

Carbon footprint fixes vary by location

Robin Meadows

When energy expert Christopher Jones of the University of California, Berkeley, wanted to measure his carbon footprint a few years ago, he couldn't find a calculator that was comprehensive. "There were lots out there", he says, "but they only gave toeprints – they didn't include everything". So he built one himself.

The resulting calculator, based on an analysis of carbon emissions across the US, was coauthored by energy and public policy expert Daniel Kammen (University of California, Berkeley) and appears in the May issue of *Environmental Science & Technology* (doi:10.1021/es102221h). The researchers estimated carbon footprints in 28 cities for a range of household sizes and incomes, with the footprints accounting for emissions from transportation, energy, water, waste, and food, as well as other goods and services.



Eating more produce reduces household carbon and cuts costs.

The study revealed that the sources of your carbon footprint – and thus the best ways to minimize it – vary hugely depending on where you live. For example, transportation is the leading source in San Francisco, CA, whereas electricity and food are the biggest contributors in St Louis, MO. "To keep people from being overwhelmed, we wanted to highlight changes with the biggest impact", Jones explains. "And there

were good options that saved people money, so we decided to focus on those." Driving fuel-efficient cars also cuts gas costs, and low-carbon foods, such as chicken and fresh fruits and vegetables, are less expensive than high-carbon choices, such as beef and processed foods.

People are also motivated by social pressure, and the online carbon calculator (<http://coolclimate.berkeley.edu/uscalc>) takes advantage of this by ranking the results. "You put in your zip code and it compares you to the rest of your community", explains Jones, adding that the calculator also compares footprints between communities. This open-access calculator is available to non-profits and local governments in California, and the researchers plan to offer a fully operational version nationwide.

Jones also uses the calculator in classroom presentations. "Young people haven't decided where to live yet and that has a huge impact on carbon [production]", he notes. "If you live near your work, shopping, and entertainment, you decrease your carbon footprint and increase your quality of life." ■

Streetwise birds have bigger brains

Jane Bradbury

New research indicates that passerine bird species that successfully colonize urban areas are more likely to belong to big-brained lineages than passerines that avoid cities. This finding, suggest Simone Immler (Evolutionary Biology Centre, Uppsala, Sweden) and colleagues, supports the hypothesis that relatively large brain size, by increasing adaptability, predisposes avian species for living in urban environments.

Immler and her coauthors study how environmental change affects biological traits. "The urban environment is very new and harsh, with limited food resources and nesting sites for most bird species", she explains, "so we were interested in discovering whether having a relatively big brain,

which is thought to make species more adaptable, is correlated with colonization of this challenging and expanding environment".

The researchers collected published data on whether 82 passerine species were breeding in 12 representative European cities and on their brain size relative to their body size. They then used a statistical model that took into account the phylogenetic tree of these closely related bird species to examine the correlation between relative brain size and urban colonization, and discovered that larger relative brain size was positively associated with the ability of a species to prosper in urban environments. Moreover, a higher proportion of species in families with relatively large brains inhabited cities than those in families with smaller brains (*Biol Letters* 2011; doi:10.1098/rsbl.2011.0341).

"This research provides more evi-

dence for the link between brain size and the ability of species to cope with environmental change", comments Susanne Shultz (University of Oxford, Oxford, UK), who studies the evolution of behavioral complexity and flexibility in vertebrates. "However, we still do not understand what drives the relationship between brain size and habitat use. Without understanding the mechanism, it is difficult to use [the information in Immler's paper] to develop management strategies to prevent declines in bird populations as urban environments become more prevalent."

Immler, however, suggests that her research highlights the importance of creating ecological niches in cities to provide habitat for less-adaptable bird species. By doing this, she says, "we can increase the chances of maintaining biodiversity while continuing to expand our cities". ■

Australian whales lead the South Pacific chorus

Claire Miller

Australian whales crooning for mates are setting musical trends for humpback (*Megaptera novaeangliae*) populations across the South Pacific. An analysis of songs, collected over 11 years from six different populations, identified 11 different song types. The song types typically start off the eastern Australian coast and rapidly ripple eastward more than 6000 km to French Polynesia.

All males within a population sing the same song each year to attract females, and the songs change over time. “But new songs appear to originate from the west”, says researcher Ellen Garland (University of Queensland, Brisbane, Australia).

The new songs take 2 years to cross the Pacific, moving like cultural waves and revolutionizing the singing in each population along the way. It is a huge geographical area, so this rate of change is very fast. “The only parallel we can draw is with human culture, with music and fashion trends”, continues Garland.

The study, which was undertaken in collaboration with the South Pacific Whale Research Consortium (Avarua, Rarotonga, Cook Islands), is the first documentation of a repeated, dynamic cultural change occurring across multiple humpback whale populations on a large geographical scale. Garland believes that the eastern Australian humpback population could be acting as the trendsetters simply because, as the largest in the South Pacific, it has a

greater cultural influence. “The males seem to like to learn brand new songs, but they have to be in acoustic contact for the songs to spread”, she explains. “We think the songs are passed on when males move between populations, seeking breeding partners. Or they could be passed along on migration routes [that pass by] New Zealand, which are shared by the eastern Australian, New Caledonian, and Tongan whales.”

Singing is a sexual display to attract females, and so Garland thinks males may rapidly pick up a new song initially to be that little bit different and stand out. But whales also have a strong urge to conform, and so all males in a given population will very quickly follow the lead and start singing from the same new song sheet. ■

Double trouble for Arctic animals

Nancy Bazilchuk

When raising their young, Arctic animals must often dip deep into their fat reserves, thereby releasing fat-soluble contaminants that may be stored in their bodies. Now, Norwegian researchers have found that this seasonal emaciation poses a second challenge to animals at a time when they are already highly vulnerable, by inducing subtle physiological changes that may magnify the harm caused by contaminants.

“We call it a ‘window of effects’”, says Geir Wing Gabrielsen, an ecotoxicologist at the Norwegian Polar Institute (Tromsø, Norway). “This is a time when a lot of things are happening: Arctic animals are working hard and losing a lot of body fat; at the same time, POPs [persistent organic pollutants], including DDT and polychlorinated biphenyls, are released from the fat into the blood, which has physiological effects.” This problem is particularly pronounced in top predators, such as polar bears (*Ursus maritimus*), Arctic foxes (*Vulpes lagopus*), and glaucous gulls (*Larus hyperboreus*), because



Raising Arctic fox pups affects the parents' toxic burden.

these animals are at the top of the food web and often have high levels of contaminants.

Gabrielsen supervised Lisa Bjørnsdatter Helgason of the University of Tromsø (Tromsø, Norway) in her doctoral research on how this flood of contaminants affects seabirds and farmed Arctic foxes. Helgason found that farmed Arctic foxes fed “naturally” contaminated minke whale (*Balaenoptera* spp) blubber during summer and autumn fattening and subsequent winter and spring emaciation had higher levels of contaminants in their livers, adrenals, brains, and blood than a control group of foxes.

Helgason found that the physiological effect of fasting affected biotransformation enzymes as well. In herring gull (*Larus* sp) chicks, which Helgason also examined, the biotransformation enzymes were upregulated, meaning that gulls were more likely to metabolize contaminants. In Arctic foxes, however, the enzymes were downregulated, meaning the foxes were more likely to be exposed to the contaminants' harmful effects. While this differential in reactions to contaminants may give some animals an edge in eliminating their chemical burden, Gabrielsen says, it may further magnify the harmful effects of contaminants by creating metabolites that act as hormone mimics.

Gabrielsen – whose research has been part of the Arctic Monitoring and Assessment Programme (www.amap.no), an international coalition that produces scientific information on Arctic pollution for the governments of the eight countries that border the Arctic region – believes that findings such as these are helping scientists to better understand the vulnerabilities of Arctic animals. ■

Pesticide ban boosts water quality

Janet Pelley

When the Canadian province of Ontario banned the cosmetic use of pesticides 2 years ago, the pesticide industry predicted that citizens would ignore the law. But a new study shows that adherence to the ban is already improving water quality in urban streams.

“Ontario’s pesticide ban is one of the most health protective in North America and maybe the world”, says Gideon Forman, Executive Director of the Canadian Association of Physicians for the Environment (Toronto, Canada). Enacted on April 22, 2009, the pesticide law prohibits the sale of about 250 products containing 90 chemicals. Moreover, no pesticide can be used to improve the aesthetic appearance of lawns, gardens, parks, or school yards. However, consumers may use a select class of products, such as those that control poison ivy and wasps, for health or safety reasons. The law also allows exemptions for industries such as agriculture and forestry, as



Ontario Ministry of the Environment

Ontario streams are healthier just 1 year after many pesticides were banned.

well as for golf courses.

The immediate, as opposed to phased-in, banning of so many chemicals provided a unique opportunity to investigate changes in environmental concentrations of pesticides, according to the Ontario Ministry of the Environment (MOE). The MOE measured concentrations of 87 pesticides in 10 urban streams across the province before and after the ban was enacted. Prior to the ban, the top-selling pesticides for lawn care included 2,4-D, dicamba, and MCPP. “We were pleasantly surprised to see an 80% reduction of these three substances in streams in just 1 year after the ban”, says Kate Jordan, a spokes-

person for the MOE (Toronto, Canada). She believes that the trace amount of these compounds persisting in stream water is likely due to historical residues deposited before the ban took place. “These results give strong evidence that pesticide bans work”, Forman declares. The chemicals pulled from store shelves have been linked to cancer, neurological disorders such as Parkinson’s disease, and birth defects, he continues.

Although pesticide concentrations observed in the study rarely exceeded Canada’s guidelines for the protection of aquatic organisms, the chemicals could still pose a threat to freshwater ecosystems, according to Forman. He pointed out that combinations of two or more pesticides were found in all of the samples; scientists suspect that multiple stressors could have a synergistic effect on wildlife.

Inspections of more than 1000 stores revealed that 80% of vendors were complying with the law, Jordan adds. “[The improvement in water quality] shows that people want to do the right thing and that the ban is effective.” ■

A more responsible lawn

Madeline McCurry-Schmidt

Growing up in England, Mark Simmons was surrounded by hills of lush, native grassland. Simmons, now director of the Ecosystem Design Group at the University of Texas at Austin, still remembers seeing native grasses thrive, and he recently wondered whether native grass species could replace non-native species in lawns. His research, published this April in *Ecological Engineering* (doi:10.1016/j.ecoleng.2011.03.004), found that mixtures of native grasses outperform non-native grasses in terms of weed resistance and blade density.

Simmons’ study suggests that cultivating combinations of native species in lawns, parks, and golf courses could benefit both homeowners and the environment. “As

much as we like lawns, they tend to be very resource heavy”, Simmons says. Bermuda grass (*Cynodon dactylon*), a non-native species commonly used in the US, often requires the application of fertilizers and herbicides, and needs frequent mowing. In the southwestern US, he explains, the cost of irrigating lawns is exasperating to homeowners. “People are ripping up their lawns.”

But Simmons is part ecologist and part landscape designer, and in his view, lawns don’t deserve the bad rap. “The lawn is being demonized because we designed them wrong. By just using one species, native or non-native, we are creating a very synthetic environment.”

In the experiment, Simmons and his colleagues planted multiple plots with different combinations of native grasses and measured the perfor-

mance of these grasses against common Bermuda grass. Mixtures of native grasses grew slower and formed a finer textured and more dense turf, which stood up well to foot traffic. To test weed resistance, the researchers sowed the plots with dandelion seeds. Again, the native grasses won out. Because they evolved with native soil types, Simmons points out, native grasses also require fewer nutrients, noting that those native to the Great Plains flourish without human intervention – nutrients are supplied by natural sources (eg animals) and the soil itself.

Although the tested mix of native species is promising for the southwestern US, Simmons believes that the next step is to figure out the best mix of native grasses for each region of the country. “It’s really applying Ecology 101 to turf grass”, Simmons concludes. ■

Safeguarding Africa's coast from oil spills

Jen Fela

Reducing potential risks from oil spills is the new focus of the Abidjan Convention – an umbrella agreement administered by the UN Environment Programme (UNEP, Nairobi, Kenya) that addresses pollution, overfishing, dumping at sea, sea-bed exploration, and other activities that can affect the health of marine and coastal ecosystems along the western coast of Africa.

In addition to being the home of numerous busy ports, the waters of this region support abundant fisheries and a tourism industry. Increased exploration for offshore oil brings substantial revenue to countries along the coast, but also increases concerns about the potential for an oil spill like the one that occurred in 2010 in the Gulf of Mexico.

In April, at the 9th Convention of

the Parties to the Abidjan Convention in Ghana, governments from 19 of the 22 countries sharing the western, central, and southern African coast of the Atlantic Ocean agreed to create an Oil Spill Contingency Plan and establish a regional center for cooperation in the case of oil spills and other emergencies.

Abou Bamba, Regional Coordinator of the Abidjan Convention for UNEP (Abidjan, Ivory Coast), says that there are currently “about 30 platforms operating in the Gulf of Guinea that are in bad shape, like the *Deepwater Horizon*” – the rig that caused the largest offshore oil spill in US history. He continues, “Western private oil and gas companies that are active in the Gulf of Guinea have an important role to play, by complying with national and international regulations regarding oil spill prevention”, but points out that the countries in the region “do not have enforcement mechanisms in place”.

“Because of the strong interactions among the three currents (Guinea, Benguela, and Canary) in the region – they flow both down and up the coast – a major oil spill will affect all the coastal and [indirectly] some landlocked countries”, explains Bamba. “The plan makes provisions for the exchange of information, including spill surveillance, requests for assistance, joint response operations, use of dispersants, and more.” Bamba says that the participating countries will need to provide initial funding, after which, “it has been suggested that a national/regional tax on oil exploration should be put in place to fund the center. It’s also likely that international aid will be required during the first years”.

Preparation of the plan was a collaborative effort between UNEP, the International Maritime Organization (London, UK), and the UN Industrial Development Organization (Vienna, Austria). ■

Lawsuit seeks to protect Pacific walrus

Adrian Burton

The US Fish and Wildlife Service (USFWS) is being sued over its failure to award the Pacific walrus (*Odobenus rosmarus divergens*) protection under the US Endangered Species Act, despite finding such action to be warranted. The Center for Biological Diversity (CBD, Tuscon, AZ), an organization that seeks to protect wildlife through litigation, formally notified the USFWS of its intent to sue on April 21st.

On February 9th, the USFWS announced it had determined that the species deserved protection under the Act, given the effect of climate change on its habitat, but that “an official rulemaking to propose that protection is currently precluded by the need to address other high priority species”. At the time, Geoff Haskett, the USFWS’s Director for Alaska, stated, “[The walrus] greater population numbers and



The Pacific walrus, waiting for protection.

ability to adapt to land-based haulouts make its immediate situation less dire than those facing other species”.

“This ‘warranted but precluded’ status means that while the USFWS recognizes the Pacific walrus needs protection under the Act – which, unlike the Marine Mammal Protection Act, guarantees designated habitat protection – it is going to do nothing about it”, explains Rebecca Noblin, CBD Director for Alaska (Anchorage, AK). “The walrus will now be added to a waiting list that contains over 250

other imperiled species. Some have been waiting 20 years for protection, and 24 have become extinct while waiting.”

The suit centers on the CBD’s understanding that the Act allows a “warranted but precluded” finding to be made only when a lack of resources prevents the USFWS from assembling the information needed to support a listing proposal and also if the agency is making progress in listing more imperiled species. Neither condition is met here, the CBD claims.

A proposed settlement of litigation brought by WildEarth Guardians, announced May 10th but yet to be accepted by the courts, requires the USFWS to deliver ‘warranted’ or ‘not warranted’ rulings by 30 September 2016 for all species on the waiting list in 2010. “This [will help us get] species on the list [and get] them off the list as soon as possible”, said Acting USFWS Director Rowan Gould. Unfortunately, it will probably not help the Pacific walrus, which is not on that list. ■

Ancient fleas underfoot

Pete Mooreside

Endemic to the tropical Americas, parasitic insects commonly known as sand fleas (*Tunga* spp) have long been recognized as the causative agent of tungiasis. This zoonotic skin disease is widespread among modern – often economically disadvantaged – communities throughout South America and Africa, and can in severe cases have debilitating consequences (such as loss of movement and toes) if left untreated. Apart from written descriptions of the malady by 15th-century Spanish colonists to the New World, the past distribution of *Tunga* in Peru has largely remained a mystery. However, striking representations of the disease's physical symptoms appear in archeological evidence – including pottery from the Maranga, a civilization that pre-dates the Inca Empire.

While searching through the Amano Museum Foundation's historical art collection in Lima, Peru, Vicente Maco (Institute of Tropical Medicine Alexander von Humboldt,



Artifact from an indigenous Peruvian culture, depicting tungiasis.

Cayetano Heredia University, Lima) and colleagues stumbled upon a rare piece hidden away in storage – a Marangan figurine, previously undescribed, depicting a human subject displaying what appears to be tungiasis' characteristic pathology (*Emerg Infect Dis* 2011; doi:10.3201/eid1705.100542). “This ceramic shows the lesions caused by the penetration of the fleas exactly as we see today on infected travelers returning from highly endemic countries”, says Maco. “The black central dot and holes left after the death of the fleas are unique to, and diagnostic of, this infection.”

Although the fragment's age was not

reported, the authors note that the Maranga culture gained prominence between 150 and 650 CE. To date, only three other artifacts – all associated with another ancient Peruvian civilization – that likely portray infection by embedded female *Tunga* parasites are known. According to Maco, “The presence of tungiasis in pre-Incan cultures suggests that this parasitosis – which probably expanded to the Andean Highlands by ancient pilgrims from endemic areas, carrying the fleas inside their feet – was *always* a problem for those who traveled.”

Museum collections throughout the world could provide further opportunities for indirectly studying the historical presence or prevalence of pathogens in various cultures. Maco concludes: “Disease-portraying ceramics left by Incan predecessors are invaluable to understand the epidemiology of many emerging and re-emerging infectious diseases. Other autochthonous skin diseases, such as bartonellosis, were also clearly represented in ancient Peruvian pottery.” ■

Unusual pollutant pattern found in loggerhead turtles

Virginia Gewin

Migratory loggerhead turtles (*Caretta caretta*) exhibit an unusual chemical pollutant profile as compared with other wildlife species, according to two new studies (*Environ Toxicol Chem*; doi:10.1002/etc.540 and doi:10.1002/etc.553).

Blood plasma samples from adult males indicate that one specific chemical compound – polybrominated diphenyl ether 154 (PBDE-154) – is the dominant flame-retardant pollutant in transient turtles. PBDEs are flame-retardant chemicals applied to furniture and electronics; typically, PBDE-47 is the dominant pollutant from this class of chemicals. Researchers also found a similar pattern of PBDEs in turtle egg yolk samples collected from North Carolina. Among the eggs tested from 44 nests located in

three areas in the southeastern US, the highest concentrations of persistent organic pollutants (including PBDEs) were detected in North Carolina; concentrations were intermediate in eastern Florida and lowest in western Florida.

“The patterns were the same in eggs as well as blood – with PBDE-154 levels much higher in the animals that traveled farther north”, says Jennifer Keller, coauthor on both papers and an ecotoxicologist at the National Institute of Standards and Technology in the Hollings Marine Laboratory (Charleston, SC).

“The big question is whether turtles are preferentially taking up the PBDE-154 from the environment or metabolically transforming larger PBDE compounds to PBDE-154”, says Mark La Guardia, an environmental chemist at the Virginia Institute of Marine Science (Gloucester Point, VA). Typically, he explains, PBDE-47, PBDE-99, and

PBDE-100 are the most common chemical signatures of PBDEs in the environment, as well as in most birds and fish; PBDE-154 is detectable, but rarely predominant. “This odd pattern is a mystery; it seems to be a location plus reptile phenomenon”, says Keller.

There's another possibility: since several fish species metabolize PBDE compounds to PBDE-154, PBDE-154 might bioaccumulate in turtles.

Listed as a threatened species, the Northwest Atlantic loggerhead subpopulation has been declining at roughly 1.6% per year since the 1980s. While habitat destruction, fisheries bycatch, poaching, and diseases are among the many causes of death, scientists are increasingly interested in documenting the sublethal effects of chemical pollutants. Going forward, Keller will compare contaminant concentrations with hatchling success, growth rates, and sex ratios to look for trends. ■