



2016–17

Outlook

Wake up call
Paris Agreement
can jump start the
global economy, says
Christiana Figueres

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The Ecotarian's
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Grantham Institute
Climate Change and Environment
An Institute of Imperial College London

Foreword

The Grantham Institute plays a key role in Imperial College London's strategy. It catalyses our efforts to inform policy through our research, provides a focal point internally and externally for climate change and environmental research, and provides a multidisciplinary education for the leaders of tomorrow. I am grateful to the Grantham Foundation for their support for the Institute.

Shifts in the political landscape since our last Outlook have given the Institute's mission renewed importance. COP21 brought climate change to the forefront of the global political agenda. The Institute was visible before, during and after the negotiations in Paris through the engagement of our most prominent academics, and a physical presence via our official conference exhibit.

There are signs that governmental action is gaining momentum. In April 2016, Christiana Figueres, formerly Executive Secretary of the UN Framework Convention on Climate Change, delivered the 2016 Grantham Lecture at Imperial and said the Paris Agreement to tackle global warming could come into effect by 2018, two years earlier than originally planned.

Yet, the Institute's work on reducing greenhouse gas emissions produced by agriculture and other forms of land use shows that urgent action is needed more than ever.

The Institute's star researchers continue to excel and share their work with policymakers and the public. For example, Dr Erik van Sebille won a prestigious place at the Royal Society Summer Science Exhibition with his work on plastics in the ocean.

The Institute's new education programme in Climate Change, Management and Finance employs a collaborative new approach to educating the economists, policymakers and business leaders of tomorrow.

The College has welcomed Professor Nick Jennings CB as Vice-Provost (Research). He is utilising his experiences as a UK Government Scientific Adviser to help our Global Institutes increase their impact even further.

As a world leader in science and technology, Imperial is addressing global challenges through multidisciplinary collaborations. In this Outlook you will read about how students and staff in the Grantham Institute collaborate to inform decision makers and influence corporate and government policies. I am excited by the Institute's plans and I hope you enjoy Outlook 2016–17. ■



*Professor Alice P. Gast
is President of Imperial
College London*

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INTRODUCTION FROM THE CO-DIRECTORS

**PROFESSOR JOANNA HAIGH CBE
FRS AND PROFESSOR MARTIN
SIEGERT FRSE**

*Co-Directors of the Grantham
Institute – Climate Change and
the Environment*

The Grantham Institute has grown again in this past year, with our education programmes, public engagement, social media engagement, and expert briefings all flourishing. With so much choice, it was a challenge to figure out what to include and what to leave out from this year's Outlook.

Since the previous issue we have seen our priorities for effective UK and international action on climate change and the environment manifested in important international agreements. The Paris Agreement on combatting climate change and the UN's Sustainable Development Goals sent a clear message that climate change and our environment are among the top priorities for people around the world.

For Outlook 2016–17, we have chosen to emphasise our work with policymakers, businesses and society, alongside our usual highlights, statistics and 'ones to watch' – where we showcase new projects in climate change and the environment that are getting underway at Imperial College London.

"We have seen our priorities for effective UK and international action on climate change and the environment manifested in important international agreements."

Among other examples, you can read how our work to understand the



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challenge of, and seek potential solutions to, plastics polluting the ocean (pages 4 and 8) has brought us together with grassroots organisations keen to make a difference. We have engaged with businesses who see the potential of innovative design and better waste management to reduce the plastic entering the ocean, and influential policymakers who rely on scientific evidence to inform their decisions. We are delighted that our students, too, are actively involved in this mission – often leading us with their energy, ideas and enthusiasm.

As governments now look to put the words of the international treaties into action, we are playing our part alongside an incredible upswell of activity from individual people, organisations and businesses. We have shaped our priorities accordingly: to inform government (pages 6–9), business and industry (pages 10–13), and civil

society (pages 14–17); to create and appraise expert knowledge; to train the next generation of leaders; and to support innovation (pages 18–21).

While we are working with our partners to uphold the UK's leadership on climate action and environmental protection, we want to connect more widely with people who share our aims, in order to multiply the outcomes. With a new venture, we aim to demonstrate the multitude of economic opportunities that exist in green innovation, by establishing a hub for climate change innovation, and making the most of opportunities at Imperial's new White City Campus (see page 18 for more).

In 2016–17, we look forward to continuing to build close relationships with our many stakeholders, sharing our knowledge, and helping shape the future. We would be more than happy to meet with you to discuss how we can work together. ■



HIGHLIGHTS

Here are some of the ways that The Grantham Institute has engaged a broad external audience with the work of Imperial College London.



Joining the debate at the COP21: UN Climate change conference

In December 2015, 195 countries signed the historic Paris Agreement, committing to keep average global warming below 2°C, or preferably below 1.5°C. Imperial staff and students met delegates at **COP21** at an official conference exhibit (pictured) and observed the ongoing negotiations. The Institute led an event in Paris discussing the role of technology in limiting climate change, and a second on the scale of the challenge and what actions will be needed after 2030. “There was a strong sense of will in the room to make change happen,” said Alyssa Gilbert, Grantham Institute Head of Policy and Translation.



2 Researchers crowdsource solutions to plastic pollution

Our oceans are awash with plastic. Pristine Arctic waters are the final destination for a large proportion of the plastic waste that enters the ocean from the UK, where it can harm all kinds of wildlife. Imperial researchers picked the brains of visitors to the **Royal Society Summer Science Exhibition** in July 2016 to crowdsource ideas to reduce the amount of plastic litter in the ocean, and inform future Imperial research and policy advice. Top answers included solutions for better materials, engineering projects to clean up plastic, and community action to change people’s behaviour.

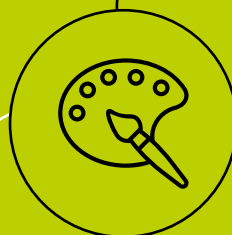
3 Wake up to a green fortune, UN chief climate diplomat tells an audience at Imperial



Christiana Figueres (pictured front cover) called for investors to take risks that benefit the environment and reduce global poverty at the **Grantham Institute Annual Lecture**. In April 2016, she told a packed-out audience that investing in clean technologies and renewable energy will jump start the global economy and pull millions out of poverty. “It is time for massive investment in low-carbon infrastructure that can get the global economy going again,” said Ms Figueres, who, as Executive Secretary of the UN Framework Convention on Climate Change led negotiations for COP21. Ms Figueres also held a roundtable with Grantham PhD students on their views for the future of the planet.

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5 Students explore climate’s artistic side



Climate change conjures up different sights, sounds and feelings for everyone. Students from the Science and Solutions for a Changing Planet Doctoral Training Partnership have been analysing the sentiment of climate change-inspired artwork created at several public events this year, including Science Museum Lates in March 2016. **Drawing climate change** team member Dan Hdidouan was also awarded the Imperial Festival medal for the ‘messiest public engagement activity’, after mixing paint, glitter, crayons and enthusiastic children at the Festival’s Energy and Environment Zone.

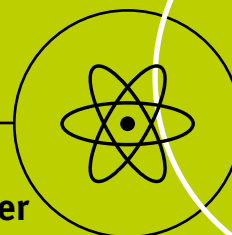
4 Conference puts sustainable business in the spotlight



Business leaders need positive mind-sets and robust strategies to overcome the challenge of climate change, according to experts speaking at the **Mobilising Business, Acting on Climate** conference in April 2016. “Strong leadership is key to this business plan,” said keynote speaker David Blood, Co-Founder (with former US Vice President Al Gore) of Generation Investment Management, a firm dedicated to long-term investing and integrated sustainability research. A hundred leaders from business, industry and academia attended the conference organised jointly by the Grantham Institute and Imperial College Business School.

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6 Experts weigh up future of nuclear power



Nuclear power could play a key role in generating the low-carbon energy required by a growing global population. The opportunities and risks it presents remain high up on the agenda for members of London’s diplomatic science scene, who attended a panel discussion about the future role for nuclear power in November 2015, ahead of COP21. The event was a collaboration between the Grantham Institute, Imperial’s Energy Futures Lab and the Embassy of the Republic of Korea.



SHAPING

POLICY



Imperial College London experts play a key role in developing and implementing strong, evidence-based policy for the UK and internationally. The Grantham Institute engages a broad network of policymakers, listening to their questions and shaping the direction of Imperial research as a result. Timely events and meetings, and expert briefings share the latest thinking on climate change and the environment with politicians and policy makers at all levels.

Now, it is time to implement the Paris Agreement on climate change, secured in December 2015. “Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue

efforts to limit the temperature increase to 1.5°C” will require the right policies, and evidence on how they are working. The UN Sustainability Development Goals and the UK’s Official Development Assistance commitment call for activities that benefit wellbeing and equality alongside the environment.

Imperial researchers have been determining the role and success of policies covering innovation, funding for research and development, emissions trading, and effecting behavioural change. They also bring policymakers together to discuss the latest state of our environment, what type of solutions might be available soon, and at what cost. ■

PROFESSOR JIM SKEA CBE

PROFILE



*Chair in Sustainable Energy
and co-chair of IPCC Working
Group III*

Jim Skea is Professor in Imperial’s Centre for Environmental Policy, with an active and wide-ranging role in climate change policy.

In the UK, he is a member of the Committee on Climate Change, the body that recommends carbon budgets far into the future to the UK government. Professor Skea notes that the new administration has taken its latest recommendations on board. The country’s target for 2020 – a 34 per cent cut in emissions compared to 1990 – will be met comfortably, he says admittedly in part because of the slow growth of the UK economy. The target for 2030 will be for a 57 per cent reduction.

On the global stage, Professor Skea is co-chair of the Intergovernmental Panel on Climate Change (IPCC) working group on climate change mitigation and the reduction of emissions. The working group operates in an innovative way, with a Technical Support Unit split between the UK (based at Imperial) and India. Professor Skea says: “We are looking at established ways of reducing carbon emissions, such as renewables, efficiency and nuclear power. But we also realise increasingly that agriculture and other forms of land use are big sources of carbon and other greenhouse gases. We plan to report by 2019 on ways of reducing these emissions as well as limiting the impacts of climate change on land use.” ■

MICROBEADS BAN ‘JUST THE TIP OF THE ICEBERG’

A committee of MPs have recommended a UK-wide ban on the use of plastic microbeads in cosmetic products, on the evidence they cause damage to marine environments.

Cosmetic companies regularly use plastic microbeads in everyday products like exfoliating scrubs, toothpaste and shaving gel for their abrasive properties. Washed down the drain, these tiny pieces of plastic often end up in the ocean, where they can harm marine life.

Dr Erik van Sebille (pictured), Grantham Lecturer in Oceanography and Climate Change, was an expert witness for the UK Parliament’s Environmental Audit Committee in May. He explained that while microbeads make a very small contribution to the amount of plastic pollution in the ocean, a ban would be an important first step in addressing this global problem, and sends a powerful signal to companies and the public that it is being taken seriously.

The Committee’s report, which was accepted by the Government, recommended legislating for companies to bring forward a voluntary ban on microbeads by 2020 to a compulsory ban by the end of 2017, and introduce a clear labelling scheme for products so consumers can make informed choices.

“A ban would be a great first step, but at the same time microbeads are just the tip of the iceberg,” said Dr van Sebille.

How plastic pollution affects wildlife and the health of the ocean depend on where exactly it ends up, and Dr van Sebille’s research at the Grantham Institute focuses on how ocean currents move plastics around. Recent results from his research show that the majority of the UK’s plastic waste that ends up in the ocean finishes up in the Arctic. ■



READ MORE
GRANTHAM INSTITUTE BRIEFING:
THE OCEAN PLASTICS POLLUTION
CHALLENGE : TOWARDS
SOLUTIONS IN THE UK

CARBON TRADING COULD HAVE BENEFITS BEYOND BORDERS

Carbon trading schemes impose a strict upper limit on greenhouse gas emissions and allow countries or companies to buy and sell emissions permits, creating a financial incentive for members to reduce their emissions. Some schemes exist in isolation, but linking them could amplify their benefits.

“If it’s cheaper for some countries to reduce their emissions and they do so beyond what their own targets require, international carbon trading would allow them to sell any remain-

ing permits to other countries,” says **Mr Ajay Gambhir**, Senior Research Fellow at the Grantham Institute.

As part of a World Bank review of carbon pricing policies around the world, Gambhir is using the TIAM-Grantham global energy systems model to determine the potential benefits of an international scheme.

“Our analysis suggests that limiting global temperature rise to 2°C by 2050 would cost roughly 50 per cent less with international carbon trading,” he says. ■

POLICY SHAPES A SUSTAINABLE FUTURE FOR CITIES

PhD student, **Mr Stéphane Mangeon** joined the ranks of the World Meteorological Organization in Geneva for a three month secondment as part of the Science and Solutions for a Changing Planet Doctoral Training Partnership.

Working at the intersection of science and global policy, he collaborated with colleagues across the organisation to compile thinking on a range of urban sustainability issues including flooding, air pollution, emissions reduction and early storm warnings. His final report will be presented at the United Nations’ conference on housing and sustainable urban development, Habitat-III, in Quito, Ecuador.

For Mangeon, this secondment was an eye-opener on how scientific research can inform policy: “This placement gave me the chance to put my own research into context, helping

me understand which outcomes of our research might be useful to others beyond the scientific sphere.” ■



READ MORE
GRANTHAM INSTITUTE BLOG:
A BEGINNERS GUIDE TO SHAPING
GLOBAL POLICY



Ones to watch

1

Measuring the atmosphere could help assess whether the Paris Agreement targets are being met. Physicist and Grantham Lecturer **Dr Heather Graven** is leading a new €1.5 million European Research Council project to develop an analysis that distinguishes between greenhouse gases from fossil fuels and those from natural sources. The new measurements could help to validate the accounting of emissions to the United Nations and help to determine how natural ecosystems respond to climate change.

2

The International Energy Agency (IEA) is taking steps to become truly global and involving the interests of all nations. Grantham Institute Senior Policy Fellow, **Mr Neil Hirst**, is working with the Chinese government and its national Energy Research Institute (ERI) to aid China’s full and equal participation in the work of the IEA. Together with new commitments by the G20 leaders, they are aiming to deliver universal affordable energy, economic growth and development, as well as meeting climate targets. The Grantham Institute has signed a new agreement with the ERI, to collaborate on energy research, policy and education.

3

Grantham Lecturer **Dr Kris Murray** is leading a new project to safeguard both animal biodiversity and human health by targeting emerging infectious diseases, such as H5N1 flu, dengue fever and malaria. With funding from the Australian Commonwealth Scientific and Industrial Research Organisation, PhD student **Mr Hiral Shah** will seek to identify policies that can benefit health and biodiversity in areas of south Asia where urban and rural environments meet.



PARTNERING WITH

BUSINESS



At Imperial College London we are keen that our knowledge and expertise can stimulate change, and businesses are essential partners in that mission. Increasingly, businesses are leading the way on environmental issues – driving down greenhouse gas emissions through their supply chains, committing to reducing waste and pollution, and supporting green consumer choices. The Grantham Institute works with the Imperial Business Partners programme and business people to share our knowledge and new ideas, and some time for learning and reflection.

The latest technologies under development at Imperial can contribute to tackling some of the world’s major environmental challenges whilst

improving competitiveness. Our ongoing work on carbon capture and storage, next-generation solar panels, and sustainable food and water continue to inspire interesting opportunities. Imperial’s researchers also investigate new business models on the circular economy, the best locations for new developments to avoid flood risk, and how policies can drive changes in behaviour. In the coming year we will delve into opportunities to reduce industrial emissions, and drive a commitment to longer-term solutions in this sector. We are also working to find new design processes and materials to help tackle the sources of plastic pollution. ■

DR COLIN COTTER

PROFILE



*Reader in numerical analysis
and scientific computing*

Grantham Affiliate Dr Colin Cotter, in the Department of Mathematics, is leading an important external collaborations for the Grantham Institute. His work is providing the modelling system that produces the UK meteorological organisation’s weather and climate forecasts with a new central engine that will make its predictions better and faster.

Dr Cotter says: “The Met Office is one of the few organisations in the world that produces long-term climate forecasts and immediate weather forecasting using the same model. They are both created on a supercomputer whose heart is a component called the Dynamical Core.”

He is leading efforts to replace the present Core, which uses conventional latitude and longitude, with a new one in which the Earth is represented as an inflated cube. This will reduce the amount of data the computer needs to relay in order to model the compressed regions of latitude and longitude near the poles. Dr Cotter says that, because data exchange is a major demand on the whole modelling process, this new Dynamical Core should allow forecasts to become more detailed and quicker to produce.

Several UK universities and research councils are carrying out the project, with funding from the Natural Environment Research Council. The new Dynamical Core should be operational in 2021 or 2022. ■

INVEST IN ELECTRICITY STORAGE TECHNOLOGY TODAY TO USE LATER

National and international infrastructure is needed to store intermittent electrical energy from solar and wind power, according to a new briefing paper by Grantham Institute Research Associate **Dr Sheridan Few** (pictured at a solar farm on the Isle of Eigg, Scotland). Installed alongside other means of matching electrical supply to demand, various technologies such as batteries, flywheels and compressed air are capable of storing electrical energy for use when supply fails to meet demand.

These are likely to play an increased role in a future energy system, although how much is uncertain. “It is hard to plan how electrical energy storage can contribute to a reliable, clean future energy system,” says Dr Few. “Firstly, technologies have not been trialled on a sufficiently large scale. Secondly,

the costs and technical characteristics are not yet well defined for many of these technologies. And finally, the present level of uncertainty around the future energy system means it is challenging to make decisions right now.”

The briefing paper explores the role for electrical energy storage, weighs up any potential environmental impacts and discusses the policies that could support both their development and deployment. ■



WATCH
ACADEMIC AND INDUSTRY EXPERTS DISCUSS ‘WHERE IS ENERGY STORAGE GOING?’ WITH AN AUDIENCE OF POLICYMAKERS AND BUSINESS LEADERS, AT AN ENERGY FUTURES LAB AND GRANTHAM INSTITUTE EVENT.



COULD CHEAPER ELECTRICITY TARIFFS CHANGE YOUR ENERGY USE?

Imperial researchers have tested systems designed to tempt domestic customers into using energy at times where there is otherwise a low level of demand. Working with UK Power Networks and EDF Energy, **Professor Goran Strbac**’s team looked at over 1,100 London households to see if residents moderated the amount of electricity they used when high, medium and low cost electricity tariffs were announced at a day’s notice. **Dr Ritsuko Ozaki** analysed

householders’ experiences of the unpredictable tariffs. Her findings suggest that while people would not want their lifestyles ruled by energy prices, many try to match their activities to tariffs and gain valuable insight about how they use energy. “I thought I couldn’t change, but now I know I can’ was something a number of our interview respondents said,” Dr Ozaki says. ■

RESEARCHERS CAUTIOUS ABOUT PROSPECT FOR BREAKTHROUGH ENERGY SOURCES

Between \$20 and 100 billion of research funding could generate advanced renewable energy technologies that could surpass fossil fuel-fired power in cost and efficiency, and create green jobs and commercial opportunities.

This is the vision set out by the Mission Innovation partnership of 20 countries responsible for 75 per cent of carbon dioxide emissions, and who fund 80 per cent of research into clean energy, and the Breakthrough Energy Coalition of 28 wealthy individuals coordinated

by Microsoft co-founder and philanthropist Bill Gates.

Research for the UK Energy Research Centre by **Dr Robert Gross**, Deputy Director of Imperial's Energy Futures Lab, implies that these expectations may need to be treated with caution. "Our research suggests it's not possible to get entirely new technologies to market as quickly as some seem to think. New research funding is great but we do need to improve and deploy existing technologies as well," cautions Dr Gross. ■

HOME INSULATION MADE FROM WASTE FEATHERS

A team of Imperial students have invented a low-carbon home insulation made using waste feathers from the poultry industry. **Ms Elena Dieckmann** and **Mr Ryan Robinson** were awarded £20,000 of funding at the 2016 Mayor's Low Carbon Entrepreneur Competition and support from City Hall to help their product AEROPOWDER succeed in the global marketplace. They pitched their business idea to judges in front of a live audience of fellow students, academics and leading experts from the energy and climate change sector. Robinson explains: "The idea actually came from watching real chickens and how well insulated they are by their feathers in the cold."

Former Mayor of London, Boris Johnson MP said at the competition:

"London is leading the way in green technology and this competition can help kick start students' sustainable ideas into business ventures. It's vital that we support young enterprising people in setting up innovative businesses to make positive change and boost the Capital's thriving green economy." ■



Ones to watch

4

Grantham Institute PhD student **Phil Sandwell** and **Professor Jenny Nelson**, Head of the Grantham Institute's mitigation team, are working with energy start-up Oorja to bring electricity to people living in rural parts of Uttar Pradesh, India. Introducing electric lighting to replacing kerosene oil lamps improves air quality for the residents, as well as reducing greenhouse gas emissions. Thanks to funding from Research Councils UK Energy Programme, they have commissioned an experimental mini-grid powered by solar panels. It will be used to develop better models of energy generation and demand, which will help the company meet local electricity needs.

5

The rise of new low-carbon technologies has created an uncertain outlook for oil and coal industries. These technologies have the potential to reduce the global market for fossil fuels and affect future investment in the industry. Grantham Institute Research Associate **Dr Tamaryn Napp** is looking at how the rapidly falling costs of electric vehicles and solar panels drives their sales, and the consequences for fossil fuel demand.

6

The Grantham Institute invites organisations to partner with the best PhD students to seek solutions to achieving the UN Sustainable Development Goals. Start-ups, corporates, NGOs and policymakers should learn more about the **Innovating for Sustainable Development** programme through the Grantham Institute website. The programme runs from November 2016 to March 2017 and is funded by the Natural Environment Research Council.



ENGAGING

SOCIETY



People sit at the heart of Imperial College London. Public opinion, the media and civil organisations support and inspire research, they guide political decisions and business offerings. The role of the Grantham Institute is to inform, engage and strengthen public debate around climate change and environmental issues. Talking to a wide range of stakeholders provides grounding and reveals surprising stories about what the environment truly means to people.

Public lectures and panel debates provide access to thought-leaders on topical issues like divestment from fossil fuels, adapting to flooding and drought, and the future

of transport. Through engagement at public science events people can talk face-to-face with researchers and get hands-on with advanced technologies. Looking further afield, academia and society work together, such as improving the outcomes of research with input from conservation practitioners, or assessing the health of commuters across Europe based on the mode of transport they choose.

Across Imperial, researchers are working with citizens, NGOs and authorities to formulate approaches to adapt to changing environmental conditions, in order to improve the lives of people living in the path of climate change. ■

THE ECOTARIANS

PROFILE



*Arnaud Koehl, Clea Kolster, Ronan McAdam and Naomi Pratt
Science and Solutions for
a Changing Planet Doctoral
Training Partnership*

A team of PhD students are spreading the word about green lifestyles beyond Imperial through a new initiative called The Ecotarian.

Group member Ms Naomi Pratt says an ecotarian is ‘someone who buys and eats food in line with eco-friendly principles’. This means limiting the environmental impact of their diet, perhaps by reducing meat consumption, through buying more local food or just by being more aware of how their food has been produced.

Ms Clea Kolster says that the group chose food as the focus for their team project in the Doctoral Training

Partnership programme because of their shared love of good food, and because of the impact of food production and distribution on critical environmental issues including land use and climate change.

One of The Ecotarian’s best-received initiatives is a map of London’s green food projects and restaurants. It has been published on The Ecotarian website and users can add their own favourites.

The Ecotarian has already been on show at the Imperial Fringe and at other public events. In October 2016 a panel will debate making food production more sustainable. Pratt says that the discussion will cover approaches ranging from the traditional, such as organic farming, to the high-tech, including the emerging field of precision agriculture. ■



READ MORE
THE ECOTARIAN BLOG,
RECIPES AND FOODIE MAP

Pictured:
The Ecotarians: Naomi Pratt,
Ronan McAdam and Arnaud Koehl

FLOOD-HIT AREAS SEE THE BENEFITS OF CITIZEN SCIENCE

Communities in mountainous areas of Nepal face a changing climate, but in many cases residents lack the knowledge to adapt to change and manage vital natural resources. Grantham Institute Research Associate, **Dr Bhopal Pandeya**, is empowering people in the Himalayas to monitor their own water supply.

“In remote regions data is very scarce, that’s why we need to generate locally relevant information that can support decision making,” he says. “We are testing instruments that can be used by citizen scientists, for example low-cost hydrological sensors, to monitor water availability in the region.”

The data collected by local people (pictured at the Karnali river basin, West Nepal) can serve multiple purposes. At one end of the

spectrum, it feeds into national-level decision making through a partnership with the Nepalese government’s Department of Hydrology and Meteorology. “We try to integrate our citizen science data into the existing flood forecasting and early warning systems,” explains Dr Pandeya.

“At the same time local people can use this data independently, for example to monitor changes in weather patterns,” he says. This enables them to better manage water resources and plan agricultural activity accordingly. ■



RESEARCHERS SEEK RESOLUTION ON CLIMATE CLASHES

Working with King’s College London and organisations across the developing world, Grantham Institute Research Associate **Dr Amiera Sawas** is investigating how a shift towards a low-carbon economy might increase the risk of conflict.

Taking over land for renewable energy or constructing a dam can displace populations and prompt resources to be re-allocated. This can create or exacerbate tensions over those resources that are essential to people’s livelihoods and wellbeing.

“The most socially, economically and politically vulnerable people and regions are also the most likely to experience conflict, according to

research,” says Dr Sawas.

“The pressures of environmental change compound their vulnerability, exacerbating grievances and incentivising conflict. However, very little is known about how responses to climate and environmental change affect vulnerability and potentially drive conflict.”

Dr Sawas aims to develop tools that enable practitioners and policymakers to better understand and anticipate these risks. “If the risks of conflict are addressed, low-carbon transitions may instead create new opportunities for peacebuilding and democratic participation,” she says. ■

Ones to watch

CAR DRIVERS ARE FOUR KILOGRAMS HEAVIER THAN CYCLISTS

Researchers are studying how transport relates to people's physical activity, and consequently their health. They have monitored 11,000 volunteers in seven European cities, asking them how they move around the city, which mode of transport they use and how much time they spend travelling.

Volunteers record their height and weight, and provide information about their attitudes towards walking and bicycling. An analysis of the data so far shows that those people who drive cars as their main form of transport are on average four kilograms (8.8 lbs) heavier than those who cycle.

The EU-funded Physical Activity through Sustainable Transport Approaches (PASTA) project includes experts from Imperial and the World Health Organization. Imperial's project lead **Dr Audrey de Nazelle** (pictured), from the Centre for Environmental Policy, says: "We don't have cause and effect yet, but we hope this first

finding will encourage more people to take part in the survey so that we can get more data over time and make a link between transport decisions and health."

The health benefits of walking and cycling outweigh the negative effects on health of air pollution, according to another study by Dr de Nazelle. She is also coordinating a new network that brings together Imperial academics who specialise in measuring, tackling or understanding the effects of poor air quality and pollution. ■



READ MORE
 GRANTHAM INSTITUTE HAS PUBLISHED A BRIEFING BY IMPERIAL STUDENTS IN THE LONDON FORUM FOR SCIENCE AND POLICY: NEW SOLUTIONS TO AIR POLLUTION CHALLENGES IN THE UK



7

World leaders have agreed to reduce their countries' greenhouse gas emissions, but what will it take for the person on the street to change their behaviour? Grantham Affiliates **Dr Mark Workman** and **Dr Felicity Mellor** aim to get a grip on this socially sensitive question, along with new PhD student Ms Geraldine Satre Buisson. A new network of communications theorists, professionals and climate change scientists will develop a best-practice guide for communicating about climate change and measure its impact on the public.

8

Imperial researchers are beginning a £1.2 million project to investigate how water is managed in South Asia. The fertile plain of the Ganges river is home to millions of people whose wellbeing directly depends on the availability of water, and the infrastructure that delivers it. **Dr Ana Mijic** and her team work to better understand how water is used and how climate change affects water resources. With collaborators in the UK and India, and support from the Natural Environment Research Council and Newton-Bhabha Fund, they aim to improve environmental conditions and wellbeing for local people by engaging farmers and regulators in managing water systems sustainably.

9

In Malawi, Africa, **Dr Jem Woods** is looking into cooking stoves that put waste plant matter, such as macadamia shells and maize cobs, to good use. Millions of the poorest people here cook on traditional wood fires, suffering the adverse effects of smoke inhalation. Alternative low-tech but modern 'gasifier' stoves could be cheaper and less damaging to health, whilst using agricultural wastes as fuel would reduce deforestation and greenhouse gas emissions. His team aims to highlight the benefits, and find ways to get more people using the stoves.

Richard Templer wants west London to become the Silicon Valley for the green economy



Professor Richard Templer is Director of Innovation at the Grantham Institute and former head of Imperial's Department of Chemistry. He has a simple ambition. He wants west London to become the Silicon Valley for the green economy, nurturing the innovations that will shape the 21st century.

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Tell us about your ambitions for London innovators.

Building on my experience with Climate-KIC, a partnership set up by industry, universities and government to push green innovation, I now want to support clean technology in the Capital with injections of cash, ideas and talent.

How is it going so far?

In the first phase, I'm working with entrepreneurship expert Andrew Burford to run an acceleration programme for new start-ups to take ideas that address climate change to the market. So far this approach has led to 60 per cent of the ideas being commercialised, finding \$80 million of investment since 2012.

What opportunities will there be for budding innovators?

With Imperial's Dr Mike Tennant, we are planning to grow the skills base for the green economy with the launch in 2018 of a new MSc for people wanting to work in clean-technology business. Drawing on expertise from across Imperial, the degree will allow students to become innovators with their

own projects, supported by experts in both business and science. We always say: "You can't learn innovation from a book."

How is this linked with Imperial's long-term commitments?

Imperial is expanding into White City, a neglected area of west London that I hope can become the clean technology innovation hub for London. My vision is that this will do for low-carbon innovation what the Stanford Science Park has done for Silicon Valley and the digital economy.

So this must be great for the Capital?

London is Europe's global city and climate change is a global issue, so it is logical for low-carbon technology to concentrate here. A quarter of the UK's low-carbon business is in this region and we have enthusiasm for this initiative from local and national government, business and the College. ■



Mirabelle Muûls on training the business leaders of tomorrow

© Fergus Burnett

Dr Mirabelle Muûls is Grantham Lecturer in the Economics of Climate Change and Assistant Professor at Imperial College Business School. Her dual appointment is the inspiration for Imperial's new MSc in Climate Change, Management and Finance. The course, for which she is programme director, welcomes its first 40 students in autumn 2016.

See page 20 or Imperial website for course information.

Who would be your perfect MSc student?

The Master's is open to graduates with 'a quantitative degree', such as maths, science, engineering, economics or finance. It is intended for people with an interest in climate change and the intention to work in business.

What does the course focus on?

The programme has an innovative new syllabus with tailor-made modules. They have been designed to address both the scientific and the business aspects of the subject. For example, the material on risk management will emphasise applications to climate change and sustainability.

"There are too few graduates with both financial and scientific skills."

How do you see the course evolving?

The overall intention is to expand student numbers to about 80 over the next five years. As climate change issues gain in significance for businesses, the attractiveness of the degree will

certainly grow too. The students are keen to aim for a career in which they will have a positive impact on society.

How is the course relevant in the business world?

Steps have been taken to ensure that the course's future graduates are attractive to employers. Firms in the energy industry and in fields such as retail, finance and consultancy were involved in its design. They all agreed that there are too few graduates with both financial and scientific skills. And the degree has an advisory board with members from leading companies, who have steered the course.

While the graduates could end up using their skills in a range of ways, our intention is to train the business leaders of tomorrow. ■

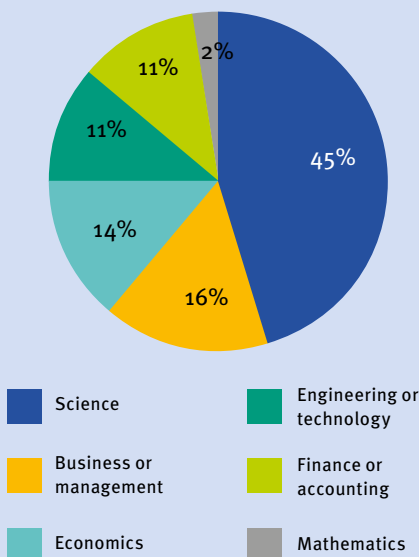
EDUCATION

MSc Climate Change, Management and Finance

Starting in October 2016 this unique course will train the business leaders of tomorrow. During this one-year programme, graduates will gain the interdisciplinary skills required in business on issues relating to climate change and sustainability. It is delivered jointly between Imperial College Business School and the Grantham Institute.

Read an interview with Dr Mira-belle Muûls, Programme Director, on page 19. ■

Academic background of MSc students 2016–17



PhD opportunities: Science and Solutions for a Changing Planet



The world class research conducted during an Imperial College London PhD is the foundation for students on the Science and Solutions for a Changing Planet Doctoral Training Partnership (SSCP DTP), a Natural Environment Research Council (NERC) funded PhD Programme.

Bespoke training and team projects gives the multidisciplinary cohort of over 90 students a broad perspective and the solid skills required to understand the wider context of their research. The programme draws on Imperial's six core research partners and a wider network from the public and private-sector to foster a close, collaborative and influential community.

Each year 15 fully-funded studentships are advertised by

the Grantham Institute and 15 other Imperial PhD students from different disciplines align with the programme. ■

CORE RESEARCH PARTNERS:

British Geological Survey

Centre for Ecology & Hydrology

Imperial College London

Met Office

Natural History Museum

Royal Botanic Gardens, Kew

Zoological Society of London

Internships for PhD students

Students on the SSCP DTP programme are encouraged to undertake a paid internship during their second or third year. These placements last between three and six months, with work focusing on a specific output, such as a technical tool or report. Previous hosts include Stanford University, the World

Meteorological Organisation and the Parliamentary Office for Science and Technology. From start-ups and charities to multinational companies, organisations interested in hosting an internship should contact Education Project Manager, Ms Sophie Smith (sophie.smith@imperial.ac.uk). ■

FLORENCE GSCHWEND

PROFILE



Department of Chemical Engineering

Ms Florence Gschwend is in the third year of her PhD, and she feels there may be a new business in it. Last year she took part in the Althea-Imperial Programme, which encourages entrepreneurship among Imperial’s female students. She was awarded a prize of £10,000 to commercialise her research where she is using ionic liquids to separate out the components of wood waste, which she is currently doing during a six-month sabbatical.

Describing her work, she says: “Ionic liquids have big molecules so they don’t evaporate or cause pollution. They can be used to fractionate wood waste into cellulose, lignin and hemicellulose. Each of these is useful, so the process makes waste into three outputs of commercial value.”

THOMAS SMALLWOOD

PROFILE



School of Public Health

Mr Thomas Smallwood is looking into the behaviour of gorillas, chimpanzees and African wild dogs, and modelling the impact of viruses on threatened wildlife populations. This work is important for designing conservation strategies. His research experience is broadened through his enrolment in the SSCP DTP, which allows him to cooperate with other scientists at a similar stage in their careers but from widely differing disciplines.

He says: “I recently worked with a palaeontologist who reconstructs past ecosystems from dinosaur bones. Together we were able to devise a research project that would make use of both our skills.”



Science and Solutions for a Changing Planet Doctoral Training Partnership students take a break from their sustainability workshop to hear an informal presentation by Grantham Institute Senior Policy Research Fellow, Ajay Gambhir.



Climate change features on the global agenda

Grantham Institute Chair, Professor Sir Brian Hoskins, hosted a televised discussion about climate change for Japan's international broadcast channel, NHK World. 'Global agenda' featured four leading voices in climate science and international affairs (pictured). It was filmed at Imperial and screened in December, ahead of the UN climate change conference in Paris. According to Sir Brian, "2015 has been described as the most important year for these international negotiations."



Making headlines

Grantham Institute and Imperial College London climate and environment experts appeared 77 times in the print, broadcast and online media in 2015–16. To discuss a media appearance, journalists should contact Simon Levey, Communications Manager: s.levey@imperial.ac.uk.

Journalists with urgent enquiries outside of office hours, call the duty media officer: 07803 886248.



Scientists share the wonder about Antarctica

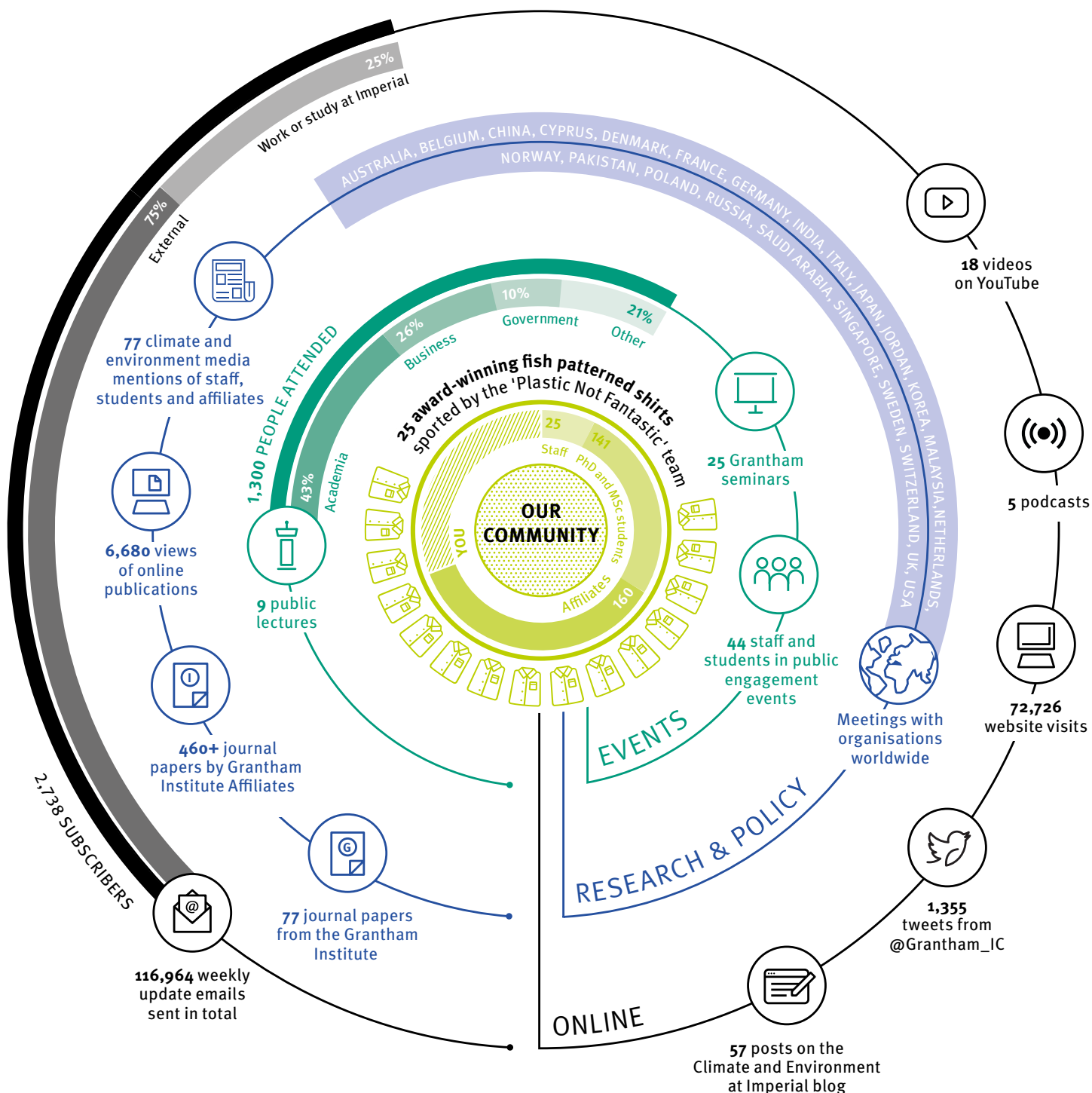
Research by glaciologist Professor Martin Siegert (pictured) was reported under the headline 'Scientists may have just found the world's largest canyon' in *The Huffington Post*, among other outlets, following a press release in January 2016. Hidden beneath the Antarctic ice, the previously unknown canyon is over 1,000 kilometres long and a kilometre deep – comparable in depth to the Grand Canyon, but many times longer. "To observe a massive canyon system is, of course, not what we were expecting," said Professor Siegert. "It simply adds to our appreciation of the world."



Environmental impact of biofuels contested

Imperial's Dr Jason Hallett, expert in bio-renewables and biofuels informed readers of *Wired UK* about the true scale of greenhouse gas emission from the production and use of biofuels. In an article in August 2016, he countered claims made by US scientists that biofuels are worse for the planet than petrol. Dr Hallett explained that: "While first generation biofuels have very little possibility of ever being carbon neutral, second generation fuels can be. The ones we have coming to market have around an 80 per cent reduction in emissions, one-fifth as carbon intensive as petroleum [...] we are actively trying to drive that number to zero."

A YEAR IN THE LIFE OF THE GRANTHAM INSTITUTE



Get involved

We are keen to hear from you

What questions do you need answered in the next five to ten years? Work with Imperial College London academics who focus on some of those important, relevant and timely questions.

Work with us

Our partnerships with the private and public sector are essential to define new research, and maximise the relevance and impact of our work.

Come to one of our events

We hold research seminars and public lectures delivered by leading figures from research, business and government. Join our mailing list to find out more.

Study with us

See pages 19–21 or visit our website to find out more about our PhD and Master's programmes.

Engage with our students

We are interested in hearing from new education partners as well as any organisation offering secondments or opportunities to our students.

Follow us online

Stay up to date with the latest activity on Twitter and Facebook, or sign up to our mailing list.

Become a Grantham Affiliate

The Grantham Affiliates scheme offers funding opportunities, studentships and other support to Imperial staff with an interest in climate change and the environment.

Support us

If you would like to offer support or discuss the role you could play in helping Imperial achieve its goals, please contact Patrick Stewart on 020 7594 2667 or Henry Shelford on 020 7594 5313.

**Visit www.imperial.ac.uk/grantham/get-involved
or email grantham@imperial.ac.uk**

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