

PREVIOUS TRACK RECORD

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Jeremy Carter is Co-Director of CURE and leads the Green and Resilient Futures theme within the Manchester Urban Institute. His research interests focus on environmental planning and management, particularly urban climate change adaptation and resilience. He has led research projects to an award value of over £1 million, and is currently PI for the UK strand of the EU -funded RESIN (Climate Resilient Cities and Infrastructures) project. He is theme leader for Greater Manchester's Climate Change Strategy, board member of the Greater Manchester Local Nature Partnership, and expert advisor to the EU Committee of the Regions for the EU Climate Change Adaptation Strategy. (Roles: WP1 lead and WP4).

Angela Connelly is an interdisciplinary social science researcher with seven years of experience working on climate change adaptation and resilience with a particular focus on the science-policy interface and co-design methods. She has worked on the EU FP7-funded Smart Resilient Tools, Technologies and Systems (SMARTeST) project (2010 – 2012) and the H2020 funded Climate Resilient Cities and Infrastructure (RESIN) project (2015 – 2018). Recent published work includes the practical application of risk-based frameworks to climate change adaptation planning: and trans-disciplinary work in arts and sciences to explore climate change and sustainability. (Roles: WP4 co-lead, and WP6 co-lead).

Nuno Pinto is a Lecturer in Urban Planning and Urban Design at the University of Manchester, and a member of the Spatial Policy and Analysis Lab of the Manchester Urban Institute. He is also a researcher at the Centre for Land Policy and Valuation at the Technical University of Catalonia, Spain. His research focuses on the development of modelling techniques for urban phenomena, with some focus on land use and transport planning and for policy design and testing, giving particular attention to decision support in planning, land use and transport, and urban policies. He has authored more than 40 scientific and technical publications, including 17 papers in peer-reviewed journals, edited books and book chapters. He has been funded by British, Portuguese, Spanish and European agencies, and is consultant to the European Commission and Portuguese administrations. (Roles: WP2 lead).

Andrew Karvonen (CoI) is Assistant Professor of Sustainable Urban Development at the KTH Royal Institute of Technology in Stockholm. He conducts research on emergent approaches to governing sustainable and low-carbon cities. He has completed research projects on water and energy infrastructure, low-carbon transitions, urban laboratories and experiments, and smart-sustainable cities. He has authored over 40 scientific publications including three books on urban infrastructure, experimental cities, and smart cities. He is currently working on 'triple helix' modes of urban innovation that involve public, private and

academic stakeholders, as well as living laboratories that include residents as key decision-makers. (Roles: WP3 lead, and WP5 co-lead).

Sudhir Chella Rajan is Professor at the [Department of Humanities and Social Sciences](#) at IIT Madras. He was formerly Head of the Department (2011-2014) and was Coordinator of the [Indo-German Centre for Sustainability](#) (2010-2016), where he is currently Area Coordinator for Land-Use. With an inter-disciplinary doctorate from the University of California Los Angeles in 1994 he has worked in senior positions in government, research consultancies, NGOs and academia. His primary focus has been on institutions and governance for infrastructure and the environment. Rajan has worked on emergent policy dilemmas in automobile pollution regulation, the politics of power sector reform in developing countries, conflicts in energy access and climate change policy, social change in transport for climate policy, ethical approaches to addressing climate change and sea level rise, new interpretations of the resource curse in resource-rich developing countries, the shifting meanings of corruption in environmental discourse. He has worked on peri-urban landscape changes in South India, and set up the network at www.periurban.in He is author of *The Enigma of Automobility: Democratic Politics and Pollution Control* and a co-author of *The Suicidal Planet: How to Avoid Global Climate Catastrophe*. He is now writing a 'big' history of corruption in India for Harvard University Press. (Roles: WP4 leader and WP5 co-lead.)

Harini Nagendra is a Professor of Sustainability at Azim Premji University. She is an internationally known ecologist with over 25 years of research experience, who uses interdisciplinary research approaches to examine the factors shaping the social-ecological sustainability of forests and cities in south Asia. Professor Nagendra anchors the Centre for Urban Ecological Sustainability at the Azim Premji University. Professor Nagendra's publications include two books, and over 150 peer reviewed papers in journals including Nature, Nature Sustainability, Science and PNAS. She is on the Future Earth India National Committee and the Scientific Committee of the Programme for Ecosystem Change and Society. In the past, she has served as Steering Committee Member of the Global Land Programme and Diversitas, and a Lead Author of the 5th IPCC Report - Working Group III. (Roles: advisor to WP1 and WP4).

Saleem Khan (CoI): is a post-doctoral scholar at the Department of Humanities and Social Sciences, IIT Madras. He works on climate change adaptation and ecosystems vulnerability in coastal areas. He has a PhD from Anna University and prior post-doctoral training at the Earth Institute in Columbia University. (Roles: WP2)

Avilash Roul: (WP4a & WP5) is a post-doctoral scholar at the Department of Humanities and Social Sciences, IIT Madras. He has experience researching governance and cross-sectoral and cross-scale subsidiarity, and co-creation via stakeholder dialogue. He has worked previously at a senior level in an international NGO working on multilateral infrastructure investment and stakeholder dialogue. (Roles: WP4 and WP5)

Balaji Narasimhan (CoI): (WP1 & WP2) is an Associate Professor in hydrology and remote sensing at the Division of Environment and Water Resources Engineering in the Civil Engineering Department, IIT Madras. He has over two decades of experience with spatial analysis, land-use and land-use change & hydrology in a changing climate. Roles: (WP2 co-lead).

The combined Chennai team worked on a Global Technology Watch for sustainable peri-urban habitat, for the Department of Science and Technology's Strategic Knowledge Mission on Climate Change, one of India's eight missions on the National Action Plan on Climate Change. These included documenting opportunities for building climate resilience in rapidly changing peri-urban regions in India, which face the intertwined challenges of rapid spatial and economic growth and climate change.

CASE FOR SUPPORT

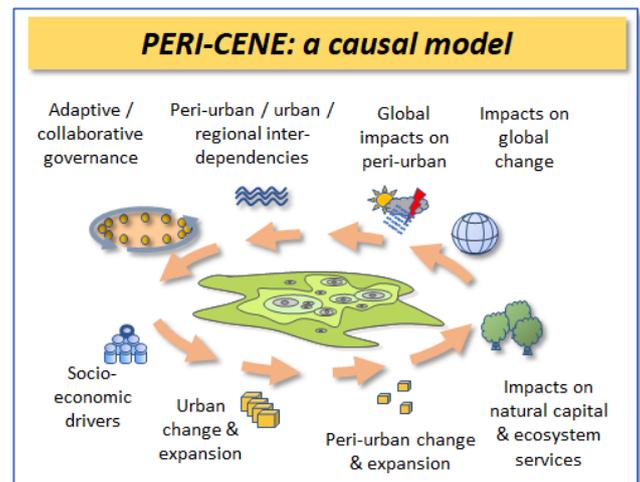
Description of the Proposed Research, not exceeding 8 sides of A4 including all tables, figures and references.

From space, the human impact on the planet is seen by the spread of cities; but the cities themselves are spreading into much larger territories, amorphous sprawling areas between and surrounding cities – i.e. the ‘peri-urban’. Arguably, the planet has not only entered the Anthropocene,¹ but also a ‘**Peri-cene**’: a global human-environment system shaped by peri-urbanization. Around the world the peri-urban displays many characteristics: global hubs and local enclaves, sprawl and disorder, disruption of communities and livelihoods, and in particular, growing climate risks and ecological disruption. Peri-urbanisation is both a material process of land-use change and impact, and a human process of social, economic, political, and cultural transitions: whether informal or planned, intensive or extensive, the peri-urban is critical to the provision of urban food, energy and water. In turn, understanding peri-urbanisation is critical to three Sustainable Development Goals: Goal 11 on *Sustainable Cities and Communities*, Goal 13 on *Climate Action*, and Goal 15 for *Life on Land*.

The PERI-CENE project will provide the first ever comprehensive assessment of peri-urbanisation climate impacts, risks and vulnerabilities. It will provide a global typology and global assessment with an inter-active peri-urban analysis tool. It builds an interactive Living Lab with 18 city-regions from around the world, and explores deeper issues in two case studies. The PERI-CENE then develops forward pathways to be scaleable and transferable.

A) UNDERLYING RATIONALE AND SCIENTIFIC AGENDA

The PERI-CENE agenda brings together three main *problematicues*. One is the dynamics of peri-urbanization, in the light of global development, emergent patterns and transitions. A second is on human-environment interactions, and the complexities of climate risk and resilience at multiple scales. A third concerns the responses, in adaptive pathways and strategic intelligence. One starting point is a simple causal loop model in Figure 1, based on the ‘DPSIR’ scheme. Here, socio-economic forces drive urban and peri-urban change: this impacts on climate and eco-systems, at local and global levels, which in turn impact on the peri-urban. With the many inter-dependencies of urban / peri-urban / rural systems, the responses call for adaptive, collaborative and intelligent governance.



Studies on the **dynamics of peri-urbanization** are emergent and eclectic, combining urban and spatial analysis, with new insights on ecosystems services, network techno-economies and geographies of multi-locality. Working definitions of ‘peri-urban’ or ‘urban sprawl’ have been established, but there are open questions on the role of the peri-urban in city-regions or functional urban areas, at multiple scales from the megalopolis to the ‘deep locality’ of urban fringes.² At the global level, current trends in urban expansion see a divergence between a ‘planet of slums’ and/or informal settlements, and the affluent ‘post-metropolis’ of automobile dependent and ‘carceral’ enclaves.³ Enabled by transport and communications the former

¹ Moore, J, (ed), 2016: *Anthropocene or Capitalocene?*. Oakland, CA: PM Press

² Ravetz, J, Fertner, C, & Nielsen, T.S, (2013): The dynamics of peri-urbanization: In: Pauleit, S., Bell, S., and Aalbers, C., (eds), *Peri-Urban Futures: Land Use and Sustainability*, Berlin: Springer.

³ Soja, E, (2001) *Post-Metropolis*

discreet edges of urban built form are shifting to a more fragmented and diffused pattern, with complex inter-dependencies between the peri-urban and other parts of a city-region system.⁴

The inter-dependence of **cities and environments** shows in the long-wave 'urban-environment transitions' of socio-technical and resource systems.⁵ Current projections see a tripling of global urbanized land 2000-2030, with consequent losses of biodiversity, carbon storage, ecosystems services, and climate resilience: many cities and their surroundings could see lethal heat-waves, sea level rises or catastrophic flooding.⁶ There is an urgent agenda, global and local, for forward looking urban climate adaptation, within a framework for climate risk and vulnerability.⁷ But while the urban-climate interface is now firmly on the global research-policy agenda, peri-urban areas present an even greater challenge. Here the typical reality is fragmented governance, communities dispersed into enclaves, vulnerability of critical infrastructure, and (in many countries) systems of deep informality: local land-use and ecosystems impacts are driven by global value chains.

A third *problematique* is about **responses to peri-urban challenges**, in situations of deep emergent complexity. Principles of governance for the urban case are generally agreed as transparent, integrated, inclusive and anticipatory: but for the peri-urban, the question is wide open. In such diffused and amorphous systems, material questions of land-use are overlaid with social inequalities, cultural exclusion, political conflict, and the ethics of climate change. This calls for new insights on systems change and urban transitions, in situations of cognitive complexity or collective intelligence.⁸ So the research agenda explores innovation in governance, and new ways of doing innovation: Living Labs, entrepreneurial or experimental governance, social learning loops, eco-social innovation in community engagement, or business innovation for resilient infrastructure.⁹ And this is not only a local issue, but a globalized policy-research agenda, with post-colonial perspectives on south-north exchange.¹⁰ In summary, the *PERI-CENE* aims to explore three key research agendas:

- peri-urbanisation as diverse, multi-scalar, multi-sector processes and emergent patterns;
- climate risk and ecosystems change in complex, diffused, inter-dependent systems;
- collaborative-intelligent governance, adaptive pathways and systemic innovation.

B) STRATEGIC SIGNIFICANCE OF THE PROJECT

PERI-CENE's agenda is globally significant, firstly for the linkage between three of the SDGs (11, 13, 15). We see as crucial the interactions between emerging patterns of urbanization, multi-functional land-use, and climate risk and resilience.

The Pillar 1 agenda explores the changes in urban and environmental systems, and their many inter-dependencies. The Pillar 2 agenda brings together stakeholders in public, private, civic and academic sectors, for dialogue and co-design. Each of these could be a huge task, so the *PERI-CENE* within modest resources, aims to bring together existing knowledge, explore new insights, and demonstrate governance innovation for systemic challenges.

Overall the *PERI-CENE* aims at a strategic scoping and agenda setting, that will help pave the way for more substantive research programs. It builds on two major EU projects, PLUREL (Peri-Urban Land-use) and RESIN (Climate Resilient Cities and Infrastructure): it

⁴ Angel, Sheppard & Civco, 2005; Ravetz 2000

⁵ McGranahan, 2006; Ravetz 2006

⁶ Seto et al, 2012; Güneralp et al 2013

⁷ Carter 2011; Connelly et al 2018

⁸ Geels 2006; Mulgan 2016

⁹ Karvonen et al 2018; Swilling and Hajer (2017)

¹⁰ Nagendra et al 2018:

draws on global frameworks such as the Rockefeller 100 Resilient Cities, and the Global Human Settlement Layer datasets. It focuses on multiple scales, from a global assessment, to an international Living Lab, to in-depth local-regional case studies.

The final result will add value to policy and research at local, national and global levels. It will provide analytical insights, a data resource and interactive tool, and policy guidance from stakeholder-researcher dialogues. *PERI-CENE* will set a strategic agenda for research and policy, for ongoing transformations of the global human-environment system.

C) RESPONDING TO THE CALL

PERI-CENE addresses this inspiring Call head on. It links between the Pillar 1 evidence and analysis, with the Pillar 2 co-design of adaptive, collaborative governance pathways. It also raises questions of scaling, transfer and knowledge exchange between different parts of society. *PERI-CENE* is a multi-scale project, from an outline global assessment to in-depth case studies. In the middle is a Living Lab of 21 city-regional partners and global organizations, with a wide range of developmental and climatic types around the world, with structured knowledge exchange and co-design of adaptive pathways.

The project is designed around three key SDGs, and focuses on the inter-dependencies between them: Goal 11: (*Make cities inclusive, safe, resilient and sustainable*): Goal 13: (*Take urgent action to combat climate change and its impacts*): Goal 15: (*Protect, restore and promote sustainable use of terrestrial ecosystems*). The key linkages include:

- peri-urbanization is framed as the interactions of (11) Cities, with (15) Land-use and ecosystems:
- peri-urban climate risk / resilience is focused on the interactions of (11) Cities, with (13) Climate change
- The urban-rural nexus and environment-climate resilience is focused on the interactions of (13) Climate change, with (15) Land-use and ecosystems.

Other Goals are also relevant, including those for poverty, food security, water, energy, economic development, infrastructure, inequality, inclusive societies, accountable institutions, and cross-cutting issues.

D) KEY RESEARCH OBJECTIVES & HYPOTHESES

PERI-CENE explores the links between peri-urbanisation and climate risk / resilience, at scales from global to local. The overall aim is:

To explore the interactions between peri-urbanisation and climate risk, at local and global levels, in order to co-design adaptive pathways towards more sustainable and resilient forms of peri-urbanisation.

With this aim the *PERI-CENE* works to five specific objectives, (corresponding to the WP structure), to provide and demonstrate: -

- 1) a framework and typology for (a) peri-urbanization impacts / effects on climate change risk: and (b) climate risk impacts / effects on peri-urban areas, in the frames of risk, vulnerability and resilience;
- 2) a global assessment of peri-urban / climate-environment conditions and trends;
- 3) a comparative and interactive study of peri-urbanisation in city-regions from around the world;
- 4) in-depth case studies, in India and the UK, which explore the deeper dynamics and potential opportunities for peri-urban climate risk interactions;

- 5) a set of adaptive pathways and tools for strategic policy intelligence, for practical solutions which are scalable and transferable.

Three working hypotheses help to shape the research:

- peri-urbanisation is the single most damaging contribution to climate change, ecosystems degradation, and urban vulnerability and risk;
- peri-urbanisation has potential for alternative forms, which lead towards environmental sustainability and resilience;
- new forms of adaptive, collaborative and entrepreneurial governance, with policy innovation and social / economic innovation, are needed to realize these alternatives.

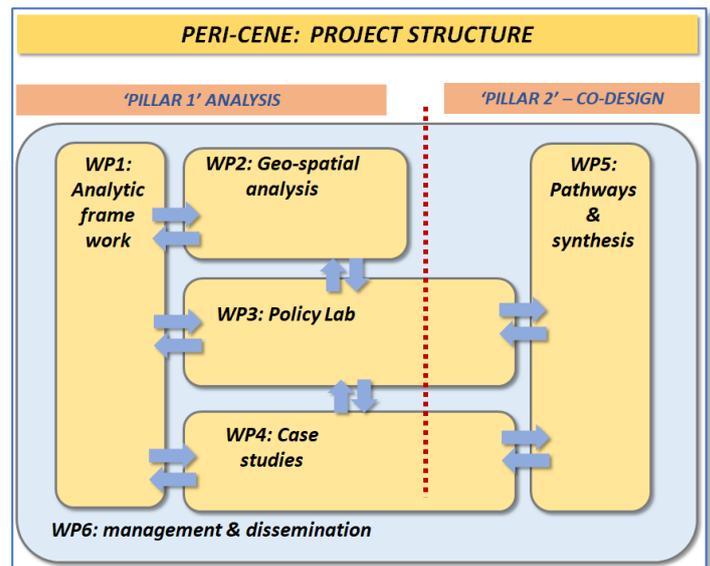
The project then addresses some very practical questions, at the appropriate level:

- What are the effects of peri-urbanisation on climate risk?
- What are the effects of climate risk on the peri-urban areas?
- How are these interactions shown in different developmental types, urban-regional types, and climatic-biome types around the world?
- What forms of governance can best mitigate the impacts, and steer towards more sustainable and resilient forms of peri-urbanisation?

E) RESEARCH METHOD AND PROCESS

The project is organized as a multi-level partnership, from global assessment to a local case studies: and from Pillar 1 'analysis' to Pillar 2 'co-design', as in Figure 2.

- Work Package (WP) 1 – Analytic Framework and typology, the theoretical backbone;
- WP2 - Geospatial Analysis: global assessment on peri-urbanization and climate risk;
- WP3 - Living Lab: a research-policy community representing 18 city-regions around the world;
- WP4 - Case Studies: in-depth analysis of the Chennai region (India), and the wider Manchester City-Region (UK), using findings from WP1, WP2, and WP3;
- WP5 – Synthesis and Pathways: a structured co-design process for co-design scalable and transferable solutions.



WP1: ANALYTICAL FRAMEWORK

PERI-CENE embraces a range of multi-scale interconnected issues: peri-urbanisation processes, patterns and inter-dependencies, each interact with climate and environmental conditions, changes, vulnerabilities and hazards. The analytic Framework will orientate and guide the project through such complexity, with explicit connections to SDGs 11, 13 and 15. The Framework will build on recent and ongoing projects, in particular the PLUREL peri-urban modelling indicators and governance framework, and the RESIN framework for adaptive pathways and resilience planning.¹¹ It will also draw on parallel EU projects such as IMPROVER, the JRC GHSL data resource: the Atlas of Urban Expansion: various

¹¹ www.plurel.org and www.resin-cities.eu

international frameworks for DRR, the Rockefeller 100 Resilient Cities programs, and the SSL long-range scenario studies. The framework will be co-produced in the early stages, in collaboration with the Living Lab partners and the case study stakeholders: it will then help them to structure their analysis and synthesis. The framework is likely to include 10 basic fields, as below, keyed where possible to spatial data. The Pillar 1 fields focus on evidence:

- Drivers of change (economic, demographic, technology, etc.)
- Peri-urbanization physical patterns (expansion and decline, density & nucleation, etc.)
- Social, technical, economic, ethical and political issues (STEEP)
- Spatial inter-dependencies (local effects, city-region interactions, global effects, etc.)
- Urban Nexus domains (food, energy and water system interactions)
- Climate-environmental change direct effects (precipitation, flood, drought, temperature, fire risk, sea-level change, storm surge, urban heat island and urban air quality, etc.)
- Climate-environmental inter-dependencies (risk, vulnerability, adaptation, resilience)

The Pillar 2 fields are more oriented to process and co-design (as outlined in WP5)

- Governance (democratic processes, civic participation, transparency, etc.)
- Spatial planning (natural resources, industry, emergency services, housing, etc.)
- Infrastructure provision (transport, water, energy, food production etc)

WP2: SPATIAL ANALYSIS AND GLOBAL ASSESSMENT:

WP2 develops analytical methods to understand and classify patterns and dynamics of peri-urbanisation, using recently published global datasets on land use and urbanisation, population distribution, and climate risk. The analyses draw on the Global Human Settlements Dataset of the EU Joint Research Centre, with urbanisation and populations distributions at a high resolution, which enables in-depth analysis of peri-urbanisation, with impacts on land consumption and climate-related risk.¹² The GHSL datasets are available for 1975, 1990, 2000 and 2014, which allows the identification of trends, and correlations of urban form and population with demand for services, as well as impacts of form in basic services (food production, water treatment), or the correlation between density, infrastructure and CO2 emissions. Global datasets for natural hazards will be used to understand the impacts of peri-urbanisation, such as land-use change ecosystems services in the peri-urban: overview of peri-urban nexus interactions, and typical spatial inter-dependences.

This will also apply a simple urban trend projection / scenario model, building on the SSP pathway studies and the Atlas of Urban Expansion data.¹³ This analytical approach will be applied to the partner city-regions and in-depth case studies for ground-truth testing, to allow an extrapolation of the analyses to similar peri-urban areas around the world.

WP2 will also develop the 'Peri-Cene Analysis Tool', an interactive online system which provides a local applications of the global spatial dataset, structured by the WP1 analytical framework. Drawing on applications from the 18 city-region partners, together with their policy challenges and possible responses, common 'archetypes' will be developed that are representative of global peri-urbanisation. Such archetypes range from affluent auto-dependency (e.g. N. America), to relatively planned rapid urbanisation (SE Asia), to relatively unplanned / informal urbanization (India), to planned consolidation (Europe). Each of these archetypes is overlaid on the climatic – biome types and the associated risk layers, and then compared with trend projection data, applying a sensitivity testing algorithm based on the WP1 framework.

WP3: LIVING LAB & PARTNERSHIP

WP3 provides an international-scale 'Living Lab', with an active community of 18 research-policy partners / associates from around the world. City-region partners / associates include

¹² Pesaresi et al. 2015

¹³ Jiang & O'Neill 2013

in the global south: Changsha, Hohhot, Dhaka, Malang, Bangkok, Johannesburg, Accra, Cairo, Belo Horizonte, Santiago and Mexicali. In the global north they include: Tokyo, Melbourne, Qatar, Helsinki, Naples, Toronto and San Diego. There are also key international organisations / networks in the Living Lab, including ICLEI, UN Global Compact on Cities, and UN Habitat, with local-regional links to Rockefeller 100 Resilient Cities. The partners have each committed up to 10 days, adding up to a significant resource to the project.

The project team will develop an online platform to engage the partners / associates in structured knowledge exchange and moderated discussion by interactive webinar. The participants will be invited to test the conceptual framework (WP1) and the geospatial Peri-cene Analysis Tool (WP2) in their specific contexts, and provide feedback to the project team. This generates a 'learning loop' which can ground-truth the analytic framework and interactive tool, together with a virtual community of interest, where participants can share ideas and experiences on adaptive pathways and strategic policy intelligence .

The findings from WP3 will emerge in parallel with the in-depth case studies (WP4), and will inform the synthesis and pathways (WP5), which also brings the Living Lab partners / associates together with indepth case studies in the proposed international workshop. The online platform will be structured around the framework / typologies above, and invite debate on both analysis & synthesis. The aim here is to build capacity and mutual learning, for the global community of peri-urban research and practice. Within a modest budget this is the most effective way to increase the leverage and work with a wider community for mutual learning and dissemination.

The online knowledge exchange platform in the Living Lab is closely linked with the '*International Handbook of Peri-Urban Studies*', co-edited by Rajan, Ravetz and Monte-Mor, (currently in discussion with Springer). Many of the city-region partners / associates are also co-authors in this work, and the timing would fit well with the *PERI-CENE* work program. This will help to magnify and disseminate the project findings, as part of a global community of readers, using modular information on a digital platform for an interactive and ongoing knowledge exchange.

WP4: CASE STUDIES

Two in-depth case studies will be conducted in close collaboration with local stakeholders to apply the analytic frameworks (WP1), the Peri-Cene Analysis Tool (WP2), and the dialogue from WP3, to identify the connections between peri-urban issues and SDGs 11, 13 and 15. The case studies will work in Chennai region (India) and the wider Manchester City-Region (UK), with very different histories, development pressures, trends and vulnerabilities.

Chennai is India's fourth largest metropolitan agglomeration with 9 million inhabitants. Founded in 1640, and a major centre of the British empire, its growth has been phenomenal only since around 1990. While the city-region operates roughly in accordance to a master plan, governance outside city corporation limits is subject to many forms and levels of authority. As in many other regions, entities make various territorial claims 'beyond the plan', which are identified with slums or other informal arrangements, that may concurrently be 'illegal' but sanctioned by the government. Chennai has a coastal tropical dry forest ecology, and intermittently faces the challenges of water scarcity and flooding, intensifying with peri-urbanization and climate change. Water management through an elaborate system of connected tanks and stream channels has been a significant part of the history of the Tamil Nadu lowland and the neighboring Deccan plateau in Karnataka and Andhra Pradesh since the 11th century. In the course of a series of interventions around urban water supply, construction and changes in agriculture, this complex socio-technical system has changed significantly, increasing the vulnerability of the city-region and its hinterland, which in 2015 resulted in widespread flooding.

As for the **wider Manchester City-Region (MCR)**, the working boundary is deliberately flexible, looking beyond the administrative boundary of Greater Manchester. Previous studies have shown that the most crucial peri-urban and climate-environment inter-dependencies are found between and cross-cutting administrative areas, water catchments or other defined units. The PERI-CENE methods and tools will help to identify the locations and patterns of most interest: e.g. the South Pennines, Mersey Plain and East Lancashire, are each variegated, amorphous but distinct peri-urban types.¹⁴ Overall this region shows a relatively mature system of spatial planning and governance, serving a largely urbanised population with medium growth. However, there are major struggles with housing pressures, economic / social segregation and polarization, urban-rural disconnections, fragmented climate-environment governance, and policy uncertainty magnified by Brexit.

Each case study is underpinned by a replicable methodology for co-design, thus building in local knowledge and commitment to the adaptive pathways. This will involve jointly identifying key problems, and co-design potential policy innovations, together with social, technical and ecological innovations. The PERI-CENE will host a series of local stakeholder workshops, to (1) introduce the spatial analysis findings and local implications, and (2) support a dialogue for adaptive learning. The result will be in the form of local adaptive pathways: and the approach draws on the 'synergistic' methods for co-learning, co-design and collective intelligence, for the governance of problems of cognitive complexity.¹⁵ In summary, each case study will:

- *define* the (porous) boundaries of the peri-urban in the local context.
- *understand* how and by whom peri-urban / climate risk issues are currently managed;
- *map* existing local data relating to human-environment interactions in the peri-urban, in order to draw through what is relevant, when, and how it might be used.
- *co-design* collaborative adaptive pathways included governance innovations.

WP5: SYNTHESIS AND PATHWAYS

The final WP will employ a co-design process to develop a synthesis, working on scalable and transferable solutions for adaptive pathways, with a focus dissemination and impact. The background, as in the review above, sees contradictions and challenges. Aspirational calls for adaptive-collaborative governance, and resilience of many kinds, are not easy to realize in practice: meanwhile there are new critiques on 'adaptation' and 'resilience' as proxies for neo-liberal agendas.¹⁶ The implication is a call for systems transitions and multi-innovation. There is an open research agenda to explore systemic cognitive capacity, and strategic policy intelligence, framed variously as 'Urban 3.0' or 'mode-III' co-learning and co-creation.¹⁷ The case of peri-urbanisation, largely beyond the mainstream economic and political structures, and fragmented between administrative units and multiple scales, is a very topical test case for new modes of entrepreneurial and experimental governance.¹⁸

For the WP5 method, we draw on foresight and road-mapping techniques, together with social and eco-innovation, with co-design thinking. It uses creative scenario visualizations, with topical examples of innovation, drawing on best practices in the Living Lab, from Bangkok to Toronto. For example, urban finance / business model innovation, can enable alternatives to the standard real-estate model of car dependent greenfield development: or socio-eco innovation can enable climate resilience of peri-urban water landscapes.

The WP5 process will set up structured deliberations and co-design thinking processes, at several points in the project. In Month 6-12, the concept of adaptive pathways and collective

¹⁴ Ravetz and Warhurst 2013

¹⁵ Ravetz 2015

¹⁶ Beilin & Wilkinson 2016

¹⁷ Cohen 2012; Ravetz 2015:

¹⁸ Argyris & Schon 2006; Swilling and Hajer 2017

intelligence will be introduced to the case study stakeholders and Living Lab partners in the form of templates and online discussion process. In month 18 an international 3-day workshop will explore in depth the challenges and potentials, based on the ‘synergy foresight’ methodology for the co-creation of adaptive pathways and road-maps.¹⁹ Consequently, we will produce a range of policy / practice briefs and guidance tools, freely available online in modular format. The main dissemination will use the existing networks and programs of our inter-governmental partners, i.e. ICLEI, UN Global Compact and UN Habitat.

F) KNOWLEDGE EXCHANGE, CO-DESIGN & DISSEMINATION

The PERI-CENE has knowledge exchange and co-design and co-production built in, at several levels from global to local. It thereby includes dissemination and ‘impact’ within the ‘triple-helix’ approach to mutual knowledge exchange and co-innovation. For the ***in depth case studies***, ‘impact’ is more about the result of a process of mutual learning & co-design of adaptive pathways, with a wider agenda for ‘deliberative and associative’ democracy. The overall conclusions will be framed in a form which is transferable and scalable, in modular digital format.

- Relevant fields and professions include: urban and rural planning, transport and communications, energy and water, construction and real estate, housing and social policy, finance and economic development, health and public services, environmental management, climate / carbon policy, farming and forestry.
- Relevant sectors include: civil service and politicians, consultants, infrastructure providers, education and academia.

For the ***Living Lab partners*** and associates, i.e. research / policy organizations in 18 city-regions around the world, this represents a great opportunity to magnify up the PERI-CENE findings and dissemination, working alongside organizations already active on the same issues. Here the impact is more focused on collective learning and strategic policy intelligence, in three main areas:

- Public policy & spatial /environmental planning, mainly government or para-statal
- Finance and urban development, mainly corporate
- Infrastructure & resource management, various

The Peri-cene Analysis Tool will also help partners to identify their profiles and trajectories, compare with others, benchmark with global standards, and support the peer-to-peer networking and co-learning. The Living Lab online platform will also compare and cross-link between problems, analysis, ideas, best practice and pathways.

Strategic global partners: the impact will be seen in wider policy development for the peri-urban and its climate risks and challenges, which so far is mostly focused on the urban. This also raises the agenda for future research and innovation. The dissemination and leverage will work alongside the existing programs of our inter-governmental partners, including ICLEI (International Council for Local Environmental Initiatives, UN Habitat and UN Global Compact on Cities, with links also to the Rockefeller 100 Resilient Cities.

Overall, the PERI-CENE follows an innovative research-policy community model, with maximum leverage, for a strategic contribution to the challenge of the ‘peri-cene’ world.

¹⁹ Ravetz & Miles 2016:

MANAGEMENT PLAN

MANAGEMENT STRUCTURE

The PI Joe Ravetz will take overall responsibility, and lead on WP6 Management and dissemination. Angela Connelly will be co-lead on WP6 and undertake day to day administration.

Each WP leader / co-leader will be responsible for all activities in the WP, deliverables and milestones, and liaisons with other WPs (see table in Justification of Resources).

Monthly video conference calls will be used as the basis for running the Work Program, structured by agendas, deliverables and milestones.

Project meetings are organized with 2 in UK and 2 in India. These overlap with the Pathways workshop (Sweden) and the Dissemination conference (UK, to be linked with a larger academic event, e.g. Development Studies Association or similar).

For each main project meeting there will be a 2-day intensive meeting, combined with a 1.5 case study engagement program. We have included for research team visits, i.e. for the supervision by UOM of the specialist GIS team in IIT.

Table 1: schedule of meetings & international travel.

Months	1	6	12	18	(24)	Other research links	UKRI prog mtgs	Total
PROJECT MTGS	India	UK	India	Internat pathways workshop Sweden	Final diss. Conference: UK, time/ place tbc	GIS team in India (time tbc)	Time / place tbc	
UOM	4		4	4		1		13
IIT-M		3		3	3		2	11
KTH	1	1	1		1		2	6
				Incl proj mtg	Incl proj mtg			

TIMETABLE

The project is scheduled for 24 months, just enough for the strategic and scoping activities which are proposed. The Work Program is structured in a simple and logical way with 6-month intervals between milestones. Each Deliverable is timed with a Milestone

These are estimates of the number of months after the start of the project to reach the following stages:

- Milestone A (month 6): complete analytic frameworks / typologies (WP1, 2): application to global data: launch partnership and case studies (WP3, 4).
- Milestone B (month 12): partnership & case studies inception report (WP3, 4): launch pathways (WP5)
- Milestone C (month 18): partnership & case studies – pathways workshop (WP3, 4, 5):
- Milestone D (month 24): review frameworks & typologies: final reports & dissemination event.

The Deliverables are detailed in the Justification of Resources.

	Months	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
	Milestones		A		B		C		D
WP1	Framework	D1-1	D1-2						D1-3
WP2	Geospatial data	D2-1	D2-2						D2-3
WP3	Living Lab								
WP4	Case studies				D4-1		D4-2		D4-3
WP5	Pathways						D5-1		D5-2
WP	Management	D6-1			D6-2				D6-3

LIVING LAB PARTNERS

The Living Lab includes 15 city-regions representing each continent around the world, with a focus on the global south. 13 of these have provided letters of commitment of time (see the Justification of Resources). This list is complemented by 3 international organizations: UN Habitat, UN Global Compact on Cities, and International Council for Local Environmental Initiatives (ICLEI). In addition there are strong links with the Rockefeller 100 Resilient Cities (100RC) in each of the case studies, and in 6 of the partner cities.

Management of this community online is in the WP3 task, where there will be 3-monthly webinar forums, supported by online information and comment. All partners will be funded to attend the international Pathways workshop in Month 18: and invited to the dissemination event in month 24 (unfunded).

(east to west)	Links / networks	Geographic type	Economic type	Contact		
Melbourne	100RC	Coastal, temperate	OECD	Mia Davison		
Changsha		Inland, sub-tropical,	Upper middle:	Kai Zhou		
Malang	100RC	Coastal, tropical	Lower middle:	Dimas Adrianto		
Bangkok	100RC	Coastal, tropical	Upper middle	Danai Thaitakoo		
Dhaka		Coastal, tropical	LDC	Manoj Kumar Roy		
Qatar		Coastal, desert	High income	Sayed Mohammad		
Cairo		Coastal, arid	Lower middle:	Eman Abouziyan		
Naples		Coastal, Mediterran	OECD	Maria Cerretta		
Helsinki		Coastal, northern	OECD	Mika Ristimaki		
Johannesburg	SACities	Inland, semi-arid	Upper middle:	Geci Karuri-		
Accra	100RC	Coastal, tropical	Lower middle:	Charles Oppong		
Belo Horizonte	100RC	Inland, tropical	Upper middle	Roberto Monte-mor		
Toronto	100RC	Inland, continental	OECD	Kathy McPherson		
Mexicali		Inland, arid,	Upper middle:	Jorge Vegas		
San Diego	Bioregional	Coastal, semi-arid	OECD	Keith Pezzoli		
UN Habitat				Sam Njuguna		
ICLEI				Cristina Garzillo		
UN Global Compact Cities				Michael Nolan		
Rockefeller 100RC				Various		

ETHICAL IMPLICATIONS STATEMENT

The main area of ethical concern will be around the conduct of the case studies in Work Package 4, which will consist of co-design workshops with non-academic stakeholders as well as interviews and surveys to supplement the workshops and to organise the research.

Although Work Package 2 will use previously collected data that is freely available, we will ensure that the repackaged data is not presented in a way that may pose ethical concerns. For instance, a simple ranking of peri-urban areas may suggest that one place is 'riskier' than another which could have wider implications for the area involved. Therefore, we will look into developing broad 'types' that can be grouped together. User testing of the outputs will further help to raise any unforeseen ethical issues should they exist.

We apply the principles outlined in the RCUK Policy and Guidelines on the Governance of Good Research Conduct, as set in the context of the Universities UK Concordat to Support Research Integrity as well as the UK Government's Universal ethical code for scientists. We will seek ethical approval from The University of Manchester's Research Ethics Committee (REC) and the developed protocol will be applicable to all international partners.

Our research participants will be anonymised and we will not name or otherwise identify individual people. Data assurance and participant privacy procedures will be followed in line with GDPR requirements. All research participants will be fully briefed on the project, informed that they are being interviewed "on the record", and all interviews will be recorded. They will retain the right to withdraw from the research at any point and/or to withdraw any comments which they do not wish to enter the public domain.