



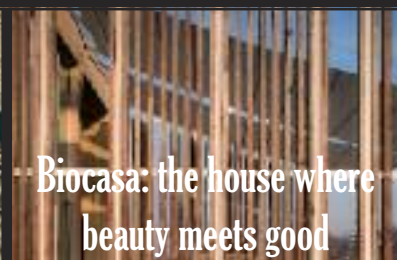
Ships, planes and cars: a licence to pollute?



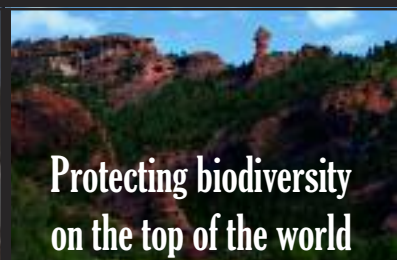
**A fine
biomass**



**The Cinese Solar
Revolution**



**Biocasa: the house where
beauty meets good**



**Protecting biodiversity
on the top of the world**



NATIONAL CHILDREN'S SCIENCE CONGRESS



A programme of
National Council for Science & Technology Communication (NCSTC)
Department of Science & Technology, Government of India



Focal Theme for 2016 & 2017

**SCIENCE, TECHNOLOGY & INNOVATION
FOR SUSTAINABLE DEVELOPMENT**



4 The long road ahead
of transport pollution

8 Polar bear books and
climate change for children

13 Meet the villagers
who protect biodiversity
on the top of the world

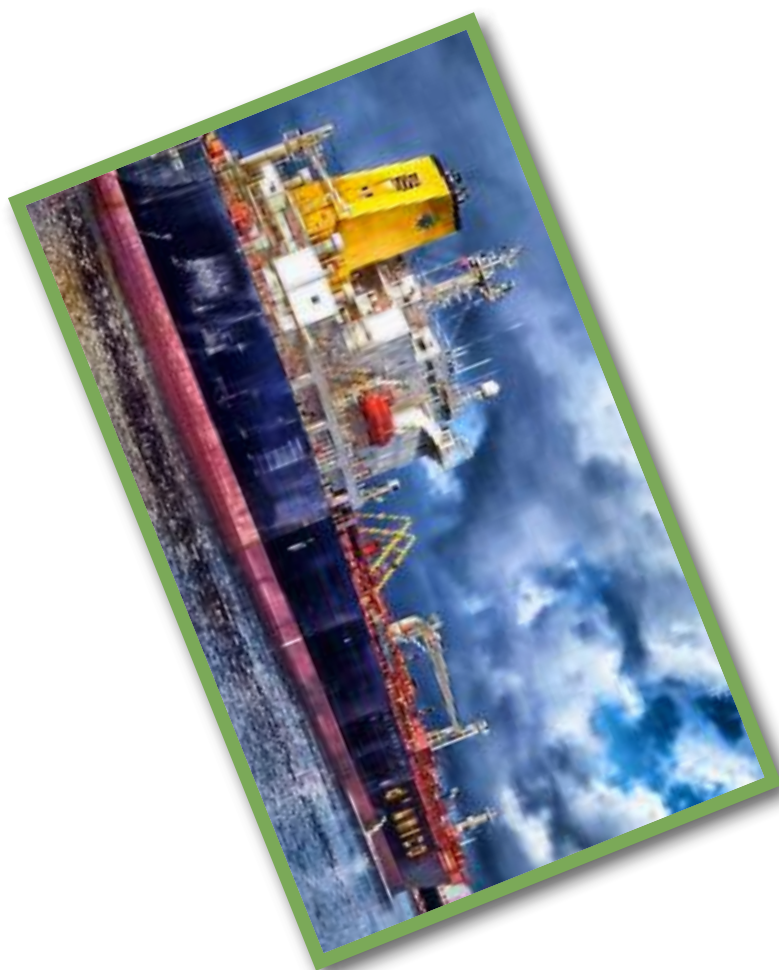
20 A fine biomass

24 Scientists scramble to understand
the invisible creatures around us
before it's too late

29 Biocasa: the house where
beauty meets good

32 The Chinese solar
revolution

34 Last stand: Bois du Cazier



Year III - Number 3
JULY-SEPTEMBER 2017

Editor:

Gianni Serra

Editorial team:

Eusebio Loria
Toby Lockwood
Jez Abbott
Alice Masili
Lenore Hitchler

Contributors:

Lindsey Konkel
Gyala Peri
Namcha Barwa

Thanks this issue:

Ensia
The Conversation

Cover Photo:

Cargo ship in the Amsterdam bay
harbour

Publisher:

Sotacarbo Ltd
CO2 Technology Centre Sulcis
Grande Miniera di Serbariu 09013
Carbonia (Italy)

Reg. Nr: 2/2014 Cagliari Ordinary Court

Only Natural Energy [ONE] is a digital
magazine published every three months.
www.onlynaturalenergy.com
info@onlynaturalenergy.com

Ships, planes and cars: a licence to pollute?

Everyday is more evident the need to tighten and improve enforcement of the emissions legislation for ships, cars, and planes. Many fear it's too late, but in Europe, something is finally happening.

By JEZ ABBOTT
ONE

Shipping

There it is on the horizon, clear as day. At half a kilometre long, it's hard to miss the hulking outline of a container ship or smaller, more elegant, ocean liner. Not so clear to the eye is the amount of fuel emissions from just one such ship – an amount equal to the emissions of up to 50 million cars.

That figure, from the Enfos software platform specialising in environmental remediation, is one of many throwing light on a transport sector responsible for environmental damage on a massive, but until recently not-so-evident, scale. Shipping emissions are predicted to jump 50% to 250% by 2050 depending on economic and energy developments – another sad statistic, this time from the EU.

Even the International Maritime Organization (IMO), the UN body tasked with tackling the climate impacts of shipping, is continually criticised for failing to act on shipping's growing contribution to greenhouse gas emissions. Some see an irony in its perceived inactivity, as the IMO's own research has found that shipping emissions are up 70% since 1990.

The amount of fuel emissions from just one container ship or an ocean liner equals to the emissions of up to 50 million cars.

Yet many critics suggest for three decades, the IMO has snubbed calls to clean up ship pollution. So while it has been illegal to spew sulphur-laden black smoke from power-station chimneys or truck exhausts, shipping has kept its licence to pollute thanks to an IMO policy agreed by around 170 governments that make up the organisation.

Meanwhile, proposals for emissions cuts by industry trade group the International Chamber of Shipping have done little to quell growing environmental fears. For this reason the EU has stepped in and is calling for a global approach to reducing greenhouse gas emissions from international shipping – recognition that maritime transport is both a large and growing source of emissions.

As a first step, large ships using EU ports will be required from 2018 to report their verified annual emissions and other relevant information. Ships of all shapes and sizes make for a truly shocking numbers' game: maritime transport emits around 1,000 million tonnes of CO₂ annually and is responsible for about 2.5% of global greenhouse gas emissions, according to the IMO.

This flies in the face of an interna-

A container ship..
(Photo by four12 | Flickr)



tionally agreed goal of keeping global temperature increase to below 2°C compared to pre-industrial levels, requiring worldwide emissions to be at least halved from 1990 levels by 2050. Yet ships' energy consumption and CO₂ emissions could be cut by up to 75% by operational changes and using existing technologies, according to another IMO report.

Many of these measures are cost-effective and reduce fuel bills. Another study, by National Oceanic and Atmospheric Administration (NOAA), found the particulate matter given off by container ships has contributed to over 60,000 premature deaths per year. The health dangers are highest around busy shipping areas like the Mediterranean, India and East Asia.

And cruise liners fare little better. According to a report in the UK's Guardian newspaper, the world's largest cruiser has a "supersized pollution problem". The Harmony of the Seas set sail from Southampton docks on the south coast of England last May on its first commercial voyage. The 16-storey ship has two engines that together burn about 66,000 US gallons of fuel a day at full power.

According to the report, a resident and member of Southampton Clean Air environmental group, insists fumes from cruise liners and bulk cargo ships are "definitely" contributing to Southampton's highly polluted air. Colin MacQueen adds: "We can smell, see and taste it".

"These ships," he said, "are like blocks of flats. Sometimes there are five or more in the docks at the same time. The wind blows their pollution directly into the city, and as far we can tell, there is no monitoring of their pollution. We are pushing for them to use shore power but they have resisted."

Royal Caribbean, which owns Harmony of the Seas and made a legal complaint about the article, insists the latest, most efficient pollution control systems are used, and the ship meets all legal requirements. Industry body Cruise Lines International Association (CLIA) meanwhile adds that companies have invested significantly to develop new technologies to help reduce air emissions.

But marine pollution analysts in Germany and Brussels say such large ships will probably burn at least 150 tonnes of fuel a day, and emit more sulphur than several million cars, more NO₂ gas than all the traffic passing through a medium-sized town and more particulate emissions than thousands of London buses. Some feel it is too late to act.

Many environmental commentators insisted before the landmark Paris Agreement on climate change of 2015 that without the inclusion of ship greenhouse gas emissions in the agreement and significant additional action to reduce emissions, shipping would swallow a growing proportion of the 2°C carbon budget. Ultimately it would be nearly impossible to meet climate targets.

That has not stopped the European Commission (EC) trying to set the world on a course that avoids dangerous climate change. The Commission is contributing €10 million to a joint EC-IMO four-year energy-efficiency project to try and set up maritime technology cooperation centres in five regions: Africa, Asia, the Caribbean, Latin America and the Pacific.

The centres will work together to build up technical expertise and capacity to promote uptake of low-carbon technologies and operations in less developed countries. They will also support the implementation of internationally agreed energy efficiency rules and standards. The net is further closing on heavily polluting large ships.

From January 2018, ships over 5 000 tonnes docking into EU ports must monitor and report CO₂ emissions and other data. Monitoring, reporting and verification (MRV) of information will be strictly regulated. Details will include fuel consumption, distance travelled, time at sea and cargo, to gather annual data into a emissions report submitted to an accredited MRV shipping verifier.

A year later in 2019, MRV companies will annually submit to the commission a satisfactorily verified emissions report for each of ship.

Furthermore, all ships will carry on board a docu-

ment of compliance that might be subject to inspections by authorities in member states.

Campaigning group the Clean Shipping Coalition (CSC) had long criticised the IMO, most recently in January when president and policy advisor at Seas At Risk John Maggs pointed out the IMO was first tasked with addressing ship greenhouse gas emissions by the Kyoto Protocol in 1997. In the 20 years since then, it had agreed only one measure, and that was “not fit for purpose”.

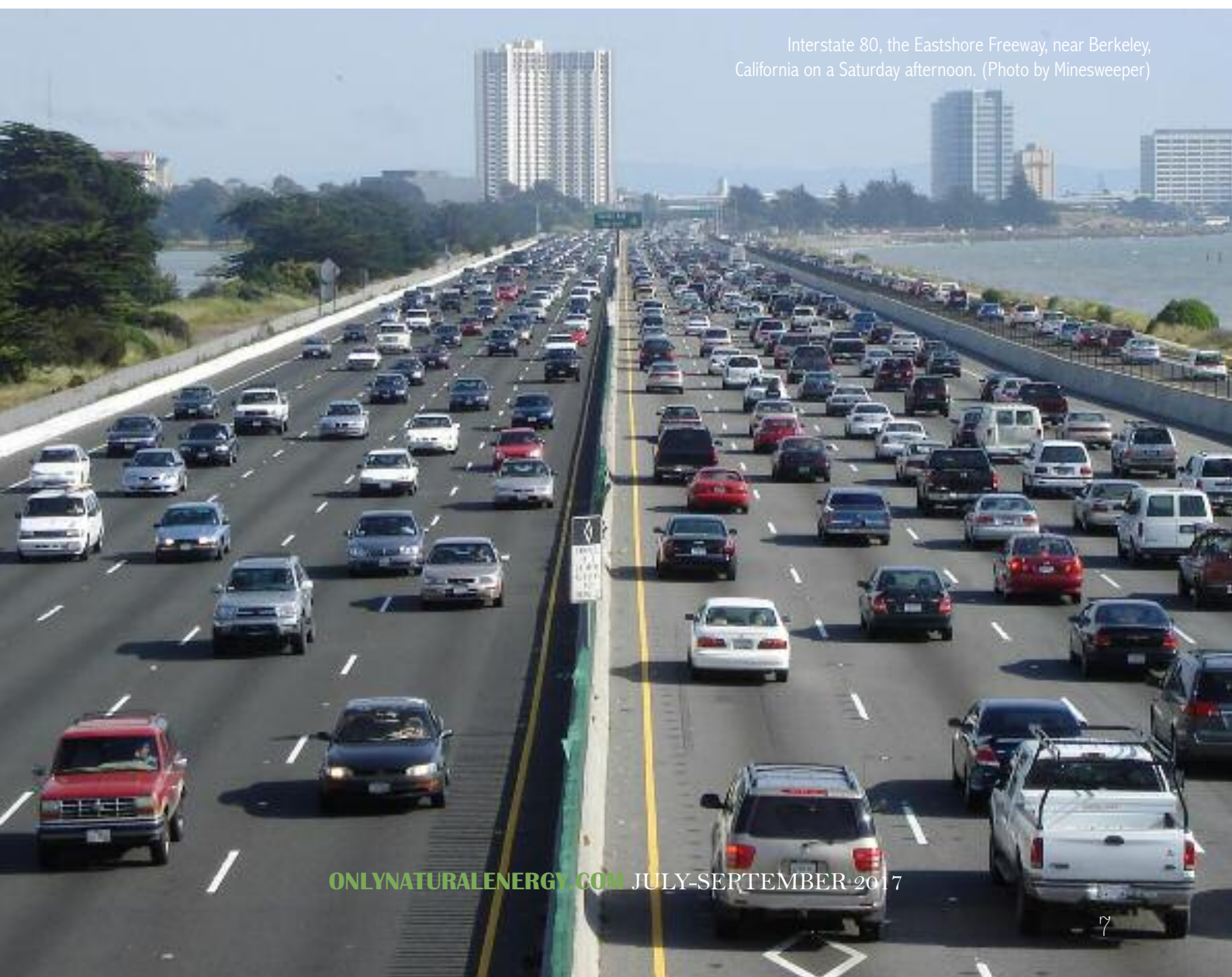
Maggs insists the world must pull together on climate change: “To achieve this all will have to play their part; there is no room for shirking responsibility or special pleading, least of all from an industry like shipping that has so much untapped potential to reduce emissions and move to a low-carbon business model.”

Cars

The EU is to pump €2.7 billion into what it calls 152 “clean and connected” transport projects, and you can see why. Transport is responsible for around a quarter of EU greenhouse gas emissions making it the second biggest greenhouse gas emitting sector after energy, according to EU chiefs.

Road transport accounts for more than two-thirds of transport-related greenhouse gas emissions and over one-fifth of total emissions of the main greenhouse gas, carbon dioxide (CO₂). But others play a part. Aviation and maritime sectors are seeing the fastest growth in emissions, reflecting a looming spiral to this well-connected, globalised world that could drill down to catastrophe.

Policies to reduce greenhouse gas emissions are there-



Interstate 80, the Eastshore Freeway, near Berkeley, California on a Saturday afternoon. (Photo by Minesweeper)

fore required for several transport modes. While greenhouse gas emissions from other sectors fell 15% between 1990 and 2007, those from transport shot up 36% in the same period, says the EU. This rise is despite improved vehicle efficiency because more people and freight are hitching a ride on trucks, trains, ships and planes.

Hence the timeliness for the €2.7 billion for all those clean and connected transport projects. Some of that money will be used to upgrade rail lines, smooth out traffic 'bottlenecks' and improve cross-border connections. In so doing, the EU leaders hope to not only modernise Europe's transport but spur job creation and stimulate economic activity.

This first tranche of funding, for example, is expected to unlock a further €4.7 billion of other public and private finance.

The EC and the European Investment Bank created a Cleaner Transport Facility (CTF) to pump cash into alternative fuels and technology. A super-fast charging network for electric vehicles linking Sweden, Denmark, Germany, France, the UK and Italy is one beneficiary.

And in late June this year EU commissioner for transport Violeta Bulc insisted: "This new wave of investment focuses on clean, innovative and digital projects to modernise Europe's transport network. We are one step closer to a true transport union, serving the needs of citizens, stimulating the economy and creating jobs."

A month later, this July, The European Commission told Brussels-based think tank Friends of Europe and a panel on the future of road freight transport it was moving to introduce legislative proposals for the booming truck sector. The panel heard that lorries were often "the forgotten elephant in the room" in terms of fuel consumption and carbon emissions.

"Trucks are the fastest growing sector in terms of oil demand," said International Energy Agency (IEA) executive director Fatih Birol. "At 17 million barrels

per day, it is one-fifth of the global oil demand. But there has been little public attention and not enough policy measures, partly because there are one billion cars in the world and only 60 million trucks."

However, truck transport nevertheless accounted for 35% of transport-related CO₂ emissions and cars only slightly more, at 40%. Birol said the USA, Canada, Japan and China already had fuel efficiency standards for trucks in place and Europe was lagging behind. More focus was needed on fuel efficiency, road freight traffic logistics and use of alternative fuels.

Commission vice-president for energy Maroš Šefčovič, said: "Freight transport is not overlooked but there is a sense of urgency to act. Our estimate

suggests freight transport in Europe will grow significantly, by 60% between 2010 to 2050. So we are already in that growth curve and the figures make it obvious that we must take action".

Europe is not alone in feeling mounting alarm at the high environmental cost of transport. According to the US government's Environmental Protection Agency,

transportation accounted for 27% of all greenhouse gas emissions in 2015 – nearly a third. Over 90% of fuel used for transport is petroleum based, with gasoline and diesel exacting a heavy, but relatively low-key toll.

Industry, on the other hand, often seen as public-enemy number one for the environment, recorded 21% of 2015 greenhouse gas emissions. So all that fossil-fuel-burning energy and production of raw materials belches out 6% fewer emissions than transport. Conventional wisdom suggests decarbonisation must await innovations in car batteries, hydrogen storage and biofuels.

But a recent report from Simon Fraser University sought to change this accepted narrative. *Driving Decarbonization: Pathways and Policies for Canadian Tran-*

In terms of fuel consumption and carbon emissions the truck sector is the forgotten elephant in the room, because there are one billion cars in the world and only 60 million trucks. But they account for 35% of transport-related CO₂ emissions and cars for 40%.

Industry, often seen as public-enemy number one for the environment, recorded 21% of 2015 greenhouse gas emissions. So all that fossil-fuel-burning energy and production of raw materials belches out 6% fewer emissions than transport. Conventional wisdom suggests decarbonisation must await innovations in car batteries, hydrogen storage and biofuels. But lifestyle changes, fuel switching, and urban redesign can have a positive impact too.

sport looked at how lifestyle changes such as energy efficiency, fuel switching, and urban redesign could cut transport emissions against a backdrop of policy change to encourage people, institutions and corporations to mend their ways.

Examples, where the use of gasoline and diesel have fallen rapidly in recent years, include Brazil during the 1980s and, more recently, Sweden, which is reducing gasoline and diesel use in buses and trucks. During the first half of 2016, biodiesel accounted for almost a quarter of all diesel fuel delivered to the Swedish transport fuel market.

This is according to an analysis made by environmental group Svebio and the Swedish Bioenergy Association and based on data from Statistics Sweden.

Biodiesel includes hydrogenated vegetable oils (HVO) and fatty acid methyl esters (FAME). HVO is based on feedstock like tall oil from pulp industries, recycled vegetable oils, and fats. FAME is mainly rapeseed-based diesel.

Canada can follow suit by introducing ethanol in vehicles and 100% biodiesel in modified trucks, reckons Mark Jaccard, who co-authored *Driving Decarbonization: Pathways and Policies for Canadian Transport*. Vehicles using electricity and maybe hydrogen will ultimately play a fundamental role with a little nudge from the political classes, he believes, with “just a bit of political leadership.”

That political leadership looks something like this: in July, nearly €4 million in European funds was awarded to low-carbon travel projects in Scotland, the UK. Five organisations such as municipal authorities will receive European Regional Development Fund (ERDF) cash to develop low-carbon transport hubs.

One will have a solar canopy and electric vehicle charging stations.

Perth and Kinross Council will use its cash to introduce a hydrogen refuelling station and more electric vehicle charging points. It will also pay for the upgrading of an electricity sub-station to provide ultra-rapid charging. The solar PV canopy with battery storage system will support the charging stations. Similar hubs are to be built in Aberdeen, North Ayrshire, Dundee and Falkirk.

Announcing the funding awards on ERDF minister for transport Humza Yousaf said: “ERDF Low Carbon Travel and Transport Challenge Fund provides a fantastic opportunity to help individuals, communities and our population benefit from sustainable and greener travel options.”

Aviation

Hopping on a plane and jetting off for a weekend break has never had such dire consequences. All those air-miles may save you money and contribute to economic growth. But elsewhere the costs are stacking up alarmingly, such as on human health, climate, and the environment.

The number of flights in Europe in 2014 was about 80% higher than in 1990, according to figures from the European Environment Agency. And after a drop caused by the global economic recession from 2008 onwards, the numbers are picking up again, fuelled by low-cost flights and new routes that offer travellers evermore choice and destinations.

UN regulator the International Civil Aviation Organisation (ICAO) projects the world's commercial air-



craft fleet will jump from 26,000 to around 47,500 by 2036. The implications of this become stark when seen in the context of European Environment Agency figures showing greenhouse gas emissions from international aviation jumped 22.7% in only seven years to 2007.

Emissions have been increasing steadily, doubling since 1990. Meanwhile, emissions were 18.3 % higher in 2014 than in 2000. The ecological footprint of a single person taking a long-haul flight, for example, causes as much pollution as a motorist does in two months according to one study led by Oslo-based research fellow Borgar Aamaas.

In other words, a one-way transatlantic flight from Paris to New York in economy class generates around 381.58 kilograms of CO₂, according to the ICAO's emissions calculator. This is equivalent to emissions generated by the energy use of an average house for ten days. Meanwhile, the noise of more take-offs and landings is having a negative effect on health and academic achievement.

The aviation sector has addressed some of these issues by boosting fuel efficiency through improved engine and plane designs. But the uptake of sustainable alternative fuels is very slow, and the recent collapse in global oil prices has eased the incentive on airlines to develop biofuel-based renewable fuels. Jet fuels used on international flights are also exempt from national taxes.

But the pace of growth in recent years and projected growth in the years ahead mean technological advances will not be enough to significantly reduce the increase in total emissions from aviation. This conclusion is echoed by the USA's Centre for Climate and Energy Solutions (C2ES), which also insists aircraft are a rapidly growing source of emissions within the transport sector.

Four years ago planes were responsible for about 3% of total US CO₂ emissions and nearly 9% from the transportation sector. Commercial flights accounted for most of the aircraft CO₂ emissions, with military

and general aviation making up the rest. And recent studies estimate US aircraft emissions will increase substantially in the next 20 years. This increasingly interconnected global aviation sector makes up about 2% of global CO2 emissions but is one of the fastest growing sources, according to C2ES. From 1990 to 2010 global aircraft CO2 emissions grew about 40%. If global aviation were a country, it would rank as the seventh largest CO2 emitter, and US aircraft emissions are 29% of all global aircraft emissions.

Without new policies, global aircraft emissions are projected to triple by 2050. For this reason, last October the International Civil Aviation Organization (ICAO) created a global offsetting scheme called the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to address those rapidly growing emissions from aviation.

And in February this year, the European Commission responded to ICAO's scheme by publishing a proposal on how to treat aviation emissions under an EU Emissions Trading System (EU ETS). The agreement reached by the ICAO foresaw the establishment of system that will oblige airlines to offset the growth of their CO2 emissions after 2020 by buying 'emission units'.

In other words airlines will spend money on projects reducing CO2 emissions in other sectors of the economy such as renewable energies to notch up their units. In its first phase, from 2021 to 2026, 65 countries will participate on a voluntary basis and thereafter it will become mandatory. The goal is to offset 80% of the emissions by the scheme between 2021 and 2035.

Not good enough according to some commentators, who argue Europe is calling for a considerably less ambitious carbon emissions standard for air planes than the US. A former flight test engineer and senior

aerospace lecturer at Delft University in the Netherlands, Joris Melkert, told the UK's Guardian newspaper, the Europe's proposals were less ambitious by a long way than the USA's.

Under the proposals, a co-called stringency option of '9' suggested by the US would reduce overall aircraft emissions by 37.5%. A '7' setting favoured by the EU would imply a 33% cut, according to the Guardian. The 4.5% gap equals 350 million tonnes of CO2, or slightly more than Spain emits a year. EU officials admit their proposal is less ambitious, but still "quite close to the US one".

Without new policies, global aircraft emissions are projected to triple by 2050. The European Commission designed a system that will oblige airlines to offset the growth of their CO2 emissions after 2020 by buying 'emission units'. The goal is to offset 80% of the emissions by the scheme between 2021 and 2035.

Environmentalists are not happy, but experts in Brussels say the variety of complex issues still to be agreed – and the amount of aircraft manufacturing countries involved, from Brazil and Ukraine to India and China – make like-for-like comparisons unwise. The EU insists it is focused on getting the global scheme up and running and serious about achieving carbon neutral growth for aviation.

An EU source is less positive: "We need a standard that reflects the state of art of the technology, that is as close as possible to what engineers are capable of doing, without going so high that a number of aircraft types would be put out of the market as that would be environmentally unhelpful, economically detrimental and also quite unfair, as lead-in times for aircraft take about 10 years."

However, European commissioner for climate action and energy Miguel Arias Cañete countered in February: "This proposal makes sure the aviation sector contributes to our climate objectives. Now, we call on countries around the world to participate in the global scheme and help us finalise and implement sound environmental criteria to deliver real emissions reductions in the aviation sector." 

Polar bear books and climate change for children

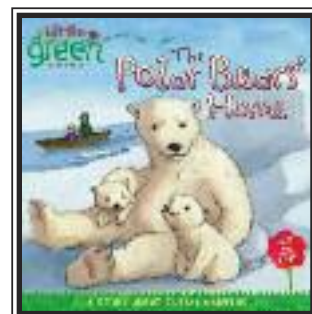
By LENORE M. HITCHLER
ONE

Can you bear it that polar bears may go extinct? Polar bears are beautiful and act cute, which leads both adults and children to care about them. Our industrial system is putting the survival of polar bears at risk. The use of fossil fuels contributes to greenhouse gases which in turn lead to global warming. Because of increasing temperatures, the Arctic ice caps are melting. This has dire consequences for polar bears who need to live on stable ice rather than open water. The plight of polar bears has alarmed both adults and children. Stories about polar bears can be used to inform readers about climate change in a manner which reaches their hearts as well as their minds.

The following is a guide to children's fiction books which deal with polar bears and climate change. The review can be used to choose books to share with the children in your life or even your inner child. These books can motivate young children to care about global warming, especially if adults talk to children about it. Interesting tidbits of information gleaned from these books are included for your perusal. Some of these books contain realistic stories of polar bears;

others are about anthropomorphic characters, who look, act, or think like humans.

Lara Bergen, author of more than a hundred children's books, is the author of *The Polar Bear's Home-A Story About Global Warming*. Illustrations are by Vincent Nguyen, and the publisher is Simon & Schuster. It is part of a collection called Little Green Books which are written for young children and have an environmental focus. This book is geared to children aged four to six.



In this book a nameless girl and her father, who live somewhere in the Arctic, see two polar bear cubs that are stuck on an isolated piece of ice. Because of global warming, the ice has broken away from land and is floating away, leaving the two cubs, who have not yet learned how to swim, stranded on the ice. Luckily, the mother finds them and rescues them. The author emphasizes that we



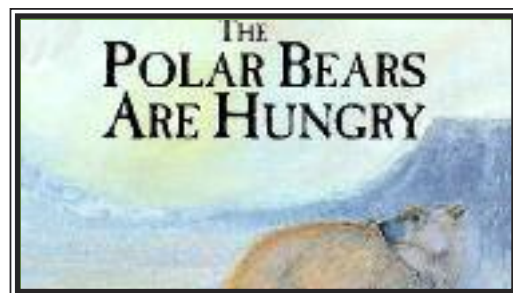
must prevent further climate change to adequately protect the entire species. During the course of the story, children learn that polar bear cubs only weigh a pound when born. Adults have a four-inch layer of fat to keep them warm, which means that even in winter they can get overheated. The final page includes suggestions of things that children can do to help the bears, including recycling, turning off lights and televisions, and unplugging computers when not in use.

Carol Carrick is the author of *The Polar Bears Are Hungry* and nearly fifty other books for children and young adults. Her son, Paul Carrick, is the illustrator, and Clarion Books is the publisher.

This story is about a mother polar bear and her two cubs. According to the book, polar bears do not swim fast enough to catch seals in open water. Therefore, they need to capture the seals at the air holes that the seals use during the colder months. The sea ice has melted during the summer leaving the bears hungry

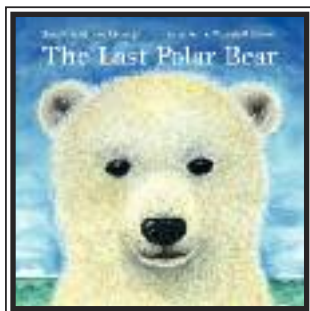
because they can no longer capture seals on the ice. The mother needs to produce

milk for her cubs, so she brings them into an Arctic village to find some food. She and her cubs are caught and put into a cage, and eventually they are set free. During the time the bears are in cages they are given water, but no food. This is meant to discourage them from returning to scavenge in human settlements.



Jean Craighead George, is a well-known and beloved children's author with a degree in both science and literature. She is the author of over one hundred children's books on animals and nature, and is the author of *The Last Polar Bear*. Wendell Miner is the illustrator of the book, and HarperCollins is the publisher. This

book is geared to children aged four to eight. The main characters, Tigluk and his grandmother, devise a plan to save the last polar bear cub. Because of rapid melting of the ice, the little cub is orphaned and in trouble. It is not clear whether this is the last polar



bear on the planet or just that particular region of the Arctic. Unfortunately, the solution to the cub's problems is unrealistic as Tigluk plans to teach the cub to survive in a warming world, which seems more

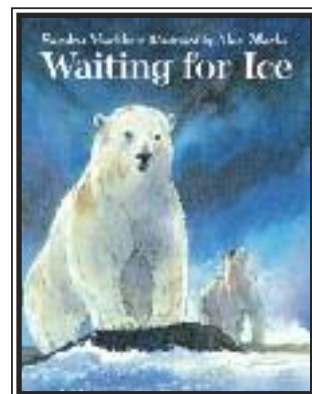
like a fantasy than a doable solution. It also ignores the fact that if there is only one polar bear left, the species could not survive. Nevertheless, the book tells a touching story. This book shows a child acting in an empathetic and compassionate manner towards a fellow creature.

Sandra Markle, a former elementary school teacher who has published over two hundred nonfiction books for children, is the author of *Waiting for Ice*. Alan Marks is the illustrator, and Charlesbridge is the publisher. The book is geared to children aged four to eight.

Like Craighead George's *The Last Polar Bear*, *Waiting for Ice* is about an orphan polar bear. However, it

doesn't contain humans, magical solutions or anthropomorphic characters. The book is realistic and shows both the struggles of an orphaned female ten-month-old polar bear cub and the impediments to the survival of the species as they respond to global warming.

The polar bears in Markle's story live on Wrangel Island, north of Russia. When not hunting for prey in the sea, polar bears need to rest on ice floes. During the summer the ice packs melt and then refreeze when it turns colder. Traditionally this occurred in September. However, due to global warming, the ice pack is more prone to developing in late November. The polar bears are thus forced to remain on the island because of the lack of adequate, stable ice.

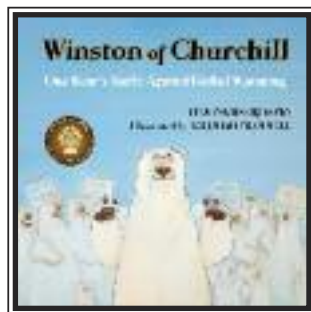


While the bears are stuck on the island, the main food supply consists of migrating birds and walrus. However, there is not enough prey to provide all of the bears with the high-fat diet which they must consume. The bear cub's fortitude in staying alive is endearing. The reader feels empathetic to the female polar bear cub in particular, and the rest of the bears



in general. The back of the book includes some interesting facts about polar bears such as the fact that their coats look white, but are not. Sunlight passes through the coat hairs to its black skin, which soaks up this solar energy. The final page provides sources to additional information including Polar Bears International and such interesting tidbits as the fact that polar bears have been called “old man in the fur cloak” and “white sea deer” by various societies.

Jean Davies Okimoto is the author of *Winston of Churchill-One Bear's Battle Against Global Warming*. Okimoto has written books for both children and adults. The book is illustrated by Jeremiah Trammell and Sasquatch Books is the publisher. The book is geared to children six to eight.



The book is very anthropomorphic. The main character is a polar bear called Winston Churchill who is the leader of a bear protest in Churchill, Manitoba, Canada. He smokes a cigar and talks like the historical Winston Churchill. Winston has written a book called *Why It's Getting Hotter*, which provides an excellent scientific explanation to children about glo-

bal warming. It explains greenhouse gases, how they cause the greenhouse effect, and how we can limit them. Winston also organizes a protest by the bears, who carry signs saying “Freeze Please,” “Save our Home,” “Brrrr is Best,” “Cool It,” and “Ice is Nice.” Some other signs are “Turn Stuff Off,” “Solar Power,” “Turn Down the Furnace,” “Make Less Garbage ...Recycle,” and “Save Trees.” The demonstrating bears are endearing to readers and present protest demonstrations as a valid and reasonable form of action. The last page includes scientific information on the conditions of polar bears. For example, ice in Hudson Bay is breaking up earlier in the year. Because there is less ice in the ocean, polar bears must swim greater distances and sometimes even drown. The bears have lost weight because they are unable to consume enough food. Also, fewer bear cubs are born, and many do not survive. Thus, there are fewer polar bears, and the ones who do survive are not healthy, which contributes to even more polar bear deaths.

Each of these books shows children why global warming should be stopped and ways in which it can be done. The books have lovely illustrations. They also teach children some of the bare facts about polar bears. [ONLYNATUREENERGY.COM](http://www.ONLYNATUREENERGY.COM)





CO2 Technology
Centre of Sulcis

SARDINIA Technology & Nature



ENEA
Agenzia Nazionale per l'Energia e la Tecnologia
Energia, Ambiente e Innovazione

REGIONE SARDEGNA
REGIONE SARDEGNA
REGIONE SARDEGNA



CO2 Technology Centre of Sulcis



SOTACARBO
SOCIETÀ PER AZIONI A CAPITALE CHIUSO

Meet the villagers who protect biodiversity on the top of the world

By GYALA PERI and NAMCHA BARWA
The Conversation

It was a chilly February day. Dangwen and his wildlife monitoring team patrolled along the upper reaches of the Yangtze River.

The river was frozen solid, easy for poachers to walk over.

That day, they encountered 220 blue sheep, five white-lipped deer, and a line of otter footprints.

On the infrared camera traps that they had set up throughout the valley, three snow leopards appeared, a mother and two cubs – and the cubs had grown much bigger than three months earlier.

Dangwen comes from Yunta, a village located in Sanjiangyuan, Qinghai Province on the Tibetan Plateau. Sanjiangyuan, is a 400,000 km² area that serves as an important habitat for rich and unique biodiversity and a watershed of the three largest rivers in Asia, the Yellow, Yangtze and Mekong, which serve a billion people downstream.

Dangwen isn't officially a researcher or an activist. But he has taken upon himself the task of monitoring local wildlife with a team of other villagers, as part of a conservation project driven by the Shanshui Conservation Center, a Beijing-based non-governmental organisation.

A pilot village for conservation

A mining company attempted to prospect the area almost a year before wildlife monitoring in the region started. The villagers were deeply disturbed because mining the mountains would go against the spiritual values of Tibetan Buddhism and threaten their safety.

So, when the Shanshui NGO proposed in 2013 the idea of organising villagers to monitor wildlife and protect their lands, Dangwen volunteered without hesitation.

Having grown up in the village, he is very familiar with the land, the river and the wildlife, and he is especially proud of the sacred mountains that surround all of them. This is the fourth year that Yunta villagers have carried out this monitoring, patrolled the village to spot poachers, and managed rubbish to keep the land and rivers clean.

Monitoring data shows that local wildlife populations, including snow leopards, are increasing.

The villagers' conservation conduct is officially authorised by the local government – their stories have been reported by China Central Television – and the mining company never returned.



An inspiration for the Tibetan plateau

Inspired by Yunta, four neighbouring villages began their own wildlife monitoring and anti-poaching patrols. With encouragement from local authorities, a village-based conservation network is being formed along the Tongtianhe Valley. Recognised as a conservation priority in China, the Sanjiangyuan National Nature Reserve was set up in 2003 and designated a national park in 2016. But the area faces big conservation challenges: government agencies have limited manpower to manage this vast area and grazing rights to all its grasslands were given to households in the 1990s.

This means that conservation in Sanjiangyuan would not be possible without support from local Tibetan communities. As Buddhists, these communities embrace the value of respecting nature and caring for other living beings. Their system of sacred lands is very similar to modern protected areas. That makes them natural allies for conservation.

Yunta's experience has proven that, with proper training, villagers can become very qualified conservationists. Essentially, they are providers of ecological services and should receive benefits from conservation in return. Based on this experience, a policy recommendation was made to the government, and the newly designated Sanjiangyuan National Park quickly responded.

A total of 16,400 jobs as guards, with monthly salaries of 1,800 yuan (about US\$260), are to be offered to villagers living inside the park (one per household). The next step is to explore the possibility of reducing grazing in key habitats to allow wildlife – especially large carnivores such as snow leopards – to increase, and to slow down grassland degradation.

Protecting animals and humans

The Tibetan Plateau is the last place in Asia that still maintains a relatively intact ecosystem where large carnivores and ungulates, many unique to the region –

After three decades of fast economic development, and demands by the Chinese people and government, a better environment is becoming a higher priority. Several large ecological programs have been initiated

such as the snow leopard, the Tibetan brown bear, the Tibetan antelope, the wild yak, the Tibetan wild ass, the Tibetan gazelle, and the blue sheep – roam freely.

Maintaining this vast ecosystem is challenging because its population of pastoralists is rapidly increasing. The human population of Sanjiangyuan has doubled since 1980. Meanwhile global climate change may have added to pressures on the grassland. Is it possible, under these conditions, to protect the ecosystem successfully while supporting the cultural and economic well-being of Tibetan communities?

After three decades of fast economic development, and demands by the Chinese people and government, a better environment is becoming a higher priority. Several large ecological programs have been initiated – perhaps among the largest financial schemes in the world – to pay for protecting and restoring forests, grasslands and wetlands, though their effectiveness could be improved by more scientific planning and participation.

The call for nature education from citizens, especially parents, is rapidly growing, and this has generated broad concerns over ongoing ecological degradation. Public participation in conservation is now protected by environmental laws. Political will, the interests of society, and traditional values are all coming together. This makes us believe that co-existence between humans and nature is not just wishful thinking. Yunta offers a strong starting point.

*Originally published
by The Conversation
June 7, 2017*

A fine biomass

Is there any real evidence that burning woody biomass is good for the climate? The debate still rages

By TOBY LOCKWOOD

ONE

Old power plants switching from coal to wood has been one of the major energy trends of the decade, allowing them to avoid carbon taxes and tap into subsidies for renewable energy.

The reasoning behind designating this 'biomass' as a renewable energy source is that the trees are harvested from forests that will grow more trees, in the process sucking in the CO₂ that was released during combustion. Although practised in countries all over the world, the UK has led the way in big coal-to-biomass conversions, with giant facilities such as the Drax Power Plant in North Yorkshire consuming over 6 million tons of wood pellets a year, shipped largely from forests in the USA and Canada.

Biomass plants like Drax now contribute around 4% of the UK's energy supply and account for a quarter of global consumption of wood pellets. Besides making effective use of existing coal plant infrastructure, the main appeal of the converted plants is that, unlike wind and solar power, they can generate electricity whatever the weather.

However, not everyone agrees that burning woody biomass has such a beneficial effect on CO₂ emissions. While some environmental groups have campaigned against the practice for years, the debate was reignited in academic circles earlier this year when a scathing report from influential British think tank Cha-

tham House declared that burning wood for power could in many cases be even worse than fossil fuels as 'carbon emissions stay higher for decades longer.' The report's author Duncan Brack argues that the carbon 'payback' from forest growth can not be taken for granted and will depend a great deal on the type of wood used and what would have happened to both the harvested wood and the forest had it not been burnt for energy.

Wood pellets are currently made from a whole range of by-products of forestry industries whose real focus is the main trunks of mature trees which can be used for producing high-value products like building timber and furniture. Much of the tree, such as bark, branches, and the tops, is of less value and may be discarded or used for lower quality materials like chipboard. Other low-value materials include smaller trees which 'thinned' from the forest to help bigger trees grow, and sawdust produced at the sawmill. Some of this lower value wood is used in the paper industry but, with paper use declining, much of it is also left to rot in the forest or burned on site without producing energy. Bioenergy is providing a new outlet for these cheap materials.

The Chatham House report suggests that only pellets made from sawmill waste and wood which has already been used by the consumer (such as discarded furniture) can be in contention as 'carbon neutral'

A Chatham House report suggests that only pellets made from sawmill waste and wood already been used by the consumer can be in contention as 'carbon neutral' energy sources worthy of renewable subsidies.

The IOI Sandakan Biomass Power Plant.
Photo by CEphoto, Uwe Aranas





energy sources worthy of renewable subsidies. It argues that any residues which would otherwise be left to decay in the forest represent a much slower re-release of carbon than in combustion for bioenergy, and can even help other tree growth by providing nutrients. Other potential uses as low-quality materials would also mean 'locking up' the carbon for longer. This idea of the time-scale of the CO₂ release is central to the report's argument, which subscribes to the idea that release of a lot of CO₂ in the short term could have a dangerous effect on the climate, even if it is reabsorbed in a few decades time. The report also expresses concern that bioenergy products can have a detrimental effect on the total carbon stored in the forest, noting research which shows that old trees actually absorb more CO₂ than younger trees.

The Chatham House report led to a furious response from a number of biomass research groups, including the International Energy Agency's Bioenergy group, which claimed the policy recommendations were based on 'unsubstantiated claims and flawed arguments.' Most critics of the research have emphasised that wood pellets for power generation account for a tiny fraction of forestry products (1% in the USA), and that the low-value product has a negligible impact on forestry practices.

As pointed out by the UK's 'Supergen' bioenergy rese-

arch group, a 100% price increase in wood pellets has in the past led to only a 3% growth in the US harvest. They also stress that, while CO₂ may be released by harvesting one part of a forest or 'stand' of trees, trees growing elsewhere mean that the whole forest remains a constant store of carbon, and there is no real 'delay' in getting back the CO₂. Supporters of woody biomass point out that forests in the US have grown in recent years.

Not to be deterred, Chatham House replied to the IEA riposte with some indignation, standing by their original findings and remarking that it is unprecedented for an intergovernmental panel to demand they withdraw their policy advice.

At the heart of the disagreement between the two sides of the debate seems to be different ways of looking at the standard bioenergy needs to achieve to be truly sustainable. Chatham House doesn't dispute that a harvested forest can hold a constant level of carbon, but maintain that this still isn't good enough.

Essentially, the argument is that untouched forest is better for the climate than a managed forest, so any risk of the bioenergy industry increasing the existing harvest should be avoided, and definitely not subsidised as a renewable energy source. Their opponents insist that wood pellets are not making a difference to



Biomass being processed at the Savannah River Site.
This award-winning plant replaces a deteriorating coal powerhouse.
(Photo by Energy.gov)

harvests anyway, and may even be having a beneficial effect by helping keep forestries in business in places where they would not otherwise exist. On a more scientific note, the two sides also have different views on whether 'natural' forest is, in fact, better for the climate, with some bioenergy supporters arguing that forestries promote healthy, large trees which absorb more CO₂.

Even if there is no effect on the rate of harvest at all, Chatham House point out that we need to look more closely at what would happen if the low-value wood were not used for bioenergy. This is where the issue of the time-scale of CO₂ release comes in, as keeping the carbon in low-quality materials or rotting on the forest floor at least postpones the CO₂ emissions for a while and lessens the chance of reaching a critical level of CO₂ in the next decade or two. The supporters of bioenergy hold that the great majority of this material either decays very rapidly or is burnt on site, without producing energy.

It is important to realise that the European Union and countries like the UK and the Netherlands already have fairly strict rules on the sustainability of biomass sources. While Chatham House would like these to take better account of how bioenergy is affecting overall forest stocks, there are indications that regulations are already moving in this direction in Europe. On the

other hand, there is always the problem of how to deal with biomass sourced from countries which don't account for greenhouse gas emissions from land use so rigorously.

The think tank suggest that one approach would be to stop treating the CO₂ emissions from biomass power plants as zero, and instead require that the 'negative' CO₂ is properly accounted for by the country selling the wood pellets. However, many are strongly opposed to this idea, as it could destroy the viability of the whole industry.

Bioenergy scientists have been addressing the issue of sustainability for many years, and they claim that the points made by Chatham House are not new questions. However, as the industry grows in scale and has more potential to influence forestry, both sides seem to agree that we must continue to scrutinise the practice, and develop new and better regulations.

Meanwhile, UK government policy appears to have cooled towards further coal-to-biomass conversions, perhaps in recognition of the fact that sustainability issues may become a problem if it continues to grow at such a rate. If other countries seek to follow in the UK's footsteps, we will need to keep a close eye on how biomass is really affecting CO₂ emissions. **ONE**

Scientists scramble to understand the invisible creatures around us before it's too late

By LINDSEY KONKEL

Ensia

In southwestern Africa, a dozen scientists dig in the dirt. In a week, they've transected 100 miles of shifting sand dunes and flat gravel plains across the Namib Desert, one of the driest places on Earth. They've filled hundreds of small sandwich bags with soil along the way.

The conditions are too harsh for most plant and animal life, but countless unidentified microbes thrive here. The researchers, led by Don Cowan, a microbiologist at the University of Pretoria in South Africa, are on a quest to survey the Namib's microbial life. Their findings will shed new light on the biodiversity of African soils.

By some estimates, fewer than 1 percent of all bacteria species have been identified, and bacteria are only one type of microbe. Some microbiologists say microbial "dark matter" forms the invisible backbone of life on our planet and plays a huge role in essential processes such as carbon and nutrient cycling. Bacteria help store carbon from the atmosphere in the soil or the ocean. Microbes also play a key role in global food webs.

Yet even as we're beginning to discover this microbial richness, some scientists worry it could be slipping away. Studies have shown that soils disturbed by environmental change boast less bacterial diversity than undisturbed soils. Just as Darwin, Audubon, Muir and other naturalists of old once described the planet's plants and animals, these new naturalists are now scrambling to catalog Earth's rich microbial infrastructure.

Their work is transforming the way we think about agriculture, energy and ecosystems, and could ultimately help us reduce human impacts on the environment.

Unlocking the "Black Box"

"We're doing something that no one has ever done before," says Cowan.

His project in the Namib Desert is part of a larger effort, dubbed the African Soil Microbiology Project, to survey the bacteria living in the soils of sub-Saharan Africa. Scientists from 10 sub-Saharan countries are collecting soil samples across 15 percent of the continent's land area. They want to compile a comprehensive catalog of microbial communities in soils that represent the region's diverse terrestrial biomes — deserts, rainforests, grasslands and everything in between.

Cowan wants to know what makes some microbes so good at surviving the Namib's extreme conditions. Parts of the desert can go years without a drop of rain.

"If you want to understand something about the molecular basis of organismal survival, the best place to look is right at the edge of life," says Cowan. He hopes that uncovering the adaptations that help microbial life prosper in the Namib Desert may provide clues for humans looking to adapt agricultural systems to a hotter, drier climate.

A project like this wouldn't have been possible two decades ago, according to Cowan. But new technologies have reinvented the field of microbiology and catalyzed interest in the study of soil.

"For a long time, soil was just a black box," says Janet Jansson, chief scientist for biology at the Pacific Northwest National Laboratory in Washington state. Microbiologists

knew microbes were growing there, but they didn't know what they were or what they were doing.

That's because they had no way to access them, explains Jansson. For more than a century, microbial culture was the main scientific technique in the microbiologist's tool kit. Microbial culture involves isolating a single bacterial species by getting it to grow and multiply under controlled laboratory conditions. That technique worked great for some bacteria and helped to spawn the field of medical microbiology.

Yet scientists struggled for years to get many environmental microbes to grow in the lab. Soil proved a particularly difficult environment to replicate indoors. Microorganisms in soil often work in tight-knit communities, each species performing a vital function essential to the survival of the group. Scientists didn't know how to tease apart these complex community networks to isolate and grow individual bacteria.

Luckily, now they don't have to. New technologies now allow scientists to sequence millions or even billions of strands of DNA quickly and cheaply. Metagenomics, a new field this capability has enabled, lets researchers study the genetic material collected from environmental samples wi-

thout actually having to grow anything in the lab. Scientists have used these techniques to reconstruct the genetic blueprints of millions of uncultivated microbes found on land, in the air or in the sea.

Eric Becraft, a microbial ecologist at Bigelow Laboratory for Ocean Sciences in Maine, says, "microbes are probably the predominant player in every ecosystem on Earth." Unidentified bacteria likely represent a "blind spot" in many predictive models of environmental change, he explains, pointing toward one group of ocean bacteria as an example.

A vial of Sargasso Sea water yielded one of the first groups of microorganisms discovered by new DNA sequencing techniques in the late 1990s. Scientists later found that these bacteria, *Pelagibacter*, are among the planet's most abundant life forms, making up about one-quarter of all plankton in the ocean. They discovered that these microbes play a huge, previously hidden role in how oceans use and store carbon. As a result, researchers had to revamp global carbon cycling models to account for the discovery of *Pelagibacter*. The carbon cycle is important because it moves heat-trapping carbon from the atmosphere into the oceans and soils, where it can be used as one of the building blocks of life.



Namib Desert. Photo by Luca Galuzzi

Cataloguing Diversity

“The world is in flux, and microbes are key to getting a handle on how it is changing,” says Jack Gilbert, a microbiologist at Argonne National Laboratory in Illinois.

And in order to understand how microbial communities are responding to environmental change, scientists first need to take inventory of what’s there.

Gilbert heads an ambitious plan to do just that. Called the Earth Microbiome Project, he’s enlisted the help of more than 1,000 scientists to create a catalog of all microbial lineages on the planet — a number estimated to be over 1 trillion.

The open-source Earth Microbiome Project aims to create access to that microbial diversity. “We’re opening the doors to environments where people have not looked before,” says Gilbert.

Since the project’s inception in 2010, researchers have analyzed more than 50,000 environmental samples for microbial DNA. They’ve sequenced and documented microbes from soils on every continent; from animals, humans and plants; from the depths of deep-sea vents to the heights of the International Space Station.

And that, says Gilbert, is the tip of the iceberg. He estimates that more than 10 million samples will be needed to really get an appreciation of the diversity of microbes on



Namib Desert. Photo by Ji-Elle

the planet. Big microbial surveys, including the Earth Microbiome Project and African Soil Microbiology Project, create a baseline against which to measure future change, say Gilbert and Cowan.

Some researchers already are using microbes to monitor change in sensitive environments. Jansson leads the Pacific Northwest National Laboratory's Microbiomes in Transition initiative. One focus of the project includes studying the impacts of changes in precipitation caused by global warming.

Precipitation is key to soil moisture, and moisture is a major driver of microbial activity in soil, says Jansson. Two ecosystems of interest include the boreal forest and the North American Great Plains. Prairie soils and permafrost — aided by their native microbes — trap and store huge amounts of carbon.

"As precipitation patterns change, we want to know what's happening to that carbon," says Jansson.

Understanding the role of soil microbes in these key ecosystems can be instrumental in developing mitigation strategies. For instance, we may one day be able to seed soils with beneficial microbes that could help to prevent the loss of carbon into the atmosphere or even allow us to trap more of it, she explains. More research needs to be done, says Jansson, but "we're in a good position to begin to tackle some of these hard questions, because we now have the tools to do so."

Adaptation Potential

In microbes, scientists also see the potential for adaptation to environmental change. Microbes could allow us to remediate pollution; make biofuels; create new, less toxic plastics; secure the global food supply; and bolster our own health.

Yet identifying and cataloguing Earth's bacterial communities is just the start. To harness these microbes, we need to know what they actually do. Without this key piece, the promise of microbial technology may amount to little more than hype.

"The major challenge going forward will be to validate the

functions of all the new organisms we have identified," says Tanja Woyke. In her lab at the U.S. Department of Energy's Joint Genome Institute, Woyke has started to address this question.

She's interested in bacteria that help degrade cellulose — the fibrous part of a plant. Scientists want to create so-called second-generation cellulosic biofuels from crop waste — the unused parts of plants. A major barrier is that these residues are extremely hard to break down using existing technologies. Researchers are searching for novel enzymes that may be able to degrade cellulose more efficiently and cheaply.

Bacteria that thrive in hard-to-study environments such as thermal vents, hot springs or even soil could provide a source, but most have never been grown in the lab. Microbial genes could serve as the genetic blueprints for new enzymes, but first scientists need to find out which genes are involved in specific cellular activities — such as breaking down cellulose.

Woyke is developing techniques to study what newly discovered bacterial genes do. She uses fluorescent molecules to make the cellulose glow under a microscope. When the uncultivated bacteria begin to degrade the cellulose, they'll light up too. That way she can tag and isolate them one cell at a time for sequencing. She'll then look at the genes of these cellulose degraders and how they code for amino acids — the building blocks of all proteins, including enzymes. That way she can better understand their function and ID the genes that are important for cellulose degradation.

The microbiologists say these are exciting times in their field. New technologies have already begun to transform the way we think about the diversity of life on Earth. As the science continues to advance, it will open up new vistas of research into medical, environmental and industrial microbiology.

"We're doing things and learning things now that we didn't even know were possible just a few decades ago," says Cowan.

*Originally published
by Ensia
May 23, 2017*



CO2 Technology
Centre of Sulcis

SARDINIA Technology & Nature



ENEA
Agenzia Nazionale per l'Energia e la Tecnologia
Energia, Ambiente e Innovazione

REGIONE SARDEGNA
REGIONE SARDEGNA
REGIONE SARDEGNA



CO2 Technology Centre of Sulcis



SOTACARBO
SOCIETÀ PER AZIONI A RESPONSABILITÀ LIMITATA

Biocasa: the house where beauty meets good

Very low energy consumption, 99% recyclable, made only with green and certificated materials.

By EUSEBIO LORIA

ONE

Biocasa is a case study of an Italian house, which is advanced from a green building perspective to be the first private building in Europe to receive the highest certificate of compliance, equivalent to platinum, for the Leadership in Energy and Environmental Design (LEED) for Homes protocol.

It is the first in Italy to be privately submitted to the carbon footprint analysis, showing that measurement of the carbon dioxide released in the environment over time, turned out to be 60% lower than the average emission from traditional buildings. A model of exemplary performance.

Built following the philosophy of "Kalos kai agathos" (beautiful and good) with the most advanced building technologies concerning bioclimatic systems and energy efficiency, *Biocasa_82* obtains minimum environmental impact with maximum comfort. It is located in Montebelluna (Treviso, Italy) with an area of 800 sq mt and meets all these targets in energy saving and conservation of natural resources.

Only green and certificated materials have been used to build the house, which are 99% recyclable and, where possible, local or zero km; with the possibility to recycle 99% of demolition waste and 74% of building waste; with very low energy consumption (< 25 kW/ m² per year, energy class A 36,19 kW/m²*a); 84% of the overall electric consumption is covered by a photovoltaic system (14kWp); a high performance geothermal system providing heat production, domestic hot water and cooling; 65% of water saving for the irrigation system; 100% of lights are very high efficiency devices (LED and CFL); 100% of rainwater is collected for indoor use and outdoor irrigation; use of very high efficiency door and window frames and energy-saving ventilation, hydraulic aspiration and geothermal systems. Impressive figures.

The indoor climatic comfort reaches accurate temperature and humidity standards according to the different activities carried out in each room; the internal air is always "renewed" and filtered, acoustics is optimal, with no noise pollution deriving from internal echoes or machinery; the lighting system is designed

to be as natural as possible, with optimum utilization of sunlight.

All the rooms are free from radon gas, synthesis products, volatile organic compounds (VOC) and from harmful electric, magnetic and electromagnetic fields.

From the perspective of interior design, the architect Rosario Picciotto studied every detail to promote the "naturalness" of the spaces, arguing that "despite being a 'major home,' it has nothing to do with consumer logic. On the customer's request, every aspect is envi-

ronmentally friendly: it's amazing how such a big house can consume so little."

Since the beginning, the project was born as a sustainable environmental restoration, with respect to landscape protection of the area, the historicity of the place and the surrounding nature.

It has achieved excellent scores according to LEED protocol in the sustainability of site, water management, energy and atmosphere, materials and resources, indoor environmental quality, dissemination, and



awareness.

The carbon footprint of the building for a 100-year life cycle, from the supply of construction materials to the demolition at the end of the life cycle, is 60% lower compared to a traditional building. A very significant result for the environment: just think that the construction sector accounts for a total of 30% of future CO2 pollution of our planet, mainly because of energy consumption.

"We dreamed of a house that, in addition to being be-

autiful and "healthy," shows consistency between our values and the social responsibility towards future generations. We hope that our choice, thanks to the impact of the symbolic carbon footprint analysis, could stimulate the debate and thus contribute to progress that we consider necessary for the future of our planet". Claudia and Enrico Moretti Polegato set an example. Of consistency and responsibility, sure.

Unfortunately still unaffordable or too expensive for most of the people. And you need to expand niches to set new trends. **ONE**



Photo by Marco Zanta

The Chinese Solar revolution

Longyangxia Dam Solar Park: how a mining area known only for coal extraction, can be turned into an extraordinary floating solar plant.

By ALICE MASILI

ONE

If we were convinced to have made the most of the sun's energy, it was because we had not yet thought of turning a dismantled coal mine into a giant floating photovoltaic plant. Someone else did it: China.

As usually happens when the term of coal extraction occurs, Huainan's mining area, in southern China, has been completely flooded. In fact, after mines stop working, all drainage and water, surface and underground water drainage systems are also extinguished. As a result, pit ponds or ditch lakes are created in the open mines. From here the idea of Sungrow Power Supply, a photovoltaic inverter company, was born.

Just another record from the Chinese government, in its effort to increase renewable energy production, which transformed a mining area for coal extraction, into a floating solar plant: the largest ever built.

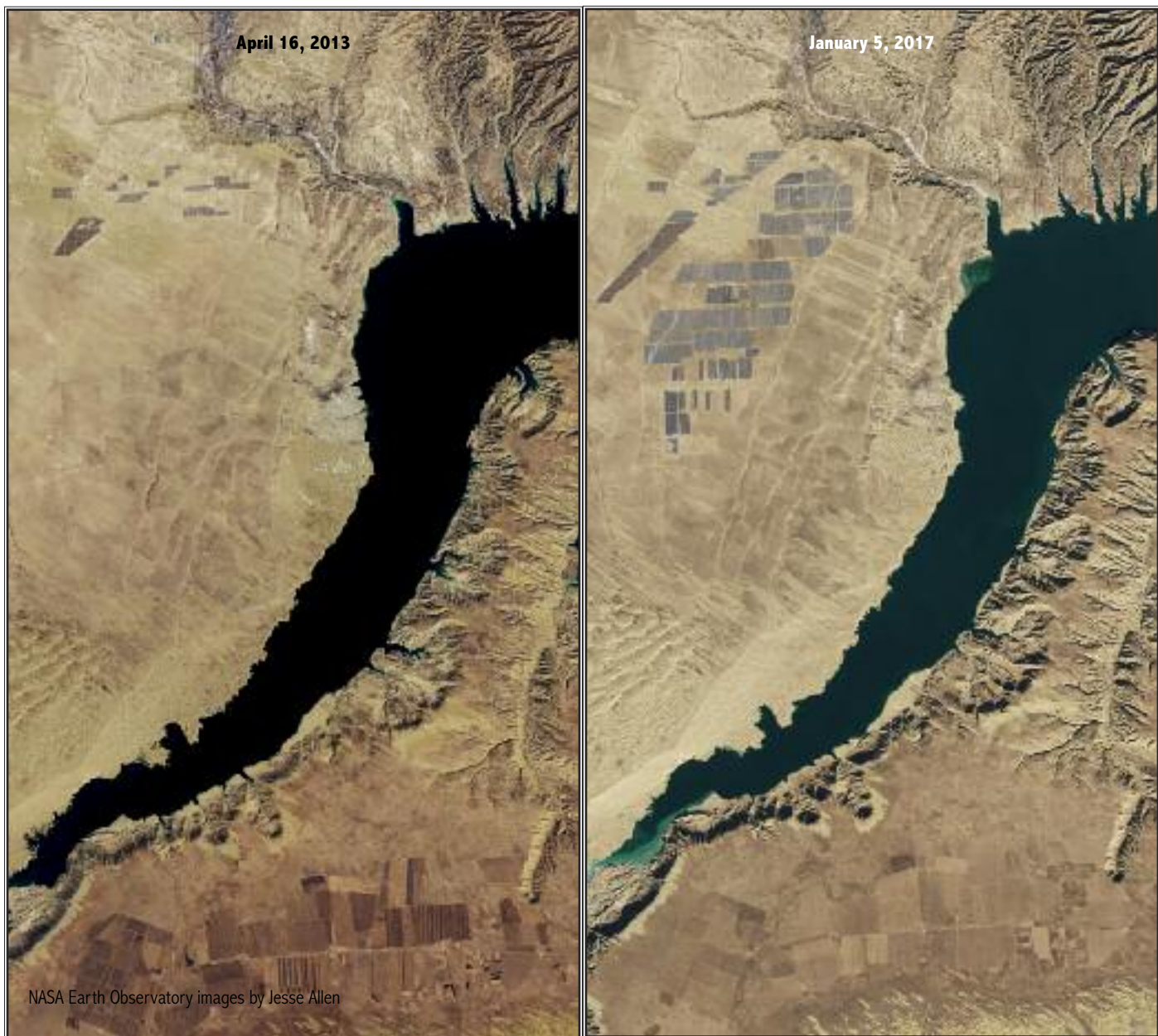
The 40 MW power plant, the most powerful ever made so far, was recently inaugurated, even though the record on paper remains with the 700 MW Indian floating photovoltaic project. "The plant not only re-uses the site, reducing land demand but also improves photovoltaic production thanks to the surface cooling effect," a local government official said. The plant is already connected to the grid and supplies electricity from renewa-

ble sources to the residents of Huainan City. This is just the first of such plants in China.

It is a pure energy conversion project, which well represents the Chinese energy policy. It is moving to a gradual transition and decarbonization of energy and the abandonment of coal to prefer sources such as solar, wind and hydroelectric, that the country is investing in. This conversion to solar is helped by the collapse of the costs of the technology itself. The nation has also announced plans to increase its use of sources derived from non-fossil fuels by 20 percent.

In fact, the Longyangxia Dam Solar Park was completed in January, one of the largest in the world: 4 million solar panels cover an area of 27 square kilometers with an installed capacity of 850 MW. A real race to photovoltaics and renewables, also demonstrated by the enormous investments of the new Chinese five-year plan: over the next three years they will invest 360 billion euros in renewable energy, to reach 110 GW of solar energy and 210 GW of wind installed. Is a solar float a good idea?

Floating solar companies are becoming very popular all over the world thanks to their unique design, which regards many problems of energy efficiency and urban planning. This design overcomes some of the drawbacks of traditional installa-



tions, starting with the most obvious, that of soil consumption.

Additionally, the essential element which constitutes this type of plant: a frame, is generally made of polyethylene pipes, which guarantees floatation, a support platform, and conventional silicon PV modules.

Sungrow technicians and several sources sustain that "resting" panels on a surface like water allows a natural cooling system, reducing evaporation of the same. In this way, it is possible to earmark the resource for other tasks and improves the performance of solar panels. The water reduces the operating temperature of the panels, decreasing

the so-called "temperature coefficient" and, at the same time, increases productivity and durability. Also, the water surface reflects the sun's rays, acting as a kind of mirror concentrator: in this way they can catch even the light reflected by increasing production.

Energy is vital for the development of the economy and society. Even though it is still one of the most exposed Asian countries in the world in the production of coal-fired power, China is however decisively promoting the development of clean energies, and initiatives such as this need to be adopted worldwide to reverse our planet current trend. **UNE**

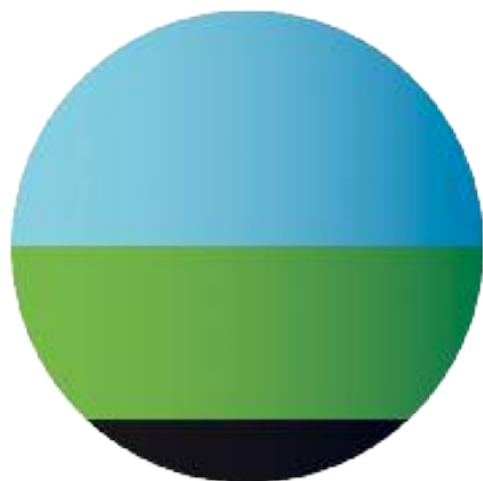
Photo: Luc Viatour (<https://lucnix.be>)



BOIS DU CAZIER

The history of the Bois du Cazier coal mining site dates back to a 1822 concession, in which a transcription error caused the name of the location to be changed from the correct Bois de Cazier. The mine originally had two shafts reaching 765 metres (2,510 ft) and 1,035 metres (3,396 ft) deep. A third was added (“the Foraky shaft”) in the Fifties. In those days the mine produced every year over 170 thousand tonnes of coal and employed nearly 800 workers, most of them foreigners and coming mainly from Italy. In August 1956 262 miners of 12 different countries were killed in the Bois du Cazier. A European tragedy, mainly Italian - 136 miners were immigrant from Italy. Those deaths forced the revision of all mining safety regulations in Europe. The mine closed in December 1967. Now it is listed as a UNESCO World Heritage Site. **ONE**

SOTACARBO



**SUSTAINABLE ENERGY
RESEARCH CENTRE**

