

# education for water resilient cities

14th | may 2018

## report

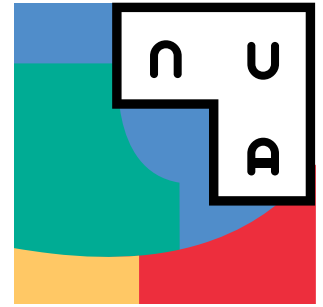
A one day-symposium for  
teachers and students  
#thecityweneed



Edited by Roberto Rocco



# education for water resilient cities



IMPLEMENTING  
THE NEW  
URBAN AGENDA

14th may 2018

A one day symposium at the  
**Faculty of Architecture and the Built Environment**

Delft University of Technology

On what to teach and how to teach spatial planning and design  
for water sensitive, climate resilient cities and communities

## EXECUTIVE REPORT

Edited by Roberto Rocco © 2018

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**DIMI** Delft  
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 **TU Delft**  
**BK Bouwkunde**

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for natural and  
built assets





# Our commitment to the SDGs and the New Urban Agenda

THE FACULTY OF ARCHITECTURE AND THE BUILT ENVIRONMENT OF THE TUDELFT IS COMMITTED TO THE IMPLEMENTATION OF THE NEW URBAN AGENDA AND HAS BECOME A LEAD PARTNER OF UN-HABITAT. THIS COMMITMENT IS REFLECTED IN ACTIVITIES, EVENTS AND COURSES.

The Sustainable Development Goals (SDGs) are a collection of 17 global goals set by 193 United Nations members states in 2013 with the objective to guide sustainable development in the next 15 years.

The SDGs cover a broad range of social and economic development issues and are part of the “Transforming our World: the 2030 Agenda for Sustainable Development”, or 2030 Agenda in short.

The broad goals are interrelated, though each has its own targets to achieve. The total number of targets is 169. Although the SDGs might sound a bit too broad, each target must be measurable through indicators and statistical data. The UN has a specific service that seeks to provide measurable indicators for each target: <https://unstats.un.org/sdgs/>

The World Council on City Data (WCCD) is also working hard to produce standardized city data through a network of innovative cities committed to improving services and quality of life with open city data. It provides a consistent and comprehensive platform for standardized urban metrics. <http://www.dataforcities.org/wccd/> The WCCD has developed the first ISO 37120 certification system and the Global Cities Registry.

The SDGs have a huge impact on the political discourse and are shaping European policy, such as



the Horizon 2020 programme. It helps shape the research agendas of research and educational institutions.

More recently, a specific document focusing on sustainable urban development was enacted. The New Urban Agenda is a binding document enacted at Habitat III in Quito in 2016, and aims to provide a framework for sustainable, inclusive and fair urban development.

The New Urban Agenda seeks to create a mutually reinforcing relationship between urbanization and development, with the idea that by promoting SDG 11 Sustainable Cities and Communities, we are able to deliver many of the other SDGs.

Bouwkunde wishes to promote SDGs and the New Urban Agenda among its community of academics, practitioners, researchers and students. Bouwkunde is intent

on contributing to SDG 11 everywhere, but our focus now is on African urbanisation, through one of the three As (Africa, Automation, Agility). But BK has a very strong track record on many other SDGs, especially SDG 4 QUALITY EDUCATION, SDG 13 CLIMATE ACTION and many more. BK wishes to improve its track-record on SDG 5 GENDER EQUALITY, SDG 10 REDUCED INEQUALITIES and many other SDGs.







- 1 NO POVERTY
- 2 ZERO HUNGER
- 3 GOOD HEALTH AND WELL-BEING
- 4 QUALITY EDUCATION
- 5 GENDER EQUALITY
- 6 CLEAN WATER AND SANITATION
- 7 AFFORDABLE AND CLEAN ENERGY
- 8 DECENT WORK AND ECONOMIC GROWTH
- 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
- 10 REDUCED INEQUALITIES
- 11 SUSTAINABLE CITIES AND COMMUNITIES
- 12 RESPONSIBLE CONSUMPTION AND PRODUCTION
- 13 CLIMATE ACTION
- 14 LIFE BELOW WATER
- 15 LIFE ON LAND
- 16 PEACE, JUSTICE AND STRONG INSTITUTIONS
- 17 PARTNERSHIPS FOR THE GOALS

What is your SUSTAINABLE DEVELOPMENT GOAL?

The United Nations Sustainable Development Goals (SDGs) are a set of 17 global goals that provide a blueprint for achieving a better and more sustainable future for all. They cover a wide range of issues, from poverty and hunger to climate change and peace.

Each goal is represented by a colorful icon and a brief description. The goals are:

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals

For more information, visit <https://www.un.org/sustainabledevelopment/>

SUSTAINABLE DEVELOPMENT GOALS





**Speakers**

# Speakers

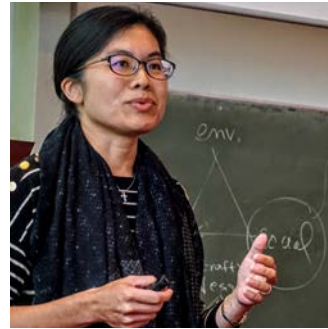
A NUMBER OF EDUCATORS, RESEARCHERS, PROFESSIONALS AND ONE ARTIST GOT TOGETHER TO DISCUSS PLANNING EDUCATION FOR WATER RESILIENT CITIES



**AMY SHARROCKS**  
BRITISH ARTIST.



**BERT SMOLDERS**  
ARCADIS, HEAD OF THE SHELTER PROGRAMME, NL.



**BETTY CHANG**  
ASSISTANT PROFESSOR, DEPARTMENT OF URBAN PLANNING, NATIONAL CHENG-KUNG UNIVERSITY, TAIWAN.



**FRANSJE HOOIMEIJER**  
ASSISTANT PROFESSOR ENVIRONMENTAL TECHNOLOGY AND DESIGN AT TU DELFT, NL



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ARCADIS, CONSULTANT SHELTER PROGRAMME, NL.



**KRISTEL AALBER**  
LECTURER ENVIRONMENTAL TECHNOLOGY & DESIGN, SUSTAINABLE URBAN PLANNING AND ARCHITECTURE WITH A FOCUS ON WATER, URBANISM MSC TRACK COORDINATOR, TU DELFT.



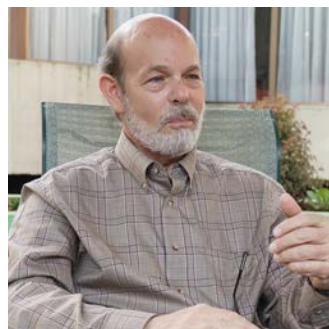
**NIKKI BRAND**  
POSTDOC INTEGRATED DESIGN OF INFRASTRUCTURES AT DELFT DELTAS, INFRASTRUCTURES AND MOBILITY INITIATIVE, TU DELFT.



**ROBERTO ROCCO**  
ASSISTANT PROFESSOR, SPATIAL PLANNING AND STRATEGY, SUMMER SCHOOL PLANNING & DESIGN WITH WATER, TU DELFT, NL.



**STEVEN FORREST**  
DOCTORAL CANDIDATE, DEPARTMENT OF PLANNING, FACULTY OF SPATIAL SCIENCES, UNIVERSITY OF GRONINGEN, NL.



**STEPHEN GOLDSMITH**  
ASSOCIATE PROFESSOR, CITY & METROPOLITAN PLANNING, UNDERGRADUATE COORDINATOR, CITY & METROPOLITAN PLANNING, THE UNIVERSITY OF UTAH, USA.



**TANEHA BACCHIN**  
ASSISTANT PROFESSOR URBAN DESIGN, RESEARCH LEADER AND COORDINATOR OF EDUCATION FOR THE DELTA URBANISM RESEARCH PROGRAM, DEPARTMENT OF URBANISM, TU DELFT, NL.





# Summary

IN LIGHT OF THE NEW URBAN AGENDA LAUNCHED IN QUITO IN 2016, WE ARE STRIVING TO UNDERSTAND HOW TO IMPLEMENT IT THROUGH EDUCATION, CAPACITY BUILDING AND TRAINING. PLANNING AND DESIGN WITH WATER FOR RESILIENT, FAIR AND INCLUSIVE CITIES IS ONE OF OUR MAIN TOPICS.

On 14 May, TU Delft in partnership the Center for the Living City (US), the University of Utah (US), the Department of Urban Planning of the National Cheng Kung University (Taiwan) and ARCADIS organized a symposium to discuss new water-sensitive urbanization paradigms and how to integrate them into EDUCATION for the built environment.

Building on the rich Dutch tradition of water sensitive urbanisation, we are seeking to create a community of educators, students, researchers and other stakeholders who can contribute to education for fair, resilient and water friendly cities, within the framework of the UN-Habitat New Urban Agenda and the 17 Sustain-

able Development Goals (SDGs) – part of a wider 2030 Agenda for Sustainable Development.

It is becoming widely recognized that there is no such a thing as a ‘natural disaster’, but only extreme climate events to which our cities and regions are ill-adapted. These extreme climate events are becoming more numerous as the planet’s climate transforms as a result of human activity. While many traditional cultures were able to manage the land and converse with nature in a sustainable way, the advent of industrialization and modernization has broken the links between settlements and the landscape in favor of a type of urbanization that pretends to tame nature.

This paradigm is no longer



viable or desirable, as time after time nature comes back at us and castigates our poorly managed cities. Recent events in Houston, San Juan, São Paulo, Cape Town, Southern Taiwan and many other cities and regions the world call for an alternative way of planning and designing our cities in compass with natural systems and, most especially, in compass with our water resources. Many places around the world, including the Netherlands, are seeking a new paradigm of urban development in which cities and regions should not 'fight' or 'tame' water, but should work with natural systems in order to create safe and resilient cities. To these challenges, we can add the need for inclusive participatory planning and community involvement.

Underpinning our need to work with natural systems is to rediscover our cultural and symbolic relationships with water. From cultural relationships that include ceremonies, lifecycle events from birth to death and the privilege of drinking clean, healthy water, our stewardship in managing water is enhanced when we bring the knowledge that water is life to our discussions. Re-educating ourselves about these relationships is a vital step as we create new ways to urbanize with water. We see it as the university's social responsibility to educate professionals, students and

society about the importance of water resilient cities.

This symposium was organized within the framework of TU Delft's lead partnership with UN-Habitat and the World Urban Campaign to promote and teach issues connected to the New Urban Agenda. This event also supports the Summer School Planning and Design Water, offered every July at the Department of Urbanism of the TU Delft now in its 5th edition.

<https://summerschooltudelft.org>











**RESILIENT CITIES**  
The ability of a city to resist, absorb, recover from, and adapt to adverse events, whether hazardous or non-hazardous, through the use of a variety of strategies and tools. Resilient cities are those that are able to maintain their essential functions and structures in the face of adversity.

**RAINFALL FLOODING**  
Portland, OR, USA  
Problem: Heavy rain events cause significant flooding in urban areas, leading to property damage and disruption of services.  
Solution: Implementation of green infrastructure, such as permeable pavements and rain gardens, to absorb and manage stormwater runoff.

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Problem: Limited access to clean, affordable water for all residents, particularly in low-income and minority communities.  
Solution: Investment in water infrastructure, such as pipe replacement and water treatment upgrades, to improve water quality and reliability.

**Problem: Water Insecurity**  
The inability of a community to ensure that all residents have access to sufficient quantities of safe, affordable water for their basic needs. This is often caused by a combination of factors, including aging infrastructure, limited investment in water infrastructure, and inequitable distribution of resources. The problem is particularly acute in low-income and minority communities, where water insecurity can have significant impacts on health, education, and economic opportunity.

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**RECONNECTION**  
TO NATURE THROUGH WATER

**WITH THE ELEMENTS**

**CONNECTION  
TO NATURE  
THROUGH WATER**

A collection of informational cards and brochures displayed on a wooden table. The cards feature various nature-themed images, including landscapes, waterfalls, and forests. Some cards have text, while others are primarily visual. The cards are propped up by small wooden log cutouts. The background shows a large window looking out onto a paved area with a bicycle rack filled with bicycles.









## HIDDEN WATER

Everything in our world has been touched by water. This "Hidden Water" is often overlooked in our daily lives. Whether it is the food we eat, the clothing we wear, or the things we produce, nothing is created without water.

WATER  
RCS

MILK

BEER

OUR PLAYER











# Contributions

EDUCATION FOR FAIR, INCLUSIVE AND SUSTAINABLE CITIES



# Amy Sharrocks

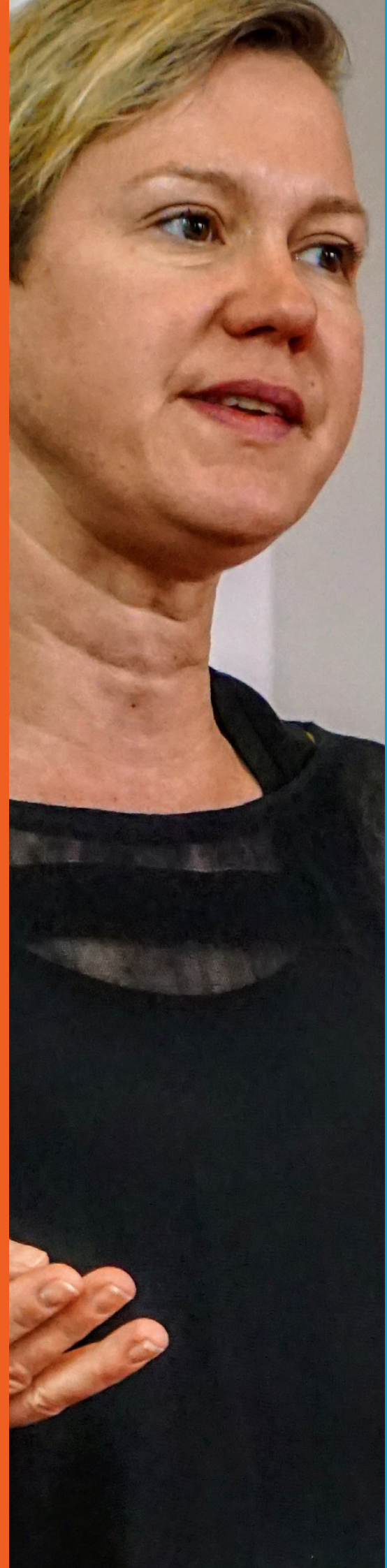
AN ALTERNATIVE TAKE ON WATER

According to website of the Artsadmin foundation, "Amy Sharrocks is a live artist, sculptor and film-maker who invites people to come on journeys in which their own experience, communication and expression are a vital part. Undertaking these journeys with a sense of humour, joy and risk, Amy creates work that is rich, unpredictable and different every time. This invitation and the bravery and invention of people's responses, produces new avenues for exploration and fantastic visions within the everyday." (Source: <https://www.artsadmin.co.uk/artists/amy-sharrocks>). Amy was invited to speak at this symposium because we wanted to explore a different view on water, different from the technical approach we usually have at TU Delft. This exploration was important for the symposium, as Amy reminded the audience about the deeper meanings of water for our lives: symbolic, practical, poetic and sensual. Amy explained how she explores these dimensions through active artistic interventions, in which the public is invited to be part of the action and to share their own stories, such as the 'Museum of Water', a project she started back in 2013. The Museum of Water is an ongoing project, composed by differently-shaped bottles of water donated by the public, accompanied by narratives that explain the origin and the significance of specific samples of water. The Museum of Water set up during the symposium by Stephen Goldsmith from the University of Utah displayed stories, postcards, signs and also samples of water collected by the students of the city and metropolitan planning of the University of Utah. This project was carried out in partnership with Amy Sharrocks. During the symposium, Amy gave an account of

several artistic performances and interventions in which water, and people's stories with water, played a central role. Amy emphasized the symbolic relationships people establish with water and how they experience water on a daily basis.

According to the Museum of Water website set up by the artist (<http://www.museumofwater.co.uk>):

"Water is our most basic need and our most overlooked, throw-away substance. We choose water metaphors to define our thoughts, while in our actions we defend against it, squeezing and pumping it, chlorinating and piping, soothed by our certainty that it will pour from our tap at a twist of our fingers. It is time to re-examine our connection with the water that surrounds us, and develop a new relationship. We need to hold on to water, consider what is precious about it and how we are using it now in order to explore how we might save it for the future. We are all implicated in this. Museum of Water has travelled to over 50 different sites worldwide, been visited by over 60,000 people, and currently holds over 1,000 bottles in the collection. These range from a melted snowman to a burst London water main and water from the last ice age, a muddy puddle in Birmingham to a canal in Rotterdam, water from Lourdes, Mecca and the Ganges, condensation from a Falmouth window, Ghost water and bad dream water, 20-year-old evaporated snow from Maine, a new born baby's bath water, Norwegian spit, three types of urine, two different breaths and water from a bedside table said to be infused with dreams." (<http://www.museumofwater.co.uk>)





# Nikki Brand

THINGS WE ARE NOT TALKING ABOUT, BUT SHOULD

Of all natural hazards faced by cities, flooding is currently the costliest. Now more than half of the global population has gone urban, the future of mankind balances on the capacity of cities to build resilience against flooding. But we underestimate both the role of urbanisation as a driver of flood risk, and its potential to build resilience. Traditional flood risk management revolves around large-scale infrastructures that prevent flooding, or evacuation and insurance that mitigate damages.

What is missing, is the engagement of urban development itself to reduce vulnerability. The urban fabric of cities naturally expands and transforms in ways that can either soften or worsen the problem. Houston's experience teaches us that the floodplain moves with development: they are like heat-seeking missiles that follow us around. However, examples like Texas Medical Center also demonstrate that retrofitting can completely prevent damage during a flood event. This is something we need to discuss in education.

Rather than waiting for large-scale engineering projects to bail us out, we, as spatial planners and urban designers of the future, have an obligation to build resilience on the scale of buildings and districts. This requires 'flood literacy': we have to plan and design under the assumption that our cities will flood, and complement the efforts pursued by mega-engineers and disaster managers.





# Kristel Aalbers

EDUCATION NEEDS TO ANTICIPATE FUTURE CHALLENGES

My colleagues at the water board of Delfland used to say that the occurrence of water nuisance every now and then would help them to get all actors involved on the same page of solving the problem.

In the late 90's big water nuisance appeared in the Delfland area with the eastern part of the old town of Delft (the lower peat area) partially flooded. Although a problem at first - especially for the ones living there - this also was the start of actually solving the problems together: municipality, inhabitants, home owners and water board. Striving to reach the shared goal, all were willing to talk and to search for a wider spectrum of possible solutions. A quick solution was implemented with temporary removable emergency pumps, gaining time to discuss, research and test sustainable, spatially and monumentally well-integrated robust solutions for the future.

Now the old city of Delft is well protected for the coming years. The lower part of the old city has become a semi polder; in periods of heavy rainfall and a rise of the water level in the larger boezem system (the boezem system consists of the main vaines of the water structure at 40 cm minus n.a.p./new Amsterdam or general level), the eastern part of the old town water structure can be closed off, preserving the desired water level and thus protecting the ancient and monumental buildings and its residents.

In education waiting for such a problem as a start for getting ready finding solutions should be a no go. Education should be upfront; should inform students

ahead preparing them for the future to be and for future problems, trying to adapt or mitigate before actual problems occur.

But that is also pretty difficult. Because we are not familiar yet with the future problems, we do not exactly know what will happen. The further away the time horizon, the less specific we know what may or may not occur.

Therefore, teaching should not be about known problems and familiar solutions, it should be about preparing future generations to be able to recognize and answer future tasks by providing them with the right equipment to do so. We cannot teach how to solve specific tasks, but we can help students to develop necessary skills to solve future tasks by encouraging their curiosity, providing context and reference projects as well as an array of possible and plausible approaches or methods. By teaching them how problems were solved in the past, how they are settled in the present, and by reflecting on these approaches, by sparking students to combine present ideas into innovative combinations, we can prepare them for their future. We can help them getting ready to bend the route from the present status to the autonomous future towards a desired future.

But most of all we can help them prepare by provoking, stimulating and encouraging their love for our world, becoming good care takers; setting sustainable goals while taking care of the planet and the people in balance with prosperity.

Let's make sure all students are equipped for the future and for future challenges!





# Fransje Hooimeijer

REVERSED ENGINEERING WITH NATURE'

The subsurface is a technical space, the “engine room of the city,” that incorporates the vital functions of water and energy supply, communication systems, sewers and drainage. Natural systems too – crucial for stable, dry, cool and nature inclusive cities – are also largely dependent on the quality of the subsoil. The subsurface is critical in an era of climate and demographic changes, the energy transition and economic uncertainty and constraints.

However, due to the domain’s current segregation and a weak urban design and planning connection, crucial design potential, benefits and innovations, remain unexploited. This contribution introduces ‘Reversed Engineering with Nature’ as a concept. In urban concepts, the subsurface is usually not identified or included as space.

By better understanding and re-thinking of this hybrid place, and re-designing the “engine room” from the integrated perspective of planning, design and engineering, the objective is to reach an efficient overall urban system that directly supports improvements in the general quality of cities. Reversed engineering with Nature goes beyond Landscape Urbanism because it does not ignore the techno-sphere but carefully creates balance in an effort to find cooperation with the biosphere. It relates the tame and wicked knowledge fields, actors and looks at the city as a hybrid performance landscape. Thus, not only allowing the operational logic of the natural system to take the lead, but working together with the agency of the technological urban constructions that currently exist. Synchronisation (in time, space, technology and interests) is one of the main goals in this approach.



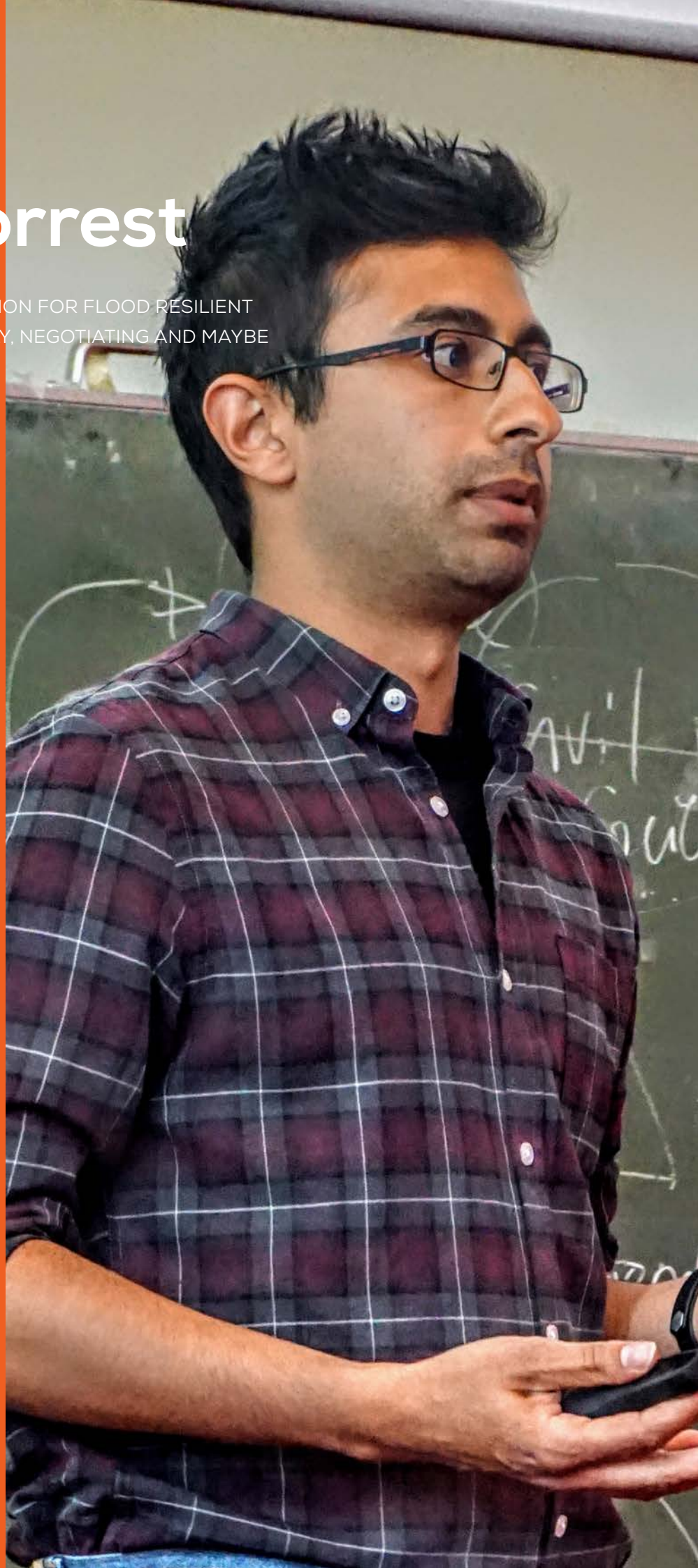


# Steven Forrest

MORE THAN LECTURING IN EDUCATION FOR FLOOD RESILIENT CITIES: WORKING COLLABORATIVELY, NEGOTIATING AND MAYBE EVEN BUILDING CONSENSUS

The TU Delft symposium (2018) highlighted the importance of planning for water resilient cities and that educational practices must be designed to support the next generation of planners by delivering both theoretical knowledge on water resilient cities and interactive opportunities to apply this knowledge (TU Delft, 2018). The University of Groningen's combined flood resilience workshop and problem-based role-play game (by Steven Forrest, Elen-Maarja Trelle and Britta Restemeyer) and the National Cheng Kung University's use of field-based learning and stakeholder workshops (by Betty Chang) were examples presented at the TU Delft symposium of changing student learning experiences on the topic of water resilient cities.

Planning for water resilient cities is growing in importance for both current and future planners in light of predictions of more frequent and intense hydrological extremes (i.e. flooding and droughts) in cities as a result of climate change (EEA, 2012; Hegger et al., 2016). Flooding is one of the challenges that needs addressing for a water resilient city and there has been a growing emphasis on 'flood resilience' for cities and local urban areas (Forrest et al., 2017; Scott, 2013; Restemeyer et al., 2015). Flood resilience is a more holistic approach towards urban flood management that focuses not only on traditional flood defences, but also on reducing the societal consequences of flooding (Forrest et al., 2017). In contrast to traditional





actors, flood resilience approaches seek to involve a broader circle of actors (Mees et al., 2016; Meijerink & Dicke, 2008). Consequently communities, citizens, businesses and non-traditional government actors are becoming more involved in decision-making and action in flood resilience approaches (Meijerink & Dicke, 2008; Scott, 2013). This greater diversity of actors presents opportunities for new cross-sectoral solutions for flood management (e.g. spatial planners and water engineers), for expanding the focus on flood control, response and recovery to also include pre-flood spatial planning approaches (e.g. the multi-layered safety approach in the Netherlands), and to access previously untapped or underutilised capacities (e.g. expertise) and resources (e.g. financial and human) from these newly-involved actors. The broader circle of those involved also presents challenges in consensus-building amongst actors with a range of diverse interests and competing visions for their urban environment. The different capacities and resources of each actor to take action or to persuade others to take action will impact the form of flood resilient urban areas that are planned. There will always be winners and losers: actors who can access more resources and achieve changes at the expense of other actors' ability to do so.

Education for flood resilience and water resilient cities needs to consider the impact of having more diverse actors involved in decision-making and the processes of seeking compromises and consensus in the midst of competing interests and visions. Lecturing can provide insights into how these opportunities and challenges unfold in different local contexts with varying actors arrangements. However, in reality these opportunities are not realised as neatly as often taught and the processes of collaborative working, including negotiating the aims and scope of planning, are difficult to convey to students. Changing student learning experiences to also include interactive opportuni-

ties to apply this knowledge in a role-play game situation can be used to simulate these aspects of negotiation and consensus building.

To summarise, the widened circle of actors involved in flood resilience approaches presents both opportunities and challenges for planners, which needs to be reflected in education for water resilient cities. Educational courses are able to engage with the theoretical debates on these important issues, but there must also be opportunities for students to apply their learnt knowledge and to experience collaborative working, negotiations between competing interests and maybe even consensus-building (or encountering conflicts) in planning for water resilient cities. The connection between the lecture hall and practice is not always possible for educators and the use of problem-based role-play games can overcome this to provide stimulating education on water resilient cities.

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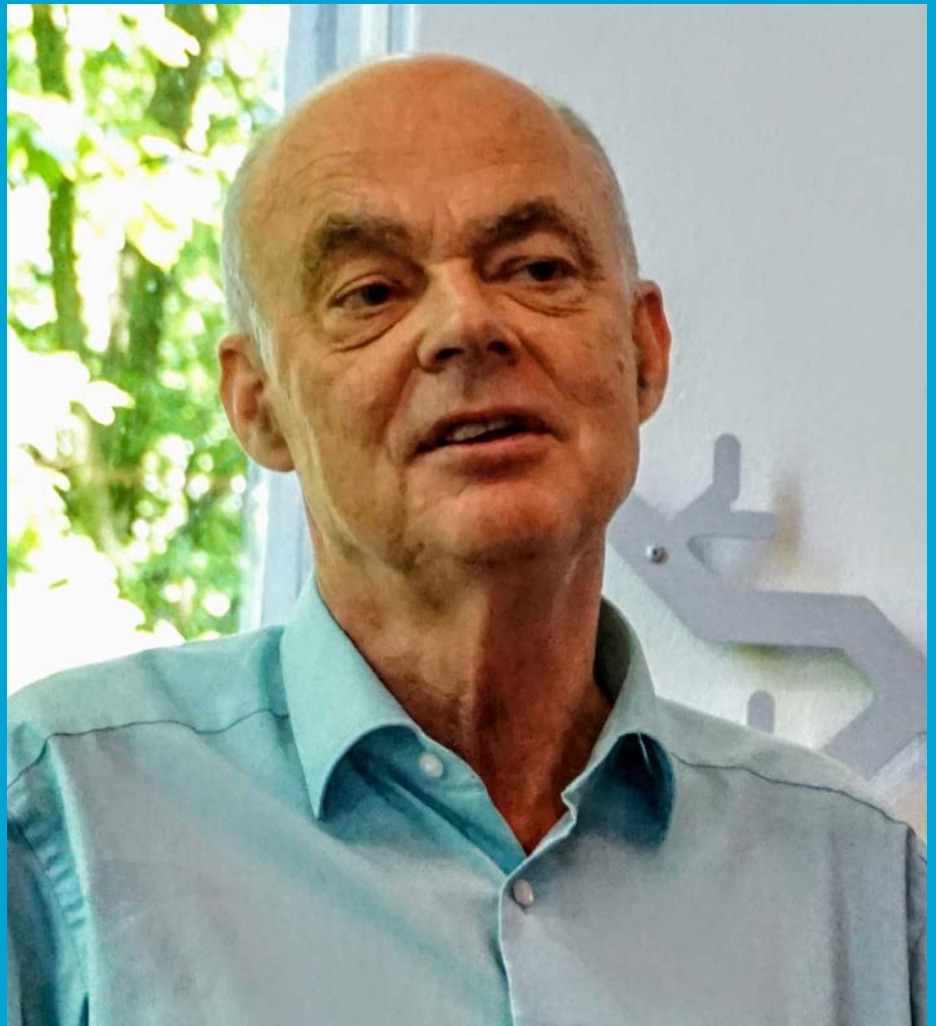
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# Bert Smolders and Iris Bijlsma

ARCADIS, SHELTER PROGRAMME

The Arcadis Shelter program supported the Water Education Symposium in the Urbanism Department of the Delft Technical University. Bert Smolders Shelter program manager and Iris Bijlsma presented principles and experience on nature based solutions for integrated urban water management, and discussed with participants. Key message in the presentations is that water should be regarded as the basic layer in urban planning, and as foundation for development. First think water then think urban is the motto. Comprehensive solutions for flood protection, building with nature, room for the river and sponge city concepts were discussed. In all these concepts there is a strong relation between water management and urbanism. So it is logic and very important that the education on urbanism should include awareness and key knowledge on water management and nature based solutions. The department of Urbanism of Delft Technical University is the natural location to develop expertise in this field, as it is based in The Netherlands with a long tradition and worldwide expertise on both water management and urbanism. This role can be enforced in future, with partnerships with all stakeholders including the Dutch consultancy offices such as Arcadis where experts work in practice on comprehensive urban water management projects all over the world.













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Professor Chang reminds the audience about the UNESCO programme for the United Nations Decade of Education for Sustainable Development. "Teaching and learning for a sustainable future is a UNESCO programme for the United Nations Decade of Education for Sustainable Development. It provides development for students, teachers, curriculum developers, education policy makers, and authors of educational materials. The modules are divided into 4 themes: 1. Curriculum rationale, 2. Sustainable development across the curriculum, 3. Contemporary issues and 4. Teaching and learning strategies. (<http://www.unesco.org/education/tlsf>). She goes on by discussing several definitions of resilience: "The degree to which cities are able to tolerate before reorganizing around a new set of structures and processes" (Alberti et al., 2003); "The capability to prepare for, respond to and recover from significant multi-hazard threats with minimum damage to public safety and health, the economy and security" (Wilbanks, 2007). Etc. and summarises by stating that a resilient city is sustainable in its economy, environment and community, but it has a deeper quality which enables it to quickly adapt to challenges and rebuilt itself from any challenge it faces (<https://infrascapedesign.wordpress.com/2011/01/07/interview-with-peter-newman/>). Professor Chang discusses urban resilience in relation to social resilience, as part of the definition of disaster resilience by the World Bank (which includes social resilience, economic resilience, institutional resilience, infrastructure

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<p><b>THEME 1</b> <b>CURRICULUM RATIONALE</b></p> <p>These modules present an introduction to the global realities, imperatives for sustainable development and educational issues that form the rationale of Education for a Sustainable Future.</p> <ol style="list-style-type: none"> <li>1. Exploring global realities</li> <li>2. Understanding sustainable development</li> <li>3. A futures perspective in the curriculum</li> <li>4. Reorienting education for a sustainable future</li> <li>5. Accepting the challenge</li> </ol>	<p><b>THEME 2</b> <b>SUSTAINABLE DEVELOPMENT ACROSS THE CURRICULUM</b></p> <p>These modules illustrate ways in which Education for Sustainable Development can be integrated into all areas of the curriculum, especially into cross curriculum themes such as health and consumer education.</p> <ol style="list-style-type: none"> <li>6. Sustainable futures across the curriculum</li> <li>7. Citizenship education</li> <li>8. Health education</li> <li>9. Consumer education</li> </ol>
<p><b>THEME 3</b> <b>CONTEMPORARY ISSUES</b></p> <p>This section illustrates ways in which a variety of curriculum themes may be recognised to integrate an interdisciplinary emphasis on a sustainable future.</p> <ol style="list-style-type: none"> <li>10. Culture &amp; religion for a sustainable future</li> <li>11. Indigenous knowledge &amp; sustainability</li> <li>12. Women &amp; sustainable development</li> <li>13. Population &amp; development</li> <li>14. Understanding world hunger</li> <li>15. Sustainable agriculture</li> <li>16. Sustainable tourism</li> <li>17. Sustainable communities</li> <li>18. Globalisation</li> <li>19. Climate change</li> </ol>	<p><b>THEME 4</b> <b>TEACHING &amp; LEARNING STRATEGIES</b></p> <p>This set of modules develops professional skills for using teaching and learning strategies that can help students achieve the wide range of knowledge, skill and values objectives of Education for Sustainable Development.</p> <ol style="list-style-type: none"> <li>20. Experiential learning</li> <li>21. Storytelling</li> <li>22. Values education</li> <li>23. Enquiry learning</li> <li>24. Appropriate assessment</li> <li>25. Future Problem Solving</li> <li>26. Learning outside the classroom</li> <li>27. Community Problem Solving</li> </ol>

(<http://www.unesco.org/education/tlsf>).

residence and community capital). For Professor Chang, professional resilience should be part of social resilience, and is connected to a shift in planning paradigms, from physical/rational planning to participatory, advocacy, communicative, collaborative, insurgent and radical planning. In order to cater for this paradigm shift, field-based learning and stakeholder workshops become the main pedagogical strategies for professional and social resilience. It is necessary to enhance students' professional competences to quickly adapt to challenges and to rebuild themselves for any new challenges they might face. At NCKU they use community-based learning and stakeholder workshops as experiential learning environments, with several courses and "project courses", as well as three levels of workshops (dialogue, visioning and action). The pedagogy of social resilience in planning education is based on 1. Community problem-solving and experiential learning, 2. Stakeholder workshops and pedagogical experiments, 3. Reflection (response paper/workshops/ interviews) and finally 4. Speakers and lectures (values/ story telling). At NCKU they are seeking to build up collaborative planning education and design thinking for planning innovation.

The role of students is defined as facilitators, process designers, innovators and entrepreneurs.



