AILA's Research and Consultation Project

Climate change adaptation skills
for Landscape Architect Professionals Stage 2
2009 - 2010

Australian Institute
of Landscape Architects ®

CONSULTATION PAPER

PAPER TWO - MODULES

Ideas for Professional Development Modules and Module Delivery

see also
Background Paper to Professional Development Modules

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Climate change adaptation skills for Landscape Architect professionals

Stage 2 (2009-2010)
Ideas for Professional Development Modules and
Module Delivery

(see also Background Paper to Professional Development Modules)

This paper follows on from the Background Paper and presents some **ideas for possible Professional Development Modules** to assist landscape architects develop **skills to deal with climate change adaptation** in their provision of planning, design and management solutions during professional practice. **The Modules represent a starting point and will be modified during consultations with landscape architects** in both private and public practice**.**

Although the focus is on **climate change adaptation skills**, there is some overlap with **climate change mitigation**. Global climate change has been described as "one of the largest, most all-encompassing and long-range problems ever to confront humankind" (Brewer 2007). However, other issues also have potential impacts on the **sustainability of human settlements** e.g. **water and food security, biodiversity conservation, peak oil** and **peak phosphorus**. These, as well as climate change, need to be considered in the development of design based approaches that deliver sustainable outcomes in terms of economics, human health and environmental systems.

Skills needed by Landscape Architects in Dealing with Climate Change Adaptation

The **Background Paper** identified the following required skills (S1-10) which will be modified during consultation with landscape architects. The ten skills are grouped into three areas.

Area (1): Climate change information (S1-S3)

S1 **understand** climate change, the significance of the climate change problem, and predictions (climate scenarios) for different locations and on a range of temporal and spatial scales

S2 **understand** adaptation to climate change, and how it differs from mitigation of climate change, including differing attitudes and perspectives of different institutions, businesses and people

S3 **interpret** information about climate change and climate change adaptation from a range of sources and disciplines

Area (2): Climate change in relation to landscape planning, design and management (S4-S9)

S4 **communicate** climate change information to clients and other stakeholders and **advocate** for its inclusion at the core of **landscape planning, design and management** through **capacity to collaborate** with colleagues in associated professions and by **taking a leadership role** in multidisciplinary teams and managing integrated processes

S5 **assess** the likely **impacts** of climate change, and vulnerabilities to climate change, in the future for different locations, and on a range of temporal and spatial scales, and the **implications of these impacts for landscape planning, design and management**

S6 **identify** and **evaluate** effective climate change **adaptation options in landscape planning and design**, as well as **barriers** to these, for identified impacts and vulnerabilities, including via the use of adaptation planning tools

S7 **apply** appropriate strategies to achieve **landscape design outcomes that are adapted to predicted climate change**, including strategies such as lateral and integrated thinking, innovation and creative synthesis, methodologies involving monitoring, evaluation, review and improvement, and self-reflection, all within conditions of climate change uncertainty and complexity

S8 **respond via design solutions** to the likely impacts, using the Landscape Principles as a basis, in ways that enhance landscape values, including the maintenance of a functioning and sustainable life support system

S9 **prioritise** the value of landscape and integrated Green Infrastructure in strategic planning and landscape design, management and restoration to obtain benefits from its connectivity and multifunctionality

Area (3): Climate change in relation to business sustainability (S10)

S10 **evaluate** risks of climate change to their business (e.g. operational impacts, regulatory risks) and opportunities associated with climate change for business enhancement (e.g. new services)

Professional Development Modules - Outlines and Focus/Content

The following is a list of broad Ideas for Professional Development Modules developed from the skills identified above (coded S1 to S10 in module titles), together with some comments on module focus/content. Like the skills, the ten modules have been grouped into three areas. Complex modules have been sub-divided into components. The modules will be modified during consultations with landscape architects.

Area (1): Climate change information

Modules 1 and 2 describe the conditions that the rest of the modules are based on and, because of this, are potentially the most important and valuable. These modules should provide a continually updated link to the most recent authoritative data on climate change, processed for local or regional areas as required by landscape architects for use in planning and design. Nevertheless, it is recognised that climate change will be an ongoing transient process (Pittock & Jones 2000), and that climate change predictions will still be highly uncertain, although steps can be taken to quantify the level of uncertainty via statements of probability and risk assessments. Real knowledge of risk at regional and local levels is essential for "capacity building" in climate change adaptation (Pittock & Jones 2000) and is currently a focus of research and modelling in Australia.

Module 1. Understanding climate change (S1, S3)

1.1 General understanding of climate change

Interpreting and understanding information on climate change from a range of sources and disciplines. Climate variability vs climate change. Appreciating the significance of the problem. Identifying key authoritative sources of information updated on a regular basis. Annotated lists of key documents and websites (e.g. IPCC 2007; CSIRO 2007; Harvey & Woodroffe 2008; CSIRO and Australian Government Bureau of Meteorology 2009). The underlying science. Hazards arising from climate change. Climate change may involve (Hare 1999, in Smithers & Smit 1997) -

- gradual changes in long term average conditions
- greater variability within the range of "normal conditions"
- changes in the types of extreme events which are possible or probable
- changes in the frequency, magnitude, and distribution of extreme events
- most likely, some combination of all of these

General impacts of hazards in various locations and sectors, as well as in different project types encountered in landscape architecture practice and within different urban processes. Predictions for Australia for various locations within States, and at a range of temporal and spatial scales, including regional and local scales. Predictions overseas for international work. Identifying positive aspects and opportunities arising from climate change, where possible.

1.2 Multiple perspectives, including Local Government perspective

Climate change can be viewed from multiple perspectives and there are different frameworks for considering climate change adaptation. Some of these may be more or less relevant/useful for landscape architects, as a basis for integrating climate change adaptation into their work. The Local Government perspective is important, given that climate change adaptation has a strong local emphasis i.e. impacts and vulnerabilities vary on a site by site basis, as do required adaptation actions. Climate change adaptation planning has already commenced in Local Government (e.g. see ICLEI Oceania 2008, for a Local Government climate change adaptation toolkit; Australian Government Department of Climate Change 2009). In terms of scale or levels of adaptation to climate change, at least five are evident - Commonwealth, State, Local Government, Organisation and Project.

The **five perspectives** listed below are mostly based on documents or websites relating to groups in Australia considering climate change adaptation -

- **Sectors of activity in Local Government** (Australian Government Department of Climate Change 2009), reviewing climate change adaptation actions to be considered by Local Government - infrastructure/property, recreation, health, planning and development approvals, natural resource management, water and sewerage.
- **Sectors for focusing on Australia-wide adaptation research and information provision** (NCCARF undated) - Terrestrial Biodiversity, Primary Industries, Water Resources and Freshwater Biodiversity, Marine Biodiversity and Resources, Human Health, Settlements and Infrastructure, Emergency Management, and Social, Economic and Institutional Dimensions.
- **Project types in landscape planning, design and management** (AILA 2009b) e.g. housing and industrial estates, urban parks and recreation areas, single dwellings, infrastructure corridors, regional recreation and other areas incorporating natural ecosystems, and waterways (both natural and constructed).
- **Urban processes** (BioCity Studio 2007; see Case Studies for Australian Landscape Principles, AILA website) e.g. water/wastewater, energy, emissions/pollution, food/agriculture, shelter/built form, transport, garbage/waste/recycling, chemicals, biodiversity and governance.
- **Socio-economic and cultural aspects** (Brewer 2007; Nicholls *et al.* 2008) - "humans are the cause and humans suffer the consequences of a goodly portion of what passes for the 'climate change' problem" (Brewer 2007), but there is a lack of socio-economic, behavioural and human dimensions in climate change studies and debates.

Enhanced professional practice business opportunities - **Local Government** is a focus for climate change adaptation, given the context and location specific nature of adaptation responses. Landscape architects already have a close working relationship with Local Government, or are working within Local Government. Their roles should become more significant as climate change adaptation develops, particularly in the **leadership and coordination of multidisciplinary groups** involved in planning for climate change adaptation. Similarly, landscape architects are accustomed to dealing with **urban processes** in their entirety and with the currently overlooked **socio-economic and cultural aspects** (human dimensions) of adaptation to climate change. There may be enhanced business opportunities in other areas as well (e.g. some suggestions in modules 3 and 6 below).

Module 2. Understanding adaptation to climate change and mitigation of climate change (S2, S3)

Adaptation as an inherent and positive element in biological and social systems, which is both responsive and creative (Burton 1994). Long-term and current responses to climate variability compared with the present and future need to respond sustainably to rapid climate change. Differences between mitigation of climate change (which received early emphasis) and adaptation to climate change (which has recently received increased attention). Examples of mitigation and adaptation activities. Complementarity and conflict between mitigation and adaptation activities. Recognition of validity of adaptation as one of the four main pillars (Schipper & Burton 2009) on which new international agreements will rest (i.e. mitigation, adaptation, technology and finance). Extent of existing adaptation to climate change (e.g. Burton 2004). Diversity of adaptation activities. Planned adaptation to climate change. Strategic planning and climate change. Differing attitudes to and perspectives on climate change and climate change adaptation, including government, corporate and community levels.

Area (2): Climate change in relation to landscape planning, design and management

Module 3. Communicating climate change information (S4)

Communication with clients, experts, decision-makers, other stakeholders and the public. Advocacy for the inclusion of climate change at the core of landscape and human settlement planning, design and management. Development of advocacy skills and greater landscape architect representation at meetings and events held by different organisations (e.g. water authorities, Property Council, Urban Development Institute of Australia, stormwater initiatives etc.). Greater landscape architect representation in existing rating tools (e.g. Green Star) and emerging rating tools. Collaborative planning with other professional groups (e.g. architects, engineers, sociologists, public health professionals etc.). Use of visualisation, engagement and advocacy tools. Refining and value-adding to the brief. Leadership role in managing the planning and design processes of multidisciplinary teams working on climate change adaptation. Related skills in facilitating conflict resolution. Development of capacity to collaborate and adaptive partnering processes resulting in long-term, multi-stakeholder climate change adaptation.

Enhanced professional practice business opportunities - the visual/graphic communication skills of landscape architects and their modelling of different scenarios (e.g. sea level rises) and alternative futures can provide a "bridge" between experts and public. Potential educational opportunities for landscape architects may be expanded, based on these communication skills. Leadership or central role in identifying and communicating both the problems of climate change and potential solutions to these problems, in visual forms understandable by all. Creative and innovative ways of engaging with the public, to focus on solutions, and not just problems.

Module 4. Assessing impacts of climate change, adaptation needs and adaptation planning, including vulnerability-based approaches, and the implications of impacts for landscape planning, design and management (S5)

Approaches to climate change impacts and adaptation assessment. Extensions of risk management approaches to assess adaptation needs and facilitate adaptation planning. Hazards-based approaches and vulnerability-based approaches. More site-specific assessment (than in Module 2 above) of impacts and vulnerabilities for various locations and at various temporal and spatial scales. Examples of vulnerability assessments already carried out, both locally (e.g. Harvey & Woodroffe 2008) and overseas. Local Government areas in Australia involved in initial testing of "Local Government Climate Change Adaptation Toolkit" (ICLEI Oceania 2008) and other Local Government areas that have subsequently used it. Adaptive capacity in Local Government e.g. amongst Sydney Coastal Councils Group (Smith *et al.* 2008). General principles in adaptation planning vs context specific factors. Land use, zoning and planning issues in relation to vulnerability assessments e.g. planning responses to sea level rises and changes in zoning. Assessments in marginal areas that may already be at their limits to adaptation.

Module 5. Identifying and evaluating climate change adaptation options in landscape planning and design, as well as barriers to adaptation options (S6)

Identifying and evaluating effective climate change adaptation options for specific contexts i.e. for identified impacts and vulnerabilities, at specific locations, over specific temporal and spatial scales. Explaining options, assessing costs and benefits of different options, and facilitating conflict resolution. Climate change adaptation options in the context of other constraints that will modify the availability or suitability of options; such other constraints include peak oil, peak phosphorus, other emerging resource constraints, the need for water security and food security, and the maintenance of resources such as soil and biodiversity. Use of climate adaptation planning tools e.g. see AILA CATSS Project - Climate Adaptation Tools for Sustainable Settlements (AILA 2009c).

Module 6. Incorporating climate change adaptation into professional practice involving landscape planning, design and management - responding to impacts and vulnerabilities based on Australian Landscape Principles (S4, S5, S6, S7, S8, S9)

Modules 6, 7 and 8 address most directly the application of climate change adaptation in professional practice. Given the wide range of work undertaken by landscape architects, the differing needs of the private and government sectors, and the fact that some practitioners work in specialist sectors (e.g. transport, water, urban design, parks, playgrounds etc.), the delivery of these modules should be tailored to the particular audience or workshopped in parallel groups.

Taken collectively, these modules effectively mainstream climate change adaptation into landscape planning, design and management.

Climate change adaptation awareness raising amongst colleagues, with clients, with other stakeholder groups and amongst the general public. Australian Landscape Principles as the basis of responses to climate change to achieve sustainable outcomes (AILA 2009a; AILA 2008). Green Infrastructure (network of natural landscape assets underpinning economic, socio-cultural and environmental functionality of our cities and towns) (AILA 2009b) as an organising system providing connectivity, multifunctionality and landscape performance.

Links between climate change adaptation and specific Landscape Principles (AILA 2008) -

- **Value our landscape** - recognise and articulate the diverse range of values in landscape, including economic contributions per se, provision of ecosystem services, and contributions to human well-being (including physical, social and cultural dimensions) such that these values are retained or enhanced in landscape interventions and in a climate-changed future

- **Protect → Enhance → Regenerate** - the hierarchy of decision-making that aims to protect existing environmental features and ecosystems, enhance existing resources in creative ways, and regenerate lost or damaged ecosystem services such that ecosystem services are protected into the future and human well-being is enhanced; protection of existing ecosystems permits their evolution in the (climate changed) future

- **Design with respect** - plan, design and manage landscapes with respect for existing socio-cultural, environmental and economic knowledge, including outcomes that avoid or minimise pollution (soil, water and air), resource consumption (natural resources and energy) and waste generation, and outcomes that promote recycling

- **Design for the future** - anticipate critical issues in possible futures (climate change, water security, food security, biodiversity loss, peak oil, peak phosphorus etc.) and design with forward-looking potential, using processes that enhance resilience, such as reducing greenhouse gas emissions, developing climate change adaptation strategies, and creating net-zero waste sites

- **Embrace responsive design** - incorporate new knowledge in design, systematically evaluate new outcomes of new processes and practices, and incorporate experimental/research components in projects where possible and evaluate results, to derive new knowledge

Enhanced professional practice business opportunities - if a truly holistic approach is taken to address climate change, to provide long-term sustainable outcomes, then landscape architecture professionals, at the core of **Green Infrastructure provision**, should play a much greater role than previously in urban planning, landscape design and management. Landscape architects should be playing a **leadership role** in providing solutions to climate change problems since they commonly deal with the **complexity of mixed social, behavioural and natural systems that are all involved in finding solutions to enable adaptation to climate change**. The "nature"/"culture" divide has been bridged in the field of Urban Ecology, which is providing a foundation for developing more resilient cities of the future, with attention to both **ecological and social functioning**. Landscape architects, who bring together **design, society and ecology**, are well placed to play a key role. It has been claimed that there is a lack of socio-economic, behavioural, and human dimensions in climate change studies and debates (Brewer 2007) which needs to be redressed; **landscape architects are in a more powerful position** to overcome these limitations than are other professionals involved in human settlements. As well, it is likely that climate change will induce a range of **stresses** on society and that landscape architects, through their **design and communication skills**, will play a valuable role in identifying and reducing those stresses, through creative design solutions.

The list of **sub-modules** below emphasises knowledge and skills needed by landscape architects to incorporate climate change adaptation into their professional practice, based on the Australian Landscape Principles (AILA 2009a) and Green Infrastructure (AILA 2009b; Gill *et al.* 2009) underpinning their work.

6.1 Landscape values - environmental, socio-cultural and economic values, including qualitative and quantitative assessments, and potential effects of climate change on these; how people's use of public and other outdoor spaces may change as a result of climate change (e.g. rainfall and temperature changes); design solutions to maintain human well-being in a climate changed future

6.2 Mapping landscape values (incl. in urban areas) - present and future scenarios with climate change

6.3 Ecosystem services - identifying and quantifying the role of landscape in the provision of ecosystem services at site level and at the broader landscape level; landscape planning and design to maintain ecosystem services under climate changed conditions

6.4 Urban Ecology - bringing natural and social sciences together, with the urban ecosystem as the environmental foundation of urban settlements; landscape planning and design enhancing human well-being in urban settlements

6.5 Green Infrastructure (GI) - mapping existing GI and potential GI enhancement (incl. in urban areas), as an adaptive landscape planning and design response to climate change; urban forestry (urban trees, shrubs and other woody vegetation) and its contribution to climate change adaptation

6.6 Urban food production - peri-urban agriculture and local community food production (including permaculture); urban food security; scope for inclusion of food production in landscape planning and design

6.7 New "growing green" technologies - roof, wall and interior landscapes; landscape planning and design opportunities to enhance Green Infrastructure as an adaptive response to climate change

6.8 Restoration ecology and intervention ecology - bush regeneration techniques, use of locally native species and provenance issues; retention of bushland patches / corridors in during new development, bush regeneration and landscape design issues in nearby areas, including species selection and provenance issues; "recreated" bushland and ecologically-based design approaches

6.9 Planning, designing and managing for extreme events e.g. fire at urban-natural area (bushland, forest) interfaces, storm inundation and flooding, tidal surges etc.; identification of possible and probable extreme events; implications for landscape planning and design

6.10 Carbon sequestration and carbon trading opportunities e.g. vegetation and soil components of landscape design to enhance carbon capture, for climate change mitigation and possible economic benefits

6.11 Project evaluation - monitoring, evaluation, review and improvement (MERI) methodology; incorporating experimentation and research into projects to determine whether actual landscape performance matches intended performance at planning / design stage; self-reflection

6.12 Climate change adaptation policy and strategy development to achieve sustainable landscapes - collaborating with other professionals involved in landscapes, forming effective partnerships focussing on co-benefits, understanding different attitudes to climate change adaptation, conflict resolution; applicable at different scales e.g. single project (private practice) or landscape network (under public management)

Module 7. Landscape Urbanism / Urban Ecosystems - re-examining natural ecosystems as models for constructed ecosystems in urban areas, using an ecologically-based design approach (S4 to S9)

A fresh look at natural ecosystems. Reading the plants, as species and communities, to understand geology, soil, topography, aspect and hydrology. Natural ecosystems as models to achieve sustainability in constructed landscapes. Responses of natural ecosystems to extreme events - fire, flood, landslip. Resilience of natural ecosystems. Energy flows and tight nutrient cycling in Australian plant communities. Special features of Australian ecosystems that mean we need to develop constructed landscapes appropriate to specific parts of Australia - low nutrient soils, low and erratic rainfall, plants adapted to extract/maintain nutrient supply from these soils, sclerophyllous and fire-adapted vegetation.

Agriculture has recently undergone a revolution in parts of Australia, as the design of new agricultural ecosystems seeks to replicate aspects of the functioning of locally indigenous vegetation (e.g. crops with specific root depths, use of perennial plants rather than annuals etc.) to manage water, soils and nutrients, in order to achieve more sustainable agricultural landscapes. The **design, planning and management of constructed ecosystems/landscapes** may use either locally indigenous plant species in communities that simulate natural ecosystems or other (non-invasive) plant species of similar structure and function, to perform similar roles in these constructed ecosystems/landscapes. Such landscapes are likely to have diverse, and usually locally native, plant species, representing a range of different functional groups. They are also likely to support a range of microorganisms and fauna and to require fewer external inputs of water, fertilisers and pesticides.

Module 8. Re-examining the approach to landscape components during landscape planning and design, in relation to climate change adaptation, to identify better design approaches and measurable outcomes (S4 to S9)

The draft implementation matrix for the Australian Landscape Principles (AILA 2008) lists measurable landscape components as soils, vegetation, hydrology, materials and human well-being. A slightly modified version of these, with the addition of biodiversity, forms the basis of six sub-modules below. **These sub-modules involve reassessing, in the light of climate change adaptation, attitudes to and treatment of these landscape components, during landscape planning and design, to achieve sustainable outcomes over the long term and under conditions of climate change.** Some increasingly important topics (over the last 20 years) are listed for each sub-module.

8.1 Soils and other growth media

Minimise soil disturbance. Soil testing to determine physical, chemical and biological properties and any requirements for remediation of problem soils. Soil "health" including soil microbial activity and carbon storage. Techniques for soil protection during landscape intervention (e.g. see EDAW AECOM (undated) Rouse Hill, Case Studies for Australian Landscape Principles on AILA website). Mycorrhizae as an essential component of plant (including tree) health. Mulching of tree root zones to protect/facilitate tree root growth. Structural soils to facilitate tree root growth and reduce tree-pavement conflicts in highly urbanised sites. Provision of appropriate/adequate water to urban trees, via soil reservoirs (including planting pit sizes). Biochar soil carbon storage potential. Phytoremediation and use of hyperaccumulating plants in contaminated sites. Design and management of growth media for use on roofs, walls, in other containers and interior landscapes. Management of soil and growth media in terms of their physical, chemical and biological properties.

8.2 Vegetation

Many aspects of vegetation covered above, under Module 6. Importance of integration of Green Infrastructure and built infrastructure during planning, and not merely in the post-construction phase. Techniques for protection of existing vegetation / trees on construction sites and during landscape intervention (e.g. AS 4970-2009). Importance of tree canopy percentage cover for delivering maximum environmental benefits to humans. Landscaping to minimise energy use associated with heating and cooling of buildings. Landscaping to reduce Urban Heat Island Effects. Restoration ecology and bush regeneration - monitoring vegetation outcomes over various time frames, and comparisons between restored or regenerated vegetation and vegetation at comparable natural ("control" or unimpacted) sites. Realistic restoration goals in human-dominated ecosystems. Control and management of invasive plants. Future invasive plants in climate change scenarios.

8.3 Biodiversity and habitat enhancement

Importance of vegetation diversity, in both species and structure, for habitat of diverse faunal species. Connectivity planning for adaption to climate change to facilitate species (plant and animal) migration in response to environmental (e.g. temperature) gradients. Provision of corridors and connectivity in urban areas. Urban fauna and its management in areas of potentially greater human population densities and with potentially greater urban vegetation. Genetic variability of plant material used e.g. seed propagated material with much genetic variability, as opposed to clonal material of limited variability. Existing locally indigenous plant nurseries and contract production of locally indigenous plants of known provenance. Interweaving of biodiversity, vegetation management and agriculture.

8.4 Hydrology

Since concerted adaptation tends to be stimulated by a local disaster or extreme event, some climate change adaptation skills in relation to water have already been developed in response to recent prolonged dry periods in many parts of Australia. Further development of adaptation strategies are required for flood and storm surges. Stormwater management on site. Greater understanding of all sources of water in landscapes, including runoff, greywater, groundwater and aquifers. Water flow through entire catchments, as well as local water availability. Maintenance or regeneration of healthy hydrologic processes. Water quality throughout the catchment. Enhanced water use efficiency and water storage. Water Sensitive Urban Design (WSUD). Maintenance techniques for wetlands, including invasive species and nutrient accumulation. Reduced irrigation for Green Infrastructure and more reliance on predicted rainfall and surplus rainwater (if any) from rainwater harvesting.

8.5 Materials and energy use

Material selection and use in relation to climate change mitigation and adaptation. Re-use of onsite structures/materials. Selection of sustainable/local/recycled landscape materials, to reduce resource depletion and greenhouse gas emissions. Reduction of energy use associated with materials including evaluation of embodied energy and life cycle evaluation. Support for sustainable production practices. Avoidance of harmful materials and practices. Creation of net-zero waste sites.

8.6 Human well-being

Assess landscapes for contributions to human well-being (physical, social and cultural dimensions) (e.g. see Francis & Hester 1991) and protect, design and/or improve aspects which benefit human well-being in the future. Prioritise interventions that offer greatest benefits and ensure sustainability of human settlements into the future, including social and cultural sustainability. Importance of Green Infrastructure to human physical, psychological and social well-being e.g. for outdoor physical activity and for mental restoration (quiet green places). Combating climate change with urban green infrastructure, including addressing Urban Heat Island effects (ASLA undated).

Module 9. Evaluation of completed landscape planning and design projects in a climate changed future, including via research components incorporated into projects, and documentation of "best practice" case study projects (S4→S9)

Methodologies for evaluating landscape architects' own projects, award winning projects or policy documents relevant to landscape architecture practice against future climate change scenarios (similar to process undertaken in BioCity Studio (2007) Case Study, AILA website, where urban processes were explored under crisis scenarios). Identification of key features to improve future projects (responsive design). Incorporating research components into projects, including defining the questions to be answered, experimental design, data collection and data analysis. Collaborating with scientists and engineers. Sources of research funding, including via industry-research organisation linkages, and grant application processes. Processes for dissemination of research findings. Documentation of "best practice" case study projects. Importance of robust management and maintenance systems, after project completion, to ensure integrity of project into the future. Techniques to ensure appropriate follow-up and correction of minor design errors.

Area (3): Climate change in relation to business sustainability

Module 10. Business adaptation to a climate changed future - enhancing opportunities and minimising risks (S10)

Sub-modules above have identified some areas of enhanced business opportunities for landscape architects in relation to climate change adaptation e.g. new services and products, or increased leadership roles. Risk assessments should also identify climate change impacts to and vulnerabilities of businesses e.g. operational impacts, asset vulnerabilities and regulatory risks (Acclimatise 2009).

Ideas for Module Delivery

The following is a list of possible ways of delivering the modules, as suggested by feedback from landscape architects during consultations and workshops undertaken to date.

1. Events run by State sub-committees (e.g. Environmental Group; Education Group; Recent Graduates Group etc.) and available for CPD points; such events could include talks, seminars, workshops or practice-hosted salons, especially including project-based examples and involving integrated module delivery (rather than separate module delivery).

2. Modules could be run in the monthly newsletter or communiqué or there could be staged, single-page email communiqués with links for further information. For example, the first communiqué could be "What is the landscape architect's role in climate change adaptation?"

3. Workshops organised jointly with other industry and professional groups addressing climate change adaptation in a multidisciplinary environment (e.g. water engineering; coastal planning). Workshops could be organised around green paper responses, coastal planning policy guidelines etc. Such workshops could simultaneously strengthen advocacy on behalf of landscape architects and allow exchange of existing knowledge and research on climate change adaptation between different professional groups.

4. Structured delivery of modules through tertiary institutions with the assistance of selected practitioners. Since tertiary institutions may have already prepared similar modules for their programs, or are planning to do so, this may be an efficient way of delivering the modules. This structured delivery could be updated via follow-up bulletins through National Office.

5. Distance study, including the use of online resources e.g. courses or modules. There may be possibilities to partner with other professions in the delivery of online or electronic-learning resources.

6. Dedicated module page(s) in each issue of Landscape Architecture Australia. Writers could be nominated or volunteers sought to prepare different topics.

7. An Advocacy Group could be started and could organise events based on modules for communication and business adaptation. An AILA Advocacy Committee could be created such that it is aligned with the Environment Group. Advocacy and response to issues in the media (e.g. bushfire controls, densification of urban areas etc.) could build AILA's and landscape architects' profiles and promote their roles in climate change adaptation to the broader community. A brochure summarising the key contributions that landscape architects can make in responding to climate change through adaptation might be useful for advocacy at several levels, including government and the community.

8. Invitations to practitioners to submit projects to feature on the website as exemplar or benchmark projects for climate change adaptation. Practitioners could identify projects they believe show demonstrable climate change adaptation responses in their planning and design.

References and further information

Acclimatise (2009) *Building business resilience to inevitable climate change*. Carbon Disclosure Project Report 2008. FTSE 350. Oxford, UK. 28pp. https://www.cdproject.net/CDPResults/65_329_211_Acclimatise_CDP6_FTSE_350_Building_Business_Resilience_HR%20(2).pdf Accessed 23 October 2009.

AILA (2008) *Draft implementation matrix for Landscape Design Principles (Australian Institute of Landscape Architects).* Prepared by Catherine Neilson. http://www.aila.org.au/climate/implementation/slides/matrix.htm Accessed 30 September 2009.

AILA (2009a) *Adapting to Climate Change: Putting a Value on Landscape. A strategic framework for planning, design and management of our urban environment.* http://www.aila.org.au/landscapeprinciples/ Accessed 29 September 2009.

AILA (2009b) *Adapting to Climate Change: Green infrastructure. Green infrastructure planning increasing connectivity, multifunctionality, and landscape performance in the built environment.* http://www.aila.org.au/greeninfrastructure/ Accessed 29 September 2009.

AILA (2009c) Climate Adaptation Tools for Sustainable Settlements (CATSS). http://www.aila.org.au/climate/catss/default.htm Accessed 8 November 2009.

AS (Australian Standard) 4970-2009 (2009) *Protection of Trees on Construction Sites*. Standards Australia. 28pp.

ASLA (American Society of Landscape Architects) (undated) *Professional Practice: combating climate change with landscape architecture.* (Component of Professional Practice Guides series.) http://www.asla.org/ContentDetail.aspx?id=21910 Accessed 21 October 2009.

Australian Government Department of Climate Change (2009) *Climate change adaptation actions for Local Government.* Department of Climate Change, Commonwealth of Australia. 71pp. (5+66pp.) http://www.climatechange.gov.au/community/~/media/publications/local-govt/localadaption_localgovernment.ashx Accessed 29 September 2009.

BioCity Studio (2007) *Design elective at UNSW, Faculty of the Built Environment - mcgregor+partners.* http://www.aila.org.au/climate/case/pages/BIOcity.htm Accessed 20 October 2009.

Brewer, G.D. (2007) Inventing the future: scenarios, imagination, mastery and control. *Sustainability Science* 2: 159-177.

Burton, I. (1994) Deconstructing adaptation … and reconstructing. In Schipper, E.L.F. & Burton, I. (eds) (2009) *The Earthscan Reader on Adaptation to Climate Change*, Earthscan, London, UK. Pp. 11-14.

Burton, I. (2004) Climate change and the adaptation deficit. In Schipper, E.L.F. & Burton, I. (eds) (2009) *The Earthscan Reader on Adaptation to Climate Change*, Earthscan, London, UK. Pp. 89-95.

CSIRO (2007) *Climate Change in Australia - Technical Report 2007*. http://www.climatechangeinaustralia.gov.au/technical_report.php Accessed 8 November 2009.

CSIRO & Australian Government Bureau of Meteorology (2009) *Climate change in Australia: Science update 2009, issue 1*. http://www.climatechangeinAustralia.gov.au/documents/resources Accessed 30 October 2009.

EDAW AECOM (undated) *Rouse Hill Landscape Restoration of Riparian Corridors and Stormwater Infrastructure.* http://www.aila.org.au/climate/case/pages/rouse.htm Accessed 20 October 2009.

Francis, M. & Hester, R.T. (eds) (1991) *The meaning of gardens*. The MIT Press, Cambridge, Massachusetts, USA.

Fussel, H.-M. (2007) Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustainability Science* 2: 265-275.

Gill, S., Handley, J., Ennos, R. & Nolan, P. (2009) Planning for Green Infrastructure: adapting to climate change. In Davoudi, S., Crawford, J. & Mehmood, A. (eds) (2009) *Planning for Climate Change: strategies for mitigation and adaptation for spatial planners*, Earthscan, London, UK. Pp. 249-261.

Harvey, N. & Woodroffe, C.D. (2008) Australian approaches to coastal vulnerability assessment. *Sustainability Science* 3: 67-87.

ICLEI (International Council for Local Environmental Initiatives) Oceania (2008) *Local government climate change adaptation toolkit.* Cities for Climate Protection (CCP) Australia: adaptation initiative. 68pp. http://www.iclei.org/index.php?id=adaptation-toolkit#c34544 Accessed 29 October 2009.

Intergovernmental Panel on Climate Change (IPCC) (2007) *IPCC Fourth Assessment Report (AR4) Climate Change 2007: Synthesis Report*.
http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf Accessed 8 November 2009.

Lyth, A., Nichols, S. & Tilbury, D. (2007) *Shifting towards sustainability: Education for climate change adaptation in the built environment sector.* A report prepared by the Australian Research Institute in Education for Sustainability (ARIES). 72pp.
http://www.aries.mq.edu.au/projects/ClimateChange/files/climateChange.pdf Accessed 21 October 2009.

National Climate Change Adaptation Research Facility (NCCARF) (undated) *Climate Change Adaptation*. http://www.nccarf.edu.au/adaptation-research-network Accessed 20 October 2009.

Nicholls, R.J., Wong, P.P., Burkett, V., Woodroffe, C.D. & Hay, J. (2008) Climate change and coastal vulnerability assessment: scenarios for integrated assessment. *Sustainability Science* 3: 89-102.

Pittock, A.B. & Jones, R.N. (2000) Adaptation to what and why? *Environmental Monitoring and Assessment* 61(1): 9-35.

Schipper, E.L.F. & Burton, I. (2009) Understanding adaptation: origins, concepts, practice and policy. In Schipper, E.L.F. & Burton, I. (eds) (2009) *The Earthscan Reader on Adaptation to Climate Change*, Earthscan, London, UK. Pp. 1-8.

Smith, T.F., Brooke, C., Measham, T.G., Preston, B., Gorddard, R., Withycombe, G., Beveridge, B. & Morrison, C. (2008) *Case studies of adaptive capacity: systems approach to regional climate change adaptation strategies.* Prepared for the Sydney Coastal Councils Group, Sydney Australia. http://www.sydneycoastalcouncils.com.au/system-approach-to-regional-climate-change-adaptation-strategies-in-metropolises/index.php Accessed 21 October 2009.

Smithers, J. & Smit, B. (1997) Human adaptation to climatic variability and change. *Global Environmental Change* 7(2): 129-146.

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