Growing cities from within: urban agriculture in inner Brisbane.

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ABSTRACT:
This paper proposes a new way to integrate urban planning and design of our cities with multifunctional agriculture through the development of local infrastructure solutions in response to food production and energy, land, water supply pressures as part of a climate change adaptation strategy.

This paper lays the groundwork for a new way of structuring cities with particular emphasis on the potential to place urban agriculture at the heart of the community. A pilot study demonstrates how this can happen through the retrofit of the inner city Brisbane neighbourhoods situated in the historical catchment of Western Creek.

Keywords: *Urban agriculture; Green infrastructure; Retrofitting cities; Raising creeks.*

Introduction

The integration of 'multifunctional' land uses including agriculture, has benefits such as decentralised food production, food security, reinforcement of farming as a way of life, cultural landscapes and biological diversity (Bjørkhauga and Richards, 2008). The difficulty arises as multifunctional approaches, although analysed from a policy and economic perspective, have not been integrated in spatial analysis (Wilson, 2009, p. 278).

Notable studies make it clear that we currently do not have the tools to deal with the planning or operation of multifunctional agriculture integrated with peri-urban communities. New ways of looking at farming practices are needed (Lawrence, et al., 2004; Bjørkhauga and Richards, 2008; Mason & Knowd, 2010). Existing planning systems are an inadequate basis for dealing with environmental change in the urban context, and new approaches are called for that respond to the specific local environmental, social, economic and institutional context (Allen, 2003). Complicating the process is the view that multifunctional planning must be locally and contextually relevant to find tangible expression on the ground (Wilson, 2009, p. 278). A new way of thinking is needed about how changing values and relationships impact on the design of sustainable urban forms and buildings (Webster-Mannison, 2006), and about how the legal framework relates to the way we design (Brannigan & Torero, 1999).

Agricultural and food planning is traditionally tackled by agriculture departments as a matter of industry policy, not integrated with landscape planning or built environments. However, there are new drivers, in particular the integration urban design, psychological perception of risk, resilience and engineering variables in the design of infrastructure (Torero, 2006), and how the urban-wild land interface and how urbanization of these spaces bring challenges to safety (Torero & Simeoni, 2010) including bushfires and flooding.

Context and Relevance

By 2030, roughly two thirds of the human population will be living in cities according to projections by the United Nations. Studies of the 'ecological footprint' of cities show that the area affected by a city's resource and waste management is much greater than its geographical spread. Consequently, in order to meet the challenges involved with this rapid urbanisation, including food security, water and waste management, biodiversity and ecosystem conservation, we need to develop a strategic planning approach that will promote sustainable resource management in cities.

Government policy calls for new understandings about community, innovation, and sustainability. The Hon Anthony Albanese MP, Minister for Infrastructure & Transport (PMSEIC, 2010) explains: "As one of the most urbanised societies on the planet, Australia's future economic prosperity and social cohesion will depend largely on how successful we are at making our cities more productive, sustainable and liveable." Disruption to agriculture and food production in Australia is likely due to climate change, and as productive landscapes approach the limits of their capacity, an integrated role for agriculture in urban development is essential to food security.

Australia's priorities at Rio+20 include the formulation of its first national food plan consistent with its vision of a sustainable, globally competitive, resilient food supply that supports access to nutritious and affordable food and includes innovative agricultural practices, building community resilience, and the development of tools for land management (Australian Government, 2012). On a policy level, the Australian Government acknowledges the pressures of urbanisation on food security and the implications for natural resource and infrastructure management and land use planning, in the State of Australian Cities 2011 and Our Cities, Our Future—A National Urban Policy for a productive, sustainable and liveable future. The integration of food production as part of urban land and development strategies is necessary given the juxtaposition of arable land and urban population centres (PMSEIC 2010, p. 41).

The South East Queensland (SEQ) Regional Plan 2009-2031 includes the recommendation for the integration of agriculture in urban environments to meet predicted global climate change challenges, and in recognition of the links between health, community wellbeing and the physical environment. Likewise, Toward Q2: Tomorrow's Queensland's targets for health include the provision of spaces for urban agriculture in the planning and design of our communities.

The international, national, and local scene is clearly set for developing and implementing new ways to integrate urban planning and design of our cities with multifunctional agriculture.

Green Infrastructure: Connecting people with landscapes through urban retrofitting

The *Green Infrastructure: Connecting people with landscapes through urban retrofitting* research project explored the potential for green infrastructure and the integration of 'multifunctional' land uses including agriculture to influence the future planning of existing urban neighbourhoods through a pilot study. The Western Creek Pilot Study involved the hypothetical retrofitting of an existing inner city neighbourhood through the development of appropriate urban typologies for increased population densities in South East Queensland (SEQ) and the integration of green infrastructure within a multifunctional urban agriculture design framework.

The research shows how a new understanding of our natural environment may influence the future planning of cities for climate adaptation relevant to government, developers and the broader community.

Pilot Study Location

The pilot study area is defined by the Western Creek catchment which is located approximately three kilometres South-West of the Brisbane CBD, and connects the Mount Cootha National Park with the Brisbane River. Western Creek ran through the inner-Brisbane suburbs of Bardon, Paddington, Auchenflower and Milton, but has been progressively buried during the course of development since the early 1940's. Like many creeks throughout Brisbane, it was once the core of a thriving ecology as well as people's social and recreational activities. Population growth and development pressures have led to the gradual destruction of Western Creek, pushing it underground and into pipes. Today though, all that remains is a short stretch of open concrete drain.

With the exception of a portion within Bardon on the Western edge of the catchment, these are some of Brisbane's older suburbs where a significant portion consists of character housing. The Western Creek catchment is 416 hectares and it is currently home to approximately 11,500 residents, or 4,160 households. The average dwelling density is 10 dwellings per hectare, significantly short of the Queensland Government (2011) target of 30-100 dwellings per hectare for Urban Neighbourhoods (P5): Higher density, walkable, mixed use neighbourhoods.

The Western Creek Catchment is a suitable pilot study area for a number of reasons. Firstly, due to its location and proximity to the Brisbane CBD, the area is projected to increase significantly in population density over the next few decades. According to Brisbane City Council's Draft CityShape 2026 (2006), the population in this area is due to increase to 16,000 residents by 2026. The South East Queensland Regional Plan 2009-2031 indicates 22,500 residents in this area by 2031. An increase in population density will need to be matched with social and physical infrastructure, as well as improved access to natural open space and public amenity which Brisbane residents consider a major priority.

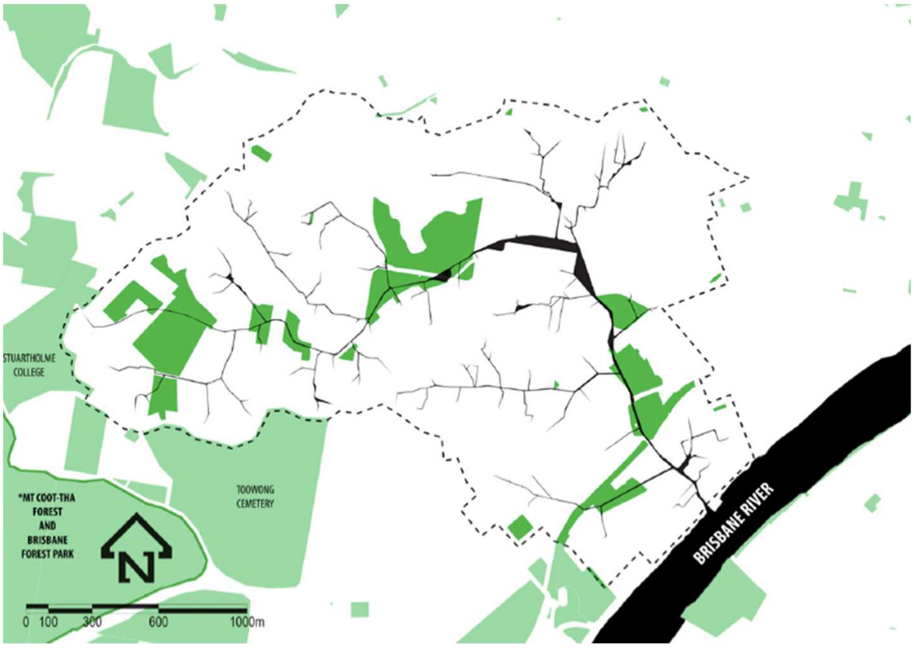
Secondly, the Brisbane City Council's Milton Station Neighbourhood Plan proposes a transit oriented development (TOD) as identified under the South East Queensland Regional Plan, yet the area as a whole has not been considered. The significant growth proposed for the area will place added pressure on existing transport and services infrastructure, therefore it is timely to consider options.

Finally, there is no plan in place to protect or reinstate natural areas in the catchment, nor to restore any segments of the creek. The planned development will place an enormous strain on the remaining open space within the catchment and will significantly reduce the health of the Western Creek waterway and the Brisbane River. The Western Creek catchment has the potential to provide an ecological link between two core biodiversity areas, the Mount Cootha National Park and Brisbane River.

Background Analysis

Preliminary research importantly identified significant public land within the original creek corridor that indicated the potential feasibility of re-creating the ecological link between Mount Cootha National Park and the Brisbane River, as shown in Map1.

Map 1: Remnant open space fragments (Grgic, 2009).



Furthermore, the viability of introducing green infrastructure to the Western Creek Catchment was established by assessing the level of permeability remaining shown in Map 2.

Map 2: Permeability of catchment (Grgic, 2009).

Map 3 shows the flooding from 2011which was classified as ‘major’ (BOM, 2011). Interestingly, the levels, and nature of the flooding coming from the Brisbane River, rather than from impact of rainfall in the catchment, is a good indication of the pattern of permanent inundation that may be anticipated with the sea level rise by 2070 predicted by the CSIRO.

Map 3: Aerial view_2011 floods in the Western Creek catchment

Examination of data from the Bureau of Meteorology shows the relative severity of flooding from the ‘major’ flood in 2011 and the previous ‘minor’ flooding such as that which took place in 2009 demonstrates that even minor flooding brings the creek alive again.

Creating the Western Creek catchment Proposition

The preliminary research, established the existing planning framework and the potential for the Western Creek Catchment to form a suitable pilot study. Namely, by establishing the feasibility of re-creating the ecological link between Mount Cootha National Park and the Brisbane River given the significant public land holdings within the original creek corridor, and the viability of introducing green infrastructure given the existing permeability Western Creek Catchment.

On this basis, the Western Creek Pilot Study was established to identify the population increase that the area could sustain with the inclusion of green infrastructure through the comparison of the following three scenarios:

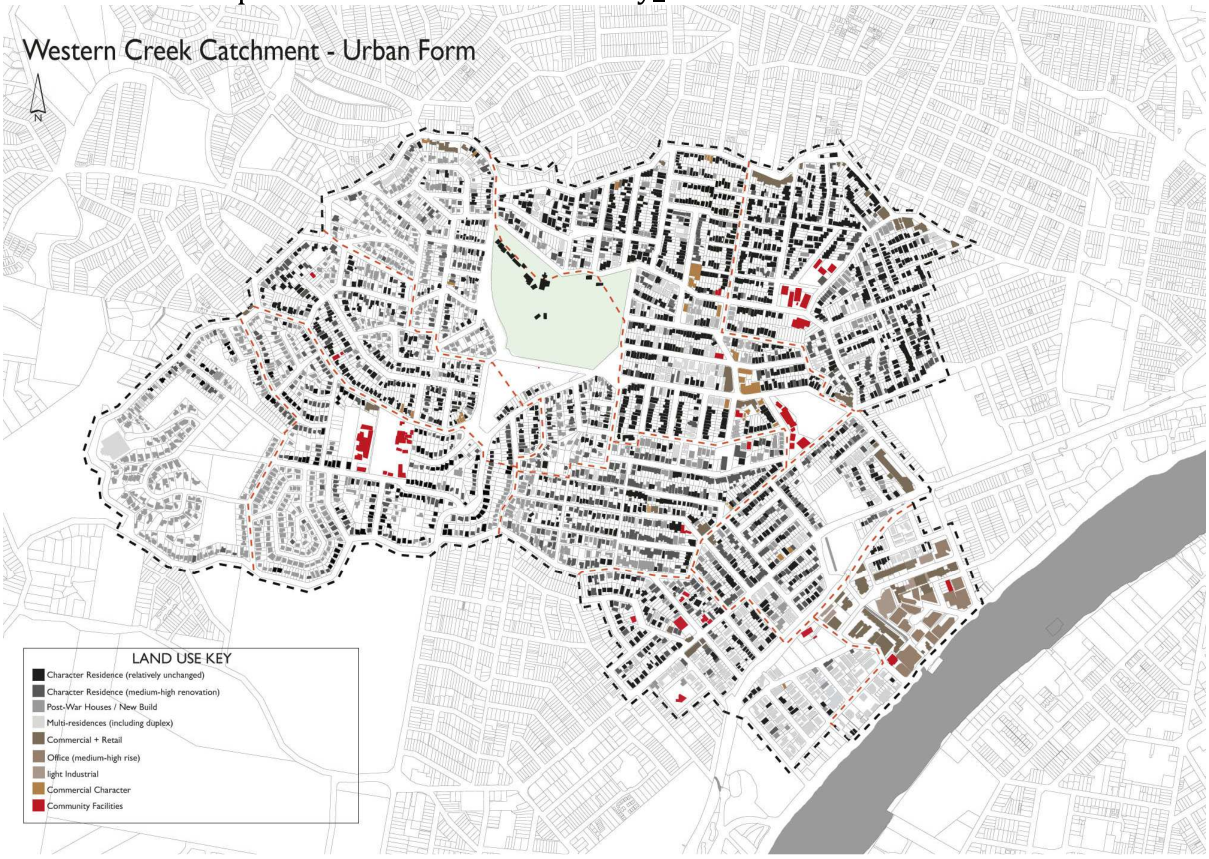
1. Scenario One_ Existing Situation
2. Scenario Two_Future Un-mitigated Urban Intensification Scenario (population densification doubled without green infrastructure or urban agriculture)
3. Scenario Three_ Mitigated Urban Intensification Scenario (population densification doubled with green infrastructure and urban agriculture).

The Western Creek Pilot Study included further assessment of the catchment, hydrological modeling of the catchment, various consultations and design charrettes to establish the feasibility of creek rehabilitation in terms of consistency with local area plans, potential to contribute to urban infrastructure (e.g. stormwater drainage, flood mitigation, water supply, transport, green links, etc) and the social character of the neighbourhood. The key steps were as follows:

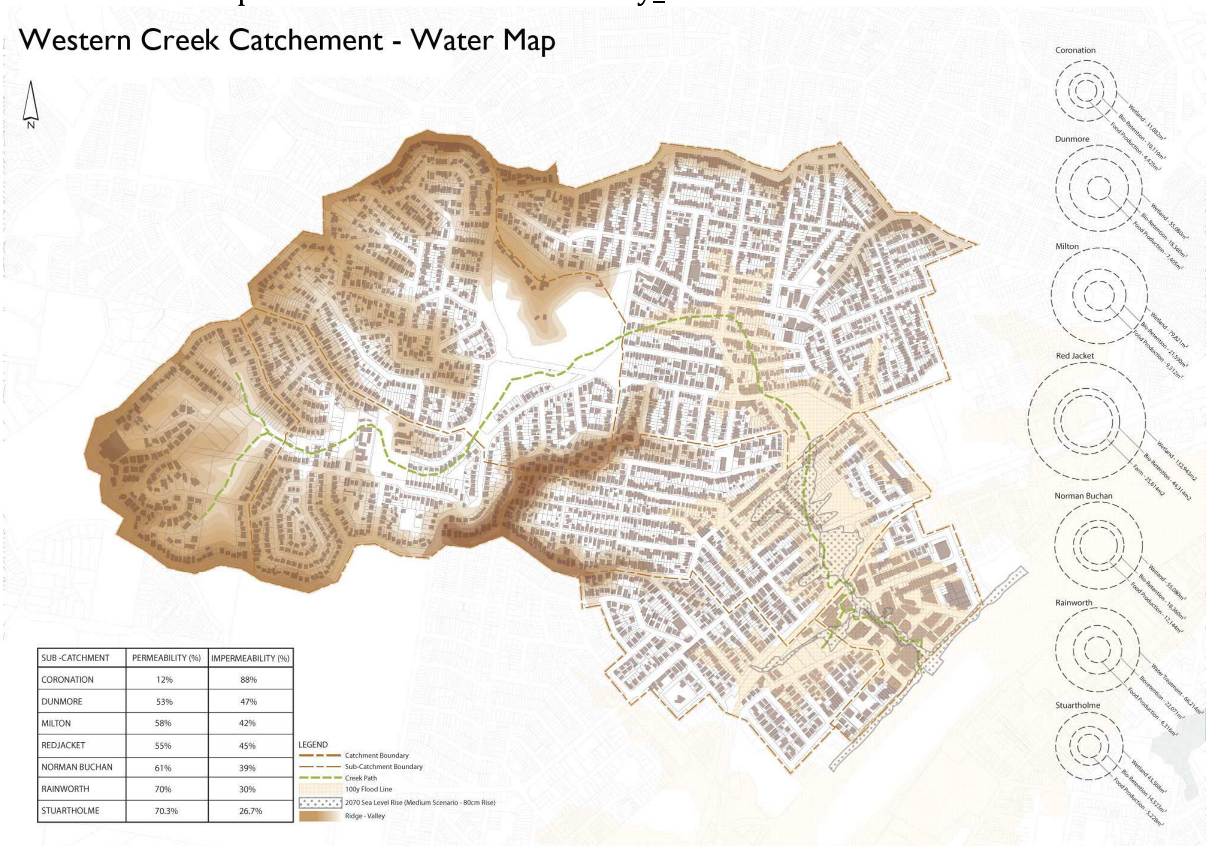
Step 1: Western Creek catchment 'layers' were mapped by Masters of Architecture students as part of their coursework for Architectural Design Studio (Semester 2, 2011-2012) to describe the locational, geophysical, historical and ecological landscape, and socio-economic and cultural context of the existing Western Creek catchment. The resulting Water, Movement, Urban Form, Landscape, Parkland and Clumps of Trees, Open Space networks, Climate and Services and Agriculture Maps 4-11 are shown on the following pages.

Step 2: Site density potential was identified on a site-by-site basis considering the potential impacts on solar access, visual privacy, acoustic privacy and views. Character housing and existing medium density developments were excluded from consideration for increased density. Hypothetical housing types and development forms appropriate to the specific site context were identified using the Residential Form Handbook (BCC and Queensland Government, 2011). The site density assumptions were further tested by approximately 100 site specific architectural studies by Masters of Architecture students which considered detailed factors of site location, and planning and building design based on the recommendations of the Transit Oriented Development Guide (Queensland Government, 2010) and the Next Generation Planning Handbook (Council of Mayors (SEQ) and the Queensland Government, 2011).

Map 4: Western Creek Pilot Study_Urban Form

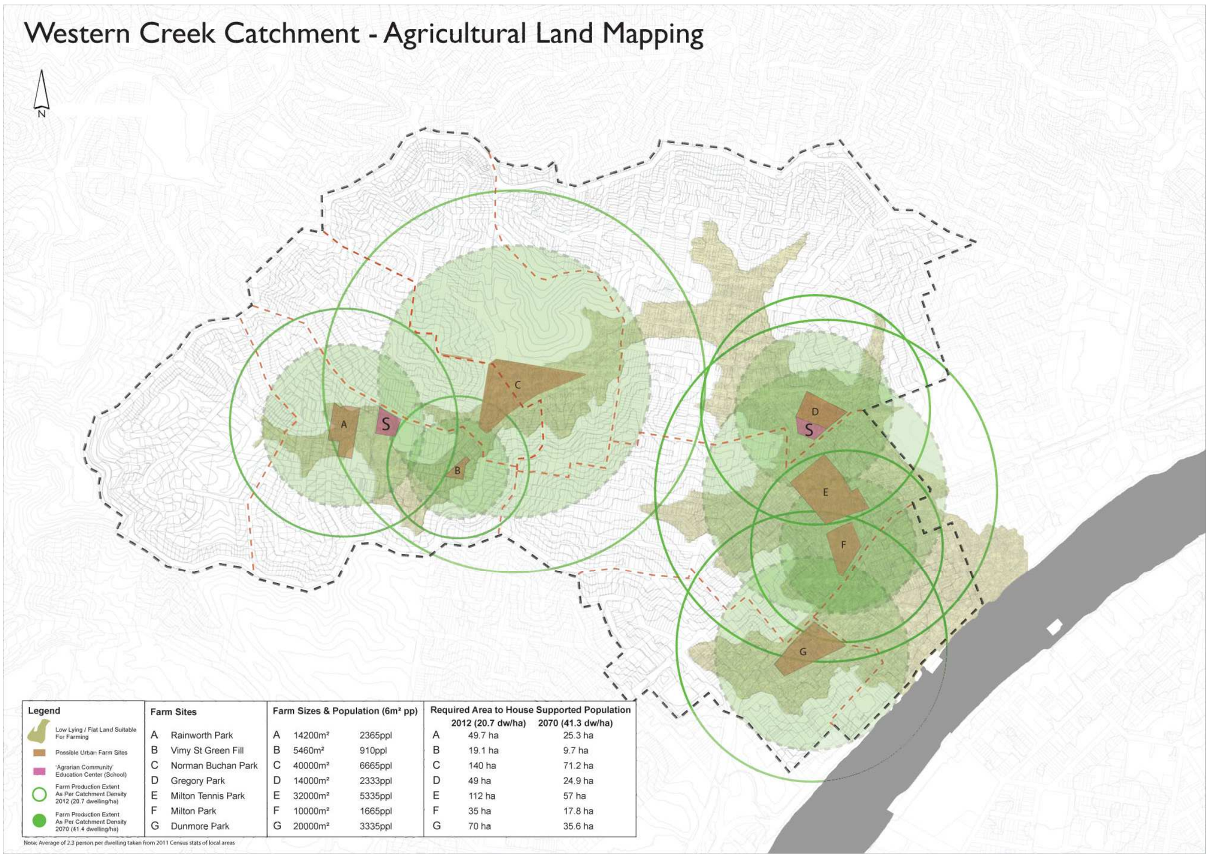


Map 5: Western Creek Pilot Study_Water



SUB -CATCHMENT	PERMEABILITY (%)	IMPERMEABILITY (%)
CORONATION	12%	88%
DUNMORE	53%	47%
MILTON	58%	42%
REDJACKET	55%	45%
NORMAN BUCHAN	61%	39%
RAINWORTH	70%	30%
STUARTHOLME	70.3%	26.7%

Map 6: Western Creek Pilot Study_Urban Agriculture



Step 3: Water and urban agriculture strategies were developed considering different scales (catchment-wide, sub-catchment, street and lot), land uses and building types. Siting strategies to deal with flooding ensured that all new development is outside of the flood extent, or if inside the flood extent protected by flood sensitive design. Site permeability of each development was kept at a minimum of 50% ground area. Each new hypothetical development included tanks sized to suit 5,000 l/person with the additional capacity to capture rainwater that may overflow from the tank during large rain events. Bioretention was provided at 2% of the contributing development site catchment area. New developments also included greywater treatment and reuse and blackwater treatment and reuse. Streets and lots were planned to receive 6hrs/day sunshine to dedicated backyard food production areas.

Step 4: Green infrastructure opportunities including locations for water retention, treatment and reuse were identified. 'Large scale' moves for the main creek included the establishment of a waterway corridor, replacement of the existing stormwater pipe with a recreated 'creek', catchment imperviouness held below 50%, and flash flooding contained within a defined overland flow path maintaining a 60m biodiversity corridor where possible connecting the Mt Coot-tha National Park to the Brisbane River.

Step 5: Concept level plans of the main creek catchment were prepared through a series of workshops to identify the location key Water Sensitive Urban Design elements (e.g. waterways, wetlands, bioretention systems, water storage). Food production areas integrated at 6m2/person in locations that receive a minimum of 6hrs/day sunshine/food production areas.

Step 6: Hydrological modeling was undertaken to quantify the benefits from employing green infrastructure solutions as part of urban intensification of the Western Creek catchment and confirm performance and sizing of Water Sensitive Urban Design elements. The modelling used MUSIC Version 5.01 (Model for Urban Stormwater Improvement Conceptualisation, eWater) and Microsoft Excel spreadsheets to measure change from existing for un-mitigated and mitigated (using green infrastructure) urban intensification scenarios. The Scenarios were modeled to measure water quality, hydrology and water conservation indicators. The results demonstrate the comparative value of employing green infrastructure.

Following further analysis, all day multi-disciplinary workshops were held with participants representing Urban Design & Architecture: Jim Gall, (Jim Gall Architects), Cameron Davies (Deicke Richards); Landscape Architecture: Arno King (Deicke Richards); and Water Engineering and Ecology: Malcolm Eadie and Peter Breen (E2DesignLab). These workshops testing the workability of Scenario Three in terms of the possible urban design outcomes for the catchment given the integration of green infrastructure and the doubling the existing population.

Modeling Results

The modeling proved the benefits that green infrastructure could provide when integrated with urban intensification, in this case, a doubling of the population. In existing urban catchments where natural and built assets are under significant pressure, green infrastructure solutions can enable population increases whilst actually improving the amenity and resilience of the urban environment, reducing the pressure on these assets and reducing the overall costs associated with population growth due to avoided and/or delayed trunk water services infrastructure augmentation.

Notably, if supported by green infrastructure and urban agriculture, doubling the existing population (Scenario Three), reduced peak stormwater flows at the catchment outlet by up to 30%, annual pollutant loads by up to 70%, and demand on regional potable water supply by 30% in comparison to existing situation (Scenario One). Scenario Three further demonstrates improved flood resilience in terms of reduced frequency of minor and nuisance flooding causing inconvenience and minor flood damages, ecological services, and landscape amenity in the local catchment, and reduced pollution from stormwater and wastewater discharges, and less demand on regional freshwater sources for human use within the broader bioregion.

Benefitis of Urban Agriculture

Loss of productive land due to urban development is a key problem for Australia's food security, and the largest impact of urban growth is currently in South East Queensland (Millara & Rootsa, 2012, p. 28). However, there is an increasing recognition of the plethora of ways that the integration of urban agriculture adds value, and is a desirable and legitimate form of long term land use. (Knowd, 2010, p. 22). The Western Creek Pilot Study reveals the important role that multifunctional urban agriculture has to play in urban development including the following:

- drought-proofing and water security;
- bushfire-proofing;
- flood mitigation;
- climate stabilisation through reduced heat island effect;
- food security;
- eco-services such as filtration systems for water, providing nutrient uptake and removing pollutants;
- integrated ecological links connecting habitats and biodiversity;
- transport spines for pedestrians and cyclists;
- community focus and health benefits of active living;
- economic benefits of increased property values, reduced maintenance and infrastructure; and
- promotion of public awareness of ecological and agricultural values, issues, problems and solutions.

Concluding Remarks

The current rather disparate efforts to plan for urban growth within the biophysical limits of our cities will challenge us to develop a coherent approach, underpinned by evidence-based research and highlighted by strategies for maintaining critical ecological, economic and social diversity. Policy needs to be informed on a wide range of issues in order to link urbanisation, food security, nutrition and livelihoods: How and where to produce food for urban inhabitants? What infrastructure is needed? How can cities protect the surrounding ecosystems?

The configuration of cities has changed significantly over the last century from one largely related to the opportunities afforded by natural features to one driven by the street pattern and infrastructure networks. If the approach to food production, transportation and energy and water networks changes, the geometry of cities is open to change and new ways of defining neighbourhoods become more relevant. The Western Creek Pilot Project lays the groundwork for a new way of structuring the urban areas of our cities as part of a climate change adaptation strategy which is particularly relevant if more local infrastructure solutions are developed in response to food production and energy and water supply pressures.

The appropriateness of this type of investigation is not unique to Brisbane. Most major cities in the world grew up around agricultural systems that were buried during the course of development, and it is only now with the awakening of sustainability as an essential ingredient of survival that interest in re-establishing the roots of food production in our cities has become apparent. Examples of urban agriculture are occurring in Scandinavia, Germany, Canada, and the United Kingdom, to name a few, as well as many countries with developing economies, which leads one to be alerted to the possibility of a global network of planning and shared outcomes.

Queensland's community generally views population growth unfavourably, prefers to live in low or medium density residential neighbourhoods, give green space a high priority and are keen to engage with the government in planning for future growth (BCC, 2006). This project challenges us to think differently about the big issues affecting our communities and to test practical ways to integrate innovative approaches into our responses to unmet social needs.

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