2º Degrees: Climate Adaptive Landscapes

Strategies and References

By John Mongard Landscape Architects, November 2019

| Specialising in community and urban design |

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Climate Adaptive Strategies

1. Adapting to Heat

Softscapes

- Prioritised retention and enhancement of existing vegetation
- Expansion of the urban forest through increased street tree numbers and varieties (Inc. fruit trees)
- Expanded verge width to accommodate trees and reduce conflict with services
- Sponsored tree planting on private and community managed land and tree propagation programs
- Direct action tree planting in forgotten and left-over spaces that are maintained by the community
- Drought tolerant planting and reduction of ground cover numbers to focus available resources on establishing canopy trees
- Greater understanding in establishing and maintaining microclimates to improve urban experience on a macro level
- Double the shade: Double the number and size of trees you are planning in open spaces. Think Mediterranean town square: continuous shade canopies to help us in the extremely hot and long summers.
- Use more gardens and less lawn: gardens absorb more water and create habitat which we will need as our biodiversity will substantially reduce. Lawns are water and labour needy.
- Favour plants and trees that will move to your area as the climate spatially diverges our ecologies. In Brisbane, which will become Mediterranean, don't plant waterway trees in open spaces. Favour drought tolerant hardy species. Move away from subtropical species reliant on regular water.
- Fertilise only with recycled products/materials. Synthetic fertilisers create carbon footprint.
- Remediate soil, don't use imported soil, where you can: existing soils have micro ecologies that imported soils don't have. Imported soil creates a carbon footprint.
- Plant species that will support the local ecology of the next 100 years: the intermix of the emerging species will create the biodiversity needed.
- Build landscapes when it's not hot.

Hardscapes

- Reduce hard surface treatments and Increase permeable surface areas to reduce radiant heat levels (e.g. smaller building footprints, road widths, crossovers, car parking and concrete footpath requirements etc.)
- Drastically reduce hard paving in all spaces. Urban heat substantially increases with hard pavements. Favour permeable surfaces.
- Use local materials and design around them: anything further away from your region has a large carbon footprint.
- Don't use plastics.
- Recycle materials and plant site: don't waste.
- Design around standard product sizes: don't waste
- Don't place seats without shade: double the seating.
- Source and design around recycled materials.
- Don't paint things unless absolutely necessary. Use raw materials suited to exposure to the climate.
- Design for minimal labour: labour intensive designs have large carbon footprints.

Architecture

- Adapt and design buildings and infrastructure to provide shaded and accessible public space under (e.g. apartments, bridges, overpasses etc.) and provide shaded links between buildings away from primary road layout to support pedestrian circulation
- Retro fit roof top gardens, trellis shading to western walls, wider eaves and window overhangs etc. to improve passive conditioning of existing buildings

Public Realm

- Embrace the river with flood resilient designs that built over and above the river to take advantage of the cooling effect of water (Not like the river walk which is ridiculously hot due to lack of shade and concrete construction)
- Design outdoor recreation spaces that are accessible and usable at night by all community members

2. Adapting to Water / Storms

- Increased permeable surface treatments to increase SW retention and reduce runoff and sediment dispersal
- Rainwater tanks, vegetated swales and bio-detention systems to reduce load on piped stormwater infrastructure
- Green buffer zones to watercourse perimeters to stabilise embankments and reduce erosion and pollutant inflow
- Reduced mowing programs to maximise infiltration and capture of open space turf areas
- Plant vegetated windbreaks to provide protection from severe weather and reduce evapotranspiration
- Design public space to capture and hold flood water while maintaining functionality and specify flood resistant species in inundation areas
- Design without irrigation. Water will be highly valuable and in short supply. Create low water-needy landscapes.

3. Adapting to Landscape & Vegetation - Fauna / Biodiversity

- Install appropriate trees now to allow them to develop a greater degree of resistance to future climate changes, while phasing out species that will not be as resilient, and work with nursery industry to facilitate this
- Provide habitat boxes, nesting roosts, bird baths and beehives etc. as urban wildlife elements within open space designs
- Increase urban population densities in conjunction with necessary public resources and stop clearing koala habitat

4. Adapting our Community

- Communal flood gauge installations (e.g. coloured telephone poles) showing actual levels and future predictions to reinforce reality of potential flood impact which is often too abstract for the community to appreciate, that would also act as visual indicators in a flood event. (i.e. I could look at the work and it would show me what 8m above sea level was?)
- High ground shelters could be established as refuge and information centres for the homeless and elderly in particular, potentially within existing buildings
- Road markings (i.e. a red line) or signposts could be installed to direct people (and emergency vehicles) along safe egress routes in case of evacuation to link to the centres
- Localised power, water and sewerage treatment etc. facilities would also increase community resilience to flood events and reduce potential isolation of individuals

References from Australia and around the World relating to Heat, Water and Landscape

Heat

- Qld Heatwave Risk Assessment (June 2019) https://apo.org.au/node/241436
- Managing heat island effects – US EPA resources https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect
- https://www.epa.gov/heat-islands/heat-island-cooling-strategies and Australian resources (NSW)
- https://climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Heat/Urban-heat
- https://www.qld.gov.au/environment/climate/climate-change/adapting/sectors-systems
- https://www.nccarf.edu.au/sites/default/files/tool_downloads/IM_5_planning_instruments_uploaded.pdf
- A framework for adaption of Australian households to heat waves https://www.nccarf.edu.au/publications/framework-adaptating-australian-households-heat-waves
- NASA Fire Study https://climate.nasa.gov/news/2891/a-drier-future-sets-the-stage-for-more-wildfires/

Water

- THE LIFE PROJECT Long Term Initiatives for Flood-risk Environments by BACA Architects with BRE and Fulcrum Consulting, Halcrow Group Ltd, Cyril Sweet and LDA Design
- WATER FUTURES Integrated Water and Flood Management Strategies for Enhancing Liveability in South East Queensland by JAMES DAVIDSON ARCHITECT
- DESIGN for FLOODING ARCHITECTURE, LANDSCAPE and URBAN DESIGN for RESILIENCE to CLIMATE CHANGE by DONALD WATSON and MICHELE ADAMS
- Pathways to a climate resilient Queensland
- Queensland Climate Adaptation Strategy 2017–2030
- By Department of Environment and Heritage Protection, QLD Government
- BIG PICTURE IDEA FOR NEW YORK CITY AFTER HURRICANE SANDY (2012)
- http://www.rebuildbydesign.org/our-work/all-proposals/winning-projects/big-u
- A 4- minute video illustrating BIG U Project in New York City: https://vimeo.com/117303273

Qld QCoast2100 Coastal Hazard Adaptation Strategies

- http://www.qcoast2100.com.au/documents/6143606/6155749/Minimum%20Standards%20and%20Guideline
- http://www.goldcoast.qld.gov.au/documents/bf/ghd-storm-tide-study.pdf
- https://mail.google.com/mail/u/0/#search/John%40mongard.com.au/FMfcgxwDrvCRNwblCVQTmcFmVpFNCGSM?projector=1&messagePartId=0.1

Adaption Support Tool

- https://www.deltares.nl/en/software/adaptation-support-tool-ast/
- https://www.jamesdavidsonarchitect.com.au/university-of-queensland-living-laboratory/

LANDSCAPE

The Green Space Strategy West End, Highgate Hill and South Brisbane

- https://mongard.com.au/project/the-green-space-strategy/https://www.qld.gov.au/__data/assets/pdf_file/0023/67631/seq-climate-change-impact-summary.pdf
- http://www.aila.org.au/imis_prod/documents/AILA/Advocacy/National%20Policy%20Statements/Climate%20Change%20Policy.pdf

Qld Climate Transition Strategy (mitigation)

- https://www.qld.gov.au/__data/assets/pdf_file/0026/67283/qld-climate-transition-strategy.pdf

Qld Climate Adaption Strategy

- https://www.qld.gov.au/__data/assets/pdf_file/0017/67301/qld-climate-adaptation-strategy.pdf

Climate solutions

- https://www.drawdown.org/solutions-summary-by-rank.
- https://www.cnn.com/interactive/2015/11/opinion/climate-calculator/

A Neighbourhood Similar In Scale To West End

- **First climate adapted neighbourhood, Copenhagen, Denmark**

  https://worldlandscapearchitect.com/first-climate-adapted-neighborhood-copenhagen-denmark-tredje-natur/#.XXrrqS4zaUk

- **Kokkedal Climate Adaption Project**

  http://landezine.com/index.php/2018/12/kokkedal-climate-adaption-by-schonherr/

- **Why is Copenhagen building parks that can turn into ponds?**

  https://www.citylab.com/design/2016/01/copenhagen-parks-ponds-climate-change-community-engagement/426618/

- **An idea for trapping water where we need it:**

  https://www.tredjenatur.dk/en/portfolio/climatetile/

A City Making Climate Headway…Population Similar To Brisbane

- **BARCELONA Green Infrastructure and Biodiversity Plan 2020**

  https://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/Barcelona%20green%20infrastructure%20and%20biodiversity%20plan%202020.pdf

- **BARCELONA A Road Map to Combat Climate Change**

  http://ciutatrefugi.barcelona/en/noticia/a-road-map-to-combat-climate-change_646065

- **BARCELONA Trees Tempering the Mediterranean City Climate (2016)**

  https://climate-adapt.eea.europa.eu/metadata/case-studies/barcelona-trees-tempering-the-mediterranean-city-climate

- **World cities combined effort to tackle climate change**

  http://www.100resilientcities.org/

2 Degrees: Up Close and Personal

By John Mongard

When young people protest on the street and tell us that we are destroying their future due to our failure to act on climate change, we know we have really ignored all the signs. Who cares about climate change? We are numb to the issue because we are daunted by its size and extent. We can't seem face it and business as usual rolls on. It's time to call it out: a climate crisis. What has this got to do with landscape architects? We cannot continue to put parsley on the pig because shortly the pig will be burning.

Scientists say that unless we drastically draw down carbon in the next twelve years, our ecologies and cities will bear the exponential grunt of up to two degrees of climate led disruption. It dawned on me that twelve years is the timeframe that my current planning projects are likely to reach fruition: this means I am effectively facing this design challenge right now. When I look more closely, it appears that many of my existing landscapes may not survive 2 degrees…what role will landscape architects like me play in helping stave off the ecological and social crisis arising from 2 degrees

If we need to become alarmed about climate change, the article The Uninhabitable Earth is a good start. (http://nymag.com/intelligencer/2017/07/climate-change-earth-too-hot-for-humans.html)

If we want to see what our lifestyle changes do to the imminent barometer rise, test the climate calculator. (https://www.cnn.com/interactive/2015/11/opinion/climate-calculator/)

If we want to know whether minor tweaking is required to our professional work, or whether it's a deep adaptation, read Professor Jed Blundell's article in Scientists Warning. Blundell outlines that we need to plan not just for climate adaptation but also for disaster risk reduction, and within the next ten years:

"…recent research suggests that human societies will experience disruptions to their basic functioning within less than ten years due to climate stress. Such disruptions include increased levels of malnutrition, starvation, disease, civil conflict and war – and will not avoid affluent nations. This situation makes redundant the reformist[2] approach to sustainable development and related fields of corporate sustainability. Instead, a new approach which explores how to reduce harm and not make matters worse is important to develop. In support of that challenging, and ultimately personal process, understanding a 'deep adaptation agenda' may be useful." (http://www.scientistswarning.org/wiki/deep-adaptation-agenda/)

Business as usual is over. Given our failures to meet all the climate targets to date, this week is when I really need to start designing for 2 degrees, so my landscapes will still be around in 2030. (https://www.pnas.org/highwire/powerpoint/539766)

We need to stop worrying so much about image and worry more about building within a climate crisis as if our lives depended on it: within future habitats where humans, plants and animals still actually coexist in the future landscape. We have to transition to cities and infrastructures made locally and from fully recycled materials; where we plant for shifting ecologies, embracing the spectrums of drought/heat and storms/floods; Where climate, water, energy, waste, food and soil are the primary drivers of design.

AILA provides a good framework for us to build climate change resilience, but it's time for each of us to move beyond reading policy and to ramp up the deep adaptation action.

(http://www.aila.org.au/imis_prod/documents/AILA/Advocacy/National%20Policy%20Statements/Climate%20Change%20Policy.pdf)

We will need to move many future communities to safer landscapes and begin the difficult transition away from current at- risk places and cities. A national settlement strategy will be required as many towns and places become at risk or uninhabitable due primarily to heat, lack of water and flooding. We may also need a national local food strategy as import systems may break down and food production collapses in various parts of the world. We need these strategies now in order to plan for the next ten to twenty years. After this, it's likely that it will become a military problem related to sovereign risk and protection.

A landmark UN report this May called for 'transformative change' as a million species risk extinction. This transformational change is essentially the deep adaptation agenda suggested by Blundell reaching mainstream world governance on biodiversity. The study concludes that biodiversity loss and climate change feed off each other in a vicious circle and that we have to save and create habitat in the process of also drawing down carbon within the world. Conventional food and forestry landscapes may draw down carbon but will not also help to preserve the biodiversity which ecosystems rely on and which keep humans alive. As the world population grows, we continue to destroy our ecology, which is as big a risk as climate change (https://www.sbs.com.au/news/landmark-un-report-calls-for-transformative-change-as-a-million-species-risk-extinction?cid=newsapp:socialshare:email).

As George Monbiot the environmentalist argues, no one is going to save us: government and industry are moving much slower than the environmental and climate changes that are occurring. We have to help mobilise our communities. We have to change our professional focus and change it fast. Monbiot notes that 'a recent estimate suggests that around one third of the greenhouse gas mitigation required between now and 2030 can be provided by carbon drawdown through natural climate solutions.' (https://www.naturalclimate.solutions/the-science).

The study suggests that about 37 percent of the carbon drawdown could be achieved through natural landscape-based solutions involving ecologically driven design and restoration. This is within the sphere of landscape architects and planners: massive inputs of natural reafforestation, forest conservation and environmental habitat rehabilitation to draw down carbon are actions we can lead on (https://www.pnas.org/content/114/44/11645). The 20 landscapes compared for climate mitigation potential in the study referred to by Monbiot show that we have to start collaborating heavily with agronomists and ecologists if we are to be a part of this deep adaptation.

Of the 80 climate mitigation actions analysed by dozens of scientists in Drawdown, a third are actions which landscape architects can assist or lead on. Again, we will need to arm ourselves with much better skills and knowledge in the planning and building of resilient food and forest landscapes, as well as train ourselves in water, waste, energy and heat systems (https://www.drawdown.org/solutions-summary-by-rank).

Things we can do

Hiding is not an answer. Neither is denial. Acting to achieve climate adaptation through the power of planning and design are things you and I can do. Like many others who have delved into 2 degrees, I find there is a temptation to become despondent, and to want to sell all my assets and go to Patagonia or New Zealand and hide in a transition farm in the forest! But this helps no-one else... so the things that I can act on most effectively in the next ten years relate to my ongoing community work and long- term projects.

For my part, I have decided to transition to a practice of 3 days a week, to leave time for me to help my local community transition around climate change in the next generation. My partner and I have worked in landscape architecture for generations: It's time to transition our practice and work on climate change projects as a priority. To do this, we will scale back on other works to make time to research, to lobby and to act on these deep adaptation challenges. It makes sense that we focus on projects that are already planned and able to be implemented in the next ten years.

Local and community projects I will focus on:

1. Help implement community action plans already in place in my neighbourhood. The Greenspace Strategy by the West End local community identifies 11 Ha of greenspace that can be reclaimed in the existing commons. We can ramp up community action on this to reduce urban heat and draw down carbon locally in the next ten years. Greenspace strategies like this could easily be led by landscape architects working in each local district with their communities. Mobilise your friends and colleagues within your local neighbourhood: create local resilience projects and actions, make a community action plan. (https://kurilpafutures.files.wordpress.com/2014/10/jmgreenspace_2.pdf)

2. Design and build forests and rewilding areas. The Living Classroom project in Bingara, NSW diverts flood water catchment into three kilometres of biodiversity forest around a chain of lakes and billabongs. I will help continue this reafforestation and permaculture farm.
3. Create and rehabilitate local waterways: identify gullies, parks and wasted spaces that you can reclaim and rehabilitate in your neighbourhood. The Local community in West end identified 12 potential new parks to reclaim in unutilized crown gully lands. I will help create these green spaces.
4. Build farms and food gardens. Reclaim unused verges and parks with community run projects. Jane Street community garden in West End is on a street verge and is run by a not- for profit association supporting local gardeners. It reclaims about 1000m2 of area that was not being used.
5. Plant street verges to create habitat and reduce heat. Plant out verges in your neighbourhood with your neighbours, schools and community groups. Kurilpa Futures community group in West End is building verge gardens with local residents.
6. Plan ahead for flooding. My neighbourhood of West End flooded in 2011 and will substantially flood with 2 degrees. Flooding strategies can be enacted with strong government intervention to transition areas and sites. The Blue Strategy in the Greenspace Plan identifies ideas for at risk areas to manage flooding locally in the West End peninsula.
7. Plan and build locally sustainable food and farms. The Tweed Shire sustainable agriculture strategy refocuses a productive region back toward a closed loop food system (https://www.tweed.nsw.gov.au/Agriculture). Build a farm: the Charleville date farm was built by volunteer pastors, a family and some helpers. It recycles all the towns wastewater and produced its first date crop after five years, all within a degraded desert landscape. Help rural communities who need it most.
8. Lobby hard for a national resilience framework, a deep adaptation agenda: to create program, funds and resources to deal with progressive climate change impacts. Make climate change the driving criteria in my projects: Landscape architecture will need to transform itself toward essential living infrastructure: a shift from amenity to survival priorities.
9. I will push for urgent policy change and immediate action in all layers of government. I will join Extinction Rebellion.
10. Change my lifestyle: eat less meat, fly and drive less, buy local, don't waste (https://www.resilience.org/stories/2018-06-12/what-can-we-do/)

We can't afford to tinker at the edges. We are being called to act in many more landscapes than those focused on amenity: It's a call to arms to prevent imminent ecological and climate collapse within our lifetime. What can each of us contribute?

A Snapshot of Heat in Brisbane in the Future

by Sarah Chapman
BSc Environmental Science, Master of Environmental Management (PHD Thesis)

The following key information is highlighted by John Mongard from this study:

"We examined the impact of climate change and urban growth on the UHI of Brisbane, a sub-tropical city in Australia, during summer. We found higher increases in average and minimum temperatures when both urban growth and climate change were considered.

This study only focussed on summer, which is important for negative impacts to health, however in many places heat stress is occurring in other seasons, such as spring and autumn. These seasons should also be included in future modelling experiments." (Chapman, p.178)

"We also found the urban heat island effect spreads out to neighbouring areas. This means even areas which do have green space may be negatively affected by nearby high-density low-green space areas. The wider impacts of inner-city development decisions on surrounding suburbs need to be considered by planners. Finally, the Urban Growth scenario considered here was not an extreme scenario. Over half of the urban area was densified, and this only included a reduction in green space of 11% and increase in building height of 2 m. Actual urban densification may be much higher than this, and so the UHI and night-time heat stress could be higher. **The health risks urban and rural residents will face in the future due to climate change will be high; urban planners need to ensure urban growth does not magnify these risks any further.**

These results still show that urban land cover changes have the potential to increase extreme as well as average temperatures, which is something that should be investigated further given the impact of extreme heat events on health." (Chapman, p153)

"We forecast major increases in heat stress, duration of heat events, and number of hot days and nights with climate change and urban growth. The number of hot days and nights doubled, and dangerous heat stress occurred every summer, even in shady conditions. These results mean outdoor work and sport will need to be limited in duration to reduce the risks of heat stress. We only examined the summer season, but given the large increases in heat stress, it is likely heat stress will be an issue in other seasons as well. Mitigation of urban temperatures will become more vital in the future and urban planners need to consider the temperature effects of development decisions to ensure they are not contributing to the heat stress burden urban residents will already face with climate change.

Secondly, how will increases in urban density affect future urban heat stress? Urban density affects how the UHI varies throughout the city, with the denser areas of the city (higher buildings, less green space), generally having higher temperatures than less dense areas." (Chapman, p.166)

"Thirdly, how does the spatial configuration of urban growth impact on future changes in the urban heat island? The distribution of vegetation and tall buildings throughout the city affect temperature, and some distributions may be more effective than others at reducing temperature. For example, evenly distributed vegetation may be more effective at cooling the city than vegetation clustered in a few areas (Zhou et al., 2011)." (Chapman, p.143)

"The final question identified in the systematic review was: how will heat stress vulnerability change in urban areas in the future, considering both climate change and urban growth? The systematic review found that heat stress was rarely examined by studies and most studies focussed only on temperature. To understand the health impacts of rising temperatures, it is necessary to examine heat stress and the vulnerability of the local population to increases in temperature and humidity. "(Chapman, p.167)

"The main drivers of AH (anthropogenic heat) are population density, vehicle traffic and building energy use.

Brisbane's population density will increase in the future due to rising total populations and a preference for infill development over urban expansion.

This will likely increase AH in the city unless energy use and vehicle traffic decrease to compensate for rising population density. With rising temperatures associated with climate change it is likely that summer energy use will increase while during winter it will decrease. Currently, the highest AH is found in the city centre during the day due to high working populations. With increasing inner-city densities and warming temperatures AH flux in these areas will likely increase, contributing to the UHI and further warming urban temperatures. Given these areas already have high AH fluxes, it is likely that AH will be an important contributor to urban temperatures in the inner city in the future. This is something that needs to be considered in building design, so that the urban form does not exacerbate summer temperatures. "(Chapman, p.168)

"We examined the impact of land cover change on the urban heat island in Brisbane, a sub-tropical city, during summer. We found that a reduction in vegetation cover had the biggest impact on urban temperatures. "(Chapman, p.126)

"Vegetation restoration is a key mitigation strategy. However, the placement and type of vegetation needs to be carefully considered to ensure the maximum cooling potential during heatwaves. In sub-tropical cities, temperature increases associated with the UHI could negatively impact on the health of residents, especially the elderly and economically-disadvantaged, and lead to increases in heat-related illness and death. Considering the temperature impacts of urban land cover change and incorporating mitigation measures into urban planning should be priorities in sub-tropical cities." (Chapman, p.126)

"Vegetation was more effective at reducing temperatures at night than during the day... Roads had a strong influence on temperature." (Chapman, p.127)

"The number of hot days and nights doubled in urban and rural areas with climate change. The number of hot nights was higher in urban areas and in the Urban Growth scenario than in the Control. **Dangerous heat stress, defined as Apparent Temperature above 40 °C, increased with climate change, and occurred on average 1 – 2 days every summer during 2041 – 2050, even in shaded conditions**. The higher temperature increases found with urban growth and climate change than with climate change alone shows that reducing urban temperatures is vital to ensure that urban design does not increase the heat stress risks urban residents will face in the future." (Chapman, p.134)

To view full PHD Thesis:

(https://espace.library.uq.edu.au/data/UQ_899c8f7/s4177348_final_thesis.pdf?Expires=1573788354&Key-Pair-Id=APKAJKNBJ4MJBJNC6NLQ&Signature=cqQ0v0d9e0UslbPFwFYDetnqynRrA8c4~-7H~5c0a~E~QN1yNDcxHl85~z3xopBNUpnQ2LGZ5TWNe4dOU61DIaFhpGRzNoioMsqzNWXnbHtlUtRInBZt0MpH3TivUwyIOL4Uqy-Pxg9ukH8RJgAF7Kd8rlKnE-njw7-0bNANQcBmeEowqFSp24wCr9GQ0QTdu-6iT2Ou5s5oPzlpBHzKXaMwkTKEAN84d~y1FE0eF~TbSMpnFWgqY0LKjoFXLnvpn~0fnd0IGMn6iiLkImhCQ4du2OlG64M1vaffnD3JAimH1mDqTa6PFB0l8Q9lOZlhGMYlVB9LliFa~ekTi9BETw).