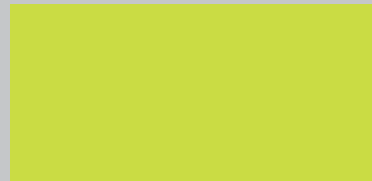


Sustainable Resources

for Sustainable Cities

Conference Proceedings

5 & 6 November 2013



About the UCL Institute for Sustainable Resources:

Established in 2012, the UCL Institute for Sustainable Resources is a cross-disciplinary institute, set up to carry out in-house research in the areas of its research themes, as well as pull together the research capabilities in these areas from across UCL. UCL ISR is part of the Bartlett Faculty of the Built Environment, and is a partner institute to the UCL Energy Institute and the UCL International Energy Policy Institute (UCL Australia).

UCL ISR supports all four of the UCL Grand Challenges posing questions and searching for solutions in the areas of sustainable cities, global health, human wellbeing and intercultural interaction.

Follow us on Twitter at [@ucl_isr](https://twitter.com/ucl_isr)

We welcome you to tweet and share your thoughts about our event using the hashtag [#UCLsrsc](https://twitter.com/hashtag/UCLsrsc)

About the UCL Grand Challenge of Sustainable Cities (GCSC):

The UCL Research Strategy defines Grand Challenges: those areas in which we are facilitating cross-disciplinary interaction – within and beyond UCL – and applying our collective strengths, insights and creativity to overcome problems of global significance.

The UCL Grand Challenge of Sustainable Cities (GCSC) seeks to rally the breadth of our expertise – in partnership with external agencies – to address aspects of the major problems facing cities in the 21st century.

Follow UCL GCSC on Twitter at [@UCL_GCSC](https://twitter.com/UCL_GCSC)

The BHP Billiton Sustainable Communities & UCL Grand Challenge Symposium Series

The BHP Billiton Sustainable Communities/UCL Grand Challenge Symposium Series was established in 2012 as a forum to bring together a variety of stakeholders integral to the debate around issues of global concern.

The series has a particular focus on the sustainability of natural resources and the links between resources and the four UCL Grand Challenges: Sustainable Cities, Global Health, Intercultural Interaction and Human Wellbeing. The series will run over five years, beginning with a strategy and question setting forum (2012), before taking a more in-depth look at each of the Grand Challenges in turn.

Sustainable Resources and Sustainable Cities

Cities - densely packed, complex, built systems - are home to nearly half the of world's population. With this trend of increasing worldwide urbanisation set to continue, urban sustainability has been identified as a key area of societal relevance, an area in which a solid research base can inform policy and practice.

The Grand Challenge of Sustainable Cities (GCSC) exists to initiate and support cross-disciplinary research into urban sustainability. Sustainability in the urban context is inextricably linked to resource flows. Among the minimum requirements for a city's population are housing, food, safe water, mobility, waste disposal, and energy for heating and cooling. Cities must draw on global resource networks to provide the raw materials to build new infrastructure, maintain current systems and retrofit existing buildings. Cities are also generally unable to generate the energy they require, grow enough food, or ensure adequate water supply. Sustainable cities rely on sustainable resources, and this reliance provides a clear link between GCSC and the work of the Institute for Sustainable Resources (ISR).

This symposium looks to address the challenges around provision of resources for growing urban populations, with regard to the physical built environment, infrastructure, transport and water. It aims 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.



BHP Billiton Sustainable Communities/UCL Grand Challenge

Symposium Series

Sustainable Resources for Sustainable Cities Programme

Date:
5 & 6 November 2013

Venue:
Darwin Lecture Theatre B40,
UCL



5 November 2013 Urban Metabolism, Feeding the city

9.30am Registration & coffee

10.00am Introductory Remarks

Professor Raimund Bleischwitz, BHP Billiton Chair in Sustainable Global Resources, UCL ISR
Dr Ian Scott, Principal Facilitator, UCL Grand Challenges programme

10.30am Session 1: Urban Challenges

 Chaired by **Andres Sevtsuk**, Assistant Professor in Architecture and Sustainable Design, Singapore University of Technology & Design

Dr Emma Terama, Research Associate, UCL Department of Science, Technology, Engineering and Public Policy (STeAPP) '[Is sustainable consumption challenged in the global urban transition?](#)'

Dr Catalina Spataru, Senior Research Associate, UCL '[Common Road to 2050 - Energy Scenarios](#)'

Dr Emily Morris, Research Associate, UCL Institute of the Americas '[Urban mobility: Havana's urgent challenge](#)'

Alison Fairbrass, Engineering Doctorate Student, Centre for Urban Sustainability and Resilience, UCL '[Developing accessible methods for urban biodiversity monitoring](#)'

Professor Graham Rook, Professor of Medical Microbiology (Emeritus) Centre for Clinical Microbiology, Department of Infection, & the National Institute for Health Research (NIHR) and UCL Hospitals Biomedical Research Centre, UCL '[Can urban greenspace and biodiversity reverse the worrying increases in chronic inflammatory disorders?](#)'

12.00pm Lunch break

1.15pm Session 2: Resource Supply

 Chaired by **Professor Raimund Bleischwitz**, UCL ISR

Marco Poletto, Director ecoLogicStudio & BIO_UD Research Cluster Director, The Bartlett, UCL '[Bio Urban Design Lab - Cities as productive landscapes](#)'

Emily King, Senior Consultant, Environmental Resources Management (ERM) '[Sustainability Profiling](#)'

Teresa Camarero-Esparza, PhD student, UCL Institute for Sustainable Resources & CECE UCL '[Integrative Sludge Management: A focus on waste production and resource recovery](#)'

Evgenii S. Matrosov, PhD Researcher, UCL '[Should we update England's water supply planning process?](#)'

Dr Paul Hellier, Department of Mechanical Engineering, UCL '[Algal Bio-fuels for Sustainable Transport](#)'

2.45pm Coffee break

3.00pm Session 3: Resource Consumption

 Chaired by **Tadj Oreszczyn**, Director of the UCL Energy Institute, Director of the RCUK Centre for Energy Epidemiology (CEE) & Professor of Energy and Environment

Sabien Windels, Project officer at Interreg IV B project called "ZECOS", KAHO Sint-Lieven (University College Ghent: industrial engineering) '[Fuel poverty and financing methods for energy efficiency measures](#)'

Professor Peter Jones, Professor of Transport and sustainable development, UCL, '[Developing an interactive tool to explore household resource use and how this might be reduced.](#)'

Oliver Wilton, Senior Teaching Fellow, The Bartlett School of Architecture & **Dr Jake Hacker**, Visiting Professor in Building Engineering Physics, UCL Energy Institute '[Phase Change Material Thermal Stores](#)'

Shoshanna Saxe, PhD Student, University of Cambridge '[A methodology for accessing the net GHG impact of new metro rail](#)'

Dr. Susan E. Lee, Research Fellow, University of Birmingham '[A City Design Framework to Elucidate Urban Challenges: Energy Flows of Birmingham](#)'

BHP Billiton Sustainable Communities/UCL Grand Challenge

Symposium Series

Sustainable Resources for Sustainable Cities Programme

Date:
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UCL



5 November 2013 Feeding the city

4.15pm Mapping UCL research on sustainable cities and sustainable resources

Charlotte Johnson, Research Associate, UCL ISR

4.45pm Break

5.00pm Keynote Address

Professor Herbert Giradet, Co-Founder, World Future Council 'Urban Metabolism'

Chaired by **Dr Robert Biel**, Senior Lecturer, Development Planning Unit, UCL

6.30-7.45pm Networking reception & Eco Action Games - an interactive event

6 November 2013 Research into action

10.00am Registration & coffee

10.20am Introductory Remarks

Professor Raimund Bleischwitz, BHP Billiton Chair in Sustainable Global Resources, UCL ISR

10.30am Panel discussion: *Cities in Transition*

Moderated by **Dr Michele Acuto**, Senior Lecturer in Global Networks & Diplomacy, Department of Science, Technology, Engineering and Public Policy (STeAPP); UCL

Panellists:

Dr Vanesa Castan Broto, Lecturer, Development Planning Unit, UCL

Rt Hon Charles Clarke, Honorary Professor of Economic Policy and Migration, University College London

Professor Herbert Giradet, Co-Founder, World Future Council & Visiting Professor, University of the West of England

Dr Yacob Mulugetta, Reader, Centre for Environmental Strategy, University of Surrey

Professor Tadj Oreszczyn, Director of the UCL Energy Institute, Director of the RCUK Centre for Energy Epidemiology (GEE) & Professor of Energy and Environment

Dr Inge Paulini, Secretary General, German Advisory Council on Global Change

Dr Lily Song, Provost (Postdoctoral) Fellow, University College London

1.00pm Close

Sustainable Resources for Sustainable Cities Abstracts

Dr Emma Terama, Research Associate, UCL Department of Science, Technology, Engineering and Public Policy (STeAPP) '[Is sustainable consumption challenged in the global urban transition?](#)' Population structure and urbanisation can substantially influence carbon emissions in particular world regions, especially through energy consumption. Similarly, the consumption of materials, renewable or otherwise, is shifting as the world is turning more urban and wealthy. Fertility differentials play a role in shaping population (and household) structure for many decades to come, while age, household size and composition has been shown to correlate with consumption. This study investigates the joint effects of population and consumption change at national level(s). Our project unveils the net effect of urbanisation and consumption using comparable national statistics. We contrast demographic change in cities vs. rural areas for India by making use of the population life table and apply vegetable/meat and energy consumption indicators to the population structure. The produced overall impact trajectories represent the net effect on environment. We investigate the sensitivity of the resulting impact to changes in the underlying parameters. Through the resulting trajectories we can demonstrate possible consequences of different fertility and consumption assumptions across a rural-urban divide. The produced scenarios may be used to inform policy options with respect to consumption and meeting the need for family planning.

Dr Catalina Spataru, Senior Research Associate, UCL '[Common Road to 2050 - Energy Scenarios](#)' A comparison of various scenarios studies for the development of a low-carbon energy system in UK has been reviewed together with an assessment of their challenges from technical and policy perspectives. Two distinct, descriptive scenario pathways for the development of a low-carbon energy system in the UK by 2050 were proposed. Whilst both achieve long-term decarbonisation and share commonalities such as development in energy demand, they each result from different short-term priorities of the 'energy trilemma' – energy security, energy affordability, and emission mitigation. These scenarios aim to identify the benefits and challenges of these opposing decarbonisation pathways, whilst acknowledging that a hybridised approach would in fact be the most probable, if not the most desired.

Dr Emily Morris, Research Associate, UCL Institute of the Americas '[Urban mobility: Havana's urgent challenge](#)' This presentation describes the aims, objectives and progress of research collaboration between UCL and Cuba's ministry of transport. The project is examining policy possibilities for sustainable urban transport in the country's capital city, Havana. The city's conditions are unique, with exceptionally low car ownership and chronic underinvestment in public transport resulting in very little congestion but also a severe lack of mobility and high levels of pollution from the old vehicle stock. As the Cuban economy undergoes reforms, and international financing for climate change mitigation becomes available, new risks are emerging but also new possibilities for the development of a sustainable urban transport system. These conditions create the potential for fruitful research collaboration, with substantial policy impact.

Alison Fairbrass, Engineering Doctorate Student, Centre for Urban Sustainability and Resilience, UCL '[Developing accessible methods for urban biodiversity monitoring](#)' A growing body of evidence demonstrates a positive correlation between human health and well-being with biological diversity. In cities, efforts to increase people's contact with bioverse green spaces can be seen in the construction of 'green infrastructure' features such as linear parks, street planting, green roofs and walls. However, how well these features are supporting biodiversity is uncertain due to the difficulties associated with biodiversity monitoring. Traditional biodiversity monitoring methods tend to be both time intensive and require specialist skills, making understanding what we have in our back gardens, parks, and cities, inaccessible to the majority of people. The availability of smart-phone technology has put sound recording technology into the hands of many. We investigate the potential of this technology for monitoring biodiversity, by exploring the relationship between the diversity of the urban soundscape and the biodiversity in our cities.

Professor Graham Rook, Professor of Medical Microbiology (Emeritus) Centre for Clinical Microbiology, Department of Infection, & the National Institute for Health Research (NIHR) and UCL Hospitals Biomedical Research Centre, UCL '[Can urban greenspace and biodiversity reverse the worrying increases in chronic inflammatory disorders?](#)' In modern cities there are dramatic increases in illnesses associated with inappropriate inflammation and failing regulation of the immune system (allergies, autoimmunity, inflammatory bowel diseases, depression). This is partly attributable to a lack of exposure to organisms ("Old Friends") from mankind's evolutionary past that needed to be tolerated, and therefore evolved roles in setting up the mechanisms that regulate the immune system. Some "Old Friends" (such as parasitic worms and infections picked up at birth that established carrier states) are almost eliminated from cities. This increases city-dwellers' dependence on organisms derived from other people, animals and the natural environment. Microbial input from the natural environment drives immunoregulation and is a major component of the beneficial effect of greenspace, and a neglected "ecosystem service". This understanding will allow green spaces to be designed to optimise health benefits, and will provide impetus from health systems for their creation in sustainable cities.

Marco Poletto, Director ecoLogicStudio & BIO_UD Research Cluster Director, The Bartlett, UCL '[Bio Urban Design Lab - 'Cities as productive landscapes'](#)' The Bio Urban Design Lab promotes a non anthropocentric understanding of the urban landscape, intended as a territory of self-organization and co-evolution of multiple dynamical systems, and prefigures a future bio-active city able to synthesize renewable energies into food and power as well as wastes into raw material for construction and growth. On one side we research bio-mimetic models of self-organization to develop adaptive urban planning strategies, while on the other we investigate innovative protocols of constructability for "building with nature".

In our most recent project in Tunisia we focused on the study of social insects like ants and the protocols they evolved to collectively build their nests and forage for food; we then converted such protocols into computational design and optimization models to evolve new urban morphologies and food production networks, the "Edible Landscapes". We then researched the use of algae and bacteria to re-metabolize large manufactured landscapes (i.e. landfills) by means of bio-catalytic cells, the "Activated Living Drosscapes".

Sustainable Resources for Sustainable Cities Abstracts

Emily King, Senior Consultant, Environmental Resources Management (ERM) '[Sustainability Profiling](#)' Sustainability profiling involves using key performance indicators to help resource-intensive industries measure product and process footprints, influence materials selection and resource policy, respond to external changes, and improve reputation and competitiveness. As well as internationally agreed approaches, such as the GRI Sustainability Reporting Guidelines, sector associations like ICMM (mining and metals) and IPIECA (oil and gas) provide member companies with guidelines for sustainability profiling. Typically, these well-established approaches to sustainability profiling examine direct impacts such as resource consumption, emissions and waste, whereas indicators for resource efficiency are less well-represented. Despite this, resource efficiency indicators are being developed by individual companies. ArcelorMittal, for example, uses a metric for kg CO₂ saved through recycling of scrap steel, and Rio Tinto reports on the annual reduction in freshwater use per tonne of product. This presentation looks at options for strengthening the current set of internationally recognised indicators for resource efficiency.

Teresa Camarero-Esparza, PhD student, UCL Institute for Sustainable Resources & CEGE UCL '[Integrative Sludge Management](#):

[A focus on waste production and resource recovery](#)' Large-scale waste water treatment has led to a massive production of sewage sludge, a hazardous solid waste that also needs to be adequately managed. Such sludge is most often stabilized via anaerobic digestion, enabling it to be recycled as organic fertilizer and producing biogas. Being a widely implemented technology amongst the water industry, the EU is currently encouraging the latter to help out in the elimination of other organic wastes through sewage sludge co-digestion. Apart from increasing Europe's biogas yields, this new approach would largely divert such solid wastes from landfilling. Nonetheless, the extent to which the water industry is able to cope with a significant extra waste input is still to be elucidated. This research aims at enhancing sustainability in large-scale urban water treatment by integrative sludge management, focusing on waste production and resource recovery via anaerobic digestion.

Evgenii S. Matrosov, PhD Researcher, UCL '[Should we update England's water supply planning process?](#)' Planning appropriate portfolios of new water supplies and demand management measures requires considering a wide array of options. Existing planning frameworks often use single-objective least-cost optimisation-based methods, where an algorithm searches systematically for the best plan(s) under one or more sets of future conditions. These optimisers often grapple with the complexity of real systems and their operating rules and the uncertainty of future conditions. System models are often spatially and temporally aggregated to reduce the computational burden whilst non-economic performance measures (environmental, engineering etc...) must be translated into costs. We propose a planning framework that links a water resource simulator and a many-objective evolutionary optimisation algorithm to reveal the many-dimensional Pareto trade-off space. Using realistic simulators embedded into many-objective global optimisers allows the consideration of non-linear and rule-based physical and management processes that are integral to accurately describing real water systems. Planners can use many-objective visual analytics to explore the trade-off surfaces showing the tradeoffs between engineering, cost, social and environmental performance measures and interactively interrogate the impact of the Pareto-optimal infrastructure portfolios on the performance measures. We implemented the framework on the Thames water resource system planning problem. We considered both supply and demand management options to produce possible water system portfolios that satisfy future demand and regulatory performance constraints. We show how considering multiple objectives explicitly in the planning problem can eliminate potential decision bias that occurs with lower dimensional optimization and discuss how this multi-criteria approach could be integrated into water supply planning practices in the UK and beyond.

Dr Paul Hellier, Department of Mechanical Engineering, UCL '[Algal Bio-fuels for Sustainable Transport](#)' Liquid fuels derived from algae are attractive alternatives to existing fossil fuels and bio-fuels, as they can potentially contribute to reductions in anthropogenic emissions of CO₂ and do not compete with food production. However, the low density growth of algae in aqueous media requires a large energy input for harvesting of useful algal oils, with further chemical processing necessary for conversion to bio-fuels. This work presents results of an ongoing collaboration between UCL Department of Mechanical Engineering's Combustion and Fuels research group and at UCL's Institute of Structural and Molecular Biology. Engine tests of fossil diesel and wet algal slurry emulsions found that such emulsions, where wet algal slurry was used to reduce the energy required for harvesting, are suitable for fuelling a modern diesel engine. Further engine tests were conducted of several bio-fuels that may potentially be produced through genetic engineering of photosynthetic micro-organisms, with effects of fuel molecular structure observed.

Sabien Windels, Project officer at Interreg IV B project called "ZECOS", KAHO Sint-Lieven (University College Ghent: industrial engineering)

['Fuel poverty and financing methods for energy efficiency measures'](#) Present-day, fuel poverty is increasingly gaining political importance due to its impact on society and human health. Prices on the rental housing market continue to rise so that affordable and decent housing is hard to find. In order to increase ownership for vulnerable groups, policy makers aim to facilitate access to buyer's markets. Examples are Community Land Trust, Social housing buyer's market, etc. The downside of these initiatives is that houses are often in poor state and need retrofitting. In this paper, we will examine strategies for vulnerable groups to refurbish their homes, taking into account a limited budget. Focus will be on energy efficiency. Moreover, we will examine how implementing these measures influences the total energy efficiency of the dwelling, making use of applied EPB software. Furthermore, this paper provides financial insight with regards to the cash flows resulting from these measures. Finally, the main challenges for implementing these measures are discussed and best practices from North-West European countries are presented.

Sustainable Resources for Sustainable Cities Abstracts

Professor Peter Jones, Professor of Transport and sustainable development, UCL, '[Developing an interactive tool to explore household resource use and how this might be reduced.](#)' One important contributor to achieving the more sustainable use of natural resources is to encourage households to adopt sustainable daily consumption patterns, both inside and outside the home.

This project has set out to develop a specification for a computer-based tool which can be used in interactive household interviews to examine current use of resources, and to explore how these patterns might be modified – both marginally and radically – to reduced overall resource consumption, either in response to market forces (e.g. price signals) or aspirational target reductions levels (e.g. CO₂). It has focused primarily on energy use, but can be extended to other categories of resources (e.g. water consumption). It has involved interviews with members of the public and interested groups, to help shape the specification and respond to proposals, which have been presented as a sequence of screen shots which take respondents through the various stages of a hypothetical interview.

Oliver Wilton, Senior Teaching Fellow, The Bartlett School of Architecture & **Dr Jake Hacker**, Visiting Professor in Building Engineering Physics, UCL Energy Institute '[Phase Change Material Thermal Stores](#)' This research project addresses the applicability of inorganic PCM (Phase Change Material) thermal stores in sustainable building design in Europe, with the objectives of evaluating the viability and identifying environmental benefits and any potential disbenefits.

PCM thermal stores in buildings have the potential to provide significant energy savings by delivering highly controllable passive summertime cooling (helping to combat the ever-increasing use of active cooling) and wintertime tempering of incoming air (eliminating cold draughts associated with discomfort and that can result in a raising of the heating set point).

The project focuses on inorganic PCMs which are currently not widely used in buildings. These are available at a range of freezing points to suit different applications and are readily available, relatively low cost and non-flammable (unlike wax-based organic PCMs).

Shoshanna Saxe, PhD Student, University of Cambridge '[A methodology for accessing the net GHG impact of new metro rail](#)' The transportation sector is lagging behind housing, industry and power in reducing greenhouse gas emissions. Transportation already accounts for 1/5th of London's CO₂ emissions. Cities are challenged by the apparent conflict between meeting growing transportation needs and simultaneously reducing environmental emissions. The availability of transportation infrastructure governs how goods and people flow through urban environments, and the associated environmental effects. The provision of new metro urban rail infrastructure is often proposed to reduce the environmental impacts of transportation. The environmental costs and benefits of new metro urban rail need to be more fully understood. On one hand, the underground infrastructure required for many urban rail projects is particularly resource intensive. On the other, urban rail has been shown to attract and concentrate development and can be a driver in creating sustainable communities. A quantitative methodology is proposed for assessing the net GHG impact of new metro urban rail.

Dr. Susan E. Lee, Research Fellow, University of Birmingham '[A City Design Framework to Elucidate Urban Challenges: Energy Flows of Birmingham](#)' Natural resources are in ever-increasing demand by cities, particularly as urban environments grow and the climate changes. The Liveable Cities project was established to understand how cities operate and perform in terms of their people, environment and governance, and to establish how urban performance relates to future visions of sustainable living, working, conserving and consuming. Furthermore, the project seeks to create both realistic and radical engineering solutions to support these visions.

This paper describes the development of a city design framework (CDF), including its philosophy and structure. The CDF provides a method for determining a city's current situation, comparing this to the city's intentions as expressed in its policies and contrasting these with the Liveable City vision. To inform the CDF, resource data are required. Current energy flows and energy consumption within Birmingham are presented. These are compared against the city's energy policies. The efficacy of this technique is assessed.

Charlotte Johnson, Research Associate, UCL ISR '[Mapping UCL research on sustainable cities and sustainable resources](#)' Cities face critical challenges as urban populations grow, demands on urban resources increase and climate change requires cities to have comprehensive adaptation and mitigation strategies. UCL is committed to researching these processes through its Grand Challenge of Sustainable Cities. Part of this initiative has been a mapping exercise to identify current work on cities and resources. UCL's multi-disciplinary research landscape has been surveyed through the lens of environmental justice in order to question the relationships between urban socio-technical forms, metabolic processes and the knowledge produced to shape these forms and flows. Martin Zaltz Austwick from CASA has created an interactive map which enables users to navigate UCL's research and find transdisciplinary connections amongst researchers.

Complementing this critical engagement with urban forms and resource use is a short film on sewage. Three UCL academics discuss their take on London's drainage, exposing the contested history and alternative futures of London's Victorian infrastructure.

Dr Paula Owen, Founder, Chief Fun & Gamer, Eco action games '[Eco Action Games - an interactive event](#)' Paula and her team will be on hand during the networking and drinks event to demonstrate some of the environmentally focused games she has created that help to educate, engage and inform the wider public and community groups on the subjects of environmental sustainability and what they personally can do to reduce their impact on the planet and cut down on their resource consumption. Paula has run events in a host of diverse locations such as the Science Museum, Natural History Museum, primary schools, Ernst & Young, festivals, The Tate and Age UK residential day-care centres. The evidence she has collected at these events is beginning to show the power inherent in such an approach to engage the previously unengaged sectors of society and to encourage them into taking action <http://ecoactiongames.org.uk>.

The UCL Institute for Sustainable Resources (ISR) generates knowledge by supporting cross-disciplinary research approaches to promote the globally sustainable use of natural resources.



Dr Michele Acuto, Senior Lecturer in Global Networks & Diplomacy, Department of Science, Technology, Engineering & Public Policy (STeAPP); UCL. Michele Acuto is

Senior Lecturer in Global Networks & Diplomacy in the Department of Science, Technology, Engineering and Public Policy (STeAPP) at University College London (UCL). Michele is also a Fellow of the Programme for the Future of Cities at the University of Oxford, and a Fellow of the Center on Public Diplomacy at the University of Southern California (USC). He has taught at Oxford, Australian National University (ANU) and University of Canberra, after working for the International Campaign to Ban Landmines and the Kimberley Process on conflict diamonds. At UCL he serves as Research Director for STeAPP and coordinates the City Leadership Lab initiative. He is the author of *The Urban Link*, editor of *Negotiating Relief* and co-editor of the Palgrave series *Cities and the Global Politics of the Environment*, *Reassembling International Theory and Global City Challenges*.



Dr Robert Biel, Senior Lecturer, Development Planning Unit, UCL. Robert Biel teaches Political Ecology and Urban Agriculture at UCL Development Planning

Unit. A practicing urban farmer, he experiments with a no-till organic method combining high productivity with low input of labour. He helped initiate the ABUNDANCE project for food-growing on low-income housing estates, part of UCL's UrbanBuzz programme, and recently presented to Parliament on the impact of peak oil for food security. In his published work, notably *The Entropy of Capitalism* (2012 : <http://bit.ly/XiueL2>), Biel employs general systems theory to reveal the current crisis as a phase in which capitalism begins to parasitise upon the chaos it itself creates.



Professor Raimund Bleischwitz, BHP Billiton Chair in Sustainable Global Resources, UCL ISR. Raimund Bleischwitz is the BHP Billiton Chair in Sustainable Global

Resources, UCL ISR. Until July 2013 he had been Co-Director on 'Material Flows and Resource Management' at the Wuppertal Institute (WI) in Germany. Since 2003 he has been Visiting Professor at the College of Europe in Bruges, Belgium. He spent fellowships at the American Institute for Contemporary German Studies at Johns Hopkins University in Washington D.C., at the Transatlantic Academy in Washington D.C. and with the Japanese Society for the Promotion of Science. Publications include 'Sustainable Resource Management' (Greenleaf 2009) and 'International Economics of Resource Efficiency' (Springer 2011).



Teresa Camarero-Esparza, PhD student, UCL ISR & CEGE UCL.

Teresa began her career as a natural scientist, receiving a Honours BSc in Environmental Biology and an MSc in Sustainable Ecosystem Management from the Complutense University of Madrid. She has always been very interested in freshwaters. Her HBS thesis was a dam's EIA; where she assessed stream habitat condition in relation to land use, getting a paper published on the topic. Since 2010, Teresa has been working as a R&D researcher in sewage treatment. She is now in her second year of her PhD at ISR and is looking at how to enhance sewage treatment sustainability via resource recovery.



Dr Vanesa Castán Broto, Lecturer, Bartlett Development Planning Unit, UCL. Vanesa Castán Broto is a lecturer at the Development and Planning Unit (DPU), UCL, since

2011. Prior to coming to the DPU she was a researcher in Durham University and in Forest

Research. She has a doctorate from the University of Surrey and degrees from Wageningen University (The Netherlands) & the Universidad Politécnica de Madrid (Spain). Vanesa's research is concerned with fostering progressive change to achieve socially and environmentally just cities. Her research has engaged with comparative analyses of urbanisation and innovation in different cities around the world, including Tuzla (Bosnia and Herzegovina), Bangalore (India), Monterrey (Mexico) and Maputo (Mozambique). Vanesa is a co-editor of the book on *Cities and Low Carbon Transitions* (2011, London: Routledge) and she co-authored one of the chapters in the UN-Habitat *Global Report on Human Settlements on Cities and Climate Change* (2011, London; Earthscan). She has published on climate change, urbanisation and environmental justice.



Rt Hon Charles Clarke, Honorary Professor of Economic Policy & Migration, UCL. Charles Clarke read mathematics and economics at Kings College Cambridge. He is

now holds Visiting Professorships at the University of East Anglia, the University of Lancaster and University College London. He was President of the National Union of Students and then a Labour councillor in Hackney before working for Neil Kinnock, the Leader of the Labour Party, as his Chief of Staff. He was elected Labour MP for Norwich South from 1997 to 2010. In 1998 he joined the government, first as a junior Minister and then joining the Cabinet in 2001 as Labour Party Chair, then Secretary of State for Education and Skills and finally Home Secretary until 2006. He is married with two sons. www.charlesclarke.org



The UCL Grand Challenge of Sustainable Cities (GCSC) seeks to rally the breadth of expertise at UCL – in partnership with external agencies – to address aspects of the major problems facing cities in the 21st century.



Alison Fairbrass, Engineering Doctorate Student, Centre for Urban Sustainability & Resilience, UCL. Alison holds a Masters in Conservation Science

(Imperial College London) and is an EngD Research Engineer at the Centre for Urban Sustainability and Resilience (University College London). She first began working with urban biodiversity while as an undergraduate at the University of Birmingham where she studied ecological populations including bats and pollinators. Alison has also worked in the commercial sector advising developers on the use of ecological design to enhance for biodiversity in the urban environment.



Professor Herbert Giradet, Co-Founder, World Future Council.

Professor Herbert Giradet is co-founder and former director of programmes of the World Future Council. He is a member of the Club of Rome and the World Academy of Art and Science. He is a recipient of a UN Global 500 Award for outstanding environmental services. He has been consultant to several UN organisations and to major cities such as London, Vienna, Adelaide, Riyadh and Bristol. He is visiting professor of the University of the West of England. He has authored many documentaries, books and reports on sustainable and regenerative development. His new book, *Creating Regenerative Cities*, will be published in May 2014.



Dr Jake Hacker, Visiting Professor in Building Engineering Physics, UCL Energy Institute.

Jake Hacker is the Royal Academy of Engineering & CIBSE Visiting

Professor in Building Engineering Physics

at UCL and a Principal Teaching Fellow at the UCL Energy Institute. Jake also works at Arup where he is part of a specialist building physics team providing computational analysis and design advice to Arup projects. Recent projects he has worked on include the 'Cheesegrater' (122 Leadenhall) in London with Rogers Stirk Harbour and a large naturally ventilated office campus building in San Francisco with Foster + Partners. Jake is also responsible for the development of Arup's in-house dynamic thermal modelling software.



Dr Paul Hellier, Department of Mechanical Engineering, UCL. Dr. Paul Hellier is a researcher in the experimental and inter-disciplinary

development of future liquid fuels. Following his graduation from Cardiff University in 2008 (Environmental Engineering MEng 1st Class Hons.), he successfully completed his PhD with UCL's Department of Mechanical Engineering, in which he investigated the impacts of liquid fuel molecular structure on the efficiency of combustion and the emission of pollutants. He has collaborated extensively with industry (BP Global Fuels) and also fellow researchers, in particular Dr. Saul Purton of UCL's Institute of Structural and Molecular Biology in the design of liquid fuels from micro-algae.



Charlotte Johnson, Research Associate, UCL ISR. Charlotte Johnson is an anthropologist researching urban infrastructure and energy. Her interest lies in

understanding urban transitions; her PhD focused on post-socialist and post-conflict transitions while her current work is on low carbon futures. Cont.

At UCL ISR we are committed to the globally sustainable and equitable use of natural resources. Our definition of resources is broad, and our research approach is equally inclusive.



She uses a material culture perspective to analyse the complex interactions between social, material and environmental factors that shape the way that resources are consumed in cities and to understand how urban metabolic processes evolve.



Professor Peter Jones, Professor of Transport and sustainable development, UCL. Peter Jones is Professor of Transport and sustainable development. His PhD,

DIC (Engineering) Thesis from Imperial College was entitled: 'The development of a new approach to understanding travel behaviour and its implications for transportation planning'. Before joining UCL in 2005, Peter was director of the Transport Studies Group at the University of Westminster where he carried out numerous research projects funded by organisations including the Department for Transport, the European Commission, the Joseph Rowntree Foundation, and BAA. He is a member of the Independent Transport Commission, the London Roads Task Force, the UCL Grand Challenges Sustainable Cities theme leader for Transport & Sustainable Mobility, and Chair of the RGS-IBG Transport Geography Research Group. He is Overseas Special Advisor to the International Association of Traffic and Safety Sciences, Japan, and a member of the International Steering Committee for the International Travel Survey Conference and a member of the Technical Committee of the South Africa Transport Conference. He has also acted as a consultant to Transport for London, the European Commission and several national and local governments.



Emily King, Senior Consultant, Environmental Resources Management (ERM). Emily King (BEng MPhil CWEM Cenv) is a Senior

Consultant within ERM's Global Product Sustainability Services team. Her experience ranges from producer responsibility and product compliance to eco design and product carbon footprinting. In recent years she has developed a special interest in materials stewardship and supply chain management and has completed projects for a wide range of clients in the Mining and Metals value chain.



Dr Susan E. Lee, Research Fellow, University of Birmingham. Susan has worked across several disciplines including Architecture and Engineering as well

as Meteorology, Ecology and the Environmental Sciences. She has extensive experience of environmental modelling and has published in a variety of journals including a paper in Nature. Prior to her research fellowship on the Liveable Cities Programme at Birmingham University, Susan worked at Leeds, Manchester and Sheffield Universities on a number of research projects, including the EPSRC funded SCORCHIO Project (2007-2010) studying the impact of climate change on the built environment. During the 1980's Susan worked as a weather forecaster for the UK Meteorological Office.



Evgenii S. Matrosov, PhD Researcher, UCL. Evgenii Matrosov is a PhD researcher focusing on water resource system planning and management at the

University of College London. His research uses multi-criteria and decision-making under uncertainty methods to inform the planning process and to promote robust and resilient systems. Cont.

“The urban metabolism of the future may be characterised by a lower use of primary resources, re-use of most resources including nutrients, a solarised blue green infrastructure, and a new culture of urban biodiversity & gardening, along with new materials and patterns of mobility. The UCL ISR aims to generate knowledge to promote the sustainable supply and use of resources worldwide, with a particular emphasis on cities and industry.”

Evgenii is the main researcher for the ‘Water Resources of East Anglia’ (WREA) project and is developing a regional model and a water supply planning under uncertainty framework for the Environment Agency and the five water companies in East Anglia. His PhD research is part of the EPSRC funded ARCC - Water ‘adaptive and resilient water systems’ project.



Dr Emily Morris, Research Associate, UCL Institute of the Americas. Emily Morris is a Development Economist, with a focus on Latin America and the

Caribbean. Before completing her doctorate in 2012, on Cuban economic policy and performance since 1990, she worked for 13 years on Latin America at the Economist Intelligence Unit, where she was Senior Economist. She has also lectured in Economic Development at SOAS, London Metropolitan and Sussex Universities.



Dr Yacob Mulugetta, Reader, Centre for Environmental Strategy, University of Surrey. Yacob Mulugetta is a Reader in the Centre for Environmental Strategy at

the University of Surrey, UK. He has a background in earth sciences and energy systems. He is the founding member of the African Climate Policy Centre (ACPC) at the UN Economic Commission for Africa (UNECA) based in Addis Ababa, Ethiopia where he worked on the opportunities and constraints of pursuing low carbon development for economic transformation. Yacob has 20 years of research, teaching and policy advice experience specializing in the links between infrastructure provision (energy mainly) and human welfare, rooted in sustainability principles of equity and environmental stewardship. He has extensive experience of managing and conducting research and policy analysis in the areas of energy development, climate change and innovation. He currently serves as a Coordinating Lead Author of the Energy Systems chapter of the IPCC’s 5th

Assessment Report (Working Group III on Mitigation), and is a member of the core writing team for the IPCC synthesis report.



Professor Tadj Oreszczyn, Director, UCL Energy Institute, Director, RCUK Centre for Energy Epidemiology (CEE) & Professor of Energy and Environment. Tadj

Oreszczyn MCIBSE MInstE, PhD, CEng is Professor of Energy and Environment and Director of the UCL Energy Institute University College London. Previously Professor Tadj was the Director of the Energy Design Advice Scheme (EDAS) regional office based at the Bartlett, UCL. Subsequently, Tadj was Head of the Bartlett School of Graduate Studies for 7 years and for 4 years, Vice Dean Research for the Bartlett Faculty of the Built Environment. Tadj has provided research support for the development of the English and Welsh Building Regulations. He has presented invited public and academic lectures at the Royal Society and the Royal Institution. Tadj is a member of the UK Department of Energy and Climate Change Scientific Advisory Group and the Scientific Council of the EU Energy Efficient Building (E2B) programme.



Dr Inge Paulini, Secretary General, German Advisory Council on Global Change. Inge Paulini holds a diploma in Nutrition (University of Bonn, Germany), a Master

of Science in Nutrition (Washington State University, USA) and a doctorate in biology (University in Hannover, Germany). From 1993 – 2008, Inge Paulini worked for the Umweltbundesamt (German Federal Environment Agency) in different fields of scientific policy advice for the Federal Government, e.g. a range of health related environmental topics and evaluation of impact assessment and life cycle analysis. Later, she was head of the section “Environmental impacts of detergents; Risk management for chemicals” and head of the section “General affairs, environmental strategies,

research planning” and thereafter served as head of the department “Strategies for sustainable development and information” with sections working on environmental strategies including resource efficiency; instruments for environmental protection (legal, economic, planning); international environmental regimes, politics and policies and others. Since 2009, she is Secretary-General of the German Advisory Council on Global Change (WBGU).



Marco Poletto, Director ecoLogicStudio & BIO_UD Research Cluster Director, The Bartlett, UCL. Marco Poletto is an engineer, architect, ecologist and educator. He co-founded

in London ecoLogicStudio, a multidisciplinary research practice focussing on new forms of digital algorithmic design, biotechnology and the development of strategic and critical concepts of urban self-sufficiency. His work has been exhibited and published internationally and includes the design and engineering of responsive architectural and urban prototypes, living artificial assemblages deployed to demonstrate future practices of ecologic urbanism. Marco has been unit master at the Architectural Association in London, the IAAC in Barcelona and Visiting Critic at Cornell University. He is now leader of the new BIO Urban Design Research Cluster at the Bartlett UCL. The cluster’s research combines virtual and physical environments to radicalize our contemporary experience of nature and prefigure new typologies of urban landscapes. Within these spatial and experiential frameworks the urban energy, waste, water and food cycles are re-engineered as synthetic hybrids of matter and digital information.

“Cities face critical challenges as urban populations grow, demands on urban resources increase and climate change requires cities to have comprehensive adaptation and mitigation strategies.”



Professor Graham Rook, Professor of Medical Microbiology (Emeritus) Centre for Clinical Microbiology, Department of Infection, & the National Institute for Health

Research (NIHR) & UCL Hospitals Biomedical Research Centre, UCL. Graham Rook studied natural sciences at Cambridge, UK, before qualifying in clinical medicine in London. Since 1994 Prof. Rook has held the post of Professor of Medical Microbiology at UCL.

A major interest has been the cause of the faulty regulation of the immune system in high-income countries (particularly in cities) that is driving massive increases in chronic inflammatory disorders such as allergies, autoimmunity, inflammatory bowel disease and some forms of depression. G.R. also co-founded a biotech company (Silence Therapeutics plc.), and is co-inventor of numerous patents. Some of G.R.'s publications can be accessed at <http://tinyurl.com/Graham-Rook> or <http://www.grahamrook.net/>.



Shoshanna Saxe, PhD Student, University of Cambridge. Shoshanna Saxe (B.Eng M.Sc P.Eng LEED AP) is a PhD candidate in the Centre for Sustainable Development

at the University of Cambridge. She is a certified Professional Engineer in Canada and a LEED Accredited Professional. Shoshanna's research investigates the intersection of metro rail infrastructure and urban environmental sustainability. She completed a Bachelor of Engineering and Applied Mechanics at McGill University in Canada (2007) and a Master's of Science in Engineering at the Massachusetts Institute of Technology in The USA (2009). From 2009 to 2012 Shoshanna worked on the design and construction of new metro stations in Toronto, Canada.



Dr Ian Scott, Principal Facilitator, UCL Grand Challenges. Ian Scott is Principal Facilitator of the UCL Grand Challenges programme, a central feature of UCL's Research

Strategy, which aims to: cultivate leadership founded in excellence; foster cross-disciplinarity grounded in expertise; and realise the impact of a global university. Ian joined UCL in 2009 from the Wellcome Trust, where he held responsibility for grants programmes relating to Neuroscience and Mental Health, Population and Reproductive Health, and UK-former Soviet bloc collaboration. Before joining the Wellcome Trust in 1987 he pursued postdoctoral research on calcium in neuronal and lymphocyte cell activation in Dundee, Helsinki and London. Ian is a graduate of the Universities of Liverpool (BSc Biochemistry) and Bristol (PhD Skeletal muscle mitochondrial metabolism).



Professor Andres Sevtsuk, Assistant Professor in Architecture and Sustainable Design, Singapore University of Technology and Design. Andres Sevtsuk is an

Assistant Professor of Architecture and Planning at the Singapore University of technology and Design (SUTD). He leads the City Form Lab at SUTD, which investigates urban form and its influence on the social, economic and environmental performance of cities using state of the art spatial analysis tools. Andres joined SUTD in 2011 from MIT, where he spent the previous seven years, initially as a student and then as a lecturer in Architecture and Urban Studies & Planning. He holds an SMArchS in architecture and urbanism, and a PhD in urban design and planning from MIT and completed his earlier studies at L'École d'Architecture de la Ville & des Territoires in France. Andres has worked as an architect, urban designer, consultant and researcher in Europe, United States and Singapore. He has led a number of international research projects, published a articles and book chapters and presented

his work at various international events, including TEDx and the World Cities Summit and the Venice Architecture Biennale.



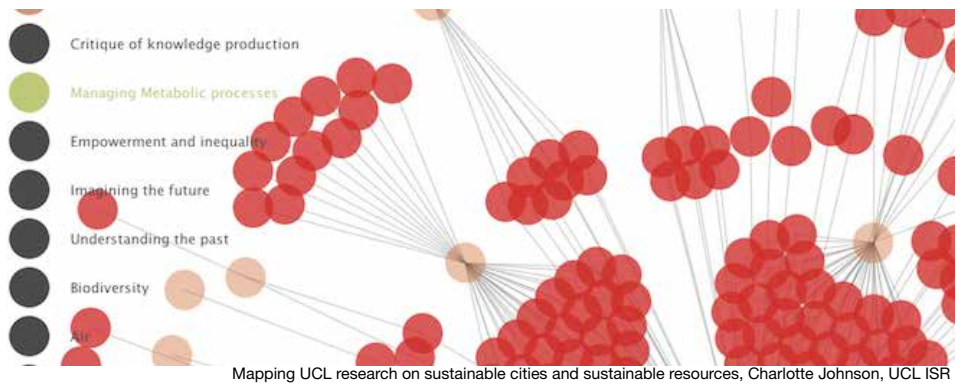
Dr Lily Song, Provost (Postdoctoral) Fellow, UCL. Lily Song is an urban planning researcher and practitioner with a background in community organizing and policy

advocacy. Her areas of interest include urban justice, sustainability, and livability; alternative local economic and workforce development; and shared value creation efforts among civil society, public sector, and private sector actors. Lily holds a PhD in Urban and Regional Planning from MIT; Master's in Urban Planning from UCLA; and BA in Ethnic Studies with a Minor in Business Administration from UC Berkeley. She is currently residing in Singapore, where she is conducting research on urban inequality, formalization of street vending, and urban governance challenges facing rapidly growing "secondary cities" in the greater Southeast Asian region.



Dr Catalina Spataru, Senior Research Associate, UCL Energy Institute. Dr Catalina Spataru is a Senior Researcher at UCL Energy Institute. She has a

background in mathematics, physics and computing science and a PhD in engineering. Her past and current research is interdisciplinary in nature, and current main interests and in the technical and economic integration of renewable energy alongside energy efficiency in dynamic energy systems; smart super grids; security of supply and prevention of blackouts; being interested in tackling energy research problems which can help in policy decisions. She is the Scientific Chair of Building Simulation and Optimization Conference to be held in London in 2014.



“Cities - densely packed, complex, built systems - are home to nearly half the of world’s population. With this trend of increasing worldwide urbanisation set to continue, urban sustainability has been identified as a key area of societal relevance, an area in which a solid research base can inform policy and practice.”



Dr Emma Terama, Research Associate, UCL Department of Science, Technology, Engineering and Public Policy (STeAPP)

UCL. Dr Terama obtained her doctorate at Helsinki University of Technology in 2007. She was an active volunteer for Finnish UNICEF engaging her in questions about sustainable development, well-being and human rights. In 2007-08 she held an Academy of Finland mobility grant, which she chose to spend at IIASA (www.iiasa.ac.at) because of their excellence in Population and Sustainable Environment research. The fellowship that followed was on combining quantitative Population and Environment research, initially at University of Amsterdam and the Finnish Environment Institute, later on at the UCL Environment Institute. In Amsterdam she was involved in teaching Introduction to Development Studies and did field work in Mumbai. In the UK, Emma has consulted for BIS on the Future of Cities and Corpra (now part of Concerto) for an Engineering & Technology Learned Society. She has worked on EU & Academy funded projects around Urban and Climate issues.

architect in private practice, undertaking a broad range of architectural, strategic advisory and environmental design consultancy.



Sabien Windels, Project officer at Interreg IV B project called “ZECOS”, KAHO Sint-Lieven (University College Ghent: industrial engineering). In 2011,

Sabien Windels obtained a master’s degree in commercial engineering at Ghent University. After working a year and a half for a consultancy firm, Sabien currently works at the Sustainable Building research group at the Catholic University College Ghent, as a project officer on the Interreg IVb ZECOS-project. Her overall interests lie in climate policy and blue economy (cradle to cradle).



Oliver Wilton, Senior Teaching Fellow, The Bartlett School of Architecture. Oliver Wilton is a Senior Teaching Fellow in the Bartlett School of

Architecture, teaching environmental design and sustainability on the BSc and MArch programmes, and is a tutor on the MSc Environmental Design and Engineering programme in The Bartlett School of Graduate Studies, dealing with the critical issues of building environmental performance, energy and occupant comfort. Oliver is an Academic Co-Director of the UCL Royal Academy of Engineering Centre of Excellence in Sustainable Building Design and also an



Sustainable Building Products Research Grant Winner

Our Research Grant competition awarded one prize of up to £15,000 for a 12-18 month research project, as part of the BHP Billiton Sustainable Communities/ UCL Grand Challenges Symposium to investigate the role of sustainable building products in the urban environment.

Phase Change Material Thermal Stores

Oliver Wilton is a Lecturer in Environmental Design at The Bartlett School of Architecture and a practicing architect. Jake Hacker is a RAEng Visiting Professor of Building Engineering Physics at the UCL Energy Institute and a building physicist at Arup. Nick Hopper is the Technical Director of Monodraught Ltd, an innovator in the field of PCM thermal stores responsible and for the design and manufacture of the CoolPhase system. The project addresses the applicability of inorganic PCM (Phase Change Material) thermal stores in sustainable building design in Europe, with the objectives of evaluating the viability and identifying environmental benefits and any potential disbenefits.

PCM thermal stores in buildings have the potential to provide significant energy savings by delivering highly controllable passive summertime cooling (helping to combat the ever-increasing use of active cooling) and wintertime tempering of incoming air (eliminating cold draughts associated with discomfort and that can result in a raising of the heating set point).

The project focuses on inorganic PCMs which are currently not widely used in buildings. These are available at a range of freezing points to suit different applications and are readily available, relatively low cost and non-flammable (unlike wax-based organic PCMs).

Some key activities being undertaken are noted below:

1. Background research on inorganic PCMs.
2. Work to ascertain the potential role and benefits of the use of PCM thermal stores in buildings in Europe.
3. Work to ascertain and describe the design principles for a range of applications of PCM thermal stores in sustainable building design considering retro-fit and new build applications.
4. Sketch design of a number of building products/systems incorporating PCM thermal stores in low energy thermal regulation.
5. Selection of a case study building and building performance modelling looking at options including natural ventilation and no cooling, full HVAC and the use of PCM thermal stores with hybrid ventilation to ascertain potential benefits.
6. Construction and testing of a physical prototype of one of the products developed under the previous points. The prototype will then be installed and tested in a live building.
7. Workshops involving an assembled industry panel to address potential benefits and identify the barriers to broad adoption of this technology.

Mapping UCL research on sustainable cities and sustainable resources

Project lead: Charlotte Johnson, Research Associate, UCL ISR

This project funded as part of the BHP Billiton Sustainable Communities/UCL Grand Challenges Symposium draws together the diverse range of UCL's research on cities and resources to strengthen the university's multi-discipline research culture and identify new approaches to researching urban sustainability.

Cities are facing critical challenges as urban populations grow, demands on urban resources increase and climate change requires cities to have comprehensive adaptation and mitigation strategies.

UCL is committed to researching these processes and, through its Grand Challenge on Sustainable Cities, has created a vehicle to bridge disciplinary divides and create novel research.

Part of this initiative has been a mapping project to identify current research on cities and resources, make connections between different perspectives and present these connections in an engaging way.

The resulting map is an interactive tool to navigate UCL's multi-disciplinary research landscape. Created by Martin Zaltz Austwick from the Centre of Advanced Spatial Analysis and Charlotte Johnson from the UCL Institute of Sustainable Resources it presents not only a snapshot of current research activities, but also provokes critical engagement with the way that knowledge about cities and resources is produced. It is a map that continues to evolve and researchers are encouraged to experiment with the tool, and are asked to add new projects, perspectives or provide feedback through UCL ISR's website.

Complementing this critical engagement with urban forms and resource use is a short film on sewage. Three UCL academics discuss their take on London's drainage, exposing the contested history and alternative futures of London's Victorian infrastructure.

To make any additions or alterations to the research map, please visit this link: opinio.ucl.ac.uk/s?s=25956



Mapping UCL research on sustainable cities and sustainable resources, Charlotte Johnson, UCL ISR

Sustainable Resources for Sustainable Cities Catalyst Grants Winners

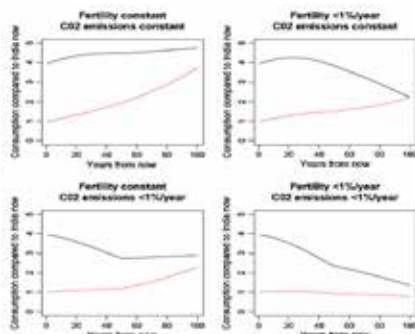
Our Catalyst Grant competition awarded five £5,000 awards as part of the BHP Billiton Sustainable Communities/UCL Grand Challenges Symposium. The grants were aimed at enabling researchers to develop realistic and relevant research partnerships across disciplines, and research strategies with the potential for significant national or international impact. The grants were designed to facilitate the development of projects which have the potential to produce on-going research activity.

Population Change and Energy Consumption in the Urban Transition

Lead: Dr Emma Terama, Research Associate, UCL STEaPP, UCL
Main collaborator: Professor Georgina Mace, Centre for Biodiversity & Environment Research, UCL

The project Population Change and Energy Consumption in the Urban Transition has generated some great contributions and discussion. Georgina Mace, I and Tim Coulson (Oxford) published a journal article in Environmental and Resource Economics (ERE) titled Perspectives on International Trends and Dynamics in Population and Consumption. In addition, I gave a talk about the project at the British Society for Population Studies annual conference in Swansea and at the TWRI conference on Census and Population Change – Impact on Planning, Land Use and the Environment as well as sharing some highlights at the fun UCL Engineering ‘How much could you get across in 400 seconds’ theme evenings.

Our findings so far underline the need for a close look at the pressures on environmental resources. Identifying population as a main driver, together with fertility and consumption may propagate our understanding of sustainability futures. The featured impact futures in terms of population numbers and consumption paint a picture of opportunity as well as threat.



Dr Emma Terama, UCL



Dr Emma Terama, UCL

It matters greatly for our resource future what the population structure entails, but also what the consumption trends are. We can affect the course of such trends.

A positive outlook arises from enabling smaller populations or a reduced impact through declining individual consumption. Global population growth is expected to stabilize somewhere in the latter half of the 21st century as fertility rates decline, but the inertia in the population is such that even with rapid reductions in fertility there is a lag in impact, especially in countries where the age structure is relatively young. In contrast reductions in individual impact, achieved through e.g. reduced emissions (improved energy efficiency can play a great role), can have immediate effect in reducing environmental pressures. Our results show that lasting, sustainable reductions in impact are seen with commitments to reductions in consumption and concomitant low fertility such as typically found in urban areas. The work continues with implementing data from China, Mexico, UK and the US for a comparative study.

More work is needed to systematically investigate different regional and country contexts, consumption types, links to household composition and age patterns of consumption. One may break down emissions data further according to categories such as industry, transport, domestic, as well as by affluence. The results of these studies may inform the debates of urban growth and sustainability, the need for more planning and governance regarding consumption, the unmet need for family planning, and resource use globally. Further considerations may include coupling with land-use change scenarios to account for increasing meat demand, and breaking down emissions to source components.

Common Road to 2050: Energy Networks and Policy Design

Lead: Dr Catalina Spataru, Senior Research Associate, UCL Energy Institute
Main collaborator: Dr Michael Emes, Dept of Space & Climate Physics, UCL.

Grand challenges such as climate change and energy supply security require substantial changes to current policy. Common Road to 2050: Energy Networks and Policy Design (ENP 2050) attempts to draw out the technical and policy challenges of achieving stable energy networks in the future, in light of a different and varied composition of energy resources meeting demand in a low-carbon world. The project evaluated the overall perception, opportunities and challenges in adopting various energy resources in the UK.

Two distinct, descriptive scenarios pathways with decadal developments (black, grey, blue and green steps) for the development of a low-carbon energy system in the UK by 2050 have been proposed and analysed. Whilst both achieve long-term decarbonisation and have commonalities such as development in energy demand, they each result from different short-term priorities of the energy trilemma – energy security, energy affordability and emission mitigation. A forum of stakeholders has been formed and different stakeholders (academics, researchers, governmental organisations and supply industry representatives) have been brought together in one-day workshop to discuss the challenges of combining various energy resources and the impact of the future energy networks, by discussing potential policies needed from the Government by different industries: gas industry (including shale gas, biogas and hydrogen), oil industry (including petrol/diesel and biofuels), coal industry (including CCS), nuclear industry, wind industry, other renewables (including solar, biomass and microgeneration).

The development and demonstration of commercially viable CCS was voted as the key priority for both the coal and gas industries, in both scenarios. This indicates the belief that the reduction of CO₂ emission from these sources is the key challenge over other issues such as security and cost of supply, and incentives to invest in new installations, were required.

More information on the project findings and workshop can be found at the link www.ucl.ac.uk/energy-networks-policy

Delivery of Urban Biodiversity Networks

Lead: Dr Helena Titheridge, Centre for Urban Sustainability & Resilience, UCL
Main Collaborator: Professor Kate Jones, Centre for Biodiversity & Environment Research, UCL

The field of urban biodiversity monitoring is in its infancy but is one of exciting and rapid innovation. The potential of the soundscape to help us understand and monitor biodiversity in the urban environment has not been previously explored, yet has the potential to make the monitoring of urban biodiversity accessible to a wide audience as the availability of smart-phone technology has made sound recording technology easily accessible.

The UCL ISR Catalyst Grant was used to kick-start the development of a biodiversity monitoring technique for the urban environment based on the theory that acoustic diversity can be used as a proxy for biodiversity. Supported by the Catalyst Grant, a suite of recording equipment was deployed across the city of London during the summer of 2013, recording everything from the hum of planes to the ultrasonic chirps of bats. Recordings were ground-truthed with comprehensive biodiversity surveys, allowing us to explore the relationship between acoustic diversity and actual biodiversity. This work, conducted throughout the summer across the city, has given us a wonderful picture of what the urban soundscape looks and sounds like, allowing us to explore the links between the anthrophony (human-associated sounds), geophony (non-biological ambient sounds of wind, rain, thunder, and so on), and biophony (sounds created by organisms) in the urban environment. Now back in the lab after our summer of recording, we are delving into the data exploring the temporal and spatial patterns in the urban soundscape. We are testing a number of methods developed in environments such as rainforest and grasslands to generate indices of biodiversity from acoustic diversity. The urban environment has its own unique patterns of sound and we will be adapting these methods, using our recordings from this summer, to develop a method of biodiversity monitoring unique to the urban environment.



Developing an interactive tool to explore household resource use and how this might be reduced

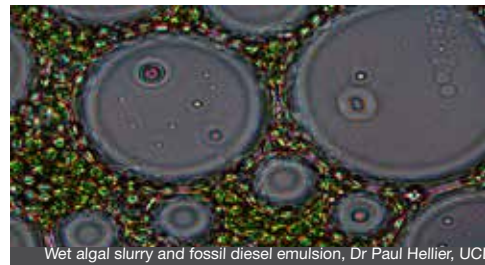
Lead: Peter Jones, Professor of Transport and sustainable development, UCL.
Main collaborator: Dr Robin Hickman, Bartlett School of Planning, UCL

The project has developed a specification for a computer-based tool which can be used in interactive household interviews, facilitated by a researcher, to examine current use of resources, and to explore how these patterns might be modified – both marginally and radically – to reduced overall resource consumption. It has focused primarily on energy use, but can be extended to other categories of resources (e.g. water consumption). It has involved several stages. First, two reviews were carried out. The first to look at the existing tools that are available on the web to help people record and reduce their resource use, particularly in relation to ecological foot-printing, energy consumption and CO₂ emissions, and water consumption; and the second to look at the kinds of data on resource use that are available on line.

Members of the public and interested groups were consulted about their awareness of these tools, and the kinds of information they would find helpful: nobody understood what ‘tonnes of CO₂’ were, and preferred to think in terms of costs and liked comparisons with similar households.

A comprehensive sequence of screen shots has been prepared, showing what the computer-based interview would cover and how information and tasks would be presented to respondents. The interview has six main sections:

- Collection of general household information
- Details of each household member
- Information about the dwelling (type, layout, insulation)
- The appliances in the home, including motor vehicles
- A detailed recording of existing household activity/travel patterns – with a report showing current energy consumption, costs and comparisons
- A scenario exercise, in which household members consider how they might reduce energy consumption, by:
 - Increasing the energy efficiency of the dwelling (better insulation, more efficient heating, etc.)
 - Using more energy-efficient appliances and motor vehicles, and
 - Changing behaviour – in the home, while travelling and at out-of-home locations



Wet algal slurry and fossil diesel emulsion, Dr Paul Hellier, UCL

Algal Bio-fuels for Sustainable Transport

Lead: Dr Paul Hellier, Department of Mechanical Engineering, UCL
Main Collaborator: Dr Saul Purton, UCL Institute of Structural & Molecular Biology

In cities across the world, road transportation by liquid fuelled vehicles is an important element of vital resource flows. However, traffic and speed restrictions within urban environments reduce engine efficiencies and, relative to rural areas, result in increased emissions of CO₂, nitrogen oxides (NO_x) and particulate matter. City habitation, therefore, results in disproportionately high levels of atmospheric pollution from road transport, and one possible method of mitigating this is through the development of sustainable alternatives to existing fossil fuels.

The use of micro-algae as a source of bio-fuels has seen much interest, as unlike currently utilised vegetable oils, no competition with food resources exists. Current research into algal bio-fuels focuses on the extraction of oils for the production of bio-diesel similar to that produced from vegetable oils. However, the low density of algae growth in aqueous media requires a large energy investment for the harvesting of useful oils, and furthermore, these oils require additional chemical processing to produce a fuel suitable for use in modern internal combustion engines. This project has addressed both of these issues via experimental investigations utilising the facilities of the Department of Mechanical Engineering's Combustion and Fuels research group and close collaboration with researchers at UCL's Institute of Structural and Molecular Biology. One approach has explored the use of algal biomass to partially displace fossil fuels through creation and successful engine testing of emulsions of fossil diesel and wet algal slurry; utilising wet algal slurry reduces the energy intensity of algae harvesting. The second approach employed was to experimentally assess several bio-fuels that may potentially be produced through genetic engineering of photosynthetic micro-organisms, and has resulted in a publication in *Fuel*, the leading peer-reviewed journal on alternative fuels (P. Hellier, L. Al-Haj, M. Talib, S. Purton & N. Ladommatos, *Fuel*, Vol 111, Sept 2013, p670-688. <http://dx.doi.org/10.1016/j.fuel.2013.04.042>).

The UCL ISR and UCL Grand Challenge of Sustainable Cities (GCSC) would like to thank all those who submitted entries for the Research Grant; Catalyst Grants; Call for Papers; Photo & Film Competition; the Session Chairs, Panellists and Keynote Speaker and finally the BHPB/GC Symposium Committee for all the work in pulling together the symposium.

Katherine Welch, UCL ISR

Dr James Paskins (Chair), UCL Grand Challenge of Sustainable Cities

Alison Parker, UCL ISR

Aimee Walker, UCL ISR

Dr Ben Croxford, The Bartlett School of Graduate Studies

John Kelsey, Bartlett School of Construction & Project Management

Mandeep Bhandal, Institute for Security & Resilience Studies

Professor Peter Jones, Department of Civil, Environment & Geomatic Engineering

Dr Pushpa Arabindoo, Department of Geography

Professor Paul Ekins, UCL ISR

Professor Raimund Bleischwitz, UCL ISR

Dr Jason Blackstock, Department of Science, Technology, Engineering and Public Policy (STeAPP)

Dr Michele Acuto, Department of Science, Technology, Engineering and Public Policy (STeAPP)

Charlotte Johnson, UCL ISR

Dr Tse-Hui The, The Bartlett School of Planning

Dr Liza Griffin, Development Planning Unit





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