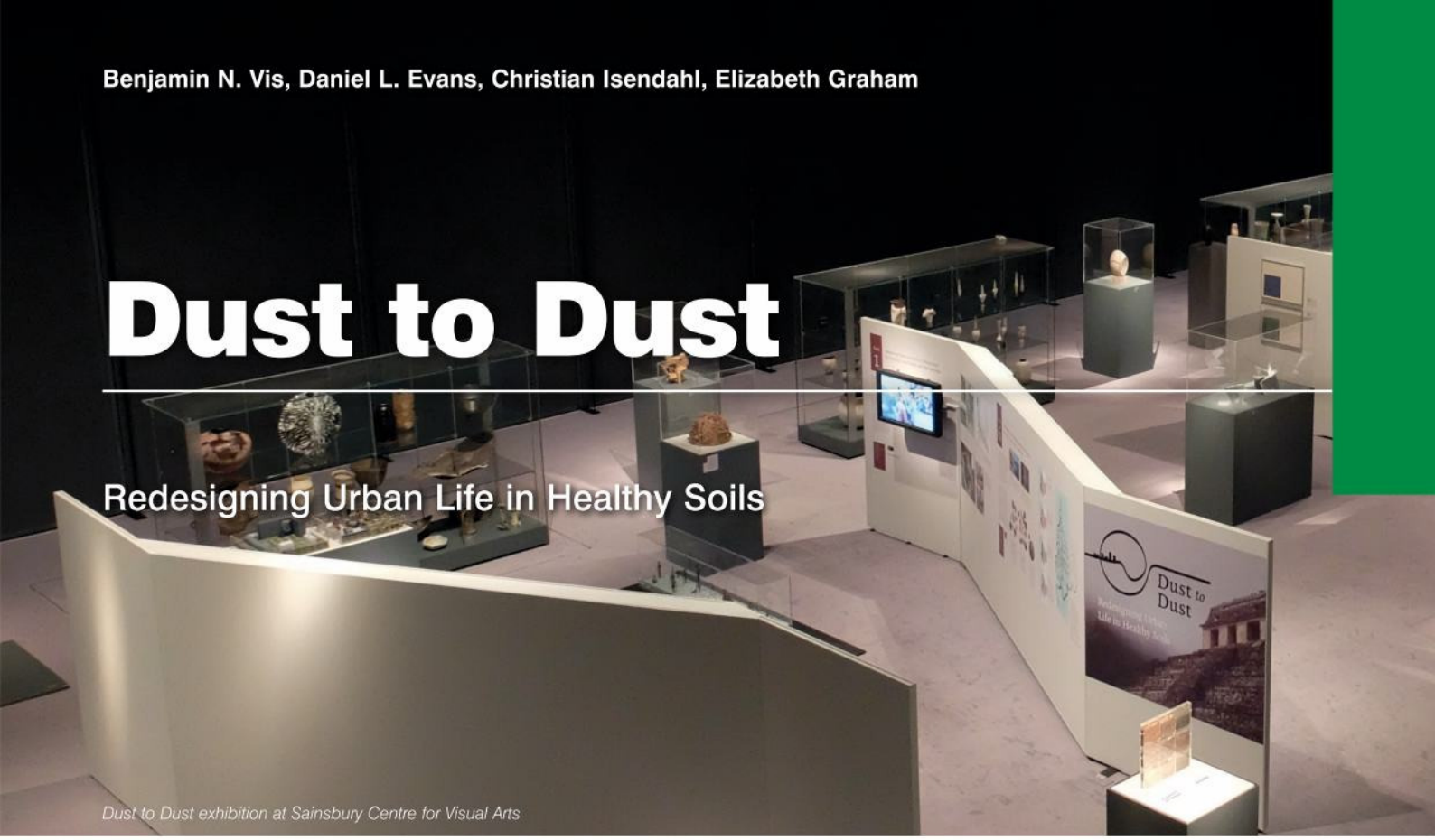
Benjamin N. Vis, Daniel L. Evans, Christian Isendahl, Elizabeth Graham

Dust to Dust

Redesigning Urban Life in Healthy Soils



Dust to Dust exhibition at Sainsbury Centre for Visual Arts

A gaping problem

Take a walk through your town or city. It may not be long before you find yourself peering over the rim of a gaping hole in the middle of the street. Whether delayed or abandoned, these half-complete construction sites serve as reminders of the impact on national budgets in the wake of government efforts to combat COVID-19. It is too early to say how, when, and at what cost the construction industry will recover from the impacts of the pandemic. For now though, as a heap of spoil lies motionless beside a pit in the ground, this prolonged pause to the building schedule affords us a rare opportunity to examine a resource that remains hidden and is often neglected.

Nowadays, a chasm in the pavement is as close as you are likely to get to a glimpse of urban soil. Indispensable for supporting our livelihoods and lifestyles, soils provide food, clean water, and energy, whilst abating climate change, safeguarding biodiversity, and protecting human health. Decades of sustained population growth, in tandem with urbanisation, bring about rapid soil degradation, caused by ecosystem fragmentation, contamination, and soil sealing. Progressively out of sight, and thus out of mind, the management of urban soils rarely enjoys priority on urban development agendas. Generally one must travel beyond the city to find the first relatively large expanses of fertile soil. Yet, many of these soils are threatened by urban encroachment, as urban land cover expands to accommodate a growing urban population. Increasing urbanisation causes urban land conversions that threaten the proximity, availability, and the accessibility of urban soils to where urban life takes place. Our urban lifestyle creates obstacles to using a key resource that provides health, wellbeing, capacities for resilience, and sustains urban livelihoods. What if we decided to develop cities that put soils first?

Imagining sustainable urban design

Staring into the pit of a construction site, the realisation may surface that the soils uncovered have sustained and enabled settlement throughout the occupation history of the city. Historically, cities are usually founded on or near fertile lands for cultivation to produce the surpluses required to sustain urban lifestyles and services. This reveals an intimate interdependency between urban life and the productivity of soils, which only tends to be revisited in times of acute (food) crises. Cut-off food supply lines in WWI and WWII led to so-called 'victory gardens' and the post-Soviet collapse led to urban agricultural permacultura practices in Cuba. In contrast, archaeological evidence shows that it was commonplace for urban traditions to be intimately related to soil maintenance. Indigenous urban design in the past, exemplified by the urban-rural integration of ancient Maya landscapes in tropical Central America, teaches us about alternatives to present-day attitudes to urban life. The Maya developed their vast urban landscapes for over two millennia. Maya cities look radically different from what we think of as cities today. Open green space was pervasive, leaving much urban space unpaved. Urban residential groups were set within large shared multipurpose plots and many cities would incorporate infield agriculture. Where studied, this space and access to soils reveal productive use, conveying that the urban Maya had a special relationship with soils. The sustenance of urban populations would have at least partially relied on local production, requiring the careful maintenance of uncovered urban lands.

While today's urban lifestyles stand in sharp contrast to ancient Maya civilisation, there is growing acceptance of the need to adjust consumptive and productive attitudes to urban life. In that context, the Maya example is inspiring. It shows us a valuable implementation of urban development that may yet confront current global challenges. >

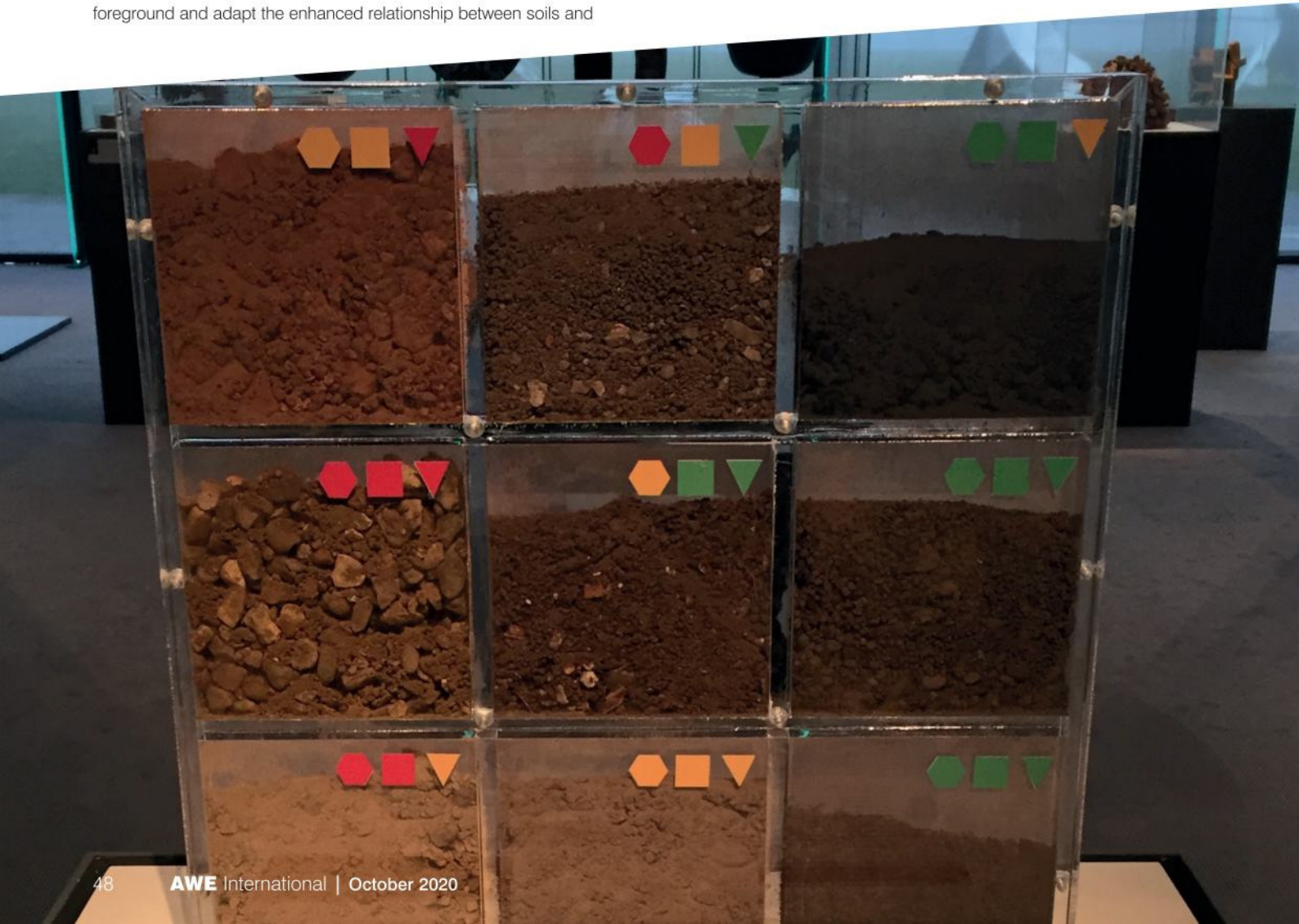
However, translating scientific insights to urban design solutions requires more than scholarship. Design is a creative act. It requires great technical skills and implementation requires the ability to account for the practical particularities and demands of real-life development cases.

In 2017 a group of multi-disciplinary researchers, principally led by Benjamin Vis at the University of Kent, met in Gothenburg for a final workshop of the TruLife (*Pre-Columbian Tropical Urban Life: Placing the Past in Designs for Sustainable Urban Futures*) network. Tapping into 26 expert minds from nine different countries, the network had explored the synergies between ancient Maya urbanism and sustainable urban design on transferable subjects such as waste management, food security, and social life. The next step of the network's plan involved inviting public and professional engagement with its findings through an urban design ideas competition. Appreciating that the proximal presence of land and access to soils in ancient Maya urbanism presents a key difference to present-day urban expectations, the network focused on this difference in soil-relations for its competition brief. This challenge would engender design approaches that address the pivotal role of soil health in urban life, guided by practice and informed by research on ancient Maya practices.

We launched *Dust to Dust: Redesigning Urban Life in Healthy Soils* with a brief calling for either interventionist or blue-sky outline ideas to foreground and adapt the enhanced relationship between soils and urban life from ancient Maya urbanism in contemporary urban settings to improve models for global sustainability. We made the competition as open and as accessible as possible by seeking outline ideas from teams internationally that would collaborate across sectors. Next phases would consist of a multiple day charrette (an intensive design workshop) hosted at The Prince's Foundation to develop ideas in collaboration with TruLife members, and the co-creation of an exhibition at the Sainsbury Centre for Visual Arts presenting these ideas to the public. By partnering and receiving endorsements from professional bodies, such as INTBAU, an International Network for Traditional Building, Architecture & Urbanism, dedicated to creating better places to live by promoting traditional building and local character, and RIBA (Royal Institute of British Architects) South/Southeast, we particularly encouraged applications from teams related to architectural and urban design professions.

A collaborative process

Dust to Dust attracted submissions from a range of professionals from the commercial, public, higher education, and NGO/Charity sectors involved in town planning, civil engineering, urban design, socio-economic development, and neighbouring areas of expertise. Calling in the help of independent expert judges, we shortlisted six outline design ideas and invited the cross-disciplinary teams coming from the UK, Mexico, the Netherlands, Saudi Arabia, USA, Ecuador, and Brazil, >



to work with TruLife members at the charrette. Over three-days of collaboratively structured intensive work the teams' original ideas were further developed, using their expertise, peer input, and formative review to hone in on exhibitable design concepts that foreground maintaining healthy soils and cities around the world.

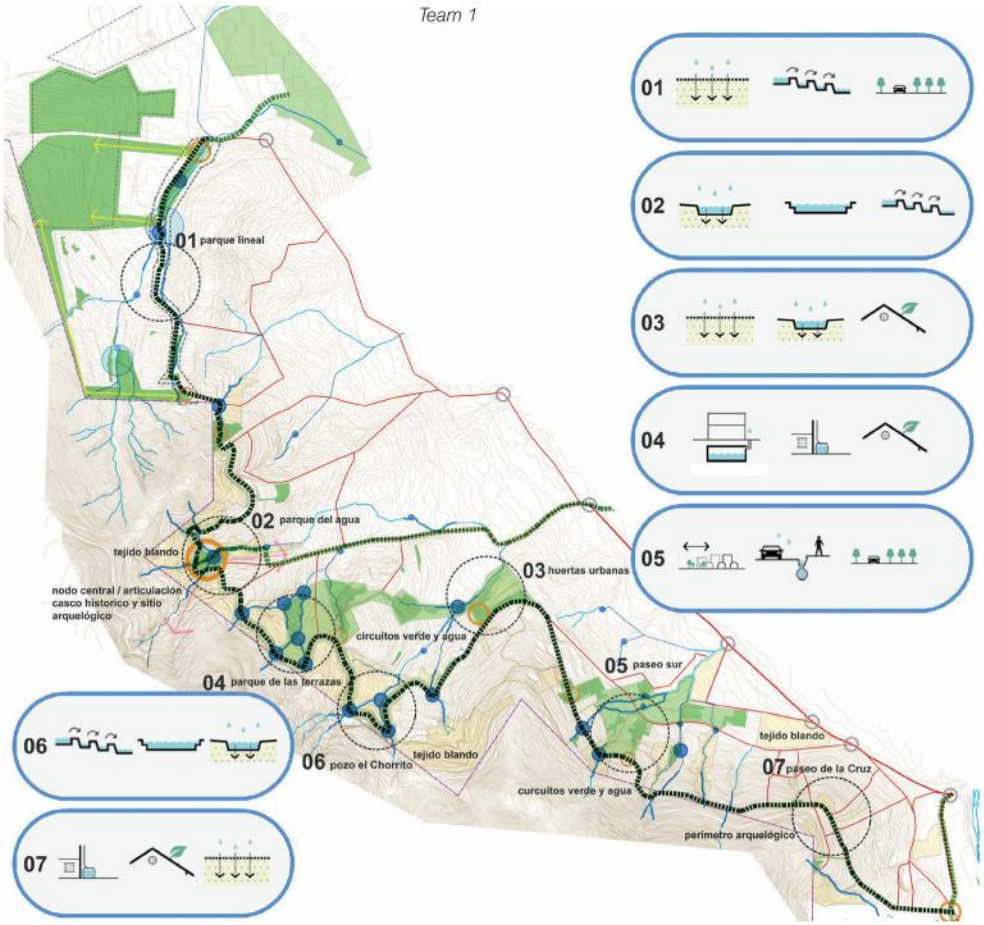
"in everyday urban life, soils are barely visible nor accessible, which leads to disinterest and lack of engagement, and ultimately to soil degradation"

Through a co-productive dialogue with the academic leads, the teams were challenged to provide evidence for the benefits of their outline schemes, critically considering the potential impacts of the schemes on the environment, and how these impacts would be both monitored and mitigated. The charrette initiated a period of remote co-creative work on select materials from the outline ideas to be prepared for exhibition in order to deliver a coherent narrative across the teams' divergent plans, cases, and approaches. We curated the exhibition at the renowned Sainsbury Centre for Visual Arts (November 2018 to February 2019) in Norwich, UK, one of our partner institutions for *Dust to Dust*.

The exhibition highlighted how urban soils today tend to be 'out of sight, out of mind'. In everyday urban life, soils are barely visible nor accessible, which leads to disinterest and lack of engagement, and ultimately to soil degradation: a key resource-dependency uncared for. The teams' progressive visions for urban responses took inspiration from Maya urbanism, and were positioned to promote long-term sustainability in cities worldwide by giving relationships between soils and urban life centre stage. Here we reflect on their exhibits, which show remarkable consistency in getting local communities directly involved in soil maintenance and experiencing the benefits of productive soils, but equally remarkable divergence in the context-specific routes taken. The exhibition demonstrated that there are multiple routes to sustainable urban development and that these routes must account for, and work with, local cultures and conditions.

Culturally inclusive planning and design

Team 1's approach centres on small-scale urban design interventions in Oaxaca City, Mexico. The designs were conceived in close collaboration with the resident population through a series of workshops and consultation events. The context of their specific case creates an interesting parallel with how Maya urbanism had been positioned in the competition, because the Zapotec first urbanised the hill adjacent to the city over two thousand years ago. Zapotec Monte Albán endured for more than a millennium thanks to an advanced and intricate system of water management measures including terraces, canals, dams, and wells, all of which channelise water and reduce soil erosion. Today, Oaxaca City is expanding quickly due to informal settlement encroaching onto the archaeological hill site. In these areas the population is confronted with a degrading environment, which affects the water flow, quality, access, and usability while also eroding soils. The modern population has lost touch with the profound Zapotec relationship to water and earth.



Inspired by Zapotec water management measures, a series of ideas for interconnected interventions in public space were developed. Following a process of inclusive planning and design, the team met with the local population in workshops to propose seven small, multifunctional communal water parks. The parks help to restore a healthy water flow along the hillside by enhancing hydrological soil properties, such as filtering and infiltration, both of which improve water quality and reduce the risks of flooding. Meanwhile, small dams and terraces improve access to the water source and retain soils for communal cultivation. Successful implementation is expected to result from the bottom-up strategy comprising a focus on community leverage and small scale cost-effective interventions in public space. Using multidisciplinary skills, the team ensures that performing such urban acupuncture in informal expansion areas achieve high-quality urban design with modest means and traditional Zapotec-inspired construction engineering. The parks

are accessible and co-created in order to encourage multiple uses fitting Mexican culture. They improve local living conditions by delivering environmental and well-being benefits, which also help to protect heritage from further damaging encroachment.

Growing awareness and scaling up

Team 2's idea focuses on operationalising personal lifestyle choices, which take root at the scale of individuals. The team's chosen approach aims to reveal the full effects when individual lifestyle choices regarding urban space use and requirements are scaled up. At the basis, their approach follows the personally confrontative bottom-up philosophy that 'achieving a sustainable world starts with you', but combines a sense of encouragement with empowerment from generative urban design and facilitatory architecture. At the heart of the team's presentation lies a 'decision chart' that encourages playfulness and values personal choice.

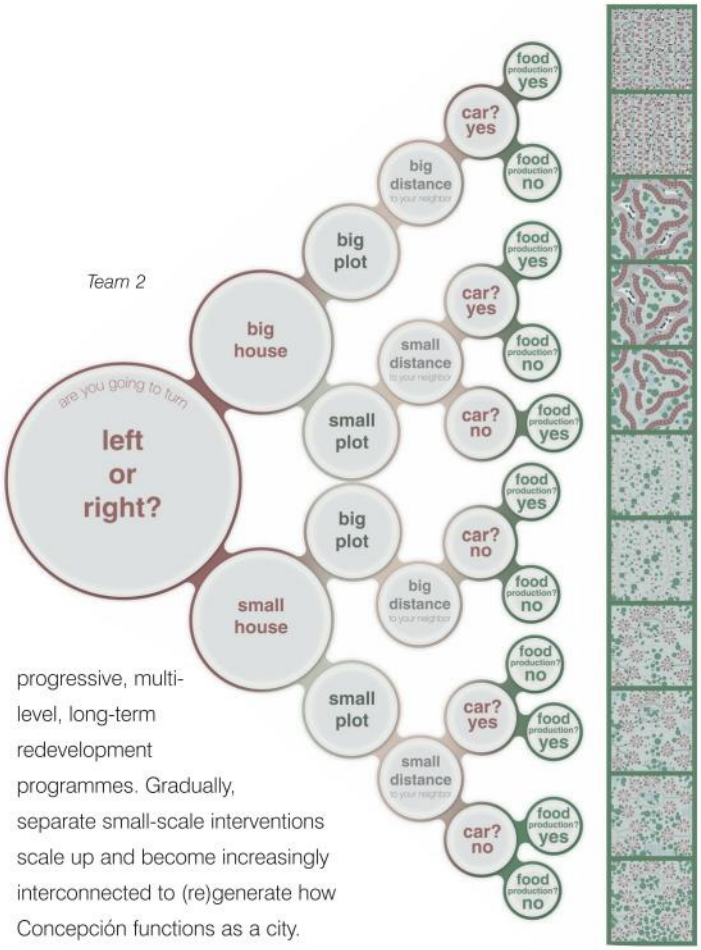
In the chart we are led through a series of simple binary decisions regarding lifestyle preferences. The end of the chart visualises patterns of basic urban land-use categories offering a vision of what could result from many people making these personal lifestyle decisions. These visualisations give cause for reflection, because the basic principles and values of some patterns look more familiar than others. The familiar patterns may not relate to what we would find most appealing when given the choice of an end-result in which we must live. The team cleverly generates awareness of space as a finite resource, but also shows the inevitability of many people making the same choices. In a bid to change behaviour and attitudes, the team also drives home the scale of the effects of car ownership or usage on sealing soil.

> "at the basis, their approach follows the personally confrontative bottom-up philosophy that 'achieving a sustainable world starts with you"

This bottom-up scenario-building approach to urban planning is balanced by an architectural vision for housing that shelters small strips of 'outside land' into the interior design of the home. The house is effectively encapsulated by a small-scale greenhouse, offering shielded and frequently traversed liminal space that negotiates the benefits of inside and outside. Such architecture clearly would enable and encourage its inhabitants to engage actively in everyday home-life activities that make direct use of soils. One is left to muse whether such a lifestyle would lead to a lower demand for large personal garden plots, thus enabling urban green space to become more communally focused, perhaps also reducing the intensity of personal transport demands.

Participatory execution of a master plan for systemic change

Team 3 approaches the economically challenged city of Concepción, Chile, as a system, through a vision structured by multidisciplinary knowledge and data sources. They show what can be achieved when starting with a progressive and reformative master plan that invests in individuals and communities to encourage them to implement



progressive, multi-level, long-term redevelopment programmes. Gradually, separate small-scale interventions scale up and become increasingly interconnected to (re)generate how Concepción functions as a city.

Such participation from the population is vital, but success hinges on people reaping immediate socio-economic benefits that improve economic opportunities, livelihoods, and wellbeing. To clarify the importance of individuals and communities feeling the benefits of interventions, the team created a number of animated storylines, to convey the messages of their data-rich projections in an accessible way. On the other extreme, the team used computer generated imagery to display views of their futuristic-feeling design implementations, which included an 'eco-boulevard', apartment complexes with aquaponics on the roofs, sculpted water towers, and suspended transport. In their design choices, the team adopted a strategy of densification in order to free up soils and green space between buildings. These soils would be remediated to serve a variety of uses, including land-efficient polyculture. Combined with building-mounted aquaponics, a local food supply is generated which reduces reliance on imports. Through decontamination and revitalisation of soils, and inner city densification, some of the suburbs could then be reserved to restore forest growth around the city. In addition, schemes of community ownership are employed to offset the costs of socio-technological and vertical growth.

Making sustainable transformations feasible by reimaging existing neighbourhood types

Team 4 seeks out opportunities for redesigning existing neighbourhoods in such a way that the use of urban soils is optimised as a public asset. In their approach, the original footprint and architecture of the buildings is fixed, which makes a sustainable transformation immediately more feasible. Moreover, by demonstrating their transformation of outside and public space in common neighbourhood patterns that typify the urban design in vogue in different decades of the twentieth century, they show that their approach could be transferable to improve a large number of cases in The Netherlands and likely beyond. >

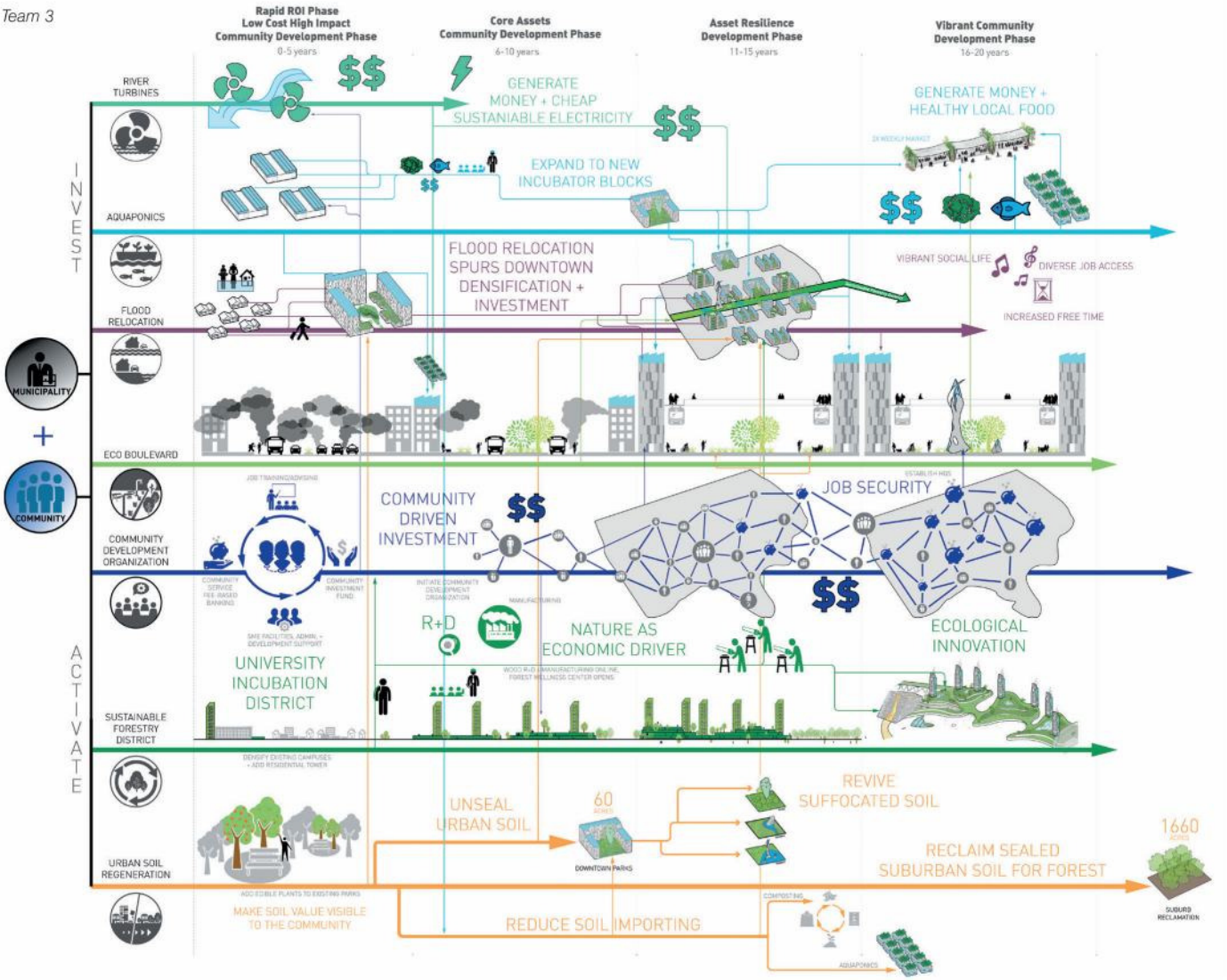
Their phased transformations are founded on the realisation that the soil underneath existing urban form is the engine driving sustainable development potential. In order to unlock the potential of urban soils, they employ a number of methods and policies that can be traced back to ancient Maya agro-urban practices. The initial steps deploy nature-based solutions to decontaminate soils including using 'Gentle Remediation Options', fertilisation through a circular regime of decomposition and of organic waste, and targeted restoration in which unproductive sands are replaced with saturated peat to halt subsidence and stabilise the natural ecosystem. Within this 'restored' state, urban households, much like their Maya counterparts, become surrounded by horticultural plots in which proactive and integrative measures are taken to manage soils and water, circularly connected to production and consumption at the household level.

Halting soil degradation and instating a productive circular rehabilitation of ecosystemic functions in areas cities now occupy, converts the often under- or reductively used open space characteristic of twentieth century neighbourhood types into more attractive and lively multifunctional social-ecological spaces. In these spaces, productive and useful (cleansing) plant, fungi, and bacteria species are introduced to enhance soil health and increase food security. At the same time, improving soil hydrological properties lessens the impacts of environmental hazards such as subsidence and flooding. Placing soils centrally to enable sustainable transitions without replacing existing buildings makes for a compelling, achievable scenario.

Setting a co-productive example of agroforestry capacity to mitigate unsustainable urban migration in the Amazon

Team 5 considered the potential of soils for sustainable urban life from the perspective of Amazonian cities, which are rapidly expanding owing to migration from forested regions. Livelihood prospects in the favelas of these Amazonian cities are rather grim. In contrast, the fertile soils underneath the Amazonian forest from where most migrants originate offer tremendous potential for economically viable lives and settlement growth. The Maya offer a clear precedent for viable large communities in the forest based on a strong interdependence of resources drawn from the forest and local food production. This team focuses on Mapia, Brazil(1), to make a contribution with a charitable institution towards mitigating the challenges that obstruct socioeconomic development by working >

Team 3



Team 4

Rule based urban regeneration to restore soils, water quality, and activate local cultural values

Team 6 took on the case of Fort Bragg, California, where the recent discontinuation of a large coastal lumber mill and associated airport deprived the city of its main source of employment, and left a sizeable urban area adjacent to the city centre lying fallow. There is great potential for urban regeneration, using the coastal tract as a catalyst. Such development would have to remedy the city's separation from the Pacific shoreline and 130 years of soil and shore contamination, and rehabilitate the Pomo Indians, whose territory the city occupies.

The integration of soil, land-use, and water management that characterised everyday Maya urban life steered the team's effort towards an ecological restorative and regenerative master plan for all of Fort Bragg incorporating local culture. Their approach comprises a vision for a Morphogenetic City, based on the pattern-based design theory of Christopher Alexander. Only few major new functional buildings were pregiven, such as a marine science centre pursuing continued regeneration through local knowledge production and a Pomo cultural centre. Allowing the emergence of a regenerative city that is reconnected to the waterfront and facilitates urban life with healthy soils requires design principles that guide development processes and proposals. The foundations for design principles that incrementally achieve beautiful, ecological, and economically viable urban form are identified through scenario-based design experiments. Desirable elements are combined in an integrative urban design plan. Local resources, such as the Giant Coastal Redwood Trees – a building material and themselves symbols of long-term resilience – and the 3,000 year old Pomo subsistence strategies and famous craft traditions, inspire these design principles so that their implementation becomes rooted.

At Fort Bragg, decaying urban fabric must be turned through restoration, remodelling, replacement, and reuse, while successful revitalisation would be reinforced by structurally including the traditional knowledge and cultural values of the original Pomo population. Design principles work because developments that violate their aims, here promoting mutually productive people, water, land, and soil relations, will be disallowed. Gradually urban form incorporates and facilitates opportunities to encourage and enable everyday urban practices that benefit soil-, water-, and waste management, and urban agriculture for food security. Local attitudes towards urban life become reconstituted by pro-environmental private-public behaviour.

collaboratively with the community to improve local livelihoods based on agroforestry. Joining forces with evaluative research on how urban growth dynamics are intertwined on a regional scale, they propose small-scale and sensitively focused architectural intervention inspired by indigenous Yanomamo traditions.

Based on the indigenous practice of building communal roundhouses as a focus for the community, this team has created a vision for community hubs(3) in which co-productive and economically instructive activities take place. First and foremost, the building is the focal point for generating knowledge and uniting the community in capacity building to facilitate livelihood improvements. Initial success has been achieved in implementing global trading standards on marketing local produce. The building itself is realised with local construction techniques and local materials, such as the timbers, which are extracted and traded through low-intensity management to avoid exhaustion of the forest resource. The building combines traditional methods for thermal comfort, while contemporary technology assists the bio-digestion of organic and sanitary waste, water harvesting, and solar energy generation, so that the hub is self-sustainable and ecological. Within the roundhouse-like structure, 'permaculture' fields are created for community managed horticulture(4). The soil fertilisers for these fields are produced as part of a circular system. The intention is that this hub-based co-production will be a model to transform socio-economic settlement practices in similar Amazon communities that are linked along the river(2).

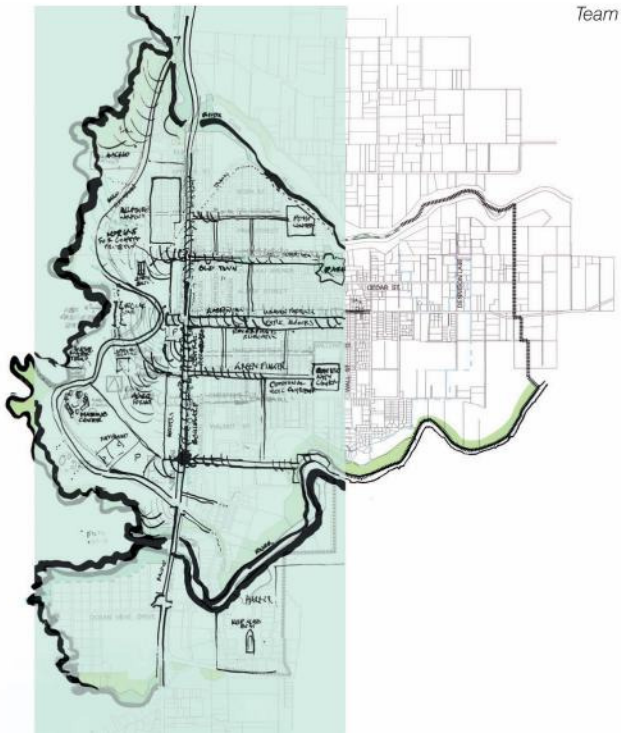
Team 5

Solutions underfoot

Urban life today is, in part, dependent on distant soils from rural and teleconnected hinterlands whilst potentially productive ground in urban environments is increasingly being sealed or progressively degraded. In our everyday urban lifestyle choices, soils often play little to no part. The contrary was true for ancient Maya urbanites. Their close-knit relationship between urban life and urban soils resulted in adaptive development over the long-term shaping urban design patterns that accommodated resilient inhabitation practices. By co-creating the *Dust to Dust* exhibition, we sought to inspire practitioners in urban development sectors and encourage the public to reflect on alternative approaches to everyday lifestyle choices. How do our current social-ecological behaviours relate to the urban environments that are able to care for us and that we desire to inhabit? In order to generate awareness of the difficult situation urban soils are in, and the potential to turn this around, we devised and specially commissioned two soil display boxes to mark the entrances to the exhibition bays.

Each soil display box contained nine soil samples extracted from a range of typical urban land-use surfaces in the vicinity of the exhibition venue, Norwich, UK. Daniel Evans analysed each sample to determine its overall health in terms of three of the most established soil property indicators: pH, bulk density, and soil organic matter content. We adopted a traffic-light scheme to make their respective soil quality readily perceptible. With captions indicating the urban land covers under which the samples were extracted, this display showed that when soils are sealed, such as those under concrete pavements and tarmac roads, they are strongly associated with poor soil health. Even more accessible, unsealed soils, such as those found in cemeteries and dirt paths, will not automatically improve soil health either, even if these represent a marginal improvement. The crucial difference to soil health and productivity is made by engaging in soil management as part of urban practices, be it through agriculture, streetside horticulture in raised beds, or simply in well-tended domestic gardens. By and large, solutions are available to us, as long as urban design and land-use allocations facilitate infrastructures for soil management and encourage everyday pro-environmental behaviour. ■

Team 6



Acknowledgements

The Dust to Dust exhibition was curated by Benjamin Vis, Daniel Evans, Christian Isendahl, and Elizabeth Graham. Benjamin Vis is Co-Investigator on the CNSF funded ComparT project on comparative urban morphology at the University of West Bohemia. Daniel Evans is a Senior Research Associate at Lancaster University, UK. Christian Isendahl is Professor of Archaeology at the Department of Historical Studies, University of Gothenburg, Sweden. Elizabeth Graham is a Professor of Mesoamerican Archaeology at the Institute of Archaeology, University College London, UK.

The curating team was supported by the Arts and Humanities Research Council, Eastern Academic Research Consortium, the University of Kent, and members of the TruLife research network. Particular thanks must go to The Prince's Foundation, INTBAU, Royal Institute of British Architects, Sainsbury Centre for Visual Arts, and the University of East Anglia.

Team members and collaborators

Team 1 comprised of Araceli Rojas[1], Martínez Gracida[1], and Nahuel Beccan Dávila[2], and collaborated with Patricia Martínez Lira, Fabián Vázquez Martínez, Bas van de Pas, Edmundo Morales, Adrián Puentes, Victor Rojas Ramírez. Ceramic artist: Patricia Gaytán. [1]Xicalli Coliuhqui Arqueología & Urbanismo; [2]Beccan Davila Urbanismo. Further information can be found at www.beccandavila.nl

Team 2 comprised of Gerald Lindner[1], Malgorzata Mader[1], Jessica Bardella[1], Peter Heideman[1], Danny van Kessel[1], and Gosia Mader[1]. [1]CC-studio architecture and engineering. Further information can be found at www.cc-studio.nl and www.kasco.cc/

Team 3 comprised of Giancarlo Mangone[1,2], Rob Cooke[2], Laurens Dominicus[2], Michael Maks Davis[3], Janina Sanchez[3], and Andrea Cristina Cordova[3]. [1]Symbiosis: Sustainable Design + Consulting; [2]BuroHappold Engineering; [3]Evolution Engineering, Design, and Energy Systems. Further information can be found at www.symbiosisarchitecture.com, www.burohappold.com, and www.evolutionecoengine.com

Team 4 comprised of Fransje Hooimeijer[1], Francesca Rizzetto[2], Kees de Vette[3], Loretta von der Tann[4], Wouter ter Heijden[1], Leyden Durand Lopéz[2], and Ian Acheilas[1,4]. [1]TU Delft; [2]UN Lab; [3]Municipality Rotterdam; [4]University College London. Further information can be found at www.tudelft.nl/staff/f.l.hooimeijer, www.unlab.eu, and www.tudelft.nl/en/infrastructures/research/special-projects/subsurface-infrastructure/

Team 5 comprised of Noelia Monteiro de Ribeiro[1], Christian Teshirogi[1], German Nieva[1] Mesas, and Felipe Bannitz[2], and collaborated with Victoria Baggio, Dante Rimondino, Mariana Orrico, Fernanda Caldeira, and Karen Doho. [1]Estudio Flume; [2]ISES Instituto de Socioeconomia Solidária. Further information can be found at www.estudioflume.com/ www.lses.org.br and http://ojs.escoladacidade.org/index.php/america/article/view/54

Team 6 comprised of Hajo Neis[1,2,5], Susan Ingham[1,3], Saul Pichardo[4], and Pamanee Chaiwat[2]. [1]Center for Environmental Structure (CES), University of California, Berkeley; [2]Portland Urban Architecture Research Laboratory (PUARL), University of Oregon; [3]KASA Architecture; [4]The Art of Building; [5]Hajo Neis and Associates. Further information can be found at: www.patternlanguage.com, blogs.uoregon.edu/puarl2018/, and www.livingneighborhoods.org/ht-0/bln-exp.htm