Biodiversity is Life

Educational Manual

A guide for zoo and aquarium educators, teachers and environmentalists.
A resource about biodiversity in support of the International Year of Biodiversity, 2010 and beyond.

World Association of Zoos and Aquariums
WAZA | *United for Conservation*

2010 International Year of Biodiversity

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Biodiversity is life.
Educational manual

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Introduction

Biodiversity is life. This three-word phrase is the slogan of the International Year of Biodiversity (IYB), a celebration, reflection and call-to-action for the sustainable future of life on Earth.

Zoos and aquariums are all about biodiversity. Everything we do comes back to biodiversity. We show it, we study it, we save it. Over 600 million people visit annually one of the 1300-plus zoos and aquariums that exist worldwide. Many of these living collections are affiliated to the World Association of Zoos and Aquariums (WAZA) who has commissioned this resource guide through its 'education arm', the International Association of Zoo Educators (IZE).

Our audiences are almost as diverse as biodiversity itself. Zoo and aquarium visitors represent a broader cross-section of local, national and regional societies than, arguably, any comparable institution. There appears to be a basic need of humans to connect with nature – with biodiversity.

As such, zoos and aquariums, both individually and collectively, represent an amazing force for inspiring people, for catalysing attitudes and behaviours in support of biodiversity conservation.

Collectively, zoos and aquariums also represent an untapped delivery mechanism for countries to fulfil some of their obligations to the Convention on Biological Diversity (CBD).

About this resource

Many zoos and aquariums will undertake events and actions in 2010 in support of the International Year of Biodiversity (IYB). These may range from formal education and public awareness programmes to full-blooded festivals and major exhibit developments.

This resource will help zoo and aquarium educators, interpreters, marketers and managers to:

- Adopt and adapt key IYB messages.
- Transmit messages to various zoo and aquarium audiences and between zoo and aquarium networks.
- Highlight zoo- and aquarium-based success stories and related biodiversity education materials.
- Offer a navigation tool to a wealth of biodiversity resources and information available (mostly) free on the internet.

A massive amount of material about biodiversity is available on the internet – it would be impossible to cite it all. There is no point in repeating material for its own sake. We hope that zoo and aquarium professionals will use the resource as a portal to ever-changing directories and web sites of the most interesting and up-to-date content.

We hope also that your efforts in 2010 have a degree of permanence that continues well beyond the year.

Here is the info. Here are the tools. Here are the ideas. Please feel free to add content to this resource. We – and the world zoo and aquarium community – would love to know what you are doing.

2010 International Year of Biodiversity

Convention on Biological Diversity

World Association of Zoos and Aquariums
WAZA | *United for Conservation*

IZE
International Zoo Educators Association

The International Year of Biodiversity (IYB)

The United Nations General Assembly has designated 2010 as the International Year of Biodiversity (IYB). A global target to significantly reduce the rate of loss of biodiversity by 2010 was agreed by nearly 200 countries back in 2002. The next conference of the Convention of Biological Diversity (CBD) in Nagoya, Japan, in October 2010, will assess international progress towards this target.

As part of the IYB, the CBD, based in Montreal, Canada, has called for countries around the world to raise the profile of the year by encouraging diverse organisations to engage with the issues and celebrate the importance of biological resources.

The key messages of IYB are:

- Biodiversity is important for human well-being and well as preserving the quality of the environment.
- The current rate of global biodiversity loss is severe – by some accounts up to 100 times the natural rate of extinction, and we need to work together to halt this loss.
- There are many 'success stories' that point the way to the future.

Life in harmony, into the future
いのちの共生を、未来へ
COP 10 / MOP 5

Resources

www.cbd.int/2010 | Convention of Biological Diversity (CBD). Outlines the tenets of the Convention and has many useful pages of information detailing the issues, problems, solutions of biodiversity from islands to invasive species, and coasts to climate change.

www.countdown2010.net | Countdown 2010. A network of partners working towards 2010 targets to significantly reduce the rate of biodiversity loss. An initiative of the International Union for Conservation of Nature (IUCN).

www.countdown2010.net/byse | the Biodiversity Year Schedule of Events 2010 is a calendar of events undertaken by museums, zoos, science centres, research institutions, local and national government, NGOs and business. It's the place to search for events worldwide and to add your own events.

www.waza.org/files/webcontent/ppts/2010%20IYB.ppt | A CBD PowerPoint outlining the basic elements of IYB.

www.iucn.org | IUCN is the oldest and largest global environmental network with 1,000 government and non government organisation (NGO) members together with 11,000 volunteer scientists in 160 countries, and 1,000 professional staff in 60 offices worldwide. The website has details of members, Commissions, programmes and publications. Is your zoo or zoo network a member?

www.iyb-uk.net | A network of UK partners from many sectors (scientific, cultural, educational, political, tourism etc) that are working together to promote IYB. This is supported by the UK Government and facilitated by a Secretariat based at London's Natural History Museum. It will feature reports of partner activities as well as general biodiversity information. Do you have a network in your country or region?

Biodiversity – what is it?

The word 'biodiversity' is short for 'biological diversity'. It refers to the multitude of life that shares the planet with us. We are as much part of biodiversity as a tortoise, tiger, toad, taiga, toadstool or tree. We are not separate from nature.

Biodiversity may be considered at three levels of organisation:

- The species level – about 1.8 million species of animals, plants, fungi, algae and microbes have been described and named. No one knows how many species inhabit Earth – estimates vary from 5–100 million. Zoos and aquariums, with maybe several hundred species, maintain the tiniest fraction of biodiversity. And it's a fraction that is heavily weighted towards the vertebrates – fish, amphibians, reptiles, birds and mammals.
- The ecosystem level – the world's species interact and depend on each other in complex webs of life based on energy flow through the processes of eating and avoiding being eaten. Ecosystems vary from polar zones to the rich forests of the wet tropics. Even within broad ecosystem categories, scientists disagree over the finer points of ecosystem classification. There are, for example, at least 40 broad types of freshwater and coastal wetlands and well over 100 sub categories of these (www.ramsar.org).
- The genetic level – genes are the conduits of DNA and DNA is the inheritable unit that makes variation possible between individuals, populations, communities and species.

How many species?

Why is it so difficult to answer the 'how many species' question?

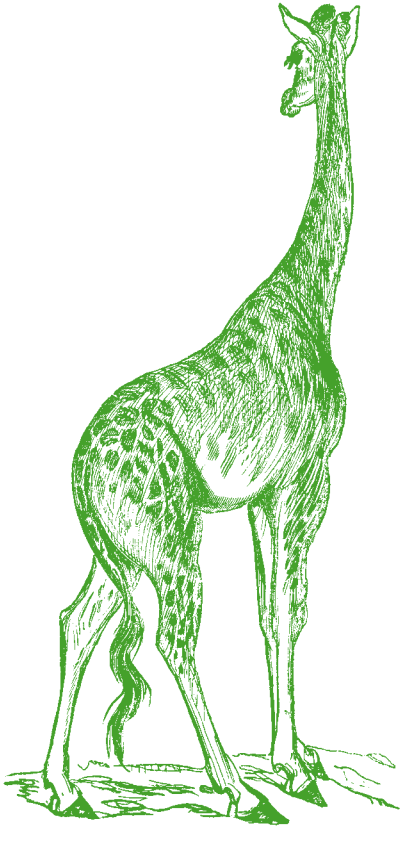
The vast majority of species are microorganisms or small invertebrates, making them hard to uncover.

Some species live in inaccessible, remote or harsh environments. Conversely, the opening up of some environments – say, a road built by loggers in a rainforest – may bring more species to the attention of scientists.

Different estimates and models of species diversity have widely differing results.

New technologies and methods may clarify species' relationships or even their presence in particular areas. For example, recent work on giraffe genetics suggests that some giraffe subspecies may be distinct enough to be considered full species. Other work concludes that there are two giraffe species and eight subspecies (www.iucnredlist.org/details/9194/0, 2009). In 2008, trip cameras recorded the continued presence of pygmy hippopotamuses in Liberia's Sapo National Park after prolonged civil war, and the presence of okapi in a hitherto unknown range within the Democratic Republic of Congo (www. ZSL.org).

The best results are obtained using a variety of evidence – from genetics and molecular research to comparative anatomy and developmental biology.



How did it happen?

Why are there so many species? How did it happen?

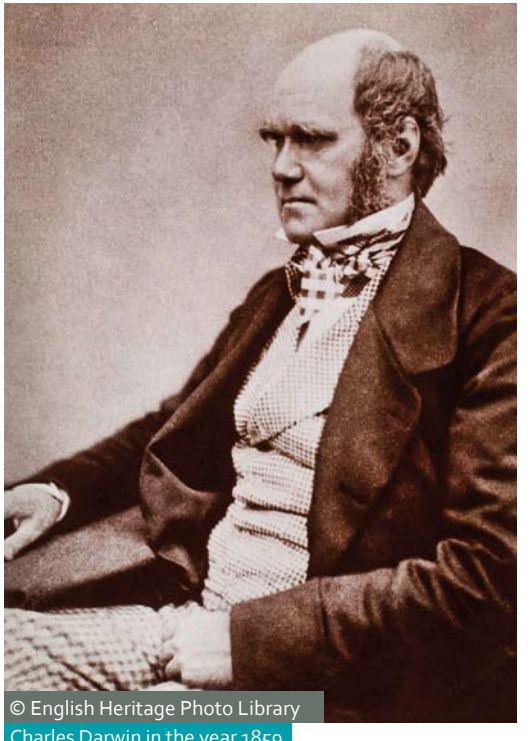
The most accepted explanation that is evidence, rather than faith-based, is that species diversity is a result of evolution.

Evolution is a fact. It happens. Species change over time in response to environmental factors and selective pressures. Thus, mosquitoes and their pathogenic passengers become resistant to pesticides and anti malarial drugs respectively, flu viruses mutate, and freshwater seals adapt to life in a Siberian lake.

How evolution happens is based on theory. Most prominent is **Charles Darwin**'s theory of Natural Selection. It doesn't explain everything, but is supported overwhelmingly by evidence from anatomy, physiology, palaeontology, embryonic biology, genetics, molecular biology, mathematics, medicine, ecology and so on. In essence, 'Natural Selection' is very simple. So simple that Darwin's great advocate, Thomas Henry Huxley, allegedly castigated himself for missing something that was blindingly obvious when uncovered.

Darwin's theory contends that like begets like. Seahorses breed seahorses and gibbons breed gibbons. Then, species produce or could produce more young than will possibly survive, whether an orang-utan mother gives birth every seven or eight years, or a cod producing thousands of eggs. The differential survival rate is due to competition – a 'struggle for existence' in Darwin's words. Species and individuals vary because of genetically inherited characteristics. Some variations confer survival advantages in particular environments. Individuals with these variations tend to prosper and breed more than individuals lacking the variations. They are the 'fittest' individuals and eventually their offspring predominates. In time, such 'selection' may lead to the divergence of a population with particular variations from an ancestral stock. Thus two species have formed where one previously existed.

Darwin's theory underpins the ideas that all species, including humans, are related. Interestingly, it was in the London Zoo of the 19th century that Darwin met the young Jenny, an orang-utan. Darwin realised immediately the deep connection between ourselves and our closest cousins. Conversely, Queen Victoria, on another occasion was rather disgusted at Jenny and not amused at all.



Charles Darwin in the year 1859.

Where is the biodiversity?

Biodiversity is all around us and we are very much part of it. The greatest species diversity is in a number of global 'hotspots'. A hotspot must meet two strict criteria: it must contain at least 1,500 species of vascular plants (>0.5% of the world's total) as endemics, and it has to be have lost 70% of its original habitat. 50% of named plant species and 42% of named terrestrial vertebrate species are endemic to these hotspots which take up only 2.3% of the world's land surface. (www.conservation.org, 2009).

Resources

www.arkive.org | A database of downloadable films, photos, sound recordings and information about global species. Billed as 'a Noah's Ark for the internet age', Arkive is very supportive of zoos and aquariums using its content for IYB activities.

www.bgci.org | BGCI is an international organisation that exists to ensure the world-wide conservation of threatened plants, the continued existence of which are intrinsically linked to global issues including poverty, human well-being and climate change.

www.biodiversitylibrary.org | A partnership of the world's 10 major natural history museums (London; Field Museum, Chicago; AMNH, New York; Smithsonian, Washington), botanical libraries (Kew, London; Missouri; New York) and Harvard University to make available online their combined collections of two million biodiversity-related volumes collected over 200 years.

www.conservation.org/explore/priority_areas/hotspots | Information about biodiversity hotspots from Conservation International.

www.eol.org | The Encyclopaedia of Life – an ambitious database that intends, in time, to contain reference material and information about all of the 1.8 million species currently described and named. Also has learning materials.

www.pbs.org/evolution | There are numerous internet sites about evolution. This one, from the US Public Service Broadcasting, offers a portal of information and learning materials.

www.ramsar.org | The website of the international, intergovernmental Ramsar Convention on Wetlands.

www.tol.org | The Tree of Life – some overlap with EOL but concentrates more on the relationships and evolutionary history of organisms along with their biological characteristics.

www.unep-wcmc.org | The World Conservation Monitoring Unit of the United Nations Environment Programme is a very sound and current database of species and habitat/ecosystems of conservation importance. Particularly good for biodiversity-related maps.

www.zsl.org | Website of the Zoological Society of London.

What's it ever done for me?

Economy – a subsidiary of the environment?

For too long, biodiversity has been viewed as peripheral to the perceived great issues of the 21st century like poverty, terrorism and security, global economics and climate change. There are many reasons for this, including:

- The all pervasive idea that, somehow, humans are different from and separate to nature – an idea encouraged by certain religions and political ideologies.
- The perception that benefits from the environment like clean air and water are 'intangibles' that are difficult to value within present global economic structures.
- The lack of political will and political short-termism. Until recently, in many countries, the 'environment' was not seen as a vote-grabber in the same way as, say, health, crime or the economic standard of living.
- A global economic system that favours the richer nations. Most global biodiversity is found in economically poorer countries.
- A collective lack of systemic thinking – that is the ability to understand how seemingly disparate things and phenomena are connected. Everything links to everything else. It is important that any biodiversity communications strategy aimed at government's shows those links. In other words, biodiversity must be mainstreamed into as many different policy areas as possible. At the government level, what has biodiversity got to do with the standard of living, the weather, the availability of food and water, the opportunities for income generation from tourism etc.? At the zoo level, what has watching tigers got to do with peat swamp forest destruction, teenage crime, refugees, oil or modern warfare?

In fact, the environment is central to everything. In terms a business person could relate to: the economy is a wholly owned subsidiary of the environment. NOT the other way round.

And biodiversity is the bedrock of environments, ecosystems and habitats.

So back to the question: what has biodiversity ever done for me?

Every day, biodiversity feeds us, fuels us, clothes us, shelters us and heals us. Without biodiversity, there are no trees for logging, fish for commercial or subsistence fisheries, food plants for agriculture, pollinators for food crops, even wildlife from forests to coral reefs for tourism. The benefits of biodiversity – often called ecosystem goods and services – may be classified as follows:

- **Provision** – biodiversity provides all living organisms with food, water, fibres, fuel and medicine.
- **Regulation** – biodiversity and its life-support systems regulate climate, water and the spread of disease. Mangrove swamps may stop coastlines from erosion and protect against extreme weather like tsunamis; forests, oceans and other habitats are major stores of carbon, many studies support the idea that immersion in nature has positive benefits for human health and well-being.
- **Cultural** – people need connection to nature. There are numerous spiritual, aesthetic, recreational and learning benefits.
- **Supporting life systems** like primary production, soil formation and nutrient cycles.

Without biodiversity, there are no livelihoods. Biodiversity is directly related to human quality of life in the following areas:

- **Security** – including personal safety, secure resources, access to resources, and disasters.
- **Basic needs** – including livelihoods, sufficient food, shelter, and access to goods.
- **Health** – including strength and feeling well, access to clean air and water.
- **Good social relations** – including social cohesion, mutual respect and the ability to help others.

Essentially, biodiversity gives us more freedom of choice.

The HIPPO in the room

Biodiversity – threats. The HIPPO in the room.

Resources

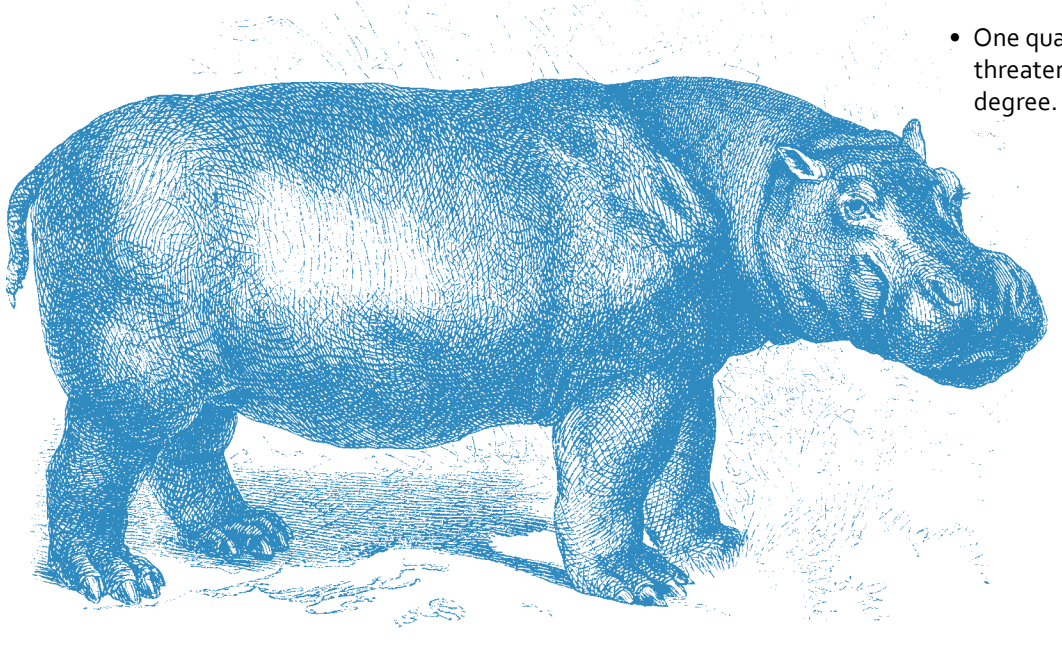
www.cbd.int/doc/meetings/cop.../cop-bur-2008-10-teeb-en.pdf | Details of the interim Economics of Ecosystems and Biodiversity (TEEB) report presented at the 2008 CBD conference. Reviews the global economic benefits of ecosystems and biodiversity as well as the costs of biodiversity loss and ecosystem degradation.

www.millenniumecosystemassessment.org | The Millennium Ecosystem Assessment is a UN initiative to review major environmental issues at the interface of the 20th and 21st centuries. The site has a synthesis report on biodiversity with a detailed section on ecosystem goods and services.

The IYB wishes to emphasise success stories relating to biodiversity conservation. Sometimes this appears rather daunting in the context of the bigger picture of biodiversity trends. There are problems – very serious and urgent ones – that require new thinking, new economic models, and the political will at global and government levels, and the proliferation of local action across the world.

Key findings from the Millennium Ecosystem Assessment make depressing reading. They include:

- Extinction is a natural process. Humans, however, have increased the species extinction rate by as much as 1,000 times the prehuman rate (from the fossil record).
- In the future, this rate may be 10-100 higher than today.
- We have changed ecosystems more in the last 50 years than at any other time in human history.
- Cultivated systems now take up one quarter of the Earth's land surface.
- 20% of coral reefs have been destroyed over the last several decades. Major reefs like Australia's Great Barrier Reef, may be lost during the lifetime of our children.
- The causes of ecosystem degradation are stable or increasing.
- 60% (15/24) of ecosystem services assessed are degraded or used unsustainably.
- More than one quarter of all fish stocks are overharvested.
- One quarter of vertebrate species are threatened with extinction to some degree.



The great biologist E. O. Wilson (Wilson 2002) sums up the situation with the acronym, 'HIPPO', or:

- **H** for habitat destruction, disturbance and fragmentation. This is possibly the greatest cause of species decline. Fragmented habitats lead to isolated small populations of species. Small populations are especially vulnerable to genetic in-breeding, random genetic drift, demographic factors and random events from warfare to extreme weather. This results in a loss of genetic variability which leads to a reduction in the reproductive fitness of individuals and the adaptability of populations. As a consequence, there is lower reproduction and higher mortality. Populations become even smaller. The result may be a spiralling vortex to extinction.

- **I** is for introduced and invasive species. It is said that a single lighthouse keeper's cat wiped out the last Stephen Island wrens, a species endemic to a small island off New Zealand. Island species are especially vulnerable to introduced rats, pigs, dogs and other aliens. Introduced species often become invasive when they breed and out-compete or eat the natives. American mink, escaped or liberated from fur farms, have decimated the UK's water vole population and the Nile perch has played havoc with the ecosystem of several African rift lakes.

- **P** is for pollution. The industrialised 'west' has been polluting en masse for two centuries since the industrial revolution. Now, nearly emerging economies of India and China are following in their footsteps. Can the west blame them for aspiring to improved standards of living? After all, lifting people out of poverty is a worthy ambition. More importantly, what are the alternatives, for every country? How far would you go to change your life? A recycled plastic bag? A self-inflicted ban on flying? Breeding... or not breeding?

- **P** is for population – human population. There's rather a lot of us – 6.7 billion at the present time with projections of an increase and peaking at 9.2 billion by 2050. Not all places have similar population growth rates. The rate is negative in central and eastern Europe and South Africa, for example, but increasing in Latin America, the Middle East and sub-Saharan Africa. We do not consume equally. The richer nations far outstrip the poorer ones in terms of consumption. As a species, we have become predominantly urban and increasingly disconnected from nature. We are drawing on nature's capital rather than living off its interest – our ecological footprint currently exceeds the capacity of Earth resources to support us by 25%.

- **O** is for over-exploitation. From tiger medicines to elephant tusks, from forest trees to oceanic fish, we are living beyond our means – consuming the equivalent of what three planets would produce per year. As E. O. Wilson (Wilson, 2002) summarised:
  - The noble savage never existed.
  - Eden occupied was a slaughterhouse.
  - Paradise found is paradise lost.
  - And we haven't even mentioned climate change (but see resources for this section).

Resources

www.millenniumecosystemassessment.org | A detailed review and analysis leading to the key findings of this section.

www.bioclimate.org | An embryonic website that will be a major portal for news, information and data concerning the links between climate change and biodiversity.

www.panda.org/livingplanet | The Worldwide Fund for Nature (WWF) and Zoological Society of London (ZSL) produce an annual report that outlines trends in biodiversity. Central to the report is the Living Planet Index (LPI) and the Human Ecological Footprint.

www.redlist.org | IUCN's red lists detail the taxonomic, conservation status and distribution information on species facing the highest risk of extinction.

www.regionalredlist.com | A new site that collates information about national red lists and action plans. Does your country or region have a red list? Here's the place to find out.

Wilson E. O. (2002)
The Future of Life (Knopf).

Biodiversity – conservation solutions

Biodiversity conservation is about monitoring, managing, money, mainstreaming, marketing and me. It involves a journey from the raw data of scientists to the policy documents of governments. It includes community involvement at grassroots level to legislation and agreements at global, regional, national and local levels. It is underpinned by the rigour of science but driven by human needs for sustainable livelihoods and quality of life as well as by economic, cultural and political factors. People are central to its success or failure. Personal action is as important as collective action.

Monitoring

You cannot conserve something if you do not know what it is, where it is, and how it's doing. Scientific monitoring provides the basic species and habitat data that can be analysed to look at trends in the status of species and the overall 'health' of ecosystems. Further, socio-economic, traditional knowledge and cultural information is often integral to the environmental management of particular places, issues and situations.

Resources

www.wildlifepictureindex.org | Initiative of New York's Wildlife Conservation Society (WCS) and the Zoological Society of London (ZSL). A database of biodiversity monitoring using camera traps.

Managing

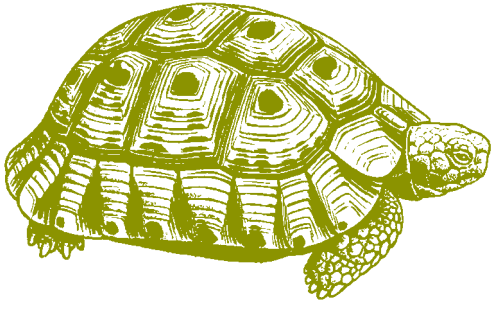
Analysed data allows conservationists to prioritise conservation actions. For example, the IUCN red lists (IUCN, 2009) rank species according to how threatened they are. Species may be extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, of least concern, data deficient, or not evaluated. Another ranking system, from the Zoological Society of London is the EDGE programme. EDGE classifies species according to their evolutionary distinctiveness and global endangerment (ZSL, 2009) – www.iucnredlist.org.

Species and habitats will then be incorporated into global, regional, national and local biodiversity conservation plans. The contents of these vary enormously. They may include protected area management, community participation and management, CEPA (Communication, Education and Public Awareness), habitat restoration, habitat creation, connecting fragmented habitats, ecosystem resilience, ecosystem-scale approaches to mitigate and adapt to the effects of climate change, wildlife crime, overexploitation, wildlife health, control of invasive species, ex-situ conservation breeding, sustainable livelihoods and poverty alleviation, eco-tourism, working in partnership, enforcing legislation and so on.

Resources

www.edgeofexistence.org | EDGE – a ZSL initiative to rank species according to evolutionary distinctiveness and global endangerment.

www.redlist.org | IUCN's revamped red list website has a very good user's guide that clarifies the categories of threat and shows how to search the database.



Money

Of course money is needed for conservation – many zoo and aquarium educators know this only too well as they juggle budgets and apply for grants.

Our zoos and aquariums also depend on being financially sustainable. The funding may come in part or wholly from local or national governments, visitor income, grants, legacies, private or corporate donations, and any combinations of these. Not easy in times of global financial recession.

There are some innovative conservation projects where the values of biodiversity are used to generate income to conserve it. Debt-for-nature schemes began in the 1980s and have been successful in many countries including Costa Rica, Guatemala and Madagascar. Essentially, a conservation organisation or rich nation's government agrees to write off a proportion of a developing country's national debt in exchange for the conservation of specific areas of high biodiversity value.

Newer still are water funds and carbon credits. In the former, revenue from downstream users of a river, say, is used to conserve upstream biodiversity. An example of carbon credit trading for biodiversity conservation is a new project in Sumatra's Berbak National Park. Local stakeholders are offered financial incentives by investors to avoid deforestation and to conserve the biodiverse rainforest as a reservoir of stored carbon to mitigate against climate change (Defra, 2009).

Mainstreaming

It is hard to see an area of government policy that is not affected by, or affects, biodiversity. See resources in the 'Biodiversity – what has it ever done for me' section.

Resources

www.darwin.defra.gov.uk/project/17029 | Details about ZSL's carbon credit project in Berbak National Park, Sumatra.

www.nature.org/wherewework/---/guatemala/---/art19052.html | A debt-for-nature scheme in Guatemala facilitated by the Nature Conservancy.

www.worldwildlife.org/conservation/finance | Details on WWF's funding schemes including debt-for-nature and water funds.

Resources

www.millennium-ecosystemassessment.org

Marketing and Me

This section is aimed at the zoo and aquarium visitor and relates directly to the International Year of Biodiversity.

The word 'biodiversity' is a barrier for many people. It may be known in policy circles, but it is not in popular circulation.

We have already said that 'biodiversity' has been seen as peripheral to the 'first-order' issues, and that many people regard themselves as separate from nature.

So 'selling' biodiversity as a concept is not like getting people to switch from one brand of soap to another. It is about getting them to use soap in the first place.

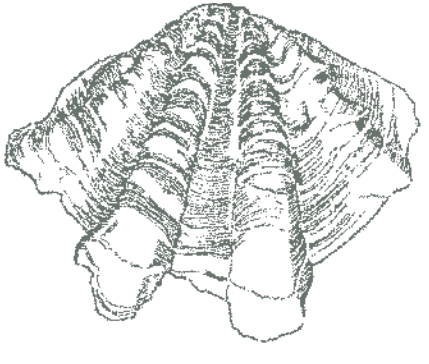
This is why the key messages from IYB focus on biodiversity's relevance to our daily lives.

Promoting numerous depressing statistics and 'doom and gloom' scenarios may be true but it's also a turnoff. The reality of biodiversity conservation can evoke complicated feelings of distress and anxiety leading to the defence mechanisms of denial, dissociation, ambivalence, apathy and hopelessness.

Marketing biodiversity has elements of managing anxiety. It's about acknowledging peoples' emotional responses as well as rational ones. It's about providing manageable steps to repair and action. One way, adopted by the IYB, is to stimulate hope and creativity by concentrating on success stories, honesty, and what people can do at the local level.

Personal action, individual lifestyle choices, using more sustainable products and reducing one's own carbon footprint are also important.

A lack of action should not be interpreted as a lack of concern. People respond best to participatory engagement rather than 'top down' initiatives. Both approaches, though, have their place.



Resources

www.carbonfootprint.com | Where you can calculate, manage and reduce your carbon footprint.

www.futerra.co.uk | Futerra is a marketing and communications company specialising in sustainability. They have created the brand identity and key messages for IYB. The website includes the downloadable '10 Rules for Communicating Sustainable Development' and 'New Rules: New Game' about communicating climate change.

www.glasshousepartnership.com/branding.pdf | A paper outlining possible strategies for communicating biodiversity. Commissioned by the UK's Royal Society for the Protection of Birds (RSPB).

Resources

Who's doing what?

www.birdlife.org/worldwide/national/index.html | Birdlife works in over 100 countries with different partner organisations. Find out about them here.

www.iucn.org/about/union/members/database | Database of IUCN members. Who's doing what in your country?

www.nwf.org/conservationDirectory | Global database of environmental organisations from the USA's National Wildlife Federation.

www.waza.org | The WAZA website has a directory of world zoos and aquariums, and a list of regional zoo and aquarium associations worldwide. International conservation projects are introduced and described.

Biodiversity embassies

WAZA Zoos and aquariums are part of the solutions

Zoos are a support – never a substitute – for the wild. Their contribution to conservation may be summarised as follows:

- **Learning and inspiration** – 600 million people worldwide – 10% of humanity – visit a zoo each year. Many zoos have extensive informal and formal learning programmes that include interpretation, inspiring exhibitry, exhibitions, animal demonstrations, talks and displays by keepers or presenters, school and university programmes, adult education programmes and much more. A tremendous opportunity for learning and communicating about biodiversity.

- **Scientific study** – many technologies and methods that are used in wild animal conservation have been developed both in zoos and the field. These include work in small population biology, genetic and demographic management, reproductive biology, diet and nutrition, taxonomy, wildlife health and veterinary medicine, animal behaviour, anatomy and physiology.

- **Training and capacity building** – some zoos and zoo associations run training courses for students, vets, zoo professionals and field biologists. Zoo professionals may also work alongside zoo-based and field-based colleagues to transfer skills and develop capacity.

- **Fundraising** – collectively, as zoo associations, or individually, many zoos raise funds for field conservation. 60% of all funding for Sumatran tiger conservation from 1998-2005 came from, or through, zoos (Christie, 2009 ZSL, pers.com).

- **Conservation breeding** – golden lion tamarins, Partula snails, Californian Condors, Socorro doves, Arabian oryx, Mauritius kestrels and pink pigeons, Przewalski's horse. These, and many other species, owe their survival to captive breeding. What other species will be helped this way in the future? Giant pandas if their mountainous temperate bamboo forests are devastated? Amphibians kept in zoo bio secure units to protect themselves and others from chytrid fungus? Diana monkeys or pygmy hippos to escape the ravages of hunting and warfare?

WAZA Book **Building a Future for Wildlife: Zoos and Aquariums committed to biodiversity conservation** can be ordered for 45 US$/29,90 €
secretariat@waza.org

Resources

www.cbsg.org | The Conservation Breeding Specialist Group of the Species Survival Commission of the IUCN.

WAZA (2005) | **Building a Future for Wildlife – The World Zoo and Aquarium Conservation Strategy** – The Strategy outlines the contribution of zoos and aquariums to biodiversity conservation as well as outlining best practice and future direction.

WAZA (2009) | **Turning the Tide – A Global Aquarium Strategy for Conservation and Sustainability**

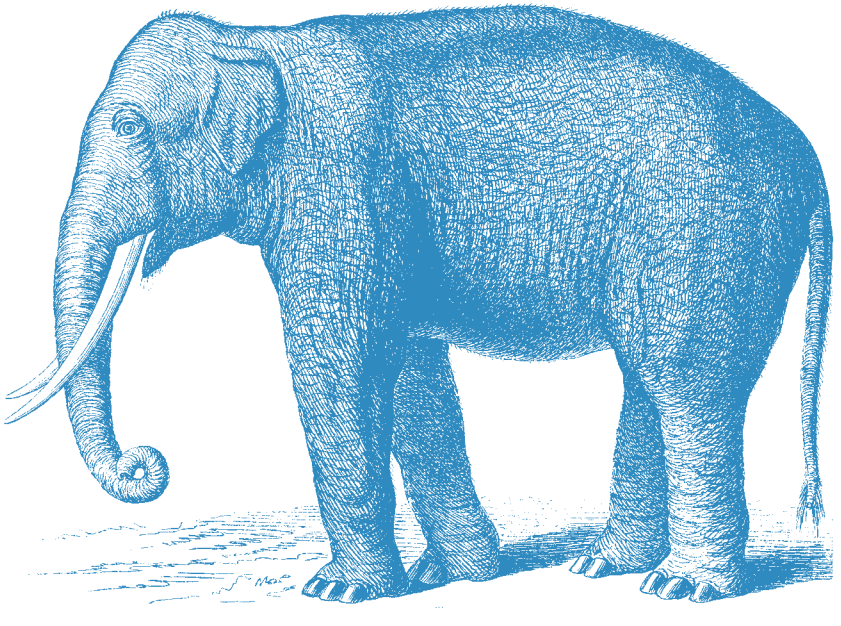
www.waza.org

Zimmerman A. et al (ed.) (2007) | **Zoos in the 21st Century – Catalysts for Conservation?** (ZSL, Cambridge University Press).

Links to biodiversity education portals

So what's it to be? An exhibit or exhibition about biodiversity? Signage that highlights the conservation status of the collection? Academic symposia? A fete, perhaps, or a fair? A publication? An enhanced website? More volunteers, explainers and keepers engaging with visitors? Working with your local museum or botanic garden? Actively contributing to your regional zoo association? Developing a learning policy and strategy that highlights biodiversity? Or a marketing and communications strategy?

Every zoo and aquarium will find its own combination of approaches, outcomes and outputs relating to IYB. Many zoos and aquariums already have well-established programmes. Below are portals to biodiversity learning support materials that include information, games, quizzes, videos, power points, art materials, lesson plans and much more.



Resources

Individual zoo and aquarium websites often have details of their learning programmes with downloads. Also check out the websites of regional zoo and aquarium associations, links to which are on www.waza.org

www.bgci.org/education | Botanic Gardens Conservation International (BGCI) is a global network of botanic gardens.

www.biodiversity911.org | A biodiversity education portal from WWF.

www.cbd.int/education | The Convention on Biological Diversity has a biodiversity education portal on its website. CBD is also producing an education toolkit for IYB.

www.ceeindia.org | India's Centre for Environmental Education produces many environmental education resources including a recipe book of zoo education activities from around the world and a CD about master planning available for purchase.

www.cepatoolkit.org | CEPA is an acronym for communication, education and public awareness. It covers all of the 'people' components of sustainability and biodiversity conservation. CEPA initiatives range from social marketing initiatives to change attitudes and behaviour for biodiversity gains, formal and informal education, political advocacy, marketing and communications, participatory community conservation, mass media campaigns, and the zoo and aquarium visitor learning journey. This handbook, compiled for CBD by IUCN's Commission on Education and Communication, covers everything you are likely to want to know in terms of planning, implementing and evaluating successful CEPA programmes. It also has loads of ideas and downloadable resources. If you only use one resource from this list, make it this one.

www.footprint.org | Footprint accounts work like bank statements, documenting whether we are living within our ecological budget. The resource accounting tool measures how much nature we have, how much we use, and who uses what.

www.countdown2010.net/biodiversity | IUCN is the world's oldest and largest global environmental network

www.izea.net | The website of the International Association of Zoo Educators has sections about different learning theories, interpretation, graphics, sustainability and case studies of good zoo and aquarium practice from five continents.

www.rspb.org.uk/youth | The RSPB has Europe's largest youth sector for a conservation organisation.

www.greenwave.cbd.int | The Green Wave, the global biodiversity outreach project for children and youth that supports the goals of the Convention on Biological Diversity to communicate, educates and raises public awareness on biodiversity. www.cbd.int/doc/notifications/2009/ntf-2009-120-greenwave-en.pdf

http://cbc.amnh.org/ | The Centre for Biodiversity and Conservation's mission is to mitigate critical threats to global biological and cultural diversity

http://cbc.amnh.org/center/pubs/pubscbcinverts.php? npid=20 | Containing the world's richest and most threatened biodiversity, the tropics are a critical area for environmental education. The 186-page manual outlines the design of an environmental interpretation program, covering exhibit design, interpretive presentations, community outreach activities, and evaluation methods. The manual has served as the basis for workshops linked with CBC field projects in Madagascar, Guatemala, and Bolivia.

www.seethebiggerpicture.org

http://kids.cbd.int/

UNESCO education kit

The **Biodiversity Learning Kit** is designed as new educational material targeting secondary-school teachers, trainers and educators to raise awareness and convey scientific and ecological information on biodiversity to students and young people (aged 12 to 16).

The primary objective of the kit is to be defined as an easy-to-use tool helping teachers and trainers to transmit its informative content in an alert and appealing manner.

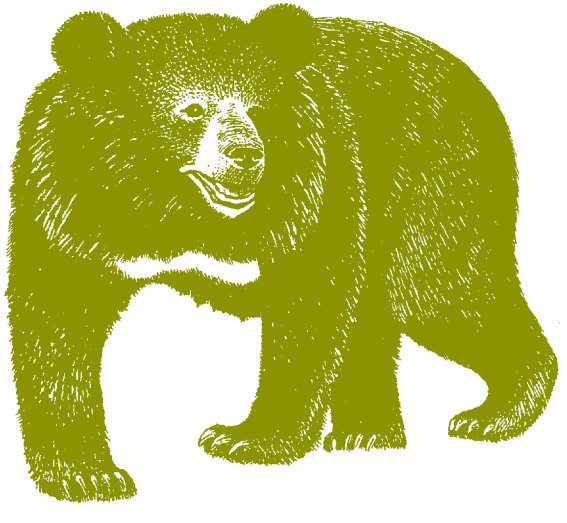
The longer term objective is to develop the ability of young generations (and population as a whole?) to understand biodiversity challenges: its environmental, economical, ethical, cultural and social (societal) values and the direct consequences of biodiversity loss on human life and organization within the next decades.

Conceived in a humanistic perspective, the kit will deliver key messages on what biodiversity is, it will alert constructively by communicating the richness (and beauty) of what is being lost and why is biodiversity loss such a concern, it will also show efforts to save biodiversity through the presentation of international initiatives (with the key-role of international cooperation) and the presentation of case studies from different parts of the world.

The in-depth presentation of these case studies leading to actions that can be taken individually will add an active dimension of critical analysis and proposition to the kit: it will show biodiversity as a concentrating source of development possibilities... how to highlight better the resources of biodiversity (of biological and genetic resources of a region for instance and the values attached to them) and a better distribution of such undertaking between its actors could lead to better sharing of the benefits and profits of biodiversity in society (and worldwide).

www.cbd.int/2010

United Nations
Educational, Scientific and
Cultural Organization



FRAGILE!

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World Association of Zoos and Aquariums
WAZA | *United for Conservation*

2010 International Year of Biodiversity

Convention on Biological Diversity