

Polar bears and PCBs

Nancy Bazilchuk

Polar bears on the Svalbard islands of Norway and in the Russian arctic carry some of the world's highest concentrations of PCBs and persistent organochlorine chemicals.

Winds from North America, industrialized Europe, and Asia converge over Svalbard and the eastern Russian arctic, where they dump their toxic load. PCB levels in Svalbard and Russian polar bears are consequently three to six times higher than in Alaskan and Canadian bears.

A suite of studies has now shown associations between the blood levels of these pollutants and altered levels of thyroid hormones, retinol, and cortisol. The studies also show that bears with high concentrations of PCBs have a weakened ability to fight infections.



Researchers measure the body fat of a tranquilized polar bear.

Courtesy of E Lie

“High contaminant levels can influence the health of these polar bears”, says Janneche Utne Skaare (National Veterinary Institute of Norway, Oslo). If all other conditions are favorable, she says, bear populations as a whole will be unaffected. “But given a new stressor, the contaminants will most likely add to the risk.”

Skaare and a team of researchers exposed free-ranging bears in Svalbard and Canada to inactivated influenza virus, reovirus, herpes

virus, and tetanus toxoid to test the effects of PCBs on immune function. The Svalbard bears with the highest levels of toxic chemicals produced the least number of antibodies (*J Toxicol Env Heal A* **67**: 555–82). High concentrations of chemicals in the blood of the bears also impaired white blood cell proliferation during in vitro experiments with infectious agents (*J Toxicol Env Heal A* in press).

Higher PCB concentrations were also associated with lower levels of retinol, or vitamin A, and depressed thyroid hormone amounts (*Environ Health Persp* **112**: 826–33). Female bears were more susceptible, with five thyroid hormones affected in females compared to just two in males. “As we don’t know too much about the normal thyroid balance in bears, we don’t know if they are hypothyroidic or not”, says Bjørn Munro Jenssen (Norwegian University of Science and Technology, Trondheim).

Cortisols, which help regulate growth and metabolism, were also lower in bears with the highest blood contaminant levels (*J Toxicol Env Heal A* **67**: 959–77). ■

Australian Greens party wins record vote

Claire Miller

The Australian Greens party won a record 7.5% of the vote in the Australian national election, held on October 16, making them the third political force behind the two major parties. The 2.5% rise in Greens support will probably deliver the party another two Senate seats, bringing their total to four. The result also strengthens the Greens’ political influence. Minor parties’ votes are often crucial in determining the outcome in close elections under Australia’s preferential voting system.

Old growth logging in Tasmania and the crisis in water quality and quantity were the main conservation issues. Almost 90% of Australians want Tasmania’s

unique forests protected from a voracious woodchip industry that has almost free reign under a sympathetic state government.

With the conservative Liberal Party and the left-wing Australian Labor Party running neck and neck in the national election, both major parties courted the Greens and the environment vote. During the final week, the Labor Party promised to protect an additional 250 000 hectares of old growth forest in Tasmania, infuriating timber unions and workers who normally vote Labor. The Liberal Prime Minister, John Howard, also initially promised to save forests, but at the last minute released a policy protecting timber jobs instead. The strategy delivered two key Tasmanian seats to the Liberals, who ultimately won a fourth term in government in

coalition with the small, rural National Party.

The Greens consistently polled 12% during the campaign, enough to have increased their Senate seats from two to seven. But blanket negative advertising by the Liberals in the campaign’s last days is thought to have frightened off some voters. Liberal advertising painted the Greens as “loopy” extremists.

The national Greens campaign coordinator, Andrew Burke, said the record level of support nonetheless showed that the environment was a rising election priority. “The fact that in the last week of the campaign – the most vital time – forests were the big issue, with both major parties announcing policies, shows how much the environment has become accepted in the legislative mainstream.” ■

South Africa launches observation network

Mike Faden

South Africa has launched the first in a network of field research centers that will monitor long-term environmental changes across the country's diverse habitats.

The South African Environmental Observation Network (SAEON) will track ecological effects of trends such as global warming and changing land use. After several years of planning, the first center is being established in savanna habitat, at the edge of Kruger National Park. According to SAEON's director, Johan Pauw, by 2006 the network will consist of six coordinated field centers, each located in a different biome.

Each field center will have a small core staff to carry out primary research. Pauw hopes these "centers of gravity" will attract researchers and students from around the world. In return for facilitating research, the network will gain datasets that can be shared and used to analyze long-term ecological impacts across the country. In the past, research in South Africa has been conducted in a more piece-



Courtesy of PH Shelton/SAEON

Patterns of land use on the South African savanna.

meal fashion. "Ecology has been done in a fragmented way – the integration side has been missing", explains Albert van Jaarsveld, a professor at the University of Stellenbosch (Matie-land, South Africa), who chairs SAEON's advisory board. A more coordinated approach may enable researchers to monitor not only major impacts but also more subtle ones that can cause ecosystems to suffer "death through a thousand cuts", adds van Jaarsveld.

The first field center, in the rural town of Phalaborwa, located just outside Kruger National Park, will pro-

vide a base for researchers to compare sites within the Park's near-pristine savanna with areas outside the Park, affected by farming and settlement. According to Pauw, mining has a huge impact both on the land and the nearby Olifants River, which flows into the Park and neighboring Mozambique.

The network hopes to add three more centers next year. One will be in the Fynbos, or Cape Floristic Province, a region noted for its extraordinary concentration of endemic species. Another will be situated on the coast, while a third will consist of an oceanic node that includes an existing research station on sub-Antarctic Marion Island, about 1800 km from the mainland. The final two centers, in grassland and arid regions, will be added in 2006. Besides acting as a focus for research, SAEON will provide educational programs.

SAEON, which receives the equivalent of about US \$770 000 a year from South Africa's Department of Science and Technology, is a member of the International Long-Term Ecological Research (LTER) network, which includes the US LTER program established by the National Science Foundation in 1980. ■

Diclofenac poisoning found in vultures

Dinesh C Sharma

High vulture mortality on the Indian subcontinent is driving the animals to extinction. Poisoning due to diclofenac, a commonly used veterinary pain killer, was found to be the probable cause of vulture deaths in Pakistan earlier this year (*Nature* 2004; 427: 630–33). Now there is evidence of the same phenomenon in India and Nepal. Livestock that die shortly after being treated with diclofenac still contain residues of the drug, which can cause kidney failure and death in vultures that feed on the carcasses.

In the past decade, population losses of more than 95% of three raptor species – *Gyps bengalensis* (oriental

white-backed vulture), *Gyps indicus* (long-billed vulture), and *Gyps tenuirostris* (slender-billed vulture) – have been reported in South Asia. A simulation model of vulture demography proposed by an international group shows that contamination with a lethal level of diclofenac, even in a small proportion of ungulate carcasses available to vultures, can cause rapid population decline (*J Appl Ecol* 2004; 41: 793–800).

Another study (*Proc R Soc Lond B* [Suppl]; DOI: 10.1098/rsbl.2004.0223) involving 25 dead or dying birds in India and Nepal found a link between visceral gout and diclofenac poisoning among oriental white-backed vultures. Gout is a metabolic disorder that allows uric acid to accumulate in the blood and tissues. However, there are ques-

tions concerning the sample size. "It is too small, opportunistically collected, and is unlikely to be representative of the subcontinent. Of the 13 locations sampled, more than two birds were sampled only from one location", points out PR Arun, who, until recently, worked for the Salim Ali Centre for Ornithology and Natural History (Coimbatore, India).

"The diclofenac theory is not convincing because the half-life of the drug in the animal's body is only a few hours and the chances of vultures finding an animal that received a shot of the drug shortly before death is very remote", says Arun. He feels the call for a ban on the drug is still premature, although the Gujarat state has decided to curtail the drug's use in government veterinary clinics. ■

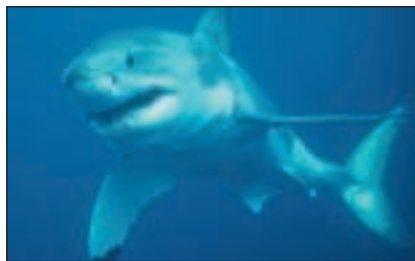
Great whites get protection

Adrian Burton

Delegations from over 160 countries and non-governmental organizations attended the 13th Conference on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in Bangkok (October 2–14, 2004), to regulate international trade in wild animals and plants – and gave the great white shark (*Carcharodon carcharias*) its first protection from humans.

CITES conferences, which take place every 3 years, provide the major platform for bestowing international protection on wild species. “The CITES conferences are major environmental events because they produce enforceable decisions and practical actions for conserving wild nature and the Earth’s biological diversity”, explains Klaus Toepfer, Executive Director for the UN Environment Programme which governs CITES.

The proposal to provide Appendix II protection (controlled international trade on the basis of CITES permits) for the great white was made by



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A great white shark - in need of protection from humans.

Australia and Madagascar and backed by more than a two-thirds majority of member states. Great whites have suffered a steady decline in numbers over recent years as a result of trophy fishing, demand for their teeth, jaws, shark fin soup, and shark leather goods, and accidental entrapment in nets. Its slow reproductive cycle makes it difficult for the species to make up its losses.

“The great white shark has been heavily demonized [and we] strongly support the motion for protecting the species”, says Ali Hood, Conservation Officer of the Shark Trust (Plymouth, UK). “Normally, people don’t think these animals need protection; we hope this will improve awareness.”

In consultations preceding the conference, Australia and Madagascar had originally sought backing for an Appendix I listing, which would have excluded the species from international trade altogether, but failed to get the required support. Japan, which disagreed with the original proposal, also voted against the species being listed in Appendix II, citing a lack of worldwide data.

Other animal and plant species received protection this year, including the minke whale (a moratorium on its trade was not lifted), the Irrawaddy dolphin (which received an Appendix I listing), the ramin tree (Appendix II), and the hoodia cactus (Appendix II). For some species, however, the future looks gloomier; permission was granted to Swaziland, Namibia, and South Africa to allow the hunting of a handful of rhinos, a move which has angered many wildlife organizations.

Other species will have to wait their turn for protection. “We are very disappointed that the spiny dogfish and the porbeagle [shark] failed to be included in the final proposals”, says Hood. ■

Brazil moves to protect savanna

Claudia Orellana

After a year of deliberation, the Brazilian Government’s work group on savanna conservation and sustainable use produced its report on September 11, 2004. On the basis of its recommendations, the Government is developing a national policy to regulate the exploitation of its tropical savanna, known as the cerrado. “The Brazilian cerrado is the richest savanna in the world. It functions as a huge water deposit”, explains Leonel Pereira, (Cerrado Work Group Coordinator, Environment Ministry, Brasilia). “Its trees, although small and twisted, have deep root systems, guaranteeing that water flows into the little rivers of Brazil.”

The cerrado is home to an estimated 10 000 plant species, of which

44% are endemic, but this diverse biome is threatened by agriculture. “When the cerrado is uprooted to plant soybeans, cotton, and maize, its wealth is replaced by a much poorer ecosystem”, says Pereira. But because of its importance as a grain-producing region, the cerrado was not included as part of the national patrimony in the 1988 constitution. “It took 500 years to destroy 93% of the Atlantic rainforest, but only half a century to clear around 60% of the cerrado’s 2 million square kilometers.. Until now, there has been no public policy for the conservation of this important region.”

The new policy requires amending the constitution to provide the legal authority for special conservation measures relating to the cerrado. Among these, land-use zoning is central, defining whether and where agriculture is permitted. Some areas would be

reserved for exploitation of native plants for foods, medicines, fibers, and resins. Pereira argues that to preserve and cultivate the knowledge base for sustainable agroforestry, the traditional communities and small farmers will need support. He also anticipates improved enforcement of the existing legal requirement that 20% of each landholding be conserved as savanna or left to revert to its original state.

Environmental NGOs are helping the Brazilian Government to identify the areas most in need of conservation. “It is important that this information be used to establish new protected areas”, comments Ricardo Machado, Director of Conservation International’s Cerrado Program, explaining that, currently, less than 5% of the original area is under any type of protection. ■

Fingerprinting fugitive dust

Virginia Gewin

Finding the sources that contribute to the estimated 1000 tons of so-called “fugitive dust” entering the atmosphere each year is of increasing concern. Scientists at the US Department of Agriculture’s Agricultural Research Service (USDA-ARS) have shown that enzymes produced by soil microorganisms can be an effective tool in tracing the origin of dust.

The researchers generated dust in the lab, thereby knowing its exact source, which is often difficult when collecting field data. The set of three soil enzymes used as a collective fingerprint are sensitive to climate, soil properties, and management, making them perfect candidates to profile soils over an entire region.

Enzymes can also provide information about specific nutrient cycles or even organic matter decomposition. USDA-ARS soil microbiologist

Veronica Acosta-Martinez (Lubbock, Texas) knew enzymes remained active in the soil for some time, but was surprised to find aryl sulfatase, typically the least predominant enzyme in these semi-arid soils, still present in the dust. “Enzymes are able to tell us about biochemical properties and the status of different soil processes”, she explains.

Enzymes are the latest in a series of dust profiling tools. Past work has focused on using fatty acid methyl esters (FAME) to profile microbial communities, as well as inorganic factors to profile soil mineral and chemical characteristics. “By layering these measures together, we can get a nice idea of what the biology of a given soil looks like under different management systems”, notes USDA-ARS soil microbiologist Ann Kennedy (Pullman, Washington), who developed soil FAME profiles.

By combining both organic and inorganic characteristics, the fingerprint becomes even more robust. “The

more you describe a person, the easier it is to trace that person”, points out Acosta-Martinez. “We’re trying to do that with dust also.”

Her research partner, soil scientist Ted Zobeck (Lubbock, Texas), is also working with others to develop additional profiling tools. Both Zobeck and Acosta-Martinez agree that enzymes alone can’t do the job.

Zobeck is starting a project with Rich Arimoto of the Carlsbad Environmental Monitoring and Research Center (Carlsbad, New Mexico) to develop another tracing method, using radionuclides. “We’re the first ones looking directly at plutonium”, says Arimoto. This method has been overlooked in the past, due to the large sample size requirements and difficult analysis.

According to Zobeck, “The overall goal of using these technologies is to identify types of cropping systems that have problems with dust, and to develop strategies to mitigate dust in the atmosphere.” ■

Global warming and insect pheromones

Leslie Bienen

Concentrations of carbon dioxide (CO₂) and ozone (O₃), two greenhouse gases associated with global climate change, have increased by more than 30% each since the mid 1800s. Gases can affect the nutrient content of plants and thus the damage inflicted on them by plant-feeding insects. For example, caterpillars may eat larger portions of plants grown in enriched CO₂ environments due to nutrient dilution in the plant tissues. Such plant-mediated “bottom-up” impacts of climate change on insect herbivores are better understood than are “top-down” effects, such as how greenhouse gases mediate interactions between insects and their enemies.

Now, Ed Mondor and his fellow entomologists at the University of Wisconsin (Madison, WI) are studying how these gases may influence top-down interactions and the corresponding health of agricultural and forest plants. “Pheromones regulate



Courtesy of IM Tremblay

A colony of the aphid *Chaitophorus stевensis* feeding on an aspen leaf.

insect behaviors as diverse as alarm signaling and sexual communication”, explains Mondor. “We need to know if increased levels of greenhouse gases alter pheromone communication, and how the production or reception of pheromones may change as climate change progresses.”

The team’s research, conducted at the Aspen Free-Air CO₂ Enrichment (FACE) site in northern Wisconsin, investigated how elevated levels of CO₂ and O₃ modified pheromone-mediated alarm dispersal, a defensive behavior, in the aspen-feeding aphid, *Chaitophorus stевensis*. “Aphids fre-

quently emit alarm pheromones only when attacked, so the signal is a reliable indicator of a predator”, says Mondor. “Dispersal responses to this pheromone differ, depending on atmospheric composition. When CO₂ was elevated, aphids did not disperse as readily. However, if O₃ was elevated, aphids exhibited an extreme dispersal response.” The researchers think this exaggerated escape behavior may explain the larger aphid populations observed under enriched O₃ conditions.

In addition to the environmental disruption that altered insect behaviors and demographics could cause, Mondor notes that the team’s research may indicate a need to “take a second look at how pheromones are used for pest management”.

“Pheromones are fundamental to insect survival”, he explains. “Understanding how pheromones and greenhouse gases interact will be vital for predicting how insect populations and the plants they eat will fare in an environment radically altered by global climate change.” ■

Human changes to forests may reduce air quality

Jane Bradbury

Emissions of biogenic volatile organic compounds (VOCs) in the eastern US are rapidly changing, suggest researchers. Drew Purves (Princeton University, NJ) and colleagues estimate that in Alabama, for example, VOC emissions increased by 30% between the 1980s and 1990s. Most importantly, explains Purves, “although annual increases in biogenic VOCs are balanced by the reductions made to anthropogenic VOCs through legislation, on a hot June day, when ozone tends to reach dangerous levels, increases in biogenic VOCs may outweigh reductions in anthropogenic VOCs”.

Compounds such as isoprenes and monoterpenes are produced both by the consumption of fossil fuels and by vegetation itself. Photochemical oxidation in the presence of nitrogen oxides converts these VOCs into

harmful tropospheric ozone. Because large amounts of biogenic VOCs are produced by vegetation, legislative efforts to reduce ozone levels that have targeted anthropogenic sources may have had less effect than expected.

The researchers used data from the US Department of Agriculture forestry inventory, which records vegetation changes in about 250 000 forest plots in the eastern US, together with information on the VOC emission characteristics of tree species, to estimate emission changes between the 1980s and 1990s (*Global Change Biology* 2004: 1737–55). Changes in land use, suggests Purves, may be increasing biogenic VOC emissions and consequently ozone pollution. “Over the past 100 years, forest cover in the northeastern US has doubled because of farm abandonment, so there are many young forests undergoing ecological succession, which can affect VOC emissions. In addition, harvesting and plantation practices, which change the

mix of trees, affect VOC emissions.”

“This is an original attempt to quantitatively analyze the impact of forest change on biogenic emissions in the eastern US”, notes Alex Guenther (National Center for Atmospheric Research, Boulder, CO). “Some of the methods used are a little out of date, but I doubt if the conclusions would be changed by the use of more current models.”

Both Guenther and Purves believe that although it is difficult to predict future biogenic VOC emissions – and even more difficult to relate these to changes in tropospheric ozone – such estimates are essential for the development of air pollution control strategies. “We are trying to do this as part of a National Science Foundation/Environmental Protection Agency program, in which we will include predictions of future land cover, climate, and anthropogenic emission scenarios in regional air quality models”, says Guenther. ■

Anthrax in the wild

Kathryn Senior

Anthrax has been branded a biological weapon favored by terrorists, but recent events in southern Africa offer a stark reminder that anthrax outbreaks still occur naturally and with disastrous consequences.

In September, an official news agency announced that anthrax killed 1500 animals in the Malilangwe and Save conservation areas near the southeastern Gonarezhou National Park in Zimbabwe. Gonarezhou Park is part of the 95 000-km² Great Limpopo Transfrontier Park, which also includes South Africa’s Kruger National Park and Mozambique’s Limpopo National Park. “About 80% of the animals that have died are kudus and the others are buffaloes and antelopes”, says Stuart Hargreaves, director of livestock and veterinary services in Zimbabwe. No human deaths were reported from the outbreak in Zimbabwe, although 13 head of livestock died from anthrax in an adjacent area. “On occasion, poor people consume such recently dead or



This rhino needs an anthrax vaccination...any volunteers?

dying animals and get [a] gastrointestinal form of anthrax, but thankfully that doesn’t seem to have happened in these outbreaks”, says Nammalwar Sriranganathan, Professor of Microbiology at Virginia–Maryland College of Veterinary Medicine (Blacksburg, Virginia).

Government and other wildlife agencies have moved fast to control the outbreak through vaccination and carcass disposal. The remains of two elephants, 100 buffalo, and more than 2000 smaller plains animals were burned, and over 800 big game animals, including 35 rhinos and buffalo,

were vaccinated. Vultures are thought to have carried the anthrax from neighboring Botswana. “When vultures feed on dead animals their feet become contaminated and when they fly to another area a lot of the anthrax spores are released”, explains Hargreaves. Sriranganathan notes that “The outbreak in a national park is an unmitigated disaster; it is very difficult to deal with because of the logistical difficulties involved in vaccinating the animals. However, all of the measures taken by the authorities in Zimbabwe and Uganda appear to be appropriate”.

In early October it was discovered that anthrax had also killed about 120 hippos over the past 3 months in Queen Elizabeth National Park, Uganda’s second largest. Wardens there began recording the hippo deaths in July, but were able to explain the deaths only after samples from the animals were studied by experts at the Robert Koch Institute in Berlin, Germany. “These recent events clearly show that we need to be prepared to deal with any outbreak, natural or initiated by terrorists”, says Sriranganathan. ■