

Science & Ideas

THE GREEN REPORT » MOVING OBJECTS, BOTTLED WATER, PLANT CHANGES AND EARTH'S ENERGY DEFICIT

A mobile home that marches to a different drummer



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In the English countryside, a house is taking its first steps.

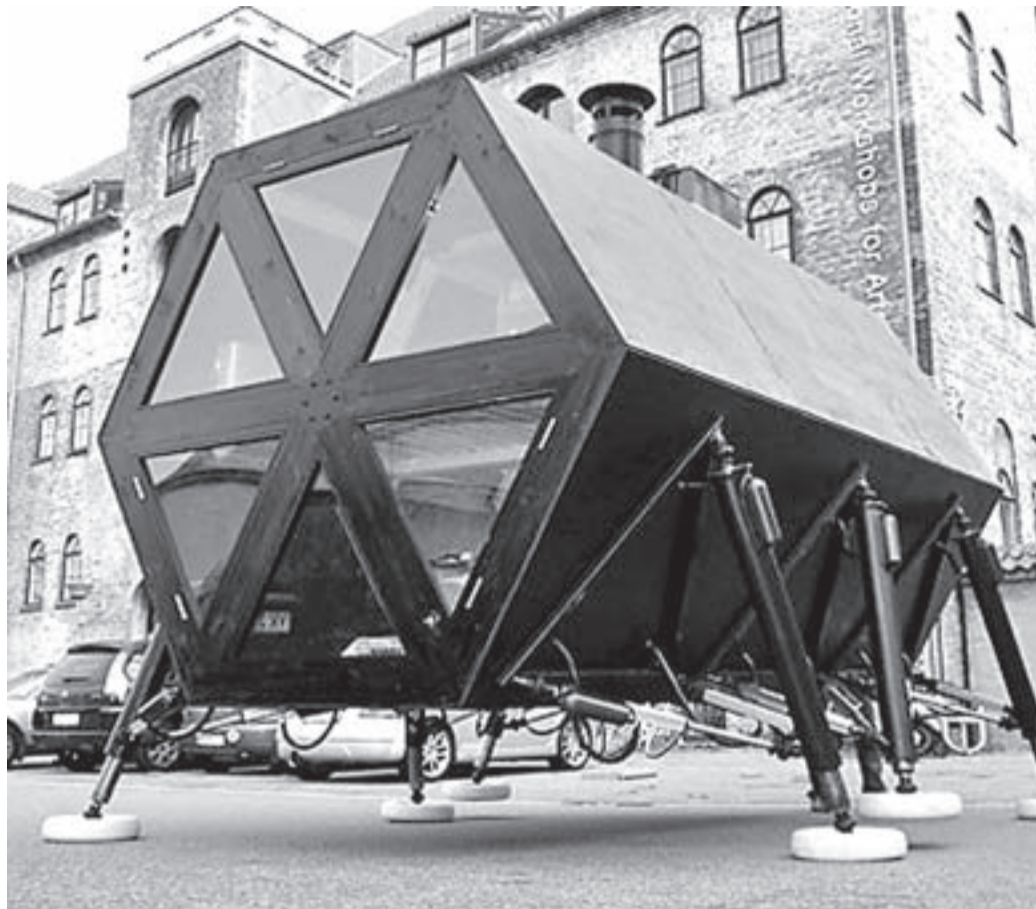
The Walking House, a 3.5-metre-high, 3.7-metre-long hexagonal chamber designed by Danish art collective N55, is slowly trundling around Cambridgeshire this month, crawling at a leisurely 60 metres an hour on six hydraulic legs designed by engineers at the Massachusetts Institute of Technology. Its maiden movements are posted on YouTube, alongside comments that deride its slow pace.

"But it's meant to move slowly," says designer Ion Sorvin from his office in Copenhagen. He and N55 member Øivind Slaatto put the house on legs rather than wheels, he explains, as an antidote to accelerated lifestyles.

There are radical philosophical motivations behind the house. Inspired by the struggles of Europe's Roma travellers, N55 promotes nomadic living. "The best way for governments to control people is to make sure they stay in one place," says Mr. Sorvin, who lives on a houseboat in Copenhagen. N55 members also believe that the private ownership of land should be abolished.

The house, containing a living room, kitchen, bed and mainframe computer, is designed to be self-sufficient, with solar panels, micro wind turbines, a compost toilet and rainwater harvesters. Wood-burning stoves or small greenhouses could be added.

This is just one of many eccentric designs architects have conceived to create more ener-



The Walking House, built by a Danish art collective, is a moving statement on sustainable lifestyles.

gy-efficient and environmentally friendly dwellings that "do more with less space." N55 has also created small submersible micro-dwellings modelled after Buckminster Fuller's geodesic dome.

Mr. Sorvin doesn't expect to see walking houses marching across the Earth or geodesic pods filling our harbours any time soon, though. "I just want to make people think about housing in a different way," he says. "In Denmark, people will pay two-thirds of their income just to have a place to live - if you can live in micro-architecture, you can spend your time and energy on other things."

With coastlines worldwide threatened by rising sea levels,

mobile and cheap homes may not seem so radical for long.

The Walking House is on display at the Wysing Arts Centre, 15 kilometres west of Cambridge, until Nov. 30.

BANISHED BOTTLES

For the first time in two decades, the sales of bottled water are slowing.

The Beverage Marketing Corporation announced last week that bottled-water sales will rise by only 2.3 per cent this year - the slowest growth since 1991, and down from consistent double digits in the early 2000s.

"This is a very significant statistic," says Richard Girard, water campaigner with the Po-

laris Institute in Ottawa.

The bottled-water industry blames the economic downturn and a cool summer - but Nestlé (one of the world's top four bottled-water producers) states in an internal document that consumers are being affected by "perceived environmental issues."

The packaging, shipping and distribution leave each bottle with a carbon footprint equivalent to filling it a quarter full with oil, according to the Pacific Institute in the U.S., which also calculated that Americans buy 29 billion plastic bottles of water a year, using 17 million barrels of oil. And yet 40 per cent of bottled water - sales of which in-

creased by 25 times from 1976 to 2007 - is just tap water with extra filtration.

British market-research firm Mintel predicted this year that there would be a "backlash" against bottled water, which it said is now becoming "unfashionable" because of ecological concerns.

Cities worldwide - including London, New York and Paris - are actively trying to persuade citizens to turn back to municipal tap water. Other cities, such as Liverpool, have banned the purchase of bottled water with city funds (as the city pays for water purification anyhow).

Toronto may do so soon, and if it does, "it could be the biggest city to have such a far-reaching bottled-water legislation," Mr. Girard says.

THOREAU'S CONTRIBUTION

Little could Henry David Thoreau have known 150 years ago, as he meticulously recorded flora and fauna in Concord, Mass., that he would help scientists today understand how climate change is affecting the world's plants.

Botanists from Harvard and Boston University published a paper last week in the Proceedings of the National Academy of Scientists documenting that a total of 473 species of plants are flowering an average of seven days earlier today - some as many as 20 days earlier - based on the records in Thoreau's journals.

Those plants that are flowering earlier in response to warmer temperatures are flourishing. But those that are flowering at the exact same time of year (because they bud in response to the length of the day, rather than temperature) are declining.

Moreover, the study shows that the plants in decline are more closely related to each other; the plants that are flourishing are also more

closely related. "So when you think about Darwin's branching tree of life, this means that entire branches are going to be pulled down from the tree," says lead author Charles Davis of Harvard.

As our climate changes, there will be winners and losers. "In this study, we've focused on the losers," which include some of the loveliest flowers, such as lilies, orchids, buttercups and violets, he says.

Now, he and his team are going to look more closely at the "winners." Though they aren't sure yet, he says, it's likely that the biggest winners will be invasive species such as mustard and hawk weeds.

ECOLOGICAL DEBT

The credit crunch has been grabbing headlines all year - but the ecological crunch is far more dire and irreversible, according to a new report.

Each year, we use 30 per cent more resources than the planet is able to regenerate, according to the Living Planet Report 2008, which adds up to an ecological debt of \$4-trillion to \$4.5-trillion each year - double what the financial crisis is costing. Speaking in London last week, the authors - led by the World Wildlife Fund and the Zoological Society of London - urged governments to set up a similar multibillion-dollar bailout to replenish and clean our air, water and soil and protect biodiversity, which they estimate has declined by 30 per cent globally since 1970.

Three-quarters of the world's population live in countries that are exacting more than they can replenish, with the United Arab Emirates ranked as the most resource-intensive, followed by the United States in second place and Canada in seventh.

» Zoe Cormier is a science writer based in London. Her column on environmental news and trends appears every other week in Focus.

ENDANGERED SPECIES



Invasion of the hybrids

The sticklebacks of coastal B.C. are ideal for studying natural selection in action - but now crayfish and crossbreeding are threatening to eliminate evolutionary scientists' favourite fish. **Elie Dolgin** reports

The threespine stickleback is found throughout the Northern Hemisphere, but in four lake systems off the Strait of Georgia in B.C., it exists in a unique form called "species pairs."

Each lake contains its own species pair and all of them are descended from a single marine ancestor that appeared after the most recent ice age, 10,000 to 15,000 years ago. The pairs have not interbred since - which makes the stickleback an ideal subject for studying speciation in action.

Now, scientists are alarmed at the imminent disappearance of one species pair in Enos Lake near Nanoose Bay, B.C., where the fish are suddenly crossbreeding themselves into a single hybrid species - a development that is the virtual opposite of natural selection.

"Million-year-old species are a dime a dozen; 15,000-year-old species are not," says Jenny Boughman, an evolutionary biologist at the University of Wisconsin-Madison who studies the B.C. sticklebacks.

The problem is an invasive crayfish, a lobster-like animal that is wreaking havoc on the Enos ecology by clear-cutting the vegetation at the bottom

of the lake, home to the tiny creatures that sustained the bottom-dwelling - or benthic - sticklebacks. The fish were forced to look for food and potential mates among the limnetic sticklebacks that live in the open water above.

After at least 10,000 years of separation, the species pair is now mingling - and interbreeding with a vengeance.

Don McPhail, a retired zoologist from the University of British Columbia, discovered the Enos Lake sticklebacks (*Gasterosteus* spp.) in 1974. In those days, the two stickleback species rarely interbred, and the most exotic creatures he ever found were red-bellied newts. "There were no crayfish then," he says. "That's for certain."

Then, in the early 1990s, the American signal crayfish (*Pacifastacus leniusculus*) arrived in Enos Lake.

The crayfish, which is native to the B.C. mainland, was probably introduced into nearby lakes on Vancouver Island as fishing bait. From there, scientists believe, the crayfish crawled overland through wet grass into Enos Lake.

"With the loss of vegetation through the crayfish, there was little to hold those two distinct

populations apart," says Ross Peterson, an aquatic ecologist in Nanoose Bay. "They began to interbreed simply because they found themselves in closer proximity to each other."

In 2001, researchers from the University of Leicester in England, first reported an unusual abundance of hybrids in Enos Lake based on morphological - or body shape - evidence. In 2006, a UBC team led by zoologist Eric Taylor confirmed the findings using genetics.

"It's just a total random mixture of genetic types," Dr. Taylor says. "These two species are collapsing into a swarm of hybrids."

Now, Mr. Peterson is spearheading an effort to remove all the crayfish in hopes of saving the sticklebacks. "Somewhere, there's a possibility, however remote, that we might be able to turn the clock back and return the pure forms back in Enos Lake," he says.

This summer alone, his team removed more than 25,000 crayfish from the lake, but he estimates that 100,000 more remain at large.

Even if Mr. Peterson's team can successfully eliminate the crayfish, however, many scientists fear it might be too late to re-establish the original stick-

leback species pair.

Unlike hybrids in other undisturbed lakes, where maladapted intermediate species usually die off without reproducing, the Enos Lake hybrids are surviving and breeding successfully.

"There is no longer selection against hybrids," Dr. Boughman says.

"It looks like there are no pure species left," Dr. Taylor adds. Even if the original lake conditions can be reconstructed, "it will be really hard to put the pieces back together again," he says.

The sticklebacks are now one of only around a dozen fish species listed as endangered under the Species at Risk Act, although each lake system species pair is listed separately because they all evolved independently of one another.

Comparing the different populations allows scientists to test the repeatability of natural selection.

Dolph Schluter, a UBC evolutionary biologist, analyzed the stickleback species from Enos Lake before the crayfish's arrival together with species pairs from two other lake systems, and showed that parallel adaptations occurred in all three cases under similar ecol-

ogical conditions.

"We're often left studying events in nature that have happened only once," Dr. Schluter says. "But here, similar species were arising again and again." Thus, the loss of the Enos Lake species pairs may be devastating for biological research. "Each of the pairs is important in and of itself," Dr. McPhail notes.

There is a silver lining, however. The Enos Lake hybrids' muddled genetics are making it easier to find new genes. For example, Dr. Boughman and her colleagues used the hybrids to identify five regions of the genome that underlie male stickleback colour patterns. "It's a conservation catastrophe," she says, "but it's also a scientific opportunity."

The Enos Lake sticklebacks are probably a lost cause, most scientists admit. Still, Mr. Peterson thinks that a valuable lesson can be learned from his team's recovery efforts.

"This should redouble people's efforts to keep invasive species, such as crayfish, out of those lakes, because we now know that it may be practically impossible to get rid of them once they're there."

» Elie Dolgin is a science writer and broadcaster in Philadelphia.

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Eric Taylor, a zoologist at the University of British Columbia

ABOVE: This male limnetic stickleback descended from a single marine ancestor that appeared 15,000 years ago.

ERNIE COOPER