

Sustainable Earth 2016

# MARKETPLACE ABSTRACTS



**NAVIGATING  
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This booklet has been compiled from the abstracts which will be presented at the marketplace sessions at Sustainable Earth 2016.

Sustainable Earth 2016 takes place on 23 and 24 June at Plymouth University, and is an event for researchers, businesses, community groups and individuals to come together for two days of inspirational speakers, networking opportunities and creative workshops designed to spark and encourage collaborations for a sustainable Earth.





# **Health and Wellbeing Biodiversity and Conservation Cities and Communities**

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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Organisation:** Plymouth University

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Climate Change and Emergency Medical Services: A Systematic Review and Thematic Analysis of the Literature

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**Background:** There is a mounting body of evidence to suggest that climate change and global warming affects humanity, with particular impacts on human health, morbidity and mortality. Emergency Medical Services (EMS) are vital constituents of the healthcare structure and planning for their delivery should aim to incorporate 'environmental legacy' considerations. Aim: This systematic review was thematically analyses published literature on EMS and sustainability by categorising papers according to their focus on effects; strategy; actions; and behaviour of the workforce. Methods: Healthcare databases AMED; CINAHL; Cochrane Library; Embase; Medline (EBSCO); Medline (Ovid); PsycInfo; PubMed; SOCINDEX; Web of Science were systematically searched for appropriate articles. Searches focussed on papers published between 2008 and 2014 and retrieved sources were quality appraised to inform the thematic analysis of their content. Results: A total of 52 publications were retrieved for further scrutiny and quality review, 37 met the inclusion criteria. These papers were categorised and discussed according to their focus. Conclusions: There is a small, yet emergent published empirical evidence base that evaluates worthwhile sustainability interventions and strategies for EMS systems. Focus now should be on a major impetus towards gathering further quality research evidence in order to implement the right strategies, share good practice and create win / win scenarios with sound financial savings and reduced carbon emissions that benefit the wider society. This also includes winning the hearts and minds of EMS employees by adopting and championing sustainability practices and campaigning for a cleaner, efficient and cost effective ethos in community emergency health.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Harmonising homeowners aspirations towards sustainable housing: An examination using the multiple sorting task

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The emerging world has empowered large and powerful consumer oriented demographics, which are aspirational and aimed at achieving western living standard and moving away from a traditional communitarian social model. In the domain of sustainable housing, it is critical to understand the social and cultural values, which enable us to propose a bottom up and localised solution for the sustainable housing strategies. This research focus on testing homeowners' preferences on one aspect of the housing, threshold or boundary condition, which is qualified by an multiple sorting task (MST) analysis. The MST enables the participants to sort representation of the building as simulation of the real environment and sorting allows researchers to conduct surveys without preconception, which will otherwise influence the judgement of the respondents. This analysis was further triangulated with study-model performance tested by sophisticated environmental simulation and fieldwork studies to help propose sustainable housing strategies. The methodology adopted has been critical to supporting the architectural response to the cultural and economic condition on one hand (social methods) and the climate responsive, traditional design and simulation models (environmental design methods) on the other. Different sets of fieldwork were conducted that involved archival searches and detailed interaction with architects, builders and homeowners. In total, 240 respondents answered a questionnaire survey and 146 semi-structured interviews were conducted. This research demonstrates how MST can be used as a research tool in understanding the social perception and economic aspirations of the homeowners, which have direct bearing on the acceptability of sustainable design and construction strategies.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Economic Sustainability? Lifestyle Entrepreneurship within surfing businesses in Devon and Cornwall, UK

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This paper focuses on a Sustainable Earth Institute funded study which explored lifestyle entrepreneurship among surfing business owners within Devon and Cornwall. How we define lifestyle entrepreneurship is considered 'fuzzy' and the purported tendency for lifestyle entrepreneurs to play down elements of growth and profit may lead to issues of precarity in economic sustainability. Definitions of lifestyle entrepreneurship frequently make recourse to the subordination of economic to lifestyle goals and yet this clear-cut distinction is not shared by all. Shaw and Williams (2004) and Lewis (2014), for example, offer another type of business owner, the freestyle entrepreneur, as someone who values a specific lifestyle, is not necessarily growth averse, but considers factors to the way they pursue their personal lifestyle before deciding upon a direction of their business, including economic gain. Conducted within Devon and Cornwall, an area where surfing generates over £600m per annum (Mills and Cummins, 2013), this study sought responses to a survey consisting of both open and closed questions which were sent electronically to surfing business owners across the two counties (n=101). Results confirmed the dominant presence of the freestyle lifestyle entrepreneur (82%) in comparison to the more traditional purist lifestyle entrepreneur (18%). It was found that freestyle entrepreneurs within surfing set up their business to sustain their lifestyle whilst incorporating their ambition to be a business owner and achieve economic sustainability. However, when these two lifestyle-focused entrepreneurs are faced with challenges, the freestyle entrepreneur is more concerned with economic sustainability than the purist entrepreneur, whose primary concern is sustaining their lifestyle.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### International Trade Strategy and Environmental Sustainability

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This paper will examine international trade policy focussing primarily on the trade policy of the EU, and its effect on sustainability in relation to the environment and biodiversity. It will advocate the need for corporations to take a leading role in driving sustainability forward which is why international trade policy in particular is a critical tool in achieving a more sustainable outcome. The EU view is that Environmental quality is considered central to health and well-being and so it integrates environmental concerns in its other policies. The EU's commitment to the environment will be considered in relation to the inclusion of climate change and energy sustainability within the Europe 2020 Growth targets. Analysis of EU trade policy during the period 2010 – 2015 against extracts from sample agreements which were negotiated primarily during that period demonstrates the relationship between the strategy and the outcomes in the agreements. A similar exercise in respect of the new approach under the current EU Trade Policy launched in October 2015 for the next five years, alongside extracts from sample trade agreements in the process of negotiation or adoption will show a real change in approach, but is this mere lip-service to greater emphasis on environmental sustainability or more? The paper will close by questioning whether current international trade policy is in harmony with the 7th Environment Action Programme and whether integration of environmental concerns into current trade policy is enough to protect the environment and biodiversity or whether a radical new approach is both required and feasible.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Branching out with Moor Trees – new woodlands, biodiversity and upland management

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Moor Trees is a Devon-based organisation that creates new woodlands, primarily to enhance biodiversity. The trees we plant are native trees, mostly grown from locally collected seed in our own nurseries. Since 2001, we have planted over 60,000 trees in and around Dartmoor and the South Hams. All this has been achieved by a dedicated team of volunteers, including students from Plymouth University, local conservation groups, company team building days and local families. In our aftercare programmes for trees, we see that our young trees are healthy but questions remain regarding the delivery of an enhanced biodiversity. Do we have more insects in our new woodlands; more birds or a greater floristic diversity than the surrounding landscape? Answers to these questions could be answered with the help of our volunteers and others to monitor and record biodiversity in our new woodlands, possibly as a 'Citizen Science' project. Our longer term vision is to restore some of Dartmoor's lost forests by establishing of a network of community woodlands and nurturing the native woodland regeneration currently occurring in some areas on Dartmoor. But what might be the best areas for this? How can we identify the most suitable sites for regeneration of native woodland? How would woodland regeneration fit in with the other needs of local communities, visitors, landowners and farmers? How much can woodland regeneration help alleviate flooding downstream? Could Dartmoor be a useful case study for the broader UK picture, providing answers of how we could best manage UK uplands?



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Licensed to kill for Biodiversity – Invasive Non-Native Species Reform

EU and domestic laws directed towards the problems posed to established ecosystems by invasive non-native species of fauna and flora have been the subject of considerable review and enhancement in the past two years. This paper examines the basis of the change in policy and law that has put 'invasive' in the spotlight – with a focus upon both the EU's 2014 strategy and the UK Law Commission's report in the same year. It locates the policy and legal developments within the general framework of biodiversity protection and enhancement in the EU and UK territories, and considers the likely impacts on landowners and other 'responsible' stakeholders in complying with both the established legal system prior to the recent developments; and the contemporary changes brought about by amendment and legal innovation. In addition, issues, in particular, of animal welfare has become a significant factor in circumstances where the law permits the culling or elimination of certain species: an issue which when applied to a very native species, the badger, has proved exceptionally controversial and polarising; and which has resulted in clarificatory litigation. Evaluating the purpose of the law, the proportionality of its obligations, and the reality of changing ecosystems will inform any assessment of the success of the measures.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### The future of health, wellbeing and physical education: Optimising children's health and wellbeing through local and global sustainable partnerships

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The partnership story presents a Health, Wellbeing & Physical Education (HW & PE) initiative; 'Best Start: A community collaborative approach to lifelong health and wellness'. The initiative models the UN ideals contextualised into local schools and communities. What began as a pathway seed quickly grew to involve multi-stakeholder partnerships; Australian universities, schools, Australian Registered Training Organisations (RTO), the local health industry (local leisure and sports centre), Education departments, sport governing bodies at the national level, and a world leading international Initial Teacher Education (ITE) university course in the UK. Sustainable partnerships are identified by the UN as essential for implementing the SDGs, which apply to all nations around the world. This is significant as Goal Three and Four of the SDGs directly relate to HW & PE. Data gathered from various stakeholders in this research project suggests quality physical education (QPE) is enhanced when partnerships are established. Hence, a sustainable earth from a health, wellbeing and physical education perspective requires sustained community relations.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Adventures in Architecture: The Ever-Increasing Circle

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This paper explores the successes of an increasingly interdisciplinary approach to building design and considers the scope of a similar attitude to post-occupancy analytics and evaluation. Post occupancy evaluations tend to focus on providing feedback for future similar projects, whilst this paper aims to establish a refocusing on empowering end-users. The proposal is considered by drawing upon experiences in architectural practice concerning the question of building performance sustainability and how it is achieved, maintained and communicated to end users. In analysing the current state of play within the industry, the paper considers first hand experiences and lessons learnt from working on eco-tourism projects in East Africa and makes comparisons to large scale UK based projects in the public eye such as Battersea Power Station and Park Hill. Whilst advances in interdisciplinary building design, data set and parametric analytics have fundamentally altered methods of production and procurement, the paper proposes that an expansion of an architect's mandatory service to include a performance auditing duty, or a 'Building MOT' would create a valuable tool of public outreach and awareness. In parallel, implementing this proposal would require a reassessment of the current syllabus of architectural education to introduce young architects to the principles of life cycle building monitoring using the analytical tools and expertise of other disciplines and, perhaps more vitally, how to implement remedial measures.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### The effects of environment on exercise and attitudes towards sustainability

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Mental and physical health problems are increasing, for example depression rates and obesity rates are rising. Studies suggest that mental and physical benefits result from spending time in nature and exercising. Motivation plays a key role in the uptake of exercise. The main objective of this study was to measure motivation to exercise in 3 environments' beach (blue), woods (green) and, urban (control). The hypothesis stated that motivation to exercise will be higher in the blue and green condition than in the control condition. A video of a beach or woods designed for cycling indoors was displayed using a projector in a laboratory. This allowed for an easy manipulation of environments and for collection of data. Sixty students from the Plymouth University participation pool cycled on a stationary exercise bike for 8 minutes in the laboratory setting and completed questionnaires. The questionnaires measured physical activity and self-esteem before the cycle and perceived exertion, self-esteem, time perception, opinions about the cycle and attitudes towards sustainability after the cycle. Heart rate was measured every minute during the cycle. It is anticipated that self-esteem, motivation to exercise, and scores on sustainability scale will be equal but higher in the green and blue condition than in the control condition. If results match the anticipated results the findings would be advantageous in designing gym layout in order to motivate people to exercise harder and regularly. People's improved attitude to sustainable behaviour could result in more sustainable behaviour. More research would be needed to determine that.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### The role of participatory food events to engage 'marginalized' communities

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**Background:** With food poverty currently a topical concern, urgent consideration needs to be given to marginalized communities to improve their food choices. The Food as a Lifestyle Motivator (FLM) pilot project (ISSR funded, 2014) explored creative methods for gaining insight into food experiences of homeless service users in Plymouth. The pilot findings have informed local practice and research is evolving to improve wellbeing and inform social sustainability. One strand of FLM explored 'the role of participatory food events to engage 'marginalized' communities'. A Stakeholder engagement workshop in November 2015, (ESRC Festival of Social Science event), brought together multi-disciplinary FLM team members with key stakeholders, including services users. Methods: Various food activities took place (education, 'photo workshop', cooking), evaluated using ranking scores and 'Participatory Action Research' (PAR) approaches (Minkler, 2010) to capture engagement. These included service user surveys, and audio-recorded discussions with service providers. One question was standardised: "How do you think food events can enhance wellbeing of hard to reach/marginalized individuals?" Results: Over 100 individuals attended, including 35 service users. Analysis is ongoing, with preliminary results showing high participant enjoyment and improved food practices. Survey findings will be presented for n=8 service users; audio-recorded discussions will be presented for n=19 service providers. Implications: Preliminary findings indicate participatory food events are effective for engaging participants in important wellbeing dialogues. This work has great potential for informing implementation of local policies/practice that promote socially inclusive food activities as part of service provision. This could also inform 'alliance commissioning' and lead to improved wellbeing outcomes.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Art can change the world

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Art can change the world. Artists have played an important part in every major social change in our society and have an indispensable role today in helping us deal with complex existential challenges. But issues-laden art can be bombastic, unsubtle and lacking in spirit, particularly when artists insist they have a message to send. In 2017, in partnership with Plymouth University, Schumacher College launches its new MA/MFA Arts & Ecology. This delivery is merely one aspect of a clustering of activity and organisations coming together under the holding title of art.earth. Art.earth will act as a hub and gathering place for artists, scientists, researchers, philosophers, organisations, academic institutions and others with a specific interest in creativity and our planet. Key partners are the Centre for Contemporary Art and the Natural World, which for more than decade has showcased the work of some of the world's leading artists concerned with the planet on which we live and how we inhabit it, and RANE (Research in Art, Nature and Environment) a research cluster formerly based at Falmouth University. Both CCANW and RANE have recently relocated: CCANW to Schumacher College and the Dartington Estate, and RANE to its new virtual home at [www.artdotearth.org](http://www.artdotearth.org). These are powerful voices – by no means acting alone – advocating contemporary art as an essential contributor to our essential conversation about the future of this fragile place we all inhabit. We argue that art can go where science cannot.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Imagining an Alternative: How Novels Have Explored Sustainability

To bring about change we need first to be able to imagine it; picturing precedes practice. So why not learn from how some of the most accomplished and rigorous imaginers around have tried to conceive of alternative communities: from the paths they've taken and the problems they've already encountered? This presentation will discuss how three novelists from the last 120 years have, at different points, tried to use literary form to explore the possibility of alternative communities and ways of being: societal, economic, environmental. Their detailed and persistent imaginings can provide insight into issues which are of pressing relevance to anyone concerned with sustainability: for instance, into the challenges posed by questions of scale (individual/communal; local/global) and the gaps between conceptualisation and action.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Additional authors or affiliations:** None

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Plymouth Community Homes Re-Use Centre

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Plymouth Community Homes (PCH) is a large social housing provider with over 14,000 residential properties across the city. In our role as a landlord we have a responsibility to collect and dispose of waste arising from items left behind in empty residential properties and from incidents of fly tipping on PCH land which can amount to as much as 100 tonnes a month. Previously all of this waste was being disposed of as unsorted, general waste which incurred a high cost to the organisation. Facing a 'trilemma' of increasing disposal costs, poor environmental outcomes and missed opportunity for realising added social value, we decided to try something different with how we deal with this waste. In June of 2015 we set up new premises to receive all of this waste giving us the chance to sort and separate items that have potential re-use value as well anything that can be recycled. We work with a range of charities, social enterprises and local businesses across the city and wider region to realise the re-use potential of these items so that they can be passed back to those people within the community who are most in need. So far we have seen recycling rates for this area increase from 0 to 50%+ with an additional 5% rate of re-use on top. The project has cut disposal costs, is helping to support local people and organisations, and is resulting in better environmental outcomes.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Healthcare waste management during the Nepal earthquake: lessons learned for disaster resistant systems.

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Healthcare waste management in low to middle income countries is seriously underfunded and often poorly executed. This results in risks to over half the population and the infringement of human rights including the right to a clean environment and the right to life and health. The danger is exacerbated during disasters when large numbers of casualties and damaged infrastructure increase the amount of waste and hamper proper disposal when the public are at their most vulnerable. Health Care Without Harm and Health Care Foundation Nepal have successfully collaborated since 2007 to implement safe and sustainable non-incineration healthcare waste management in Nepal, employing technologies including autoclaving, biodigestion and materials recycling. However, the majority of healthcare facilities still dispose of their waste untreated or burn it in the open or in highly polluting small scale incinerators. In April 2015, Nepal suffered a magnitude 7.8 earthquake and severe aftershocks which killed over 8,000 people and damaged or destroyed some 1,000 hospitals or healthcare centres. Hospitals were flooded with casualties, and many more were treated in the field hospitals sent and staffed by the international community. This paper will outline the successful waste treatment systems used in facilities of different types in Nepal, how the staff and systems coped in the crisis, and options for treating the waste generated in temporary field hospitals. The lessons learned are presented in the context of the need for resilience against natural and manmade disasters including climate related events.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### Sustainable Procurement in the Healthcare Sector: a powerful tool for environmental health and justice.

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For twenty years, Health Care Without Harm has worked with health professionals, hospitals, health systems, ministries of health and UN organizations to reduce the environmental footprint of the healthcare sector and engage its political, moral and economic clout as a force for broader societal sustainability. The healthcare sector procures products worth many billions of dollars annually. These range from pharmaceuticals and surgical instruments to everyday products including disposable gloves, electronics and cleaning agents. Many are manufactured in developing countries where workers' and human rights are not respected and child labour is employed. However, many environmentally friendly and socially responsible services and products are already available and can be purchased today. As part of its mission, HCWH has developed deep collaborations with leading hospital systems in the United States and innovated sustainable procurement criteria and practices that are increasingly employed by the US health care system. Similar HCWH-led innovations are underway in Europe, where public procurement equates to 20% of GDP and local authorities procure a vast amount of products for the healthcare sector. In 2015, HCWH began a project with the UN interagency Task Team on Sustainable Procurement in the Health. The project will develop tools to guide procurement of safer alternatives to hazardous chemicals and products in order to protect health care workers, patients, communities, and the environment. Opportunities and recommendations for the implementation of green procurement in the health sector will be discussed.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

#### A new methodology to determinate the number of representative sampling points of PM10 in an area

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One of Earth's most important natural resources is its atmosphere. Clean air is essential for life, for this reason its control is very important for sustainable cities. One of the main problems that arises in the assessment of air quality in an area is to estimate the number of representative sampling points of each microenvironment in it. Thus in this study a new statistical tool to facilitate this decision is presented. The research is based on the assessment of PM10 in microenvironments within a city in eastern Spain, Vila-real. This city is in the province of Castellón. This province is a strategic area in the framework of European Union (EU) pollution control. Approximately 80% of European ceramic tiles and ceramic frit manufacturers are concentrated in two areas, forming the so-called "ceramics clusters"; one is in Modena (Italy) and the other one in Castellón. In this kind of areas there are a lot of air pollutants from this industry making it difficult to fulfill de European limits of PM10 therefore it is necessary to control the air quality in them. The PM10 samples were collected by a medium volume sampler according to European regulations (Council Directive, 2008/50/EC). Particle concentration levels were determined gravimetrically (EN 12341:1999). Nowadays, the methodology used for this issue by other authors does not use the covariates (distances, meteorology...) and external elements (sources) that affect the problem. We present a new model that reduces the variability and increases the quality of the comparison of the sampling points. The methodology carried out in this paper is a useful tool for developing future Air Quality Plans in other industrialised areas.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:**

Health and Wellbeing | Biodiversity and Conservation | Cities and Communities

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### ABSTRACT

**Adapting the Collaborative Leadership for Sustainability programme for community activists in Plymouth and Inuit people in Rigolet, Canada.**

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Eliciting action and social change at the community level is key to transitioning societies towards better futures. In this paper we introduce “Community Classrooms for Sustainability”, a community-based learning programme adapted from the Collaborative Leadership for Sustainability co-curricular course for Plymouth University students. Community Classrooms have been piloted with community activists from a neighbourhood in Plymouth which has been affected by the development of an Energy from Waste plant and Inuit people in the far north of Canada who are affected by climate change. Key to the successful adaptation of the programme was the communication of key concepts which included constructivist approaches, complexity, distributed leadership, social identity and self-transcending world-views, in ways that are meaningful and of practical relevance to the learners. This was achieved by placing an emphasis on active learning such that the students could experience themselves as collaborative leaders for sustainability and by facilitating reflective processes that enable learners to relate the course concepts to their own experience using their own language and cultural references. The programmes, which have been piloted with small initial cohorts, can be shown to have fostered a social identity in sustainability and tapped into a collective intrinsic motivation to participate in generating better futures for all. They have helped to instil skills and strategies for collaborative exploration and consensus-based approaches to addressing community problems. The approaches used are of relevance to the development of pedagogies for deep learning in leadership education and education for sustainability, both in higher education and in community contexts.



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**Water**

**Energy**

**Responsible Consumption  
and Production**

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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Mine Water Heat Resource in SW England

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Cornwall and west Devon are one of the most intensely mined areas in the UK. This historic activity has left a legacy of abandoned mine workings and despoiled ground, with the associated negative environmental impacts of subsidence and contamination. Several areas of the world have identified the potential to create a positive impact from their mining legacy by utilising flooded mine workings as a source of resilient and sustainable low-exergy heating and cooling for buildings. Although a few small scale heating schemes are operating in the UK, the concept remains relatively undeveloped in the South West, where many of the rural communities are remote from the mains gas network, but lie within or close to former mining districts. In this region there were over 2,000 mines active at various periods during the nineteenth century, with approximately 70 of these mines reaching depths in excess of 300 metres, where temperatures would be  $>20^{\circ}\text{C}$ . These wide-spread and extensive abandoned mine workings could provide an enormous sustainable energy resource that would make a significant contribution towards the demands of domestic and industrial heating and cooling and towards the aspirations of the UK's energy trilemma. A detailed assessment based on the information shown on abandoned mine plans could enable an initial estimate of the deep mine water resource in the South West and identify locations where specific opportunities may exist for commercial scale heating and cooling.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Mr Mike Collins

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**Organisation:** Arup

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**Additional authors or affiliations:** Dr Matthew Free (Arup) and Dr Ryan Law (Geothermal Engineering Ltd)

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Low Carbon, Low Risk and Low Cost Deep Geothermal Single Well Technology – Towards Heat Decarbonisation

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Deep Geothermal Development in the UK is presently non-existent due predominantly to the perceived high risks and high costs associated with exploration and indeed the presence (or not) of high temperature / permeable thermal reservoirs at depth. Geon Energy (which combines the technical and commercial capabilities of Geothermal Engineering Ltd and Arup) has developed the Deep Geothermal Single Well (DGSW) which is a 2-2.5km well that can work in almost any geological environment. The DGSW and is proven to produce up-to 400kw of thermal capacity (2GWh annually) of low carbon and sustainable renewable heat at temperatures of 60-75C. The presentation would introduce the innovative technology behind the DGSW and discuss the projects that Geon Energy are engaged upon in the UK, including the Scottish Government Deep Geothermal Challenge Funded (LCITP) feasibility study for the installation of a DGSW at the new AECC in Aberdeen where we are collaborating with St Andrews University. Our active projects cover a range of developments in both sedimentary and igneous geological settings and our Cheshire project is approaching drilling stage for a 2.5km DGSW at Manchester Metropolitan University's Crewe Campus in 2016. The DGSW does not require fracking, hydraulic stimulation or use any chemicals in its construction and can be designed for a 50 year + operational life and has attracted significant funding from DECC. Collaboration with Universities is a major opportunity and we will discuss the benefits of industry / academia collaboration in addressing decarbonisation of heat with reference to our current projects.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Dr Roger Cutting

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**Organisation:** Plymouth University

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**Additional authors or affiliations:** Mr Alan Dyer

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

**Fuelling the Community: The role of community based wood-fuel co-operatives in providing sustainable fuel resources and their wider contribution to community engagement in environmental management.**

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The Hill Review (2012) suggests almost 9 million people, including 1.5 million children, in the UK will be living in fuel poverty by the end of 2016 with rural communities experiencing a depth of fuel poverty twice that of urban areas (Hill, 2012). However, across England a number of community based wood-fuel co-operatives have been established, with the intention of providing an alternative and sustainable fuel source, managed, produced and utilised by the community (Small Woods Association, 2009; Bell and Cutting, 2015). Government support for community programmes is in place, indeed, "Community engagement in the energy sector will be vital to our mission of the development of energy in the UK" Greg Baker, Minister of State for Climate Change (2013) Focusing on Axewoods Wood-Fuel Co-operative in East Devon, this presentation explores the motivations and mechanisms by which the co-operative has been initiated along with respective aims, governance and membership. It evaluates the development of local and sustainable wood-fuel resources and the establishment and legitimisation of wider collective learnt experiences through the operation of the co-operative in relation to the development of skills, wider environmental commitments and the empowerment of a community to engage in fuel harvesting and processing. The implications and management of Charlara dieback, also known as Ash dieback, at community levels combined with Local Authorities woodland asset transfers to community groups (Guardian, 2014; Plunkett Foundation, 2016) suggests a review of the contribution of such groups to localised sustainable fuel securement and wider environmental management is timely and apposite.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Dr Peter Downs

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**Organisation:** Plymouth University

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Sustaining the non-sustainable? Early implications of the effectiveness of gravel augmentation in restoring salmonid habitat in upland rivers below large dams

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Mitigating the adverse ecological impacts downstream of large dams is a taxing challenge. Whereas unsafe or obsolete dams can be removed, viable dams require measures that allow the downstream water body to sustain 'good' or 'good potential' surface water status under the EU Water Framework Directive. In the River Avon (Devon, UK), gravel augmentation is being trialled as a measure to mitigate the presumed effects of the Avon Dam on salmonid populations, with the benefits assessed using a combination of habitat mapping, fish surveys and several new sediment monitoring technologies. A combination of seismic impact plates and RFID-tagged particles are being used to establish the mobility rates, dispersal distances and settling locations of transported gravels, and so assist in determining appropriate volumes, frequencies and locations for future augmentation. 150 tagged particles of augmented (42 mm) and native (55-58 mm) sediments were added to a pilot gravel augmentation in autumn 2014. In the relatively dry winter that followed, 17 small floods mobilised a majority of the augmented load with 58% of the material passing over an impact plate situated just downstream. Tracer recovery is challenging but indicated that particle transport distances were proportional to the flow energy applied, but only weakly size-related. Initial conclusions suggest that augmented particles are easily entrained and were starting to settle in depositional locations, but many were transported beyond the augmentation reach. Analyses indicated that continued augmentation could progressively replenish sediment storage in the reach but would require far greater volumes of added material.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Dr Julie Goodhew

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**Organisation:** Plymouth University

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**Additional authors or affiliations:** Goodhew, Fox, Pahl and Goodhew

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Making solar gain visible

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Solar power deployment is important in achieving the UK government's 2020 target of having renewable energy sources provide 15% of the UK's final consumption. Whilst photovoltaic (PV) generation is a popular form of renewable power, the UK government recognises that to maintain this support, more collective take-up is required and there could be increased use of solar gain as well as solar PV and solar thermal.

Investors in solar energy systems need to believe in the efficacy and realistic nature of this natural power source. Imagery can shape perceptions of real-world issues and thermal imaging can provide visual evidence of solar gain. Previous research has shown that using thermal visuals with householders promoted the uptake of energy efficiency actions (Goodhew, et. al, 2015). Thermal imaging cameras provide images showing infrared radiation and the apparent surface temperature of a building. Time series imaging enables the observation of transient changes in material properties, providing a visual of the natural resource in relation to the building (Fox et al, 2012).

We present a time series thermal visualisation tool showing the effect of solar gain on buildings taken over a 24 hour period (imaged every 5 minutes). Secondly, we present the results of a laboratory study which evaluated the impact of viewing this visualisation, compared to a digital time-lapsed photograph of the same buildings over the same 24 hour period. This laboratory study tested the effect of viewing the images on the antecedents of energy related behaviours, especially efficacy, knowledge and perceived benefit.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Mr Mark Hodgson

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**Organisation:** Co-cars Ltd

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**Additional authors or affiliations:** Carplus

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### on-demand sustainable mobility for all

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Co-cars is the SW largest car club from Wiltshire to Somerset, Devon, Dorset and now coming to Plymouth, and Cornwall. In 2016 we will be launching on-demand e-bikes in Exeter. Co-cars offers on demand low carbon mobility access for all. Low carbon cars & e-bikes are located across the cities and towns and can be booked from 1 hour to day, your smartphone and accessed with a smart card & pin. You only pay for what you use. This maximises the efficiency of the resource produced (cars are only used 6% of the time, our are used 25% of the time), reduces congestion, the need for new roads, commuting etc. In drives behaviour change enables smart travel and smart cities, as all data is tracked and can be analysis to improve the cities travel patterns.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Mr Peter Ledingham

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**Organisation:** GeoScience Limited

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**Additional authors or affiliations:** BSc ACSM

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Is geothermal energy really such a bad idea?

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About 99% of the Earth's mass exists at a temperature above 100 degrees C and the amount of thermal energy stored at accessible depths in the crust far exceeds the world's current total energy consumption, yet only a tiny fraction of it is exploited. Why? Because it's a bad idea. It is expensive to develop and operate, too limited in geographical location, too dangerous, too polluting and too risky. It will run out, it requires expensive infrastructure, it causes earthquakes, it is too fickle, too novel and too ugly, and it's not as good as other renewable energy sources. At least that's what its detractors say. This paper sets out to examine the main objections that are raised against geothermal developments and the barriers that have limited growth. It shows that some concerns are unfounded, that others can be readily addressed and argues that geothermal energy could play a more prominent part in energy diversity and security in many countries, including the UK.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Ms Katie Miller

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**Organisation:** ClientEarth (as secretariat, on behalf of the Sustainable Seafood Coalition)

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**Additional authors or affiliations:** The Sustainable Seafood Coalition is composed of 22 member organisations across the UK seafood supply chain and a secretariat, ClientEarth (non-profit environmental law organisation). The full list of SSC members can be found here: <http://sustainableseafo>

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### The Sustainable Seafood Coalition

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The Sustainable Seafood Coalition is a group of UK businesses committed to finding common solutions for a more responsible and sustainable seafood supply chain. With a vision that all UK-sold fish and seafood be from sustainable sources, the SSC brings together almost 75% of the UK retail market for seafood, leading suppliers, brands and food service outlets. The SSC's 23 members, many of them direct competitors, worked together for three years to develop two voluntary codes of conduct (launched September 2014), building trust and ownership in the process. The SSC ensures consistency and minimum criteria are available to the market in areas where laws are insufficient, or non-existent. Based on agreement of what "sustainability" and "responsibility" mean in relation to fish, the labelling code creates a level playing field and ensures voluntary claims are clear, consistent and meaningful. Members commit to only using those claims if all own-brand products were sourced in line with agreed minimum standards. Responsible sourcing behaviour includes doing a risk assessment, and taking remedial action to improve the fishery or farm towards sustainability where necessary, such as involvement in improvement projects. There has been growing interest in the SSC's approach by industry and NGOs alike, replacing initial scepticism such an initiative could work. It is gaining international recognition as an example of best practice for using market influence to achieve positive change. The SSC was a finalist under the SeaWeb Seafood Champion awards' "Vision" category and continues to collaborate on seafood sustainability issues.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Dr Sabine Pahl

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**Organisation:** Plymouth University

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**Additional authors or affiliations:** Christine Boomsma, Rory Jones and Alba Fuertes

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

Exploring relationships between housing conditions, energy consumption, health and well-being among social housing tenants: Findings from the EnerGAware project.

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A key concern for social housing tenants is how to achieve adequate levels of warmth and comfort in their home within a limited household budget. The multi-disciplinary EnerGAware project ([energaware.eu](http://energaware.eu)) aims to develop a game that can help social housing tenants to reduce their energy consumption by increasing energy understanding and providing behavioural strategies. The first phase of this research project included a large tenant survey to capture responses from over five hundred social housing tenants in South-West England; findings from this survey will feed into the game development. The survey measured social housing tenants' perceptions of their home; energy-related attitudes, beliefs and behaviours; socio-demographics, health and mental well-being. The results are indicative of a strong negative effect of condensation, damp and mould problems on tenants' self-reported health and well-being. Being able to keep comfortably warm in winter was also an important factor, while issues with overheating were associated less strongly with health. Worries about energy bills also had a negative effect on health and well-being, and tenants reported better health if they felt satisfied with their home. Further relationships between housing conditions, energy-related beliefs and behaviours, and health and well-being are explored. The survey findings provide an insight into the important inter-linking factors that surround health, well-being and energy use in this sample of vulnerable tenants. We discuss the implications of the findings for the development of the EnerGAware game and other initiatives aimed at helping social housing tenants manage their energy use and ensure a comfortable home.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Dr Sujata Ray

**Organisation:** Indian Institute of Science Education and Research Kolkata

**Additional authors or affiliations:** None

**Abstract theme:** Water | Energy | Responsible Consumption and Production

### ABSTRACT

#### Human Exposure to Pesticides: Lessons from Kolkata, India

The sustainable use of pesticides requires balancing the twin needs of protecting agricultural crops from pests and simultaneously preventing negative health impacts on non-target organisms. This balance is achieved by regulating the use of the chemicals so that the environmental concentrations are high enough to control pests but low enough to protect human health. This requires active monitoring, so that unacceptable risks are identified.

We investigate pesticide exposure in and near Kolkata, India, using concentrations detected in human milk as an indicator. We study both organochlorines, which are gradually being phased out of use, and Pyrethroids, which are the new generation chemicals.

We detected the organochlorines Hexachlorohexane and DDT and its metabolites in 100% of samples. However, the Pyrethroids Bifenthrin, Permethrin and Lambdacyhalothrin were detected only in 46%, 15% and 11% samples respectively. While the concentrations of the majority of pesticides fell within the allowable limit, there were two important exceptions. The organochlorine Hexachlorohexane, detected at an average concentration of 2.2 ng/g whole milk and the Pyrethroid Lambdacyhalothrin, at 2.75 ng/g were above this threshold. By comparisons with previous studies, we found that the organochlorines decreased in concentration over time. The most notable was DDT, which decreased steadily since the ban on its agriculture usage, showing that regulation may lead to positive impacts.

These results identify the chemicals that, for sustainable use, require further regulation and identification of sources. This is one of the first studies to characterize Pyrethroid concentrations in human milk in this region of India.





## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Ms Kathleen Royston

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**Organisation:** SevernNet

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**Additional authors or affiliations:** None

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Working with the neighbours. Developing Circular Economy thinking through collaboration and co-operation

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SevernNet developed from an initiative looking at opportunities for industrial ecology (IE) across port industrial areas where vast quantities of resource go in, through and out of the area. Circular economy thinking can provide opportunities to use residual resources more smartly. This was demonstrated in the Netherlands from the late 80s where IE was a key tool enabling beneficial exchange of residual resources and sharing utilities and waste. SevernNet grew from a meeting of 5 Bristol Port area businesses in 2009 to 50+ businesses coming together over a 2 year period achieving known savings of £287k. There are lots of examples of collaboration across the area including:

- Sugarich receiving waste food products such as bread and dough from Warburtons and other businesses across the area. This is used to make pig food.
- Anstee and Ware refurbish and rewind very old motors still in use across utilities such as motors for pumping. These can be retained in service rather than new provision.
- The Biobus is powered by Biomethane from sewage; and residue can be spread on land as an agricultural enricher

Bringing stakeholders and businesses together triggers quick wins which can develop into major infrastructure projects over time as confidence grows. One of the most important ingredients is gaining a wider knowledge of the businesses and organisations across the area and sharing information about their needs, requirements and residual resources. We'd like to see the SevernNet Area developing into an exemplar circular community as we move towards 2030. Are there similar opportunities for Plymouth?



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Ms Kate Royston

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**Organisation:** Transition Tavistock

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**Additional authors or affiliations:** Prof. Kit Harbottle, Liz Whitwell and Simon Platten

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Tavistock and District Local Economic Blueprint – how much local benefit comes from our spending on food and energy?

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Our patterns of spending on food and energy have a significant impact on our local economy. The Tavistock and District (TAD) Local Economic Blueprint (LEB) evaluates how much is spent in these sectors, how much benefit this brings to the local economy, and what steps might be needed in order to achieve increasing proportions of our needs through local supply chains. The project was led by Transition Tavistock with support from local public, business and community stakeholders. Spending on food and energy are essential to meet our everyday needs. Across TAD this adds up to over £120m pa. Much of this is spent with large organisations based elsewhere. The question we're asking: Do we understand what benefits this brings to our local economy and communities, and what opportunities there are for these sectors to deliver more for our future health, wellbeing, resilience and prosperity? Importantly, how can we engage local stakeholders through the supply chain from growers and generators to consumers to take action to re-localise economic benefit and grasp these opportunities? The food study indicated that we probably don't buy much local food, but eating and drinking outside the home may have greater local impact, with the wide range of diverse outlets and local sourcing often an explicit part of the cultural or quality offer. Laying out clearly the local impact and consequences of our spending habits is a valuable tool to help effect change and stimulate local co-operation and collaboration. [www.transitiontavistock.org.uk](http://www.transitiontavistock.org.uk)



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Dr David Smith

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**Organisation:** South West Water

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**Additional authors or affiliations:** Dr. Emilie Grand-Clement, University of Exeter and South West Water.

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Upstream Thinking “catchment management action and evidence”

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Upstream Thinking 2 is South West Water’s second five-year catchment management programme to improve water quality working with partners to change land-use in favour of improved water quality in our rivers. The programme is designed to help SWW deliver its business plan commitments to:

- provide clean safe and reliable supply of drinking water
- Protect the environment
- Available and sufficient resources
- Resilience in extreme conditions
- Benefiting the community
- Fair charging.

Working in partnership with the Exmoor National Park Authority, the Westcountry Rivers Trust, Devon Wildlife Trust and Cornwall Wildlife Trust, the aim is to improve water quality in 11 catchments through Moorland and lowland farm interventions. Comprising 14 separate projects run by the four partners in combination and separately, the programme is worth nearly £12million and will benefit 15 water treatment works – 50% of South West Water’s water treatment works supplying 72% of the total daily water into supply. The programme is fully endorsed by local quality regulators, the Environment Agency and Natural England and is wholly aligned with the national guidance issued for PR14 by Defra in the Statement of Obligations, the EA and DWI. In addition to moorland re-wetting work and the farm scale actions in the catchments our aim is to develop an empirical evidence-based monitoring programme to enable SWW to understand the business and wider benefits of sustainable catchment management. This work is being undertaken by the University of Exeter in collaboration with SWW and the Upstream Thinking delivery Partners.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Prof. Russell Thomas

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**Organisation:** WSP|Parsons Brinckerhoff

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**Additional authors or affiliations:** Prof. Bob Kalin, Chris Gallagher and Fabrizio Colosimo (all University of Strathclyde)

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Innovative Approaches to Understanding Environmental Legacy of the British Gas Industry

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Gasworks were a common feature across the UK, present in every city, town and many villages. There were over 4000 Gasworks in the UK and many more worldwide. Continuous development was undertaken in the gas industry to improve the manufacture of gas and to meet its changing demands. Its original purpose was primarily for street lighting to its eventual use for domestic and commercial heating purposes, this led to a very wide diversity of gas manufacturing processes being used across the UK. They have left an environmental legacy, for which the application of accurate environmental forensic methods may help provide a greater degree of understanding than that currently provided by standard analytical methods. The land ownership issues posed by the former MGPs in the UK are complex and this greatly affects how forensics may be used in the UK. When this is combined with the range of different processes used, the different by-products formed, how these were handled, used and disposed of and the potential impacts on other nearby historic industries, it creates a very complex picture. With the development of 2D GCMS methods for the detailed analysis of gasworks residues such as coal tar coupled to an understanding of the historical development of gasworks, environmental forensics can now be applied to former gasworks sites. Within this presentation we review the development of this industry and the technologies used and try to demonstrate how this industry's evolution may impact on how environmental forensics techniques are used in the UK and abroad.





## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Mr Peter Thorn

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**Organisation:** The Coal Authority

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**Additional authors or affiliations:** Jeremy Crooks, Principal Manager – Innovation, The Coal Authority

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### Pollution to Solution – Greening the legacy of mining

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Britain has centuries of mining that have led to both wealth creation, and environmental damage and pollution. As we deal with the impact of mining from early man, through the Romans to the industrial revolution and to recent times, the historical problems left behind can, through innovation, lead to solutions for modern issues of climate change, and energy and water scarcity. Over 100 billion litres of water a year from Britain's abandoned mines is treated to benefit the environment. But, as well as providing environmental improvement, this water has a value as a water supply, a source of energy and a source of minerals to help with modern societal problems. Heat from the water can be used to provide renewable energy; treated water can be used to offset potable water in industrial usage; and iron from the water, once causing rivers to run orange, can be extracted and used to prevent eutrophication of watercourses by removing phosphate. With economic, political and social drivers these innovations are becoming reality.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Mr Antony Turner

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**Organisation:** Carbon Visuals

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**Additional authors or affiliations:** None

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**Abstract theme:** Water | Energy | Responsible Consumption and Production

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### ABSTRACT

#### The university campus as low-carbon learning tool

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Energy use in buildings accounts for around 40% of the world's carbon emissions but for most people these are unseen and unknown. Forward-thinking universities have the potential to use their own campuses as learning tools. Engaging animated videos and visual tools make energy and emissions from buildings real.

Carbon Visuals is developing a visual web-tool that reveals actual volumes of carbon dioxide associated with energy use for every building on campus – as real-time streams and daily 'piles' of turquoise blue bubbles. Unlike conventional energy dashboards used by estates departments and energy managers this tool is designed for non-engaged audiences – people who have no prior knowledge or interest in the subject.

Using a simple interactive map of the campus everyone can now see and compare the emissions and energy saving measures associated with all buildings. Images can be saved and shared on social media, and prompts for energy-saving behaviour can be accessed on a building-by-building basis. Designed to be displayed on kiosks in high-footfall parts of the university, the tool can initially be accessed on the internet.

To raise awareness of the subject a short animated video, designed for social media, can be created to show the university's total emissions. A longer explanatory animation, like the one created for Plymouth University in 2014 can also be created. This shows not just total emissions but also a significant energy and carbon saving initiative in one building.



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# **Climate Change Resources Education**

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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Mr Hezron Andang'o

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**Organisation:** National Drought Management Authority – Kenya

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**Additional authors or affiliations:** Philip Omondi – World Food Programme

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**Abstract theme:** Climate Change | Resources | Education

---

### ABSTRACT

#### Impacts of Climate Change and Variability on Food Security in Kenya

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The economies and livelihoods of people in Kenya is dependent on rain-fed agriculture that is highly sensitive to weather, climate variability and extremes. Despite progress made in reducing extreme poverty and food insecurity in this country, climate continues to pose significant threats. It is therefore critical to address these risks, and focus efforts in building resilience among the most vulnerable populations. In order to identify policies to support the most vulnerable people in Kenya, it is important to understand what the climate impacts are on livelihoods and food security. This study documents past and current climate trends, identify geographic patterns of variability, and understand how previous climate shocks and stressors align with trends in food production outcomes. The methodology adopted include an estimation of the annual economical exposition to drought based on Standardized Precipitation Index (SPI), key food security variables for analysis include crop production, area under crop cover, and yields. The results showed that areas with decreasing rainfall trends, high population density, high land degradation and intense agricultural activities are some of the most vulnerable. The outcome of this study is useful to a wide range of stakeholders who intends to target priority areas for intervention.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Miss Ugonwa Aroh

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**Organisation:** University of Huddersfield

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**Additional authors or affiliations:** Dr Emma Salter and Dr Julia Meaton

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Green Economy: is it achievable in Nigeria?

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After the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012 (known as Rio+20), several countries have witnessed a remarkable development of the 'green economy' by, for example, promoting energy efficiency and clean energy technologies. The 'green economy' project responds to the social, economic and ecological crises presently afflicting the world by aiming to support the values underpinning ecology and sustainable development. Drawing on empirical data gathered from case-study research in Rivers State, Nigeria, this paper investigates the relationship between Nigeria attaining a green economy in the near future, and teaching and learning about ecology and sustainability in secondary school education. Initial results show that even though these topics are included in the country's education curricular, they are often omitted during the classroom teaching. A lack of awareness about ecology and sustainability amongst Nigeria's young population means it will be difficult for Nigeria to achieve a green economy any time soon. Therefore, the research recommends that classroom teaching should reflect education curricular because education is believed to play an important role in sustaining the green economy project.





## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Miss Nuria Bonet

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**Organisation:** Interdisciplinary Centre for Computer Music Research (ICCMR),  
Plymouth University

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**Additional authors or affiliations:** None

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Public Engagement in Sustainability through Music and Sound Art

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My research looks at music and sound art as ways to engage audiences with topics of sustainability and climate change. In particular, I work with sonification which is the transmission of data through audio rather than visually. When sonifying data related to climate change for example, the audience can effectively listen to climate change. Interpreting data aurally can have advantages as we can understand different more complex aspects of information through our ears than our eyes. Furthermore, music evokes an emotional reaction in a listener which can further the empirical perception of scientific concepts. As a composer and researcher, I look for data to sound mappings which can result in the most powerful but also scientifically correct sonification. These result in music pieces and installations aimed at a non-specialist audience. A recent example includes a work based on climate change data taking the temperature and salinity values from the British Coast over the last century. It was presented at the Eden Project as part of NUS' launch of the Students Organizing for Sustainability Network (SOS) in October. The audience response was overwhelmingly positive as they felt that they had gained an understanding of the scale of the climate change occurring in the Atlantic Ocean while also engaging emotionally with the subject matter. This paper discusses methods available to composers and sound artists to further the sustainability cause as sonification can be a powerful tool to catch listeners' attentions. This is bolstered by examples of my own work as a composer and other related practitioners.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

**Author:** Ms Isabel Carlisle

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**Organisation:** South Devon bioregion

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**Additional authors or affiliations:** Dr. Alun Morgan, Lecturer in Education (Science), Plymouth University

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### The South Devon bioregional experiment

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There will be no one-size-fits-all solution to climate change, resource-depletion and economies faltering as they reach the limits to growth. It makes sense, therefore, that the intractable global issues we are facing around food, water, waste and energy can best be solved at the level of the bio-region, a geographical area with unique features of geology and geography that make it a distinct territory. By recognising the role that communities have always played in stewarding their bio-regional ecologies and managing their local economies, we can ally that resource into multi-stakeholder partnerships with local government, learning institutions, businesses and many other kinds of organisations. The issues that we are facing need all of us to tackle them, not just experts. A bioregional experiment is now under way in South Devon—an area that is geographically and culturally distinctive, that is small enough to call home and large enough to function as a network of overlapping systems. We are connecting the dots between innovative ways to generate clean energy, grow and distribute healthy food locally, source “makers” and their products locally, finance new enterprise, take care of our eco-systems and regenerate our economies. We include place-based learning that takes Place as the starting point for curriculum and pedagogy: celebrating the local and working collaboratively and inter-generationally on real-world problems in South Devon. The experiment initiators are inviting conversations within Plymouth University to find points of convergence and to design learning pathways for Plymouth students and the broader community.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Students' energy literacy in UK universities

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Energy-saving forms an important part of efforts to enhance sustainability on campus, yet little is known about levels of energy literacy amongst HE students. Previous research suggest that students' understanding of energy is often patchy, with high concern but lower knowledge and skills (DeWaters & Powers, 2011). Where energy issues do appear in HE, this is mainly in the context of campus greening or energy-reduction schemes, particularly in student residences where the focus is predominantly behaviour change, an emphasis that may have important implications for the longer-term impact of changes. This paper reports on research which explored energy literacy in the student population at five UK universities which sat at different positions in the UK Green League. The research utilised an online questionnaire to explore similarities and differences between the institutions, exploring the extent to which differences in the universities' commitment to sustainability was reflected in students' energy literacy. Early findings suggest that there were a number of similarities in student responses between the different institutions, including widespread enthusiasm for sustainability and energy issues, but patchy experience in the curriculum. Gaps in knowledge mean that behavioural choices are not always the most effective, and energy-saving initiatives on campus are often unseen by students or undermined by 'mixed messages'. Most differences between universities could be attributed to discipline mix or gender rather than position in the Green League. However, universities with higher Green League positions were seen as doing more to save energy, and providing more information to students about energy-saving.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Greater than the sum of its parts: connecting student research with non-academic organisations

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Through the newly-launched Dissertations for Good programme, NUS connects students with charities, non-profits, and SMEs to use their dissertations or final-year projects as a force for good. The online platform, [www.nus.org.uk/dfg](http://www.nus.org.uk/dfg), partners students with organisations to complete relevant research relating to real economic, social, or environmental sustainability topics. The UK produces one world leader in every 50,000 graduates and has educated one in ten current world leaders, so there is a particular responsibility to ensure that our students are prepared to solve the world's greatest challenges. Dissertations for Good equips students with the experience and skills to be real agents of change in their future personal and professional lives. We know that 95% of students who volunteer during their time in further and higher education aim to improve things and help others. Their main difficulty is a lack of time due to academic pressures. Through Dissertations for Good, students gain hands-on experience solving real-life challenges as a part of their formal coursework. They get to use their work to have a real impact. Non-academic organisations get to tap into the knowledge, enthusiasm and resources available through university and college students. Already, students have helped CIBSE investigate building performance, Islington Council research constituents' opinions of energy metering and Generation Rent learn from housing activism in Madrid. In this session, we will explore successes and challenges of existing partnerships. We will look at the skills, knowledge, and attributes students have developed and improved and the mutual benefits of collaborative working.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Geoscience and the Sustainable Development Goals

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Geoscientists have the potential to make a significant contribution to tackling some of the major socio-environmental challenges of today. This presentation explores the opportunities for and responsibility of geoscientists to engage in such work through the Sustainable Development Goals (SDGs). The 17 internationally-agreed SDGs aim to eradicate global poverty, end unsustainable consumption patterns and facilitate sustained and inclusive growth, social development and environmental protection. Specific goals relate to clean water and sanitation, clean and affordable energy, the development of resilient infrastructure, and the need for climate action. Through the use of a matrix visualisation, a synthesis is presented that relates the 17 agreed SDGs to 11 key aspects of geoscience (agrogeology, climate change, energy, engineering geology, geohazards, geoheritage and geotourism, hydrogeology and contaminant geology, mineral and rock resources, geoeducation, geological capacity building and a miscellaneous category). The matrix demonstrates that geoscientists have an important role in achieving all 17 of the SDGs. This synthesis can help mobilise the broader geoscience community to engage in the SDGs, allowing those working on specific aspects of geoscience to consider their work in the context of sustainable development. The contribution that geoscientists can make to sustainable development is also demonstrated to other relevant disciplines, and development policy and practitioner communities. The effective engagement of geoscientists in sustainable development may require changes to existing structures and practice. Here three topics are highlighted for discussion, including (i) the development of supporting skills in education, (ii) improving transnational research collaborations, and (iii) ensuring respectful capacity building initiatives.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

### ABSTRACT

#### Visions of (Un)Sustainability

Geographers have helped analyse, and increase our understanding of, the complex relationship between the physical and human environment(s), regularly using maps and visualisations to help shape our view of the world. Graphical displays have a long history in translating the complexity of our environment into understandable visual representation, with maps the most common way of representing the geography of our world. In recent years this has resulted in the emergence of a broad range of novel ways of (re)mapping the world with the advanced use of geographical information systems (GIS). A wide range of geographic information from the human and physical environment is now available in an unprecedented level of detail. Combining this new golden age of data with the advanced capabilities of digital visualization techniques issues as diverse as wealth, rainfall, or even the environmental conditions of the oceans can be imagined in an entire new way. This allows us to gain a new understanding of how these issues shape our planet and how humans and the environment interrelate and influence each other. Why not look at the world a little differently? Creating a fairer and a more sustainable world starts with the way we see the world. This contribution will showcase and explain a wide range of innovative new maps highlighting our place on this planet which will help changing our mental map of the world from one that guides our everyday travels us to one that navigates our journey into a more sustainable future.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Geoeducation and Geoethics: two crucial disciplines for Sustainable Earth

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Humankind has achieved considerable progress in terms of science and technology in the past century. Global Cooperation in the Age of Sustainable Development requires a multidisciplinary approach. Studies on Earth and Planetary Sciences are undertaking an extraordinary transformation, which not only involves classical scientific and academic issues, but also societal, cultural and ethical approaches. In the near future, we will develop an enormous activity on our planet (and beyond), involving a vast expansion of knowledge and potential changes of the humankind's view of the world and nature. In this framework, geoscience education and geoethics are intrinsically linked. Geoscience education is a key factor in the academic, scientific and professional progress of any modern society. Likewise, geoscientists have new skills and tasks linking different disciplines and facing new responsibilities and challenges on the earth and beyond. The aim of this contribution is to give an overview of the main global initiatives on geoeducation and geoethics, highlighting the institutional activities of the International Union of Geological Sciences Commission on Geoscience Education, Training and Technology Transfer (IUGS-COGE) and the International Association for Geoethics (IAGETH). Likewise, new perspectives from geosciences to culture (e.g. the significance of geoparks) will also be provided, to develop innovative roadmaps and recommendations. The future of humankind depends, to a large extent, on the depth of our understanding about the main global scientific and technological challenges, the limitation of our natural resources, and many other environmental issues, involving the preservation of the natural systems and linking geodiversity and biodiversity.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Using game-based learning to engage students with the sustainability of waste management

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Key questions focussing on the sustainability of waste management include the following:

- What types of wastes are generated by human activities?
- How does unregulated disposal of wastes create pollution?
- How does this pollution affect environmental quality and the health of animals and humans?
- Is it acceptable for industrialised countries to export their waste to developing countries?
- What should we do (as individuals and nations) to eliminate or reduce the negative impacts of waste?

To explore these questions, delegates are invited to play Waste Connections, a card game designed to introduce students to wastes and their management. Based on the popular card game 'Concentration' (aka 'Memory' or 'Pairs'), players aim to collect pairs of cards. Each pair comprises a product and its possible impact on environmental quality or human health if disposed of improperly. Students are introduced therefore to a wide variety of wastes which range in size from bottle tops to ships, from the everyday to the specialised and from hazardous to inert. The game tests therefore not only memory but also the ability to identify links of varying complexity. Participants can choose to play solo or in groups of two, the latter option providing a choice of either a competitive or a cooperative game. Waste Connections is followed up with a series of slides which provide contextual information, quantitative data and management strategies for each waste. These slides act as a launching pad for discussion on the wider issues of sustainable waste management.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Cinctorres-Dinomania: educating with dinosaurs and geology

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Cinctorres is an inland little village in the province of Castellón, in the Valencian Community, at the Eastern part of the Iberian Peninsula. It has 424 inhabitants and it is set to 167 km from Valencia and 274 km from Barcelona, belonging to the Iberian range geological domain, concretely to the Aragonian branch, at the Maestrat basin. After several years in this rural area, in 2013, we started an ambitious project for the study, protection and promotion of their valuable and significant natural heritage. Under the name of "Project for the Promotion of Scientific Culture and Palaeontological Heritage of Cinctorres" we have attempted to approach different insights of Geology and Palaeontology to the broadly society and especially to students. Earth sciences are really vital and strategic in science education, because through the understanding and approach of geological knowledge let us to move on towards supporting and positive attitudes concerning to the environment and sustainability. In this sense, several infrastructures are being used in the project, as the educational and interpretation area, the relevant palaeontological outcrop known as "Ana's site", the dinosaur's museum, and the "Dino-Routes". All forming an exceptional scientific and dynamic cultural complex called Cinctorres-Dinomania, where we have developed a wide range of geological and palaeontological activities. One of this tasks is to teach different topics to students of the last grade of secondary school and first grade of "Bachillerato" (=High School). During the present year, it is expected that the number of students will be over a thousand.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

### ABSTRACT

#### Project of Modelling data in soils to a sustainable Soil Management

Soil is a natural resource, an interface between the atmosphere, hydrosphere and geosphere full connected with the biosphere by the energy flow that empowers the cycles of matter and triggers interactions between all trophic levels and other subsystems. As a natural resource, it is essential and strategic, at the same time as fragile and partially renewable, so that arises a crucial necessity to study because of our vital and economical requirement, on the physical environment, that let allow us to move towards a more sustainable development and management insight. Starting from the importance of soil, as an essential natural resource, this manuscript presents a project that aims to perform a modelling of geochemical, mineralogical and agronomic variables, using data from surface soil samples, and in some cases from current sediments, in the county of Castellon, Spain. This would allow to obtain a soil study characterization (geochemistry, mineralogy, soil nutrients, salinity, texture, structure, organic matter content) with a clear improvement in the criteria for targeting potential land uses and environmental land management. As a starting point, in the analysis of the area, the Geochemical Atlas of Spain data base (IGME, 2012) would be used. In addition, it is intended to finalize the Atlas introducing the new techniques of Geographic Information System (GIS) using R software.





## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Developing Seismology – The TeSS Project

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The TeSS project (Developing Seismology – Teaching Seismology in Schools) has been a highly successful project between four European schools (two schools in the UK, one from France and one from Italy) working together to develop teaching materials and resources that will enable the teaching of the principles of seismology in the developing world. This project has been funded through the EU Erasmus+ Education programme. A key component of the project has been to allow students to develop practical “low-cost” materials can be developed for the recording of seismic events. Torquay Girls' Grammar School has worked with our project partners to develop a set of materials that are low cost and portable to help with the practical aspects of teaching seismology. This has involved the use of Raspberry Pi computers and seismometers which have been made from what are effectively “scrap” materials. The project between the partner schools has allowed students to develop their understanding of seismic risk and has given them practical tools to enable them to take seismic readings and allow them to contribute to the global schools seismic network. This is seen as especially important in the countries that are less well economically developed, but which are often in seismically active zones.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### The Sustainable University – creating new learning spaces that are fit for purpose

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This workshop combines research findings on the apt design of learning spaces for sustainability education with a presentation of plans to create a new Sustainability Hub on campus for staff and students. This workshop begins by outlining the international call for interdisciplinary, collaborative, and active learning approaches to Sustainability Education. From this starting point we move on to consider the design of physical spaces conducive to such teaching and learning approaches in Higher Education. We present a research informed perspective that draws specifically from a small scale mixed-methods research project. This sought to develop an understanding of the complexity of learning spaces inhabited by HE students in the 21st century and resulted in a theoretical model for future sustainability learning spaces that places an emphasis on dynamic, engaging, ecological and participatory (DEEP) dimensions. How we might create such DEEP learning spaces with our students and staff here at Plymouth provides the final interactive element of this workshop. Participants will be able to see plans for a new Sustainability Hub on campus and share their perspectives on its design and the range of potential activities it will need to host. This Hub is in direct response to the University's sustainability strategy and will be based at Kirkby Lodge. It is hoped that the design of the Sustainability Hub will further enhance the University's integrated 'whole institutional approach to sustainability' and will provide a range of flexible spaces for staff and students to utilise in pursuit of sustainability as it relates to curriculum, research and operations.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

What do zombies, pet logs, piskies and a creature called 'IT', have in common?

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When we started I Love Nature last summer, we wanted to support children and adults have nature experiences that were different, unusual and perhaps a bit quirky. Besides, there are an awful lot of other exciting things that keep people indoors, such as gaming, social media and soap operas. Naturally, we asked ourselves if nature could afford to be as daring? We love bird watching, pond dipping and sifting through dirt like any other nature enthusiast. It's just these types of nature activities may not be as seductive as chatting to your boyfriend on Facebook on a Sunday afternoon. But tell people there's a zombie apocalypse on its way, or that a storm has trashed a pisky village and their help is required, or that a creature called 'IT' is terrorising local villages and a quest is underway to find its lair, and maybe even throw in a pet log for adoption... and you have a call to action that gets people out into nature. Build into these experiences all sorts of nature activities, such as foraging, making dens, plant identification and a bit of natural navigation, and you have a recipe for nature-connectedness equal to, and perhaps even more powerful than, Grand Theft Auto and EastEnders! In this presentation we outline a narrative-based approach for engaging people's interest in nature, and ask participants to consider if such an approach would be useful in other areas of sustainability education.



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Organisation:** Plymouth University

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Sustainable Mining and Rare Earth Element Resources – the potential of the Fen Complex, Norway

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Sustainable Mining and Rare Earth Element Resources – the potential of the Fen Complex, Norway. Wilkins, C., Dijkstra, A. and Marien, C. Geology (SOGEEES), Plymouth University. The principles of sustainable mining can be stated in two different ways: 1) Developing mines in a sustainable manner that preserves the local environment, respects and protects indigenous cultures, cares for the local community and aims to fully rehabilitate the land after mining has finished. Or, 2) Extracting minerals from the Earth in such a way that exploitation can continue indefinitely. Hence mineral resources can be thought of as effectively infinite. In this presentation we will consider the second definition of sustainable mining and discuss it in relation to the exploitation and use of REE (Rare Earth Elements) – a critical commodity in our increasingly technological society. If this question was considered for relatively well known commodities such as copper, nickel, chrome, tin, tungsten, etc. then mining must be (ultimately) unsustainable as reserves would eventually be exhausted and, of course, we live on a finite planet. However, the geological community would take a different position on this issue as consideration of known reserves and future resources, together with improvements in recycling, substitution and efficient extraction and use of commodities indicates that depletion, scarcity and exhaustion are not likely in the foreseeable future. But what about REE? They are required in increasing amounts to sustain a wide range of devices such as hybrid and electrical vehicles, catalytic converters, wind power generators, LEDs, computer hard discs, flat panel display screens, portable electronics and more. REE have been identified as critical commodities needed for our technological future but are considered to have a supply risk due to the current scarcity of economically recoverable resources as growth in demand has been rapid over the last 20 years. They are also difficult to process (separation of ore from waste), have significant environmental impacts



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when mined (e.g. associated with Th), and have potential for export restrictions from producer states. The current scarcity of REE mining operations has led to worldwide exploration initiatives that require basic research into understanding the geological processes that concentrate REE into potential ore bodies. The Fen Complex in Norway, a c. 580 Ma igneous complex containing REE-bearing carbonatites, has the potential to become a REE mine, but high Th concentrations are an impediment to exploitation at present. Carbonatite containing primary REE-minerals and REE fluorocarbonates (e.g. Bastnäsite) is progressively hydrothermally altered to hematite-rich rødbergite. The transformation of carbonatite to rødbergite causes Th-bearing REE fluorocarbonates to be replaced by hematite in conjunction with precipitation of monazite – a REE-phosphate, but with low-Th concentrations. It is hoped that future work on the separation of REE-bearing phases from Th-bearing phases during hydrothermal alteration will identify areas with potential exploitable concentrations of REE within the Fen Complex.





## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### Student Capital: the role of students in city transformation

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This paper reports on an action research project carried out by Bristol University and UWE, funded by HEFCE, which has explored how students can be mobilised to contribute to transformation in the city in which they study, the impact upon the city, the city-University relationship and upon the students themselves and their perception of what it means to live in a city. In a city where 10% of the population are students, the research has tracked how students engage with the city, has produced 100,000 hours of student volunteering for sustainability in the city and a wealth of data and insight about the impacts of this large scale engagement for the city, universities and students. This paper reflects upon the conditions for success and the transferability of large scale student sustainability engagement in cities. Was Bristol unique because of Green Capital 2015 – or is it replicable?



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## SUSTAINABLE EARTH 2016 | ABSTRACTS

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**Abstract theme:** Climate Change | Resources | Education

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### ABSTRACT

#### European deforestation and prehistoric land human use

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When was Europe transformed from a land of forests to its current land-cover mosaic? The answer to this question requires a long-term perspective, for which fossil pollen analysis is well suited. Understanding past human land use change is important for future sustainable land use and valuable to climate modelling. Fossil pollen preserved in peat and lake sediments provides a record of vegetation change; the 'pseudobiomization' approach turns pollen data into anthropogenic land cover classes. This approach has been applied to over 800 fossil pollen records from the European Pollen Database through two Leverhulme Trust funded projects. Europe-wide land cover maps have been generated at 200-year time steps, from the time of the first farming communities 9000 years ago to the present-day, which have been used to identify when human land use intensified and where impacts were most significant.



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