

WEEG NEWSLETTER JUNE/JULY 2020

The newsletter is published monthly by the University of Southampton's Water and Environmental Engineering Group WEEG, and reports things of interest in this field worldwide, as well as ongoing undergraduate student and research work in WEEG itself.

We believe that water and energy are the most important topics worldwide for the next decades. Our work covers river and coastal engineering, water and wastewater and energy related to water.

Editorial: we have all heard about global warming and its consequences, such as a change in weather patterns and the rise of sea levels. Both of course have a direct effect on our topic of environmental engineering. An effect which is far less known, but which will also have significant consequences, is *global greening*. Never heard of it? Then read on...

Hydraulic Engineering International: *Global greening*

Global warming is driven by the increase in greenhouse gases in our atmosphere, including CO₂ generated by burning fossil fuels and the production of gases such as methane from a variety of biological processes (not least by animals). It is also an intriguing thought that a growing human population, breathing oxygen in and exhaling it as CO₂, is part of the mix. Each human produces around 1 kg of CO₂ a day, in total equivalent to around 7% of fossil emissions, although of course this comes from the degradation of organic matter (food and drink) which is primarily from the short term carbon cycle.

So, the Earth's climate warms up. The increased CO₂ content has another effect, however: it accelerates the growth of plants which use CO₂ as one key component of photosynthesis, and emit the oxygen needed for aerobic organisms to respire.

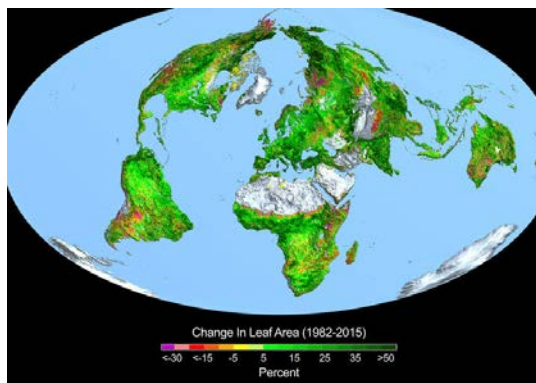


Fig. 1: Change in leaf area 1982 – 2015

Boston University researchers have conducted a study to document the change in leaf area worldwide from 1982 to 2015: the results are shown in Fig. 1. The increase in leaves and trees corresponds to an area twice the size of the Continental United States. This is not all a

natural process in response to rising CO₂ concentrations. The increase in agricultural land in India and China as well as reforestation projects add to the effect of global greening. When looking at the map, however, you can see an increase in leaf area in the arctic region. Here, the increase in temperature means that vegetation can expand northwards, reaching areas where next to nothing has grown so far.



Fig. 2: Change in vegetation cover in Canada and Alaska

The changes in weather patterns and the increased atmospheric CO₂ content have also led to a massive change in North Africa.



Fig. 3: Vegetation cover in sub-saharan Africa (NASA image)

The area of the Sahara desert has shrunk by 8% in the last three decades, according to NASA. Apart from CO₂, an additional driver of change is the decline in vegetation fires in a warmer and more humid climate. There are further factors, such as the new vegetation not being trees but so-called woody plant encroachments or shrubs (Fig. 4) – which are not used as fuel, and are therefore allowed to grow. These WPEs are usually only recognised at local scale, so that the growth has gone largely unnoticed.

The increased vegetation cover also changes the micro-climate, leading to a change in the water balance. The existence of plants means

that humidity is captured from the air, soil is created, water is retained, and rainfall is increased. An example of this can be seen on Ascension Island, transforming it from a desert into a thriving ecosystem (WEEG Newsletter 6).



Fig. 4: New vegetation in the Sahel Zone

So, what can we learn from this? The researchers at Boston University estimated that the greening occurring since the early 1980s may have slowed the rate of global warming in this period, possibly by 0.2 to 0.25 degrees Celsius. The emission of CO₂ by human activity (industrial and natural) therefore actually drives a process which increases the removal of CO₂ from the atmosphere.

The recent rise in precipitation in the Sahel is interesting and encouraging from the environmental point of view; but the region is also subject to cyclic changes in rainfall, and the overall change does not correlate well with the steady increase in global temperature since the start of the industrial revolution. But it is an example of how the Earth's ecosystem contains multiple feedback loops whereby a change in one parameter leads to changes in others, which in turn can affect the first parameter. This is what makes the study of climate change so complex and fascinating...

WEEG websites

WEEG has its own websites where we publish what we are doing, project descriptions, teaching materials etc: <https://hydro.soton.ac.uk>, <https://borrg.soton.ac.uk>, www.icer.soton.ac.uk

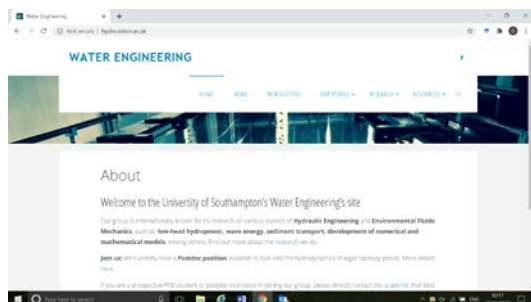


Fig. 5: Our new Hydraulics website

And of course there's the Newsletter archive where you can look up all NLs ever published: <https://hydro.soton.ac.uk/resources/newsletters/>

Novel hybrid biofilm technology to remove nutrients from wastewater

Eutrophication of water bodies by discharge of nutrients from agriculture and wastewater treatment plants is a widely recognised issue. Existing technology for removal of nutrients from wastewater cannot currently achieve very low levels of Total Nitrogen (TN) and Total Phosphorus (TP) in a sustainable, cost-effective manner. WEEG staff have thus teamed up with Plantwork Systems Ltd (PWS) to develop a novel hybrid technology to enhance nutrient removal by integrating biofilm technology into existing activated sludge treatment systems.



Fig. 6: PWS Biological Nutrient Removal process

This proof of concept (POC) project is funded by the National Biofilm Innovation Centre (NBIC). We are looking for a full-time researcher to conduct lab-scale biofilm studies in sequential batch reactors (SBR) for 8 months. If interested, please contact Dr Yongqiang Liu at Y.Liu@soton.ac.uk.

Jobs in water engineering:

This section gives you an idea of the type of work you can do working in industry.

Advert: A job with Southern Water that combines several of WEEG's areas of interest

Hydraulic Modeller - Wastewater

www.southernwater.co.uk/careers/job-details?autoReqId=7020BR

Civil and Environmental Engineering at Southampton University:

WEEG: Civil and Environmental Engineering modules offer the chance to deepen your knowledge in water-related areas, and prepare you for environmental engineering projects.

Contact: Dr Sonia Heaven, s.heaven@soton.ac.uk, Bldg 178, Room 5015

Further information:

We have two Facebook pages that provide a logbook of our laboratory activities:

www.facebook.com/Hydraulicslaboratory/

www.facebook.com/environmental.lab.universityof.southampton/

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