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Biodiversity Loss—It Will Make You Sick

‘Sustaining Life’ Identifies Huge Losses to Medical Science from the Decline and Extinction of the World’s Nature-Based Assets

Singapore/Nairobi, 24 April— A new generation of antibiotics, new treatments for thinning bone disease and kidney failure, and new cancer treatments may all stand to be lost unless the world acts to reverse the present alarming rate of biodiversity loss a new landmark book says.

The natural world holds secrets to the development of new kinds of safer and more powerful pain-killers; treatments for a leading cause of blindness-- macular degeneration-- and possibly ways of re-growing lost tissues and organs by, for example studying newts and salamanders.

But, the experts warn that we may lose many of the land and marine-based life forms of economic and medical interest before we can learn their secrets, or, in some cases, before we know they exist.

The new book, ‘Sustaining Life’, is the most comprehensive treatment of this subject to date and fills a major gap in the arguments made to conserve nature.

Promising Treatment for Peptic Ulcers Lost

A particularly illustrative example, highlighted by the book’s authors, of what may be lost with species extinctions can be found in the southern gastric brooding frog (*Rheobatrachus*) which was discovered in undisturbed rainforests of Australia in the 1980s.

The frogs raise their young in the female’s stomach where they would, in other animals, be digested by enzymes and acid.

Preliminary studies indicated that the baby frogs produced a substance, or perhaps a variety of substances, that inhibited acid and enzyme secretions and prevented the mother from emptying her stomach into her intestines while the young were developing.

The authors point out that the research on gastric brooding frogs could have led to new insights into preventing and treating human peptic ulcers which affect some 25 million people in the United States alone.

“But these studies could not be continued because both species of *Rheobatrachus* became extinct, and the valuable medical secrets they held are now gone forever,” say Eric Chivian and Aaron Bernstein, the key authors of the book based at the Center for Health and the Global Environment, Harvard Medical School.

The findings, announced during the Business for the Environment Summit in Singapore, come in the run up to the 9th meeting of the parties to the UN Environment Programme (UNEP)-linked Convention on Biological Diversity (CBD) taking place in Bonn, Germany later in May.

Here delegates from close to 190 countries; business leaders, academia and members of civil society will look to accelerate action to reduce the rate of loss of biodiversity by 2010.

(See Quotes by Key Players below)

‘*Sustaining Life*’, the work of more than 100 experts and published by Oxford University Press, has been supported by UNEP; the Secretariat of the CBD; the UN Development Programme (UNDP) and IUCN.

At the heart of the book is a chapter dedicated to exploring seven threatened groups of organisms valuable to medicine, including amphibians, bears, cone snails, sharks, nonhuman primates, gymnosperms, and horseshoe crabs that underscore what may be lost to human health when species go extinct.

These losses include: promising new avenues of medical research and new treatments, pharmaceuticals and diagnostic tests.

Experts, including the authors, emphasize that the book’s conclusions should not be construed as a license to harvest wildlife in a way that puts further pressure on already threatened, vulnerable and endangered species.

Instead they should be a spur for even greater conservation and improved management of species and the ecosystems they inhabit.

Amphibians

The class Amphibians is made up of frogs, toads, newts, salamanders and caecilians—little known legless organisms that resemble giant earthworms. Nearly one third of the approximately 6000 known amphibian species are threatened with extinction.

These animals produce a wide range of novel substances, some of which are made only by amphibians living in the wild, not by those in captivity.

These include the:-

Pumiliotoxins, like those made by the Panamanian Poison Frog that may lead to medicines that strengthen the contractions of the heart and thus prove useful in treating heart disease.

Alkaloids made by species like the Ecuadorian Poison Frog, which could be the source of a new and novel generation of pain-killers.

Antibacterial compounds produced in the skin of frogs and toads such as the African Clawed Frog and South and Central American leaf frogs.

Bradykinins and maximakinins, made in the skin glands of species like the Chinese Large-Webbed Bell Toad; Mexican Leaf Frog, and North American Pickerel Frog that dilate the smooth muscle of blood vessels in mammals and therefore offer promising avenues for treating high blood pressure.

Frog glue, produced by species such as the Australian frog, could lead to natural adhesives for repairing cartilage and other tissue tears in humans.

Many species of newts and salamanders, such as the Eastern Spotted Newt, can re-grow tissues such as heart muscle; nerve tissue in the spinal cord and even whole organs. As we are in evolutionary terms relatively closely related to these species, they are vital models for understanding how we might someday harness our own dormant regenerative potential.

Some frogs, such as the Gray Tree Frog and the Chorus Frog can survive long periods of freezing without suffering cell damage—understanding how these frogs do this may yield key insights into how we might better preserve scarce organs needed for transplant.

Bears

Nine species of bear are threatened with extinction including the polar bear; the Giant Panda, and the Asiatic Black Bear.

The threats to bears are similar to those amphibians face, but in addition many bears are at risk because they are killed for body parts, such as gall bladders, which can command high prices in black markets in places like China, Japan and Thailand.

Several medical benefits have already arisen from the study of bears, including the development of ursodeoxycholic acid, found in the gall bladders of some bear species such as polar and black bears, into a medicine.

The substance is used to prevent the build up of bile during pregnancy; dissolve certain kinds of gallstones; and prolong the life of patients with a specific kind of liver disease, known as primary biliary cirrhosis, giving them more time to find a liver transplant.

Some bear species, known as “denning” bears because they enter into a largely dormant state when food is scarce, are of tremendous value to medicine as they are able to recycle a wide variety of their body’s substances.

Unlike people, who if ‘bed-ridden’ for a five-month period can lose up to a third of their bone mass, bears actually lay down new bone during the denning period.

Bears appear to produce a substance that inhibits cells that break down bone and promote substances that encourage bone and cartilage-making cells. Currently, 740,000 deaths a year are the result of hip fractures worldwide, a large number of which are caused by osteoporosis.

By 2050 there will be an estimated six million osteoporosis-linked hip fractures globally.

Denning bears can survive for a period of five months or more without excreting their urinary wastes, whereas humans would die from the build up of these toxic substances after only a few days.

An estimated 1.5 million people worldwide are receiving treatment for end-stage renal disease, and more than 80,000 die each year in the U.S. alone from this disease. By studying denning bears, we may be able to learn how to treat them more effectively and help large numbers to survive.

Denning bears may also hold clues to treating Type 1 and Type II diabetes as well as obesity. Worldwide there are an estimated 150 to 200 million cases of Type II diabetes.

When produced in a non-invasive and ethically acceptable way, without pushing already threatened species further towards extinction, these substances are of great value to medicine.

Gymnosperms including pines and spruces

Close to 1,000 species of Gymnosperms have been identified. Evolutionary they are among the oldest of any plants alive but many groups, such as the cycads, are classified as endangered.

Several pharmaceuticals, including decongestants and the anti-cancer drug taxol, have already been isolated from gymnosperms.

The researchers believe many more are yet to be discovered and may be lost if species of Gymnosperms become extinct.

Substances from one Gymnosperm, the Ginkgo tree may reduce the production of receptors in the human nervous system linked with memory loss. Thus they may play a role in countering Alzheimer's disease. They may also help in the treatment of epilepsy and depression.

Cone Snails

Around 700 species make up the cone snails, seven of which were identified only since 2004. While only four are now classified as vulnerable, no thorough assessment has been made in over ten years and thus current listings may underestimate the true number of endangered cone snail species.

For example almost 70 per cent of some 380 cone snail species surveyed had more than half their geographic range within areas where coral reefs, their main habitats, are threatened.

Cone snail species may produce as many as 70,000 to 140,000 peptide compounds, large numbers of which may have value as human medicines, yet only a few hundred have been characterized.

One compound, known as ziconotide, is thought to be 1000 times more potent than morphine and has been shown in clinical trials to provide significant pain relief for advanced cancer and AIDS patients. Another cone snail compound has been shown in animal models to protect brain cells from death during times of inadequate blood flow.

It could prove a breakthrough therapy for people suffering head injuries and strokes and may even contribute to therapy for patients with Parkinson's and Alzheimer's. Other potential developments from cone snail peptides include treatments for urinary incontinence and cardiac arrhythmias.

Sharks

There are at least 400 species of sharks, which, as a group, evolved in ancient seas 400 to 450 million years ago.

Many species are now threatened, with some species, such as the Scalloped Hammerhead, White Shark and Thresher Shark, falling in numbers by as much as 75 percent over the past 15 years.

Over-fishing has been the main reason for the losses, and has been driven by: an increased demand for shark meat as a substitute for traditional commercial fish catches in foods like fish and chips; the rise in consumption of shark fin soup; increases in by-catch, for example, in tuna fisheries; and an increased market for shark cartilage products for a variety of unproved medical purposes.

- Squalamine, a substance isolated from sharks such as dogfish, especially abundant in their livers, may lead to a new generation of antibiotics as well as treatments against fungal and protozoan infections.
- Studies are also being undertaken with squalamine compounds as possible antitumor and appetite-suppressant substances.
- Trials are now also underway to see if squalamine can treat age-related macular degeneration which can lead to severe vision loss. The shark substance may halt the growth of new blood cells in the retina, which is linked to a loss of retinal function and blindness in these patients.
- The salt glands of some sharks are also being studied to gain insight into how the human kidney functions and how chloride ions are transported across membranes, which may shed light on two diseases--cystic fibrosis and polycystic kidney disease.
- Sharks, having evolved as some of the first creatures with a fully functioning 'adaptive' immune system are irreplaceable models to help us understand human immunity. "What potential these creatures may still hold to further our knowledge of immunity is being rapidly depleted with the mass slaughter of sharks and the endangerment of sharks worldwide," say the book's authors.

Horseshoe Crabs

There are four species of horseshoe crabs, with each organism possessing four eyes and six other light-detecting organs as well as blood that turns cobalt blue when exposed to the air.

Because only around ten offspring survive out of the estimated 90,000 eggs produced by a female, they are highly sensitive to overfishing.

Once harvested and processed to be used as fertilizer, they are now used as bait for eel and whelk fisheries. Horseshoe crabs are also important in the food chain, especially for

birds like the Red Knott, which rely upon the eggs for fuel over their 16,000 km migratory journey

Horseshoe crabs also have tremendous value to medicine.

Several classes of peptides have been isolated from the creatures' blood that appear to kill a wide range of bacteria.

Another peptide from the horseshoe crab has been developed into a compound known as T140 which locks onto the receptor in humans that allows the Human Immunodeficiency Virus (HIV) to gain access into the body's immune cells. Preclinical trails indicate that the substance is at least as effective as the drug AZT at inhibiting the replication of HIV.

T140 has also shown promise in preventing the spread of certain cancers such as leukemia, prostate cancer and breast cancer, and as a possible treatment for rheumatoid arthritis.

Other cells in the blood of horseshoe crabs can, for example, detect the presence of key bacteria in the spinal fluid of people suspected of having cerebral meningitis.

The test is so sensitive it can detect at levels of 1 picogram per milliliter of solution—roughly the equivalent of finding one grain of sugar in an Olympic-sized swimming pool.

Quote from Key Players

Achim Steiner, UN Under-Secretary General and UNEP Executive Director, said: "Habitat loss, destruction and degradation of ecosystems, pollution, over-exploitation and climate change are among the powerful and persistent impacts that are running down the planet's nature-based capital, including the medical treasure trove of the world's biodiversity".

"The CBD has achieved a great deal but it needs to achieve much more if it is to meet the international community's goals and objectives. We need a breakthrough in Bonn on all three pillars of the convention—conservation, sustainable use, and access and benefit sharing of genetic resources," he said.

Sigmar Gabriel, Minister of the Environment, Germany said: "We are currently in the process of wiping nature's hard drive - at a tremendous pace and without any hope of restoring the data once it is lost. We have to comprehend the extent of the damage we are doing to ourselves so that we can bring about a change of course. In order to curb the ongoing destruction of biodiversity before 2010 and thus reverse the trend, we must finally adopt effective measures at international level. This is our overriding goal for the upcoming 9th Meeting of the Conference of the Parties to the Convention on Biological Diversity in Bonn."

Ahmed Djoghlaif, UN Assistant Secretary General and Executive Secretary, Convention on Biological Diversity, said: "The Earth's biodiversity, much of which has yet to be discovered, provides a unique opportunity to improve not only the health of current but also that of future generations".

"However as species are lost so too are our options for future discovery and advancement. Thus, "Sustaining Life" provides poignant evidence that biodiversity loss is

not merely an environmental issue but one which affects us on a very basic, fundamental and personal level,” he said.

Jeffrey McNeely, Chief Scientist at IUCN and a co-author of the book, says: “While extinction is alarming in its own right, this book demonstrates that many species can help save human lives . If we needed more justification for action to conserve species, this book offers dozens of dramatic examples of both why and how citizens can act in ways that will conserve, rather than destroy, the species that enrich our lives.

Notes to Editors

‘Sustaining Life: How Human Health Depends on Biodiversity’ is published by Oxford University Press priced \$34.95

<http://www.oup.com/us/catalog/general/subject/LifeSciences/Ecology/?view=usa&ci=9780195175097#> On 24 April 2008

A link to the Sustaining Life web site at Harvard Medical School Center for Health and the Global Environment <http://chge.med.harvard.edu/programs/bio/index.html>

The book can also be purchased online at Amazon.com.

The related resources can be accessed at www.unep.org

The Convention on Biological Diversity including details of the Bonn meeting www.cbd.int

The UN Development Programme www.undp.org

IUCN www.iucn.org

Business for the Environment Global Summit 2008 www.b4esummit.com

For More Information Please Contact Nick Nuttall, Spokesperson/Head of Media, UNEP on Tel: +254 20 7623084, Mobile: +254 733 632755, E-mail:

nick.nuttall@unep.org

Or Anne-France White, Associate Information Officer, at tel: +254 20 762 3088, Mobile: + 254 728600494, or e-mail: anne-france.white@unep.org.

Ms. Marie Aminata Khan, Information Officer and Gender Focal Point
Secretariat of the Convention on Biological Diversity, on Tel: +514 287-8701
Email: marie.khan@cbd.int

Sarah Halls, IUCN Media Relations Officer, Tel: +41 22 999 0127; Mobile: +41 79 528 3486; Email: sarah.halls@iucn.org

Stanislav Saling, UNDP Communications Officer, on Tel: + 1 212 906 5296
Or Niamh Collier-Smith, UNDP Communications Officer, +1 212 906 6111;
niamh.collier@undp.org or the UNDP newsroom on +1212 906 5382.

