UCL Institute for Sustainable Resources

UCL

# ANNUAL REVIEW 2014

cover image: Silk Moth by Nils Vanwezer, UCL Institute of Archaeology
Highly Commended (Best Fit to Theme) First Prize, Resources:Framed Photography Competiton 2014

# DIRECTOR'S REPORT

This UCL ISR Annual Review reports on the third year of our activities, since its founding through a generous donation from BHP Billiton Sustainable Communities (BHPBSC). It also marks the year when UCL ISR can be said to have come of age.

The main heads of the five-year founding agreement between UCL and BHPBSC provided for the appointment of the BHP Billiton Chair in Sustainable Global Resources, the recruitment of 20 PhD students in the field of sustainable resource management, and the organisation of an annual Symposium related to the UCL Grand Challenges.

As is clear from the report below, the last 14 months have seen the fulfilment of all these commitments. Raimund Bleischwitz took up the Chair in Sustainable Global Resources in August 2013, the last two of the PhD students arrived at UCL ISR in September 2014, the second Grand Challenges Symposium was held in November 2013, and the third is scheduled for November 2014.

It was expected, of course, that on this foundation UCL ISR would establish itself as a world-class Institute for Sustainable Resources in terms of both research and teaching. While it is perhaps not up to me to judge as to whether this broader objective has yet been achieved, the information in this Review bears witness to intense activity in both these areas, that spans a range of relevant subjects and that is carried out in partnership with leading organisations at national, European and international levels.

Research has been or is being carried out with the United Nations Environment Programme (UNEP), the Organisation for Economic Co-operation and Development (OECD), the European Bank for Reconstruction and Development (EBRD), HSBC Bank and the European Commission. Nationally UCL ISR leads the Energy Resources theme of the UK Energy Research Centre (UKERC) and has ambitious research programmes in bioenergy and hydrogen. At UCL ISR's instigation, UCL has signed a Memorandum of Understanding with the Joint Research Centre (JRC) of the European Commission, to facilitate cooperation especially between UCL ISR and the JRC Institute for Sustainability at Ispra in Italy. The two UCL ISR Professors are well-known internationally, and play important roles in UNEP's International Resource Panel, the European Resource Efficiency Platform, and German and UK expert bodies, as well as UKERC, of which I am Deputy Director.

On teaching UCL ISR was the architect of the Masters in the Economics and Policy of Energy and the Environment (EPEE), which started its second year in September 2014. With over 50 students in its first year, split about evenly between European and non-European students, and 60 in its second, this has been a resounding success. A Masters in Sustainable Resources is now in preparation, for launch in September 2016.

There is, of course, much more to do, in terms of understanding both the nature of sustainable resource management and what changes in policy and practice are required to bring it about. But at the same time this Institute is already making a very positive contribution to these important objectives, as this Review shows in some detail. I hope that you find it inspiring and enjoyable, and will very much welcome your feedback.

**Paul Ekins**
**Professor of Resources and Environmental Policy, and Director UCL Institute for Sustainable Resources**

# RESEARCH

UCL ISR continued to strengthen its research portfolio in 2013/14 with the addition of several new projects. These projects not only complement the Institute's existing research programme, but have widened our project diversity under the five main themes: definitions and indicators of sustainability; green economy; biotic resources; abiotic resources; and resource efficiency.

Meanwhile, during the year a number of the Institute's short-term research activities reached their conclusion, producing a range of valuable and insightful outputs.

image (c) Vidit Taneja

## COMPLETED PROJECTS

### Lancet Commission - Climate Crisis: Emergency Actions to Protect Human Health

In 2013 researchers from UCL ISR joined colleagues across UCL to begin the 2013 UCL-Tsinghua Lancet Commission on Climate Change. The commission represented an ambitious new initiative aimed at bringing together senior international climate scientists, economists, energy experts, and health professionals. It offered an opportunity to accelerate mitigation and adaptation policy to respond to the health effects of climate change.

The Commission will deliver its final report in December 2014, to be published in the Lancet in February 2015.The report will conduct a review of the climate science and its subsequent impacts on human health since 2009.

During Climate Week 2014 (3-9 March), the Lancet Commission project team also joined UCL staff and students in blogging daily through the week.

### UCL Green Economy Policy Commission

The UCL Green Economy Policy Commission concluded in 2014 with the publication of the project's final report 'Greening the Recovery'. The Commission (chaired by UCL ISR Director, Professor Paul Ekins) and drawn from a range of academic disciplines across UCL – argues that the need to mitigate climate change and growing resource insecurity mean that decisive action is now needed by the UK government to green the economy.

Greening the Recovery argues that there is a window of opportunity for policies that acknowledge future resource constraints and deliver more sustainable growth. Such policies will address fundamental structural weaknesses in the innovation system and infrastructure provision and achieve a more robust economic recovery.

The report provides a comprehensive overview of the key elements of a green economy. It emphasises that a green economy is not about

niche sectors, but about the whole economy. As well as identifying the major challenges for the UK, it makes a number of specific recommendations for policies to address them.

Greening the Recovery identifies innovation, infrastructure and information as the key areas in which policies are needed to support a green economy, in addition to arguing for environmental fiscal reform and specific policies at UK and EU level to support resource efficiency.

The Commission's work was presented widely to government departments and conferences in the UK and abroad, and has resulted in a request to prepare a policy paper on innovation for the UK Trades Union Congress.

### Mapping UCL Research on Sustainable Cities and Sustainable Resources

In 2013, as part of the Sustainable Resources for Sustainable Cities Symposium, UCL ISR commissioned a mapping exercise to scope the research landscape at UCL, with particular regard to research relating to cities and sustainability.

The resulting online visualisation map/tool, designed and built by Martin Zaltz Austwick at CASA and Charlotte Johnson at UCL ISR, allows UCL's research terrain to be navigated in a number of ways.

Users can select the themes that are relevant to their research interests and find people who share these interests. Equally important as this interactive network, are the absences that can be identified.

The map draws attention to gaps in the research field and the relative distances between departments around specific themes or resources.

The long-term aim is to create a fully interactive web-based tool which will lead to new research collaborations as users to navigate UCL's extensive cross disciplinary expertise on cities and resources finding research synergies and identifying research gaps.

## ONGOING PROJECTS

### RECREATE: Raw Materials and Innovation Policy

Starting in July 2013, The RECREATE project seeks to improve the understanding of how policy interventions impact research and innovation developments in the fields of climate action, resource efficiency and raw materials, and how these are interrelated.

Within the overall project UCL ISR will develop a scoreboard that compares, measures and benchmarks research-based innovation efforts in the European Research Area (ERA) along the three dimensions of raw materials, resource efficiency, climate action, and their interactions.

UCL ISR is also in charge of the global trends analysis. RECREATE will also condense strategically important information for research policy-makers.

The research results will be made available to policy-makers, research funding agencies, researchers and other stakeholders and the general public in the form of reports, an online presence and concise policy briefs, by the project's conclusion in 2018.

### Wind2050: local acceptance of wind power projects in Denmark, Ireland and the UK

IN 2013 UCL ISR joined partners in Denmark, Ireland and across the UK on a unique project drawing on international experience to understand the dynamics of local acceptance of both off-shore and land based wind energy projects focusing on the institutional and regulatory context, as well as technical and social aspects in project development.

The scientific findings of the Wind2050 project will form the basis for recommendations to both improve and guide public regulation and decision-making processes and to ensure private project developers mitigate the risk of an unsatisfactory implementation of wind power projects.

These are actions that are vital in order to achieve its target of a fossil-free energy system by 2050.

## Policy Options for a Resource-Efficient Economy

UCL ISR is leading this six-institute project, which has constructed a theoretical framework for the analysis of resource efficiency, with detailed comparison of policies at EU and Member State level, and an analysis of business barriers to resource efficiency.

The project team are developing an enhanced understanding of the drivers of inefficient resource use, as well as new policies to enhance resource efficiency, on scenarios and on modelling a resource-efficient economy.

In the past year a number of project-related stakeholder workshops have been coordinated to help inform development of the project's work packages, while a number of reports have also already been produced.

## Choosing Efficient Combinations of Policy Instruments for Low-carbon development and Innovation

The CECILIA2050 project combines a backward-looking (ex-post) and a forward-looking (ex-ante) analysis to understand how policy instruments work in interaction, what factors determine their performance, and how the European climate policy instrument mix should evolve to guide the transformation to a low-carbon economy.

Activities relating to this project continued throughout 2013-14, including a number of workshops and conferences and the production of reports, policy briefings and scenario planning papers.

## Environmental Macro-Indicators of Innovation

Work in the EMInInn project also continued throughout 2013-14 with the project now nearing its 2015 completion date.

This seven-partner project aims to generate deeper insights into the role of innovation in decoupling environmental impacts from economic growth, helping policy makers to both assess the benefits from past innovations as well as maximise benefits from present and emerging innovations.

image (c) iStockPhoto

# NEW PROJECTS

## UK Energy Research Centre (UKERC)

A major new research grant was received by UCL ISR when in May 2014 the Research Councils' Energy Programme confirmed the commissioning of a Phase 3 for the UK Energy Research Centre, with Paul Ekins being appointed UKERC Deputy Director and the Co-Director to lead UKERC's Energy Resources and Vectors theme.

Over five years this theme will explore the role in the world's energy system of unconventional oil and gas, the macro-economic implications of different UK energy futures, the network implications of decarbonisation at the UK and European levels, and the impacts of different energy system on water resources and eco-systems.

## Hydrogen's value in the energy system

The EPSRC Hydrogen's value in the energy system (HYVE) project is assessing the potential value of hydrogen to the UK as part of a transition to a low-carbon economy. Through it we are estimating the potential demand for and the value of hydrogen in different markets across the energy system.

Hydrogen from electrolysers can contribute to load balancing in the UK electricity system as the penetration of renewable electricity increases. We are soft-linking the UKTM energy system model with electricity and gas network models from the University of Edinburgh to assess the direct value of electrolysed hydrogen for use in the gas network (power-to-gas), industry, transport or for large-scale electricity storage. We are also extending the UCL SHIPMod infrastructure planning model to identify the optimum deployment of hydrogen supply infrastructure across the UK.

## Bioenergy value chains

The EPSRC Bioenergy Value Chains project aims to better understand the potential role of biomass in the UK energy system.

This project will integrate models of different aspects of the international and UK bioenergy supply chains across multiple scales. The resulting tools will provide guidance to policy makers about the complex social and environmental impacts of differing bioenergy strategies to underpin policy development.

We are attempting to better estimate the potential size of international bioenergy trade in the future using the TIAM-UCL global energy system model. We are also examining the most appropriate uses of biomass resources in the UK using the new UKTM-UCL model. These studies will provide boundary conditions for the more spatially-explicit models of bioenergy value chains that are being developed by the rest of the project consortium.

## Investments in Resource Efficiency

UCL ISR began a collaboration with the European Bank for Reconstruction and Development (EBRD) in early 2014 to analyses the rationale for investments in resource efficiency and provide a framework for assessing such investment decisions in practise. The project will outline costs and benefits for those investments from an environmental, economic and political point of view.

Furthermore, it will evaluate the practical barriers to investments and analyse how they relate to market and government failures as well as additional inefficiencies. It presents various intervention measures for policy makers and international financial institutions to overcome investment barriers and promote resource efficiency investments.

## Natural Capital Accounting

Working in partnership with the Global Legislators Organisation, GLOBE International, UCL ISR has published a major review of national laws and policies in 21 countries concerning natural capital accounting. The study featured contributions from 56 individuals, including parliamentarians, government officials, external consultants, and experts from UCL.

The study was officially launched on 7 June 2014 at the 2nd World Summit of Legislators, hosted by the Mexican Congress of the Union in Mexico City.

# Doctoral Research

In 2013 UCL ISR appointed the majority of its BHP Billiton funded studentships, 13 in total. Within this cohort, eight of the studentships will collaborate on measuring regional progress toward or away from environmental sustainability.

This work stems from Paul Ekins' previous research at Keele University, where he developed the "sustainability gap" (SGAP) metric. The SGAP is designed to measure the difference between current impact levels and sustainable limits. It is then used to calculate the "Years-to-Sustainability" (YtS) indicator, which describes a region's progress over time either toward or away from sustainability. Over the last 12 months, the new group of PhDs have made progress on both developing the SGAP methodology and generating data to make it operational, as a foundation for their own research topic, related to some aspect of the sustainable management of their particular resources, such as water, air or materials.

In addition, we have appointed four further researchers considering wider, but complementary areas of work; sustainability and cities, business, resource politics and modeling the economic contribution of resources to natural capital.

In 2014, we appointed the remaining two BHP Billiton funded studentships, bringing the total cohort to 20. These final two researchers will also focus their work on modeling resources and natural capital, further strengthening UCL ISR's modelling capabilities in this crucial research area. This modeling team will be further strengthened in 2015 with the appointment of a senior academic to lead this topic area.

On the following pages each of our students outlines their research project and the work they have been undertaking over the past year.

image (c) UCL ISR

## Lessons in sustainable waste management from an ancient Maya salt production centre in Belize

*Lindsay Duncan*

Over the past year my research encompassed investigations of the archaeological deposits and environmental history at the ancient Maya site of Marco Gonzalez in Belize; exploring ancient activities, characterising the fabric of cultural materials and identifying environmental markers.

This information will be used to study the relationship between human occupation and the formation of fertile soils and increased biodiversity at the site, which emphasise a very long-term impact of humans on the environment.

This summer I visited Ambergris Caye in Belize to complete data collection started in Summer 2013, which included soil sample

processing (excavated in 2013) to retrieve ancient plant material that will be used to study environmental history and the relationship between activities and black carbon, which is a potentially large contributor to soil fertility. Work was also initiated on the quantification and characterisation of cultural materials in the archaeological deposits to determine the repository of available parent materials for soil formation.

My research in the coming year will seek to identify the nature of the archaeobotanical remains and continue the characterisation of cultural material in order to produce a systemic view of resource use, other activities and waste disposal, that contributed to environmental signatures seen at the site today.

### Sustainability of 'manufactured water': Comparative political ecology of desalination plants

*Niranjana Ramesh*

My research project examines how discourses of sustainability emerged in the planning process leading up to the construction of desalination plants feeding urban water networks in London, UK and Chennai, India.

It will explore desalination technology as a site of discursive politics in the governance of urban water. Through a comparative analysis of the two case studies, it will consider global and local production of knowledge.

During my first year, I completed a Masters course in Urban Studies, and took the opportunity of the MSc dissertation to explore a microcosm of the cultural politics of water in Chennai. I undertook a month long ethnography of a single neighbourhood observing household water usage practices.

The dissertation confirmed the premise that urban water supply was far from a techno-natural project and was shaped by social, political and cultural processes. I have been working towards my MPhil to PhD upgrade in the past year, building a conceptual framework to approach the study of the desalination projects. I will be starting fieldwork in January, 2015, first at Chennai, followed by London.

### Energy efficiency in the Zambian copper industry

*Bernard Tembo*

Zambia's economy is heavily reliant on it's copper industry. Growth of the industry means corresponding growth in the economy, however, this could also cause other negative side effects. Some of the effects would lead to increased investment in the energy supply system. Thus, understanding how the energy system will evolve is of primary interest.

The second theme of the research focuses on understanding how investment decisions are made in the local industry, particularly with respect to energy efficiency and profitability. The research investigates how changing energy drivers in the industry will impact on energy demand and profitability of industry, and how the effects of these changes can be mitigated by investing in energy efficient technologies. Energy systems and simulation decision making models will be used to analysis the effects of different proposed energy-related policies and the resulting environment and economic benefits/costs.

### Towards sustainable and risk free gas production from an unconventional source

*Jabraan Ahmed*

After what has been an extremely challenging year, we have made significant headway on the project concerning sustainable and risk-free shale-gas production.

The main barriers to progress involved the procurement of suitable material to conduct our suite of analyses on. With this hurdle almost past us, the study has somewhat changed scope incorporating material from not only the Bowland, but also other UK basins including the Craven and Weald.

This more comprehensive study will allow me to compare and contrast theories on shale deposition in different environments and give tighter constraints on its architecture, which is fundamental in determining where the gas is actually generated.

The inclusion of the Weald basin in particular will prove to be very insightful given that it contains all the

necessary geological elements to produce shale-gas, yet seems to be void of the resource.

The groundwork has also been laid for addressing the risk element of the project. Given interest in UK shale-gas systems has only risen recently, there is a severe lack of literature evaluating the effect of gas stimulation processes and their impact on local seismicity.

It seems obvious such practises would increase induced seismicity and potentially reactivate movement on fault planes within the shallow crust. However estimates on the upper bounds, with respect to the volume of fluid injected, have been called into question due to over simplification of the geology and assumptions made in these calculations.

Through numeric modelling with data input from my analyses of the aforementioned shales, I hope to be place a more realistic value on these estimates and determine which factors exert the greatest influence on induced seismicity.

### Macro-modelling natural capital: water pricing policies

*Victor Nechifor-Vostinaru*
In the past 12 months, I have been engaged in developing the Institute's CGE-UCL model. CGE-UCL is a general equilibrium economic model relying on the GTAP database which in its current version comprises 129 countries and 57 economic sectors. CGE-UCL will work with various aggregations of countries and economic activities and will prove to be versatile in a wide range of energy-environment-economy modelling (3E) exercises. I am currently looking into extending the model to comprise a detailed representation of water use in the agricultural sector.

With strong micro-economic foundations, the model will aim at capturing the substitution possibilities between natural capital and other factors of production in a dynamic setting.

CGE-UCL will thus be used to simulate pathways to sustainable development under different assumptions for policy intervention, technological progress and resource productivity. The incidence of the considered scenarios will be analysed from various angles which will cover the three axes of SD.

In my doctoral research, I will be employing the CGE-UCL model formulation to analyse the economy-wide implications of water pricing policies triggered by environmental and food security considerations.

### Resource efficiency strategies in the European Union

*Florian Flachenecker*
My research focuses on the channels through which material efficiency can influence competitiveness in the European Union. There are several different channels, but they can broadly be summarised in three categories: Cost reduction, risk mitigation, and value creation.

Cost reduction as a consequence of material efficiency refers to reduced resource expenditure at the firm level, or the unlocking of funds for investments at the macro level potentially enhancing competitiveness. Risk mitigation pertains to hedging against material price volatility (ie lower exposure to price fluctuations), as well as reduction of negative externalities, which may entail environmental risks and help to sustain an existing level of competitiveness. Value creation can result in an increase in competitiveness both on the micro and macro level through for instance the promotion of (eco-) innovations, the creation of new markets (e.g. recycling markets), and an improved corporate image.

In the past year, as part of a research collaboration with the European Bank for Reconstruction and Development, I contributed to the report 'Investments in Resource Efficiency: Costs and Benefits, Investment Barriers, and Intervention Measures' as a co-author.

### Material flows and urban metabolism

*Louise Guibrunet*
The objective of my research is to develop a method to represent urban material flows in the context of the informal economy. It is argued that urban metabolism studies and

the methods associated (such as material flow analysis) need to integrate resource flows that take place in informal contexts in order to increase their relevance as a policy tool.

My research will explore the possibility of using methods of co-production of knowledge with non-expert stakeholders to generate data on urban material flows associated with informal economic activities, using the case study of the informal markets of Tepito in Mexico City.

In the past year I have contributed to the 'Globe Natural Capital Accounting Study' (UCL ISR project) and published a book review in 'Sustainable Urban Metabolism' in the journal Regional Studies.

## Energy systems, air pollution and public health

*Melissa Lott*

I am currently conducting research at the intersection of energy systems and public health. During my first year at UCL, I have focused on developing the methodology that I will use to investigate my research questions related to urban transportation systems and the air pollution that they create.

Through coursework, a literature review, and discussions with key researchers in the United Kingdom, I have identified key gaps between energy system, air pollution and public health models. I have then structured a process for bridging

image (c) iStockPhoto

some of these gaps and began an initial proof of concept for my methodology.

During the summer, I published my first conference paper on a portion of this work at the International Society for Ecological Economics (ISEE) annual meeting in Reykjavik, Iceland. This publication focused on a process for measuring sustainability trends related to air pollution and public health in the United Kingdom. I also completed limited analysis on my initial data sets, which will be the basis for my longer-term PhD work.

## Ecosystems, biodiversity and sustainability

*Marie Longnecker*

My research interests include biodiversity, ecosystem services, sustainability and applied conservation in the face of global environmental change.

I am particularly interested in how national-scale conservation strategies consider the relationship between environmental/biodiversity conservation and ecosystem services management and whether they are considered to be complementary land uses, or whether they are perceived to be competing land uses.

To this end, I am currently focused on developing a map-based strategy to assess this in priority areas identified in national strategies. Additionally, over the past year, I have worked on several projects looking at different aspects of sustainability and conservation.

Projects of particular note include The Globe Natural Capital Accounting Study 2nd Edition, for which I was an academic contributor, as well as work on the Sustainability Gap or SGAP Indicator for biodiversity.

## Governance of the mairine environment and the role of Marine Protected Areas

*Thuy Duong Khuu*

The global marine environment is currently under a very high pressure resulting from the rapid population growth and economic development. Many marine resources have shown signs of degradation and depletion such as many highly productive fisheries have collapsed, marine and coastal habitats have been degraded, and climate change is changing some characteristics of the marine environment.

My research is firstly to analyse whether or not the use of marine resource (focusing on fisheries sector) is sustainable and how long it would take to reach to sustainability based on the Sustainability Gap Framework.

The data to be assessed is at UK level. Since many marine conservationists have strongly clarified the role of Marine Protected Areas on the conservation of depleted fish stocks and marine environment and in implementing of the ecosystem based management.

The second part of my research will be on Marine Protected Areas, on whether or not they are the real solution to achieve environmental sustainability in the use of marine resources and how the good governance of MPAs can be put into practice to obtain their targets.

## Sustainability, policy and business

*Nino Jordan*

In the first year of my PhD I have gathered a variety of publicly accessible sources on corporate preferences towards environmental regulation. I have also looked into how these could be related to a variety of measures on corporate environmental performance, such as toxic chemical releases and greenhouse gas emissions.

I have explored how these and other additional variables could be best analysed with a range of different software tools. In this process I have further acquainted myself with the quantitative text analysis capabilities of the statistical packages Stata and R, the qualitative text coding software MAXQDA, and the management of relational databases with SQL.

As a result of the first year I have devised two research designs that aim to tackle similar questions, yet approach the formation of preferences towards the regulation of different environmental pollutants in more qualitative or quantitative ways, respectively.

## Sustainable Resource Governance in Mining Countries – The Case of Australia and Chile

*Ruya Perincek*

My research considers sustainable resource management and governance in mining countries, with a particular focus on Australia and Chile. I am investigating the role of the mining industry as a driving force in the greening of the economy, and the sustainable use of natural resources supported by government policies and bilateral environmental cooperation agreements.

I will analyse functional linkages between the mining industry and resource efficiency supporting sectors in the context of physical, environmental and social limits to production, as governments and businesses in mining countries need to adapt and prevent further environmental pressures.

## Interaction of materials and energy technologies in future energy transition pathways

*Seyed Mehdi Mohaghegh*

In my PhD I explore the interaction of materials and energy technologies. It is anticipated that the deployment of low-carbon technologies will increase in response to the threat posed by climate change.

The main aim is to investigate whether there are sufficient amounts of material to deploy these low-carbon technologies on the scale needed, and, further, what are the potential bottlenecks caused by the consequent increase in demand from energy sector.

For this purpose, I am using TIAM-UCL which is an integrated assessment model. By considering the material requirement of energy technologies, bottom-up, technology-rich energy system models can be used to examine and

calculate demand-side dynamics in conjunction with supply-side dynamics. Such an approach would represent a significant enhancement to the existing literature. My PhD also contributes to the third phase of UKERC research program.

The second theme of UKERC's project, which is led by Paul Ekins, will explore the current and future roles of different resources and energy vectors in the UK energy system.

In the last year I conducted a quantitative literature review on the studies addressed the energy related critical materials and presented my results in International School on Energy Systems (ISES 2014) held by Jülich Research Centre.

## Solid waste, recycling, and the circular economy

*Stijn van Ewijk*
In my PhD research I try to understand the role of solid waste generation and treatment in achieving sustainable production and consumption.

Waste pollutes the environment through waste recovery, incineration, and landfilling. Furthermore, waste generation drives consumption since disposed goods are substituted with new ones. As a consequence, the many environmental impacts of production and consumption can partly be avoided by being less wasteful.

Key to solving waste problems is to understand why something is called waste in the first place, which has to do with government regulation, human behaviour and market economics.

The management of waste is inspired by different strategies for minimising environmental impacts and resource depletion, such as the waste hierarchy or the circular economy. By capturing such strategies in indicators, and comparing their scores with environmental impacts, I hope to discover the strategies' relative merit and limitations.

In summary, I hope to find the links between waste generation, resource consumption, environmental sustainability, conceptions of waste and different waste and resource management strategies, and hopefully contribute to the human understanding of environmental problems and their solutions.

## Sustainable Water Resources and Policy

*Simon Damkjaer*
Water scarcity is defined as an imbalance between water demand and flux-derived annual water supply and metrics that assess such conditions ignore the role that surface and groundwater stores play when estimating water availability.

My research aims to derive a metric which incorporates ground and surface water storage in order to redefine water scarcity to occur only when these added stores are unable to meet the proportion of demand that is in excess of those supplies which are derived from discharge, at the intra-annual temporal scale. The metric further incorporates Environmental Flow Requirements and will be trialed in the Great Ruaha Basin, Tanzania.

During 2013/14 I have held the role of Team Leader at the Singapore International Water Week's Young Water Leader's Summit; been a Rapporteur at the Stockholm International Water Institute's World Water Week; and elected Youth Water Leader by the Water Youth Network.

Recently, I also joined the Editorial Board of The Journal of Water and Gender and its involvement in the U.N. World Water Assessment Programme's Gender Working group, which subsequently led me to launch Y2H2O: Youth to Water Bulletin where I serve as Editor-in-Chief.

## Sustainability, land degredation and land-water-biomass resources

*Darshini Ravindranath*
My research over the past year has focused on land degradation and climate resilience. Current approaches to managing dryland degradation often fail to produce significant improvements because local knowledge is often undervalued and the complexity of underlying processes leading to degradation are not well understood.

image (c) iStockPhoto

The aim of my research is to provide a methodological framework that investigates land degradation through not only conservation/restoration of land-water-biomass resources but also the adaptability of its ecosystem to adjust to climate variability and risks.

With a focus on a multi-scale analysis of three dryland agro-ecosystems in India, the framework will identify the ways through which status and use of land-water-biomass resources intersect with patterns of vulnerability (to current climate variability and future climate risk).

In addition to working on my research aims and methodology I was involved in a project at the Asia Research Centre at the London School of Economics & Political science (LSE). As part of a wider project I worked on a climate resilience study of dryland districts in Karnataka, India.

I was also co-author to a book chapter, Sustainable Growth and Climate Change: Evolution of India's Strategies, in 'The Global Development of Policy Regimes to Combat Climate Change' edited by Bowen, A. Whalley, J. and Stern, N; from the Grantham Research Institute on Climate Change. I have also presented my work at a conference of the Global Land Project in Taipei, Taiwan.

## Non-renewable resources – economic and fiscal management of fossil commodities

*Jun Rentschler*

Throughout this year I have been pursuing various research projects on the topics of environmental taxation, discounting of carbon mitigation projects, fossil fuel subsidy reforms and the economic costs of oil price volatility – a number of these are research collaborations with the World Bank.

The methodologies in these projects include General Equilibrium modelling, as well as econometric

analysis of time series data. With a keen interest in climate change adaptation and resilience building, I am also involved in the drafting of a report on the economic benefits of disaster risk management (with the World Bank's Global Facility for Disaster Reduction and Recovery, in partnership with LSE and ODI).

Commissioned by the European Bank for Reconstruction and Development (EBRD), I also co-authored a report on market failures in the context of resource efficiency investments in the industrial sector.

Currently, I am involved in applying the insights from this report to country assessments and project evaluations as part of the EBRD's Sustainable Resource Initiative. Lastly, the World Development Report 2014 for which I was a contributing team member, was published in the first semester of the academic year 2013/2014.

### Modelling Natural Capital in the Macroeconomy

*Adam Roer*

Having joined UCL ISR in September 2014 my work is primarily concerned with the symbiotic relationship between ecosystems and the human economy, thus falling into the discipline of Ecological Economics.

One contemporary method of modelling this relationship is by attempting to measure the value of so called 'Natural Capital' to the economy. I will carry out reviews of existing models to appraising the way that Natural Capital attempts to link ecosystems with the human economy. These studies take various forms differing in spatial and temporal dimensions allowing for global, regional, static and dynamic investigation.

This research will be partly conducted through reviewing case studies, and by exploring the success with which theoretical models have been used in historic policy implementation, academic appraisal will be tested against actual observations.

Simultaneously I will build my own models under the framework of existing modelling techniques such as econometrics, input/ output modelling and general equilibrium modelling, and system dynamics.

### Economic Modelling of Natural Resources

*Maike Hohberg*

Many of the current economic models under business as usual assumptions do not adequately represent the feedback mechanisms from the use of natural capital on economic growth and neglect the economic value of ecosystems.

To overcome these drawbacks in current economic modelling practice, my proposed research project is structured into three parts. A first step will be to critically assess how existing models represent natural resources and their linkages to economic variables. In the next step, an econometric model will be adapted or built to better represent natural capital, ecosystem goods and services, technological change, and consumer behaviour.

Finally, the model will be used to understand the processes and determinants of green and brown growth and to explore environmental policy options including green growth and no growth scenarios.

## STRONG START FOR ENERGY AND THE ENVIRONMENT MSC

The Economics and Policy of Energy and the Environment MSc, developed by the UCL-Energy Institute and UCL ISR, proved extremely successful in its first year, with more than 200 applicants and 52 students starting on the course in October 2013.

The course aims to give its students the essential knowledge they need to understand, analyse and manage environment-resources-economy interactions through a range of modules taught by staff from UCL ISR, UCL-Energy and other faculty across UCL.

The MSc received positive feedback from the first round of students, a small number of which have gone on to start PhDs with the UCL-Energy Institute.

In 2014, the course continues to deliver with 80 students starting in October 2014.

# ACTIVITIES AND OUTREACH

UCL ISR continued to expand its events and engagement programme in 2013-14, producing a range of public events, focused workshops and student orientated activities throughout the year. Below are selected highlights from the programme.


image (c) UCL ISR

## THE EUROPEAN UNION RAW MATERIALS INITIATIVE: RESPONDING TO KEY LEGAL AND POLICY ISSUES

In November 2013, UCL ISR coordinated a special workshop to discuss developments at the European level on the European Commission's Raw Materials Initiative.

The workshop had a particular focus on the key legal and policy issues, with reflections on the implementation challenges and gaps within the policy, and the aim of providing a valuable contribution to the design of improved responses and of innovative research.

The event, facilitated by a small grant award from the UCL European Institute, was hugely successful and welcomed a range of delegates from academia, industry, government and civil society including participants from across Europe.

Discussions during the workshop generated a number of follow on questions, including:

- How to manage relationships with the East, particularly regarding the environmental pressures caused by resource-intensive mining shifts to the East
- How can Europe turn its advantage in environmental technologies and policies into new policy approaches?
- How can Europe rethink the role of European development cooperation in resource-intensive developing countries?
- How can the EU develop a common regulatory framework addressing policy and legal challenges of reducing dependency on raw materials?

These and the many other questions raised will be used to inform future research projects in this area at UCL ISR.

## BUSINESS AND THE RESOURCE NEXUS: OPPORTUNITIES, CHALLENGES AND POLICY OPTIONS

In 2013, UCL ISR was pleased to win funding from the UCL School of the Built Environment, Engineering and Mathematical and Physical Sciences (BEAMS) and the UCL Public Engagement Unit to convene a workshop bringing together its PhD research students and representatives of the business community.

The workshop's purpose was to explore corporate strategies and policies to address the ways that resource nexus issues impact business, and to discuss how public policy could support these strategies and create a level playing field between those companies that are

taking these issues seriously, and those that are not yet doing so.

Held in June, we welcomed 15 industry partners including HSBC, PwC, EBRD, Jaguar Land Rover and Thames Water, to the workshop which led to two main outcomes. Firtsly it provided  an understanding of the resource nexus and related policy issues from the business perspective, that can aid the future academic work of the department, and secondly we identified opportunities for further collaboration.

### CAREERS IN ENERGY AND RESOURCES

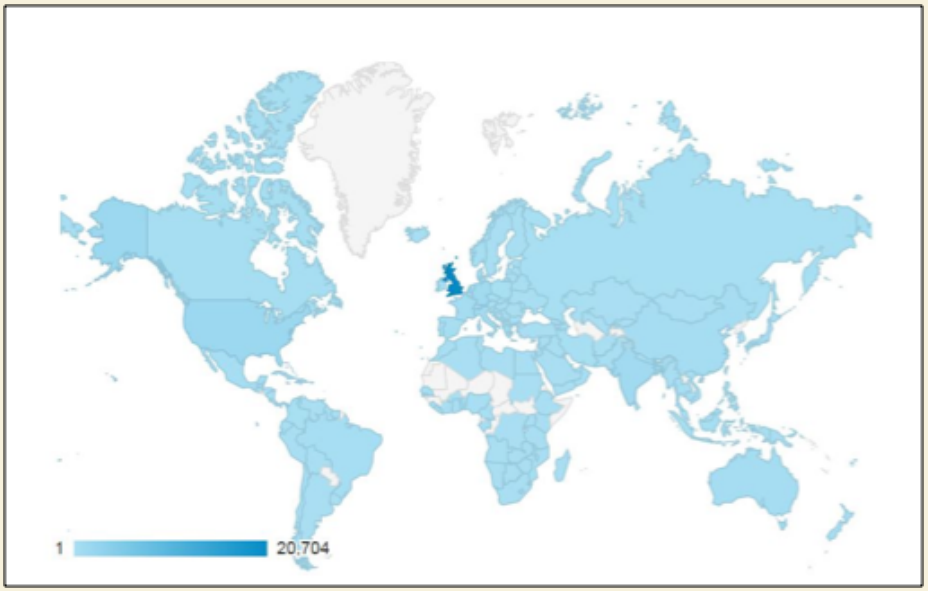
Each year the UCL ISR Careers Event brings together undergraduate and graduate students at UCL with an interest in natural resources and sustainability, and a variety of resource-related companies on an open forum to discuss career types, paths and current opportunities.

In 2014 this event built on its successful start in 2013, expanding in both size and scope.

We welcomed the UCL Energy Institute as a partner at the event, adding an energy dimension, as well as new participating companies including Ricardo-AEA, Buro Happold, Carbon Disclosure Project and the European Bank for Reconstruction and Development.

In addition we were able to expand the size of the event, allowing more than 120 UCL students to participate.

# OUR GLOBAL PRESENCE




UCL ISR has a truely global presence, reaching out to almost 100 different countries around the world.

As part of London's Global University it is important to UCL ISR that our research and engagement have as wide a reach as possible.

Our research staff and students have formed numerous collaborations and partnerships with individuals and organisations around the world and our research portfolio already includes a number of critical international projects.

Through our research we already have established partnerships across Europe, the Americas and Asia, and we continue to form new alliances further afield.

Meanwhile our events and communications continue to give us a global presence.

Visitors to our website come from 97 different countries,  and we have over 1,300 unique Twitter followers (77% growth on 2013) and 1,358 subscribers to our newsletter and event announcements (58% growth).

Our events have also grown in scale and continue to attract sell out audiences from a range of backgrounds. UCL ISR intends to continue to build on this success in 2014-15.

# Resources:Framed 2014

In 2013-14 we received an impressive response to our second Resources:Framed Photography Competition, which focused on the theme ‘Cultures of Farming’. We received a wide variety of images from staff and students across UCL, a shortlist of which were displayed at UCL in June 2014.

Top: Peoples choice winner Melvin Wan, UCL Division of Psychology and Language Sciences;
Clockwise from right shortlisted images by Carrie Behar, UCL Energy Institute; Vidit Taneja, UCL Information Services Division; Prayash Giria, Bartlett Development Planning Unit, UCL; Sophie Herbert, UCL Medical School;

# SUSTAINABLE RESOURCES FOR SUSTAINABLE CITIES SYMPOSIUM 2014

UCL ISR's largest event in 2013-14 was the annual BHP Billiton Sustainable Communities/UCL Grand Challenges Symposium, which welcomed some 200 delegates to a two-day conference on the theme of 'Sustainable Resources for Sustainable Cities'.

The conference, developed in partnership with the UCL Grand Challenge on Sustainable Cities, looked to address the challenges around provision of resources for growing urban populations, with regard to the physical built environment, infrastructure, transport and water. It aimed to address the question of how cities can continue to meet their present needs without compromising the future of the city, the region or the planet.

Our keynote speaker Professor Herbert Giradet from the World Future Council presented a glimpse of his upcoming new book 'Creating Regenerative Cities' and presentations covered many fascinating topics including medical reasons for urban biodiversity, new tools for water planning, intelligent new materials and examples of research from across UCL and wider afield.

The bredth of the resesrch presented at the conference indicates the compleixty of the field and the variety of sustainability challenges faced in expanding urban environments.

Key themes to emerge from the conference were the roles of technology, innovation and governance in addressing these challenges.

A primary objectives of the symposium series is to facilitate collaborative and cross-disciplinary research and it is hoped that discussions during the conference will have helped establish new research connections, as well as identify new themes to be taken forward by the Grand Challenge for Sustainable Cities.

In addition to the conference itself, funding for the symposium series supported a range of satellite research and engagement activities.

These included the award of five £5,000 research catalyst grants, one further award of a £15,000 research project grant and an open film competition for students, won by Mike Fell, UCL Energy Institute for 'Secret Signal' (Judges Prize) and Maria Ossul Vermehren, UCL Development Planning Unit for 'Squator Settlement' (Peoples Choice Prize).

## SUPPORTING UCL RESEARCH

UCL ISR and the UCL Grand Challenge for Sustainable Cities awarded five £5,000 catalyst grants as part of the 2013 BHP Billiton Sustainable Communities/UCL Grand Challenges Symposium.

These grants were awarded to innovative short-term research activities that addressed issues concerning resource use in the urban environment and encouraged inter-disciplinarity and collaborative working. The winners of the 2013 Catalyst Grants were:

**'Algal Bio-fuels for Sustainable Transport'** investigated the use of micro-algae as a source of bio-fuels by exploring the use of algal biomass to partially displace fossil fuels through engine-testing of emulsions of fossil diesel and wet algal slurry and experimentally assessing several bio-fuels that may potentially be produced through genetic modification of photosynthetic micro-organisms.

The positive results generated during this project warrant continuation of the research, and grant applications are currently in preparation to the Leverhulme Trust and Royal Society for further support.
*Project lead: Dr Paul Hellier, UCL Mechanical Engineering*


image (c) iStockPhoto

**'Population Change and Energy Consumption in Urban Transition'** aimed to explore the net effect of population and consumption on dwindling natural resources, highlighting the difference (if any) between the consumption patterns in an urban vs. rural setting.

Findings from the project underline the need for a close look at the population pressures on environmental resources, and that identifying population as a main driver, together with fertility and consumption may propagate our understanding of sustainability futures.

Projections in terms of population numbers and consumption scenarios paint a picture of opportunity as well as threat. It matters greatly for our resource future what the population structure entails, but also what the consumption trends are.

The catalyst grant contributed significantly to enabling the data acquisition and model development necessary at the early stages of the project. The project results have been published in one academic article so far, and presented to various academic and policy audiences, as well as forming the basis for a successful further funding proposal.
*Project lead: Dr Emma Terama, UCL ISR*

**'Developing a new mechanism for delivery of urban biodiversity networks'** sought the development of a biodiversity monitoring technique that can be used to measure changes in biodiversity by both ecologists and non-ecologists making the measurement of biodiversity accessible to all and formed the pilot study of a 4-year EPSRC-funded Engineering Doctorate research project based at UCL's Centre for Urban Sustainability & Resilience.

The field of urban biodiversity monitoring is one of rapid and exciting innovation and the results of the project add to the debate on how to monitor the conservation and use of biodiversity in the urban

environment. The work of the pilot project forms the foundation of an improved understanding of techniques of urban biodiversity monitoring.

The long-term intended output of the research, the development of techniques to make the quantification of biodiversity accessible to a wide audience, will facilitate the consideration of biodiversity in debates regarding the sustainable use of natural resources in the urban environment.
*Project lead: Dr Helena Titheridge, UCL Centre for Urban Sustainability & Resilience*

**'Common Road to 2015'** aimed to identify key policy options to produce an energy network which meets the multi-dimensional requirements (economic, societal, environmental, legal and security of supply) by 2050, through the development of two scenarios and a workshop held at UCL in the summer of 2013.

The work was successful in produce a range of options (scenarios) for the development of a low-carbon energy system in UK, considering the role of different energy resources in order to reduce system costs and emissions and further increase the proportion of renewable energy.

This information has been widely disseminated through the use of media and multimedia outlets and a journal paper is in preparation.
*Project lead: Dr Catalina Spataru, UCL Energy Institute*

The primary objective of the final practical-based project, **'Reducing Resource Use in the Household'** was to develop a specification for a computer-based tool which would be used in interactive household interviews to examine current use of resources, including the tracking of actual consumption patterns; and to explore how these patterns might be modified – both marginally and radically – to reduced overall resource consumption.

The project has resulted in the development of such a tool: CATHAT (Consumption and Travel Household Activity Tool) which is set to be further tested with a future study in the London Borough of Haringey, pending funding from the Economic and Social Research Council (ESRC).
*Project lead: Peter Jones, Centre for Transport Studies, CEGE*

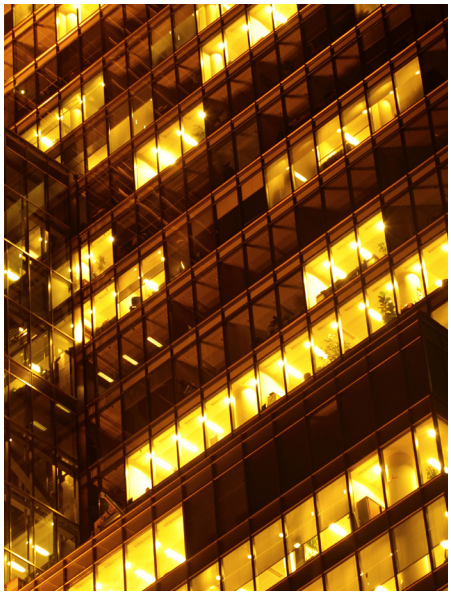


image (c) iStockPhoto

## Sustainable Building Products Research Grant

Our £15,000 research grant was awarded to Oliver Wilton, The Bartlett School of Architecture to fund an 18-month long research project into the applicability of inorganic Phase Change Material (PCM) thermal stores in sustainable building design in Europe and evaluate enviromental benefits and drawbacks.

PCM thermal stores in buildings have the potential to provide significant energy savings by delivering highly controllable passive seasonal cooling and heating.

The development of controllable passive cooling/heating is particularly timely given developments in the construction industry including the tightening of statutory requirements, increasing use of timber frame buildings, and adaption of building practices to address climate change, changing weather patterns and increasing summertime temperatures.

The principle results of this research will be the development and of a broader understanding of the potential role of non-organic PCM thermal stores in sustainable architecture in Europe, including potential benefits and disbenefits, and also the development, prototyping, testing and evaluation of a new PCM thermal store product/system.

The project is due for competion by the end of 2014.

# 2013-14 EVENT LISTINGS

19 September; Seminar
Professor Mark Swilling, University of Stellenbosch
Global Crisis, Sustainability and a Just Transition

25 September; Seminar
Prof Clive Hamilton, Charles Sturt University
Earthmasters: Playing God with the climate

24 October; Seminar
Prof Georgina Mace, Centre for Biodiversity and Environment Research (CBER), UCL
Biodiversity conservation in a resource hungry world

05 November; Symposium
Sustainable Resources for Sustainable Cities Symposium

08 November; Workshop
The European Union Raw Materials Initiative

21 November; Seminar
Dr Nigel Jollands, Principal Policy Manager, Energy Efficiency & Climate Change, European Bank for Reconstruction and Development
Resource efficiency, finance and the Rolling Stones

26 November; Seminar
Kathryn Davidson, Senior Ecological Economist, University of Adelaide
The Urban Revolution that Isn't: The Political Ecology of the New 'Urbanolog'

02 December; ISR Lecture Series
Yvo De Boer, Special Global Advisor, Climate Change & Sustainability, KPMG
Can the international climate policy impasse be broken?

23 January; Seminar
Luke Sussams, Researcher, Carbon tracker
Unburnable carbon: Coaxing the capital markets towards a low carbon future

20 February; Seminar
Rupert Howes, Chief Executive Officer, Marine Stewardship Council
Our Fisheries, Our Future

13 March
Careers in Sustainable Resources & Energy 2014

20 March; Seminar
Ray Cunningham, freelance writer, editor, translator and consultant
Reclaiming 'SUSTAINABILITY'

01 April; ISR Lecture Series
Dr Christof Rühl, Group Chief Economist & Vice President of BP plc
BP Energy Outlook 2035

22 May; Seminar
Prof Pete Smith, Univeristy of Aberdeen
Addressing the joint challenges of climate change and food security

06 June; Seminar
Ester van der Voet, Associate Professor, Leiden University
Impacts of Resource Use

16 June; ISR Lecture Series
Dr Janez Potočnik, Commissioner for Environment, European Commission
New Environmentalism and the Circular Economy

19 June; Seminar
Ben Davies, Manager - Materials Stewardship, International Council on Mining and Metals (ICMM)
Mining's contribution to sustainable development through the value chain of minerals & metals

# INDUSTRY AND BUSINESS

image (c) iStockPhoto

Working with partners in the commercial world is important to us; by engaging with commercial partners, the institute is more likely to create a real-world impact with its research.

We continue to build on UCL's substantial track record of collaborative research worldwide, with an international network comprising Australia, China, Japan, and Taiwan, among other countries.

In addition we are developing our relationships with the business community.

BHP Billiton Sustainable Communities is the founding contributor to the UCL ISR.

BHP Billiton Sustainable Communities is a charity established by BHP Billiton as part of its community investment programme. It has a target to commit 1% of pre-tax profit to community programmes in markets where it has a business interest.

In 2011 BHP Billiton Sustainable Communities provided UCL ISR with US$5 million over a five year period to support research, fellowships and scholarships, as well as the appointment of a Chair in Sustainable Global Resources.

The use of this funding is at the discretion of UCL ISR and is not influenced by or a reflection of BHP Billiton's business practice.

In the past year UCL ISR has worked with:

**BHP Billiton Sustainable Communities**
**British Geological Survey**
**Carbon Disclosure Project**
**Chatham House**
**EBRD**
**HSBC**
**KPMG**
**Jaguar Land Rover**
**Ofgem**
**GLOBE International**
**Rio Tinto**
**Tata Steel**
**Thames Water**
**Unilever**
**PriceWaterhouse Cooper**
**SSE**
**Evershed**

# WORKING ACROSS UCL

UCL ISR also works closely with colleagues across UCL faculties and departments from Anthropology to Engineering and as far as the UCL School of Energy and Resources in Adelaide, Australia, part of our remit as a cross-disciplinary institute.

Through these relationship, and a network of contacts in Asia, North and South America, Africa and Europe, UCL ISR already forms part of an international institutional and research community committed to developing innovative responses to the complex economic, legal, environmental, technological and cultural issues facing humanity's use of resources.

## Academic Engagement

To facilitate these relationships we have created an Academic Engagement Group comprising colleagues from across UCL which meets three times a year to discuss opportunities for collaboration.

Such collaborations take the form of joint research projects, co-supervision of PhD students and a range of events from topical half-day workshops to a series of smaller seminars.

Our collaborations across UCL include the following institutes and departments:

- UCL-Energy
- Bartlett School of Graduate Studies
- Development Planning Unit
- Centre for Biodiversity and Environment Research
- Centre for CO2 Technology
- Department of Civil, Environmental and Geomatic Engineering
- Department of Earth Sciences
- Department of Economics
- Department of Geography
- Department of Mechanical Engineering
- Department of Political Science
- Environment Institute
- European Institute
- Faculty of Laws
- Institute for Risk and Disaster Reduction
- Institute for Security and Resilience Studies
- Institute of Archaeology
- School of Energy and Resources (Australia)

## The UCL Grand Challenges

UCL ISR also has a direct relationship with the UCL Grand Challenges, primarily through our Symposium activities, but also more generally. This relationship aims to address issues of global concern.

**Resources and Sustainable Cities**
With more than 50% of the global population now living in urban areas, the number of cities of more than one million inhabitants is set to continue to grow. This will place continuing pressure on both land use and resources.

**Resources and Global Health**
Access to resources has a profound impact on global health. Loss of biodiversity and pollution from resource extraction can have a negative impact on human health while access to resources, in particular clean water, could substantially reduce disease, malnutrition and poverty-related mortality.

**Resources and Intercultural Interaction**
Resources from water and food to energy and building materials are critical to social development and economic growth. The development of a 'green economy' aims to simultaneously address resource and economic stress as well as social cohesion.

**Resources and Human Wellbeing**
An estimated 925 million people currently live in poverty. More equitable and sustainable management of resources including food and water could profoundly reduce current levels of poverty as well as support the additional two billion people expected by 2050.

# APPOINTMENTS

Congratulations to the following new appointments at UCL ISR.

### Professor Michael Grubb
### Professor of International Energy and Climate Change Policy

Michael Grubb joined UCL ISR as Professor of International Energy and Climate Change Policy in July 2014.

In addition to his role at UCL ISR Michael is editor-in-chief of the journal Climate Policy, and Senior Advisor on Sustainable Energy Policy to the UK Energy Regulator Ofgem. His former (and continuing) positions include Senior Research Associate at Cambridge University (Departments of Economics and Land Economy); Chair of the international research organization Climate Strategies; Chief Economist at the Carbon Trust; Professor of Climate Change and Energy Policy at Imperial College London; and head of Energy and Environment at Chatham House.

Michael has also served on the UK Climate Change Committee, established under the UK Climate Change Bill to advise the government on future carbon budgets and to report to Parliament on their implementation.

In 2013 he was the Specialist Advisor to a House of Lords European Committee enquiry. 'No Country is an Energy Island: securing investment for the EU's Future' (2013).

At UCL ISR Michael's work will focus on three main areas: dimensions of UK energy, and particularly electricity policy in the aftermath of UK Energy Market Reform, including investment and macroeconomic dimensions; consumption-based perspectives and policies for carbon mitigation; and aspects of international climate negotiations, most particularly in context of his role on the Scientific Panel for the French COP Presidency scientific conference on "Our Common Climate".

### Dr Emma Terama
### Research Associate

Emma works on a Kone Foundation grant studying sustainable consumption in the urban transition. She uses mathematical models for population projections, multivariate regression and socio-economic scenarios to combine population trends with resources, environmental impact and climate adaptation.

Her background in applied natural and computational sciences allows for an understanding of modelled and real life structures, causal dependencies (or the lack of) and quantitative analytics.

### Dr Julia Tomei
### Research Associate

Julia's broad research interests focus on the social and environmental dimensions of energy and resources in the global South.

Julia's PhD, undertaken at UCL-Energy, investigated of how global processes and local contexts have influenced the development of biofuels in Guatemala. Her research drew on insights from political ecological research, which has demonstrated that phenomena such as biofuels cannot be understood in isolation from the political economic contexts within which they are embedded.

### Charlotte Johnson
### Public Engagement Fellow

In November 2013, Charlotte was awarded a Public Engagement Fellowship by the UCL Public Engagement Unit, to study the role assigned to 'the public' in energy policy research. During this Fellowship Charlotte is developing collaborative research projects with local authorities and not-for-profit groups related to their sustainability priorities.

Charlotte's research focuses on infrastructure, energy, financialisation and the material culture of the home. She draws on theories from anthropology, economic geography and STS.

As part of her Public Engagement Fellowship, Charlotte will be developing research projects in collaboration with public sector and community groups that support low carbon urban energy use.

# PUBLICATIONS

## PUBLICATIONS 2013


Agnolucci, P; Mcdowall, W; (2013) Designing future hydrogen infrastructure: Insights from analysis at different spatial scales. International Journal of Hydrogen Energy, 38 (13) 5181 - 5191. 10.1016/j.ijhydene.2013.02.042.

Agnolucci, P; McDowall, W; Akgul, O; Papageorgiou, LG; (2013) The importance of economies of scale, transport costs and demand patterns in optimising hydrogen fuelling infrastructure: An exploration with SHIPMod (Spatial hydrogen infrastructure planning model). International Journal of Hydrogen Energy, 38 (26) pp. 11189-11201. 10.1016/j.ijhydene.2013.06.071.

Anandarajah, G; McDowall, W; Ekins, P; (2013) Decarbonising road transport with hydrogen and electricity: Long term global technology learning scenarios. International Journal of Hydrogen Energy, 38 (8) 3419 - 3432. 10.1016/j.ijhydene.2012.12.110.

Bleischwitz, R; (2013) It's a Material World: Managing Metals and Critical Materials against All Odds. [Digital scholarly resource]. http://www.aicgs.org/publication/its-a-material-world-managing-metals-and-critical-materials-against-all-odds/

Bleischwitz, R; (2013) The Resource Hope. [Digital scholarly resource]. http://www.project-syndicate.org/

Bleischwitz, R; (2013) Transparency in the Extractive Sector. [Digital scholarly resource]. http://www.sef-bonn.org/en/publications/global-governance-spotlight/global-governance-spotlight-52013.html

Bleischwitz, R; (2013) Transparenz im Rohstoffbereich : Grundlage für nachhaltige Entwicklung. (Global governance spotlight). Stiftung Entwicklung und Frieden: Bonn.

Bleischwitz, R; (2013) Kurskorrekturen für eine faire Rohstoffwirtschaft. In: Stottrop, U, (ed.) Kohle. Global. Eine Reise in die Reviere der anderen. Katalog zur Ausstellung im Ruhr Museum. : Ruhr Museum Essen.

Bleischwitz, R; Bahn-Walkowiak Bettina,; Wilts Claas Henning,; (2013) How to identify a successful policy mix for a resource-efficient Europe. In: (Proceedings) 10th biennal conference of the European Society for Ecological Economics. (pp. ? - ?). Europ. Soc. for Ecological Economics: Wien.

Bleischwitz, R; Fischer Susanne,; Bringezu Stefan,; (2013) Ressourcen und nachhaltige Entwicklung. In: Einführung in die Entwicklungspolitik. (113 - 125). LIT-Verl.: Berlin.

Bleischwitz, R; Fischer Susanne,; Bringezu Stefan,; (2013) Ressourcen und nachhaltige Entwicklung. LIT-Verl: Berlin.

Bleischwitz, R; Johnson, CM; Dozler, MG; (2013) Re-Assessing resource dependency and criticality. Linking future food and water stress with global resource supply vulnerabilities for foresight analysis. European Journal for Futures Research, 2 (1) , Article 34. 10.1007/s40309-013-0034-1.

Bleischwitz, R; O'Brien Meghan,; Steger Sören,; Fischer Susanne,; Miedzinski Michal,; Campregher Christoph,; ... Karjalainen Anne,; + view all (2013) Europe in transition : paving the way to a green economy through eco-innovation ; annual report 2012. Eco-Innovation Observatory: Brussels.

Bleischwitz, R; Wilts, H; (2013) An international metal covenant: a step twoards global sustainable resource management. In: Angrick,, M and Burger,, A and Lehmann, H, (eds.) Factor X: Re-source – Designing the recycling society. (87-98). Springer: Heidelberg.

Browne, J., Dresner, S. Ekins, P., Hamilton, I, Preston, I. and White, V.2013 'Designing Carbon Taxation to Protect Low-Income Households', March, Joseph Rowntree Foundation, York, http://www.jrf.org.uk/publications/carbon-tax

Drummond, P; Ekins, P; (2013) Carbon Price Floor for Electricity Generation. [Digital scholarly resource].

Drummond, PT; (2013) CECILIA2050: Review of the Existing Instrument Mix at EU Level and in Selected Member States - United Kingdom.

Ekins, P. 'Post-Durban Prospects for Low-Carbon Green Growth', Ch. 4 in Chung, S-Y. Ed. 2013 Post-2020 Climate Change Regime Formation, Routledge, London/New York, pp.68-91

Ekins, P 2013 'Some socio-economic thoughts', in Ch. 6 of O'Riordan, T. Ed. Tipping Points, Oxford University Press, Oxford, pp.188-193

Ekins, P; 2013; Environmental Tax Reform: Experience in Europe and Implications for East Asia. In: Mori, A and Ekins, P and Lee, SC and Speck, S and Ueta, K, (eds.) The Green Fiscal Mechanism and Reform for Low Carbon Development. Routledge, pp.105-122

Ekins, P. and Shaw, B. 2013 'Green Fiscal Commissions in Europe', in Mori, A., Speck, S., Lee, S. and Ueta, K. Eds. 2013 The Green Fiscal Mechanism and Reform for Low Carbon Development, Routledge, London/New York, pp.152-186

Ekins, P.; 2013; 'Is Economic Growth Compatible with Environmental Sustainability?', Chapter 1 in Bell, C., Chaplin, J. and White, R. Eds. 2013 Living Lightly. Living Faithfully: Religious faiths and the future of sustainability, Faraday Institute for Science and Religion, Cambridge, pp.33-48

Ekins, P. 2013 'Weighing the true price of nuclear power', ENDS Report 457, March, pp.34-35, http://www.endsreport.com/37645/comment-by-paul-ekins-weighing-the-true-price-of-new-nuclear-power

Ekins, P., Keppo, I., Skea, J., Strachan, N., Usher, W. and Anandarajah, G. 2013 'The UK Energy System in 2050: Comparing Low-Carbon Resilient Scenarios', UKERC Research Report UKERC RR/ESY/2013/001, February, UKERC, London

Ekins, P. 'Innovation and R&D – Essential for a Low-Carbon Future', Energy World, June, p.7

Ekins, P. 2013 'Mad dash to frack Britain puts carbon targets in danger', The Conversation, , August, http://theconversation.com/mad-dash-to-frack-britain-puts-carbon-targets-in-danger-17025

Knight, Z., Robins, N., Chan, W-S. with Ekins, P. 2013 HSBC 2013 Natural Capital: Identifying Implications for Economies, November, HSBC, London

Ekins, P.; Evidence to Environmental Audit Committee Inquiry (July 10 2013) Energy Subsidies, Vol.I, 9th Report of Session 2013-2014, HC61-I, December, pp.Ev 29-31, The Stationery Office, London

Ekins, P.; 'Labour's ten-point energy plan goes too far - or not far enough', The Conversation, December, http://theconversation.com/labours-ten-point-energy-plan-goes-too-far-or-not-far-enough-20997

Ekins, P.; 'Missed chance to seal draughts and make heat affordable to all', The Conversation, December, https://theconversation.com/missed-chance-to-seal-draughts-and-make-heat-affordable-to-all-21243

Hodbod, J; Tomei, J; (2013) Demystifying the Social Impacts of Biofuels at Local Levels: Where is the Evidence? Geography Compass, 7 (7) 478 - 488. 10.1111/gec3.12051.

McDowall, W., Ekins, P., Radosevic, S. and Zhang, L-Y. 2013 'Development of the Wind Innovation System in Three Jurisdictions: An Activity Analysis', Technology Analysis and Strategic Management, Vol. 25, No. 2, pp.163–185, http://dx.doi.org/10.1080/09537325.2012.759204

McDowall, WAS; (2013) The development of wind energy in the UK: critical reflections on UK policy from an innovation system perspective. In: (Proceedings) 12th World Wind Energy Conference.

McGlade, C; Anandarajah, G; (2013) What is the role of natural gas as a bridging fuel to a low-carbon global energy system? In: (Proceedings) ETSAP semi-annual workshop.

McGlade, C; Speirs, J; Sorrell, S; (2013) Methods of estimating shale gas resources - Comparison, evaluation and implications. Energy, 59 116 - 125. 10.1016/j.energy.2013.05.031.

McGlade, C; Speirs, J; Sorrell, S; (2013) Unconventional gas - A review of regional and global resource estimates. ENERGY, 55 571 - 584. 10.1016/j.energy.2013.01.048.

Mori, A., Ekins, P. and Speck, S. 2013 'Introduction', in Mori, A., Speck, S., Lee, S. and Ueta, K. Eds. 2013 The Green Fiscal Mechanism and Reform for Low Carbon Development, Routledge, London/New York, pp.1-19

Preston, I; White, V; Browne, J; Dresner, S; Ekins, P; Hamilton, IG; (2013) Designing carbon taxation to protect low-income households. Joseph Rowntree Foundation

Rentschler, J. E. (2013). Oil Price Volatility, Economic Growth and the Hedging Role of Renewable Energy. World Bank Policy Research Working Papers (Vol. 6603). Washington DC.
Rentschler, J. E. (2013). Why Resilience Matters The Poverty Impacts of Disasters. World Bank Policy Research Working Papers (Vol. 6699).

Upham, P; Dendler, L; Tomei, J; (2013) Policy and regulatory controversy: the case of UK and EC biofuel policy. In: Roberts, T and Upham, P and Mclachlan, C and Mander, S and Thomas, R and Gough, C and Boucher, P and Ghanem, DA, (eds.) Low-Carbon Energy Controversies. Routledge

Upham, P; Taylor, PG; Christopherson, D; McDowall, WAS; (2013) The role of the scientific model in policy imagery: MARKAL as boundary object. In: (Proceedings) Tools in the Policy Formulation Process.

The World Bank. (2013). World Development Report 2014 - Risk and Opportunity: Managing Risk for Development. Washington DC: The World Bank.

## PUBLICATIONS 2014

Avner, P., Rentschler, J., & Hallegatte, S. (2014). Carbon Price Efficiency Lock-in and Path Dependence in Urban Forms and Transport Infrastructure. World Bank Policy Research Working Papers, 6941.

Carter, T.R.; Fronzek, S; Inkinen, A; Lahtinen, I; Lahtinen, M; Mela, H; O'Brien, K.L.; Rosentrater, L.D.; Ruuhela, R; Simonsson, L; Terama, T; (2014) Characterising vulnerability of the elderly to climate change in the Nordic region. Regional Environmental Change, 10.1007/s10113-014-0688-7

Ekins, P; Baddeley, M; Medda, F; Nesheim, L; Radosevic, S; (2014) Greening the recovery: the report of the UCL Green Economy Commission. OVPR/UCL Public Policy: University College London.

Ekins, P., Meyer, B., Schmidt-Bleek, F. and Schneider, F. 2014 'Reducing Resource Consumption: a proposal for Resource and Environmental Policy' in Angrick, M., Burger, A. and Lehmann, H. Eds. 2014 Factor X: Policy, Strategies and Instruments for a Sustainable Resource Use, Springer, pp.249-273

Ekins, P. 2014 'Less talk, more walk required to green the economy', The Conversation, February, http://theconversation.com/less-talk-more-walk-required-to-green-the-economy-23556

Ekins, P., McDowall, W. and Zenghelis, D.2014 'Greening the Recovery', the Report of the UCL Green Fiscal Commission, University College London, UCL, http://www.ucl.ac.uk/public-policy/Policy_Commissions/GEPC

Ekins, P. and Speck, S. 2014 'The Fiscal Implications of Climate Change and Policy Responses', Special Issue of Mitigation and Adaptation Strategies for Global Change, Vol.19, pp.355–374, DOI 10.1007/s11027-013-9533-4

Ekins, P. 2014 'Replacing the Internal Combustion Engine: Why the Future Is Electric', Huffington Post, March 23, http://www.huffingtonpost.co.uk/intelligence-squared/replacing-the-internal-combustion-engine-why-the-future-is-electric_b_5018669.html

Ekins, P. 2014 'Executive Summary' and 'Conclusions' in Dodds, P. and Hawkes, A. Eds 2014 'The Role of Hydrogen and Fuel Cells in Providing Affordable, Secure Low-Carbon Heat', a White Paper from H2FC SUPERGEN, London, pp.v-xxvi, 126-132

Ekins, P. and Watson, J. 2014 (Eds.) UK Energy in a Global Context: Synthesis Report, UKERC/RR/FG/2014/001, April, UK Energy Research Centre, London, http://www.ukerc.ac.uk/support/UK+Energy+in+a+Global+Context+Ext

Ekins, P. 2014 'The key to increasing resource efficiency', Europe's World, Summer issue, June, http://europesworld.org/2014g-their-loss-of-value/#.U6AZcfldWxV, pp.56-58

Ekins, P. 2014 (forthcoming) 'Strong Sustainability and Critical Natural Capital', in Atkinson, G., Dietz, S., Neumayer, E. and Agarwala, M. 2014 (forthcoming) Handbook of Sustainable Development, Edward Elgar, Cheltenham

Ekins, P., Bradshaw, M. and Watson, J. 2014 (forthcoming) Global Energy: Issues, Potentials and Policy Implications, Oxford University Press, OUP

Hallegatte, S., & Rentschler, J. (2014). Risk Management for Development-Assessing Obstacles and Prioritizing Action. Risk Analysis.

Johnson, C; Austwick, MZ; (2014) PICKS: Exploring Post-disciplinary knowledge in a university's urban sustainability research landscape. Sustainability (United States) , 7 (3) 160 - 169. 10.1089/SUS.2014.9789.

McDowall, W; (2014) Exploring possible transition pathways for hydrogen energy: A hybrid approach using socio-technical scenarios and energy system modelling. Futures, 63 1 - 14. 10.1016/j.futures.2014.07.004.

McGlade, C., Bradshaw, M., Anandarajah, G., Watson, J. and Ekins, P. 2014 'A bridge to a low carbon future? Modelling the long-term global potential of natural gas', Final report to UKERC, mimeo, London

McGlade, C; Ekins, P; (2014) Un-burnable oil: an examination of oil resource utilisation in a decarbonised energy system. Energy Policy, 64 102 - 112. 10.1016/j.enpol.2013.09.042.

McGlade, CE; (2014) Comment on the 'Uppsala critique'. Energy Policy, 67 pp. 154-158. 10.1016/j.enpol.2013.11.036.

McGlade, CE; (2014) Uncertainties in the outlook for oil and gas. Doctoral thesis, UCL (University College London).

Tomei, J; (2014) "I always wore my machete when travelling on the bus": reflections on danger in the field. In: Fieldwork in the Global South: Ethical Challenges and Dilemmas. : Taylor & Francis.

Tomei, J; Diaz-Chavez, RDC; (2014) Guatemala. In: Solomon, B and Bailie, R, (eds.) Sustainable Development of Biofuels in Latin America and the Caribbean. Springer: New York.

Ucci, M; Domenech, T; Ball, A; Whitley, T; Wright, C; Mason, D; ... Westaway, A; (2014) Behaviour change potential for energy saving in non-domestic buildings: Development and pilot-testing of a benchmarking tool. BUILDING SERVICES ENGINEERING RESEARCH & TECHNOLOGY, 35 (1) 36 - 52. 10.1177/0143624412466559.

# THE UCL ISR TEAM

image (c) UCL

## Management and Administration

Prof Paul Ekins
Director
Professor of Resources and Environmental Policy

Prof Raimund Bleischwitz
Deputy Director
BHP Billiton Chair in Sustainable Global Resources

Katherine Welch
Institute Manager

Kiran Dhillon
Administrator

## Students

Abdulaziz Ahmad Al-Shalabi
Jabraan Ahmed
Seyed Mehdi Mohaghegh
Xing Chen
Lindsay Duncan
Simon Damkjaer
Thuy Duong Khuu
Stijn van Ewijk
Florian Flachenecker
Louise Guibrunet
Maike Hohberg
Nino Jordan
Marie Longnecker
Melissa Lott
Victor Nechifor
Ruya Perincek
Niranjana Ramesh
Darshini Ravindranath
Jun Rentschler
Adam Roer
Bernard Tembo

## Research Staff

Paolo Agnolucci
Chiara Armeni
Teresa Domenech
Paul Drummond
Michael Grubb
Charlotte Johnson
Will McDowall
Christophe McGlade
Michelle O'Keeffe
Matthew Winning
Emma Terama
Julia Tomei

www.bartlett.ucl.ac.uk/sustainable
sustainable-resources@ucl.ac.uk
Follow us on Twitter @UCL_ISR
Central House, 14 Upper Woburn Place
London, WC1H 0NN



This report is printed on 100% recycled paper