

# A GLOBAL APPROACH TO A GREENER FUTURE

Korea University researchers are **FOSTERING WORLDWIDE PARTNERSHIPS** to create effective sustainable development solutions.

**With a vision to develop leaders who can create a better world,** Korea University (KU) has an institute that is supporting a global approach to tackle some of the world's greatest challenges: the OJER Resilience Institute (OJERI) with a focus on sustainability.

To guide their research, Korea University researchers are focusing on the United Nations' Sustainable Development Goals (SDGs), a series of 17 targets and 169 associated indicators set by the United Nations in 2015 to address global problems such as climate change, environmental degradation, and access to clean water and sanitation. Achieving these goals by 2030 will require a diverse range of solutions, from developing sustainable farming practices, to finding ways to recycle and reuse plastics.

## OUR INSTITUTE IS ACTIVELY RESEARCHING RESILIENT SOLUTIONS TO THE PROBLEMS.

The Seoul-based university, a leading institution in the Asia-Pacific region, is well placed to contribute to the SDGs. In the 2021 Quacquarelli Symonds (QS) Asia University Rankings, it climbed to first place among

South Korean universities and took the top spot in the international research category for the third year in a row.

### DIVERSE SOLUTIONS FOR A MORE RESILIENT WORLD

"Our current problems are complex—notably, climate change is not a single problem," says Professor Woo Kyun Lee, director of OJERI. The institute aims to build ecological, environmental, and social resilience against climate change and human impacts, paving the way to a more sustainable society, says Lee. "Our institute is actively researching resilient solutions to the problems. We can find answers by adopting a multidisciplinary approach."

OJERI fosters connections between disciplines across its five research programmes that focus on climate, ecosystems, water, and waste. For example, biologists team up with social scientists to improve environmental policies, while engineers and aquatic ecologists work together to better manage water resources.

OJERI also promotes cross-border cooperation through the Mid-Latitude Region Network (MLRN), which Lee established in 2016 to address the rising food, water, and energy challenges in the area.

The Mid-Latitude Region is a temperate, northern hemisphere belt that includes 36 countries, including those in the Korean Peninsula, Central Asia, southern Europe, and North America. The area is characterized by dry land and desert, with rapid population growth, urbanization, and climate change leading to a depletion in food and water resources.

"Almost half of the global population lives in this region," says Lee. "The region, particularly in central Asian countries, is facing challenges in food, water, and energy security, but has received very little attention."

The MLRN involves 64 experts from across the globe who are working on strategies to solve these problems in line with the SDGs, such as creating sustainable livelihoods, climate change mitigation, and building food, water, and energy security.

This involves developing indicators and models to evaluate the central Asian region's vulnerability to challenges that threaten its food, water, and energy, such as droughts, floods, and air pollution.

These data, available on an open web-based platform, are continually updated

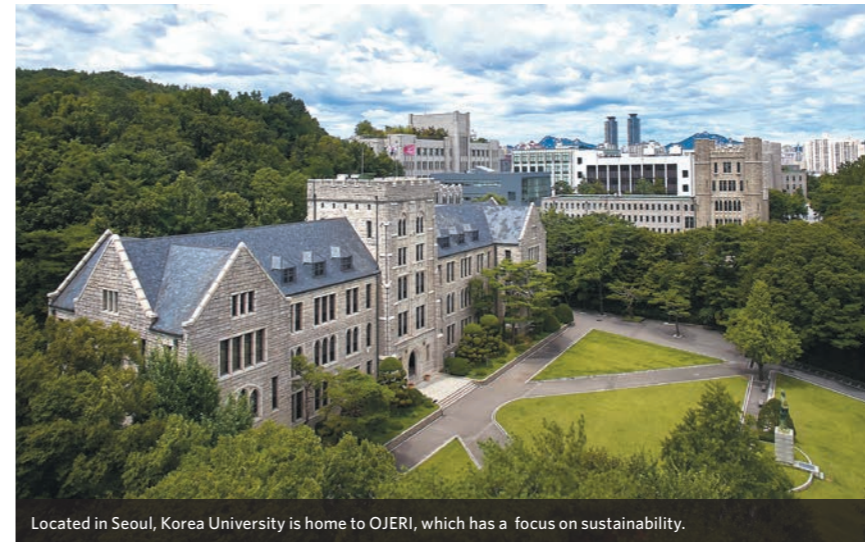
based on feedback from users. The MLRN also holds regular webinars where users discuss improvements to the methodologies and algorithms.

MLRN research results are shared with the United Nations Sustainable Development Solutions Network (UN-SDSN), a global initiative that brings together researchers and experts to implement the SDGs. SDSN-Korea's headquarters are at OJERI.

### BUILDING GLOBAL LINKS

OJERI takes an ambitious approach to collaboration. Since it was established in 2014, it has formed research partnerships with more than 30 global universities and research institutes, including the International Institute for Applied Systems Analysis (IIASA) in Austria, the University of California in the United States, and the National University of Singapore.

OJERI is also home to the Asia Resilience Center (ARC), an initiative that aims to address sustainability challenges in the region. As a research hub that includes institutions across Asia and Europe, ARC facilitates collaborations between developed and developing countries to tackle challenges in ecosystems, energy, health and wellbeing.



Located in Seoul, Korea University is home to OJERI, which has a focus on sustainability.



Professor Woo Kyun Lee, director of OJERI.



Achieving SDGs requires a diverse range of solutions, from developing sustainable farming practices, to finding ways to recycle and reuse plastics.

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In November 2020, OJERI hosted the ARC Conference series, which brought international researchers together to explore ways to build resilience in Asia. Attendees discussed potential solutions such as using adsorbents to reduce harmful algal blooms in water, turning plastic waste into energy and materials that can capture carbon dioxide, and using reforestation to mitigate climate change in the Mid-Latitude Region.

### TACKLING THE PLASTIC PROBLEM

The COVID-19 pandemic has led to a surge in plastic waste, making the implementation of sustainable management solutions more urgent.

In December 2020, OJERI hosted a Nature Forum on plastics and sustainability, the first of its kind to be held in South Korea. Along with the chief editor of *Nature Nanotechnology* and associate editor of *Nature Reviews Earth*

*& Environment*, more than a thousand international researchers participated and discussed the current challenges in plastic waste management, the impacts of microplastics, and potential solutions that are aligned with the SDGs.

"The forum presented an opportunity to shine a light on neglected challenges, such as the accumulation of plastic waste in soil," explains Professor Yong Sik Ok, Korea University's global research director and a

director of the Association of Pacific Rim Universities (APRU) Sustainable Waste Management (SWM) programme.

"The public is aware of the plastic problem in the ocean, but plastic pollution in the soil is an even greater concern, as it affects food security and human health," says Ok, one of the forum organisers. "We need to change the paradigm."

With his international colleagues in the APRU SWM group, Ok is currently developing

a new technology that can collect plastics from soils and convert them into smart carbon-based materials for a variety of industrial applications, such as air purification filters.

“It’s easy to collect plastic floating in the ocean, but plastic in soils is buried. As a result, no-one has looked at how to address this,” says Ok.

### TURNING WASTE INTO VALUABLE PRODUCTS

In 2019, Ok was the first South Korean to be selected as a highly cited researcher (HCR) in the field of environment and ecology by the Web of Science’s HCR index, with more than 80 highly cited papers (HCPs) and hot papers. Ok’s HCPs in 2019 alone represented 40% of all HCPs published by Korea University in that year, demonstrating his huge academic influence.

Ok is working at the vanguard of global efforts to develop sustainable waste management strategies and technologies to address the rising crisis in electronic and plastic waste, and pollution of soil and air with particulate matter.

In 2020, Ok and his colleagues used biochar — a carbon-rich product

produced by heating biomass in the absence of oxygen — made from various materials, such as food, wood and animal waste, to create highly efficient CO<sub>2</sub> adsorbents that can be produced on a large scale. They are also investigating nature-based solutions to clean up soils contaminated with heavy metals and metalloids, a major threat to ecosystems and human health. The proposed technologies could offer a greener and cheaper alternative to chemical and physical soil treatments.

### MOBILIZING IDEAS

APRU SWM is also facilitating the exchange of ideas through hosting numerous virtual conferences, workshops, and events. In 2021, Ok hosted the APRU SWM Virtual Winter School for international professors and students. A series of three sessions included discussions on wastewater treatment and recycling, the effects of plastics on land and aquatic ecosystems, and use of biochar to address challenges in sustainable development. The virtual event also included demonstrations on how to conduct analyses on plastics in the environment. “We do lots of

training and demonstrate how experiments are done in our laboratory,” says Ok.

In December 2019, Ok initiated a conference series on engineering sustainable development in collaboration with the American Institute of Chemical Engineers (AIChE). A year later, scientists, engineers, and policymakers gathered again to discuss the challenges of meeting the UN’S 2030 Agenda for Sustainable Development and the 17 SDGs and environmental, social and governance (ESGs), with a strong focus on microplastics in the environment.

As well as sharing the latest advances in microplastics research, attendees discussed international policies on plastics in both aquatic and land-based ecosystems and proposed ideas to improve them. Ok’s team explored the use of AI and machine learning applications in environmental systems.

To further this knowledge exchange, APRU SWM is also co-organising the first Nature Conference on Waste Management and Valorisation for a Sustainable Future, which will be held at Korea University in October 2021. Ok will chair the conference with the chief

editors of *Nature Electronics*, *Nature Nanotechnology*, and *Nature Sustainability*, experts from academic research, industry, government, and green groups will gather to formulate effective sustainable waste management strategies and assess new treatment technologies for recycling and recovering organic waste.

One of APRU SWM’s major achievements since its launch two years ago is raising public awareness of plastic pollution and the SDGs, says Ok.

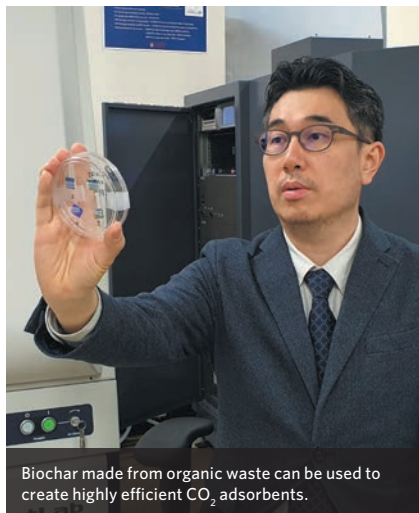
“Plastic pollution is not yet adequately regulated by law. There are many types of plastic pollution that people are not aware of yet,” says Ok. “We aim to develop this kind of standard and make solid government regulations for future generations by implementing the E in ESG scoring.” ■



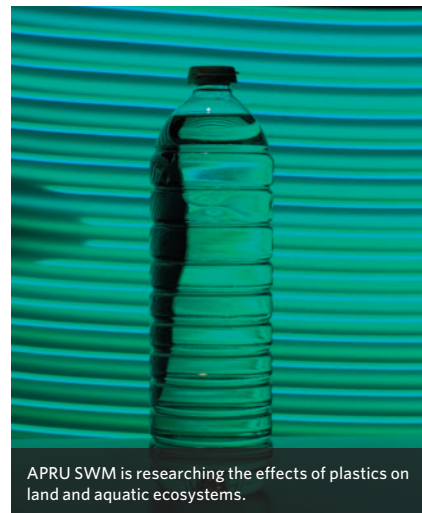
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Professor Yong Sik Ok is the first South Korean highly cited researcher (HCR) in environment and ecology.



Biochar made from organic waste can be used to create highly efficient CO<sub>2</sub> adsorbents.



APRU SWM is researching the effects of plastics on land and aquatic ecosystems.

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