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Red faces all round

Make no mistake: the emails from the University of East Anglia climate scientists which were obtained from a hacked server and posted onto the internet in November paint a shocking picture.

The emails reveal the private conversations of scientists who commanded universal respect amongst environmentalists, politicians and journalists. And they're not pretty...

The headline revelations have been well bandied-about in the mainstream press. In one particularly shocking email, Professor Phil Jones, director of the Climate Research Unit at UEA, tells his US counterpart Professor Michael E Mann that he will try to block the inclusion of a controversial scientific paper in the forthcoming IPCC report, 'even if we have to redefine what the peer-review literature is'.

In another, perhaps even more disturbing exchange, Professor Jones claims that he will delete an unfavourable temperature record from his computer rather than risk it being made public through a Freedom of Information request - the kind of obfuscation that was more usually associated with the early years of the Bush administration.

The fall-out has been extensive: climate sceptic Lord Lawson has called for a public enquiry; US 'shock-jocks' such as Glenn Beck have salivated over the details in lengthy broadcasts; and environmental commentator George Monbiot used his *Guardian* column to call for Professor Jones' resignation (which was refused).

The defence mounted has been weak at best. Monbiot resorted to satire in his usually rigorous column, the UEA press office has been at best slow to respond, and scientists writing on the 'Real Climate' blog site – a much-visited forum for climate science updates – dwelt on the fact that the hacking was illegal, and argued, with reference to one particularly controversial email, that scientists use the word 'trick' all the time to mean 'a good way to deal with a problem'. Really?

Let's be clear what this does and doesn't mean. No, it doesn't invalidate the science that underpins our approach to tackling climate change, which has been verified by dozens of independent research establishments across the globe.

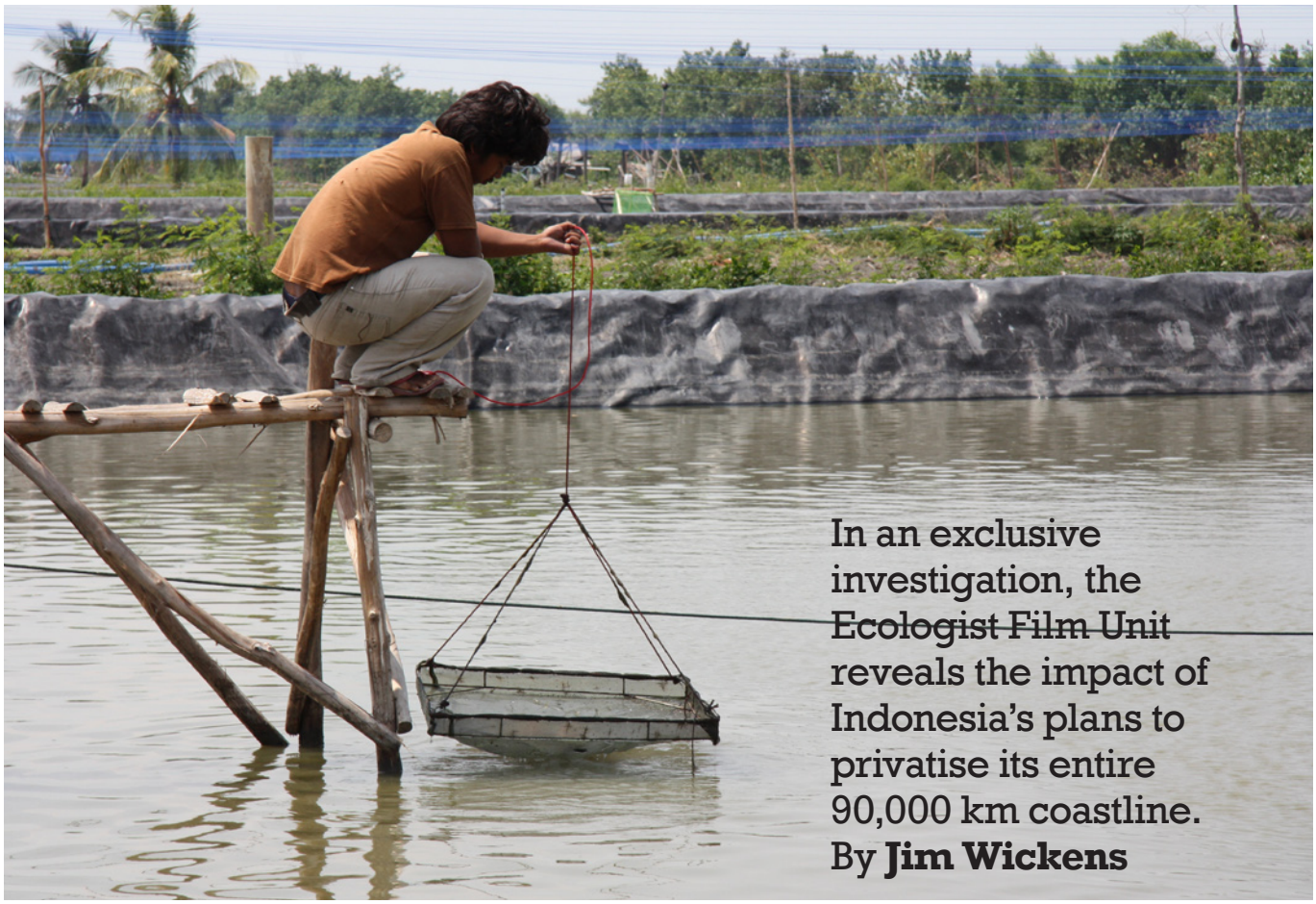
Neither should it have any real impact on the Copenhagen negotiations, which, even if they succeed, will set targets based on very conservative science at any rate.

But what is does do is to serve as a reminder that science is a business, and is subject to exactly the same pressures and compromises that any business faces.

Many of the emails deal with reputational issues, which have a direct bearing on the likelihood of scientists to receive funding for their work. Some deal directly with the problems of finding funding; others hint at the political difficulties with maintaining a scientific neutrality when dealing with an issue that is so emotionally charged.

But to acknowledge this is not to forgive it. Had these emails been hacked from the accounts of prominent climate sceptics, the *Ecologist* would have been amongst the first to highlight their nefarious content. Our standards must cut both ways.

Mark Anslow, Editor



In an exclusive investigation, the ~~Ecologist Film Unit~~ reveals the impact of Indonesia's plans to privatise its entire 90,000 km coastline. By **Jim Wickens**

SELLING INDONESIA'S COAST FOR CHEAP PRAWNS AND PROFIT

Set against the looming construction cranes and gleaming plastic roofs of the newly built factories, the last remaining fishing village in Jakarta Bay looks increasingly out of place.

For countless generations the community here at Marunda Kepu village have eeked out a living from the sea; farming fish, collecting mussels and setting nets in the estuaries and shallow coastal waters of this region of Northern Java.

But today they live in squalor, penned in by industrial developments all around them. Puddles of stagnant water surround the crumbling brick homes and disease is rife.

'My livelihood is the sea. If there is no more access to the coast or the sea then where should I go? How can I live?' asked Habiba, as she nursed her sick child.

She is referring to the impact of the 'coastal areas and small island management law', or HP-3 as it is more commonly known. If passed, HP-3 will allow all of the commonly-held land on and around the Marunda Kepu community, as well as the coastal waters and the seabed up to 12 km offshore, to be offered to the highest bidder, on leases lasting up to 60 years.

'HP-3 will definetly destroy our livelihood: the more factories here, the more difficult it will be for us. If they do this coastal develop-

ment, we, the fishermen in the coastal area, will be jobless', said Koba, one of a hundred fisherman from Marunda Kepu struggling to feed their families.

Squeezed into ever tighter patches of land from industrial developments on either side of them, the pressure on the community has been enormous, and when the *Ecologist* spoke with them, they complained of harassment and intimidation from private companies seeking to build on their land.

Threat of eviction

It is the same for coastal communities across Indonesia. Hundreds of thousands of people will face potential eviction if they do no have official land certificates, irrespective of how long they may have lived in the area or used the coastal resources, explains Riza Damanik, Secretary General of the Indonesian coastal advocacy group KIARA.

'It means in the future, Indonesia's coastal areas would be dominated by those with big funds, big capital, either they are local or international businessperson or those who are related or linked to government officials or those in power. People's access to their natural resources will be even more limited because they will be driven out from coastal areas,' he said.

Industrial aquaculture, mining and commercial tourism sectors all look set to reap rewards from the offering up of Indonesia's coastline. Supporters of the controversial new law claim that the transformation of rural coastal areas into industrial zones helps to create employment in areas otherwise starved of economic assistance. But these employment opportunities come at a price.

'The farmers are forced to buy prawn feed from the company, the farmers are forced to buy fertilisers, prawn seed, electricity and water from the company'

Guarded development

You could be forgiven for thinking you were entering a military zone. Armed guards, dressed head-to-toe in black, stop and search vehicles passing in and out of this tightly controlled piece of mud road.

We had travelled to the Lampung district of Southern Sumatra, at the entrance to the largest shrimp farm in the world. Carved out of mangrove forest and covering over 16,000 hectares, it is home to 20,000 people; shrimp pond workers, their wives and children.

The workers are bonded in contract or 'plasma' farming arrangements whereby almost everything in their life is owned by the parent company, in this case a Thai multinational.

In the eyes of Riza, this so-called 'contract' farming is deeply exploitative. 'The farmers are forced to buy prawn feed from the company, the farmers are forced to buy fertilisers, prawn seed from the company, they are forced to get electricity, water and even houses from the company. This is unjust. It makes the farmers dependent on the company,' explains Riza.

Dressed in company uniforms so as to avoid detection, the *Ecologist* was smuggled through the strict security controls, and managed to meet farmers on this coastal development, whose plight has been invisible up till now.

Farmers are increasingly frustrated at the price they receive for harvests, in light of western demand

Don't read; just sign

Like thousands of others in the shrimp farm complex, Khalid has a house and a couple of shrimp ponds that he shares with his family. He explained how he first entered into the contracts that dog them to this day. 'We signed the contract without reading it first... there was no time to read. There was a long queue behind me, so we had to be very quick.'

Today most of the farmers at this farm are deeply indebted to the company that owns their land and houses. It is, claims Riza, a problem he comes across in shrimp farms across the country.

'If we look deeper into this shrimp farming industry, we could see clearly that the shrimp farmers do not anymore have control or access to their own resources or to their ponds, because they are dependent on big companies, in terms of getting prawn feed, prawn seeds, water, electricity etc.'

As we snaked our way along the myriad canals, embankments and bridges that form this vast farm, the local union leader spoke of their growing frustration at relying upon one company for everything in their life. As the economic crisis has affected the company, so has this in turn slowed the investment in the services that the farm workers and their families need to survive.

'Everything has slowed down and it has affected our household economy, money for our children to go to school. And the economy of the local community has not recovered. We sell our prawns at local price, and the company then sells them at export price. It means there is a big gap between our price and the company's price...we think they don't care too much about social problems, including public facilities, whether it is the mosque, road, school etc,' says Nafian Pais, head of the the shrimp farm union.

Environmental price

It's not just the contracts that worry the community. What was once a healthy mangrove forest protecting coastal communities from storms surges and freak tsunamis, now resembles a patchwork of rudimentary worn-down flood defences and tree stumps, explains Tukiyat, a farmer who traces his finger across the breaking waves, pointing to where the forest used to be.

'In the past, the mangrove trees stretched around one kilometre from the ponds to the beach,' Tukiyat says. 'But now, only several metres are left. In some places there are no mangrove swamps at all. I think it's a critical condition now. The company here hasn't

responded to the call to look after the mangrove swamp.'

A fair trade?

One particular source of anger is the huge differential between the price that the prawn farmers receive and what western consumers are prepared to pay for the end product. The *Ecologist* has learned that the contract farmers we spoke to are paid about £1.90 per kilo for the prawns they raise. By comparison, Indonesian prawns are sold on the UK high street for around ten times the price at £17-26 per kilo.

'When can we pay off our debts?' asked Agus, another shrimp farmer who agreed to act as our host for the night. 'We don't know when we can do it! We're used to being disappointed here, we don't know where to channel our anger!'

Despite the social and environmental problems that have arisen from industrial prawn farms in southern Sumatra, with the passing of HP-3 these colossal contract farms look set to spread. Eager to cash in on foreign export earning, the Indonesian government plans to expand industrial prawn farming in coastal areas by over 700,000 hectares in the coming years.

Amidst the crowded coastlines and dwindling mangrove forests of Indonesia however, question marks remain over where this land will come from, and who really benefits, from the sale of Indonesia's seas.

Jim Wickens is a journalist with the investigative agency Ecostorm and works with the Forest Peoples Programme

Where once stood mangroves, now a makeshift barrier stands against the rising tides

MANGROVES: WHY THEY MATTER AND HOW TO SAVE THEM

In the past few decades, the shrimp industry has undergone phenomenal growth: world production rose from over 1 million tons in the 70s to some 6.5 million tons today.

Much of this abundant supply has not been fetched from the sea, but harvested in shrimp farms that now pepper the shores of Southeast Asia and more recently parts of Africa and South America. An estimated one million hectares of coastal wetlands, including mangroves, are estimated to have been lost in the process.

Mangroves exist at the junction of land and sea. They are among the most productive ecosystems in the world, providing spawning grounds for a great diversity of marine life – including wild shrimp.

The recent UN 'Blue Carbon' report highlights the importance of life in the oceans in capturing carbon dioxide from the atmosphere. But mangroves, along with salt marshes and seagrass beds, really stand out in their ability to lock this carbon away.

Together they cover less than 0.5 per cent of the seabed, but they absorb up to 70 per cent of all carbon permanently stored in the ocean floor: the equivalent of nearly half of the emissions from global transportation.

But the world is rapidly losing these natural allies against climate change. More than a third of the world's mangroves are estimated to have been lost since the 1940s, while the figure is as high as 60 percent in some parts of Asia. While human population pressures along the world's coastlines are partly to blame, shrimp farming is considered the number one threat to mangroves.

Nearly 40 per cent of mangrove loss to date has been attributed to the industry. Most of the shrimp is destined for export markets in the US, Europe and Japan, making the industry something of a poster child for the kind of climate haggling going on between the 'consuming nations' of the industrialised world and the 'producing nations' of the developing world.

'India and China are very significant countries in the climate negotiations,' said Dr. Christian Nellemann, editor of the Blue Carbon report. 'There is a lot of uncertainty on whether a deal can be reached on reducing emissions in Copenhagen because developing and emerging countries are reluctant to hold back development.

'But the way to tackle climate change is not just by reducing emissions but by ensuring that we capture more carbon dioxide,' said Nellemann. 'We can actually take our emissions back to their original form over time.'

Reversing the tide of mangrove destruction would be, in Nellemann's words, 'a super win-win' for countries like India, in reference to a statement made by the environment minister, Jairam Ramesh, which suggested that his country would likely support a U.N. proposed fund to protect and restore carbon sinks.

Fortunately, the forests can be restored with a little help. One environmental campaign group, the Mangrove Action Project (MAP) has its eyes on the quarter million hectares of abandoned shrimp farms for a mangrove restoration initiative, which banks on nature's capacity to self-heal.

'In nature, mangroves restore themselves via seedlings that fall from the trees into the water and then get deposited on the shore during high tide,' said Alfredo Quarto of MAP. 'Shrimp farms alter the natural hydrology of the landscape.'

By restoring natural water flows and relying – when possible – on nearby forests to supply seedlings, the MAP approach essentially sets the stage for the forests to recover on their own. Over half a million mangrove saplings were planted in one day in the Thatta District of Pakistan, in what is now a Guiness World Record.

With looming sea-rises threatening 10 per cent of the world's population that live along the coast, this kind of fervor seems warranted.

Carolyn Lebel

All carbon is not BORN EQUAL

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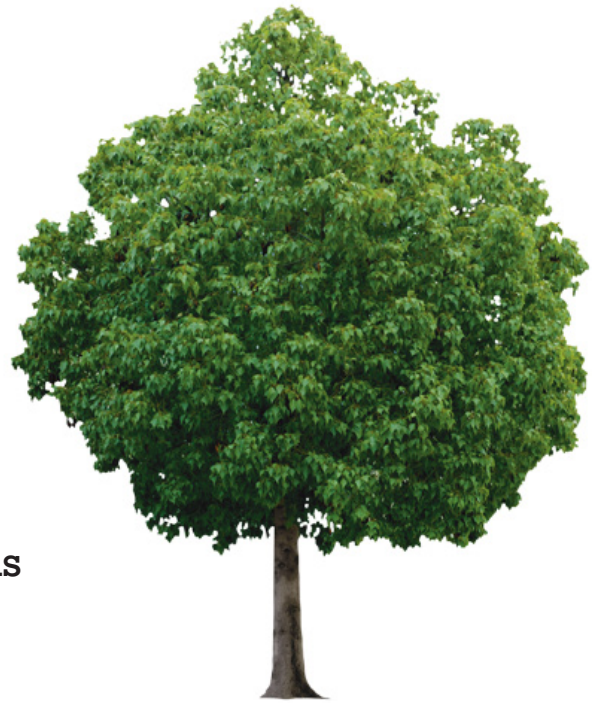


Are we risking serious problems if action to tackle deforestation assumes that a tonne of tree carbon is the same as a tonne of fossil carbon? **Eric Marx** reports

Ranil Senanayake has never been content trying to influence those at the policymaking table – or even sitting at that table himself.

Instead, the maverick systems ecologist has tried to construct a new table altogether. He set about this by crisscrossing the globe in search of farming communities willing to adopt and be trained in 'analog forestry', a land restoration system he first began developing in the early 1980s in the upland hills of his native Sri Lanka.

The principles behind analog forestry are simple, and spring from the understanding that natural forests are some the most productive, and diverse, ecosystems on Earth.

Analog forestry sets out to mimic the original ecosystems, with subtle adjustments that mean they can be economically productive as well, yielding food and shelter as well as maintaining habitat in ways that will be familiar to those who have studied or who practice permaculture. The scheme also tries to strengthen rural communities, recognising that forests are their homes and livelihoods.

From tree to desk

Despite his preference for field work, Senanayake has frequently found himself counselling the international community when it comes to discussing how carbon is stored within living organisms – first as an adviser to the Australian Government and then to the World Bank and UN.

The reasons that governments are so interested is simple: if natural carbon sinks such as forests and soils could be managed to increase their uptake of carbon, nations would have much less trouble hitting greenhouse gas reduction targets. In turn, governments from forested nations know that any trade in carbon sequestered by forest ecosystems might offer huge funding potential for forest conservation.

All that was needed to light the fuse on this

lucrative scheme was some science to prove that 'biological' carbon cycled through ecosystems is substantially similar to the carbon that comes from our use of fossil fuel. This is where Senanayake came in.

They didn't like what he had to say. Senanayake told policymakers that their plan to use biological processes to sequester atmospheric carbon was flawed, principally because biological processes are short-lived and all of the fossil carbon emissions quickly wind up back in the atmosphere.

Moreover, Senanayake warned that the economic credibility of carbon sequestration rested upon recognising two distinct sources of carbon – biological or biotic carbon that cycles through living systems via photosynthesis and respiration – and geological or fossil carbon, which is an effectively permanent removal from that biotic cycle, at least on timescales affecting climate change. The two would have to be priced separately, he said, with fossil carbon eliciting a far higher price.

'This was school kid level science,' Senanayake said to me when we met recently in an Amsterdam hotel lobby. 'Fossil carbon, which has been locked up for tens of millions of years, cannot be treated the same as carbon from biotic sources lasting at most a few tens of thousands of years.'

His words fell on deaf ears. What became known as 'land-carbon sink' mitigation found its way into the 1997 Kyoto Protocol, but not before Senanayake gave a presentation at a World Bank meeting in Washington in which he pointedly accused those gathered of committing environmental fraud.

'I told them, "what you're talking about is carbon laundering"', Senanayake recalled. But those assembled – including vice presidents and executive directors of the World Bank, United National Environmental Programme and United Nations Development Programme – didn't want to hear the message.

REDD

Fast-forward to 2009 and forest carbon now stands center stage in negotiations leading up to the Copenhagen climate talks. Evidence is growing that natural carbon sinks might be weakening faster than previously thought, and yet prospects look good for a deal on a new funding mechanism, known as Reduced Emissions from Deforestation and Forest Degradation (REDD).

REDD is based on the deceptively simple concept of paying landowners to keep trees standing. By putting a price on the carbon sequestered in trees, it makes better financial sense to preserve the trees rather than eradicate them.

The money for REDD would come from carbon credits sold on the anticipation of reduced carbon emissions to the atmosphere.

In theory, REDD could generate billions of dollars a year for reducing forest loss in the tropics, where deforestation accounts for about 20 per cent of global greenhouse gas emissions.

'Avoiding deforestation is about preventing a source of emissions, rather than creating a sink, which is why those previously skeptical of forests in the run-up to Kyoto are now in favour of this,' said Jutta Kill, a climate campaigner monitoring REDD negotiations for The Forests and the European Union Resource Network (FERN).

Sceptics like WWF were also won over by emerging guidelines such as the Climate, Community & Biodiversity (CCB) Standards, improvements in GPS monitoring and computer mapping of deforestation, and proposed accounting methodologies measuring reduced deforestation on a national rather than project level basis.

'I told them, "what you're talking about is carbon laundering". This is school kid level science'

Does anyone know how to plumb a sink?

It's now clear that primary forests in the tropics are net sinks taking up carbon, as are temperate zone forests extending up into the boreal regions. According to recent research, tropical forests have an annual global uptake of around 1.3 gigatonnes of carbon – equivalent to approximately 15 per cent of the total global anthropogenic carbon emissions.

But NGO groups like FERN and Friends of the Earth insist there remain huge inaccuracies in measuring forest carbon and argue against any kind of market linkage.

'The issue here is how you finance REDD,' said FERN's Jutta Kill. 'If it is financed through carbon trading, then there has to be a common metric so that you can trade tonnes of fossil carbon released for tonnes of biotic carbon avoided [from avoided deforestation].'

That requires measuring the carbon stored in forests and then extrapolating that out to carbon not emitted at some future date. While accuracy has improved over the past decade, said Kill, these measurements are still performed by proxy (i.e. by measuring something other than the actual carbon saved, which is incredibly hard to calculate) and sometimes, when they are looked at more closely, lead to changes in estimated CO_2 reductions of as much as 90 per cent, as

Greenpeace recently reported in its evaluation of a highly touted REDD scheme known as the Noel Kempff Climate Action Project in Bolivia.

Does this measurement error matter? It does when you think what's at stake – allowing increased emissions from fossil fuels on the basis of these estimates.

Kill believes the risk is too great: 'Rather than fund the reduction of emissions through avoided deforestation, you actually buy the right to emit a tonne of carbon, meaning an overall increase if that tonne of emission reductions is not permanent or results in leakage'.

Splitting hairs, or logs?

The threat from this risk – that developed nations may continue to blithely emit carbon dioxide because of a perceived equivalence between a tonne of fossil carbon and a tonne of forest carbon – has split conservationists.

Groups like FERN propose a voluntary fund that could be used to protect forests, essentially regardless of their carbon value.

Others, such as WWF and Greenpeace, propose a 'phased approach', in which forest carbon is eventually linked to carbon markets after plenty of capacity building and pilot project development.

Kill believes there are alternatives beyond the market, and highlights Norway's proposed auction fund and her own group's involvement with FLEGT, a program implementing EU forestry law now in effect with the Government of Ghana.

The other side

But market backers have their own arguments. Some point out that linking avoided deforestation schemes to markets need not mean instant mayhem: there are examples of projects outside of the Kyoto Protocol which have been designed and implemented with community program and landowner involvement to avoid carbon leakage.

Leakage occurs when local communities affected by a project aren't given alternative livelihood options, resulting in deforestation shifting to another location outside the protected area.

Market supporters also maintain that there are all sorts of ways REDD can contribute to poverty alleviation, which is an underlying cause of deforestation, through sustainable agriculture, community forestry and promotion of indigenous land rights.

'I've spoken to a lot of indigenous groups who see this as an opportunity as well as a risk,' said Joanna Durbin, director of the Climate, Community & Biodiversity Alliance. 'But if you want to unlock greater sources of funding for reducing deforestation it's hard to understand why you would not want to give it some kind of equivalency within the global emissions regime.'

'You can't block people off from their forests - it's where they live and so you have to design systems where they can live and yet produce these other things that are economically useful'

Following the money

Watching the REDD negotiations from his distant perch in the Sri Lankan hills, Ranil Senanayake still believes a financial link to fossil carbon offsets will snub out global warming mitigation efforts – irrespective of how well individual projects are managed.

He also points out that the sheer sums of money that could be made available through REDD are a sore temptation to cash-starved groups.

'You should understand what this is really all about,' says Senanayake, pointing to his own work with a voluntary carbon credit programme as an example of the funding potential REDD offers.

Although the the Dutch government has offered financial backing for an analog forestry restoration project on a Sri Lanka tea plantation, for the most part Senanayake's work has been a slow grind to establish a grassroots network of organisations, seed banks and training programs to individually spread the word from farmer to farmer.

Funding remains a supreme challenge. It's why conservation groups are backing REDD and why he makes no apologies in promoting Analog Forestry as a carbon enhancing system distinct from what he terms 'traditional carbon-capture projects' which tend to be 'monocultural and industrial in nature'.

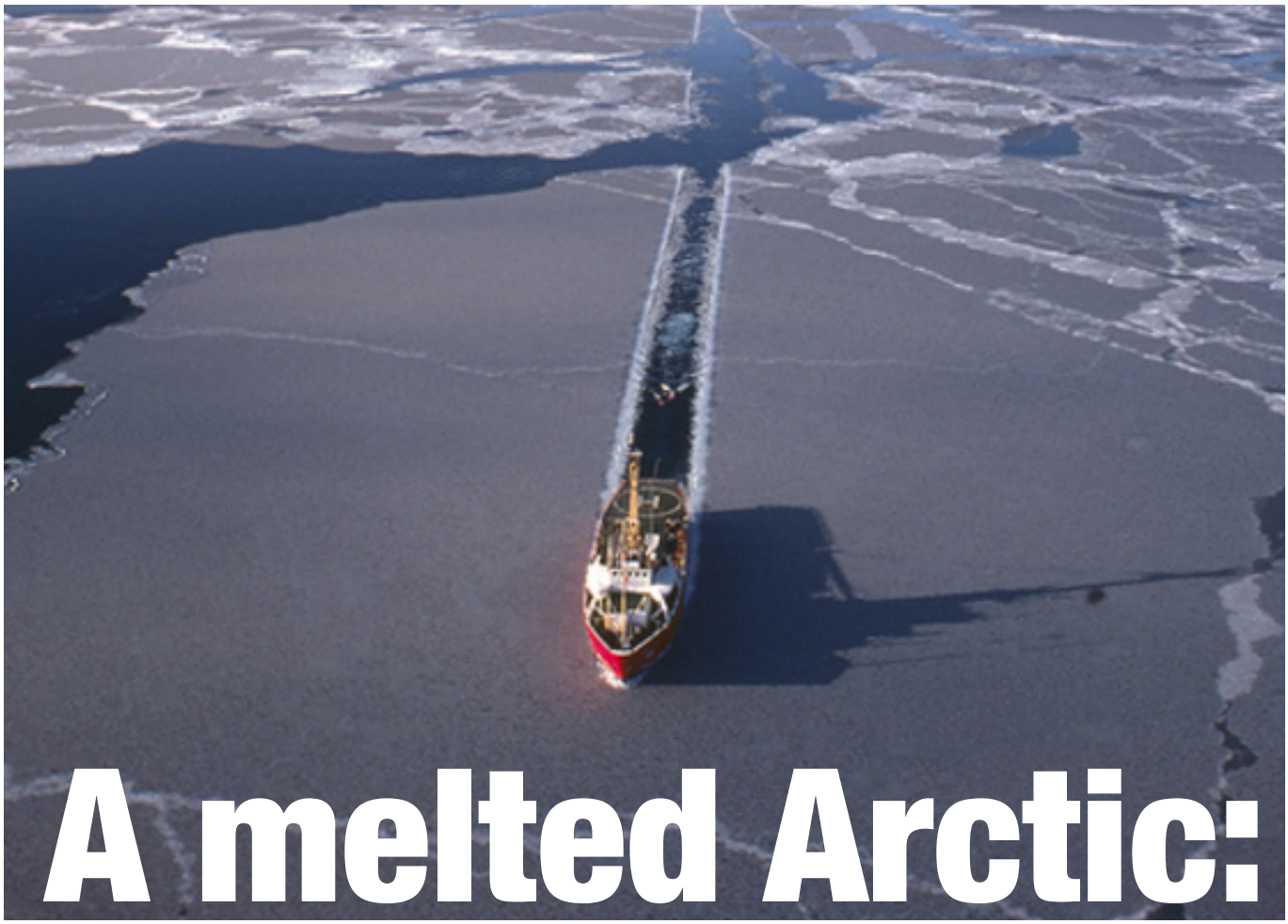
'You can't block people off from their forests,' he says. 'It's where they live and so you have to design systems where they can live and yet produce these other things that are economically useful.'

That means letting trees mature, says Senanayake, and it means recognising both natural and anthropogenic biodiversity, even when that might mean importing non-native species.

'Exotic species are essential quite often, but because they [the conservation community] haven't separated these two clearly there's still great confusion,' he warns.

As for REDD and the upcoming negotiations in Copenhagen, Senanayake had one piece of advice: put the right value on fossil carbon. Otherwise it's all just carbon laundering.

Eric Marx is a freelance journalist



A melted Arctic:
GOLD MINE OR HONEY TRAP?

As the melting Arctic ice cap opens a new ocean to the world, governments and private speculators are rushing to cash in on lucrative resource deposits and shipping lanes. But they may find these virgin waters a dangerous place to do business… By Andrew Marszal

When the U.N. Conference on Climate Change convenes in Copenhagen next month, one inconvenient truth little discussed will be the benefits Arctic nations stand to gain from global warming.

It has become generally accepted that, as ice starts to cover less and less of the north pole each year, an emergent new ocean will offer prospects of untold mineral resources and unparalleled access to distant markets via new, shorter shipping routes.

Numerous recent reports have made startling predictions regarding the rate of this ice break-up. Last month, introducing the results of the Catlin Arctic Survey, Professor Wadhams of the University of Cambridge declared a new consensus that 'the summer ice will disappear within twenty to thirty years', with most of that melt occurring in the next ten.

He went on to say, 'That means you'll be able to treat the Arctic as if it were essentially an open sea in the summer and have transport across the Arctic Ocean'.

A brave - or foolish? - new world

Though the ice certainly is thinning and receding rapidly, politicians and commercial pioneers would be well advised to exercise caution, and indeed scepticism, in considering its implications. Though a particularly strong summer melting trend is indisputable over the last half century, there is little evidence that the consequent ecological upheavals are making the region any more hospitable. It may be getting less so.

Given a lack of comprehensive research in the region and the sheer number of variables at play, it is impossible to speak authoritatively about future conditions. But a wealth of reputable voices, drawing on both scientific reasoning and operating experience, do indicate that several regions of the Arctic Ocean are becoming more hazardous and inaccessible.

There are many reasons why this may be so. For one, the ice is not just melting quickly: it is melting erratically. This creates highly unpredictable conditions for all marine activities from Inuit narwhal hunting to operating floating gas platforms. Although the sea around the Arctic refreezes during the winter, this creates increasingly abundant

'first-year' seasonal ice, which is less 'solid' than the dwindling expanses of multi-year ice, and can be more brittle.

Lawson Brigham, a former US Coastguard captain and the author of the 200-page Arctic Marine Shipping Assessment (AMSA) report for the international Arctic Council, warns that 'operating conditions for Arctic ships will remain challenging, particularly in winter'.

But the same report forecasts a growth in such activity across the seasons, often with highly hazardous cargo. 'Year-to-year [ice] variability poses a serious challenge to risk and the overall reliability of Arctic marine transport systems,' it notes. In response to regional climate change, more mobile sea ice is likely to create 'more difficult operating conditions for marine navigation'.

The AMSA report also pours cold water on the notion that Arctic waters will suddenly become a commercial shipping free-for-all. 'With the exception of nuclear icebreakers,' it warns, 'very few ships have been built that could safely carry out year-round commercial navigation in the Canadian Arctic'.

With summer ice expected to endure for two or three decades more in these passages, the dangers moving ice presents to ships will be heightened by complex shipping routes with many narrow chokepoints and shallow depth restrictions.

According to Dr Michael Bravo of the Scott Polar Research Institute at the University of Cambridge, most mariners and forecasters with practical experience of shipping in today's Arctic would agree. In an interview with the *Ecologist* he said:

'All those people say that particularly in areas where you have strong currents – like the Canadian High Arctic archipelago – the freeing up of ice will make navigation more difficult. They are people who deserve listening to.'

'With the exception of nuclear icebreakers, very few ships have been built that could safely carry out year-round commercial navigation in the Canadian Arctic'

It is the kind of warning that rekindles memories of oil tanker disasters – memories that are still as fresh as the the 26,000 gallons of the Exxon Valdez's lost oil still trapped along the Alaskan coastline, causing lasting ecological damage.

Climate change bites

Climatic studies have also pointed to stormier conditions as a direct result of the sea ice disappearing. Last month's annual update to the Arctic Report Card, a collaborative effort of 71 international scientists, indicated major shifts in atmospheric circulation due to summer ice loss that may bring in storm patterns from the mid-latitudes. In a paper published in 2006 by researchers at the University of Bristol it is noted that 'sea ice plays an important role in the climate system in that it influences ocean-to-atmosphere fluxes, surface albedo, and ocean buoyancy'.

With the ice layer removed, temperature and moisture exchanges between the ocean and atmosphere occur much more readily. Complex simulation models have indicated this will cause higher precipitation levels and an intensification of storm tracks over the next century as a result of lower pressure and higher temperatures at surface level. In other words, the moderating influence of the sea ice on atmospheric conditions is disappearing.

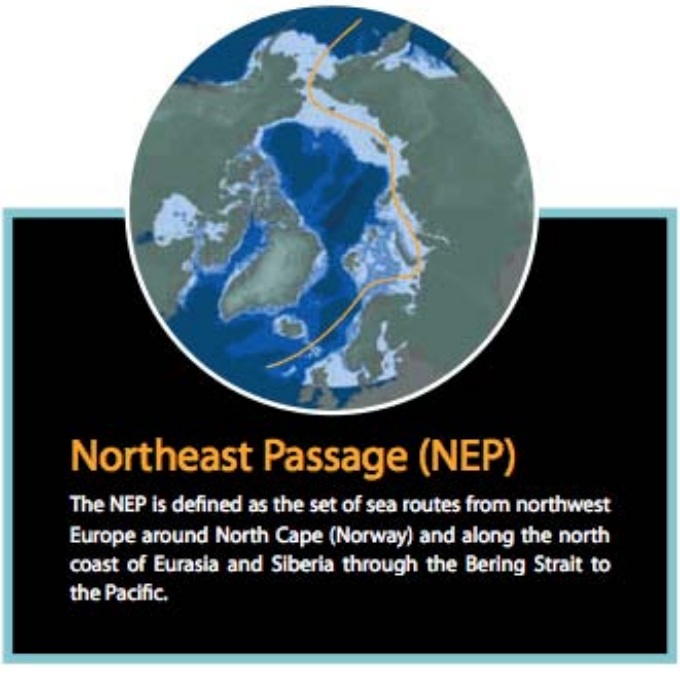
The implications do not bode well for those operating in the open Arctic. Large ice islands are now breaking free more frequently due to heightened heat and wind stress. Although small icebergs have been encountered by North Atlantic navigators for decades, these colossal chunks pose even greater threats. Regardless of new regulations requiring tankers to be double-hulled, they are capable of crushing ships and immobile oil rigs alike.

The new frontier

And yet it is evident that the new commercial colonisation of the Arctic has begun. Most recent were the voyages made by the Beluga Fraternity and Foresight, the twin German merchant ships that became the first Western commercial vessels to traverse Russia's Arctic coastline this September. Soviet shipping along the Russian coastline was established decades ago, but many hope constraints of expensive icebreaker escorts and narrow seasonal windows will soon disappear – an expectation encouraged by the Beluga voyages.

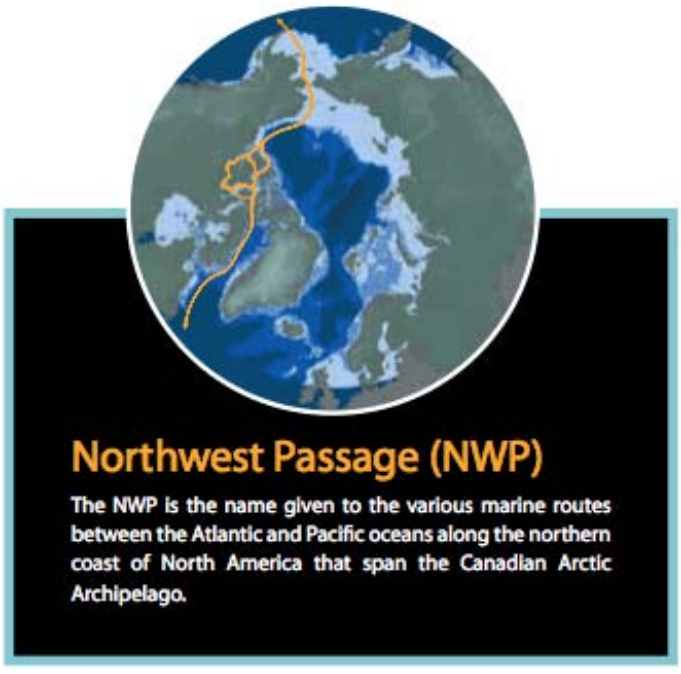
More significantly, a number of major resource extraction and shipping operations have begun in earnest in a region at the western end of this route known as the Pechora basin. Located within the Barents Sea, the area is believed to hold 610 million oil barrels for extraction.

Though modest by Gulf standards, the draw has been enough to prompt a flurry of infrastructure investments. The Varandey 'fixed offshore ice resistant terminal' recently began loading tankers with 12 million tons of



Northeast Passage (NEP)

The NEP is defined as the set of sea routes from northwest Europe around North Cape (Norway) and along the north coast of Eurasia and Siberia through the Bering Strait to the Pacific.



Northwest Passage (NWP)

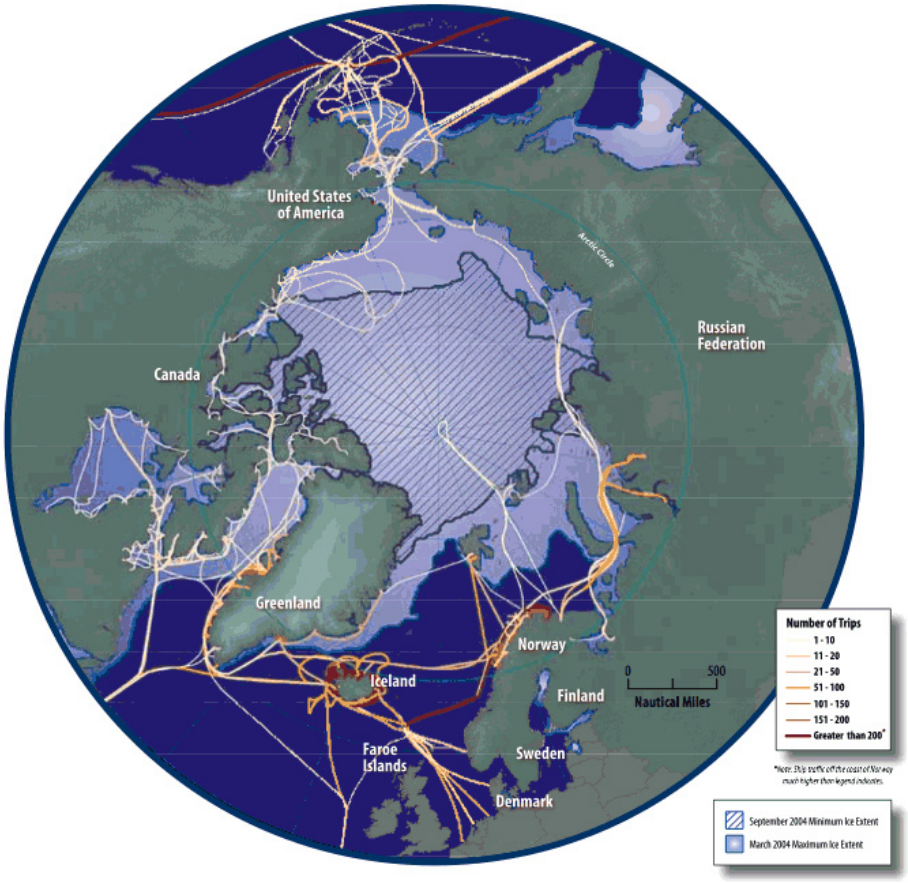
The NWP is the name given to the various marine routes between the Atlantic and Pacific oceans along the northern coast of North America that span the Canadian Arctic Archipelago.

oil per annum for immediate shipment to European and North American markets. Another Russian firm is constructing a rival floating platform at a nearby location, even though it is currently ice-free only 110 days of the year.

These are both serviced by tankers as large as 70,000 deadweight tons, which in a sign of growing faith in Arctic marine conditions were opted for in preference to a pipeline. To put these behemoths into context, many would be too large to fit through the Panama Canal.

U.S. and Canadian ships were busy too this summer, mapping the Beaufort Sea basin. Typically forward-thinking corporate energy giants scouted the region long ago, but this government-led operation aims to support national territorial claims to vast, untapped resource deposits. Future extraction is evidently in mind: the U.S. Minerals Management Service is already fielding fierce controversy after leasing a number of offshore Alaskan Shelf drilling sites to Royal Dutch Shell.

In total approximately 6000 ships were active in the Arctic Ocean by 2004. Anecdotal evidence suggests numbers have increased further since.



Shipping traffic in the Arctic for the AMSA survey year 2004. Source: AMSA

What's driving the risk-takers?

The risks of extracting resources or sailing in the Arctic are plain for all to see. So why have those behind the schemes outlined above chosen to ignore them, and why are national governments so happy to turn a blind eye?

The answer lies in a complex web of factors, and not all are as simple as melting ice. In fact, one of the main drivers may be the international commodities market.

It is a matter of simple economics that with higher prices, resource reserves previously too expensive to extract become economically viable. Given the sizeable problem ice caps pose to accessibility, resources buried underneath have always been assumed too expensive to extract. But today, investors positioning themselves for a role in the Arctic's future are driven more by the expectation of resource prices rising than of the ice melting.

'A couple of years ago when people got so excited about [Arctic resources] the price of oil was extremely high,' Dr Bravo explains. 'In the last year it has crashed, and in the Arctic you can see the consequences of that. All kinds of mineral extraction projects and oil and gas explorations have just stopped.'

Oil prices were scaling unprecedented heights around the time of most significant investment in the Barents Sea offshore projects. In February 2008, the same month crude oil passed the $100 per barrel mark, the U.S. Minerals Management Service received a staggering $2.7billion for Alaskan offshore lease sales.

Sovereign seas

Political agendas in the Arctic are perhaps even more complex, but there are many reasons why governments should choose to encourage activity in the Arctic, even when operating conditions for oil rig workers and sailors may potentially worsen.

States hold the greatest responsibility for regulating marine activity, but portraying the Arctic waters as safe is convenient for politicians keen to encourage hazardous yet profitable activities there. Thus Russia stands to gain a slice of the lucrative international shipping trade, and the US may relieve future oil dependency concerns.

Governments are also likely to overstate the accessibility of the Arctic because new shipping routes and oil fields require regulation, and hence must be strategically 'claimed' (when frozen, inaccessible waters tend to occupy a special perpetual limbo in international legislation).

An interesting example is Article 234 of the U.N. Law of the Sea (UNCLOS), which allows states to legally restrict naval passage through nearby coastal waters according to individual environmental standards. This clause was proposed by Canada after the U.S. disputed its claims to the North-West Passage as strictly internal waters, and has enabled it to extend existing legislation such as the Canadian Shipping Act to establish greater control over the straits.

Many in the field believe that such a piecemeal and opportunistic approach to regulation based on national interests is inadequate where the environmental stakes are so high. A more joined-up, international approach is called for, particularly for international waters beyond any nation's claims.

The idea that climate change makes the Arctic more hospitable is simply a myth. In fact the opposite is often true. But blaming melting ice for the growing scramble for Arctic resources risks ignoring other political and economic motives that may be almost as hard to tackle as climate change itself.

Andrew Marszal is a freelance journalist

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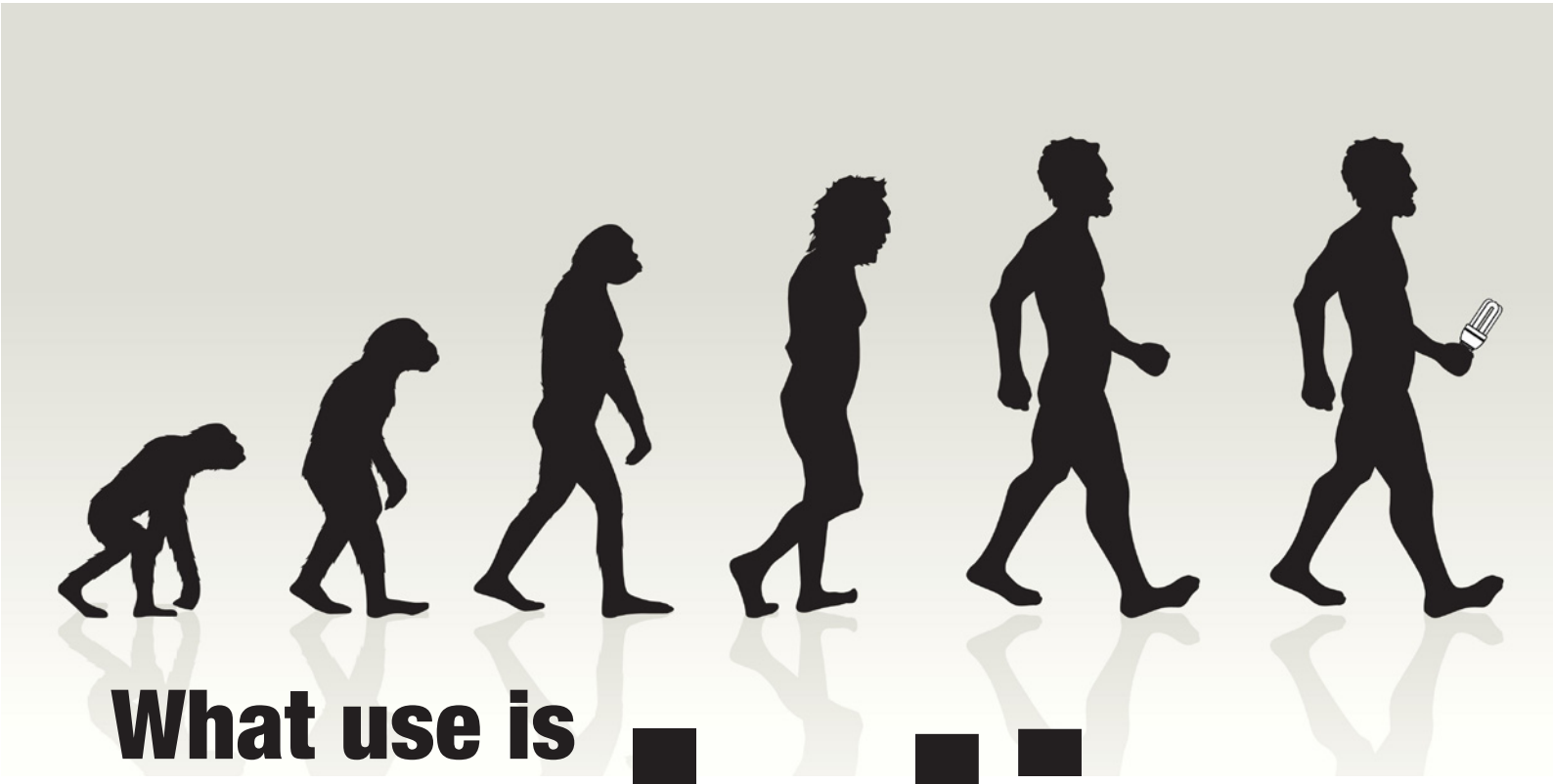


What use is evolution to environmentalists?

Evolution may be a brilliant model by which to explain the diversity of the natural world, but it doesn't contain the slightest hint as to how human-beings should act towards that world. By **Amelie Wachner**

Charles Darwin would have celebrated his 200th birthday this year. And his magnum opus, *On the Origin of Species by Means of Natural Selection*, has its 150th anniversary.

It is difficult to underestimate Darwin's legacy for 20th and 21st century thought: his theory was largely accepted during his lifetime despite a tidal wave of controversy at its launch, and the fact that it was not confirmed experimentally until 20th Century.

But just what does the theory of evolution mean for ecology, and for environmentalism? Does it explain how we should respond to and interact with the natural world? Does it shine a light on the current ecological crisis? Is it even helpful to think of nature purely in evolutionary terms?

As with all great theories, the idea behind the theory of evolution is in fact really simple. It goes like this: what if species are not fixed entities?

Think of the following: a given habitat does not have enough resources for a population. It follows that some individuals from that population will die before they can reproduce. Others, which have slightly different characteristics, may be better suited to survive.

The mechanism tugging at a species leading to the preservation of some variants and the elimination of others is called 'natural selection'. It's a famous phrase, but the term fails to indicate the randomness by which natural selection occurs. A better term – one which Darwin later admitted he should have used – would be 'natural preservation'. Variants that have a certain edge compared to others mean their owners get to reproduce, whereas those which are less well adapted die early or fail to reproduce.

Natural preservation is determined by several factors, such as food supply, climate, the disposition of the sexual partners and the predator pressure. A change in one of these factors can potentially benefit one member of a species, and lead to their survival and prosperity. Eventually, a new species might evolve.

But these conditions do not conspire to create the 'perfect' form. Trade-offs are inevitable. Evolution is therefore not a

'ladder' leading to the best adapted of all species. Instead, the whole apparatus functions pretty randomly, meaning that the metaphor of choice should be a tree with many different, tangled branches symbolising the different factors that influence species and their relationships. The tree metaphor illustrates that each twig is meaningful: a tree does not grow with the purpose of producing one 'special' branch.

Evolution and Ecology

Without the theory of evolution, ecology as it exists today could not have developed. Darwin himself did not use the term ecology, but he was the first to point out the way all living things are inherently connected. The actual term 'ecology' was coined in 1866 by Ernst Haeckel, an admirer of Darwin's.

Without Darwin the way disturbances in the environment can affect living creatures would be a complete mystery to us. Take climate change. We know that climate change will drastically alter biodiversity: many species will become extinct; new ones might evolve. This is because many species are set in a fragile connection with their environment and even the slightest changes in conditions can affect them severely. Changing conditions might favour different species. Variety might be lost, and not necessarily where human beings might choose it. To put it bluntly, cockroaches will have fewer problems than polar bears. And we can only foresee and act against these things by knowing our Darwin.

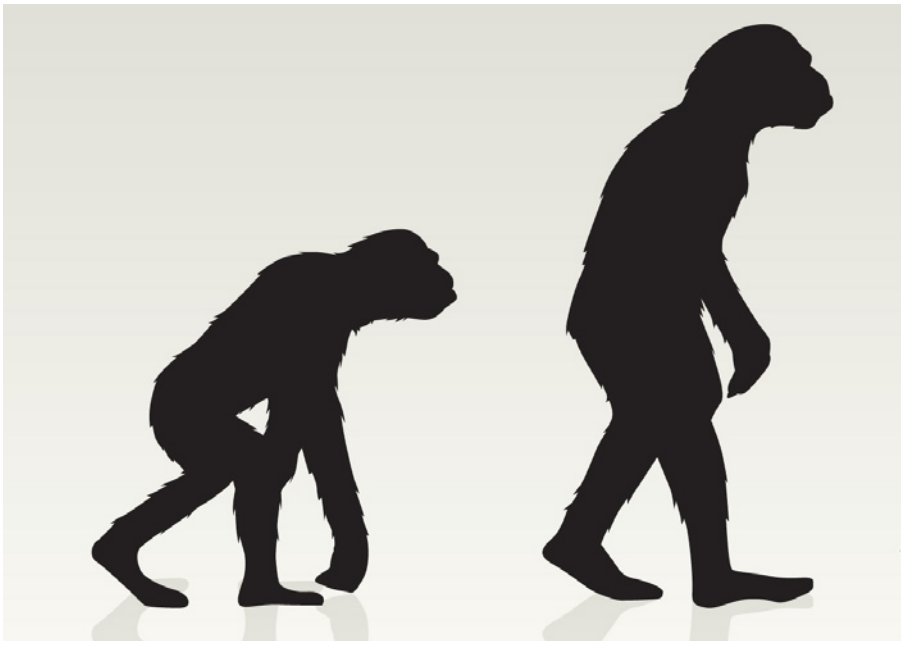
A moral lesson from evolution?

But why is it a problem to lose biodiversity on the planet in the first place? The question is heresy to most environmentalists, but it is worth pointing out that no answer to it is supplied by the theory of evolution. Evolution is something that happens at random and pursues no goals, offers no justifications, and has no moral.

Moral purpose is to the domain of mankind, although evolution can be (and often is) hitched to morality at some peculiar points. According to the German philosopher of science Thomas Potthast, the ongoing debate over the safety of genetic modification is a case in point.

Potthast's research has showed that those who are in favour of GM argue (amongst other things) that the technology is not that different to natural selection, and that human interests are preserved through copying mechanisms of evolution.

Opponents of GM counter that by altering the genetic material of certain individuals within a species, the natural flow of evolution is disturbed. Furthermore, they say, the complexity of the mechanisms of evolution mean that it is impossible to foresee the consequences of altering the genetic stock of a population in the long run.



'Why is it a problem to lose biodiversity on the planet in the first place? The question is heresy to most environmentalists, but evolution offers no answers'

'Taken to its logical extreme, Social Darwinism fosters uncontrolled markets and non-interventionist politics, which spell bad news for people and the environment'

Pick 'n' Mix

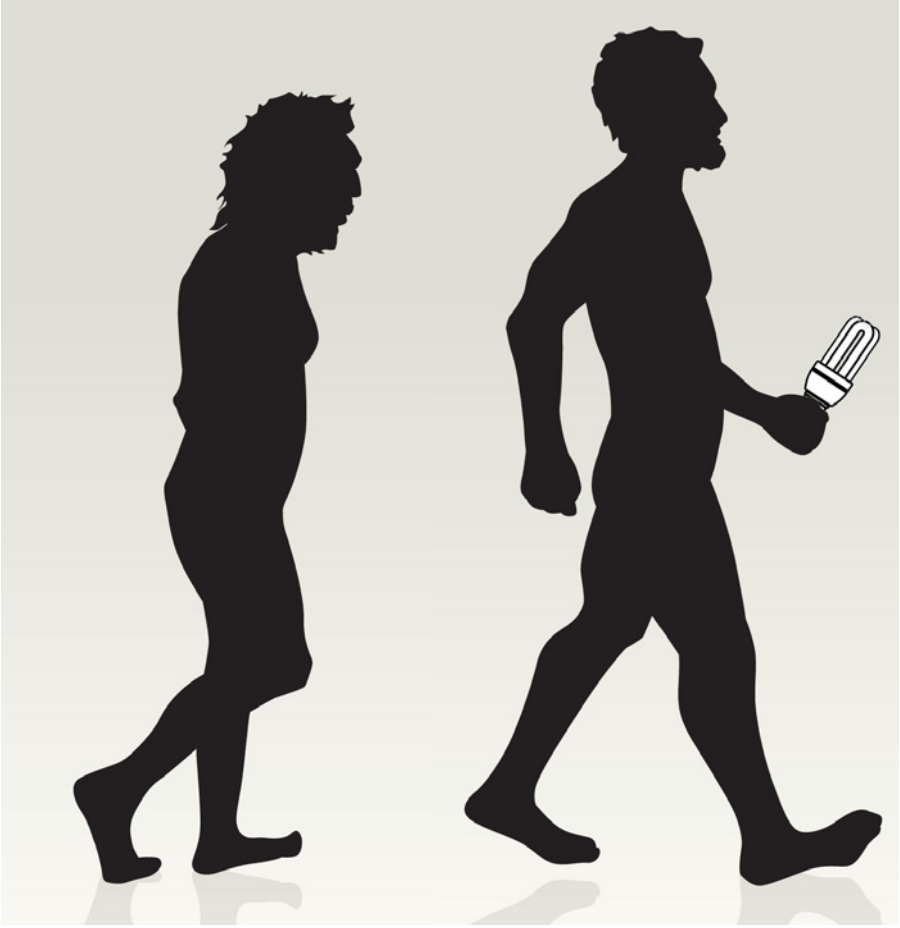
Evolution can, then, to a certain extent be what you make of it. And the theory has its dark side too. Take Social Darwinism – the projection of some of Darwin's observations of nature onto human society, suggesting that unfettered competition is healthy, natural and productive.

The notion had been considered even before Darwin set sail on the HMS Beagle, but he himself had hardly anything to do with it. Yet Darwin's research underpins its core concepts.

Taken to its logical extreme Social Darwinism essentially fosters uncontrolled markets and non-interventionist politics, which, as the financial crisis has shown, spell bad news both for people and the environment.

Social Darwinism was also used to legitimate colonialism as an expression of the notion that in the 'struggle of existence', the stronger party has the right to overcome the weaker party and claim territory.

The concept is a dangerous misperception: although human beings are products of evolution and are descended from apes, that doesn't mean that their social structures



'However alien other organisms might seem to you, Darwin's notion of common ancestry means that you are related to them in the same way as your relatives'

must function according to the 'survival of the fittest' (a catchphrase Darwin didn't use). Social Darwinism is not only dangerous for society, it also doesn't grasp the kernel of evolution. Evolution doesn't necessarily mean things improve for the best, nor is it strength and power that are automatically desirable, but rather flexibility.

But despite the inappropriateness of Social Darwinism, the theory of evolution itself still offers a fairly grim view of the natural world. One could argue, for example, that species loss due to climate change is really not a problem. Adapt or die, so to speak.

The theory of evolution doesn't know Gaia and mother earth. Life forms do not interact in a 'circle of life', but in a struggle for existence. And from an evolutionary point of view, sharks are more worthy of preservation than pandas.

Ecology under the cross?

These are ideas that have sat uncomfortably with environmentalists for decades, including the *Ecologist*'s founder Edward Goldsmith, who struggled with the idea that evolution could be purely random and without purpose.

It is perhaps unsurprising then, that some have been drawn towards more spiritual conceptions of environmentalism. Christians, for example, hold that a belief in God as creator gives the sense of responsibility towards nature that is needed in order to preserve it. Mankind is seen as God's steward, who has creation at his disposal but must handle it with care.

But monotheistic attitudes towards the natural world immediately throw up difficulties. The Judeo-Christian notion of man as the crown of creation teaches a fundamental separation between human beings and the rest of the world, as the historian Lynn White has pointed out.

The Bible describes a world that is basically at man's disposal: 'Be fruitful, and multiply, and replenish the earth, and subdue it,' commands the Book of Genesis. Is that really a motto under which to try to save the environment?

White even sees the roots of environmental destruction exactly in this world view, because of its tendency to foster an indifference towards the processes of the natural world, especially when it comes to the benefits mankind can reap through the destruction of nature.

A secular ethic

So how about a solution with ethics but less anthropocentrism? Arne Naess, founder of the Deep Ecology branch of philosophy, strived for an ethic that would regard human beings as part of wildlife and the whole of wildlife as one system, whereby the whole system is superior to any part of it. But in many ways, such a notion is only possible in the first place because of the theory of evolution. Deep Ecology could never exist without Darwin's findings. After all, Darwin was the first to actually show man his place in nature.

And this, at root, may be Darwin's legacy to environmentalists. His theories should teach us humility, since they argue that every living thing on the planet has a common ancestry. As Mark Pallen, Professor for Microbial Genomics puts it, 'However alien these organisms [i. e. cats, dogs, bees or zebrafish] seem to you, Darwin's notion of common ancestry means that you are related to them in the same way that you are related to your human relatives'.

Perhaps tempering environmentalism with a healthy dose of Darwinism may even lead us to challenge long-held beliefs. Having studied his Darwin, Peter Bridgewater, Chair of the UK Government's Joint Nature Conservation Committee (JNCC), recently called for a pragmatic attitude towards the fight against biodiversity loss.

'Loss cannot be prevented, but it can be managed,' he said. 'Novel ecosystems are being created, and these offer hope for the fight against loss, and also help with adaptation to climate change.'

He may have ruffled the feathers of conservationists, but his perspective is one that fuses environmentalism with Darwinism precisely because of its amorality.

Being aware of ecology necessarily means being aware of evolution, of its entire dynamic and randomness. Sometimes, this might entail casting aside the images of nature that we have grown to love. But it also means that above all, mankind is part of nature. The logic behind evolution might at times be frightening, but it also offers hope for a more realistic understanding of our place in this world.

Amelie Wachner is a researcher in social and environmental science. She holds degrees in Biology and Media Studies

Pricing the tonne of carbon that tips us into climate catastrophe

In this brilliant winning entry to the *Ecologist*/New Economics Foundation essay competition, **Janine Morley** imagines buying 'the final tonne' from a carbon broker

How do you price the extra tonne of carbon that, once burned, tips the balance and triggers potentially catastrophic, irreversible global warming?

'So you're looking for a quote on a tonne of carbon? It's a very special tonne that you're interested in buying, I understand? You're after the tonne that tips the climate into a runaway conversion to a chaotic state. Hmm, well, I can't guarantee you that precise tonne, I should warn you, but scientists are convinced this runaway effect will be triggered by what we're emitting right about now. So any tonne you buy today could be the one. And it's a great time to buy - the markets have adjusted to the new global scenario and prices have really dropped off following the boom earlier in the year. You're in for a bargain!

'But first, I am obliged to check that, as a private customer, you are aware that there is no legal or other requirement for you to buy carbon emissions rights. Not even for that special tonne that tips the climate. Can you confirm that you understand? Great, so you're definitely looking to buy.

'Looking at your options, then, the first route is to buy from one of the many carbon trading systems around the world. Some are closed markets, limited to controlled participants only. But in others anyone can trade through an agent - so long as you're not buying too much. For one tonne, I can give you a quote on the EU Emissions Trading Scheme for £21.17. Remember, it could be the tonne that tips the climate and procured this way you're using an internationally reputable scheme

'I thought I'd be out of work when the news reports kept coming. I thought the governments would close down the markets, impose restrictions'

that is helping to deliver the climate change targets of the Copenhagen Protocol.

'Your second option, which I'm sure you've heard of, is the purchase of offsetting credits. Now, these aren't strictly emissions rights, but they work in a similar way. Copenhagen-compliant credits are priced at roughly equivalent value to the market price. I'm looking at a well-regarded scheme here for £19.67 a tonne. Or for a Gold Standard scheme the price of a tonne is about £30. Just depends on how much you're looking to spend.

'If that doesn't do it for you, there's a relatively new scheme you might like: community carbon trading groups. These are limited companies that recruit members of the public and give them support to cut their carbon emissions which they then sell on. The price is fixed to the Government's shadow price of carbon, plus a small administration fee. Let's see, you can buy one tonne, today, for £35.80.

'Which of those take your fancy? Which is the most legitimate and legally defendable? Hmm, good question, I would say buying from a Copenhagen-compliant trading scheme. That's what you're going for? Great! I'll just start processing the transaction...

'Huh, I can tell you back in 2009 when I got into this business it had such a bright future. I was a bit of an idealist back then – I needed to make a living as well, of course– but everyone thought carbon trading was going to be the solution to climate change. It felt like we had years to prevent the worst case. I never thought I would end up selling the "last tonne" so soon! Hmm? Oh, I'm sorry, the "last tonne": that's what we call it. You know, the last tonne of the world as we know it, the one that tips the climate, the tonne that everyone was working to avoid. Don't get me wrong. As I've said, I can't give any guarantees on the one you've just bought. But every tonne this year is playing its part. The scientists are pretty convinced we'll emit enough carbon this year to ensure we go through that tipping point – a 95 per cent chance they say. Come 2019, we're in a new age.

'I thought I'd be out of work, to be honest, when the news reports kept coming. I thought the governments would close down the markets, impose severe restrictions, even buy up the rights themselves once they realised it was too late to adjust their own 2050 targets. But then, as I guess you know, the markets went stellar – prices soared – and the governments hoped they would work. I even thought about quitting. I wasn't sure if I could live with myself, for selling the very carbon that would damn us. But I'm just a middle man if I'm honest with myself. If not me, somebody else would do it. And with such high prices I couldn't say no. I've my parents and my brother's family to support.

'Unfortunately, the boom was short-lived. Once everyone realised the governments weren't going to do anything and a chaotic climate seemed inevitable the pressure just eased off.

'There, it's almost processed. Yes, that's right, the ID system is clogged up again. So...I hope you don't think I'm being rude: are you planning to do anything special with your carbon emissions? Ah, I see. Yes, I had to get rid of my car – so expensive. And why the special interest in buying the tonne that tips the climate? What, it felt wrong, did it? Ah, so you wanted to buy it, to make sure it was all legal and accounted for. Make sure it's on the record so to speak. Ease your conscience and all that. No, it doesn't sound that funny. In fact, you're not the first to say that to me. Hmm? Likewise, I never thought I could sell it but life goes on.

'Right, that's it. Your credit certificate and receipt will be emailed to you. I hope you'll feel like keeping your conscience at rest by buying more carbon in the future. At least, you'll know the ropes. Cheerio.'

Read other entries to the competition at www.theecologist.org