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Environmental responsibility should be part of any project plan that seeks to make urban space more liveable.

[Image 2 Woolloomooloo Bay & Land Bridge over Cahill Expressway].

Why? Let's briefly look at our environmental big picture.

- Australia still clears more native vegetation than any other developed country in the world.
- 45% of native vegetation in NSW has already been cleared.
- The water of all inland rivers in NSW, except the Paroo, are more than 100% allocated to extraction.
- NSW has lost 50% of the organic content in the soil of its agricultural lands.
- NSW has 927 animals and 15,930 plants listed as endangered, vulnerable or extinct.
- The United Nations Environment Programme records that the global rate that productive land is being lost to degradation equals the rate that new farmland is being cleared - we're running on the spot!

Gardens are artificial constructs requiring energy, materials and other inputs to create and maintain them. However clean and green we may wish our cities to be, all that we can really do is to reduce the use of non-renewable resources and reduce any polluting or wasteful outputs from gardens. Gardens will never replace the biodiversity or environmental services provided by natural ecosystems. But we can take pressure off the environment.

[Image 3 Flooded Flower Bed Lawn and high tide, Royal Botanic Gardens, Sydney].

Our cities are seemingly independent of the ebb and flow of the natural environment, escaping almost untouched from the impact of the drought and dust storms of 2002 -2003. Gardeners work with climate change and a hole in the ozone layer.

In a way Australian society has returned to the failed 'First Farm' of 1788. All that has changed between those first European settlers and our current situation is the magnitude of our dilemma. The question that this conference seems to me to be asking is - will our industry passively observe as these outcomes worsen or will we take the opportunity presented by every design brief to negotiate environmentally responsible outcomes?

[Image 4 Room with a View]

Urban consolidation brings more people closer together than ever before. For many citizens the modern garden is a borrowed view from a balcony - or a rooftop garden.

There is reason for optimism, however: the rise in community gardeners is cultivating a renewed sense of community and the Australian invention of permaculture (sustainable cultivation)

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indicate our gardening culture is attempting to reconcile who we are with how, and where, we garden.

In preparing a good design brief, every design team can take small, meaningful initiatives that can have a beneficial impact on the environment and also deliver a project on time, within budget and to agreed standards.

One of these small meaningful initiatives is selecting the right plants to grow.

Being involved in the horticultural media, one of the commonest requests is for instant solutions to pest and disease problems, and increasingly, people are looking for non-chemical solutions. Quick fixes, such as suggesting a spray that will kill a weed, rarely resolve the causes of the problem. Understanding why weeds can get a foothold in the first place, where the weak link in their reproductive cycle is, can help to prevent a problem from arising.

[Image 4a Pennisetum setaceum and Salvinia molesta]

Yet our industry spreads weeds in our landscapes. The Australian Fountain Grass, *Pennisetum alopecuroides*, is a decorative, unfussy tufted perennial grass useful in a variety of situations. But an African species of Fountain grass, *Pennisetum setaceum*, which has known weed potential, has found its way into nurseries and landscapers are using this widely, mistakenly thinking that they're using an Australian plant.

They're relatively easy to separate at flowering stage but you're much more likely to buy African Fountain Grass than the Australian species. Landscapers have already spread it around Hawaii and New Zealand, where it's classified as a noxious weed, and it's spreading across Fiji, French Polynesia, Guam, New Caledonia, Indonesia, southern California and the Canary Islands. African Fountain Grass smothers and inhibits natural regeneration and changes the fire intensity of bushland as well as being a promiscuous urban weed.

Let's see our industry be proactive about this issue; spreading awareness, avoiding further use of either grasses until the nursery industry can guarantee it has eradicated African Fountain Grass and can reliably offer our Australian species. And how will we rid the landscapes planted with it? It occurs in some of Sydney's most celebrated new landscapes. Their problem or a shared problem?

Salvinia (*Salvinia molesta*) is well known as one of Australia's worst environmental water weeds and its control is required by law. But I have seen many garden designers and retailers still displaying this in water features and selling it to the public.

When I drafted the regulations for exhibitors and for judging plant displays for the 'Gardening Australia Live' Expo I included sanctions against the entry of pests, diseases and weeds. Another small meaningful initiative, but that was the only gardening show that I know of to have a pre-show pest, disease and weed audit and the capacity to destroy any found. Why isn't this standard practice?

These are just two examples of how our industry can knowingly spread plants with serious weed potential and highlights inadequacies in horticultural training, a lack of vigilance and official intervention to eliminate such plants from our landscapes.

[Image 5 China Rose, *Rosa mutabilis*]

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Even when non-weedy plants are selected there are opportunities to eliminate the traditional triggers where people resort to pesticides. Chemical use is messy, complex, expensive, risky, increasingly questionable ethically and rarely solves problems. Good horticulturists and landscapers can plan to avoid weeds, pests and diseases – the triggers for chemical use. The best time to do this is whilst negotiating the design brief, another small, meaningful initiative.

A client wants a rose garden in warm-temperate, humid Sydney? Avoiding the chemicals traditionally associated with rose culture is simple - select Noisette roses, Tea roses and China roses and then grow them organically. They love our climate and they will feature in the Royal Botanic Gardens, Sydney's new rose garden, currently in the final stages of design.

[Image 6 Darling Park roof top garden]

The NSW Department of Public Works and Road and Transport Authority have created partnerships with botanic horticulturists at the Royal Botanic Gardens, Sydney, in a number of projects, including the redevelopment of St Mary's Cathedral, Central Station, the Eastern Distributor Land Bridge, Darling Park and the roofscape of the Conservatorium of Music.

[Image 7 roof gardens on the refurbished Conservatorium of Music]

Here the primary environmental benefits worked in to the designs were the use of plants that are suited to the climate, that rarely suffer from pests or diseases, that need little feeding and only occasional watering. Many of these plants are also uncommonly used in public open space.

Critical to the success of this garden was the careful specification of the planting mix. Select the right planting mix at the outset and you'll avoid up to half of the common gardening problems. A typical Sydney planting mix uses alluvial 'loam', one of the cheapest and nastiest materials for gardening. When it's dry it cakes and repels water, so re-wetting is very difficult. When it's wet it's airless - the tiny particles infiltrate and block all the soil pore space, so it suffocates plant roots, encourages dieback, fungal diseases and drains very poorly. The particle size also means that it will ooze out of drainage holes along with ground and stormwater, blocking land drainage lines and ending up, once again as silt in our rivers.

We used a mix with 50% cinders for perfect drainage, well-aerated soil. It was also as inexpensive as alluvial 'loam'. Ordinary people who visit and use public garden passively absorb messages on how things are done and how things look. We can be a positive influence by being more environmentally responsible:

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8 *Acalypha wilkesiana* - various colour forms; an old favourite evergreen put to good on the Gold Coast (at Conservatorium of Music)

9 *Bauhinia galpinii* - another old favourite, a sprawling ground cover or climber rediscovered on the Gold Coast (at Conservatorium of Music)

10 *Molineria capitulata* - more likely to be found in Grannies' garden; a robust slow growing Australian ground cover for shade or sun (at Conservatorium of Music)

11 *Juniperus sabina* - near to 'no maintenance', accepts sun, shade, little food or water and doesn't collect autumn leaves from nearby deciduous trees (at St Marys Cathedral)

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12 *Canna x orchioides* - luscious foliage and glowing colours, happy in shallow soils, can flower all year round if fed annually and watered once weekly in dry weather (at Royal Botanic Gardens, Sydney)]

[Image 13 Cardamom, *Elettaria cardamomum*, displaying its dense, weed-suppressing aromatic foliage, great for flavouring baked fish. (at Royal Botanic Gardens, Sydney)]

Landscapes should have more productive plants in them to satisfy increasing public interest in growing and cooking productive plants. Productive landscapes do not necessarily require any more maintenance than their ornamental counterparts, unless intensive, continual production is the aim of the project. Nor do they have to be ugly.

This conference has heard already just how popular the Community Greening project of the Royal Botanic gardens Sydney and the NSW Department of Housing has been in creating productive gardens for tenants, cultivating a sense of community and reducing petty crime. Cuba offers an inspiring alternative view for urban greening. Following the collapse of the Soviet Union, Cuba lost its major source foreign exchange from the export of sugar, and it also lost its source of oil and gas, the source of its petrochemical pesticides and artificial fertilisers.

Over the following ten years food rationing was necessary although no one went hungry or suffered from malnutrition. The National Urban Agriculture programme converted urban green space to produce food. Initially people became organic gardeners by necessity, not choice, but over the past ten years this has changed and organic gardening is bringing health to the heart of their cities.

The National Urban Agriculture programme requires self-provisioning gardens to be attached to schools and businesses. Now the norm, Cuba's cities now grow their own food, often producing a surplus. I wonder how many self-provisioning establishments there will be in Sydney's CBD in ten years?

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14 Society Garlic, *Tulbaghia violacea Variegata* - loves full sun and an occasional watering, grown as a living bed edge reduces soil and mulch erosion, and it's great for stir fries (at Conservatorium of Music)

15 Kaffir Lime, *Citrus hystrix* - ideal for topiary, enjoys full sun, an ideal Mediterranean-style shrub, foliage indispensable for Thai salads and curries (at Herb Garden, Royal Botanic Gardens, Sydney)

16 Lemon Grass, *Cymbopogon citratus* - bullet proof, tufted accent plant, good for oriental salads and soups (at Herb Garden, Royal Botanic Gardens, Sydney)

17 Pineapple Sage, *Salvia elegans* - a Mexican perennial for full sun, ideally planted where people can brush past it and release its aromatic scent (at Herb Garden, Royal Botanic Gardens, Sydney)

18 Curry Leaf, *Murraya koenigii* - ideal evergreen shrub, hedge or small tree, foliage widely used in curries (at Herb Garden, Royal Botanic Gardens, Sydney)

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[Image 19 Babingtonia Nana - we're used to seeing Australian plants grown in informal or bushland settings. Clipped, this could replace English Box in Sydney parterre gardens. (at Conservatorium of Music)]

Landscapes should have more interesting plants and these can easily be tailored to landscapes as the stuff we're all used to seeing used ad nauseum: Agapanthus, Dietes and Murraya. It's easy to create a sense of theatre by using common plants in uncommon ways and by using uncommon plants in common ways.

In the Sydney Basin we are easily able to grow an enormous range of non-weedy plants from the cool temperate regions to the tropics - as long as we provide the right microclimate. The Royal Botanic Gardens, Sydney, Mt Annan and Mt Tomah grow more plants than you'd find listed in an illustrated plant encyclopaedia. Often the right microclimate for tropical plants is simply achieved by providing shelter from cold winter winds and desiccation, providing some reflected heat from walls and paving, so Sydney certainly isn't short of opportunities.

[Image 20 Tree Germander, Teucrium fruticans (at the NSW Police Memorial). The brief wanted a tough, reliable, easy care plant with foliage that contrasted with polished black granite, and blue flowers that was capable of growing in shallow soil over a rock shelf].

There are some plant groups that can be problematic. Some silver foliage plants can suffer from fungal problems during our moist, humid summers. Some Mediterranean plants also suffer in coastal Sydney - naturally conditioned to growing in wet winters and resting during summer droughts, here they usually experience summer rain and winter drought.

Both silver foliaged and Mediterranean types of plants generally benefit from drip or trickle irrigation so that their foliage isn't too wet for too long in warmer weather, infrastructure that must be identified early in the project plan. Another small meaningful initiative.

[Image 21 Toughened, Tropical effect plants that need only once weekly watering in dry weather (at Conservatorium of Music)]

Even with leafy tropical plantings, it's possible to condition plants to make sturdy growth that only requires periodic irrigation. Just like people, plants can be conditioned to be lean and tough or obese and feeble. Conditioning is a gradual process. For example, a combination of occasional, deep watering and a modest application of nitrogen fertiliser, you can limit the production of the weak, sappy growth that invites pest attack, fungal problems and storm damage.

[Image 22 Pachypodium lameri from S Africa, grown from 30cm to 2.5m in four years - grown in raised bed with 50% gravel (at Royal Botanic Gardens, Sydney)]

Obviously plants from semi-arid regions require little if any irrigation and the limiting factor in Sydney is more likely to be our humidity and waterlogging in poorly drained positions during our periodic, heavy rains.

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23 Pachystachys lutea from tropical South America - ideal for sheltered low rise buildings (at Conservatorium of Music)

24 Canary Island flora, well tested in 19th century Sydney - typical Mediterranean flora ideal for medium rise buildings (at Royal Botanic Gardens, Sydney)

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25 Semi-arid flora - perfect for high rise buildings with drying winds, high UV and reflected heat (at the Royal Botanic Gardens, Sydney) As a rough guide you could consider the following natural plant communities for planting on walled roof gardens. For low rise buildings use Australian or exotic rainforest flora; for medium rise use Mediterranean (eg Canary Island, Californian, S. African flora); for high rise use semi-arid to arid flora (eg Central America, Africa, Arabia, India, Australia).

And of course there are productive plants from all of these regions that could be grown just as easily. If these rooftop gardens were enclosed conservatories the range of tender plants grown and the quality of plants grown could be greatly enhanced.

[Image 26 Bidwills Coral Tree, *Erythrina x bidwillii*, Australian-bred cultivar from 1840's; a rare 'fashion victim', but an ideal low maintenance small tree for Sydney's climate]

The main issues associated with growing unusual plants are: extra lead time for sourcing and mass production and the extra costs involved in this process.

Plant availability can also be a problem. While we still retain a reasonable diversity of plants in Australia, many useful plants have fallen from fashion or have become extinct in cultivation last century, and those that survive often exist in small numbers at specialist growers. The Royal Botanic Gardens has overcome this problem by engaging a commercial nursery to bulk up the numbers and advising their staff how to cultivate unusual plants.

[Image 27 Conservatorium of Music]

Budget blowouts due to unforeseen problems, such as unearthing a heritage artefact, or public pressure to alter construction plans (both of which happened during the refurbishment of the Conservatorium of Music) inevitably impact upon the landscape delivered. Budget blowouts usually occur at the expense of the horticultural aspects of the project, which are generally regarded as the least important element.

Here lies one of the major flaws in urban gardens: aftercare during the first year after construction: the establishment phase. This is when plant conditioning and training must occur, where tree ties may choke a specimen, and where the spatial arrangements between plants will change.

There are long term benefits if you create a maintenance plan for the first year post planting establishment phase and this can then be adapted for a routine or cyclical maintenance plan for the second year onwards. After all, having completed an award winning landscape, you might like to be able to return to see it looking in as good a condition as you originally intended.

[Image 28 Jerry's 'Hedge on the Edge' Phillip Island Hibiscus, *Hibiscus insularis* - critically endangered, stock was returned to the wild by the Royal Botanic Gardens, Sydney after feral pests had been eradicated from that island in the 1970's. This species flowers for nine months a year in Sydney. It makes a great evergreen shrub and it's ideal for a medium-sized hedge].

The public and official reactions to Darling Park and the Conservatorium of Music roof gardens have been very good and the use and approval of these new landscapes is higher than ever before. The benefit of having professional botanical horticulturists in project teams is that we operate on a different level from TAFE trained horticulturists. We're used to working with plant communities, unusual and heritage plants and generally appreciate a broader palette of plants.

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[Image 29 'Colour forgives all']

However professional we are and however well executed our landscapes are, there's one basic message from the public: they want more colour! Rainforests are nice, but they're green, green, green! And no matter how tastefully you try to combine flower displays it always seems that it's the most gaudy and violently clashing colours that get the most praise.

[Image 30 The Flower Bed Lawn at the Royal Botanic Gardens, Sydney during the Olympics]

My brief for the new landscape for the international terminal at Sydney Airport specifically stated that no trees that could attract birds or flying foxes - and consequently cause plane accidents - were to be planted. A potential problem easily avoided and thirty suitable tree species were recommended, so it was a shock to see flying fox and bird-attracting fig trees planted in the finished landscape.

Ultimately it is horticultural advice that I provide, and that advice may not be heeded. So if there's a bird or flying fox-related plane crash at Sydney Airport, please don't call me!

Key points:

- Environmental responsibility should be central to every project: start taking small, meaningful initiatives.
- Plant selection can eliminate the traditional triggers for pesticide use.
- Productive plants are overlooked and the benefits of using them misunderstood.
- Use more interesting plants: if we Sydneysiders have access to a wealth of plants, why don't we use them?
- The establishment phase is critical and maintenance plans are often overlooked.
- Botanical horticulture is distinct from domestic horticulture.

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