



Cities and the Anthropocene: Urban Governance for the New Era of Regenerative Cities.

Journal:	<i>Urban Studies</i>
Manuscript ID	CUS-867-17-10.R1
Manuscript Type:	Special Issue
Discipline: Please select a keyword from the following list that best describes the discipline used in your paper.:	Planning
World Region: Please select the region(s) that best reflect the focus of your paper. Names of individual countries, cities & economic groupings should appear in the title where appropriate.:	Australia, Southeast Asia
Major Topic: Please identify up to 5 topics that best identify the subject of your article.:	Agglomeration/Urbanisation, Built Environment, Environment/Sustainability, Infrastructure, Planning
You may add up to 2 further relevant keywords of your choosing below.:	Regenerative Cities

SCHOLARONE™
Manuscripts

Cities and the Anthropocene: Urban Governance for the New Era of Regenerative Cities

Abstract

The emerging “grand challenges” of climate change, resource scarcity and population growth present a risk nexus to cities in the Anthropocene. This paper discusses the potential that rapid urbanization presents to help mitigate these risks through large-scale transitions *if* future urban development is delivered using evidence-based policies that promote regenerative urban outcomes (e.g. decarbonizing energy, recycling water and waste, generating local food, reclaiming areas for biodiversity). Observations from an Australian case study are used to describe urban governance approaches capable of supporting regenerative urbanism.

The regenerative urbanism concept is associated with macro-scale urban and transport planning that shape different urban fabrics (walking, transit, automobile urban fabric) as the underlying infrastructure of each fabric exhibits different performance, with automobile fabric being the least regenerative. Supporting urban systems based upon regenerative design principles at different scales (macro, meso and micro) can deliver deep and dramatic outcomes for not just reducing impact from the grand challenges but turning them into regenerative change. In combination, these approaches form the cornerstone of regenerative cities that can address the grand challenges of the Anthropocene, while simultaneously improving liveability and urban productivity to foster human flourishing.

Keywords:

Regenerative cities, Anthropocene, regenerative design, urban governance, urban fabrics, urban transitions.

Introduction

Once constructed, urban environments can be slow to change. Buildings typically last for decades and infrastructure such as roads and pipes can last for centuries. Therefore, urban structures should be designed, not only to meet the needs of today, but ideally to meet the social, environmental and economic needs of the long-term future.

However, the long-term future is increasingly uncertain. The world is currently undergoing a period of rapid change, ecologically, socially and economically. Rapid change and uncertainty are associated with the so-called “grand challenges” of climate change, resource scarcity, population growth and social inequity (Bina et al. 2016). The uncertainties presented by the grand challenges tend to be polarizing and lend themselves to fostering fear (Newman et al, 2017); but in times of fear, positive narratives can generate momentum for collective action to deliver a hopeful future (Inayatullah and Milojević 2015). Regenerative cities offer such a narrative.

In keeping with this special issue on Environmental Governance for Urban Resilience in the Asia-Pacific, this paper makes reference to a case study from Australia. Australia is a nation where 89% of the population live in cities, making it one of the most urbanized nations in the world. As developing countries in the Asia Pacific region urbanize, they can perhaps learn from the successes and failures of rapid urbanization as witnessed in Australia and even from new demonstrations taking urban development into a regenerative phase as outlined in this paper.

The Anthropocene

A major topic of consideration in recent years has been the carrying capacity of the planet in light of human impact and the ability of the biosphere to regenerate and to absorb wastes at a pace equal or greater to the pace that resources are used and pollutants generated (Rees and Wackernagel 2008, Rockström et al. 2009; Steffen, Richardson, et al. 2015). The ubiquitous impact of humans upon the biosphere is encapsulated in the term – the Anthropocene (Baccini & Brunner, 2012; Crutzen, 2002; Crutzen & Stoermer, 2000; Ruddiman, Ellis, Kaplan, & Fuller, 2015; Steffen et al., 2011; Steffen, Broadgate, Deutsch, Gaffney, & Ludwig, 2015; Steffen, Crutzen, & McNeill, 2007; Whitmee et al., 2015; Zalasiewicz, Williams, Steffen, & Crutzen, 2010).

Although arguments exist for recognition of the Anthropocene as a legitimate geologic epoch (Waters et al., 2016) this designation is still under debate by the various supporting committees and the ultimate authority on geologic time scales, the International Society of Geologic Sciences (see: Zalasiewicz, Waters, Head, & Castree, 2017). Never-the-less, the use of the term Anthropocene has become synonymous with the threat posed by human activity to planetary systems. Recent writers such as Bonneuil & Fressoz (2016) suggest that , rather than focus on geologic nomenclature, the usefulness of the term Anthropocene is in the opportunity it provides as a way to “rethink our visions of the world” and frame various future oriented narratives (Bonneuil & Fressoz, 2016 p.12). This paper explores the positive future oriented narrative of regenerative cities.

1
2
3
4
5
6
7
8 Numerous dates have been suggested for the commencement of the Anthropocene,
9 including the emergence of agriculture and cities around 10,000 years ago, the colonization of
10 America, or the beginning of the industrial revolution (Bonneuil & Fressoz 2016); but a recent
11 review by Steffen, Broadgate, et al. (2015) suggests a revised start date, around 1945, to coincide
12 with the detonation of the atomic bomb and the exponential resource use driven by rapid
13 industrial, population and economic growth post-WWII based on fossil fuels. This period marks
14 the beginning of the so called 'great acceleration', a concept described in some detail by Steffen,
15 Broadgate et al. (2015). This post-WWII, period also witnessed the wholehearted embrace of
16 Modernist planning and transport agendas in western society, which had been evolving in the
17 Europe and the US over the previous decades (Newman et al, 2017).
18
19
20
21
22
23
24
25
26
27
28

29 If we take 1945 to mark the start of the Anthropocene; then the Anthropocene is
30 synchronous with this widespread uptake of Modernist planning and transportation ideals.
31 This paper addresses the narrative of the Anthropocene as applied to urban planning and the
32 creation of a planning regime being framed to address the failings of this Modernist approach.
33
34
35
36
37

38 Narratives are critically important to urban governance, because it is narratives that form
39 the norms and values of society which, in turn, impact the governance models that shape cities.
40 Over just a few decades in mid to late 20th Century, a dominant Modernist narrative infiltrated
41 all aspects of western society. This paper demonstrates how these values have resulted in
42 unsustainable cities, and conversely, how the adoption of a new regenerative narrative, could
43 shape new regimes and governance models that could support a new era of regenerative cities.
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

A new urban paradigm for the Anthropocene – Regenerative cities

We suggest a successful city in the Anthropocene would be:

- *Regenerative* in that it would be capable of not only offsetting the high consumption patterns of conventional cities but will begin to regenerate parts of the biosphere that have already led to limits being exceeded, and
- *Livable* to ensure that the city continues to offer its opportunities for people to flourish, to provide citizens with security, health, culture and commerce.

Quality of life and livability have long been recognized as factors making cities competitive and attractive for investment and for citizens to create opportunities for their families and communities not available elsewhere. The Sustainable Development Goals (SDG's) are reflecting these livability visions (United Nations 2015b).

Regenerative cities are grounded within a restorative ecological world view (Girardet 2010), they require urban design, urban renewal and circular economy approaches that recognize cities as complex systems dependent upon the local bioregion. As explained below:

The road to regenerative urban development begins with a switch in our thinking so that by-products conventionally considered "waste" can be reframed and reused as resource inputs.

Regenerative cities are productive centers that help to regenerate the materials and resources

1
2
3
4
5
6
7
8 they use and foster a mutually beneficial relationship between urban areas and their
9 surrounding territories (Woo 2014).
10

11
12 Cities are the dynamic centers of commerce and trade, so the sheer scale and volume of
13 goods and material resource flows that they process make them the world's most complex
14 "nexus" of social, political, economic and environmental systems (GIZ and ICLEI 2014). The
15 material needs of cities are supplied by a vast national hinterland and, increasingly, by a global
16 supply chain. The volume of consumption in most cities exceeds the rate at which the local
17 bioregion and global biosphere can regenerate (Rees and Wackernagel 2008). Thus, the
18 management of cities is no longer merely about maintaining a healthy economy to finance
19 material purchases, but rather it must expand to include management of material resource
20 flows and other environmental impacts, local and global whilst continuing to enable human
21 flourishing.
22
23
24
25
26
27
28
29
30
31
32
33

34 Girardet (2010) states that cities will require comprehensive political, financial and
35 technological strategies, grounded in a regenerative paradigm, in order to create an
36 environmentally enhancing, restorative relationship between cities and the ecosystems from
37 which they draw resources. A systems approach to urban development performance and
38 management is needed to achieve this, but integrated approaches are not currently how most
39 siloed government agencies and business structures are organized or funded (Brugmann 2011;
40 GIZ and ICLEI 2014). No single agency is responsible for the urban agenda to coordinate
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 development and sustainability (Fink 2011), and the role of civil society and industry can
9 complement and accelerate sustainability policy.
10

11
12 A number of highly efficient integrated exemplars do exist that demonstrate technological
13 capability to deliver not just sustainable development (reduced impact) but regenerative
14 development (e.g. Europacity (Germany), BedZED (UK), Hammarby Sjöstad (Sweden)).
15
16 However, the reality is that uptake of such initiatives is slow and proportionally small.
17
18 Genuinely regenerative projects are rare and barely a tiny fraction of the global building stock.
19
20
21

22
23 United Nations projections indicate a global population of 9.7 billion by 2050 (United
24 Nations 2015c), if this projection is correct, it will be necessary to build approximately the
25 equivalent of a city for one million every five days (Norman and Reid 2016). These high rates of
26 urbanization coincide with recent changes in international policy direction that could help
27 catalyze a rapid shift toward regenerative urban development.
28
29
30
31
32

33 34 35 36 Changing international policy direction 37

38 The primary impediment to widespread regenerative urban transitions is cultural (Lowe
39 2015). To emerge as a dominant cultural movement requires a strategic transition, a shift that
40 changes culture: inevitably a long-term proposition according to Loorbach (2007). The narrative
41 for cultural transitions has a long history; it is around 30 years since the publication of *Our*
42 *Common Future* (United Nations 1987) but the announcement of the Sustainable Development
43 Goals (SDGs) in September 2015 (United Nations General Assembly 2015) and the “Paris
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 Agreement" (COP21) in December 2015 (United Nations 2015a) may mark the tipping point for
9
10 a societal reframing of sustainability as the cultural mainstreaming of sustainability has
11
12 deepened to a point where it is an imperative politically. However, the pathways to meet the
13
14 objectives of these agreements are not clearly set out, so some possible mechanisms are offered
15
16 below. Sustainable cities, can function as a central plank in addressing the grand challenges of
17
18 climate change, resource scarcity and rapid population growth (Bai, Norman, and Edwards
19
20 2016) but the next agenda will require cities to go beyond this sustainability transition to being
21
22 regenerative (Girardet 2015; Thomson and Newman 2016). This paper suggests how cities can
23
24 scale up such urban transitions to become regenerative.
25
26
27
28
29

30 Urban Transitions

31
32 Considerable literature exists describing the negative impacts that large automobile
33
34 dependent cities have in terms of sustainability (e.g., Newman and Kenworthy 1989, 2015;
35
36 Newman 1999) and livability (e.g., Gehl and Rogers 2013; Matan and Newman, 2017). Our
37
38 previous research explored how cities can work to harness the positive potential of urbanization
39
40 in the Anthropocene to sequester carbon through a range of infrastructural measures (Thomson
41
42 and Newman 2016). Central to this approach is the (infra)structural transition of cities away
43
44 from automobile dependence (Newman and Kenworthy 1999, 2015; Newman and Kenworthy
45
46 2011). These infrastructural measures in turn require new governance systems to optimize
47
48 urban systems to increase regenerative repair whilst also enhancing livability through more
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 human centered urban design outcomes (Thomson and Newman 2016; Thomson, Newton, and
9 Newman 2016).

10
11
12 The two concepts of sustainability and livability, based upon the dominant urban and
13 transport (infra)structures, are intertwined. A sustainable city can also be a more people
14 friendly city – a city that fosters human flourishing. Community or industry leadership has
15 resulted in exemplary sustainable districts such as BedZED, Vauban and various One Planet
16 Community developments (Thomson, Matan, and Newman 2013), the goal is now to push these
17 ideas into a deeply challenging arena of regenerative urbanism.
18
19
20
21
22
23
24
25

26
27 So how might it be possible to shift conventional urban planning and design practice,
28 which typically deliver unsustainable development, to more sustainable practices and then to
29 more regenerative practices? Strong governance will be necessary to shape such a transition.
30
31 The New Urban Agenda, the SDGs, the Paris Agreement, all add policy thrust at a high level
32 but implementation will be difficult unless it is grasped by communities as their agenda and by
33 industry as an opportunity for commercial activity. There is no clear road map and difficulties
34 arise because alternative futures are not systematically structured within existing regimes;
35 rather, the dominant policy and industry actors tend to emphasize short- and mid-term
36 outcomes due to political cycles, individual interests and public pressure (Loorbach 2010).
37
38
39
40
41
42
43
44
45

46 Conflicting agendas and short termism have delayed sustainable urban transitions, and
47 solutions are only just being sketched out for regenerative urbanism. Never the less there are
48 some exemplars that demonstrate it is possible to be regenerative in terms of energy, water,
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 food and biodiversity within cities (Woo 2014; Newman et al, 2017). But these examples are the
9
10 exceptions rather than the rule. Most regenerative developments are rarely larger than the
11
12 community and occasionally may be as large as a district; to shift from niche to mainstream
13
14 requires a radical rethink of urban fabric.
15
16
17
18

19 The transformative role of urban fabric

20
21 The theory of urban fabrics (Newman and Kenworthy 1999, Newman, Kosonen and
22
23 Kenworthy 2016) shows how transportation systems create city form and function. The ideas
24
25 basically demonstrate how three dominant underlying transport infrastructures – walking,
26
27 transit, and automobile-based urban fabrics – result in different urban morphologies with
28
29 differing urban qualities including sustainability and livability performance. This analysis can
30
31 now be applied to the regenerative urbanism agenda as it shows that there are deep and
32
33 dramatic differences in the consumption patterns of the three fabrics and hence they can be a
34
35 focus of how we can change in a deep and dramatic way to being regenerative in our cities. The
36
37 difference between walking and transit fabrics is orders of magnitude less than that of
38
39 automobile fabric in most cities (Thomson and Newman, 2017; Newman, Kosonen, and
40
41 Kenworthy 2016)).
42
43

44 It is worth noting that the majority of urban areas within Australia were built post-1945
45
46 following large population growth (from 7.5 million in 1945 to 24 million in 2014 (ABS, 2014)),
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 urban and transport planning over that period has faithfully followed Modernist principles,
9
10 making Australia an ideal location to observe the performance of automobile fabric.

11
12 Our earlier work (Thomson and Newman 2017) examined the metabolism of Perth based
13
14 on its three urban fabrics and revealed that there is a vast difference in the resource
15
16 consumption patterns in the three urban fabrics; not only in relation to fuel for transport but
17
18 also in relation to basic raw materials (BRM) such as sand, gravel and clay as a result of greater
19
20 infrastructure requirements and reduced shared surfaces (e.g., party walls). The circles in Figure
21
22 1 represent the proportional BRM in tonnes / capita for each fabric in the case study. It was
23
24 observed that business as usual (BAU) automobile fabric in Perth was almost twice as inefficient
25
26 in terms of material consumption as fabric in the denser walking parts of the city. Scenarios
27
28 looking at further improvements offered through the application of Technology and
29
30 Construction Innovation (TCI), such as prefabricated building, to reduce material waste and
31
32 construction, suggest that per capita basic raw material input could be reduced by almost 20
33
34 times that of typical automobile urban fabric without TCI.
35
36
37
38
39

40 [INSERT Figure 1.]
41

42 Figure 1: Perth's basic raw material demand in terms of three urban fabrics plus Technology and
43
44 Construction Innovation (TCI) Source: Thomson and Newman 2017.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 It is expected that walking and transit urban fabrics have far less negative environmental
9
10 impact (in most areas of resource consumption) than automobile fabric in all cities as the
11
12 evidence on walking and transit fabrics being generically lower in energy use is powerful
13
14 (Newman and Kenworthy 1989, 1999, 2015)).
15

16
17 The Perth study shows how the Modernist planning ideas that have perpetuated urban
18
19 sprawl have resulted in a less sustainable urban form in a city where climate, culture and other
20
21 variables remain the constant. It demonstrates how underlying values (the various transport
22
23 and planning manuals of Modernism) can deliver different urban fabrics with different
24
25 performance.
26

27
28 The larger footprint of sprawling automobile urban fabric displaces food producing
29
30 agricultural land and ecologically valuable land to accommodate urban development as cities
31
32 grow (Seto, Güneralp, and Hutyrá 2012). While automobile dependent urban areas themselves
33
34 are suboptimal due to: higher transport emissions (Newman and Kenworthy 1989); higher
35
36 embodied energy and carbon emissions due to greater material volumes (Gardner and
37
38 Newman 2013); additional costs due to increased infrastructure lengths and traffic congestion
39
40 (Dodson and Sipe 2006; Trubka, Newman, and Bilsborough 2010); lower social interaction
41
42 including increased social isolation due to lower population density (Buys et al. 2012), more
43
44 obesity, increased road fatalities, and higher local air pollution levels (Ewing, Pendall, and Chen
45
46 2003),
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 The inefficiencies of automobile fabric make it an inappropriate building block for the cities
9
10 of the Anthropocene. However, the converse is true, by building more walking and transit
11
12 fabric it is possible to deliver profound enhancements in urban performance – both
13
14 environmentally and socially. Simply substituting electric vehicles for hydrocarbon fuelled
15
16 vehicles is not enough. There are many structural considerations embedded in the
17
18 infrastructure of a city's urban fabric; transport fuel is important, but not enough to address
19
20 many other aspects of regenerative urbanism in a holistic and integrated way.
21
22
23
24

25 A central tenet of urban governance in the Anthropocene is the need to minimize
26
27 automobile fabric in favor of walking and transit urban fabrics.
28
29
30
31

32 Incorporating regenerative design principles into urban planning 33 34 35

36 Regenerative design principles can address many of the functional aspects of a city seeking
37
38 to maximize human flourishing and livability whilst radically reducing ecological footprint.
39

40 Additional principles to underpin urban governance for regenerative cities might include:
41
42
43
44

- 45 • **Prioritize renewable energy and storage.** Energy can become regenerative if
46
47 the fuel used to build and operate buildings and build and run transport is
48
49 renewable and is greater than is actually being consumed by the city and thus
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 can be used to help power and fuel the surrounding bioregion. This is likely to
9 occur through renewably-powered electric systems in buildings and transport
10 as well as renewable-gas (Green and Newman, 2017; Newman et al 2017).
11
12
13

- 14 • **Build integrated water systems.** Water can be collected at source within a city,
15 and grey water and black water can be recycled and used to help regenerate
16 aquifers and water bodies in the bioregion (Gandy 2004; Nair et al. 2014). This
17 can be done with current technologies (BioRegional 2009, 22–33).
18
19
20
21
22
- 23 • **Consider waste as a resource.** Waste can be reduced to very small amounts but
24 not regenerated unless very large amounts of energy are used due to
25 thermodynamic limitations. However, the return of carbon, phosphorus,
26 nitrogen and other trace elements to surrounding soils in the bioregion can be
27 achieved, for example, through compost systems at the local or neighborhood
28 or even regional level (Newman and Jennings 2008).
29
30
31
32
33
34
- 35 • **Maximize biodiversity and open space.** Biodiversity can become regenerative
36 if it is built into every part of the urban fabric, including the new technologies
37 of green roofs and green walls. Bioregional needs for biodiversity can be
38 assisted by the city with its different structural habitats and intensive human
39 power (e.g. through gardening, urban agriculture and urban biodiversity
40 conservation) (see Davison and Kirkpatrick 2013; Beatley 2009, 2011; Newman
41 and Jennings 2008; Newman and Matan 2013; Newman 2014; Dramstad, Olson,
42 and Forman 1996; Forman and Godron 1986; Soderlund and Newman 2015).
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- **Integrate sequestration.** Increasingly, the potential of sequestration mechanisms capable of actively “scrubbing” CO₂ from the atmosphere is being demonstrated. Mechanisms include increasing biomass sequestration (cf. biodiversity above); building or otherwise incorporating third way materials for example, bio-char or carbon sequestering rocks in urban infrastructure (see Flannery 2015); the large-scale incorporation of biogenic materials, for example, cross laminated timber, into building design (see Thompson and Waugh 2009); the redesign of cities for low carbon and carbon sequestering activity (see Fink 2013; Thomson and Newman 2016).
- **Monitor performance.** Critically the efficacy of new governance measures and policies must monitor and measure performance against regenerative design principles such as those outlined above.

The question remains how can this be done on a scale that matters? The rest of this paper will set out some policy directions for governance at different scales that appear to provide the best options for achieving regenerative urbanism.

Transforming different scales of urban fabric

At any stage in a city’s history the patterns of land use can be changed and opportunities can be taken to transform the urban fabric. It is possible to greatly improve the regenerative urban performance of low density areas within a city by rebuilding automobile urban fabric

1
2
3
4
5
6
7
8 with higher density transit and walking fabric that can service the surrounding car-based
9 suburbs.
10

11
12
13
14 Different parts of the city present different opportunities and scale of impact when
15 considering regenerative urban transition potential. These shifts may be described in terms of
16 macro, meso and micro scales.
17
18
19
20
21
22
23

24 Macro scale

25
26
27

28 The macro scale takes in the whole urban area or large parts of a city region.
29

30 Historical patterns for car-based sprawl that emerged in the second half of the 20th century
31 can no longer be sustained, not simply from a sustainability perspective, but also from
32 economic and social perspectives (Newman and Kenworthy 2015). So how can they be re-
33 imagined as part of a regenerative urbanism?
34
35
36
37
38
39
40

41 As cities grow and the mean exposure time to travel extends beyond a 30-minute commute
42 (an hour a day) known as the Marchetti constant (Marchetti 1994), the urban system tends to
43 become dysfunctional. This appears to be happening to automobile urban fabric across the
44 world (Newman and Kenworthy 2015). The dysfunctional nature of cities tends to have the
45 greatest negative impact in terms of lost productivity, stress and cost (related to fuel) on the
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 citizens with the longest commute, who also tend to be from lower socioeconomic
9
10 demographics (Dodson and Sipe 2006). Thus, changing cities to be less car dependent will
11
12 improve their livability as well as their impacts on the planet.
13
14
15

16
17 Urban infrastructure can change this by improving travel times through mode changes and
18
19 through land use change. In larger cities, the most efficient mode for travelling longer distances
20
21 is rail, which is now faster than private vehicle travel times in most larger cities (Newman,
22
23 Kenworthy, and Glazebrook 2013). However perhaps the most important element that can be
24
25 created by bringing fast rail into automobile fabric is the provision of dense urban centers or
26
27 TODs around stations which can create opportunities for local jobs, local services and local
28
29 community not available in the privatized spaces of automobile city fabric. This is becoming
30
31 even more possible with the new technology of 'local shared mobility' that can mean car-free
32
33 areas around rail stations as demand-responsive services provide 'last mile' connections
34
35 (Glazebrook and Newman, 2018).
36
37
38
39

40 In response, some larger cities are introducing planning policies that encourage the
41
42 integration of land use planning and transport that can create such opportunities. This involves
43
44 a shift from monocentric "hub-and-spoke" cities, with a central business district surrounded by
45
46 dormitory suburbs, to polycentric cities with multiple activity centers (Moir, Moonen, and Clark
47
48 2014). To improve transport speeds and efficiency, polycentric city activity centers or TODs are
49
50 often built around transit hubs such as heavy or light rail stations (Curtis and Scheurer 2010;
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 Newman and Kenworthy 2011; Scheurer and Curtis 2008; Thomson, Newton and Newman,
9
10 2016). The demand for such centers is now so great it is possible to use private finance in land
11
12 development to fund new rail lines deep into automobile dependent fabric.
13
14
15
16

17 Integrating transit and land use around urban finance. 18 19 20 21

22 In order to build such combinations of urban rail and TODs around stations that enable
23
24 automobile fabric to be transformed, there is a need to enable urban finance to be redirected
25
26 from primarily funding automobile fabric through high capacity roads to urban rail integrated
27
28 with land development. Such an approach is outlined by Newman, Davies-Slate and Jones
29
30 (2017) as the entrepreneur rail model and is the model used by Japan and Hong Kong to build
31
32 rail lines. This approach recognizes that there is now a major demand both for new rail lines
33
34 and new urban centres or TOD's that minimize automobile dependence. It suggests that only by
35
36 tapping the ability of private enterprise to identify the best sites for urban redevelopment will it
37
38 be possible to bring private capital such as pension funds into long term investment for the
39
40 long-term future of cities. The model uses private capital to finance urban transformation but is
41
42 best done in partnership with public planners who can identify the corridors that enable the
43
44 most public good when provided with a rail and multiple TOD opportunities. The model
45
46 permits low density areas to be transformed into high density public transport corridors, with
47
48 "value capture" from the redeveloped sites to fund the adjacent rail infrastructure. Value
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 capture is a tried and tested policy and has been successful in the delivery of infrastructure such
9 as rail or district energy in many locations (McIntosh, Trubka, and Newman 2014; Mittal 2014).
10 Value capture offers a financial tool for the transformation of automobile fabric into more
11 regenerative transit urban fabric punctuated by a collection of higher density mixed use cellular
12 communities – “precincts”, “districts” and “neighborhoods”.
13
14
15
16
17
18
19
20

21 Meso scale

22
23
24
25
26 Meso scale development includes precinct (district or neighborhood) level development,
27 which may involve housing and public infrastructure (e.g., roads, open space, utilities).
28 Comprehensive precinct scale development may present the greatest opportunity for meeting
29 regenerative urbanism and livability needs. This is because the precinct scale allows for the
30 coordination and economic feasibility of shared eco-infrastructure – localized solutions versus
31 centralized solutions are a major issue in future planning as many sustainability solutions,
32 particularly infrastructure (e.g. distributed energy, sustainable transport, water sensitive urban
33 design) are local in scale (Bunning et al. 2013; Green and Newman 2017; Newton et al. 2011;
34 Rauland and Newman 2015). Infrastructure integration at the precinct scale can improve
35 efficiencies and provide opportunities for a more holistic approach to urban environments
36 (Newton 2014; Newton, et al. 2012).
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 Precincts are also the scale of community and as such present the optimal scale for
9
10 community involvement in shared decision making. Precincts can reduce long term operating
11
12 costs, and importantly can grow a local green economy from the construction, management and
13
14 maintenance of distributed eco-infrastructure to foster an engaged citizenry; it is even possible
15
16 to see 'citizen utilities' emerging from the rapid growth of solar PV, batteries and blockchain-
17
18 based Peer-to-Peer trading (Green and Newman, 2017).
19

20
21
22
23 Perhaps most importantly, in terms of delivery, the precinct is the scale at which land
24
25 development takes place. Precinct scale development permits the integrated planning of
26
27 buildings, open space and infrastructure, and as such is the ideal scale for shaping the quality of
28
29 the built environment in terms of regenerative performance (Sharifi and Murayama 2013) and
30
31 livability (Carmona et al. 2012).
32

33
34
35
36 The smaller scale of the precinct versus the city allows for greater planning control and
37
38 community engagement through more focused governance and management to oversee
39
40 development outcomes and to prototype new models and replicate those that are most
41
42 successful.
43

44
45
46 Precincts are the building blocks of cities (Rohe 2009; Newton et al. 2011), as such,
47
48 regenerative precincts can function as transitional, decentralized, semi-autonomous, cellular
49
50 units. A city comprised of a series of semi-autonomous units is more resilient (as the risk of
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 shocks are distributed across the network) and can incrementally work towards an aspirational
9
10 regenerative city end state. A new development in Perth, Australia, called WGV (White Gum
11
12 Valley) is demonstrating elements of regenerative urbanism at a precinct scale. It has solar and
13
14 batteries that enable it to export renewable power to the grid through a 'citizen utility', it has
15
16 water sensitive design that enables it to be almost free of mains water, and it has a range of
17
18 social housing opportunities and community engagement that have made it highly desirable as
19
20 a place to live (Green and Newman, 2017; Josh Byrne & Associates 2016). The project was
21
22 extremely popular among buyers and renters and now many developers want to copy the new
23
24 'regenerative' formula, indicating how rapid change can be seeded by such precinct scale
25
26 development (Wiktorowicz et al, 2018).
27
28
29
30
31

32 Micro scale

33
34
35

36
37 Micro scale, in the context of cities, relates to the piecemeal transformation of individual
38
39 plots. Although important, this is the least effective means of transformation. However, if small
40
41 transformations occur *en masse*, it may be possible to achieve massive small change that is
42
43 capable of harnessing the collective power of many small actions (Campbell 2011). This has
44
45 been observable in the remarkable growth of roof-top solar in recent years which is disrupting
46
47 traditional grids and creating the possibility of micro-grids with peer-to-peer trading that can
48
49 enable whole areas to be exporting green energy and hence becoming regenerative (Green and
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 Newman 2017). The household solar photovoltaic revolution in Perth, Australia, shows that
9 collectively household solar which in 7 years went from almost nothing to being 30% of
10 household rooftops is now effectively the biggest power station in the state of Western
11 Australia, and projections suggest this figure could grow to 50% of rooftops by 2020 (Clover
12 2016). There are now periods when rooftop solar is producing more power than the base-load
13 coal-fired power stations and hence a way forward to rapidly phasing them out is now
14 appearing, without this being driven by a plan; it will need a continuing partnership between
15 households who are buying the solar PV (and batteries for storage), precinct scale management
16 and broader scale governance to ensure the grid is stable and available for everyone. This
17 integration of governance scales illustrates the potential for one element of the regenerative city,
18 renewable power, to become a model for how other elements can be demonstrated as well.
19
20
21
22
23
24
25
26
27
28
29
30

31 The distributed and decentralized nature of the internet can help such models flourish, be
32 shared and replicated through such software technology as blockchain which are rapidly being
33 adopted to provide shared, trustworthy information that can respond immediately to demand
34 (Green and Newman 2017).
35
36
37
38
39
40

41 Discussion of scales

42
43

44 Each scale has its relative advantages and disadvantages. At the micro scale it is possible to
45 have the greatest control over the product as it is usually in single ownership. It may be easier
46 to deliver a regenerative building and there are examples, and models (e.g., the Living Building
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 Challenge (2014)) that demonstrate how this can be done. Site planning at the micro scale is the
9
10 typical model in many parts of the western world.
11
12
13

14 However, the opportunity for system integration greatly increases at the larger meso, and
15
16 macro, scale. At the macro city scale, large transport infrastructure projects (e.g. urban rail) will
17
18 have a very strong influence on the urban fabric that will develop around these infrastructures,
19
20 which in turn influence regenerative urban performance and livability at all scales below it.
21
22 Similarly, comprehensive precinct planning at the meso scale allows for the coordinated
23
24 delivery of social infrastructure and distributed infrastructures to deal with transport, energy,
25
26 water and waste.
27
28
29
30

31 The greatest potential for regenerative outcomes result from meso or macro scale urban
32
33 development that accommodate growth within a city's existing footprint and can replace
34
35 automobile urban fabric. Concentrating higher density urban growth in redevelopment areas
36
37 around new urban rail can offset the need for fringe land to accommodate a city's population
38
39 increase. The larger the scale of development (i.e. plot<block<precinct) the greater the
40
41 opportunity to coordinate physical and social infrastructure and even incorporate new local
42
43 distributed infrastructure such as solar energy, water sensitive design and waste recycling
44
45 systems as part of transit oriented designs.
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 While the macro-scale presents the greatest opportunity for rapid change, it is also the
9 most disruptive to existing communities. The creation of large centralized systems tends to
10 reduce opportunities for citizen engagement, for this reason it is critical that affected
11 communities (including future residents where possible) are involved in the decision-making
12 process. Deliberative democracy approaches directly involve the community in decision
13 making processes so that change is not just done to the community, but rather is driven by the
14 community (Gollagher and Hartz-Karp 2013; Hartz-Karp 2007). Models for macro scale urban
15 transformation such as the entrepreneur rail model (Newman et al. 2017) need community
16 support. In Portland, Oregon the transformation of the Pearl District through an infrastructure
17 led redevelopment program was funded through an entrepreneurial rail project and value
18 capture (TriMet 2015). Supporting this strategy was strong leadership by the City of Portland,
19 which had the mandate from the community through the city vision, which included a compact
20 city enforced by maintaining a long standing urban growth boundary, integrated land use
21 planning laws for high density development and an expanded network of transit (VisionPDX
22 2007).

41 Management, maintenance and operation

42
43
44 Delivery of new distributed regenerative-infrastructures will require new forms of urban
45 governance including ongoing management and maintenance that collectively have the
46 capacity to build a local green economy (Truffer and Coenen 2012; UNEP 2013). Regular
47 monitoring of urban regenerative performance through the use of urban metabolism (resource
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 inputs and waste outputs, see Thomson and Newman, 2017) as an analytical tool will help
9
10 ensure iterative design approaches that identify points in the urban system that are suboptimal,
11
12 thus highlighting the best locations for improvement.
13
14
15

16
17 Consistent measurements are not commonly used but they are required to provide a
18
19 common lexicon for urban regenerative performance comparison and coordination (Fink 2011;
20
21 Rauland and Newman 2015). However, this may change following the development of
22
23 consistent urban regenerative measurements proposed by the International Standards
24
25 Organization – *Sustainable Development in Communities* (ISO 2016) to enable comparison and
26
27 rolling up of metrics, between jurisdictions and through the tiers of government. A
28
29 standardized reporting structure will be essential for intercity and international knowledge
30
31 sharing exercises such as those that now occur between cities involved in C40, 100 Resilient
32
33 Cities and ICLEI.
34
35
36
37

38 Cities are always changing. Change may be slow in some cases, particularly when
39
40 considering the underlying infrastructure of roads, rail and underground services. However,
41
42 rapid urbanization, is putting pressure on some cities to redevelop. It is important that the right
43
44 kind of development occurs. The new evidence of decoupling may indicate that a major change
45
46 in global footprint could now be underway (Newman, 2017). New evidence from Shanghai and
47
48 Beijing show that decoupling of GDP from car use is well underway as the new growth in
49
50 mobility is around the Metro and the dense urban fabric associated with this (Gao and
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 Newman, 2018). But to ensure this has any hope of becoming a powerful new mainstream trend
9
10 will require the world's cities to operate under a new urban paradigm. To recast the trajectory
11
12 of cities will require a major change in education, governance processes, planning practice and
13
14 political leadership. This paradigm must be regenerative urbanism.
15

16
17 A regenerative urbanism requires integrated policy bundling, and ideally, the proliferation
18
19 of supportive entrepreneurial models for governance and finance across a range of scales such
20
21 as:

- 22
- 23 • value capture to fund public infrastructure (Newman et al. 2017),
- 24
- 25 • citizen utilities to provide power and other services (Green and Newman 2017)
- 26
- 27 and
- 28
- 29 • local funding mechanisms to manage, monitor and maintain supporting
- 30
- 31 regenerative-infrastructure and green enterprise initiatives (Rauland and
- 32
- 33 Newman, 2015; Newman et al 2017).
- 34

35
36 Once underway it will require constant vigilance and system evaluation to ensure the
37
38 required outcomes are happening.

39
40 For much of the past century Modernist planning paradigms have influenced planning
41
42 policy based upon architectural fashion and market preference based on automobile urban
43
44 fabric, but research indicates that as cities grow ever larger this is to the detriment, not only of
45
46 environmental performance, but also livability (Calthorpe 2010; Carmona et al. 2012; Gehl and
47
48 Svarre 2013; Jacobs 1989). Increasingly sophisticated flows of information, especially digital
49
50

1
2
3
4
5
6
7
8 information, has the potential to help disseminate feedback to the right people in a timely
9
10 manner to support regenerative urban transitions and maintain or improve quality of life.

11
12 Local development decisions need to feed into larger regenerative city plans and a global
13
14 network of regenerative cities if urbanization is to be harnessed as a potential solution to
15
16 reduce, and then reverse an excessive ecological footprint.
17
18

19 20 Conclusions

21
22
23 The cumulative messaging of the Paris Agreement, the Sustainable Development Goals
24
25 and the New Urban Agenda may herald a global shift in culture to help facilitate the delivery of
26
27 more sustainable and resilient cities but this paper suggests it must go beyond this to produce
28
29 regenerative cities. The transition towards this future oriented narrative of regenerative
30
31 urbanism is only just beginning to be mapped out but there is enough evidence to believe it
32
33 may be possible to achieve (Thomson and Newman 2016).
34
35
36
37

38 The use of evidence-based policy is critical to meeting the objectives of these high-level
39
40 international policies. Evidence based policy should shape strong planning. As this paper has
41
42 discussed, strong planning and monitoring of urban environments can shape more
43
44 regenerative, productive and livable development outcomes. Hall (2013) refers to the “lost art of
45
46 urbanism” as being at the heart of many urban issues and it would appear to be highly relevant
47
48 to this new regenerative urbanism agenda. Strong planning does not imply that it should be
49
50 dictated in a non-democratic way, it means having clear objectives that inform every step of the
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 planning process and tapping the entrepreneurial and community-based local knowledge so
9
10 critical at smaller scales of urban activity. The opportunity presented by strong planning is to
11
12 enable the fundamentals of regenerative urbanism to inform the whole planning system. This is
13
14 not unlike the way that Modernism and car-based planning infiltrated every area of planning to
15
16 create the dominance of automobile urban fabric in most global cities; it is possible with 'peak
17
18 car' that we are on the edge of a similar transformative urban change (Newman and Kenworthy
19
20 2015; Newman, Beatley and Boyer, 2017). Emerging trends discussed in this paper are showing
21
22 potential demand that could create exponential changes.
23
24

25 The regenerative urbanism agenda will need to proceed at various scales in urban
26
27 development. Precinct scale development can deliver regenerative outcomes because it permits
28
29 a comprehensive approach to planning that allows for the integration of urban elements.
30
31 However, not all precincts are equal in their ability to demonstrate regenerative urbanism, even
32
33 if they superficially appear so (e.g., have a similar density, look and feel). Performance metrics
34
35 and indicators can be used to determine where best to focus attention for improvement and to
36
37 identify the best exemplars from which to learn. Performance is strongly influenced by physical
38
39 design including urban fabric, site layout and urban systems (e.g., transport, energy, water,
40
41 waste, biodiversity) integration. Similarly, the other scales of physical design in cities also have
42
43 an impact upon the livability of a place, from regional corridors to the whole of city perspective.
44
45 Regenerative design of cities at all scales is critical to both their environmental performance and
46
47 quality of life – both impact upon the ability of humans to flourish.
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8 To be successful in the risk nexus presented by the Anthropocene, cities and the
9
10 governance that shapes them will need to be open to monitoring, modification and continuous
11
12 improvement. In such a governance environment, cities of the Anthropocene have the potential
13
14 to regenerate the biosphere and promote human flourishing.
15
16
17
18
19

20 Acknowledgements

21

22
23 The Authors would like to thank the National University of Singapore, Asia Research
24
25 Institute for the invitation and financial support to attend their March 2017 Workshop on
26
27 Resilient Cities: Environmental Governance for Human Flourishing in Urbanising Asia and the
28
29 Pacific, where the nucleus of this paper was developed. Thanks are also due to the peer
30
31 reviewers for their thoughtful and constructive comments, which have been incorporated to the
32
33 benefit of the final paper.
34
35
36
37
38
39

40 References

41

- 42
43 Bai X, Norman B, and Edwards P (2016) "Navigating through the Urban Age®: Principles
44
45 Navigating through the Urban Age®: Principles and Innovations." *Solutions* 7(May): 55–62.
46
47 Beatley, T (2011) *Biophilic Cities: Integrating Nature Into Urban Design and Planning*. Washington,
48
49 D.C.: Island Press.
50
51 Beatley, T (2009) "Biophilic Urbanism: Inviting Nature Back to Our Communities and Into Our
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Lives." *William & Mary Environmental Law & Policy Review* 34(1): 209–38.
- 10 Bina O, Mateus S, Pereira P, and Caffa A (2016) "The Future Imagined: Exploring Fiction as a
11 Means of Reflecting on Today's Grand Societal Challenges and Tomorrow's Options."
12 *Futures*. <http://dx.doi.org/10.1016/j.futures.2016.05.009>.
- 13
14
15
16 BioRegional (2009) *BedZED: Toolkit Part II A Practical Guide to Producing Affordable Carbon*
17 *Neutral Developments*. London, UK.
- 18
19
20 Bonneuil C and Fressoz J (2016) *The Shock of the Anthropocene: the Earth, history and us*.
21 London, UK. Verso.
- 22
23
24 Brugmann J (2011) *Financing the Resilient City: A Demand Driven Approach to Development,*
25 *Disaster Risk Reduction, and Climate Adaptation*. Bonn, Germany.
- 26
27
28 Bunning J, Beattie C, Rauland V and Newman P (2013) "Low-Carbon Sustainable Precincts: An
29 Australian Perspective." *Sustainability* 5(6): 2305–26. [http://www.mdpi.com/2071-](http://www.mdpi.com/2071-1050/5/6/2305/)
30 [1050/5/6/2305/](http://www.mdpi.com/2071-1050/5/6/2305/).
- 31
32
33 Burdett R and Sudjic D (2010) *The Endless City: The Urban Age Project by the London School of*
34 *Economics and Deutsche Bank's Alfred Herrhausen Society*. London, UK. Phaidon Press.
- 35
36
37 Buys L, Snow S, van Megen K and Miller E (2012) "Transportation Behaviours of Older Adults:
38 An Investigation into Car Dependency in Urban Australia." *Australasian Journal on Ageing*
39 31(3): 181–86.
- 40
41
42
43 Calthorpe P (2010) *Urbanism in the Age of Climate Change*. Washington, D.C.: Island Press.
- 44
45 Campbell K (2011) *Massive Small: The Operating Programme for Smart Urbanism*. London, UK:
46 Urban Exchange.
- 47
48
49 — — — (2016) "Massive Small Declaration." *Massive small*. London, UK
50 <http://www.massivesmall.com/declaration/> (November 25, 2016).
- 51
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Carmona M, Heath T, Oc T and Tiesdell S (2012) *Public Places - Urban Spaces*. London, UK:
10 Taylor & Francis.
11
12 City of Melbourne (2012) "Urban Forest Strategy: Making a Great City Greener 2012-2032." : 68.
13
14 https://www.melbourne.vic.gov.au/Sustainability/UrbanForest/Documents/Urban_Forest_
15
16 [Strategy.pdf](https://www.melbourne.vic.gov.au/Sustainability/UrbanForest/Documents/Urban_Forest_).
17
18 Clover, I (2016) "Western Australia's Rooftop Solar Now State's 'biggest Power Station.'" *Reneweconomy*. [http://reneweconomy.com.au/western-australias-rooftop-solar-now-states-](http://reneweconomy.com.au/western-australias-rooftop-solar-now-states-biggest-power-station-27206/)
19
20 [biggest-power-station-27206/](http://reneweconomy.com.au/western-australias-rooftop-solar-now-states-biggest-power-station-27206/).
21
22
23
24 Crutzen, P (2002) "Geology of Mankind." *Nature* 415(January): 23.
25
26 Curtis C and Scheurer J (2010) "Planning for Sustainable Accessibility: Developing Tools to Aid
27
28 Discussion and Decision-Making." *Progress in Planning* 74(2): 53–106.
29
30 Davison A and Kirkpatrick J (2013) "Re-Inventing the Urban Forest: The Rise of Arboriculture
31
32 in Australia." *Urban Policy and Research* 32(2): 145–62.
33
34 <http://www.tandfonline.com/doi/abs/10.1080/08111146.2013.832669>.
35
36 Dodson J and Sipe N (2006) "Suburban Shocks®: Assessing Locational Vulnerability to Rising
37
38 Household Fuel and Mortgage Interest Costs." In *29th Australasian Transportation Research*
39
40 *Forum*, Gold Coast, Queensland.
41
42 Dramstad W, Olson J and Forman R (1996) *Landscape Ecology Principles in Landscape Architecture*.
43
44 Washington, D.C.: Harvard University Graduate School of Design, Island Press, American
45
46 Institute of Landscape Architects.
47
48 Ewing R, Pendall R, and Chen D (2003) "Measuring Sprawl and Its Transportation Impacts." *Journal of the Transportation Research Board* 1831:10 (3): 175–83.
49
50
51 Fink J (2011) "The Case for an Urban Genome Project: A Shortcut to Global Sustainability." *The*
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 *Bridge, Linking Engineering and Society* 41(1).
- 10 Fink J (2013) "Geoengineering Cities to Stabilise Climate." *Proceedings of the ICE - Engineering*
11
12 *Sustainability* 166(5): 242–48.
13
14 <http://www.icevirtuallibrary.com/content/article/10.1680/ensu.13.00002>.
- 15
16 Flannery T (2015) *Atmosphere of Hope: Solutions to the Climate Crisis*. Penguin Books Limited.
- 17
18 Forman R and Godron M (1986) *Landscape Ecology*. Wiley. New York, NY
- 19
20 Gandy M (2004) "Rethinking Urban Metabolism: Water, Space and the Modern City." *City* 8(3):
21
22 363–79.
- 23
24 Gardner H and Newman P (2013) *Reducing the Materials and Resource Intensity of the Built Form in*
25
26 *the Perth and Peel Regions*. Curtin University Sustainability Policy (CUSP) Institute. Perth,
27
28 Australia.
- 29
30 Gehl J and Rogers R (2013) *Cities for People*. Island Press. Washington DC.
- 31
32 Gehl J and Svarre B (2013) *How to Study Public Life*. Island Press. Washington DC.
- 33
34 Girardet H (2015) *Creating Regenerative Cities*. Routledge. London, UK.
- 35
36 Girardet H (2010) *Regenerative Cities*. Hamburg, Germany. www.worldfuturecouncil.org.
- 37
38 GIZ and ICLEI (2014) *Operationalizing the Urban NEXUS: Towards Resource Efficient and Integrated*
39
40 *Cities and Metropolitan Regions*. Eschborn, Germany.
- 41
42 Glazebrook G and Newman P (2018) "The City of the Future" *Urban Planning* 3(2): 1-20.
43
44 [10.17645/up.v3i2.1247](https://doi.org/10.17645/up.v3i2.1247)
- 45
46 Goa Y and Newman P (2018) "Beijing's Peak Car Transition: Hope for Emerging Cities in the
47
48 1.5°C Agenda" *Urban Planning* 3(2): 82-93. [10.17645/up.v3i2.1246](https://doi.org/10.17645/up.v3i2.1246)
- 49
50 Gollagher M, and Hartz-Karp J (2013) "The Role of Deliberative Collaborative Governance in
51
52 *Achieving Sustainable Cities.*" *Sustainability (Switzerland)* 5(6): 2343–66.
- 53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Green J and Newman P (2017) "Citizen Utilities: The Emerging Power Paradigm. A Case Study
10 in Perth, Australia" *Energy Policy* 105: 283–293
11
12 Hajer M (2011) *The Energetic Society*. The Hague, The Netherlands.
13
14 Hall P (2013) *Good Cities, Better Lives: How Europe Discovered the Lost Art of Urbanism*. New York,
15 NY: Routledge.
16
17
18 Hartz-Karp J (2007) "How and Why Deliberative Democracy Enables Co-Intelligence and
19 Brings Wisdom to Governance How and Why Deliberative Democracy Enables Co-
20 Intelligence and." *Journal of Public Deliberation* 3(1).
21
22 <http://www.publicdeliberation.net/jpd/vol3/iss1/art6>.
23
24
25
26 Inayatullah S and Milojević I (2015) *CLA 2.0 Transformative Research in Theory and Practice*. eds. S
27 Inayatullah and I Milojević. Tamkang University Press. Taipai, Taiwan
28
29
30 ISO (2016) *INTERNATIONAL STANDARD Sustainable Development in Communities —*
31 *Management System for Sustainable Development*. Switzerland.
32
33
34 Jacobs J (1989) *The Death and Life of Great American Cities*. New York, NY: Vintage.
35
36 Josh Byrne & Associates (2016) *WGV Waterwise Development Exemplar 2015 / 16 Partner Update*.
37 Fremantle, Australia.
38
39
40 Landry C and Burke T (2014) *The Fragile City and the Risk Nexus*. Comedia Publications Limited.
41 Stroud, UK.
42
43
44 Living Building Challenge (2014) "Living Building. A Visionary Path to a Regenerative Future."
45 *Living Building Challenge 3.0. A Visionary Path to a Regenerative Future*. [http://living-](http://living-future.org/sites/default/files/reports/FINAL_LBC_3_0_WebOptimized_low.pdf)
46 [future.org/sites/default/files/reports/FINAL_LBC_3_0_WebOptimized_low.pdf](http://living-future.org/sites/default/files/reports/FINAL_LBC_3_0_WebOptimized_low.pdf).
47
48
49 Loorbach D (2007) *Transition Management: New Mode of Governance for Sustainable Development*.
50 Utrecht: International Books.
51
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Loorbach D (2010) "Transition Management for Sustainable Development: A Prescriptive,
10 Complexity-Based Governance Framework." *Governance, An International Journal of Policy,*
11 *Administration, and Institutions.* 23(1): 161–83. 10.1111/j.1468-0491.2009.01471.x.
12
13
14 Lowe I (2015) "Causal Layered Analysis, Climate Change and Limits to Growth." In *CLA 2.0 -*
15 *Transformative Theory in Research and Practice*, eds. S Inayatullah and I Milojević. Taipei,
16 Taiwan: Tamkang University Press, 109–22.
17
18
19
20 Matan A and Newman P (2016) *People Cities. The Life and Legacy of Jan Gehl.* Island Press.
21 Washington, USA.
22
23
24 Marchetti C (1994) "Anthropological Invariants in Travel Behavior." *Technological Forecasting*
25 *and Social Change* 47: 75–88.
26
27
28 McIntosh J, Trubka R and Newman P (2014) "Can Value Capture Work in a Car Dependent
29 City? Willingness to Pay for Transit Access in Perth, Western Australia." *Transportation*
30 *Research Part A: Policy and Practice* 67: 320–39.
31
32 <http://www.sciencedirect.com/science/article/pii/S0965856414001736>.
33
34
35 Mittal J (2014) "Self-Financing Land and Urban Development via Land Readjustment and Value
36 Capture." *Habitat International* 44: 314–23.
37
38 <http://linkinghub.elsevier.com/retrieve/pii/S0197397514001155>.
39
40
41 Moir E, Moonen T and Clark G (2014) *The Future of Cities: What Is the Global Agenda?* London,
42 UK.
43
44
45 Nair S et al (2014) "Water-Energy-Greenhouse Gas Nexus of Urban Water Systems: Review of
46 Concepts, State-of-Art and Methods." *Resources, Conservation and Recycling* 89: 1–10.
47
48 <http://dx.doi.org/10.1016/j.resconrec.2014.05.007>.
49
50
51 Newman, P., and I. Jennings (2008) *Cities as Sustainable Ecosystems: Principles and Practices.*
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Washington, D.C.: Island Press.
- 10
11 Newman, P., and A. Matan (2013) *Green Urbanism in Asia: The Emerging Green Tigers*. Singapore:
12 World Scientific Publishing.
- 13
14 Newman P, Beatley T and Boyer H (2017) *Resilient Cities: Overcoming Fossil Fuel Dependence*,
15 Island Press, Washington DC.
- 16
17
18 Newman P, Davies-Slate S, and Jones E (2017), The Entrepreneur Rail Model: Funding urban
19 rail through majority private investment in urban regeneration, Research in
20 Transportation Economics <http://dx.doi.org/10.1016/j.retrec.2017.04.005>
21
22
23 Newman P and Kenworthy J (1989) *Cities and Automobile Dependence: An International Sourcebook*.
24 ed. Gower. Aldershot, UK.
- 25
26
27
28 — — — (1999) *Sustainability and Cities: Overcoming Automobile Dependence*. Washington, D.C.:
29 Island Press.
- 30
31
32 — — — (2015) *The End of Automobile Dependence: How Cities Are Moving Beyond Car-Based*
33 *Planning*. Washington, D.C.: Island Press.
- 34
35
36 Newman P, Kenworthy J, and Glazebrook G (2013) "Peak Car Use and the Rise of Global Rail:
37 Why This Is Happening and What It Means for Large and Small Cities." *Journal of*
38 *Transportation Technologies* 3(4): 272–87.
- 39
40
41 Newman P, Kosonen L, and Kenworthy J (2016) "The Theory of Urban Fabrics: Planning the
42 Walking, Transit and Automobile Cities for Reduced Automobile Dependence." *Town*
43 *Planning Reviews* 87(4).
- 44
45
46
47 Newman P (1999) "Sustainability and Cities: Extending the Metabolism Model." *Landscape and*
48 *Urban Planning* 44(February): 219–26.
- 49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 — — — (2014) "Biophilic Urbanism: A Case Study on Singapore." *Australian Planner* 51(1): 47–65.
10 <http://www.tandfonline.com/doi/abs/10.1080/07293682.2013.790832>.
11
12 Newman P and Kenworthy J (2011) "Peak Car Use: Understanding the Demise of Automobile
13 Dependence." *World Transport Policy and Practice* 17(2): 32–42.
14
15 Newton P, Newman P, Glackin S and Trubka R (2012) "Greening the Greyfields: Unlocking
16 the Redevelopment Potential of the Middle Suburbs in Australian Cities." *World Academy*
17 *of Science, Engineering and Technology* 71(11): 658–77.
18
19 Newman P (2017) Decoupling Economic Growth from Fossil Fuels, *Modern Economy*, 8, 791-805.
20 <https://doi.org/10.4236/me.2017.86055>
21
22
23
24
25
26
27 Newton P et al. (2011) AHURI Final Report *Towards a New Development Model for Housing*
28 *Regeneration in Greyfield Residential Precincts*.
29
30 — — — (2012) *AHURI Research & Policy Bulletin How Do We Regenerate Middle Suburban "*
31 *Greyfield " Areas? Melbourne, Australia*.
32
33
34 — — — (2014) "Regeneration: Tackling the Greyfields." In *Creating Sustainable Precincts*, ed. Tina
35 Perinotto. Sydney, Australia: The Fifth Estate, 106–11.
36
37 <http://evacoust.startlogic.com/TimeToyota.pdf>.
38
39
40 Norman B and Reid J (2016) "In Quito, the World Meets to Discuss the Future of Cities." *The*
41 *Conversation* (October): 1–4. [https://theconversation.com/in-quito-the-world-meets-to-](https://theconversation.com/in-quito-the-world-meets-to-discuss-the-future-of-cities-67125)
42 [discuss-the-future-of-cities-67125](https://theconversation.com/in-quito-the-world-meets-to-discuss-the-future-of-cities-67125).
43
44
45
46 Rauland V and Newman P (2015) *Decarbonising Cities: Mainstreaming Low Carbon Urban*
47 *Development*. Springer International Publishing.
48
49
50 Rees W, and Wackernagel M (2008) "Urban Ecological Footprints: Why Cities Cannot Be
51
52
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Sustainable-and Why They Are a Key to Sustainability." *Urban Ecology: An International*
10
11 *Perspective on the Interaction Between Humans and Nature* 16: 537–55.
- 12 Rittel H and Webber M (1973) "Dilemmas in a General Theory of Planning." *Policy Sciences*
13
14 4(December 1969): 155–69.
- 15
16 Rockström J et al. (2009) "Planetary Boundaries®: Exploring the Safe Operating Space for
17
18 Humanity." 14(2). http://pdxscholar.library.pdx.edu/iss_pub.
- 19
20 Roggema R and van Dobbelsteen A (2008) "Building Resilience: Responding to a Turbulent
21
22 World." In *UK Systems Society International Conference*, Oxford, UK.
- 23
24 Rohe W (2009) "From Local to Global: One Hundred Years of Neighborhood Planning." *Journal*
25
26 *of the American Planning Association* 75(2): 209–30.
- 27
28 Scheurer J, and Curtis C (2008) *Spatial Network Analysis of Multimodal Transport Systems:*
29
30 *Developing a Strategic Planning Tool to Assess the Congruence of Movement and Urban*
31
32 *Structure*. Perth, Australia.
- 33
34 Seto K, Güneralp B, and Hutyrá L (2012) "Global Forecasts of Urban Expansion to 2030 and
35
36 Direct Impacts on Biodiversity and Carbon Pools." *Proceedings of the National Academy of*
37
38 *Sciences of the United States of America* 109(40): 16083–88.
- 39
40 Sharifi A and Murayama A (2013) "A Critical Review of Seven Selected Neighborhood
41
42 Sustainability Assessment Tools." *Environmental Impact Assessment Review* 38: 73–87.
- 43
44 Soderlund J, and Newman P (2015) "Biophilic Architecture: A Review of the Rationale and
45
46 Outcomes." *AIMS Environmental Science* 2(4): 950–69.
47
48 <http://www.aimspress.com/article/10.3934/environsci.2015.4.950>.
- 49
50 Steffen W et al. (2011) "The Anthropocene®: From Global Change to Planetary Stewardship."
51
52 *Ambio* 40(7): 739–61.
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6
7
8
9 Steffen W, Richardson K, et al. (2015) "Planetary Boundaries: Guiding Human Development on
10 a Changing Planet." *Science* 347(6223): 736–47.
11
12 Steffen W, Broadgate W, et al. (2015) "The Trajectory of the Anthropocene: The Great
13 Acceleration." *The Anthropocene Review* 2(1): 81–98.
14
15 Steffen W, Crutzen J, and McNeill J (2007) "The Anthropocene: Are Humans Now
16 Overwhelming the Great Forces of Nature?" *Ambio* 36(8): 614–21.
17
18 Thompson H and A Waugh (2009) *A Process Revealed*. FUEL Publ. London, UK
19
20 Thomson G, Matan A, and Newman P (2013) "A Review of International Low Carbon Precincts
21 to Identify Pathways for Mainstreaming Sustainable Urbanism in Australia." In *SOAC*
22 *National Conference Proceedings, Nov 26-29 2013. Sydney, NSW: State of Australian Cities*
23 *Research Network, Sydney, Australia*.
24
25 Thomson G and Newman P (2016) "Geoengineering in the Anthropocene through Regenerative
26 Urbanism." *Geosciences* 6(4).
27
28 — — — (2017) "Urban Fabric and Urban Footprint." *Resources, Conservation and Recycling*.
29
30 <http://dx.doi.org/10.1016/j.resconrec.2017.01.010>.
31
32 Thomson G, Newton P and Newman P. (2016) "Urban Regeneration and Urban Fabrics in
33 Australian Cities." *Urban Regeneration and Renewal* 10(2).
34
35 TriMet (2015) *45 Years Making History and Transit in the Portland Region*. Portland, Oregon.
36
37 Trubka R, Newman P, and Bilsborough D (2010) "Costs of Urban Sprawl (1) – Infrastructure
38 and Transport." *Environment Design Guide* (83): 1–6.
39
40 Truffer B and Coenen L (2012) "Environmental Innovation and Sustainability Transitions in
41 Regional Studies." *Regional Studies* 46(1): 1–21.
42
43 <http://www.tandfonline.com/doi/abs/10.1080/00343404.2012.646164>.
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9 UNEP (2013) *City-Level Decoupling Urban Resource Flows Urban Resource Flows and the Governance*
10 *of Infrastructure Transitions. A Report of the Working Group on Cities of the International*
11 *Resource Panel. A Report of the Working Group on Cities of the International Res.* United
12 Nations Environment Programme.

13
14
15
16 United Nations (1987) *Our Common Future - Brundtland Report*. New York, NY: Oxford
17 University Press.

18
19
20 — — — (2014) Department of Economic and Social Affairs, Population Division *World*
21 *Urbanization Prospects: The 2014 Revision, Highlights*. New York, NY.

22 <http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf>.

23
24
25
26 — — — (2015a) 21930 Framework Convention on Climate Change “Adoption of the Paris
27 Agreement” *Adoption of the Paris Agreement*. Paris, France.

28 <http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>.

29
30
31
32 — — — (2015b) *Outcome Document of the United Nations Summit for the Adoption of the Post-2015*
33 *Development Agenda*. Nairobi, Kenya.

34
35
36 — — — (2015c) Working Paper World Population Prospects: The 2015 Revision, Key Findings
37 and Advance Tables. *World Population Prospects*.

38
39
40
41 — — — (2016) *Habitat III New Urban Agenda. Draft Outcome Document for Adoption in Quito,*
42 *October 2016*.

43 United Nations General Assembly (2015) *Transforming Our World: The 2030 Agenda for*
44 *Sustainable Development*. NY.

45
46
47 VisionPDX (2007) *Portland 2030: A Vision for the Future*. Portland, Oregon.

48 <http://www.portlandonline.com/bds/index.cfm?a=195005&c=46936>.

49
50
51 Wiktorowicz J, Babaeff T, Breadsell J, Byrne J, Eggleston and Newman P (2018) “WGV: An

1
2
3
4
5
6
7
8
9 Australian Urban Precinct Case Study to Demonstrate the 1.5°C Agenda Including
10 Multiple SDGs " Urban Planning 3(2): 64-81. 10.17645/up.v3i2.1245
11
12 Woo F (2014) *Regenerative Urban Development*. World Future Council. Hamburg, Germany.
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Basic Raw Materials of Three Different Urban Fabrics
Business as Usual (BAU) vs. Technology and Construction Innovation (TCI)

