



**Urbia Group**  
Think Beyond

# A HOLISTIC TRANSITION *to climate-resilient cities*



Winner of the  
2014 Global Award  
for Sustainable  
Architecture

# ABOUT THE AUTHOR



**BERND GUNDERMANN**

**Urbia Group** transforms the challenges of Climate Change into opportunities, developing alternatives that encompass the complexity of urban societies. We **think beyond** the current paradigm and creating vibrant, natural places filled with culture and community. Our vision brings together a range of experts united by a common goal; to envisage cities where people love to live.

**Bernd Gundermann**, founder of Urbia Group, is at the forefront of global thinking in the area of coastal response options to climate change. He believes that to meet the challenge of climate change, mankind needs to change our mindset of operating in isolated disciplines and bring together our thinking into a comprehensive and holistic approach.

His research on coastal design to protect against the effects of Climate Change has just been published in a text book in India, and will be adopted into the curriculum for smart planning in many universities

throughout the country. He has produced two booklets on Sea-Level Rise and Coastal Responses; Adaptive Urbanism and From Resistance to Resilience, demonstrating his philosophy of aligning urban interventions with the natural environment.

Before becoming an architect, Bernd studied geosciences and was actively engaged in the preservation of coastal estuaries. Since then he has had more than 30 years experience as an architect and urban designer. Bernd was Lead Master Planner and Architect for the Hanseatic Trade Centre in Hamburg, converting 15 hectares of former port into a mixed use development, which led to the largest port-conversion project in Europe; Hamburg's Harbour City.

Bernd converts a seemingly overwhelming problem into an opportunity to reinvent cities into vibrant, communal, natural environments.

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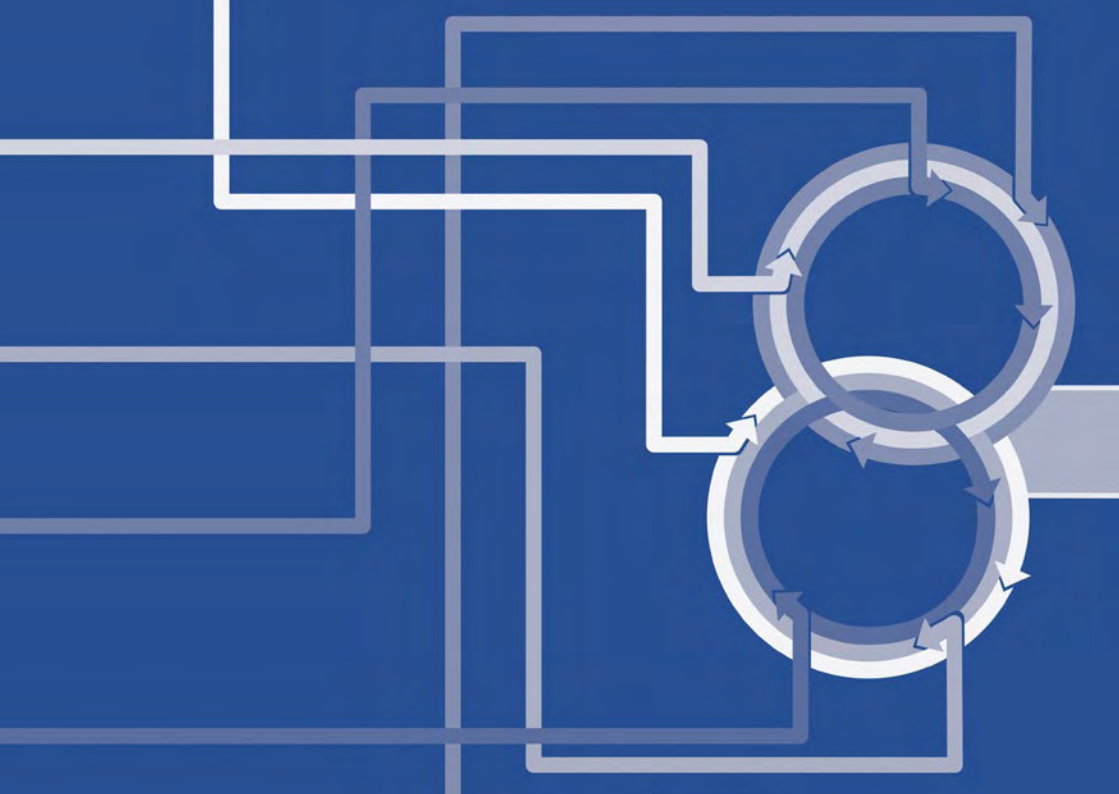
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## CREDITS

**Editor:** Gabrielle Free

**Assistant Editor:** Andrea Munroe

**Layout:** Catherine Hugo





**RESEARCH**

# THE CHALLENGE

Climate Change is the biggest challenge facing the world today. The evidence is undeniable. It is an issue that is no longer limited to melting polar ice-caps and rising seas, but drastic climatic variation that will impact every living organism on this planet.

The coastal effects of Climate Change include, but are not limited to, changes in temperature, sea-level rise, coastal erosion, storm surges, changes in rainfall, more frequent and intense extreme weather events, salinization, acidification, rising water tables, all of which are a threat to life, health, property and the environment. The damage that this will have is irreversible and growing daily. Our general response, or lack thereof, has been described by sociologist Ulrich Beck (2000) as "organized irresponsibility".

Economically, the cost of the extreme weather events that have occurred as a result of Climate Change have cost the world US \$1.6trillion in the decade 2003-2012 (SwissRe) and it is estimated that this will increase to US \$1 trillion annually by 2050 (Nature Climate

Change). As the population grows, and urbanization increases, by 2025 75% of the world's population (or 6 billion people) will live in coastal areas. The World Economic Forum recently conducted an overview of risks and put the 'Failure of climate change adaptation' as having the most 'knock on' effects for the next decade.

The issue is not limited to a specific continent, or level of development or wealth. A report issued as part of an OECD project on Cities and Climate Change in 2007 list cities that are the most financially exposed including:

- Miami (\$3,513B), New York (\$2,147B) and New Orleans (\$1,013B) (USA)
- Guangzhou (\$3,358B), Shanghai (\$1,771B), Tianjin (\$1,231B) and Hong Kong (\$1,164B) (China)
- Mumbai (\$1,598B) and Kolkata (\$1,961B) (India)
- Tokyo (\$1,207B) and Osaka (\$969B) (Japan)
- Bangkok (\$1,118B) (Thailand)
- Rotterdam (\$826B) and Amsterdam (\$844B) (Netherlands)
- Ho Chi Minh (\$653B) (Vietnam)



*Figure 1. Storm surge in Auckland , New Zealand  
in January 2011*

Cities such as Dhaka in Bangladesh, Lagos in Nigeria, and Jakarta in Indonesia have larger populations exposed to coastal flooding, but do not have the same financial investment.

Environmentally, we are losing biodiversity at an unprecedented rate. The IPCC Fourth Assessment Report Working Group 2 (2007) states that the current global extinction rate is one species per year. This will increase to 400,000 species per year when our global temperature increases by 2°C, and at 4°C up to 1 million species per year will become extinct. The economic value of biodiversity loss has been calculated by Pavan Sukhdev from the Deutsche Bank, who estimated that the business activity of the world's 3000 largest corporations has caused approximately US\$2.2 trillion annually in loss or damage to the natural environment as of 2008.

Researching the cost of Climate Change to the human population is more complex and harder to quantify. A report titled Climate Vulnerability Monitor 2nd Edition conducted by DARA in 2012 estimates that Climate Change was responsible for the deaths of over one million people in 2010 as a result of food shortages, drought, disease, weather related events

and extreme temperatures. This does not take into account the psychological effects of extreme weather events, the loss of homes and possessions, the uncertainty regarding future wellbeing, or displacement. The most recent example is Typhoon Haiyan which devastated the Philippines in November 2013, killing more than 5,500, leaving just under 2000 missing, injuring over 26,000, displacing 1.8 million children and affecting 14 million people in total.



Figure 2. Perspective of soft, eco-system based techniques in Wellington, NZ



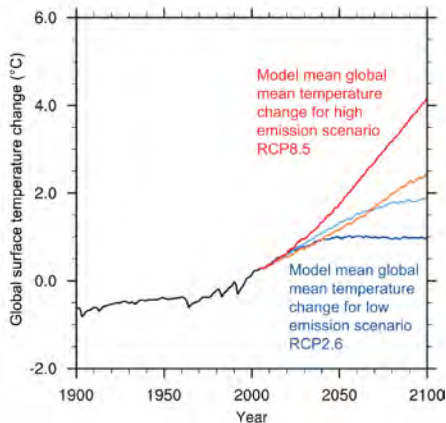


Figure 3. Global mean temperature change averaged across all Coupled Model Intercomparison Project Phase 5 (CMIP5) models (relative to 1886–2005) for the four Representative Concentration Pathway (RCP) scenarios: RCP2.6 (dark blue), RCP4.5 (light blue), RCP6.0 (orange) and RCP8.5 (red). Taken from IPCC 2014, Chapter 12: Long-term Climate Change: Projections, Commitments and Irreversibility

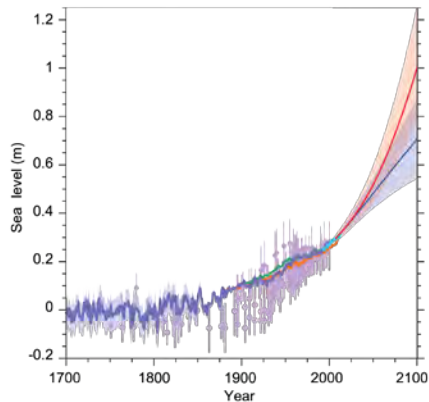


Figure 4. Compilation of paleo sea level data, tide gauge data, altimeter data (from Figure 13.3), and central estimates and likely ranges for projections of global mean sea level rise for RCP2.6 (blue) and RCP8.5 (red) scenarios (Section 13.5.1), all relative to pre-industrial values. Taken from IPCC 2014, Chapter 13: Sea Level Change

Unfortunately, Climate Change has been framed as a political issue that is based on international policy negotiations rather than national responses to physical risks. Debating who is at fault and what is 'fair' has consumed decades of political discussions. Sceptics continue to claim that these changes are part of the natural glacial and interglacial cycle without researching to find that the levels of CO<sub>2</sub> in the atmosphere have not occurred in the last 3 million years. Even if international agreements can lead to a dramatic reduction in emissions, Climate Change has already been triggered. How much time we have is unknown, but the effects are unavoidable.

Climate research has been criticized as being inefficient because of the Kyoto Protocol's fixation on Greenhouse Gas emission reduction and an approach that is unlikely to lead to meaningful outcomes.

Meanwhile, the hype of algorithmic modelling has led to the impression that the 20,000 UN researchers travelling the planet are making progress towards saving it. However while developing knowledge about the effects and extent of climate change may be useful, it is not itself a plan of response.

In addition to all this, Climate Change is difficult to challenge due to the scale of the problem. Every country in the world will be affected. The complexity of the natural environment means that there are many contributing factors and many possible responses which can make it hard to know where to begin.

If we are serious about protecting our cities, we can't wait until the damage is done before we figure out what to do. We need to consider our options well in advance and come to a collective agreement on new forms of coastal development. The complexity and the scale of the issue will require time to research possible solutions, come to agreement, amend legislation, and implement measures around coastal areas. We must start now if we want to be prepared in time. The more we delay, the more limited our options will become. If we continue to wait for complete certainty, we will be investing in hazard recovery, rather than preparation. The UN Development Programme (UNDP) estimates that "Every \$1 spent reducing people's vulnerability to disasters saves around \$7 in economic losses". However the social and environmental costs are immeasurable.



Figure 5. Perspective of Auckland CBD, New Zealand

# PARADIGM SHIFT

Currently humanity is trying to 'engineer' its way out of the issues that we are facing as a result of controlling the natural environment. This means that we are applying solutions of the same thinking that created the problems in the first place, an impossibility according to Einstein. Instead, we need to consider both our current tools as they are still valid, as well as open the possibility to other sources and approaches to overcome issues in a new way.

Our approach therefore marks a paradigm shift by deploying response options to the coastal effects of Climate Change in a holistic way, understanding mankind as intrinsically interconnected with the natural environment.

This approach thereby overcomes the Cartesian Split that separated material and metaphysical realms and focusses on a various bodies of knowledge that can be applied to respond to our current challenges. Ancient wisdom, both long forgotten or suppressed, is drawn upon in the same way that science and eco-

nomics have been over the last centuries. We believe that the place where the realms intersect will help us move forward.

Collaboration is vital to both our process and solutions emulating the interconnectedness of the natural environment, the work style we apply supports out-of-the-box thinking and communicating the findings via web-based tools removing silo-mentality and allowing for unexpected insights. The range of industries include social and natural sciences, economics, engineering, urban design, philosophy and spirituality and thus communication between these widespread fields demands a common language that removes jargon in order to be comprehensible by the wider public.

Aiming to overcome the separation and inaccessibility of science, we wish to transform the complexity of the coastal effects of Climate Change into something which the general public can comprehend, engage with and offer their opinions about. The open source nature of our enquiry will increase awareness and education and thereby widen the general basis for public involvement in tackling Climate Change which is crucial to the success of resilience.



# WORLD LEADING INNOVATION

Our approach is innovative for several reasons. First, we challenge thinking that has been prevalent in our society for hundreds of years; the artificial separation of humankind from the environment. We are challenging this assumption and the repetition of solutions that have lead to our current predicament. However if **we want to shift from resisting nature to aligning with it** we must emulate it by using a totally inclusive and holistic approach.

We also replicate **natural complexity and interconnectness** by involving a multi-disciplinary team in our process including scientists, engineers, philosophers, designers, economists. It is very rare to find scientific research, which deals in the measurable, being augmented by cultural and historical beliefs that cannot necessarily be quantified, but that give the project a much richer integrity and viability.

Currently only risk and vulnerability assessments have been undertaken, with minimal efforts to respond to

the result through adaptation. Our approach will go **one step further to create and implement tangible results** to mitigate the effects of Climate Change.

This approach is also proactive in preparing for the effects of Climate Change by **minimise the damage**, in contrast with the majority of research which addresses recovery in the wake of extreme events.

We have a high degree of private sector input that allows for a **seamless implementation** into real environments and shifts the focus of research away from large institutions.

Lastly we avoid generic, insensitive, and imposed solutions. Our efforts are not only about resilience, but about creating urban environments **people feel deeply connected to**. This is particularly important in places with historical or cultural significance where we will involve local cultural experts to direct the research, ensuring that it is respectful of the place.





Figure 6. Perspective of Quay St, Auckland, New Zealand

# AOTEAROA

Over the last 500 years the world has taken eager interest in the progress taking place in Europe and North America. Since the 14th century, when modern banking was invented in Italy, Europe has led the way. Copernicus, Galileo, Newton, and others took Western thought to ever-increasing heights which was then dispersed around the world.

Success, however, came at a price. Our thought and innovation is all about the material, measurable, (profitable!), aspects of the universe, to the neglect of everything else. People of today would consider it strange to talk about the mystical atmosphere of a native forest, but they know how many logs of rare timber can be harvested or what minerals in its soil might be worth exploiting. The dark side of 'mankind's mastery over nature' is the deep wounds we have inflicted on our environment. Climate Change appears to be the latest manifestation of our systematic abuse of Earth, and its impact challenges every aspect of humanity's civilization.

Our quest for survival still refers to a model of controlling nature as a result of encouraging pragmatic science which maintains status-quo rather than following curiosity to seek solutions for the future. We need to take a step back and look at the bigger picture, especially at those aspects deemed irrelevant for centuries; the immeasurable, immaterial, meta-physical realm. It's time to think outside of our narrow materialism and unify our human efforts within the environment we are embedded in.

One way to do this is to explore the insights of pre-modern concepts, conversing with indigenous cultures that have preserved their wisdom. New Zealand (Aotearoa) is one of those rare places. It is a developed member of the OCED, where the land still contains places unspoiled by modernity, and which encourages the Maori people to retain their ancient beliefs and listens to their contribution. Hence our unique approach, drawn from the unique landscapes of New Zealand, creates an archetype for intercultural dialogues with native peoples elsewhere.





Figure 7. Photo of Bream Bay, Northland, New Zealand taken by Bernd Gundermann

On a philosophical and spiritual level, our approach aligns with Maori beliefs. Māori traditions have been closely tied to the land and sea and their values are encapsulated in coastal settlements, reserves and traditional burial grounds. With their cultural and historical ties to the shore, and their opposition to hard-engineering and attempting to control the natural environment, the Māori way is similar to our eco-system based approach to coastal protection.

Western thought has only predominated in New Zealand for 200 years. Now New Zealand may be the first to challenge its limitations, opening unprecedented insights into the interconnected nature of life and pathways to a better humanity.

We believe there needs to be a transition from ownership to guardianship, protecting what we have inherited instead of taking advantage of it. This ideology is common in many indigenous populations who have been living on earth for thousands of years, yet hav-

ing minimal adverse impact due to their respect for the land.

We work with local cultural advisors, as well as involving the indigenous and local people as stakeholders and end-users to promote their inclusion in development. This way we ensure that the investigation and proposals are in line with local beliefs and knowledge.

The integration of local culture helps to build a vital connection between people and the urban environment they live in, creating recognition through vernacular architecture, pride, ownership, and pleasure. Not only does this make healthier environments, but it gives coastal environments a unique identity avoiding the homogenized waterfronts we see in many places in the world.

Our approach is to integrate indigenous, cultural, religious contributors relative to the sites that are selected, learning from ancient wisdom to replenish the land for the future. If we heal the land, it will heal us.



Figure 8. Huawai Bay, Mahurangi West, New Zealand. Photo taken by Gabrielle Free

# IPCC REPORT 2014

The IPCC report Working Group II released their contribution to the Fifth Assessment Report in March 2014. This report focuses on the 'Impacts, Adaptation and Vulnerability' of Climate Change.

The report reinforces our focus on cities outlining that “action in urban centres is essential to successful global climate change adaptation”, and “the population and assets exposed to coastal risks as well as human pressures on coastal ecosystems will increase significantly in the coming decades due to population growth, economic development and urbanization”.

It also follows the same paradigm shift that identifies the constraints of hard-engineering and believes that more work needs to be done to progress ecosystem-based adaptation.

The report recognises that “ecosystem-based adaptation which is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to

help people to adapt to the adverse effects of climate change is becoming an integral approach to adaptation”, and that “working with nature’s capacity and pursuing ecological options, such as coastal and wetland maintenance and restoration, to absorb or control the impact of climate change in urban and rural areas can be efficient and effective”. However the major barrier “is the lack of comparable standards and methodologies applied to engineering approaches, thus demonstrating the need for more dialogue between the engineering and ecological communities.”

The limitations of hard-engineered adaptation include that:

- “they often must cope with uncertainties associated with projecting climate impacts arising from assumptions about future weather, population growth, and human behaviour”
- “the longevity and cost of engineered infrastructure affect the feasibility at the outset”
- “they also are subject to consequences that were not anticipated”

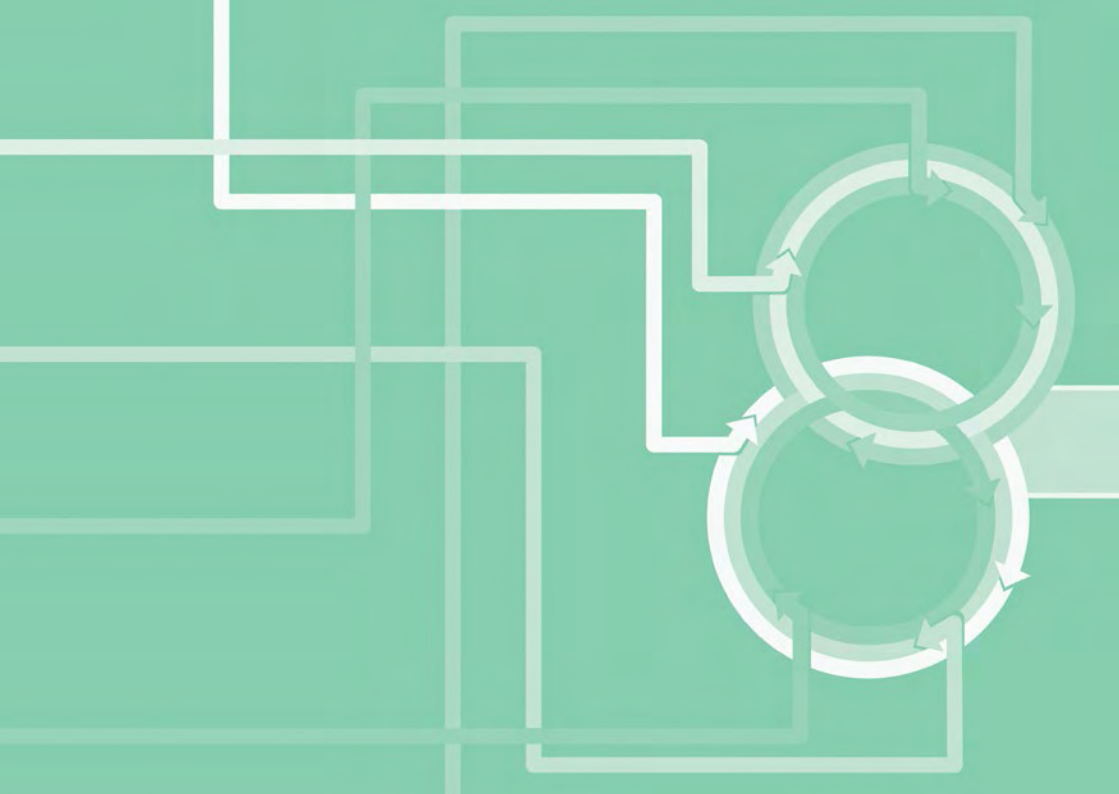
Another key aspect is the appreciation of the value of local and indigenous knowledge within the scientific realm. “Indigenous, local, and traditional knowledge systems and practices, including indigenous peoples’ holistic view of community and environment, are a major resource for adapting to climate change, but these have not been used consistently in existing adaptation efforts. Integrating such forms of knowledge with existing practices increases the effectiveness of adaptation”.



The report varies from the previous issue in its shift away from solely international and governmental solutions to recognising the importance of local efforts and the inclusion of the private sector- “Urban adaptation benefits from effective multi-level urban risk governance, alignment of policies and incentives, strengthened local government and community adaptation capacity, synergies with the private sector, and appropriate financing and institutional development.”

Most importantly, the report states the need to act immediately; “Poor planning, overemphasizing short-term outcomes, or failing to sufficiently anticipate consequences can result in mal-adaptation” ... “for the 21st century, the benefits of protecting against increased coastal flooding and land loss due to submergence and erosion at the global scale are larger than the social and economic costs of inaction.”

The UN-endorsed IPCC Report demonstrates that our approach aligns with the most up-to-date, leading international body of researchers.





**METHOD**

# APPROACH

Soft engineering measures have been a possible alternative for years, yet they have lacked the scientific verification and results tracking needed to justify large-scale investment. We think this shows a lack of holistic enquiry in the scientific realm.

We not only need to overcome the separation between the urban and the natural, we also need to overcome separation between scientific disciplines.

Processes such as the Kyoto Protocol have been in effect for over 20 years, creating awareness but no significant results. This demonstrates that we need development at a local level to prove that immediate action can be taken, rather than waiting decades for data and political negotiations. We aim to improve city's (which are often the economic hubs of a country) climatic performance to become the exemplars of adaptation and the precedent of cities of the future.

Our research strategy incorporates as many elements of coastal environments as possible; the buildings,

infrastructure, soil, biology, hydrology, ecosystems, landscaping, marine structures, marine life. Some minor overlaps are created to ensure thorough research and that no aspects were unaccounted for. We highlight the need for collaboration among researchers to ensure there are no disjunctions. For example, building structure will connect with inner city landscaping through researching how buildings can minimize impact on the natural environment, and how landscape can be brought into buildings to ensure a revitalised and healthy working environment. We are intentionally avoiding the separation that usually occurs due to extreme specialisation.

Our research team includes a range of scientific disciplines as well as urban designers, economists, philosophers, policy-makers, community, and stakeholders. To successfully adapt we must unite our resources to achieve an integrated solution. We want our research programme to be an experiment to see how holistic, user-oriented design might be achieved through collaborative effort. Enabling participants to



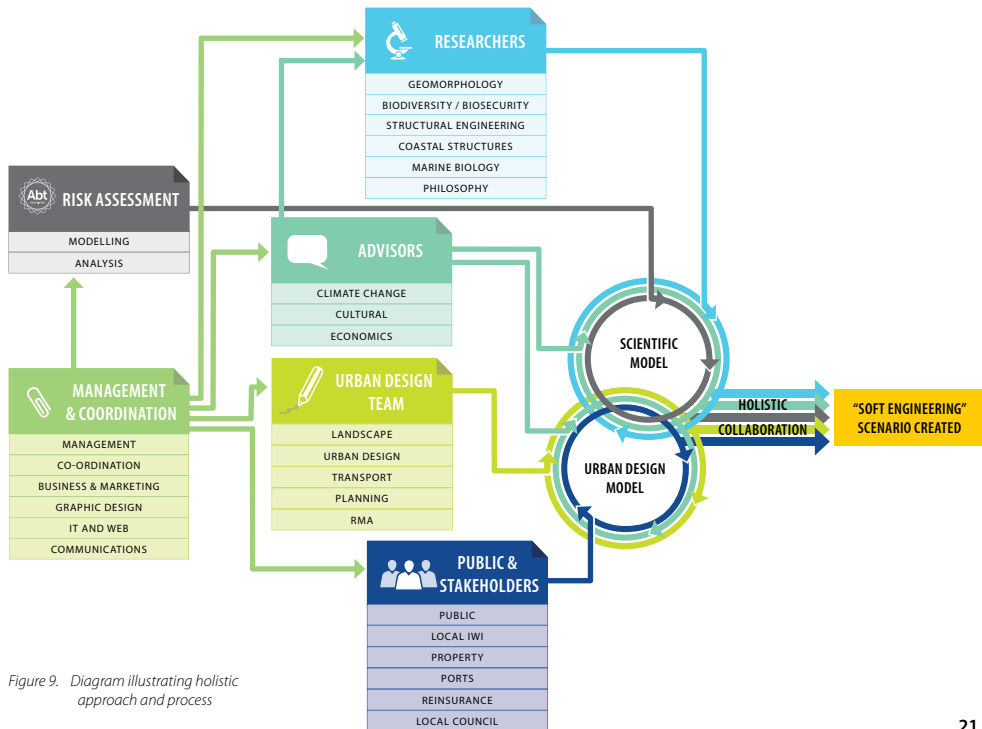


Figure 9. Diagram illustrating holistic approach and process

reiterate research questions or hypotheses beyond the usual limitations will help to avoid 'scientific silos'. Transdisciplinary communication has been proven to open forums where sparks can fly, leading to new insights.

Our approach is to translate climate science into an understanding of hazards and risk areas through assessment modelling of current vs hypothetical future coastal conditions. With this information we will develop innovative geospatial tools that communicate both the risk and the location-specific opportunities to apply adaptive strategies.

As soft, ecosystem-based measures rely fundamentally on local input we will be collaborating with local authorities, advisors and scientists to determine solutions that address the specific nature of the place.

We will investigate the specific effects of sea-level rise or storm surge on each environment, and then investigate a variety of ecosystem-based options to mitigate these. The findings from scientists, engineers, philosophers, modellers, planners, consultants and stakeholders will inform the urban design proposals for each of the sites.

These plans will be available for public comment as visual 3D fly-throughs uploaded to a comprehensive web platform that is used to facilitate risk communication, adaptation measures and community resilience. This allows feedback from the public to ensure the final result has the support of the stakeholders.

This platform has various levels of privacy in that the research team is able to upload all data and findings to the central model which will be controlled by Abt Associates and just the significant findings and urban proposals are available for the public. The central model is updated whenever new information is provided, thus keeping all parties up to date.

To create a complete understanding of the situation, we are proposing a comparison with a business-as-usual 'control scenario' which makes no attempts to mitigate sea-level rise, as well as a 'hard-engineering' scenario which will compare the costs and benefits of using current engineering practices such as sea walls to protect the coasts.

Climate Change is a challenge that we believe needs to be researched in a manner that emulates the complexity of the natural and human environments.

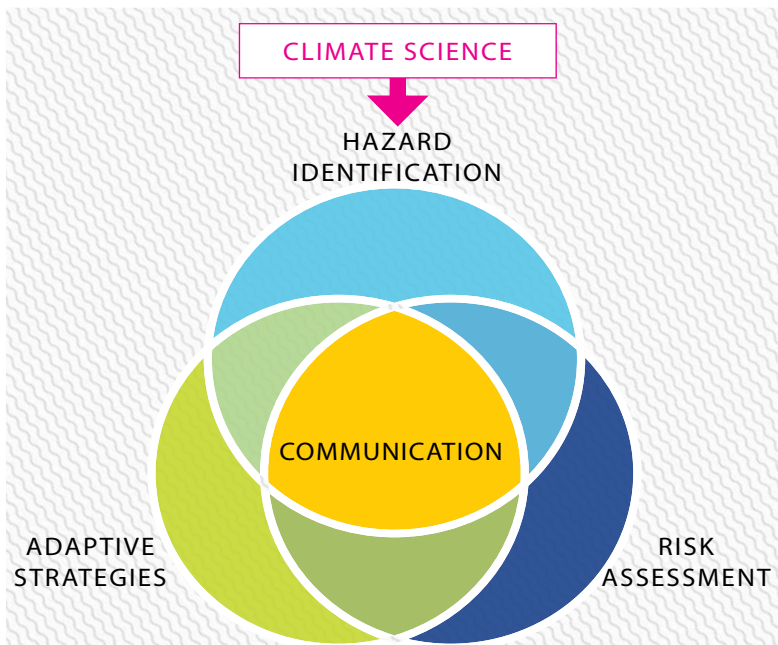


Figure 10. The intersection of identifying the location of the effects of Climate Change, calculating the risk exposure and presenting adaptive strategies must be a robust communication platform. Diagram adapted from ABT Associates.

# SCIENTIFIC & URBAN MODELS

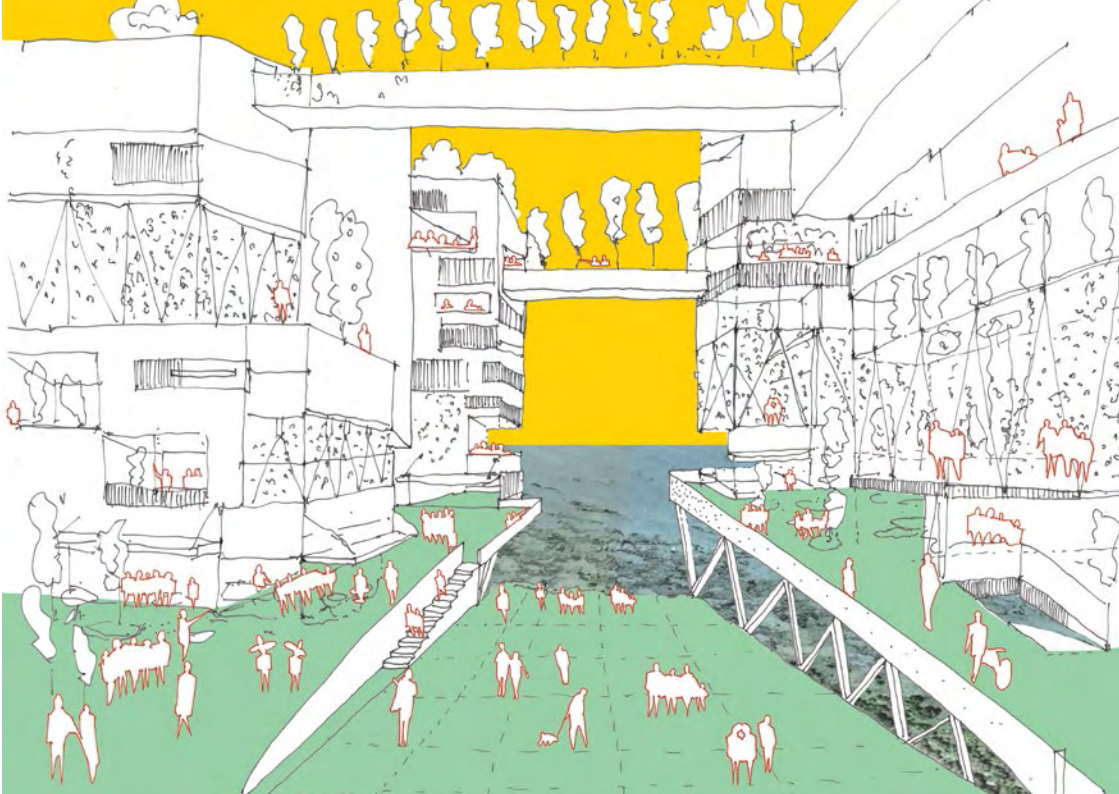


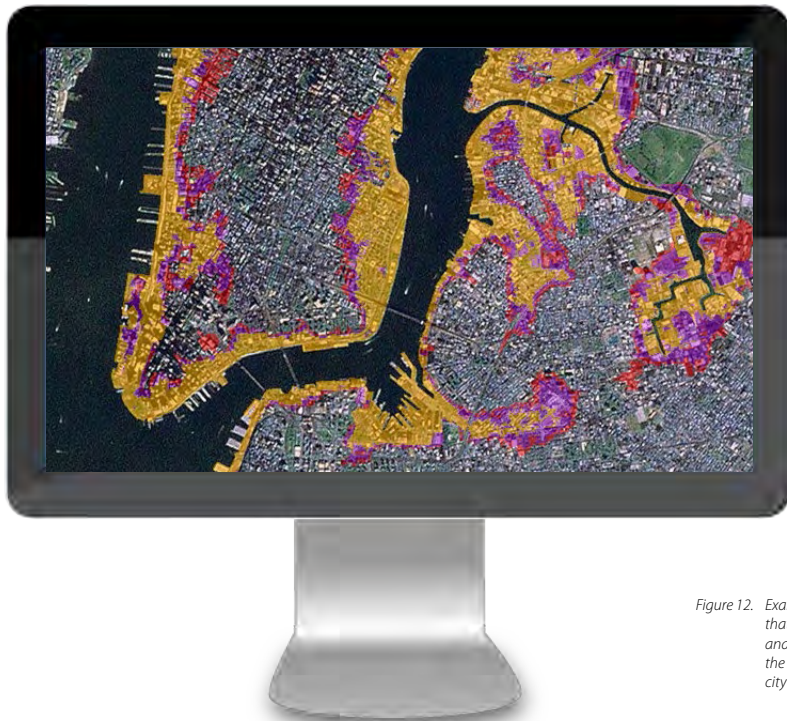
The separation between the scientific realm and tangible results will be overcome through our multi-model system.

The risk assessment and analysis of the site will feed into the scientific model. This information will then be transferred into a model of the physical environment translating the complexity of the scientific findings into a visualization of the vulnerability to the public.

Analysis of the coastal effects of Climate Change will be undertaken by the urban design team and used to derive possible solutions in conjunction with the advisors, public and stakeholders.

*Figure 11. Understanding future resilient cities as adaptive, ever-changing environments leads us to a re-definition of formerly static concepts into fluid ones*





*Figure 12. Example of the Scientific Model that is used by the researchers and advisors, and translated by the Urban Design team into the city model*



*Figure 13. Example of the Urban Design Model that is created to communicate the effects and potential urban design solutions to the public and stakeholders*



# PROCESS

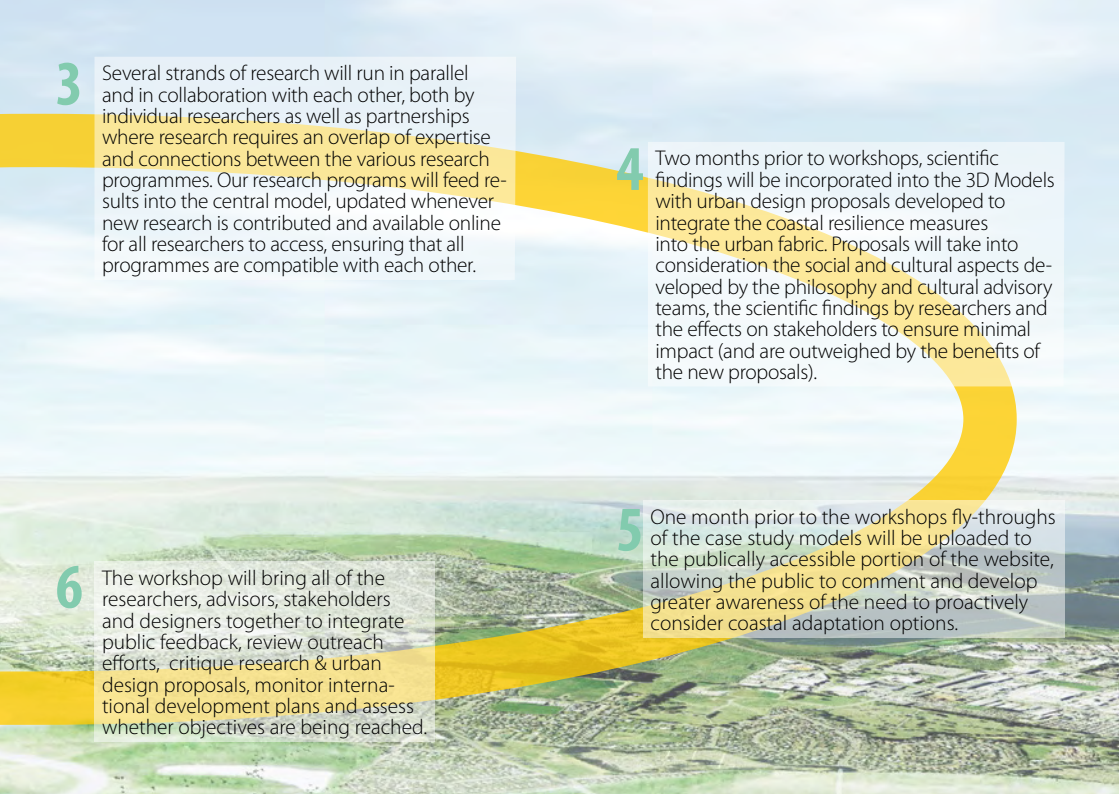
**1** Our team will organize and attend a face-to-face project kickoff meeting. We will use the project kickoff as an opportunity to bring together this new range of skills into a collective framework to discuss the outcomes and objectives, research briefs, success factors, and their key dependencies to establish a common purpose towards completing the work. This time will also be spent compiling relevant research, data resources and local contacts for the team.

**2** Abt Associates will model the hazards and risk assessment, including three sea level rise scenarios. Initial hazard identification and risk assessment for current conditions will be conducted, as well as hard-engineering solutions and soft, ecosystem-based solutions. The risk assessment will include economic, social, cultural, physical and environmental impacts.

**8** A final workshop will be held. This workshop will be a reflection of the process, understanding what research has been undertaken and outlining any gaps that may have occurred.

**7** Steps 2-5 will be repeated multiple times to allow research to continue and multiple proposals to be developed to ensure the highest level output is achieved





3 Several strands of research will run in parallel and in collaboration with each other, both by individual researchers as well as partnerships where research requires an overlap of expertise and connections between the various research programmes. Our research programs will feed results into the central model, updated whenever new research is contributed and available online for all researchers to access, ensuring that all programmes are compatible with each other.

4 Two months prior to workshops, scientific findings will be incorporated into the 3D Models with urban design proposals developed to integrate the coastal resilience measures into the urban fabric. Proposals will take into consideration the social and cultural aspects developed by the philosophy and cultural advisory teams, the scientific findings by researchers and the effects on stakeholders to ensure minimal impact (and are outweighed by the benefits of the new proposals).

6 The workshop will bring all of the researchers, advisors, stakeholders and designers together to integrate public feedback, review outreach efforts, critique research & urban design proposals, monitor international development plans and assess whether objectives are being reached.

5 One month prior to the workshops fly-throughs of the case study models will be uploaded to the publically accessible portion of the website, allowing the public to comment and develop greater awareness of the need to proactively consider coastal adaptation options.

# PUBLIC ENGAGEMENT

As Climate Change is a global issue that we are all responsible for, a fundamental part of our research process is the inclusion of stakeholders and the general public. We want our solutions to be understood and supported by the public as part of a groundswell of hope and action.

## STUDENT INVOLVEMENT

The inclusion of PhD students and post-graduate students involved with Climate Change Policy, Design Anthropology, Urban Design and Planning will increase awareness amongst the younger generation who are responsible for future decision-making and who cannot avoid the effects of Climate Change.

## THE WEB FORUM

The Changing Shores web-based research hub for all parties will also have a section available to the public who are interested in engaging with this project. This forum will be referenced in PR releases. The web forum will host our most recent research and fly-throughs of our proposed urban environments

with the ability for the public to comment and the research team to respond.

## EACH PARTY'S OWN MEDIA STREAMS

Our group will be encouraged to use their own marketing/media streams/websites to promote the project. These will include the local universities who have access to a large student base, alumni, and affiliates, or through networks such as the news releases that Abt Associates distribute to a wide audience. Bernd Gundermann, Project Manager, already has a global network in place that is talking about sea level rise and his concept of soft response options. For example on December 12, 2013 he interviewed with Canadian television which will go to air on Discovery Channel in 2014.

## PUBLIC ENGAGEMENT CONFERENCES

Public engagement conferences will be held half yearly where all parties will present their interim results in a format that is attractive and accessible to the public. These will be held at local universities

and research institutes so that various academics can observe and participate as well as promote the discussions among students.

### PR / NEWS RELEASES

Our press officer will be in touch with local media to assist with information releases as a result of our findings. He will also be invited to the half-yearly presentations and lecture series (see following).

### LECTURE SERIES

We will hold a series of lectures featuring one of our researchers /advisors /stakeholders discussing their involvement in Changing Shores; their research, background, key issues, and any project updates that might apply. These will be open to the public and may be flexibly scheduled depending on availability of parties and how much public interest there is likely to be.

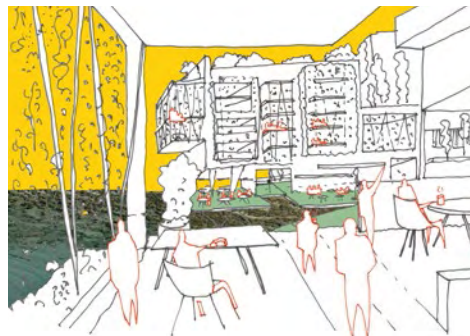
### ACADEMIC PUBLICATIONS

Our experts will be encouraged to publish com-

mentary/results in academic journals, engaging the science community with our project.

### INTERNATIONAL CONFERENCE ATTENDANCE

Attendance of relevant conferences enables Changing Shores to demonstrate findings and engage with the wider community. These conferences may include any industries relating to our work including science, urban design and social science.



# OUTCOMES

We expect the impact of our work to transform coastal cities, creating a new paradigm of urban design that provides adequate protection against the coastal effects of climate change as well as enhancing the urban environment. This paradigm will lead to exploration, debate, discussion and development in the realm of urban responses to sea level rise. We need to start these conversations now to ensure we are prepared when necessary.

The pathway to impact is as follows:

- Dynamic, interactive, collaborative research project exploring soft response options to sea level rise that also bring revitalised urbanism
- Presentation of research to local decision makers to provide more detail and answer questions regarding the research and proposals
- Consultation with urban decision makers about local site responses
- Urban design projects applied to coastal cities around the world

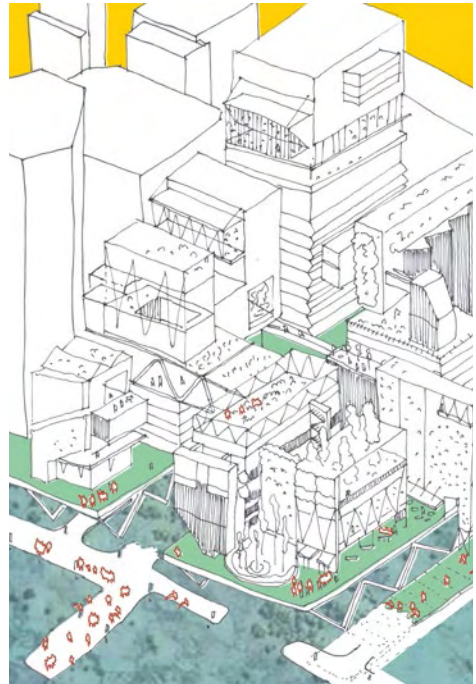
- Policy updated to include measures of resilience to the coastal effects of climate change to protect and enhance coastal development
- Long-term urban strategies

Our research provides the scientific basis to validate policy change and adaptation efforts for coastal land use, waterfront development, open space and natural habitat preservations, and emergency response evacuation. The output that we produce can be integrated into planning documents, environmental policy and building codes to create legislation that requires the introduction of resilient measures in areas that are vulnerable to the effects of Climate Change or an additional document such as a Coastal Protection Code which requires any development within these areas to comply with certain resilience measures.

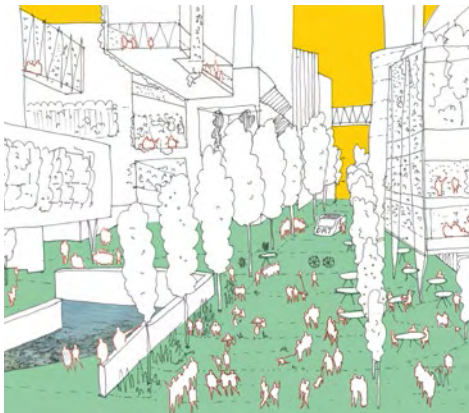
Representatives of the local culture will become more informed and have a larger range of soft, ecosystem-based protection measures that align with their

beliefs and improve the land in which they have deep historical and cultural ties to. Property owners will have increased awareness regarding the risk of their assets and become more proactive in investing in protection measures.

Engineering techniques for infrastructure in coastal areas will be complemented with geo-engineering and bio-mimicry alternatives, and may have to comply with new legislation or relocate out of areas susceptible to flooding or erosion. It should be considered though, that this research may not trigger immediate impacts but suggest alterations applicable after the design-life of current buildings.



# BENEFITS



Hard engineering creates an artificial boundary that interrupts the natural flow and continuity of the landscape. Their harshness is due to their fixed, static nature that allows no flexibility or adaptation, causing an abrupt transition between the natural and man-made environments.

The implementation of hard engineering solutions into coastal environments causes irreversible ecological damage. Not only do they disrupt sediment movement, and salt- and freshwater ecosystems, but they also lead to increased erosion and soil-salination on the land.

In addition they are an expensive capital investment for a barrier that requires regular maintenance and replacement, and can only protect the land to a certain limit. Hard engineering solutions are not very aesthetically pleasing or a valuable contribution to the urban environment.

However using a soft, ecosystem-based approach to mitigate the coastal effects of Climate Change has a number of direct and flow on benefits for the natural and built environments as well as the economy. As resilience increases, both the environment and the economy benefits, as demonstrated on the following page.

## ■ RESILIENCE

- Coastal protection
- Adaptable to unknown effects
- Comprehensive, easy-to-use tool
- Greater understanding of effects

## ■ ENVIRONMENTAL

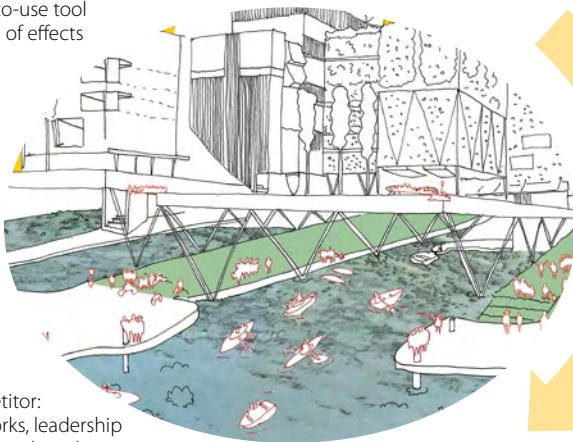
- Water purified
- Ecologies remediated
- Emissions reduced

## ■ ECONOMY

- Reduction in potential future damage - \$1T/yr
- Lower capital and maintenance costs
- Increases tourism revenue
- Reverse brain drain
- No current leaders or competitor: employment, growth, networks, leadership
- R&D, advisory services, clean-tech and infrastructure construction opportunities
- Increased productivity in the work place (Sick Building Syndrome)
- Reduce economic losses of biodiversity \$2.2 T/yr
- New methodology/work styles that combine variety of contributors /Holistic combination of expertise

## ■ URBAN

- Built and natural environments become connected
- More stimulating, interesting cities
- Place making and maritime lifestyles









**TEAM**

# COMPOSITION

The composition of our research team is very diverse. Our team includes: engineers, scientists, designers, planners, modellers, cultural experts, an economist, philosophers, a climate science expert and a risk analyst. The range of researchers and advisors demonstrates the holistic nature of our approach to coastal design and how we believe all future research needs to occur. The team will be tailored on a case by case basis in order to address the specific nature of each place.

Our team is a strong public-private collaboration. We believe that it is hugely beneficial for the private sector to partner with research institutions and universities in order to bring a commitment to practical and viable results alongside cutting-edge science. The high degree of private sector contributors warrants a realistic, commercially practical and viable implementation process, while the research institutions and universities provide the wealth of resources and existing knowledge only possible in large research institutions.

Our team will be working with a variety of research structures including:

- Individual Researchers
- Government Bodies
- Private Research Organisations
- Universities

We will also incorporate an independent assessment panel to ensure our research is of the highest quality. This panel will include experts in the following areas:

- Climate Change
- Structural Design
- Geomorphology
- Funding & Management
- Local Culture

Furthermore, we wish to create an intellectual space that shares ideas at a global level as well as working together locally. Our research will act as a node of a larger network allowing collaboration between industries and countries. This ensures that we are aware of any complementary research worldwide and can remain world leaders in the area of Climate Change Resilience.

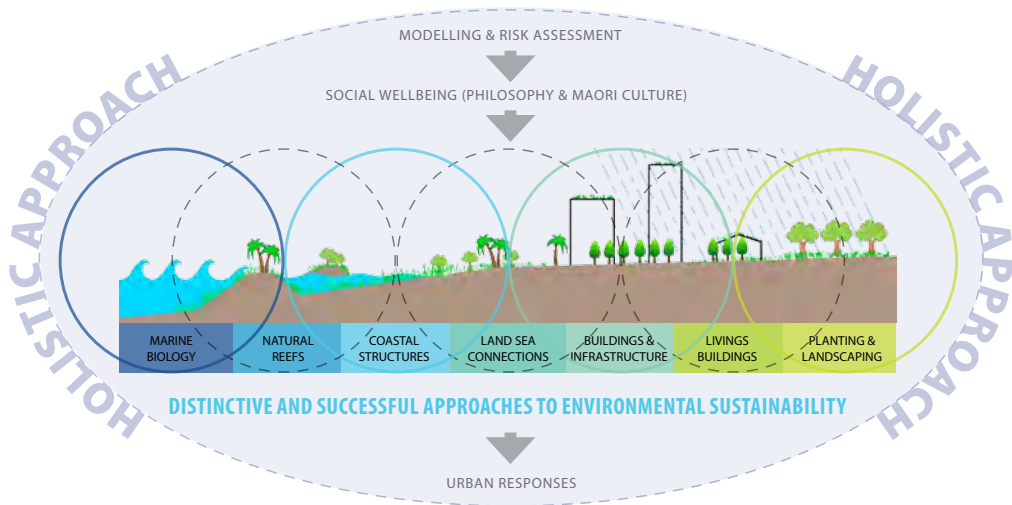


Figure 14. Diagram illustrating overlapping paths of research to ensure all aspects of coastal development are included in the holistic approach

# INTERNATIONAL COLLABORATION

Abt Associates will be a significant part of our research team and have a focus on “decision-making processes for adaptive management”. Abt Associates is a mission-driven, global leader in research and program implementation in the fields of health, social and environmental policy, and international development. Known for its rigorous approach to solving complex challenges, Abt Associates is regularly ranked as one of the top 20 global research firms and one of the top 40 international development innovators. Abt has worked in over 100 countries, and is currently leading much of the ecosystem goods and service valuation and ecosystem based engineering approaches in the US. Abt has extensive experience and subject matter expertise in modelling coastal hazards, evaluating sea level rise, incorporating stakeholder involvement, and performing risk assessment for numerous agencies.

Further, Abt has extensive climate change mitigation and adaptation experience, including understanding the near- and long-term impacts of climate change on human health and welfare, and how these impacts may be mitigated by policy.

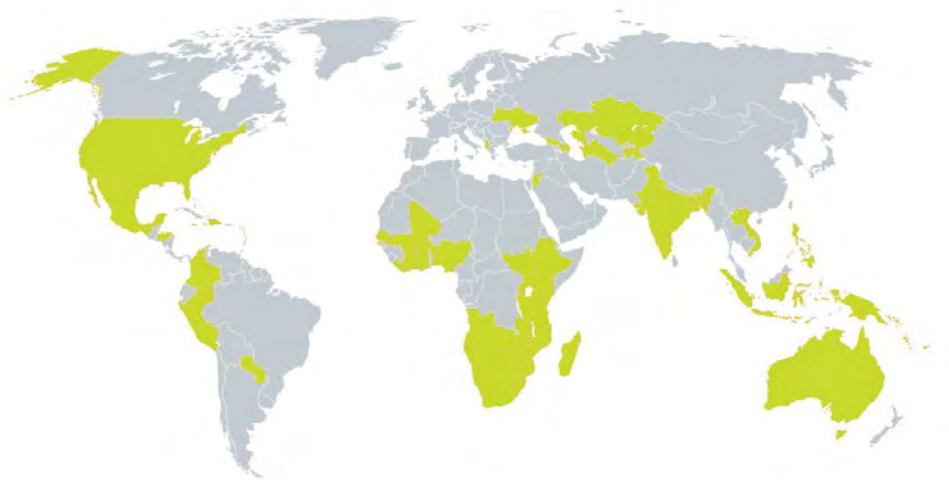
Abt have already run other projects that involve hydrological modelling and use the US Army Corps of Engineers model for assessing flood risk which was used in the recovery process for Hurricane Katrina's impacts on New Orleans in 2005. This model is closely related to planning for sea level rise in other cities.

Our proposal would act as a pilot for what is a trillion dollar market worldwide. Abt can concentrate their efforts on calculating risk and assessing the effects that Climate Change will have on various countries around the world, and our holistic team of researchers, advisors and designers - in addition to local advisors – can follow up with response options that will increase the resilience of these regions.

Abt Associates will also connect us with various other research organisations. Through their North Atlantic Coast Comprehensive Study they are working with U.S. Army Corps of Engineers, The Nature Conservancy, National Fish and Wildlife Federation, National Oceanic and Atmospheric Administration, and Federal Emergency Management Agency.

In addition, their work evaluating ecosystem services in the US, includes leading stakeholder meetings throughout the US with all federal and state agencies that par-

ticipating in coastal and/or flood risk characterization. This allows us to network with many stakeholders and decision makers, as well as well-known scientists.



*Figure 15. Green countries represent the exposure of Abt Associates internationally*





# CASE STUDIES

# AUCKLAND, NEW ZEALAND

Auckland is the largest city and economic hub of New Zealand. It is located in a unique setting where an isthmus (which connects the Tasman Sea in the west with the Pacific in the east) intersects with a vast natural harbour. Waitemata Harbour is protected to the open sea by the Coromandel peninsular and several islands that have the capacity to break the wave energy before storm-surges reach the city. The narrow isthmus creates a bottle neck of infrastructure between Northland and the rest of the country within Auckland City. As a result, these major transport connections will need to be maintained despite the effects of Climate Change.

Currently the coast is fortified against natural forces by seawalls, which would require upgrades as the sea-level increases. This creates further separation of Aucklanders from the water, an unnatural separation for a population who love the sea. Therefore measures protecting the city from sea-level rise should provide safety and re-connect people with the water.

The most valuable part of the CBD is built on land reclaimed from the harbour. Over the next decades a port conversion project, Wynyard Quarter, will add to the high investment in this area. The damage of new buildings in recent earthquakes in Wellington have demonstrated that reclamations are very unstable and will be eroded quickly once SLR and other effects of Climate Change become more forceful in the second half of this century.

We envisage the re-instatement of coastal wetlands that formerly constituted the natural coast, as well as the implementation of other soft, eco-system based measures, to mitigate the coastal effects of climate change and become the basis for iconic coastal cities. We consider soft resilience crucial for countless metropolises in the world and Auckland shall be our prototype.

In the last 200 years coastal cities have been fortified against the water in order to allow for moorings





TIDAL  
CURRENTS

GREEN CONNECTION

BEACH  
RENOURISHMENT

LINEAR PARK

COASTLINE

WHARFS AS  
WAVE BREAKS

PORT

0m 250m 500m

as well as to protect landside investments. Climate Change and sea-level rise are going to shift the paradigm. Hard-engineering is not only a costly and insufficient solution but it also contributes to the problem through green house gas emissions in the production of cement used for heavy engineering.

#### CASE STUDIES

Wetlands intrinsic ability to absorb and retain water and reduce the energy of storm-surges make them naturally the best buffer for our coasts. Therefore our coastal cities should consider softening shores by [re]introducing wetlands that can be superimposed by buildings and civic structures. This multi-layered approach to urban resilience also provides citizens with unpredicted opportunities to re-connect with the natural environment for health and recreation.



# CHRISTCHURCH, NEW ZEALAND

Three years after a series of earthquakes devastated Christchurch's historic centre and parts of the suburbs, the city has been selected as one of the Rockefeller Foundation's 100 Resilient Cities. This challenge is for cities who have demonstrated a dedicated commitment to building their capacity to prepare for and withstand disaster. Besides well-organised economic recovery, this appraisal recognises particular dedication to 'bounce back' after the experience of multiple extreme earthquakes as well as hundreds of aftershocks.

However, the current plan framework focuses on damage that has already occurred and does not sufficiently reflect the challenge ahead - Climate Change.

Subsidence of areas located in and around the estuary and rivers has now reached the same conditions that sea-level rise was expected to create by around 2050. The tectonic changes increased the damage caused by the rain-induced, 100-year flooding in

March 2014, of which many more are expected to occur in coming decades. A recent hydro engineering report released in December 2013 has identified large additional areas in the estuary that will potentially liquefy, but the plan ignores this threat and continues to zone new residential developments in these areas.

Before the earthquakes Christchurch was an urban city with a strong CBD. The quakes however, caused people to flee the city centre and move outwards. Strengthening and infrastructure followed the people. In suburban areas there has been 900 hectares of newly zoned commercial land, numerous residential developments are on their way and the shopping malls have been extended. Thus it is unlikely that there will be sufficient funding to rebuild a core city centre. Life made choices ahead of city planners, and we believe plans should to some extent reflect the instincts of the people.





**LIQUIFIED AREA  
TRANSFORMED INTO  
PARKLAND**

**COASTAL EROSION  
FROM SEALEVEL RISE**

**DECENTRALISED CITY  
CENTRE**

**GREEN ACCESSWAYS  
TO CITY**

**GREENBELT  
SURROUNDING  
HISTORIC CENTRE**

**RETREAT AND REVERSE  
ENGINEER POTENTIAL  
LIQUIFIED AREA**

0m 500m 1km

The REbuild master plan is too focused on events that have already occurred. We suggest a comprehensive rethink of past and future threats to help Christchurch become truly resilient. We would call this a PRObuild strategy.

The central focus of our proposal is to make Christchurch a liveable, resilient city that draws from its legacy as a 'garden city'. Areas of past and potential future liquefaction will be abandoned, reverse engineered and transformed into tidal marshes, creating a new green heart to the city. Wetlands and marshes are well-known for their ability to absorb and retain water, reducing the effects of floods and storm-surges. A densely woven web of green connections between existing open spaces and the urban marsh will encourage healthy transportation alternatives such as walking or cycling.

Creating a green centre may, in fact, attract people who enjoy outdoor space back into the central areas. This depends on the interest and will of the people - thus the city core will be constructed only when the people of Christchurch want it to be.

This approach follows the logic of our internet based age where we have the liberty to connect, work and learn wherever we want. We are liberated from the historic model of urban cores and suburbs since we have a digital network instead. This means we can be more inventive with city layouts, and can shift away from fuel-based transport to encouraging earth-friendly transport.



# WASHINGTON D.C., U.S.A.

The National Mall in Washington DC is the one of the most significant places in the United States and embodies national pride and identity. The federal city, following L'Enfant's 1791 plan, has been composed around two monumental landscaped axes with the Washington memorial intended to be at the intersection. This plan lapsed when the memorial needed to be shifted away from the swampy banks of the Potomac River.

The reclamation of the West and East Potomac Parks and the Tidal Basin in 1890 created the land required for the McMillan Plan that formed Washington DC's "monumental core" in 1901. The creation of the National Mall stretching beyond Washington Monument included the place where The Lincoln Memorial would be erected in 1922. The nature of the reclaimed areas in the west of the mall makes it vulnerable to sea-level rise, increased erosion, and flooding.

Since the implementation of L'Enfant's plan, the mall has witnessed several stages of adapting to the zeit-

geist of changing periods. During the 19th century the area between Capitol Hill, The White House and Washington Memorial became railway structures and an army barracks. The subsequent McMillan plan changed the character and aura of the core to a monumental scale, reflecting the established standing of the United States at the time. However its proposed Washington Monument Gardens, derived meticulously from European baroque tradition, were never built.

West of Washington Monument the mall changes its character. West and East Potomac Park are more casual, walking away from European formalism. This style is being continued with the recent concept of Weiss/Manfredi & OLIN for Sylvan grove and theatre.

The effects of Climate Change will challenge the traditional character of West Potomac Park as the land that was reclaimed to create the park is taken back by the sea. We assume that the zeitgeist of our century will be centred on mitigating the effects of Climate





GREEN ROOF PRECINCT

BOARDWALKS

LINCOLN, JEFFERSON &  
WASHINGTON  
ISLANDS

RENATURALISED ZONE

WETLANDS

NATURAL  
POTOMAC VALLEY

TIBER CREEK  
REOPENED

0km 0.5km 1km

Change. Thus we propose another stage of development to develop the current lawn under a canopy of trees into a tidal marshland that would link the icons of American heroes being retained as 'islands' not only to features of cultural performance but also to the rhythm of nature expressed in the ebb and flow of the river.

Examples of expressing monumentality through open spaces and landscape is a long standing tradition in the New World, from Thomas Jefferson's University of Virginia to the city plans of Washington, Canberra, and Brasilia. Our proposal follows this logic, allowing the land to gently absorb the effects of Climate Change.







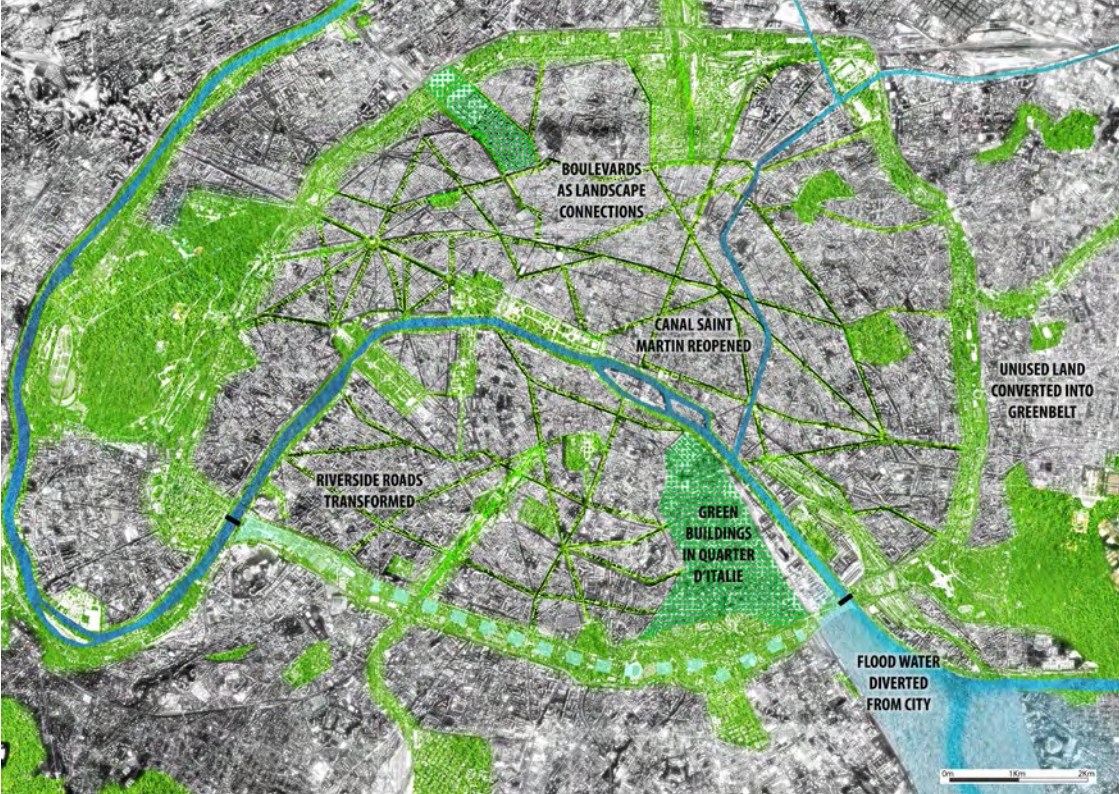
# PARIS, FRANCE

The city of Paris is a supreme accomplishment of built European culture. Beginning on an island in the Seine River, Paris' urban form has been focused on the river. Line-of-sight axes connect the monuments in a system that refers geometrically to the river and still plays a vital role of visually organising the city.

As an inland city, Paris is not directly affected by the impact of sea-level rise, but it will experience other effects of Climate Change such as river flooding and the heat-island effect. The high proportion of sealed urban areas pushes up the temperature of the local climate, which in turn changes weather patterns. Since the days of Haussmann it has been best practice to base urban transformations on civic engineering; roads, sewerage, or railways. Even the 2009 visions for the Greater Paris in 2030 follow this tradition. In the age of online connectivity this system seems to have lost its priority. Therefore we suggest using structures of ecological performance as the backbone of future Paris.

Adapting Paris to challenges of Climate Change can be based on historical unbuilt concepts and reinterpreting the grandeur of the city's legacy through the realisation of the green belt adjacent to the outer ring of boulevards and the current Boulevard Peripherique. This would incorporate a spillway for the Seine River around the South of Paris in preparation for flooding events, complementing the flood barriers locking the actual river bed.

As a result Paris would retain the unique quay-landscape including the historical bridges connecting the banks and focusing the axes. Progressing efforts to reduce individual motor vehicle transportation would perhaps allow for abandoning the Boulevard Peripherique as well as the Voie Georges-Pompidou on the right bank, which would create many additional connections between the city and both the river and the suburbs.



**BOULEVARDS  
AS LANDSCAPE  
CONNECTIONS**

**CANAL SAINT  
MARTIN REOPENED**

**RIVERSIDE ROADS  
TRANSFORMED**

**GREEN  
BUILDINGS  
IN QUARTER  
D'ITALIE**

**UNUSED LAND  
CONVERTED INTO  
GREENBELT**

**FLOOD WATER  
DIVERTED  
FROM CITY**

0m 1km 20m

The new green belt will become the basis for greening the adjacent areas of the city, occurring when precincts are renewed. Greenways will connect existing open spaces, parks and gardens in order to allow alternative options of circulation. The introduction of green roofs on new buildings would increase green space and mitigate flood risk even further. The recessed railway tracks that enter the inner city should also be covered with light suspended webs that enable climbing plants to overgrow them. Along with the introduction of permeable paving there should be studies of greening facades following Henri Sauvage's ideas of stepped back residential buildings (*Right*).

These preliminary examples are ideas for improving Paris' ecological performance and the wellbeing of its inhabitants. Increased resilience will have many flow on effects that can benefit the economy, the environment and urban life which will make the renewed 13th Arrondissement as valuable as the 16th.



Figure 16. Detail of Henri Sauvage's tiered apartment building in Paris, Rue Vavin. Photo taken by Bernd Gundermann.











**REFLECTIONS**

# CONCLUSION

As our knowledge of Climate Change advances, we are becoming increasingly aware that its effects are irreversible. Rather than focus on the damage it will cause, we concentrate on the opportunities it can bring.

Einstein stated that we cannot solve problems using the same thinking that created them. We need to begin with changing mindsets. By fundamentally understanding that humanity is intrinsically linked with the natural environment, we can transcend the status-quo to a new concept of cities that align with nature rather than working against it.

We strive for a new approach that is:

- holistic in its fields of expertise
- proactive rather than reactive
- includes the private sector
- integrates local knowledge and techniques
- is open and transparent to the public and stakeholders
- is economically, socially and culturally beneficial

Climate Change is an opportunity to further the philosophical and cultural foundations on which humanity is based. It will act as a vehicle for us to move forward and reach a new and healthy relationship between humanity and the natural environment. Not only will we overcome the challenge of Climate Change, but it will lead to an improved quality of life for all.

# CONTACT

For more information, please visit our website:

**[www.urbiagroup.com](http://www.urbiagroup.com)**

or contact

**Bernd Gundermann**

(+64) 29 920 9517

[bernd@urbiagroup.com](mailto:bernd@urbiagroup.com)



**Urbia Group**  
Think Beyond

"Adapting to Climate Change has become the greatest challenge for the 21st century and there are major uncertainties about our capacity to manage this effectively.

When one considers the extent of structural transformations along our coasts required as a result of climate change, that challenge becomes very clear. The response options for dealing with this will become increasingly limited over time, unless the basis for developing them becomes anticipatory rather than retrospective.

Some have argued that our whole evolution must go far beyond acceptance of predetermined outcomes and instead be based on innovation entering from left-field. The approach that is taken in this booklet by Urbia Group is an example of how this can occur."

- *Professor Martin Manning, Founding Director of NZ Climate Change Research Institute and New Zealand representative on the Intergovernmental Panel on Climate Change (IPCC) which received the 2007 Nobel Peace Prize. In 2008 Martin also became Officer of the New Zealand Order of Merit.*

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