Article 26. Reports

Each Contracting Party shall, at intervals to be determined by the Conference of the Parties, present to the Conference of the Parties, reports on measures which it has taken for the implementation of the provisions of this Convention and their effectiveness in meeting the objectives of this Convention.

Glossary

audit objective	A precise statement of what the audit intends to accomplish and/or the question the audit will answer. This may include financial, regularity or performance issues.
audit scope	The framework or limits and subjects of the audit.
audit criteria	Criteria are benchmarks against which the subject matter can be assessed.
biodiversity	"The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems." The definition covers plants, animals, humans and micro-organisms, their genes, and the systems they inhabit.
biodiversity hotspot	Area that harbours a great diversity of **endemic species** and, at the same time, have been significantly impacted and altered by human activities. To be declared a hotspot, the area must have lost 70 percent of more of its original habitat.
compliance audit	With regard to environmental issues, may relate to providing assurance that governmental activities are conducted in accordance with relevant environmental laws, standards and policies, both at national and international (where relevant) levels. See also **regularity audit**.
Convention on Biological Diversity	Signed at the 1992 Earth Summit and ratified by 190 countries as of 2007, this convention obliges countries to protect plant and animal species through habitat preservation and other means. Protection of endangered species is also enforced through CITES—the 1973 Convention on International Trade in Endangered Species.
coordinated audit	Any form of co-operation between **joint** and **concurrent** audits. This can be either a joint audit with separate reports or a concurrent audit with a single, international audit report in addition to separate national reports.
concurrent audit	An audit conducted more or less simultaneously by two or more SAIs, but with a separate audit team from each SAI reporting only to its own legislature or government and on only the observations and/or conclusions pertaining to its own country.
desertification	Land degradation in arid, semi-arid and dry sub-humid areas brought about by factors such as climatic variations and human activities.

Earth Summit	UN Conference on the Environment and Development (UNCED) held in Rio de Janeiro in 1992. This conference was a major milestone in a global effort to deal with global environmental problems: 105 countries endorsed the Rio Declaration.
ecosystem	A dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit.
ecological integrity	The ability of an ecosystem to function healthily and continue to provide natural goods and services and maintain biodiversity.
endemic	A species or higher taxonomic unit found only within a specific area.
environmental audit	Audit by a SAI of an environmental subject, for example environmental policies or programs, environmental aspects of other government policies and public money related to environmental measures. Environmental auditing can encompass all types of audit: **financial, compliance, and performance** audits.
eutrophication	The increase in additions of nutrients to freshwater or marine systems, which leads to increases in plant growth and often to undesirable changes in ecosystem structure and function. Eutrophication is often a result of **nutrient loading.**
ex-situ conservation	The conservation of components of biological diversity outside their natural habitats, often in such institutions as zoos, museums, botanical gardens, aquariums and gene banks.
extinction	Disappearance of a taxonomic group of organisms from existence in all regions.
financial audit	The audit of financial statements allows the auditor to express an opinion on whether financial statements are prepared, in all material respects, in accordance with an identified financial reporting framework. See also **regularity audit.**
game animals	Wild animals, birds or fish hunted for food or sport.
genetics	The chromosomes, genes and deoxyribonucleic acid (DNA) that determine the uniqueness of each individual and species. Also used to denote the scientific study of heredity.
habitat	The environment in which an animal or plant lives, generally defined in terms of vegetation and physical features.

in-situ conservation	The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.
invasive species	Organisms that enter an ecosystem in which they are not naturally known to exist—through deliberate or inadvertent actions by humans—and thereby pose a threat to native species. Invasive species are also known as alien or exotic species.
IUCN	International Union for Conservation of Nature and Natural Resources. See **World Conservation Union**
joint audit	Audit conducted by one audit team composed of auditors from two or more SAIs, who prepare a single audit report for publishing in all participating countries.
List of Wetlands of International Importance	Each signatory to the Ramsar Convention is obliged to select at least one wetland site for inclusion in the List, in accordance with the Criteria for Identifying Wetlands of International Importance delineated by the Convention.
living modified organism	Any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology.
Millennium Development Goals	In September 2000, 191 countries adopted the United Nations Millennium Declaration that led to the Millennium Development Goals (MDGs). The MDGs are a set of specific targets for poverty reduction, health, education, gender equality, environmental sustainability and global partnerships to be reached by 2015.
nutrient loading	Excess nutrients such as nitrogen and phosphorus compounds come mainly from municipal sewage and farm runoff containing fertilizers and animal waste. When these nutrients are introduced to lakes, rivers, and marine environments, they can cause **eutrophication**.
performance audit	An audit of the economy, efficiency and effectiveness with which the audited entity uses its resources in carrying out its responsibilities.
Ramsar List	See **List of Wetlands of International Importance**

regularity audit	Attestation of financial accountability of accountable entities, involving examination and evaluation of financial records and expression of opinions on financial statements; attestation of financial accountability of the government administration as a whole; audit of financial systems and transactions, including an evaluation of compliance with applicable statutes and regulations; audit of internal control and internal audit functions; audit of the probity and propriety of administrative decisions taken within the audited entity; and reporting of any other matters arising from or relating to the audit that the SAI considers should be disclosed.
resilient (resilience)	The capacity of an ecosystem to return to its original stage after modification or disturbance.
species	A group of organisms capable of interbreeding freely with each other but not with members of other species.
sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
sustainable use of biodiversity	The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs of present and future generations.
wetland	Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by shallow water. Note that the Ramsar Convention on Wetlands; see the box on the Ramsar Convention under section 3.3 of this document.
World Conservation Union	The World Conservation Union (IUCN) is the world's largest conservation network. The Union brings together 82 States, 111 government agencies, more than 800 non-governmental organizations (NGOs), and some 10,000 scientists and experts from 181 countries in a unique worldwide partnership. The Union's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. The IUCN also publishes a 'Red List' of species threatened with extinction worldwide.
World Heritage List	A list of sites selected by the World Heritage Centre, a branch of United Nations Educational, Scientific and Cultural Organization, forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding universal value.

Bibliography

Convention on Biological Diversity (1992), (http://www.biodiv.org)

Costas, C., Hillel, O., Matus, S., Sweeting, J., *Tourism and Biodiversity: Mapping Tourism's Global Footprint*, 53 pages, (http://www.unep.org/PDF/Tourism-and-biodiversity.pdf), 2003

Intergovernmental Panel on Climate Change—IPCC *Climate Change 2007: The Physical Science Basis. Summary for Policymakers*, *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 18 pages, (http://www.ipcc.ch/SPM2feb07.pdf), 2007

INTOSAI Working Group on Environmental Auditing (2004): *Results of the Fourth Survey on Environmental Auditing*, 26 pages, (http://www.environmental-auditing.org/intosai/wgea.nsf/viewContainerPub/fourth_survey_environmental_auditing.pdf/$file/fourth_survey_environmental_auditing.pdf), 2003

Millennium Ecosystem Assessment *Ecosystems and Human Well-being: Synthesis*, Island Press, Washington DC, 137 pages, (http://www.maweb.org/documents/document.356.aspx.pdf), 2005

Millennium Ecosystem Assessment *Ecosystems and Human Well-being: Biodiversity Synthesis*, World Resources Institute, Washington DC, 86 pages. (http://www.maweb.org/documents/document.354.aspx.pdf), 2005

Millennium Ecosystem Assessment (2005): *Ecosystems and Human Well-being: Wetlands and Water—Synthesis*, World Resources Institute, Washington DC, 68 pages, (http://www.maweb.org/documents/document.358.aspx.pdf)

Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Desertification Synthesis*, World Resources Institute, Washington DC, 26 pages, (http://www.maweb.org/documents/document.355.aspx.pdf), 2005

Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Volume 1—Current State and Trends: Findings of the Condition and Trends Working Group*, Edited by Rashid Hassan, Robert Scholes, Neville Ash, Island Press, Washington, DC, 917 pages, (http://www.maweb.org/en/Condition.aspx), 2005

Mulongoy, K.J., Chape, S.P. (Eds), *Protected Areas and Biodiversity Report—An Overview of Key Issues*, 52 pages, (http://quin.unep-wcmc.org/resources/publications/pa_biodiv/), 2004

Secretariat of the Convention on Biological Diversity, *Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that Threaten Ecosystems, Habitats or Species*, (http://www.biodiv.org/programmes/cross-cutting/alien/decision-v8.shtml?dec=VI/23&menu=cross-cutting&filter=alien), 2002

Secretariat of the Convention on Biological Diversity, *Global Biodiversity Outlook 2*, Montreal, 81+vii pages, (http://www.biodiv.org/gbo2/default.shtml), 2006

Secretariat of the Convention on Biodiversity and United Nations Environmental Programme, *Biosafety and the Environment: An Introduction to the Cartagena Protocol on Biosafety*, 20 pages, (http://www.biodiv.org/doc/press/presskits/bs/cpbs-unep-cbd-en.pdf), 2003

United Nations Environment Programme, *Global Environmental Outlook-3 (GEO-3)*, 416 pages, (http://www.unep.org/Geo/geo3/), 2002

United Nations Environmental Programme, *Global Environmental Outlook (GEO) Yearbook 2006*, 100 pages, (http://www.unep.org/geo/yearbook/yb2006/), 2006

United Nations Environment Programme and the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals, *Migratory Species and Climate Change: Impacts of a Changing Environment on Wild Animals*, Bonn, Germany, 68 pages, (http://www.cms.int/publications/pdf/CMS_CimateChange.pdf), 2006

World Conservation Union (IUCN), *Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species*, (http://www.iucn.org/themes/ssc/publications/policy/invasivesEng.htm), 2000