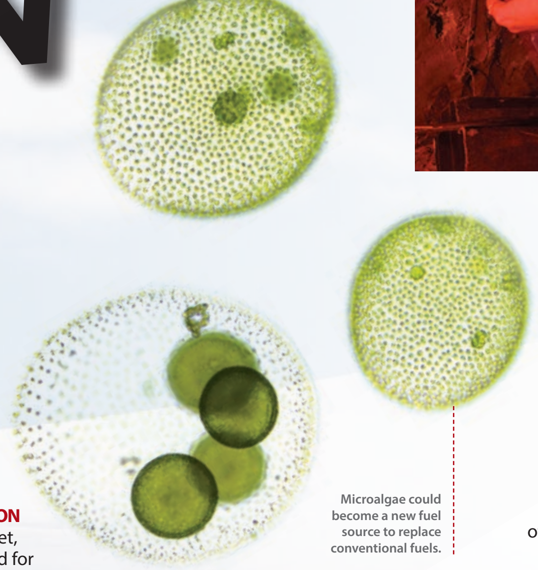
ENVIRONMENTAL REVOLUTION

Environmental scientists are finding revolutionary ways to solve environmental challenges, from protecting our environment to discovering green energy options and how humans evolved.

Macquarie University scientist Kira Westaway was part of the team that discovered a new human species.



Microalgae could become a new fuel source to replace conventional fuels.

GREEN ENERGY

AS EARTH'S POPULATION and industries skyrocket, there is a growing need for a fuel source that is renewable, large-scale and doesn't compete for farming space. And as unlikely as it sounds, microalgae could be the answer, according to Associate Professor Vladimir Strezov, a Macquarie University environmental scientist working to identify which of the thousands of species of microalgae could become a new fuel source.

This potential new fuel source offers several benefits. Microalgae is a biomass, just like plants, so when it is degraded at high temperatures it leaves behind high quality bio-oil and biogas. Another benefit is that microalgae farms are tiny in comparison to the space needed to farm other plant matter for fuel, plus they have the potential to break down pollution and create biochar when degraded. Biochar (a type of charcoal) acts as a carbon sink and improves soil quality. Biochar is so beneficial that when Strezov derived biochar from sewerage sludge, it helped a test plot of cherry tomatoes grow faster than adding contemporary fertiliser! By understanding the best fuel-producing options, environmental scientists are finding revolutionary ways to produce energy to reduce climate change.

EVOLUTION REVOLUTION

SEARCHING FOR CLUES to modern humans' migration to Australia, researchers discovered something remarkable in a cave on the island of Flores, Indonesia in 2003. They found the remains of an adult skeleton only 1 m tall, which existed at the same time as modern humans. The find completely changed our view of human evolution and was controversially named a new human species, *Homo floresiensis* – nicknamed 'the hobbit'. Macquarie University environmental scientist Dr Kira Westaway, a member of the team of international scientists who made the discovery, led the dating component of the fossil find.

At Traps, Macquarie University's Luminescence Dating Facility, one of only a few such facilities in Australia, Westaway uses lasers to measure when quartz grains were last exposed to sunlight to determine how long a fossil had been buried.

She recently used this technique to date a fossil at more than 46,000 years old – the oldest modern human found in South East Asia so far. "By understanding where and how humans once lived, and the climate and environmental changes that accompanied this occupation, it helps us understand where we have come from and what we've evolved into now," says Westaway.

ICY CLIMATE

THERE IS NOWHERE like it. "You can go down to Antarctica and stand on a surface that is millions of years old; it's an astounding feeling," says Associate Professor Damian Gore, a Macquarie University environmental scientist whose students regularly work on the frozen continent to protect it and explore its history.

Much of Gore's time spent there involves working with waste that Australians left behind decades ago. Though removing big pieces of trash is straightforward, chemicals such as hydrocarbons and heavy metals can leak into the environment and cause problems. "We are working to develop a technique called silica micro encapsulation; which we hope will lock these metals and hydrocarbons inside small, silica-coated grains to prevent them from moving and contaminating the environment, which can have long-term toxic consequences," he says.

Gore is also investigating the history of the East Antarctic ice sheet to discover how it formed and broke up in the past. When ice sheets retreat, ancient rocks are exposed to cosmic rays from space. Elements in the rock are then altered and this change can be used to calculate how long ago the ice retreated. This research is vital to helping us understand how Antarctica will respond to future climate change.

Environmental science can take you to some unique places, including Antarctica.

LIQUID LIFELINES

AS A COUNTRY dominated by dry, arid regions, Australia's rivers are its lifelines. Early settlers altered many of these rivers, removing wood and river bank vegetation for agriculture and to improve navigation. This had drastic consequences, increasing flooding and erosion in many catchments.

Macquarie University environmental scientist Dr Kirstie Fryirs works to repair our river systems, investigating how rivers have evolved and changed and looking at how they may change in the future. "It's important to consider the unique qualities of each river," she says. "Every river type operates differently, so the management technique has to be tailored to the river type," explains Fryirs. Enhancing river systems has many advantages, including increasing biodiversity and improving water quality. It can also save lives. In one river Fryirs worked on with a team, placing woody debris and replanting vegetation in the river area slowed down floodwaters, giving people time to prepare and escape from a major flood.

Maintaining a natural ecosystem is important to river health. Macquarie University research is helping to understand how river systems evolve and respond to changes, including increased erosion and flooding.

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ENVIRONMENTAL CAREERS – making a difference

Environmental scientists apply their expertise to solve key challenges and are in high demand.

CATHERINE BAIRD

Project Officer at NSW Environment Protection Authority

WHY THIS AREA OF STUDY?
When I was in high school I volunteered for community environment groups such as The Wilderness Society and my local Landcare group. It provided me with a range of different experiences and insights into the opportunities that the field of environmental science could provide. That's when I realised that doing environmental work could be more than a hobby – I could make it my career.

WHAT HAS BEEN A HIGHLIGHT?
I educate the community about waste avoidance and recycling and have the opportunity to help design and develop programs that are implemented through non-governmental organisations and local government. It's the small things that you do on a day-to-day basis that are rewarding; such as seeing the campaign materials about the program you helped create being used in the local community, reading an article online about your program, and talking with community members at local events who have benefited from your program. I also enjoy the wonderful opportunities that my work has given me to explore, travel and appreciate the diversity of our natural environments.

WHY SO PASSIONATE ABOUT YOUR WORK?
I love that I have a job where I can help others to contribute to living a more sustainable lifestyle that will protect and enhance our natural environments. When you talk with community members about the programs that you helped design, that's when you can see the change you are creating. And that's why we do it – to encourage and support people to make changes that help our environment.

Course: Masters Environment degree at Macquarie University

BEN DOMENSINO

Senior Meteorologist at Weatherzone

WHY THIS AREA OF STUDY?
My path to being a meteorologist wasn't planned, but developed as I followed my interests. I have always found science captivating, so I spent the first half of my university degree sampling different areas and subjects. In my third year I found myself moving towards atmospheric science. One of the projects I did at Macquarie University involved a six-week trip as part of a small field team extracting ice cores from Mill Island, East Antarctica!

WHAT HAS BEEN A HIGHLIGHT?
I have been lucky to have a number of high points in my career so far. My time in Antarctica was certainly an experience that I will never forget. While at Weatherzone, I have had the opportunity to work as an aviation forecaster, which has been the most challenging and rewarding role of my career so far. Another highlight early in my forecasting career was working on shift as Cyclone Yasi made landfall on the Queensland coast early in 2011. To this day I have not seen a weather system as large and powerful impact Australia.

WHY SO PASSIONATE ABOUT YOUR WORK?
The practicality and real-world applications of meteorology make this an exciting field. As a forecaster, you are constantly challenged to find answers to new and interesting questions. Meteorology is an exciting mix of research, problem solving, communication and creative thinking. I have had the opportunity to explain the weather to private companies, the general public and through radio and TV interviews. There is also a significant personal benefit to having an inside knowledge of the weather!

Course: Bachelor of Science with a major in Atmospheric Science (now called Climate Science) at Macquarie University

ALISHA CASTELLINO

Environmental Science student at Macquarie University

WHY THIS AREA OF STUDY?
I enjoy spending time outdoors and have a great respect for the environment so I was eager to learn more about the current environmental management issues and processes. I was also enticed by the practical aspects and good reputation of the Bachelor of Environment degree at Macquarie University.

WHAT HAS BEEN A HIGHLIGHT?
The combination of theory complemented with good quality fieldwork has been a highlight of studying the Bachelor of Environment. The vacation unit in New Zealand, for example was definitely a highlight as it allowed us to explore and learn about a completely different landscape and apply some of the theoretical skills we had learnt during the semester.

HOPES FOR THE FUTURE?
When I complete my degree, I plan to travel and develop my understanding of the world and different landscapes. I also hope to secure a job that offers a combination of desk and practical work, such as an environmental field officer or within sustainability recreation and education.

Course: Bachelor of Environment at Macquarie University

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