







9.

# **Keynote Speeches**

## **1 Resilient Urbanism 2.0: Designing for risk, crisis and everyday uncertainty**

**Jon Coaffee**



# **Urban Social Dimensions**

(Tuesday 13<sup>th</sup> June 2017, 11:20-12:30, Seminar Suite A)

## **1. The Social Networks of Urban Resilience in Self-Help Urban Settlements: the Case of Nezahualcoyotl, in the Metropolitan Area of Mexico City**

**Manuel Alejandro Rivero Villar<sup>1</sup>**

<sup>1</sup> UCL, United Kingdom.

**Keywords:** management Urban Resilience, Global South, Self-help settlements

### **Abstract**

This paper investigates the networks of social capital that participate in the achievement of urban resilience of self-help settlements (settlements self-produced by low-income groups lacking of adequate infrastructures and services, often occupying areas of high risk (Gilbert, 2007; Platt, 2010)) at the municipal scale. Self-help settlements are widely acknowledged as intrinsically vulnerable to the effects of climate change (Hardoy & Romero Lankao, 2011; Satterthwaite, 2013b) and are foreseen to be the predominant form of urbanisation in the Global South for the XXI century (UNHabitat, 2006). UN's recent adoption of the 'Sustainable Development Goals' have placed the resilience of self-help settlements at the top of the global development agenda (UNGA, 2015).

Urban resilience is understood as the continued adjustment of cities in an evolutionary fashion through their histories (W. Neil Adger, 2000; Pickett, Cadenasso, & Grove, 2004) in face of environmental uncertainties and nonlinearities (Leichenko, 2011). Urban resilience depends on cities' ability to transform in relation to those factors driving vulnerability and risk (Bahadur & Tanner, 2014). It is acknowledged that societies have

metropolitan area of Mexico City. In its history, Neza has faced multiple hazards, both environmental (the settlement is located on the drained bed of a salty lake, prone to flooding and sand storms) and institutional (at the moment of its formation, the area lacked formal government structures).

The approach of the research is longitudinal, given that the investigation tracked the evolution of the case-study, from its beginnings (1950s) to its consolidation (1980s). The research investigated the social networks linked with the collective goals that helped the case-study overcome the causes of its vulnerability, and thus improve its resilience: access to water supply & drainage infrastructures, roads & public transit, secure land tenure, and accountable governance. Data was collected relying on archive mining, and then analysed using the theoretical and methodological procedures of Social Network Analysis (SNA).

The main findings of the research are three: the evolution of networks, the emergence of strategic goals, and the formalisation of networks. The evolution of the social networks that participated in the resilience of the case-study followed a trajectory of three stages: formation, peak, and dissolution. Social networks, in the formation stage, gather participants around a particular topic, which keeps growing and gaining momentum, until social networks reach a peak in size, which allows them to achieve the pursued collective goals. Once a goal is achieved, social networks tend to dissolve.

The second finding is the longitudinal prioritization of collective goals, measured by the size of the networks; and the relative position that goals occupy in the network. While the most tangible goals (i.e. drainage and water supply infrastructures) were the ones that consistently gathered the largest number of participants, other collective goals occupied more central positions (secure land tenure and accountable governance), and linked the most influential members. This indicates a more strategic character of goals. It is interesting that even when these strategic goals gathered a relatively small number of participants, these goals helped the most to the achievement of the more tangible ones.

The last finding is the evolution of networks towards its formalisation. This means that even when the observed social networks had their origins as informal, local and bottom-up, all of them followed a trajectory in which government actors assumed the most relevant positions in the networks. Even when community



and joint community and government events), regarding the identified collective goals. Data was then analysed using SNA's dedicated software UCINET (Stephen P Borgatti, Everett, & Freeman, 2002). This was done to measure and map Neza's social networks, which allowed the identification of the patterns present in them.

### **Potential development impact**

This research contributes to the debate of the role of social networks in urban resilience, particularly in underdeveloped areas of the global south, where future urbanisation and the increasing damaging effects of climate change are expected to occur the most. This research also contributes to the global policy agenda, forwarded in the recent adoption of UN's Global Sustainable Development Goals.

### **Recommendations for future research and application**

Future research should investigate the structure of social networks for urban resilience in multiple settings and time frames. The contrast of multiple results would increase our knowledge of the importance of social networks in urban resilience. And furthermore, this would shed light on what kind of social networks are relevant for the achievement of resilient urban environments.

## 2. The Social Dimension of Urban Resilience: a Methodology to Assess Social Dynamics Contributions to Urban Sustainability

Joana Dias<sup>1</sup>, Margarida Barros<sup>2</sup>, Maria Partidário<sup>3</sup>

<sup>1</sup> Joana Dias, Instituto Superior Técnico, Universidade de Lisboa;

<sup>2,3</sup> Margarida Barros and Maria Partidário, Instituto Superior Técnico, Universidade de Lisboa

**Keywords:** Urban Resilience, Long-term Resilience, Social Dynamics, Social Innovation, Lisbon.

### Abstract

The world has been facing a staggering population growth, as well as a continuous increase in the number

### **3. Patients' Written R**

service experience had problems with reaching their GP service. Insufficient GP facilities, complaints about staff insensitivity and suspected cases of misdiagnosis were less likely to make reviewers refrain from

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## **Abergwaun Wind Turbine**

Sited on land adjacent to Fishguard this is a joint venture with Parc-y-Morfa Farms Ltd. It took 4 years from conception to installation; On 27th August 2015 an Endurance X-29 225kW Turbine was commissioned. Raising the £285,000 needed for TBG's 50% share of the project proved easier than expected, the whole amount being lent by 29 individuals and 3 local community groups within five months. The turbine estimated output is 590,000 KWh per year, equivalent of powering approx 140 homes, within





## **6. Building Sustainable and Resilient Cities to Climate Variability and Climate Change. A case Study in Tijuana, Mexico**

**Roberto Sanchez-Rodriguez<sup>1,2</sup>**

<sup>1</sup>El Colegio de la Frontera Norte,





## 8. Dubai's Morphological Evolution: Mapping Urban Change and Transformation

**Khaled Alawadi<sup>1</sup>, Asim Khanal<sup>1</sup>, Ahmed Almulla<sup>1</sup>**

<sup>1</sup> Masdar Institute of Science and Technology, United Arab Emirates.

**Keywords:** Dubai, Morphological Analysis, Regional Planning, Urban Form, Neighborhood Pattern, Typology, Urban Growth

### **Abstract**

### **Background**

In the United Arab Emirates, a nation set up in 1971 when seven Emirates joined to shape a Federation framework, Dubai is the most populated city (Herd-Bey, 1982). The city's informal birth is regularly followed to 1833 when a tribe from neighboring Abu Dhabi withdrew and made a trip up north to settle a town at the

Offshore Developments and Exclusive Waterfront Developments. Moreover, two landmark projects such as Business Bay Canal and Calatrava Tower are also included. Identifying and classifying is aimed at creating a typological index for Dubai's urban landscape. These patterns are presented under six thematic developmental periods stretching from 1900 – 2016. Based on the identified typologies, the analysis further compares four main elements of the built landscape across the different landscapes: street systems, land use, open space, and land parcelization. Analysis and mapping are applied to an area of 1 square kilometer (1 km<sup>2</sup>) at a neighborhood scale. This area is large enough to explore how morphological attributes shape people's lives, behavior, and mobility (Wheeler, 2015).

available data through intensive analysis. Picturing the same set of data in a disparate way, just considering some particular attribute is made possible by the ArcGIS software. Also, AutoCAD has been used in many instances to edit and modify polygons representing communities, parcels, plots or buildings. Moreover, the Adobe Creative Suite has been used to finalize the diagrams to make them visually appealing. After the process of identification, literature regarding Dubai, its history, and its development were referred extensively. The facts and details from the scholarly articles have been used to back the fact that the historical, political and social spheres that influenced and consequently led to the creation of the 10 uniquely distinguishable urban forms ranging from 0.059 km<sup>2</sup> (fishing village) to 219 km<sup>2</sup> (contemporary suburban neighborhoods) in size, as we witness today.

## 9. Can Governance Enable Resilience? The Case of Urban Density in Mumbai

Rachna Lévêque<sup>1 2</sup>

<sup>1</sup> UCL, United Kingdom;

<sup>2</sup> BuroHappold, United Kingdom.

**Keywords:** Cities, social-ecological resilience, urban densification, governance.

### Abstract

#### Research context

Popular interpretations of resilience often consider resilience to involve a rapid return to a fixed stable state. Similarly, current approaches to metropolitan planning and governance seek certainty and linearity and resist change. Yet, transformations in complex urban systems are effectuated by diverse actors influenced by intricately linked social, economic, political, environmental and technological factors. In this context, how can governance in cities help successfully navigate slow and uncertain, yet desirable, change?

This paper elaborates the demands that rapid urban change (caused by increasing urban density) places



in the 'social' of social-ecological systems.) Hence, the social-ecological systems view moves away from the linearity and predictability of separate sub-systems to emphasize non-linearity, uncertainty, emergence,



# Green Infrastructure

(Tuesday 13<sup>th</sup> June 2017, 11:00-11:20, Seminar Suite B)

## 10. Viscous Biomaterials for Application in the Built – Environment

**Shneel Malik<sup>1</sup>**

<sup>1</sup> UCL, United Kingdom.

**Keywords:** Biomaterials, Adaptive, Interdisciplinary, Bio-scaffolds, Additive manufacturing

### **Abstract**

With the increasing urgency to respond to the changing Climate, Researchers and innovators are increasingly finding ways of developing artificial 'natural' systems. We have evolved to not just 'mimic' natural-existing biological systems, rather to progressively imbibe the spirit of its performative function within the designed environment. The field of Art, Design and the Sciences are increasingly beginning to work closely, in order to design composite technologies and create hierarchical architecture that aims to give shape to a more 'responsive-based' naturally pure - version of tomorrow.

Assimilating from the natural world, wherein shape and matter has been carefully crafted through growth and adaptation, resulting in highly tunable and hierarchically structured constructs. We identify water as nature's molecule of life; explore the possibilities of developing water-based biomaterials, that when incorporated with stiffness gradients would demonstrate the creation of multi-functional graded components for application within 'biological' construction. They are further seeded with 'algae-cell' cultures, that flourish within the material due to it's biocompatibility, performing photosynthesis and allowing the 'gel-like' material to behave as a photo-bioreactor; which opens up a wide range of applicatory-based possibilities for the scaffold.

Integrated material-based design studies, novel computational technologies, advanced manufacturing mechanisation driven with a sustainable motivation give shape to a technique that produces functional bio scaffolds - in the form of architectural components or product - based prototypes - diversely embedded with microorganism cultures. These large-

This research aims at exploring new grounds in architecture, that involve material 'tunability' of water-based gel materials, along with an added dimension of biologically - attuned systems through the active involvement of living cells as part of the system building.

However, what remains key amongst such technological advancements is the neT364.1 agination /Subty3 r

As the field of architecture is governed by visual and aesthetic appeal, it becomes rather crucial to investigate into ways and techniques of fabricating material ecologies with a new aesthetic appeal. In contrast with common techniques, this research discusses and explores the use of soft materials as active and a rather new means of fabrication in architecture. While exploring the 'living' dimension of such materials, we also look at design and fabrication techniques through which even soft materials are made capable of holding their geometric form, rendering such materials suitable for both visual and physical use in architecture.

This research project combines the fields of architecture with synthetic biology. This interdisciplinary

order to establish informed nano-to-macro scale relationships between shape, material composition, hydration rates, and design-induced deformation.

**11.**

to either natural or manicured green spaces. The positive perception about dual provision was linked to their ability to provide naturalness along with social elements like paths, benches, other users, and open spaces.

Objective 2 – to identify the barriers and/or



which can be catered to local needs. The first phase of the guideline states how dual provision can be implemented by taking into account both subjective and objective aspects of UGS based on user preferences, perceptions and usage patterns. The second phase provides management guidelines for overcoming barriers to implementation and resolving conflicts between the functions. The third phase is about monitoring and evaluation of the provision to ensure compatibility is maintained and to feedback the findings influence changes in phase 1, creating a fluid adaptive system.

This research addressed the key knowledge gaps related to dual provision of social and ecological functions in UGS. However, further research in this area is needed to overcome the limitations of this study and generate more knowledge on the interface between the two functions. While this study tried to account for the socio-cultural diversity of UGS users in selecting respondents, the small sample size and narrow geographical focus impeded the analysis of the inter-group differences which can be a focus of future studies. This study analysed direct observation of user behaviour; future studies could also incorporate behavioural studies of the fauna to better understand how aspects of their behaviour like nesting, foraging and mating impacts and is impacted by people's use behaviours. Finally, the theoretical understanding developed in this study needs to be tested in other socio-economic and geopolitical contexts.

## 12. Building with Nature: Developing a Benchmark for Green Infrastructure

**Gemma Jerome**<sup>1, 2</sup>

<sup>1</sup> Gloucestershire Wildlife Trust, United Kingdom;

<sup>2</sup> University of the West of England (Bristol), United Kingdom.

**Keywords:** Theoretical framework; user preference and perception; spatial use behaviour and pattern; urban biodiversity; human-nature interface.

### **Abstract**

#### **Overview**

This paper presents the development of a benchmark for green infrastructure (GI). Green infrastructure brings together many land uses (e.g. parks, gardens, cemeteries, allotments, nature reserves, surface water), urban design (e.g. street trees, landscaping) and functional features (e.g. sustainable urban drainage systems, green roofs) operating at differing spatial scales. There is a substantial body of research demonstrating the multiple benefits of GI. Despite this evidence base there is still considerable uncertainty as to how GI can best be delivered and maintained in practice.

This benchmark for GI has been developed through a combination of literature review and engagement with key stakeholders including the planning, landscape architecture, and developer communities. It provides a points-based benchmark that allows an assessment of the process of GI creation, from policy, through to planning, design, delivery and long-term management, ensuring that current good practice has been adopted at all stages.

The benchmark standards consider differ



# **Resilient Infrastructure - Part 1**

(Tuesday 13<sup>th</sup> June 2017, 14:00-15:10, Seminar Suite B)

## **13. Infrastructure: Opportunities from Interdependencies**

**Darren R. Grafius<sup>1</sup>, Liz Varga<sup>1</sup> and Simon Jude<sup>2</sup>**

<sup>1</sup> Complex Systems Research Centre (CSRC), School of Management, Cranfield University MK43 0AL, United Kingdom;

<sup>2</sup> Centre for Environmental Risks and Futures (CERF), School of Water, Energy and Environment,

most tightly-coupled variety, where two systems are interconnected and interdependent through shared functioning.

Infrastructure systems have largely originated from a traditional systems engineering perspective, in which design principles are goal-oriented and deterministic; however, the complex and interdependent nature of modern global systems has forced the adoption of more systematic perspectives<sup>4</sup>. Ecological systems exemplify ways in which complexity can build resilience rather than vulnerability, and as such their key principles of interdependence, cyclical flows, cooperation, flexibility, and diversity<sup>5</sup> are explored in the context of current and proposed infrastructure developments.

Examples of advantageous use of interdependencies were found to fit most combinations of ecological sustainability principles and type of opportunity. Current efforts to upgrade various infrastructures with smart technologies, enabling real-time feedbacks between information and functionality, represent integrative opportunities that build on interdependency, cooperation and flexibility<sup>6</sup>. By optimising information flows through the system about system functioning, both managers and end users may gain the ability to match supply to demand and maximise efficient behaviours. The ongoing transition toward circular economies to increase efficient and sustainable use of resourc



## **14. Infrastructure Resilience: Towards a Transdisciplinary Definition and Analytical Framework**

**Ges Rosenberg<sup>1</sup>, Neil Carhart<sup>1</sup>, Colin Taylor<sup>1</sup>, Vedran Zerjav<sup>2</sup>, Andrew Edkins<sup>2</sup>**

<sup>1</sup>









## Acknowledgements





**17. Getting Better Oversight of Infrastructure Resilience in the UK: Assessing the P**

**18.**





**Figure 2:** Proposed PBE framework for OWT structure. Green = included in the case study, Dashed line = included but simplified.

To demonstrate applying the framework shown in Figure 2 we estimate potential losses associated with an OWF by calculating the probability of structural failure combined with the losses expected from other sub-systems (i.e. electrical) in an OWF with 170 turbines. The framework is simplified to allow us to present it in a concise form and so uncertainties are limited to environmental loading. The structure employed was the NREL 5MW OWT [18] sited at the Kriegers Flak OWF in Denmark. Hazard analysis was performed



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# **Disaster Management**

(Wednesday 14<sup>th</sup>)

We will present the initial findings from fieldwork that is due to take place in April-May 2017 at a number of different sites in Nepal (looking at recovery since the 2015 earthquake) and the Philippines (recovery following typhoons, in particular Typhoon Haiyan in 2013), with a particular focus on the implications of this research for urban self-recovery processes. Although this is a pilot study, it is valuable in providing empirical research findings to support the emerging debate on this important yet neglected topic.



# Urban Metabolism

(Wednesday 14<sup>th</sup> June 2017, 11:00-12:40, Seminar Suite A)

## 21. Peri-Urban Food Production Promoting Urban Resilience and Bridging Urban and Rural Regions

**Gunilla Almered Olsson<sup>1</sup>**

<sup>1</sup>School of Global Studies, University of Gothenburg, Sweden.

**Keywords:** Peri-urban Food Production; Urban Food Security; Urban-rural Resilience, Multifunctional Food Production, Social Sustainability

### **Abstract**

The dimension of food provisioning is mostly overlooked in the discussion of urban resilience. The sustainable city is a frequently used vision but in the analysis of sustainable and resilient systems for housing, energy, waste, communication and security etc., the food security issue is most often absent. The food system in the industrial world is totally integrated in a global food system and directly linked to the globalized economic market. For efficient functioning of the global food system it is necessary to have uninterrupted and reliable access to natural resources, energy, efficient and undisturbed transportation along routes in land, water, cyber space and absence of accidents, sabotage, political and military conflicts. To the uncertainty of all those factors must be added the environmental uncertainty, e.g. climate warming, thus making food security endangered. The strong current interest in urban agriculture in many cities is partly a response to this situation although the food produced here cannot satisfy the need of the urban population. The peri-

the agricultural landscape include meat production from grass-fed livestock – grazing is part of the biodiversity management – preservation of biocultural values, and simultaneously facilitating visitor access for recreation purposes. Local food production is creating new job opportunities; Food production activities can be seen as arena for knowledge sharing and cultural integration between different socio-ethnic-cultural groups; Combining the urban and peri-urban food production and including adjoining rural municipalities can revitalize the region, e.g. by ‘food charters’- different types of economic agreements on food production and cultivation between consumers and producers/farmers in the near and distant peri-urban-rural regions. This creates new jobs in the rural regions and contributes to a direct link between the city and its distant peri-urban-rural regions. Food production activities increasing social and environmental sustainability have a potential for increasing resilience of urban-rural regions. Several of the above mentioned issues are considered in the ongoing work in Gothenburg on a local food strategy that started Spring 2017. Some highlights from this work will be given.









## **23. Sustainable and Resilient Urban Development Pathways: the value in combining different elements to deliver truly sustainable, plan-led transformations.**

**Jonathan Essex**<sup>1</sup>

<sup>1</sup> IMC Worldwide, United Kingdom.

**Keywords:** Sustainability, resilience, urban, green, economy

### **Abstract**

Urban development programmes are often labelled in different ways. For example, different aid funded initiatives and programmes focus on Smart Cities, Green Growth and Inclusive Growth.

This paper explores how Sustainability and Resilience are defined, planned and delivered in the urban context – and to what approaches are required to deliver long-term sustainability and resilience for cities as a whole. This will draw on different recent programme experience from IMC



the disaster management cycle can be met by extending the often limited notion of a 'circular economy'



was launched to incentivize and support Limburg to transition to its next economy focusing on industry 4.0 and circular economy. At the same time the spatial development department (RV) launched a territorial development program T.OP Limburg, connecting spatial questions to the economic SALK agenda. Within T.OP Limburg, research by design has played a major role since the beginning. In 2015, RV and OVAM commissioned a study to redevelop the Ford Genk site as a hub for circular economy, departing from principles of urban metabolism.

Case study two, the City of Antwerp, is actively taking a role in directing resource flows imposed on the city from the 'top-down'. Traffic and resource flows linked to international trade via the harbor or the congested ring road extend city boundaries but highly impact the city's livability. The study of the city's metabolism aims to add a spatial development layer to Antwerp's spatial structure plan (2006). The research by design study is commissioned by a consortium of the City of Antwerp, Ruimte Vlaanderen, de OVAM and the port of Antwerp.

### **Potential development impact**

Based on the critical study and evaluation of the application of research by design in two case studies, this paper aims to outline an agenda for the application of research by design in planning processes of transition to the circular economy. It aims to clarify the potential role urbanists or urbanists in research by design on urban metabolism could play. It aims to articulate clear questions and problem statements around urban metabolism and circular economy's (potential) spatial dimension.

### **Recommendations for future research and application: hypothesis**

Research by design's future application in transition processes should be understood as an out-of-the-box method gaining insight in complex development questions through creation of spatial future imaginaries. The future imaginaries have the capacity to integrate and synthesize social and ecological parameters in the



# New Methods

(Wednesday 14<sup>th</sup> June 2017, 9:30-10:40, Seminar Suite B)

## **25. Strategic transitions: Examining the role of standardised green infrastructure evaluation in sustainable neighbourhood masterplans**

**Rosalie Callway<sup>1</sup>, Tim Dixon<sup>1</sup>, Dragana Nikolic<sup>1</sup>**

<sup>1</sup>School of Built Environment, University of Reading, United Kingdom.

**Keywords:** Sustainable Neighbourhoods; Green Infrastructure; Strategy-as-practice; Evaluative Practice; Masterplanning.

### **Abstract**

#### **Research objectives and methodology**

This research project examines the role of BREEAM Communities, a standard evaluative framework that aims to promote 'sustainable neighbourhoods' within larger-scale mixed-use development projects. The standard carries an implicit assumption that the enactment of various evaluative practices will enable the rationale refinement of design decisions that will support the creation of a more sustainable neighbourhood development. What is less certain is the degree to which these evaluative practices and decisions are embedded in the transition from design to construction and use. To examine the assumption of embeddedness throughout the masterplan journey a broad question is addressed:

*How does a standardised approach to evaluation contribute to sustainable neighbourhood masterplanning? )*

As such it is necessary to empirically examine how both BREEAM Communities and evaluative processes are understood and practiced by the various actors involved. Therefore the research questions and objectives are strongly focused on the people and processes behind evaluation, and adopts Strategy-as-Practice theory as a core analytical framework.

Tracing the journey, from neighbourhood vision and design to construction and use, there may be a shift from strategic idealised values to pragmatic practice. This highlights a need to examine what role evaluative practices may play in that transition. The research uses a mixed method approach, combining literature review, semi-structured interviews, informal observation and analysis of public documentation. It asks whether and how evaluations are used to inform and shape masterplan decisions and practice relating to green infrastructure along the masterplan journey. It aims to make the role of evaluative practices more explicit and clarify the intentions and experiences of different interest groups in the process.

### **Case studies**

The research examines evaluation of one issue addressed in the BREEAM Communities (BC) standard

Communities, with specific recommendations seeking to make it more salient to masterplanning practitioners.

### **Future research and application**

The further application of this research will include a multi-actor dialogue to consider the wider sectoral relevance of this empirical study. Future research will be also required in a number of areas, including (but not only):

- challenges with transparency and negotiation of evaluative compromise;
- examining further the dynamic and transaction nature of evaluative practices, how and why these change over time;
- the processes of defining and operationalising sustainable value management.





## **27. Towards Liveable Cities –**

# **Waste and Water Treatment**

(Wednesday 14<sup>th</sup> June 2017, 11:00-12:40, Seminar Suite B)

## **28. Microbial Fuel Cells for the Production of Electricity and Biogas from Organic Waste in Cities**

**Enrique Lopez Arroyo<sup>1</sup>, Jingyuan Shi<sup>1</sup>, Paul Helier<sup>1</sup>, Ilan Adler<sup>1</sup>, Luiza Campos<sup>1</sup>**  
<sup>1</sup>UCL, United Kingdom.

**Keywords:** Water, Energy, Nutri

electricity could allow the pre-treatment (co-digestion) in situ of organic residues and organically contaminated WW, reducing the amount of organic contaminants being discharged. While at the same time powering small appliances and reducing the need of other sources of energy.

The aim of this study is to evaluate the effect that the use of a MFC has on the production of biogas (volume and composition) in an anaerobic digestion reactor.

### **Methodology**

A set of six 500 ml anaerobic digestion batch reactors were constructed using high density polyethylene (HDPE) bottles. Three of the reactors were fitted with a membrane-less MFC consisting of a graphite rod as anode and a steel rod as cathode<sup>79</sup>. The electrodes had a total contact surface of approximately 15.7 cm<sup>2</sup>. The six reactors were kept in a water bath at 37°C and operated under similar conditions using digestate (from a biogas plant located in a farm within London) as inoculum for the reactors. The farm digester uses food waste from the farm's restaurant as feedstock. A volatile solids (VS) analysis was undertaken to assess the composition of the digestate. For this, three digestate samples were placed first in the oven at 105°C for a period of 12 hours and later in the furnace at 550°C for two hours<sup>10</sup>. The digestate has an organic matter content of around 5.5% and a volatile solids (VS) content of 3.2%, each reactor was run with 500ml of digestate which represents a total of 16g of VOCs, a total of 8g of glucose was used in each reactor as feedstock in a ratio of 2:1 (2 inoculum : 1 feedstock)<sup>11,12</sup>. Glucose was used to achieve a 100% digestibility of the fuel. The pH of the mix at the beginning of the experiment was of 7.4. The biogas produced was measured by volume displacement. Each of the reactors is connected to a one litre column where the biogas produced was collected in order to assess its volume and composition (CH<sub>4</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>, H<sub>2</sub>S and O<sub>2</sub>). The gas composition was determined using a GFM406 series GasDATA gas analyser.

°ETBT0 Tc333.79 500p4.2(d)-f516.34 450.91F6-58(a)-9( )-71(o)-12aofstatol74 450.43 Td79(the)4o of3.9187s 10



## **Results**

Preliminary results show no significant differences between the two types of reactors in terms of biogas production and composition. At the end of the biogas production the values of methane, hydrogen, carbon

**Figure 3**

The initial voltage within the MFCs of around 1.2 V (similar to those obtained using an aerobic cathode).

## **29. Improving Management of Container Based Sanitation Systems in Urban Off-Grid Living and Working Environments**

**E. Mackinnon<sup>1</sup>, I. Soumpasis<sup>2</sup>, N. Sawant<sup>2</sup>, L. Ciric<sup>1</sup>, P. Parikh<sup>1</sup>, L. C. Campos<sup>1</sup>,**

<sup>1</sup> Department of Civil, Environmental and Geomatic Engineering, UCL, Gower Street, London WC1E 6BT, United Kingdom;

<sup>2</sup> Unilever Safety and Environmental Assurance Centre (SEAC), Colworth Science Park, Sharnbrook, MK44 1LQ, United Kingdom

***Keywords***



The research outcomes support sustainable and resilient urban systems. The scale up and adoption of this technology is



## **31. Urban-Rural Interactions and Surface Water Management in Xochimilco, Mexico City**

**Garcia Alba Garciadiego<sup>1</sup>**

<sup>1</sup> UCL, United Kingdom.

**Keywords:** Xochimilco, UNESCO, Urban surface water, Management Plan, urbanization.

**Abstract**

**Session aim & learning objective**



three academics, six members of the UNESCO team and a member of ICOMOS—the agency in charge to report the UNESCO about the heritage site condition. One politician and the ICOMOS member were not involved during the PUX design phase, yet they are currently active members of their respective agencies and they were quite informed about what was the project about. The academic papers and newspapers are used to study the context of this project and delimitate the regime and the landscape.

### **Future application of outcomes**

Xochimilco and its surrounding heritage area cannot be understood from a single point of view. This area was comprised of a series of historical decisions that created a very complex area, while many ongoing processes continue to modify the area. Even though some projects aim to provide an integral solution, they miss allocating all the factors that influence the project itself from a contextual reality. The failure to implement the UNESCO's Management Plan shows highly uncoordinated government agencies, especially from one electoral cycle to another. Still, the community remembers this project with some enthusiasm as they felt empowered during their participation.

Most of the participants claimed that the lack of government will is what is undermining the projects, while most of them deny having any kind of trust in the authority to provide a solution for the degrading environment. On the other hand, even with political desire to maintain the aquatic system, it seems that the municipalities' political structure are not able to support environmental conservation practices. "Xochimilco is overstudied" as one of the participants claim. I would like to add to that observation, it is also over intervened, as there were implemented big projects as the 1989 Xochimilco's Ecological Park, and small projects as current chinampas ground re-posting. Still, urban intervention projects tend to be diminished because of the lack of coordination among governmental agencies while the area is degrading in a considerable rapid pace.

# Workshops

## **1 Urban world 2050: exploring policy research needs to realise the 'urban opportunity'**

**Amy Kirbyshire<sup>1</sup>, Rebecca Nadin<sup>1</sup>**

<sup>1</sup> Overseas Development Institute, United Kingdom.

**Keywords:** Urban, Resilience, Policy

### **Abstract**

In a rapidly urbanising world, there is an important opportunity to lock-

## 2. Community Partnerships for Green Infrastructure in London

**Sarah Bell<sup>1</sup>**

<sup>1</sup>CEGE/Engineering Exchange, UCL, United Kingdom.

**Keywords:** Collaborative, communities, STEM, green infrastructure.

### **Abstract**

#### **Session aim, including learning objective**

The workshop will present key outcomes from the NERC-funded project 'Community Partnerships for Green Infrastructure in London' which will run January – April 2017. Led by the Engineering Exchange at UCL and working in partnership with Energy Garden, Just Space, and the London Sustainability Exchange (LSx), the project will deliver a series of outputs to support broader community engagement with Green Infrastructure research and policy in London.

Session attendees will gain a better understanding of some of the challenges and initiatives for implementing green infrastructure in London, which – depending on the project's research outcomes –



original interview data from the London Borough of Newham, this paper argues that for Newham residents there are two local communities which exist simultaneously, but which are imagined as fundamentally different – one is resilient and cohesive, while the other is fragile and fragmented.

### **Paper 3: What can we do to build social relationships as well as homes?**

The importance of good social relations among people living in local neighbourhoods is well recognised, contributing to wellbeing, reducing fear of crime and helping build local resilience. But creating relationships between people from different backgrounds is in practice more difficult than encouraging those who already have a lot in common to get to know each other. Social Life works with councils, community organisations and property developers and this paper will explore what we have learnt about working with different stakeholders involving in shaping the built environment about what can help residents get to know people they might not usually meet, building Robert Putnam’s “bridging social capital” and what gets in the way.

4.



The workshop will be used to facilitate bringing together a group of stakeholders that can better understand the issues associated with Black Sky Hazards and Multi-Modal Infrastructure Resilience to take it back to enhance either academic or industry applications. The workshop will provide academics and industry the opportunity to develop multi-modal networks to enhance understanding and future opportunities for collective working on infrastructure resilience.



# **Posters**

(Wednesday 14<sup>th</sup> June 2017, 13:45-15:00)

## **1. Solar Home Systems (SHSs) as Viable, Clean Energy Access Options for Off-Grid and 'Under the Grid' Populations: a Case Study of Rwanda.**

**Iwona Bisaga<sup>1</sup>**

<sup>1</sup> UCL, United Kingdom.

## 2. The Air Travel Experiences of Wheelchair Users

10101-81)RYAF170707R110G W d2 Andrew Philip Davies<sup>1</sup>, Nicola Christie<sup>1</sup>

<sup>1</sup>UCL, United Kingdom.

**Keywords:** disability, flying, access, manual handling, wheelchair

### Abstract

Air travel has grown steadily in the region of 5-6% every year since 1970 meaning that in the UK alone, over 600,000 people use flying as a means of transport every day. Disability rates are also increasing in the UK, with nearly 13 million people having one. Air travel for the mobility impaired has been relatively unexplored, this study aimed to fill that gap by exploring the experiences of severely disabled flight passengers and recommend service improvements. This study used qualitative semi-structured interviews with eight participants. Key findings showed notable issues with the manual handling of people with disabilities, including the equipment used in this process and accessing the toilet on the aircraft. Recommendations included developing consistency, further disability training and a review of the equipment involved.

### Introduction

The World Health Organisation (WHO) states that there are over a billion people with a disability, equating to just over 15% of the world's total population (2011). It has been estimated that 30% of a population will have access requirements at any point in time, and most people will have a disability at some stage during their life (Darcy & Dickson 2009). Accessibility is largely related to those with disabilities, however, as a broader concept it should be thought of being something that benefits or applies to everybody. The aviation industry is a truly global industry and travelling by air has never been more popular. Global air travel growth rates have been in the order of 5–6% per year in the period 1970–2000; air transport volume is now five times as large as it was in 1970 (Gössling &

establish frequencies and to gauge whether class or haulage had an impact on the disabled traveller's experience. 'The Journey' was the main aspect of the study and was divided into subsections: Booking air travel; Getting to the airport; Checking in; Security; Shopping, restaurants and duty free; Getting to the gate; Boarding the plane; On board the plane; Disembarking and Overall experiences of flying. The topic guide concluded with the opportunity for participants to suggest service improvements to the aviation industry and



'These are real issues. And that's one of the reasons I don't fly more. It's a personal hygiene issue, it's nothing to do with flying here ... the wheelchair accessible toilets on some flights are not accessible to me because I cannot get into them and I need to be lifted into one of these other chairs again' [Participant A, Male, 69, Powered Wheelchair User]

### **Strategies to Avoid Using the Toilet**

Due to a lack of accessible toilets on aircraft, some participants reported methods they used to avoid using the toilet including fasting and catheterisation:

'... If I go on a long haul flight, I have to use an internal catheter, because I just know there is just no way I can get into the toilet. I would just not drink beforehand, and kind of risk it in a way. Yes, which does make me kind of anxious about the flight, I am going to the toilet  
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The results obtained through the qualitative research concurred with previous research whose results showed that wheelchair users reported the boarding procedures with being able to go on first and come off last being an advantageous in giving them more time to do what they need to do without the feeling of being pressured by others, however the majority of physical barriers occurred when boarding and leaving the plane as staff were reported as not always knowing how to appropriately manually handle wheelchair users in and out of their seats and that a combination of the arm rest not always being able to be lowered and poor manual handling can cause severe pain as well as pressure sores. The on board experience of flying was where emotional differences were found because going to the toilet was the biggest problem as getting to the toilet meant using the aisle trolley, which is not suitable for the toilet on board. As a consequence of

on and off the plane with the assistance of two people using limited physical manual handling (Haycomp 2016).

The interventions suggested should be implemented to remove the struggles that wheelchair users encounter whilst travelling by air.

### **Implications for Future Research**

There is scope for further research in this field. It is vital to establish the difficulties the aviation industry has aiding wheelchair users to understand both groups issues so that the best possible solution can be found. Observational research should be carried ou

### 3. Application of Risk Perception Theory for City Resilience: A Case Study of Newcastle, UK

Maiko Ebisudani<sup>1</sup>

<sup>1</sup>Newcastle University, United Kingdom.

**Keywords:** city resilience, risk management, risk perception, sustainability

#### **Abstract**

In order to further develop a more holistic conceptualization of resilience, multidisciplinary approaches are considered necessary. With regard to the definition of resilience, it is generally stated as a system's ability to respond and recover from disturbances (Fisher et al., 2010), but different research disciplines have considered this from slightly different perspectives. Holling (1996) originally defined resilience in two ways, namely, engineering and ecological resilience. While engineering resilience is the more traditional of the



## 4. Re-growing the Kathmandu Valley: research methodology

**Amara Roca Iglesias<sup>1</sup>**

<sup>1</sup>Architecture of Rapid Change and Scarce Resources, London Metropolitan University, United Kingdom.

**Keywords:** Urban agriculture, Renaturing cities, Civic engagement, Research methodology, Kathmandu

### **Abstract**

#### **Introduction to the setting**

Rapid urbanisation has transformed the Kathmandu Valley into one of the fastest-growing metropolitan regions in South Asia. The Valley is an urban assemblage anchored on a core city surrounded by suburban areas and satellite cities and towns whose economies are becoming highly integrated (Muzzini and Aparicio, 2013).

The Kathmandu Valley farming community, known collectively as Jyapu (Bharat, 2011), have traditionally supplied the city market with much of its fresh vegetables but the loss of fertile farmland to residential and commercial uses has impaired their ability to feed the current valley population (Haack and Rafter, 2006).

As Toffin (2013) states the steady urbanisation of the Kathmandu Valley has had a considerably negative impact, producing traffic congestion, atmospheric pollution, and a total collapse of the former fragile ecological equilibrium between the city and its territory. The urban development pattern in the Valley is environmentally unsustainable (Muzzini and Aparicio, 2013).

#### **Hypothesis**



## 5. Multi-Hazard Vulnerability Assessment of School Infrastructure – the case of Cagayan de Oro, Philippines

Arash Nassirpour<sup>1</sup>, Carmine Galasso<sup>1</sup>, Dina D'Ayala<sup>1</sup>

<sup>1</sup>UCL, United Kingdom.

**Keywords:** Multi-Hazards, Vulnerability Assessment, Rapid Visual Survey, School Infrastructure, Philippines

### Abstract

The Philippines is one of the most hazard-prone countries in the world. It is regularly subject to various hazard-events, inflicting loss of lives and costly damage to the country's infrastructure. In particular, the Philippines straddles a region of complex tectonics, exposing the country to large and damaging earthquakes. For example, the most recent earthquake, the M 7.2 Bohol earthquake (2013), damaged more than 73,000 structures, of which more than 14,500 were totally destroyed, including several schools. According to UNICEF, 275,855 school children were affected by the earthquake. Similarly, several areas characterized by high wind and heavy rain exist along the northeast Philippine Sea coast. In 1991, a flash flood killed around 8,000 people and destroyed many structures in Leyte Island. Furthermore, Typhoon Haiyan (2013) was one of the strongest tropical cyclones ever recorded, which devastated several portions of the country, killing at least 6,300 people and damaging 3,171 schools. The recent history of reported damage and destruction indicates the substantial vulnerability of the country's infrastructure, particularly schools, to different forms of natural hazards.

Schools play a critical role in the education of the next generation and one of the most vulnerable part of the society due to their age and their developmental stage. A safer school can save valuable lives of children, provide a safe haven for the local community, serve as a temporary shelter and help to bring normalcy back to society in times of disaster. Taking into consideration the high probability of occurrence for any type of natural hazard in the Philippines, vulnerability of the school buildings should be of high priority for the governmental authorities and first responders. Considering the large number of existing school infrastructure and their geographical distribution, appropriate tools and approaches are required to address the prevailing vulnerabilities of Philippine's school infrastructure.

The main aim of this study is to develop a methodology for a rapid yet reliable visual vulnerability assessment of school infrastructures against the most common natural hazards of the Philippines. As part of this objective, a rapid visual survey form is proposed. In addition, a mobile application has been developed to assist the surveyors for assessing the school building in a more efficient way. Furthermore, a preliminary investigation is conducted on 115 schools, in the city of Cagayan de Oro to relate the collected data to vulnerability indices to swiftly determine the safety level of the considered buildings. Cagayan de Oro is a highly urbanized first class city with over 602,000 citizens and multi-hazard profile of earthquakes, floods, cyclones, tsunami, among others. The city has established a full-time unit in U115(t)-1(e)-117(of)-dis,

## 6. Assessing Building Response to Flooding and Climate Change: Developing Multi-Sensor Moisture Measurement Methodologies

Scott Allan Orr<sup>1</sup>

<sup>1</sup>University of Oxford, United Kingdom.

**Keywords:** flooding, non-destructive techniques, surveying, building materials, traditional construction

### Abstract

Urban infrastructure is at risk from increased severity of natural disasters, such as flooding, and more frequent and intense weather events. Materials such as brick, stone, mortar and concrete are present in buildings spanning the gamut of architectural history. Due to their porous nature, most processes affecting their strength, appearance, and hygrothermal properties are caused—or supported—by water. Diagnosing patterns and time scales of moisture movement following natural disasters or intense weather events is imperative to characterising a building's resilience to a changing climate and informing sustainable maintenance. Current non-destructive technologies that infer moisture contents from physical properties cannot accurately identify levels of moisture at depth over time. This project addresses this gap through a multi-sensor approach to moisture monitoring. Specifically, by employing microwave field moisture sensors, infrared thermography, and high-frequency radar to monitor drying patterns of building façades following a period of intense wetting. This approach capitalises on the unique spatial scales and resolutions of commercial devices while compensating for fundamental limitations of the techniques. To produce useful output that informs management decisions, data fusion algorithms are explored that streamline information into a single output.

Of specific interest is developing in situ techniques that are adaptable to complex building scenarios that incorporate a range of materials: for example, the assessment of mortar performance in traditional masonry constructions. Although radar is typically used to investigate sub-surface features and material interfaces, this work demonstrates the novel technique of feature identification in localised traces to identify surface moisture at a high spatial resolution. This can be combined with grids of multi-depth microwave moisture measurements to elucidate moisture movement through masonry systems – something that most stand-alone techniques smooth over.

Developing robust moisture monitoring methodologies that can diagnose patterns and time scales at

**7. AfriCity – Adaptability, Food Security, Risk, and the Right to the City in Sub-Saharan Africa: Towards Sustainable Livelihoods and Green Infrastructure**

## **8. Affordable housing and climate change: An interdisciplinary focus**

**Andrew Jack Venning<sup>1</sup>**

<sup>1</sup>University of the Sunshine Coast, Australia.

**Keywords:** compact city, vulnerability, meaning, law

### **Abstract**

#### **Research objectives and methodology**

Climate change presents challenges for the provision of affordable housing in South East Queensland (SEQ) that is exacerbated by rapid population growth, increasing wealth inequity and ageing population (ABS 2014, LGAQ 2013). However, in compact residential developments, planners, decision makers and legislators are bound to a stationarity assessment that neglects climate change vulnerability. To understand this research problem, three research questions were posed: RQ1; What are the objectives of Queensland affordable housing (QAH)? RQ2; What is the relative climate change vulnerability of the QAH cohort and the extent of constraints on QAH objectives in light of that vulnerability? RQ3; How may legal instruments enhance QAH objectives and restrain climate change vulnerability? This study embraced an interdisciplinary lens that encapsulated natural science, social science and law (e.g. climate change science, built environment science and planning law). The thesis adopted a research paradigm that is structured with an interpretivist theoretical perspective, multiple realities, knowledge construction and a multi-method praxis with a comparative case study as the primary method. The comparative case study comprised three built environment developments in SEQ, namely: 1) Halcyon Landing (20 hectare site, elderly community); 2) Caloundra South (2310 hectare site, a compact city) and 3) Fitzgibbon Chase (122 hectare site, a diverse community). Data was collected through secondary sources and field visits, and



opportunity for future innovative research and a breadth of findings. This thesis establishes a research platform for more general applications to urban and built environments other than dealing with anthropogenic effects of climate change and vulnerability.

Other studies could migrate from this transdisciplinary approach and not include the discipline of law but continue with the social and natural science disciplines to build on the knowledge of this study's findings between neighbourhood communities and the built environment. Fu



## 9. A Critical Review on the Improvement of Neighbourhood Sustainability Assessment Frameworks

Qi Zhang<sup>1</sup>, Esther Hiu Kwan Yung<sup>1</sup>, Edwin Hon Wan Chan<sup>1</sup>

<sup>1</sup>The Hong Kong Polytechnic University, HK.

**Keywords:** Neighbourhood, Neighbourhood Sustainability Assessment, Improvement, Sustainability, China

### Abstract

To optimize the Neighbourhood Sustainability Assessment (NSA) framework, frequent version updates were done in most countries which aim to improve local sustainability by evaluating the neighbourhood development. However, a number of these updated frameworks were still recently criticized for underperforming in the social and institutional sustainability, limited guiding effects on practical projects as well as very few corresponding mechanism for local adaptability and participation. Thus, this study firstly aims to examine the recent improvement of five NSA frameworks in the United Kingdom, Germany, Japan, the United States and Hong Kong in terms of scope coverage of the framework. It secondly aims to ascertain the barriers which hinder the improvement of local adaptability and actual guiding effects of NSA frameworks. This research mainly involves intensive literature review on the version updates, especially the frequently ignored social and institutional sustainability aspects, of selected frameworks to investigate the general and common changes of sustainability scope. It also identifies the obstacles affecting the applicability and effectiveness of NSA frameworks in an analytical way. The authors argued that the social and institutional aspects as well as local adaptability of the NSA frameworks should be given more concern