

Diverse ecosystems are crucial to climate change buffer



Preserving diverse plant life will be crucial to buffer the negative effects of climate change and desertification in the world's drylands, according to a new landmark study.

The findings of the multi-author study, published in the journal *Science*, are based on samples of ecosystems in every continent except Antarctica. They confirm for the first time that the more diverse an ecosystem is the more ecological functions it performs. It also has implications for carbon sequestration and soil health.

"This is the most extensive study of the links between function and diversity ever undertaken," noted co-author Prof David Eldridge of the University of New South

Wales' School of Biological Earth and Environmental Sciences.

According to the study, dryland ecosystems cover about 40% of the Earth's land surface, support 40% of its people, and are particularly vulnerable to environmental changes and desertification. "Our findings suggest that plant species richness may be particularly important for maintaining ecosystem functions linked to carbon and nitrogen cycling, which sustain carbon sequestration and soil fertility," reported Prof Eldridge. "And because land degradation is often accompanied by the loss of soil fertility, plant species richness may also promote ecosystem resistance to desertification."

It is generally accepted that the loss of biodiversity may impair how natural ecosystems function by reducing the quality of services they provide. These include provisioning services such as the availability of drinking water, food and energy; regulating services such as carbon sequestration and waste decomposition; and supporting services such as nutrient cycling and seed dispersal.

Ecosystems that provide multiple services – such as carbon storage,

productivity, and the build-up of nutrient services – are described as multi-functional. However, the links between biodiversity and multi-functionality in dryland ecosystems have never been assessed globally.

In this study, a team of scientists from 14 countries evaluated how the diversity of perennial plants, and a range of climatic and landscape variables, were related to multi-functionality of 224 dryland systems. Researchers surveyed plots large enough to represent the main ecosystem features at each site and assessed 14 functions all related to the cycling and storage of carbon, nitrogen and phosphorus.

These functions were chosen because they deliver some of the fundamental supporting and regulating ecosystem services, and because they are used to identify the onset of desertification processes, explained Prof Eldridge. "Climate change will reduce the ability of dryland ecosystems to perform multiple functions related to the cycling of these elements. Changing climate is also likely to reduce plant richness and increase the areas affected by desertification."

World biodiversity crisis 'worse than climate change'

The challenge of conserving the world's biodiversity is perhaps even larger than mitigating the effects of global climate change.

This is the main conclusion from a discussion at the University of Copenhagen where researchers and policy experts gathered to discuss how to organise the future UN Intergovernmental Panel for Biodiversity and Ecosystem Services.

Species extinction and the degradation of ecosystems are proceeding rapidly and the pace is accelerating. The world is losing species at a rate that is 100 to 1 000 times faster than the natural extinction rate.

Mass extinctions of species have occurred five times previously in the

history of the world – the last time was 65 million years ago when the dinosaurs and many other species disappeared. Previous periods of mass extinction and ecosystem change were driven by global changes in climate and in atmospheric chemistry, impacts by asteroids and volcanism. Now we are in the 6th mass extinction event, which is a result of a competition of resources between one species on the planet – humans – and all others.

"The biodiversity crisis – i.e. the rapid loss of species and the rapid degradation of ecosystems – is probably a greater threat than global climate change to the stability and prosperous future of mankind on Earth," said Prof Carsten Rahbek,

Director for the Centre for Macroecology, Evolution and Climate at the University of Copenhagen. "There is a need for scientists, politicians and government authorities to closely collaborate if we are to solve this crisis."

The new planned Biodiversity panel is equivalent to the UN panel on climate change, which has resulted in enhanced policy awareness and changes around the world. Unfortunately the same cannot be said when it comes to reducing the threats to ecosystems and the loss of animal and plant species. "There is a need to produce future scenarios that are easily understood and, at the same time, bring together the best scientists in the field," noted Prof Rahbek.

Banana peel can purify water, say scientists

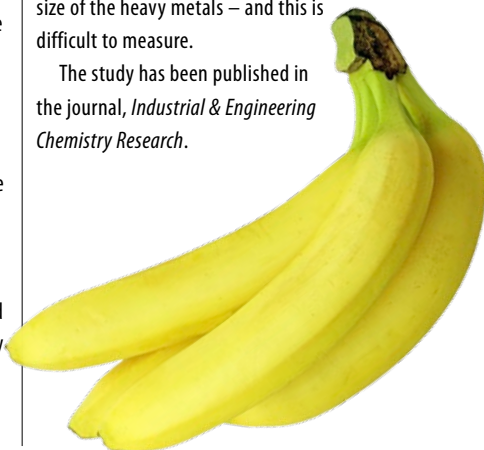
Banana peels can be used to purify water contaminated with toxic heavy metals such as copper and lead, according to Brazilian scientists.

Research from the Bioscience Institute at Botucatu, Brazil, reported that the skins can outperform even conventional purifiers such as aluminium oxide, cellulose and silica. The team's method follows previous work that showed that plant parts, such as apple and sugarcane wastes, coconut fibres and peanut shells, can remove toxins from water. These natural materials contain chemicals that have an affinity for metals.

Co-author of the study Gustavo Rocha de Castro explains that the peels were dried in the sun for a week, then ground and added to river water containing known concentrations of copper and lead. The researchers found that the peels absorbed 97% of the metals after only one hour.

Castro said that, although the peels were tested only on copper and lead, the material could also work on cadmium, nickel and zinc. However, he warned that this sort of filter is better suited to industrial purposes and cannot be used for water purification at home as the extraction capacity of banana peels depend on the particle size of the heavy metals – and this is difficult to measure.

The study has been published in the journal, *Industrial & Engineering Chemistry Research*.



New species of tiny frog is world's smallest vertebrate



Researchers have found two new frog species in New Guinea, one of which is the new smallest known vertebrate on Earth.

The discovery was made by a team of researchers led by Christopher

Austin of Louisiana State University, in the US.

The new smallest vertebrate species is called *Paedophryne amauensis*, named after Amau village in Papua New Guinea, where it was found. The adult body size for these frogs ranges from just 7 to 8 mm.

According to Dr Austin, the discovery is "of considerable interest to biologists because little is understood about the functional constraints that come with extreme body size, whether large or small." The previous smallest vertebrate was a fish, called *Paedocypris progenetica*, with an adult size of 7.9 to 10.3 mm.

To read the scientific description of the species, Visit: www.plosone.org/article/info:doi/10.1371/journal.pone.0029797

Temperate freshwater wetlands are 'forgotten' carbon sinks

Results of a new study out of the US comparing the carbon-holding power of freshwater wetlands indicate that wetlands in temperate regions are more valuable as carbon sinks than current policies imply.

The study compared several wetlands at two wetlands sites in Ohio, US: one composed of mostly stagnant water and one characterised by water regularly flowing through it. The study showed that the stagnant wetland had an average carbon storage rate per year that is almost twice as high as the carbon storage rate of the flow-through wetland.

In addition, the scientists came up with measures of carbon storage in the stagnant wetland that exceed carbon measurements recorded in recent years in various types of wetlands, suggesting to the researchers that temperate freshwater wetlands may have a significant role in worldwide strategies to offset greenhouse gas emissions.

All types of wetlands deserve more credit than they receive as carbon sequestering systems in global carbon budgets, the researchers say. However, they also say that boreal peatlands – wetlands containing deep layers of organic matter in subarctic regions – should not be the only wetlands favoured in policy considerations.

"These numbers are a lot higher than those often used to determine policy about wetlands. All of our numbers are, in general, considerably higher than the average rates of carbon sequestration for boreal peatlands, but the boreal peatland numbers rule the roost in climate change," said William Mitsch, senior author of the study and environmental and natural resources professor at Ohio State University. "Wetlands make up 6% to 8% of the landscape, but they hold much more than 6% to 8% of the world's carbon. They are the forgotten carbon sink."

Disease-causing fungi prevalent in sink drains, study finds

A study examining the prevalence of the fungus *Fusarium* in bathroom sink drains suggests that plumbing systems may be a common source of human infections.

US researchers from Penn State's College of Agricultural Sciences sampled nearly 500 sink drains from 131 buildings – businesses, homes, university dormitories and public facilities. They analysed fungal DNA to compare the spectrum of *Fusarium* species and sequence types found in drains with those recovered from human infections.

The study identified at least one *Fusarium* isolate in 66% of the drains and in 82% of the buildings. About 70% of those isolates came from the six sequence types of *Fusarium* most frequently associated with human infections.

"With about two thirds of sinks found to harbour *Fusarium*, it is clear that those buildings' inhabitants are exposed to fungi on a regular basis," noted lead investigator Dylan Short, who recently completed his doctorate in plant pathology. "This strongly supports the hypothesis that plumbing-surface biofilms serve as reservoirs for human pathogenic fusaria."

Some species of *Fusarium* cause opportunistic and sometimes fatal infections in humans, typically entering the body through wounds or trauma, via catheters and intravenous devices or by introduction of a biofilm to the eye. While relatively rare, *Fusarium* infections can be difficult to treat because of the organism's resistance to many antifungal drugs. Those most at risk are individuals with weak or compromised immune systems.

Short explained that biofilms on plumbing surfaces are known to comprise a diverse spectrum of fungi and other microbes. "Based on its very high frequency, it is clear that *Fusarium* is a ubiquitous component of biofilm microbial communities in plumbing systems. The adaptations that make *Fusarium* biofilm growth possible also may facilitate infection of humans."

The study results have been published in the *Journal of Clinical Microbiology*.



Water on the Web

www.dwa.gov.za/DSO/

This is the official website of the Department of Water Affairs' Dam Safety Office. Legislative and guidelines documents and forms pertaining to dam safety can be found at this site.

www.reservoir.co.za

This website, developed by Rand Water, is an information centre for the Upper Vaal Water Management Area (WMA). It has been developed to facilitate communication of information between stakeholders and role-players participating within all catchment forums

and associated management structures of the Upper Vaal WMA. Water quality information and reports for both river and drinking water are provided.

www.worldfishcenter.org/

The WorldFish Centre is an international, non-profit research organisation dedicated to reducing poverty and hunger by improving fisheries and aquaculture. WorldFish is one of the 15 members of the CGIAR Consortium. The site offers interesting information regarding aquaculture and its role in poverty and hunger alleviation, especially in developing countries.



New Zealand river is top satellite image of 2011



An image of New Zealand's Rakaia River has come out tops in global commercial satellite imagery company, DigitalGlobe's, top satellite image contest.

The Rakaia River is located in the Canterbury Plains in New Zealand's South Island. It rises in the Southern Alps, travelling 150 km in a generally

easterly or southeasterly direction before entering the Pacific Ocean 50 km south of Christchurch. It is one of the country's largest braided rivers.

The satellite imagery company placed images, ranging from natural disasters to natural wonders, on its Facebook page, asking viewers to vote for their favourite.

Artificial wetlands can provide long-term benefits over the long haul

Wetlands created to replace those lost to environmental degradation or development take up carbon from the atmosphere and so potentially reduce greenhouse warming, a unique 15-year study suggests.

Such artificial wetlands caused emissions of methane, which may contribute to warming, smaller than those from natural wetlands.

William J Mitsch, of the University of Florida Gulf Coast University in Naples and his colleagues, describe the development of two one-hectare wetlands in Ohio created by pumping water from the nearby Olentangy river, starting in 1994. One was manually planted with vegetation, and the other was left to develop naturally.

The results, reported in the March issue of *BioScience*, show that over time

the manually planted and the unplanted wetlands differed principally in the variety of plants present and in how much gas they exchanged with the atmosphere. The manually planted wetland showed more variety, but the unplanted one took up more carbon from the atmosphere. Methane emissions from the unplanted wetland, unlike the planted one, meant that it was estimated to contribute slightly to net greenhouse warming. Both created wetlands, however, removed large amounts of nitrogen and phosphorus from the incoming river water. Emissions of nitrous oxide, which can also increase warming, were small.

This study may prove useful as a model for future wetland reclamation or replacement projects and for determining the amount of human intervention that is necessary for these projects to be successful.

Scientists measure human water footprint

The average person consumes 4 000 ℓ/day of water – including water for food and other products. This is the main finding of a recent study into the global water footprint published by researchers at the University of Twente.

The 'Water Footprint of Humanity' study, published in the 13 February *Proceedings of the National Academy of Sciences*, looks at the use of rainwater, groundwater and surface water, as well as contaminated water. Water used by the agricultural sector accounts for nearly 92% of annual global freshwater consumption, the largest proportion which is 'green' water (74%).

In the period between 1996 and 2005, the average consumer used an annual total of 1 385 m³. However, on examining the statistics per country, startling differences emerge: one American consumes more than double the average global amount, while the inhabitants of China and India consume little more than 1 000 m³. The water footprint of the average consumer is determined mainly by the consumption of cereals (27%), meat (22%) and dairy products (7%).

The study also shows the virtual import and export of water through trade in resources and products. Some countries, such as China and the US, are both large importers and exporters of water. Research shows that water-rich countries in northern Europe often rely on water imports from areas struggling with severe water scarcity.

The researchers also expect to see a drastic change in consumption in China as it relies increasingly on farmland in, for example, Africa. This will lead to much greater water imports. "These are all indicators that water scarcity is not a local problem but must be seen from a global perspective," the researchers said in a statement. They are therefore questioning whether the continued use of the limited blue water footprint approach for export is sustainable.

Source: University of Twente

Water by numbers

- **350** – The number of people who had to be evacuated or airlifted to safety following heavy flooding in the Hoedspruit area, in Limpopo, earlier this year. The floods, caused by Cyclone Dando when it moved inland from the coast of Mozambique, struck the hardest in Mpumalanga's Nkomazi area south of Malelane, Hoedspruit and the Kruger National Park.
- **R2-billion** – The potential shortfall faced by the Limpopo Province at the end of this financial year. According to a statement by Treasury, the province's finances would be restructured in order to find savings to cover the shortfall. The province's large, accumulated unauthorised expenditure (R2,7-billion in 2011) has been given as the main reason for the shortfall.
- **102** – The number of families in Makana Municipality, in Grahamstown, Eastern Cape, which still make use of the bucket toilet system. The municipality aims to spend around R3-million to eradicate the buckets by May, BuaNews reported.
- **2013** – The expected completion date of the new Spring Grove Dam, which is currently under construction near Rosetta in the KwaZulu-Natal midlands. The dam will increase the yield of the uMgeni system, which supplies water to Durban, Pietermaritzburg and surrounds, to 394-million m³/year. The dam will be about 42 m high, with a gross storage capacity of 142,5-million m³.
- **10%** – The percentage of Rand Water's 3 500 km pipeline network which is constructed out of concrete. The remainder of the network is made up of steel pipelines.
- **46** – The number of new species discovered by scientists during a recent expedition to the pristine tropical forests of Suriname, BBC Nature reports. A total of 1 300 species were recorded, with frogs, crickets and catfish being counted among the new finds.

Millennium Development Goals – Drinking water target in site

According to the latest report by UNICEF and the World Health Organisation (WHO), the world is well on its way to meeting the Millennium Development Goal (MDG) of improving access to safe drinking water by 2015. However, soaring population growth is hampering progress in some areas.

"The good news is that almost 1,8 billion more people now have access to drinking water compared to the start of the 1990s," reports Sanjay Wijsekera, UNICEF Associate Director. "The bad news is that the poorest and most marginalised are being left behind."

The report, *Drinking Water Equity, Safety and Sustainability*, says that between 1990 and 2008, the proportion of the world's population with access to improved drinking water sources increased from 77% to 87%. Despite this progress, however, there were still 884 million people that did not use improved drinking water sources.

At the current rate of progress, 672 million people will not use improved drinking water sources in 2015. It is likely that many hundreds of millions more will still lack sustainable access to safe drinking water.

The report stresses that, even though good progress has been made in some regions, others are still not on track to meet the target. Of the millions of people without access to improved sources



Today, at least 1,8 million more people have access to safe water.

Pierre Holtz/UNICEF

of drinking water in 2008, 37% live in sub-Saharan Africa, 25% in Southern Asia, 17% in Eastern Asia and 9% in South-Eastern Asia.

In sub-Saharan Africa, for example, total access has significantly increased since 1990, jumping from 49% to 60%, and reaching an additional 126 million people in urban and 111 million in rural areas. However, population growth has outstripped the progress to the extent that the actual number of

people without access was greater in 2008 than it was in 1990.

Of particular concern among those people without access to improved drinking water sources are those who rely on surface water sources. Such sources include rivers, dams, lakes, ponds, and canals, and are often the most susceptible to pollution and most likely to have poor water quality. Since 1990, use of surface water sources has decreased significantly

and accounts for only a small proportion of drinking water sources in most regions, however, in sub-Saharan Africa 20% of the population is still dependent on these water sources.

Furthermore, the report found that the richest 20% in sub-Saharan African countries are more than twice as likely to use an improved drinking water source as the poorest 20%. In addition, poor people in rural areas have the lowest access to safe drinking water, with the greatest burden in collecting water falling to women and girls.

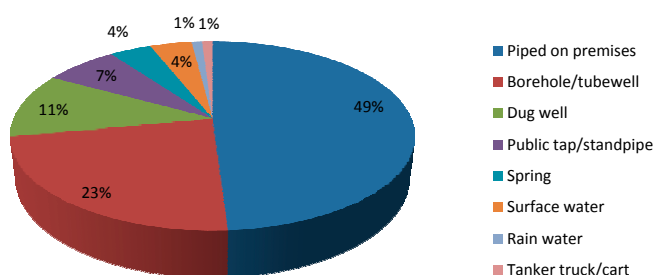
Globally, more than eight out of ten persons without an improved drinking water source live in rural areas. However, the proportion of the rural population in developing regions using piped drinking water on premises (considered the optimal service level) was still only 31% in 2008, up from 21% in 1990. In urban areas it went from 71% to 73% during the same period. This proves, according to the report, that investment in water and sanitation is not being optimised – almost two thirds of total official development assistance for drinking water and sanitation goes to the development of large urban systems.

The report adds that even where there is access to water, it is often not safe for drinking. Water quality surveys show that many improved drinking water sources – such as piped supplies, boreholes and protected wells – do not conform to WHO guidelines. On average, half of all protected dug wells may be contaminated, along with one-third of protected springs and boreholes.

Climate change also poses threats to water infrastructure. The increasing frequency of droughts and floods could lead to loss of functioning which would set back progress in drinking water supply, and affect other MDG targets. Investments should, therefore, be aimed at making systems and services more resilient in the face of extreme weather conditions.

To access the report, *Drinking Water Equity, Safety and Sustainability*, Visit: www.unicef.org/media/files/JMP_Report_DrinkingWater_2011.pdf 

Proportion of the population using different drinking water source types in developing regions (2008)



Source: *Drinking Water Equity, Safety and Sustainability*